Colorado Department of Transportation
Golden, CO

SUBMITTAL MANUAL - SECTION 613

Programmable Logic Controllers

For project:

Eisenhower/Johnson Memorial Tunnel 480V Motor Control Center Replacement

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Submittal Information		
Facility / Building / Area	Eisenhower/Johnson Memorial Tunnel	
General Contents / Description	Programmable Logic Controllers	
Panel No. / Equipment No. / Etc.	East PLC and West PLC	
Submittal Number	**613-002-D**	
Volume	**1 of 1**	
Specification Section(s)	613 – Programmable Logic Controllers	
Submittal Type	☐Product Data	
	☐Informational	☐Interim O&M Manual
		☒Final O&M Manual

Revision History:	
REVA	05MAR2020
REVB	06APR2020
REVC	07MAY2020
REVD	16SEP2021 – Final O&M

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REVISION OF SECTION 613
PROGRAMMABLE LOGIC CONTROLLERS

Section 613 of the Standard Specifications is hereby revised for this project as follows:

Subsection 613.01 shall include the following:

GENERAL

The project is located east of Silverthorne on I-70. The project consists of work in the east and west ventilation buildings of the Eisenhower Johnson Memorial Tunnels.

The project consists of the replacement of the 480V electrical motor control centers and ventilation fan controls and re-routing of selected conduits and replacing wires from the existing motors to the new motor control centers. The work also includes the installation, programming, and training of the new Programmable Logic Controller (PLC) and the individual PLC units as well as programming, integration, and training of the new SCADA system.

Furnish, install, and test SCADA/PLC rack, workstations and associated work as shown on the Contract Drawings, hereinafter specified or otherwise required for a complete and fully operable system.

The work shall include the procurement, installation, testing, and commissioning of SCADA Servers and Programmable Logic Controllers (PLCs).

CDOT is upgrading the Ventilation Building Exhaust and Supply Fan controls; and installing Allen Bradley Control Logix (or approved equal) controllers, I/O modules, Comm modules and power supplies. The contractor shall coordinate all material selection, software selection and programming, and installation with the CDOT Electrical Engineer.

PLCs shall be in conformance with the latest NEMA Standards and Federal Specifications listed below.

DEFINITIONS

CPU	Central Processing Unit. The hardware that controls the functioning of a PLC RACK.
PLC rack	PLC rack. An assembly consisting of a CPU, power supplies, communications modules, and I/O modules that directly monitors field equipment and passes along the monitored values to the SCADA. PLC rack also accept commands from the SCADA and controls field equipment based on those commands.
PLC	Programmable Logic Controller. A microprocessor unit with a CPU, Random Access Memory, and communications ports designed to be used with I/O modules to process inputs and provide control and communications outputs.
SCADA	Supervisory Control and Data Acquisition. The computer network that monitors and controls equipment, systems, and conditions for the tunnel.
TVSS	Transient Voltage Surge Suppressor. TVSS is a device used to eliminate or reduce damage to data processing equipment by limiting transient (surge) voltages and currents (surges) on electrical circuits. These transients or surges may come from inside a facility, or may be injected into a facility from the outside.

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QUALITY ASSURANCE

For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
Submit qualification data for firms and persons specified in the Quality Assurance Plan to demonstrate their capabilities and experience. Provide evidence of applicable registration or certification. A vendor with a local presence in the state of Colorado is preferred.

Persons having at least 5 years experience installing that equipment shall perform installation of equipment.

When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturer's Association (NEMA), and Underwriters Laboratories (UL), proof of such conformance shall be submitted for approval. If an organization uses a label or listing in compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable tests and is approved by Engineer of Record in advance of the Submittal. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for approval. The certificate shall identify the manufacturer, the product, and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project specification and of the referenced standards listed.

SUBMITTALS

Manufacturer’s data which clearly indicates that the proposed material or equipment complies with Contract Specification requirements shall be submitted for:

(a) Manufacturer's product data.

(b) Drawings showing outline dimensions and proposed circuit arrangements of the specified equipment. Include catalog designations, approximate weights of the assemblies, and schematic wiring diagrams.

(c) List of special tools needed for erection and adjustment of the equipment.

(d) Certified copies of production test reports shall be supplied demonstrating compliance with these standards when requested by the Quality Assurance Manager.

(e) Shop drawings shall be submitted and approved before procurement of material. Partial submittals are not acceptable. Such submittals shall be returned without review.

PLC rack Technical Data: Submit for review and acceptance, by the Engineer of Record, complete manufacturer's data including all technical information such as manufacturer's name, model number, catalog number, system ratings, system capacities, cabinet construction, cabinet finishes, major component information (microprocessors, I/O cards, memory media, etc.), catalog cut sheets and all agency approvals, manufacturing test qualifications and specifications.

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Field Test Plans: Submit for review and acceptance a complete and detailed field commissioning test plan that shall verify all SCADA components, system operability, field wiring, and equipment interfaces. The initial test plan phase shall verify that all field wiring is correct. The final test plan phase shall verify system operability and equipment interfaces. The test plan shall require documentation of the manufacturer's name, model numbers, serial numbers, test instrumentation manufacturer, test instrumentation model number, calibration dates, etc. All test steps in the test report form shall have space for initials and dates for the person performing the tests and Engineer of Record witnessing the tests. The test report forms shall include comment and resolution at the bottom of each page. At the end of each test phase, include a test page indicating all tests were satisfactory performed with signatures and dates and space for Engineer of Record signatures and dates of acceptance. Test instruments shall be calibrated not more than nine (9) months prior to use in testing programs. All test equipment shall be within the calibration due date at the end of the testing.

Field Test Schedule: The field testing shall be subject to witnessing by the Engineer of Record. Submit the proposed field test schedule for review and acceptance in advance of any testing.

The proposed test schedule shall identify the proposed start and finish dates of each test plan phase, as described above. Submit for review and approval any changes to the proposed test plan schedule in advance of the existing affected schedule date.

Field Test Reports: Field test reports shall be submitted for review and approval upon completion of field testing of the revised SCADA system.

Training Plan: Submit a training plan as required elsewhere in this specification.

Drawings:

(a) Manufacturer shall supply upon shipment of equipment a complete set of "as manufactured" drawings and wiring diagrams including interconnection diagrams of all components and assemblies of the equipment which will assist in operation and maintenance of the equipment. All drawings shall be prepared in accordance with current industry standards and good industrial practice. All information shall be in the English language, clearly readable, with IEEE, NEMA and ANSI symbols, device numbers and other

requirements. Dimensions shall be in inches and may be in both English and metric values. Fractional values shall be given in decimal form.

Instruction Manuals:

(a) The manufacturer shall submit prior to shipment, complete installation and operation and maintenance instructions/manuals suitable for the specific items(s) to be supplied, including such information as is available from the manufacturer of each and every purchased accessory. Included shall be interconnection diagrams, drawings and instructions describing procedures for items which are to be shipped disassembled, but which are to be assembled and interconnected for operation when sited. These shall contain special rigging instructions as required for unloading, moving by skidding or rolling, and lifting. Also, supplied shall be instructions, enclosure assembly and disassembly, and other information designed to assist in proper operation and periodic maintenance of the equipment being supplied. Key interlocking provisions shall be identified and serial numbers supplied. All catalog cuts, web pages, etc. shall be original copies.

(b) All manuals, instructions, supporting drawings and parts lists supplied by the manufacturer and supplemental instructions and data supplied by accessory manufactures shall be in English, clearly

readable and arranged in such format as to make the subject items easily identifiable.

Each manual shall have an index and/or table of contents identifying each item/subject and shall include information contained therein. All values shall be given in English units and may be in both English and metric values. Fractional values shall be given in decimal form.

Spare Parts Data:

(a) As soon as practicable after acceptance of materials and equipment, furnish to Engineer of Record spare parts data for each different item listed. The data shall include a complete list of parts and supplies, with current unit prices and source of supply. The foregoing shall not relieve the Contractor of any responsibilities under the warranty.

Test Procedures,

(a) Submit detailed tests to be conducted, description of how tests will be performed, and what the expected results shall be, shall be submitted as indicated by the Contract Specification sections.

Copies of all receipt inspections, installation data, and field tests shall be submitted to the Quality Assurance Manager for approval.

PRODUCT DELIVERY, STORAGE AND HANDLING

Provide as described below:

Ship each unit or component securely packaged and labeled for safe handling in shipment and to avoid damage or distortion.

Mark each item, unit or component in accordance with applicable reference standard.

Subsection 613.02 shall include the following:

Manufacturers:

Subject to compliance with the requirements specified and as approved by the Engineer of Record. The SCADA/PLC system shall be Allen Bradley, Control Logix or approved equal. Manufacturers Qualifications

The SCADA/PLC system shall be furnished by a single manufacturer who has actively been manufacturing PLCs of the required capacities and whose products have operated successfully.

The manufacturer shall have a fully operational quality assurance and quality control program in place and shall comply with ISO 9001 standards for "Quality Systems Model for Quality Assurance in Design/Development, Production, Installation, and Servicing".+

Offer local on-site support and 24-hour telephone support service.

Materials:

As shown on the Contract Documents. The major components of the system shall include a main PLC unit (with redundant PLC in standby mode) and the quantity of i/o as shown on the Contract Documents.

Configuration as schematically shown on the Contract Drawings.

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Instrumentation and sensors shall be directly hardwired to PLC racks as shown on the Contract Drawings.

Final PLC configurations shall be as required by the Contract Drawings and Specification documents with any modifications approved by the Engineer of Record.

PLC Rack:

The PLC rack shall include the appropriate modules for the I/O points as listed in the SCADA Input/Out Points List Specification, with an additional fifty percent (50%) spare of each point type (DI, DO, AI, etc.).

PLC racks shall be located as indicated on the Contract Drawings.

Environmental Conditions:

All hardware shall operate within temperature range of 14 to 140 degrees F.

The hardware shall function continuously in the relative humidity range of 5 percent to 95 percent with no condensation.

The PLC rack shall withstand vibration and impact shock tests as per IEC 60068 2 6 and IEC 60068 2 27.

Wiring and Terminations:

A standardized connection technique shall be used as much as possible using the front adapters, adapter modules and prefabricated system cables to connect the I/O modules.

120volt AC circuits shall be provided for the power supply modules on the remote I/O chassis and stand-alone 24volt DC power supplies for instrumentation. Terminal blocks shall be provided for connection to instruments/ devices/ modules.

All PLC racks shall be powered from UPS power source.

All analog signals I/O wiring shall be minimum #16 AWG conductors, shielded twisted paired cable with FEP, insulation, (UL type CMP), XPL, LSZH, except as indicated on the drawings. All Digital I/O wiring shall be #14 AWG, 600volt, unless indicated otherwise on the drawings. All SCADA control power cables shall be #12 AWG, 600volt, unless indicated otherwise on the drawings.

All field wiring to I/O modules shall be through heavy duty terminals. Pressure type screw terminals shall be used to provide fast, secure wire connections.

Input and output modules shall have face plates, which shall be marked or labeled.

All wiring shall be neatly installed using wire ways. All wiring shall be identified at both ends by permanent sleeve type wire markers with indelible lettering.

Instrument grounds and cable shields shall remain isolated from the equipment enclosure and distribution system grounds except at the RCU enclosure single-point bond.

Drain wire from shielded cables shall be connected to ground at one end only. Generally, at the source of the signal devices. The non-terminated end of the drain wire shall be insulated and tapped back.

Input and Output Modules:

During normal operation, a malfunction in any RIO chassis shall affect the operation of only that chassis and not the operation of the RCU or any other chassis.

Upon loss of communication with the PLC rack shall maintain the last commanded state for all i/o outputs.

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Isolation shall be used between all internal logic and external power circuits. This isolation shall meet the minimum specification of 1500 VRMS.

Discrete output modules shall be provided with fuses for overload and short circuit protection of the module.

All I/O modules shall be color coded and have distinctive labels.

All input modules shall have a specified filter time constant to limit the effects of voltage transients.

All digital input modules shall be isolated. Input modules shall provide the power to interrogate isolated (dry) field contacts.

All digital output modules shall be isolated contacts with normally open contacts. Each output shall have a separate common and shall be electrically isolated from module logic circuitry. Each output shall conduct a maximum load of 2.0 amps continuously at 500 VA for ac loads.

Analog input modules shall have isolated differential channels with a minimum of 12 bit resolution. Analog inputs shall be 4-20 milliamps (mA).

The processor module shall interface I/O modules in PLC racks to the remote primary and secondary processors across the Network.

Power Supplies:

Power supplies shall be provided to power the PLC racks.

Stand-alone 24volt DC power supplies shall be provided in the PLC racks for instrument loop power.

Store materials in secure and dry facility and in original packaging in a manner to prevent soiling, physical damage, wetting or corrosion prior to installation.

Where possible maintain protective coverings until installation is complete and remove such covers as part of final clean up.

REFERENCES

The latest issue of publications listed below form a part of these Specifications to the extent referenced. The publications are referred to in the text by basic designation only. In case of conflict between provisions of codes, laws, ordinances, and these Specifications, including the Contract Drawings, the more stringent requirements will apply.

(a) American National Standards Institute (ANSI):

C1 General Requirements for a Quality Program

(b) International Electrotechnical Commission (IEC):

60068 2 6 Environmental Testing Part 2: Tests Test Fc: Vibration (Sinusoidal)

60068 2 27 Environmental Testing Part 2: Tests Test Ea and Guidance: Shock

60664 1 Insulation Coordination for Equipment Within Low Voltage Systems Part 1: Principles, Requirements and Tests

(c) Institute of Electrical and Electronic Engineers (IEEE):

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802.3 Ethernet

802.3.1 Management Information Base (MIB) Definitions For Ethernet

C37.1 Definition, Specification and Analysis of Systems Used for Supervisory Control and Data Acquisition, and Automatic Control

C62.41.1 Guide On the Surge Environment In Low-Voltage (1000 V And Less) AC Power Circuits

C62.41.2 Recommended Practice On Characterization Of Surges In Low-Voltage (1000 V and Less) AC Power Circuits

C62.45 Guide on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits

C63.12 American National Standard for Recommended Practice for Electromagnetic Compatibility Limits

(d) National Electrical Manufacturers Association (NEMA):

IA2.1 Programmable Controllers General Information

IA2.2 Programmable Controllers Equipment Requirements and Tests

IA2.3 Programmable Controllers Programming Languages

IA2.5 Programmable Controllers-Part 5: Communications

ICS1 Industrial Control and Systems: General Requirements

ICS1.1 Safety Guidelines for the Application, Installation and Maintenance of Solid State Control

ICS6 Industrial Control and Systems: Enclosures

250 Enclosures for Electrical Equipment

(e) National Fire Protection Association

NFPA 70 National Electrical Code (NEC)

NFPA 502 Standard for Road Tunnels, Bridges and other limited Access Highways

(f) Underwriters' Laboratories, Inc. (UL):

508 Industrial Control Equipment

840 Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment

Subsection 613.02 shall include the following:

PRODUCTS

Manufacturers are subject to compliance with the requirements specified and as approved by Engineer of Record.

All software and hardware shall be compatible with the new hardware and software already installed by CDOT. Coordinate all hardware and software selection with the CDOT Engineer.

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Furnish and install complete PLC rack, MCC PLC and Local Control Stations as shown on the contract drawings. All material shall be compatible with existing SCADA/PLC system and compatible with future planned SCADA upgrades.

Each PLC rack shall be furnished with a complete software package to enable operations that are specific to the equipment being monitored and/or controlled. Substantial portions of the software operating logic will be common to all systems, but certain system characteristics will require the Contractor to furnish and install a specific operating program. Each PLC Operating program will accept the quantity of analog inputs, digital inputs, and digital outputs shown in the contract drawings. Further, memory capacity for the PLC at each location shall allow for 40% of each point type over the quantities shown in the contract drawings.

PLC Rack's shall be installed as shown on the Contract Documents. The cabinets shall be rated as specified herein and applicable to the installed environment as shown on the Contract documents and described herein. Cabinets installed in the Fan Deck Area shall be rated Nema 4X.

The PLC Rack shall contain hardware and software to provide two-way communication with the SCADA system. The PLC Rack hardware and software shall be compatible with the existing SCADA/PLC system such that no modification of the SCADA shall be necessary to allow communication with the new PLC Rack.

All equipment shall be UL listed for the environment it is installed in and purpose it is installed for.

PLC Rack:

(a) The PLC Rack shall be designed, manufactured and tested to the latest ANSI, IEC, IEEE, and NEMA standards as listed in this Specification.

(b) All PLC Rack components and associated equipment shall be UL listed.

(c) Where PLC Racks are located in the same cabinet as local control panels, PLC Rack wiring shall be separated from other wiring using metal barriers.

(d) All of the requirements in this specification section shall apply to the local control panel where PLC Rack share the same enclosure as local control panels. The more restrictive of the PLC Rack or local control panel requirements shall prevail.

(e) Isolated instrument grounds shall not be shared with local control panel grounds.

(f) Dual nameplates shall be used to identify both the PLC Rack and local control panel.

(g) Each PLC Rack shall consist of a single chassis mounted on a back panel with the number of modules as shown on the Contract Drawings.

(h) PLC Rack shall be located as shown on the Contract Drawings.

(i) All similar PLC Rack (by enclosure type, number and type of modules) shall be identical and interchangeable. All assemblies and sub- assemblies performing similar functions shall be interchangeable. All PLC Rack's shall have same size, type, capacity modules.

Surge Protection:

(a) All PLC Rack cabinets shall be protected by TVSS equipment.

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(b) The TVSS shall be connected to the load side of the primary circuit breaker. The TVSS shall be sized for the incoming current and loads to be protected.

(c) The TVSS shall be UL and cUL Listed as TVSS and secondary surge arrestors. The TVSS shall meet ANSI/IEEE C62.11-1987.

(d) The TVSS shall be rated by its manufacturer with a minimum operating temperature range of -40°C to 70°C. The TVSS shall have protected lines L and N.

(e) The TVSS shall operate with maximum power consumption per phase of 500 milliwatts.

(f) The TVSS shall have a minimum surge energy capability per phase of 560 joules, 8/20μs wave.

(g) The TVSS shall have a maximum surge current rating scope phase of 36 kAmp peak, 8/20 μs wave.

(h) The TVSS shall have a maximum clamping voltage on a 10 kAmp 8/20 μs combination surge current for each phase of 750V with a 1 inch lead.

(i) The TVSS shall have a response time of less than 50 nanoseconds. The TVSS shall provide lightning induced voltage surge protection.

(j) All TVSS's shall be grounded per their manufacturers recommendations.

(k) The Contractor shall furnish and install transient suppression devices for all electrical (copper) connections providing a direct path to the equipment from outside the cabinet, including CAT 5E cabling from the camera, power, and communications cabling. Transient surge suppressors shall be designed for the specific application intended (e.g. serial communications/UTP, etc.) and shall be installed in accordance with manufacturer recommendations.

Enclosures:

(a) Each PLC Rack chassis and its associated equipment shall be housed in a wall mount type cabinet or in a 19 inch rack cabinet unless otherwise shown on the contract drawings.

(b) All system modules and chassis shall be designed to provide for free airflow convection cooling. No internal fans or other means of cooling, except heat sinks, shall be permitted for NEMA Type 12 cabinets. Forced ventilation shall be permitted in NEMA Type 4X cabinets. The enclosure inside temperature shall not exceed 131 degrees Fahrenheit at an ambient temperature of 104 degrees Fahrenheit. Calculations shall be submitted that verify the temperature limits will not be exceeded.

(c) All cabinets shall have strip heaters with 50 degree Fahrenheit thermostat to maintain a minimum of 50 degrees Fahrenheit temperature inside the cabinet. All cabinets shall have humidistats to maintain less than 90% relative humidity inside the cabinets.

(d) The enclosures shall be designed and constructed to accommodate power cable entrance and control/communication cable entrance from the top.

(e) The enclosure shall incorporate a dedicated instrument ground bus that is isolated from the enclosure/distribution ground.

Chassis and Component Rack:

(a) Modules shall be plugged into a chassis that is designed to restrict improper module insertion and to allow installation in only one direction. The design shall prohibit upside down insertion and backward insertion, as well as safeguard against the insertion of a module into the wrong slot. The chassis shall be mounted on a back panel.

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(b) All system and signal power to the processor and support modules shall be distributed on a single motherboard or backplane. The modules shall not be interconnected using wiring or plug terminated jumpers.

(c) All modules shall include an LED that is visible from the front (insertion side) and that will illuminate if, and only if, the module is properly and completed inserted with power from the backplane.

(d) All I/O modules shall be firmly attached to the I/O chassis.

(e) The chassis design shall allow replacement of any input or output module without disturbing field wiring.

(f) Nameplates shall be provided for the cabinet, for each module, for each device, and for all related equipment. Nameplates shall include all appropriate data such as equipment number, rating, serial number, and manufacturer.

Front Controls and Indicators (PLC Rack Functions Only):

(a) The front of each PLC Rack (inside cover) shall include, but not be limited to, the following controls and in indications:

1. The run/fault status of the processor.
2. I/O rack fault.
3. Enabled/disabled state of outputs.
4. Forced states present/active.
5. On/Off status of individual input or output points for each I/O module.
6. Fault status of each I/O module.

(b) PLC Rack identification tag - Securely mounted plastic laminate with engraving to show 1/4 inch (min.) black lettering on a white background.

(c) Tag identifying related fan numbers - Securely mounted plastic laminate with engraving to show 1/4 inch (min.) black lettering on a white background.

Wiring and Terminations:

The standardized connection technique shall be used as much as possible using the front adapters, adapter modules, and prefabricated system cables to connect the I/O modules of PLC Rack's.

120 volt AC circuit shall be provided for the power supply module on the Distributed I/O Cabinet and standalone DC power supply located within. Terminal blocks shall be provided for connection to instruments/devices/modules.

Rigid galvanized steel conduits shall be used as a raceway between instruments and PLC Rack. Liquidtight flexible steel conduit may be used in lengths not to exceed 3 feet for final make-up to sensing devices.

All I/O wiring shall be minimum No. 16 AWG, XHHW, 600 volt, low smoke zero halogen.

All field wiring to I/O modules shall be through heavy duty terminal strips. Pressure type screw terminals shall be used to provide fast, secure wire connections. Ferrule connectors for conductors (particularly twisted/shielded. Torque requirements terminations at terminal blocks shall be provided. Termination paperwork to be provided on I/O terminations.

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Input and output modules shall have face plates which shall be marked or labeled in accordance with the Contract Plans.

All wiring shall be neatly installed and wireways shall be used wherever possible. All wiring shall be identified at both ends by wire markers. Wireways shall not be shared with local control panel wiring.

Instrument grounds and cable shields shall remain isolated from the enclosure/distribution system grounds except at the PLC RACK enclosure single-point bond.

Input and Output Modules:

(a) During normal operation, a malfunction in any PLC Rack shall affect the operation of only that PLC Rack and not the operation of any other PLC Rack.

(b) Any PLC Rack shall be field selectable to shut down the PLC Rack upon failure of that PLC Rack.

(c) Upon remote channel shutdown, the SCADA/PLC system shall see all inputs on the malfunctioning PLC Rack as they were when the shutdown occurred and all outputs shall de energize in that PLC Rack.

(d) Isolation shall be used between all internal logic and external power circuits.

(e) Discrete output modules shall be provided with self contained fuses for overload and short circuit protection of the module. These cards shall also be capable of having fused swing arms for each point so as not to disturb the card and/or wiring while changing a blown fuse.

(f) All I/O modules shall be color coded and titled with a distinctive label.

(g) All input modules shall have a specified filter time constant to limit the effects of voltage transients.

(h) All non-intrinsically safe digital I/O modules shall be 120 volts AC and shall have 16 or 32 optically isolated circuits per module.

(i) All I/O modules that receive inputs from sensors in areas that are classified as Class 1 shall be of the intrinsically safe type. All sensors in pump pits or operating level of pump rooms shall be considered to be in a Class 1 are

(j) Analog input modules shall have eight isolated differential channels per module with a minimum of 12 bit resolution. Analog inputs shall be 4 to 20 mA.

(k) Resistance temperature detector (RTD) input modules shall have minimum six isolated channels per module with minimum 16 bit (plus or minus 0.1 degree Centigrade per bit) resolution. Each channel shall be configurable for a 100 ohm platinum RTD.

(l) The processor module shall interface I/O modules in a PLC Rack to the remote primary and secondary processors across the remote I/O network. The transmission rate of communication shall operate at minimum 50K baud on the remote I/O network.

Power Supply:

(a) The manufacturer shall provide system power supplies capable of converting 120 volts AC line power to the power type required to operate the PLC Rack.

(b) A separate, independent power supply shall be provided for each PLC Rack. The power supplies shall have the capability of supplying power to the PLC and I/O modules.

(c) The power supplies shall automatically shut down the PLC Rack whenever its output current is detected as exceeding 125 percent of its rated current.

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(d) The power supplies shall monitor the incoming AC line voltage for proper levels. When the power supply is wired to utilize 120 volt AC power, the system shall function properly within the range of 97 to 132 volts AC. If the voltage level is detected as being out of range for more than 5 line cycles, the power supply shall automatically shut down the system and remain disabled until the proper voltage level returns. In addition, the power supply shall provide surge protection, isolation, and outage carry over for up to two cycles of the AC line.

(e) Design features of the PLC Rack power supply shall include diagnostic indicators mounted in a position to be easily viewed by the user. These indicators shall provide the operator with the status of the DC power applied. In addition, a means of disabling power to the PLC Rack shall be possible from a power disconnect switch mounted in a position easily accessible by the operator.

(f) At the time of power up, the power supply shall inhibit operation of the processor and I/O modules until the DC voltages are within specified range.

(g) The power supply shall have fuse protection.

Software Performance, Capabilities, And Requirements:

(a) Each PLC Rack shall be furnished with a completely installed set of software to support communication with the Remote I/O network. All software supplied which requires licenses shall include 5 licenses assigned to CDOT. The software shall include at least the following packages:

1. Program Creation and Editing Software
2. PLC Operating Software

(b) The programming at the PLC Rack shall be modified to monitor and control the equipment being added.

(c) Local Building Workstations software in the two ventilation buildings shall be modified to monitor and control the equipment being added.

(d) New screens shall be developed to display operating conditions and allow remote control of the switchboards being added under this contract.

(e) New screens shall be developed to display operating conditions and allow remote control of the new motor control centers being added under this contract.

(f) New screens shall be developed to display operating conditions and allow remote control of the new variable frequency drives being added under this contract.

Auxiliary Equipment:

Spares shall be provided for each component in the PLC Rack and MCC PLC as follows:

(a) One PLC

(b) One power supply

(c) One communications card

(d) Ten percent (minimum of one) of each type of I/O module

(e) Each PLC Rack shall be provided with a spare EEPROM memory cartridge, non-volatile storage device, or other form of reliable program back-up containing the control program.

Hardware:

(a) Fasteners:

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1. In accessible areas, fasteners shall be hexagonal head bolts with hexagonal nuts, provided with heavy duty lock washers.
2. In inaccessible areas, fasteners shall be hexagonal head tap bolts, provided with heavy duty lock washers.
    a. Bolts and tap bolts shall be stainless steel and shall conform to the requirements of ASTM A 193, Grade B8M or B8MA, equivalent to AISI Type 316 with suitable lock washers.
    b. Nuts shall be stainless steel and shall conform to the requirements of ASTM A 194, Grade 2H, equivalent to AISI Type 316.
    c. Lockwashers shall be stainless steel.

(b) Anchor Bolts:

1. Anchor bolts shall be stainless steel and shall conform to the requirements of ASTM A 193, Grade B8M or Grade B8MA, equivalent to AISI Type 316, with suitable lock washers.
2. Anchor bolt nuts shall be stainless steel and shall conform to the requirements of ASTM A 194, Grade 2H, equivalent to AISI Type 316.
3. All equipment, components, and supports shall be designed to withstand the seismic effects of a peak ground acceleration of 0.025g.

(c) Environmental Conditions:

1. All hardware of the PLC Rack shall operate at an ambient temperature of 14 to 140 degrees Fahrenheit. Additional heating shall be added to maintain these temperatures in cabinets in the Fan Deck.
2. The PLC Rack hardware shall function continuously in the relative humidity range of 5 percent to 95 percent with no condensation.
3. The PLC Rack shall withstand vibration and impact shock tests as per IEC 68 2 6 and IEC 68 2 27.

CONSTRUCTION METHODS

General

(a) Provide all material, equipment, and labor to install PLC Rack as indicated and as specified.

(b) Coordinate all hardware and software installation with the CDOT Engineer.

Subsection 613.03 shall include the following:

Installation

(a) Installation shall comply with ANSI C2, NFPA 70, and to the requirements specified herein.

(b) Provide and install all necessary raceway, wiring, control and ancillary equipment and appurtenances required to form complete operational systems for equipment supplied under other specification sections whether explicitly stated or implied.

(c) All work shall be closely coordinated between ALL work disciplines and shall be worked in accordance with CDOT's "Instructions to Bidders" and as indicated on the Drawings.

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REVISION OF SECTION 613
PROGRAMMABLE LOGIC CONTROLLERS

(d) Equipment installation shown on the contract drawings is diagrammatic. The contractor is responsible for final raceway routing and equipment location. All equipment shall be located in a manner to allow convenient access, inspection, and maintenance of the equipment.

Personnel Training:

(a) The Contractor shall provide on- site training for each discipline in maintenance, operating and engineering as specified for the various electrical systems comprised within this project as specified in the various sections. An authorized representative from the manufacturer or vendor of the system shall perform the training provided. All curriculum for each system/ equipment/ course shall be submitted for prior approval by CDOT. Contractor shall provide a video of each training session for Owners internal training purposes.

Equipment and Work Specified Elsewhere:

(a) Certain items of control and other equipment are indicated on electrical drawings for connection, but are specified in other Sections. Such items are not furnished as part of electrical work. The Contractor is responsible for connections to all such equipment, as specified and indicated.

(b) Provide quantity and sizes of equipment as shown on the contract drawings.

(c) The Contractor shall make all necessary field measurements to verify that the PLC Rack shall fit in the allocated space in full compliance with the minimum required clearances specified in the applicable codes.

(d) Wire connections shall be made as shown on the Contract Drawings and in accordance with Revision of Section 613, "Electrical Conduit and Wires".

(e) Grounding connections shall be made as shown on the Contract Drawings and in accordance with Revision of Section 613, "Bonding and Grounding". Grounding connections shall use Meyers Hubs and ring terminals.

Coordination:

(a) Electrical work shall be coordinated with other trades involved in the construction project. All work shall be carefully laid out in advance to coordinate electrical features with architectural, structural, and mechanical features of construction.

(b) The Contractor shall coordinate his work through the Engineer regarding other ongoing Construction. The Contractor shall be required to adhere to the CDOT LockOut/TagOut (LO/TO) Procedures and shall comply with OSHA and the Contractor’s own regulations.

(c) Spare Parts

1. Spare parts shall be supplied in accordance with the Manufacturer’s recommendations and as modified by each applicable Technical Section.

Factory Tests

General:

(a) The Contractor shall meet the following minimum testing requirements for PLC Rack. The Contractor shall also perform any additional standard tests normally performed by the manufacturers for similar equipment.

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REVISION OF SECTION 613
PROGRAMMABLE LOGIC CONTROLLERS

(b) Factory tests shall be witnessed by the Engineer (or Engineer's designated representative). Costs for transportation, lodging, and meals shall be paid for by the contractor. The manufacturer shall notify the Engineer minimum of two (2) weeks prior to the date the tests are to be performed.

(c) Observations made during the tests and test results shall be recorded in a document form acceptable to the Engineer, certified by the Contractor and submitted to the Engineer for acceptance. All expenses in connection with or incidental to the testing shall be borne by the Contractor.

(d) The test procedure shall be sequential in the order prescribed unless otherwise approved by the Engineer. Any PLC Rack component that fails to satisfactorily perform any test as specified shall be considered unacceptable. Failing parts shall be redesigned and the entire unit shall be retested as specified herein, at no additional cost.

(e) The submitted test plan shall show the verification of all hardware and software functions. The test plan shall be organized to attack the verification in an organized step-by-step approach that will assure that all components, functions, and processes are verified without exception. The steps shall also be organized in an efficient hierarchy that will isolate the larger-impact faults and the more common faults as early as possible.

(f) All factory tests results, whether witnessed or un-witnessed shall be submitted to CDOT for acceptance. The person performing the test and all witnesses to the test shall sign all test results. Any test that fails shall be re-performed until the test is successful.

(g) Unwitnessed factory tests and checks shall include:

1. Check of control and power wiring continuity, insulation resistance, and freedom from shorts and grounds.
2. All assemblies and components used in the PLC Rack shall be tested including, but not limited to, the following:
    a. Production and conformance tests in accordance with the relevant specified standards
    b. Temperature cycling tests
    c. Dielectric withstand capability tests in accordance with IEEE 318
    d. Radiated and conducted electromagnetic susceptible tests.
    e. IEEE 472 Surge Withstand Capability Testing on all I/O modules and field terminal points
    f. Showering arc tests
    g. Mechanical Stress Tests
    h. Vibration

(e) Shock
1. Free fall at height of three feet

(f) Point Assignment and Continuity

(g) One complete, operating PLC Rack unit shall be subjected to a burn in test of 140 degrees Fahrenheit for at least 48 hours. The unit shall remain continuously operational throughout the test.

(h) Witnessed Tests and Testing Software:

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REVISION OF SECTION 613
PROGRAMMABLE LOGIC CONTROLLERS

1. Each PLC Rack shall be tested for operation, sequencing, point assignment, interlocking, communications, diagnostics, graphic displays, fault conditions, data logging, and alarming functions as outlined in this Specification and the Contract Drawings. Testing shall include the primary and secondary communications links.
2. The Contractor shall perform preliminary developmental testing to assure that debugging and corrections are implemented prior to the Witnessed testing.

The functional program software shall be completely tested to verify all operating modes, conditions, alerts, failures, interlocks, automatic sequences, etc. The Contractor shall develop all required testing software to facilitate testing including simulating all field input functions.

Field Tests

(a) General:

1. The Contractor shall perform a complete inspection, as specified herein, prior to performing the field tests as specified herein.
2. Field testing shall be performed when the Engineer has determined that interfacing work is sufficiently complete to allow for valid results. The testing shall not begin until the Engineer has made this determination.
3. Field testing shall not be performed without the presence of the Engineer's representative.
4. Electrical energy required for field testing shall be furnished by the Contractor.
5. Tests that fail shall be repeated upon correction of any deficiencies. Tests shall be repeated as often as required until satisfactory performance is demonstrated. Repeat testing shall be performed at no additional cost.
6. The Contractor shall provide all required field test instrumentation. The Contractor shall provide the field test instrumentation as submitted and accepted by the Engineer. After field testing is completed and accepted by the Engineer, the field test instrumentation shall remain the property of the Contractor.
7. Testing, checking and, start up of the new PLC Rack shall be performed under the technical direction of the manufacturer's service engineer. The Contractor, in conjunction with the PLC Rack manufacturer, shall provide, at no additional cost, a start up service package for all PLC Rack provided.
8. A copy of all tests and checks performed in the field, complete with meter readings and recordings, where applicable, shall be submitted to the Engineer for acceptance.

(b) Inspection:

1. The Contractor shall perform the following inspections before starting the field testing on each new PLC Rack:
   A. Verify that PLC Rack and other related components are in place and securely mounted in accordance with the applicable contract plans and accepted submittals.
   B. Verify that CPU, power supplies, communications modules, I/O modules, and other devices in the PLC Rack are securely in place and are installed in the correct slots.
   C. Check all incoming power connections including main disconnect, fusing, main power supply, and I/O device power.

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REVISION OF SECTION 613
PROGRAMMABLE LOGIC CONTROLLERS

D. Verify that each communication cable is installed and correctly corresponds to rack address assignments.

E. Use an I/O address assignment listing to verify that a connection is made at the module end and at the device end for all listed inputs and outputs.

F. Apply power to each PLC Rack to verify that the proper input voltage is at the processor power supply terminals and that the DC voltages are within range.

G. Verify against the I/O address assignment list that each connected output has a programmed control sequence or ladder rung with the same address.

H. Briefly review the logic of operation of each output device and compare with its programmed sequence.

I. Inspect the program printout for any entry errors, such as references to unused I/O addresses, or use of word or bit storage locations for duplicate purposes.

J. Verify that timer, counter, and other preset values are programmed with the correct values.

K. Verify that each output is programmed and that no unplanned duplication exists.

2. The Contractor shall perform the following inspections before starting the field testing on each PLC Rack that has had new I/O modules inserted as part of this contract:

A. Verify that CPU, power supplies, communications modules, I/O modules, and other devices in the PLC Rack are securely in place and are installed in the correct slots.

B. Use an I/O address assignment listing to verify that a connection is made at the module end and at the device end for all new listed inputs and outputs.

Verify against the I/O address assignment list that each connected new output has a programmed control sequence or ladder rung with the same address.

Briefly review the logic of operation of each new output device and compare with its programmed sequence.

Inspect the program printout for any entry errors, such as references to unused I/O addresses, or use of word or bit storage locations for duplicate purposes.

Verify that timer, counter, and other preset values are programmed with the correct values for new I/O addresses.

Verify that each new output is programmed and that no unplanned duplication exists.

(c) Field Tests:

1. The Contractor shall perform the following field tests on each new PLC Rack:

A. Input Wiring Test: Perform the following tests:

(1) Verify that all power supply, CPU, I/O, and network communication diagnostic indicators are signaling correct operation.

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REVISION OF SECTION 613
PROGRAMMABLE LOGIC CONTROLLERS

(2) Manually activate each input device and use an I/O assignment listing to verify that the corresponding input status LED correctly reflects the change. Use the workstation to verify that the corresponding address reflects the correct state.

(3) Where mechanical activation is not practical, simulate operation by installing jumpers or lifting wires at the device. It is not acceptable to simulate operation at the PLC Rack.

B. Output Wiring Test: Perform the following tests:

(1) Disconnect all outputs that will cause equipment to operate or become energized.

(2) Apply power to the controller and I/O system and clear memory.

(3) Starting with the first output, use the CPU I/O force or similar forcing function to sequentially set each output to "1" and observe the status LED of the related output address, for an "ON" state. Only the output device should energize unless purposely disconnected. Clear each forced output before proceeding to the next.

(d) Dynamic Program Test:

1. The Contractor shall perform dynamic program testing to verify the correct operation of individual outputs and for complete program operation.

2. Prepare and submit all inspection, test and repair documentation to the Quality Assurance Manager

Furnishing and Installation of PLC Equipment including all specified appurtenances and accessories will be measured and paid for separately per each. The unit price will be full compensation for all work required to install, test, and certify the equipment as specified herein.

Subsection 613.12 shall include the following:

Programmable Logic Controllers and associated components described herein and the installation thereof will not be measured and paid for separately. Included in the term “associated components” are all equipment required to perform the complete installation of programmable logic controllers required for the tunnel facility. The completed and accepted work for programmable logic controllers shall not be paid for separately, but will be included in the Systems Integration payment item.

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STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

ELECTRICAL SYMBOLS

SYMBOL	DESCRIPTION
	RELAY CONTACT, NORMALLY CLOSED
	RELAY CONTACT, NORMALLY OPEN
	LIMIT SWITCH, NORMALLY CLOSED
	LIMIT SWITCH, NORMALLY CLOSED, HELD OPEN
	LIMIT SWITCH, NORMALLY OPEN
	LIMIT SWITCH, NORMALLY OPEN, HELD CLOSED
	PRESSURE SWITCH, NORMALLY CLOSED
	PRESSURE SWITCH, NORMALLY OPEN
	PUSHBUTTON, NORMALLY CLOSED
	PUSHBUTTON, NORMALLY OPEN
	PUSHBUTTON, NORMALLY CLOSED, HELD OPEN
	MUSHROOM HEAD PUSH BUTTON, NORMALLY CLOSED
	MUSHROOM HEAD PUSH BUTTON, NORMALLY OPEN
	2 POSITION SELECTOR SWITCH, CLOSED
	2 POSITION SELECTOR SWITCH, OPEN
	TEMPERATURE SWITCH, NORMALLY CLOSED
	TEMPERATURE SWITCH, NORMALLY OPEN
	TIMER CONTACT, NORMALLY CLOSED, TIMED OPEN
	TIMER CONTACT, NORMALLY CLOSED, TIMED OPEN, SHOWN OPEN
	TIMER CONTACT, NORMALLY OPEN, TIMED CLOSED
	TIMER CONTACT, NORMALLY OPEN, TIMED CLOSED, SHOWN CLOSED
	FLOW SWITCH, NORMALLY CLOSED
	FLOW SWITCH, NORMALLY OPEN
	PROXIMITY SWITCH, NORMALLY OPEN
	LEVEL SWITCH, NORMALLY CLOSED
	LEVEL SWITCH, NORMALLY OPEN
	RELAY COIL
	SOLENOID VALVE
R	PILOT LIGHT (R=RED, A=AMBER, B=BLUE, G=GREEN)
	NODE
	TERMINAL BLOCK
	KNIFE TERMINAL BLOCK
	TERMINAL BLOCK, FUSED

ELECTRICAL SYMBOLS CONTINUED

SYMBOL	DESCRIPTION
	GROUND
M	MOTOR
	ALARM HORN
	MOTOR STARTER COIL
	FIELD WIRING
	INTERNAL PANEL WIRING
	CAPACITOR
»	MOTION DETECTOR

NOTE:
THIS IS A STANDARD LEGEND SHEET. SOME SYMBOLS OR ABBREVIATIONS MAY APPEAR ON THIS SHEET AND NOT ON THE PLANS.

ABBREVIATIONS

ABBREVIATION	DESCRIPTION
A	AMPERE, AMBER
AC	ALTERNATING CURRENT
AWG	AMERICAN WIRE GAUGE
BRN	BROWN
BLU	BLUE
BLK	BLACK
C	CONTACTOR
CB	CIRCUIT BREAKER
CR	CONTROL RELAY
DC	DIRECT CURRENT
DIV	DIVISION
ES	EMERGENCY STOP
ESR	EMERGENCY STOP RELAY
F, FU	FUSE
FB	FUSE BLOCK
GRN	GREEN
GND	GROUND
GFR	GROUND FAULT RELAY
H	HORN
HP	HORSEPOWER
IPT	CURRENT TO PRESSURE TRANSDUCER
J-BOX	JUNCTION BOX
KVA	KILOVOLT AMPS
LS	LIMIT SWITCH
LT FLEX	LIQUID TIGHT FLEX CONDUIT
M	MOTOR
MC	MOTOR CONTACTOR
MCC	MOTOR CONTROL CENTER
MCR	MASTER CONTROL RELAY
MHPB	MUSHROOM HEAD PUSHBUTTON
MS	MOTOR STARTER

ABBREVIATION	DESCRIPTION
N	NEUTRAL
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
OL	OVERLOAD RELAY
ORN	ORANGE
P	POLE
PB	PUSHBUTTON SWITCH
PS	PRESSURE SWITCH, POWER SUPPLY
PT	PRESSURE TRANSMITTER
PIT	PRESSURE TO CURRENT TRANSDUCER
RTD	RESISTIVE TEMPERATURE DETECTOR
REV	REVERSE
SR	SAFETY RELAY
SS	SELECTOR SWITCH
SV	SOLENOID VALVE
TB	TERMINAL BLOCK
TC	THERMOCOUPLE
TDR	TIME DELAY RELAY
V	VOLTAGE
VA	VOLT AMPS
VFD	VARIABLE FREQUENCY DRIVE
VIO	VIOLET
W	WATT
WHT	WHITE
XFMR	TRANSFORMER
YEL	YELLOW
Ø	PHASE

FUSE SCHEDULE

FUSE#	QTY	FUSE TYPE	SIZE	MFGR	PART#	DESCRIPTION
FB01-FB24	24	CLASS CC	1A	MERSEN	ATDR1	CONTROL STATION POWER
FB25	1	5x20mm	10A	LITTELFUSE	218-010	PLC LOCAL RACK PS
FB26	1	5x20mm	10A	LITTELFUSE	218-010	PLC REMOTE RACK PS
FB27	1	5x20mm	5A	LITTELFUSE	218-005	GFCI OUTLET
FB28	1	5x20mm	2A	LITTELFUSE	218-002	PANEL LIGHT
FB29-FB36	8	5x20mm	2A	LITTELFUSE	218-002	OUTPUT MODULES
FB37	1	5x20mm	5A	LITTELFUSE	218-005	24VDC POWER SUPPLY
FB38	1	5x20mm	5A	LITTELFUSE	218-005	24VDC
FB39-FB46	8	CLASS CC	1A	MERSEN	ATDR01	SPEED SENSOR & LIMIT SW
FB100	1	CLASS CC	20A	MERSEN	ATDR20	PLC PANEL POWER

LABEL DEFINITIONS

WIRE NUMBERS

E01A20A01
- LINE NUMBER ON THE DRAWING (01, 02, ETC.)
- WIRE POSITION ON THE LINE (A, B, ETC.)
- DRAWING NUMBER (E01A30, E01A40, ETC.)

THREE LINE WIRE NUMBERS

280-L100A
- WIRE POSITION
- A TWO DIGIT NUMBER
- PHASE
- A LETTER FOR SEPARATION
- VOLTAGE

CROSS REFERENCES

(E01A20:01)
- RAIL NUMBER
- DRAWING NUMBER

DRAWING NUMBERS

AA000-E01A20
- THESE TWO CHARACTERS INDICATE THE TYPE OF DRAWING
- LETTER INDICATES IF THIS IS THE ORIGINAL PROJECT OR SUBSEQUENT BUT ESSENTIALLY IDENTICAL PROJECT
- PANEL DESIGNATION WITHIN THE PROJECT. 00=DRAWINGS FOR PROJECT, BUT NOT PANEL SPECIFIC, 01=FIRST PANEL, 02=SECOND PANEL, ETC.
- DESIGNATES THE DRAWING AS ELECTRICAL
- PROJECT NUMBER

PANEL DRAWING INDEX

WIRE COLOR CODE

COLOR	DESCRIPTION
BLACK	ALL UNGROUNDED CIRCUIT CONDUCTORS OPERATING AT A VOLTAGE GREATER THAN 120VAC
WHITE OR GREY	GROUNDED AC CURRENT CARRYING CONTROL CIRCUIT CONDUCTOR
GREEN OR GREEN/YELLOW	GROUNDING CONDUCTOR
BLUE	UNGROUNDED DC CONTROL CIRCUITS
WHITE/BLUE STRIPE	DC COMMON CONTROL CIRCUIT CONDUCTOR
ORANGE	UNGROUNDED CONTROL CIRCUITS OR OTHER WIRING THAT MAY BE ENERGIZED WHEN MAIN DISCONNECT IS OFF
WHITE/ORANGE STRIPE	GROUNDED AC CONTROL CIRCUIT CURRENT CARRYING CONDUCTOR THAT REMAINS ENERGIZED WHEN THE MAIN DISCONNECT IS IN THE OFF POSITION
RED	UNGROUNDED CIRCUIT CONDUCTORS OPERATING AT 120VAC
VARIES	ANALOG INPUT, 2 COND. (SHIELDED)
VARIES	ANALOG OUTPUT, 2 COND. (SHIELDED)

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - INDEX SHEET

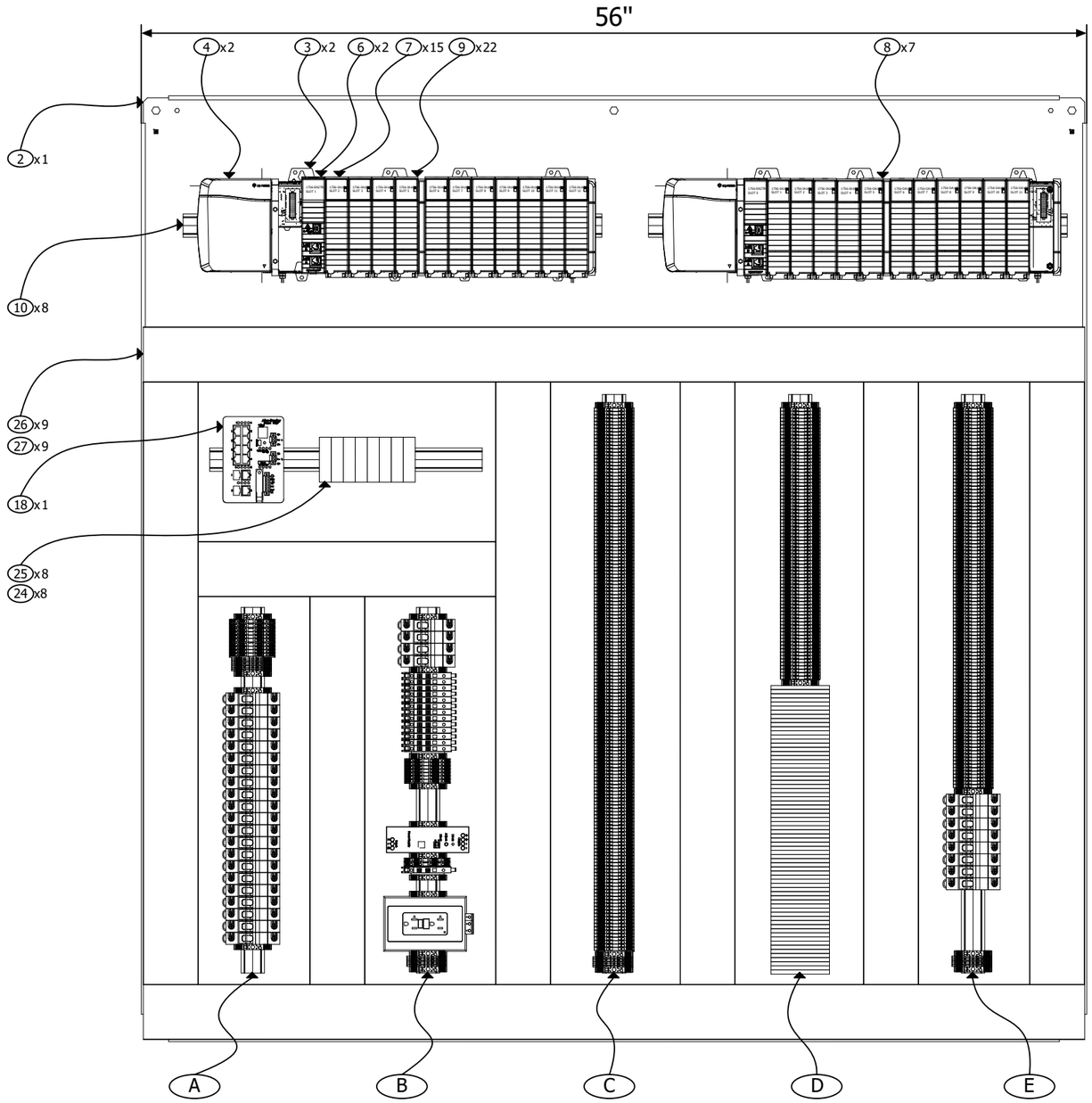
PROJECT # CMS203 | SCALE N/A | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
4.0	08/02/21	ekilgore	AS-BUILT

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT
3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
2.0	09/04/20	ekilgore	SUBMITTAL APPROVED. RELEASED FOR FABRICATION.
1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

DWG # CMS203-E01A00



SEE DWG E01A03 FOR TERMINAL BLOCK LAYOUT

SEE DWG E01A03 FOR TERMINAL BLOCK LAYOUT

SEE DWG E01A04 FOR TERMINAL BLOCK LAYOUT

SEE DWG E01A04 FOR TERMINAL BLOCK LAYOUT

SEE DWG E01A05 FOR TERMINAL BLOCK LAYOUT

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - BACK PANEL LAYOUT

PROJECT # CMS203 | SCALE 1:8 | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT
2.1	09/04/20	ekilgore	SHOP REDLINES

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
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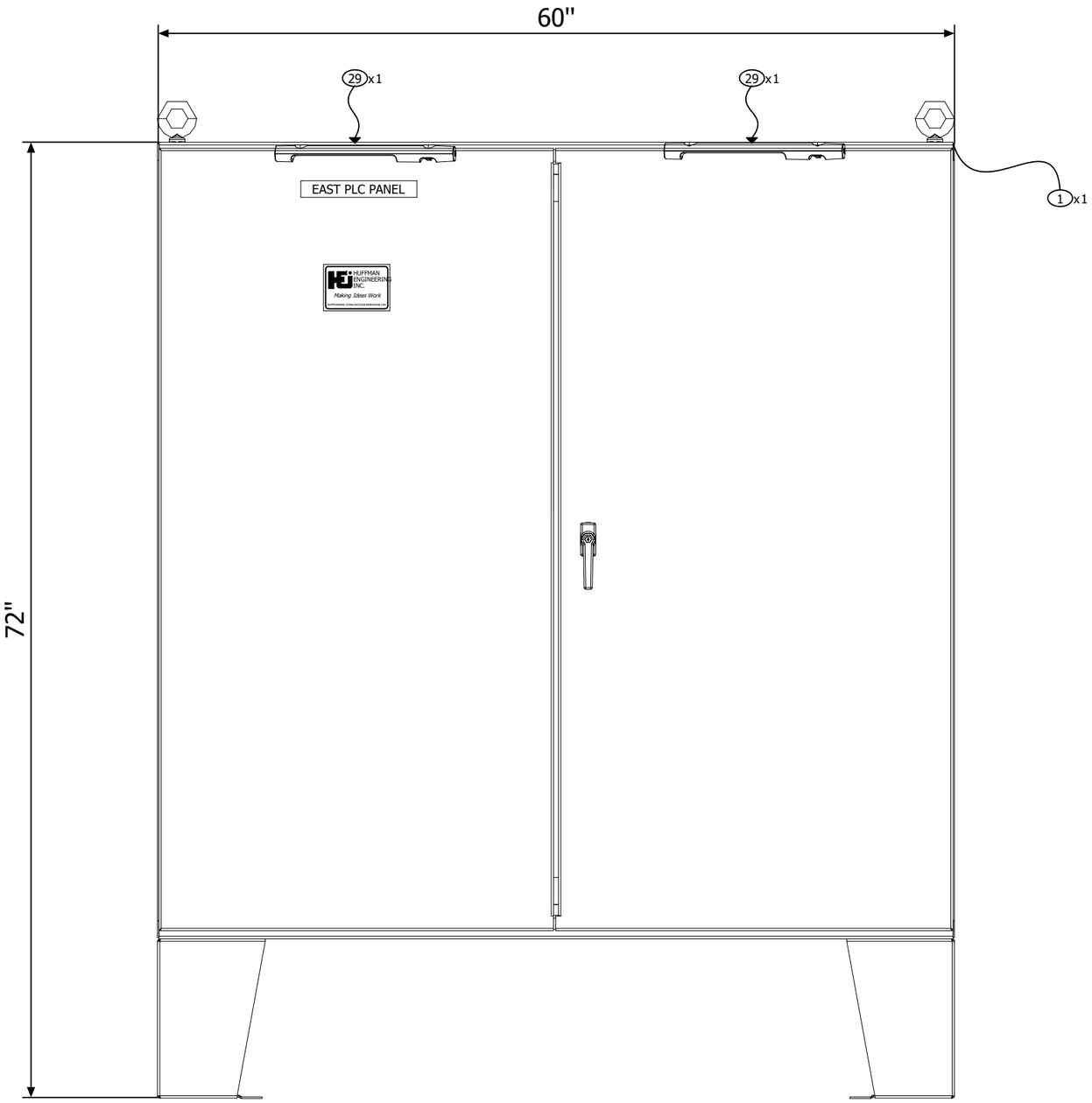
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT
3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
2.0	09/04/20	ekilgore	SUBMITTAL APPROVED. RELEASED FOR FABRICATION.
1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

DWG # CMS203-E01A01

CUSTOM BUILT BY	HUFFMAN ENGINEERING INC.	5301 North 57th Street Lincoln, NE 68507 402-464-6823	
PROJECT #	CMS203	DATE	APR 2020
PANEL #	EAST PLC PANEL		
INTERRUPT RATING	200kA	TOTAL FLA	20
LARGEST MTR FLA	N/A	SCCR	10kA
VOLTS 120	HZ. 60	PHASE 1	ENCL TYP 12
ELECT DWG INDEX #	CMS203-E01A00		

LEGEND PLATE SCHEDULE				
ITEM NO.	FIRST LINE	LEGEND PLATE COLOR	TEXT COLOR	TEXT HEIGHT
T.0	EAST PLC PANEL	BLACK	WHITE	1/2"



DEPTH = 16"

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - FRONT PANEL LAYOUT

PROJECT # CMS203 | SCALE 1:10 | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT
4.0	08/02/21	ekilgore	AS-BUILT
2.1	09/04/20	ekilgore	SHOP REDLINES

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
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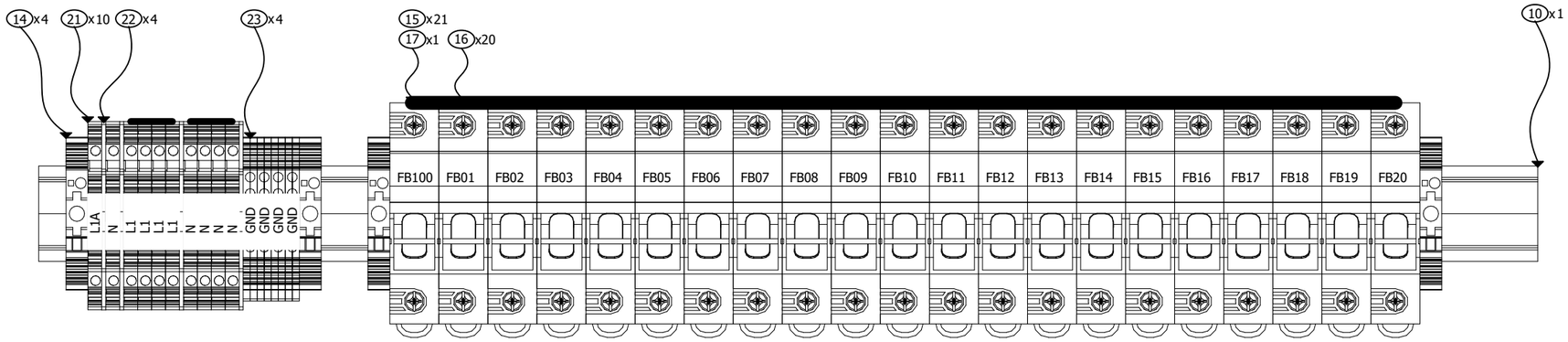
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT
3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
2.0	09/04/20	ekilgore	SUBMITTAL APPROVED. RELEASED FOR FABRICATION.
1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

DWG # CMS203-E01A02

A

DIN RAIL TO
INCLUDE STANDOFFS



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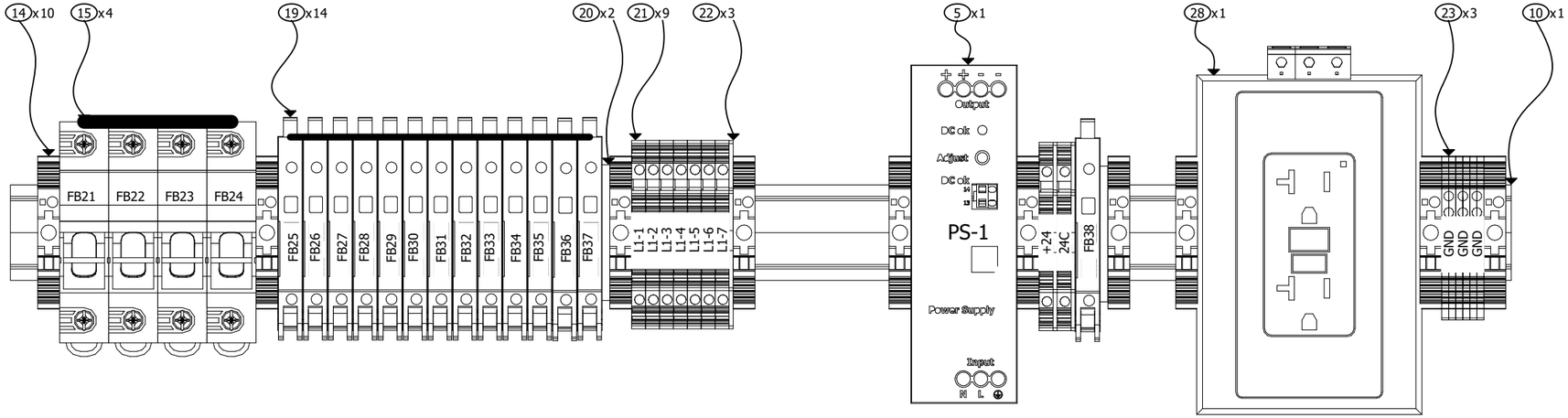
DIN RAIL TO
INCLUDE STANDOFFS



STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - TERMINAL BLOCK LAYOUTS

PROJECT # CMS203 | SCALE N/A | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
4.0	08/02/21	ekilgore	AS-BUILT
2.1	09/04/20	ekilgore	SHOP REDLINES

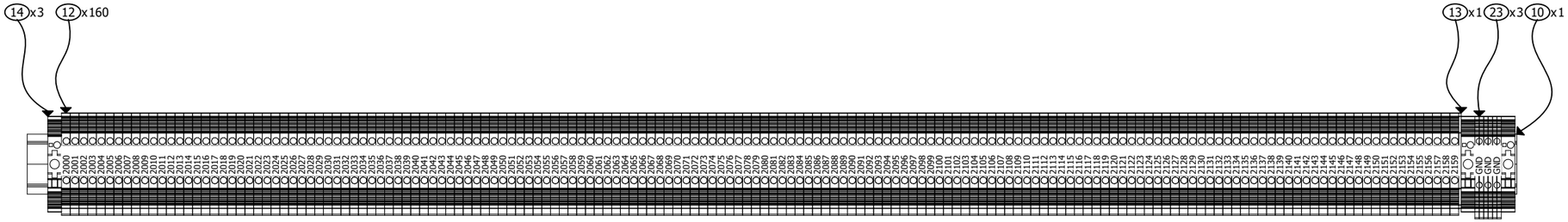
HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT
3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
2.0	09/04/20	ekilgore	SUBMITTAL APPROVED. RELEASED FOR FABRICATION.
1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

DWG # CMS203-E01A03

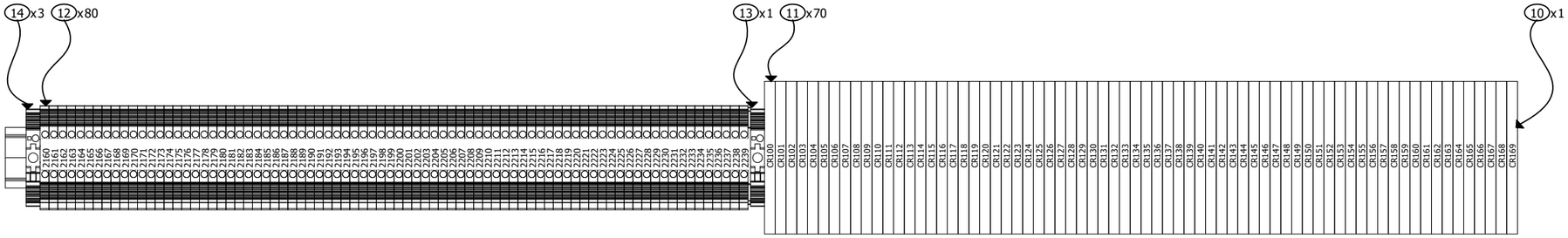
C

DIN RAIL TO
INCLUDE STANDOFFS



D

DIN RAIL TO
INCLUDE STANDOFFS



STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - TERMINAL BLOCK LAYOUTS

PROJECT # CMS203 | SCALE N/A | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT
2.1	09/04/20	ekilgore	SHOP REDLINES

HUFFMAN ENGINEERING INC.

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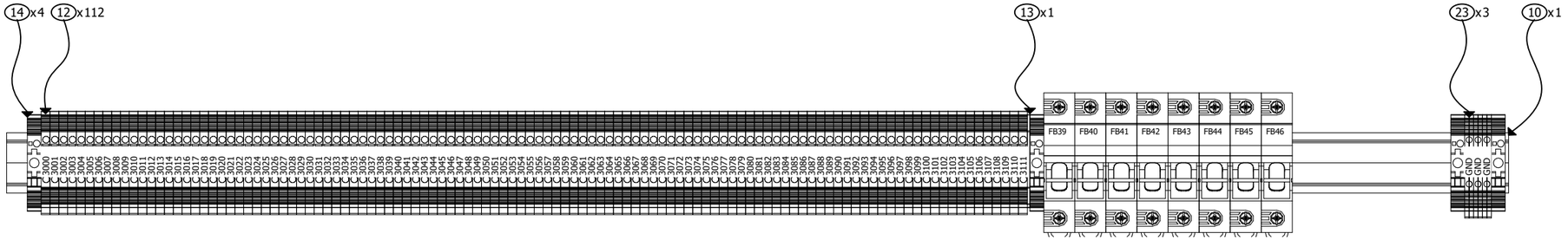
LINCOLN, NEBRASKA 68507
(402) 464-6823

112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT
3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
2.0	09/04/20	ekilgore	SUBMITTAL APPROVED. RELEASED FOR FABRICATION.
1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

DWG # CMS203-E01A04



E

DIN RAIL TO
INCLUDE STANDOFFS

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - TERMINAL BLOCK LAYOUTS

PROJECT # CMS203 | SCALE N/A | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
4.0	08/02/21	ekilgore	AS-BUILT
2.1	09/04/20	ekilgore	SHOP REDLINES

HUFFMAN ENGINEERING INC.
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3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
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1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

DWG # CMS203-E01A05

ITEM #	QTY	MANUFACTURER	MANUFACTURERS P/N	DESCRIPTION
1	1	HOFFMAN	A606016LPG	60"X60"X16" ENCLOSURE WITH STANDS
2	1	HOFFMAN	A60P60	60"X60" BACKPANEL
3	2	ALLEN-BRADLEY	1756-A13	CONTROLLOGIX CHASSIS 13-SLOT
4	2	ALLEN-BRADLEY	1756-PA72	CONTROLLOGIX 85-265VAC, 10A POWER SUPPLY
5	1	ALLEN-BRADLEY	1606-XLB120E	24VDC, 5A POWER SUPPLY
6	2	ALLEN-BRADLEY	1756-EN2TR	CONTROLLOGIX HIGH CAPACITY DUAL PORT ETHERNET/IP MODULE
7	15	ALLEN-BRADLEY	1756-IA16I	CONTROLLOGIX 16 CH. 120VAC ISOLATED DIGITAL INPUT MODULE
8	7	ALLEN-BRADLEY	1756-OA16I	CONTROLLOGIX 16 CH. ISOLATED DIGITAL OUTPUT MODULE
9	22	ALLEN-BRADLEY	1756-TBCH	CONTROLLOGIX MODULE TERMINAL BLOCK
10	8	ENTRELEC	101 598.26	DIN MOUNTING RAIL
11	70	ALLEN-BRADLEY	700-HLT1U1	SPDT RELAY, 6A, 120VAC COIL
12	352	ALLEN-BRADLEY	1492-J3	TERMINAL BLOCK 1 TIER
13	3	ALLEN-BRADLEY	1492-EBJ3	TERMINAL BLOCK 1 TIER END BARRIER
14	24	ALLEN-BRADLEY	1492-EAJ35	TERMINAL BLOCK END ANCHOR
15	41	ALLEN-BRADLEY	1492-FB1C30-L	CLASS CC FUSE HOLDER, 1P, WITH INDICATION
16	40	MERSEN	ATDR1	1A FUSE, CLASS CC FUSE
17	1	MERSEN	ATDR20	20A FUSE, CLASS CC FUSE
18	1	ALLEN-BRADLEY	1783-BMS10CA	STRATIX 5700 10 PORT MANAGED SWITCH
19	14	ALLEN-BRADLEY	1492-H4	FUSE TERMINAL BLOCK WITH INDICATION
20	2	ALLEN-BRADLEY	1492-N37	FUSE TERMINAL BLOCK END BARRIER
21	19	ALLEN-BRADLEY	1492-JD3C	TERMINAL BLOCK, 1P, 2 TIER
22	7	ALLEN-BRADLEY	1492-EBJD3	TERMINAL BLOCK, 2 TIER, GRAY, END BARRIER
23	13	ALLEN-BRADLEY	1492-JG3	TERMINAL BLOCK, 2 TIER, GROUNDING
24	8	SIGNAMAX	KI-DIN-RMM-SL	DIN RAIL KEYSTONE JACK HOUSING
25	8	SIGNAMAX	KJ458MT-C6C-GY	CAT 6 KEYSTONE JACK
26	9	PANDUIT	F3X4LG6	NARROW SLOTTED WIRING DUCT, PVC
27	9	PANDUIT	C3LG6	3" WIRING DUCT COVER
28	1	PHOENIX CONTACT	5600462	RECEPTACLE, 120VAC, 15A, GFI
29	2	HOFFMAN	LEDA1S35	ENCLOSURE LIGHT, 120V, LED

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - BILL OF MATERIAL

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT

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REV	DATE	NAME	REMARKS
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3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
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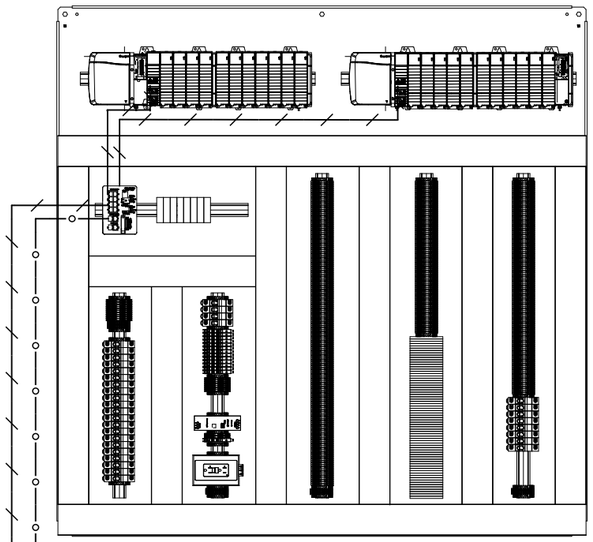
1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

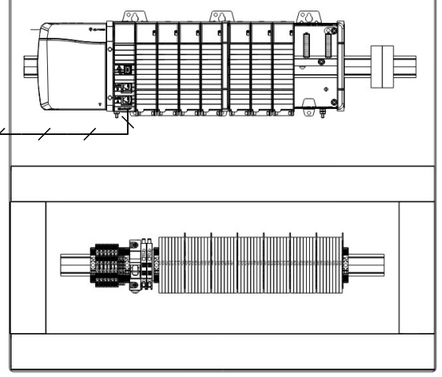
DWG # CMS203-E01A06

CAT 6 ETHERNET
FIBER OPTIC CABLE

WEST PLC PANEL



WEST RTD ENCLOSURE



MCC-1 WEST
2 STRATIX SWITCHES

EF-1, EF-2
EF-3, EF-4
SF-1, SF-2
SF-3, SF-4
100HP VFDS

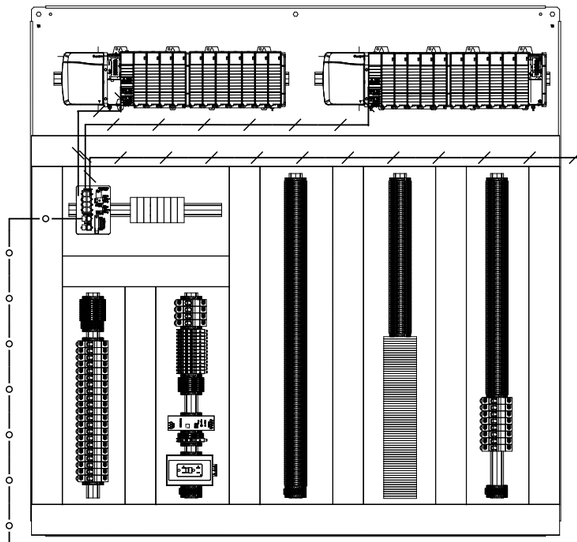
EF-1, EF-2
EF-3, EF-4
SF-1, SF-2
SF-3, SF-4
600HP VFDS

MCC-1 EAST
2 STRATIX SWITCHES

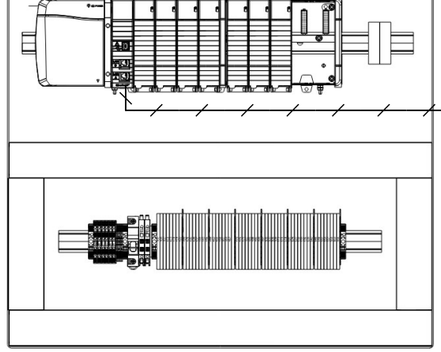
EF-1, EF-2
EF-3, EF-4
SF-1, SF-2
SF-3, SF-4
100HP VFDS

EF-1, EF-2
EF-3, EF-4
SF-1, SF-2
SF-3, SF-4
600HP VFDS

EAST PLC PANEL



EAST RTD ENCLOSURE



WEST SCADA RACK

WEST 480V SWGR

EAST 480V SWGR

EAST SCADA RACK

DELL KVM SWITCH

DELL SCADA SERVER
AND ATTACHED STORAGE

STRATIX ETHERNET SWITCH

CORNING FIBER PANEL

PRIMARY PLC CHASSIS

SECONDARY PLC CHASSIS

SIEMENS ETHERNET SWITCH

DELL KVM SWITCH

DELL SCADA SERVER
AND ATTACHED STORAGE

STRATIX ETHERNET SWITCH

CORNING FIBER PANEL

PRIMARY PLC CHASSIS

SECONDARY PLC CHASSIS

SIEMENS ETHERNET SWITCH

EAST WORKSTATION

SOUTH TUNNEL PLC

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - COMMUNICATIONS OVERVIEW

PROJECT # CMS203 | SCALE N/A | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
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REV	DATE	NAME	REMARKS
5.0	09/17/21	ekilgore	FIELD MODIFICATIONS
5.0	09/17/21	ekilgore	FIELD MODIFICATIONS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT
3.1	09/28/20	ekilgore	ADDED SWBD
1.2	08/31/20	ekilgore	RFI RESPONSE
1.1	06/18/20	ekilgore	SUBMITTAL REV D
0.1	05/08/20	ekilgore	DESIGN CHANGES

DWG # CMS203-E01A09

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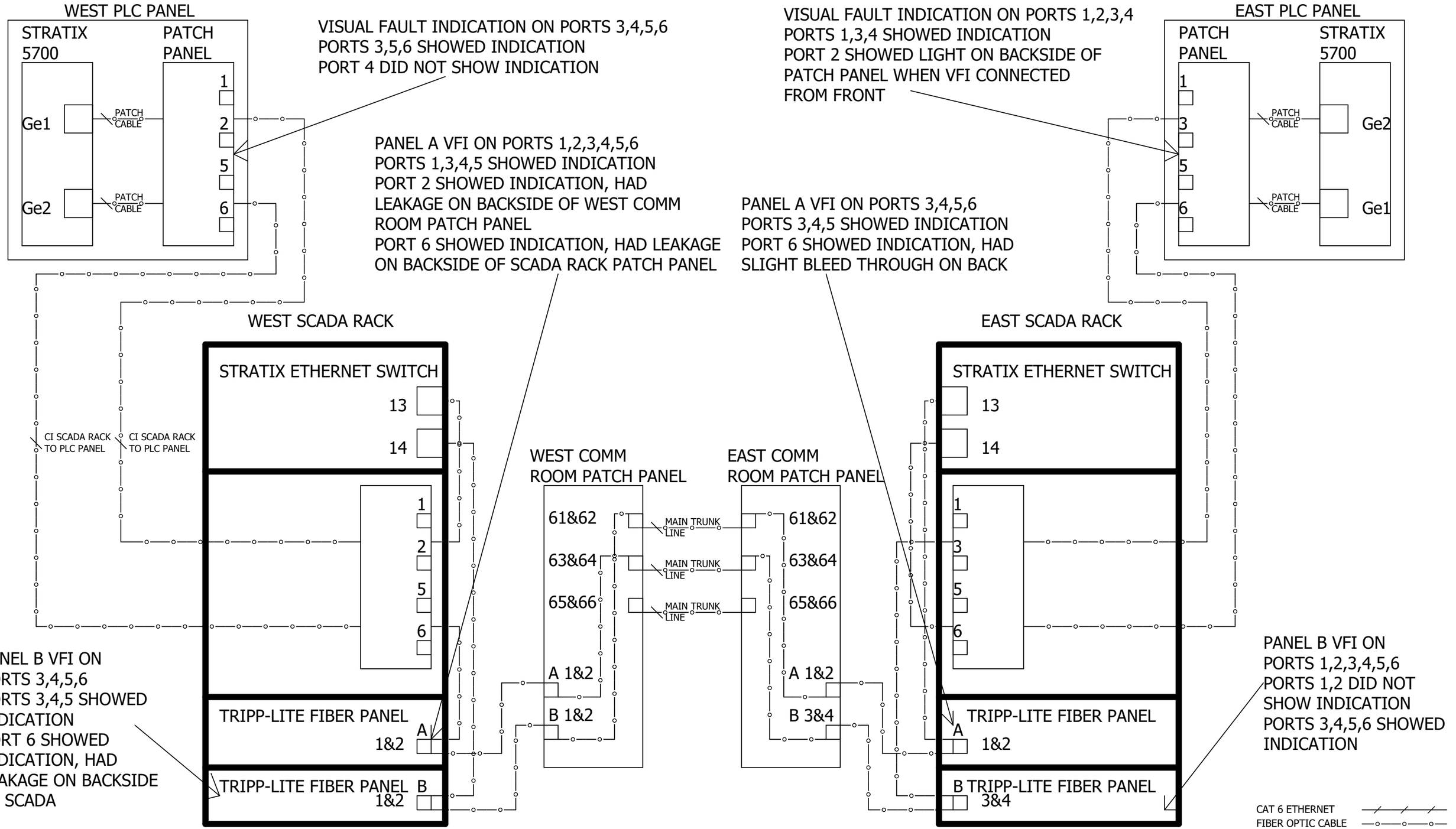

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

FIBER TESTING RESULTS

PROJECT # CMS203 | SCALE N/A | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
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REV	DATE	NAME	REMARKS
4.1	04/26/21	ekilgore	FIBER TESTING RESULTS
4.0	04/26/21	ekilgore	FIBER TESTING RESULTS
	04/26/21	ekilgore	New page created
3.1	09/28/20	ekilgore	ADDED SWBD
1.2	08/31/20	ekilgore	RFI RESPONSE
1.1	06/18/20	ekilgore	SUBMITTAL REV D
0.1	05/08/20	ekilgore	DESIGN CHANGES

DWG # CMS203-E01A09A

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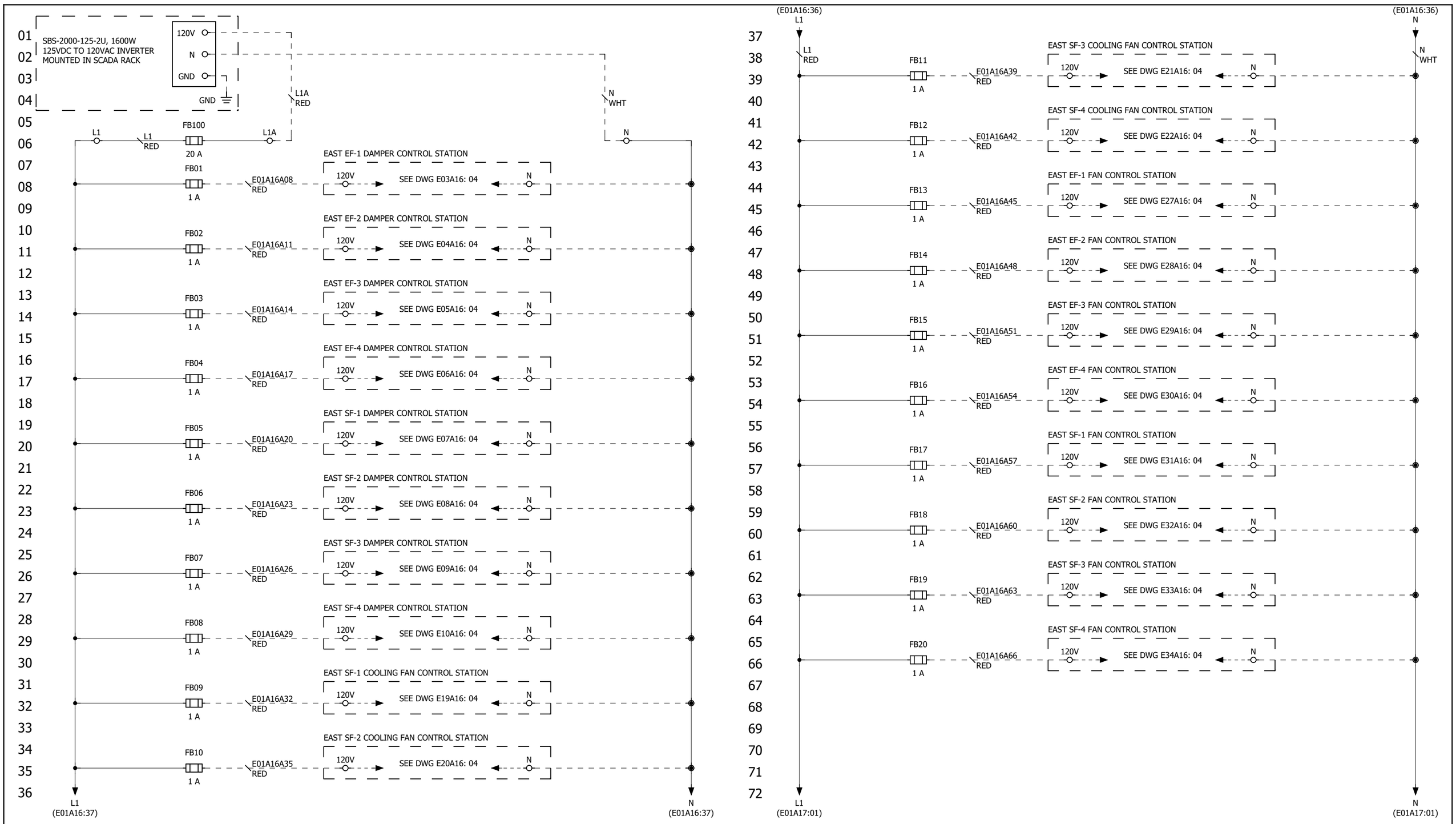

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - CONTROL POWER DISTRIBUTION

PROJECT # CMS203 | SCALE N/A | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
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LINCOLN, NEBRASKA 68507
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REV	DATE	NAME	REMARKS
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DWG # CMS203-E01A16

(E01A16:72)
L1

(E01A16:72)
N

(E01A17:36)
L1

(E01A17:36)
N

L1
RED

N
WHT

L1
RED

N
WHT

FB22
1 A
SPARE

FB23
1 A
SPARE

FB24
1 A
SPARE

1756-PA72
CONTROLLOGIX PLC RACK
120VAC POWER SUPPLY

FB25
10 A
E01A17A15
RED
L1
L2
GND
GND

1756-PA72
CONTROLLOGIX I/O RACK
120VAC POWER SUPPLY

FB26
10 A
E01A17A21
RED
L1
L2
GND
GND

GFCI
OUTLET

FB27
5 A
E01A16A26
RED

FB28
2 A
E01A17A29
RED

PANEL LIGHT

PANEL LIGHT

FB29
2 A
L1-1
RED
TO T'BLK L1-1
DISCRETE OUTPUTS REMOTE RACK SLOT 5
SEE DWG E01A30

FB30
2 A
L1-2
RED
TO T'BLK L1-2
DISCRETE OUTPUTS REMOTE RACK SLOT 6
SEE DWG E01A31

FB31
2 A
L1-3
RED
TO T'BLK L1-3
DISCRETE OUTPUTS REMOTE RACK SLOT 7
SEE DWG E01A32

FB32
2 A
L1-4
RED
TO T'BLK L1-4
DISCRETE OUTPUTS REMOTE RACK SLOT 8
SEE DWG E01A33

FB33
2 A
L1-5
RED
TO T'BLK L1-5
DISCRETE OUTPUTS REMOTE RACK SLOT 9
SEE DWG E01A34

FB34
2 A
L1-6
RED
TO T'BLK L1-6
DISCRETE OUTPUTS REMOTE RACK SLOT 10
SEE DWG E01A35

FB35
2 A
L1-7
RED
TO T'BLK L1-7
DISCRETE OUTPUTS REMOTE RACK SLOT 11
SEE DWG E01A36

FB36
2 A
SPARE

PS-1
24VDC, 5A POWER SUPPLY
1606-XLB120E

FB37
5 A
E01A17A59
RED
PE
L
N
OUT1+
OUT2+
OUT1-
OUT2-
E01A17A58
BLU
FB38
5 A
+24
+24
BLU
24C
24C
WHT/BLU

1783-BMS10CA
10 PORT STRATIX SWITCH
PWR A DC+
PWR A DC-

L1
(E01A17:37)

N
(E01A17:37)

L1
(E01A20:01)

N
(E01A20:01)

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - CONTROL POWER DISTRIBUTION

PROJECT # CMS203

SCALE

ENG:E. KILGORE

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

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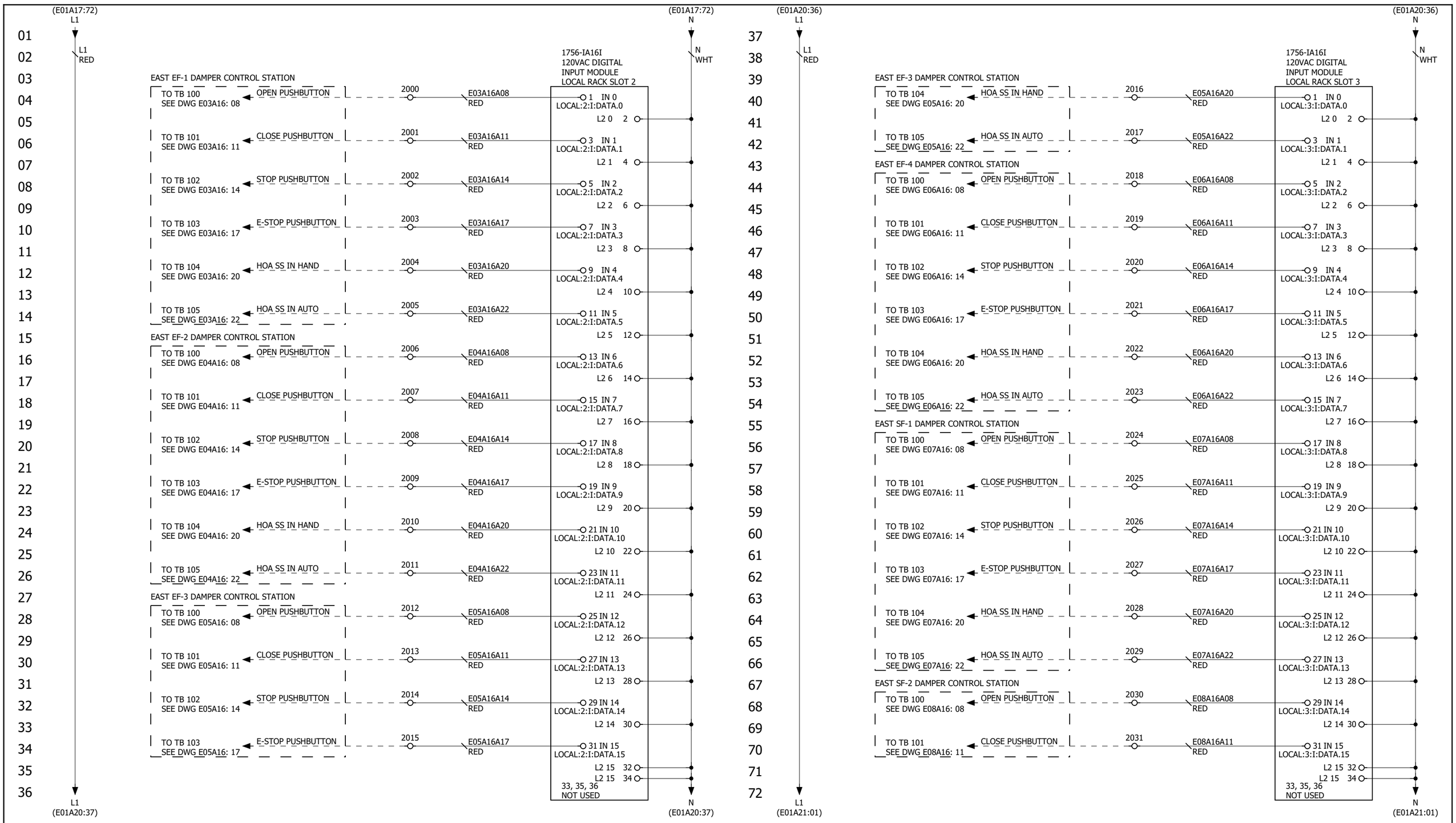
DWG # CMS203-E01A17

(E01A17:72)
L1

(E01A17:72)
N

(E01A20:36)
L1

(E01A20:36)
N



L1
(E01A20:37)

N
(E01A20:37)

L1
(E01A21:01)

N
(E01A21:01)

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - DISCRETE INPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

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DWG # CMS203-E01A20

(E01A20:72)
L1

(E01A20:72)
N

(E01A21:36)
L1

(E01A21:36)
N

L1
RED

N
WHT

1756-IA16I
120VAC DIGITAL
INPUT MODULE
LOCAL RACK SLOT 4

EAST SF-2 DAMPER CONTROL STATION

TO TB 102 SEE DWG E08A16: 14	STOP PUSHBUTTON	2032	E08A16A14 RED	1 IN 0 LOCAL:4:I:DATA.0	L2 0 2
TO TB 103 SEE DWG E08A16: 17	E-STOP PUSHBUTTON	2033	E08A16A17 RED	3 IN 1 LOCAL:4:I:DATA.1	L2 1 4
TO TB 104 SEE DWG E08A16: 20	HOA SS IN HAND	2034	E08A16A20 RED	5 IN 2 LOCAL:4:I:DATA.2	L2 2 6
TO TB 105 SEE DWG E08A16: 22	HOA SS IN AUTO	2035	E08A16A22 RED	7 IN 3 LOCAL:4:I:DATA.3	L2 3 8

EAST SF-3 DAMPER CONTROL STATION

TO TB 100 SEE DWG E09A16: 08	OPEN PUSHBUTTON	2036	E09A16A08 RED	9 IN 4 LOCAL:4:I:DATA.4	L2 4 10
TO TB 101 SEE DWG E09A16: 11	CLOSE PUSHBUTTON	2037	E09A16A11 RED	11 IN 5 LOCAL:4:I:DATA.5	L2 5 12
TO TB 102 SEE DWG E09A16: 14	STOP PUSHBUTTON	2038	E09A16A14 RED	13 IN 6 LOCAL:4:I:DATA.6	L2 6 14
TO TB 103 SEE DWG E09A16: 17	E-STOP PUSHBUTTON	2039	E09A16A17 RED	15 IN 7 LOCAL:4:I:DATA.7	L2 7 16
TO TB 104 SEE DWG E09A16: 20	HOA SS IN HAND	2040	E09A16A20 RED	17 IN 8 LOCAL:4:I:DATA.8	L2 8 18
TO TB 105 SEE DWG E09A16: 22	HOA SS IN AUTO	2041	E09A16A22 RED	19 IN 9 LOCAL:4:I:DATA.9	L2 9 20

EAST SF-4 DAMPER CONTROL STATION

TO TB 100 SEE DWG E10A16: 08	OPEN PUSHBUTTON	2042	E10A16A08 RED	21 IN 10 LOCAL:4:I:DATA.10	L2 10 22
TO TB 101 SEE DWG E10A16: 11	CLOSE PUSHBUTTON	2043	E10A16A11 RED	23 IN 11 LOCAL:4:I:DATA.11	L2 11 24
TO TB 102 SEE DWG E10A16: 14	STOP PUSHBUTTON	2044	E10A16A14 RED	25 IN 12 LOCAL:4:I:DATA.12	L2 12 26
TO TB 103 SEE DWG E10A16: 17	E-STOP PUSHBUTTON	2045	E10A16A17 RED	27 IN 13 LOCAL:4:I:DATA.13	L2 13 28
TO TB 104 SEE DWG E10A16: 20	HOA SS IN HAND	2046	E10A16A20 RED	29 IN 14 LOCAL:4:I:DATA.14	L2 14 30
TO TB 105 SEE DWG E10A16: 22	HOA SS IN AUTO	2047	E10A16A22 RED	31 IN 15 LOCAL:4:I:DATA.15	L2 15 32 L2 15 34

33, 35, 36
NOT USED

L1
(E01A21:37)

N
(E01A21:37)

L1
(E01A22:01)

N
(E01A22:01)

L1
RED

N
WHT

1756-IA16I
120VAC DIGITAL
INPUT MODULE
LOCAL RACK SLOT 5

EAST SF-1 COOLING FAN CONTROL STATION

TO TB 100 SEE DWG E19A16: 08	LOW SPEED PUSHBUTTON	2048	E19A16A08 RED	1 IN 0 LOCAL:5:I:DATA.0	L2 0 2
TO TB 101 SEE DWG E19A16: 10	HIGH SPEED PUSHBUTTON	2049	E19A16A10 RED	3 IN 1 LOCAL:5:I:DATA.1	L2 1 4
TO TB 102 SEE DWG E19A16: 12	STOP PUSHBUTTON	2050	E19A16A12 RED	5 IN 2 LOCAL:5:I:DATA.2	L2 2 6
TO TB 103 SEE DWG E19A16: 14	E-STOP PUSHBUTTON	2051	E19A16A14 RED	7 IN 3 LOCAL:5:I:DATA.3	L2 3 8
TO TB 104 SEE DWG E09A16: 17	HOA SS IN HAND	2052	E19A16A17 RED	9 IN 4 LOCAL:5:I:DATA.4	L2 4 10
TO TB 105 SEE DWG E09A16: 19	HOA SS IN AUTO	2053	E19A16A19 RED	11 IN 5 LOCAL:5:I:DATA.5	L2 5 12

EAST SF-2 COOLING FAN CONTROL STATION

TO TB 100 SEE DWG E20A16: 08	LOW SPEED PUSHBUTTON	2054	E20A16A08 RED	13 IN 6 LOCAL:5:I:DATA.6	L2 6 14
TO TB 101 SEE DWG E20A16: 10	HIGH SPEED PUSHBUTTON	2055	E20A16A10 RED	15 IN 7 LOCAL:5:I:DATA.7	L2 7 16
TO TB 102 SEE DWG E20A16: 12	STOP PUSHBUTTON	2056	E20A16A12 RED	17 IN 8 LOCAL:5:I:DATA.8	L2 8 18
TO TB 103 SEE DWG E20A16: 14	E-STOP PUSHBUTTON	2057	E20A16A14 RED	19 IN 9 LOCAL:5:I:DATA.9	L2 9 20
TO TB 104 SEE DWG E20A16: 17	HOA SS IN HAND	2058	E20A16A17 RED	21 IN 10 LOCAL:5:I:DATA.10	L2 10 22
TO TB 105 SEE DWG E20A16: 19	HOA SS IN AUTO	2059	E20A16A19 RED	23 IN 11 LOCAL:5:I:DATA.11	L2 11 24

EAST SF-3 COOLING FAN CONTROL STATION

TO TB 100 SEE DWG E21A16: 08	LOW SPEED PUSHBUTTON	2060	E21A16A08 RED	25 IN 12 LOCAL:5:I:DATA.12	L2 12 26
TO TB 101 SEE DWG E21A16: 10	HIGH SPEED PUSHBUTTON	2061	E21A16A10 RED	27 IN 13 LOCAL:5:I:DATA.13	L2 13 28
TO TB 102 SEE DWG E21A16: 12	STOP PUSHBUTTON	2062	E21A16A12 RED	29 IN 14 LOCAL:5:I:DATA.14	L2 14 30
TO TB 103 SEE DWG E21A16: 14	E-STOP PUSHBUTTON	2063	E21A16A14 RED	31 IN 15 LOCAL:5:I:DATA.15	L2 15 32 L2 15 34

33, 35, 36
NOT USED

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - DISCRETE INPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT
3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
2.0	09/04/20	ekilgore	SUBMITTAL APPROVED. RELEASED FOR FABRICATION.
1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

DWG # CMS203-E01A21

(E01A21:72)
L1

(E01A21:72)
N

1756-IA16I
120VAC DIGITAL
INPUT MODULE
LOCAL RACK SLOT 6

EAST SF-3 COOLING FAN CONTROL STATION

TO TB 104
SEE DWG E21A16: 17
HOA SS IN HAND
2064
E21A16A17
RED
1 IN 0
LOCAL:6:I:DATA.0
L2 0 2

TO TB 105
SEE DWG E21A16: 19
HOA SS IN AUTO
2065
E21A16A19
RED
3 IN 1
LOCAL:6:I:DATA.1
L2 1 4

EAST SF-4 COOLING FAN CONTROL STATION

TO TB 100
SEE DWG E22A16: 08
LOW SPEED PUSHBUTTON
2066
E22A16A08
RED
5 IN 2
LOCAL:6:I:DATA.2
L2 2 6

TO TB 101
SEE DWG E22A16: 10
HIGH SPEED PUSHBUTTON
2067
E22A16A10
RED
7 IN 3
LOCAL:6:I:DATA.3
L2 3 8

TO TB 102
SEE DWG E22A16: 12
STOP PUSHBUTTON
2068
E22A16A12
RED
9 IN 4
LOCAL:6:I:DATA.4
L2 4 10

TO TB 103
SEE DWG E22A16: 14
E-STOP PUSHBUTTON
2069
E22A16A14
RED
11 IN 5
LOCAL:6:I:DATA.5
L2 5 12

TO TB 104
SEE DWG E22A16: 17
HOA SS IN HAND
2070
E22A16A17
RED
13 IN 6
LOCAL:6:I:DATA.6
L2 6 14

TO TB 105
SEE DWG E22A16: 19
HOA SS IN AUTO
2071
E22A16A19
RED
15 IN 7
LOCAL:6:I:DATA.7
L2 7 16

EAST EF-1 FAN CONTROL STATION

TO TB 100
SEE DWG E27A16: 09
HOA SS IN HAND
2072
E27A16A09
RED
17 IN 8
LOCAL:6:I:DATA.8
L2 8 18

TO TB 101
SEE DWG E27A16: 11
HOA SS IN AUTO
2073
E27A16A11
RED
19 IN 9
LOCAL:6:I:DATA.9
L2 9 20

TO TB 102
SEE DWG E27A16: 13
25% SPEED PUSHBUTTON
2074
E27A16A13
RED
21 IN 10
LOCAL:6:I:DATA.10
L2 10 22

TO TB 103
SEE DWG E27A16: 15
50% SPEED PUSHBUTTON
2075
E27A16A15
RED
23 IN 11
LOCAL:6:I:DATA.11
L2 11 24

TO TB 104
SEE DWG E27A16: 17
100% SPEED PUSHBUTTON
2076
E27A16A17
RED
25 IN 12
LOCAL:6:I:DATA.12
L2 12 26

TO TB 105
SEE DWG E27A16: 19
STOP PUSHBUTTON
2077
E27A16A19
RED
27 IN 13
LOCAL:6:I:DATA.13
L2 13 28

TO TB 106
SEE DWG E27A16: 21
E-STOP PUSHBUTTON
2078
E27A16A21
RED
29 IN 14
LOCAL:6:I:DATA.14
L2 14 30

EAST EF-2 FAN CONTROL STATION

TO TB 100
SEE DWG E28A16: 09
HOA SS IN HAND
2079
E28A16A09
RED
31 IN 15
LOCAL:6:I:DATA.15
L2 15 32
L2 15 34

33, 35, 36
NOT USED

L1
(E01A22:37)

N
(E01A22:37)

(E01A22:36)
L1

(E01A22:36)
N

1756-IA16I
120VAC DIGITAL
INPUT MODULE
LOCAL RACK SLOT 7

EAST EF-2 FAN CONTROL STATION

TO TB 101
SEE DWG E28A16: 11
HOA SS IN AUTO
2080
E28A16A11
RED
1 IN 0
LOCAL:7:I:DATA.0
L2 0 2

TO TB 102
SEE DWG E28A16: 13
25% SPEED PUSHBUTTON
2081
E28A16A13
RED
3 IN 1
LOCAL:7:I:DATA.1
L2 1 4

TO TB 103
SEE DWG E28A16: 15
50% SPEED PUSHBUTTON
2082
E28A16A15
RED
5 IN 2
LOCAL:7:I:DATA.2
L2 2 6

TO TB 104
SEE DWG E28A16: 17
100% SPEED PUSHBUTTON
2083
E28A16A17
RED
7 IN 3
LOCAL:7:I:DATA.3
L2 3 8

TO TB 105
SEE DWG E28A16: 19
STOP PUSHBUTTON
2084
E28A16A19
RED
9 IN 4
LOCAL:7:I:DATA.4
L2 4 10

TO TB 106
SEE DWG E28A16: 21
E-STOP PUSHBUTTON
2085
E28A16A21
RED
11 IN 5
LOCAL:7:I:DATA.5
L2 5 12

EAST EF-3 FAN CONTROL STATION

TO TB 100
SEE DWG E29A16: 09
HOA SS IN HAND
2086
E29A16A09
RED
13 IN 6
LOCAL:7:I:DATA.6
L2 6 14

TO TB 101
SEE DWG E29A16: 11
HOA SS IN AUTO
2087
E29A16A11
RED
15 IN 7
LOCAL:7:I:DATA.7
L2 7 16

TO TB 102
SEE DWG E29A16: 13
25% SPEED PUSHBUTTON
2088
E29A16A13
RED
17 IN 8
LOCAL:7:I:DATA.8
L2 8 18

TO TB 103
SEE DWG E29A16: 15
50% SPEED PUSHBUTTON
2089
E29A16A15
RED
19 IN 9
LOCAL:7:I:DATA.9
L2 9 20

TO TB 104
SEE DWG E29A16: 17
100% SPEED PUSHBUTTON
2090
E29A16A17
RED
21 IN 10
LOCAL:7:I:DATA.10
L2 10 22

TO TB 105
SEE DWG E29A16: 19
STOP PUSHBUTTON
2091
E29A16A19
RED
23 IN 11
LOCAL:7:I:DATA.11
L2 11 24

TO TB 106
SEE DWG E29A16: 21
E-STOP PUSHBUTTON
2092
E29A16A21
RED
25 IN 12
LOCAL:7:I:DATA.12
L2 12 26

EAST EF-4 FAN CONTROL STATION

TO TB 100
SEE DWG E30A16: 09
HOA SS IN HAND
2093
E30A16A09
RED
27 IN 13
LOCAL:7:I:DATA.13
L2 13 28

TO TB 101
SEE DWG E30A16: 11
HOA SS IN AUTO
2094
E30A16A11
RED
29 IN 14
LOCAL:7:I:DATA.14
L2 14 30

TO TB 102
SEE DWG E30A16: 13
25% SPEED PUSHBUTTON
2095
E30A16A13
RED
31 IN 15
LOCAL:7:I:DATA.15
L2 15 32
L2 15 34

33, 35, 36
NOT USED

L1
(E01A23:01)

N
(E01A23:01)

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - DISCRETE INPUTS

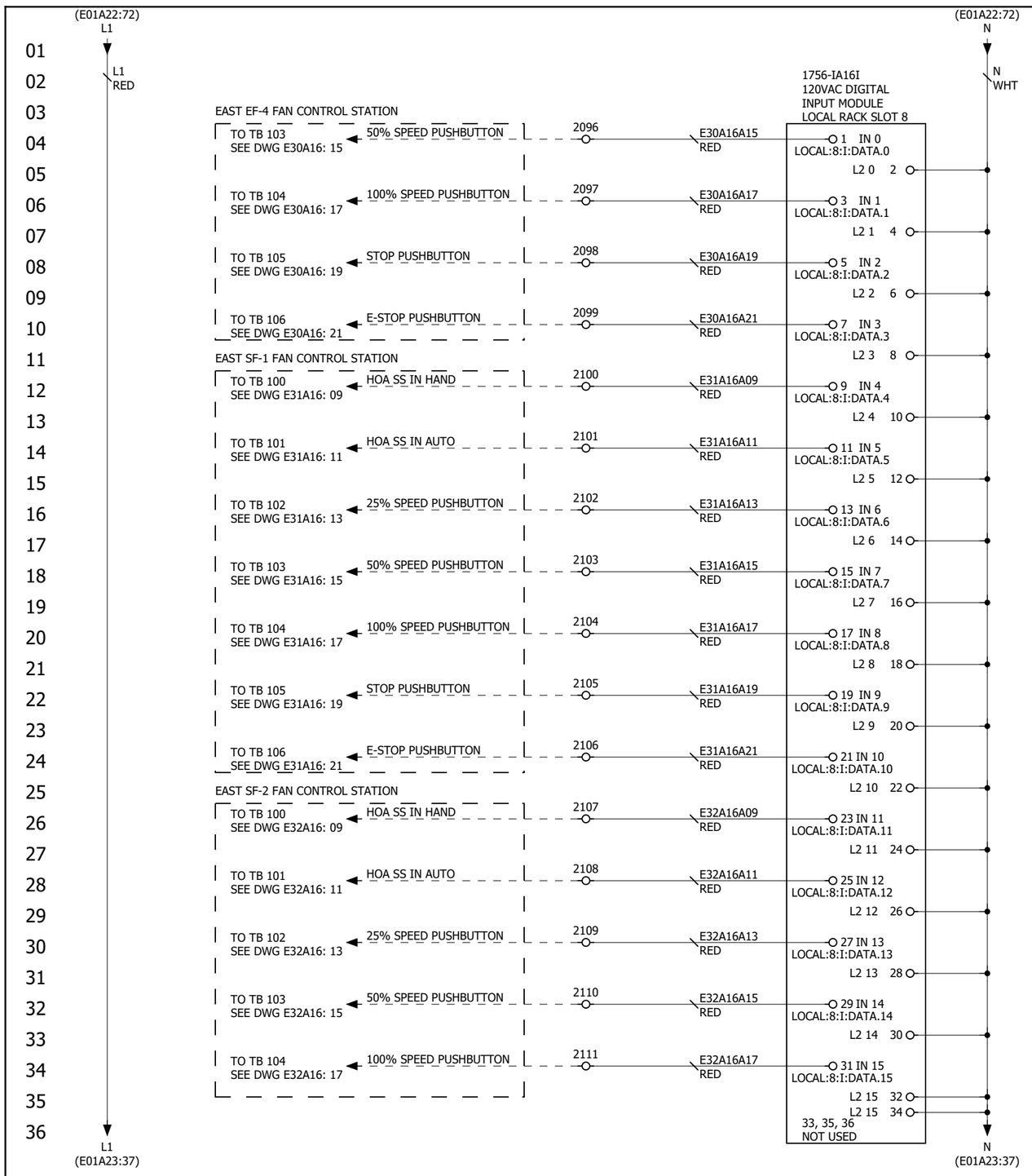
PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT
3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
2.0	09/04/20	ekilgore	SUBMITTAL APPROVED. RELEASED FOR FABRICATION.
1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

DWG # CMS203-E01A22



STATE OF COLORADO DEPARTMENT OF TRANSPORTATION

EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - DISCRETE INPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

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(303) 376-6280

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3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
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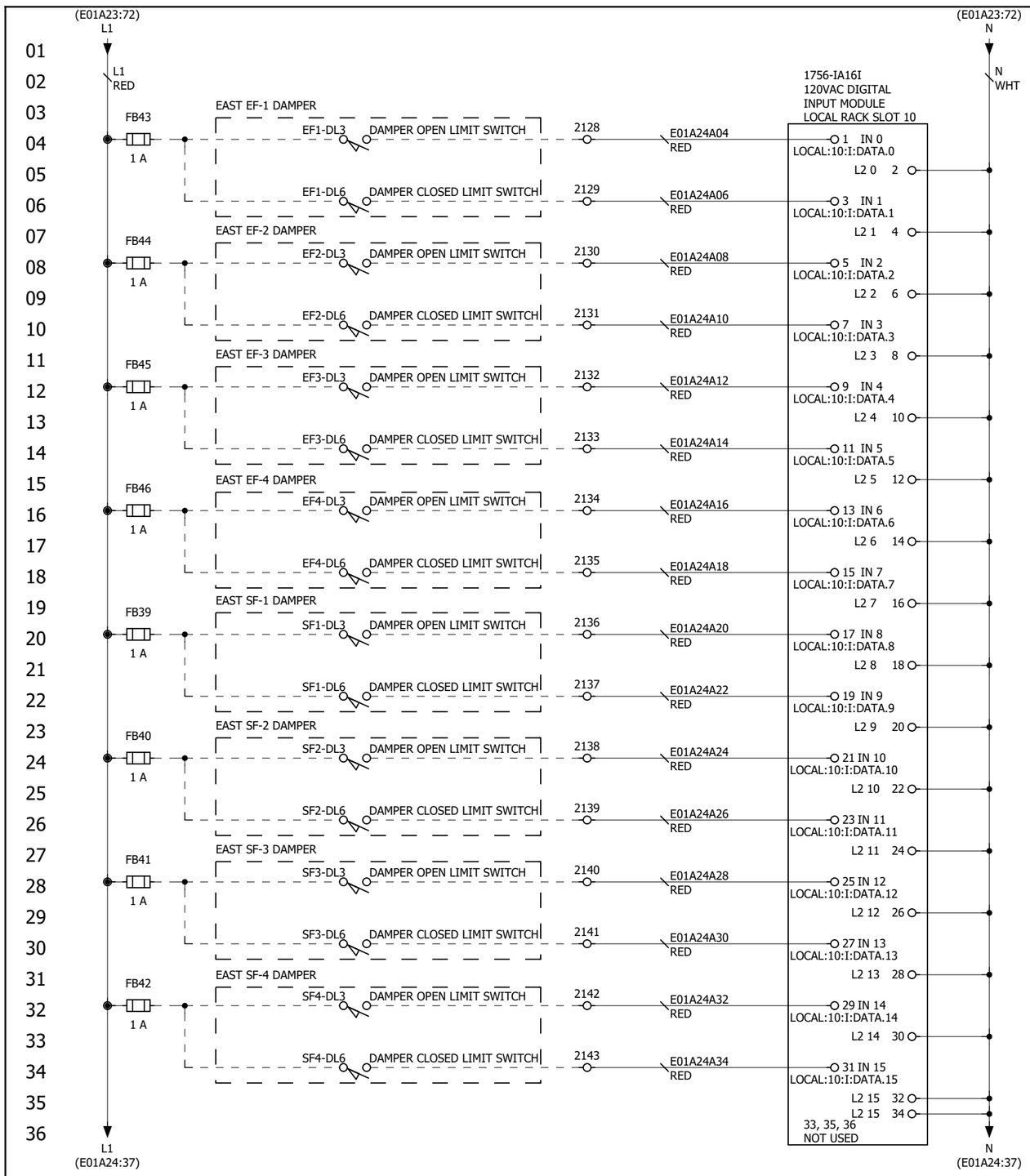
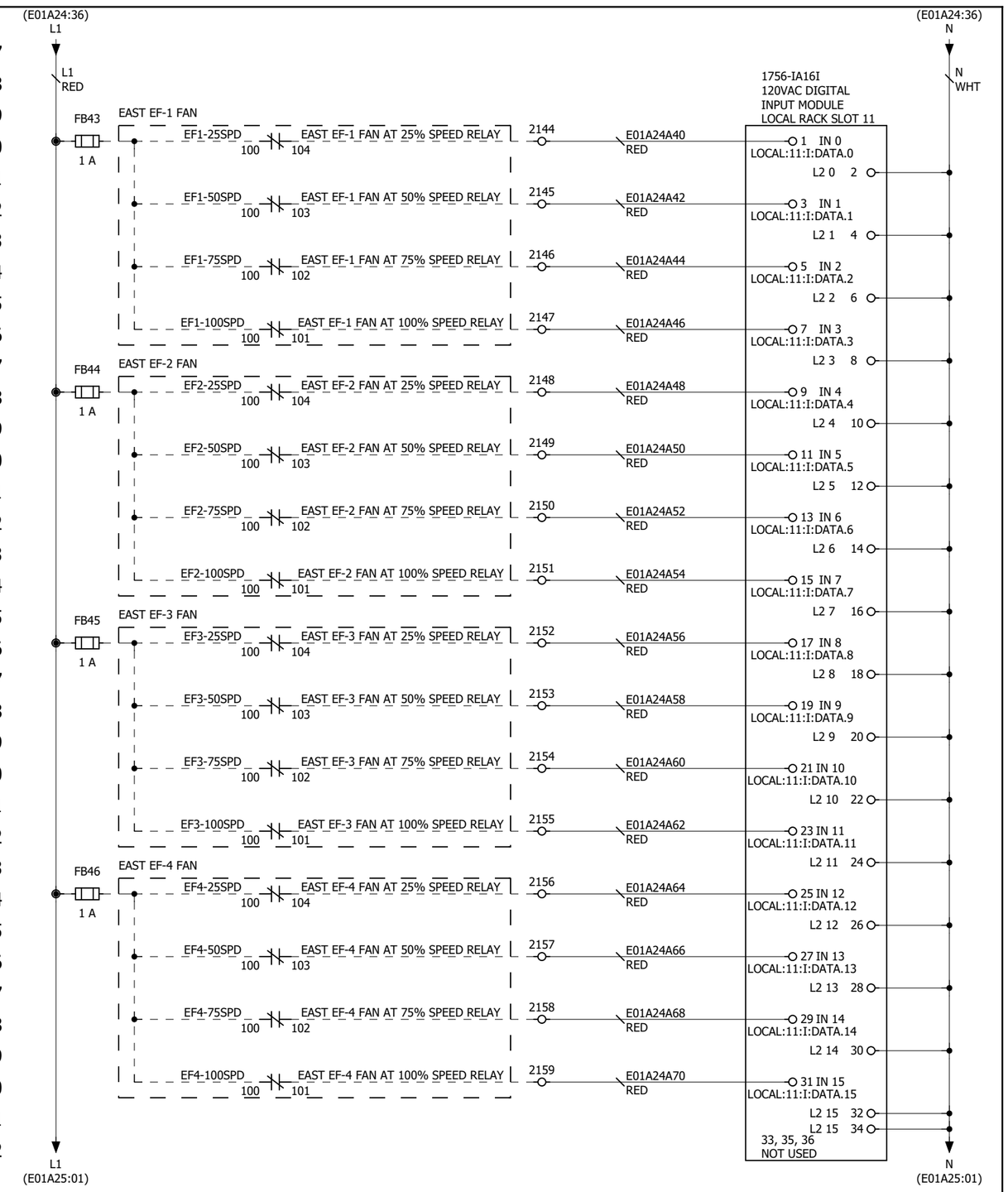
DWG # CMS203-E01A23





STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - DISCRETE INPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
4.0	08/02/21	ekilgore	AS-BUILT

HUFFMAN ENGINEERING INC.
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REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
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3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
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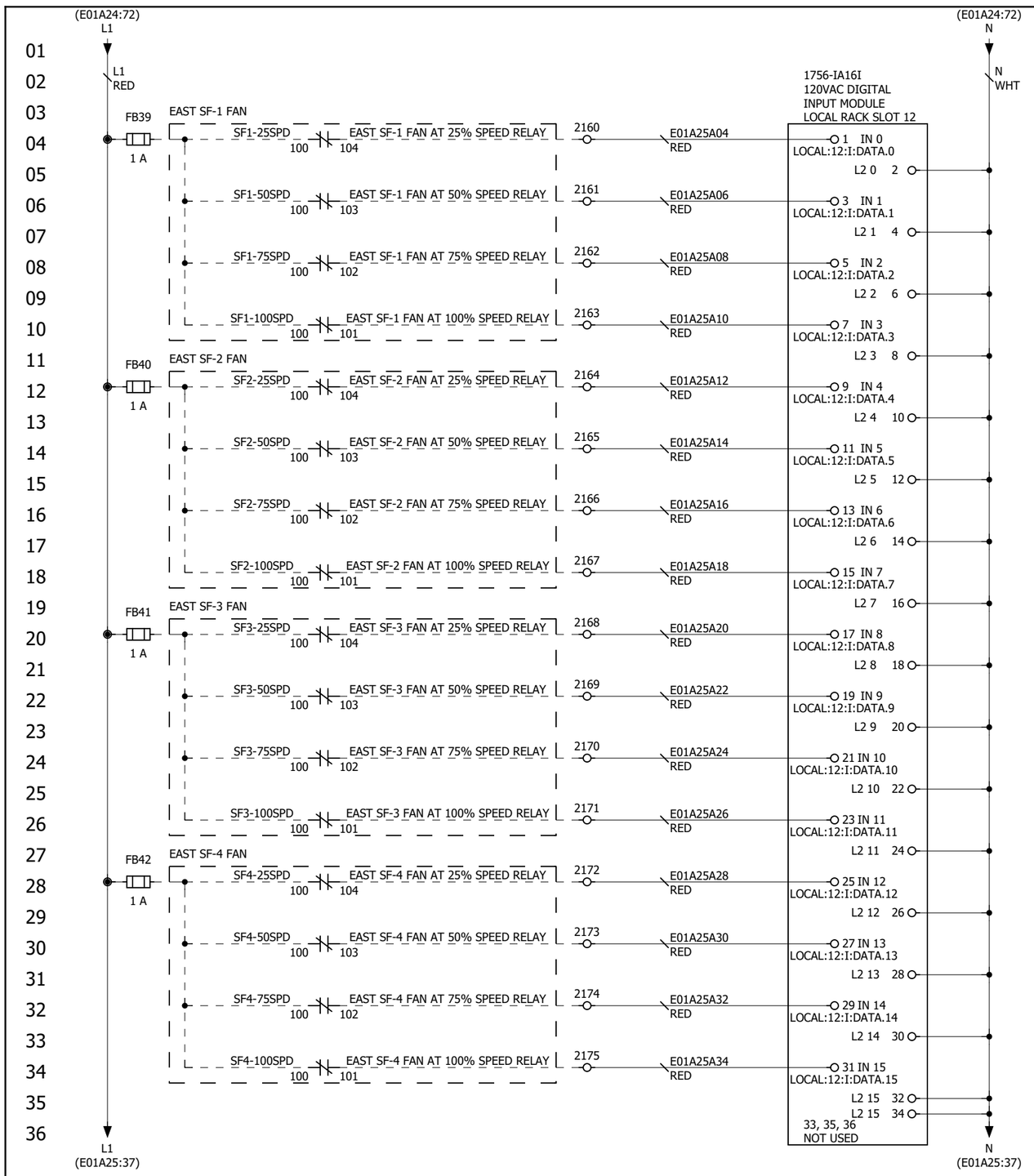
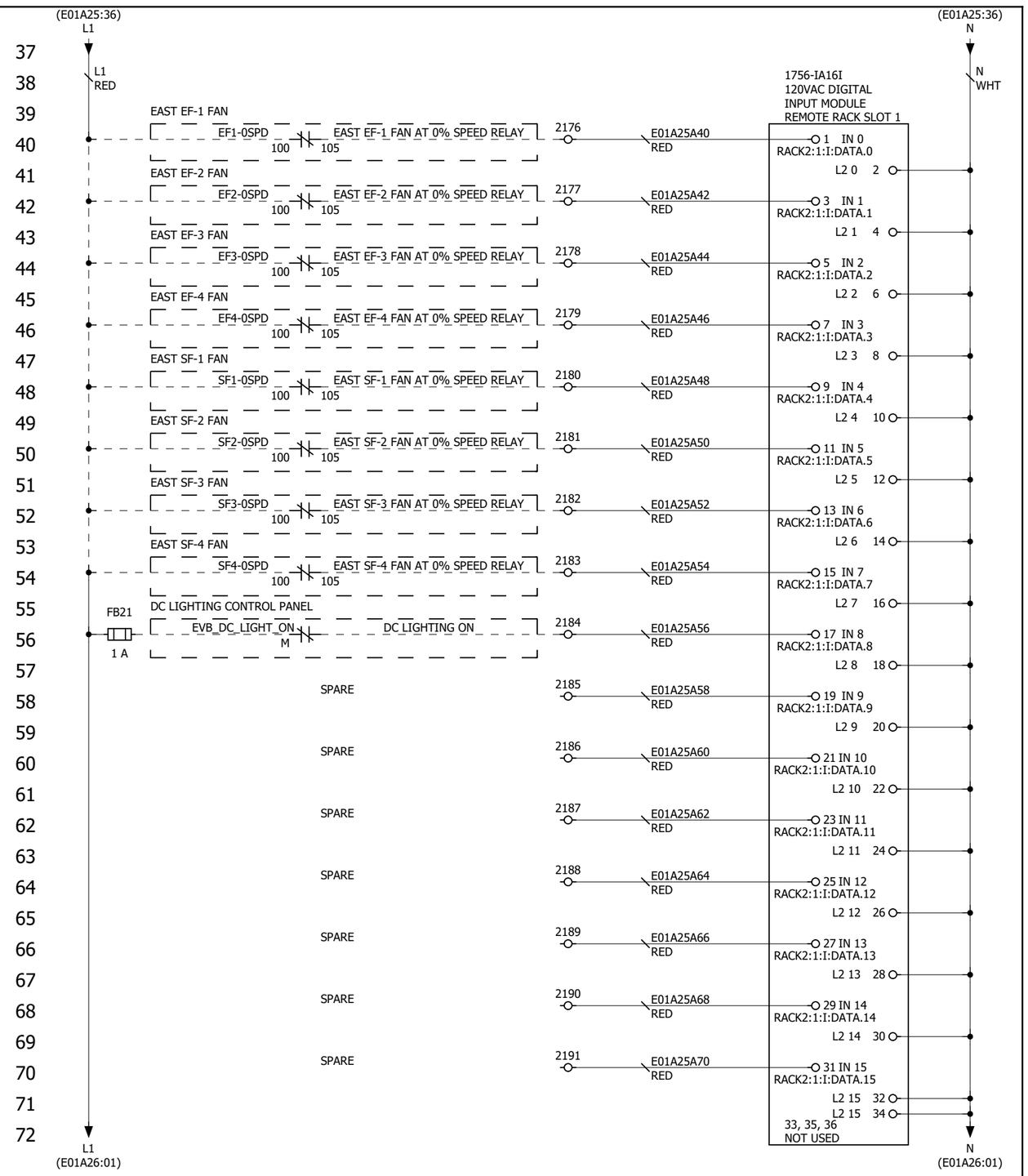
1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

DWG # CMS203-E01A24





STATE OF COLORADO DEPARTMENT OF TRANSPORTATION

EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - DISCRETE INPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT

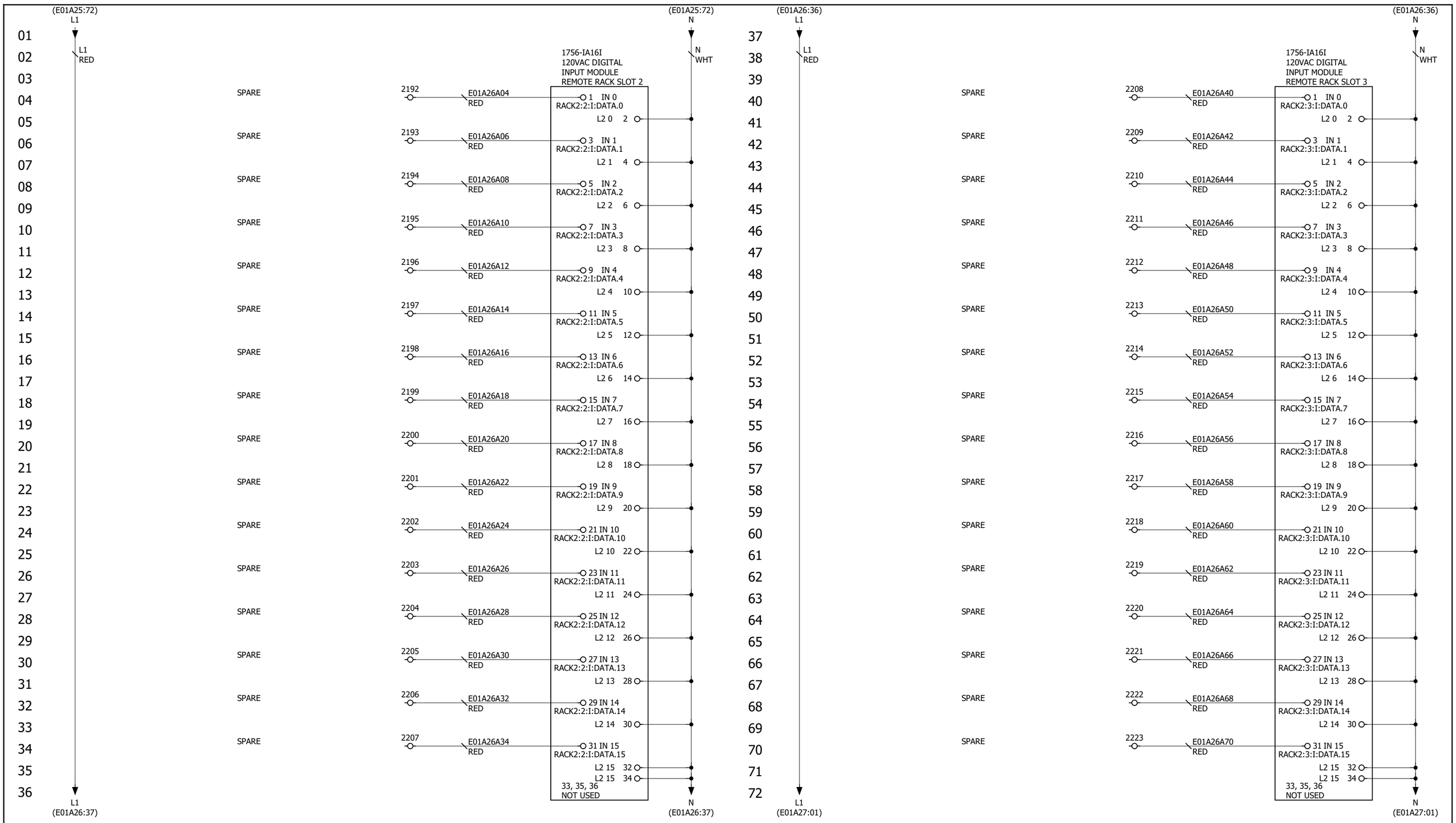
HUFFMAN ENGINEERING INC.

5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823

112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT
3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
2.0	09/04/20	ekilgore	SUBMITTAL APPROVED. RELEASED FOR FABRICATION.
1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

DWG # CMS203-E01A25



STATE OF COLORADO DEPARTMENT OF TRANSPORTATION

EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - DISCRETE INPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.

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LINCOLN, NEBRASKA 68507
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112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
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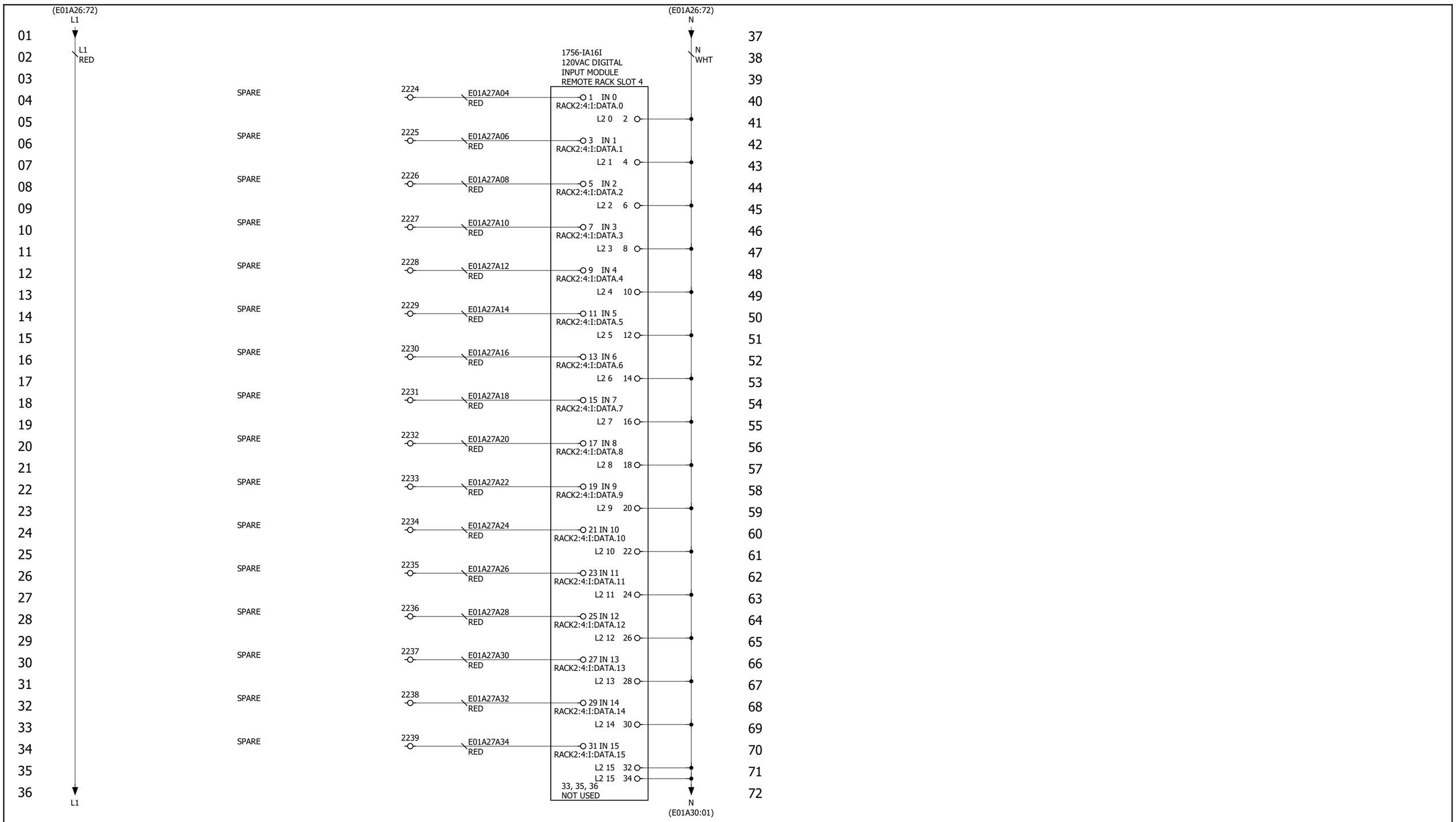
4.0	08/02/21	ekilgore	AS-BUILT
3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
2.0	09/04/20	ekilgore	SUBMITTAL APPROVED. RELEASED FOR FABRICATION.
1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

DWG # CMS203-E01A26



STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - DISCRETE INPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
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ENGLEWOOD, COLORADO 80112
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REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
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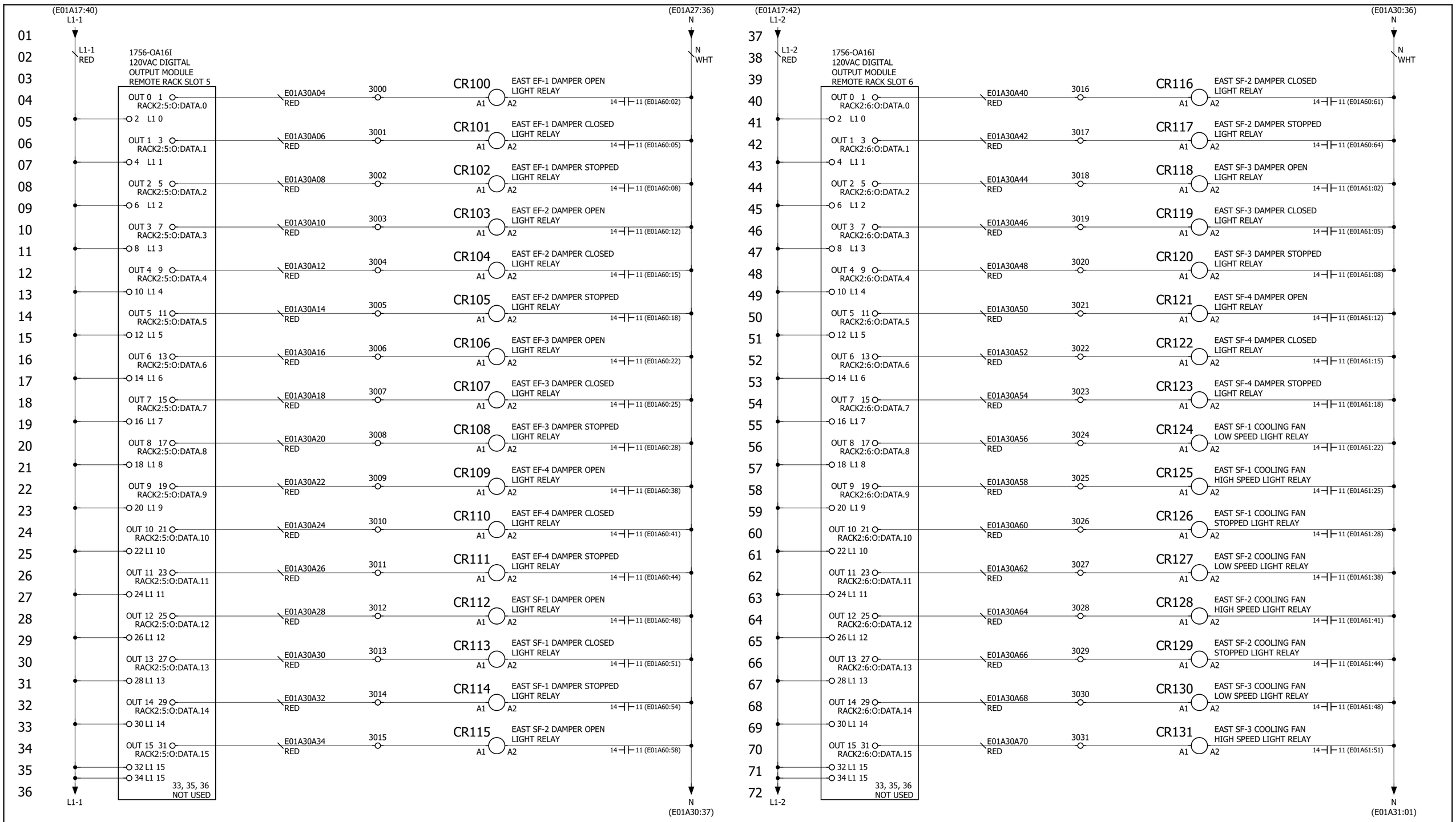
3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
2.0	09/04/20	ekilgore	SUBMITTAL APPROVED. RELEASED FOR FABRICATION.
1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

DWG # CMS203-E01A27



STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - DISCRETE OUTPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
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5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
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3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
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1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

DWG # CMS203-E01A30

(E01A17:44)
L1-3

(E01A30:72)
N

(E01A17:46)
L1-4

(E01A31:36)
N

L1-3
RED

1756-OA16I
120VAC DIGITAL
OUTPUT MODULE
REMOTE RACK SLOT 7

OUT 0 1 RACK2:7:O:DATA.0	2 L1 0	E01A31A04 RED	3032	CR132	EAST SF-3 COOLING FAN STOPPED LIGHT RELAY
OUT 1 3 RACK2:7:O:DATA.1	4 L1 1	E01A31A06 RED	3033	CR133	EAST SF-4 COOLING FAN LOW SPEED LIGHT RELAY
OUT 2 5 RACK2:7:O:DATA.2	6 L1 2	E01A31A08 RED	3034	CR134	EAST SF-4 COOLING FAN HIGH SPEED LIGHT RELAY
OUT 3 7 RACK2:7:O:DATA.3	8 L1 3	E01A31A10 RED	3035	CR135	EAST SF-4 COOLING FAN STOPPED LIGHT RELAY
OUT 4 9 RACK2:7:O:DATA.4	10 L1 4	E01A31A12 RED	3036	CR136	EAST EF-1 FAN AT 25% SPEED LIGHT RELAY
OUT 5 11 RACK2:7:O:DATA.5	12 L1 5	E01A31A14 RED	3037	CR137	EAST EF-1 FAN AT 50% SPEED LIGHT RELAY
OUT 6 13 RACK2:7:O:DATA.6	14 L1 6	E01A31A16 RED	3038	CR138	EAST EF-1 FAN AT 100% SPEED LIGHT RELAY
OUT 7 15 RACK2:7:O:DATA.7	16 L1 7	E01A31A18 RED	3039	CR139	EAST EF-1 FAN STOPPED LIGHT RELAY
OUT 8 17 RACK2:7:O:DATA.8	18 L1 8	E01A31A20 RED	3040	CR140	EAST EF-2 FAN AT 25% SPEED LIGHT RELAY
OUT 9 19 RACK2:7:O:DATA.9	20 L1 9	E01A31A22 RED	3041	CR141	EAST EF-2 FAN AT 50% SPEED LIGHT RELAY
OUT 10 21 RACK2:7:O:DATA.10	22 L1 10	E01A31A24 RED	3042	CR142	EAST EF-2 FAN AT 100% SPEED LIGHT RELAY
OUT 11 23 RACK2:7:O:DATA.11	24 L1 11	E01A31A26 RED	3043	CR143	EAST EF-2 FAN STOPPED LIGHT RELAY
OUT 12 25 RACK2:7:O:DATA.12	26 L1 12	E01A31A28 RED	3044	CR144	EAST EF-3 FAN AT 25% SPEED LIGHT RELAY
OUT 13 27 RACK2:7:O:DATA.13	28 L1 13	E01A31A30 RED	3045	CR145	EAST EF-3 FAN AT 50% SPEED LIGHT RELAY
OUT 14 29 RACK2:7:O:DATA.14	30 L1 14	E01A31A32 RED	3046	CR146	EAST EF-3 FAN AT 100% SPEED LIGHT RELAY
OUT 15 31 RACK2:7:O:DATA.15	32 L1 15 34 L1 15	E01A31A34 RED	3047	CR147	EAST EF-3 FAN STOPPED LIGHT RELAY

33, 35, 36
NOT USED

L1-3

N
(E01A31:37)

L1-4
RED

1756-OA16I
120VAC DIGITAL
OUTPUT MODULE
REMOTE RACK SLOT 8

OUT 0 1 RACK2:8:O:DATA.0	2 L1 0	E01A31A40 RED	3048	CR148	EAST EF-4 FAN AT 25% SPEED LIGHT RELAY
OUT 1 3 RACK2:8:O:DATA.1	4 L1 1	E01A31A42 RED	3049	CR149	EAST EF-4 FAN AT 50% SPEED LIGHT RELAY
OUT 2 5 RACK2:8:O:DATA.2	6 L1 2	E01A31A44 RED	3050	CR150	EAST EF-4 FAN AT 100% SPEED LIGHT RELAY
OUT 3 7 RACK2:8:O:DATA.3	8 L1 3	E01A31A46 RED	3051	CR151	EAST EF-4 FAN STOPPED LIGHT RELAY
OUT 4 9 RACK2:8:O:DATA.4	10 L1 4	E01A31A48 RED	3052	CR152	EAST SF-1 FAN AT 25% SPEED LIGHT RELAY
OUT 5 11 RACK2:8:O:DATA.5	12 L1 5	E01A31A50 RED	3053	CR153	EAST SF-1 FAN AT 50% SPEED LIGHT RELAY
OUT 6 13 RACK2:8:O:DATA.6	14 L1 6	E01A31A52 RED	3054	CR154	EAST SF-1 FAN AT 100% SPEED LIGHT RELAY
OUT 7 15 RACK2:8:O:DATA.7	16 L1 7	E01A31A54 RED	3055	CR155	EAST SF-1 FAN STOPPED LIGHT RELAY
OUT 8 17 RACK2:8:O:DATA.8	18 L1 8	E01A31A56 RED	3056	CR156	EAST SF-2 FAN AT 25% SPEED LIGHT RELAY
OUT 9 19 RACK2:8:O:DATA.9	20 L1 9	E01A31A58 RED	3057	CR157	EAST SF-2 FAN AT 50% SPEED LIGHT RELAY
OUT 10 21 RACK2:8:O:DATA.10	22 L1 10	E01A31A60 RED	3058	CR158	EAST SF-2 FAN AT 100% SPEED LIGHT RELAY
OUT 11 23 RACK2:8:O:DATA.11	24 L1 11	E01A31A62 RED	3059	CR159	EAST SF-2 FAN STOPPED LIGHT RELAY
OUT 12 25 RACK2:8:O:DATA.12	26 L1 12	E01A31A64 RED	3060	CR160	EAST SF-3 FAN AT 25% SPEED LIGHT RELAY
OUT 13 27 RACK2:8:O:DATA.13	28 L1 13	E01A31A66 RED	3061	CR161	EAST SF-3 FAN AT 50% SPEED LIGHT RELAY
OUT 14 29 RACK2:8:O:DATA.14	30 L1 14	E01A31A68 RED	3062	CR162	EAST SF-3 FAN AT 100% SPEED LIGHT RELAY
OUT 15 31 RACK2:8:O:DATA.15	32 L1 15 34 L1 15	E01A31A70 RED	3063	CR163	EAST SF-3 FAN STOPPED LIGHT RELAY

33, 35, 36
NOT USED

L1-4

N
(E01A32:01)

All CR relays: A1 / A2; 14 — 11 (E01A61:54) … 11 (E01A62:51) … 11 (E01A63:47)

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - DISCRETE OUTPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT
3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
2.0	09/04/20	ekilgore	SUBMITTAL APPROVED. RELEASED FOR FABRICATION.
1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

DWG # CMS203-E01A31

(E01A17:48)
L1-5

(E01A31:72)
N

(E01A17:50)
L1-6

(E01A32:36)
N

L1-5
RED

1756-OA16I
120VAC DIGITAL
OUTPUT MODULE
REMOTE RACK SLOT 9

OUT 0 1 RACK2:9:O:DATA.0	E01A32A04 RED	3064	CR164 EAST SF-4 FAN AT 25% SPEED LIGHT RELAY	14 — 11 (E01A63:51)	
2 L1 0					
OUT 1 3 RACK2:9:O:DATA.1	E01A32A06 RED	3065	CR165 EAST SF-4 FAN AT 50% SPEED LIGHT RELAY	14 — 11 (E01A63:54)	
4 L1 1					
OUT 2 5 RACK2:9:O:DATA.2	E01A32A08 RED	3066	CR166 EAST SF-4 FAN AT 100% SPEED LIGHT RELAY	14 — 11 (E01A63:57)	
6 L1 2					
OUT 3 7 RACK2:9:O:DATA.3	E01A32A10 RED	3067	CR167 EAST SF-4 FAN STOPPED LIGHT RELAY	14 — 11 (E01A63:60)	
8 L1 3					
OUT 4 9 RACK2:9:O:DATA.4	E01A32A12 RED	3068	CR168 DC LIGHTING OFF COMMAND RELAY	14 — 11 (E01A63:64)	
10 L1 4					
OUT 5 11 RACK2:9:O:DATA.5	E01A32A14 RED	3069	CR169 DC LIGHTING ON COMMAND RELAY	12 — 11 (E01A63:67)	
12 L1 5					
OUT 6 13 RACK2:9:O:DATA.6	E01A32A16 RED	3070	SPARE		
14 L1 6					
OUT 7 15 RACK2:9:O:DATA.7	E01A32A18 RED	3071	SPARE		
16 L1 7					
OUT 8 17 RACK2:9:O:DATA.8	E01A32A20 RED	3072	SPARE		
18 L1 8					
OUT 9 19 RACK2:9:O:DATA.9	E01A32A22 RED	3073	SPARE		
20 L1 9					
OUT 10 21 RACK2:9:O:DATA.10	E01A32A24 RED	3074	SPARE		
22 L1 10					
OUT 11 23 RACK2:9:O:DATA.11	E01A32A26 RED	3075	SPARE		
24 L1 11					
OUT 12 25 RACK2:9:O:DATA.12	E01A32A28 RED	3076	SPARE		
26 L1 12					
OUT 13 27 RACK2:9:O:DATA.13	E01A32A30 RED	3077	SPARE		
28 L1 13					
OUT 14 29 RACK2:9:O:DATA.14	E01A32A32 RED	3078	SPARE		
30 L1 14					
OUT 15 31 RACK2:9:O:DATA.15	E01A32A34 RED	3079	SPARE		
32 L1 15					
34 L1 15					
33, 35, 36 NOT USED					

L1-5

N
WHT

N
(E01A32:37)

L1-6
RED

1756-OA16I
120VAC DIGITAL
OUTPUT MODULE
REMOTE RACK SLOT 10

OUT 0 1 RACK2:10:O:DATA.0	E01A32A40 RED	3080	SPARE
2 L1 0			
OUT 1 3 RACK2:10:O:DATA.1	E01A32A42 RED	3081	SPARE
4 L1 1			
OUT 2 5 RACK2:10:O:DATA.2	E01A32A44 RED	3082	SPARE
6 L1 2			
OUT 3 7 RACK2:10:O:DATA.3	E01A32A46 RED	3083	SPARE
8 L1 3			
OUT 4 9 RACK2:10:O:DATA.4	E01A32A48 RED	3084	SPARE
10 L1 4			
OUT 5 11 RACK2:10:O:DATA.5	E01A32A50 RED	3085	SPARE
12 L1 5			
OUT 6 13 RACK2:10:O:DATA.6	E01A32A52 RED	3086	SPARE
14 L1 6			
OUT 7 15 RACK2:10:O:DATA.7	E01A32A54 RED	3087	SPARE
16 L1 7			
OUT 8 17 RACK2:10:O:DATA.8	E01A32A56 RED	3088	SPARE
18 L1 8			
OUT 9 19 RACK2:10:O:DATA.9	E01A32A58 RED	3089	SPARE
20 L1 9			
OUT 10 21 RACK2:10:O:DATA.10	E01A32A60 RED	3090	SPARE
22 L1 10			
OUT 11 23 RACK2:10:O:DATA.11	E01A32A62 RED	3091	SPARE
24 L1 11			
OUT 12 25 RACK2:10:O:DATA.12	E01A32A64 RED	3092	SPARE
26 L1 12			
OUT 13 27 RACK2:10:O:DATA.13	E01A32A66 RED	3093	SPARE
28 L1 13			
OUT 14 29 RACK2:10:O:DATA.14	E01A32A68 RED	3094	SPARE
30 L1 14			
OUT 15 31 RACK2:10:O:DATA.15	E01A32A70 RED	3095	SPARE
32 L1 15			
34 L1 15			
33, 35, 36 NOT USED			

L1-6

N
(E01A33:01)

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - DISCRETE OUTPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
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DWG # CMS203-E01A32

(E01A17:52)
L1-7

L1-7
RED

1756-OA16I
120VAC DIGITAL
OUTPUT MODULE
REMOTE RACK SLOT 11

01					
02					
03					
04	OUT 0 1 RACK2:11:O:DATA.0	E01A33A04 RED	3096	SPARE	
05	2 L1 0				
06	OUT 1 3 RACK2:11:O:DATA.1	E01A33A06 RED	3097	SPARE	
07	4 L1 1				
08	OUT 2 5 RACK2:11:O:DATA.2	E01A33A08 RED	3098	SPARE	
09	6 L1 2				
10	OUT 3 7 RACK2:11:O:DATA.3	E01A33A10 RED	3099	SPARE	
11	8 L1 3				
12	OUT 4 9 RACK2:11:O:DATA.4	E01A33A12 RED	3100	SPARE	
13	10 L1 4				
14	OUT 5 11 RACK2:11:O:DATA.5	E01A33A14 RED	3101	SPARE	
15	12 L1 5				
16	OUT 6 13 RACK2:11:O:DATA.6	E01A33A16 RED	3102	SPARE	
17	14 L1 6				
18	OUT 7 15 RACK2:11:O:DATA.7	E01A33A18 RED	3103	SPARE	
19	16 L1 7				
20	OUT 8 17 RACK2:11:O:DATA.8	E01A33A20 RED	3104	SPARE	
21	18 L1 8				
22	OUT 9 19 RACK2:11:O:DATA.9	E01A33A22 RED	3105	SPARE	
23	20 L1 9				
24	OUT 10 21 RACK2:11:O:DATA.10	E01A33A24 RED	3106	SPARE	
25	22 L1 10				
26	OUT 11 23 RACK2:11:O:DATA.11	E01A33A26 RED	3107	SPARE	
27	24 L1 11				
28	OUT 12 25 RACK2:11:O:DATA.12	E01A33A28 RED	3108	SPARE	
29	26 L1 12				
30	OUT 13 27 RACK2:11:O:DATA.13	E01A33A30 RED	3109	SPARE	
31	28 L1 13				
32	OUT 14 29 RACK2:11:O:DATA.14	E01A33A32 RED	3110	SPARE	
33	30 L1 14				
34	OUT 15 31 RACK2:11:O:DATA.15	E01A33A34 RED	3111	SPARE	
35	32 L1 15				
36	34 L1 15				

33, 35, 36
NOT USED

L1-7

(E01A32:72)
N

N
WHT

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STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - DISCRETE OUTPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

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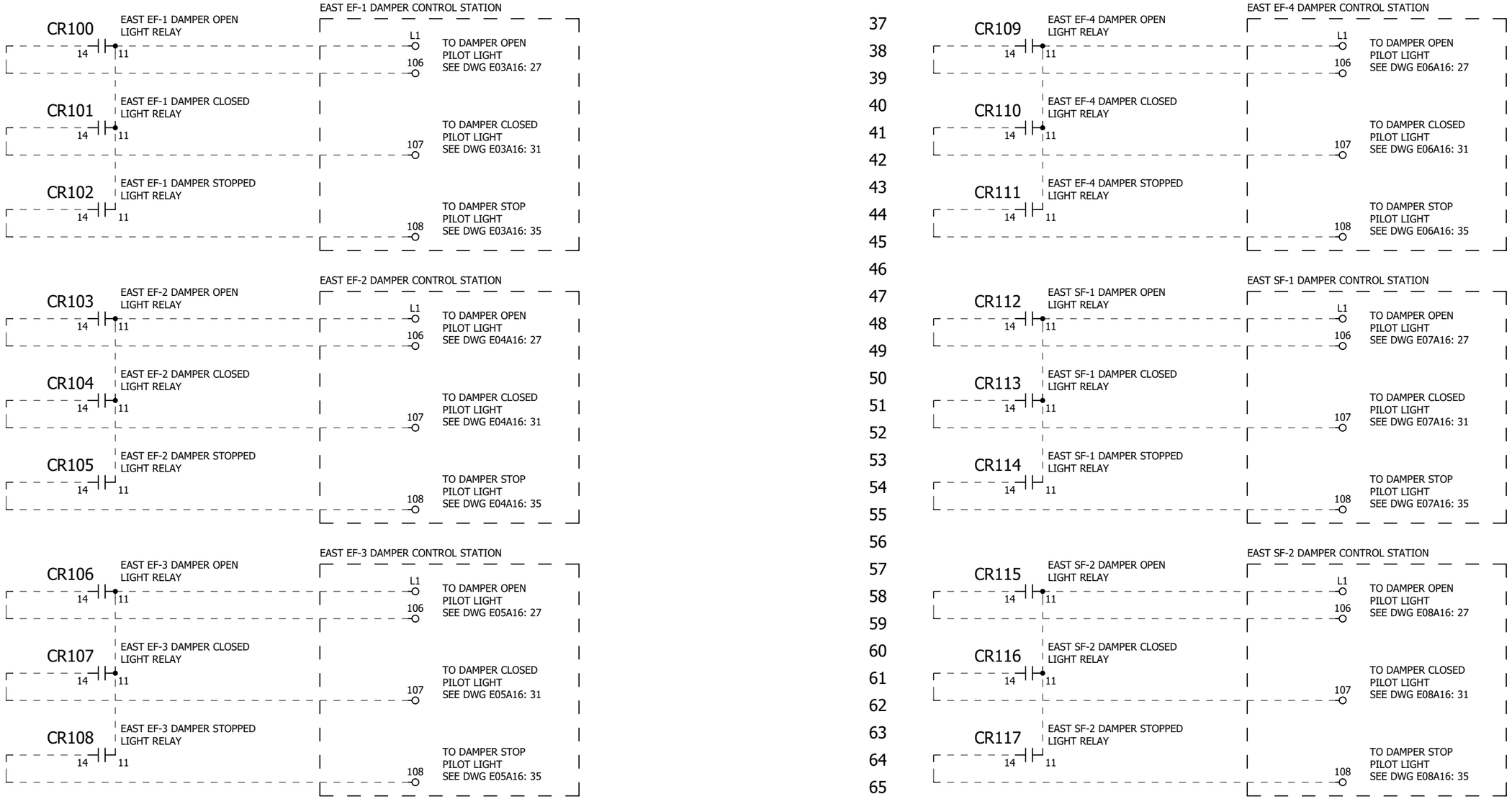
DWG # CMS203-E01A33



STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - CONTROL RELAY INTERFACE

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

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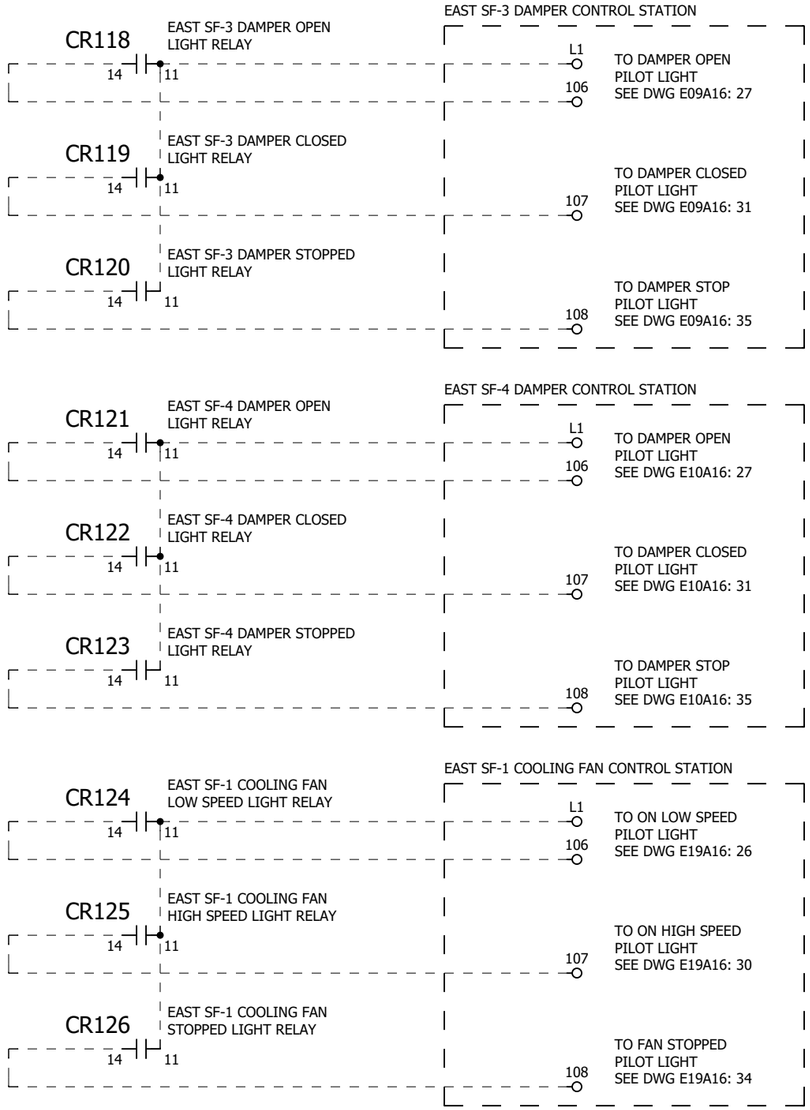
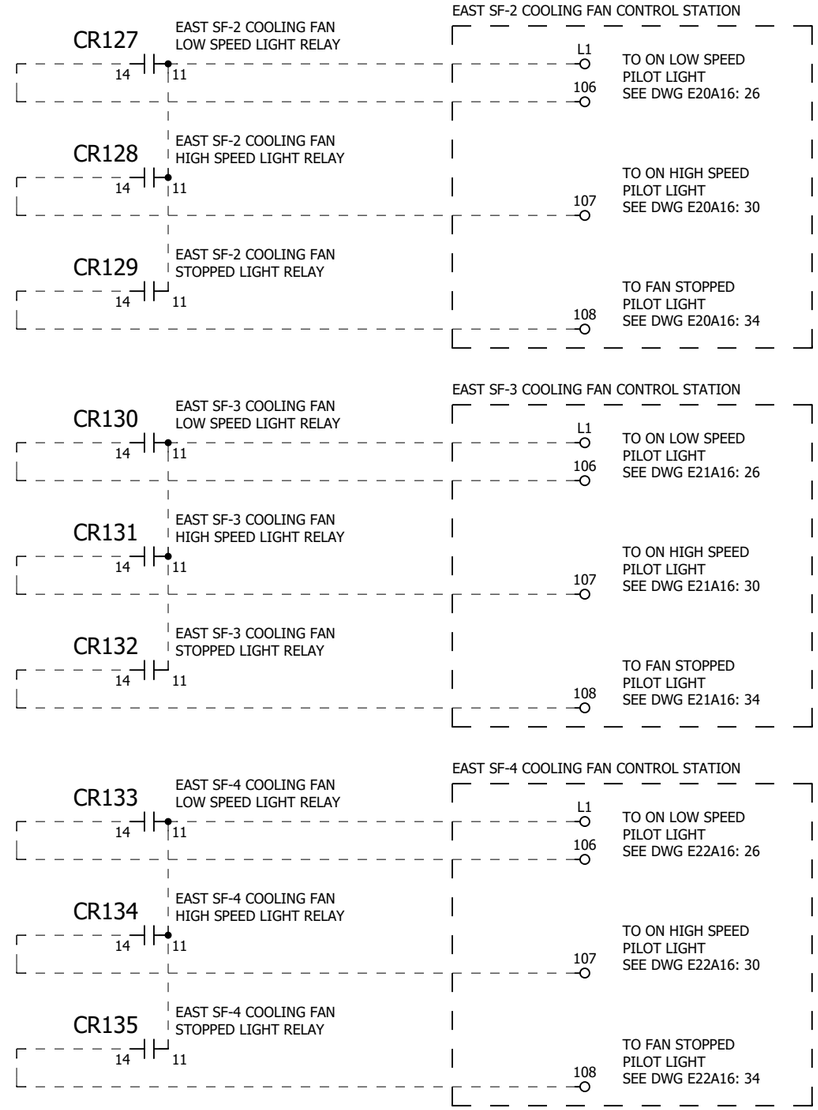
DWG # CMS203-E01A60





STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - CONTROL RELAY INTERFACE

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

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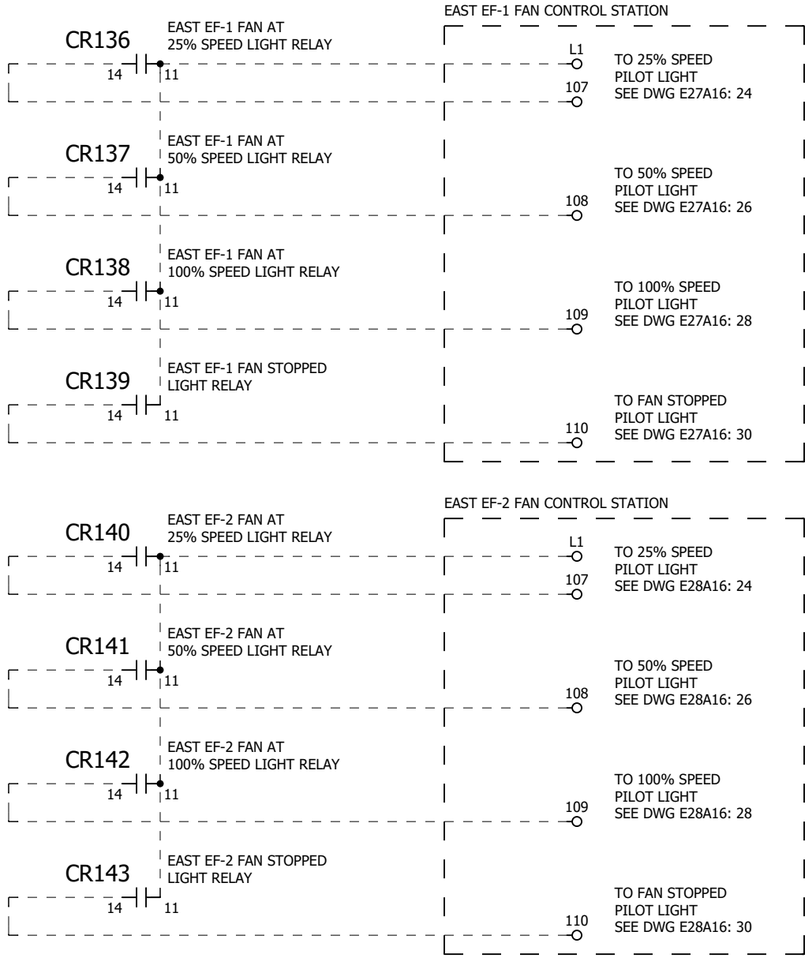
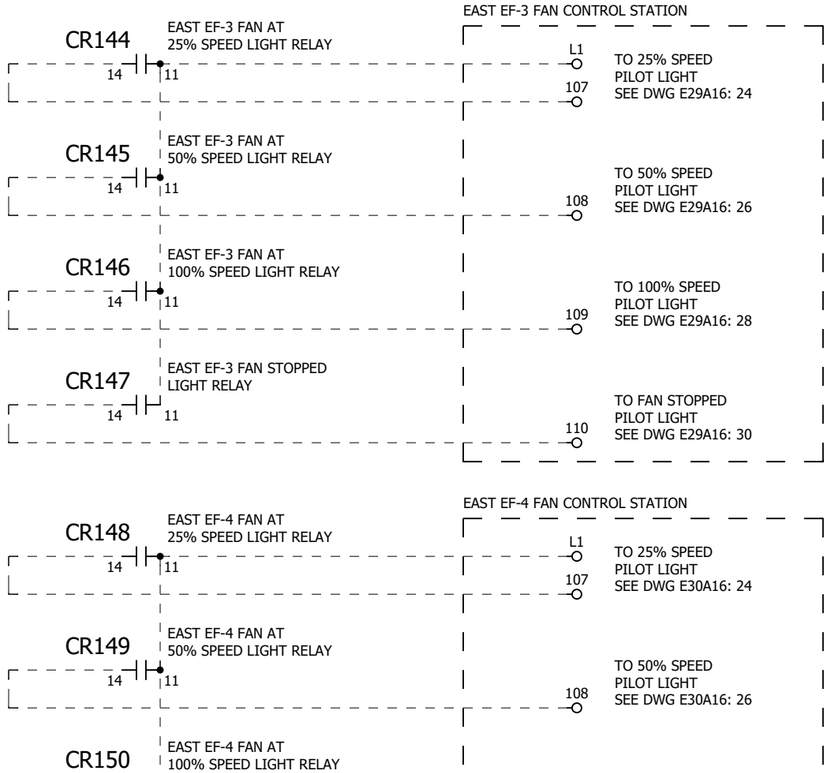
DWG # CMS203-E01A61





STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - CONTROL RELAY INTERFACE

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

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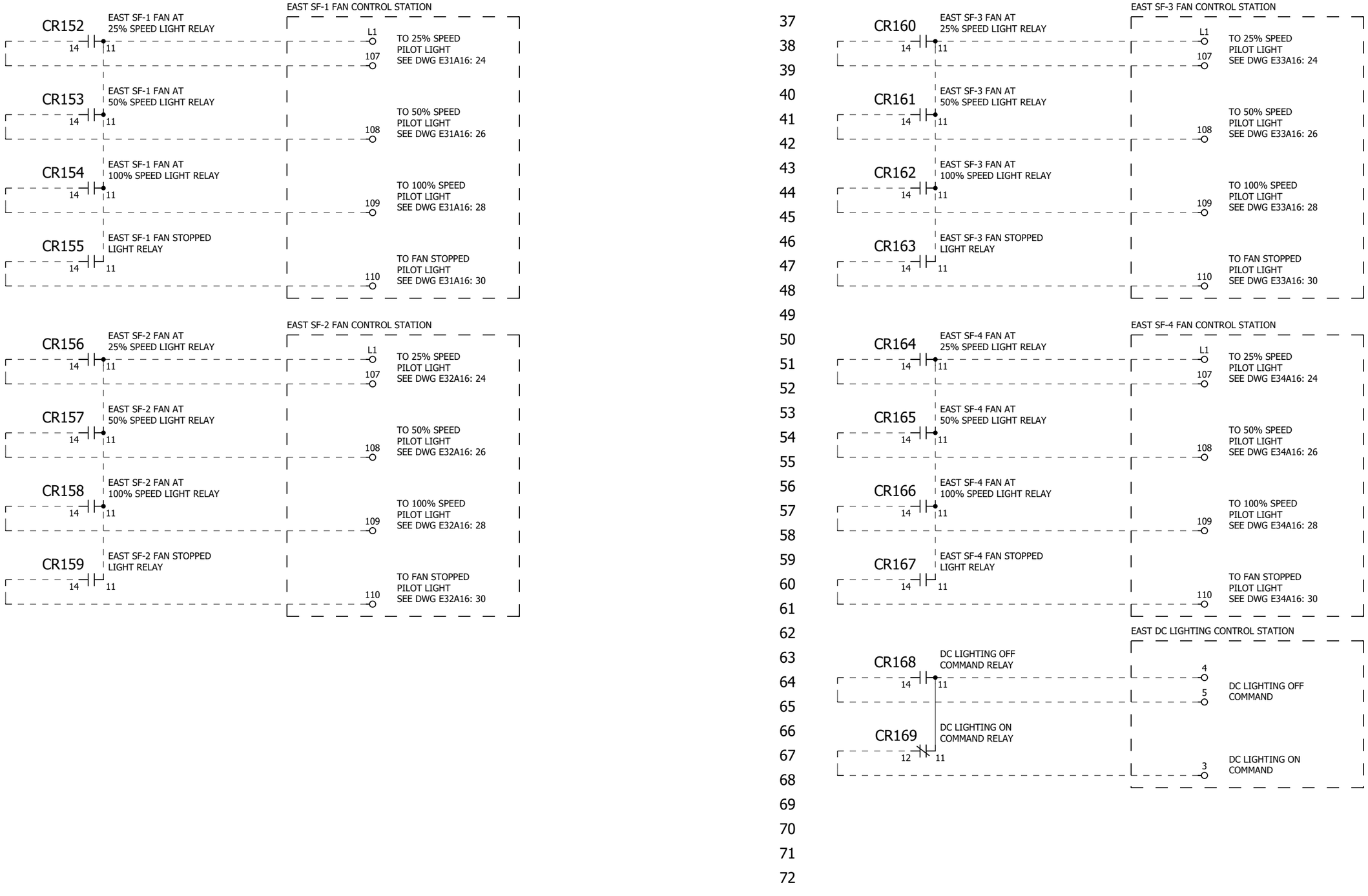
REV	DATE	NAME	REMARKS

DWG # CMS203-E01A62



STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - CONTROL RELAY INTERFACE

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

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REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E01A63

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STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

ELECTRICAL SYMBOLS

SYMBOL	DESCRIPTION
	RELAY CONTACT, NORMALLY CLOSED
	RELAY CONTACT, NORMALLY OPEN
	LIMIT SWITCH, NORMALLY CLOSED
	LIMIT SWITCH, NORMALLY CLOSED, HELD OPEN
	LIMIT SWITCH, NORMALLY OPEN
	LIMIT SWITCH, NORMALLY OPEN, HELD CLOSED
	PRESSURE SWITCH, NORMALLY CLOSED
	PRESSURE SWITCH, NORMALLY OPEN
	PUSHBUTTON, NORMALLY CLOSED
	PUSHBUTTON, NORMALLY OPEN
	PUSHBUTTON, NORMALLY CLOSED, HELD OPEN
	MUSHROOM HEAD PUSH BUTTON, NORMALLY CLOSED
	MUSHROOM HEAD PUSH BUTTON, NORMALLY OPEN
	2 POSITION SELECTOR SWITCH, CLOSED
	2 POSITION SELECTOR SWITCH, OPEN
	TEMPERATURE SWITCH, NORMALLY CLOSED
	TEMPERATURE SWITCH, NORMALLY OPEN
	TIMER CONTACT, NORMALLY CLOSED, TIMED OPEN
	TIMER CONTACT, NORMALLY CLOSED, TIMED OPEN, SHOWN OPEN
	TIMER CONTACT, NORMALLY OPEN, TIMED CLOSED
	TIMER CONTACT, NORMALLY OPEN, TIMED CLOSED, SHOWN CLOSED
	FLOW SWITCH, NORMALLY CLOSED
	FLOW SWITCH, NORMALLY OPEN
	PROXIMITY SWITCH, NORMALLY OPEN
	LEVEL SWITCH, NORMALLY CLOSED
	LEVEL SWITCH, NORMALLY OPEN
	RELAY COIL
	SOLENOID VALVE
R	PILOT LIGHT (R=RED, A=AMBER, B=BLUE, G=GREEN)
	NODE
	TERMINAL BLOCK
	KNIFE TERMINAL BLOCK
	TERMINAL BLOCK, FUSED

ELECTRICAL SYMBOLS CONTINUED

SYMBOL	DESCRIPTION
	GROUND
M	MOTOR
	ALARM HORN
	MOTOR STARTER COIL
	FIELD WIRING
	INTERNAL PANEL WIRING
	CAPACITOR
	MOTION DETECTOR

NOTE:
THIS IS A STANDARD LEGEND SHEET. SOME SYMBOLS OR ABBREVIATIONS MAY APPEAR ON THIS SHEET AND NOT ON THE PLANS.

ABBREVIATIONS

ABBREVIATION	DESCRIPTION
A	AMPERE, AMBER
AC	ALTERNATING CURRENT
AWG	AMERICAN WIRE GAUGE
BRN	BROWN
BLU	BLUE
BLK	BLACK
C	CONTACTOR
CB	CIRCUIT BREAKER
CR	CONTROL RELAY
DC	DIRECT CURRENT
DIV	DIVISION
ES	EMERGENCY STOP
ESR	EMERGENCY STOP RELAY
F, FU	FUSE
FB	FUSE BLOCK
GRN	GREEN
GND	GROUND
GFR	GROUND FAULT RELAY
H	HORN
HP	HORSEPOWER
IPT	CURRENT TO PRESSURE TRANSDUCER
J-BOX	JUNCTION BOX
KVA	KILOVOLT AMPS
LS	LIMIT SWITCH
LT FLEX	LIQUID TIGHT FLEX CONDUIT
M	MOTOR
MC	MOTOR CONTACTOR
MCC	MOTOR CONTROL CENTER
MCR	MASTER CONTROL RELAY
MHPB	MUSHROOM HEAD PUSHBUTTON
MS	MOTOR STARTER
N	NEUTRAL
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
OL	OVERLOAD RELAY
ORN	ORANGE
P	POLE
PB	PUSHBUTTON SWITCH
PS	PRESSURE SWITCH, POWER SUPPLY
PT	PRESSURE TRANSMITTER
PIT	PRESSURE TO CURRENT TRANSDUCER
RTD	RESISTIVE TEMPERATURE DETECTOR
REV	REVERSE
SR	SAFETY RELAY
SS	SELECTOR SWITCH
SV	SOLENOID VALVE
TB	TERMINAL BLOCK
TC	THERMOCOUPLE
TDR	TIME DELAY RELAY
V	VOLTAGE
VA	VOLT AMPS
VFD	VARIABLE FREQUENCY DRIVE
VIO	VIOLET
W	WATT
WHT	WHITE
XFMR	TRANSFORMER
YEL	YELLOW
Ø	PHASE

FUSE SCHEDULE

FUSE#	QTY	FUSE TYPE	SIZE	MFGR	PART#	DESCRIPTION
FB01-FB24	24	CLASS CC	1A	MERSEN	ATDR1	CONTROL STATION POWER
FB25	1	5x20mm	10A	LITTELFUSE	218-010	PLC LOCAL RACK PS
FB26	1	5x20mm	10A	LITTELFUSE	218-010	PLC REMOTE RACK PS
FB27	1	5x20mm	5A	LITTELFUSE	218-005	GFCI OUTLET
FB28	1	5x20mm	2A	LITTELFUSE	218-002	PANEL LIGHT
FB29-FB36	8	5x20mm	2A	LITTELFUSE	218-002	OUTPUT MODULES
FB37	1	5x20mm	5A	LITTELFUSE	218-005	24VDC POWER SUPPLY
FB38	1	5x20mm	5A	LITTELFUSE	218-005	24VDC
FB100	1	CLASS CC	20A	MERSEN	ATDR20	PLC PANEL POWER

LABEL DEFINITIONS

WIRE NUMBERS

E01A20A01
- LINE NUMBER ON THE DRAWING (01, 02, ETC.)
- WIRE POSITION ON THE LINE (A, B, ETC.)
- DRAWING NUMBER (E01A30, E01A40, ETC.)

THREE LINE WIRE NUMBERS

280-L100A
- WIRE POSITION
- A TWO DIGIT NUMBER
- PHASE
- A LETTER FOR SEPARATION
- VOLTAGE

CROSS REFERENCES

(E01A20:01)
- RAIL NUMBER
- DRAWING NUMBER

DRAWING NUMBERS

AA000-E01A20
- THESE TWO CHARACTERS INDICATE THE TYPE OF DRAWING
- LETTER INDICATES IF THIS IS THE ORIGINAL PROJECT OR SUBSEQUENT BUT ESSENTIALLY IDENTICAL PROJECT
- PANEL DESIGNATION WITHIN THE PROJECT. 00=DRAWINGS FOR PROJECT, BUT NOT PANEL SPECIFIC, 01=FIRST PANEL, 02=SECOND PANEL, ETC.
- DESIGNATES THE DRAWING AS ELECTRICAL
- PROJECT NUMBER

PANEL DRAWING INDEX

WIRE COLOR CODE

COLOR	DESCRIPTION
BLACK	ALL UNGROUNDED CIRCUIT CONDUCTORS OPERATING AT A VOLTAGE GREATER THAN 120VAC
WHITE OR GREY	GROUNDED AC CURRENT CARRYING CONTROL CIRCUIT CONDUCTOR
GREEN OR GREEN/YELLOW	GROUNDING CONDUCTOR
BLUE	UNGROUNDED DC CONTROL CIRCUITS
WHITE/BLUE STRIPE	DC COMMON CONTROL CIRCUIT CONDUCTOR
ORANGE	UNGROUNDED CONTROL CIRCUITS OR OTHER WIRING THAT MAY BE ENERGIZED WHEN MAIN DISCONNECT IS OFF
WHITE/ORANGE STRIPE	GROUNDED AC CONTROL CIRCUIT CURRENT CARRYING CONDUCTOR THAT REMAINS ENERGIZED WHEN THE MAIN DISCONNECT IS IN THE OFF POSITION
RED	UNGROUNDED CIRCUIT CONDUCTORS OPERATING AT 120VAC
VARIES	ANALOG INPUT, 2 COND. (SHIELDED)
VARIES	ANALOG OUTPUT, 2 COND. (SHIELDED)

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - INDEX SHEET

PROJECT # CMS203 | SCALE N/A | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

REV	DATE	NAME	REMARKS

DWG # CMS203-E02A00

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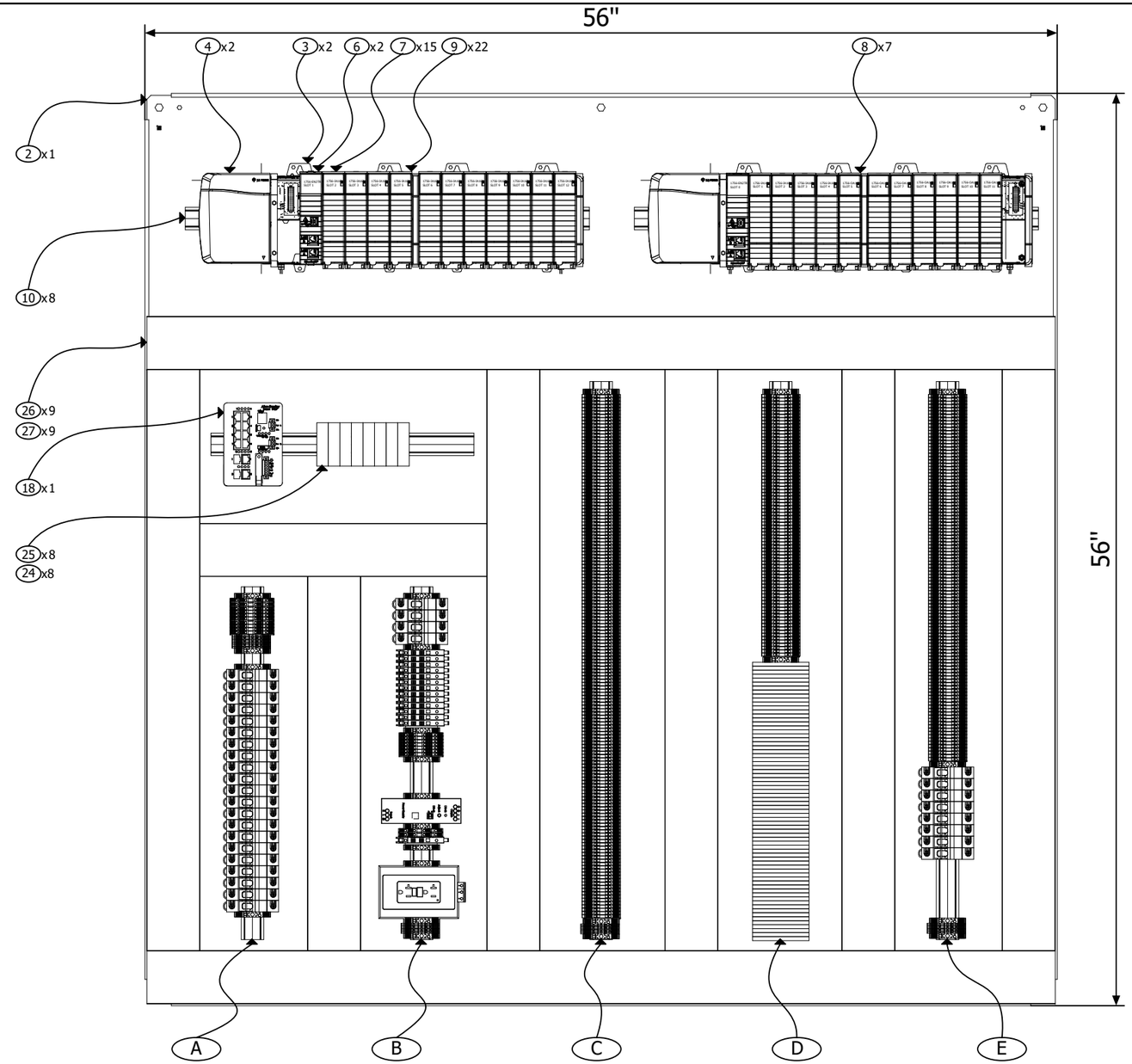


SEE DWG E02A03 FOR TERMINAL BLOCK LAYOUT

SEE DWG E02A03 FOR TERMINAL BLOCK LAYOUT

SEE DWG E02A04 FOR TERMINAL BLOCK LAYOUT

SEE DWG E02A04 FOR TERMINAL BLOCK LAYOUT

SEE DWG E02A05 FOR TERMINAL BLOCK LAYOUT

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - BACK PANEL LAYOUT

PROJECT # CMS203 | SCALE 1:8 | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

DWG # CMS203-E02A01

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

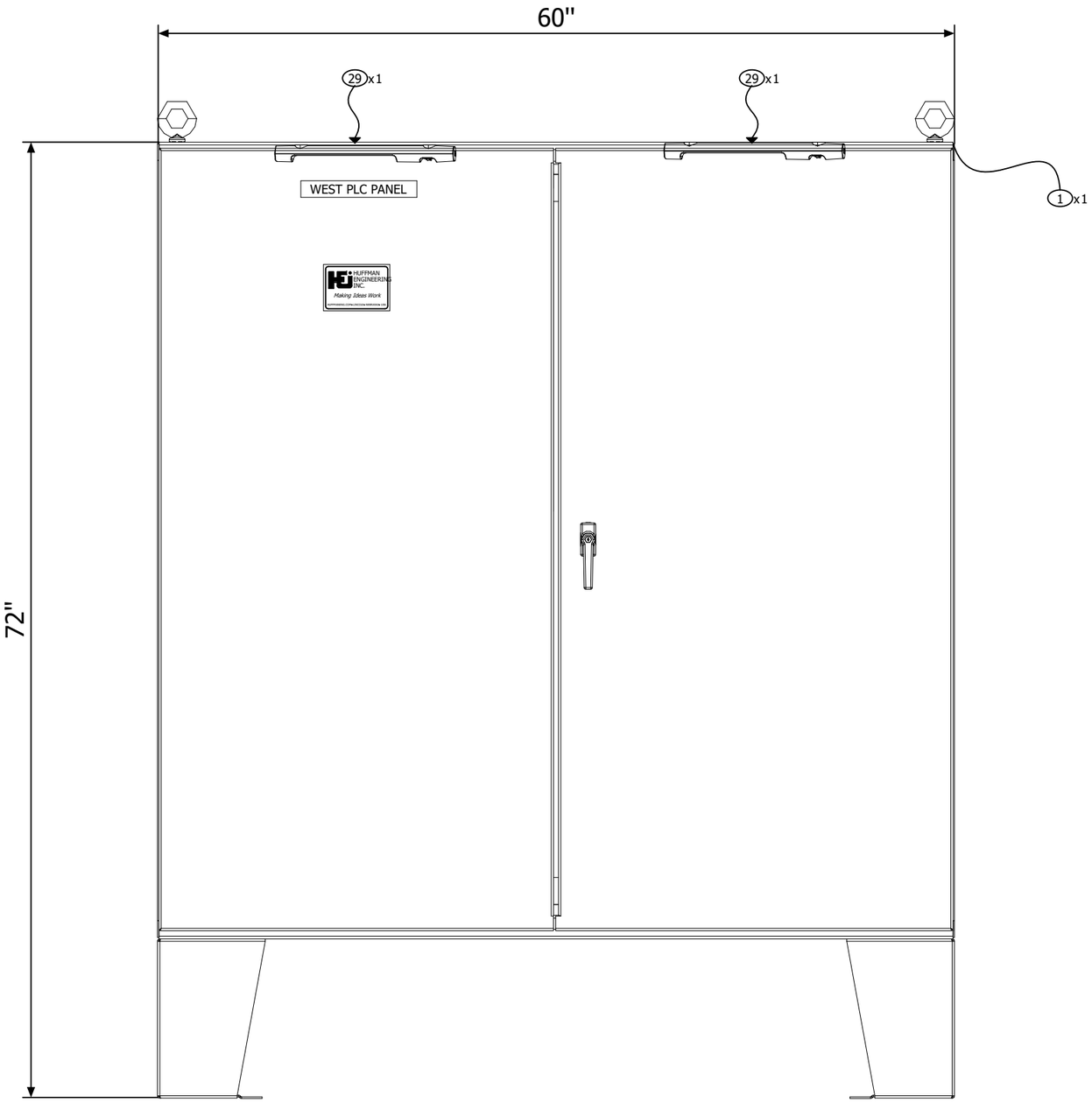
CUSTOM BUILT BY

HUFFMAN ENGINEERING INC.

5301 North 57th Street
Lincoln, NE 68507
402-464-6823

PROJECT #	CMS203	DATE	APR 2020
PANEL #	WEST PLC PANEL		
INTERRUPT RATING	200kA	TOTAL FLA	20
LARGEST MTR FLA	N/A	SCCR	10kA
VOLTS	120	HZ. 60 PHASE	1
ENCL TYP	12		
ELECT DWG INDEX #	CMS203-E02A00		

LEGEND PLATE SCHEDULE				
ITEM NO.	FIRST LINE	LEGEND PLATE COLOR	TEXT COLOR	TEXT HEIGHT
T.0	WEST PLC PANEL	BLACK	WHITE	1/2"



DEPTH = 16"

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - FRONT PANEL LAYOUT

PROJECT # CMS203 | SCALE 1:10 | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.

5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823

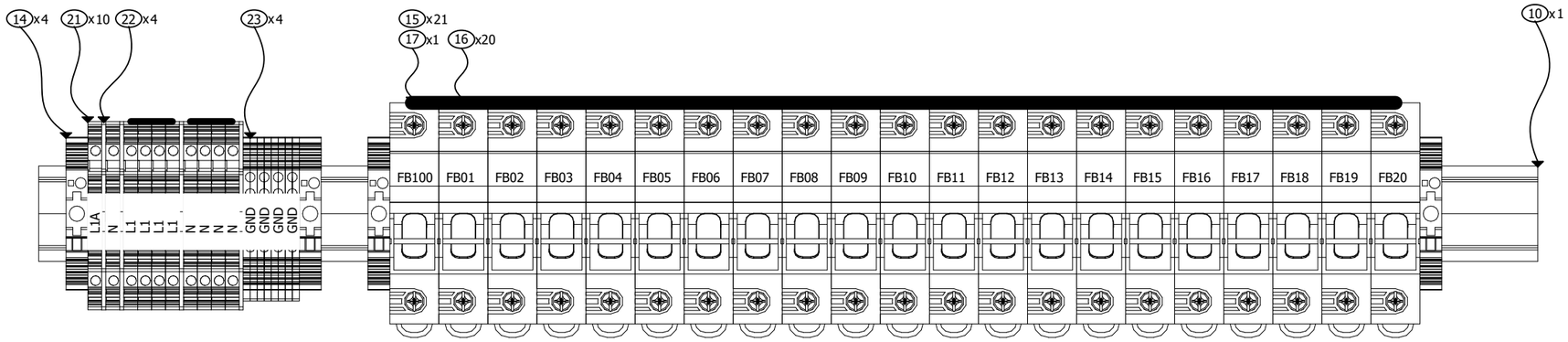
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E02A02

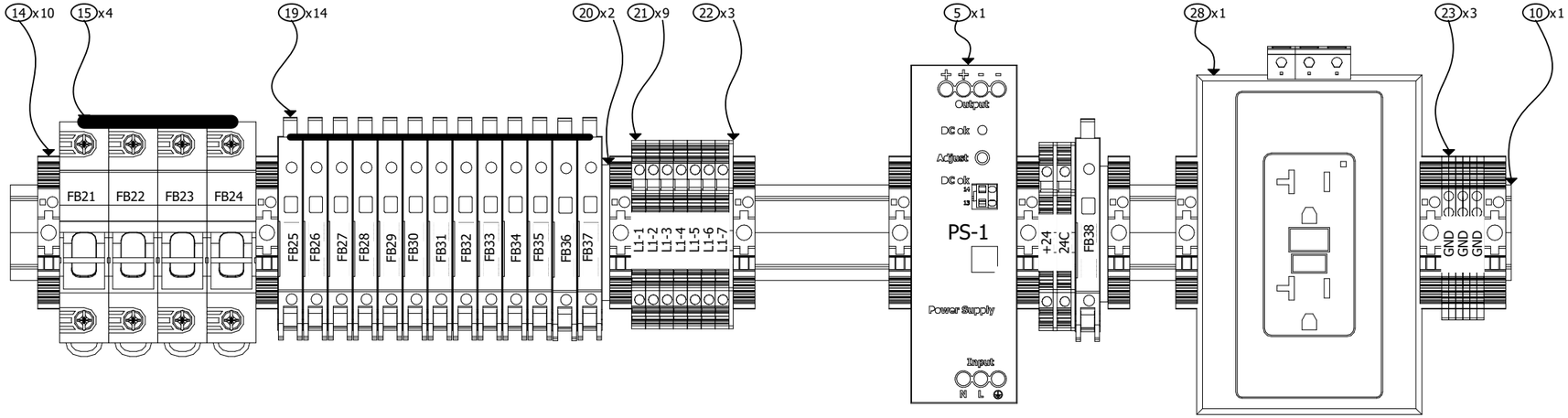
A

DIN RAIL TO
INCLUDE STANDOFFS



B

DIN RAIL TO
INCLUDE STANDOFFS



STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - TERMINAL BLOCK LAYOUTS

PROJECT # CMS203 | SCALE N/A | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

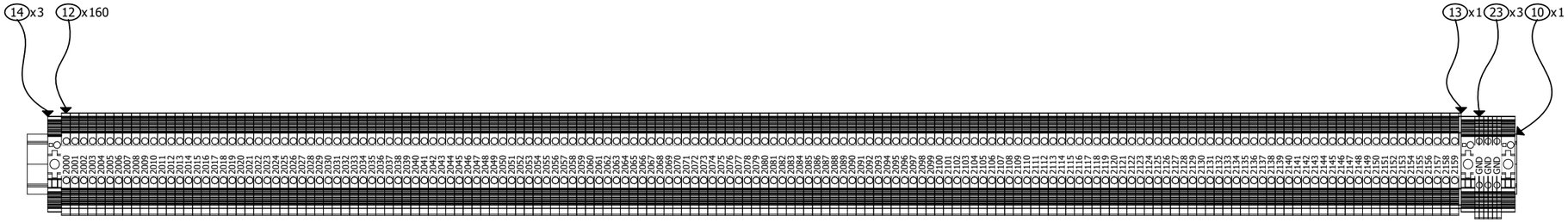
HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E02A03

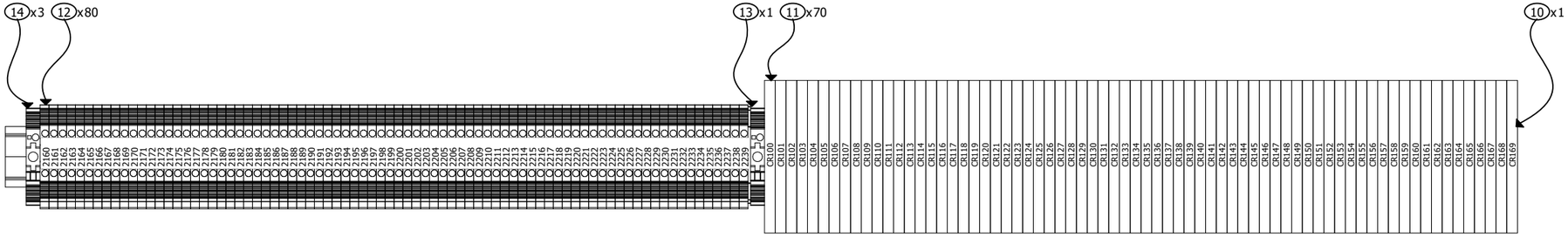
C

DIN RAIL TO
INCLUDE STANDOFFS



D

DIN RAIL TO
INCLUDE STANDOFFS



STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - TERMINAL BLOCK LAYOUTS

PROJECT # CMS203 | SCALE N/A | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

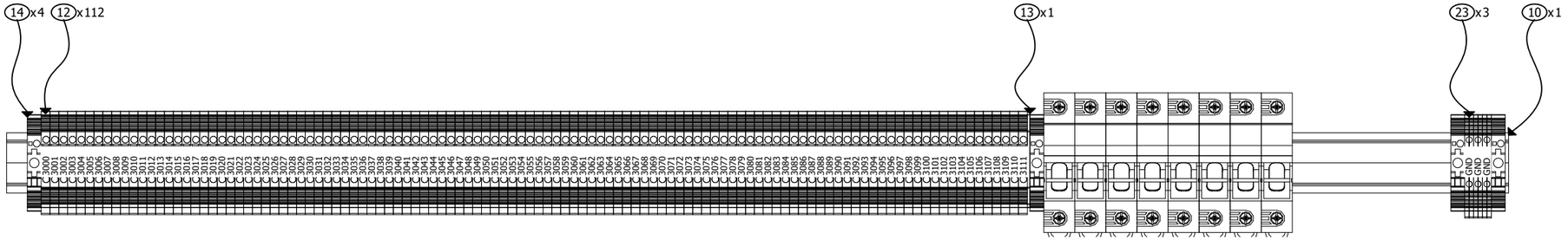
HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E02A04

E

DIN RAIL TO
INCLUDE STANDOFFS



STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - TERMINAL BLOCK LAYOUTS

PROJECT # CMS203 | SCALE N/A | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
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REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E02A05

ITEM #	QTY	MANUFACTURER	MANUFACTURERS P/N	DESCRIPTION
1	1	HOFFMAN	A606016LPG	60"X60"X16" ENCLOSURE WITH STANDS
2	1	HOFFMAN	A60P60	60"X60" BACKPANEL
3	2	ALLEN-BRADLEY	1756-A13	CONTROLLOGIX CHASSIS 13-SLOT
4	2	ALLEN-BRADLEY	1756-PA72	CONTROLLOGIX 85-265VAC, 10A POWER SUPPLY
5	1	ALLEN-BRADLEY	1606-XLB120E	24VDC, 5A POWER SUPPLY
6	2	ALLEN-BRADLEY	1756-EN2TR	CONTROLLOGIX HIGH CAPACITY DUAL PORT ETHERNET/IP MODULE
7	15	ALLEN-BRADLEY	1756-IA16I	CONTROLLOGIX 16 CH. 120VAC ISOLATED DIGITAL INPUT MODULE
8	7	ALLEN-BRADLEY	1756-OA16I	CONTROLLOGIX 16 CH. ISOLATED DIGITAL OUTPUT MODULE
9	22	ALLEN-BRADLEY	1756-TBCH	CONTROLLOGIX MODULE TERMINAL BLOCK
10	8	ENTRELEC	101 598.26	DIN MOUNTING RAIL
11	70	ALLEN-BRADLEY	700-HLT1U1	SPDT RELAY, 6A, 120VAC COIL
12	352	ALLEN-BRADLEY	1492-J3	TERMINAL BLOCK 1 TIER
13	3	ALLEN-BRADLEY	1492-EBJ3	TERMINAL BLOCK 1 TIER END BARRIER
14	24	ALLEN-BRADLEY	1492-EAJ35	TERMINAL BLOCK END ANCHOR
15	41	ALLEN-BRADLEY	1492-FB1C30-L	CLASS CC FUSE HOLDER, 1P, WITH INDICATION
16	40	MERSEN	ATDR1	1A FUSE, CLASS CC FUSE
17	1	MERSEN	ATDR20	20A FUSE, CLASS CC FUSE
18	1	ALLEN-BRADLEY	1783-BMS10CA	STRATIX 5700 10 PORT MANAGED SWITCH
19	14	ALLEN-BRADLEY	1492-H4	FUSE TERMINAL BLOCK WITH INDICATION
20	2	ALLEN-BRADLEY	1492-N37	FUSE TERMINAL BLOCK END BARRIER
21	19	ALLEN-BRADLEY	1492-JD3C	TERMINAL BLOCK, 1P, 2 TIER
22	7	ALLEN-BRADLEY	1492-EBJD3	TERMINAL BLOCK, 2 TIER, GRAY, END BARRIER
23	13	ALLEN-BRADLEY	1492-JG3	TERMINAL BLOCK, 2 TIER, GROUNDING
24	8	SIGNAMAX	KI-DIN-RMM-SL	DIN RAIL KEYSTONE JACK HOUSING
25	8	SIGNAMAX	KJ458MT-C6C-GY	CAT 6 KEYSTONE JACK
26	9	PANDUIT	F3X4LG6	NARROW SLOTTED WIRING DUCT, PVC
27	9	PANDUIT	C3LG6	3" WIRING DUCT COVER
28	1	PHOENIX CONTACT	5600462	RECEPTACLE, 120VAC, 15A, GFI
29	2	HOFFMAN	LEDA1S35	ENCLOSURE LIGHT, 120V, LED

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

Summarized parts list : HOFFMAN.A606016LPG - LEDA1S35

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
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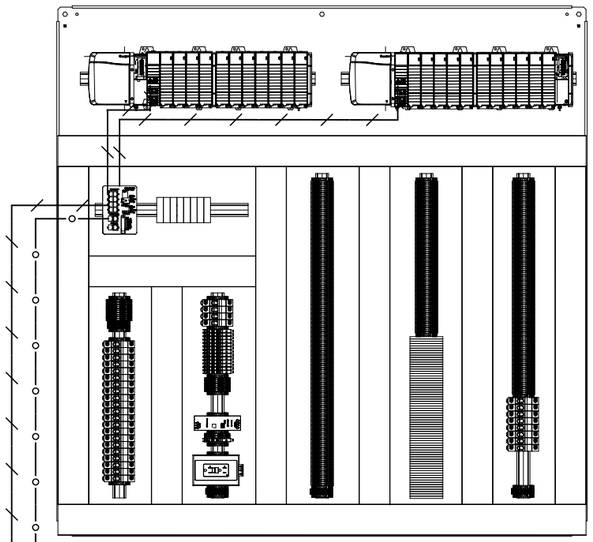
REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

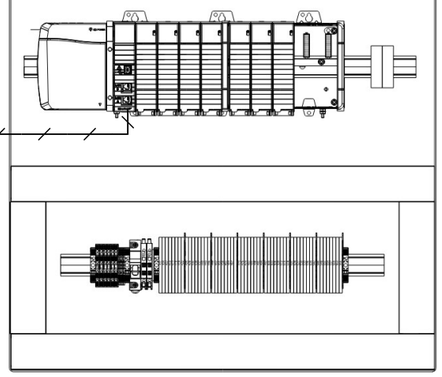
DWG # CMS203-E02A06

CAT 6 ETHERNET
FIBER OPTIC CABLE

WEST PLC PANEL



WEST RTD ENCLOSURE



MCC-1 WEST
2 STRATIX SWITCHES

EF-1, EF-2
EF-3, EF-4
SF-1, SF-2
SF-3, SF-4
100HP VFDS

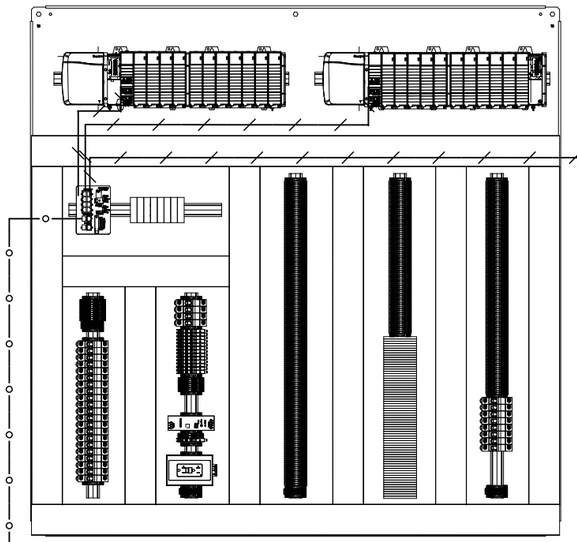
EF-1, EF-2
EF-3, EF-4
SF-1, SF-2
SF-3, SF-4
600HP VFDS

MCC-1 EAST
2 STRATIX SWITCHES

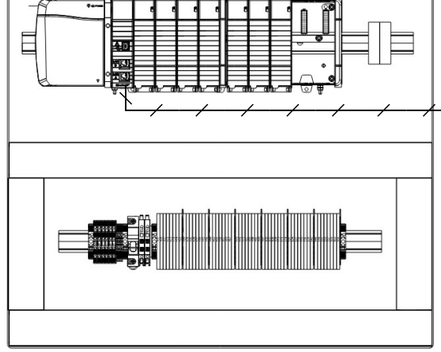
EF-1, EF-2
EF-3, EF-4
SF-1, SF-2
SF-3, SF-4
100HP VFDS

EF-1, EF-2
EF-3, EF-4
SF-1, SF-2
SF-3, SF-4
600HP VFDS

EAST PLC PANEL



EAST RTD ENCLOSURE



WEST SCADA RACK

WEST 480V SWGR

EAST 480V SWGR

EAST SCADA RACK

DELL KVM SWITCH

DELL SCADA SERVER
AND ATTACHED STORAGE

STRATIX ETHERNET SWITCH

CORNING FIBER PANEL

PRIMARY PLC CHASSIS

SECONDARY PLC CHASSIS

SIEMENS ETHERNET SWITCH

DELL KVM SWITCH

DELL SCADA SERVER
AND ATTACHED STORAGE

STRATIX ETHERNET SWITCH

CORNING FIBER PANEL

PRIMARY PLC CHASSIS

SECONDARY PLC CHASSIS

SIEMENS ETHERNET SWITCH

EAST WORKSTATION

SOUTH TUNNEL PLC

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

EAST PLC PANEL - COMMUNICATIONS OVERVIEW

PROJECT # CMS203 | SCALE N/A | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT
3.0	09/04/20	ekilgore	SHIPPED FOR ONSITE INSTALLATION
2.0	09/04/20	ekilgore	SUBMITTAL APPROVED. RELEASED FOR FABRICATION.
1.0	05/08/20	ekilgore	SUBMITTED FOR CUSTOMER APPROVAL

REV	DATE	NAME	REMARKS
5.0	09/17/21	ekilgore	FIELD MODIFICATIONS
5.0	09/17/21	ekilgore	FIELD MODIFICATIONS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS
4.0	08/02/21	ekilgore	AS-BUILT
3.1	09/28/20	ekilgore	ADDED SWBD
1.2	08/31/20	ekilgore	RFI RESPONSE
1.1	06/18/20	ekilgore	SUBMITTAL REV D
0.1	05/08/20	ekilgore	DESIGN CHANGES

DWG # CMS203-E01A09

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

SBS-2000-125-2U, 1600W
125VDC TO 120VAC INVERTER
MOUNTED IN SCADA RACK

120V
N
GND
GND

L1A
RED

N
WHT

L1
L1
RED
FB100
20 A
L1A
N

WEST EF-1 DAMPER CONTROL STATION
FB01 — 1 A — E02A16A08 RED — 120V — SEE DWG E11A16: 04 — N

WEST EF-2 DAMPER CONTROL STATION
FB02 — 1 A — E02A16A11 RED — 120V — SEE DWG E12A16: 04 — N

WEST EF-3 DAMPER CONTROL STATION
FB03 — 1 A — E02A16A14 RED — 120V — SEE DWG E13A16: 04 — N

WEST EF-4 DAMPER CONTROL STATION
FB04 — 1 A — E02A16A17 RED — 120V — SEE DWG E14A16: 04 — N

WEST SF-1 DAMPER CONTROL STATION
FB05 — 1 A — E02A16A20 RED — 120V — SEE DWG E15A16: 04 — N

WEST SF-2 DAMPER CONTROL STATION
FB06 — 1 A — E02A16A23 RED — 120V — SEE DWG E16A16: 04 — N

WEST SF-3 DAMPER CONTROL STATION
FB07 — 1 A — E02A16A26 RED — 120V — SEE DWG E17A16: 04 — N

WEST SF-4 DAMPER CONTROL STATION
FB08 — 1 A — E02A16A29 RED — 120V — SEE DWG E18A16: 04 — N

WEST SF-1 COOLING FAN CONTROL STATION
FB09 — 1 A — E02A16A32 RED — 120V — SEE DWG E23A16: 04 — N

WEST SF-2 COOLING FAN CONTROL STATION
FB10 — 1 A — E02A16A35 RED — 120V — SEE DWG E24A16: 04 — N

L1
(E02A16:37)

N
(E02A16:37)

(E02A16:36)
L1

L1
RED

WEST SF-3 COOLING FAN CONTROL STATION
FB11 — 1 A — E02A16A39 RED — 120V — SEE DWG E25A16: 04 — N

WEST SF-4 COOLING FAN CONTROL STATION
FB12 — 1 A — E02A16A42 RED — 120V — SEE DWG E26A16: 04 — N

WEST EF-1 FAN CONTROL STATION
FB13 — 1 A — E02A16A45 RED — 120V — SEE DWG E35A16: 04 — N

WEST EF-2 FAN CONTROL STATION
FB14 — 1 A — E02A16A48 RED — 120V — SEE DWG E36A16: 04 — N

WEST EF-3 FAN CONTROL STATION
FB15 — 1 A — E02A16A51 RED — 120V — SEE DWG E37A16: 04 — N

WEST EF-4 FAN CONTROL STATION
FB16 — 1 A — E02A16A54 RED — 120V — SEE DWG E38A16: 04 — N

WEST SF-1 FAN CONTROL STATION
FB17 — 1 A — E02A16A57 RED — 120V — SEE DWG E39A16: 04 — N

WEST SF-2 FAN CONTROL STATION
FB18 — 1 A — E02A16A60 RED — 120V — SEE DWG E40A16: 04 — N

WEST SF-3 FAN CONTROL STATION
FB19 — 1 A — E02A16A63 RED — 120V — SEE DWG E41A16: 04 — N

WEST SF-4 FAN CONTROL STATION
FB20 — 1 A — E02A16A66 RED — 120V — SEE DWG E42A16: 04 — N

L1
(E02A17:01)

N
(E02A16:36)
N
WHT

N
(E02A17:01)

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - CONTROL POWER DISTRIBUTION

PROJECT # CMS203 | SCALE N/A | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
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REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E02A16

(E02A16:72)
L1

L1
RED

FB22
1 A
SPARE

FB23
1 A
SPARE

FB24
1 A
SPARE

1756-PA72
CONTROLLOGIX PLC RACK
120VAC POWER SUPPLY

FB25
10 A
E02A17A15
RED
L1
L2
GND
GND

1756-PA72
CONTROLLOGIX I/O RACK
120VAC POWER SUPPLY

FB26
10 A
E02A17A21
RED
L1
L2
GND
GND

GFCI
OUTLET

FB27
5 A
E02A17A26
RED

FB28
2 A
E02A17A29
RED

PANEL LIGHT

PANEL LIGHT

L1
(E02A17:37)

(E02A16:72)
N

N
WHT

N
(E02A17:37)

(E02A17:36)
L1

L1
RED

FB29
2 A
L1-1
RED
TO T'BLK L1-1
DISCRETE OUTPUTS REMOTE RACK SLOT 5
SEE DWG E02A30

FB30
2 A
L1-2
RED
TO T'BLK L1-2
DISCRETE OUTPUTS REMOTE RACK SLOT 6
SEE DWG E02A31

FB31
2 A
L1-3
RED
TO T'BLK L1-3
DISCRETE OUTPUTS REMOTE RACK SLOT 7
SEE DWG E02A32

FB32
2 A
L1-4
RED
TO T'BLK L1-4
DISCRETE OUTPUTS REMOTE RACK SLOT 8
SEE DWG E02A33

FB33
2 A
L1-5
RED
TO T'BLK L1-5
DISCRETE OUTPUTS REMOTE RACK SLOT 9
SEE DWG E02A34

FB34
2 A
L1-6
RED
TO T'BLK L1-6
DISCRETE OUTPUTS REMOTE RACK SLOT 10
SEE DWG E02A35

FB35
2 A
L1-7
RED
TO T'BLK L1-7
DISCRETE OUTPUTS REMOTE RACK SLOT 11
SEE DWG E02A36

FB36
2 A
SPARE

PS-1
24VDC, 5A POWER SUPPLY
1606-XLB120E

FB37
5 A
E02A17A59
RED
PE
L
N
OUT1+
OUT2+
OUT1-
OUT2-
E02A17A58
BLU
FB38
5 A
+24
+24
BLU
24C
24C
WHT/BLU

1783-BMS10CA
10 PORT STRATIX SWITCH
PWR A DC+
PWR A DC-

L1
(E02A20:01)

(E02A17:36)
N

N
WHT

N
(E02A20:01)

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - CONTROL POWER DISTRIBUTION

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

REV	DATE	NAME	REMARKS

DWG # CMS203-E02A17

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
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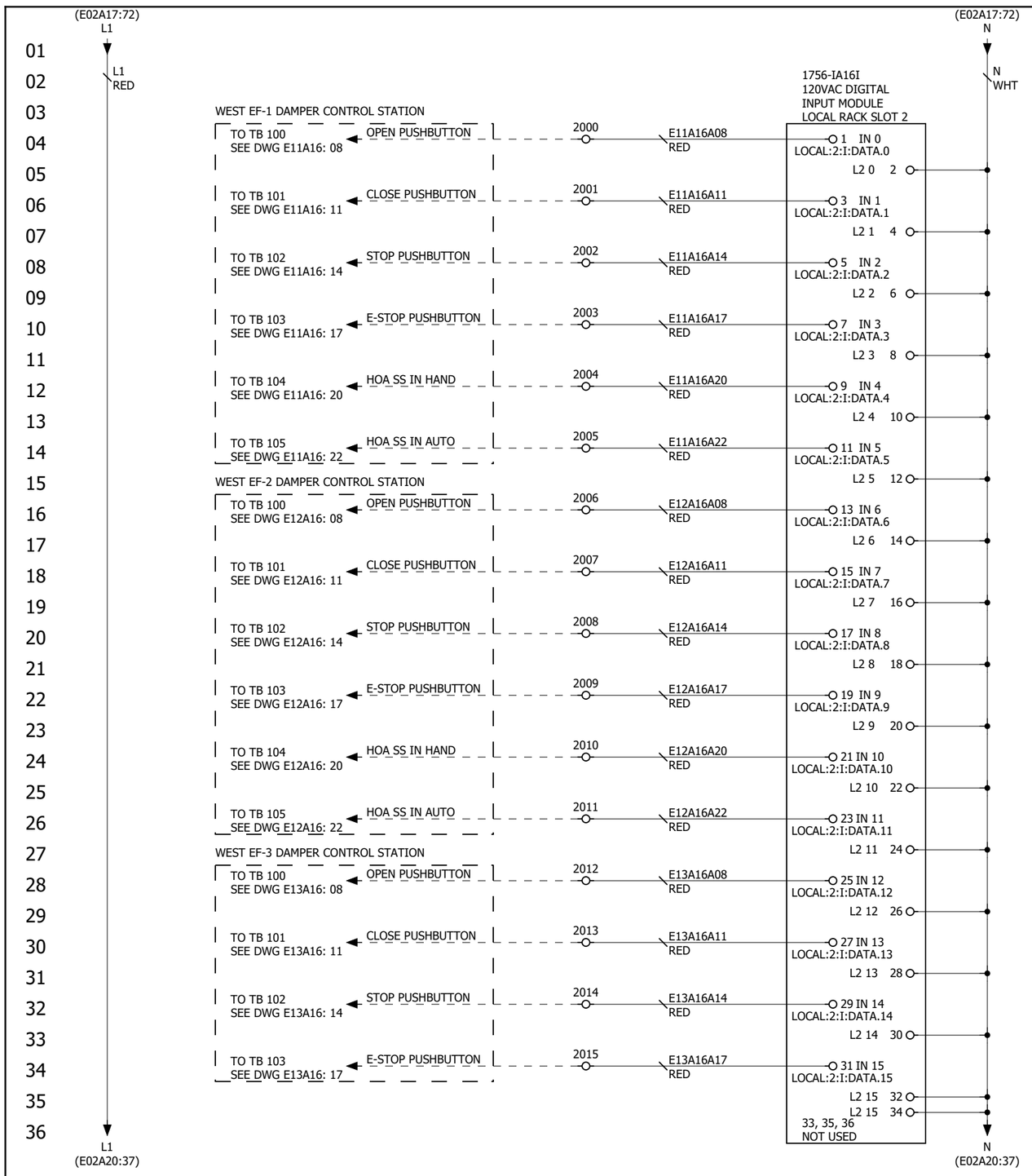

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - DISCRETE INPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
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REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

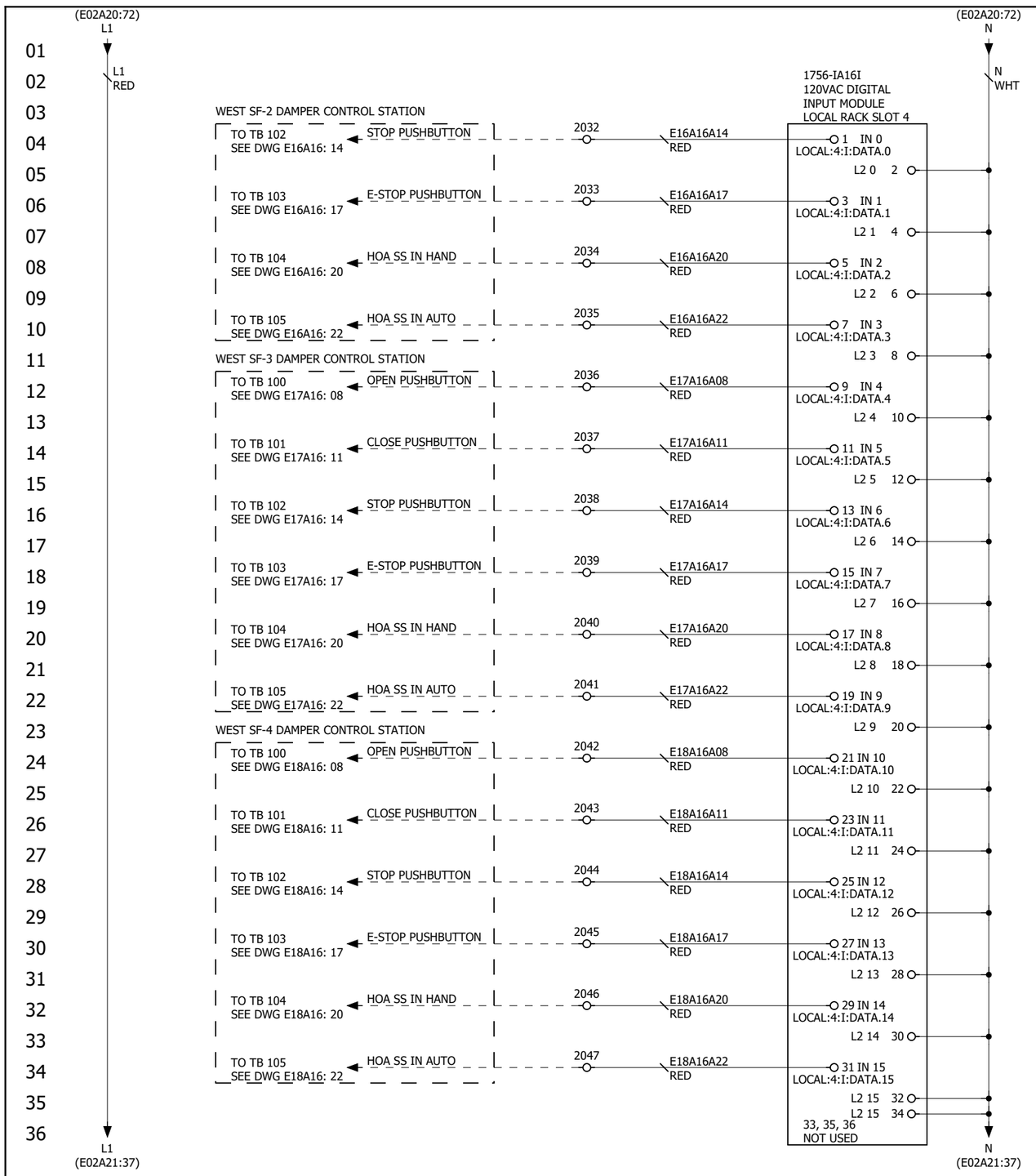
DWG # CMS203-E02A20

(E02A20:72)
L1

(E02A20:72)
N

(E02A21:36)
L1

(E02A21:36)
N



STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - DISCRETE INPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

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REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E02A21

(E02A21:72)
L1

(E02A21:72)
N

(E02A22:36)
L1

(E02A22:36)
N

L1
RED

N
WHT

1756-IA16I
120VAC DIGITAL
INPUT MODULE
LOCAL RACK SLOT 6

WEST SF-3 COOLING FAN CONTROL STATION

TO TB 104 SEE DWG E25A16: 17	HOA SS IN HAND	2064	E25A16A17 RED	1 IN 0 LOCAL:6:I:DATA.0	L2 0 2
TO TB 105 SEE DWG E25A16: 19	HOA SS IN AUTO	2065	E25A16A19 RED	3 IN 1 LOCAL:6:I:DATA.1	L2 1 4

WEST SF-4 COOLING FAN CONTROL STATION

TO TB 100 SEE DWG E26A16: 08	LOW SPEED PUSHBUTTON	2066	E26A16A08 RED	5 IN 2 LOCAL:6:I:DATA.2	L2 2 6
TO TB 101 SEE DWG E26A16: 10	HIGH SPEED PUSHBUTTON	2067	E26A16A10 RED	7 IN 3 LOCAL:6:I:DATA.3	L2 3 8
TO TB 102 SEE DWG E26A16: 12	STOP PUSHBUTTON	2068	E26A16A12 RED	9 IN 4 LOCAL:6:I:DATA.4	L2 4 10
TO TB 103 SEE DWG E26A16: 14	E-STOP PUSHBUTTON	2069	E26A16A14 RED	11 IN 5 LOCAL:6:I:DATA.5	L2 5 12
TO TB 104 SEE DWG E26A16: 17	HOA SS IN HAND	2070	E26A16A17 RED	13 IN 6 LOCAL:6:I:DATA.6	L2 6 14
TO TB 105 SEE DWG E26A16: 19	HOA SS IN AUTO	2071	E26A16A19 RED	15 IN 7 LOCAL:6:I:DATA.7	L2 7 16

WEST EF-1 FAN CONTROL STATION

TO TB 100 SEE DWG E35A16: 09	HOA SS IN HAND	2072	E35A16A09 RED	17 IN 8 LOCAL:6:I:DATA.8	L2 8 18
TO TB 101 SEE DWG E35A16: 11	HOA SS IN AUTO	2073	E35A16A11 RED	19 IN 9 LOCAL:6:I:DATA.9	L2 9 20
TO TB 102 SEE DWG E35A16: 13	25% SPEED PUSHBUTTON	2074	E35A16A13 RED	21 IN 10 LOCAL:6:I:DATA.10	L2 10 22
TO TB 103 SEE DWG E35A16: 15	50% SPEED PUSHBUTTON	2075	E35A16A15 RED	23 IN 11 LOCAL:6:I:DATA.11	L2 11 24
TO TB 104 SEE DWG E35A16: 17	100% SPEED PUSHBUTTON	2076	E35A16A17 RED	25 IN 12 LOCAL:6:I:DATA.12	L2 12 26
TO TB 105 SEE DWG E35A16: 19	STOP PUSHBUTTON	2077	E35A16A19 RED	27 IN 13 LOCAL:6:I:DATA.13	L2 13 28
TO TB 106 SEE DWG E35A16: 21	E-STOP PUSHBUTTON	2078	E35A16A21 RED	29 IN 14 LOCAL:6:I:DATA.14	L2 14 30

WEST EF-2 FAN CONTROL STATION

TO TB 100 SEE DWG E36A16: 09	HOA SS IN HAND	2079	E36A16A09 RED	31 IN 15 LOCAL:6:I:DATA.15	L2 15 32 L2 15 34

33, 35, 36
NOT USED

L1
(E02A22:37)

N
(E02A22:37)

L1
(E02A23:01)

N
(E02A23:01)

1756-IA16I
120VAC DIGITAL
INPUT MODULE
LOCAL RACK SLOT 7

WEST EF-2 FAN CONTROL STATION

TO TB 101 SEE DWG E36A16: 11	HOA SS IN AUTO	2080	E36A16A11 RED	1 IN 0 LOCAL:7:I:DATA.0	L2 0 2
TO TB 102 SEE DWG E36A16: 13	25% SPEED PUSHBUTTON	2081	E36A16A13 RED	3 IN 1 LOCAL:7:I:DATA.1	L2 1 4
TO TB 103 SEE DWG E36A16: 15	50% SPEED PUSHBUTTON	2082	E36A16A15 RED	5 IN 2 LOCAL:7:I:DATA.2	L2 2 6
TO TB 104 SEE DWG E36A16: 17	100% SPEED PUSHBUTTON	2083	E36A16A17 RED	7 IN 3 LOCAL:7:I:DATA.3	L2 3 8
TO TB 105 SEE DWG E36A16: 19	STOP PUSHBUTTON	2084	E36A16A19 RED	9 IN 4 LOCAL:7:I:DATA.4	L2 4 10
TO TB 106 SEE DWG E36A16: 21	E-STOP PUSHBUTTON	2085	E36A16A21 RED	11 IN 5 LOCAL:7:I:DATA.5	L2 5 12

WEST EF-3 FAN CONTROL STATION

TO TB 100 SEE DWG E37A16: 09	HOA SS IN HAND	2086	E37A16A09 RED	13 IN 6 LOCAL:7:I:DATA.6	L2 6 14
TO TB 101 SEE DWG E37A16: 11	HOA SS IN AUTO	2087	E37A16A11 RED	15 IN 7 LOCAL:7:I:DATA.7	L2 7 16
TO TB 102 SEE DWG E37A16: 13	25% SPEED PUSHBUTTON	2088	E37A16A13 RED	17 IN 8 LOCAL:7:I:DATA.8	L2 8 18
TO TB 103 SEE DWG E37A16: 15	50% SPEED PUSHBUTTON	2089	E37A16A15 RED	19 IN 9 LOCAL:7:I:DATA.9	L2 9 20
TO TB 104 SEE DWG E37A16: 17	100% SPEED PUSHBUTTON	2090	E37A16A17 RED	21 IN 10 LOCAL:7:I:DATA.10	L2 10 22
TO TB 105 SEE DWG E37A16: 19	STOP PUSHBUTTON	2091	E37A16A19 RED	23 IN 11 LOCAL:7:I:DATA.11	L2 11 24
TO TB 106 SEE DWG E37A16: 21	E-STOP PUSHBUTTON	2092	E37A16A21 RED	25 IN 12 LOCAL:7:I:DATA.12	L2 12 26

WEST EF-4 FAN CONTROL STATION

TO TB 100 SEE DWG E38A16: 09	HOA SS IN HAND	2093	E38A16A09 RED	27 IN 13 LOCAL:7:I:DATA.13	L2 13 28
TO TB 101 SEE DWG E38A16: 11	HOA SS IN AUTO	2094	E38A16A11 RED	29 IN 14 LOCAL:7:I:DATA.14	L2 14 30
TO TB 102 SEE DWG E38A16: 13	25% SPEED PUSHBUTTON	2095	E38A16A13 RED	31 IN 15 LOCAL:7:I:DATA.15	L2 15 32 L2 15 34

33, 35, 36
NOT USED

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - DISCRETE INPUTS

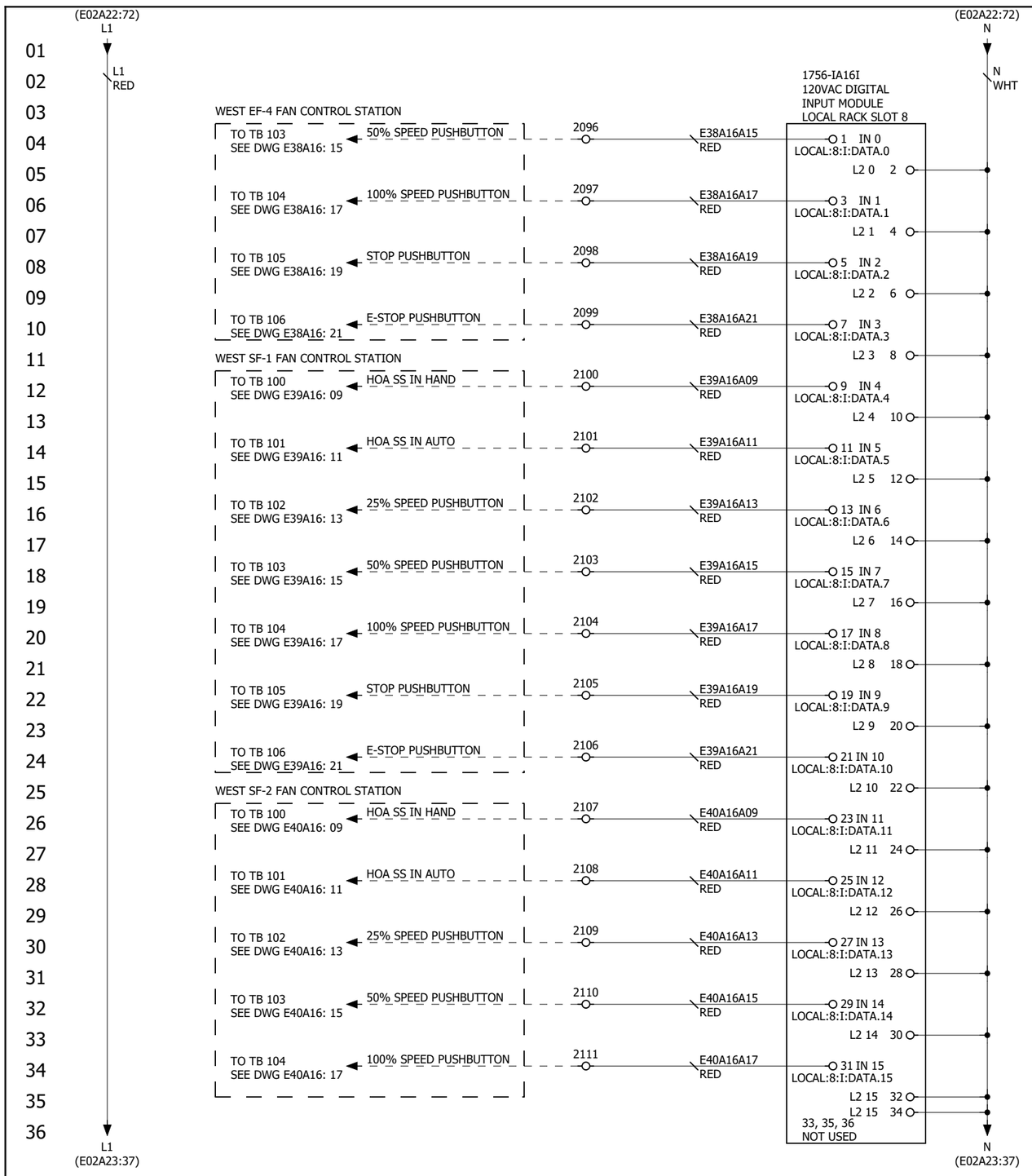
PROJECT # CMS203 | SCALE | ENG:E. KILGORE

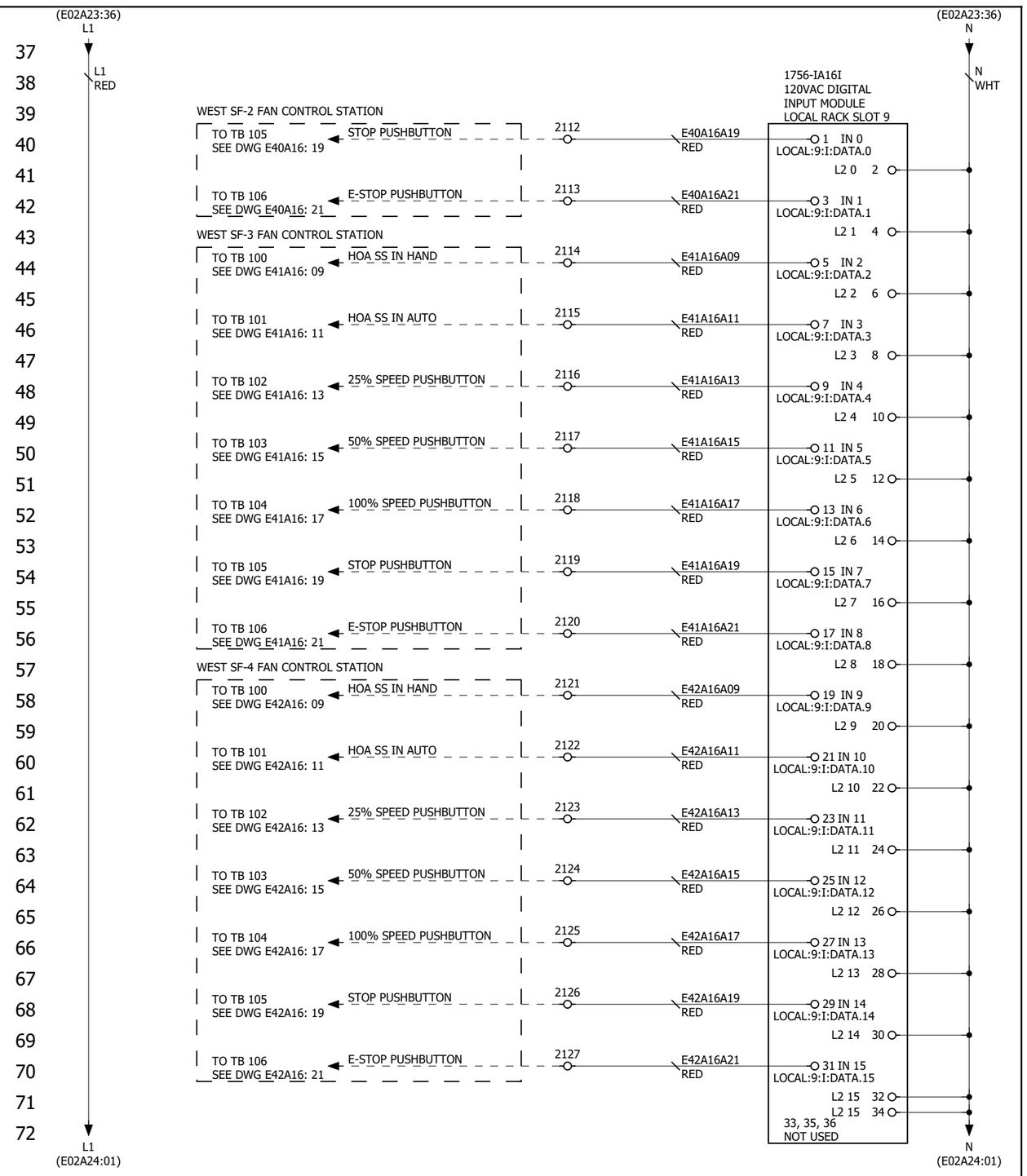
REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E02A22





STATE OF COLORADO DEPARTMENT OF TRANSPORTATION

EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - DISCRETE INPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.

5301 NORTH 57TH STREET
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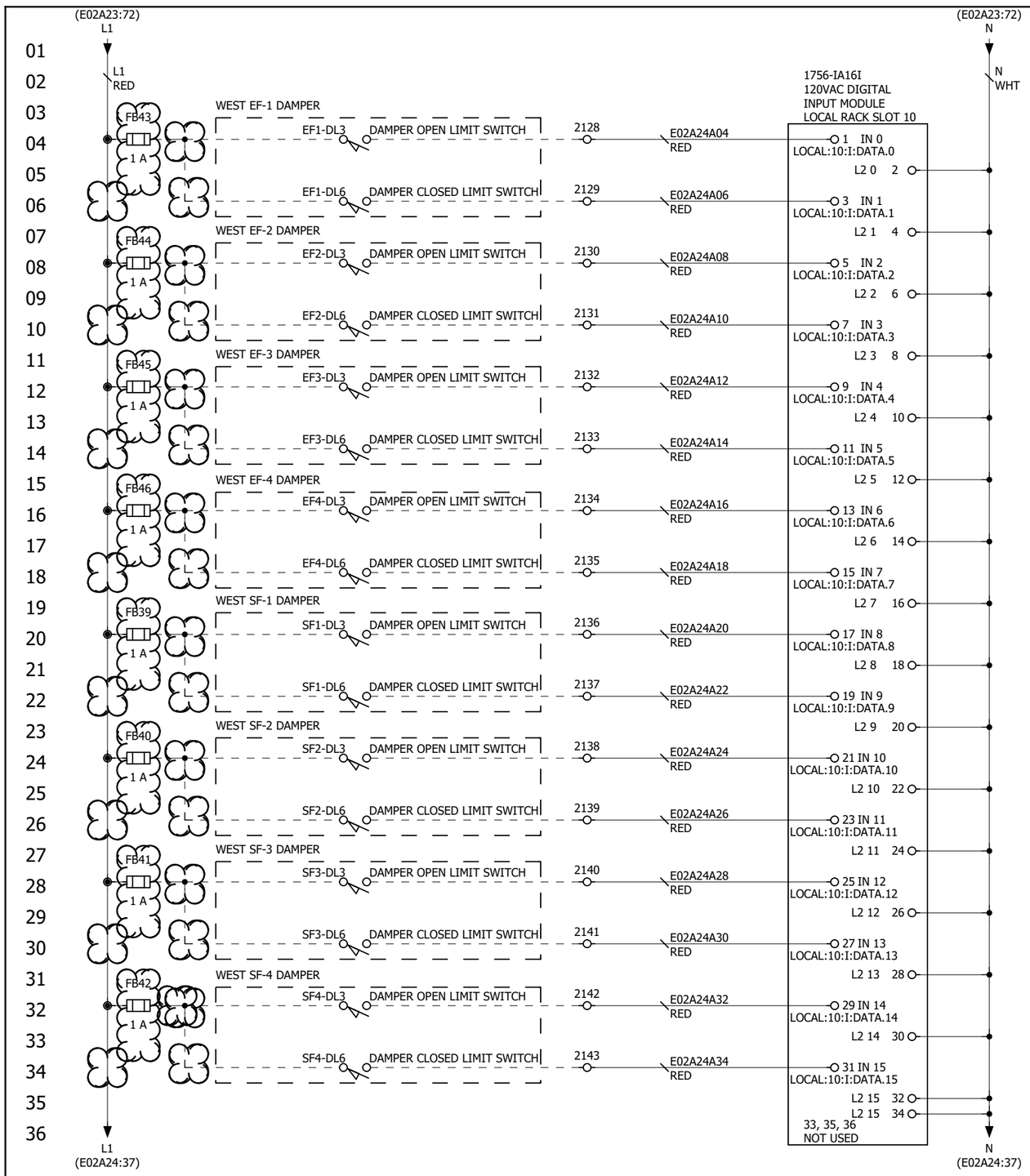
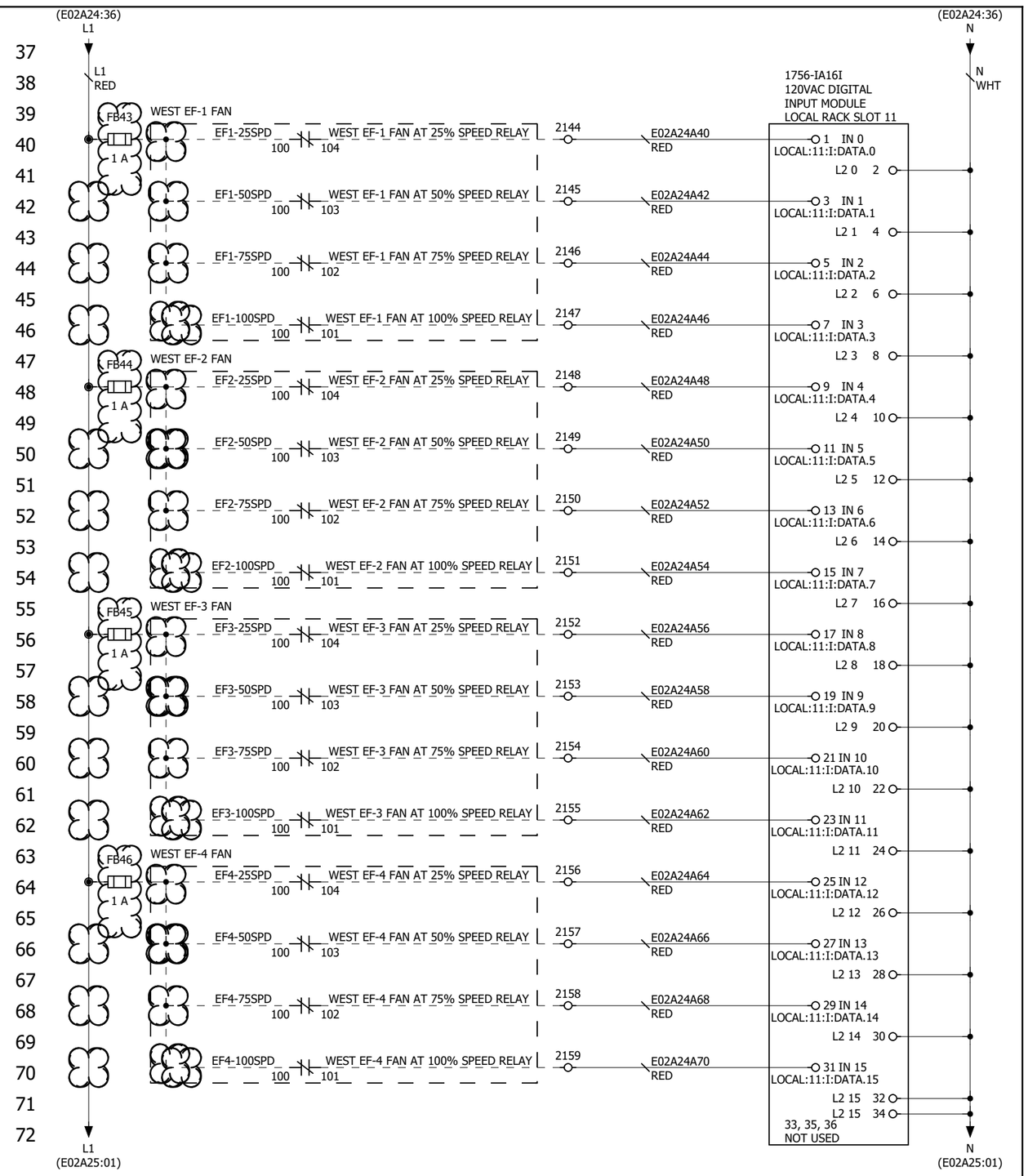
(303) 376-6280

DWG # CMS203-E02A23





STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - DISCRETE INPUTS

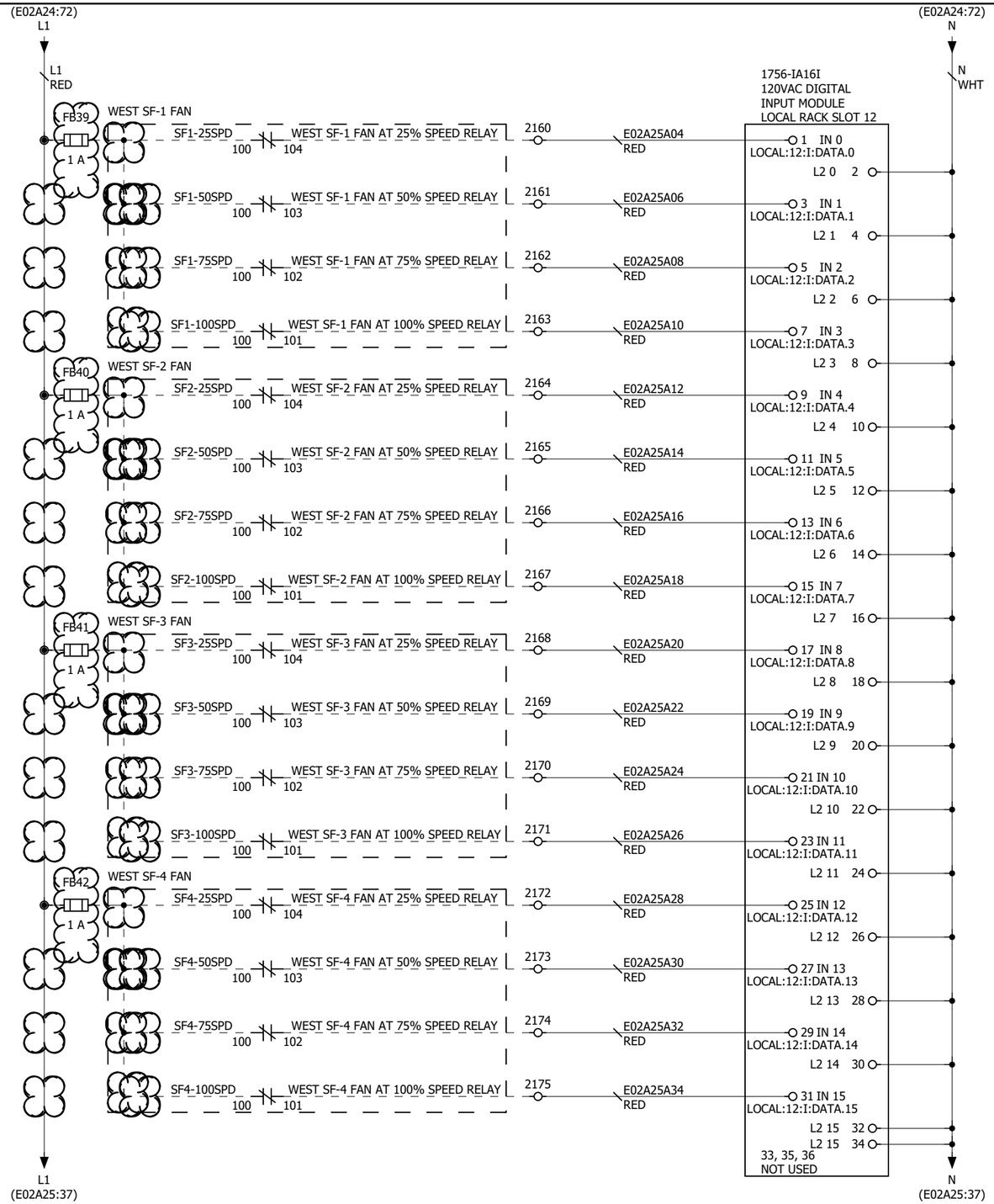
PROJECT # CMS203 | SCALE | ENG:E. KILGORE

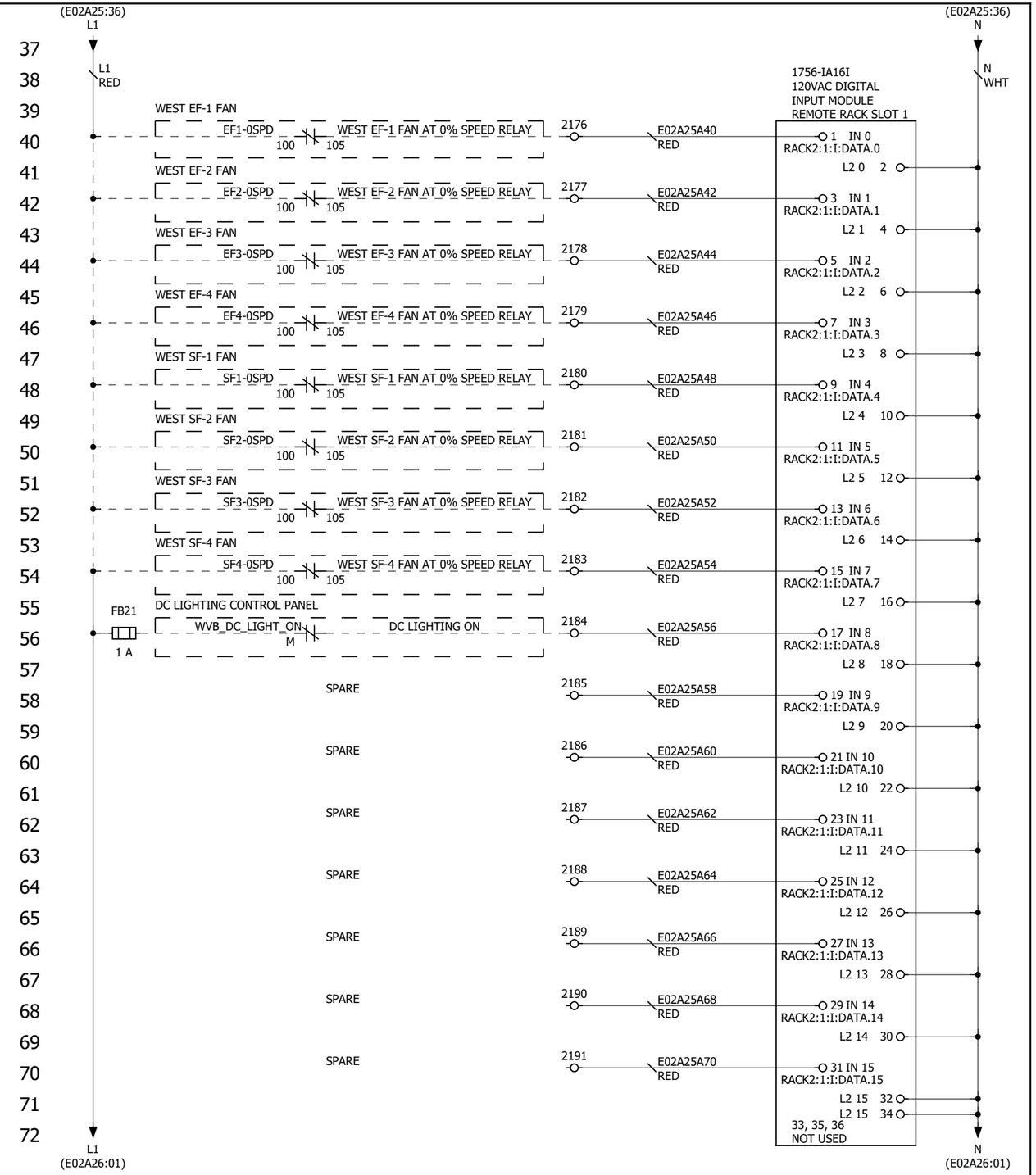
REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

REV	DATE	NAME	REMARKS

DWG # CMS203-E02A24

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280





STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - DISCRETE INPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
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(402) 464-6823
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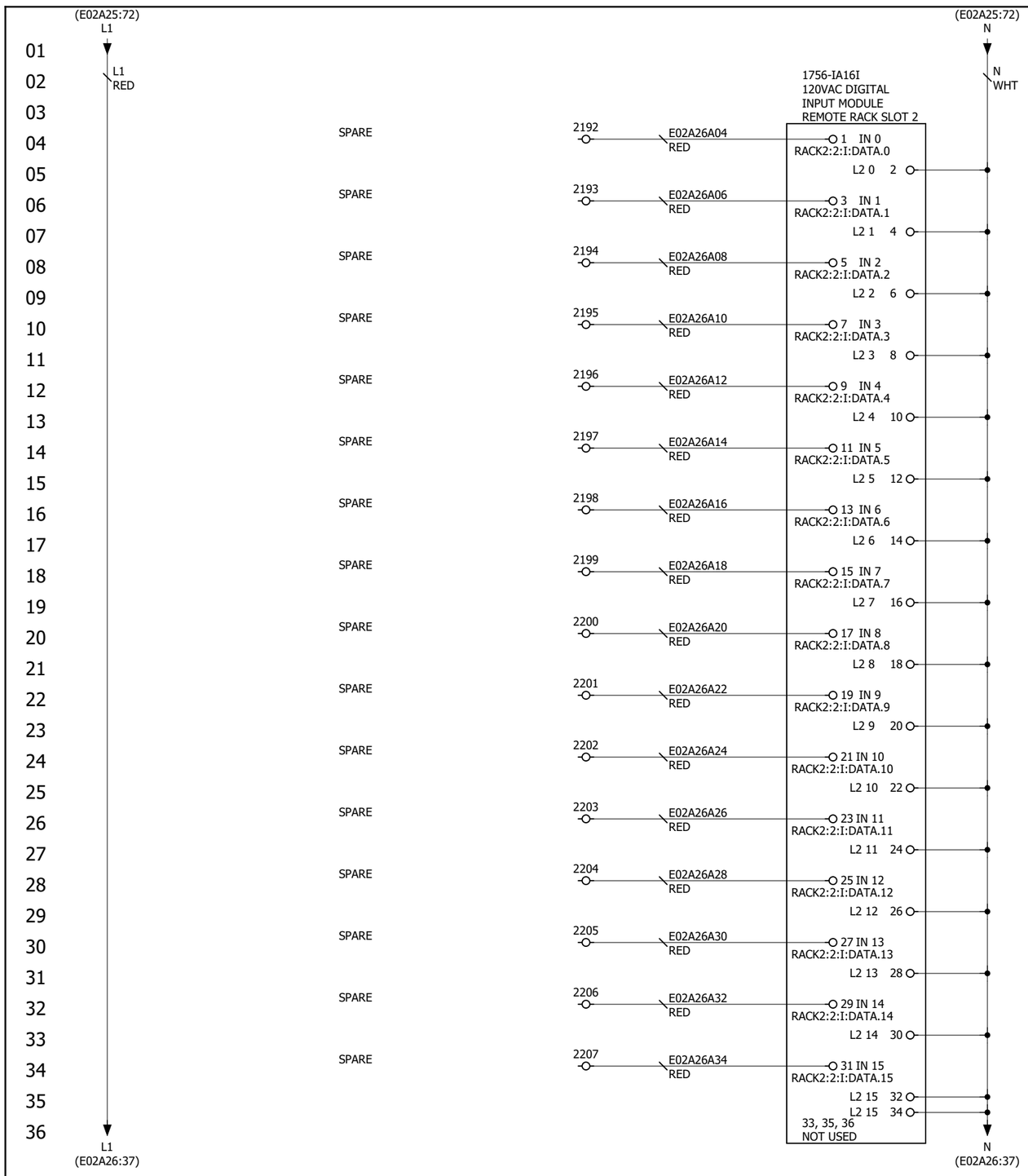
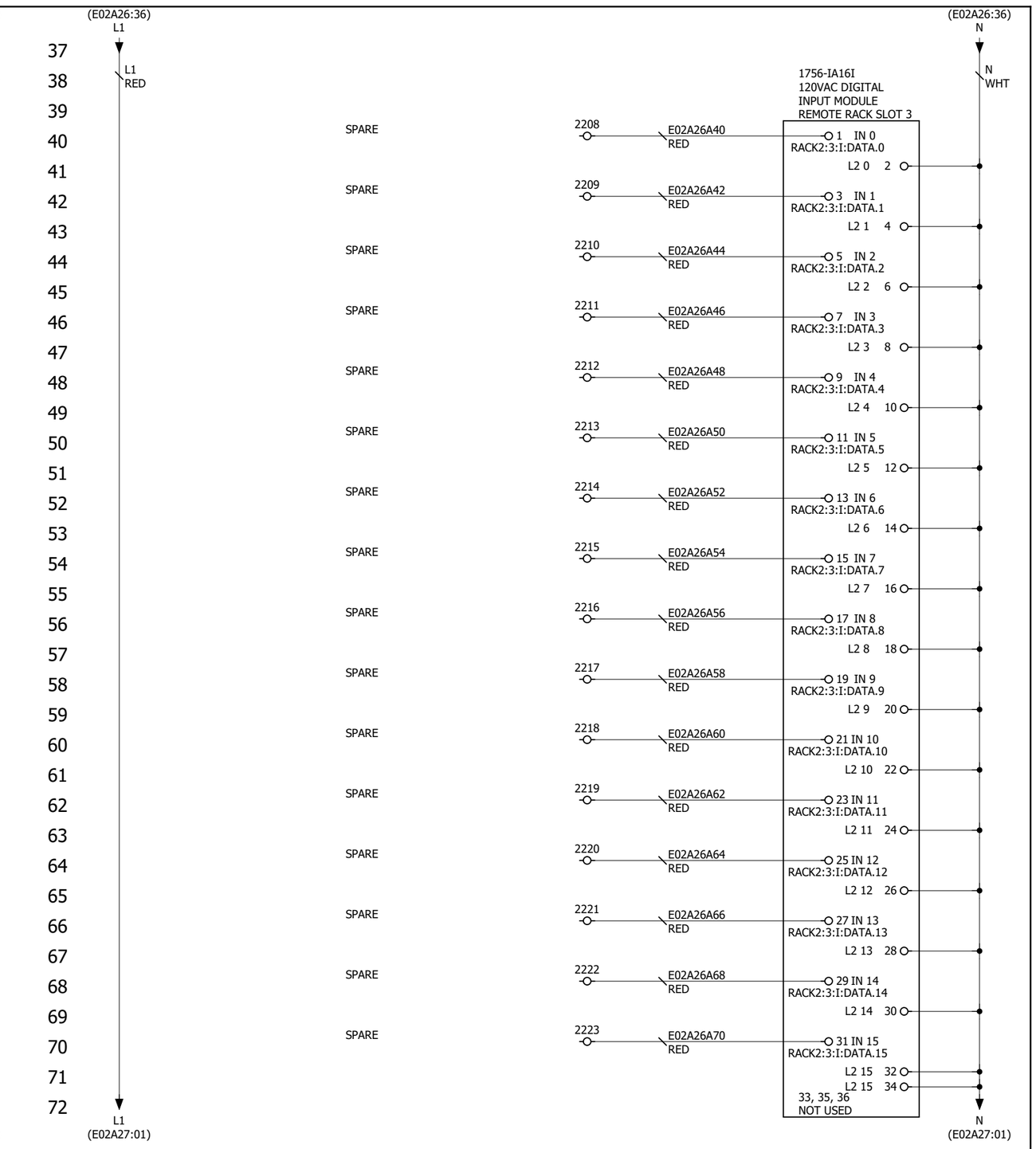
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E02A25





STATE OF COLORADO DEPARTMENT OF TRANSPORTATION

EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - DISCRETE INPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.

5301 NORTH 57TH STREET
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ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E02A26

(E02A26:72)
L1

(E02A26:72)
N

1756-IA16I
120VAC DIGITAL
INPUT MODULE
REMOTE RACK SLOT 4

SPARE	2224	E02A27A04 RED	1 IN 0 RACK2:4:I:DATA.0	L2 0 2	
SPARE	2225	E02A27A06 RED	3 IN 1 RACK2:4:I:DATA.1	L2 1 4	
SPARE	2226	E02A27A08 RED	5 IN 2 RACK2:4:I:DATA.2	L2 2 6	
SPARE	2227	E02A27A10 RED	7 IN 3 RACK2:4:I:DATA.3	L2 3 8	
SPARE	2228	E02A27A12 RED	9 IN 4 RACK2:4:I:DATA.4	L2 4 10	
SPARE	2229	E02A27A14 RED	11 IN 5 RACK2:4:I:DATA.5	L2 5 12	
SPARE	2230	E02A27A16 RED	13 IN 6 RACK2:4:I:DATA.6	L2 6 14	
SPARE	2231	E02A27A18 RED	15 IN 7 RACK2:4:I:DATA.7	L2 7 16	
SPARE	2232	E02A27A20 RED	17 IN 8 RACK2:4:I:DATA.8	L2 8 18	
SPARE	2233	E02A27A22 RED	19 IN 9 RACK2:4:I:DATA.9	L2 9 20	
SPARE	2234	E02A27A24 RED	21 IN 10 RACK2:4:I:DATA.10	L2 10 22	
SPARE	2235	E02A27A26 RED	23 IN 11 RACK2:4:I:DATA.11	L2 11 24	
SPARE	2236	E02A27A28 RED	25 IN 12 RACK2:4:I:DATA.12	L2 12 26	
SPARE	2237	E02A27A30 RED	27 IN 13 RACK2:4:I:DATA.13	L2 13 28	
SPARE	2238	E02A27A32 RED	29 IN 14 RACK2:4:I:DATA.14	L2 14 30	
SPARE	2239	E02A27A34 RED	31 IN 15 RACK2:4:I:DATA.15	L2 15 32 L2 15 34	

33, 35, 36
NOT USED

L1

N
WHT

N
(E02A30:01)

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - DISCRETE INPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E02A27

(E02A17:40)
L1-1

(E02A27:36)
N

(E02A17:42)
L1-2

(E02A30:36)
N

01											37								
02	L1-1 RED	1756-OA16I 120VAC DIGITAL OUTPUT MODULE REMOTE RACK SLOT 5						N WHT			38	L1-2 RED	1756-OA16I 120VAC DIGITAL OUTPUT MODULE REMOTE RACK SLOT 6						N WHT
03											39								
04		OUT 0 1 RACK2:5:O:DATA.0	E02A30A04 RED	3000	CR100	WEST EF-1 DAMPER OPEN LIGHT RELAY	14 11 (E02A60:02)				40		OUT 0 1 RACK2:6:O:DATA.0	E02A30A40 RED	3016	CR116	WEST SF-2 DAMPER CLOSED LIGHT RELAY	14 11 (E02A60:61)	
05		2 L1 0									41		2 L1 0						
06		OUT 1 3 RACK2:5:O:DATA.1	E02A30A06 RED	3001	CR101	WEST EF-1 DAMPER CLOSED LIGHT RELAY	14 11 (E02A60:05)				42		OUT 1 3 RACK2:6:O:DATA.1	E02A30A42 RED	3017	CR117	WEST SF-2 DAMPER STOPPED LIGHT RELAY	14 11 (E02A60:64)	
07		4 L1 1									43		4 L1 1						
08		OUT 2 5 RACK2:5:O:DATA.2	E02A30A08 RED	3002	CR102	WEST EF-1 DAMPER STOPPED LIGHT RELAY	14 11 (E02A60:08)				44		OUT 2 5 RACK2:6:O:DATA.2	E02A30A44 RED	3018	CR118	WEST SF-3 DAMPER OPEN LIGHT RELAY	14 11 (E02A61:02)	
09		6 L1 2									45		6 L1 2						
10		OUT 3 7 RACK2:5:O:DATA.3	E02A30A10 RED	3003	CR103	WEST EF-2 DAMPER OPEN LIGHT RELAY	14 11 (E02A60:12)				46		OUT 3 7 RACK2:6:O:DATA.3	E02A30A46 RED	3019	CR119	WEST SF-3 DAMPER CLOSED LIGHT RELAY	14 11 (E02A61:05)	
11		8 L1 3									47		8 L1 3						
12		OUT 4 9 RACK2:5:O:DATA.4	E02A30A12 RED	3004	CR104	WEST EF-2 DAMPER CLOSED LIGHT RELAY	14 11 (E02A60:15)				48		OUT 4 9 RACK2:6:O:DATA.4	E02A30A48 RED	3020	CR120	WEST SF-3 DAMPER STOPPED LIGHT RELAY	14 11 (E02A61:08)	
13		10 L1 4									49		10 L1 4						
14		OUT 5 11 RACK2:5:O:DATA.5	E02A30A14 RED	3005	CR105	WEST EF-2 DAMPER STOPPED LIGHT RELAY	14 11 (E02A60:18)				50		OUT 5 11 RACK2:6:O:DATA.5	E02A30A50 RED	3021	CR121	WEST SF-4 DAMPER OPEN LIGHT RELAY	14 11 (E02A61:12)	
15		12 L1 5									51		12 L1 5						
16		OUT 6 13 RACK2:5:O:DATA.6	E02A30A16 RED	3006	CR106	WEST EF-3 DAMPER OPEN LIGHT RELAY	14 11 (E02A60:22)				52		OUT 6 13 RACK2:6:O:DATA.6	E02A30A52 RED	3022	CR122	WEST SF-4 DAMPER CLOSED LIGHT RELAY	14 11 (E02A61:15)	
17		14 L1 6									53		14 L1 6						
18		OUT 7 15 RACK2:5:O:DATA.7	E02A30A18 RED	3007	CR107	WEST EF-3 DAMPER CLOSED LIGHT RELAY	14 11 (E02A60:25)				54		OUT 7 15 RACK2:6:O:DATA.7	E02A30A54 RED	3023	CR123	WEST SF-4 DAMPER STOPPED LIGHT RELAY	14 11 (E02A61:18)	
19		16 L1 7									55		16 L1 7						
20		OUT 8 17 RACK2:5:O:DATA.8	E02A30A20 RED	3008	CR108	WEST EF-3 DAMPER STOPPED LIGHT RELAY	14 11 (E02A60:28)				56		OUT 8 17 RACK2:6:O:DATA.8	E02A30A56 RED	3024	CR124	WEST SF-1 COOLING FAN LOW SPEED LIGHT RELAY	14 11 (E02A61:22)	
21		18 L1 8									57		18 L1 8						
22		OUT 9 19 RACK2:5:O:DATA.9	E02A30A22 RED	3009	CR109	WEST EF-4 DAMPER OPEN LIGHT RELAY	14 11 (E02A60:38)				58		OUT 9 19 RACK2:6:O:DATA.9	E02A30A58 RED	3025	CR125	WEST SF-1 COOLING FAN HIGH SPEED LIGHT RELAY	14 11 (E02A61:25)	
23		20 L1 9									59		20 L1 9						
24		OUT 10 21 RACK2:5:O:DATA.10	E02A30A24 RED	3010	CR110	WEST EF-4 DAMPER CLOSED LIGHT RELAY	14 11 (E02A60:41)				60		OUT 10 21 RACK2:6:O:DATA.10	E02A30A60 RED	3026	CR126	WEST SF-1 COOLING FAN STOPPED LIGHT RELAY	14 11 (E02A61:28)	
25		22 L1 10									61		22 L1 10						
26		OUT 11 23 RACK2:5:O:DATA.11	E02A30A26 RED	3011	CR111	WEST EF-4 DAMPER STOPPED LIGHT RELAY	14 11 (E02A60:44)				62		OUT 11 23 RACK2:6:O:DATA.11	E02A30A62 RED	3027	CR127	WEST SF-2 COOLING FAN LOW SPEED LIGHT RELAY	14 11 (E02A61:38)	
27		24 L1 11									63		24 L1 11						
28		OUT 12 25 RACK2:5:O:DATA.12	E02A30A28 RED	3012	CR112	WEST SF-1 DAMPER OPEN LIGHT RELAY	14 11 (E02A60:48)				64		OUT 12 25 RACK2:6:O:DATA.12	E02A30A64 RED	3028	CR128	WEST SF-2 COOLING FAN HIGH SPEED LIGHT RELAY	14 11 (E02A61:41)	
29		26 L1 12									65		26 L1 12						
30		OUT 13 27 RACK2:5:O:DATA.13	E02A30A30 RED	3013	CR113	WEST SF-1 DAMPER CLOSED LIGHT RELAY	14 11 (E02A60:51)				66		OUT 13 27 RACK2:6:O:DATA.13	E02A30A66 RED	3029	CR129	WEST SF-2 COOLING FAN STOPPED LIGHT RELAY	14 11 (E02A61:44)	
31		28 L1 13									67		28 L1 13						
32		OUT 14 29 RACK2:5:O:DATA.14	E02A30A32 RED	3014	CR114	WEST SF-1 DAMPER STOPPED LIGHT RELAY	14 11 (E02A60:54)				68		OUT 14 29 RACK2:6:O:DATA.14	E02A30A68 RED	3030	CR130	WEST SF-3 COOLING FAN LOW SPEED LIGHT RELAY	14 11 (E02A61:48)	
33		30 L1 14									69		30 L1 14						
34		OUT 15 31 RACK2:5:O:DATA.15	E02A30A34 RED	3015	CR115	WEST SF-2 DAMPER OPEN LIGHT RELAY	14 11 (E02A60:58)				70		OUT 15 31 RACK2:6:O:DATA.15	E02A30A70 RED	3031	CR131	WEST SF-3 COOLING FAN HIGH SPEED LIGHT RELAY	14 11 (E02A61:51)	
35		32 L1 15									71		32 L1 15						
36		34 L1 15									72		34 L1 15						
	L1-1	33, 35, 36 NOT USED						N (E02A30:37)				L1-2	33, 35, 36 NOT USED						N (E02A31:01)

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - DISCRETE OUTPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

REV	DATE	NAME	REMARKS

DWG # CMS203-E02A30

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

(E02A17:44)
L1-3

(E02A30:72)
N

(E02A17:46)
L1-4

(E02A31:36)
N

L1-3
RED

1756-OA16I
120VAC DIGITAL
OUTPUT MODULE
REMOTE RACK SLOT 7

OUT 0 1 RACK2:7:O:DATA.0	E02A31A04 RED	3032	CR132	WEST SF-3 COOLING FAN STOPPED LIGHT RELAY	14 11 (E02A61:54)
2 L1 0					
OUT 1 3 RACK2:7:O:DATA.1	E02A31A06 RED	3033	CR133	WEST SF-4 COOLING FAN LOW SPEED LIGHT RELAY	14 11 (E02A61:58)
4 L1 1					
OUT 2 5 RACK2:7:O:DATA.2	E02A31A08 RED	3034	CR134	WEST SF-4 COOLING FAN HIGH SPEED LIGHT RELAY	14 11 (E02A61:61)
6 L1 2					
OUT 3 7 RACK2:7:O:DATA.3	E02A31A10 RED	3035	CR135	WEST SF-4 COOLING FAN STOPPED LIGHT RELAY	14 11 (E02A61:64)
8 L1 3					
OUT 4 9 RACK2:7:O:DATA.4	E02A31A12 RED	3036	CR136	WEST EF-1 FAN AT 25% SPEED LIGHT RELAY	14 11 (E02A62:02)
10 L1 4					
OUT 5 11 RACK2:7:O:DATA.5	E02A31A14 RED	3037	CR137	WEST EF-1 FAN AT 50% SPEED LIGHT RELAY	14 11 (E02A62:05)
12 L1 5					
OUT 6 13 RACK2:7:O:DATA.6	E02A31A16 RED	3038	CR138	WEST EF-1 FAN AT 100% SPEED LIGHT RELAY	14 11 (E02A62:08)
14 L1 6					
OUT 7 15 RACK2:7:O:DATA.7	E02A31A18 RED	3039	CR139	WEST EF-1 FAN STOPPED LIGHT RELAY	14 11 (E02A62:11)
16 L1 7					
OUT 8 17 RACK2:7:O:DATA.8	E02A31A20 RED	3040	CR140	WEST EF-2 FAN AT 25% SPEED LIGHT RELAY	14 11 (E02A62:15)
18 L1 8					
OUT 9 19 RACK2:7:O:DATA.9	E02A31A22 RED	3041	CR141	WEST EF-2 FAN AT 50% SPEED LIGHT RELAY	14 11 (E02A62:18)
20 L1 9					
OUT 10 21 RACK2:7:O:DATA.10	E02A31A24 RED	3042	CR142	WEST EF-2 FAN AT 100% SPEED LIGHT RELAY	14 11 (E02A62:21)
22 L1 10					
OUT 11 23 RACK2:7:O:DATA.11	E02A31A26 RED	3043	CR143	WEST EF-2 FAN STOPPED LIGHT RELAY	14 11 (E02A62:24)
24 L1 11					
OUT 12 25 RACK2:7:O:DATA.12	E02A31A28 RED	3044	CR144	WEST EF-3 FAN AT 25% SPEED LIGHT RELAY	14 11 (E02A62:38)
26 L1 12					
OUT 13 27 RACK2:7:O:DATA.13	E02A31A30 RED	3045	CR145	WEST EF-3 FAN AT 50% SPEED LIGHT RELAY	14 11 (E02A62:41)
28 L1 13					
OUT 14 29 RACK2:7:O:DATA.14	E02A31A32 RED	3046	CR146	WEST EF-3 FAN AT 100% SPEED LIGHT RELAY	14 11 (E02A62:44)
30 L1 14					
OUT 15 31 RACK2:7:O:DATA.15	E02A31A34 RED	3047	CR147	WEST EF-3 FAN STOPPED LIGHT RELAY	14 11 (E02A62:47)
32 L1 15					
34 L1 15					

33, 35, 36
NOT USED

L1-3

N
(E02A31:37)

L1-4
RED

1756-OA16I
120VAC DIGITAL
OUTPUT MODULE
REMOTE RACK SLOT 8

OUT 0 1 RACK2:8:O:DATA.0	E02A31A40 RED	3048	CR148	WEST EF-4 FAN AT 25% SPEED LIGHT RELAY	14 11 (E02A62:51)
2 L1 0					
OUT 1 3 RACK2:8:O:DATA.1	E02A31A42 RED	3049	CR149	WEST EF-4 FAN AT 50% SPEED LIGHT RELAY	14 11 (E02A62:54)
4 L1 1					
OUT 2 5 RACK2:8:O:DATA.2	E02A31A44 RED	3050	CR150	WEST EF-4 FAN AT 100% SPEED LIGHT RELAY	14 11 (E02A62:57)
6 L1 2					
OUT 3 7 RACK2:8:O:DATA.3	E02A31A46 RED	3051	CR151	WEST EF-4 FAN STOPPED LIGHT RELAY	14 11 (E02A62:60)
8 L1 3					
OUT 4 9 RACK2:8:O:DATA.4	E02A31A48 RED	3052	CR152	WEST SF-1 FAN AT 25% SPEED LIGHT RELAY	14 11 (E02A63:02)
10 L1 4					
OUT 5 11 RACK2:8:O:DATA.5	E02A31A50 RED	3053	CR153	WEST SF-1 FAN AT 50% SPEED LIGHT RELAY	14 11 (E02A63:05)
12 L1 5					
OUT 6 13 RACK2:8:O:DATA.6	E02A31A52 RED	3054	CR154	WEST SF-1 FAN AT 100% SPEED LIGHT RELAY	14 11 (E02A63:08)
14 L1 6					
OUT 7 15 RACK2:8:O:DATA.7	E02A31A54 RED	3055	CR155	WEST SF-1 FAN STOPPED LIGHT RELAY	14 11 (E02A63:11)
16 L1 7					
OUT 8 17 RACK2:8:O:DATA.8	E02A31A56 RED	3056	CR156	WEST SF-2 FAN AT 25% SPEED LIGHT RELAY	14 11 (E02A63:15)
18 L1 8					
OUT 9 19 RACK2:8:O:DATA.9	E02A31A58 RED	3057	CR157	WEST SF-2 FAN AT 50% SPEED LIGHT RELAY	14 11 (E02A63:18)
20 L1 9					
OUT 10 21 RACK2:8:O:DATA.10	E02A31A60 RED	3058	CR158	WEST SF-2 FAN AT 100% SPEED LIGHT RELAY	14 11 (E02A63:21)
22 L1 10					
OUT 11 23 RACK2:8:O:DATA.11	E02A31A62 RED	3059	CR159	WEST SF-2 FAN STOPPED LIGHT RELAY	14 11 (E02A63:24)
24 L1 11					
OUT 12 25 RACK2:8:O:DATA.12	E02A31A64 RED	3060	CR160	WEST SF-3 FAN AT 25% SPEED LIGHT RELAY	14 11 (E02A63:38)
26 L1 12					
OUT 13 27 RACK2:8:O:DATA.13	E02A31A66 RED	3061	CR161	WEST SF-3 FAN AT 50% SPEED LIGHT RELAY	14 11 (E02A63:41)
28 L1 13					
OUT 14 29 RACK2:8:O:DATA.14	E02A31A68 RED	3062	CR162	WEST SF-3 FAN AT 100% SPEED LIGHT RELAY	14 11 (E02A63:44)
30 L1 14					
OUT 15 31 RACK2:8:O:DATA.15	E02A31A70 RED	3063	CR163	WEST SF-3 FAN STOPPED LIGHT RELAY	14 11 (E02A63:47)
32 L1 15					
34 L1 15					

33, 35, 36
NOT USED

L1-4

N
(E02A32:01)

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - DISCRETE OUTPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.

5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823

112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E02A31

(E02A17:48)
L1-5

(E02A31:72)
N

(E02A17:50)
L1-6

(E02A32:36)
N

01	L1-5 RED	1756-OA16I 120VAC DIGITAL OUTPUT MODULE REMOTE RACK SLOT 9	OUT 0 1 RACK2:9:O:DATA.0	E02A32A04 RED	3064	CR164 WEST SF-4 FAN AT 25% SPEED LIGHT RELAY A1 A2	14 11 (E02A63:51)	N WHT	
02			2 L1 0						
03			OUT 1 3 RACK2:9:O:DATA.1	E02A32A06 RED	3065	CR165 WEST SF-4 FAN AT 50% SPEED LIGHT RELAY A1 A2	14 11 (E02A63:54)		
04			4 L1 1						
05			OUT 2 5 RACK2:9:O:DATA.2	E02A32A08 RED	3066	CR166 WEST SF-4 FAN AT 100% SPEED LIGHT RELAY A1 A2	14 11 (E02A63:57)		
06			6 L1 2						
07			OUT 3 7 RACK2:9:O:DATA.3	E02A32A10 RED	3067	CR167 WEST SF-4 FAN STOPPED LIGHT RELAY A1 A2	14 11 (E02A63:60)		
08			8 L1 3						
09			OUT 4 9 RACK2:9:O:DATA.4	E02A32A12 RED	3068	CR168 DC LIGHTING OFF COMMAND RELAY A1 A2	14 11 (E02A63:64)		
10			10 L1 4						
11			OUT 5 11 RACK2:9:O:DATA.5	E02A32A14 RED	3069	CR169 DC LIGHTING ON COMMAND RELAY A1 A2	12 11 (E02A63:67)		
12			12 L1 5						
13			OUT 6 13 RACK2:9:O:DATA.6	E02A32A16 RED	3070	SPARE			
14			14 L1 6						
15			OUT 7 15 RACK2:9:O:DATA.7	E02A32A18 RED	3071	SPARE			
16			16 L1 7						
17			OUT 8 17 RACK2:9:O:DATA.8	E02A32A20 RED	3072	SPARE			
18			18 L1 8						
19			OUT 9 19 RACK2:9:O:DATA.9	E02A32A22 RED	3073	SPARE			
20			20 L1 9						
21			OUT 10 21 RACK2:9:O:DATA.10	E02A32A24 RED	3074	SPARE			
22			22 L1 10						
23			OUT 11 23 RACK2:9:O:DATA.11	E02A32A26 RED	3075	SPARE			
24			24 L1 11						
25			OUT 12 25 RACK2:9:O:DATA.12	E02A32A28 RED	3076	SPARE			
26			26 L1 12						
27			OUT 13 27 RACK2:9:O:DATA.13	E02A32A30 RED	3077	SPARE			
28			28 L1 13						
29			OUT 14 29 RACK2:9:O:DATA.14	E02A32A32 RED	3078	SPARE			
30			30 L1 14						
31			OUT 15 31 RACK2:9:O:DATA.15	E02A32A34 RED	3079	SPARE			
32			32 L1 15						
33			34 L1 15						
34			33, 35, 36 NOT USED						
35									
36	L1-5					N (E02A32:37)			

37	L1-6 RED	1756-OA16I 120VAC DIGITAL OUTPUT MODULE REMOTE RACK SLOT 10	OUT 0 1 RACK2:10:O:DATA.0	E02A32A40 RED	3080	SPARE		N WHT	
38			2 L1 0						
39			OUT 1 3 RACK2:10:O:DATA.1	E02A32A42 RED	3081	SPARE			
40			4 L1 1						
41			OUT 2 5 RACK2:10:O:DATA.2	E02A32A44 RED	3082	SPARE			
42			6 L1 2						
43			OUT 3 7 RACK2:10:O:DATA.3	E02A32A46 RED	3083	SPARE			
44			8 L1 3						
45			OUT 4 9 RACK2:10:O:DATA.4	E02A32A48 RED	3084	SPARE			
46			10 L1 4						
47			OUT 5 11 RACK2:10:O:DATA.5	E02A32A50 RED	3085	SPARE			
48			12 L1 5						
49			OUT 6 13 RACK2:10:O:DATA.6	E02A32A52 RED	3086	SPARE			
50			14 L1 6						
51			OUT 7 15 RACK2:10:O:DATA.7	E02A32A54 RED	3087	SPARE			
52			16 L1 7						
53			OUT 8 17 RACK2:10:O:DATA.8	E02A32A56 RED	3088	SPARE			
54			18 L1 8						
55			OUT 9 19 RACK2:10:O:DATA.9	E02A32A58 RED	3089	SPARE			
56			20 L1 9						
57			OUT 10 21 RACK2:10:O:DATA.10	E02A32A60 RED	3090	SPARE			
58			22 L1 10						
59			OUT 11 23 RACK2:10:O:DATA.11	E02A32A62 RED	3091	SPARE			
60			24 L1 11						
61			OUT 12 25 RACK2:10:O:DATA.12	E02A32A64 RED	3092	SPARE			
62			26 L1 12						
63			OUT 13 27 RACK2:10:O:DATA.13	E02A32A66 RED	3093	SPARE			
64			28 L1 13						
65			OUT 14 29 RACK2:10:O:DATA.14	E02A32A68 RED	3094	SPARE			
66			30 L1 14						
67			OUT 15 31 RACK2:10:O:DATA.15	E02A32A70 RED	3095	SPARE			
68			32 L1 15						
69			34 L1 15						
70			33, 35, 36 NOT USED						
71									
72	L1-6					N (E02A33:01)			

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - DISCRETE OUTPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
5301 NORTH 57TH STREET
LINCOLN, NEBRASKA 68507
(402) 464-6823
112 INVERNESS CIRCLE EAST, SUITE E
ENGLEWOOD, COLORADO 80112
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E02A32

(E02A17:52)
L1-7

(E02A32:72)
N

1756-OA16I
120VAC DIGITAL
OUTPUT MODULE
REMOTE RACK SLOT 11

01						37
02	L1-7 RED				N WHT	38
03						39
04		OUT 0 1 RACK2:11:O:DATA.0	E02A33A04 RED	3096	SPARE	40
05	2 L1 0					41
06		OUT 1 3 RACK2:11:O:DATA.1	E02A33A06 RED	3097	SPARE	42
07	4 L1 1					43
08		OUT 2 5 RACK2:11:O:DATA.2	E02A33A08 RED	3098	SPARE	44
09	6 L1 2					45
10		OUT 3 7 RACK2:11:O:DATA.3	E02A33A10 RED	3099	SPARE	46
11	8 L1 3					47
12		OUT 4 9 RACK2:11:O:DATA.4	E02A33A12 RED	3100	SPARE	48
13	10 L1 4					49
14		OUT 5 11 RACK2:11:O:DATA.5	E02A33A14 RED	3101	SPARE	50
15	12 L1 5					51
16		OUT 6 13 RACK2:11:O:DATA.6	E02A33A16 RED	3102	SPARE	52
17	14 L1 6					53
18		OUT 7 15 RACK2:11:O:DATA.7	E02A33A18 RED	3103	SPARE	54
19	16 L1 7					55
20		OUT 8 17 RACK2:11:O:DATA.8	E02A33A20 RED	3104	SPARE	56
21	18 L1 8					57
22		OUT 9 19 RACK2:11:O:DATA.9	E02A33A22 RED	3105	SPARE	58
23	20 L1 9					59
24		OUT 10 21 RACK2:11:O:DATA.10	E02A33A24 RED	3106	SPARE	60
25	22 L1 10					61
26		OUT 11 23 RACK2:11:O:DATA.11	E02A33A26 RED	3107	SPARE	62
27	24 L1 11					63
28		OUT 12 25 RACK2:11:O:DATA.12	E02A33A28 RED	3108	SPARE	64
29	26 L1 12					65
30		OUT 13 27 RACK2:11:O:DATA.13	E02A33A30 RED	3109	SPARE	66
31	28 L1 13					67
32		OUT 14 29 RACK2:11:O:DATA.14	E02A33A32 RED	3110	SPARE	68
33	30 L1 14					69
34		OUT 15 31 RACK2:11:O:DATA.15	E02A33A34 RED	3111	SPARE	70
35	32 L1 15					71
36	34 L1 15	33, 35, 36 NOT USED				72
	L1-7					N

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - DISCRETE OUTPUTS

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
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112 INVERNESS CIRCLE EAST, SUITE E
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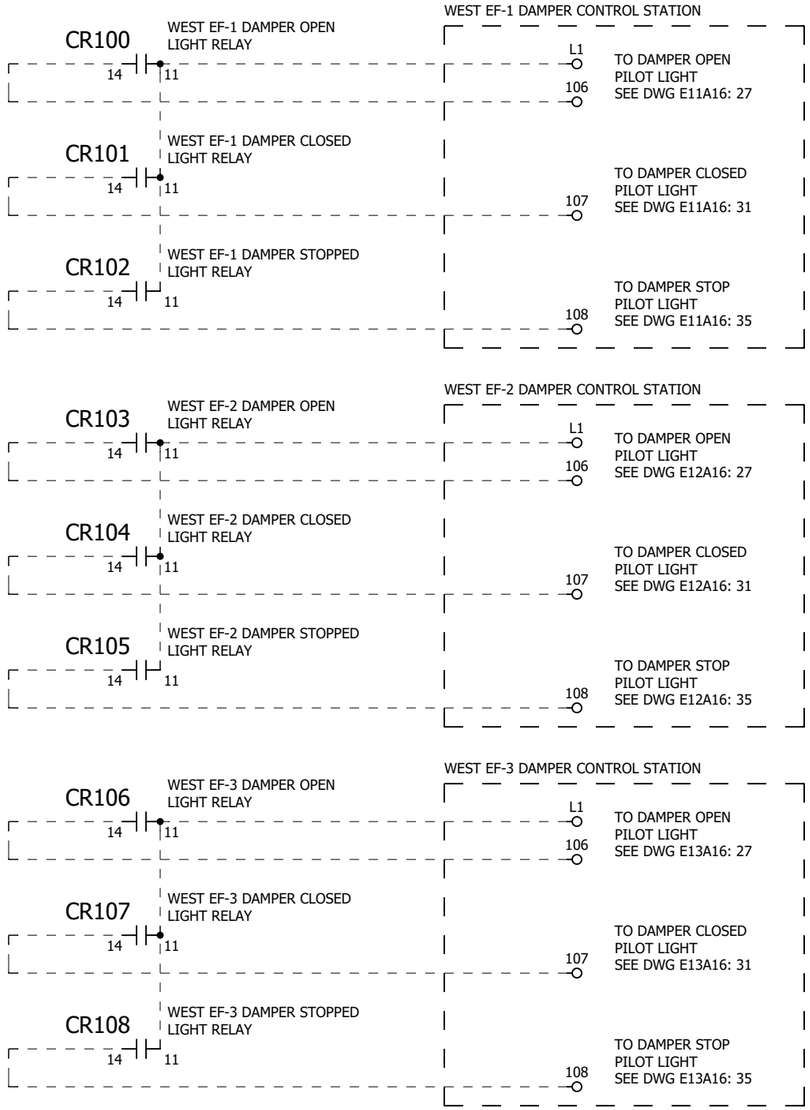
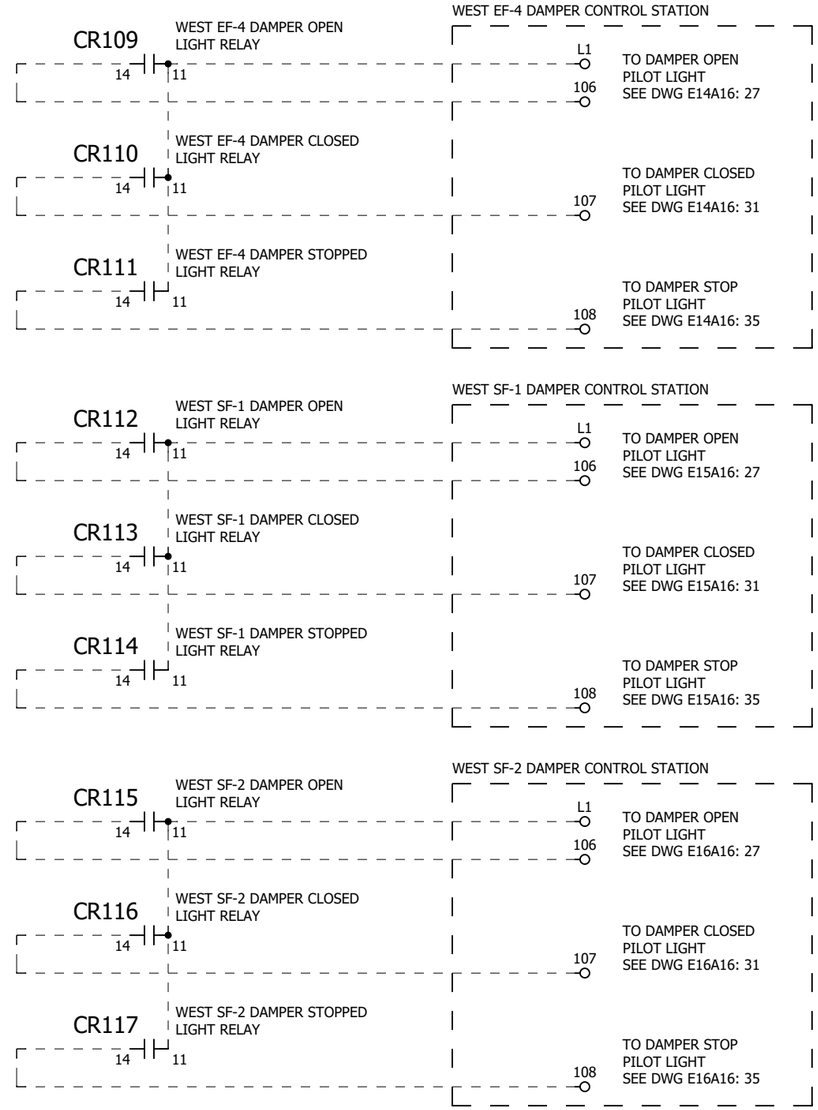
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E02A33





STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - CONTROL RELAY INTERFACE

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

REV	DATE	NAME	REMARKS

DWG # CMS203-E02A60

HUFFMAN ENGINEERING INC.
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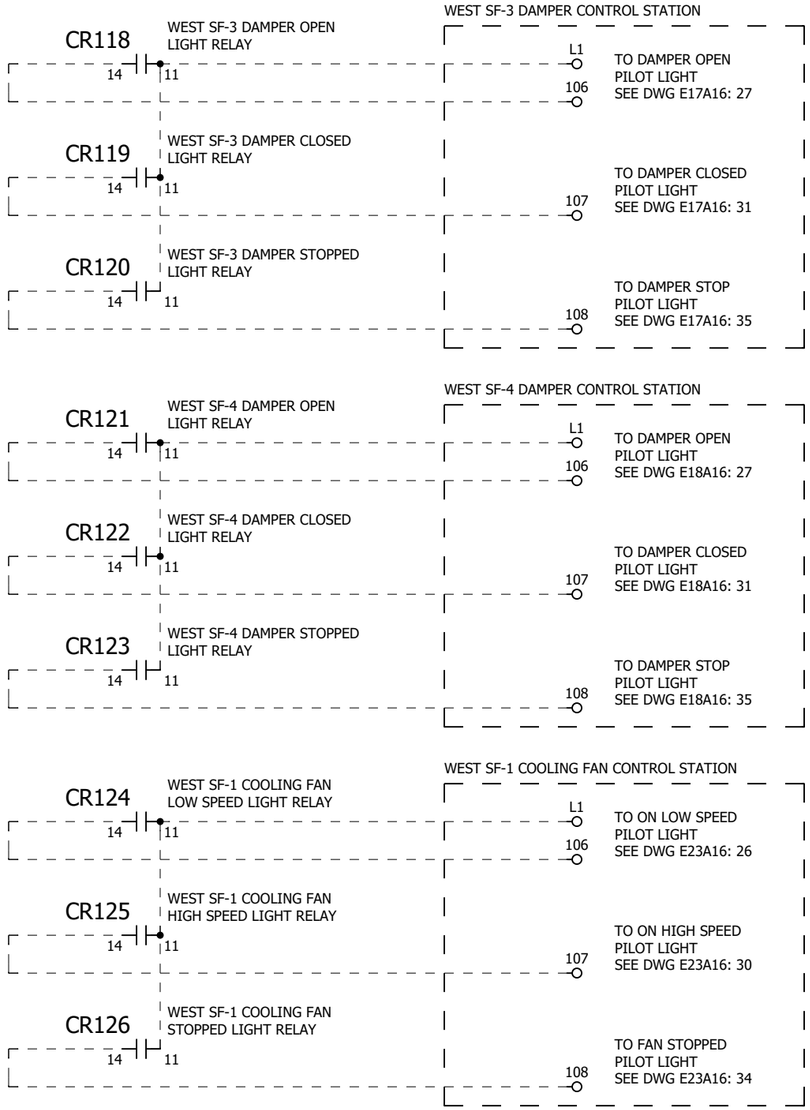

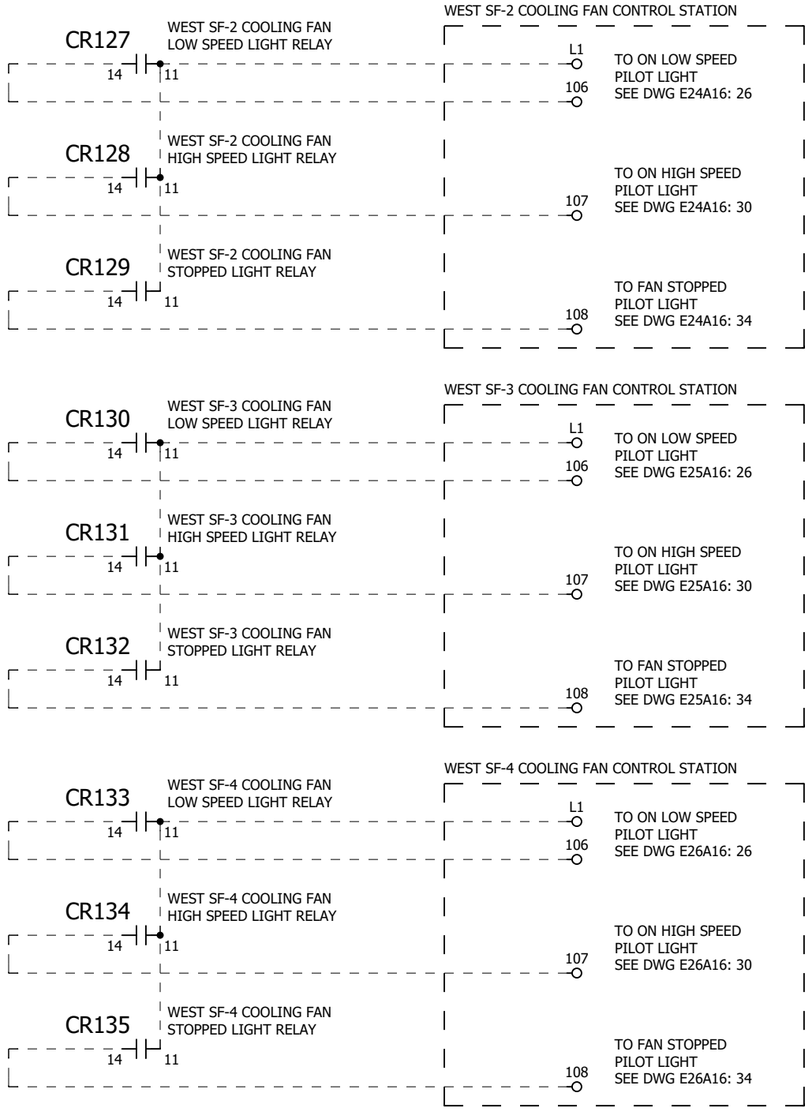

STATE OF COLORADO DEPARTMENT OF TRANSPORTATION

EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - CONTROL RELAY INTERFACE

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

HUFFMAN ENGINEERING INC.
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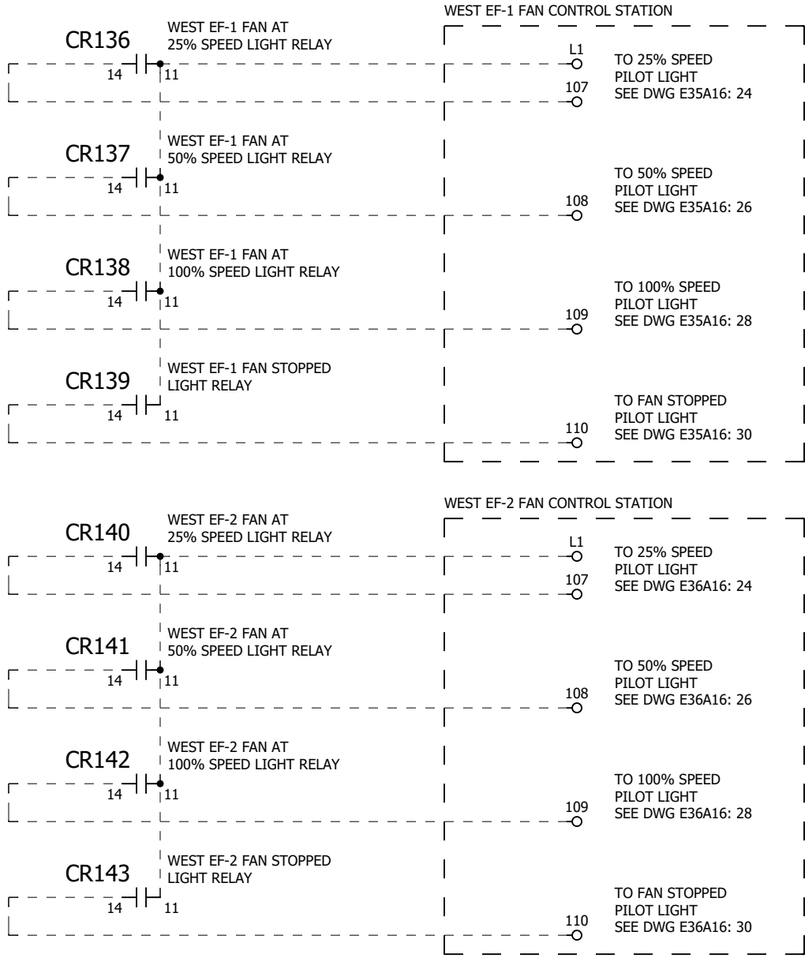
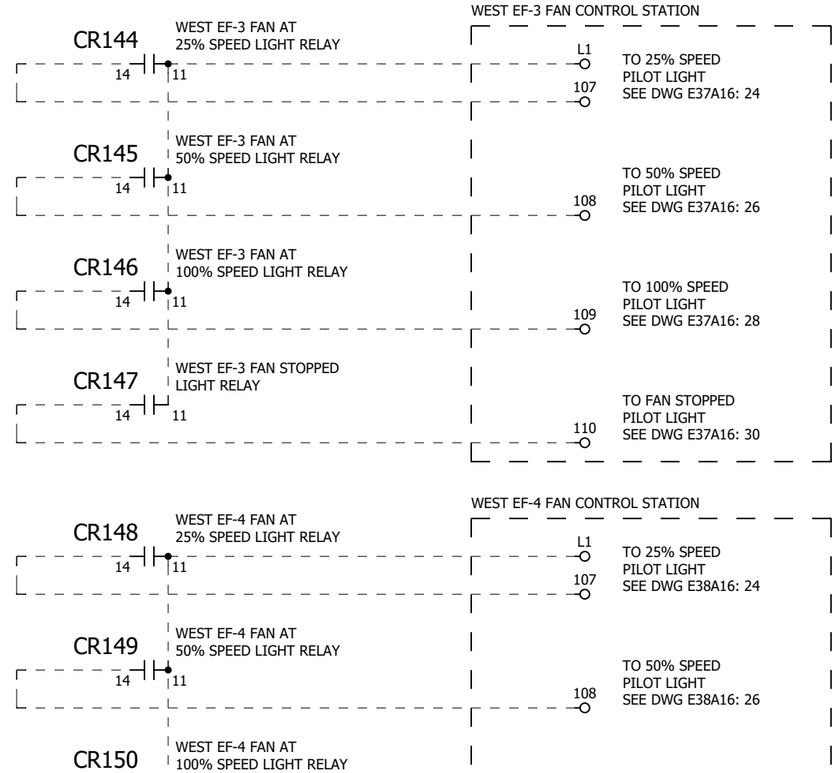
(303) 376-6280

REV	DATE	NAME	REMARKS

DWG # CMS203-E02A61





STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - CONTROL RELAY INTERFACE

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

REV	DATE	NAME	REMARKS

HUFFMAN ENGINEERING INC.
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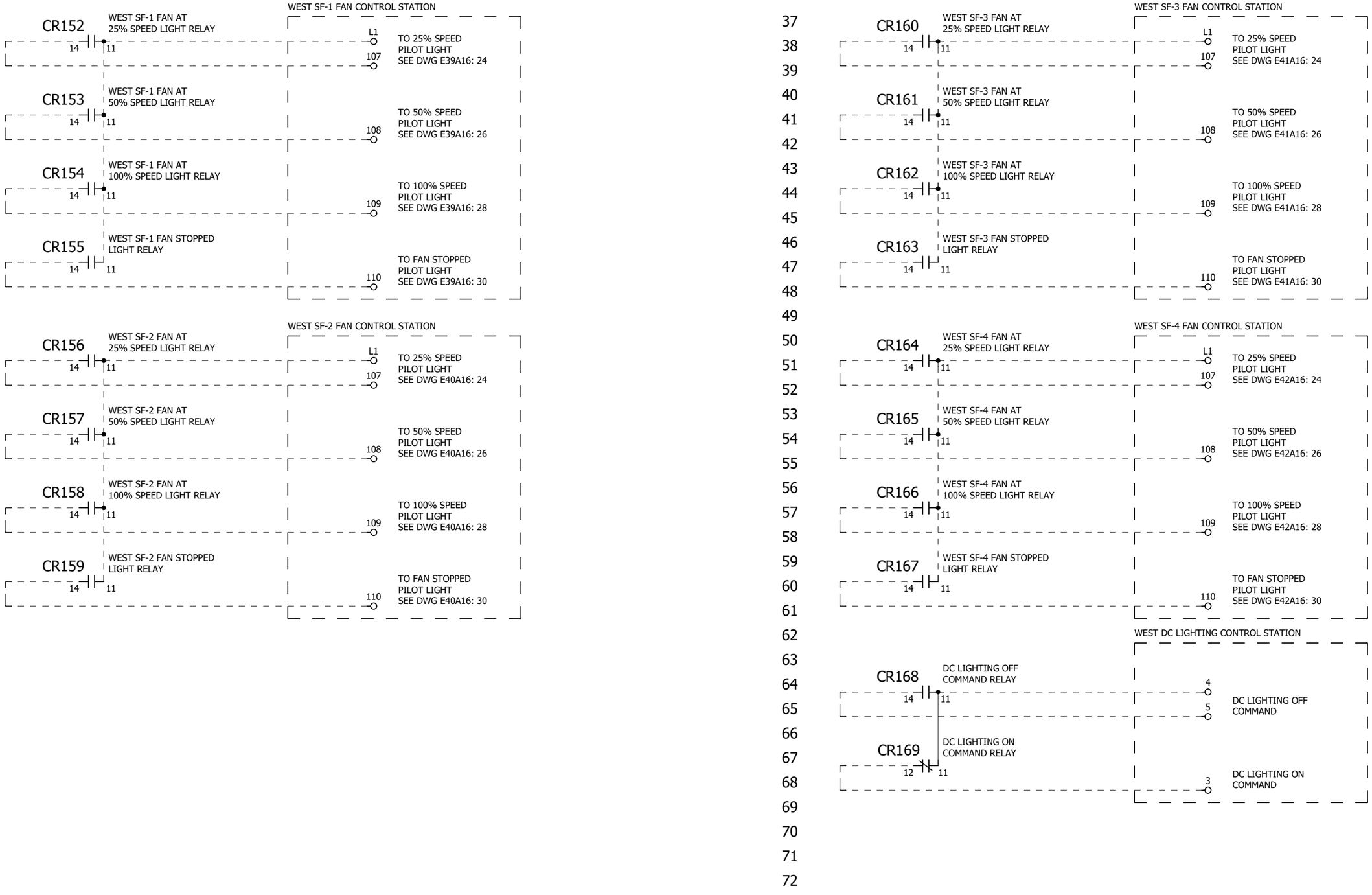
(303) 376-6280

REV	DATE	NAME	REMARKS
5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E02A62



STATE OF COLORADO DEPARTMENT OF TRANSPORTATION
EISENHOWER/JOHNSON MEMORIAL TUNNEL 480V MCC REPLACEMENT

WEST PLC PANEL - CONTROL RELAY INTERFACE

PROJECT # CMS203 | SCALE | ENG:E. KILGORE

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5.0	09/08/21	ekilgore	FIELD MODIFICATIONS

DWG # CMS203-E02A63

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TWO-DOOR WITH FLOOR STANDS AND 3-POINT LATCH, TYPE 12

SPECIFICATIONS

- Seams continuously welded and ground smooth; no holes or knockouts
- Gasketed overlapping doors with no centerpost
- 3-point latch mechanism operated by oil-tight key-lock handle
- Concealed, easy-to-remove hinges
- Data pocket is high-impact thermoplastic
- 12-in. floor stands welded to enclosure
- Heavy-duty lifting eyes
- Panel supports
- Oil-resistant gasket
- Collar studs for mounting optional panel
- Bonding provision on door
- Provision for mounting fluorescent light

FINISH

Two finishes available: ANSI 61 gray, polyester powder paint outside and inside; or ANSI 61 gray outside and white, polyester powder paint inside. Optional panels available with a white or conductive finish.

ACCESSORIES

Panels
PANELITE Enclosure Lights
Enclosure Stabilizers
SPECTRACOOL Indoor/Outdoor
HF Side-Mount Filter Fans
Steel, Stainless Steel and Non-Metallic Window Kits
Electric Heaters
HOL-SEALERS Hole Seals
INTERSAFE Data Interface Ports, Type 4/4X/12

INDUSTRY STANDARDS

UL 508A Listed; Type 12; File No. E61997
cUL Listed per CSA C22.2 No. 94; Type 12; File No. E61997

NEMA/EEMAC Type 12
CSA, File No. 42186, Type 12
IEC 60529, IP55

APPLICATION

Enclosures have gasketed, overlapping doors to give protection in industrial environments and floor stands that provide additional height and access for cleaning under the enclosure. Because there is no centerpost, it is simple to install and remove panels.

MODIFICATION AND CUSTOMIZATION

Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

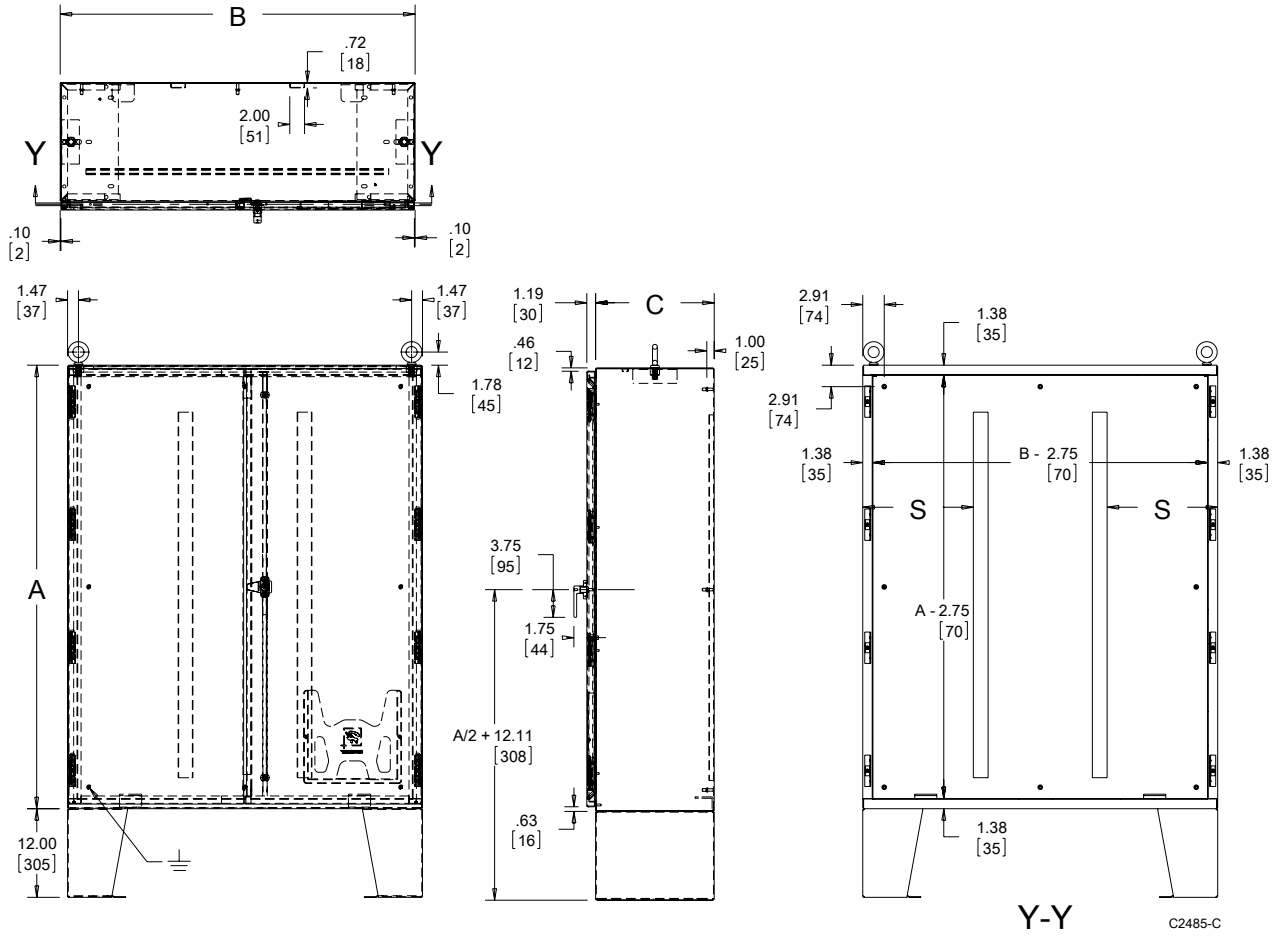
BULLETIN: A12L

Standard Product

Catalog Number	AxBxC in.	AxBxC mm	Interior Finish	Gauge	Panel	Conductive Panel	Panel Gauge	Panel Size (in.)	Panel Size (mm)	Stiffener (in.)	Stiffener (mm)	S (in.)	S (mm)
A544208LPG	54.00 x 42.00 x 8.00	1372 x 1067 x 203	Gray	12	A54P42	A54P42G	11	50.00 x 38.00	1270 x 965	15.00	381	—	—
A544208LP	54.00 x 42.00 x 8.00	1372 x 1067 x 203	White	12	A54P42	A54P42G	11	50.00 x 38.00	1270 x 965	15.00	381	—	—
A604808LPG	60.06 x 48.06 x 8.06	1526 x 1221 x 205	Gray	12	A60P48	A60P48G	11	56.00 x 44.00	1422 x 1118	15.00	381	15.92	404
A604808LP	60.06 x 48.06 x 8.06	1526 x 1221 x 205	White	12	A60P48	A60P48G	11	56.00 x 44.00	1422 x 1118	15.00	381	15.92	404
A604810LPG	60.06 x 48.06 x 10.06	1526 x 1221 x 256	Gray	12	A60P48	A60P48G	11	56.00 x 44.00	1422 x 1118	15.00	381	15.92	404
A604810LP	60.06 x 48.06 x 10.06	1526 x 1221 x 256	White	12	A60P48	A60P48G	11	56.00 x 44.00	1422 x 1118	15.00	381	15.92	404
A606010LPG	60.06 x 60.06 x 10.06	1526 x 1526 x 256	Gray	12	A60P60	A60P60G	11	56.00 x 56.00	1422 x 1422	21.00	533	19.92	506
A606010LP	60.06 x 60.06 x 10.06	1526 x 1526 x 256	White	12	A60P60	A60P60G	11	56.00 x 56.00	1422 x 1422	21.00	533	19.92	506
A726010ULPG	72.06 x 60.06 x 10.06	1830 x 1526 x 256	Gray	12	A72P60	A72P60G	11	68.00 x 56.00	1727 x 1422	21.00	533	19.92	506
A726010ULP	72.06 x 60.06 x 10.06	1830 x 1526 x 256	White	12	A72P60	A72P60G	11	68.00 x 56.00	1727 x 1422	21.00	533	19.92	506
A727210ULPG	72.06 x 72.06 x 10.06	1830 x 1830 x 256	Gray	12	A72P72	A72P72G	11	68.00 x 68.00	1727 x 1727	24.00	610	23.92	608
A727210ULP	72.06 x 72.06 x 10.06	1830 x 1830 x 256	White	12	A72P72	A72P72G	11	68.00 x 68.00	1727 x 1727	24.00	610	23.92	608
A604812LPG	60.06 x 48.06 x 12.06	1526 x 1221 x 306	Gray	12	A60P48	A60P48G	11	56.00 x 44.00	1422 x 1118	15.00	381	15.92	404
A604812LP	60.06 x 48.06 x 12.06	1526 x 1221 x 306	White	12	A60P48	A60P48G	11	56.00 x 44.00	1422 x 1118	15.00	381	15.92	404
A606012LPG	60.06 x 60.06 x 12.06	1526 x 1526 x 306	Gray	12	A60P60	A60P60G	11	56.00 x 56.00	1422 x 1422	21.00	533	19.92	506
A606012LP	60.06 x 60.06 x 12.06	1526 x 1526 x 306	White	12	A60P60	A60P60G	11	56.00 x 56.00	1422 x 1422	21.00	533	19.92	506
A726012ULPG	72.06 x 60.06 x 12.06	1830 x 1526 x 306	Gray	12	A72P60	A72P60G	11	68.00 x 56.00	1727 x 1422	21.00	533	19.92	506
A726012ULP	72.06 x 60.06 x 12.06	1830 x 1526 x 306	White	12	A72P60	A72P60G	11	68.00 x 56.00	1727 x 1422	21.00	533	19.92	506
A727212ULPG	72.06 x 72.06 x 12.06	1830 x 1830 x 306	Gray	12	A72P72	A72P72G	11	68.00 x 68.00	1727 x 1727	24.00	610	23.92	608
A727212ULP	72.06 x 72.06 x 12.06	1830 x 1830 x 306	White	12	A72P72	A72P72G	11	68.00 x 68.00	1727 x 1727	24.00	610	23.92	608
A604816LPG	60.06 x 48.06 x 16.06	1526 x 1221 x 408	Gray	12	A60P48	A60P48G	11	56.00 x 44.00	1422 x 1118	15.00	381	15.92	404
A604816LP	60.06 x 48.06 x 16.06	1526 x 1221 x 408	White	12	A60P48	A60P48G	11	56.00 x 44.00	1422 x 1118	15.00	381	15.92	404
A606016LPG	60.06 x 60.06 x 16.06	1526 x 1526 x 408	Gray	12	A60P60	A60P60G	11	56.00 x 56.00	1422 x 1422	21.00	533	19.92	506
A606016LP	60.06 x 60.06 x 16.06	1526 x 1526 x 408	White	12	A60P60	A60P60G	11	56.00 x 56.00	1422 x 1422	21.00	533	19.92	506
A726016ULPG	72.06 x 60.06 x 16.06	1830 x 1526 x 408	Gray	12	A72P60	A72P60G	11	68.00 x 56.00	1727 x 1422	21.00	533	19.92	506
A726016ULP	72.06 x 60.06 x 16.06	1830 x 1526 x 408	White	12	A72P60	A72P60G	11	68.00 x 56.00	1727 x 1422	21.00	533	19.92	506

Catalog Number	AxBxC in.	AxBxC mm	Interior Finish	Gauge	Panel	Conductive Panel	Panel Gauge	Panel Size (in.)	Panel Size (mm)	Stiffener (in.)	Stiffener (mm)	S (in.)	S (mm)
A727216ULPG	72.06 x 72.06 x 16.06	1830 x 1830 x 408	Gray	12	A72P72	A72P72G	11	68.00 x 68.00	1727 x 1727	24.00	610	23.92	608
A727216ULP	72.06 x 72.06 x 16.06	1830 x 1830 x 408	White	12	A72P72	A72P72G	11	68.00 x 68.00	1727 x 1727	24.00	610	23.92	608
A604820LPG	60.06 x 48.06 x 20.06	1526 x 1221 x 510	Gray	12	A60P48	A60P48G	11	56.00 x 44.00	1422 x 1118	15.00	381	15.92	404
A604820LP	60.06 x 48.06 x 20.06	1526 x 1221 x 510	White	12	A60P48	A60P48G	11	56.00 x 44.00	1422 x 1118	15.00	381	15.92	404
A726020ULPG	72.06 x 60.06 x 20.06	1830 x 1526 x 510	Gray	12	A72P60	A72P60G	11	68.00 x 56.00	1727 x 1422	21.00	533	19.92	506
A726020ULP	72.06 x 60.06 x 20.06	1830 x 1526 x 510	White	12	A72P60	A72P60G	11	68.00 x 56.00	1727 x 1422	21.00	533	19.92	506
A727220ULPG	72.06 x 72.06 x 20.06	1830 x 1830 x 510	Gray	12	A72P72	A72P72G	11	68.00 x 68.00	1727 x 1727	24.00	610	23.92	608
A727220ULP	72.06 x 72.06 x 20.06	1830 x 1830 x 510	White	12	A72P72	A72P72G	11	68.00 x 68.00	1727 x 1727	24.00	610	23.92	608
A604824LPG	60.06 x 48.06 x 24.06	1526 x 1221 x 611	Gray	12	A60P48	A60P48G	11	56.00 x 44.00	1422 x 1118	15.00	381	15.92	404
A604824LP	60.06 x 48.06 x 24.06	1526 x 1221 x 611	White	12	A60P48	A60P48G	11	56.00 x 44.00	1422 x 1118	15.00	381	15.92	404
A606024LPG	60.06 x 60.06 x 24.06	1526 x 1526 x 611	Gray	12	A60P60	A60P60G	11	56.00 x 56.00	1422 x 1422	21.00	533	19.92	506
A606024LP	60.06 x 60.06 x 24.06	1526 x 1526 x 611	White	12	A60P60	A60P60G	11	56.00 x 56.00	1422 x 1422	21.00	533	19.92	506
A726024ULPG	72.06 x 60.06 x 24.06	1830 x 1526 x 611	Gray	12	A72P60	A72P60G	11	68.00 x 56.00	1727 x 1422	21.00	533	19.92	506
A726024ULP	72.06 x 60.06 x 24.06	1830 x 1526 x 611	White	12	A72P60	A72P60G	11	68.00 x 56.00	1727 x 1422	21.00	533	19.92	506
A727224ULPG	72.06 x 72.06 x 24.06	1830 x 1830 x 611	Gray	12	A72P72	A72P72G	11	68.00 x 68.00	1727 x 1727	24.00	610	23.92	608
A727224ULP	72.06 x 72.06 x 24.06	1830 x 1830 x 611	White	12	A72P72	A72P72G	11	68.00 x 68.00	1727 x 1727	24.00	610	23.92	608

Purchase panels separately.



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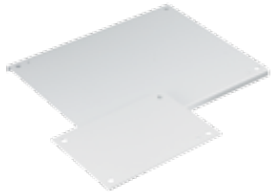
PANELS FOR TYPE 3R, 4, 4X, 12 AND 13 ENCLOSURES

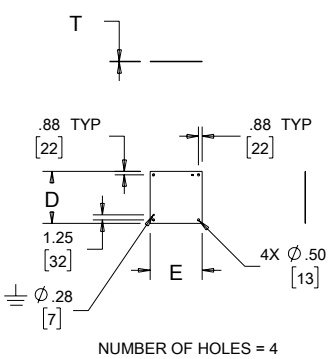


Steel panels are 11 or 12 gauge, finished with white polyester powder paint or a conductive, corrosion-resistant coating. Larger panels have flanges on two or four sides. Some larger steel panels are 11 gauge and include extra holes for panel lifting. Aluminum panels are 5052-H32 aluminum alloy. Larger panels have flanges on four sides. Aluminum panels are protected on one side with a plastic film. Stainless steel panels are Type 316 stainless steel. Panel mounting hardware is furnished with all enclosures which accept these panels.

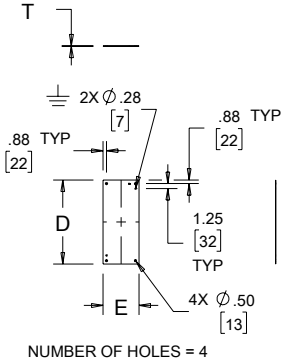
BULLETIN: PNLFS, PNLJ, PNLWM

Catalog Number	Material	Panel Size D x E (in.)	Panel Size D x E (mm)	Panel Gauge or Thickness	Edge Flanges	T (in.)	T (mm)	Number of Holes
A12P24	Painted steel	9.00 x 21.00	229 x 533	12 ga.	0	–	–	4
A12P24G	Conductive steel	9.00 x 21.00	229 x 533	12 ga.	0	–	–	4
A16P12	Painted steel	13.00 x 9.00	330 x 229	12 ga.	0	–	–	4
A16P12G	Conductive steel	13.00 x 9.00	330 x 229	12 ga.	0	–	–	4
A16P12SS6	Stainless Steel	13.00 x 9.00	330 x 229	12 ga.	0	–	–	4
A16P12AL	Aluminum	13.00 x 9.00	330 x 229	0.10 in./3 mm	0	–	–	4
A16P16	Painted steel	13.00 x 13.00	330 x 330	12 ga.	0	–	–	4
A16P16G	Conductive steel	13.00 x 13.00	330 x 330	12 ga.	0	–	–	4
A16P16SS6	Stainless Steel	13.00 x 13.00	330 x 330	12 ga.	0	–	–	4
A16P16AL	Aluminum	13.00 x 13.00	330 x 330	0.10 in./3 mm	0	–	–	4
A18P18	Painted steel	15.00 x 15.00	381 x 381	12 ga.	0	–	–	4
A18P18G	Conductive steel	15.00 x 15.00	381 x 381	12 ga.	0	–	–	4
A20P12	Painted steel	17.00 x 9.00	432 x 229	12 ga.	0	–	–	4
A20P12G	Conductive steel	17.00 x 9.00	432 x 229	12 ga.	0	–	–	4
A20P16	Painted steel	17.00 x 13.00	432 x 330	12 ga.	0	–	–	4
A20P16G	Conductive steel	17.00 x 13.00	432 x 330	12 ga.	0	–	–	4
A20P16SS6	Stainless Steel	17.00 x 13.00	432 x 330	12 ga.	0	–	–	4
A20P16AL	Aluminum	17.00 x 13.00	432 x 330	0.10 in./3 mm	0	–	–	4
A20P20	Painted steel	17.00 x 17.00	432 x 432	12 ga.	0	–	–	4
A20P20G	Conductive steel	17.00 x 17.00	432 x 432	12 ga.	0	–	–	4
A20P20SS6	Stainless steel	17.00 x 17.00	432 x 432	12 ga.	0	–	–	4
A20P20AL	Aluminum	17.00 x 17.00	432 x 432	0.10 in./3 mm	0	–	–	4
A24P16	Painted steel	21.00 x 13.00	533 x 330	12 ga.	0	–	–	4
A24P16G	Conductive steel	21.00 x 13.00	533 x 330	12 ga.	0	–	–	4
A24P16SS6	Stainless Steel	21.00 x 13.00	533 x 330	12 ga.	0	–	–	4
A24P20	Painted steel	21.00 x 17.00	533 x 432	12 ga.	2	0.75	19	4
A24P20G	Conductive steel	21.00 x 17.00	533 x 432	12 ga.	2	0.75	19	4
A24P20SS6	Stainless Steel	21.00 x 17.00	533 x 432	12 ga.	2	0.75	19	4
A24P20AL	Aluminum	21.00 x 17.00	533 x 432	0.10 in./3 mm	4	0.75	19	4
A24P24	Painted steel	21.00 x 21.00	533 x 533	12 ga.	2	0.75	19	4
A24P24G	Conductive steel	21.00 x 21.00	533 x 533	12 ga.	2	0.75	19	4
A24P24SS6	Stainless Steel	21.00 x 21.00	533 x 533	12 ga.	2	0.75	19	4
A24P24AL	Aluminum	21.00 x 21.00	533 x 533	0.10 in./3 mm	2	0.75	19	4
A30P16	Painted steel	27.00 x 13.00	686 x 330	12 ga.	2	0.75	19	4
A30P16G	Conductive steel	33.00 x 27.00	838 x 686	12 ga.	2	0.75	19	4
A30P20	Painted steel	27.00 x 17.00	686 x 432	12 ga.	2	0.75	19	4
A30P20G	Conductive steel	27.00 x 17.00	686 x 432	12 ga.	2	0.75	19	4
A30P20SS6	Stainless Steel	27.00 x 17.00	686 x 432	12 ga.	2	0.75	19	4
A30P24	Painted steel	27.00 x 21.00	686 x 533	12 ga.	2	0.75	19	4
A30P24G	Conductive steel	27.00 x 21.00	686 x 533	12 ga.	2	0.75	19	4
A30P24SS6	Stainless Steel	27.00 x 21.00	686 x 533	12 ga.	2	0.75	19	4
A30P24AL	Aluminum	27.00 x 21.00	686 x 533	0.10 in./3 mm	2	0.75	19	4
A30P30	Painted steel	27.00 x 27.00	686 x 686	12 ga.	4	0.75	19	4
A30P30G	Conductive steel	27.00 x 27.00	686 x 686	12 ga.	4	0.75	19	4
A30P30SS6	Stainless Steel	27.00 x 27.00	686 x 686	12 ga.	4	0.75	19	4
A36P16	Painted steel	33.00 X 13.00	838 X 330	12 ga.	2	0.75	19	4
A36P16G	Conductive steel	33.00 x 13.00	838 x 330	12 ga.	2	0.75	19	4
A36P24	Painted steel	33.00 x 21.00	838 x 533	12 ga.	2	0.75	19	6
A36P24G	Conductive steel	33.00 x 21.00	838 x 533	12 ga.	2	0.75	19	6
A36P24SS6	Stainless Steel	33.00 x 21.00	838 x 533	12 ga.	2	0.75	19	6
A36P24AL	Aluminum	33.00 x 21.00	838 x 533	0.10 in./3 mm	2	0.75	19	6
A36P30	Painted steel	33.00 x 27.00	838 x 686	12 ga.	4	0.75	19	6
A36P30G	Conductive steel	33.00 x 27.00	838 x 686	12 ga.	4	0.75	19	6
A36P30SS6	Stainless Steel	33.00 x 27.00	838 x 686	12 ga.	4	0.75	19	6
A36P30AL	Aluminum	33.00 x 27.00	838 x 686	0.10 in./3 mm	4	0.75	19	6
A36P36	Painted steel	33.00 x 33.00	838 x 838	12 ga.	4	0.75	19	8
A36P36G	Conductive steel	33.00 x 33.00	838 x 838	12 ga.	4	0.75	19	8
A36P36SS6	Stainless Steel	33.00 x 33.00	838 x 838	12 ga.	4	0.75	19	8
A40P24	Painted steel	37.00 x 21.00	940 x 533	12 ga.	4	0.75	19	6
A40P24G	Conductive steel	37.00 x 21.00	940 x 533	12 ga.	4	0.75	19	6
A40P30	Painted steel	37.00 x 29.00	940 x 737	12 ga.	4	0.75	19	4
A40P30G	Conductive steel	37.00 x 29.00	940 x 737	12 ga.	4	0.75	19	4
A42P24	Painted steel	39.00 x 21.00	991 x 533	12 ga.	2	0.75	19	6
A42P24G	Conductive steel	39.00 x 21.00	991 x 533	12 ga.	2	0.75	19	6
A42P30	Painted steel	39.00 x 27.00	991 x 686	12 ga.	4	0.75	19	6

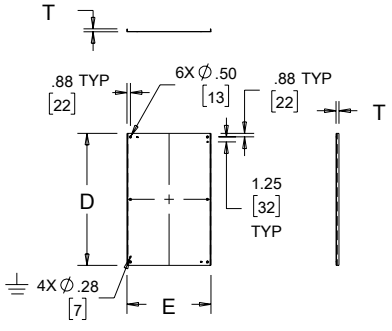
Catalog Number	Material	Panel Size D x E (in.)	Panel Size D x E (mm)	Panel Gauge or Thickness	Edge Flanges	T (in.)	T (mm)	Number of Holes
A42P30G	Conductive steel	39.00 x 27.00	991 x 686	12 ga.	4	0.75	19	6
A42P30SS6	Stainless Steel	39.00 x 27.00	991 x 686	12 ga.	4	0.75	19	6
A42P36	Painted steel	39.00 x 33.00	991 x 838	12 ga.	4	0.75	19	8
A42P36G	Conductive steel	39.00 x 33.00	991 x 838	12 ga.	4	0.75	19	8
A42P36SS6	Stainless Steel	39.00 x 33.00	991 x 838	12 ga.	4	0.75	19	8
A42P42	Painted steel	39.00 x 39.00	991 x 991	12 ga.	4	0.75	19	8
A42P42G	Conductive steel	39.00 x 39.00	991 x 991	12 ga.	4	0.75	19	8
A48P24	Painted steel	45.00 x 21.00	1143 x 533	12 ga.	2	0.75	19	6
A48P24G	Conductive steel	45.00 x 21.00	1143 x 533	12 ga.	2	0.75	19	6
A48P30	Painted steel	45.00 x 27.00	1143 x 686	12 ga.	4	0.75	19	6
A48P30G	Conductive steel	45.00 x 27.00	1143 x 686	12 ga.	4	0.75	19	6
A48P36	Painted steel	45.00 x 33.00	1143 x 838	12 ga.	4	0.75	19	8
A48P36G	Conductive steel	45.00 x 33.00	1143 x 838	12 ga.	4	0.75	19	8
A48P36SS6	Stainless Steel	45.00 x 33.00	1143 x 838	12 ga.	4	0.75	19	8
A48P36AL	Aluminum	45.00 x 33.00	1143 x 838	0.10 in./3 mm	4	0.75	19	8
A48P42	Painted steel	45.00 x 39.00	1143 x 991	12 ga.	4	0.75	19	8
A48P42G	Conductive steel	45.00 x 39.00	1143 x 991	12 ga.	4	0.75	19	8
A48P48	Painted steel	44.00 x 44.00	1118 x 1118	11 ga.	4	0.84	21	10
A48P48G	Conductive steel	44.00 x 44.00	1118 x 1118	11 ga.	4	0.84	21	10
A54P42	Painted steel	50.00 x 38.00	1270 x 965	11 ga.	4	0.84	21	10
A54P42G	Conductive steel	50.00 x 38.00	1270 x 965	11 ga.	4	0.84	21	10
A60P24	Painted steel	57.00 x 21.00	1448 x 533	12 ga.	4	0.75	19	6
A60P24G	Conductive steel	57.00 x 21.00	1448 x 533	12 ga.	4	0.75	19	6
A60P30	Painted steel	57.00 x 27.00	1448 x 686	12 ga.	4	0.75	19	6
A60P30G	Conductive steel	57.00 x 27.00	1448 x 686	12 ga.	4	0.75	19	6
A60P36	Painted steel	57.00 x 33.00	1448 x 838	12 ga.	4	0.75	19	8
A60P36G	Conductive steel	57.00 x 33.00	1448 x 838	12 ga.	4	0.75	19	8
A60P36SS6	Stainless Steel	57.00 x 33.00	1448 x 838	12 ga.	4	0.75	19	8
A60P36AL	Aluminum	57.00 x 33.00	1448 x 838	0.10 in./3 mm	4	0.75	19	8
A60BFP42	Painted steel	56.00 x 38.00	1422 x 965	11 ga.	4	0.84	21	10
A60BFP42G	Conductive steel	56.00 x 38.00	1422 x 965	11 ga.	4	0.84	21	10
A60P48	Painted steel	56.00 x 44.00	1422 x 1118	11 ga.	4	0.84	21	10
A60P48G	Conductive steel	56.00 x 44.00	1422 x 1118	11 ga.	4	0.84	21	10
A60P60	Painted steel	56.00 x 56.00	1422 x 1422	11 ga.	4	0.84	21	10
A60P60G	Conductive steel	56.00 x 56.00	1422 x 1422	11 ga.	4	0.84	21	10
A72P36	Painted steel	69.00 x 33.00	1753 x 838	12 ga.	4	0.75	19	8
A72P36G	Conductive steel	69.00 x 33.00	1753 x 838	12 ga.	4	0.75	19	8
A72P60	Painted steel	68.00 x 56.00	1727 x 1422	11 ga.	4	0.84	21	10
A72P60G	Conductive steel	68.00 x 56.00	1727 x 1422	11 ga.	4	0.84	21	10
A72P72	Painted steel	68.00 x 68.00	1727 x 1727	11 ga.	4	0.84	21	10
A72P72G	Conductive steel	68.00 x 68.00	1727 x 1727	11 ga.	4	0.84	21	10



NUMBER OF HOLES = 4
A = < 24 in / 310 mm



NUMBER OF HOLES = 4
A = ≥ 24 in / 310 mm



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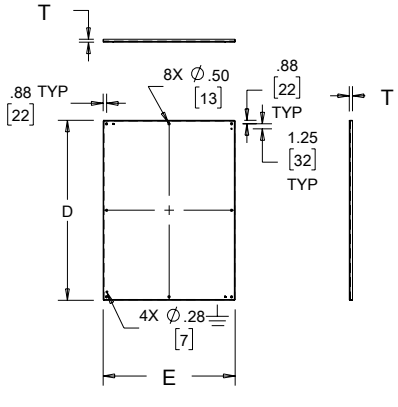

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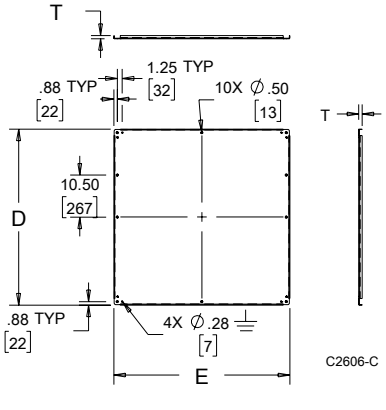
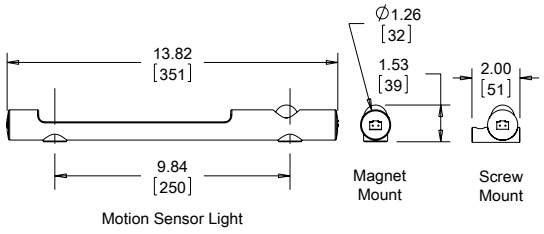


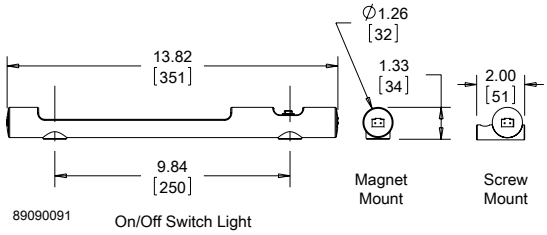
NUMBER OF HOLES = 10

LED LIGHT KIT

LED light kits provide interior enclosure lighting. These light kits are ideal for remote and darkened enclosure applications. The light can be mechanically fastened with included hardware to maintain enclosure UL listing (up to Type 4X), or can be magnetically attached to flat steel surfaces. The lights have auto-sensing circuitry (AC voltage 90 VAC to 265 VAC and DC voltage 20 VDC to 60 VDC). LED lights are light-weight and in a small form factor while providing 400 LM of 6000-7000K light. Power consumption for all models is 5 watts.

BULLETIN: A80LT





Catalog Number	AxBxC in./mm	Weight (oz)	Weight (gm)	Mounting Style	Power Source	Activation	Voltage
LEDA1M35	1.34 x 1.26 x 13.82 34 x 32 x 351	4.8	135	Magnetic	AC	On/off switch	90 VAC-265 VAC
LEDA2M35	1.54 x 1.26 x 13.82 39 x 32 x 351	5.0	140	Magnetic	AC	IR Motion Sensor	90 VAC-265 VAC
LEDA1S35	1.42 x 2.05 x 13.82 36 x 52 x 351	4.8	135	Screw	AC	On/off switch	90 VAC-265 VAC
LEDA2S35	1.63 x 2.05 x 13.82 41 x 52 x 351	5.0	140	Screw	AC	IR Motion Sensor	90 VAC-265 VAC
LEDD1M35	1.34 x 1.26 x 13.82 34 x 32 x 351	4.8	135	Magnetic	DC	On/off switch	20 VDC-60 VDC
LEDD2M35	1.54 x 1.26 x 13.82 39 x 32 x 351	5.0	140	Magnetic	DC	IR Motion Sensor	20 VDC-60 VDC
LEDD1S35	1.42 x 2.05 x 13.82 36 x 52 x 351	4.8	135	Screw	DC	On/off switch	20 VDC-60 VDC
LEDD2S35	1.63 x 2.05 x 13.82 41 x 52 x 351	5.0	140	Screw	DC	IR Motion Sensor	20 VDC-60 VDC

LED LIGHT INPUT CONNECTOR/CABLE ASSEMBLY

The input connector/cable assembly is used to provide supply power to the LED light. Preassembled connector/cable assembly with 78.7-in. (2000 mm) long cable whip. Cables are constructed of 16 AWG copper wire.

BULLETIN: A80LT

Catalog Number	A in./mm	Power Source	Use with
LEDA20C	78.74 2000	AC	AC LED Lights
LEDD20C	78.74 2000	DC	DC LED Lights

LED LIGHT EXTENSION CONNECTOR/CABLE ASSEMBLY

The extension connector/cable assembly is used to connect adjacent LED lights (daisy chain). Up to 10 LED lights can be ganged or connected in series. Pre-assembled connector/cable assembly with 39.4-in. (1000 mm) long cable between input and output connectors. Cables are constructed of 16 AWG copper wire.

BULLETIN: A80LT

Catalog Number	A in./mm	Power Source	Use with
LEDA10E	39.37 1000	AC	AC LED Lights
LEDD10E	39.37 1000	DC	DC LED Lights

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Allen-Bradley

1756 ControlLogix Chassis Specifications

Catalog Numbers 1756-A4/B, 1756-A4K/B, 1756-A4/C, 1756-A4K/C, 1756-A7/B, 1756-A7K/B, 1756-A7/C, 1756-A7K/C, 1756-A10/B, 1756-A10K/B, 1756-A10/C, 1756-A10K/C, 1756-A13/B, 1756-A13K/B, 1756-A13/C, 1756-A13K/C, 1756-A17/B, 1756-A17K/B, 1756-A17/C, 1756-A17K/C, 1756-A4LXT/B, 1756-A5XT/B, 1756-A7LXT/B, 1756-A7XT/B, 1756-A7XT/C, 1756-A10XT/C

The ControlLogix® system is a modular system that requires a 1756 ControlLogix chassis. The chassis are designed for only horizontal back-panel mounting. Place any module into any slot. The backplane provides a high-speed communication path between modules.

AutoCAD product drawings are available at http://www.rockwellautomation.com/global/support/drawings.page.

Standard ControlLogix Chassis Specifications

The chassis backplane provides a high-speed communication path between modules and distributes power to each of the modules within the chassis.

Technical Specifications - ControlLogix Standard Chassis (Series B)

Attribute	1756-A4/B	1756-A7/B	1756-A10/B	1756-A13/B	1756-A17/B
Backplane current, chassis/slot max @ 1.2V DC	1.5 A/–				
Backplane current, chassis/slot max @ 3.3V DC	4 A/4 A				
Backplane current, chassis/slot max @ 5.1V DC	15 A/6 A				
Backplane current, chassis/slot max @ 24V DC	2.8 A/2.8 A				
Power dissipation, max	4 W	4.5 W	5 W	5.4 W	6 W
Isolation voltage	Determined by installed power supply and modules				
Slots	4	7	10	13	17
Mounting method	Only horizontal				
Cabinet size (HxWxD), min	50.8 x 50.8 x 20.3 cm (20 x 20 x 8 in.)	50.8 x 60.9 x 20.3 cm (20 x 24 x 8 in.)	50.8 x 76.2 x 20.3 cm (20 x 30 x 8 in.)	60.9 x 76.2 x 20.3 cm (24 x 30 x 8 in.)	76.2 x 91.4 x 20.3 cm (30 x 36 x 8 in.)
Weight, approx	0.75 kg (1.7 lb)	1.10 kg (2.4 lb)	1.45 kg (3.2 lb)	1.90 kg (4.2 lb)	2.20 kg (4.8 lb)
Location	Panel				
Wire size	Functional Earth Ground - 8.3 mm^2 (8 AWG) solid or stranded copper wire rated at 90 °C (194 °F) or greater Protective Earth Ground - 2.1 mm^2 (14 AWG) solid or stranded copper wire rated at 90 °C (194 °F) or greater				
North American temperature code	T5				
IEC temperature code	T4	T5			
Enclosure type rating	None (open-style)				

Technical Specifications - ControlLogix Standard Chassis (Series C)

Attribute	1756-A4/C	1756-A7/C	1756-A10/C	1756-A13/C	1756-A17/C
Backplane current, chassis/slot max @ 1.2V DC	1.5 A/–				
Backplane current, chassis/slot max @ 3.3V DC	4 A/4 A				
Backplane current, chassis/slot max @ 5.1V DC	15 A/6 A				
Backplane current, chassis/slot max @ 24V DC	2.8 A/2.8 A				
Power dissipation, max	4 W	4.5 W	5 W	5.4 W	6 W
Isolation voltage	Determined by installed power supply and modules				
Slots	4	7	10	13	17
Mounting method	Only horizontal				
Cabinet size (HxWxD), min	50.8 x 50.8 x 20.3 cm (20 x 20 x 8 in.)	50.8 x 60.9 x 20.3 cm (20 x 24 x 8 in.)	50.8 x 76.2 x 20.3 cm (20 x 30 x 8 in.)	60.9 x 76.2 x 20.3 cm (24 x 30 x 8 in.)	76.2 x 91.4 x 20.3 cm (30 x 36 x 8 in.)
Weight, approx	0.75 kg (1.7 lb)	1.10 kg (2.4 lb)	1.45 kg (3.2 lb)	1.90 kg (4.2 lb)	2.20 kg (4.8 lb)
Location	Panel				
Wire size	Functional earth ground - 8.3 mm^2 (8 AWG) solid or stranded copper wire rated at 90 °C (194 °F) or greater Protective earth ground - 2.1 mm^2 (14 AWG) solid or stranded copper wire rated at 90 °C (194 °F) or greater				
North American temperature code	T4				
IEC temperature code	T4				
Enclosure type rating	None (open-style)				

Environmental Specifications - ControlLogix Standard Chassis

Attribute	1756-A4/B, 1756-A7/B, 1756-A10/B, 1756-A13/B, 1756-A17/B	1756-A4/C, 1756-A7/C, 1756-A10/C, 1756-A13/C, 1756-A17/C
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0…60 °C (32…140 °F)	-25…+60 °C (-13…+140 °F)
Temperature, surrounding air	60 °C (140 °F)	
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…+85 °C (-40…+185 °F)	
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing	
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz	
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g	
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g	30 g
Emissions	IEC 61000-6-4	
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges	
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz	

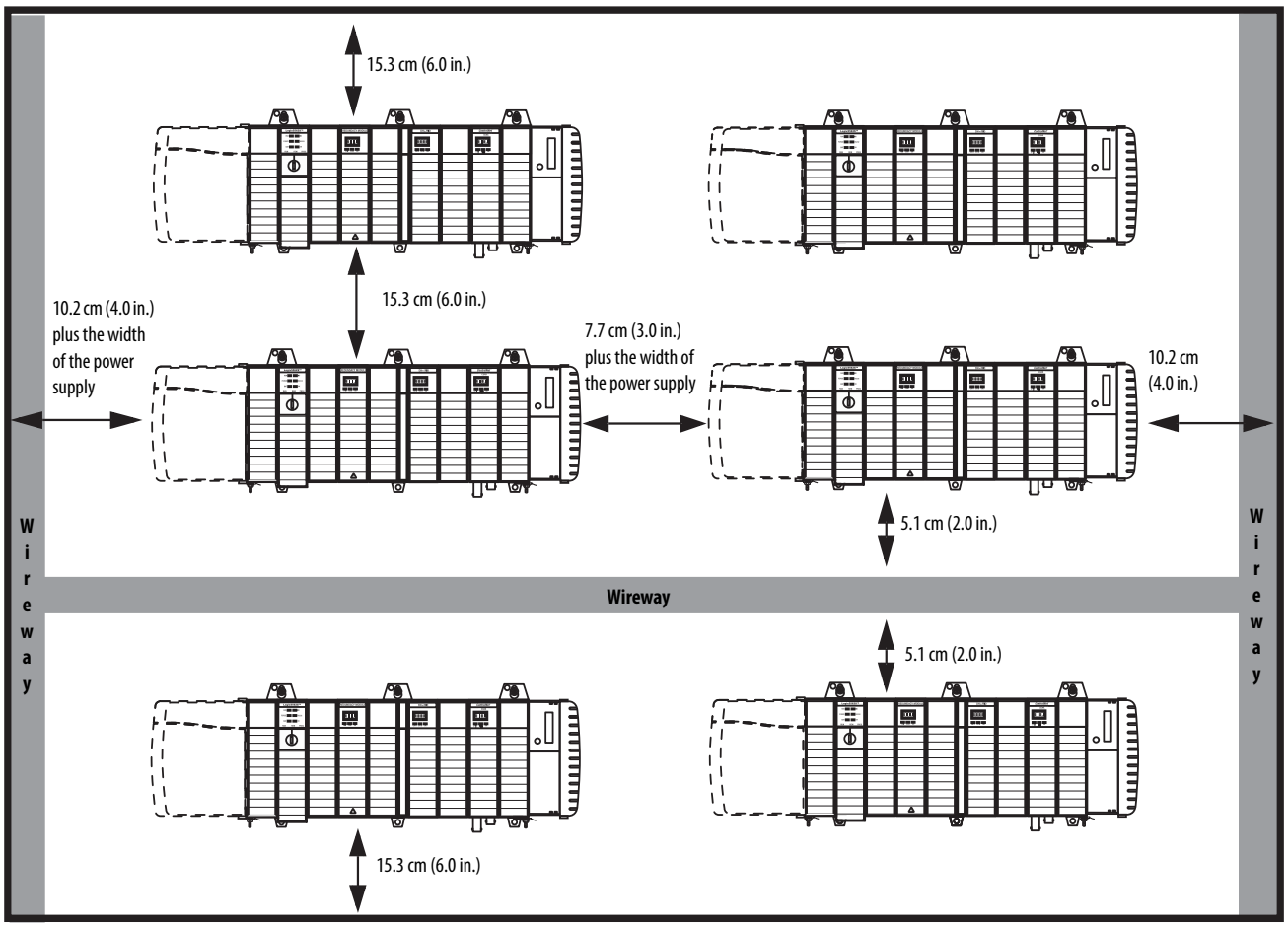
Certifications - ControlLogix Standard Chassis

Certification[(1)]	1756-A4/B	1756-A7/B, 1756-A10/B, 1756-A13/B, 1756-A17/B	1756-A4/C, 1756-A7/C, 1756-A10/C, 1756-A13/C, 1756-A17/C
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.		
CSA	CSA Certified Process Control Equipment. See CSA File 54689. CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File 69960.		
FM	FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations.		
CE	European Union 2004/108/EC EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)		
RCM	Australian Radiocommunications Act, compliant with: EN 61000-6-4; Industrial Emissions		
Ex	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements • II 3 G Ex nA IIC T4 Gc X	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements • II 3 G Ex nA IIC T5 Gc X	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements • II 3 G Ex nA IIC T4 Gc • DEMKO13ATEX1325026X
IECEx	N/A		IECEx System, compliant with: • IEC 60079-15; Potentially Explosive Atmospheres, Protection "n" • IEC 60079-0; General Requirements • II 3 G Ex nA IIC T4 Gc • IECExUL14.0008X
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3		
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation		

(1) See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

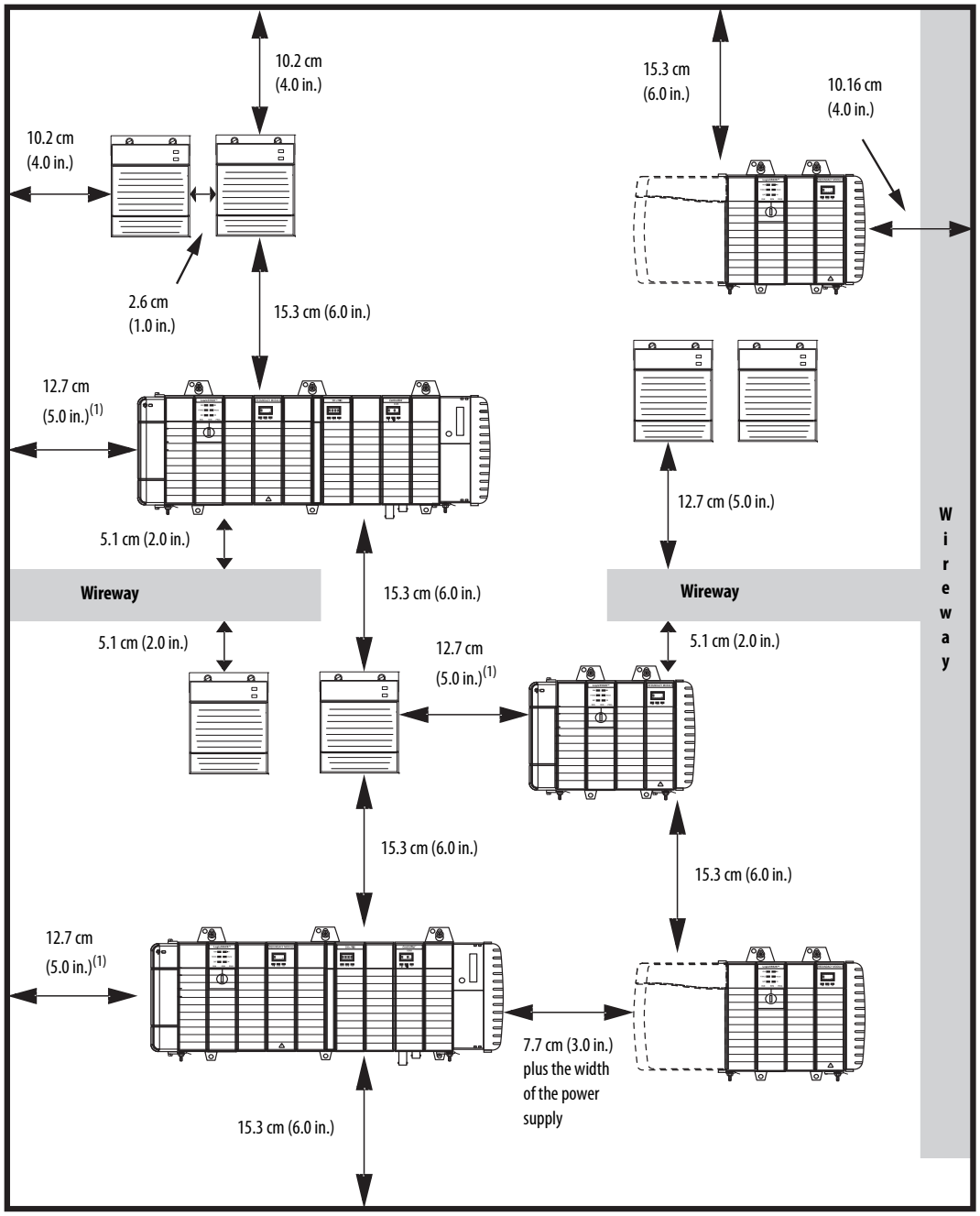
Spacing Requirements

When you mount a ControlLogix chassis with a standard power supply in an enclosure, follow these spacing requirements (series C chassis depicted).



IMPORTANT The 1756-CPR2 cable has a bend radius of 12.7 cm (5.0 in.). The chassis must have a minimum clearance of 12.7 cm (5.0 in.) on the left side to route and connect the 1756-CPR2 cable. The redundant power supplies must have a minimum clearance of 12.7 cm (5.0 in.) below the supply to route and connect the 1756-CPR2 cable.

When you mount a ControlLogix chassis with a redundant power supply and a chassis adapter in an enclosure, follow these spacing requirements (series C chassis depicted).



(1) The measurements for systems that use 1756-CPR2D or 1756-CPR2U cables are 10.2 cm (4.0 in.).

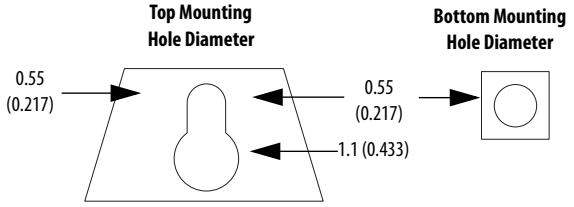
Series C chassis offer these features:

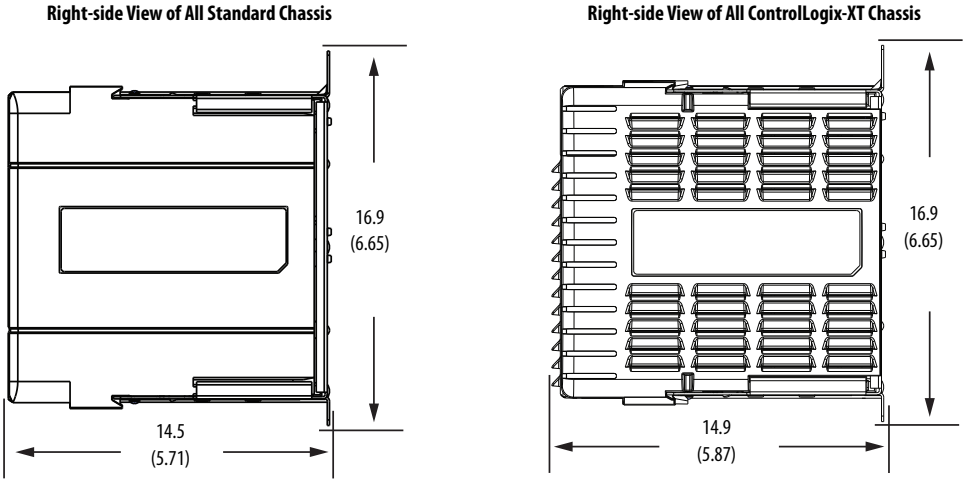
- Improved slot guidelines
- Improved ventilation
- Stronger mounting tabs
- Additional hole in mounting tab
- Additional ground screw

Series B ControlLogix Chassis with Standard and Slim Power Supply Mounting Dimensions

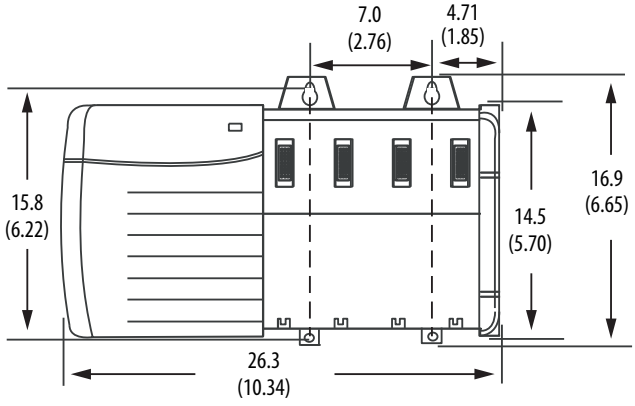
Dimensions are in cm (in.).

Chassis Common Dimensions

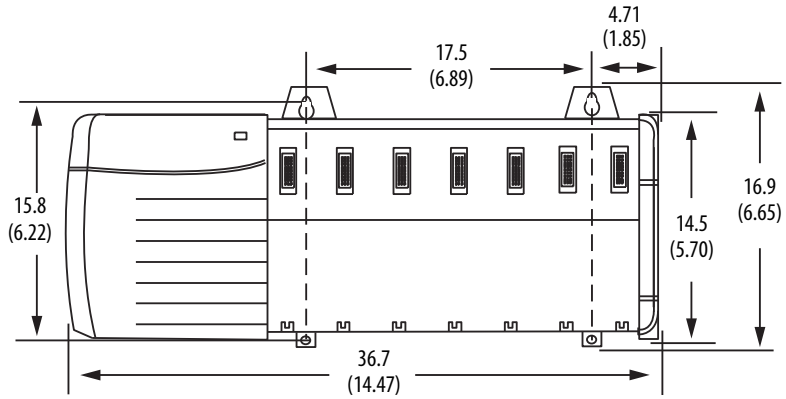




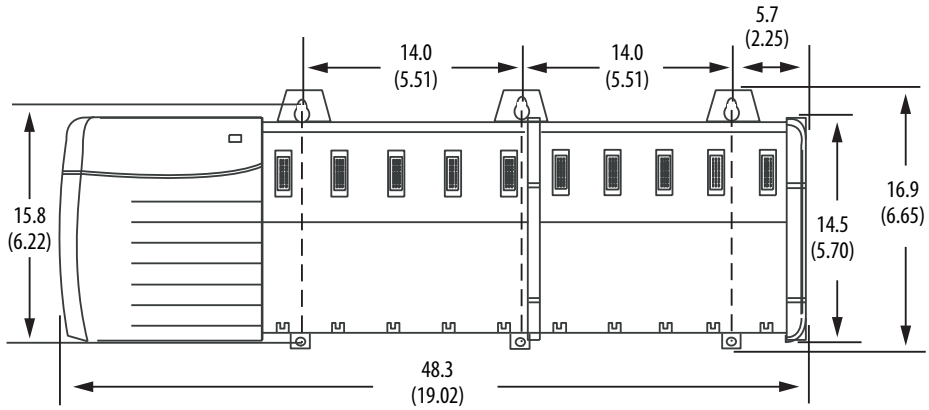
1756-A4/B Chassis and Power Supply



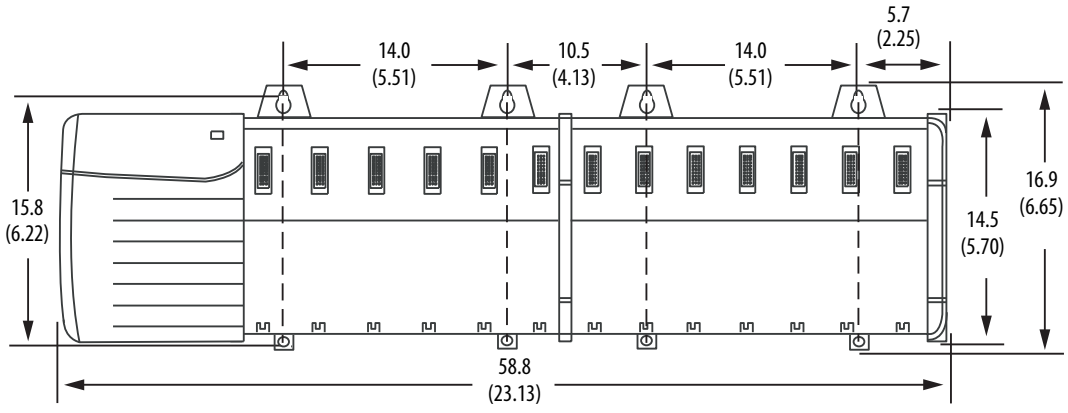
1756-A7/B Chassis and Power Supply



1756-A10/B Chassis and Power Supply



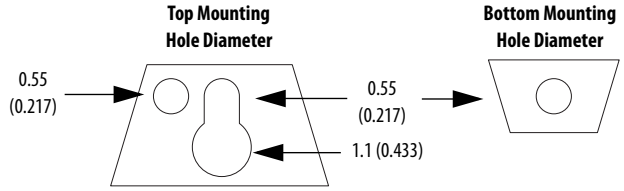
1756-A13/B Chassis and Power Supply



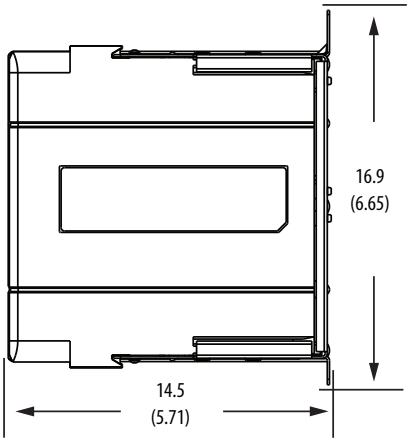
Series C ControlLogix Chassis with Standard and Slim Power Supply Mounting Dimensions

Dimensions are in cm (in.).

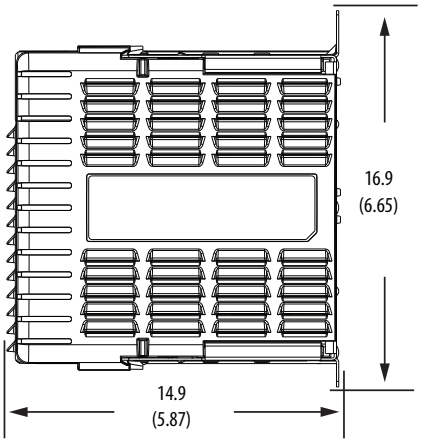
Chassis Common Dimensions



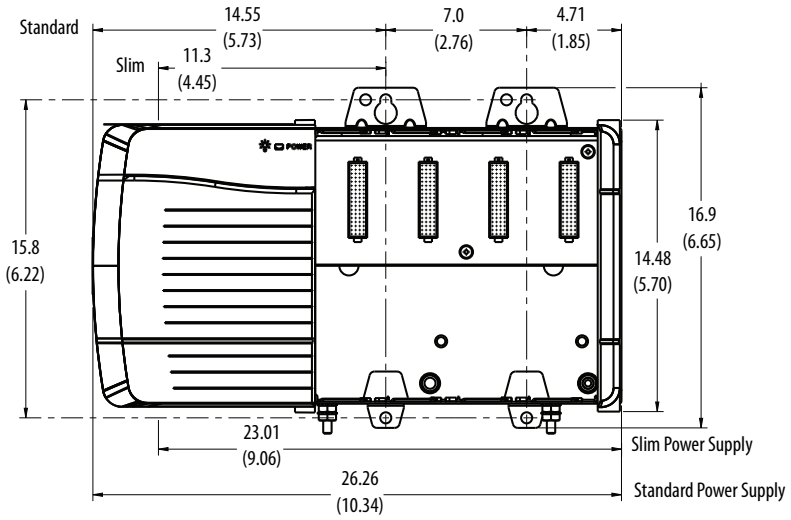
Right-side View of All Standard Chassis



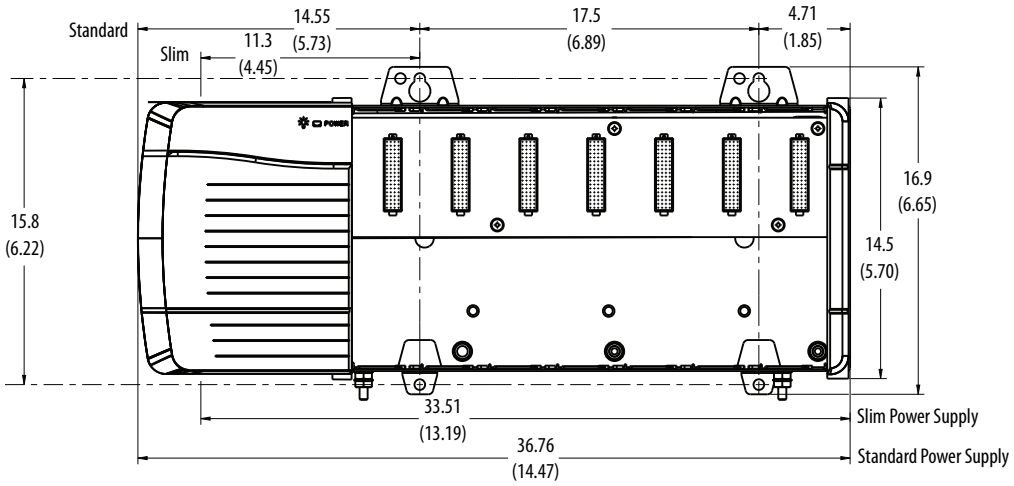
Right-side View of All ControlLogix-XT Chassis



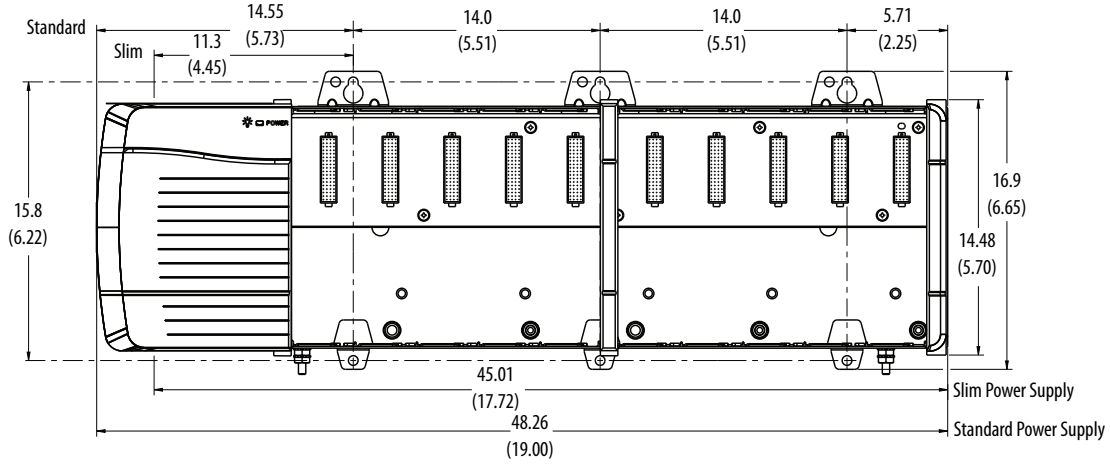
1756-A4/C Chassis and Power Supply



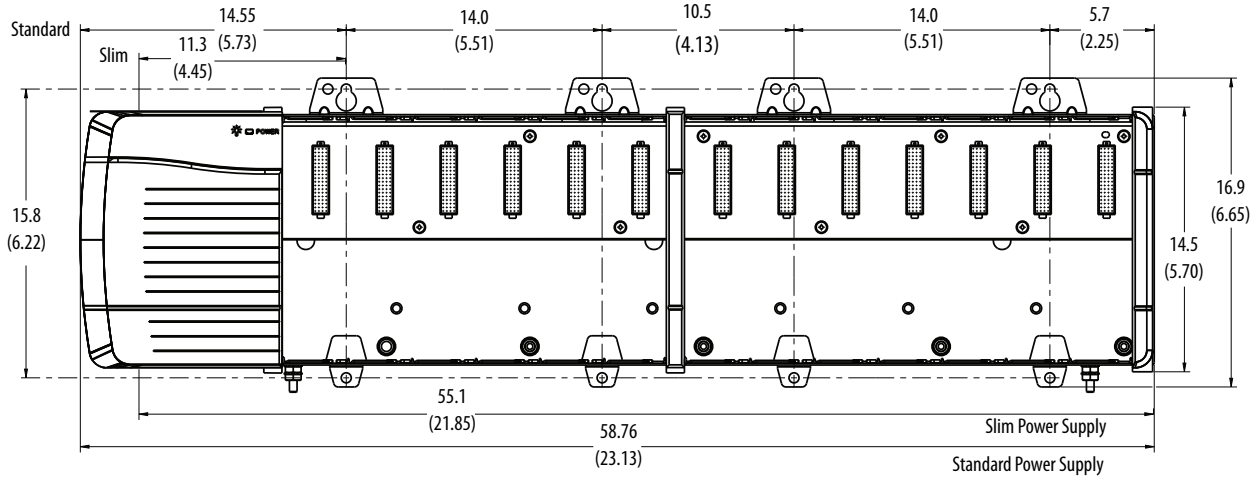
1756-A7/C Chassis and Power Supply



1756-A10/C Chassis and Power Supply



1756-A13/C Chassis and Power Supply



Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	www.rockwellautomation.com/knowledgebase
Local Technical Support Phone Numbers	Locate the phone number for your country.	www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	www.rockwellautomation.com/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	www.rockwellautomation.com/global/support/pcdc.page

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Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the How Are We Doing? form at http://literature.rockwellautomation.com/idc/groups/literature/documents/du/ra-du002_-en-e.pdf.

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Publication 1756-TD006F-EN-E - March 2017
Supersedes Publication 1756-TD006E-EN-E - October 2014

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Installation Instructions

Original Instructions

ControlLogix Chassis

Catalog Numbers 1756-A4, 1756-A7, 1756-A10, 1756-A13, 1756-A17, 1756-A4LXT, 1756-A5XT, 1756-A7LXT, 1756-A7XT, 1756-A10XT, 1756-A4K, 1756-A7K, 1756-A10K, 1756-A13K, 1756-A17K

Product Overview

The ControlLogix® system is a modular system that requires a 1756 ControlLogix chassis. The chassis are designed for only horizontal back-panel mounting. Place any module into any slot. The backplane provides a high-speed communication path between modules.

Summary of Changes

We added a 10-slot ControlLogix-XT® chassis, catalog number 1756-A10XT, to these installation instructions.

ATTENTION: Read this document and the documents listed in the Additional Resources section about installation, configuration and operation of this equipment before you install, configure, operate or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

注意：在安装、配置、操作和维护本产品前，请阅读本文档以及 “ 其他资源 ” 部分列出的有关设备安装、配置和操作的相应文档。除了所有适用规范、法律和标准的相关要求之外，用户还必须熟悉安装和接线说明。

安装、调整、投运、使用、组装、拆卸和维护等各项操作必须由经过适当训练的专业人员按照适用的操作规范实施。

如果未按照制造商指定的方式使用该设备，则可能会损害设备提供的保护。

ATENCIÓN: Antes de instalar, configurar, poner en funcionamiento o realizar el mantenimiento de este producto, lea este documento y los documentos listados en la sección Recursos adicionales acerca de la instalación, configuración y operación de este equipo. Los usuarios deben familiarizarse con las instrucciones de instalación y cableado y con los requisitos de todos los códigos, leyes y estándares vigentes.

El personal debidamente capacitado debe realizar las actividades relacionadas a la instalación, ajustes, puesta en servicio, uso, ensamblaje, desensamblaje y mantenimiento de conformidad con el código de práctica aplicable.

Si este equipo se usa de una manera no especificada por el fabricante, la protección provista por el equipo puede resultar afectada.

ATENÇÃO: Leia este e os demais documentos sobre instalação, configuração e operação do equipamento que estão na seção Recursos adicionais antes de instalar, configurar, operar ou manter este produto. Os usuários devem se familiarizar com as instruções de instalação e fiação além das especificações para todos os códigos, leis e normas aplicáveis.

É necessário que as atividades, incluindo instalação, ajustes, colocação em serviço, utilização, montagem, desmontagem e manutenção sejam realizadas por pessoal qualificado e especializado, de acordo com o código de prática aplicável.

Caso este equipamento seja utilizado de maneira não estabelecida pelo fabricante, a proteção fornecida pelo equipamento pode ficar prejudicada.

ВНИМАНИЕ: Перед тем как устанавливать, настраивать, эксплуатировать или обслуживать данное оборудование, прочитайте этот документ и документы, перечисленные в разделе «Дополнительные ресурсы». В этих документах изложены сведения об установке, настройке и эксплуатации данного оборудования. Пользователи обязаны ознакомиться с инструкциями по установке и прокладке соединений, а также с требованиями всех применимых норм, законов и стандартов.

Все действия, включая установку, наладку, ввод в эксплуатацию, использование, сборку, разборку и техническое обслуживание, должны выполняться обученным персоналом в соответствии с применимыми нормами и правилами.

Если оборудование используется не предусмотренным производителем образом, защита оборудования может быть нарушена.

注意： 本製品を設置、構成、稼動または保守する前に、本書および本機器の設置、設定、操作についての参考資料の該当箇所に記載されている文書に目を通してください。ユーザは、すべての該当する条例、法律、規格の要件に加えて、設置および配線の手順に習熟している必要があります。

設置調整、運転の開始、使用、組立て、解体、保守を含む諸作業は、該当する実施規則に従って訓練を受けた適切な作業員が実行する必要があります。

本機器が製造メーカにより指定されていない方法で使用されている場合、機器により提供されている保護が損なわれる恐れがあります。

ACHTUNG: Lesen Sie dieses Dokument und die im Abschnitt „Weitere Informationen“aufgeführten Dokumente, die Informationen zu Installation, Konfiguration und Bedienung dieses Produkts enthalten, bevor Sie dieses Produkt installieren, konfigurieren, bedienen oder warten. Anwender müssen sich neben den Bestimmungen aller anwendbaren Vorschriften, Gesetze und Normen zusätzlich mit den Installations- und Verdrahtungsanweisungen vertraut machen.

Arbeiten im Rahmen der Installation, Anpassung, Inbetriebnahme, Verwendung, Montage, Demontage oder Instandhaltung dürfen nur durch ausreichend geschulte Mitarbeiter und in Übereinstimmung mit den anwendbaren Ausführungsvorschriften vorgenommen werden.

Wenn das Gerät in einer Weise verwendet wird, die vom Hersteller nicht vorgesehen ist, kann die Schutzfunktion beeinträchtigt sein.

ATTENTION : Lisez ce document et les documents listés dans la section Ressources complémentaires relatifs à l'installation, la configuration et le fonctionnement de cet équipement avant d'installer, configurer, utiliser ou entretenir ce produit. Les utilisateurs doivent se familiariser avec les instructions d'installation et de câblage en plus des exigences relatives aux codes, lois et normes en vigueur.

Les activités relatives à l'installation, le réglage, la mise en service, l'utilisation, l'assemblage, le démontage et l'entretien doivent être réalisées par des personnes formées selon le code de pratique en vigueur.

Si cet équipement est utilisé d'une façon qui n'a pas été définie par le fabricant, la protection fournie par l'équipement peut être compromise.

주의 : 본 제품 설치 , 설정 , 작동 또는 유지 보수하기 전에 본 문서를 포함하여 설치 , 설정 및 작동에 관한 참고 자료 섹션의 문서들을 반드시 읽고 숙지하십시오 . 사용자는 모든 관련 규정 , 법규 및 표준에서 요구하는 사항에 대해 반드시 설치 및 배선 지침을 숙지해야 합니다 .

설치 , 조정 , 가동 , 사용 , 조립 , 분해 , 유지보수 등 모든 작업은 관련 규정에 따라 적절한 교육을 받은 사용자를 통해서만 수행해야 합니다 .

본 장비를 제조사가 명시하지 않은 방법으로 사용하면 장비의 보호 기능이 손상될 수 있습니다 .

ATTENZIONE Prima di installare, configurare ed utilizzare il prodotto, o effettuare interventi di manutenzione su di esso, leggere il presente documento ed i documenti elencati nella sezione “Altre risorse”, riguardanti l'installazione, la configurazione ed il funzionamento dell'apparecchiatura. Gli utenti devono leggere e comprendere le istruzioni di installazione e cablaggio, oltre ai requisiti previsti dalle leggi, codici e standard applicabili.

Le attività come installazione, regolazioni, utilizzo, assemblaggio, disassemblaggio e manutenzione devono essere svolte da personale adeguatamente addestrato, nel rispetto delle procedure previste.

Qualora l'apparecchio venga utilizzato con modalità diverse da quanto previsto dal produttore, la sua funzione di protezione potrebbe venire compromessa.

DİKKAT: Bu ürünün kurulumu, yapılandırılması, işletilmesi veya bakımı öncesinde bu dokümanı ve bu ekipmanın kurulumu, yapılandırılması ve işletimi ile ilgili İlave Kaynaklar bölümünde yer listelenmiş dokümanları okuyun. Kullanıcılar yürürlükteki tüm yönetmelikler, yasalar ve standartların gereksinimlerine ek olarak kurulum ve kablolama talimatlarını da öğrenmek zorundadır.

Kurulum, ayarlama, hizmete alma, kullanma, parçaları birleştirme, parçaları sökme ve bakım gibi aktiviteler sadece uygun eğitimleri almış kişiler tarafından yürürlükteki uygulama yönetmeliklerine uygun şekilde yapılabilir.

Bu ekipman üretici tarafından belirlenmiş amacın dışında kullanılırsa, ekipman tarafından sağlanan koruma bozulabilir.

注意事項：在安装、設定、操作或維護本產品前，請先閱讀此文件以及列於 「其他資源」章節中有關安装、設定與操作此設備的文件。使用者必須熟悉安裝和配線指示，並符合所有法規、法律和標準要求。

包括安装、調整、交付使用、使用、組装、拆卸和維護等動作都必須交由已經過適當訓練的人員進行，以符合適用的實作法規。

如果將設備用於非製造商指定的用途時，可能會造成設備所提供的保護功能受損。

POZOR: Než začnete instalovat, konfigurovat či provozovat tento výrobek nebo provádět jeho údržbu, přečtěte si tento dokument a dokumenty uvedené v části Dodatečné zdroje ohledně instalace, konfigurace a provozu tohoto zařízení. Uživatelé se musejí vedle požadavků všech relevantních vyhlášek, zákonů a norem nutně seznámit také s pokyny pro instalaci a elektrické zapojení.

Činnosti zahrnující instalaci, nastavení, uvedení do provozu, užívání, montáž, demontáž a údržbu musí vykonávat vhodně proškolený personál v souladu s příslušnými prováděcími předpisy.

Pokud se toto zařízení používá způsobem neodpovídajícím specifikaci výrobce, může být narušena ochrana, kterou toto zařízení poskytuje.

UWAGA: Przed instalacją, konfiguracją, użytkowaniem lub konserwacją tego produktu należy przeczytać niniejszy dokument oraz wszystkie dokumenty wymienione w sekcji Dodatkowe źródła omawiające instalację, konfigurację i procedury użytkowania tego urządzenia. Użytkownicy mają obowiązek zapoznać się z instrukcjami dotyczącymi instalacji oraz oprzewodowania, jak również z obowiązującymi kodeksami, prawem i normami.

Działania obejmujące instalację, regulację, przekazanie do użytkowania, użytkowanie, montaż, demontaż oraz konserwację muszą być wykonywane przez odpowiednio przeszkolony personel zgodnie z obowiązującym kodeksem postępowania.

Jeśli urządzenie jest użytkowane w sposób inny niż określony przez producenta, zabezpieczenie zapewniane przez urządzenie może zostać ograniczone.

OBS! Läs detta dokument samt dokumentet, som står listat i avsnittet Övriga resurser, om installation, konfigurering och drift av denna utrustning innan du installerar, konfigurerar eller börjar använda eller utföra underhållsarbete på produkten. Användare måste bekanta sig med instruktioner för installation och kabeldragning, förutom krav enligt gällande koder, lagar och standarder.

Åtgärder som installation, justering, service, användning, montering, demontering och underhållsarbete måste utföras av personal med lämplig utbildning enligt lämpligt bruk.

Om denna utrustning används på ett sätt som inte anges av tillverkaren kan det hända att utrustningens skyddsanordningar försätts ur funktion.

LET OP: Lees dit document en de documenten die genoemd worden in de paragraaf Aanvullende informatie over de installatie, configuratie en bediening van deze apparatuur voordat u dit product installeert, configureert, bediend of onderhoudt. Gebruikers moeten zich vertrouwd maken met de installatie en de bedradingsinstructies, naast de vereisten van alle toepasselijke regels, wetten en normen.

Activiteiten zoals het installeren, afstellen, in gebruik stellen, gebruiken, monteren, demonteren en het uitvoeren van onderhoud mogen uitsluitend worden uitgevoerd door hiervoor opgeleid personeel en in overeenstemming met de geldende praktijkregels.

Indien de apparatuur wordt gebruikt op een wijze die niet is gespecificeerd door de fabrikant, dan bestaat het gevaar dat de beveiliging van de apparatuur niet goed werkt.

Environment and Enclosure

ATTENTION: This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC 60664-1), at altitudes up to 2000 m (6562 ft) without derating.

This equipment is not intended for use in residential environments and may not provide adequate protection to radio communication services in such environments.

This equipment is supplied as open-type equipment for indoor use. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA or be approved for the application if nonmetallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

In addition to this publication, see the following:

- Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1, for additional installation requirements.
- NEMA Standard 250 and EN/IEC 60529, as applicable, for explanations of the degrees of protection provided by enclosures.

North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations:	**Informations sur l'utilisation de cet équipement en environnements dangereux:**
Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local authority having jurisdiction at the time of installation.	Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation
WARNING **EXPLOSION HAZARD** • Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. • Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. • Substitution of components may impair suitability for Class I, Division 2. • If this product contains batteries, they must be changed only in an area known to be nonhazardous.	**AVERTISSMENT** **RISQUE D'EXPLOSION** • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. • La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. • S'assurer que l'environnement est classé non dangereux avant de changer les piles.

European Hazardous Location Approval

The following applies to products marked CE, Ex, II 3: Such modules:

- Are Equipment Group II, Equipment Category 3, and comply with the Essential Health and Safety Requirements relating to the design and construction of such equipment given in Annex II to Directive 94/9/EC. See the EC Declaration of Conformity at http://www.rockwellautomation.com/products/certification for details.
- The type of protection is "Ex nA IIC T4 Gc" according to EN 60079-15.
- Comply to Standards: EN 60079-0:2012+A11:2013, EN 60079-15:2010, reference certificate number DEMKO13ATEX1325026X.
- Are intended for use in areas in which explosive atmospheres caused by gases, vapors, mists, or air are unlikely to occur, or are likely to occur only infrequently and for short periods. Such locations correspond to Zone 2 classification according to ATEX directive 1999/92/EC.

IEC Hazardous Location Approval

The following applies to products with IECEx certification: Such modules:

- Such modules are intended for use in areas in which explosive atmospheres caused by gases, vapors, mists, or air are unlikely to occur, or are likely to occur only infrequently and for short periods. Such locations correspond to Zone 2 classification to IEC 60079-0.
- The type of protection is "Ex nA IIC T4 Gc" according to IEC 60079-15.
- Such modules comply to Standards IEC 60079-0:2011 6th Edition, IEC-60079-15:2010 4th Edition, reference IECEx certificate number IECExUL14.0008X.

Special Conditions for Safe Use

WARNING:

- This equipment is not resistant to sunlight or other sources of UV radiation.
- This equipment shall be mounted in an ATEX/IECEx Zone 2 certified enclosure with a minimum ingress protection rating of at least IP54 (as defined in EN/IEC 60529) and used in an environment of not more than Pollution Degree 2 (as defined in EN/IEC 60664-1) when applied in Zone 2 environments. The enclosure must be accessible only by the use of a tool.
- This equipment shall be used within its specified ratings defined by Rockwell Automation.
- Provision shall be made to prevent the rated voltage from being exceeded by transient disturbances of more than 140% of the rated voltage when applied in Zone 2 environments.
- The instructions in the user manual shall be observed.
- Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product.
- Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.

Prevent Electrostatic Discharge

ATTENTION: This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- Use a static-safe workstation, if available.
- Store the equipment in appropriate static-safe packaging when not in use.

ATTENTION:

- If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- Installation, adjustments, putting into service, use, assembly, disassembly, and maintenance shall be carried out by suitably trained personnel in accordance with applicable code of practice. In case of malfunction or damage, no attempts at repair should be made. The module should be returned to the manufacturer for repair. Do not dismantle the module.
- This equipment is certified for use only within the surrounding air temperature range of -25…+60 °C (-13…+140 °F) for non-XT ControlLogix chassis. The 1756-A5XT/B, 1756-A7XT/B, 1756-A7XT/C, and 1756-A10XT chassis are certified for use only within the surrounding air temperature range of -25…+70 °C (-13…-158 °F). The equipment must not be used outside of this range.
- Use only a soft dry cloth to wipe down equipment. Do not use any cleaning agents.

Tools Required

When installing your chassis and power supplies, the following items are required:

- 3.18 mm (0.125 in.) slotted screwdriver
- 6.35 mm (0.25 in.) slotted or #2 Phillips-head screwdriver
- Torque screwdriver
- Needle-nose pliers
- Crimper
- Wire stripper
- Drill

Parts Required

These parts are not included with the chassis and must be ordered separately.

Parts Required Per Mounting Tab

Tab Position	With SEM Screws[1]	Without SEM Screws
Top	1 Phillips screw 1 flat washer 1 split-lock washer	N/A
Bottom	1 SEM screw	1 Phillips screw 1 star washer

(1) Phillips screw with attached star washer.

Total Parts Required Per Chassis

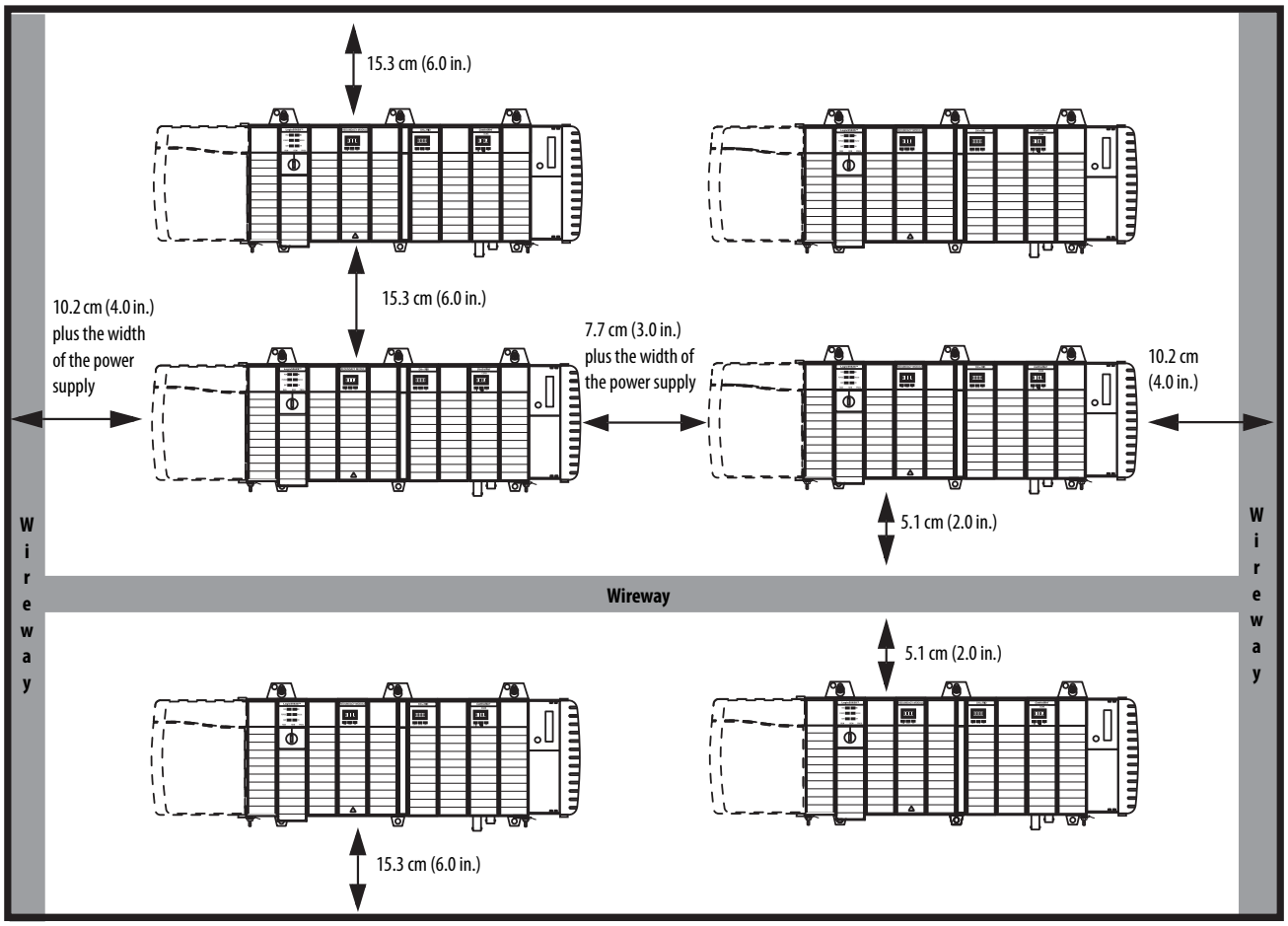
Chassis	Number of Mounting Tabs	Total Parts Required Per Chassis	
		With SEM Screws	Without SEM Screws
1756-A4/A, 1756-A4/B, 1756-A4/C, 1756-A7/A, 1756-A7/B, 1756-A7/C, 1756-A4LXT/B, 1756-A7LXT/B	2 top 2 bottom	• 2 Phillips screws • 2 flat washers • 2 split-lock washers • 2 SEM screws	• 4 Phillips screws • 2 flat washers • 2 split-lock washers • 2 star washers
1756-A10/A, 1756-A10/B, 1756-A10/C, 1756-A5XT/B, 1756-A7XT/B, 1756-A7XT/C	3 top 3 bottom	• 3 Phillips screws • 3 flat washers • 3 split-lock washers • 3 SEM screws	• 6 Phillips screws • 3 flat washers • 3 split-lock washers • 3 star washers
1756-A10XT/C, 1756-A13/A, 1756-A13/B, 1756-A13/C	4 top 4 bottom	• 4 Phillips screws • 4 flat washers • 4 split-lock washers • 4 SEM screws	• 8 Phillips screws • 4 flat washers • 4 split-lock washers • 4 star washers
1756-A17/A, 1756-A17/B, 1756-A17/C	5 top 5 bottom	• 5 Phillips screws • 5 flat washers • 5 split-lock washers • 5 SEM screws	• 10 Phillips screws • 5 flat washers • 5 split-lock washers • 5 star washers

Spacing Requirements for a System with a Non-redundant Power Supply

IMPORTANT Make sure that you meet the minimum spacing requirements specified.

Allow 15.3 cm (6.0 in.) between chassis and a heat source at the top or bottom of a chassis, and allow 5.1 cm (2.0 in.) between a wireway and the top or bottom of a chassis.

Chassis are intended to be mounted only horizontally. Do not mount vertically.



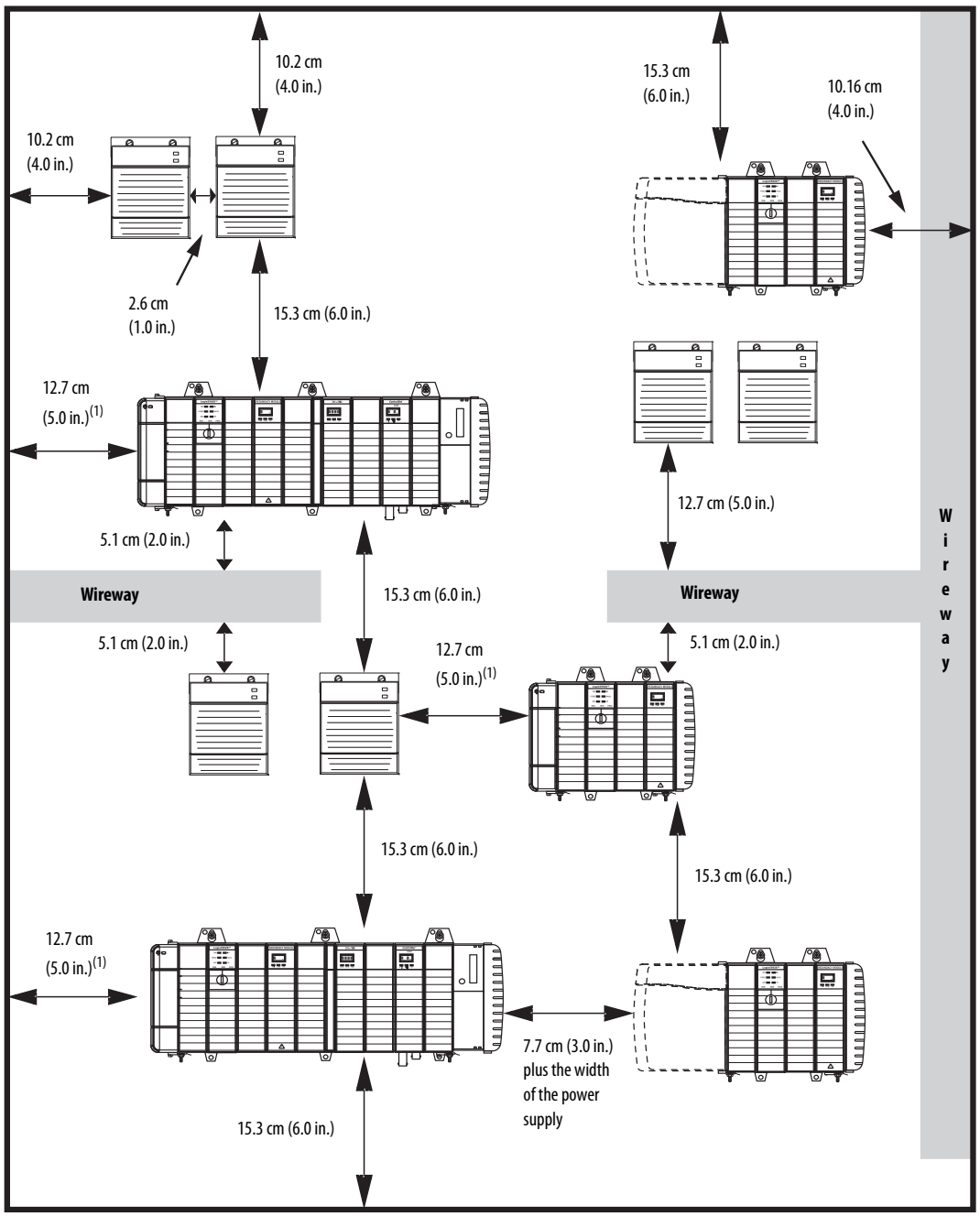
Spacing Requirements for a System with Redundant Power Supplies

IMPORTANT Make sure that you meet the minimum spacing requirements specified.

Chassis and redundant power supplies are intended to be mounted only horizontally. Do not mount vertically.

The 1756-CPR2 cable has a bend radius of 12.7 cm (5.0 in.). The chassis must have a minimum clearance of 12.7 cm (5.0 in.) on the left side to route and connect the 1756-CPR2 cable. The redundant power supplies must have a minimum clearance of 12.7 cm (5.0 in.) below the supply to route and connect the 1756-CPR2 cable.

The 1756-CPR2D and 1756-CPR2U cables have right-angle connectors. The chassis must have a minimum clearance of 10.16 cm (4.0 in.) on the left side to route and connect the 1756-CPR2D and 1756-CPR2U cables.

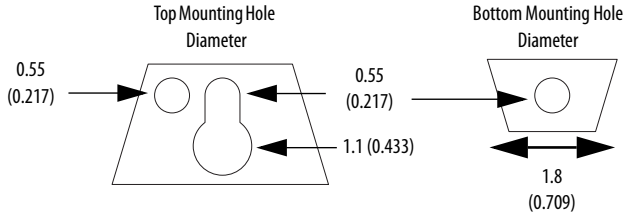


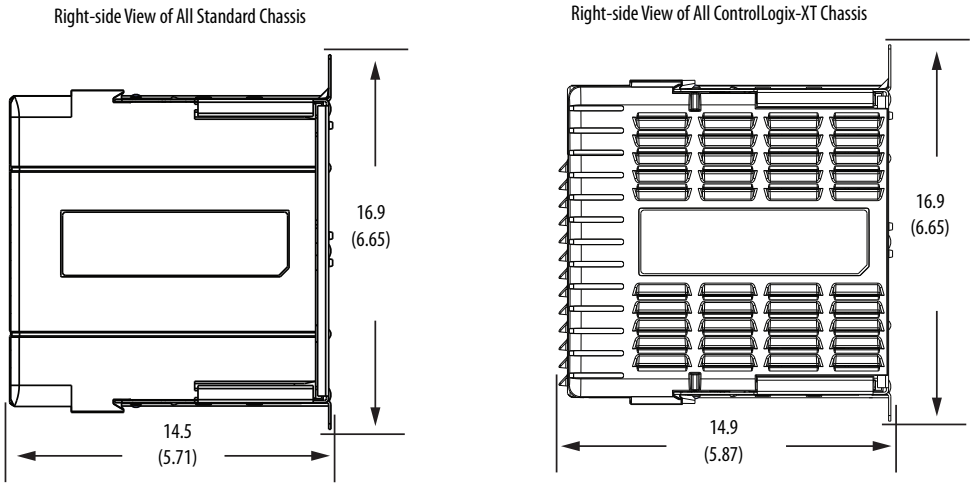
(1) The measurements for systems that use 1756-CPR2D or 1756-CPR2U cables are 10.2 cm (4.0 in.).

Mounting Dimensions

Dimensions are in cm (in.).

Chassis Common Dimensions

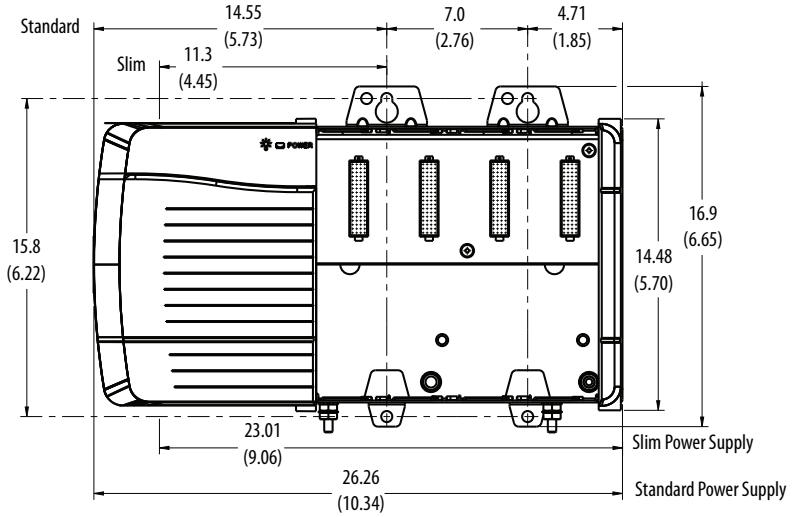




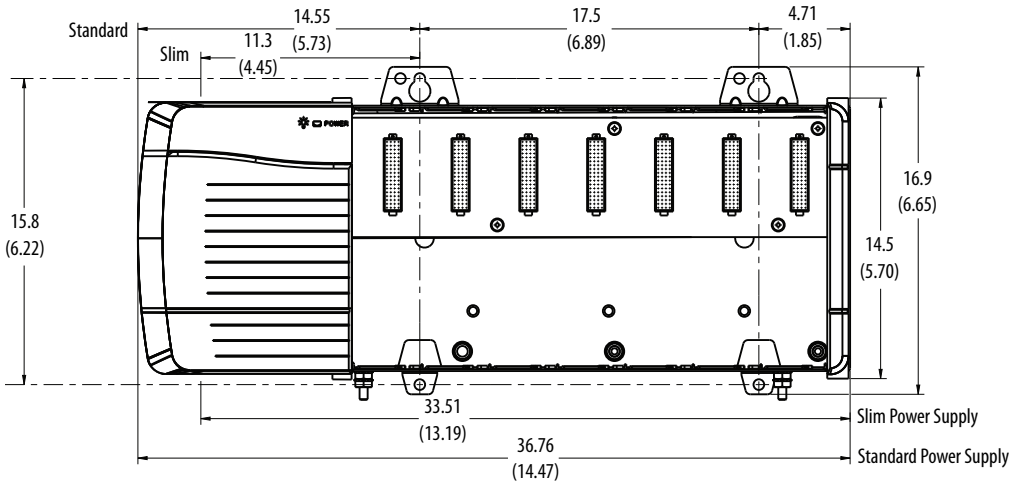
This section depicts Series C chassis, except where noted.

Standard refers to a standard power supply, and slim refers to a reduced-width power supply.

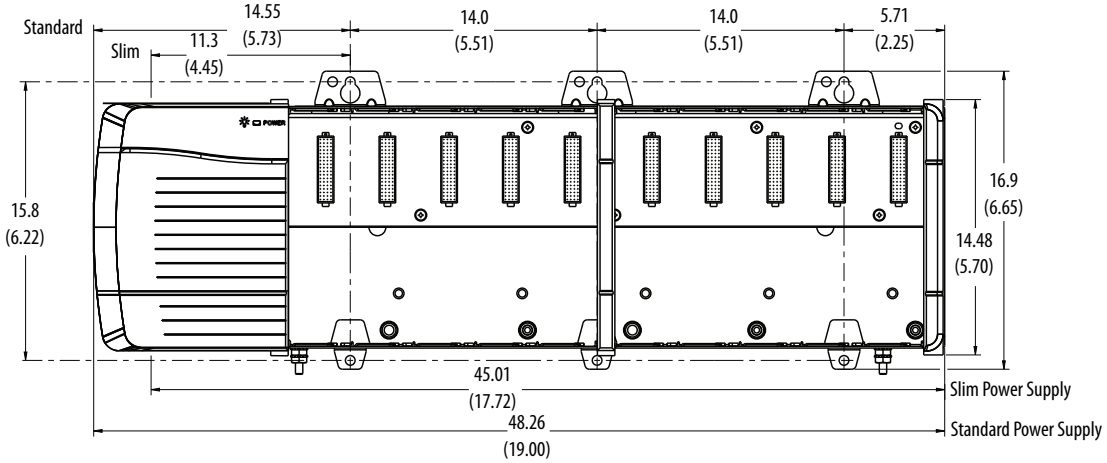
1756-A4 Chassis and Power Supply



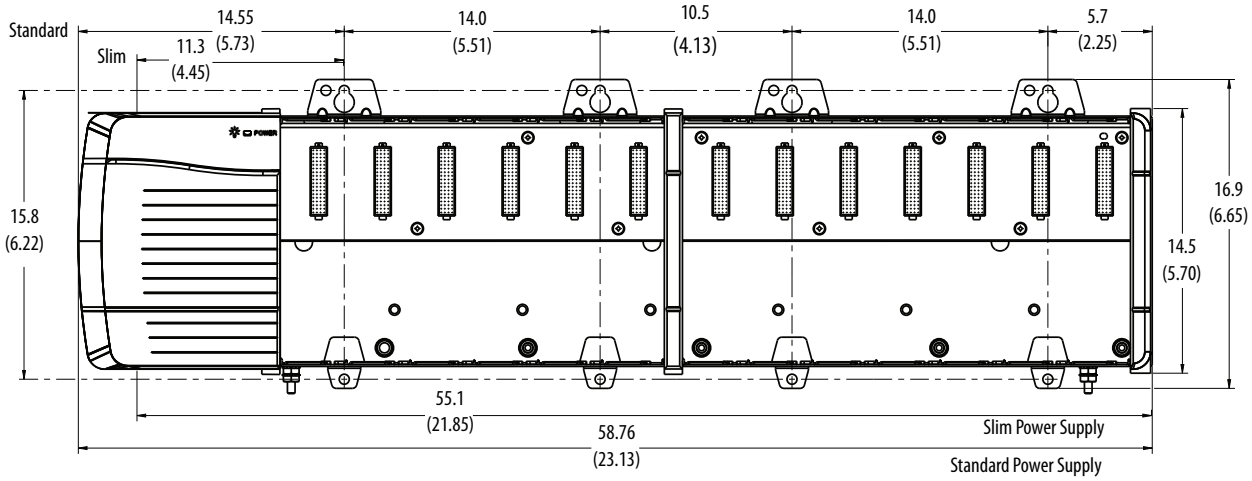
1756-A7 Chassis and Power Supply



1756-A10 Chassis and Power Supply



1756-A13 Chassis and Power Supply



Install the Chassis

After planning your system, use these instructions to install the chassis.

ATTENTION: Do not drill holes above an installed chassis. Metal chips from drilling can damage the backplane and cause intermittent operation.

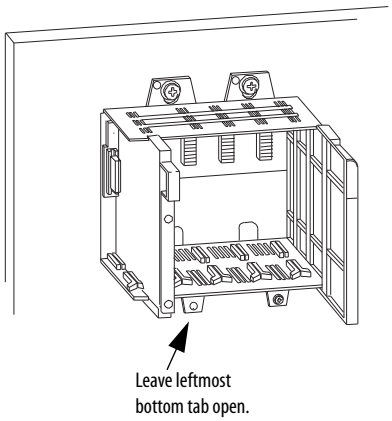
IMPORTANT Chassis are intended to be mounted only horizontally. Do not mount vertically.

1. Drill holes in the back panel of the enclosure for the chassis mounting tabs.
2. Scrape paint off the back panel for an electrical connection between the chassis and back panel.
3. Hold the chassis in place against the holes.

ATTENTION: If the chassis mounting tabs do not lay flat before the screws are tightened, use additional washers as shims so the chassis is not warped by tightening the screws.

Warping a chassis can damage the backplane and cause intermittent operation.

4. Install the hardware for the top mounting tabs and tighten. See Parts Required on page 5 for more information.
5. Install the remaining tab screws, but leave the leftmost bottom tab open for the functional ground.

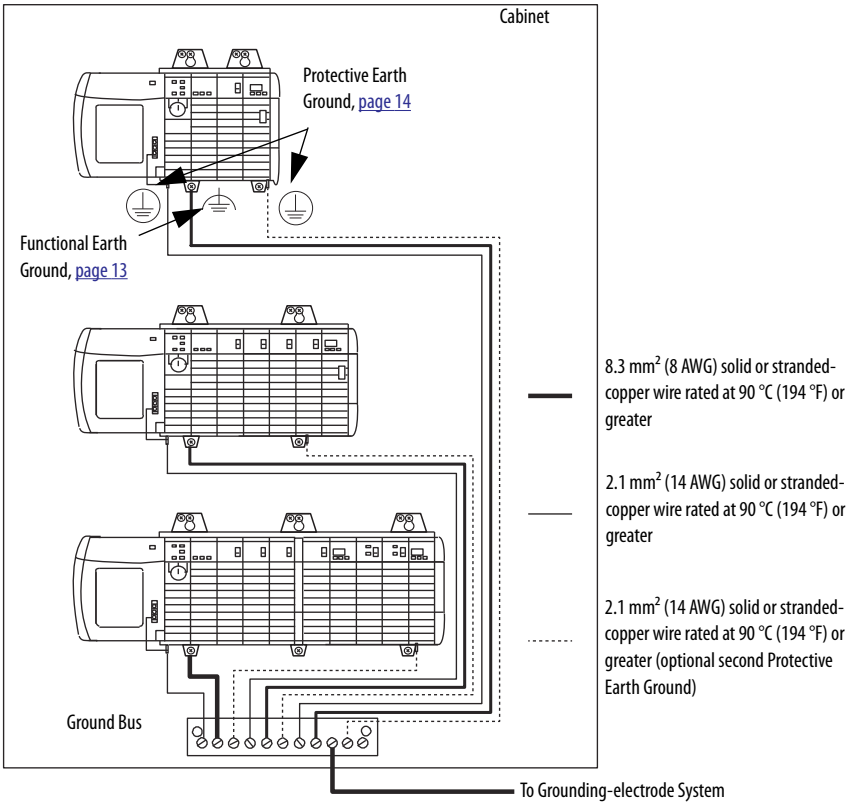


Ground the Chassis

The following figure shows an example grounding configuration. After you complete the grounding steps, your system looks similar to this figure.

TIP To minimize the resistance between the chassis and ground connection, keep wire lengths as short as possible.

Grounding Configuration Example



Use these guidelines when connecting the grounding:

- Use a steel enclosure to guard against electromagnetic interference (EMI).
- Install a bonding wire for electrical contact between the enclosure door and the enclosure; do not rely on the hinge.
- Make sure the enclosure-door viewing window is a laminated screen or a conductive optical substrate (to block EMI).

Install a Central Ground Bus

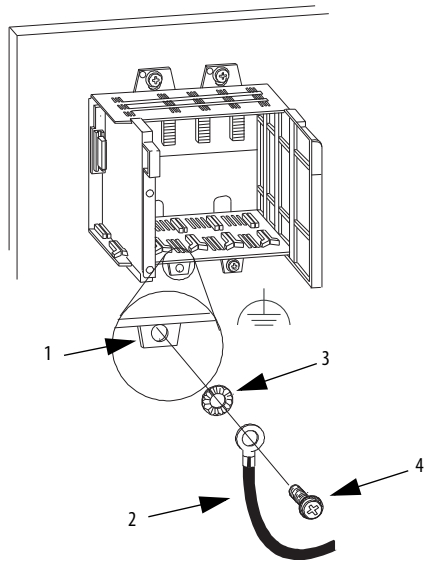
Each enclosure must contain a central ground bus. The ground bus is the common connection for each chassis within the enclosure and the enclosure itself. For more information on how to install a central ground bus, see the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Connect the Functional Earth Ground on the Chassis

Use 8.3 mm² (8 AWG) solid or stranded-copper wire rated at 90 °C (194 °F) or greater to connect the functional earth ground.

Connect the functional earth ground as shown in the following figure.

Functional Earth Ground Connection



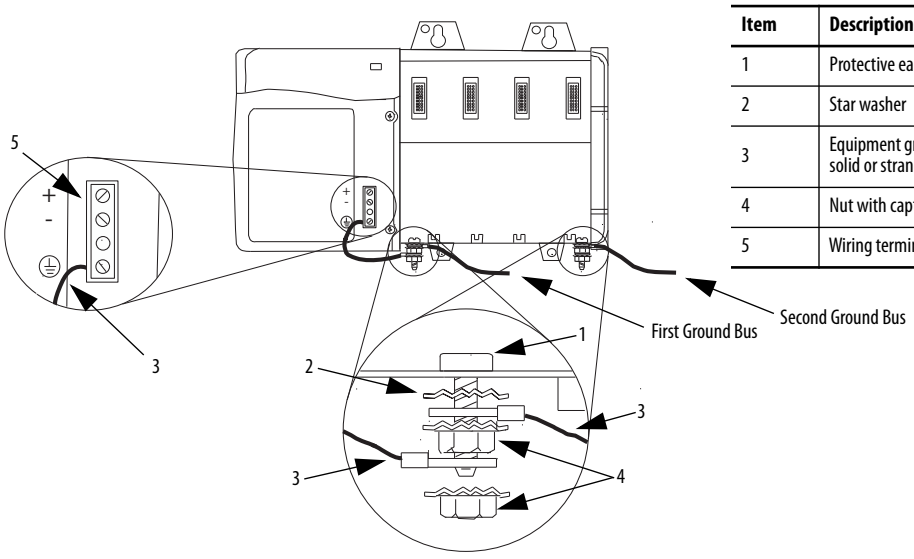
Item	Description
1	Chassis mounting tab
2	Equipment grounding conductor (ground lug with 8.3 mm² [8 AWG] solid or stranded-copper wire rated at 90 °C [194 °F] or greater)
3	M4 or M5 (#10 or #12) flat or star washer
4	M4 or M5 (#10 or #12) Phillips screw and flat or star washer (or SEM screw)

Connect the Protective Earth Ground

Use 2.1 mm² (14 AWG) solid or stranded-copper wire that is rated at 90 °C (194 °F) or greater to connect the protective earth ground. Tighten the nuts on the protective earth ground terminal stud to a torque of 16.27 N•m (12 lb•in).

Connect the functional earth ground as shown in the following figure.

Protective Earth Ground Connection



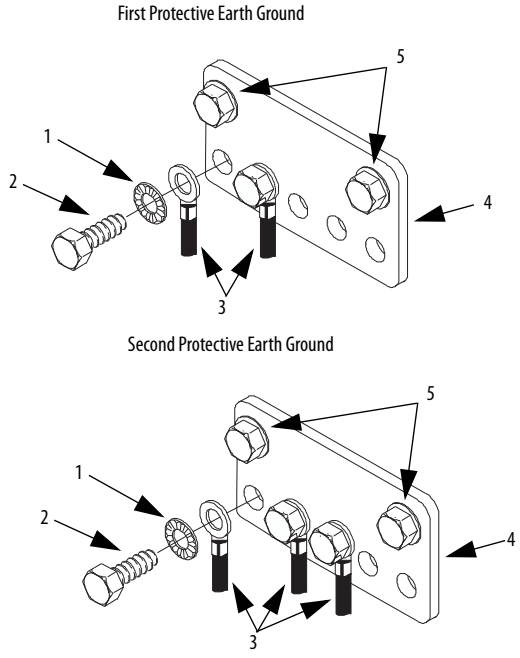
Item	Description
1	Protective earth-ground terminal stud
2	Star washer
3	Equipment grounding conductor (ground lug with 2.1 mm² [14 AWG] solid or stranded-copper wire rated at 90 °C [194 °F] or greater)
4	Nut with captive star washer
5	Wiring terminal block (bottom terminal is protective earth ground)

IMPORTANT If your application requires the use of the second protective earth-ground terminal stud, use the additional protective earth-ground terminal stud to connect the chassis to the ground bus. The Protective Earth Ground Connection figure depicts the connection of the second protective earth-ground terminal stud.

Connect the Grounding Conductors to the Ground Bus

Connect the equipment grounding conductors (functional and protective earth ground) directly from each chassis to an individual bolt on the ground bus.

Ground Bus Connection



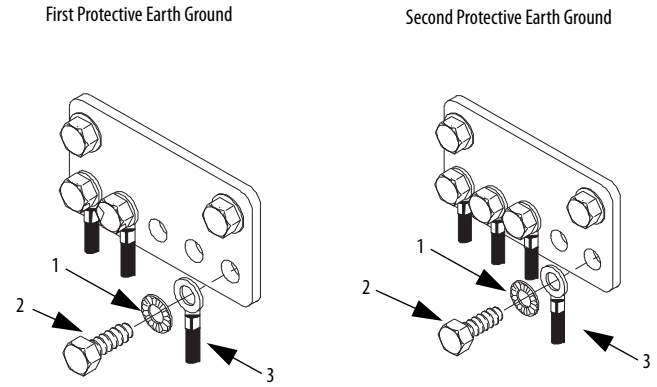
Item	Description
1	Protective earth-ground terminal stud
2	Star washer
3	Equipment grounding conductor (ground lug with 2.1 mm^2 [14 AWG] solid or stranded-copper wire rated at 90 °C [194 °F] or greater)
4	Nut with captive star washer
5	Wiring terminal block (bottom terminal is protective earth ground)

Connect Ground Bus to Grounding-electrode System

Use a grounding-electrode conductor to connect the ground bus to the grounding-electrode system.

At minimum, use 8.3 mm^2 (8 AWG) solid or stranded-copper wire that is rated at 90 °C (194 °F) or greater for the grounding-electrode conductor to guard against EMI. The National Electrical Code specifies safety requirements for the grounding-electrode conductor.

Grounding-electrode System Connection



Item	Description
1	Flat or star washer
2	Bolt
3	Equipment grounding conductor (ground lug with minimum 8.3 mm^2 [8 AWG] solid or stranded-copper wire rated at 90 °C [194 °F] or greater)

Specifications

Standard ControlLogix Chassis Specifications (Series B)

Attribute	1756-A4/B	1756-A7/B	1756-A10/B	1756-A13/B	1756-A17/B
Backplane current, chassis/slot max @ 1.2V DC	1.5 A/–				
Backplane current, chassis/slot max @ 3.3V DC	4A/4A				
Backplane current, chassis/slot max @ 5.1V DC	15 A/6 A				
Backplane current, chassis/slot max @ 24V DC	2.8 A/2.8 A				
Isolation voltage	Determined by installed power supply and modules				
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0…60 °C (0…140 °F)				
Temperature, surrounding air, max	60 °C (140 °F)				
Enclosure type rating	None (open-style)				
Slots	4	7	10	13	17
Wire size	Functional Earth Ground: 8.3 mm^2 (8 AWG) solid or stranded copper wire rated at 90 °C (194 °F) or greater Protective Earth Ground: 2.1 mm^2 (14 AWG) solid or stranded copper wire rated at 90 °C (194 °F) or greater				
North American temperature code	T5				
IECEx temperature code	T4	T5			

Standard ControlLogix Chassis Specifications (Series C)

Attribute	1756-A4/C	1756-A7/C	1756-A10/C	1756-A13/C	1756-A17/C
Backplane current, chassis/slot max @ 1.2V DC	1.5 A/–				
Backplane current, chassis/slot max @ 3.3V DC	4A/4A				
Backplane current, chassis/slot max @ 5.1V DC	15 A/6 A				
Backplane current, chassis/slot max @ 24V DC	2.8 A/2.8 A				
Isolation voltage	Determined by installed power supply and modules				
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	-25…+60 °C (-13…+140 °F)				
Temperature, surrounding air, max	60 °C (140 °F)				
Enclosure type rating	None (open-style)				
Slots	4	7	10	13	17
Wire size	Functional Earth Ground: 8.3 mm^2 (8 AWG) solid or stranded copper wire rated at 90 °C (194 °F) or greater Protective Earth Ground: 2.1 mm^2 (14 AWG) solid or stranded copper wire rated at 90 °C (194 °F) or greater				
North American temperature code	T4				
IECEx temperature code	T4				

ControlLogix-XT Chassis Specifications

Attribute	1756-A4LXT/B	1756-A7LXT/B	1756-A5XT/B	1756-A7XT/B	1756-A7XT/C	1756-A10XT/C
Backplane current, chassis/slot max @ 1.2V DC	1.5 A/–					
Backplane current, chassis/slot max @ 3.3V DC	4 A/4 A					
Backplane current, chassis/slot max @ 5.1V DC	10 A/6 A				15 A/6 A	
Backplane current, chassis/slot max @ 24V DC	2 A/2 A				2.8 A/2.8 A	
Isolation voltage	Determined by installed power supply and modules					
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	-25…+60 °C (-13…+140 °F)		-25…+70 °C (-13…+158 °F)			
Temperature, surrounding air, max	60 °C (140 °F)		70 °C (158 °F)			
Enclosure type rating	None (open-style)					
Slots	4	7	4	7	7	10
Wire size	Functional Earth Ground: 8.3 mm^2 (8 AWG) solid or stranded copper wire rated at 90 °C (194 °F) or greater Protective Earth Ground: 2.1 mm^2 (14 AWG) solid or stranded copper wire rated at 90 °C (194 °F) or greater					
North American temperature code	T5			T4A	T4	
IECEx temperature code	T5		T4			

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
ControlLogix Chassis Specifications Technical Data, publication 1756-TD006	Provides technical specifications for ControlLogix chassis.
ControlLogix Power Supplies Specifications Technical Data, publication 1756-TD005	Provides technical specifications for ControlLogix power supplies.
ControlLogix Power Supply Installation Instructions, publication 1756-IN619	Provides information on how to install ControlLogix standard power supplies.
ControlLogix Redundant Power Supply Installation Instructions, publication 1756-IN620	Provides information on how to install ControlLogix redundant power supplies.
ControlLogix System User Manual, publication 1756-UM001	Provides instructions for installation and use of ControlLogix Systems, application design, and other general information for these systems.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.rockwellautomation.com/rockwellautomation/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	https://rockwellautomation.custhelp.com/
Local Technical Support Phone Numbers	Locate the phone number for your country.	http://www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	http://www.rockwellautomation.com/global/literature-library/overview.page
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	http://www.rockwellautomation.com/global/support/pcdc.page

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the How Are We Doing? form at http://literature.rockwellautomation.com/idc/groups/literature/documents/du/ra-du002_-en-e.pdf.

Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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Publication 1756-IN621B-EN-P - March 2017
Supersedes Publication 1756-IN621A-EN-P - May 2016

PN-417161

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Allen-Bradley

1756 ControlLogix Power Supplies Specifications

Product	Catalog Number
Standard Power Supplies	1756-PA72, 1756-PA72K, 1756-PA75, 1756-PA75K, 1756-PB72, 1756-PB72K,1756-PB75, 1756-PB75K,1756-PC75, 1756-PH75
Standard Slim Power Supplies	1756-PA50, 1756-PA50K, 1756-PB50, 1756-PB50K
ControlLogix-XT Power Supplies	1756-PAXT, 1756-PBXT
ControlLogix-XT Slim Power Supplies	1756-PA30XT, 1756-PB30XT
Redundant Power Supplies	1756-PA75R, 1756-PA75RK,1756-PB75R, 1756-PB75RK
Redundant Power Supplies Chassis Adapter	1756-PSCA2, 1756-PSCA2K
ControlLogix-XT Redundant Power Supplies	1756-PAXTR, 1756-PBXTR
ControlLogix-XT Redundant Power Supplies Chassis Adapter	1756-PSCA2XT
Redundant Power Supply Power Cable	1756-CPR2, 1756-CPR2D, 1756-CPR2U

ControlLogix® power supplies are used with the 1756 chassis to provide 1.2V, 3.3V, 5V, and 24V DC power directly to the chassis backplane. Standard, Slim, ControlLogix-XT™, and redundant power supplies are available.

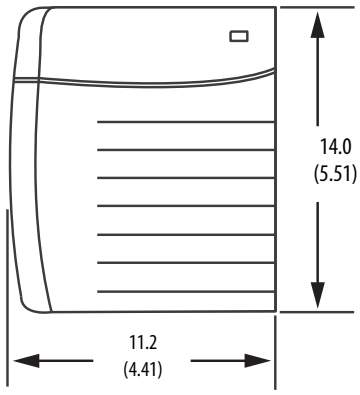
Summary of Changes

This manual contains updated torque requirements on pages 3, 5, 9, 13, and 15.

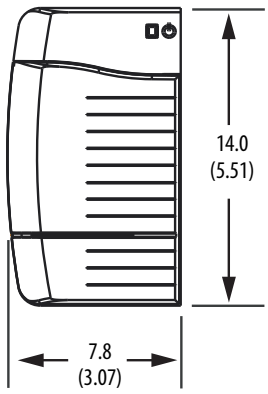
Standard AC Power Supplies

Mounting Dimensions

1756-PA72, 1756-PA72K, 1756-PA75, 1756-PA72K



1756-PA50, 1756-PA50K



Dimensions are in cm (in.).

Technical Specifications - Standard AC Power Supplies

Attribute	1756-PA50, 1756-PA50K	1756-PA72/C, 1756-PA72K/C	1756-PA75/B, 1756-PA75K/B
Input voltage range[1]	85…265V AC		
Input voltage, nom	120V/240V AC		
Input frequency range	47…63 Hz		
Input power, max	81 W/91VA @ 50 °C (122 °F) 68 W/77VA @ 60 °C (140 °F)	100VA/100 W	
Output power, max	60 W @ 0…+50 °C (+32…+122 °F)[3] 50 W @ 0…+60 °C (+32…+140 °F)[4]	75 W @ 0…+60 °C (+32…+140 °F)[6]	
Inrush current, max	20 A		
Hold up time[2]	4 cycles @85...265V AC, 50/60 Hz, 60 W 5 cycles @85...265V AC, 50/60 Hz, 50 W	5 cycles @ 85V AC, 50/60 Hz 6 cycles @ 120V AC, 50/60 Hz 6 cycles @ 200V AC, 50/60 Hz 6 cycles @ 240V AC, 50/60 Hz	2 cycles @ 85V AC, 60 Hz 6 cycles @ 120V AC, 60 Hz 20 cycles @ 220V AC, 60 Hz
Current capacity @ 1.2V DC	1.5 A		
Current capacity @ 3.3V DC	2 A	4 A	
Current capacity @ 5.1V DC	8 A @ 50 °C (122 °F) 6 A @ 60 °C (140 °F)	10 A	13 A
Current capacity @ 24V DC	2.5 A @ 50 °C (122 °F) 2.0 A @ 60 °C (140 °F)	2.8 A	
Isolation voltage	250V (continuous), Reinforced Insulation Type, Power Input to Backplane Type tested @ 3150V DC for 60 s	250V (continuous), Reinforced Insulation Type, Power Input to Backplane Type tested at 3500V DC for 60 s	
Weight, approx	0.77 kg (1.7 lb)	0.95 kg (2.10 lb)	
Dimensions (HxWxD), approx	14.0 x 7.8 x 14.5 cm (5.51 x 3.07 x 5.71 in.)	14.0 x 11.2 x 14.5 cm (5.51 x 4.41 x 5.71 in.)	
Module location	Left side of 1756 chassis		
Chassis	1756-A4, 1756-A7, 1756-A10, 1756-A13, 1756-A17		
Chassis compatibility	Series A Series B Series C		Series B Series C
Wire size	2.5 mm^2 (14 AWG) solid or stranded copper wire rated at 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max		

Technical Specifications - Standard AC Power Supplies

Attribute	1756-PA50, 1756-PA50K	1756-PA72/C, 1756-PA72K/C	1756-PA75/B, 1756-PA75K/B
Wire category	1 - on power ports[5]		
Conductor screw torque	0.565 N•m (5 lb•in)		
North American temperature code	T4		
Enclosure type rating	None (open-style)		

(1) UL certification for 120/240V AC, 50/60 Hz nominal. Rockwell Automation specified 85…265V AC, 47…63 Hz.
(2) The hold up time is the time between input voltage removal and DC power failure.
(3) The combination of all output power (5.1V backplane, 24V backplane, 3.3V backplane, and 1.2V backplane) cannot exceed 60 W @ 50 °C (122 °F) maximum temperature.
(4) The combination of all output power (5.1V backplane, 24V backplane, 3.3V backplane, and 1.2V backplane) cannot exceed 50 W @ 60 °C (140 °F) maximum temperature.
(5) Use this conductor category information to plan conductor routing as described in the system level installation manual. See the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.
(6) The combination of all output power (5.1V backplane, 24V backplane, 3.3V backplane, and 1.2V backplane) cannot exceed 75 W.

Environmental Specifications - Standard AC Power Supplies

Attribute	1756-PA50, 1756-PA50K	1756-PA72/C, 1756-PA72K/C, 1756-PA75/B, 1756-PA75K/B
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0 °C < Ta < +60 °C (+32 °F < Ta < +140 °F)	
Temperature, surrounding air, max	60 °C (140 °F)	
Temperature, non-operating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…+85 °C (-40…+185 °F)	
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing	
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz	
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g	
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g[1]	
Emissions	IEC 61000-6-4	
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges	
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz	
EFT/B immunity IEC 61000-4-4	±4 kV at 5 kHz on power ports	
Surge transient immunity IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on power ports	
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz	
Voltage variation IEC 61000-4-11	30% dips for 1 period at 0° and 180° on AC supply ports 60% dips for 5 and 50 periods on AC supply ports ±10% fluctuations for 15 min on AC supply ports >95% interruptions for 250 periods on AC supply ports	
Damped oscillatory wave immunity IEC 61000-4-18	±2.5 kV line-line (DM) and ±2.5 kV line-earth (CM) on power ports	–

(1) Series C chassis have a maximum nonoperating shock value of 30 g. If you select a Series C chassis for use with your power supply, you are limited to a maximum nonoperating shock value of 30 g.

Certifications - Standard AC Power Supplies

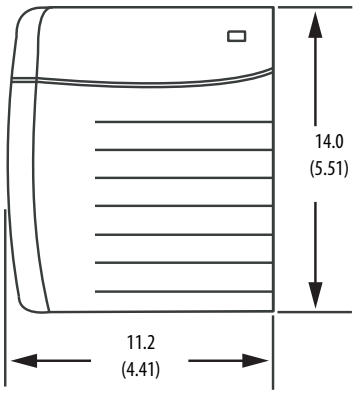
Certification[1]	1756-PA50, 1756-PA50K	1756-PA72/C, 1756-PA72K/C	1756-PA75/B, 1756-PA75K/B
UL	–	UL Listed Industrial Control Equipment. See UL File E65584.	
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.	–	
CSA	–	CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File LR69960C.	
FM	FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations		
CE	European Union 2014/30/EU EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2014/35/EU LVD, compliant with: • EN 61010-2-201; Control Equipment Safety Requirements	European Union 2014/30/EU EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2014/35/EU LVD, compliant with: • EN 61131-2; Programmable Controllers (Clause 11)	
RCM	Australian Radiocommunications Act, compliant with: • EN 61000-6-4; Industrial Emissions		
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: • Article 58-2 of Radio Waves Act, Clause 3		
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation		

(1) See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

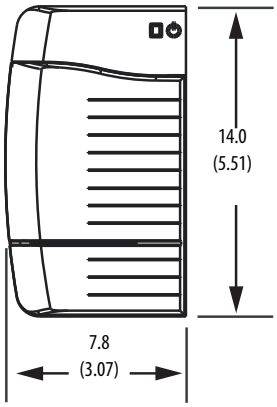
Standard DC Power Supplies

Mounting Dimensions

1756-PB72, 1756-PB72K, 1756-PB75, 1756-PB75K, 1756-PC75, 1756-PH75



1756-PB50, 1756-PB50K



Dimensions are in cm (in.).

Technical Specifications - Standard DC Power Supplies

Attribute	1756-PB50, 1756-PB50K	1756-PB72/C, 1756-PB72K/C	1756-PB75/B, 1756-PB75K/B	1756-PC75/B	1756-PH75/B
Input voltage range	18…32V DC[2]			30…60V DC[5]	90…143V DC[6]
Input voltage, nom	24V DC			48V DC	125V DC
Input power, max	85 W @ 50 °C (122 °F) 70 W @ 60 °C (140 °F)	95 W			

Power Load and Transformer Sizing

The following graphs show the input power requirements for slim and standard power supplies, given the power that they are providing to the modules in the chassis.

Follow these steps to determine the power requirements for your chassis.

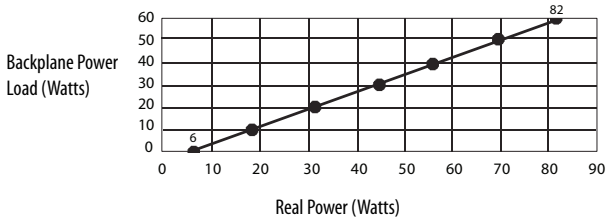
1. Calculate the Backplane Power load by adding the power draw (in watts) for all planned modules.

   For module power draws, refer to the module specification tables in the ControlLogix Selection Guide, publication 1756-SG001.
2. Locate the Backplane Power load on the vertical (y) axis of the graph and determine the corresponding Real Power (input-power) rating on the horizontal (x) axis.

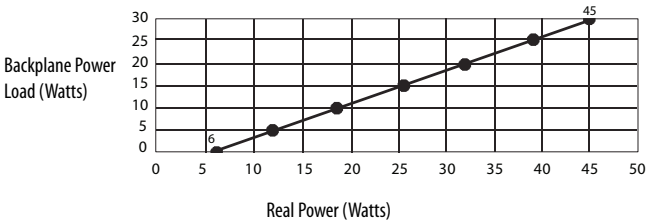
   The Real Power value is the amount of power that is consumed by the power supply.

Slim Power Supply Power Requirements

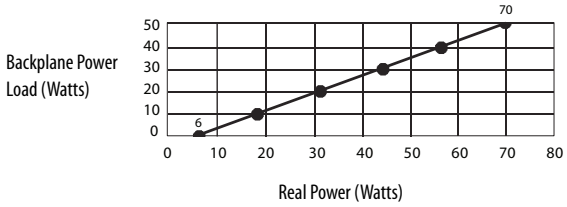
1756-PA50, 1756-PA50K @ 50 °C (AC)



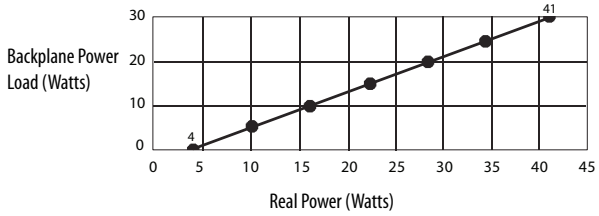
1756-PA30XT (AC)



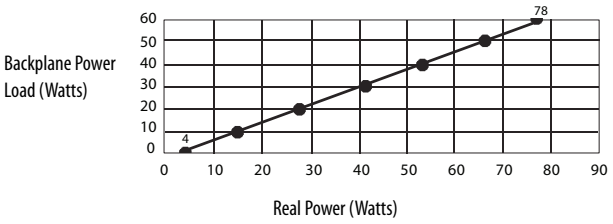
1756-PA50, 1756-PA50K @ 60 °C (AC)



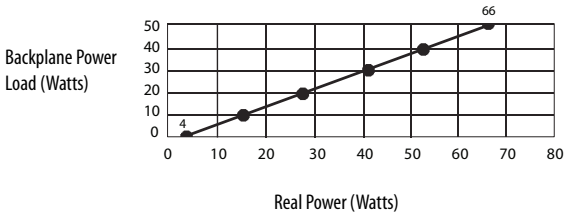
1756-PB30XT (DC)



1756-PB50, 1756-PB50K @ 50 °C (DC)



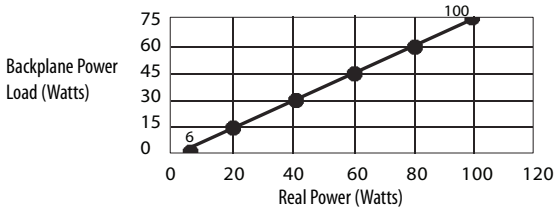
1756-PB50, 1756-PB50K @ 60 °C (DC)



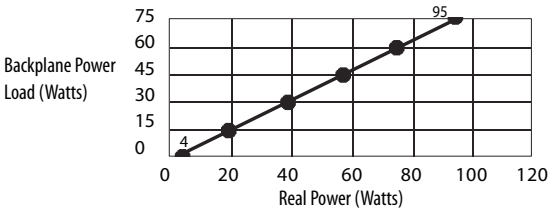
Apparent Power (Watts) = Transformer Load (VA) = Real Power (Watts)

Standard Power Supply Power Requirements

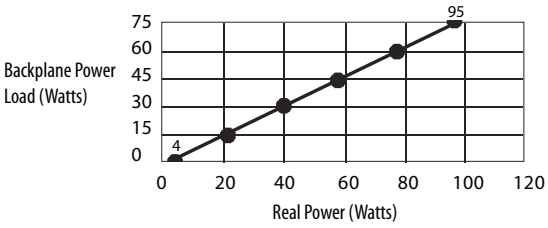
1756-PA72/C, 1756-PA72K/C, 1756-PA75/B (AC), 1756-PA75K/B (AC)



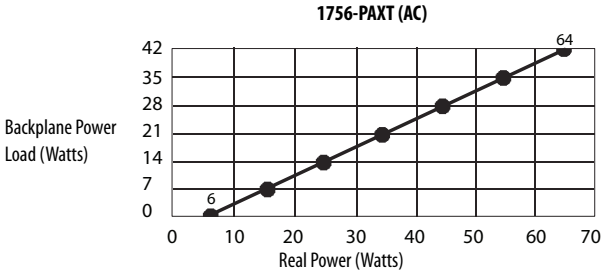
1756-PB72/C, 1756-PB72K/C, 1756-PB75/B (AC), 1756-PB75K/B (DC)



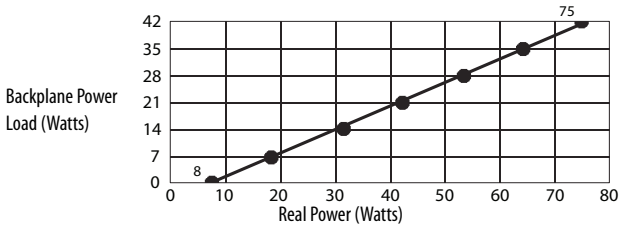
1756-PH75/B, 1756-PC75/B (DC)



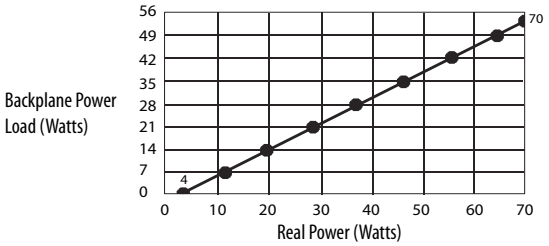
1756-PAXT (AC)



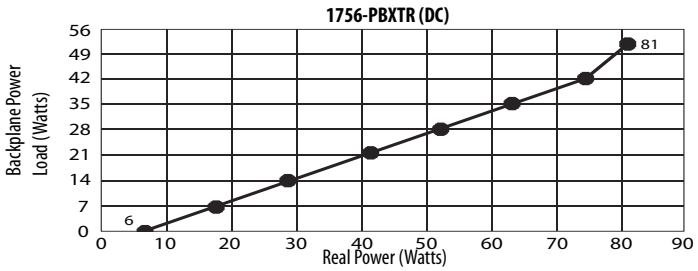
1756-PAXTR (AC)



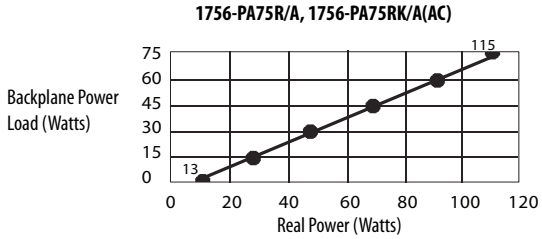
1756-PBXT (DC)



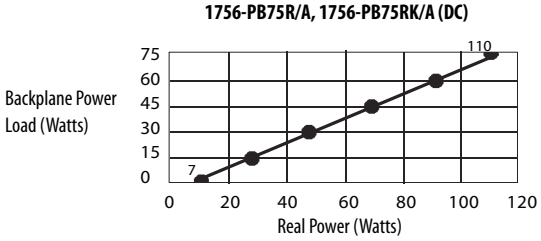
1756-PBXTR (DC)



1756-PA75R/A, 1756-PA75RK/A(AC)



1756-PB75R/A, 1756-PB75RK/A (DC)



Apparent Power (Watts) = Transformer Load (VA) = Real Power (Watts)

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
ControlLogix Chassis Specifications Technical Data, publication 1756-TD006	Provides technical specifications for ControlLogix chassis.
ControlLogix Selection Guide, publication 1756-SG001	Provides overview of the ControlLogix system and its products.
ControlLogix Power Supply Installation Instructions, publication 1756-IN619	Provides information on how to install ControlLogix standard power supplies.
ControlLogix Redundant Power Supply Installation Instructions, publication 1756-IN620	Provides information on how to install ControlLogix redundant power supplies.
ControlLogix Chassis Installation Instructions, publication 1756-IN621	Provides information on how to install ControlLogix chassis.
ControlLogix System User Manual, publication 1756-UM001	Provides information on how to install, configure, program, and use ControlLogix systems.
Industrial Automation Wiring and Grounding Guidelines, publication 1770.4.1	Provides general guidelines for installing a Rockwell Automation® industrial system.
Product Certifications website, http://www.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	www.rockwellautomation.com/knowledgebase
Local Technical Support Phone Numbers	Locate the phone number for your country.	www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	www.rockwellautomation.com/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	www.rockwellautomation.com/global/support/pcdc.page

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the How Are We Doing? form at http://literature.rockwellautomation.com/idc/groups/literature/documents/du/ra-du002_-en-e.pdf.

Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 1756-TD005I-EN-E - October 2018
Supersedes Publication 1756-TD005H-EN-E - November 2017

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Installation Instructions

Original Instructions

ControlLogix Power Supply

Catalog Numbers 1756-PA30XT, 1756-PA50, 1756-PA50K, 1756-PA72, 1756-PA72K, 1756-PA75, 1756-PA75K, 1756-PB30XT, 1756-PB50, 1756-PB50K, 1756-PB72, 1756-PB72K, 1756-PB75, 1756-PB75K, 1756-PC75, 1756-PH75, 1756-PH75K, 1756-PAXT, 1756-PBXT

ControlLogix® power supplies are used with the 1756 chassis to provide 1.2V, 3.3V, 5V, and 24V DC power directly to the chassis backplane. Standard, ControlLogix-XT™, and slim (reduced width) power supplies are available.

The catalog number of the conformal coated product includes the designation 'K' in the last position before the series identifier.

Power Supply and Chassis Compatibility

Your chassis series determines the power supply that you can use. This table lists the chassis that can be installed with each power supply.

Power Supply Cat. No.	Chassis Cat. No.
1756-PA72/C, 1756-PA72K	1756-A4/A, 1756-A7/A, 1756-A10/A, 1756-A13/A, 1756-A17/A, 1756-A4/B, 1756-A7/B, 1756-A10/B, 1756-A13/B, 1756-A17/B, 1756-A4/C, 1756-A7/C, 1756-A10/C, 1756-A13/C, 1756-A17/C
1756-PB72/C, 1756-PB72K	
1756-PA50, 1756-PA50K	
1756-PB50, 1756-PB50K	
1756-PA75/B, 1756-PA75K	1756-A4/B, 1756-A7/B, 1756-A10/B, 1756-A13/B, 1756-A17/B, 1756-A4/C, 1756-A7/C, 1756-A10/C, 1756-A13/C, 1756-A17/C
1756-PB75/B, 1756-PB75K	
1756-PC75/B	
1756-PH75/B, 1756-PH75K	
1756-PBXT	1756-A4LXT/B, 1756-A5XT/B, 1756-A7LXT/B, 1756-A7XT/B, 1756-A7XT/C, 1756-A10XT/C
1756-PAXT	
1756-PA30XT	
1756-PB30XT	

ATTENTION: Read this document and the documents listed in the Additional Resources section about installation, configuration and operation of this equipment before you install, configure, operate or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

注意：在安装、配置、操作和维护本产品前，请阅读本文档以及 “ 其他资源 ” 部分列出的有关设备安装、配置和操作的相应文档。除了所有适用规范、法律和标准的相关要求之外，用户还必须熟悉安装和接线说明。

安装、调整、投运、使用、组装、拆卸和维护等各项操作必须由经过适当训练的专业人员按照适用的操作规范实施。

如果未按照制造商指定的方式使用该设备，则可能会损害设备提供的保护。

ATENCIÓN: Antes de instalar, configurar, poner en funcionamiento o realizar el mantenimiento de este producto, lea este documento y los documentos listados en la sección Recursos adicionales acerca de la instalación, configuración y operación de este equipo. Los usuarios deben familiarizarse con las instrucciones de instalación y cableado y con los requisitos de todos los códigos, leyes y estándares vigentes.

El personal debidamente capacitado debe realizar las actividades relacionadas a la instalación, ajustes, puesta en servicio, uso, ensamblaje, desensamblaje y mantenimiento de conformidad con el código de práctica aplicable.

Si este equipo se usa de una manera no especificada por el fabricante, la protección provista por el equipo puede resultar afectada.

ATENÇÃO: Leia este e os demais documentos sobre instalação, configuração e operação do equipamento que estão na seção Recursos adicionais antes de instalar, configurar, operar ou manter este produto. Os usuários devem se familiarizar com as instruções de instalação e fiação além das especificações para todos os códigos, leis e normas aplicáveis.

É necessário que as atividades, incluindo instalação, ajustes, colocação em serviço, utilização, montagem, desmontagem e manutenção sejam realizadas por pessoal qualificado e especializado, de acordo com o código de prática aplicável.

Caso este equipamento seja utilizado de maneira não estabelecida pelo fabricante, a proteção fornecida pelo equipamento pode ficar prejudicada.

ВНИМАНИЕ: Перед тем как устанавливать, настраивать, эксплуатировать или обслуживать данное оборудование, прочитайте этот документ и документы, перечисленные в разделе «Дополнительные ресурсы». В этих документах изложены сведения об установке, настройке и эксплуатации данного оборудования. Пользователи обязаны ознакомиться с инструкциями по установке и прокладке соединений, а также с требованиями всех применимых норм, законов и стандартов.

Все действия, включая установку, наладку, ввод в эксплуатацию, использование, сборку, разборку и техническое обслуживание, должны выполняться обученным персоналом в соответствии с применимыми нормами и правилами.

Если оборудование используется не предусмотренным производителем образом, защита оборудования может быть нарушена.

注意：本製品を設置、構成、稼動または保守する前に、本書および本機器の設置、設定、操作についての参考資料の該当箇所に記載されている文書に目を通してください。ユーザは、すべての該当する条例、法律、規格の要件に加えて、設置および配線の手順に習熟している必要があります。

設置調整、運転の開始、使用、組立て、解体、保守を含む諸作業は、該当する実施規則に従って訓練を受けた適切な作業員が実行する必要があります。

本機器が製造メーカにより指定されていない方法で使用されている場合、機器により提供されている保護が損なわれる恐れがあります。

ACHTUNG: Lesen Sie dieses Dokument und die im Abschnitt „Weitere Informationen“aufgeführten Dokumente, die Informationen zu Installation, Konfiguration und Bedienung dieses Produkts enthalten, bevor Sie dieses Produkt installieren, konfigurieren, bedienen oder warten. Anwender müssen sich neben den Bestimmungen aller anwendbaren Vorschriften, Gesetze und Normen zusätzlich mit den Installations- und Verdrahtungsanweisungen vertraut machen.

Arbeiten im Rahmen der Installation, Anpassung, Inbetriebnahme, Verwendung, Montage, Demontage oder Instandhaltung dürfen nur durch ausreichend geschulte Mitarbeiter und in Übereinstimmung mit den anwendbaren Ausführungsvorschriften vorgenommen werden.

Wenn das Gerät in einer Weise verwendet wird, die vom Hersteller nicht vorgesehen ist, kann die Schutzfunktion beeinträchtigt sein.

ATTENTION : Lisez ce document et les documents listés dans la section Ressources complémentaires relatifs à l’installation, la configuration et le fonctionnement de cet équipement avant d’installer, configurer, utiliser ou entretenir ce produit. Les utilisateurs doivent se familiariser avec les instructions d’installation et de câblage en plus des exigences relatives aux codes, lois et normes en vigueur.

Les activités relatives à l’installation, le réglage, la mise en service, l’utilisation, l’assemblage, le démontage et l’entretien doivent être réalisées par des personnes formées selon le code de pratique en vigueur.

Si cet équipement est utilisé d’une façon qui n’a pas été définie par le fabricant, la protection fournie par l’équipement peut être compromise.

주의 : 본 제품 설치 , 설정 , 작동 또는 유지 보수하기 전에 본 문서를 포함하여 설치 , 설정 및 작동에 관한 참고 자료 섹션의 문서들을 반드시 읽고 숙지하십시오 . 사용자는 모든 관련 규정 , 법규 및 표준에서 요구하는 사항에 대해 반드시 설치 및 배선 지침을 숙지해야 합니다 .

설치 , 조정 , 가동 , 사용 , 조립 , 분해 , 유지보수 등 모든 작업은 관련 규정에 따라 적절한 교육을 받은 사용자를 통해서만 수행해야 합니다 .

본 장비를 제조사가 명시하지 않은 방법으로 사용하면 장비의 보호 기능이 손상될 수 있습니다 .

ATTENZIONE Prima di installare, configurare ed utilizzare il prodotto, o effettuare interventi di manutenzione su di esso, leggere il presente documento ed i documenti elencati nella sezione “Altre risorse”, riguardanti l’installazione, la configurazione ed il funzionamento dell’apparecchiatura. Gli utenti devono leggere e comprendere le istruzioni di installazione e cablaggio, oltre ai requisiti previsti dalle leggi, codici e standard applicabili.

Le attività come installazione, regolazioni, utilizzo, assemblaggio, disassemblaggio e manutenzione devono essere svolte da personale adeguatamente addestrato, nel rispetto delle procedure previste.

Qualora l’apparecchio venga utilizzato con modalità diverse da quanto previsto dal produttore, la sua funzione di protezione potrebbe venire compromessa.

DİKKAT: Bu ürünün kurulumu, yapılandırılması, işletilmesi veya bakımı öncesinde bu dokümanı ve bu ekipmanın kurulumu, yapılandırılması ve işletimi ile ilgili İlave Kaynaklar bölümünde yer listelenmiş dokümanları okuyun. Kullanıcılar yürürlükteki tüm yönetmelikler, yasalar ve standartların gereksinimlerine ek olarak kurulum ve kablolama talimatlarını da öğrenmek zorundadır.

Kurulum, ayarlama, hizmete alma, kullanma, parçaları birleştirme, parçaları sökme ve bakım gibi aktiviteler sadece uygun eğitimleri almış kişiler tarafından yürürlükteki uygulama yönetmeliklerine uygun şekilde yapılabilir.

Bu ekipman üretici tarafından belirlenmiş amacın dışında kullanılırsa, ekipman tarafından sağlanan koruma bozulabilir.

注意事項：在安装、設定、操作或維護本產品前，請先閱讀此文件以及列於 「其他資源」章節中有關安装、設定與操作此設備的文件。使用者必須熟悉安裝和配線指示，並符合所有法規、法律和標準要求。

包括安装、調整、交付使用、使用、組装、拆卸和維護等動作都必須交由已經過適當訓練的人員進行，以符合適用的實作法規。

如果將設備用於非製造商指定的用途時，可能會造成設備所提供的保護功能受損。

POZOR: Než začnete instalovat, konfigurovat či provozovat tento výrobek nebo provádět jeho údržbu, přečtěte si tento dokument a dokumenty uvedené v části Dodatečné zdroje ohledně instalace, konfigurace a provozu tohoto zařízení. Uživatelé se musejí vedle požadavků všech relevantních vyhlášek, zákonů a norem nutně seznámit také s pokyny pro instalaci a elektrické zapojení.

Činnosti zahrnující instalaci, nastavení, uvedení do provozu, užívání, montáž, demontáž a údržbu musí vykonávat vhodně proškolený personál v souladu s příslušnými prováděcími předpisy.

Pokud se toto zařízení používá způsobem neodpovídajícím specifikaci výrobce, může být narušena ochrana, kterou toto zařízení poskytuje.

UWAGA: Przed instalacją, konfiguracją, użytkowaniem lub konserwacją tego produktu należy przeczytać niniejszy dokument oraz wszystkie dokumenty wymienione w sekcji Dodatkowe źródła omawiające instalację, konfigurację i procedury użytkowania tego urządzenia. Użytkownicy mają obowiązek zapoznać się z instrukcjami dotyczącymi instalacji oraz oprzewodowania, jak również z obowiązującymi kodeksami, prawem i normami.

Działania obejmujące instalację, regulację, przekazanie do użytkowania, użytkowanie, montaż, demontaż oraz konserwację muszą być wykonywane przez odpowiednio przeszkolony personel zgodnie z obowiązującym kodeksem postępowania.

Jeśli urządzenie jest użytkowane w sposób inny niż określony przez producenta, zabezpieczenie zapewniane przez urządzenie może zostać ograniczone.

OBS! Läs detta dokument samt dokumentet, som står listat i avsnittet Övriga resurser, om installation, konfigurering och drift av denna utrustning innan du installerar, konfigurerar eller börjar använda eller utföra underhållsarbete på produkten. Användare måste bekanta sig med instruktioner för installation och kabeldragning, förutom krav enligt gällande koder, lagar och standarder.

Åtgärder som installation, justering, service, användning, montering, demontering och underhållsarbete måste utföras av personal med lämplig utbildning enligt lämpligt bruk.

Om denna utrustning används på ett sätt som inte anges av tillverkaren kan det hända att utrustningens skyddsanordningar försätts ur funktion.

LET OP: Lees dit document en de documenten die genoemd worden in de paragraaf Aanvullende informatie over de installatie, configuratie en bediening van deze apparatuur voordat u dit product installeert, configureert, bediend of onderhoudt. Gebruikers moeten zich vertrouwd maken met de installatie en de bedradingsinstructies, naast de vereisten van alle toepasselijke regels, wetten en normen.

Activiteiten zoals het installeren, afstellen, in gebruik stellen, gebruiken, monteren, demonteren en het uitvoeren van onderhoud mogen uitsluitend worden uitgevoerd door hiervoor opgeleid personeel en in overeenstemming met de geldende praktijkregels.

Indien de apparatuur wordt gebruikt op een wijze die niet is gespecificeerd door de fabrikant, dan bestaat het gevaar dat de beveiliging van de apparatuur niet goed werkt.

Environment and Enclosure

ATTENTION: This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in EN/IEC 60664-1), at altitudes up to 2000 m (6562 ft) without derating.

This equipment is not intended for use in residential environments and may not provide adequate protection to radio communication services in such environments.

This equipment is supplied as open-type equipment for indoor use. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA or be approved for the application if nonmetallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

In addition to this publication, see the following:

- Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1, for additional installation requirements.
- NEMA Standard 250 and EN/IEC 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosures.

Prevent Electrostatic Discharge

ATTENTION: This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- Use a static-safe workstation, if available.
- Store the equipment in appropriate static-safe packaging when not in use.

IMPORTANT **ControlLogix-XT system components are rated for extreme environmental conditions only when used properly with other Logix-XT system components. The use of ControlLogix-XT components with standard ControlLogix system components nullifies extreme-environment ratings.**

If a ControlLogix-XT module is used with standard ControlLogix products, the ControlLogix-XT module can withstand only the environments specified for the standard ControlLogix version of the module. For example, if a 1756-L63XT controller is used in a standard 1756-A10 chassis, the ControlLogix-XT controller can withstand only the environment specified for the standard 1756-L63 controller.

The ControlLogix-XT system components are designed to meet the same and greater operational and environmental requirements as traditional ControlLogix products.

When a ControlLogix-XT component is used as a replacement for a traditional ControlLogix component, the functional and environmental requirements of the traditional ControlLogix component apply, with the exception of the power output ratings.

North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations.	Informations sur l'utilisation de cet équipement en environnements dangereux.
Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.	Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.
WARNING: EXPLOSION HAZARD • Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. • Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. • Substitution of components may impair suitability for Class I, Division 2. • If this product contains batteries, they must be changed only in an area known to be nonhazardous.	**AVERTISSMENT: RISQUE D'EXPLOSION** • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. • La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. • S'assurer que l'environnement est classé non dangereux avant de changer les piles.

European Hazardous Location Approval

The following applies to products marked CE, Ex, II 3:

- Such modules are Equipment Group II, Equipment Category 3, and comply with the Essential Health and Safety Requirements relating to the design and construction of such equipment given in Annex II to Directive 94/9/EC. See the EC Declaration of Conformity at rok.auto/certifications for details. The type of protection for 1756-PB50, 1756-PB72, 1756-PB75, 1756-PBXT, and 1756-PB30XT is "Ex nA IIC T4 Gc" according to EN 60079-15.
- Such modules may have catalog numbers followed by a "K" to indicate a conformal coating option.
- Such modules are intended for use in areas in which explosive atmospheres caused by gases, vapors, mists, or air are unlikely to occur, or are likely to occur only infrequently and for short periods. Such locations correspond to Zone 2 classification according to ATEX directive 1999/92/EC.
- The 1756-PB50, 1756-PB72, 1756-PB75, 1756-PBXT, and 1756-PB30XT comply to Standards EN 60079-0:2012+A11:2013, EN 60079-15:2010, reference ATEX certificate number DEMKO13ATEX1325026X.

IEC Hazardous Location Approval

The following applies to products with IECEx certification:

- Such modules are intended for use in areas in which explosive atmospheres caused by gases, vapors, mists, or air are unlikely to occur, or are likely to occur only infrequently and for short periods. Such locations correspond to Zone 2 classification to IEC 60079-0.
- Such modules may have catalog numbers followed by a "K" to indicate a conformal coating option.
- The type of protection for 1756-PB50, 1756-PB72, 1756-PB75, 1756-PBXT, and 1756-PB30XT, is "Ex nA IIC T4 Gc" according to IEC 60079-15.
- The 1756-PB50, 1756-PB72, 1756-PB75, 1756-PBXT, and 1756-PB30XT comply to Standards IEC 60079-0:2011, IEC 60079-15:2010, reference IECEx certificate number IECExUL14.0008X.

ATEX and IECEx Hazardous Location Conformity

Model	Protection Type	ATEX Certificate	IECEx Certificate
1756-PA50, 1756-PA50K	None	—	—
1756-PA72, 1756-PA72K	None	—	—
1756-PA75, 1756-PA75K	None	—	—
1756-PB50, 1756-PB50K	Ex nA IIC T4 Gc	DEMKO13ATEX1325026X	IECEx UL 14.0008X
1756-PB72, 1756-PB72K	Ex nA IIC T4 Gc	DEMKO13ATEX1325026X	IECEx UL 14.0008X
1756-PB75, 1756-PB75K	Ex nA IIC T4 Gc	DEMKO13ATEX1325026X	IECEx UL 14.0008X
1756-PC75	None	—	—
1756-PH75, 1756-PH75K	None	—	—
1756-PAXT	None	—	—
1756-PBXT	Ex nA IIC T4 Gc	DEMKO13ATEX1325026X	IECEx UL 14.0008X
1756-PA30XT	None	—	—
1756-PB30XT	Ex nA IIC T4 Gc	DEMKO13ATEX1325026X	IECEx UL 14.0008X

Waste Electrical and Electronic Equipment (WEEE)

At the end of its life, this equipment should be collected separately from any unsorted municipal waste.

Special Conditions for Safe Use

WARNING:

- This equipment shall be mounted in an ATEX/IECEx Zone 2-certified enclosure with a minimum ingress protection rating of at least IP54 (as defined in EN/IEC 60529) and used in an environment of not more than Pollution Degree 2 (as defined in EN/IEC 60664-1) when applied in Zone 2 environments. The enclosure must be accessible only by the use of a tool.
- This equipment shall be used within its specified ratings defined by Rockwell Automation.
- Provision shall be made to prevent the rated voltage from being exceeded by transient disturbances of more than 140% of the rated voltage when applied in Zone 2 environments.
- This equipment must be used only with ATEX/IECEx certified Rockwell Automation backplanes.
- Instructions in the user manual shall be observed.
- Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product.
- Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.
- Devices shall be used in an environment of not more than Pollution Degree 2.

Summary of Changes

We updated the torque requirement on pages 7 and 10 for these power supplies.

Tools Required

When installing the standard or ControlLogix-XT versions of your 1756 chassis and power supplies, the following items are required:

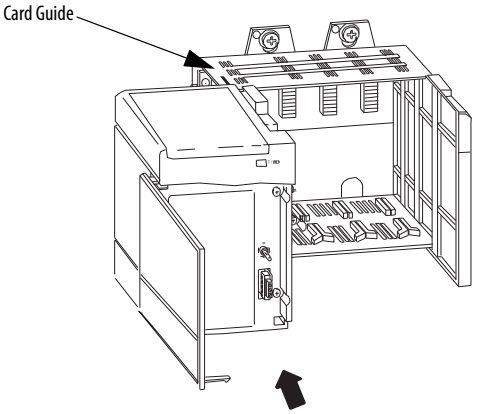
- 3.18 mm (0.125 in.) slotted screwdriver
- 6.35 mm (0.25 in.) slotted or #2 Phillips screwdriver
- Torque screwdriver
- Needle-nose pliers
- Crimper
- Wire stripper
- Drill

ATTENTION: If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

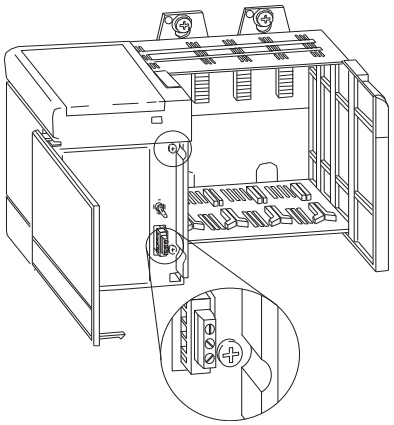
ATTENTION: Make sure the chassis is mounted and all panel fabrication is complete before you remove the protective label. This label protects the power supply from metal shavings falling inside the power supply and damaging it during operation.

Install the Power Supply

1. Make sure that the chassis is installed and grounded correctly.
2. Align the power-supply circuit board with the card guides on the left side of the chassis.
3. Slide the power supply back until it is flush with the front of the chassis.



4. Tighten the top and bottom screws to fasten the power supply to the chassis.



Connect the Power

WARNING: EXPLOSION HAZARD
If you connect or disconnect wiring while the field-side power is on, an electric arc can occur. This can cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

ATTENTION: Do not wire more than one conductor on any single terminal.

Use 15 A time-delay type fuse in all ungrounded power connections.

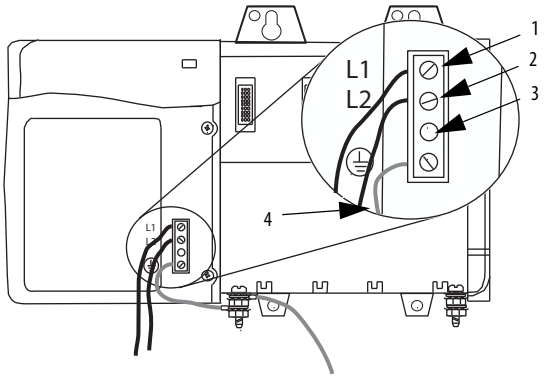
Use 2.5 mm2(14 AWG) solid or stranded-copper wire that is rated at 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation maximum to connect power. Tighten the terminals to a torque of 0.565 N•m (5 lb•in).

Connect the power as shown in the figure.

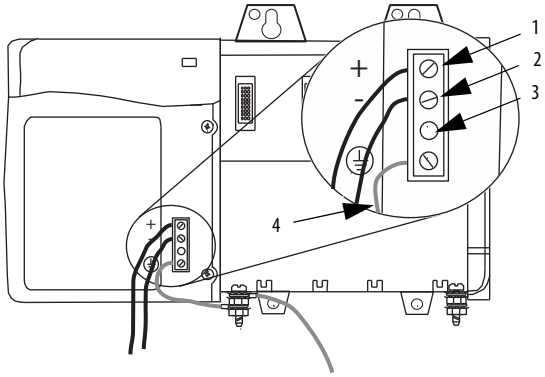
IMPORTANT The voltage input connections of the power supplies are auto-sensing.

You do **not** use a jumper, for example, a 120/240V AC jumper, when connecting external power to the power supply, as shown in the following figure.

AC Power Supplies



DC Power Supplies



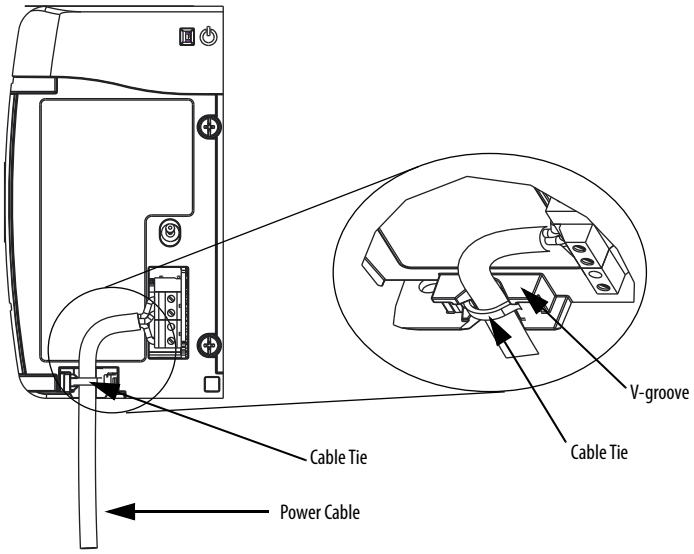
Item	Description, AC Power Supplies	Description, DC Power Supplies
1	L1 (high side of line power)	DC+ (positive supply)
2	L2 (low side of line power)	DC- (negative supply return)
3	This terminal is not used and is capped to prevent use.	
4	Protective Earth. Attach to chassis ground lug or ground bus. See the ControlLogix Chassis Installation Instructions, publication 1756-IN621, for details.	

Optional Power Cable Connection

The 1756-PA50, 1756-PA50K, 1756-PB50, 1756-PB50K, 1756-PA30XT, and 1756-PB30XT power supplies offer an optional cable retention mechanism.

Install the optional cable retention mechanism per the following procedure.

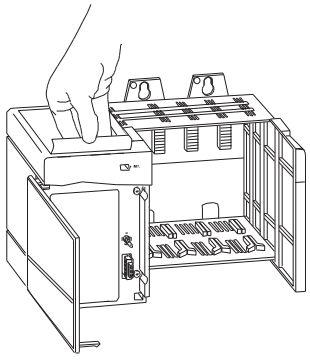
1. Align the power cable in the v-groove at the front of the power supply.
2. Feed a cable tie through the retainer on the v-groove.
3. To secure the power cable, tighten the cable tie.
4. Trim any excess cable tie length as appropriate.



Remove the Protective Label

ATTENTION: Make sure the chassis is mounted and all panel fabrication is complete before you remove the protective label. This label protects the power supply from metal shavings falling inside the power supply and damaging it during operation.

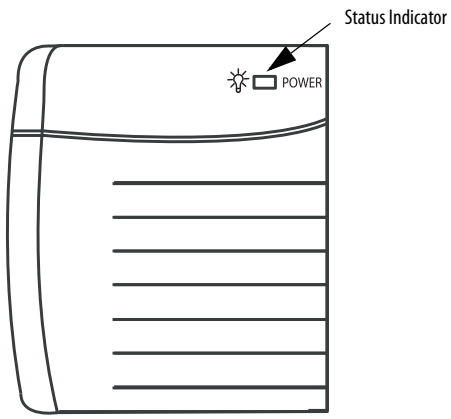
Remove the protective label from the top of the power supply.



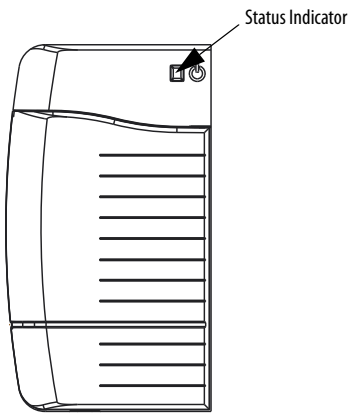
Troubleshoot the Power Supply

All ControlLogix power supplies have a green status indicator that remains ON during normal operation.

Standard Power Supply



Slim Power Supply



If the indicator turns OFF during operation, take these steps to troubleshoot the power supply.

1. Verify that the line voltage is within the specified range.
2. If the indicator remains OFF, turn off the power.
3. Loosen the screws that secure the power supply to the chassis.
   See step 4 on page 6 for the location of the screws on the power supply.
4. Slide the power supply out so that the rear connector is disconnected.
5. Turn on the power.
6. Follow these steps if the indicator does the following:
   - Turns ON:
     a. Verify that the Backplane Power Load of the system is within the output rating of the power supply.
     b. Turn off the power.
     c. Reinstall the power supply in the chassis.
     d. Turn on the power.
   - Remains OFF: Contact your local Allen-Bradley distributor.

Specifications

Attribute		1756-PA72, 1756-PA72K	1756-PA75, 1756-PA75K	1756-PB72, 1756-PB72K	1756-PB75, 1756-PB75K	1756-PC75	1756-PH75, 1756-PH75K
Voltage and current ratings	Input	120/240V AC, 50/60 Hz, 100VA, 100 W	120/240V AC, 50/60 Hz, 100VA, 100 W	24V DC, 95 W	24V DC, 95 W	48V DC, 95 W	125V DC, 95 W
	Output (current capacity)	2.8 A, 24V DC; 10.0 A, 5.1V DC; 4.0 A, 3.3V DC; 1.5 A, 1.2V DC; 75 W max, 20 A inrush max	2.8 A, 24V DC; 13.0 A, 5.1V DC; 4.0 A, 3.3V DC; 1.5 A, 1.2V DC; 75 W max, 20 A inrush max	2.8 A, 24V DC; 10.0 A, 5.1V DC; 4.0 A, 3.3V DC; 1.5A, 1.2V DC; 75 W max, 30 A inrush max	2.8 A, 24V DC; 13.0 A, 5.1V DC; 4.0 A, 3.3V DC; 1.5 A, 1.2V DC; 75 W max, 30 A inrush max	2.8 A, 24V DC; 13.0 A, 5.1V DC; 4.0 A, 3.3V DC; 1.5 A, 1.2V DC; 75 W max, 30 A inrush max	2.8 A, 24V DC; 13.0 A, 5.1V DC; 4.0 A, 3.3V DC; 1.5 A, 1.2V DC; 75 W max, 30 A inrush max
Isolation voltage		250V (continuous), Reinforced Insulation Type, Power Input to Backplane					
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)		0 °C < Ta < +60 °C (+32 °F < Ta < 140 °F)					
Temperature, surrounding air, max		60 °C (140 °F)					
Enclosure type rating		None (open-style)					
Torque		0.565 N•m (5 lb•in)					
Dimensions (HxWxD), approx		14.0 x 11.2 x 14.5 cm (5.51 x 4.41 x 5.71 in.)					
Wire size		2.5 mm² (14 AWG) solid or stranded copper wire rated at 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max					
North American temperature code		T4					
ATEX temperature code		-		T4		-	
IECEx temperature code		-		T4		-	

Attribute		1756-PA50, 1756-PA50K	1756-PB50, 1756-PB50K
Voltage and current ratings	Input	120/240V AC, 50/60 Hz, 81 W (90VA), 50 °C (122 °F), 68 W (77VA), 60 °C (140 °F)	24V DC; 50 °C (122 °F), 85 W; 60 °C (140 °F), 70 W
	Output (current capacity)	2.5 A, 24V DC; 8.0 A, 5.1V DC; 2.0 A, 3.3V DC; 1.5 A, 1.2V DC; 50 °C (122 °F), 60 W max; 60 °C (140 °F), 50 W max; 20 A inrush max	2.5 A, 24V DC; 8.0 A, 5.1V DC; 2.0 A, 3.3V DC; 1.5 A, 1.2V DC; 50 °C (122 °F), 60 W max; 60 °C (140 °F), 50 W max; 20 A inrush max
Isolation voltage		250V (continuous), Reinforced Insulation Type, Power Input to Backplane	
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)		0 °C < Ta < +60 °C (+32 °F < Ta < +140 °F)	
Temperature, surrounding air, max		60 °C (140 °F)	
Enclosure type rating		None (open-style)	
Torque		0.565 N•m (5 lb•in)	
Dimensions (HxWxD), approx		14.0 x 7.8 x 14.5 cm (5.51 x 3.07 x 5.71 in.)	
Wire size		2.5 mm² (14 AWG) solid or stranded copper wire rated at 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max	
North American temperature code		T4	
ATEX temperature code		-	T4
IECEx temperature code		-	T4

Attribute	1756-PAXT	1756-PBXT	1756-PA30XT	1756-PB30XT
Voltage and current ratings Input	120/240V AC, 50/60 Hz, 82VA, 64 W	18…32V DC, 70 W	120/240V AC, 50/60 Hz, 50 W (60VA), 70 °C (158 °F)	24V DC, 50W 70 °C (158 °F)
Output (current capacity)	1.75 A, 24V DC, 8.0 A, 5.1V DC, 4.0 A, 3.3V DC, 1.5 A, 1.2V DC, 42 W max, 20 A inrush max	2.1 A, 24V DC, 10.0 A, 5.1V DC, 4.0 A, 3.3V DC, 1.5 A, 1.2V DC, 52 W max, 30 A inrush max	1.25 A, 24V DC; 6.0 A, 5.1V DC; 2.0 A, 3.3V DC; 1.5 A, 1.2V DC; 30 W max, 20 A inrush max	1.25 A, 24V DC; 6.0 A, 5.1V DC; 2.0 A, 3.3V DC; 1.5 A, 1.2V DC; 30 W max, 20 A inrush max
Isolation voltage	250V (continuous), Reinforced Insulation Type, Power Input to Backplane			
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	-25 °C < Ta < +70 °C (-13 °F < Ta < +158 °F)			
Temperature, surrounding air, max	70 °C (158 °F)			
Enclosure type rating	None (open-style)			
Torque	0.565 N•m (5 lb•in)			
Dimensions (HxWxD), approx	14.0 x 11.2 x 14.5 cm (5.51 x 4.41 x 5.71 in.)		14.0 x 7.8 x 14.5 cm (5.51 x 3.07 x 5.71 in.)	
Wire size	2.5 mm^2 (14 AWG) solid or stranded copper wire rated at 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max			
North American temperature code	T4	T4A	T4	
ATEX temperature code	-	T4	-	T4
IECEx temperature code	-	T4	-	T4

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
1756 ControlLogix Specifications Technical Data, publication 1756-TD006	Provides technical specifications for ControlLogix chassis.
1756 ControlLogix Power Supplies Specifications Technical Data, publication 1756-TD005	Provides technical specifications for ControlLogix power supplies.
ControlLogix Chassis Installation Instructions, publication 1756-IN621	Provides information on how to install ControlLogix chassis.
ControlLogix System User Manual, publication 1756-UM001	Provides instructions for installation and use of ControlLogix Systems, application design, and other general information for these systems.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.rockwellautomation.com/rockwellautomation/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	https://rockwellautomation.custhelp.com/
Local Technical Support Phone Numbers	Locate the phone number for your country.	http://www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	http://www.rockwellautomation.com/global/literature-library/overview.page
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	http://www.rockwellautomation.com/global/support/pcdc.page

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the How Are We Doing? form at http://literature.rockwellautomation.com/idc/groups/literature/documents/du/ra-du002_-en-e.pdf.

Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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Publication 1756-IN619E-EN-P - September 2019
Supersedes Publication 1756-IN619D-EN-P - October 2018

PN-550057

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Allen-Bradley

1756 ControlLogix and GuardLogix Controllers

ControlLogix Controller Catalog Numbers	1756-L61, 1756-L62, 1756-L63, 1756-L63XT, 1756-L64, 1756-L65 1756-L71, 1756-L72, 1756-L73, 1756-L73XT, 1756-L74, 1756-L75 1756-L71K, 1756-L72K, 1756-L73K, 1756-L74K, 1756-L75K 1756-L81E, 1756-L82E, 1756-L83E, 1756-L84E, 1756-L85E, 1756-L81EK, 1756-L82EK, 1756-L83EK, 1756-L84EK, 1756-L85EK
GuardLogix Controller Catalog Numbers	1756-L61S, 1756-L62S, 1756-L63S, 1756-LSP 1756-L71S, 1756-L71SK, 1756-L72S, 1756-L72SK, 1756-L73S, 1756-L73SK, 1756-L7SP, 1756-L7SPK, 1756-L73SXT, 1756-L7SPXT 1756-L81ES, 1756-L81ESK, 1756-L82ES,1756-L82ESK, 1756-L83ES, 1756-L83ESK, 1756-L84ES, 1756-L84ESK, 1756-L8SP, 1756-L8SPK
Armor ControlLogix Catalog Numbers	1756-L72EROM, 1756-L73EROM
Armor GuardLogix Catalog Numbers	1756-L72EROMS, 1756-L73EROMS
ControlLogix Redundancy Catalog Numbers	1756-RM2, 1756-RM2XT

1756 ControlLogix Controllers

The ControlLogix® controller provides a scalable controller solution that is capable of addressing many I/O points. You can place the ControlLogix controller into any slot of a ControlLogix I/O chassis, and install multiple controllers in the same chassis.

ControlLogix controllers can monitor and control I/O across the ControlLogix backplane, and over network links. The ControlLogix 5580 controllers have an embedded Ethernet port for a direct connection to Ethernet-enabled devices and networks, and also support communication interface modules in the local chassis. To provide communication for ControlLogix 5570 or ControlLogix 5560 controllers, install the appropriate communication interface module into the local chassis.

ControlLogix 5580 and ControlLogix 5570 controllers are available with a conformal coating. A conformal coating provides a layer of protection against contaminants and humidity to help protect the assembly and extend product life in harsh, corrosive environments. Products with a conformal coating have a 'K' suffix at the end of the catalog number.

ControlLogix 5570 Controllers Features and Specifications

Feature	1756-L71, 1756-L71K, 1756-L72, 1756-L72K, 1756-L73, 1756-L73K, 1756-L74, 1756-L74K, 1756-L75, 1756-L75K
Controller tasks	• 32 tasks • 100 programs/task • Event tasks: all event triggers
Built-in communication ports	1 port USB[2]
Communication options	• EtherNet/IP • ControlNet • DeviceNet • Data Highway Plus • Remote I/O • SynchLink • Third-party process and device networks
USB port communication	Programming, configuration, firmware update, and on-line edits only
Controller connections supported, max[1]	500
Network connections, per network module	• 100 ControlNet (1756-CN2/A) • 40 ControlNet (1756-CNB/D, 1756-CNB/E) • 128 ControlNet (1756-CN2/B) • 256 EtherNet/IP; 128 TCP (1756-EN2*x*) • 128 EtherNet/IP; 64 TCP (1756-ENBT)
Controller redundancy	Full support
Integrated motion	• SERCOS interface • Analog options (encoder input, LDT input, SSI input) • Integrated Motion on the EtherNet/IP network
Programming languages	• Relay Ladder • Structured Text • Function Block Diagram • Sequential Function Chart (SFC)

(1) ControlLogix 5570 controllers use connections to establish communication links between devices. For more information on how to use and calculate connections, see the ControlLogix System User Manual, publication 1756-UM001.

(2) The USB port is intended for temporary local programming purposes only and not intended for permanent connection. Do not use the USB port in hazardous locations.

Technical Specifications - ControlLogix 5570 Controllers

Attribute	1756-L71, 1756-L71K	1756-L72, 1756-L72K	1756-L73, 1756-L73K	1756-L74, 1756-L74K	1756-L75, 1756-L75K
User memory	2 MB	4 MB	8 MB	16 MB	32 MB
I/O memory	0.98 MB				
Optional nonvolatile memory storage	1 GB (1784-SD1 ships with every controller) 2 GB (1784-SD2)				
Digital I/O, max	128,000				
Analog I/O, max	4000				
Total I/O, max	128,000				
Energy storage module	• 1756-ESMCAP, 1756-ESMCAPK capacitor energy storage module (removable, ships installed with every controller) • 1756-ESMNSE, 1756-ESMNSEK capacitor energy storage module (removable, no residual WallClockTime power backup) • 1756-ESMNRM, 1756-ESMNRMK capacitor energy storage module (nonremovable, helps prevent USB connection and SD card use to help secure the controller)				
Current draw @ 1.2V DC	5 mA				
Current draw @ 5.1V DC	800 mA				
Power dissipation	2.5 W				
Thermal dissipation	8.5 BTU/hr				
Isolation voltage	30V (continuous), basic insulation type, USB port-to-system Type tested at 500V AC for 60 s				
USB port(1)	USB 2.0, full speed (12 Mbps)				
Weight, approx	0.25 kg (0.55 lb)				
Slot width	1				
Module location	Chassis-based, any slot				
Chassis	1756-A4, 1756-A4K, 1756-A7, 1756-A7K, 1756-A10, 1756-A10K, 1756-A13, 1756-A13K,1756-A17, 1756-A17 K				
Power supply, standard	1756-PA50, 1756-PA72, 1756-PA72K, 1756-PA75, 1756-PA75K, 1756-PB50, 1756-PB72, 1756-PB72K, 1756-PB75, 1756-PB75K, 1756-PH75				
Power supply, redundant	1756-PA75R, 1756-PA75RK, 1756-PB75R, 1756-PB75RK,1756-PSCA2, 1756-PSCA2K				
Wire category(2)	3 - on USB port				
North American temperature code	T4A				
ATEX temperature code	T4				
IECEx temperature code	T4				
Enclosure type rating	None (open-style)				

(1) The USB port is intended for temporary local programming purposes only and not intended for permanent connection. Do not use the USB port in hazardous locations.
(2) Use this conductor category information to plan conductor routing. See Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Environmental Specifications - ControlLogix 5570 Controllers

Attribute	1756-L71, 1756-L71K, 1756-L72, 1756-L72K, 1756-L73, 1756-L73K, 1756-L74K, 1756-L74, 1756-L75, 1756-L75K
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0 °C < Ta < +60 °C (+32 °F < Ta < +140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…+85 °C (-40…+185 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g (45 g with SD card installed)
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz
Conducted RF Immunity IEC 61000-4-6	Not applicable: USB is a temporary programming port.

Certifications - ControlLogix 5570 Controllers

Certification[1]	1756-L71, 1756-L71K, 1756-L72, 1756-L72K, 1756-L73, 1756-L73K, 1756-L74, 1756-L74K, 1756-L75, 1756-L75K
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CE	European Union 2004/108/EC EMC Directive, compliant with: EN 61326-1; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)
RCM	Australian Radiocommunications Act, compliant with EN 61000-6-4; Industrial Emissions
Ex	European Union 94/9/EC ATEX Directive, compliant with: EN 60079-0; General Requirements EN 60079-15; Potentially Explosive Atmospheres, Protection "n" II 3 G Ex nA IIC T4 Gc DEMKO13ATEX1325026X
IECEx	IECEx System, compliant with: IEC 60079-0; General Requirements IEC 60079-15; Potentially Explosive Atmospheres, Protection "n" II 3 G Ex nA IIC T4 Gc IECEx UL 14.0008X
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with Article 58-2 of Radio Waves Act, Clause 3
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation

(1) When marked. See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

Controller Compatibility

The following tables provide compatibility with I/O modules, display devices, and other controllers and communication devices.

Control Distributed I/O Modules

The controller can control these distributed I/O modules via the I/O Configuration tree in the programming software.

I/O Modules	EtherNet/IP	ControlNet	DeviceNet	Remote I/O
Chassis-based I/O				
1715 Redundant I/O	Yes	No	No	Yes
1746 SLC™ I/O	No	No	No	Yes
1756 ControlLogix I/O	Yes	Yes	No	No
1769 Compact I/O™	No	No	Yes	Yes(2)
1771 Universal I/O	No	Yes	No	Yes
In-cabinet I/O				
1734 POINT I/O™	Yes	Yes	Yes	No
1734D POINTBlock I/O	No	No	Yes	No
1790, 1790D, 1790P CompactBlock™ LDX I/O	No	No	Yes	No
1791D, 1791P, 1791R CompactBlock I/O	No	No	Yes	No
1794 FLEX™ I/O	Yes	Yes	Yes	Yes
1797 FLEX Ex™ I/O	No	Yes	No	No
5069 Compact I/O™ (1)	Yes	No	No	No
On-Machine™ I/O				
1732 ArmorBlock® I/O	Yes	No	Yes	No
1738 ArmorPOINT® I/O	Yes	Yes	Yes	No
1792D ArmorBlock® MaXum™ I/O	No	No	Yes	No
1799 Embedded I/O	No	No	Yes	No

(1) Compatible with ControlLogix 5580 Controllers only.

(2) With a third-party module.

Control Safety Distributed I/O Modules

The GuardLogix controller can control these safety distributed I/O modules in a safety system.

I/O Modules	EtherNet/IP	ControlNet	DeviceNet
In-cabinet I/O			
1791DS CompactBlock™ Guard I/O™	No	No	Yes
1791ES CompactBlock Guard I/O	Yes	No	No
1734 POINT Guard I/O™	Yes	No	Yes
On-Machine I/O			
1732DS ArmorBlock® Guard I/O™	No	No	Yes
1732ES ArmorBlock Guard I/O	Yes	No	No

Communicate with Display Devices

The controller can communicate with these display devices.

Display Devices	EtherNet/IP	ControlNet	DeviceNet	DH+™	Remote I/O	RS-232 (DF1)
Industrial Computers						
Allen-Bradley® industrial computers (all)(1)	Yes	Yes	Yes	Yes	Yes	Yes
Graphic Terminals						
PanelView™ Plus and PanelView e terminals	Yes	Yes	Yes	Yes	Yes	Yes
PanelView Standard terminals	Yes	Yes	Yes	Yes	Yes	Yes
PanelView e terminals	No	Yes	No	Yes	Yes	No
Message Displays						
InView™ message displays	Yes	Yes	Yes	Yes	Yes	Yes

(1) Includes Allen-Bradley integrated display rotating media (HDD) and solid state (SSD) computers, Rockwell Automation® non-display computers, and Allen-Bradley integrated display computers with keypad.

Communicate with Other Controllers

The controller can communicate with these programmable controllers.

Controller	EtherNet/IP	ControlNet	DeviceNet	DH+	RS-232 (DF1)	DH-485(5)
1756 ControlLogix 1756 GuardLogix	Yes	Yes	Yes	Yes	Yes	Yes
5069 CompactLogix™	Yes	No	No	No	No	No
1768, 1769 CompactLogix 1768, 1769 Compact GuardLogix	Yes	Yes	Yes	No	Yes	Yes
1789 SoftLogix™ 5800	Yes	Yes	Yes	No	Yes	No
1794 FlexLogix™	Yes	Yes	Yes	No	Yes	Yes
PowerFlex® with DriveLogix™	Yes	Yes	Yes	No	Yes	Yes
1785 PLC-5®(1) (2)(3)	Yes	Yes	Yes	Yes	Yes	No
1747 SLC™(4)	Yes	Yes	Yes	Yes	Yes	Yes
1761 MicroLogix™(4)	Yes	No	Yes	No	Yes	Yes
1762 MicroLogix(4)	Yes	No	Yes	No	Yes	Yes
1763 MicroLogix (4)	Yes	No	Yes	No	Yes	Yes
1764 MicroLogix (4)	Yes	No	Yes	No	Yes	Yes
1772 PLC-2®	No	No	No	Yes	Yes	No
1775 PLC-3®	No	No	No	Yes	Yes	No
5250 PLC-5/250	No	No	No	Yes	Yes	No

(1) The Ethernet PLC-5 controller must be series C, firmware revision N.1 or later; series D, firmware revision E.1 or later; or series E, firmware revision D.1 or later.
(2) The 1785-ENET Ethernet communication interface module must be series A, firmware revision D or later.
(3) The PLC-5, SLC, and MicroLogix processors appear as I/O points to the Logix controller. Use the appropriate DeviceNet interface for the controller.
(4) Use a 1747-L55*x* controller with OS501 or later.
(5) The 1756-DH485 module supports full DH-485 functionality.

Communicate with Other Communication Devices

The controller can communicate with these communication devices.

Communication Device	EtherNet/IP	ControlNet	DeviceNet	DH+
Linking device	1788-EN2DNROM	1788-CN2DN 1788-CN2FF	1788-EN2DNR 1788-EN2DNROM (On-Machine version) 1788-CN2DN	—
PCMCIA card	—	1784-PCC	1784-PCD	1784-PCMK
PCI card	—	1784-PCIC 1784-PCICS	1784-PCID 1784-PCIDS 1784-CPCIDS	—
Drives SCANport™ module (1)	—	1203-FM1 1203-FB1	—	—
Communication module (2)	—	1203-CN 1770-KFC15 1770-KFCD15 1747-KFC15	1770-KFD 1770-KFG	1770-KF2
Communication card	—	1784-PKTCS 1784-KTCS 1784-KTCX15	1784-PKTX 1784-PKTXD	—
USB communication device	—	1784-U2CN	1784-U2DN	1784-U2DHP

(1) Use a CIP generic MSG instruction to communicate with the 1203-FM1 SCANport™ module on a DIN rail that is remote to the controller. The remote DIN rail also requires a 1794-ACN15 or 1794-ACNR15 ControlNet adapter.
(2) Use the generic module configuration to configure the 1203-CN1 module and a CIP generic MSG instruction to communicate with the module.

ControlLogix Redundancy

The ControlLogix 5560 and ControlLogix 5570 controllers support controller redundancy. In a redundant controller system, you need these components:

- Two 1756 chassis, each with the same of the following:
  - Number of slots
  - Compatible modules in the same slots
  - Redundancy firmware revisions in each module
  - Two additional ControlNet nodes outside the redundant chassis pair if the application uses ControlNet networks
- One 1756-RM2 or 1756-RM2XT redundancy module per chassis that is connected by a 1756-RMC*x* cable
- One or two ControlLogix 5560 or ControlLogix 5570 controllers
- As many as seven enhanced communication modules, that is, 1756-CN2/B, 1756-CN2R/B, 1756-CN2RXT modules, or 1756-EN2T, 1756-EN2TR, 1756-EN2TXT modules

1756-RM2, 1756-RM2XT Redundancy Modules

Technical Specifications - 1756-RM2, 1756-RM2XT Redundancy Modules

Attribute	1756-RM2, 1756-RM2K	1756-RM2XT
Current draw @ 5.1V DC	1.16 A	
Current draw @ 24V DC	3.4 mA	
Power dissipation	6 W, max	
Thermal dissipation	21 BTU/hr	
Connector cables	1756-RMC1, 1 m (3.28 ft) 1756-RMC3, 3 m (9.84 ft) 1756-RMC10, 10 m (32.81 ft)	
Slot width	1 slot	
Module location	Chassis-based, any slot	
Chassis	1756-A4, 1756-A7, 1756-A10, 1756-A13, 1756-A17	1756-A7XT, 1756-A10XT, 1756-A4LXT, 1756-A5LXT, 1756-A7LXT
Controller families, supported	ControlLogix 5560, ControlLogix 5570	
Power supply, standard	1756-PA72, 1756-PA75, 1756-PB72, 1756-PB75	1756-PAXT, 1756-PBXT
Power supply, redundant	1756-PA75R, 1756-PB75R, 1756-PSCA2	None
North American temperature code	T4	
IECEx temperature code	T4	
ATEX temperature code	T4	
Enclosure type	None (open-style)	
Weight, approx	0.29 kg (0.64 lb)	
Mounting	ControlLogix-XT chassis, single-slot module	

Environmental Specifications - 1756-RM2, 1756-RM2XT Redundancy Modules

Attribute	1756-RM2, 1756-RM2K	1756-RM2XT
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0…60 °C (32…140 °F)	-25…+70 °C (-13…+158 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…+85 °C (-40…+185 °F)	
Temperature, surrounding air, max	60 °C (140 °F)	70 °C (158 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing	
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz	
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g	
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g	
Emissions	IEC 61000-6-4	
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges	
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz	

Certifications - 1756-RM2, 1756-RM2XT Redundancy Modules

Certification[1]	1756-RM2, 1756-RM2K	1756-RM2XT
CSA	CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File LR69960C.	—
CE	European Union 2004/108/IEC EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)	
RCM	Australian Radiocommunications Act, compliant with EN 61000-6-4; Industrial Emissions	
c-UL-us	UL Listed Industrial Control Equipment, certified for U.S. and Canada. See UL file E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.	
Ex	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection “n” • EN 60079-0; General Requirements • II 3 G Ex nA IIC T4 Gc • DEMKO13ATEX1325026X	
IECEx	IECEx System, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection “n” • EN 60079-0; General Requirements • II 3 G Ex nA IIC T4 Gc • IECEx UL 14.0008X	
FM	FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations	—
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with Article 58-2 of Radio Waves Act, Clause 3	
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation	

(1) When marked. See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

ControlLogix Controller Accessories

You can use these accessories with ControlLogix controllers.

Memory Cards

Memory cards offer nonvolatile memory to store a user program and tag data on a controller.

- The ControlLogix 5560 controllers support optional 1784-CF128 CompactFlash cards purchased separately.
- The ControlLogix 5570 controllers come with the 1784-SD1 Secure Digital (SD) card installed and support optional 1784-SD2 cards purchased separately.
- The ControlLogix 5580 controllers come with the 1784-SD2 Secure Digital (SD) card installed and support optional 1784-SDHC8 and 1785-SDHC32 cards purchased separately.

The memory cards are installed in a socket on the controller. Through the programming software, you can manually trigger the controller to save to, or load from, nonvolatile memory or configure the controller to load from nonvolatile memory on powerup.

Technical Specifications - 1784 Memory Cards

Attribute	1784-CF128	1784-SD1	1784-SD2	1784-SDHC8	1784-SDHC32
Memory	128 MB	1 GB	2 GB	8 GB	32 GB
Supported controllers	1756-L6, 1756-L6S(1)	1756-L71, 1756-L71K, 1756-L71S, 1756-L71SK, 1756-L72, 1756-L72K, 1756-L72S, 1756-L72SK,1756-L72EROM, 1756-L72EROMS, 1756-L73, 1756-L73K, 1756-L73S, 1756-L73SK, 1756-L73EROM, 1756-L73EROMS, 1756-L73XT, 1756-L73SXT, 1756-L74, 1756-L74K, 1756-L75, 1756-L75K		—	
		1756-L81E, 1756-L81EK, 1756-L81ES, 1756-L81ESK,1756-L82E, 1756-L82EK, 1756-L82ES, 1756-L82ESK, 1756-L83E, 1756-L83EK, 1756-L83ES, 1756-L83ESK, 1756-L84E, 1756-L84EK, 1756-L84ES, 1756-L84ESK, 1756-L85E, 1756-L85EK			
Weight, approx	14.20 g (0.50 oz)	1.76 g (0.06 oz)			

(1) For safety controllers using RSLogix 5000 programming software version 18 or later.

Environmental Specifications - 1784 Memory Cards

Attribute	1784-CF128, 1784-SD1, 1784-SD2, 1784-SDHC8, 1784-SDHC32
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	-25…+70 °C (-13…+158 °F)
Temperature, storage IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…+85 °C (-40…+185 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g

Environmental Specifications - 1784 Memory Cards

Attribute	1784-CF128, 1784-SD1, 1784-SD2, 1784-SDHC8, 1784-SDHC32
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions CISPR 11	Group 1, Class A
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz

Certifications - 1784 Memory Cards

Certification(1)	1784-CF128, 1784-SD1, 1784-SD2, 1784-SDHC8, 1784-SDHC32
CE	European Union 2004/108/EC EMC Directive, compliant with: • EN 61000-6-4; Industrial Emissions • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)
RCM	Australian Radiocommunications Act, compliant with EN 61000-6-4; Industrial Emissions
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with Article 58-2 of Radio Waves Act, Clause 3

(1) See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	www.rockwellautomation.com/knowledgebase
Local Technical Support Phone Numbers	Locate the phone number for your country.	www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	www.rockwellautomation.com/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	www.rockwellautomation.com/global/support/pcdc.page

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Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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Publication 1756-TD001P-EN-P - August 2019
Supersedes Publication 1756-TD0010-EN-P - February 2018

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User Manual

Original Instructions

Allen-Bradley

ControlLogix System

Catalog Numbers 1756-L61, 1756-L62, 1756-L63, 1756-L63XT, 1756-L64, 1756-L65, 1756-L71, 1756-L72, 1756-L73, 1756-L73XT, 1756-L74, 1756-L75, 1756-L72EROM, 1756-L73EROM

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

Chapter 4

ControlLogix System and Controllers

Chapter 5

Communication Networks

Chapter 6

Serial Communication on 1756-L6x Controllers

Chapter 7

Manage Controller Communication

Chapter 8

I/O Modules

Chapter 9

Develop Motion Applications

Chapter 10

Develop Applications

Chapter 11

Using the PhaseManager Tool

Chapter 12

Redundant Systems

Troubleshoot the Module

Appendix A

This publication provides this information:

- Design and planning considerations
- Installation procedures
- Configuration procedures
- Maintenance and troubleshooting methods

This publication is designed for use by anyone responsible for planning and implementing a ControlLogix® system:

- Application engineers
- Control engineers
- Instrumentation technicians

The contents of this publication are for anyone who already has an understanding of Logix5000™ control systems, programming techniques, and communication networks.

Summary of Changes

We've added the 1756-L72EROM and 1756-L73EROM Armor™ ControlLogix controllers to this user manual.

ControlLogix Controllers Overview

There are five types of ControlLogix controllers available. These types include the following:

- Standard ControlLogix controllers
- Extreme environment ControlLogix controllers
- Armor ControlLogix controllers
- Standard GuardLogix® controllers
- Armor GuardLogix controllers

This manual explains how to use standard, extreme environment, and Armor ControlLogix controllers.

For detailed information about GuardLogix and Armor GuardLogix safety controllers, see the following publications.

Resource	Description
GuardLogix 5570 Controllers User Manual, publication 1756-UM022	Provides information on how to install, configure, and operate GuardLogix 5570 controllers in Studio 5000® projects, version 21 or later.
GuardLogix 5570 and Compact GuardLogix 5370 Controller Systems Reference Manual, publication 1756-RM099	Provides information on how to meet safety application requirements for GuardLogix 5570 controllers in Studio 5000 projects, version 21 or later.
GuardLogix Controllers User Manual, publication 1756-UM020	Provides information on how to install, configure, and operate GuardLogix 5560 and GuardLogix 5570 controllers in RSLogix 5000® projects, version 20 or earlier.
GuardLogix Controller Systems Safety Reference Manual, publication 1756-RM093	Provides information on how to meet safety application requirements for GuardLogix 5560 and GuardLogix 5570 controllers in RSLogix 5000 projects, version 20 or earlier.
GuardLogix Safety Application Instruction Set Safety Reference Manual, publication 1756-RM095	Provides programmers with details about the GuardLogix safety application instruction set.

Standard ControlLogix Controllers

Two lines of standard ControlLogix controllers are now available. These controllers are identified as 1756-L6*x* controllers and 1756-L7*x* controllers according to abbreviations of their full catalog numbers.

Table 1 - ControlLogix Catalog Numbers

Abbreviated Cat. No.	Cat. No.
1756-L6*x*	1756-L61, 1756-L62,1756-L63, 1756-L64,1756-L65
1756-L7*x*	1756-L71, 1756-L72, 1756-L73,1756-L74, 1756-L75

The standard ControlLogix controllers share many similar features, but also have some differences. Table 2 provides a brief overview the differences between the controllers. For further details about these features and differences, see the appropriate chapters of this manual.

Table 2 - Differences between 1756-L7*x* and 1756-L6*x* Controllers

Feature	1756-L7*x*	1756-L6*x*
Clock support and backup used for memory retention at powerdown	Energy Storage Module (ESM)	Battery
Communication ports (built-in)	USB	Serial
Connections, controller	500	250
Memory, nonvolatile	Secure Digital (SD) card	CompactFlash card
Status display and status indicators	Scrolling status display and four status indicators	Six status indicators
Unconnected buffer defaults	20 (40, max)	10 (40, max)

For information on using ControlLogix controllers in SIL 2 applications, see the Using ControlLogix in SIL 2 Applications Safety Reference Manual, publication 1756-RM001.

Redundant ControlLogix Controllers

Certain ControlLogix controllers are also supported for use in redundant systems. For more information about controllers and redundant systems, see Chapter 12.

Extreme Environment ControlLogix Controllers

The extreme environment ControlLogix controllers, catalog numbers 1756-L73XT and 1756-L63XT, provide the same functionality as the 1756-L73 and 1756-L63 controllers, but are designed to withstand temperatures -25...+70 °C (-13...+158 °F).

Armor ControlLogix Controllers

The Armor ControlLogix controller combines a 1756-L72 or 1756-L73 ControlLogix controller with two EtherNet/IP DLR-capable 1756-EN3TR communication modules in an IP67-rated housing for mounting on a machine. For more information about the Armor ControlLogix controllers, catalog numbers 1756-L72EROM and 1756-L73EROM, refer to the Armor ControlLogix Controller Installation Instructions, publication 1756-IN061.

Though the 1756-L72EROM and 1756-L73EROM controllers have functionality identical to that of the 1756-L72 and 1756-L73 controllers, the Armor controller energy storage modules (ESM) cannot be removed or replaced.

Before You Begin

Before you begin using your ControlLogix controller, verify that you have the applications that are required to configure and program the controller.

Required Software

Use Table 3 to identify the minimum software versions that are required to use your ControlLogix controller.

Table 3 - Required Software for Controller Use

Cat. No.	Studio 5000 Environment	RSLogix 5000 Software	RSLinx® Classic
1756-L61/A	—	Version 12.06.00 or later	Any version
1756-L61/B	—	Version 13.04.00 or later	
1756-L62/A	—	Version 12.06.00 or later	
1756-L62/B	—	Version 13.04.00 or later	
1756-L63/A	—	• If not using a CompactFlash card, version 10.07.00 or later • If using a CompactFlash card, version 11.16.00 or later	
1756-L63/B	—	Version 13.04.00 or later	
1756-L63XT/B	—	Version 13.04.00 or later	Version 2.55.00 or later
1756-L64/B	—	Version 16.03.00 or later	Any version
1756-L65/B	—	Version 17.01.02 or later	
1756-L71	Version 21.00.00 or later	Version 20.01.02	Version 2.59.00 or later
1756-L72		Version 19.01.00 or later	Version 2.57.00 or later
1756-L73			
1756-L73XT			
1756-L74			
1756-L75			
1756-L72EROM			2.59.02 or later
1756-L73EROM			

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
1756 ControlLogix and GuardLogix Controllers Technical Data, publication 1756-TD001	Provides specifications for ControlLogix and GuardLogix controllers.
1756 ControlLogix I/O Specifications Technical Data, publication 1756-TD002	Provides specifications for ControlLogix I/O modules.
Armor ControlLogix Controllers Installation Instructions, publication 1756-IN061	Provides information about how to install the Armor ControlLogix controllers.
ControlLogix Battery Module Installation Instructions, publication 1756-IN576	Provides information for battery module installation.
ControlLogix Chassis and Power Supply Installation Instructions, publication 1756-IN005	Describes how to install and troubleshoot standard and ControlLogix-XT™ versions of the 1756 chassis and power supplies, including redundant power supplies.
ControlLogix Analog I/O Modules User Manual, publication 1756-UM009	Provides information about analog I/O module configuration properties.
ControlLogix Configurable Flowmeter Module User Manual, publication 1756-UM010	Provides information about configurable flowmeter configuration properties.
ControlLogix Data Highway Plus-Remote I/O Communication Interface Module User Manual, publication 1756-UM514	Provides information about Data Highway Plus™ communication and remote I/O communication module configuration properties.
ControlLogix DH-485 Communication Module User Manual, publication 1756-UM532	Describes how to connect a 1756-DH485 module to a DH-485 network with multiple controllers.
ControlLogix Digital I/O Modules User Manual, publication 1756-UM058	Provides information about digital I/O module configuration properties.
ControlLogix Enhanced Redundancy System User Manual, publication 1756-UM535	Provides detailed information about ControlLogix redundancy systems.
ControlLogix HART Analog I/O Modules User Manual, publication 1756-UM533	Describes how to use HART analog I/O modules.
ControlLogix High-speed Analog I/O Module User Manual, publication 1756-UM005	Provides information about high-speed analog I/O module configuration properties.
ControlLogix High-speed Counter Module User Manual, publication 1756-UM007	Provides information about high-speed counter-module configuration properties.
ControlLogix Low-speed Counter Module User Manual, publication 1756-UM536	Provides information about low-speed counter-module configuration properties.
ControlLogix Peer I/O Control Application Technique, publication 1756-AT016	Describes typical peer control applications and provides details about how to configure I/O modules for peer control operation.
ControlLogix Programmable Limit Switch Module User Manual, publication 1756-UM002	Provides information about programmable limit switch configuration properties.
ControlLogix Redundancy System User Manual, publication 1756-UM523	Provides information ControlLogix standard redundancy systems.
ControlLogix Remote I/O Communication Module User Manual, publication 1756-UM534	Provides information for remote I/O network communication configuration.
ControlLogix SIL2 System Configuration Using RSLogix 5000 Subroutines Application Technique, publication 1756-AT010	Provides information about ControlLogix SIL2- certified fault-tolerant systems.
ControlLogix SIL2 System Configuration Using SIL2 Add-On Instructions Application Technique, publication 1756-AT012	Provides information about ControlLogix SIL2- certified fault-tolerant systems.
ControlLogix System Selection Guide, publication 1756-SG001	Describes how to design and select components for your ControlLogix system.

Resource	Description
ControlNet Network Configuration User Manual, publication CNET-UM001	Describes how to use ControlNet modules.
DeviceNet Network Configuration User Manual, publication DNET-UM004	Provides information about DeviceNet modules and devices.
Ethernet Design Considerations Reference Manual, publication ENET-RM002	Provides additional information about network design for your system.
EtherNet/IP and ControlNet to FOUNDATION Fieldbus Linking Device User Manual, publication 1788-UM057	Describes in detail how to use the available Foundation Fieldbus devices.
EtherNet/IP Network Configuration User Manual, publication ENET-UM001	Provides information about EtherNet/IP communication modules.
FOUNDATION Fieldbus Design Considerations Reference Manual, publication PROCES-RM005	Describes in detail how to use the available Foundation Fieldbus devices.
Guidelines for Handling Lithium Batteries Technical Data, publication AG-5.4	Describes how to store, handle, transport, and dispose of lithium batteries.
Integrated Architecture and CIP Sync Configuration Application Technique, publication IA-AT003	Describes how to configure CIP Sync with Integrated Architecture® products and applications.
Integrated Motion on the EtherNet/IP Network Configuration and Startup User Manual, publication MOTION-UM003	Details how to design your ControlLogix system for Integrated Motion on the EtherNet/IP network applications.
Logix5000 Controllers Add-On Instructions Programming Manual, publication 1756-PM010	Describes in detail how to use add-on instructions.
Logix5000 Controllers General Instructions Reference Manual, publication 1756-RM003	Provides more information about GSV instructions, SSV instructions, objects, and attributes.
Logix5000 Controllers I/O and Tag Data Programming Manual, publication 1756-PM004	Describes how to create and configure program tags for optimal task and program execution.
Logix5000 Controllers Major, Minor and I/O Faults Programming Manual, publication 1756-PM014	Provides more information for I/O faults.
Logix5000 Controllers Messages Programming Manual, publication 1756-PM012	Provides information for controller messages.
Logix5000 Controllers Motion Instructions Reference Manual, publication MOTION-RM002	Provides programmers with details about the motion instructions that are available for a Logix5000 controller.
Logix5000 Controllers Nonvolatile Memory Card Programming Manual, publication 1756-PM017	Provides information about changing the project that is available to load from nonvolatile memory,
Logix5000 Controllers Produced and Consumed Tags Programming Manual, publication 1756-PM011	Provides more information for produced and consumed tags.
Motion Coordinate System User Manual, publication MOTION-UM002	Details how to create and configure a coordinated motion application system.
PhaseManager™ User Manual, publication LOGIX-UM001	Provides more information about instructions for use with equipment phases.
SERCOS and Analog Motion Configuration and Startup User Manual, publication MOTION-UM001	Details how to configure a sercos motion application system.
Using ControlLogix in SIL2 Applications Safety Reference Manual, publication 1756-RM001	Provides specific configuration and programming considerations.
Using Logix5000 Controllers as Masters or Slaves on Modbus Application Solution, publication CIG-AP129	Describes how to use Modbus sample programs.

Resource	Description
Industrial Automation Wiring and Grounding Guidelines Application Data, publication 1770-4.1	Provides general guidelines to install a Rockwell Automation industrial system.
Product Certifications website, http://www.rockwellautomation.com/rockwellautomation/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.
Programmable Controllers Battery Reference, http://www.ab.com/programmablecontrol/batteries.html	Provides Material Safety Data Sheets (MSDS) for individual replacement batteries.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Notes:

Install the 1756-L7*x* Controller

ATTENTION: Personnel responsible for the application of safety-related programmable electronic systems (PES) shall be aware of the safety requirements in the application of the system and shall be trained in using the system.

Table 4 - Environment and Enclosure

ATTENTION:

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC 60664-1), at altitudes up to 2000 m (6562 ft) without derating.

This equipment is not intended for use in residential environments and may not provide adequate protection to radio communication services in such environments.

This equipment is supplied as open-type equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA or be approved for the application if nonmetallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

In addition to this publication, see the following:

- Industrial Automation Wiring and Grounding Guidelines, Rockwell Automation publication 1770-4.1, for additional installation requirements
- NEMA Standard 250 and IEC 60529, as applicable, for explanations of the degrees of protection provided by enclosure

Table 5 - North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations.	**Informations sur l'utilisation de cet équipement en environnements dangereux.**
Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.	Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.
WARNING: EXPLOSION HAZARD • Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. • Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. • Substitution of components may impair suitability for Class I, Division 2. • If this product contains batteries, they must only be changed in an area known to be nonhazardous.	**WARNING:** RISQUE D'EXPLOSION • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. • La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. • S'assurer que l'environnement est classé non dangereux avant de changer les piles.

Table 6 - European Hazardous Location Approval

The following applies when the product bears the Ex Marking.
This equipment is intended for use in potentially explosive atmospheres as defined by European Union Directive 94/9/EC and has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of Category 3 equipment intended for use in Zone 2 potentially explosive atmospheres, given in Annex II to this Directive. Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN 60079-15 and EN 60079-0.

ATTENTION: This equipment is not resistant to sunlight or other sources of UV radiation.

WARNING:

- This equipment shall be mounted in an ATEX certified enclosure with a minimum ingress protection rating of at least IP54 (as defined in IEC60529) and used in an environment of not more than Pollution Degree 2 (as defined in IEC 60664-1) when applied in Zone 2 environments. The enclosure must utilize a tool removable cover or door.
- This equipment shall be used within its specified ratings defined by Rockwell Automation.
- This equipment must be used only with ATEX certified Rockwell Automation backplanes.
- Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product.
- Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.

Before You Begin

See 1756-IN005 to install a ControlLogix® chassis and power supply before you install your controller and power supply.

1756-L7*x* Controller Parts

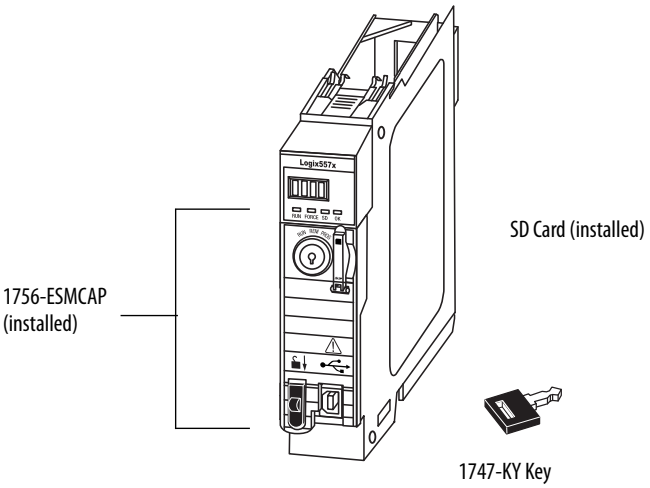
These sections describe parts that are included with the L7*x* controllers and available accessory parts.

Parts Included with the 1756-L7*x* Controller

These parts are included with the controller:

- 1756-ESMCAP capacitor-based energy storage module (ESM)
- 1784-SD1 Secure Digital (SD) card, 1 GB
- 1747-KY controller key

Figure 1 - Parts with the 1756-L7*x* Controller



IMPORTANT The 1756-L7*x* controllers ship with an SD card installed. We recommend that you leave the SD card installed.

Parts Available for Use with the 1756-L7*x* Controller

You can choose to use the parts included with the controller and these parts specific to your application.

If your application requires	Then use this part
USB connection from a computer to the controller	USB cable(1)
Nonvolatile memory	1784-SD1 (1 GB) or 1784-SD2 (2 GB)
ESM without WallClockTime back-up power	1756-ESMNSE This ESM does not have WallClockTime back-up power. Use this ESM if your application requires that the installed ESM deplete its residual stored energy to 40 µJ or less before transporting it into or out of your application.(2) Additionally, you can use this ESM with only a 1756-L73 (8 MB) or smaller memory-sized controller.
ESM that secures the controller by blocking the USB connection and SD card use(2) This ESM provides your application an enhanced degree of security.	1756-ESMNRM

(1) The USB port is intended only for temporary local programming purposes and not intended for permanent connection. The USB cable is not to exceed 3.0 m (9.84 ft) and must not contain hubs.

(2) For information about the hold-up time of the ESMs, see Estimate the ESM Support of the WallClockTime on page 75 and stored energy depletion rate on page 27.

WARNING: Do not use the USB port in hazardous locations.

ATTENTION:

- The USB port is intended only for temporary local programming purposes and not intended for permanent connection.
- The USB cable is not to exceed 3.0 m (9.84 ft) and must not contain hubs.

1756-L7*x* Controller Installation

These sections explain how to install the 1756-L7*x* controller. To install the 1756-L7*x* controller, complete the tasks summarized in this table.

✓	Task	Page
	Insert the Controller into the Chassis	21
	Insert the Key	22
	Install the SD Card	23
	Remove the SD Card	25
	Install the ESM	26

Insert the Controller into the Chassis

When installing a ControlLogix controller, you can do the following:

- Place the controller in any slot.
- Use multiple controllers in the same chassis.

You can install or remove a ControlLogix controller while chassis power is on and the system is operating.

WARNING: When you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding. Repeated electrical arcing causes excessive wear to contacts on both the controller and its mating connector on the chassis. Worn contacts may create electrical resistance that can affect controller operation.

Table 7 - Prevent Electrostatic Discharge

ATTENTION: This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

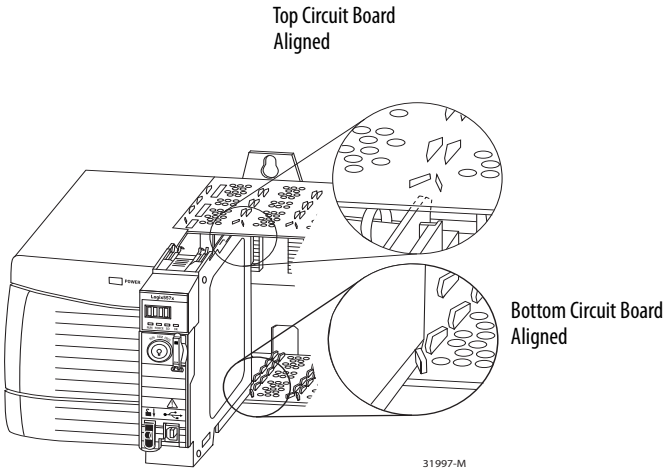
- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- Use a static-safe workstation, if available.
- Store the equipment in appropriate static-safe packaging when not in use.

IMPORTANT The ESM begins charging when one of these actions occurs:

- The controller and ESM are installed into a powered chassis.
- Power is applied to the chassis that contains a controller with the ESM installed.
- An ESM is installed into a powered controller.

After power is applied, the ESM charges for up to two minutes as indicated by CHRG or ESM Charging on the status display.

1. Align the circuit board with the top and bottom guides in the chassis.

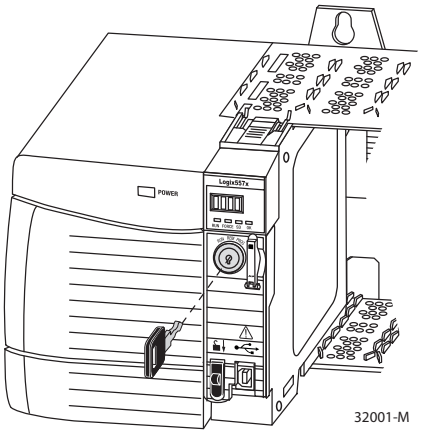


2. Slide the module into the chassis until it snaps into place.
3. Verify that the controller is flush with the power supply or other installed modules.

After you have inserted the controller into the chassis, reference the Troubleshoot the Module on page 183 for information to interpret the status indicators.

Insert the Key

After the controller is installed, insert the key.



Install the SD Card

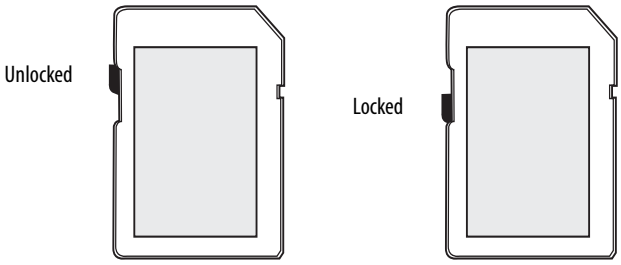
Complete these steps to install the SD card in the 1756-L7*x* controllers.

We recommend that you leave the SD card in the controller, even when it is not used. If the controller experiences a major nonrecoverable fault, fault information is saved to the card.

WARNING: When you insert or remove the Secure Digital (SD) memory card while power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

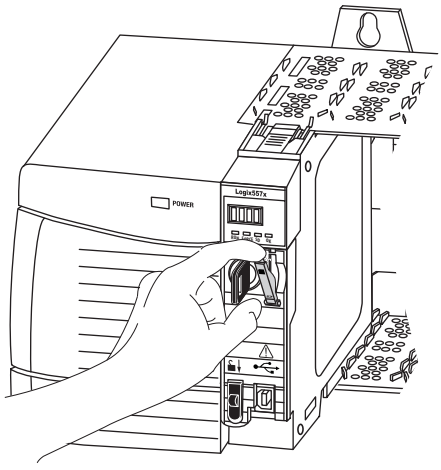
Be sure that power is removed or the area is nonhazardous before proceeding.

1. Verify that the SD card is locked or unlocked according to your preference.



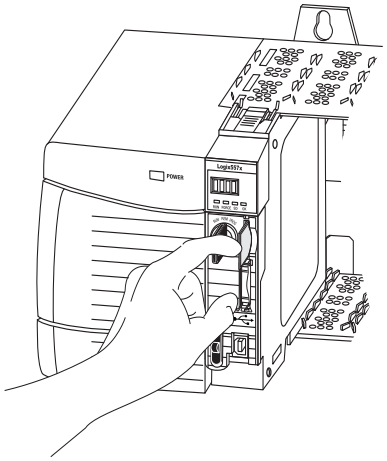
   For more information about the lock/unlock memory settings, see the Load or Store to the Memory Card on page 68.

2. Open the door for the SD card.

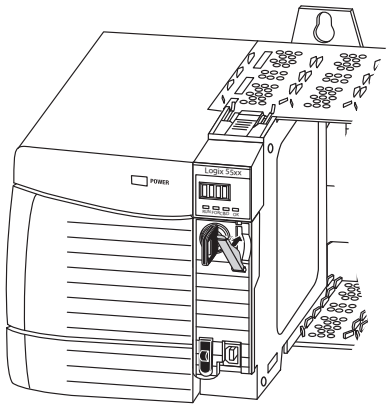


3. Insert the SD card into the SD card slot.

4. Gently press the card until it clicks into place.



5. Close the SD card door.



Remove the SD Card

The 1756-L7*x* controller ships with an SD card installed. Complete these steps to remove the SD card from the 1756-L7*x* controller.

WARNING: When you insert or remove the Secure Digital (SD) memory card while power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

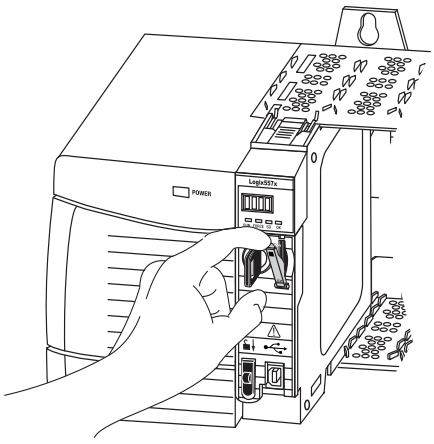
IMPORTANT

- Verify that the SD card status indicator is off and that the card is not in use before removing it.
- We recommend that you do the following:
  - Leave an SD card installed.
  - Use the SD cards available from Rockwell Automation (catalog number 1784-SD1 or 1784-SD2).
- While other SD cards can be used with the controller, Rockwell Automation has not tested the use of those cards with the controller. If you use an SD card other than those cards that are available from Rockwell Automation, you can experience data corruption or loss.
- Also, SD cards that are not provided by Rockwell Automation do not have the same industrial, environmental, and certification ratings as those cards that are available from Rockwell Automation.

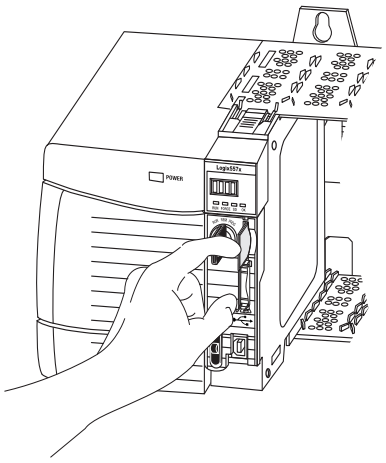
1. Verify that the SD card is not in use by checking to be sure that the SD indicator is Off.

   TIP You can also put the controller into Hard Run mode to keep the controller from writing to the SD card while it is removed.

2. Open the door to access the SD card.



3. Press and release the SD card to eject it.



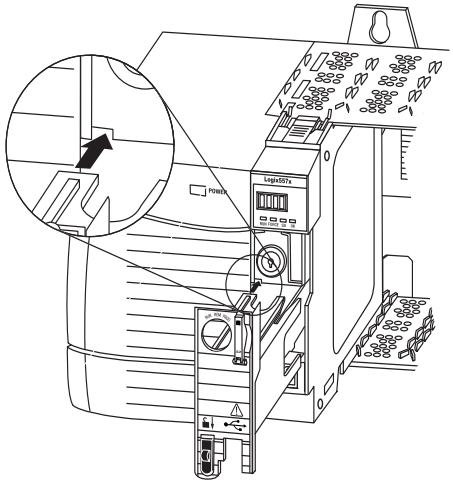
4. Remove the SD card and close the door.

Install the ESM

To install an ESM in the 1756-L7*x* controller, complete these steps.

ATTENTION: To avoid potential damage to the product when inserting the ESM, align it in the track and slide forward with minimal force until the ESM snaps into place.

1. Align the tongue-and-groove slots of the ESM and controller.



2. Slide the ESM back until it snaps into place.

   The ESM begins charging after installation. The following status messages indicate charging status:

   - ESM Charging
   - CHRG

After you install the ESM, it can take up to 15 seconds for the charging status messages to display.

IMPORTANT Allow the ESM to finish charging before removing power from the controller. Failure to do so can result in the loss of the application program. A type 1, code 40 major fault is logged on powerup.

To verify that the ESM is fully charged, check the status display to confirm that messages CHRG or ESM charging are no longer indicated.

TIP We recommend that you check the WallClockTime object attributes after installing an ESM to verify that time of the controller is correct.

The ESM contains a real-time clock. If the ESM is new or came from another controller, the WallClockTime object attributes for your controller can change.

Uninstall the ESM

WARNING: If your application requires the ESM to deplete its residual stored energy to 40 µJ or less before you transport it into or out of the application, use only the **1756-(SP)ESMNSE(XT)** module. In this case, complete these steps before you remove the ESM.

- Turn power off to the chassis.

After you turn power off to the chassis, the controller's OK status indicator transitions from green to solid red to OFF.

- Wait **at least 20 minutes** for the residual stored energy to decrease to 40 µJ or less before you remove the ESM.

There is no visual indication of when the 20 minutes has expired. **You must track that time period**.

WARNING: When you insert or remove the energy storage module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding. Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector.

IMPORTANT Before you remove an ESM, make necessary adjustments to your program to account for potential changes to the WallClockTime attribute.

Consider these points before removing the ESM:

- The following ESM modules can be currently installed in your 1756-L7*x* or 1756-L7*x*XT controller:
  - 1756-ESMCAP
  - 1756-ESMNSE
  - 1756-ESMCAPXT
  - 1756-ESMNSEXT
- The 1756-L7*x* controllers come with the 1756-ESMCAP module installed. The 1756-L7*x*XT extreme temperature controller ships with a 1756-ESMCAPXT module installed. For more information on how to use a 1756-ESMNSE, 1756-ESMNRM, 1756-ESMNSEXT, or 1756-ESMNRMXT module, see page 26.
- After the 1756-L7*x* or 1756-L7*x*XT controllers lose power, because the chassis power is turned off or the controller has been removed from a powered chassis, do not immediately remove the ESM.

  Wait until the OK status indicator on the controller transitions from Green to Solid Red to OFF before you remove the ESM.
- You can use the 1756-ESMNSE module with only a 1756-L73 (8 MB) or smaller memory-sized controller.
- Use the 1756-ESMNSE module if your application requires that the installed ESM deplete its residual stored energy to 40 µJ or less before transporting it into or out of your application.
- Once it is installed, you cannot remove the 1756-ESMNRM or 1756-ESMNRMXT module from a 1756-L7*x* or 1756-L7*x*XT controller.
- The Armor™ controller energy storage modules (ESM) cannot be removed or replaced.

Complete these steps to remove an ESM module from the controller.

1. Remove the key from the mode switch.

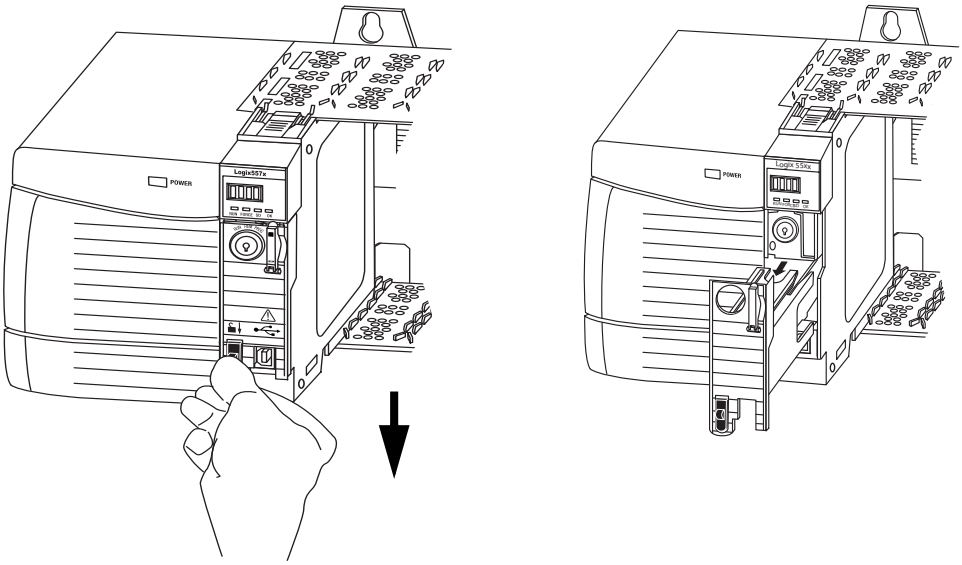
IMPORTANT The next step depends on which of the following conditions applies to your application.

- If you are removing the ESM from a powered 1756-L7*x* controller, go to step 2.
- If you are removing the ESM from a 1756-L7*x* controller that is not powered, because the chassis power is turned off or the controller has been removed from a powered chassis, **do not immediately remove** the ESM.

Wait until the OK status indicator on the controller transitions from Green to Solid Red to OFF before you remove the ESM.

After the OK status indicator transitions to Off, go to step 2.

2. Use your thumb to press down on the black release and pull the ESM away from the controller.



Notes:

Start Using the Controller

Make Connections

Before you can begin using your controller, you must make a connection to the controller.

1756-L7*x* Connection Options

Connection options with the 1756-L7*x* include the following:

- Connect by using a **USB cable** as described in Connect to the 1756-L7x Controller on page 44.
- Install and configure a **communication module** in the chassis with the controller as described in the installation instructions for the communication module.

For information on Double Data Rate (DDR) backplane communication usage, see Double Data Rate (DDR) Backplane Communication on page 92.

1756-L6*x* Connection Options

Connection options with the 1756-L6*x* include the following:

- Connect by using a **serial cable** as described in Connect to the 1756-L6x Controller on page 47.
- Install and configure a **communication module** in the chassis with the controller as described in the installation instructions for the communication module.

TIP When upgrading your 1756-L6*x* controller firmware, we recommend that you use a network connection other than the serial cable. Serial connections are much slower than other communication connections.

Connect to the 1756-L7*x* Controller

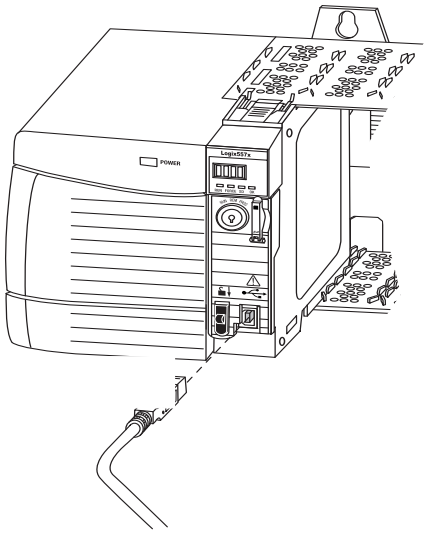
The controller has a USB port that uses a Type B receptacle. The port is USB 2.0 compatible and runs at 12 Mbps.

To use the USB port of the controller, you must have RSLinx® software, version 2.56 or later, installed on your workstation. Use a USB cable to connect your workstation to the USB port. With this connection, you can upgrade firmware and download programs to the controller directly from your workstation.

ATTENTION: The USB port is intended only for temporary local programming purposes and not intended for permanent connection. The USB cable is not to exceed 3.0 m (9.84 ft) and must not contain hubs.

WARNING: Do not use the USB port in hazardous locations.

Figure 3 - USB Connection



Configure the USB Driver

To configure RSLinx software to use a USB port, you must first configure a USB driver.

To configure a USB driver, perform this procedure.

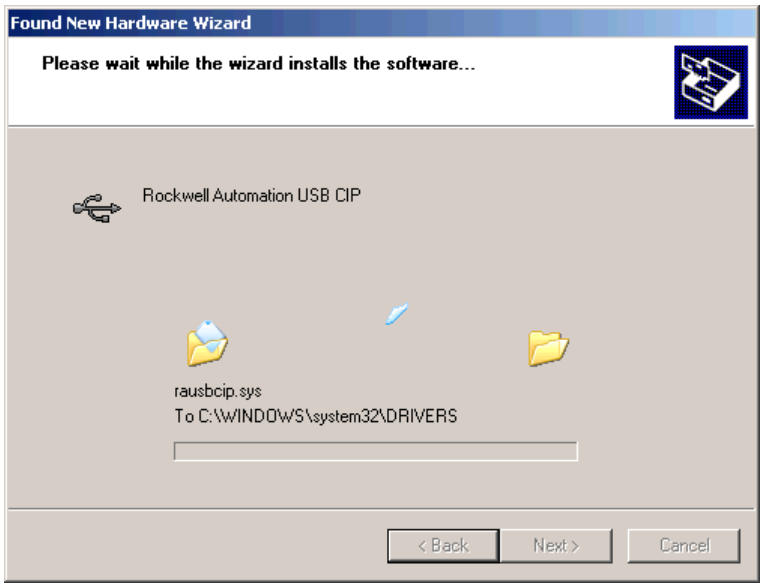
1. Connect your controller and workstation by using a USB cable.

   The Found New Hardware Wizard dialog box appears.

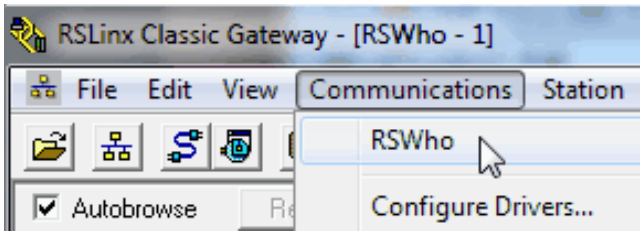
2. Click any of the Windows Update connection options and click Next.

   TIP If the software for the USB driver is not found and the installation is canceled, verify that you have installed RSLinx Classic software, version 2.57 or later.

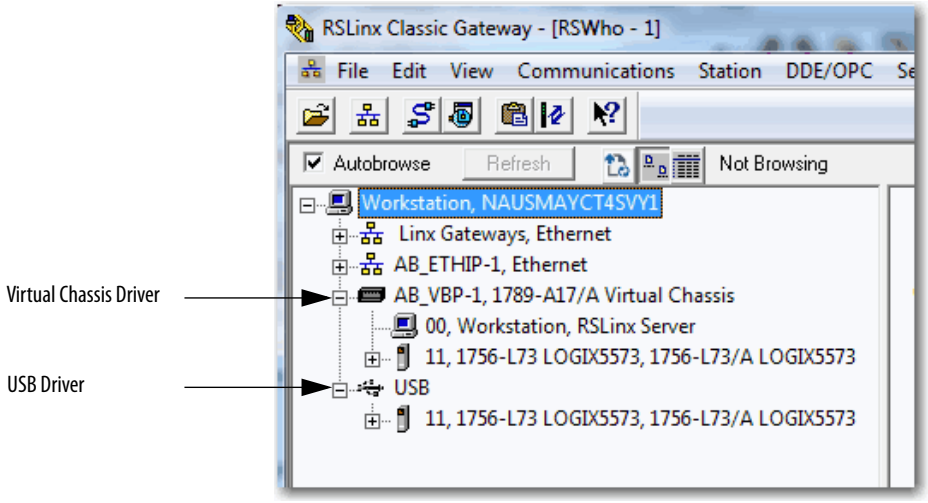
3. Click Install the software automatically (Recommended) and click Next. The software is installed.



4. Click Finish to configure your USB driver.
5. From the Communications pull-down menu, choose RSWho.



The USB port driver appears.



Your controller appears under two drivers, a virtual chassis and the USB port. You can use either driver to browse to your controller.

Connect to the 1756-L6*x* Controller

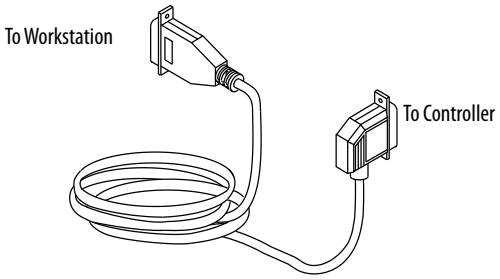
The 1756-L6*x* ControlLogix® controller uses a serial port for workstation connections.

WARNING: If you connect or disconnect the serial cable with power applied to this module or the serial device on the other end of the cable, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

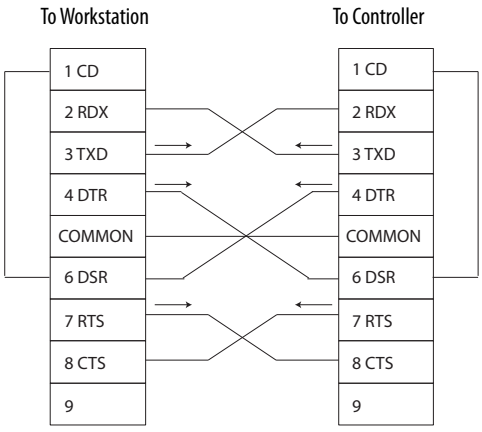
To connect a workstation to the serial port, you can make your own serial cable or use one of these cables:

- 1756-CP3 serial cable
- 1747-CP3 cable from the SLC™ product family (if you use this cable, it can be difficult to close the controller door)

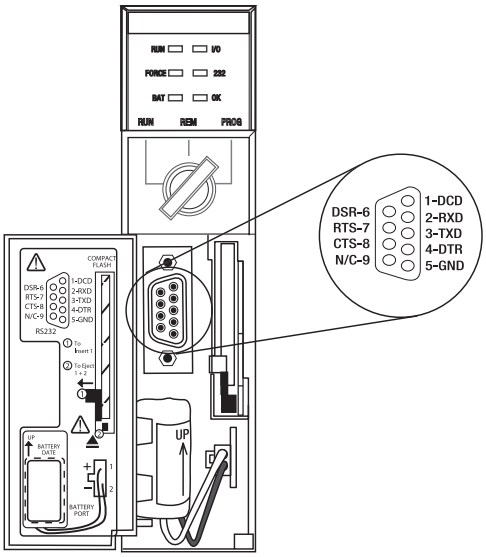


Follow these guidelines if you make your own serial cable:

- Limit the length to 15.2 m (50 ft).
- Wire the connectors as shown.
- Attach the shield to the connectors.



Plug the controller end of the serial cable into the RS-232 port on the front of the controller.

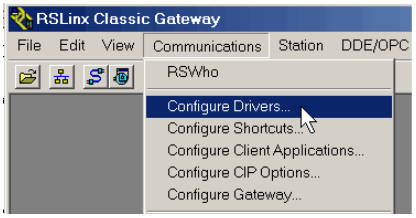


Configure the Serial Driver

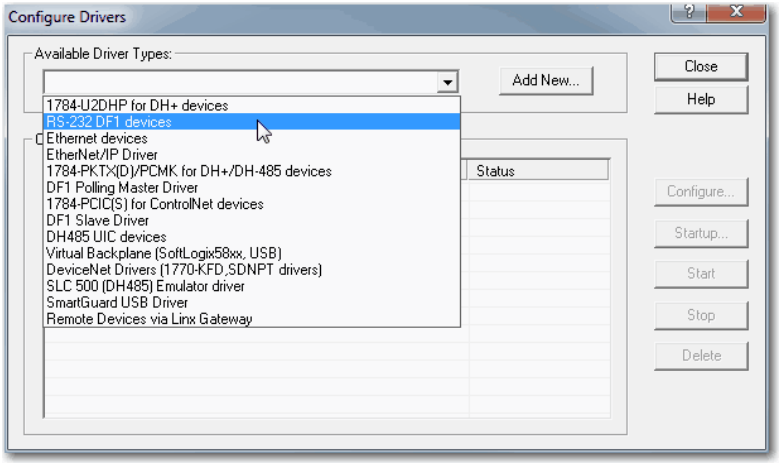
Use RSLinx software to configure the RS-232 DF1 device driver for serial communication.

To configure the driver, perform this procedure.

1. In RSLinx software, from the Communications menu, choose Configure Drivers.

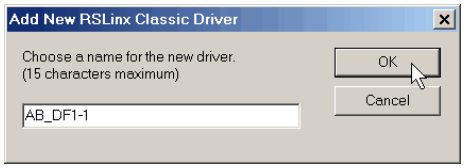


2. From the Available Driver Types pull-down menu, choose the RS-232 DF1 device driver.



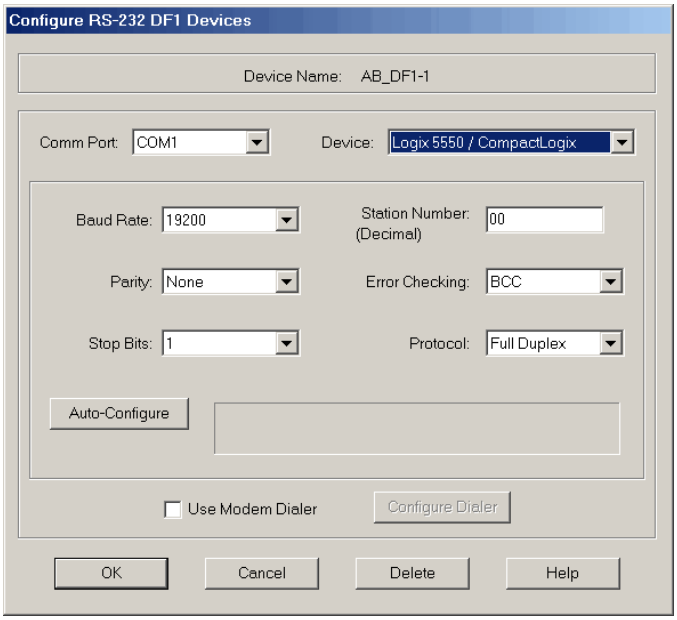
3. Click Add New.

   The Add New RSLinx Driver dialog box appears.



4. Type the driver name and click OK.

5. Specify the serial port settings.
   a. From the Comm Port pull-down menu, choose the serial port on the workstation to which the cable is connected.
   b. From the Device pull-down menu, choose Logix 5550/ CompactLogix.
   c. Click Auto-Configure.



6. If the auto configuration is successful, click OK.

   If the auto configuration is not successful, verify that the correct Comm Port was selected.

7. Click Close.

Upgrade Controller Firmware

You can choose to upgrade controller firmware by using one of these tools:

- ControlFLASH™ software that is packaged with the Studio 5000® environment
- AutoFlash feature of the Logix Designer application

To upgrade your controller firmware, complete the tasks that are listed in this table.

✓	Task	Page
	Determine Required Controller Firmware	51
	Obtain Controller Firmware	52
	Use ControlFLASH Software to Upgrade Firmware	52
	Use AutoFlash to Upgrade Firmware	57

Determine Required Controller Firmware

IMPORTANT The controller must be in Remote Program or Program mode and all major recoverable faults must be cleared to accept upgrades.

Use Table 12 to determine what firmware revision is required for your controller.

Table 12 - Firmware Required for Controllers

Controller	Series	Use this firmware revision
1756-L61	A	12.*x* or later
	B	13.40 or later
1756-L62	A	12.*x* or later
	B	13.40 or later
1756-L63	A	• If not using a CompactFlash card, 10.*x* or later • If using a CompactFlash card, 11.*x* or later
	B	13.40 or later
1756-L63XT	B	13.40 or later
1756-L64	B	16 or later
1756-L65	B	17 or later
1756-L71	A	20 or later
1756-L72	A	19 or later
1756-L72EROM	A	19 or later
1756-L73	A	19 or later
1756-L73XT	A	19 or later
1756-L73EROM	A	19 or later
1756-L74	A	19 or later
1756-L75	A	19 or later

Obtain Controller Firmware

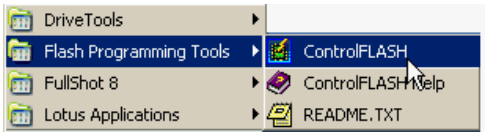
Controller firmware is packaged with the Studio 5000 environment. In addition, controller firmware is also available for download from the Rockwell Automation Technical Support website at http://www.rockwellautomation.com/support/.

Use ControlFLASH Software to Upgrade Firmware

To upgrade your controller firmware with ControlFLASH software, complete these steps.

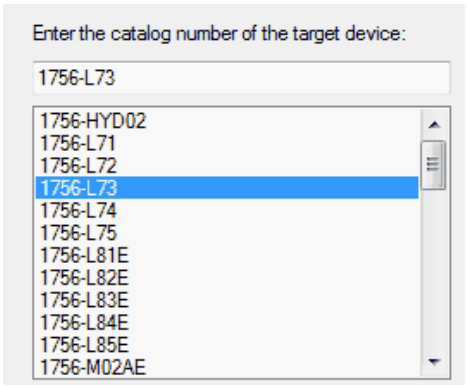
IMPORTANT If the SD card is locked and the Load Image option of the store project is set to On Power Up, the controller firmware is not updated as a result of these steps. The previously stored firmware and project are loaded instead.

1. Verify that the network connection is made and the network driver has been configured in RSLinx software.
2. Start ControlFLASH software and click Next to begin the upgrade process.

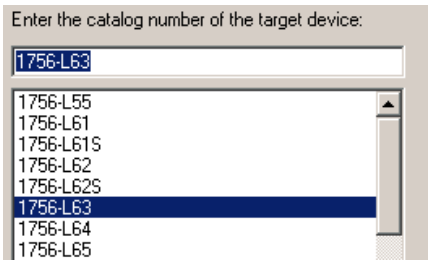


3. Select the catalog number of your controller and click Next.

1756-L7*x* Controllers

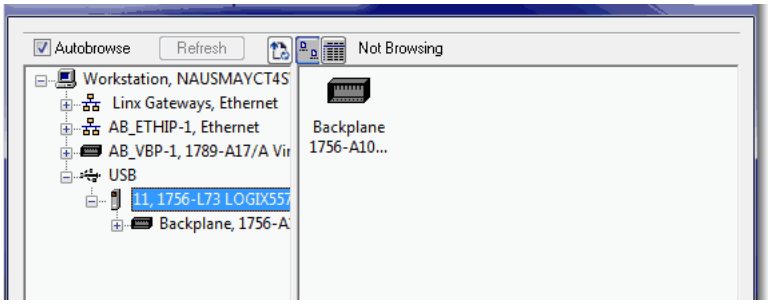


1756-L6*x* Controllers

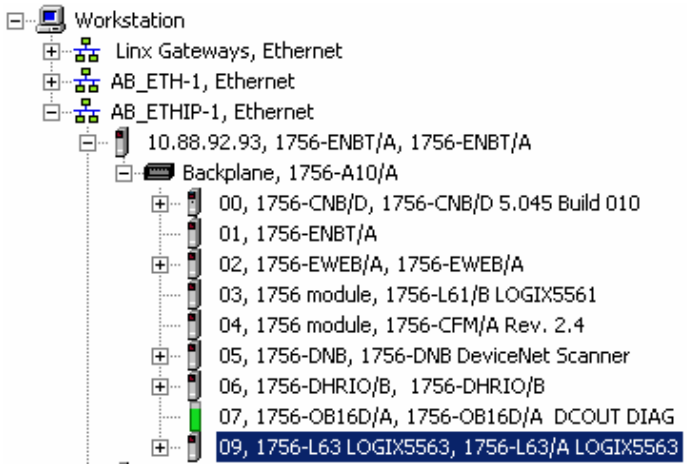


4. Expand the network driver to locate your controller.

1756-L7*x* Controller with USB Network Driver



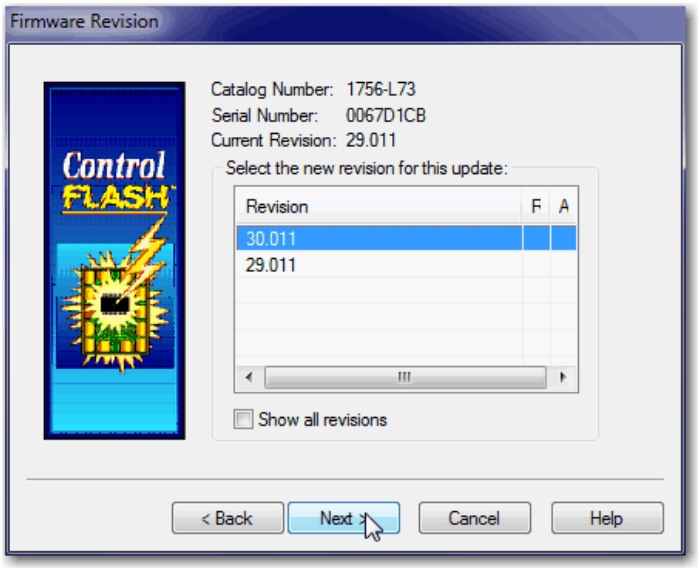
1756-L6*x* Controller with Ethernet Network Driver



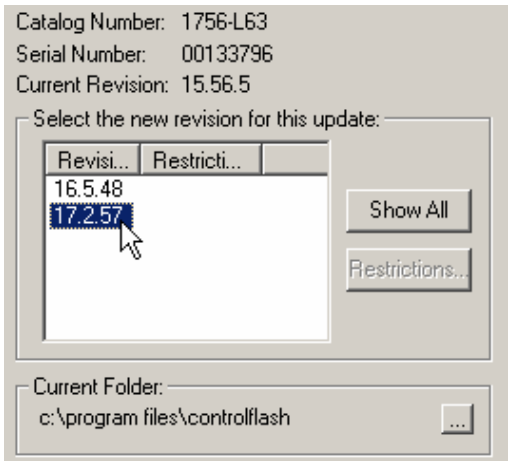
5. Select the controller and click Next.

6. Select the desired firmware revision and click Next.

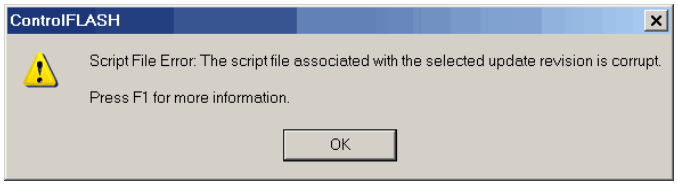
1756-L7*x* Controller Upgrade



1756-L6*x* Controller Upgrade



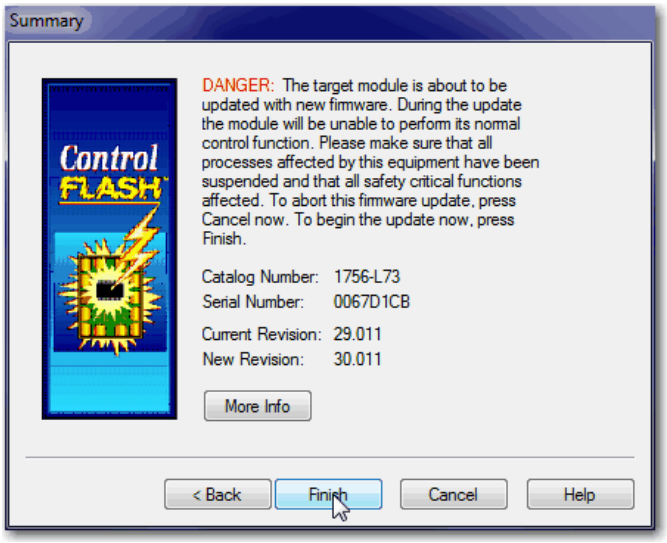
TIP If you are using a 1756-L7*x* controller and experience a Script File Error after selecting the firmware revision number (see the following example), there is likely an anomaly with your firmware files.



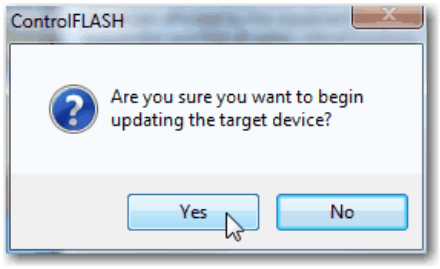
To recover, perform the following:

- Go to http://www.rockwellautomation.com/support/ and download the firmware revision you are trying to upgrade. Replace the firmware revision that you have previously installed with that posted on the Technical Support website.
- If the replacement firmware revision does not resolve the anomaly, contact Rockwell Automation Technical Support.

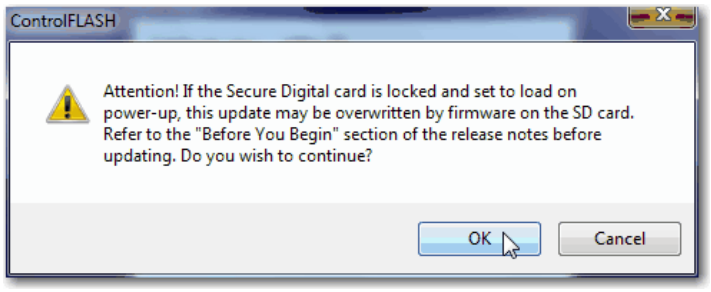
7. Click Finish.



8. When a confirmation dialog box appears, click Yes.



Before the firmware update begins, this dialog box appears. Take the required action for your application. In this example, the upgrade continues when you click OK.



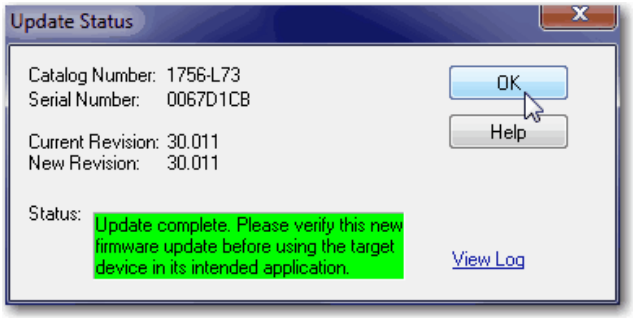
A progress dialog box indicates the progress of the firmware upgrade. The 1756-L7*x* controllers show progress in updates and blocks. The 1756-L6x controllers show progress only in blocks.

WARNING: Let the firmware update to fully complete before cycling power or otherwise interrupting the upgrade.

TIP If the ControlFLASH upgrade of the controller is interrupted, the controllers revert to boot firmware, that is firmware revision 1.*xxx*.

When the upgrade is complete, the Update Status dialog box indicates that the upgrade is complete.

9. Click OK.



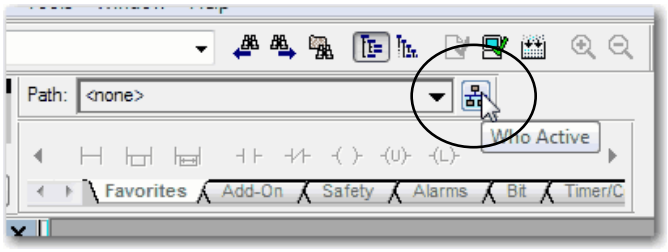
10. Close ControlFLASH software.

Use AutoFlash to Upgrade Firmware

To upgrade your controller firmware with the AutoFlash feature, complete these steps.

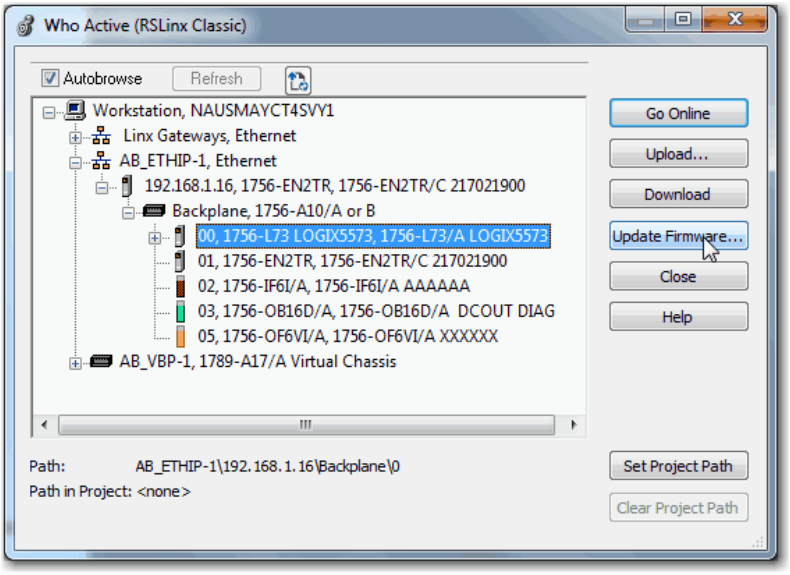
IMPORTANT If the SD card is locked and the Load Image option of the stored project is set to On Power Up, the controller firmware is not updated as a result of these steps. The previously stored firmware and project are loaded instead.

1. Verify the following:
   - The network connection is made.
   - The network driver has been configured in RSLinx Classic software.
   - The controller is in Remote Program or Program mode and all major recoverable faults are cleared.
2. Use the Logix Designer application to create a controller project.
3. On the Path bar, click Who Active.

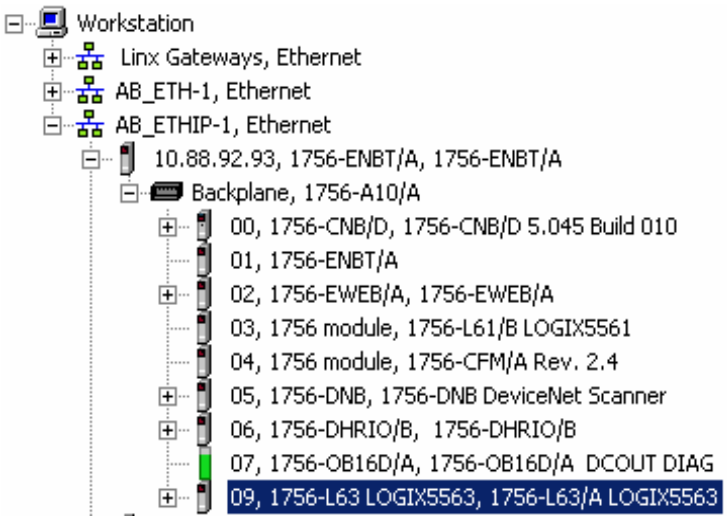


4. Select your controller and click Update Firmware.

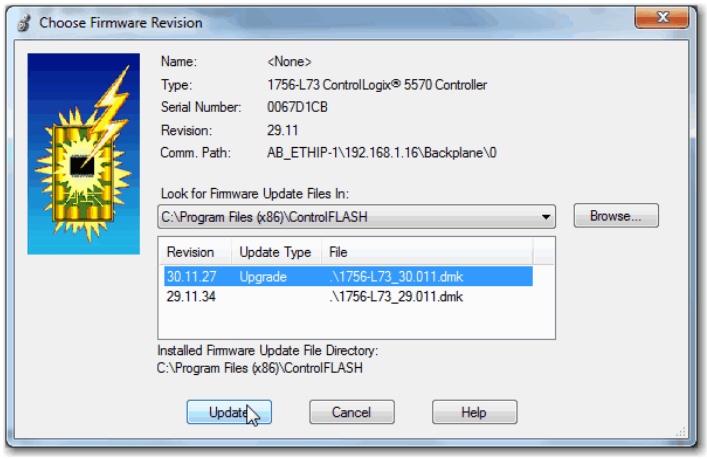
1756-L7*x* Controller with USB Driver



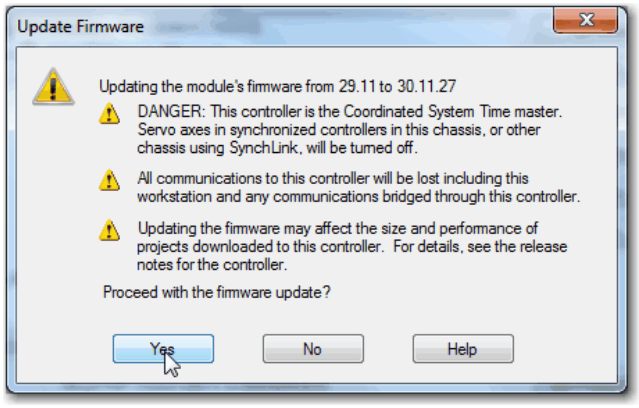
1756-L6*x* Controller with Ethernet Driver



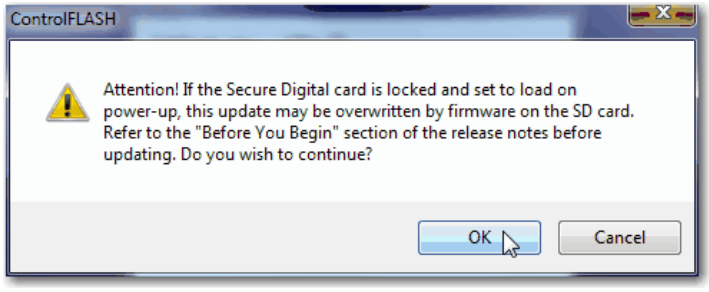
5. Select the firmware revision to upgrade to and click Update.



6. On the Update Firmware dialog box, click Yes.



7. On the ControlFLASH dialog box, click OK.



A progress dialog box indicates the progress of the firmware upgrade. The 1756-L7*x* controllers show progress in updates and blocks. The 1756-L6x controllers show progress only in blocks.

WARNING: Let the firmware update to fully complete before cycling power or otherwise interrupting the upgrade.

TIP If the ControlFLASH upgrade of the controller is interrupted, the controllers revert to boot firmware, that is firmware revision 1.*xxx*.

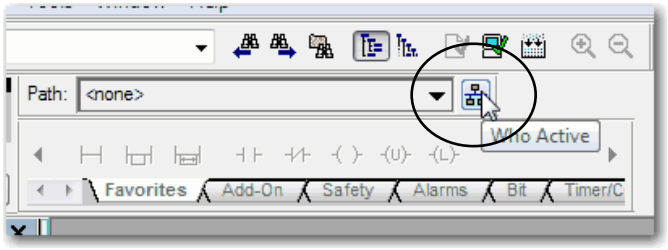
When the upgrade is complete, the Update Status dialog box indicates that the upgrade is complete.

Set the Communication Path

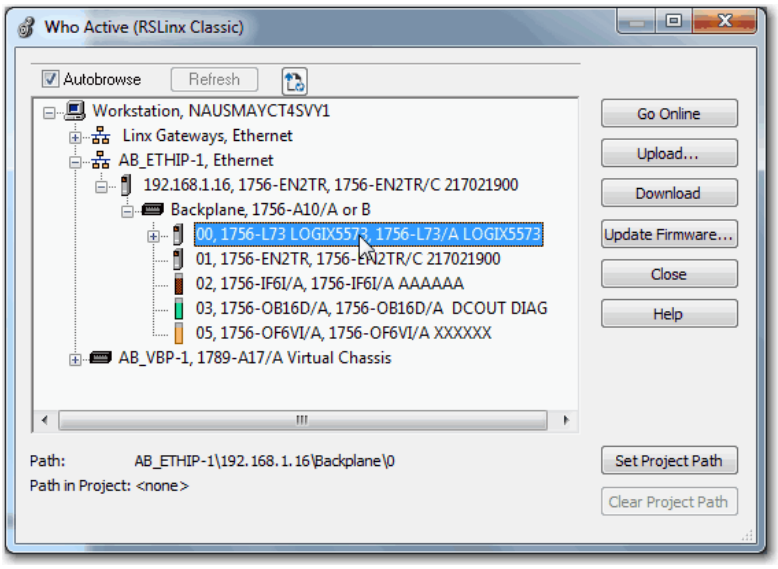
To go online with the controller, you must specify a communication path in the Logix Designer application. You specify the communication path after you create a controller program.

Complete these steps to specify the communication path after you have created your program.

1. Click Who Active.



2. Expand the communication path and select the controller.

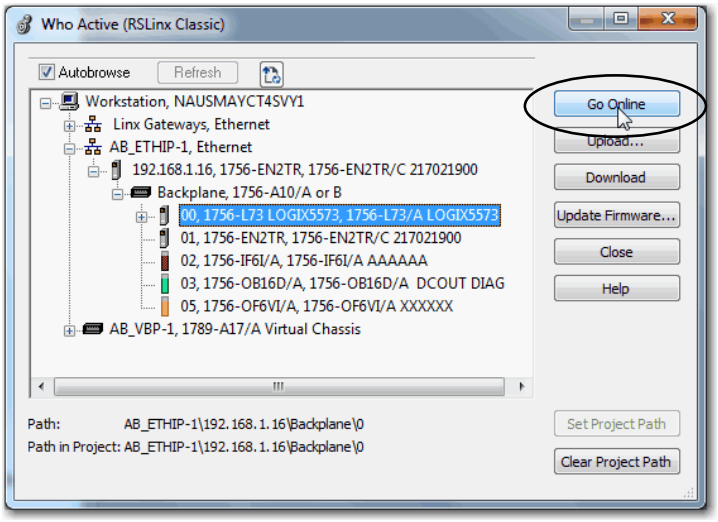


3. Click Set Project Path.

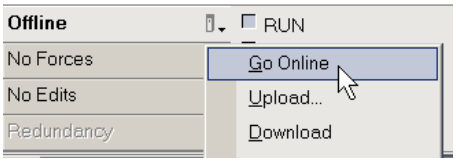
Go Online with the Controller

Use one of these methods to go online with the controller:

- After setting the communication path, click Go Online in the Who Active dialog box.



- From the Controller Status menu, choose Go Online.



Download to the Controller

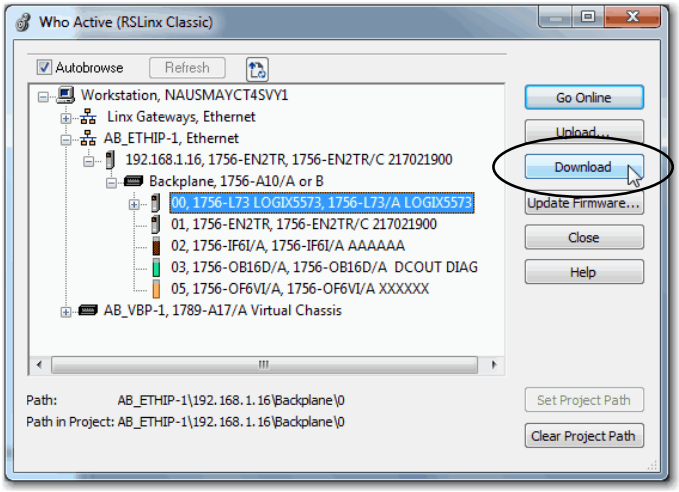
When you download a project to the controller, it moves the project from the Logix Designer application onto the controller. You can download a project in two ways:

- Use the Who Active Dialog Box to Download on page 62
- Use the Controller Status Menu to Download on page 63

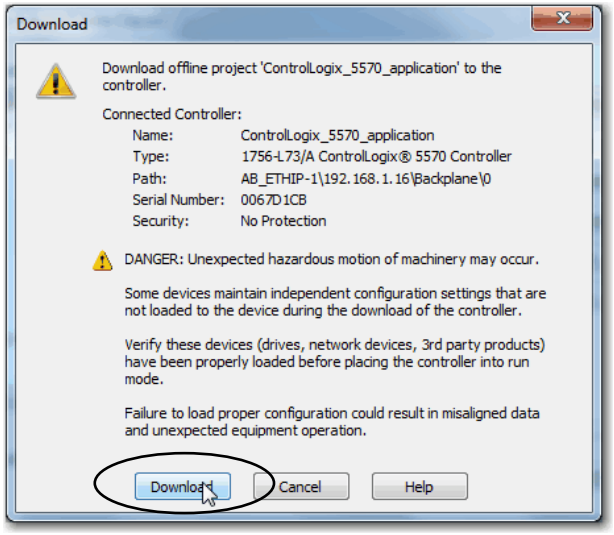
Use the Who Active Dialog Box to Download

You can use the features of the Who Active dialog box to download to your controller after you have set the communication path. Complete these steps to download to the controller.

1. After setting the communication path, click Download in the Who Active dialog box.



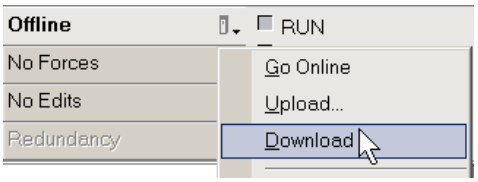
2. Read the warnings on the Download dialog box and click Download.



Use the Controller Status Menu to Download

After you set a communication path in the Logix Designer application, you can use the Controller Status menu to download to the controller. To download, from the Controller Status menu, choose Download.

Figure 4 - Download Via the Controller Status Menu



TIP After the download completes on a 1756-L7*x* controller, the project name is indicated on the scrolling status display.

Upload from the Controller

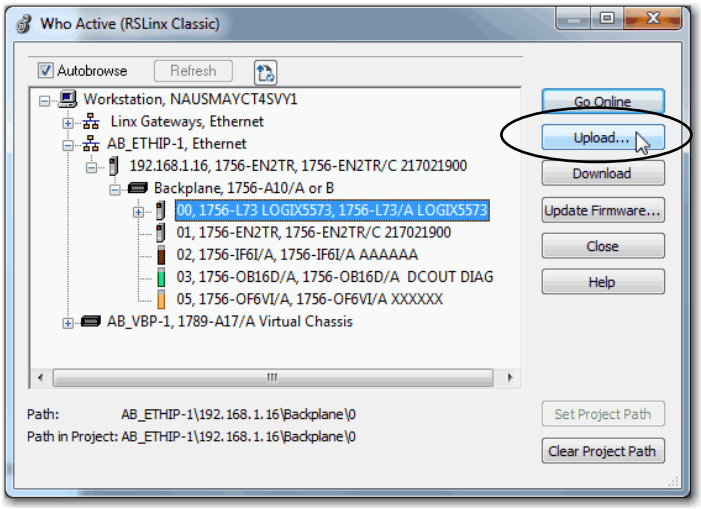
When you upload a project to the controller, it copies the project from the controller to the Logix Designer application. To upload a project, use one of these methods:

- Use the Who Active Dialog Box to Upload, page 63
- Use the Controller Status Menu to Upload, page 64

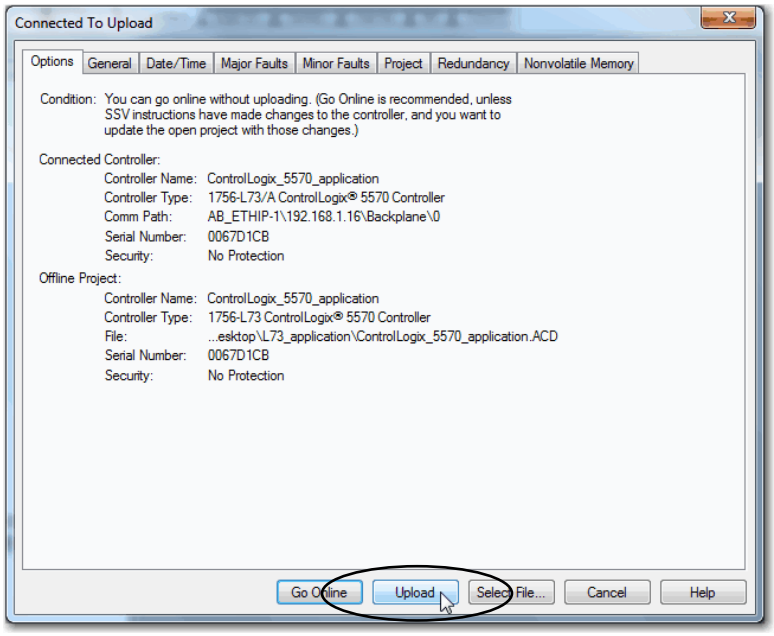
Use the Who Active Dialog Box to Upload

You can use the features of the Who Active dialog box to upload from your controller after you have set the communication path. Complete these steps to upload from the controller.

1. After setting the communication path, click Upload in the Who Active dialog box.



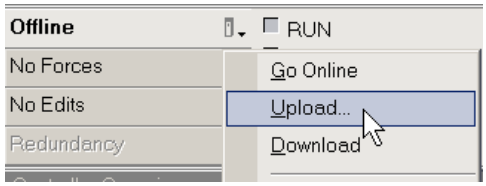
2. Click Upload after verifying the project that you are uploading in the Connected to Upload dialog box.



Use the Controller Status Menu to Upload

After you have set a communication path in the project, you can use the Controller Status menu to upload from the controller. To upload, from the Controller Status menu, choose Upload.

Figure 5 - Upload Via the Controller Status Menu



Choose the Controller Operation Mode

Use Table 13 as a reference when determining your controller Operation mode.

Table 13 - Controller Operation Modes and Meanings

If you want to	Select one of these modes				
	Run	Remote			Program
		Run	Test	Program	
Turn outputs to the state commanded by the logic of the project	X	X			
Turn outputs to their configured state for Program mode			X	X	X
Execute (scan) tasks	X	X	X		
Change the mode of the controller via Logix Designer application		X	X	X	
Download a project		X	X	X	X
Schedule a ControlNet network				X	X
While online, edit the project		X	X	X	X
Send messages	X	X	X		
Send and receive data in response to a message from another controller	X	X	X	X	X
Produce and consume tags	X	X	X	X	X

Use the Mode Switch to Change the Operation Mode

Use the mode switch to change the operation mode. The controller mode switch provides a mechanical means to enhance controller and control system security. You must physically move the mode switch on the controller to change its operating mode from RUN, to REM, or to PROG. When the mode switch on the controller is set to RUN mode, features like online editing, program downloads, and firmware upgrades are prohibited. See Table 13 for a complete list of prohibited features.

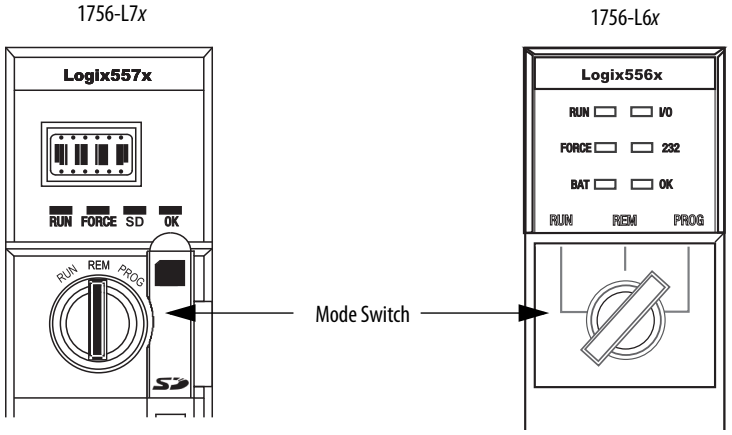
The physical mode switch can complement other authorization and authentication methods that similarly control user-access to the controller, such as the following:

- Logix CPU Security tool
- FactoryTalk® Security service

IMPORTANT During runtime, we recommend that you place the controller mode switch in RUN mode and remove the key (if applicable) from the switch. This can help discourage unauthorized access to the controller or potential tampering with the program of the controller, configuration, or device firmware. Place the mode switch in REM or PROG mode during controller commissioning and maintenance and whenever temporary access is necessary to change the program, configuration, or firmware of the product.

The mode switch on the front of the controller can be used to change the controller to one of these modes:

- Run (RUN)
- Remote (REM)
- Program (PROG)



Mode Switch Position	Available Controller Modes	ATTENTION:
RUN	**Run mode**—The controller is actively controlling the process/machine. Projects cannot be edited in the Logix Designer application when in Run mode.	Run mode is used only when all conditions are safe.
REM	**Remote Run mode**—This mode is identical to Run mode except you can edit the project online.	You are able to modify a project file online in Remote Run mode. Be sure to control outputs with care to avoid injury to personnel and damage to equipment.
	Remote Program mode—This mode is identical to Program mode.	
	Remote Test mode—The controller mode during which code is executing. I/O is not controlled, and limited editing operations are available. Output modules are commanded to their Program mode state (on, off, or hold).	Outputs are commanded to their Program mode state, which can cause a dangerous situation.
	Note: The mode of the controller can be changed from within the Logix Designer application.	
PROG	**Program mode**—The controller mode during which programming language is not executing. I/O is not controlled, and limited editing operations are available. Output modules are commanded to their Program mode state (On, Off, or Hold). In this position, controller modes cannot be changed through the Logix Designer application.	Do not use Program mode as an emergency stop (E-stop). Program mode is not a safety device. Outputs are commanded to their Program mode state, which can cause a dangerous situation.

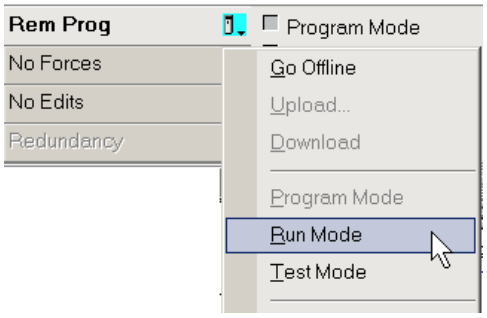
Use Logix Designer to Change the Operation Mode

Dependent on the mode of the controller you specify by using the mode switch, you can change the Operation mode of the controller in the Logix Designer application.

After you are online with the controller and the controller mode switch is set to Remote (REM or the center position), you can use the Controller Status menu in the upper-left corner of the application window to specify these operation modes:

- Remote Program
- Remote Run
- Remote Test

Figure 6 - Operation Mode



TIP For this example, the controller mode switch is set to Remote mode. If your controller mode switch is set to Run or Program modes, the menu options change.

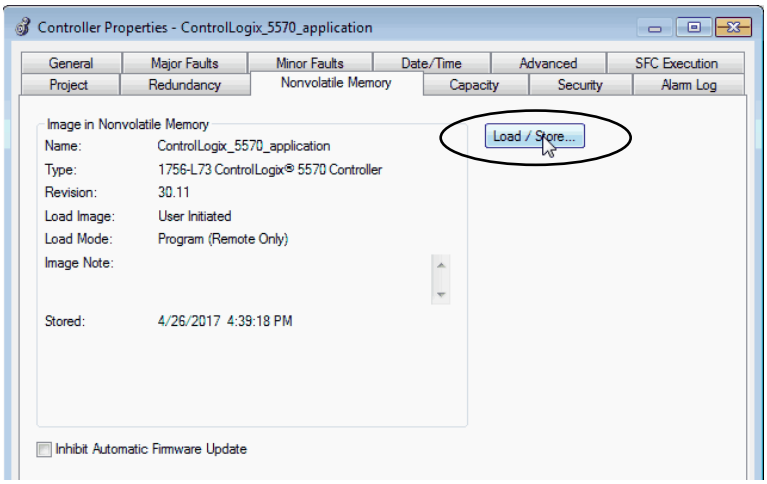
Load or Store to the Memory Card

The memory card that is compatible with your ControlLogix controller is used to load or store the contents of user memory for the controller.

Store to the Memory Card

After you are online with the controller and have changed the controller to Program or Remote Program mode, complete these steps to store a project to the memory card.

1. Open the Controller Properties dialog box and click the Nonvolatile Memory tab.
2. Click Load/Store.



TIP If Load/Store is dimmed (unavailable), verify the following:

- You have specified the correct communication path and are online with the controller in Program mode.
- The memory card is installed.
- With the 1756-L7*x* controllers, if the SD card is locked, Store is dimmed (unavailable) and the locked status is indicated in the bottom-left corner of the Nonvolatile memory/Load Store dialog box. See step 4.

If the memory card is not installed, a message in the lower-left corner of the Nonvolatile Memory tab indicates the missing card as shown here.

3. Change the Load Image, Load Mode, and Automatic Firmware Update properties according to your application requirements.

   The following table describes the Load Image options that you can choose for the project.

   IMPORTANT If the SD card is locked and the Load Image option of the project is set to On Power Up, the controller firmware is not updated as a result of a firmware upgrade. The previously stored firmware and project are loaded instead.

If you want the image (project) to load when	Then choose
Power to the controller is applied or cycled	On Power Up
The controller has lost the project and power has been cycled or applied	On Corrupt Memory
Initiated via the Logix Designer application	User Initiated

   The following table describes the Load Mode options that you can choose for the project.

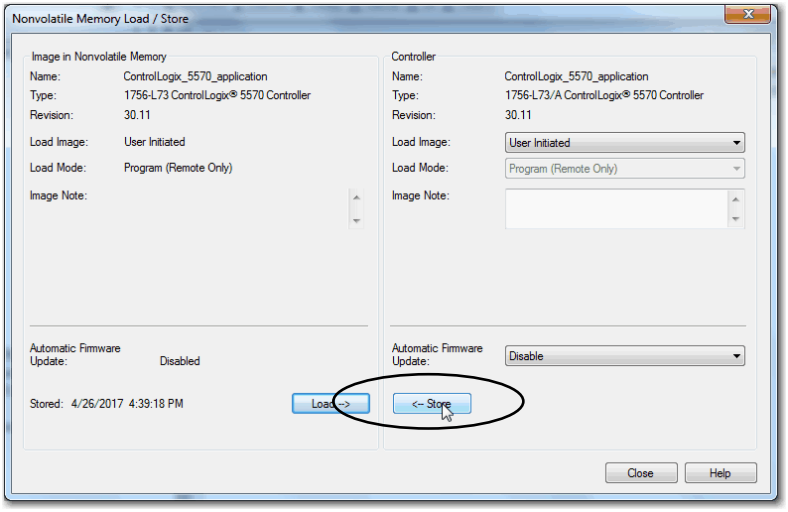
If you want the controller to go to this mode after loading	Then choose
Program	Program (remote only)
Run	Run (remote only)

   The following table describes the Automatic Firmware Update options that you can choose for the project. The Automatic Firmware Update property is also referred to as the Firmware Supervisor feature.

If you want to	Then choose
Enable automatic firmware updates so I/O devices in the configuration tree of the controller that are configured to use Exact Match Keying are updated as required	Enable and Store Files to Image(1)
Disable automatic firmware updates and remove any I/O firmware files that are stored with the image	Disable and Delete Files from Image
Disable automatic firmware updates when there are no firmware files are stored with the image	Disable

(1) The devices that are used with this option must support the revision of firmware being updated to.

4. Click Store.



5. If a confirmation dialog box appears, click Yes.

The project is saved to the memory card as indicated by the controller status indicators.

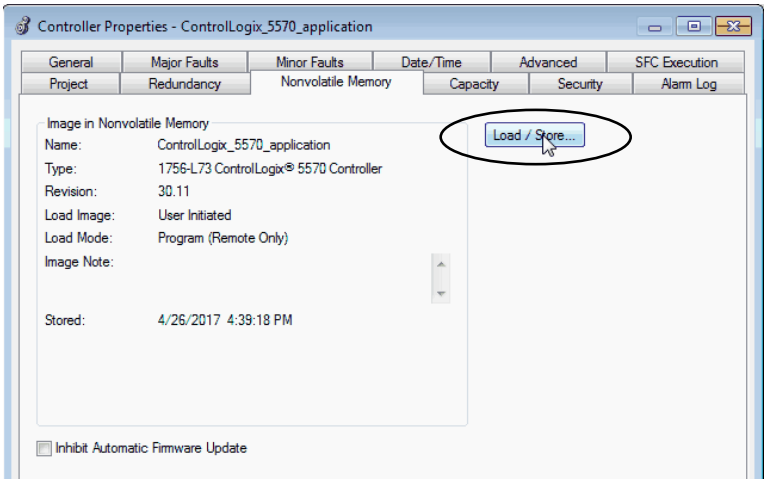
With these controllers	These indications show the store status
1756-L6*x*	While the store is **in progress**, the following occurs: • OK indicator on the controller is solid red • A dialog box in the Logix Designer application indicates that the store is in progress When the store is **complete**, the following occurs: • OK indicator on the controller is momentarily red, then solid green
1756-L7*x*	While the store is **in progress**, the following occurs: • OK indicator is flashing green • SD indicator is flashing green • SAVE is shown on the status display • A dialog box in the Logix Designer application indicates that the store is in progress When the store is **complete**, the following occurs: • OK indicator on the controller is momentarily red, then solid green • SD indicator on the controller is Off

IMPORTANT Allow the store to complete without interruption. If you interrupt the store, data corruption or loss can occur.

Load from the Memory Card

After you have set the communication path, are online with the controller, and have changed the controller to Program mode, complete these steps to load a project to the controller from the memory card.

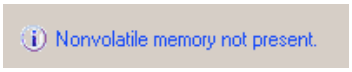
1. Open the Controller Properties and click the Nonvolatile Memory tab.
2. Click Load/Store.



TIP If Load/Store is dimmed (unavailable), verify the following:

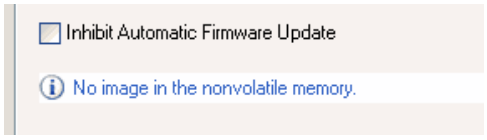
- You have specified the correct communication path and are online with the controller.
- The memory card is installed.

If the memory card is not installed, a message in the lower-left corner of the Nonvolatile Memory tab indicates the missing card as shown here.



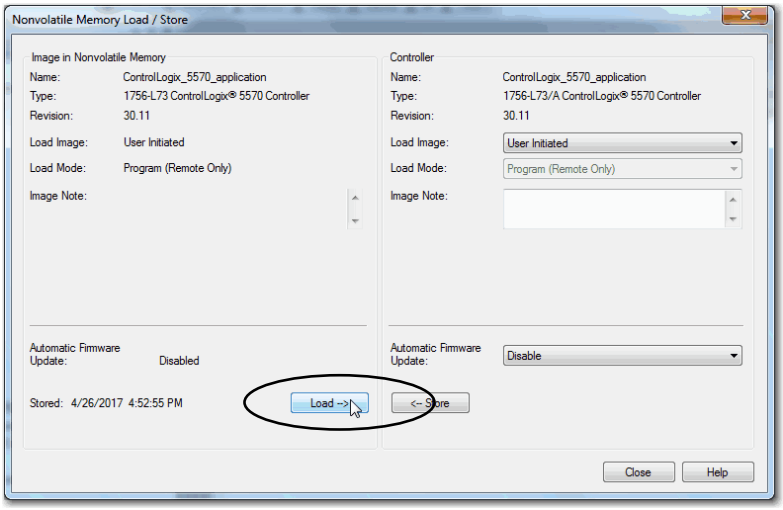
3. Verify that the image in nonvolatile memory (that is, the project on the memory card) is the project that you want to load.

TIP If no project is stored on the memory card, a message in the lower-left corner of the Nonvolatile Memory tab indicates that an image (or project) is not available as shown here.



TIP For information to change the project that is available to load from nonvolatile memory, see the Logix5000™ Controllers Nonvolatile Memory Programming Manual, publication 1756-PM017.

4. Click Load.



5. If a confirmation dialog box appears, click Yes.

   The project is loaded to the controller as indicated by the controller status indicators.

With these controllers	These indications show the store status
1756-L6*x*	While the **load is in progress**, the following occurs: • OK indicator on the controller is flashing green • A dialog box in the Logix Designer application indicates that the store is in progress When the **load is complete**, the following occurs: • OK indicator on the controller is momentarily red, then solid green
1756-L7*x*	While the **load is in progress**, the following occurs: • OK indicator is solid red • SD indicator is flashing green • LOAD is shown on the status display • UPDT can be shown on the status display if the firmware is also updating with the load • A dialog box in the Logix Designer application indicates that the store is in progress When the **load is complete**, the following occurs: • OK indicator on the controller is momentarily red, then solid green • SD indicator on the controller is Off

IMPORTANT Allow the load to complete without interruption. If you interrupt the load, data corruption or loss can occur.

Other Memory Card Tasks

Other tasks that you can complete by using the memory cards of the controller include the following:

- Change the image that is loaded from the card
- Check for a load that was completed
- Clear an image from the memory card
- Store an empty image
- Change load parameters
- Read/write application data to the card

For more information to complete any of these tasks, see the Logix5000 Controllers Memory Card Programming Manual, publication 1756-PM017.

Use ControlLogix Energy Storage Modules (ESMs)

You can use the ControlLogix ESMs to execute one of the following tasks:

- Provide power to 1756-L7*x* controllers to save the program to the on-board nonvolatile storage (NVS) memory of the controller after power is removed from the chassis or the controller is removed from a powered chassis.

  IMPORTANT When you are using an ESM to save the program to on-board NVS memory, you are **not** saving the program to the SD card installed in the controller.

- Clear the program from the on-board NVS memory of the 1756-L7x controller. For more information, see Clear the Program from On-board NVS Memory.

This table describes the energy storage modules (ESM).

Cat. No.	Description
1756-ESMCAP	Capacitor-based ESM The 1756-L7*x* controllers come with this ESM installed.
1756-ESMNSE	Capacitor-based ESM without WallClockTime back-up power Use this ESM if your application requires that the installed ESM deplete its residual stored energy to 40µJ or less before transporting it into or out of your application. Additionally, you can use this ESM with only a 1756-L73 (8 MB) or smaller memory-sized controller.
1756-ESMNRM	Secure capacitor-based ESM (non-removable) This ESM provides your application an enhanced degree of security by blocking physical access to the USB connector and the SD card.

Save the Program to On-board NVS Memory

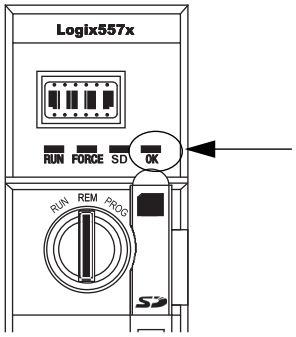
Follow these steps to save the program to NVS memory when the controller loses power.

1. Remove power from the controller.

   You can remove power in one of two ways:
   - Turn power off to the chassis while the controller is installed in the chassis.
   - Remove the controller from a powered chassis.

   Immediately after the controller is no longer powered, the program starts saving while the OK status indicator is green (this green is a dimmer green than normal operation), then turns red after program save is complete. Once the ESM stops operating, it turns off.

   This graphic shows the OK status indicator on the controller.



2. Leave the ESM on the controller until the OK status indicator is Off.

Clear the Program from On-board NVS Memory

If your application lets you, follow these steps to clear the program from the on-board NVS memory of the 1756-L7x controller.

1. Remove the ESM from the controller.
2. Remove power from the controller.

   You can remove power in one of the following two ways:
   - Turn power off to the chassis while the controller is installed in the chassis.
   - Remove the controller from a powered chassis.
3. Reinstall the ESM into the controller.
4. Restore power to the controller in one of these two ways:
   - If the controller is installed in the chassis, turn power back onto the chassis.
   - If the controller is not installed into the chassis, reinstall the controller into the chassis and turn power back onto the chassis.

Estimate the ESM Support of the WallClockTime

The ESM provides support for the maintenance of the WallClockTime of the controller when power is not applied. Use this table to estimate the hold-up time of the ESM based on the temperature of the controller and installed ESM.

	Hold-up Time (in days)		
Temperature	**1756-ESMCAP**	**1756-ESMNRM**	**1756-ESMNSE**
20 °C (68 °F)	12	12	0
40 °C (104 °F)	10	10	0
60 °C (140 °F)	7	7	0

IMPORTANT Any action that causes the 1756-L7*x* controller to reset (hard or soft), without an ESM installed, results in the controller's wal clock time of the controller being reset to the factory default of 01/01/1998.

To check the status of the ESM, see General Status Messages on page 186.

Maintain the Battery (Only 1756-L6*x* Controllers)

This section explains how to monitor and maintain the lithium batteries that the ControlLogix controllers support.

Table 14 - 1756-L6*x* Controllers and Compatible Batteries

Cat. No.	Series	Compatible Battery
1756-L61 1756-L62 1756-L63	A	1756-BA1 **or** 1756-BATA **or** 1756-BATM
1756-L61 1756-L62 1756-L63 1756-L64 1756-L65	B	1756-BA2
1756-L63XT	B	

For further information, see the Additional Resources section in the preface.

Check the Battery Status

When the battery is approximately 95% discharged, these low-battery warnings are indicated:

- The BAT is solid red.
- A minor fault (type 10, code 10) is logged.

IMPORTANT To prevent possible battery leakage, even if the BAT status indicator is off, replace a battery according to this schedule.

If the temperature 2.54 cm (1 in.) below the chassis is	Replace the battery within
-25…35 °C (-13…95 °F)	No replacement required
36…40 °C (96.8…104 °F)	3 years
41…45 °C (105.8…113 °F)	2 years
46…50 °C (114.8…122 °F)	16 months
51…55 °C (123.8…131 °F)	11 months
56…70 °C (132.8…158 °F)	8 months

1756-BA1 or 1756-BATA Battery Life

To estimate how long a 1756-BA1 or 1756-BATA battery can support controller memory on 1756-L6*x*, series A controllers, perform this procedure.

1. Determine the temperature 2.54 cm (1 in.) below the chassis.
2. Determine the weekly percentage of time that the controller is turned on.

EXAMPLE If a controller is Off at one of these times:

- 8 hr/day during a 5-day work week
- All day Saturday and Sunday

Then the controller is off 52% of the time:

- Total hours per week = 7 x 24 = 168 hrs
- Total off hours per week = (5 days x 8 hr/day) + Saturday + Sunday = 88 hrs
- Percentage off time = 88/168 = 52%

3. Determine the estimated worst-case battery life before and after the BAT status indicator turns on.
4. For each year of battery life, decrease the time before the BAT status indicator turns on by the percentage that is shown in the table.

   Do not decrease the time after the BAT status indicator turns on.

IMPORTANT If the BAT status indicator turns on when you apply power to the controller, the remaining battery life can be less than Table 15 indicates. Some of the battery life can be used up while the controller is off and unable to turn on the BAT status indicator.

Table 15 - Worst-case Estimates of 1756-BA1 Battery Life

Temperature	Battery Life Before BAT Status Indicator Turns On			Battery Life After BAT Status Indicator Turns On and Power is Off
	Power Off 100%	Power Off 50%	Yearly Decrease	
60 °C (140 °F)	22 days	43 days	23%	6 hrs
25 °C (77 °F)	21 days	42 days	17%	28 hrs
0 °C (32 °F)	14 days	28 days	17%	2.5 days

Table 16 - Worst-case Estimates of 1756-BATA Battery Life

Temperature	Battery Life Before BAT Status Indicator Turns On			Battery Life After BAT Status Indicator Turns On and Power is Off
	Power Off 100%	Power Off 50%	Yearly Decrease	
60 °C (140 °F)	98 days	204 days	11%	104 days
25 °C (77 °F)	146 days	268 days	5%	157 days
0 °C (32 °F)	105 days	222 days	6%	113 days

1756-BATM Battery Module and Battery Life

Use the 1756-BATM battery module with any 1756-L6*x*/A controller. The battery module is highly recommended for higher-memory controllers.

IMPORTANT If your project is not stored in nonvolatile memory, the use of the battery module is highly recommended.

When the 1756-BATA battery within the 1756-BATM module is approximately 50% discharged, these low-battery warnings are indicated:

- The BAT is solid red.
- A minor fault (type 10, code 10) is logged.

Estimate 1756-BA2 Battery Life

The 1756-BA2 batteries are for use in 1756-L6*x*/B controllers. Use Table 17 to estimate how much time can elapse before the battery becomes low.

Table 17 - Worst-case Estimates of 1756-BA2 Life according to Temperatures and Power Cycles

Temperature 2.54 cm (1 in.) Below the Chassis, max	Power Cycles	Battery Life Before the BAT Status Indicator Turns Red				
		Project Size				
		1 MB	2 MB	4 MB	8 MB	16 MB
-25…35 °C (-13…95 °F)	3 per day	3 years	3 years	26 months	20 months	10 months
	2 per day or less	3 years	3 years	3 years	31 months	16 months
41…45 °C (105.8…113 °F)	3 per day	2 years	2 years	2 years	20 months	10 months
	2 per day or less	2 years	2 years	2 years	2 years	16 months
46…50 °C (105.8…113 °F)	3 per day or less	16 months	16 months	16 months	16 months	10 months
51…55 °C (123.8…131 °F)	3 per day or less	11 months	11 months	11 months	11 months	10 months
56…70 °C (132.8…158 °F)	3 per day or less	8 months	8 months	8 months	8 months	8 months

Estimate 1756-BA2 Battery Life After Warnings

Use this table to estimate the battery life after the low-battery warnings are indicated. Use these times even if the controller does not have power because there is a small power-drain on the battery.

IMPORTANT When you power up the controller, see if there is a low-battery warning. If you get a low-battery warning for the first time, you have less battery life than this table shows. While powered down, the controller still drains the battery but it cannot give the low-battery warning.

Temperature 2.54 cm (1 in.) Below the Chassis, max	Power Cycles	Battery Life After the BAT Status Indicator Turns Red (worst case)				
		Project Size				
		1 MB	2 MB	4 MB	8 MB	16 MB
0…20 °C (32…68 °F)	3 per day	26 weeks	18 weeks	12 weeks	9 weeks	5 weeks
	1 per day	26 weeks	26 weeks	26 weeks	22 weeks	13 weeks
	1 per month	26 weeks	26 weeks	26 weeks	26 weeks	26 weeks
21…40 °C (69.8…104 °F)	3 per day	18 weeks	14 weeks	10 weeks	8 weeks	5 weeks
	1 per day	24 weeks	21 weeks	18 weeks	16 weeks	11 weeks
	1 per month	26 weeks	26 weeks	26 weeks	26 weeks	26 weeks
41…45 °C (105.8…113 °F)	3 per day	12 weeks	10 weeks	7 weeks	6 weeks	4 weeks
	1 per day	15 weeks	14 weeks	12 weeks	11 weeks	8 weeks
	1 per month	17 weeks	17 weeks	17 weeks	17 weeks	16 weeks
46…50 °C (105.8…113 °F)	3 per day	10 weeks	8 weeks	6 weeks	6 weeks	3 weeks
	1 per day	12 weeks	11 weeks	10 weeks	9 weeks	7 weeks
	1 per month	12 weeks	12 weeks	12 weeks	12 weeks	12 weeks
51…55 °C (123.8…131 °F)	3 per day	7 weeks	6 weeks	5 weeks	4 weeks	3 weeks
	1 per day	8 weeks	8 weeks	7 weeks	7 weeks	5 weeks
	1 per month	8 weeks	8 weeks	8 weeks	8 weeks	8 weeks
56…60 °C (132.8…140 °F)	3 per day	5 weeks	5 weeks	4 weeks	4 weeks	2 weeks
	1 per day	6 weeks	6 weeks	5 weeks	5 weeks	4 weeks
	1 per month	6 weeks	6 weeks	6 weeks	6 weeks	6 weeks

EXAMPLE Under these conditions, the battery lasts at least 20 months before the BAT status indicator turns red:

- The maximum temperature 2.54 cm (1 in.) below the chassis = 45 °C (113 °F).
- You cycle power to the controller three times per day.
- The controller contains an 8 MB project.

Battery Storage and Disposal

Follow these general rules to store your batteries:

- Store batteries in a cool, dry environment. We recommend 25 °C (77 °F) with 40…60% relative humidity.
- You can store batteries for up to 30 days in temperatures from -45…85 °C (-49…185 °F), such as during transportation.
- To avoid leakage or other hazards, do not store batteries above 60 °C (140 °F) for more than 30 days.

This product contains a sealed lithium battery that needs to be replaced during the life of the product.

At the end of its life, the battery contained in this product should be collected separately from any unsorted municipal waste.

The collection and recycling of batteries helps protect the environment and contributes to the conservation of natural resources as valuable materials are recovered.

ControlLogix System and Controllers

ControlLogix System

The ControlLogix® system is chassis-based and provides the option to configure a control system that uses sequential, process, motion, drive control, and communication and I/O capabilities.

Configuration Options

This section describes some of the many system configuration options that are available with ControlLogix controllers.

Standalone Controller and I/O

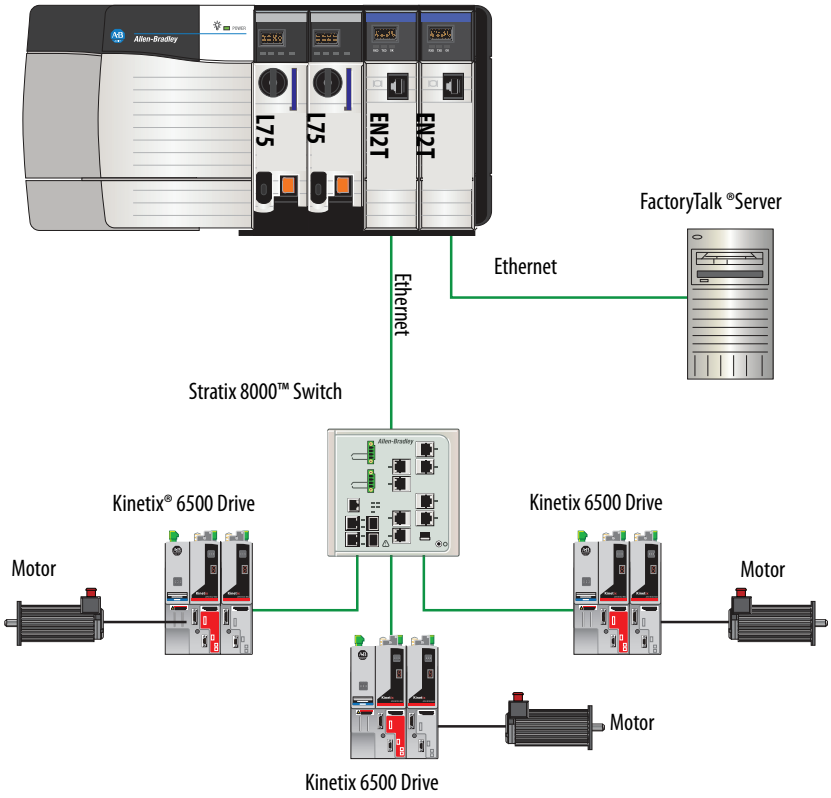
One of the simplest ControlLogix configurations is a standalone controller with I/O assembled in one chassis.

Figure 7 - Standalone Controller and I/O5

Multiple Controllers in One Chassis

For some applications, multiple controllers can be used in one ControlLogix chassis. For example, for better performance, multiple controllers can be used in motion applications.

Figure 8 - Multiple Controllers in One Chassis

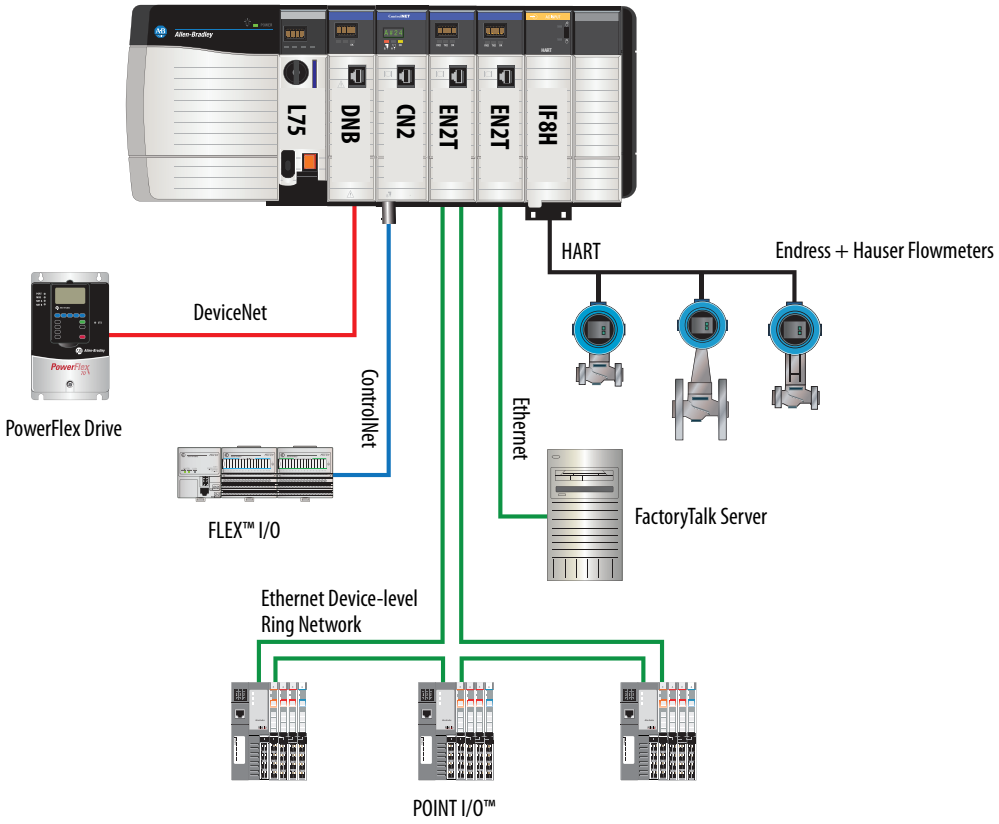


Multiple Devices Connected Via Multiple Networks

For some applications, various devices can be connected to the ControlLogix chassis via multiple communication networks. For example, a system can be connected to the following:

- Distributed I/O via an Ethernet network
- A PowerFlex® drive connected via a DeviceNet network
- Flowmeters that are connected via a HART connection

Figure 9 - Multiple Devices Connected Via Multiple Networks



Design a ControlLogix System

When you design a ControlLogix system, there are several system components to consider for your application. Some of these components include the following:

- I/O devices
- Motion control and drive requirements
- Communication modules
- Controllers
- Chassis
- Power supplies
- Studio 5000® environment

For more information to design and select components for your ControlLogix system, see the ControlLogix Selection Guide, publication 1756-SG001.

See the Additional Resources section in the preface for more information if you are designing your ControlLogix System for any of the following applications:

- Motion with Integrated Motion on the EtherNet/IP network
- Motion with the use of a coordinate system
- Motion with sercos or analog motion
- Enhanced redundancy
- Standard redundancy
- SIL2
- SIL2 fault-tolerant I/O with Studio 5000 subroutines
- SIL2 fault-tolerant I/O with Studio 5000 Add-On Instructions

ControlLogix Controller Features

The ControlLogix controllers are part of the Logix5000™ family of controllers that are offered by Rockwell Automation. The sections that follow describe the differentiating features of the ControlLogix controllers.

System, Communication, and Programming Features

Table 18 lists the system, communication, and programming features available with ControlLogix controllers.

Table 18 - ControlLogix Controller Features

Feature	1756-L61, 1756-L62, 1756-L63, 1756-L64, 1756-L65	1756-L71, 1756-L72, 1756-L73, 1756-L74, 1756-L75	1756-L72EROM, 1756-L73EROM
Controller tasks	• 32 tasks • 100 programs/task • Event tasks: all event triggers	• 32 tasks • 1000 programs/task • Event tasks: all event triggers	
Communication ports	1 port - RS-232 serial	1 port - USB, 2.0 full-speed, Type B	
Communication options	• EtherNet/IP • ControlNet • DeviceNet • Data Highway Plus™ • Remote I/O • SynchLink • Third-party process and device networks		EtherNet/IP
Serial port communication	• ASCII • DF1 full/half-duplex • DF1 radio modem • DH-485 • Modbus via logic	N/A	
Controller connections supported, max	250	500	
Network connections, per network module	• 128 ControlNet (1756-CN2/B) • 100 ControlNet (1756-CN2/A) • 40 ControlNet (1756-CNB) • 256 EtherNet/IP; 128 TCP (1756-EN2*x*) • 128 EtherNet/IP; 64 TCP (1756-ENBT)		256 EtherNet/IP; 128 TCP (1756-EN2*x*)
Controller redundancy	Full support except for motion applications		
Integrated motion	• Integrated Motion on the EtherNet/IP network • Sercos interface • Analog options: – Encoder input – LDT input – SSI input		
Programming languages	• Relay ladder • Structured text • Function block • Sequential function chart (SFC)		

Memory Options

The ControlLogix controller is available in different combinations of user memory. Use Table 19 to determine which controller meets your memory requirements.

Table 19 - ControlLogix Controller Memory Options

Controller	Memory for Data and Logic	I/O	Back-up Memory
1756-L61	2 MB	478 KB	CompactFlash card(1)
1756-L62	4 MB		
1756-L63, 1756-L63XT	8 MB		
1756-L64	16 MB		
1756-L65	32 MB		
1756-L71	2 MB	0.98 MB (1006 KB)	SD card
1756-L72	4 MB		
1756-L73, 1756-L73XT	8 MB		
1756-L74	16 MB		
1756-L75	32 MB		
1756-L72EROM	4 MB		
1756-L73EROM	8 MB		

(1) These nonvolatile memory cards are optional and do not come with the controller.

IMPORTANT The 1756-L7*x* controllers ship with an SD card installed. We recommend that you leave the SD card installed, so if a fault occurs, diagnostic data is automatically written to the card and Rockwell Automation can use the data to troubleshoot the anomaly.

IMPORTANT We recommend that you use the SD cards available from Rockwell Automation (catalog numbers 1784-SD1 or 1784-SD2).

While other SD cards can be used with the controller, Rockwell Automation has not tested the use of those cards with the controller. If you use an SD card other than those cards that are available from Rockwell Automation, you can experience data corruption or loss.

Also, SD cards that are not provided by Rockwell Automation can have different industrial, environmental, and certification ratings as those cards that are available from Rockwell Automation and can have difficulty with survival in the same industrial environments as the industrially rated versions available from Rockwell Automation.

Electronic Keying

Electronic Keying reduces the possibility that you use the wrong device in a control system. It compares the device that is defined in your project to the installed device. If keying fails, a fault occurs. These attributes are compared.

Attribute	Description
Vendor	The device manufacturer.
Device Type	The general type of the product, for example, digital I/O module.
Product Code	The specific type of the product. The Product Code maps to a catalog number.
Major Revision	A number that represents the functional capabilities of a device.
Minor Revision	A number that represents behavior changes in the device.

The following Electronic Keying options are available.

Keying Option	Description
Compatible Module	Lets the installed device accept the key of the device that is defined in the project when the installed device can emulate the defined device. With Compatible Module, you can typically replace a device with another device that has the following characteristics: • Same catalog number • Same or higher Major Revision • Minor Revision as follows: – If the Major Revision is the same, the Minor Revision must be the same or higher. – If the Major Revision is higher, the Minor Revision can be any number.
Disable Keying	Indicates that the keying attributes are not considered when attempting to communicate with a device. With Disable Keying, communication can occur with a device other than the type specified in the project. **ATTENTION**: Be extremely cautious when using Disable Keying; if used incorrectly, this option can lead to personal injury or death, property damage, or economic loss. **We strongly recommend that you do not use Disable Keying.** If you use Disable Keying, you must take full responsibility for understanding whether the device being used can fulfill the functional requirements of the application.
Exact Match	Indicates that all keying attributes must match to establish communication. If any attribute does not match precisely, communication with the device does not occur.

Carefully consider the implications of each keying option when selecting one.

IMPORTANT Changing Electronic Keying parameters online interrupts connections to the device and any devices that are connected through the device. Connections from other controllers can also be broken.

If an I/O connection to a device is interrupted, the result can be a loss of data.

More Information

For more detailed information on Electronic Keying, see Electronic Keying in the Logix5000 Control Systems Application Technique, publication LOGIX-AT001.

Notes:

Communication Networks

Networks Available

Several communication networks are available for use with ControlLogix® systems. Table 20 describes typical network applications that are used with ControlLogix systems and lists the networks available to support such applications.

Table 20 - Applications and Supported Networks

Application Type	Supported Networks
Integrated Motion	EtherNet/IP
Integrated Motion on the EtherNet/IP network for time synchronization	EtherNet/IP
Control of distributed I/O	• ControlNet • DeviceNet • EtherNet/IP • Foundation Fieldbus • HART • Universal remote I/O
Produce/consume data between controllers	• ControlNet • EtherNet/IP
Messaging to and from other devices, including access to the controller via the Studio 5000 Logix Designer® application	• ControlNet • DeviceNet (only to devices) • Data Highway Plus™ (DH+) • DH-485 • EtherNet/IP • Serial

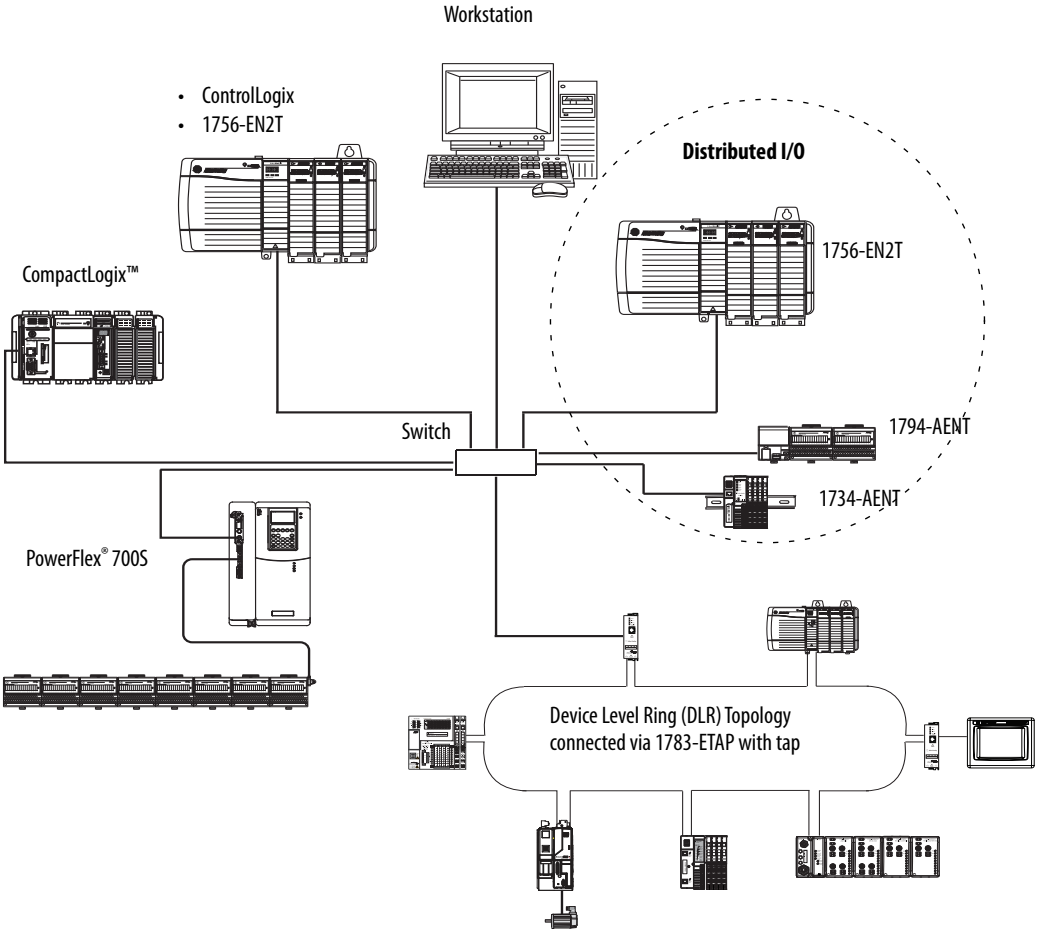
For more information about network design for your system, see the Ethernet Design Considerations Reference Manual, publication ENET-RM002.

EtherNet/IP Network Communication

The EtherNet/IP network offers a full suite of control, configuration, and data collection services by layering the Common Industrial Protocol (CIP) over the standard internet protocols, such as TCP/IP and UDP. This combination of well-accepted standards provides the capability that is required to support information data exchange and control applications.

The EtherNet/IP network uses commercially available Ethernet components and physical media, providing you with a cost-effective plant-floor solution.

Figure 10 - EtherNet/IP Network Example



For more information about using EtherNet/IP modules, see the EtherNet/IP Modules in Logix5000™ Control Systems User Manual, publication ENET-UM001.

ControlLogix EtherNet/IP Module Features

The ControlLogix EtherNet/IP communication modules provide these features:

- Support for messaging, produced/consumed tags, HMI, and distributed I/O
- The ability to encapsulate messages within the standard TCP/UDP/IP protocol
- A common application layer with ControlNet and DeviceNet networks
- Network connections via an RJ45 cable
- Support half/full duplex 10 MB or 100 MB operation
- Support standard switches

ControlLogix EtherNet/IP Communication Modules

For EtherNet/IP network communication in a ControlLogix system, you have a number of modules to choose from. Table 21 lists their primary features.

Table 21 - EtherNet/IP Communication Modules and Capabilities

Module	Is used to
1756-ENBT	• Connect controllers to I/O modules (requires an adapter for distributed I/O). • Communicate with other EtherNet/IP devices (messages). • Serve as a pathway to share data between Logix5000 controllers (produce/consume). • Bridge EtherNet/IP nodes to route messages to devices on other networks.
1756-EN2T	• Perform the same functions as a 1756-ENBT module, with twice the capacity for more demanding applications. • Provide a temporary configuration connection via the USB port. • Configure IP addresses quickly by using rotary switches. • Supports as many as 8 CIP Motion axes
1756-EN2F	• Perform the same functions as a 1756-EN2T module. • Connect fiber media by an LC fiber connector on the module.
1756-EN2TR	• Perform the same functions as a 1756-EN2T module. • Support communication on a ring topology for a Device Level Ring (DLR) single-fault tolerant ring network.
1756-EN2TRXT	• Perform the same functions as a 1756-EN2T module. • Support communication on a ring topology for a Device Level Ring (DLR) single-fault tolerant ring network. • Operate in extreme environments with -25…+70 °C (-13…+158 °F) temperatures.
1756-EN3TR	• Perform the same functions as the 1756-EN2TR module. • Extended Integrated Motion on EtherNet/IP network. • Support of up to 128 motion axes.
1756-EN2TSC	• Perform the same functions as a 1756-ENBT module, with twice the capacity for more demanding applications. • Provide a temporary configuration connection via the USB port. • Configure IP addresses quickly by using rotary switches.
1756-EN2TXT	• Perform the same functions as a 1756-EN2T module. • Operate in extreme environments with -25…+70 °C (-13…+158 °F) temperatures.
1756-EWEB	• Provide customizable web pages for external access to controller information. • Provide remote access via an internet browser to tags in a local ControlLogix controller. • Communicate with other EtherNet/IP devices (messages). • Bridge EtherNet/IP nodes to route messages to devices on other networks. • Support Ethernet devices that are not EtherNet/IP-based with a socket interface. This module does not provide support for I/O or produced/consumed tags.

Software for EtherNet/IP Networks

Table 22 lists software that is used with the EtherNet/IP networks and modules

Table 22 - Software for Use with EtherNet/IP Networks

Software	Is used to	Required or Optional
Logix Designer application	• Configure ControlLogix projects. • Define EtherNet/IP communication.	Required
RSLinx® Classic or RSLinx Enterprise	• Configure communication devices. • Provide diagnostics. • Establish communication between devices.	Required
BOOTP/DHCP Utility	Assign IP addresses to devices on an EtherNet/IP network.	Optional
RSNetWorx™ for EtherNet/IP™	• Configure EtherNet/IP devices by IP addresses and/or host names. • Provide bandwidth status.	

Connections Over an EtherNet/IP Network

You indirectly determine the number of connections the controller uses by configuring the controller to communicate with other devices in the system. Connections are allocations of resources that provide more reliable communication between devices as compared to unconnected messages.

All EtherNet/IP connections are unscheduled. The requested packet interval (RPI) for I/O control or the program, such as a MSG instruction triggers an unscheduled connection. Unscheduled messaging lets you send and receive data when needed.

Double Data Rate (DDR) Backplane Communication

DDR communication can be achieved with the 1756-L7*x* controller. The following communication modules support DDR when used with the 1756-L7*x* controller. Minimum series are indicated as follows:

- 1756-EN2T/C
- 1756-EN2TR/B
- 1756-EN2TF/B
- 1756-EN2TXT/C
- 1756-EN3TR/A
- 1756-RM/B
- 1756-RM2/A

DDR communication is achieved most efficiently when all modules in the communication path are DDR modules, or, in other words, as one conversation (connection) only between DDR modules.

DDR communication is achievable in a chassis with a mix of DDR and non-DDR modules. The DDR communication occurs between the modules that support it. If non-DDR modules are also in the chassis, communication between those modules is at the non-DDR rate.

For example, you can have a chassis with two 1756-L7*x* controllers in slots 0 and 1 communicating with each other by using DDR, and two 1756-L6*x* controllers in slots 2 and 3 communicating by using non-DDR.

When multicast communication is used within a chassis to multiple modules, the transmission rate is limited to the slowest module—or at the non-DDR rate.

For example, if a 1756-L7*x* controller is producing a tag to a 1756-L7*x* controller **and** a 1756-L6*x* controller on the same multicast connection, it must use the non-DDR rate.

ControlNet Network Communication

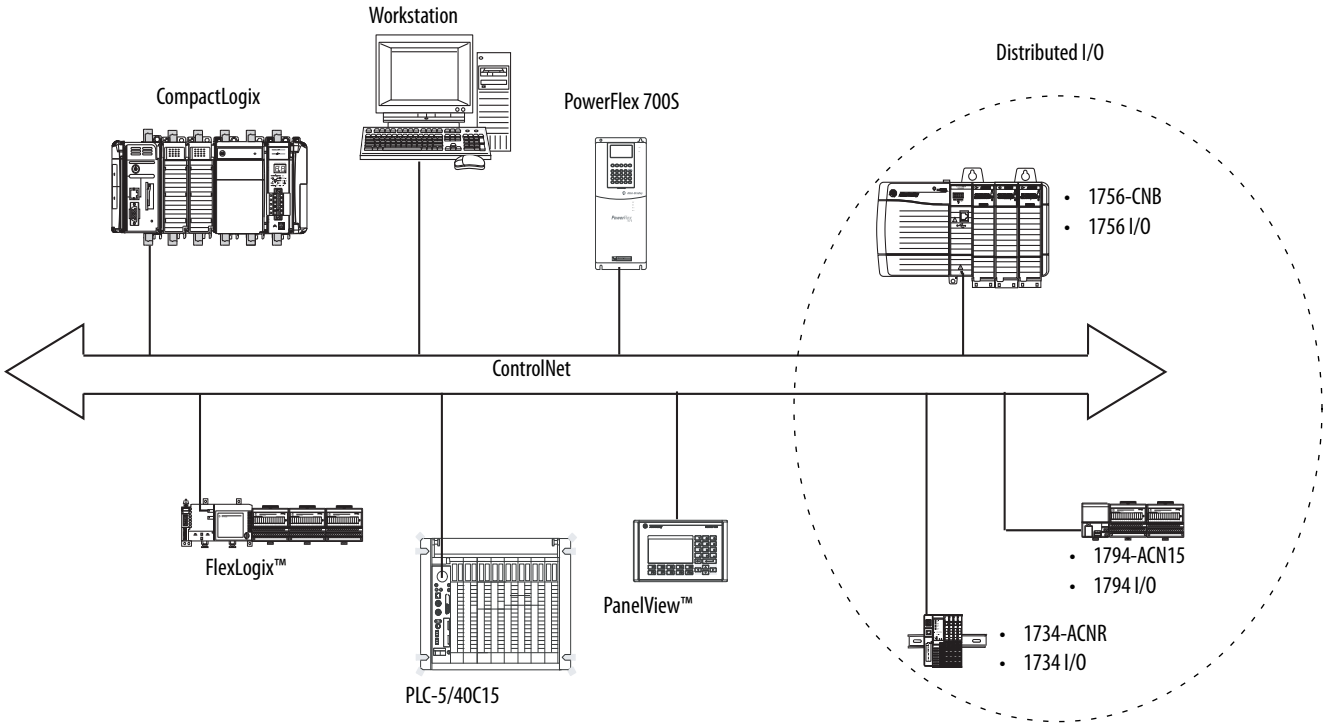
The ControlNet network is a real-time control network that provides high-speed transport of time-critical I/O and interlocking data and messaging data. This includes the upload and download of program and configuration data on one physical-media link. The highly efficient data transfer capability of the ControlNet network significantly enhances I/O performance and peer-to-peer communication in any system or application.

The ControlNet network is highly deterministic and repeatable and is unaffected when devices are connected or disconnected from the network. This quality results in dependable, synchronized, and coordinated real-time performance.

The ControlNet network often functions as the following:

- A substitute/replacement for the remote I/O (RIO) network because the ControlNet network adeptly handles large numbers of I/O points
- A backbone for multiple distributed DeviceNet networks
- A peer interlocking network

Figure 11 - ControlNet Network Overview



In this example, these actions occur via the ControlNet network:

- The controllers produce and consume tags.
- The controllers initiate MSG instructions that do the following:
  - Send and receive data.
  - Configure devices.
- The workstation is used to do the following:
  - Configure the ControlNet devices and the ControlNet network.
  - Download and upload projects from the controllers.

For more information about using ControlNet modules, see ControlNet Modules in Logix5000 Control Systems User Manual, publication CNET-UM001.

ControlLogix ControlNet Module Features

The ControlNet communication modules provide these features:

- Support for messaging, produced/consumed tags, and distributed I/O
- Use a common application layer with DeviceNet and EtherNet/IP networks
- Requires no routing tables
- Support the use of coax and fiber repeaters for isolation and increased distance
- Support redundant media (only 1756-CNBR, 1756-CN2R, and 1756-CN2RXT modules)

ControlLogix ControlNet Modules

Table 23 lists the available ControlLogix ControlNet modules and their primary features.

Table 23 - ControlNet Modules and Capabilities

Module	Is used to
1756-CNB	• Control I/O modules. • Communicate with other ControlNet devices (messages). • Share data with other Logix5000 controllers (produce/consume). • Bridge ControlNet links to route messages to devices on other networks.
1756-CNBR	• Perform the same functions as a 1756-CNB module. • Support redundant ControlNet media.
1756-CN2	• Perform the same functions as a 1756-CNB module. • Provide twice the capacity for more demanding applications.
1756-CN2R	• Perform the same functions as a 1756-CN2 module. • Support redundant ControlNet media.
1756-CN2RXT	• Perform same functions as a 1756-CN2R module. • Operate in extreme environments with -25…+70 °C (-13…+158 °F) temperatures.

Software for ControlNet Networks

Table 24 lists software that is used with the ControlNet networks and modules.

Table 24 - Software for Use with ControlNet Networks

Software	Is used to	Required or Optional
Logix Designer application	• Configure ControlLogix projects. • Define ControlNet communication.	Required
RSNetWorx™ for ControlNet™	• Configure ControlNet devices. • Schedule a network.	
RSLinx Classic or Enterprise	• Configure communication devices. • Provide diagnostics. • Establish communication between devices.	

Connections Over a ControlNet Network

You indirectly determine the number of connections the controller uses by configuring the controller to communicate with other devices in the system. Connections are allocations of resources that provide communication between devices as compared to unconnected messages.

Table 25 - ControlNet Connections

Connection	Definition
Scheduled (unique to a ControlNet network)	A scheduled connection is unique to ControlNet communication. A scheduled connection lets you send and receive data repeatedly at a predetermined interval, which is the requested packet interval (RPI). For example, a connection to an I/O module is a scheduled connection because you repeatedly receive data from the module at a specified interval. Other scheduled connections include connections to the following: • Communication devices • Produced/consumed tags On a ControlNet network, you must use RSNetWorx for ControlNet software to enable all scheduled connections and establish a network update time (NUT). A scheduled connection reserves network bandwidth specifically to handle the connection.
Unscheduled	An unscheduled connection is a message transfer between devices that the requested packet interval (RPI) or the program, such as a MSG instruction, triggers. Unscheduled messaging allows you to send and receive data when you must: Unscheduled connections use the remainder of network bandwidth after scheduled connections are allocated.

ControlNet Module Connections

The 1756-CNB and 1756-CNBR communication modules support 64 CIP connections over a ControlNet network. However, for optimal performance, configure a maximum of 48 connections for each module.

The 1756-CN2, 1756-CN2R, and 1756-CN2RXT communication modules support 128 connections over a ControlNet network, all of which can be configured without risk of performance degradation.

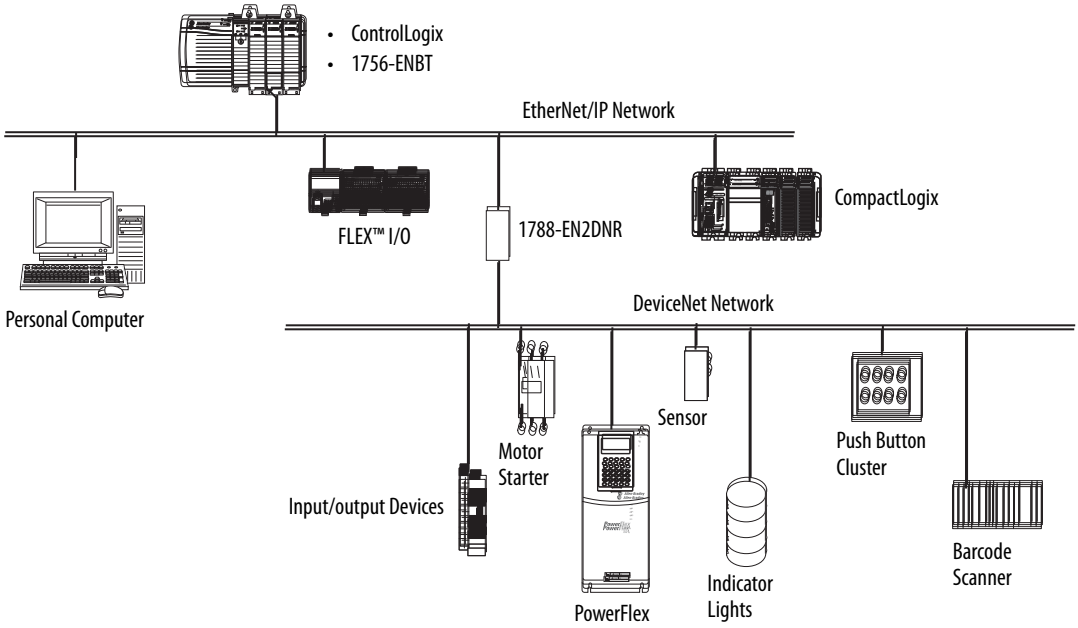
DeviceNet Network Communication

The DeviceNet network uses the Common Industrial Protocol (CIP) to provide the control, configuration, and data collection capabilities for industrial devices. The DeviceNet network uses the proven Controller Area Network (CAN) technology, which lowers installation costs and decreases installation time and costly downtime.

A DeviceNet network provides access to the intelligence present in your devices by letting you connect devices directly to plant-floor controllers without having to hard-wire each device into an I/O module.

With a ControlLogix system, DeviceNet communication requires the use of a 1756-DNB DeviceNet communication module.

Figure 12 - ControlLogix DeviceNet Network Overview



In this example, the ControlLogix controller is connected to the DeviceNet network and devices via the 1788-EN2DNR linking device.

For more information about using DeviceNet modules and devices, see DeviceNet Modules in Logix5000 Control Systems User Manual, publication DNET-UM004.

ControlLogix DeviceNet Module Features

The DeviceNet communication module provides these features:

- Supports messaging to devices (not controller to controller)
- Shares a common application layer with ControlNet and EtherNet/IP networks
- Offers diagnostics for improved data collection and fault detection
- Requires less wiring than standard, hard-wired systems

ControlLogix DeviceNet Bridge Module and Linking Devices

Table 26 lists the available ControlLogix DeviceNet bridge and linking devices that can be used with the DeviceNet network.

Table 26 - DeviceNet Communication Modules and Capabilities

Module/Device	Is used to
1756-DNB	• Control I/O modules. • Communicate with other DeviceNet devices (via messages).
1788-EN2DNR	Link an EtherNet/IP network to a DeviceNet network.
1788-CN2DN	Link a ControlNet network to a DeviceNet network.

Software for DeviceNet Networks

Table 27 lists software that is used with the DeviceNet networks and modules.

Table 27 - Software for Use with DeviceNet Networks

Software	Is used to	Required or Optional
Logix Designer application	• Configure ControlLogix projects. • Define DeviceNet communication.	Required
RSNetWorx™ for DeviceNet™	• Configure DeviceNet devices. • Define the scan list for those devices.	
RSLinx Classic or Enterprise	• Configure communication devices. • Provide diagnostics. • Establish communication between devices.	

Connections Over DeviceNet Networks

The ControlLogix controller requires two connections for each 1756-DNB module. One connection is for module status and configuration. The other connection is a rack-optimized connection for the device data.

ControlLogix DeviceNet Module Memory

The 1756-DNB module has fixed sections of memory for the input and output data of the DeviceNet devices on the network. Each device on your network requires some input or output memory of the scanner. Some devices send and receive data, so they need input and output memory. The 1756-DNB module supports up to add the following:

- 124 DINTs of input data
- 123 DINTs of output data

Data Highway Plus (DH+) Network Communication

For DH+™ network communication, you have two module options for use in the ControlLogix chassis. Table 28 lists the DH+ modules and capabilities.

Table 28 - DH+ Modules and Capabilities

RIO Module	Is used to
1756-DHRIO	• Function as a remote I/O (RIO) scanner. • Support 32 logical rack connections or 16 block transfer connections per channel. • Establish connections between controllers and I/O adapters. • Distribute control so that each controller has its own I/O.
1756-DHRIOXT	• Function as a remote I/O (RIO) scanner. • Support 32 logical rack connections or 16 block transfer connections per channel. • Establish connections between controllers and I/O adapters. • Distribute control so that each controller has its own I/O. • Operate in extreme environments with -25…70 °C (-13…158 °F) temperatures.

For DH+ network communication, use a 1756-DHRIO or 1756-DHRIOXT module in the ControlLogix chassis to exchange information between these controllers:

- PLC and SLC™ controllers
- ControlLogix controllers and PLC or SLC controllers
- ControlLogix controllers

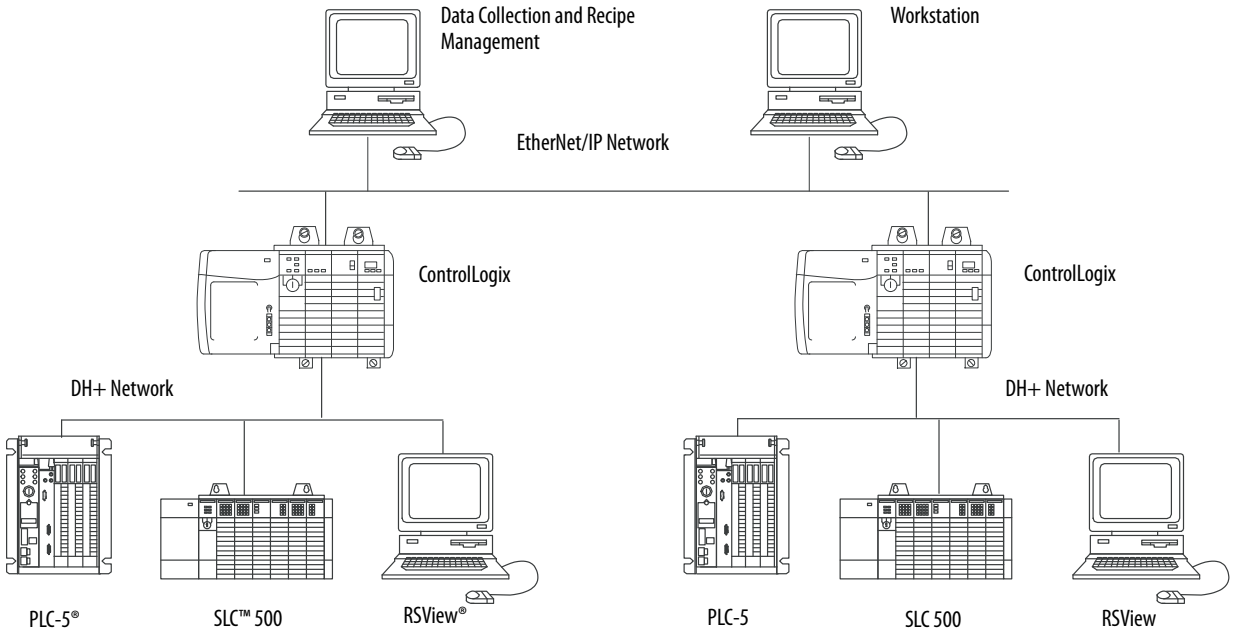
The DH+ network also provides the following:

- Data exchange between controllers
- Plant-wide data sharing
- Cellular level data sharing

You can connect a maximum of 32 stations to one DH+ link:

- Channel A supports 57.6 Kbps, 115.2 Kbps, and 230.4 Kbps.
- Channel B supports 57.6 Kbps and 115.2 Kbps.

Figure 13 - ControlLogix DH+ Network Communication Example



Communicate Over a DH+ Network

For the controller to communicate to a workstation or other device over a DH+ network, use RSLinx Classic software to do the following:

- Specify a unique link ID for each ControlLogix backplane and additional network in the communication path.
- Configure the routing table for the 1756-DHRIO or 1756-DHRIOXT module.

The 1756-DHRIO or 1756-DHRIOXT module can route a message through up to four communication networks and three chassis. This limit applies only to the routing of a message and not to the total number of networks or chassis in a system.

For more information to configure and use a DH+ network via the 1756-DHRIO or 1756-DHRIOXT module, see the Data Highway Plus-Remote I/O Communication Interface Module User Manual, publication 1756-UM514.

Universal Remote I/O (RIO) Communication

For universal remote I/O communication, you have two module options for use in the ControlLogix chassis. Table 29 lists the RIO modules and capabilities.

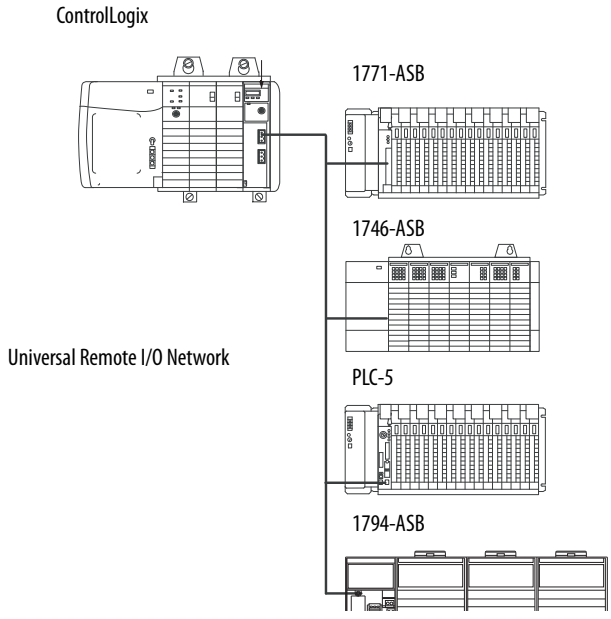
Table 29 - RIO Modules and Capabilities

RIO Module	Is used to
1756-RIO	• Function as an RIO scanner and adapter. • Support connections to 32 racks in any combination of rack size or block transfers. • Update data to the ControlLogix controller by using scheduled connections.
1756-DHRIO	• Function as an RIO scanner. • Support 32 logical rack connections or 16 block transfer connections per channel. • Establish connections between controllers and I/O adapters. • Distribute control so that each controller has its own I/O.
1756-DHRIOXT	• Function as an RIO scanner. • Support 32 logical rack connections or 16 block transfer connections per channel. • Establish connections between controllers and I/O adapters. • Distribute control so that each controller has its own I/O. • Operate in extreme environments with -25…70 °C (-13…158 °F) temperatures.

When a channel on the 1756-DHRIO or 1756-DHRIOXT module is configured for remote I/O, the module acts as a scanner for a universal remote I/O network. The controller communicates to the module to send and receive the I/O data on the universal remote I/O network.

The 1756-RIO module can act as a scanner or adapter on a remote I/O network. The 1756-RIO module transfers digital, block transfer, analog, and specialty data without message instructions.

Figure 14 - ControlLogix Universal Remote I/O Communication Example



Communicate over a Universal Remote I/O Network

For the controller to control I/O over a universal remote I/O network, you must complete these tasks.

1. Configure the remote I/O adapter.
2. Lay out the remote I/O network cable.
3. Connect the remote I/O network cable.
4. Configure the scanner channel.

For more information to configure a remote I/O network with the 1756-RIO, 1756-DHRIO, or 1756-DHRIOXT modules, see these publications:

- Data Highway Plus-Remote I/O Communication Interface Module User Manual, publication 1756-UM514
- ControlLogix Remote I/O Communication Module User Manual, publication 1756-UM534

As you design your remote I/O network, remember the following:

- All devices that are connected to a remote I/O network must communicate by using the same communication rate. These rates are available for remote I/O:
  - 57.6 Kbps
  - 115.2 Kbps
  - 230.4 Kbps
- You must assign unique partial and full racks to each channel used in Remote I/O Scanner mode.

  Both channels of a 1756-DHRIO or 1756-DHRIOXT module cannot scan the same partial or full rack address. Both module channels can communicate to 00...37 octal or 40...77 octal, but each channel can communicate only with one address at a time in whichever of these two ranges it falls.

Foundation Fieldbus Communication

Foundation Fieldbus is an open interoperable fieldbus that is designed for process control instrumentation. The fieldbus devices that are described in Table 30 can be connected to the ControlLogix controller via another network as shown in the following example.

Table 30 - Fieldbus Devices and Capabilities

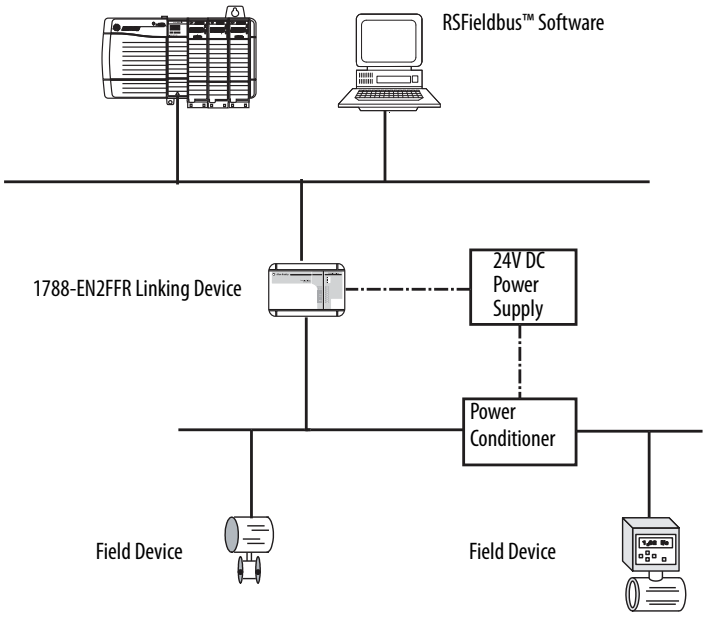
Fieldbus Device	Is used to
1788-EN2FFR	• Bridge an EtherNet/IP network to Foundation Fieldbus. • Connect via a low-speed serial (H1) and high-speed Ethernet (HSE) network connections. • Access devices directly via an OPC server.
1788-CN2FFR	• Connect via low-speed serial (H1) connections. • Bridge a ControlNet network to a Foundation Fieldbus. • Support redundant ControlNet media.

Foundation Fieldbus distributes and executes control in the device. The Foundation Fieldbus linking device does the following:

- Bridges from an EtherNet/IP network to an H1 connection
- Accepts HSE or EtherNet/IP messages and converts them to the H1 protocol

Figure 15 - Foundation Fieldbus Example

- ControlLogix
- 1756-ENBT



For more information about using the Foundation Fieldbus devices available from Rockwell Automation, see these publications:

- EtherNet/IP and ControlNet to FOUNDATION Fieldbus Linking Device User Manual, publication 1788-UM057
- FOUNDATION Fieldbus Design Considerations Reference Manual, publication PROCES-RM005

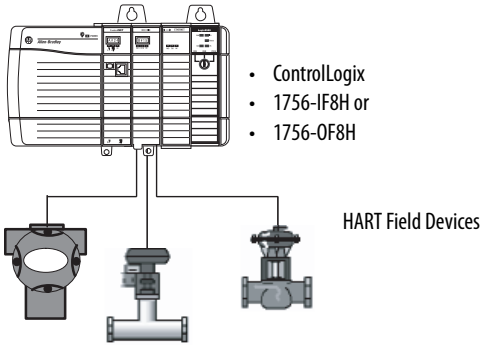
HART Communication

HART (Highway Addressable Remote Transducer) is an open protocol that is designed for process control instrumentation.

Device	Is used to
1756 analog HART I/O modules:	• Act as HART master to allow communication with HART field devices. • Interface directly with field devices (through built-in HART modems), which eliminates the need for external hardware and more wiring. • Provide access to more field device data, including voltage and current measurements. • Directly connect asset management software to HART devices. • Support differential wiring for environments where improved noise immunity is needed (input modules).
ProSoft interface MVI56-HART	• Acquire data or control application with slow update requirements, such as a tank farm. • Does not require external hardware to access HART signal. • Does not provide a direct connection to asset management software.

The HART protocol combines digital signals with analog signals to ready the digital signal for the Process Variable (PV). The HART protocol also provides diagnostic data from the transmitter.

Figure 16 - HART Protocol Example



For more information about using the HART I/O modules, see the ControlLogix HART Analog I/O Modules User Manual, publication 1756-UM533.

For more information about the ProSoft HART interface, see the ProSoft Technologies website at http://www.prosoft-technology.com.

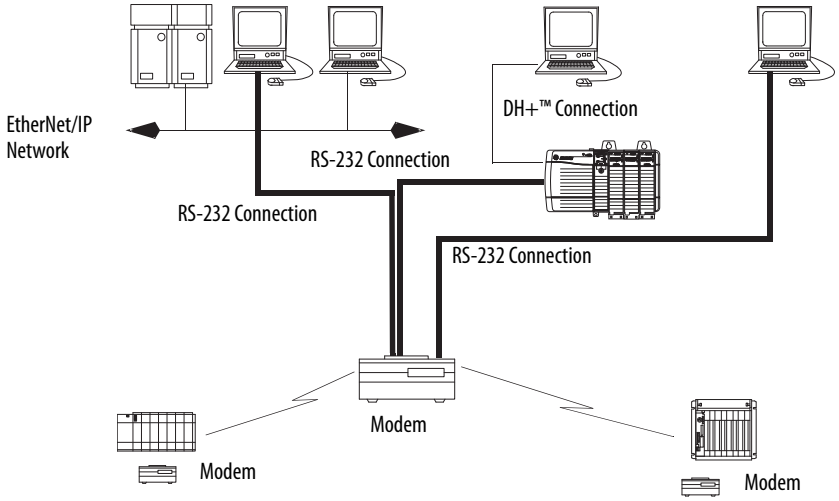
Serial Communication on 1756-L6*x* Controllers

1756-L6*x* Controller Serial Port

The 1756-L6*x* ControlLogix® controllers have a built-in RS-232 port that can be used in various serial-based applications. The potential serial communication applications include the following:

- DF1 modes (including broadcast message support)
- DF1 radio modem
- ASCII device communication

Figure 17 - ControlLogix DF1 Device Communication Example



ControlLogix Chassis Serial Communication Options

You can use the serial port of the ControlLogix controller or use ProSoft modules in the ControlLogix to achieve serial communication. Options specific to the ControlLogix controller serial port are described in this chapter.

For more information about ProSoft modules that can be used to establish serial communication, see the ProSoft Technology website or go to http://www.prosoft-technology.com and browse available products.

Communication with Serial Devices

When configuring the controller for serial communication, you first specify a Serial Port mode (System or User), then a protocol.

Figure 18 - Serial Port Mode in the Controller Properties

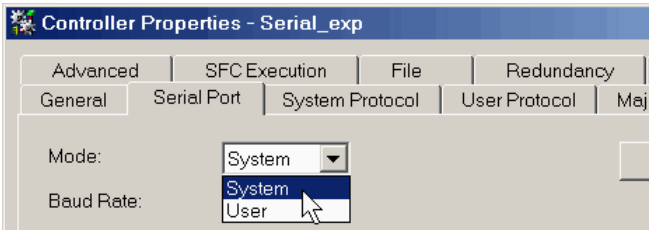


Table 31 describes the serial communication protocols for use with each mode.

Table 31 - Serial Port Modes, Protocols, and Uses

Mode	Protocol	Is used to	Page
System	DF1 Master	Control polling and message transmission between the master and slave nodes.	106
	DF1 Point to Point	• Communicate between the controller and one other DF1-protocol-compatible device. • Program the controller via the serial port.	107
	DF1 Radio Modem	• Communication with SLC 500™ and MicroLogix™ 1500 controllers. • This protocol supports master/slave and store/forward configurations.	107
	DF1 Slave	Configure the controller as a slave station in a master/slave serial communication network.	110
	DH-485	Communication with other DH-485 devices via a multi-master and token-passing network that enables programming and peer-to-peer messaging.	110
User	ASCII	• Communicate with ASCII devices. • Use ASCII instructions to read and write data from and to an ASCII device.	111

DF1 Master Protocol

The master/slave network includes one controller that is configured as the master node and up to 254 slave nodes. Link slave nodes by using modems or line drivers.

A master/slave network can have node numbers from 0...254. Each node must have a unique node address. Also, at least two nodes, one master and one slave, must exist to define your link as a network.

DF1 Point to Point Protocol

The DF1 Point to Point protocol is used when connecting from the controller to one DF1 device. DF1 Point to Point protocol is the default System mode protocol. Default parameters are listed in Table 32.

Table 32 - Default DF1 Point to Point Parameters

Parameter	Value
Baud Rate	19,200
Data Bits	8
Parity	None
Stop Bits	1
Control Line	No Handshake
RTS send Delay	0
RTS Off Delay	0

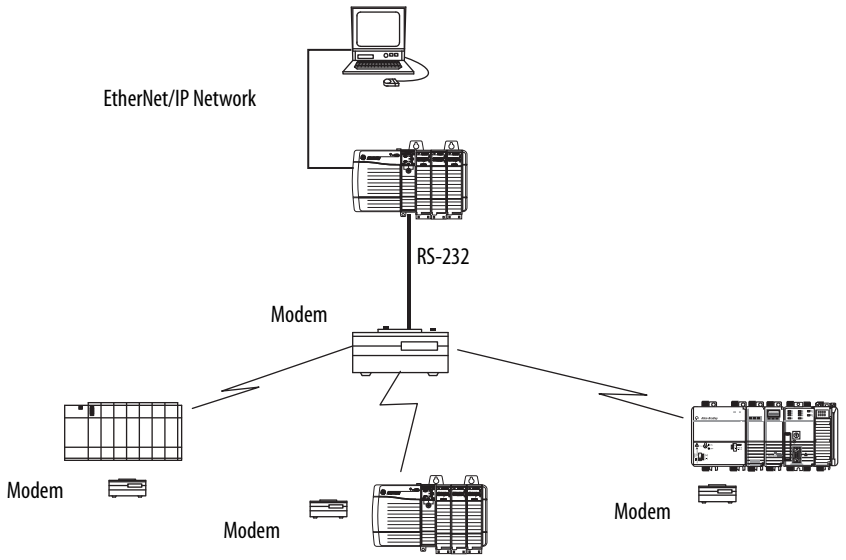
DF1 Radio Modem Protocol

Your ControlLogix controller includes a driver that lets it communicate over the DF1 Radio Modem protocol. The DF1 radio modem driver implements a protocol, optimized for use with radio modem networks, that is a hybrid between DF1 full-duplex protocol and DF1 half-duplex protocol, and therefore is not compatible with these protocols.

IMPORTANT The DF1 radio modem driver is used only among devices that support and are configured for the DF1 Radio Modem protocol.

Additionally, there are some radio modem network configurations that do not work with the DF1 radio modem driver. In these configurations, continue to use DF1 half-duplex protocol.

Figure 19 - DF1 Radio Modem Network Example



Like DF1 full-duplex protocol, the DF1 radio modem lets any node initiate to any other node at any time (that is, if the radio modem network supports full-duplex data-port buffering and radio-transmission collision avoidance). Like DF1 half-duplex protocol, a node ignores any packets received that have a destination address other than its own, except for broadcast packets and passthru packets.

Unlike DF1 full-duplex or DF1 half-duplex protocols, the DF1 radio modem protocol excludes ACKs, NAKs, ENQs, or poll packets. The CRC checksum verifies Data integrity.

DF1 Radio Modem Advantages

The primary advantage of using the DF1 radio modem protocol for radio modem networks is in transmission efficiency. Each read/write transaction (command and reply) requires only one transmission by the initiator (to send the command) and one transmission by the responder (to return the reply). This efficiency minimizes the number of times the radios must key-up to transmit, which maximizes radio life and minimizes radio power consumption.

In contrast, DF1 half-duplex protocol requires five transmissions for the DF1 master to complete a read/write transaction with a DF1 slave—three by the master and two by the slave.

The DF1 radio modem driver can be used in a pseudo master/slave mode with any radio modems, as long as the designated master node is the only node that initiates MSG instructions, and as long as only one MSG instruction is triggered at a time.

For modern serial radio modems that support full-duplex data port buffering and radio transmission collision avoidance, the DF1 radio modem driver can be used to configure a masterless peer-to-peer radio network, where any node can initiate communication to any other node at any time, as long as the nodes are within radio range so that they receive transmissions from each other.

DF1 Radio Modem Limitations

These considerations must be made if you can implement the new DF1 radio modem driver in your radio modem network:

- If the devices on the network are ControlLogix controllers, you must configure them with the DF1 radio modem driver via RSLogix 5000® software, version 17.01.02 or later or Logix Designer application, version 21.00.00 or later. If not, then make sure that the nodes can support the DF1 radio modem protocol.

- If each node receives the radio transmissions of each other node, being within radio transmission/reception range and on a common receiving frequency (via a Simplex radio mode or via one, common, full-duplex repeater) the radio modems must handle full-duplex data port buffering and radio transmission collision avoidance.

  If so, you can take full advantage of the peer-to-peer message initiation capability in each node (for example, the ladder logic in any node can trigger a MSG instruction to any other node at any time).

  If not all modems can handle full-duplex data port buffering and radio transmission collision avoidance, you can use the DF1 radio modem driver. Use the DF1 radio modem driver only if you limit MSG instruction initiation to one master node who transmits to each other node.

- If not all nodes receive the radio transmission of each other node, you can use the DF1 radio modem driver. Use the DF1 radio modem driver only if you limit MSG instruction initiation to the node connected to the master radio modem who transmits to each other radio modem in the network.

- You can take advantage of the ControlLogix controller channel-to-channel passthru to program the other nodes via RSLinx® Classic and Logix Designer applications that run on a personal computer that is connected to a local ControlLogix controller via DH-485, DH+, or Ethernet network.

DF1 Radio Modem Protocol Parameters

Use Table 33 as a reference when setting the parameters for the use of the DF1 Radio Modem Protocol.

Table 33 - DF1 Radio Protocol Parameters

Parameter	Description
Station Address	Specifies the node address of the controller on the serial network. Select a number 1…254 decimal, inclusive. To optimize network performance, assign node addresses in sequential order. Initiators, such as personal computers, are assigned the lowest address numbers to minimize the time that is required to initialize the network.
Error Detection	Click one of the radio buttons to specify the error detection scheme that is used for all messages. • BCC - the processor sends and accepts messages that end with a BCC byte. • CRC - the processor sends and accepts messages with a 2 byte CRC.
Enable Store and Forward	Check 'Enable Store and Forward' if you want to enable the store and forward functionality. When enabled, the destination address of any received message is compared to the Store and Forward tag table. If there is a match, the message is then forwarded (rebroadcasted) out the port. From the Store and Forward Tag pull-down menu, choose an integer (INT[16]) tag. Each bit is a station address. If this controller reads a message that is destined for a station that has its bit set in this table, it forwards the message.

DF1 Slave Protocol

With the DF1 slave protocol, a controller uses DF1 half-duplex protocol. One node is designated as the master and it controls who has access to the link. The other nodes are slave stations and must wait for permission from the master before transmitting.

Make these considerations when using the DF1 Slave protocol:

- If multiple slave stations are used on the network, link slave stations by using modems or line drivers to the master.
- If you are using one slave station on the network, you do not need a modem to connect the slave station to the master.
- Control parameters can be configured without handshaking.
- 2...255 nodes can be connected to one link.

DH-485 Protocol

The controller can send and receive messages to and from other controllers on a DH-485 network. The DH-485 connection supports remote programming and monitoring via the Logix Designer application. However, excessive traffic over a DH-485 connection can adversely affect overall controller performance and lead to timeouts and decreased performance of the configuration.

You can also use a 1756-DH485 module to connect the ControlLogix chassis to a DH-485 network with multiple controllers. For more information, see the ControlLogix DH-485 Communication Module User Manual, publication 1756-UM532.

IMPORTANT Use Logix5000™ controllers on DH-485 networks only when you want to add controllers to an existing DH-485 network.

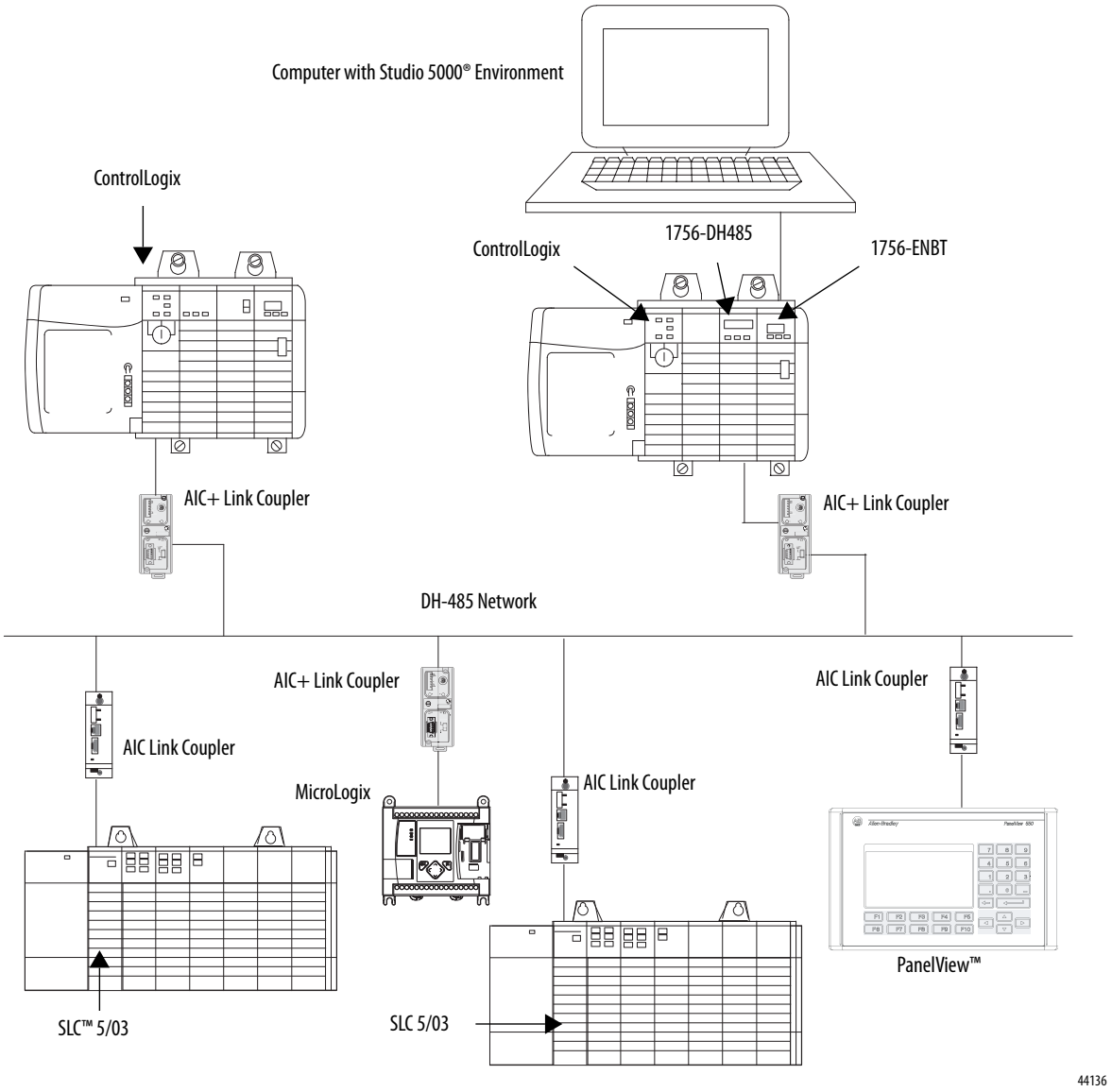
For new applications with Logix5000 controllers, we recommend that you use networks in the NetLinx open architecture.

The DH-485 protocol uses RS-485 half-duplex as its physical interface. RS-485 is a definition of electrical characteristics, not a protocol. You can configure the RS-232 port of the ControlLogix controller to act as a DH-485 interface.

To connect the controller to the DH-485 network, you must use these components:

- A 1761-NET-AIC converter (two controllers can be connected to one converter)
- An RS-232 cable (catalog number 1756-CP3 or 1747-CP3) for each controller to connect to the converter

Figure 20 - DH-485 Network Communication Overview



IMPORTANT A DH-485 network consists of multiple cable segments. Limit the total length of the segments to 1219 m (4000 ft).

ASCII Protocol

When you configure the serial port for User mode and the ASCII protocol, you can use it to do the following:

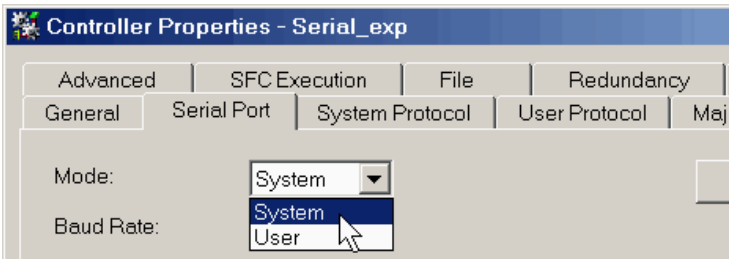
- Read ASCII characters from a weigh scale module or barcode reader.
- Send and receive messages from an ASCII-triggered device, such as a MessageView™ terminal.

After you configure the controller for use with the ASCII protocol, program the controller by using the ASCII instructions. Reference the Logix5000 Controllers General Instruction Reference Manual, publication 1756-RM003, for information about the ASCII instructions.

Configure the 1756-L6*x* Controller for Serial Communication

Complete these steps to configure your 1756-L6*x* controller for serial communication after creating a controller project in the Logix Designer application.

1. Open the Controller Properties and click the Serial Port tab.

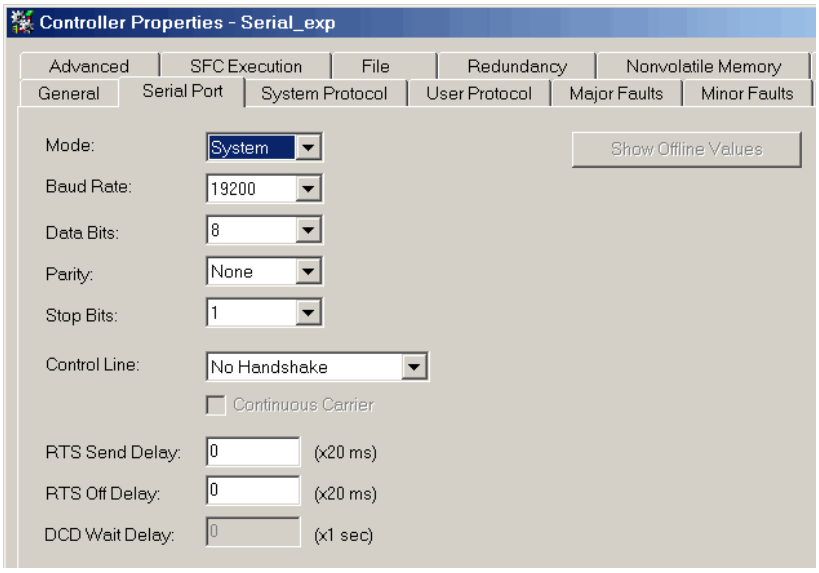


2. From the Mode pull-down menu, choose the mode that corresponds to your intended protocol.

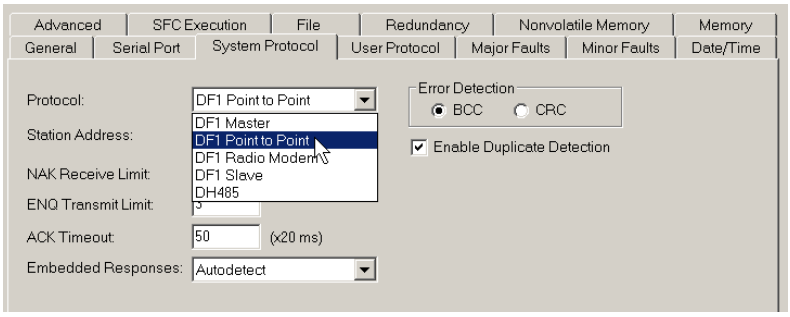
   Use this table as a reference.

For this protocol	Choose this mode
DF1 Master	System
DF1 Point to Point	
DF1 Radio Modem	
DF1 Slave	
DH-485	
ASCII	User

3. Specify the remaining properties in the Serial Port tab according to your communication preferences.

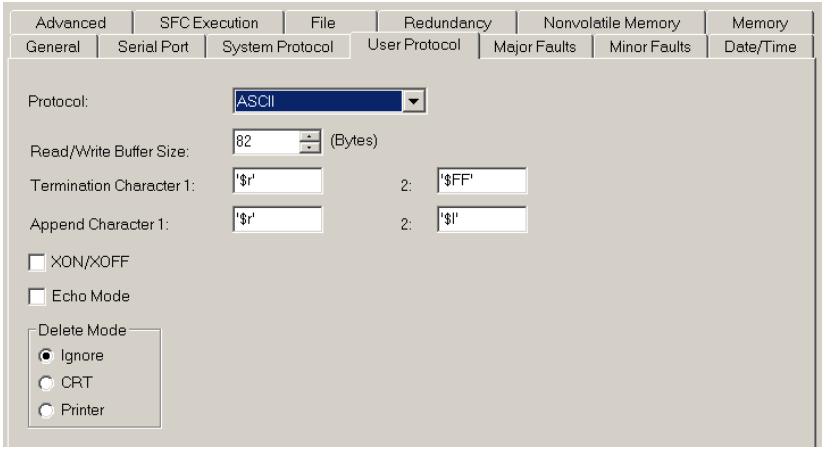


4. If you are using the System mode protocols, click the System Protocol tab and specify the protocol parameters.
   a. From the Protocol pull-down, choose the protocol that you need.



   b. Specify the parameters for the protocol.

5. If you are using the User mode protocol (ASCII), click the User Protocol tab and specify the ASCII parameters.



After you have configured the controller for ASCII protocol communication, reference the Logix5000 Controllers General Instruction Reference Manual, publication 1756-RM003, for the available ASCII instructions.

Broadcast Messages Over a Serial Port

You can broadcast messages over a serial port connection from a master controller to its slave controllers by using several communication protocols. These protocols include the following:

- DF1 Master
- DF1 Radio Modem
- DF1 Slave

Use the 'message' tag to broadcast over a serial port. Because messages are sent to receiving controllers, only the 'write' type messages can be used for broadcasting.

The broadcast feature can be configured by using ladder logic or structured text. The broadcast feature can also be set by modifying the path value of a message tag in the tag editor.

To configure and program the controller to broadcast messages via the serial port, complete these procedures:

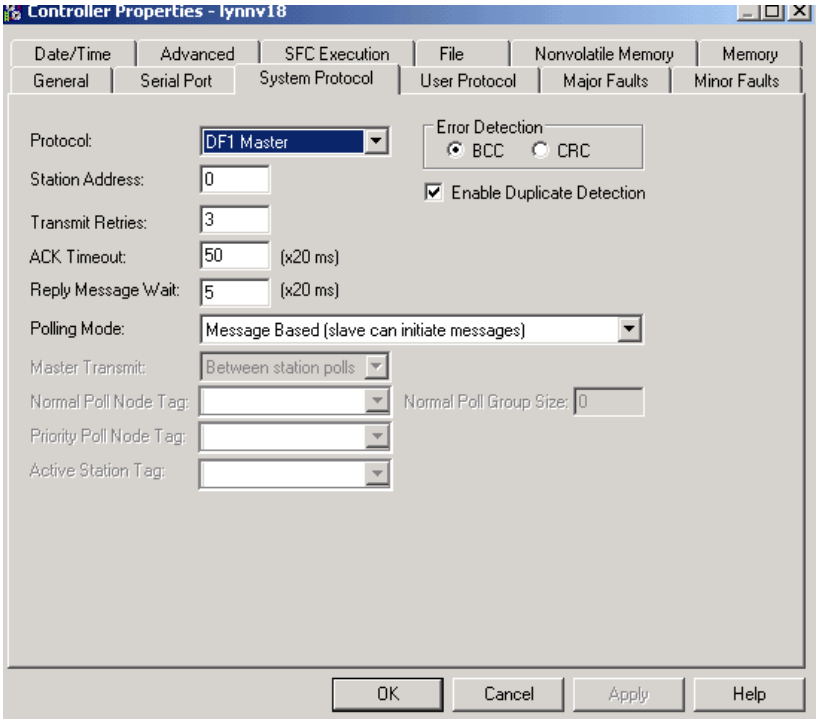
- Configure Controller Serial Port Properties on page 115
- Program the Message Instruction on page 116

For these procedure examples, ladder logic programming is used.

Configure Controller Serial Port Properties

First, set the System Protocol by following these steps.

1. In the Controller Organizer, right-click the controller and choose Properties.
2. In the Controller Properties dialog box, from the System Protocol tab, choose the settings for the controller and click OK.



Use this table when specifying settings for the protocols listed.

Field	DF-1 Master Protocol	DF-1 Slave Protocol	DF-1 Radio Modem Protocol
Station Address	Controller station address number	Controller station address number	Controller station address number
Transmit Retries	3	3	N/A
ACK Timeout	50	N/A	N/A
Slave Poll Timeout	N/A	3000	N/A
Reply Message Wait	5	N/A	N/A
Polling Mode	Message: polls the slave by using the Message instruction Slave: initiates messages for slave-to-slave broadcast Standard: schedules polling for the slave	N/A	N/A
EOT Suppression	N/A	Disable	N/A
Error Detection	BCC	BCC	BCC
Duplicate Detection	Enabled	Enabled	N/A
Enable Store and Forward	N/A	N/A	Choose enable if you want to use the store and forward tag. The last bit of the INT[16] Enable Store and Forward array must be 'enabled.' For example, say that you create an INT[16] tag named EnableSandF. Then EnableSandF[15].15 must be set to 1 for broadcast to work on radio modem.

Program the Message Instruction

Add and configure the Message instruction according to the protocol you are using. For more information to specify the configuration details, see the Logix5000 Controllers General Instruction Reference Manual, publication 1756-RM003.

IMPORTANT When using structured text, broadcast over a serial port is set by typing MSG(aMsg) and right-clicking an MSG to display the Message Configuration dialog box.

Modbus Support

To use ControlLogix controllers with the Modbus protocol, establish a serial port connection and execute a ladder-logic routine.

Two controller projects specific to the Modbus network are available as sample programs within the Logix Designer application:

- ModbusMaster.ACD
- ModbusSlave.ACD

For information about using these sample programs, see the Using Logix5000 Controllers as Masters or Slaves on Modbus Application Solution, publication CIG-AP129.

Manage Controller Communication

Connection Overview

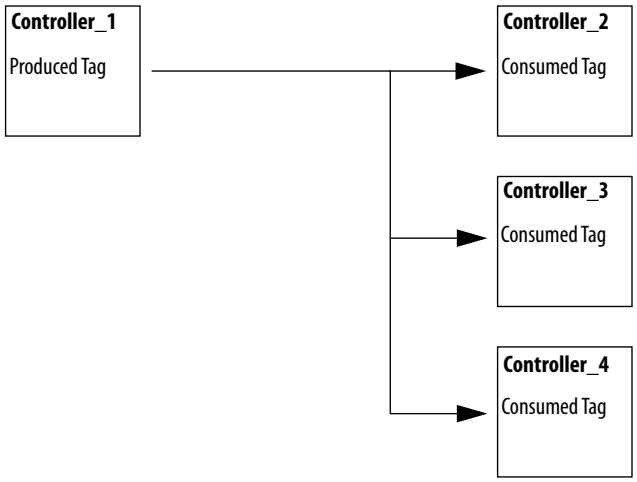
A Logix5000™ system uses a connection to establish a communication link between two devices. The types of connections include the following:

- Controller-to-local I/O modules or local communication modules
- Controller-to-remote I/O or remote communication modules
- Controller-to-remote I/O (rack-optimized) modules
- Produced and consumed tags
- Messages
- Controller access via the Studio 5000 Logix Designer® application
- Controller access via RSLinx® Classic or RSLinx Enterprise applications for HMI or other applications

Produce and Consume (Interlock) Data

ControlLogix® controllers let you produce (transmit) and consume (receive) system-shared tags.

Figure 21 - Illustration of Produced and Consumed Tags



The system-shared tags are explained in Table 34.

Table 34 - Produced and Consumed Tag Definitions

Tag	Definition
Produced tag	A tag that a controller makes available for use by other controllers. Multiple controllers can simultaneously consume (receive) the data. A produced tag sends its data to one or more consumed tags (consumers) without using logic.
Consumed tag	A tag that receives the data of a produced tag. The data type of the consumed tag must match the data type (including any array dimensions) of the produced tag. The RPI of the consumed tag determines the period at which the data updates.

For two controllers to share produced or consumed tags, the controllers must be attached to the same network. You cannot bridge produced and consumed tags over two networks.

Produced and consumed tags use connections of the controller and the communication modules being used. For a ControlNet network, produced and consumed tags use scheduled connections.

Connection Requirements of a Produced or Consumed Tag

Produced and consumed tags each require connections. As you increase the number of controllers that can consume a produced tag, you reduce the number of connections the controller has available for other operations, like communication and I/O.

IMPORTANT If a consumed-tag connection fails, the other tags being consumed from that remote controller stop receiving new data.

Each produced or consumed tag uses the number of connections that are listed in Table 35. Adding status information to a produced/consumed tag does not affect the number of connections used.

Table 35 - Produced and Consumed Tag Connections

This Type of Tag	Uses This Many Connections	Of This Module
Produced tag	*number_of_configuredconsumers* + 1	Controller
Consumed tag	1	
Produced or consumed tag	1	Communication

EXAMPLE Calculations of connections for produced or consumed tags:

- A ControlLogix controller producing 4 tags for 1 controller uses 8 connections.

Each tag uses 2 connections (1 consumer + 1 = 2).

2 connections per tag x 4 tags = 8 connections.

- Consuming 4 tags from a controller uses 4 connections (1 connection per tag x 4 tags = 4 connections).

The number of available connections limits the number of tags that can be produced or consumed. If the controller uses its connections for I/O and communication devices, no connections are left for produced and consumed tags.

Table 36 - ControlLogix Modules and Available Connections

Module Type	Cat. No.	Available Connections
Controller	1756-L7*x*	500
	1756-L6*x*	250
EtherNet/IP	• 1756-EN2F • 1756-EN2T • 1756-EN2TXT • 1756-EN2TR	256
	• 1756-ENBT • 1756-EWEB	128
ControlNet	• 1756-CN2 • 1756-CN2R • 1756-CN2RXT	128
	• 1756-CNB • 1756-CNBR	64

For more information about produced/consumed tags, see the Logix5000 Controllers Produced and Consumed Tags Programming Manual, publication 1756-PM011.

Send and Receive Messages

Messages transfer data to other devices, such as other controllers or operator interfaces. The MSG instruction is a ladder logic output instruction that asynchronously reads or writes a block of data to or from another module over the backplane or a network. The size of the instruction depends on the data types and message command that you program.

Messages use connection resources to send or receive data. Messages can leave the connection open (cache) or closed when the message is done transmitting.

Each message uses one connection out of the controller, regardless of how many devices are in the message path. To conserve connections, configure one message to read from or write to multiple devices.

Table 37 - Message Types

Message Type	Communication Method	Connected Message	Message Can Be Cached
CIP data table read or write	N/A	Configurable	Yes
PLC-2®, PLC-3®, PLC-5®, or SLC™ (all types)	CIP	No	No
	CIP with Source ID	No	No
	DH+	Yes	Yes
CIP generic	N/A	Optional (1)	Yes(2)
Block-transfer read or write	N/A	Yes	Yes

(1) You can connect CIP generic messages. However, for most applications we recommend that you leave CIP generic messages unconnected.

(2) Consider caching only if the target module requires a connection.

For more information about using messages, see these publications:

- Logix5000 Controllers Messages, publication 1756-PM012
- Logix5000 Controllers General Instructions, publication 1756-RM003

Determine Whether to Cache Message Connections

When you configure a MSG instruction, you can choose whether to cache the connection. Use Table 38 to determine options for caching connections.

Table 38 - Options for Caching Connections

If the message executes	Then
Repeatedly	Cache the connection. This keeps the connection open and optimizes execution time. Opening a connection each time the message executes increases execution time.
Infrequently	Do not cache the connection. This closes the connection upon completion of the message, which frees up that connection for other uses.

TIP Cached connections transfer data faster than uncached connections. The controller supports only 32 cached messages.

Calculate Connection Use

The total connection requirements of a ControlLogix system include local and remote connections.

Local Connections

Local connections refer to connections used to communicate between modules that are housed in the same ControlLogix chassis (that is, the local modules). Use Table 39 to calculate the number of local connections that are based on the configuration of your local chassis.

Table 39 - Local Chassis Connections

Local Connection To	Device Quantity	Connections per Device	Total Connections
Local I/O module (a direct connection)		1	
1756-M16SE, 1756-M08SE, or 1756-M02AE servo module		3	
• 1756-CN2, 1756-CN2R, 1756-CN2RXT ControlNet communication module • 1756-CNB, 1756-CNBR ControlNet communication module		0	
• 1756-EN2F, 1756-EN2T, 1756-EN2TXT, or 1756-EN2TR EtherNet/IP communication module • 1756-ENBT EtherNet/IP communication module		0	
1756-EWEB EtherNet/IP web server module		0	
1756-DNB DeviceNet communication module		2	
1756-RIO remote I/O communication module (Connection count depends on module configuration and can be as many as 10 per module.)		1	
1756-DHRIO DH+/universal remote I/O communication module Each adapter that is associated with the module		1 1	
1756-DHRIOXT DH+/universal remote I/O communication module Each adapter that is associated with the module		1 1	
1756-DH485 DH-485 communication module		1	
		Total	

Remote Connections

Use remote connections when the communication module is in a chassis that is remote from the controller. The number of connections a communication module supports determines how many remote connections the controller can access through that module.

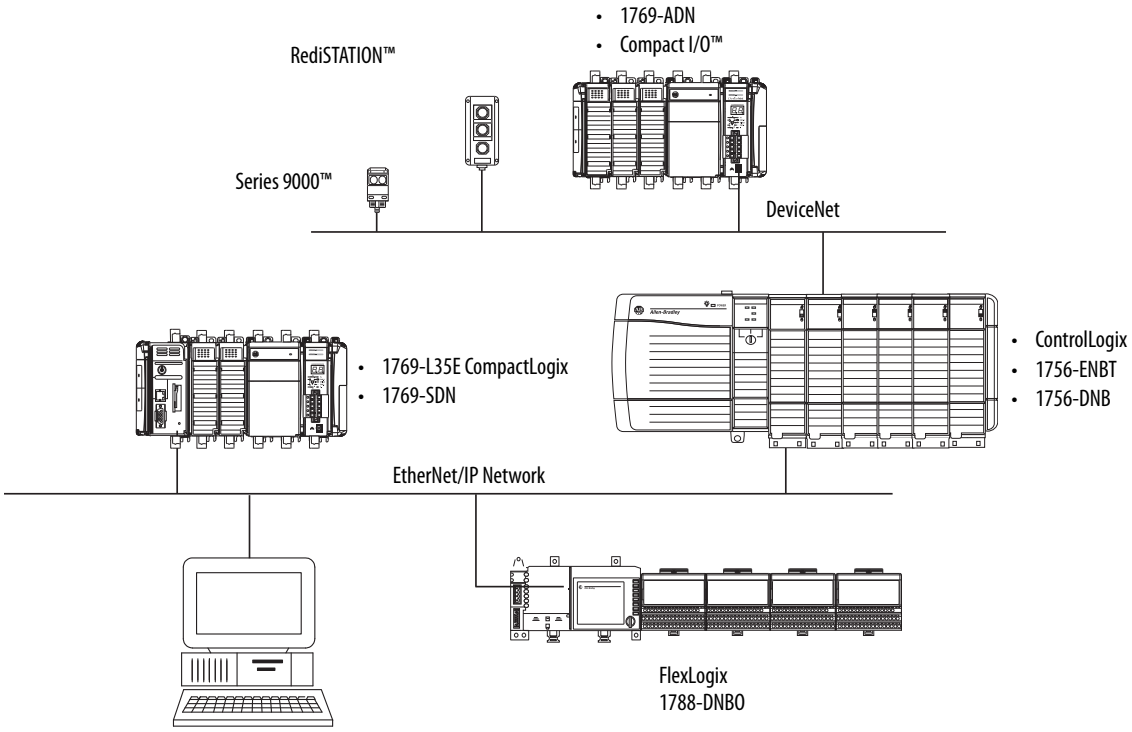
Table 40 - Remote Connections

Remote Connection Type	Device Quantity	Connections per Device	Total Connections
Remote ControlNet communication module I/O configured as direct connection (none) I/O configured as rack-optimized connection		 0 1	
Remote I/O module over a ControlNet network (direct connection)		1	
Remote EtherNet/IP communication module I/O configured as direct connection (none) I/O configured as rack-optimized connection		 0 1	
Remote I/O module over a EtherNet/IP network (direct connection)		1	
Remote device over a DeviceNet network (accounted for in rack-optimized connection for local 1756-DNB)		 0	
DeviceNet module in a remote chassis		2	
Other remote communication adapter		1	
Produced tag Each consumer		1 1	
Consumed tag		1	
Message (see Table 37 for message types) Connected Unconnected		 1 0	
Block-transfer message		1	
		Total	

Connections Example

In this example system, the 1756 ControlLogix controller does the following:

- Controls local digital I/O modules in the same chassis
- Controls remote I/O devices on a DeviceNet network
- Sends and receives messages to and from a CompactLogix™ controller on an EtherNet/IP network
- Produces one tag that the 1794 FlexLogix™ controller consumes
- Is programmed via the Logix Designer application



The ControlLogix controller in this example uses these connections.

Table 41 - Connections Example Calculation

Connection Type	Device Quantity	Connections per Device	Total Connections
Controller to local I/O modules	4	1	4
Controller to 1756-ENBT module	1	0	0
Controller to 1756-DNB module	1	2	2
Controller to Logix Designer application	1	1	1
Message to CompactLogix controller	2	1	2
Produced tag Consumed by FlexLogix controller	1 1	1 1	1 1
		Total	11

Notes:

I/O Modules

Selecting ControlLogix I/O Modules

Rockwell Automation offers several ControlLogix® I/O modules for use in ControlLogix systems. When you select your I/O modules, remember the following:

- A wide variety of digital, analog, and specialty I/O modules are available from Rockwell Automation. Some features of these I/O modules include the following:
  - Field-side diagnostics
  - Electronic fusing
  - Individually isolated inputs/outputs
- Removable terminal blocks (RTBs) or 1492 wiring systems are required for use with I/O modules.
- 1492 PanelConnect™ modules and cables can be used to connect input modules to sensors.

For more information about ControlLogix I/O module features, specifications, and wiring options, see the ControlLogix System Selection Guide, publication 1756-SG001.

Local I/O Modules

The ControlLogix chassis that you choose affects how many local I/O modules you can use. Several ControlLogix chassis sizes are available to suit your configuration requirements. You can fill the slots of your chassis with any combination of controllers, communication modules, and I/O modules.

Table 42 lists the available ControlLogix and ControlLogix-XT™ chassis and the number of slots available with each.

Table 42 - ControlLogix and ControlLogix-XT Chassis and Slots

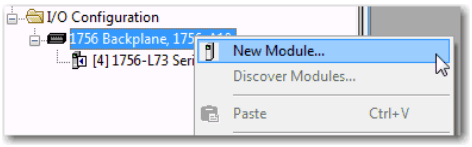
Chassis	Slots
1756-A4	4
1756-A4LXT	
1756-A5XT	5
1756-A7	7
1756-A7LXT	
1756-A7XT	
1756-A10	10
1756-A10XT	
1756-A13	13
1756-A17	17

If you have empty slots in your chassis, use the 1756-N2 or 1756-N2XT slot-filler module.

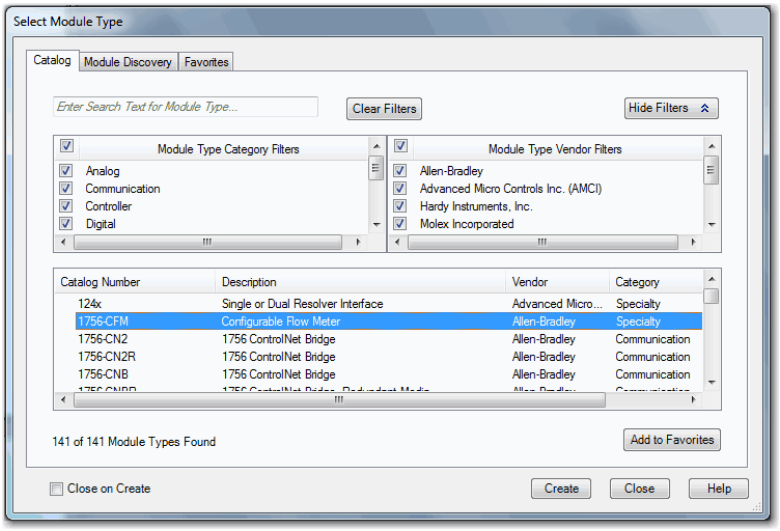
Add Local I/O to the I/O Configuration

If you are adding local I/O, add the I/O module to the backplane with the controller. To add an I/O module to the local chassis, complete these steps.

1. Right-click the backplane and choose New Module.



2. Select the I/O module that you want to add and click OK.



3. Specify the configuration properties according to the module and network configuration you are using.

   See the Additional Resources section in the preface for more information if you are designing your ControlLogix System for any of the following modules:

   - Analog I/O
   - Configurable flowmeter
   - Digital I/O
   - HART analog I/O
   - High-speed analog I/O
   - High-speed counter
   - Low-speed counter
   - Programmable limit switch

Remote I/O Modules

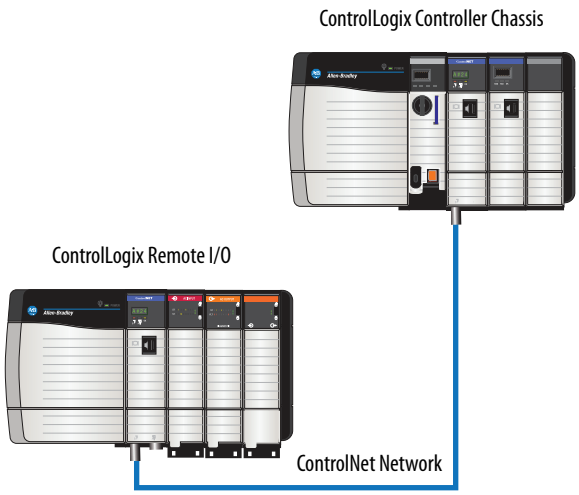
Remote I/O refers to I/O that is not in the local chassis and is connected to the controller via a communication network.

The ControlLogix controller supports the use of remote I/O via these networks:

- EtherNet/IP
- ControlNet
- DeviceNet
- Universal remote I/O

For more information about the network configurations that can be used to connect remote I/O, see Communication Networks on page 89.

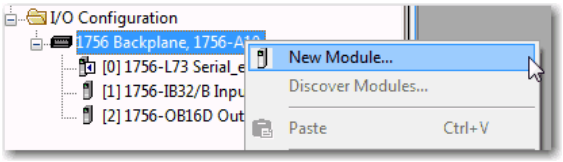
Figure 22 - ControlLogix Controller and Remote I/O Example

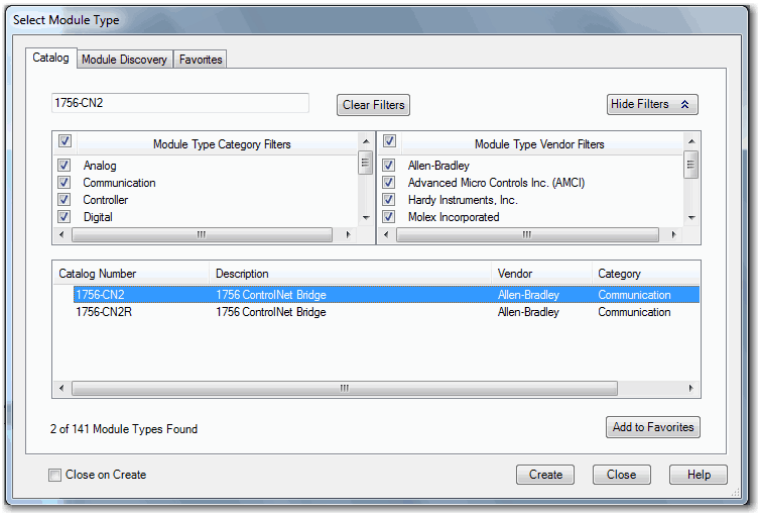


Add Remote I/O to the I/O Configuration

If you are adding remote I/O, add the I/O modules to the backplane of the remote communication module that is connected to the controller. To add a remote I/O to the I/O Configuration folder in the Logix Designer application, complete these steps.

1. Add a communication module to the backplane that contains the controller.

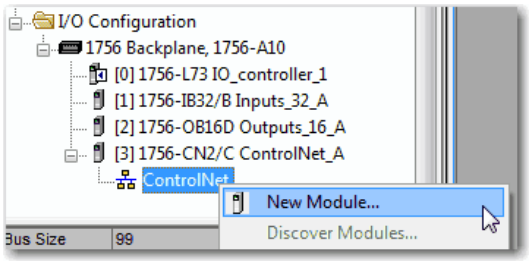




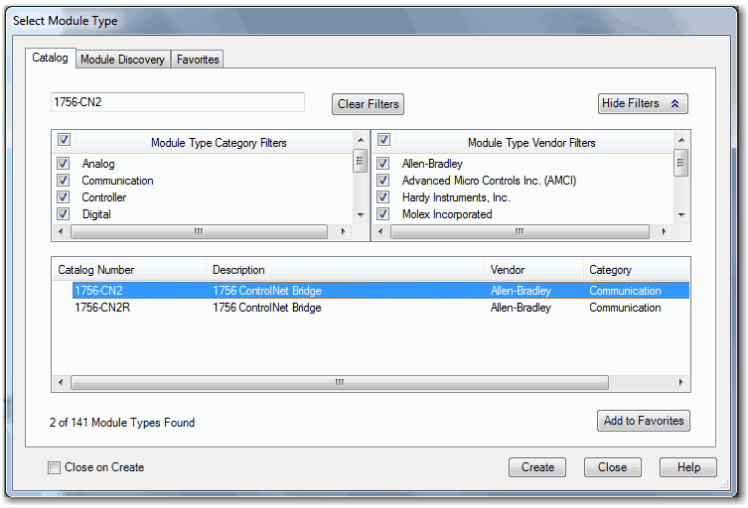
2. Specify the communication module properties according to your network configuration.

   For more information about the communication module and network properties, see the Additional Resources section in the preface.

3. Right-click the communication network and choose New Module.

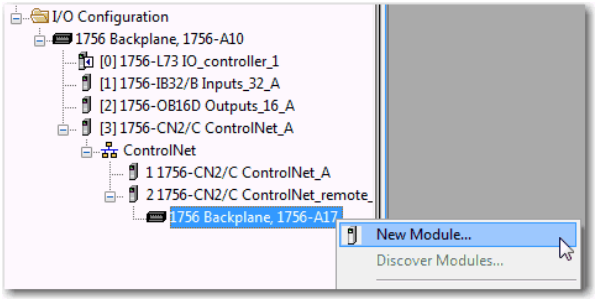


4. Add the remote communication module that you are using.

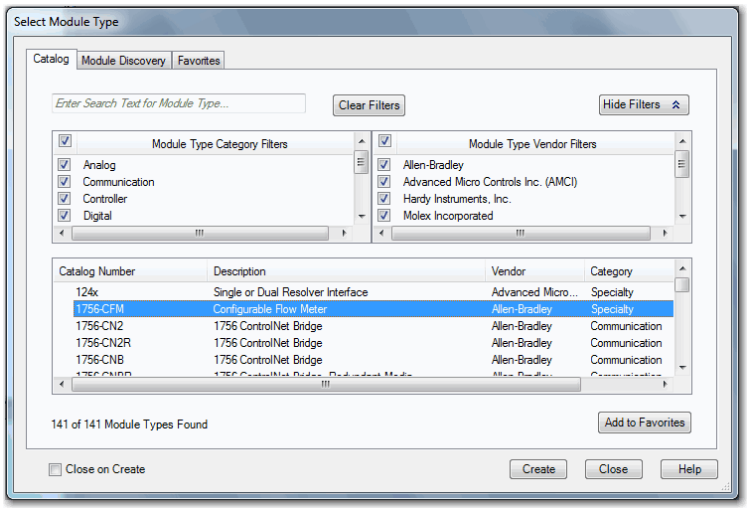


5. Specify the chassis and connection properties according to your network configuration.

6. Right-click the backplane of the newly added communication module and choose New Module.



7. Select the I/O module that you want to add and click OK.

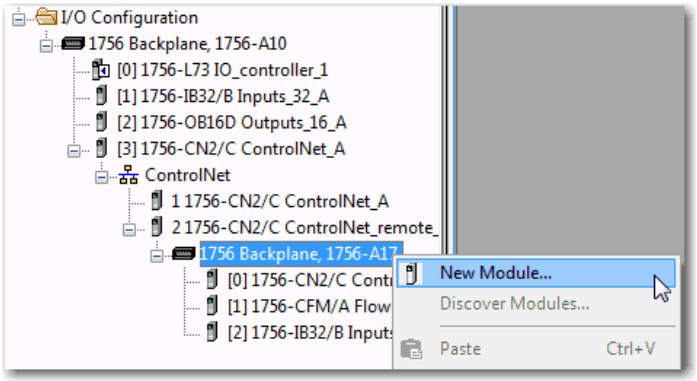


8. Specify the Module Properties according to your module and application.

   See the Additional Resources section in the preface for more information about the module configuration properties for any of the following modules:

   - Analog I/O
   - Configurable flowmeter
   - Digital I/O
   - HART analog I/O
   - High-speed analog I/O
   - High-speed counter
   - Low-speed counter
   - Programmable limit switch

9. Add any other I/O modules that you are using in the remote chassis.



10. Complete steps 1...9 until your remote I/O network and I/O modules are configured.

Distributed I/O

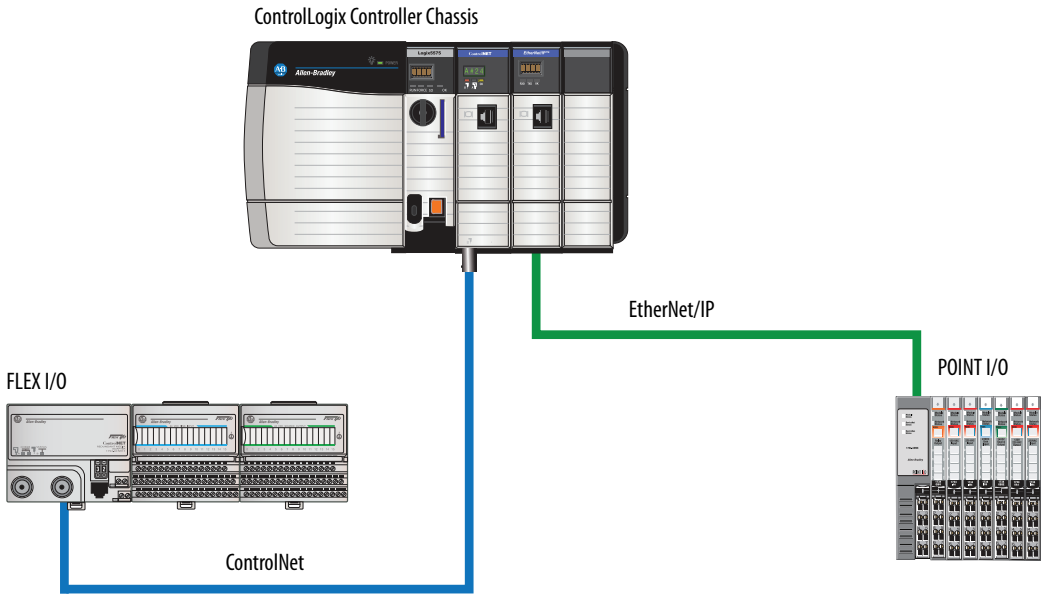
Distributed I/O refers to I/O that is remote from the controller and is not designed for use with a specific controller. Examples of distributed I/O that can be used with Logix5000™ controllers include the following:

- 1794 FLEX™ I/O modules
- 1734 POINT I/O™ modules
- 1797 FLEX Ex™ I/O modules
- 1738 ArmorPOINT® I/O modules
- 1732 ArmorBlock® I/O modules
- 1753 GuardPLC™ Safety I/O modules
- 1790 CompactBlock™ LDX I/O modules
- 1791 CompactBlock Guard Safety I/O modules
- 1791 CompactBlock I/O modules
- 1732DS ArmorBlock Guard Safety I/O modules
- 1792 ArmorBlock MaXum™ I/O modules

Distributed I/O is connected to the ControlLogix controller via a communication network. The ControlLogix controller supports the use of distributed I/O via these networks:

- EtherNet/IP
- ControlNet
- DeviceNet

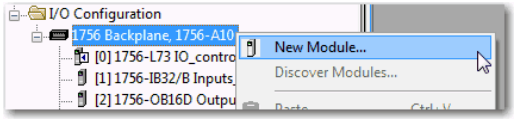
Figure 23 - ControlLogix System with Distributed I/O Example

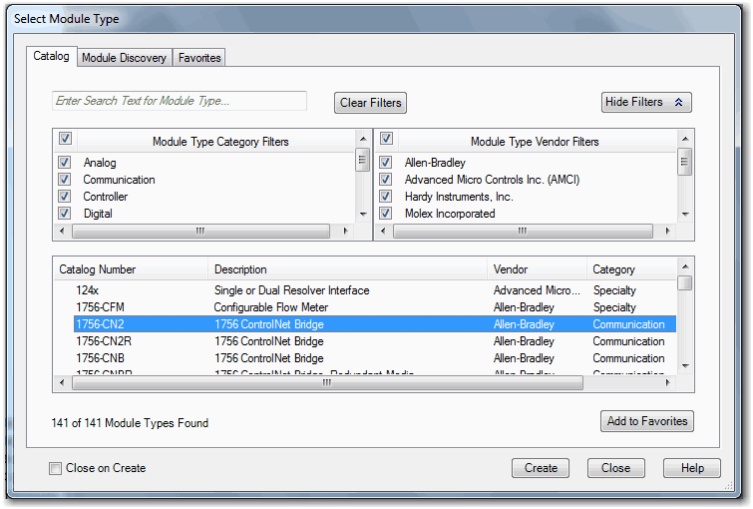


Add Distributed I/O to the I/O Configuration

If you are adding distributed I/O, add the I/O modules to the communication adapter of the I/O. To add distributed I/O to the I/O Configuration folder for the ControlLogix controller, complete these steps.

1. Add a communication module to the backplane that contains the controller.

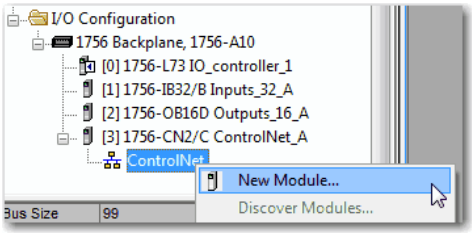




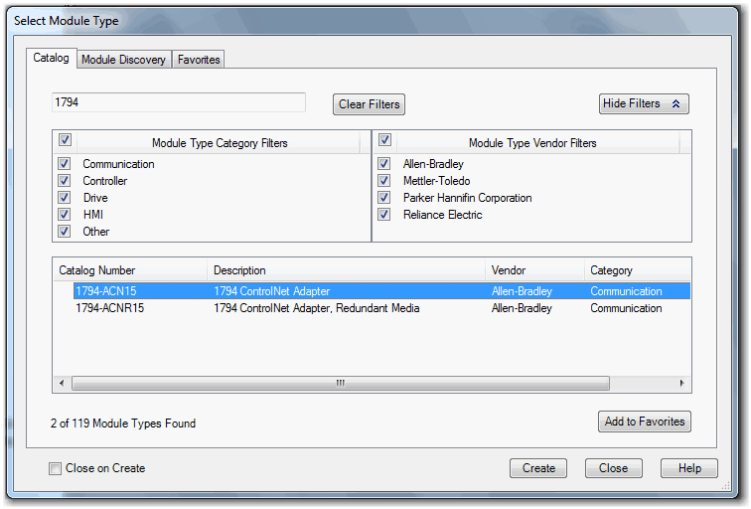
2. Specify the communication module properties according to your network configuration.

   For more information about the communication module and network properties, see the Additional Resources section in the preface.

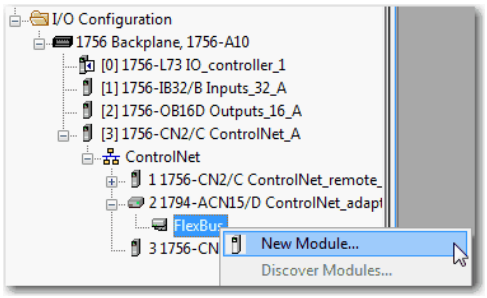
3. Right-click the communication network and choose New Module.



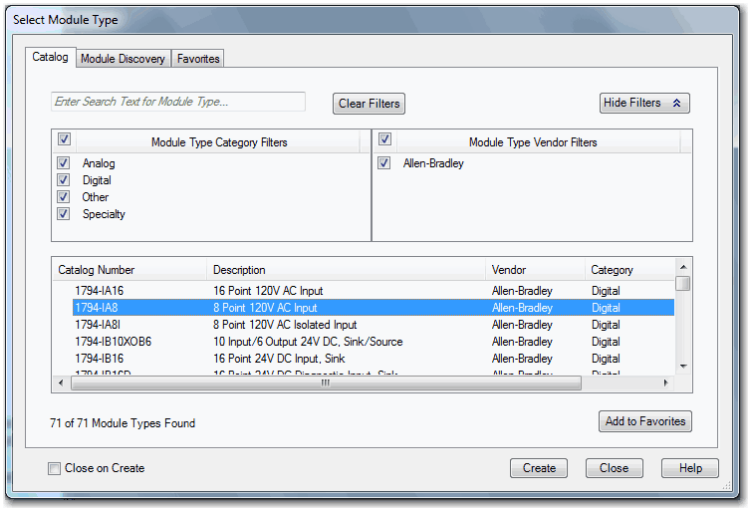
4. Add the communication adapter for the distributed I/O platform that you are using.



5. Specify the module and connection properties according to your network configuration.
6. Right-click the bus of the newly added communication adapter and choose New Module.



7. Select the I/O module that you want to add and click OK.



8. Specify the Module Properties according to your module and application.

   For more information about the module configuration properties, see the user manual for the I/O module you are adding.

9. Add any other I/O modules that you are using in this bus.
10. Complete steps 1...9 until your remote I/O network and distributed I/O modules are configured.

Reconfigure an I/O Module

If an I/O module supports reconfiguration, you can reconfigure the module via the following:

- The Module Properties dialog box in the I/O Configuration folder
- A MSG instruction in program logic

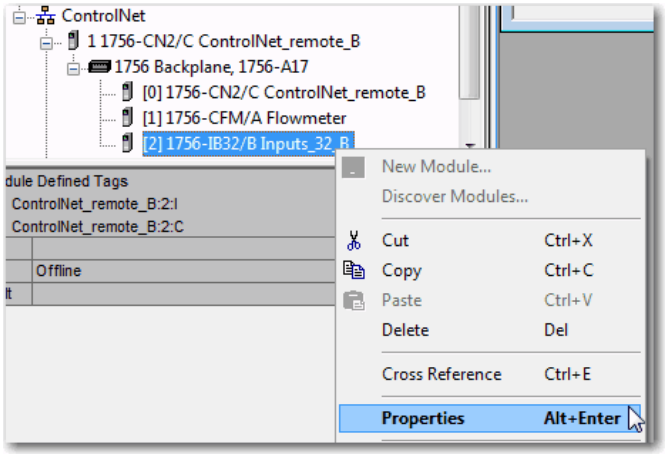
IMPORTANT Use care when changing the configuration of an I/O module. You can inadvertently cause the I/O module to operate incorrectly.

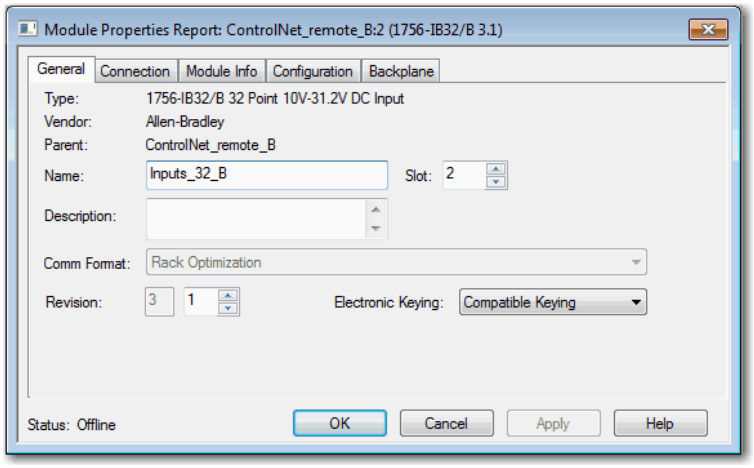
Use a MSG instruction of type Module Reconfigure to send new configuration information to an I/O module. During the reconfiguration, consider the following:

- Input modules continue to send input data to the controller
- Output modules continue to control their output devices

Reconfigure an I/O Module Via the Module Properties

To reconfigure an I/O module by using the module properties, right-click the module in the I/O Configuration tree and choose Properties. Then, edit the properties that you must change and click Apply.





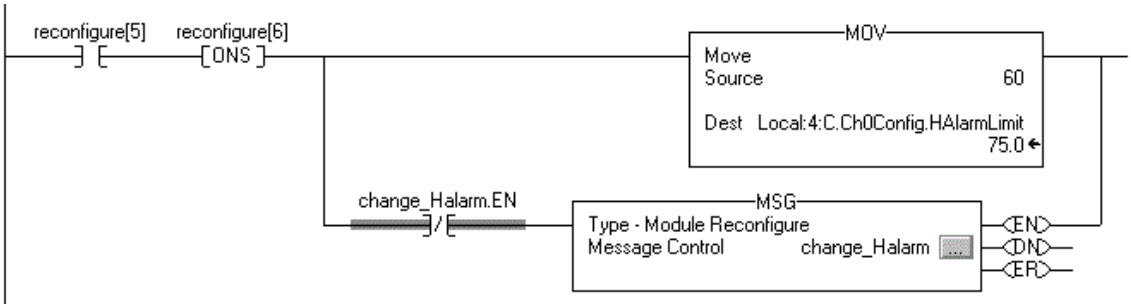
Reconfigure an I/O Module Via a Message Instruction

To reconfigure an I/O module via a message instruction, use this procedure.

1. Set the required member of the configuration tag of the module to the new value.
2. Send a Module Reconfigure message to the module.

EXAMPLE Reconfigure an I/O module

When reconfigure[5] is on, the MOV instruction sets the high alarm to 60 for the local module in slot 4. The Module Reconfigure message then sends the new alarm value to the module. The ONS instruction does not allow the rung to send multiple messages to the module while the reconfigure[5] is on.



For more information about using Message instructions, see the Logix5000 Controllers General Instruction Reference Manual, publication 1756-RM003.

Add to the I/O Configuration While Online

With RSLogix 5000 software, version 15.02.00 or later, and Logix Designer application, version 21.00.00 or later, you can add I/O and other devices to the controller configuration while you are online and in Run mode.

The modules and devices you can add while online depends on the version of the software you are using. Later versions have more modules and devices that can be added while online.

You can add these modules and devices to the local or remote chassis via the unscheduled portion of a ControlNet network or via an EtherNet/IP network.

Modules and Devices That Can Be Added While Online

These modules and devices **can be added** to the ControlLogix controller I/O configuration while online as of RSLogix 5000 software, version 19.01.00 or later and Logix Designer application, version 21.00.00 or later.

- 1756 controllers
- 1756 ControlNet modules
- 1756 DeviceNet bridges
- 1756 EtherNet/IP modules
- 1756 I/O and specialty modules
- 1756-DHRIO
- 1756-DHRIOXT

IMPORTANT These ControlLogix modules **cannot** be added while online:

- Motion modules (1756-M02AE, 1756-HYD02, 1756-M02AS, 1756-M03SE, 1756-M08SE, 1756-M08SEG, 1756-M16SE)
- 1756-RIO
- 1756-SYNCH
- 1756-56AMXN

Online Additions - ControlNet Considerations

ControlNet considerations that must be made depend upon the ControlLogix ControlNet modules you are using.

1756-CNB and 1756-CNBR Modules

When you add I/O to the ControlNet network via the 1756-CNB or 1756-CNBR modules while online, these considerations must be made:

- Digital I/O modules can be added as rack-optimized connections if the parent module is configured with rack-optimized connections.

  TIP While you can add a new digital I/O module to an existing rack-optimized connection, you cannot add rack-optimized connections while online.

- Digital I/O modules can also be added as direct connections.
- Analog I/O modules can be added only as direct connections.
- Disable the Change of State (COS) feature on digital input modules because it can cause inputs to be sent more quickly than the RPI.

- If you plan to add large amounts of I/O to the ControlNet network, dedicate one ControlNet network for I/O. For the dedicated ControlNet network, verify that there is little or none of the following:
  - HMI traffic
  - MSG traffic
  - Programming workstations
- Requested Packet Intervals (RPIs) faster than 25 ms for unscheduled modules can overload the 1756-CNB or 1756-CNBR communication module. To avoid the overload, make these considerations:
  - Use a NUT of 10 ms or more.
  - Keep the SMAX and UMAX values as small as possible.
- If the module has a Real Time Sample (RTS), disable it or set it to a rate that is greater than the RPI.
- You can add I/O modules until you reach these limits:
  - 75% of CPU utilization of the 1756-CNB or 1756-CNBR communication module
  - Plan for a CPU-use increase of 1...4% of the 1756-CNB or 1756-CNBR module for each I/O module you add, depending on the RPI.
  - 48 connections on the 1756-CNB or 1756-CNBR communication module
  - Less than 400,000 unscheduled bytes per second are displayed in RSNetWorx™ for ControlNet™ software after the network has been scheduled.

1756-CN2, 1756-CN2R, 1756-CN2RXT Modules

The use of 1756-CN2/B, 1756-CN2R/B, and 1756-CN2RXT modules provides increased capacity for adding I/O while online compared to 1756-CNB or 1756-CNBR modules. With this increased capacity, you can easily add I/O and increase ControlNet connections that are used with less impact on the overall system.

Table 43 demonstrates the performance factors of the 1756-CN2/B, 1756-CN2R/B, and 1756-CN2RXT modules when adding I/O online.

Table 43 - 1756-CN2, 1756-CN2R, and 1756-CN2RXT Performance Example(1)

No. of Direct Analog I/O Connections Added Online	RPI = 2 ms		RPI = 4 ms		RPI = 10 ms		RPI = 20 ms		RPI = 50 ms		RPI = 100 ms	
	CPU %(2)	Avg. API(3)	CPU %(2)	Avg. API(3)	CPU %(2)	Avg. API(3)	CPU %(2)	Avg. API(3)	CPU %(2)	Avg. API(3)	CPU %(2)	Avg. API(3)
0	1.50%	N/A	1.50%	N/A	1.50%	N/A	1.50%	N/A	1.50%	N/A	1.50%	N/A
1	4.80%	2.0	3.70%	4.0	2.50%	10.0	2.30%	20.0	1.90%	50.0	1.70%	100.0
2	7.00%	2.0	5.00%	4.0	3.30%	10.0	2.70%	20.0	2.10%	50.0	1.90%	100.0
3	9.00%	2.0	6.10%	4.0	3.80%	10.0	3.00%	20.0	2.20%	50.0	2.00%	100.0
4	11.20%	2.2	7.40%	4.0	4.40%	10.0	3.40%	20.0	2.40%	50.0	2.10%	100.0
5	11.50%	3.3	8.70%	4.0	5.00%	10.0	3.70%	20.0	2.60%	50.0	2.20%	100.0
6	12.80%	3.3	9.70%	4.0	5.50%	10.0	4.00%	20.0	2.70%	50.0	2.30%	100.0
7	13.80%	3.4	10.80%	4.0	5.90%	10.0	4.30%	20.0	2.90%	50.0	2.30%	100.0
8	15.10%	3.4	11.90%	4.0	6.40%	10.0	4.50%	20.0	3.00%	50.0	2.50%	100.0
9	15.00%	3.3	13.20%	4.0	7.00%	10.0	4.80%	20.0	3.20%	50.0	2.60%	100.0
10	15.60%	3.6	13.20%	4.0	7.50%	10.0	5.20%	20.0	3.40%	50.0	2.70%	100.0
11	16.40%	3.8	13.50%	4.0	8.20%	10.0	5.50%	20.0	3.50%	50.0	2.70%	100.0
12	17.00%	3.8	14.00%	4.0	8.80%	10.0	5.80%	20.0	3.70%	50.0	2.80%	100.0
13	17.80%	3.7	14.60%	4.0	9.30%	10.0	6.10%	20.0	3.80%	50.0	2.90%	100.0
14	18.50%	3.7	15.20%	4.0	9.90%	10.0	6.40%	20.0	4.00%	50.0	2.90%	100.0
15	19.40%	3.9	15.80%	4.0	10.50%	10.0	6.70%	20.0	4.10%	50.0	3.00%	100.0

(1) Example assumes that adequate unscheduled bandwidth is available.
(2) Approximate use of the central-processing unit (CPU) of the module in percent.
(3) The average Actual Packet Interval with 2000 samples (shown in ms).

Because of the increased performance that is provided by the 1756-CN2, 1756-CN2R, and 1756-CN2RXT modules, many of the considerations that must be made with the 1756-CNB and 1756-CNBR modules are not applicable. With the 1756-CN2, 1756-CN2R, and 1756-CN2RXT modules, you can add I/O while online as long as you use reasonable RPI settings and remain within the CPU limitations of the ControlNet module.

When adding to the I/O Configuration with 1756-CN2, 1756-CN2R, and 1756-CN2RXT modules, make these considerations:

- Digital I/O modules can be added as rack-optimized connections if the parent module is configured with rack-optimized connections.

  TIP While you can add a new digital I/O module to an existing rack-optimized connection, you cannot add rack-optimized connections while online.

- Digital I/O modules can also be added as direct connections.
- Analog I/O modules can be added only as direct connections.
- Disable the Change of State (COS) feature on digital input modules because it can cause inputs to be sent more quickly than the RPI.

- If you plan to add large amounts of I/O to the ControlNet network, dedicate one ControlNet network for I/O. For the dedicated ControlNet network, verify that there is little or none of the following:
  - HMI traffic
  - MSG traffic
  - Programming workstations
- If the module has a Real Time Sample (RTS), disable it or set it to a rate that is greater than the RPI.
- You can add I/O modules until you reach these limits:
  - 80% of CPU utilization of the 1756-CN2, 1756-CN2R, or 1756-CN2RXT communication module.
  - Less than 400,000 unscheduled bytes per second are displayed in RSNetWorx for ControlNet software after the network has been scheduled.

Online Additions—EtherNet/IP Considerations

When you add I/O modules to the EtherNet/IP network, make these considerations:

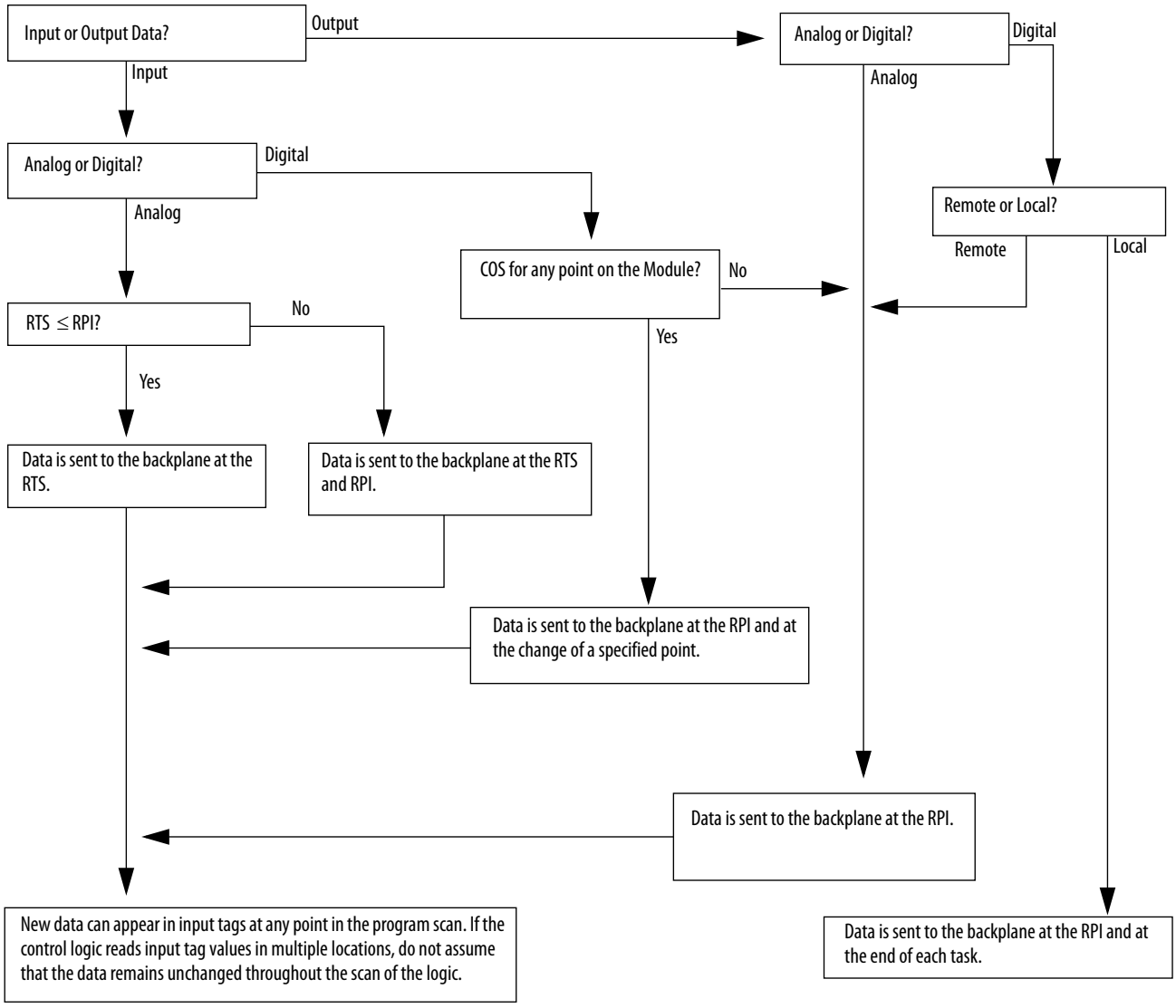
- The EtherNet/IP I/O modules that you add can be added as these connection types:
  - Rack-optimized connections, including new and existing connections
  - Direct connections
- You can add I/O modules until you reach the limits of the communication connections of the module.

  For EtherNet/IP module limitations, see the EtherNet/IP Modules in Logix5000 Control Systems User Manual, publication ENET-UM001.

Determine When Data Is Updated

ControlLogix controllers update date asynchronously with the execution of logic. Use this flowchart to determine when a producer, such as a controller, input module, or bridge, sends data.

Figure 24 - Data Update Flowchart



- Over a ControlNet network, remote data is sent at the actual packet interval.
- Over an EtherNet/IP network, remote data is usually sent close to the RPI.

Notes:

Develop Motion Applications

Motion Control Options

ControlLogix® controllers support digital, analog, and Integrated Motion interfaces:

- Digital drive interfaces include EtherNet/IP connected drives and sercos interface connected drives.
- Analog drives support ±10V analog output and can interface with various feedback device types including quadrature encoder, SSI, and LVDT feedback.
- Integrated Motion on an EtherNet/IP network supports Kinetix® 350, Kinetix 5500, Kinetix 6500, and PowerFlex® 755 drives.

Motion Overview

The configuration process varies, depending on your application and your drive selection. The following are general steps to configure a motion application.

1. Create a controller project.
2. Select the type of drive.

Drive Type	Requirements
CIP Sync	• EtherNet/IP communication module • Digital drive with an EtherNet/IP connection
Sercos interface	Select a sercos interface module: • 1756-M03SE • 1756-M08SE • 1756-M16SE
Analog interface	Select an analog interface module: • 1756-HYD02 • 1756-M02AE • 1756-M02AS

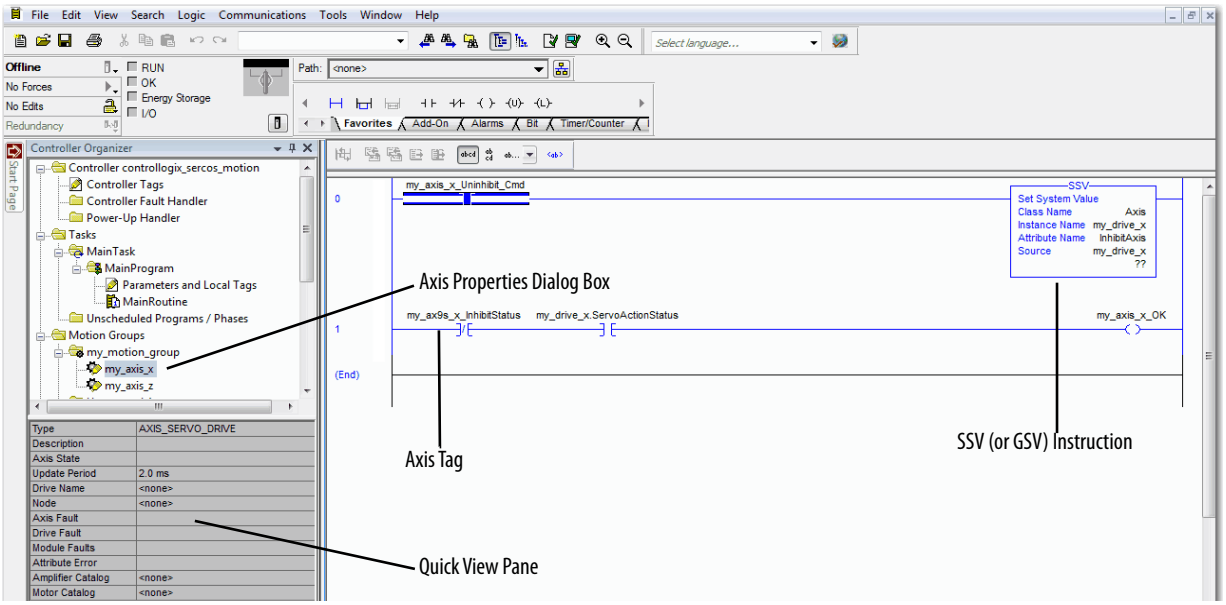
3. Create axis tags as needed.
4. Configure the drive.
5. Create axes as needed.

Obtain Axis Information

You can obtain axis information by using these methods:

- Double-click the axis to open the Axis Properties dialog box.
- Use a Get System Value (GSV) or Set System Value (SSV) instruction to read or change the configuration at runtime.
- View the Quick View pane to see the state and faults of an axis.
- Use an axis tag for status and faults.

Figure 25 - Obtain Axis Information

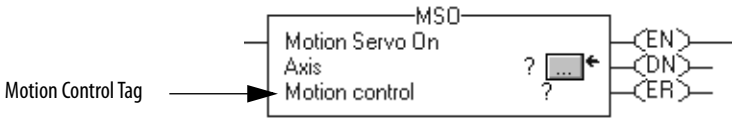


Program Motion Control

The controller provides a set of motion control instructions for your axes:

- The controller uses these instructions just like the rest of the Logix5000™ instructions.
- Each motion instruction works on one or more axes.
- Each motion instruction needs a motion control tag. The tag uses a MOTION_INSTRUCTION data type and stores the information status of the instruction.
- You can program by using motion control instructions in these programming languages:
  - Ladder Diagram (LD)
  - Structured Text (ST)
  - Sequential Function Chart (SFC)

Figure 26 - Motion Control Instruction



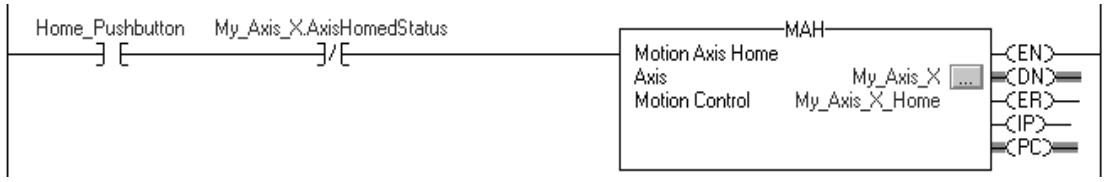
ATTENTION: Use the tag for the motion control operation of motion instruction only once. Unintended operation of the control variables can happen if you reuse of the same motion control tag in other instructions.

Example

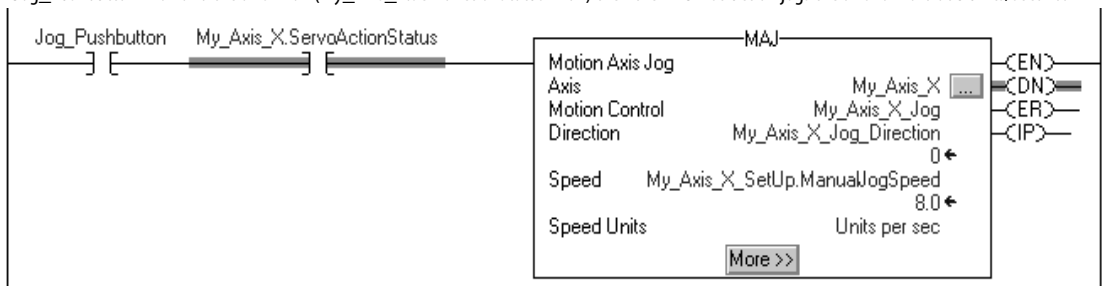
In this example, a simple ladder diagram that homes, jogs, and moves an axis.

If Initialize_Pushbutton = on and the axis = off (My_Axis_X.ServoActionStatus = off) then the MSO instruction turns on the axis.

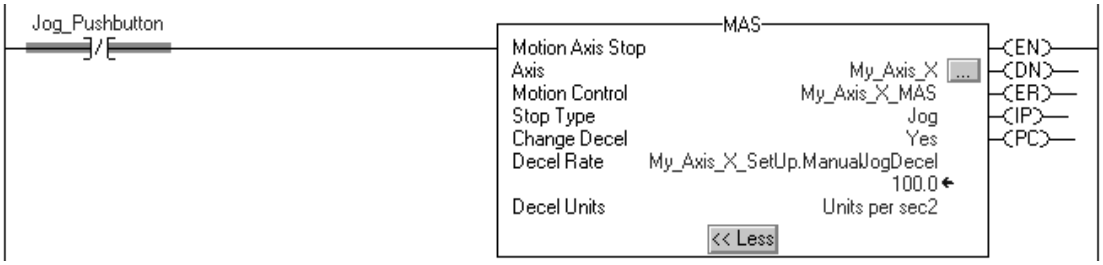
If Home_Pushbutton = on and the axis hasn't been homed (My_Axis_X.AxisHomedStatus = off) then the MAH instruction homes the axis.



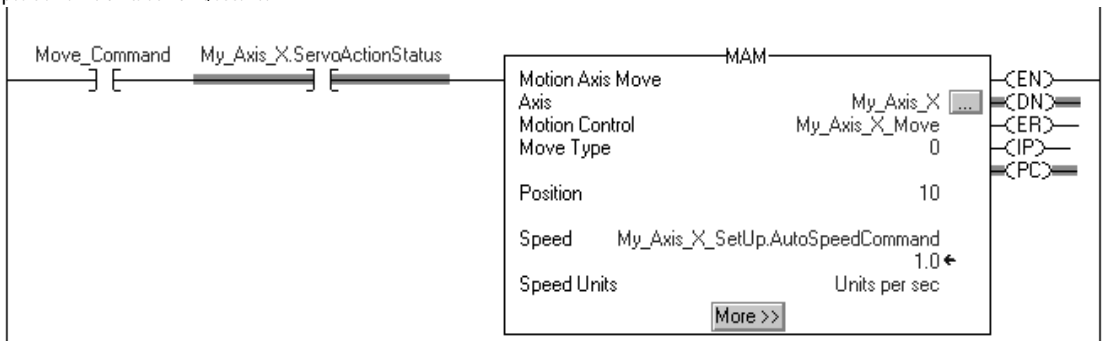
If Jog_Pushbutton = on and the axis = on (My_Axis_X.ServoActionStatus = on) then the MAJ instruction jogs the axis forward at 8 units/second.



If Jog_Pushbutton = off then the MAS instruction stops the axis at 100 units/.second^2. Make sure that Change Decel is Yes. Otherwise, the axis decelerates at its maximum speed.



If Move_Command = on and the axis = on (My_Axis_X.ServoActionStatus = on) then the MAM instruction moves the axis. The axis moves to the position of 10 units at 1 unit/second.



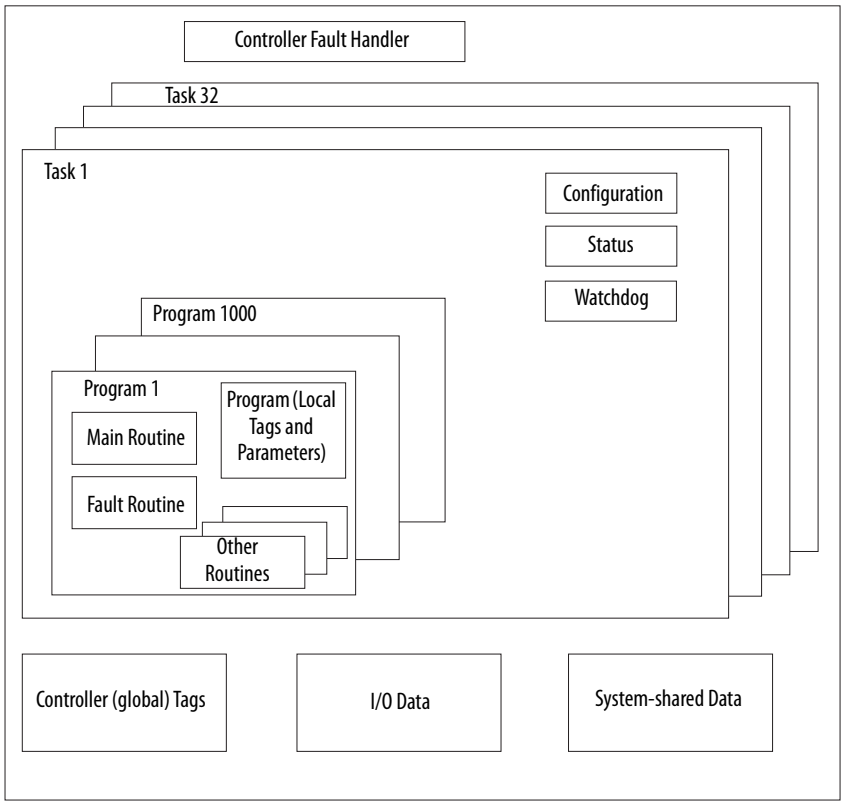
Develop Applications

Elements of a Control Application

A control application is comprised of several elements that require planning for efficient application execution. Application elements include the following:

- Tasks
- Programs
- Routines
- Parameters and Local Tags

Figure 27 - Elements of a Control Program



Tasks

A Logix5000™ controller lets you use multiple tasks to schedule and prioritize the execution of your programs based on criteria. This multitasking allocates the processing time of the controller among the operations in your application:

- The controller executes only one task at a time.
- One task can interrupt the execution of another and take control.
- In any given task, multiple programs can be used. However, only one program executes at a time.
- You can display tasks in the Controller or Logical Organizer views, as necessary.

Figure 28 - Task Within a Control Application

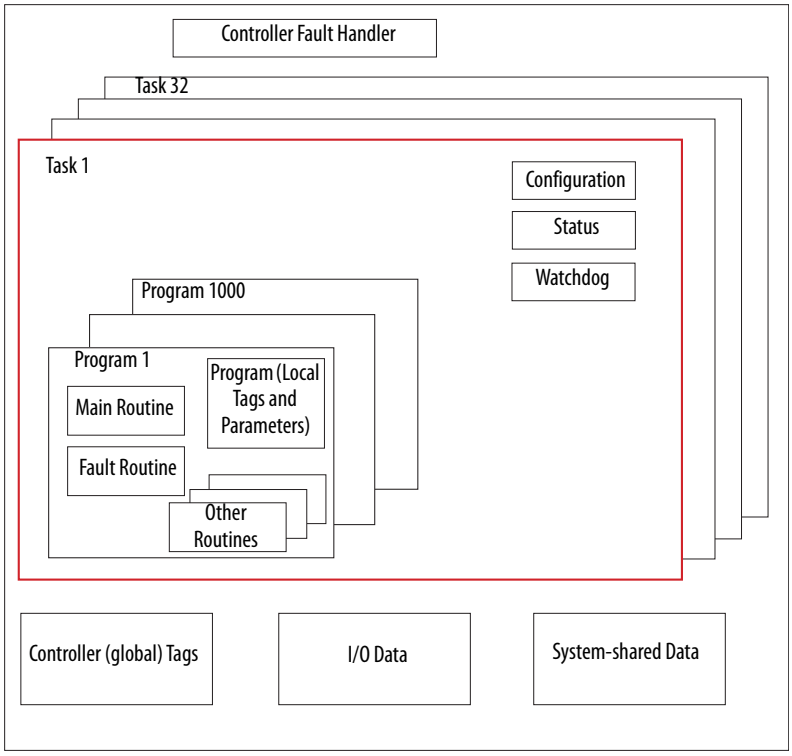
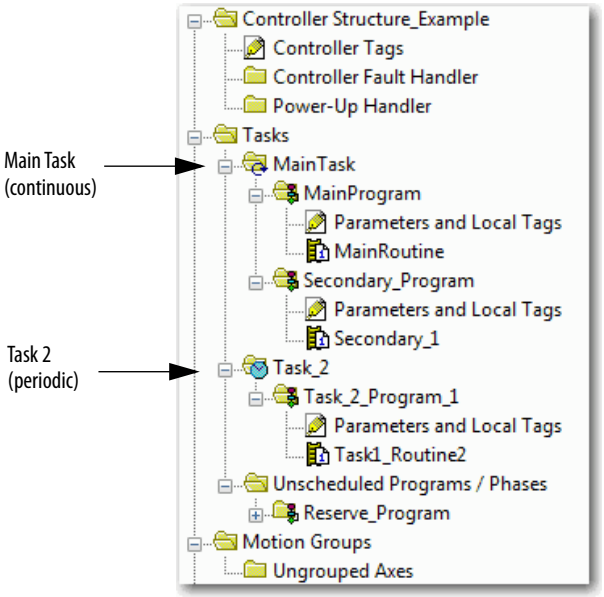
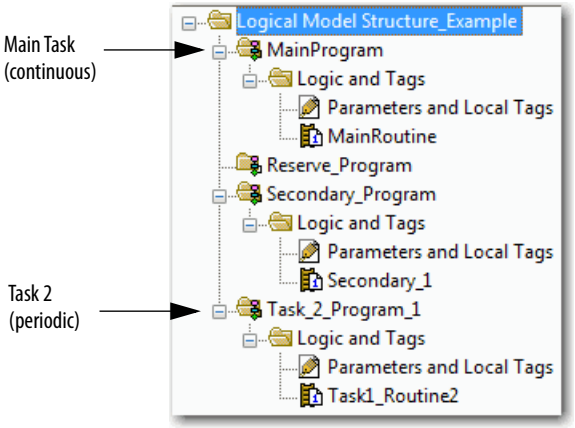


Figure 29 - Tasks

Controller Organizer



Logical Organizer



A task provides scheduling and priority information for a set of one or more programs. Configure tasks as continuous, periodic, or event by using the Task Properties dialog box.

Figure 30 - Configuring the Task Type

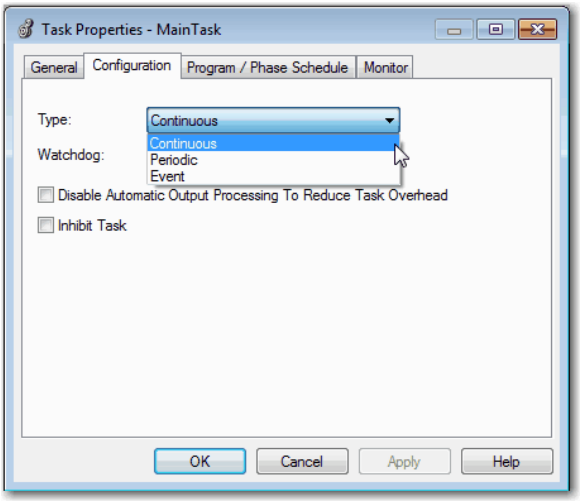


Table 44 explains the types of tasks you can configure.

Table 44 - Task Types and Execution Frequency

Task Type	Task Execution	Description
Continuous	Constant	The continuous task runs in the background. Any CPU time that is not allocated to other operations (such as motion, communication, and other tasks) is used to execute the programs in the continuous task. • The continuous task runs constantly. When the continuous task completes a full scan, it restarts immediately. • A project does not require a continuous task. If used, there can be only one continuous task.
Periodic	• At a set interval, such as each 100 ms • Multiple times within the scan of your other logic	A periodic task performs a function at an interval. • Whenever the time for the periodic task expires, the task interrupts any lower priority tasks, executes once, and returns control to where the previous task left off. • You can configure the time period from 0.1…2,000,000.00 ms. The default is 10 ms. It is also controller and configuration dependent. • The performance of a periodic task depends on the type of Logix5000 controller and on the logic in the task.
Event	Immediately when an event occurs	An event task performs a function only when an event (trigger) occurs. The trigger for the event task can be the following: • Module input data change of state • A consumed tag trigger • An EVENT instruction • An axis trigger • A motion event trigger

The ControlLogix® controller supports up to 32 tasks, only one of which can be continuous.

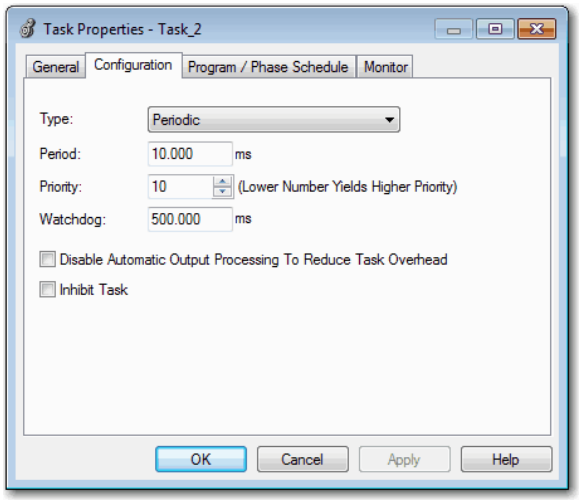
A task can have up to 1000 programs, starting with Logix Designer application, version 24.00.00 and later, each with its own executable routines and program-scoped tags. Once a task is triggered (activated), the programs that are assigned to the task execute in the order in which they are grouped. Programs can appear only once in the Controller Organizer and multiple tasks cannot share them.

Task Priority

Each task in the controller has a priority level. The operating system uses the priority level to determine which task to execute when multiple tasks are triggered. A higher priority task interrupts any lower priority task. The continuous task has the lowest priority and a periodic or event task interrupts it.

You can configure periodic and event tasks to execute from the lowest priority of 15 up to the highest priority of 1. Configure the task priority by using the Task Properties dialog box.

Figure 31 - Configure Task Priority



Programs

The controller operating system is a preemptive multitasking system that is in compliance with IEC 1131-3. This system provides the following:

- Programs to group data and logic
- Routines to encapsulate executable code that is written in one programming language

Each program contains the following:

- Local Tags
- Parameters
- A main executable routine
- Other routines
- An optional fault routine

Figure 32 - Program Within a Control Application

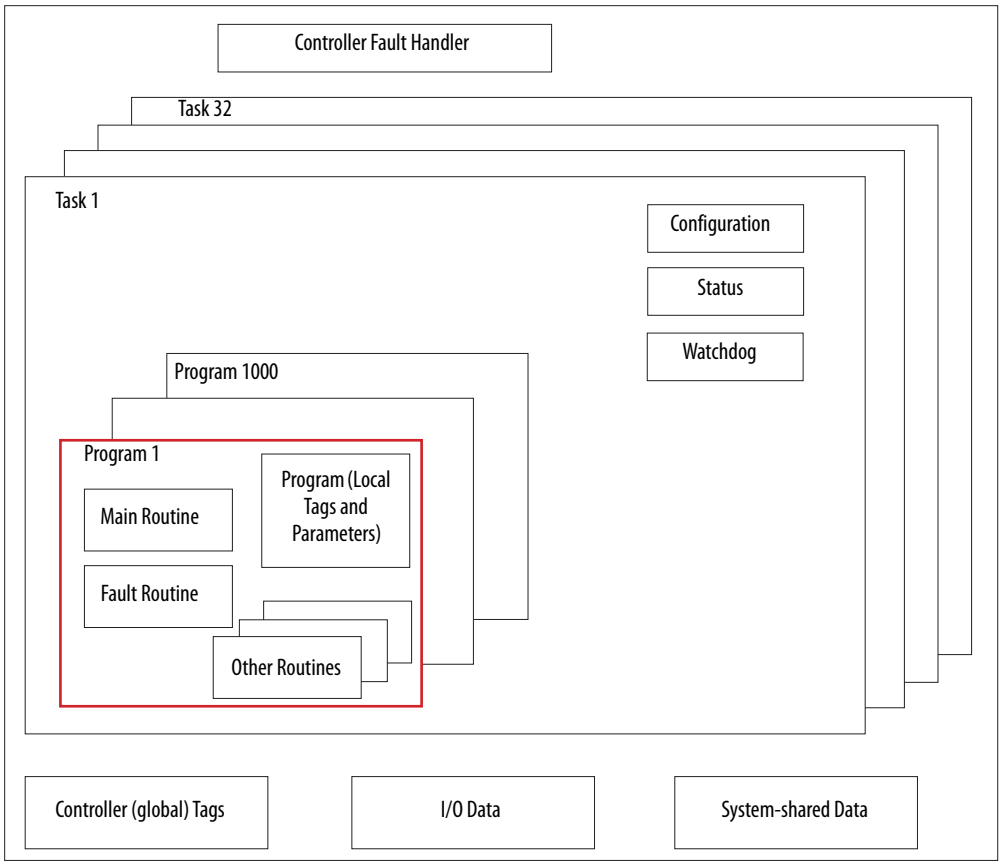
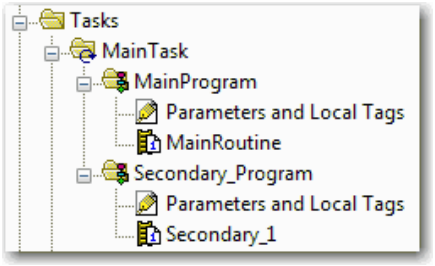
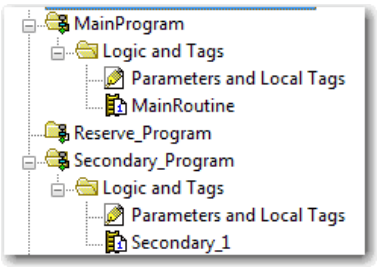


Figure 33 - Programs

Controller Organizer



Logical Organizer



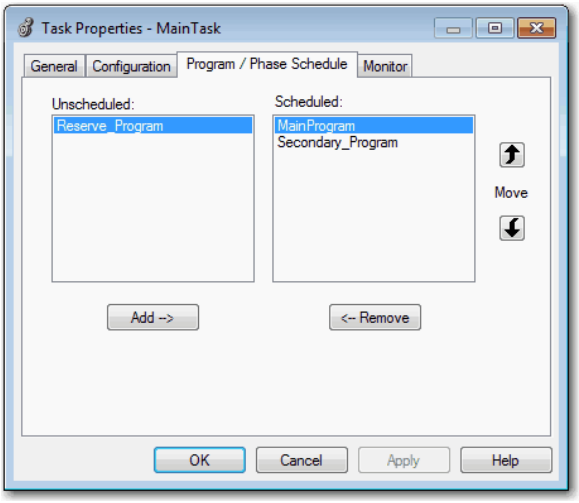
Scheduled and Unscheduled Programs

The scheduled programs within a task execute to completion from first to last. Programs that are not attached to any task show up as unscheduled programs.

Unscheduled programs within a task are downloaded to the controller with the entire project. The controller verifies unscheduled programs but does not execute them.

You must schedule a program within a task before the controller can scan the program. To schedule an unscheduled program, use the Program/ Phase Schedule tab of the Task Properties dialog box.

Figure 34 - Scheduling an Unscheduled Program



Routines

A routine is a set of logic instructions in one programming language, such as Ladder Diagram (ladder logic). Routines provide the executable code for the project in a controller. A routine is similar to a program file or subroutine in a PLC or SLC™ processor.

Each program has a main routine. The main is the first routine to execute when the controller triggers the associated task and calls the associated program. Use logic, such as the Jump to Subroutine (JSR) instruction, to call other routines.

You can also specify an optional program fault routine. The controller executes this routine if it encounters an instruction-execution fault within any of the routines in the associated program.

Figure 35 - Routines in a Control Application

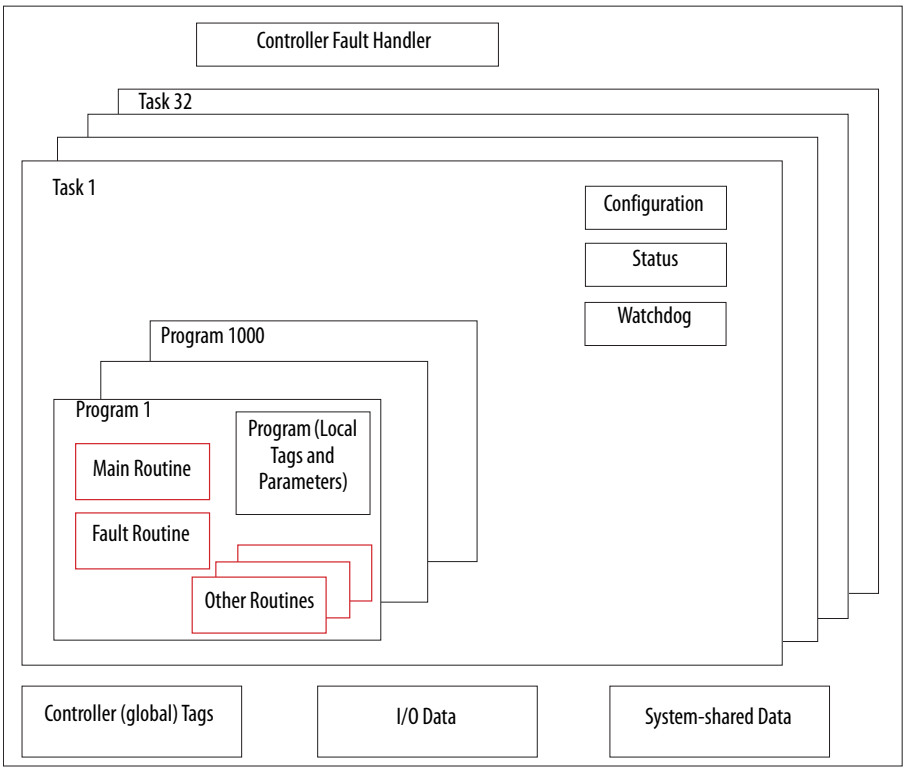
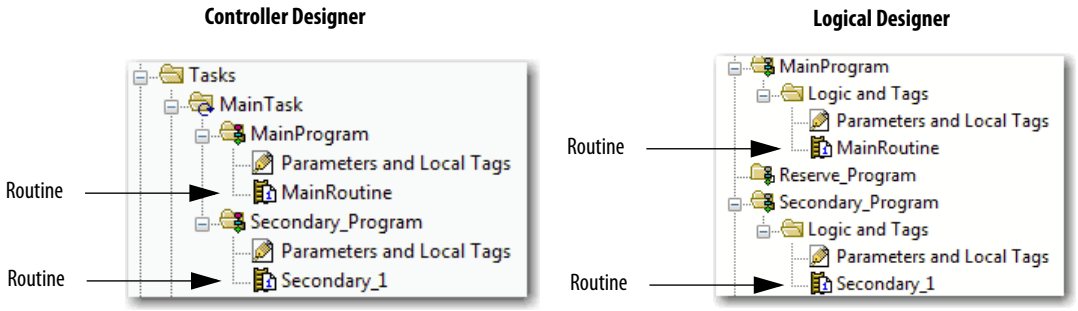


Figure 36 - Routines



Parameters and Local Tags

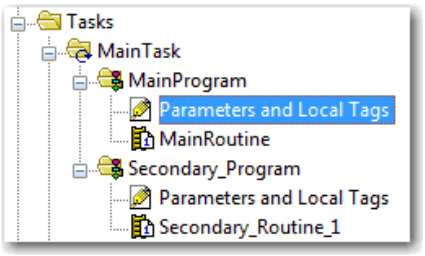
With a Logix5000 controller, you use a tag (alphanumeric name) to address data (variables). In Logix5000 controllers, there is no fixed, numeric format. The tag name identifies the data and lets you do the following:

- Organize your data to mirror your machinery.
- Document your application as you develop it.

This example shows data tags that are created within the scope of the Main Program of the controller.

Figure 37 - Tags Example

Controller Organizer —Main Program Parameters and Local Tags



Program Tags Window—Main Program Parameters and Local Tags

Analog I/O Device

Integer Value
Storage Bit
Counter
Timer
Digital I/O Device

Scope: MainProgram Show: All Tags Enter Name Filter...

Name	Usage	Alias For	Base Tag	Data Type	Description	External Access	Constant	Style
north_tank_mix	Local			BOOL		Read/Write		Decimal
north_tank_pr...	Local			REAL		Read/Write		Float
north_tank_temp	Local			REAL		Read/Write		Float
one_shots	Local			DINT		Read/Write		Decimal
recipe	Local			TANK		Read/Write		
recipe_number	Local			DINT		Read/Write		Decimal
replace_bit	Local			BOOL		Read/Write		Decimal
running_hours	Local			COUNTER		Read/Write		
running_secon...	Local			TIMER		Read/Write		
start	Local			BOOL		Read/Write		Decimal
stop	Local			BOOL		Read/Write		Decimal

There are several guidelines for creating and configuring parameters and local tags for optimal task and program execution. For more information, see the Logix5000 Controllers and I/O Tag Data Programming Manual, publication 1756-PM004.

Extended Properties

The Extended Properties feature lets you define more information, such as limits, engineering units, or state identifiers, for various components within your controller project.

Component	Extended Properties
Tag	In the tag editor, add extended properties to a tag.
User-defined data type	In the data type editor, add extended properties to data types.
Add-On Instructions	In the properties that are associated with the Add-On Instruction definition, add extended properties to Add-On Instructions.

Pass-through behavior is the ability to assign extended properties at a higher level of a structure or Add-On Instruction and have that extended property automatically available for all members. Pass-through behavior is available for descriptions, state identifiers, and engineering units and you can configure it. Configure pass-through behavior on the Project tab of the Controller Properties dialog box. If you choose not to show pass-through properties, only extended properties that have been configured for a given component are displayed.

Pass-through behavior is **not** available for limits. When an instance of a tag is created, if limits are associated with the data type, the instance is copied.

You must know which tags have limits that are associated with them as there is no indication in the tag browser that extended properties are defined for a tag. If, however, you try to use extended properties that have not been defined for a tag, the editors show a visual indication and the routine does not verify.

Access Extended Properties in Logic

You can access limits that are defined on tags by using the .@Min and .@Max syntax:

- You cannot write to extended properties values in logic.
- To use extended tag properties in an Add-On Instruction, you must pass them in as input operands to the Add-On Instruction.
- Alias tags that have extended properties cannot access the extended properties in logic.
- Limits can be configured for input and output parameters in Add-On Instructions. However, limits cannot be defined on an InOut parameter of an Add-On Instruction.
- Limits cannot be accessed inside Add-On Instruction logic. Limits are only for use by HMI applications.

If an array tag is using indirect addressing to access limits in logic, the following conditions apply:

- If the array tag has limits that are configured, the extended properties are applied to any array element that does not explicitly have that particular extended property configured. For example, if the array tag MyArray has Max configured to 100, any element of the array that does not have Max configured inherits the value of 100 when being used in logic. However, it is not visible to you that the value inherited from MyArray is configured in the tag properties.

- At least one array element must have a limit that is configured for indirectly referenced array logic to verify. For example, if MyArray[x].@Max is being used in logic, at least one array element of MyArray[] must have Max extended property configured if MyArray has not configured Max.

- Under the following circumstances a data type default value is used:

  – Array is accessed programmatically with indirect reference.
  – Array tag does not have the extended property configured.
  – A member of an array does not have the extended property configured.

  For example, for an array of SINT type, when max limit is called in logic for a member, the value 127 is used.

If an array element is directly accessed, the element has to have the extended property defined. If not, verification fails.

Programming Languages

The ControlLogix controller supports these programming languages: online and offline.

Table 45 - ControlLogix Controller Programming Languages

Language	Is best used in programs with
Relay ladder	Continuous or parallel execution of multiple operations (not sequenced)
	Boolean or bit-based operations
	Complex logical operations
	Message and communication processing
	Machine interlocking
	Operations that service or maintenance personnel have to interpret to troubleshoot the machine or process
Function block diagram	Continuous process and drive control
	Loop control
	Calculations in circuit flow
Sequential function chart (SFC)	High-level management of multiple operations
	Repetitive sequence of operations
	Batch process
	Motion control using structured text
	State machine operations
Structured text	Complex mathematical operations
	Specialized array or table loop processing
	ASCII string handling or protocol processing

For information about programming in these languages, see the Logix5000 Controllers Common Procedures Programming Manual, publication 1756-PM001.

Add-On Instructions

With RSLogix 5000® software, version 16.03.00 or later, and Logix Designer application, version 21.00.00 or later, you can design and configure sets of commonly used instructions to increase project consistency. Similar to the built-in instructions that are contained in Logix5000 controllers, these instructions you create are called Add-On Instructions. Add-On Instructions reuse common control algorithms. With them, you can do the following:

- Ease maintenance by animating logic for one instance.
- Help protect intellectual property with locking instructions.
- Reduce documentation development time.

You can use Add-On Instructions across multiple projects. You can define your instructions, obtain them from somebody else, or copy them from another project.

Table 46 explains some of the capabilities and advantages of use Add-On Instructions.

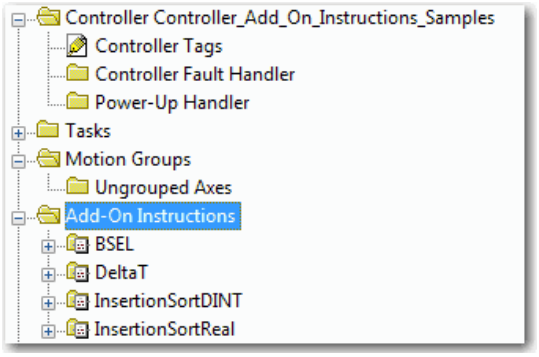
Table 46 - Add-On Instruction Capabilities

Capability	Description
Save Time	With Add-On Instructions, you can combine your most commonly used logic into sets of reusable instructions. You save time when you create instructions for your projects and share them with others. Add-On Instructions increase project consistency because commonly used algorithms all work in the same manner, regardless of who implements the project.
Use Standard Editors	You create Add-On Instructions by using one of three programming editors: • Relay Ladder • Function Block Diagram • Structured Text
Export Add-On Instructions	You can export Add-On Instructions to other projects and copy and paste them from one project to another. Give each instruction a unique name so that you don't accidentally overwrite another instruction of the same name.
Use Context Views	Context views let you visualize the logic of an instruction for instant, simplified online troubleshooting of your Add-On Instructions. Each instruction contains a revision, a change history, and an auto-generated help page.
Create Custom Help	When you create an instruction, you enter information for the description fields. This information becomes custom Help.
Apply Source Protection	As the creator of Add-On Instructions, you can limit users of your instructions to read-only access, or you can bar access to the internal logic or local parameters that are used by the instructions. This source protection lets you stop unwanted changes to your instructions and helps protect your intellectual property.

Once defined in a project, Add-On Instructions behave similarly to the built-in instructions in Logix5000 controllers. They appear on the instruction tool bar for easy access along with internal instructions.

Figure 38 - Add-On Instructions

Controller Organizer



Instruction Toolbar

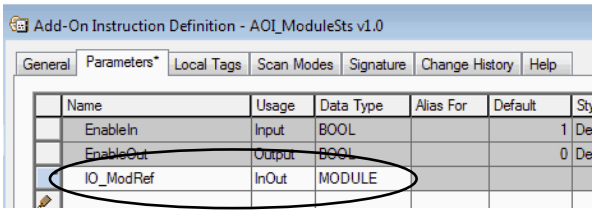
Access the Module Object

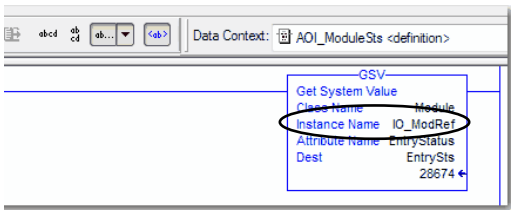
The MODULE object provides status information about a module. To select a particular module object, set the Object Name operand of the GSV/SSV instruction to the module name. The specified module must be present in the I/O Configuration section of the controller organizer and must have a device name.

Create the Add-On Instruction

With Logix Designer application, version 24.00.00 and later, you can access a MODULE object directly from an Add-On Instruction. Previously, you could access the MODULE object data but not from within an Add-On Instruction.

You must create a Module Reference parameter when you define the Add-On Instruction to access the MODULE object data. A Module Reference parameter is an InOut parameter of the MODULE data type that points to the MODULE Object of a hardware module. You can use module reference parameters in both Add-On Instruction logic and program logic.





For more information on the Module Reference parameter, see the Logix5000 Controllers Add-On Instructions Programming Manual, publication 1756-PM010 and the Logix Designer application online help.

The MODULE object uses the following attributes to provide status information:

- EntryStatus
- FaultCode
- FaultInfo
- FWSupervisorStatus
- ForceStatus
- Instance
- LEDStatus
- Mode
- Path

The Path attribute is available with Logix Designer application, version 24.00.00 and later. This attribute provides a communication path to the module.

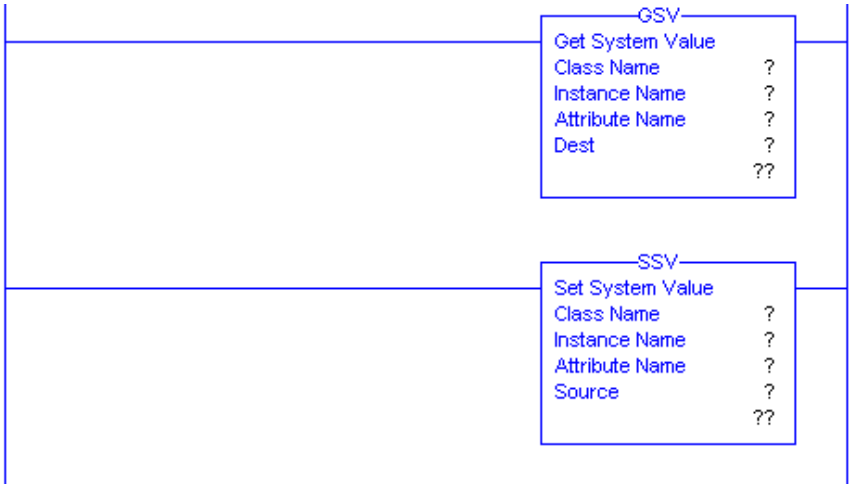
For more information on the attributes available in the MODULE object, see the Logix 5000 Controllers General Instructions Reference Manual, publication 1756-RM003.

Monitoring Controller Status

The ControlLogix controller uses Get System Value (GSV) and Set System Value (SSV) instructions to get and set (change) controller data. The controller stores system data in objects. There is no status file, as in the PLC-5® processor.

The GSV instruction retrieves the specified information and places it in the destination. The SSV instruction sets the specified attribute with data from the source. Both instructions are available from the Input/Output tab of the Instruction toolbar.

Figure 39 - GSV and SSV Instructions for Monitoring and Setting Attributes



When you add a GSV/SSV instruction to the program, the object classes, object names, and attribute names for the instruction are shown. For the GSV instruction, you can get values for the available attributes. For the SSV instruction, only the attributes you can set are shown.

Some object types appear repeatedly, so you have to specify the object name. For example, there can be several tasks in your application. Each task has its own Task object that you access by the task name.

There are several objects and attributes that you can use the GSV and SSV instructions to monitor and set the system. For more information about GSV instructions, SSV instructions, objects, and attributes see the Logix5000 Controllers General Instructions Reference Manual, publication 1756-RM003.

Monitoring I/O Connections

If communication with a device in the I/O configuration of the controller does not occur in an application-specific period, the communication times out and the controller produces warnings.

The minimum timeout period that, once expired without communication, causes a timeout is 100 ms. The timeout period can be greater, depending on the RPI of the application. For example, if your application uses the default RPI = 20 ms, the timeout period is 160 ms.

For more information on how to determine the time for your application, search the Rockwell Automation® Knowledgebase for answer ID 38535. The document is available at http://www.rockwellautomation.com/knowledgebase.

When a timeout does occur, the controller produces these warnings;

- An I/O fault status code is indicated on the status display of the 1756-L7*x* controller.
- The I/O status indicator on the front of the 1756-L6x controller flashes green.
- A ⚠ shows over the I/O configuration folder and over the devices that have timed out.
- A module fault code is produced, which you can access via the following:
  - The Module Properties dialog box
  - A GSV instruction

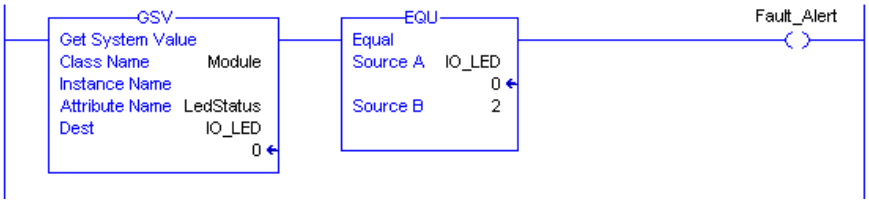
For more information about I/O faults, see the Major, Minor, and I/O Faults Programming Manual, publication 1756-PM014.

Determine If I/O Communication Has Timed Out

This example can be used with the 1756-L7*x* or 1756-L6*x* controllers:

- The GSV instruction gets the status of the I/O status indicator (via the LEDStatus attribute of the Module object) and stores it in the IO_LED tag.
- IO_LED is a DINT tag that stores the status of the I/O status indicator or status display on the front of the controller.
- If IO_LED equals 2, then at least one I/O connection has been lost and the Fault_Alert is set.

Figure 40 - GSV Used to Identify I/O Timeout



For more information about attributes available with the Module object, see the Logix5000 Controllers General Instructions Reference Manual, publication 1756-RM003.

Determine If I/O Communication to a Specific I/O Module Has Timed Out

If communication times out with a device (module) in the I/O configuration of the controller, the controller produces a fault code and fault information for the module. You can use GSV instructions to get fault code and information via the FaultCode and FaultInfo attributes of the Module object.

For more information about attributes available with the Module object, see the Logix5000 Controllers General Instructions Reference Manual, publication 1756-RM003.

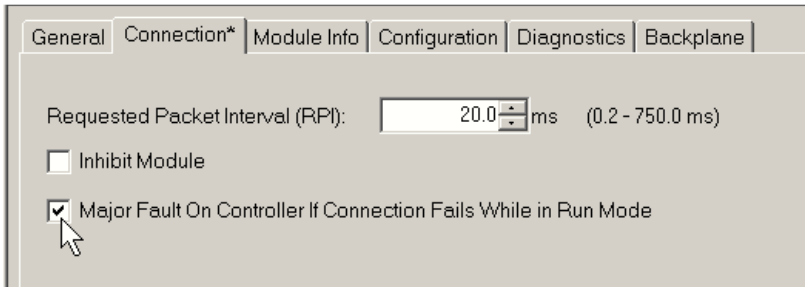
Interrupt the Execution of Logic and Execute the Fault Handler

Dependent on your application, you can want an I/O connection error to cause the Controller Fault Handler to execute. To do so, set the module property that causes a major fault to result from an I/O connection error. The major fault causes the execution of the Controller Fault Handler.

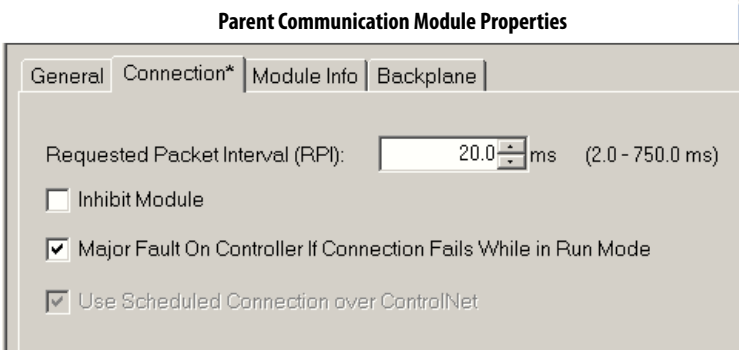
First, develop a routine in the Controller Fault Handler that can respond to I/O connection faults. Then, in the Module Properties dialog box of the I/O module or parent communication module, check Major Fault On Controller If Connection Fails While in Run Mode.

Figure 41 - I/O Connection Fault Causes Major Fault

I/O Module Properties



Parent Communication Module Properties



For more information about programming the Controller Fault Handler, see the Major, Minor, and I/O Faults Programming Manual, publication 1756-PM014.

System Overhead Time Slice

The controller communicates with other devices at a specified rate (scheduled) or when processing time is available to service the communication.

The system overhead time slice specifies the percentage of time a controller devotes to service communication. If you have a continuous task, the system overhead time slice that is entered on the Advanced tab of the Controller Properties dialog box specifies the continuous task/service communication ratio. However, if there is no continuous task, the overhead time slice has no effect.

Table 47 shows the ratio between the continuous task and service communication at various system overhead time slices for RSLogix 5000, version 16.03.00 or later, and Logix Designer version 21.00.00 or later.

Table 47 - Ratio between Continuous Task and Service Communication

Time Slice	Continuous Task Duration	Service Communication Duration
10%	9 ms	1 ms
20%	4 ms	1 ms
25%	3 ms	1 ms
33%	2 ms	1 ms
50%	1 ms	1 ms
66%	1 ms	2 ms
75%	1 ms	3 ms
80%	1 ms	4 ms
90%	1 ms	9 ms

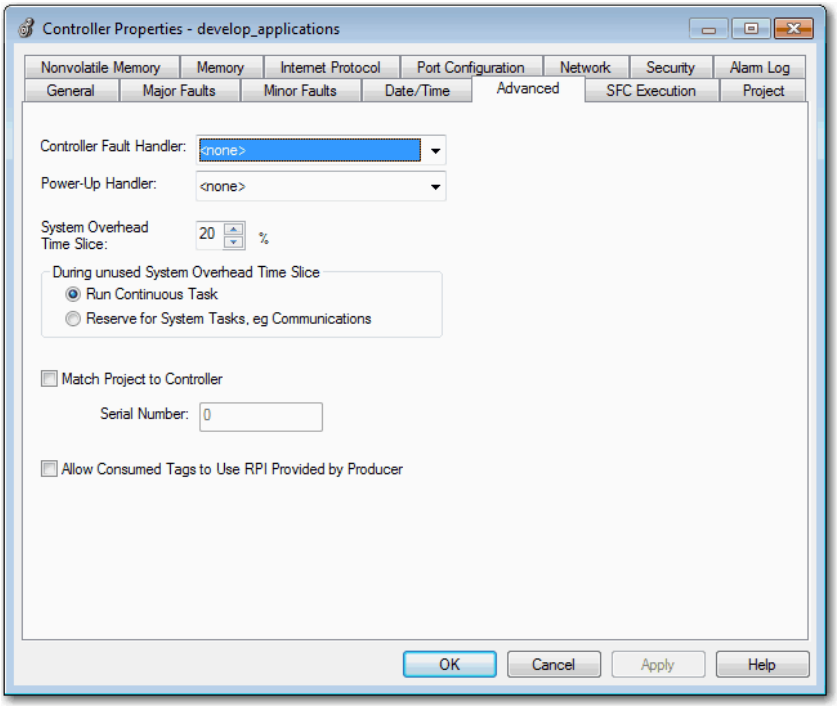
As shown in the table, if the system overhead time slice is less than or equal to 50%, the duration stays fixed at 1 ms. The same applies for 66% and higher, except there are multiple 1 ms intervals. For example, at 66% there are two 1 ms intervals of consecutive time and at 90% there are nine 1 ms intervals of consecutive time.

Configure the System Overhead Time Slice

To configure the system overhead time slice, perform this procedure.

1. In the Controller Organizer, right-click the controller and choose Properties.

   The Controller Properties dialog box appears.

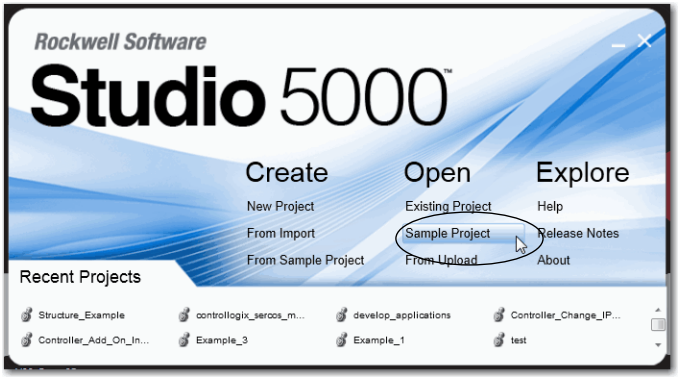


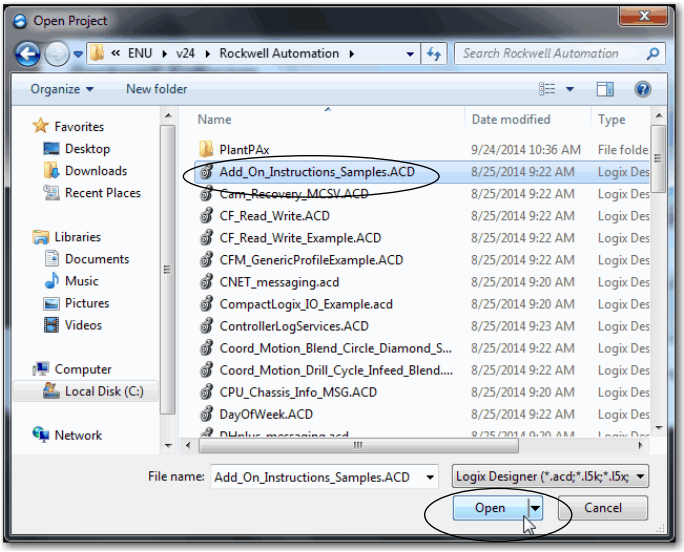
2. Click the Advanced tab.
3. Enter a numeric value in the System Overhead Time Slice box.
4. Use Run Continuous Task (default) or Reserve for System Tasks.
   - The Run Continue Task radio button is used when there is no communication or background tasks to process; controller immediately returns to the continuous task.
   - The Reserve for System Task radio button allocates the entire 1 ms of the system overhead time slice whether the controller has communication or background tasks to perform before returning back to the continuous task. This option lets you simulate a communication load on the controller during design and programming before HMIs, controller to controller messaging, and so forth, are configured.
5. Click OK.

Sample Controller Projects

The Studio 5000 Logix Designer® application includes sample projects that you can copy and modify to fit your application. To access the sample projects, choose Open Sample Project in the Studio 5000® interface and navigate to Samples > ENU > v24 > Rockwell Automation.

Figure 42 - Opening Sample Projects





Notes:

Using the PhaseManager Tool

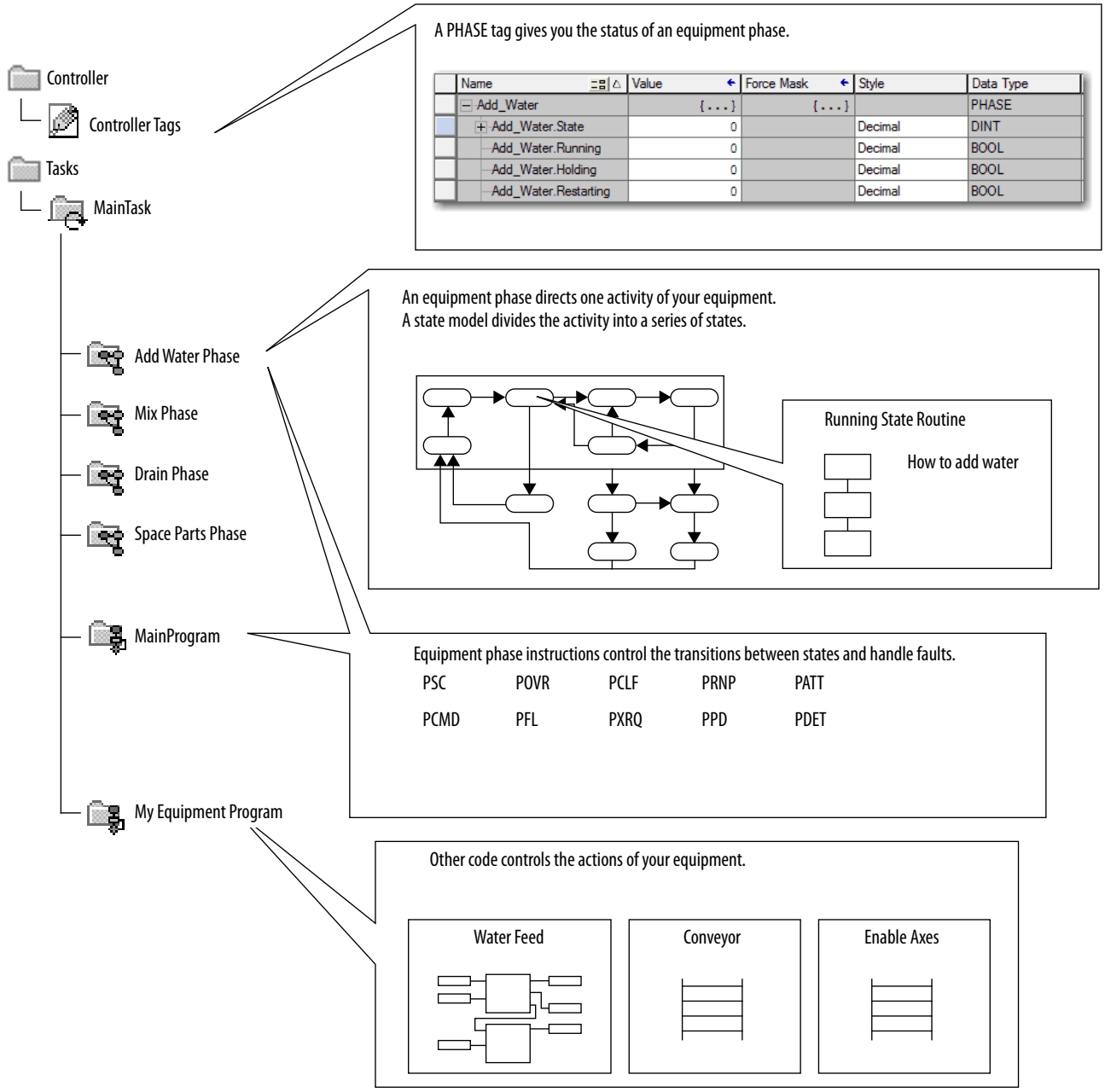
PhaseManager Overview

The PhaseManager™ tool lets you add equipment phases to your controller. An equipment phase helps you lay out your code in sections that are easier to write, find, follow, and change.

Table 48 - PhaseManager Terminology

Term	Description
Equipment phase	• As with a program, an equipment phase is run in a task and is given a set of routines and tags. • Unlike a program, an equipment phase runs by a state model and lets you do one activity.
State model	• A state model divides the operating cycle of your equipment into a series of states. Each state is an instance in the operation of the equipment, the actions, or conditions of the equipment at a given time. • The state model of an equipment phase resembles that of the S88 and Pack*ML* state models.
State machine	An equipment phase includes an embedded state machine that does the following: • Calls the routine that is associated with an active state • Manages the transitions between states with minimal coding • Makes sure that the equipment goes from state to state along an allowable path
PHASE tag	When you add an equipment phase, the application creates a tag for the equipment phase. The tag uses the PHASE data type.

Figure 43 - PhaseManager Overview



Minimum System Requirements

To develop PhaseManager programs, you need the following:

- A ControlLogix® controller at firmware revision 16 or later
- A communication path to the controller
- RSLogix 5000® software, version 16.03.00 or later or Logix Designer application, version 21.00.00 or later

To enable PhaseManager support, you need the Full or Professional edition of the software, or the software with PhaseManager software (catalog number 9324-RLDPMENE).

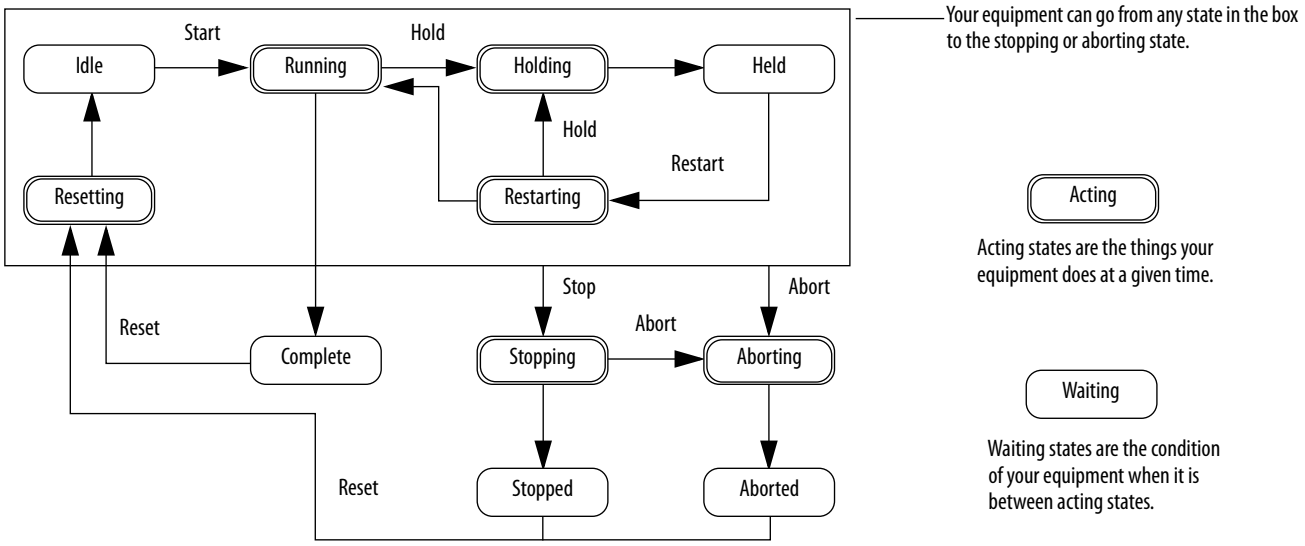
State Model Overview

A state model defines what your equipment does under different conditions, and how the states relate to each other. Each state can be described as an Acting state or Waiting state.

Table 49 - States in PhaseManager Software

State	Description
Acting	Does something or several things for a certain time or until certain conditions are met. An acting state runs once or repeatedly.
Waiting	Shows that certain conditions are met and the equipment is waiting for the signal to go to the next state.

Figure 44 - PhaseManager State Transitions



With a state model, you define the behavior of your equipment during Acting states.

Table 50 - Acting States in the PhaseManager State Model

State	Question to Ask
Resetting	How does the equipment get ready to run?
Running	What does the equipment do to make product?
Holding	How does the equipment temporarily stop making product without making scrap?
Restarting	How does the equipment resume production after holding?
Stopping	What happens during a normal shutdown?
Aborting	How does the equipment shut down if a fault or failure occurs?

How Equipment Changes States

The arrows of the state model show the states through which your equipment progresses:

- Each arrow is called a transition.
- A state model lets the equipment make only certain transitions. This restriction standardizes the behavior of the equipment so that other equipment using the same model behaves the same way.

Figure 45 - PhaseManager Transition Commands

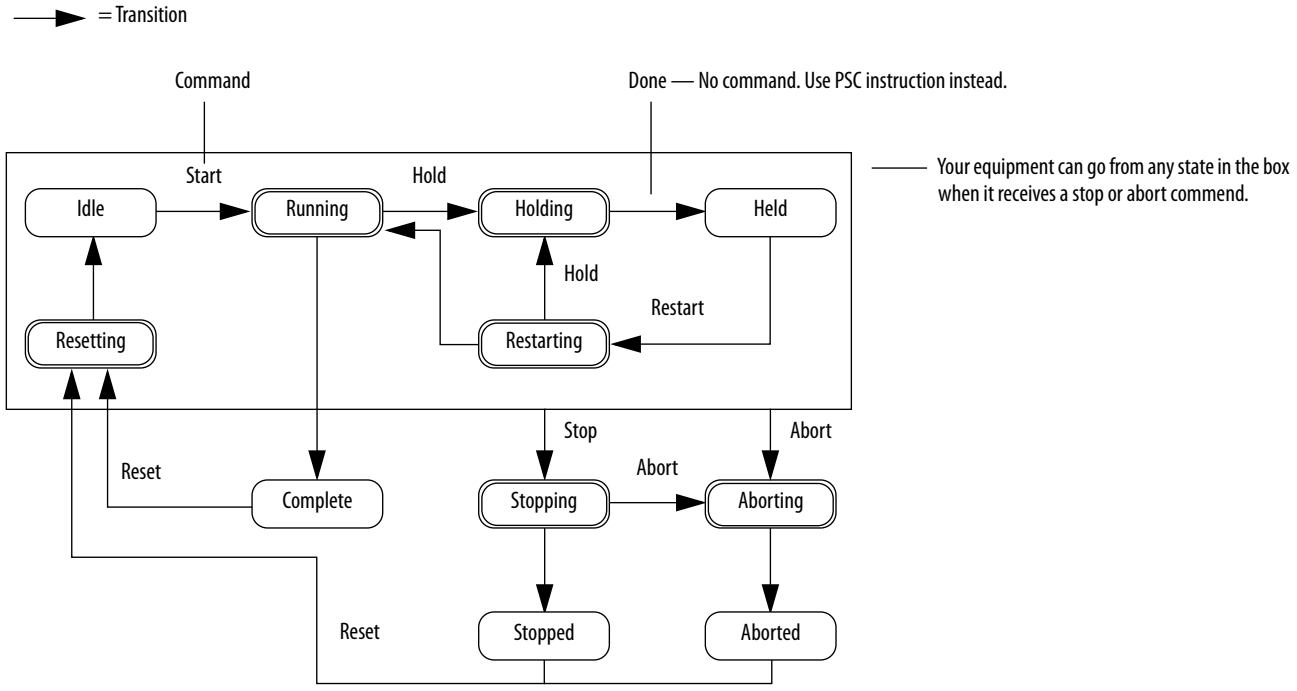


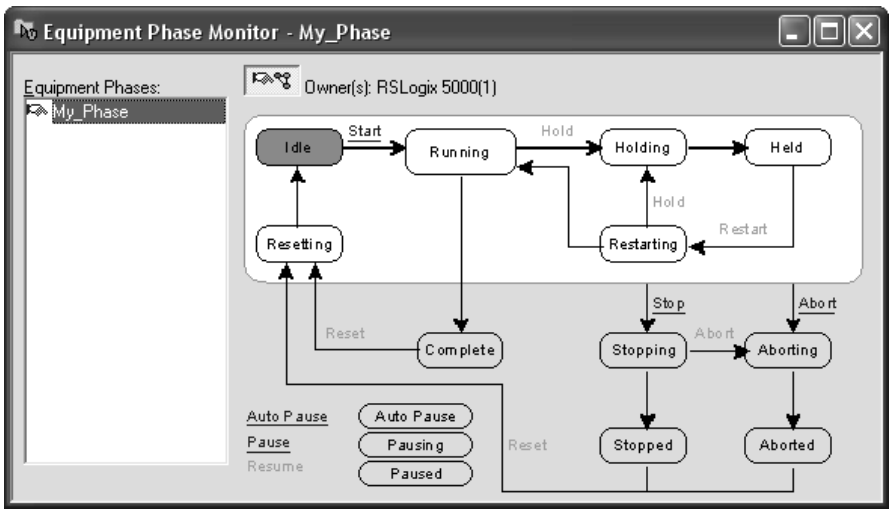
Table 51 - PhaseManager Transitions

Type of Transition	Description		
Command	A command tells the equipment to do something. For example, the operator pushes the start button to begin production and the stop button to halt production. The PhaseManager tool uses these commands:		
	Reset	Stop	Restart
	Start	Hold	Abort
Done	Equipment goes to a waiting state when it is finished with what it is doing. You do not give the equipment a command. Instead, you configure your code to signal when the phase state is finished.		
Fault	A fault tells you that something out of the ordinary has happened. You configure your code to look for faults and act if it finds any. If you want to shut down your equipment as quickly as possible when it detects a fault, configure your code to look for that fault and give the abort command if it finds it.		

Manually Change States

You can manually change an equipment phase. To change a PhaseManager state, perform this procedure.

1. Open the Equipment Phase Monitor.
2. Take ownership of the equipment phase by clicking Owners and clicking Yes.
3. Click the command that initiates the state you need (for example, Start or Reset).
4. After you have finished manually changing the state, click Owners to release your ownership.



PhaseManager Tool versus Other State Models

Table 52 compares PhaseManager state models to other state models.

Table 52 - PhaseManager Tool and Other State Models

PhaseManager Tool	S88	Pack*ML*
Resetting…Idle	Idle	Starting…Ready
Running…Complete	Running…Complete	Producing
Subroutines or breakpoints	Pausing…Paused	Standby
Holding…Held	Holding…Held	Holding…Held
Restarting	Restarting	None
Stopping…Stopped	Stopping…Stopped	Stopping…Stopped
Aborting…Aborted	Aborting…Aborted	Aborting…Aborted

Equipment Phase Instructions

The controller supports several equipment-phase relay ladder and structured text instructions.

Table 53 - Instructions for Use with PhaseManager Tool

Instruction	Instruction Function
PSC	Signal a phase that the state routine is complete and to go ahead to the next state.
PCMD	Change the state or substate of a phase.
PFL	Signal a failure for a phase.
PCLF	Clear the failure code of a phase.
PXRQ	Initiate communication with RSBizWare™ Batch software.
PRNP	Clear the NewInputParameters bit of a phase.
PPD	Configure breakpoints within the logic of a phase.
PATT	Take ownership of a phase to **one** of the following: • Stop another program or RSBizWare Batch software from commanding a phase. • Make sure another program or RSBizWare Batch software does not own a phase.
PDET	Relinquish ownership of a phase.
POVR	Override a command.

For more information about instructions for use with equipment phases, see the PhaseManager User Manual, publication LOGIX-UM001.

Redundant Systems

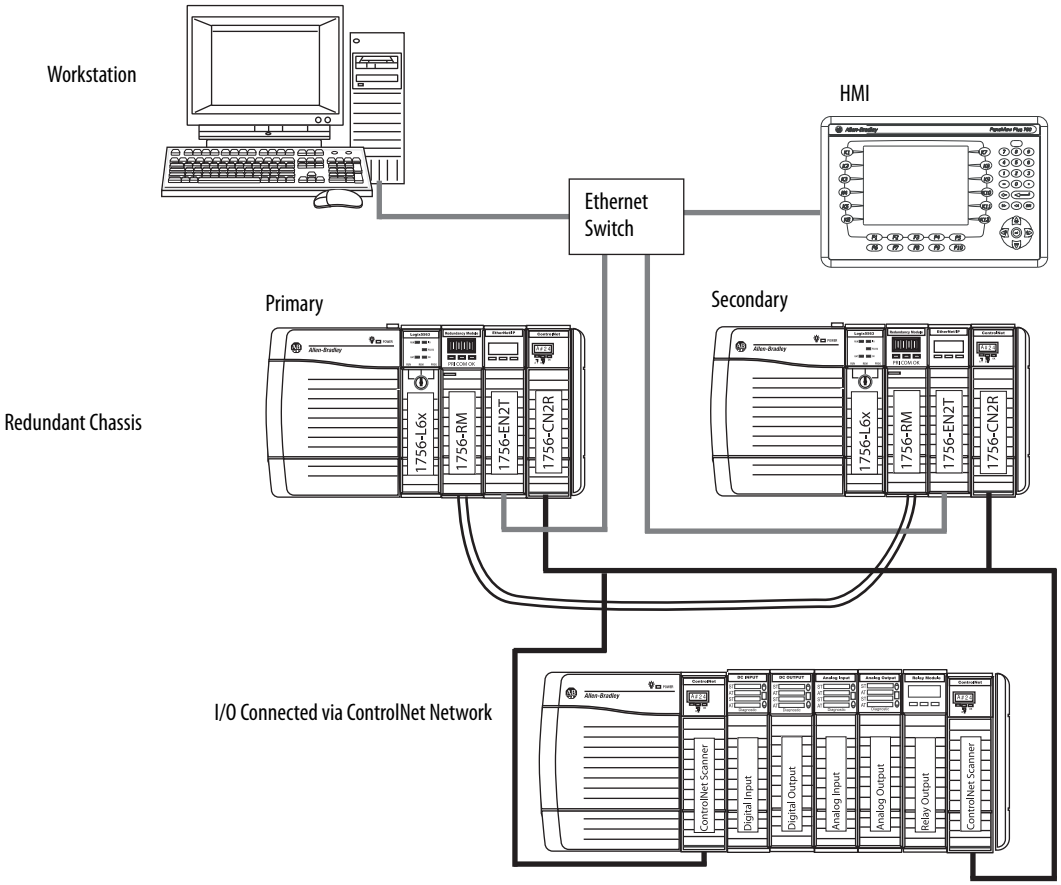
ControlLogix Redundancy Overview

Redundancy provides more system availability by switching control to a secondary controller chassis if a fault occurs in the primary controller chassis.

The redundant system switches control from the primary to the secondary when these faults occur:

- Power loss to primary chassis
- Hardware or firmware failure of any module in the primary chassis
- A major fault in the user program on the primary controller
- Loss of communication between the primary chassis and remote ControlNet or EtherNet/IP modules
- Disconnection of an Ethernet patch cable from an EtherNet/IP communication module or ControlNet cable connector on ControlNet communication module in the primary chassis
- Removal or insertion of any module in the primary chassis
- A user command that causes a switchover

Figure 46 - ControlLogix Enhanced Redundancy System



I/O can be connected via an EtherNet/IP network beginning with Enhanced Redundancy System revision 19.50.

Redundancy requires no additional programming and is transparent to any devices connected over an EtherNet/IP or ControlNet network.

Redundancy modules that are placed in each redundant chassis maintain the communication between the redundant chassis.

Depending on how you organize your project, outputs can experience a change in state (bump) during a switchover:

- During the switchover, outputs that are controlled by the highest priority task experience a bumpless switchover. For example, outputs do not revert to a previous state.
- Outputs in lower priority tasks can experience a change of state.

For detailed information about ControlLogix® redundancy systems, see the ControlLogix Enhanced Redundancy User Manual, publication 1756-UM535.

System Requirements

Most redundant systems must use at least these system components. For some applications, the ControlNet and EtherNet/IP modules are optional.

Table 54 - System Requirements

Quantity	Item	Notes
2	ControlLogix chassis	Both chassis must be the same size.
2	ControlLogix power supply	Must be the same in each chassis.
2	ControlLogix controller	• Use 1756-L6*x* or 1756-L7*x* controllers. • Use the same catalog number, series, firmware revision, and memory size controllers in each chassis. • Same slot placement.
2	ControlLogix ControlNet communication module	• Use 1756-CN2/B, 1756-CN2R/B, or 1756-CN2RXT modules. • ControlNet modules in the chassis must be identical in firmware revision, in series, slot placement, and module type.
2	ControlLogix EtherNet/IP communication modules	• Use the 1756-EN2T, 1756-EN2TXT, or 1756-EN2TR modules. • Must be identical in firmware revision, slot placement, and module type.
2	Redundancy module	• Use 1756-RM2 or 1756-RM2XT modules. • Redundancy modules in the chassis must be identical in firmware revision and slot placement. • For L7x high performance systems, RM modules must be RM/B and must have the same series and firmware revision in the chassis.
1 or 2	Redundancy module cable (fiber-optic)	• Use the 1756-RMC*x* cable. • Standard lengths are available.
2	Additional ControlNet nodes	• Place all I/O in remote chassis or DIN rails. • Add at least two nodes to each ControlNet network and the redundant chassis pair. • For enhanced redundancy, you must have at least one keeper-capable ControlNet device at a node address lower than the node addresses of the ControlNet modules in the redundant chassis.

System Considerations

When you are configuring a redundant ControlLogix system, these considerations to modules in the redundant chassis must be made.

Items in Primary and Secondary Chassis	Consideration
ControlLogix controller	• When configured for redundancy, the secondary controller automatically receives and buffers data. • A redundant controller uses twice as much data memory and I/O memory space as a nonredundant controller. • A redundant controller has a longer scan time than a nonredundant controller. • The ControlLogix Enhanced Redundancy User Manual, publication 1756-UM535, provides detailed information about minimizing the scan time impact. • You do not need a redundancy-specific version of Logix Designer software, but it must match your Enhanced Redundancy System revision level. • In an enhanced redundancy system, two controllers of the same type can reside in a controller chassis.
Communication modules	• In an enhanced redundancy system, as many as seven communication modules can reside in a controller chassis in any combination of EtherNet/IP modules and ControlNet modules. • To connect to other networks, bridge through another ControlLogix chassis outside the redundant system. • For best results, use a separate network for HMI and I/O communication.
I/O modules	• All I/O is remote from the redundant controller chassis. • Beginning with Enhanced Redundancy System revision 19.50, EtherNet/IP networks in redundant systems can be used for remote I/O or produced/consumed data.
Redundant power supplies	The 1756-PA75R and 1756-PB75R redundant power supplies provide reliable chassis power.
Redundant ControlNet media	Redundant media provide more reliable ControlNet communication.
Ethernet Device Level Ring	Duel-port Ethernet modules (1756-EN2TR) can be used to connect to a ring to provide more reliable Ethernet communication.

For complete information about to design and plan modules for use in your redundant ControlLogix chassis, see the ControlLogix Enhanced Redundancy User Manual, publication 1756-UM535.

Enhanced Versus Standard Redundancy

While the enhanced and standard redundancy systems operate in a similar manner, there are some key differences between the two platforms. Table 55 compares the enhanced and standard redundancy system features.

Table 55 - Comparison of Enhanced Redundancy to Standard Redundancy

Feature	Enhanced System(1)	Standard System
Supports enhanced ControlLogix ControlNet and EtherNet/IP communication modules, for example, the 1756-CN2/B or 1756-EN2T modules	✓	
Supports standard ControlLogix ControlNet and EtherNet/IP communication modules, for example, the 1756-CNB/D or 1756-ENBT modules		✓
Compatible with the single-slot 1756-RM redundancy modules	✓	✓
Compatible with the double-slot 1757-SRM redundancy modules		✓
Support for all 1756-L6*x* and 1756-L7*x* ControlLogix controllers	✓	
Use of ControlLogix- system components, for example, the 1756-L63XT controller and the 1756-CN2XT module	✓	
Availability of I/O over an EtherNet/IP network, including Redundant I/O systems	✓	

(1) Availability of some features that are supported in enhanced redundancy is dependent on the system revision used. For more information, see ControlLogix Enhanced Redundancy System User Manual, publication 1756-UM535.

Build a Redundant System

To build a typical redundant system, perform this procedure.

1. Install a ControlLogix chassis and power supply.
2. To the primary chassis, add 1756-L6*x* or 1756-L7*x* controllers.

   You cannot mix 1756-L6x and 1756-L7x controllers in the same chassis.
3. Add one or more ControlNet or EtherNet/IP communication modules.
4. Add one redundancy module.
5. Configure a secondary chassis that is identical to the primary chassis.

IMPORTANT Components in the redundant chassis pair must be identical in module configuration.

6. Connect the redundancy modules in the chassis.
7. Add I/O modules to ControlNet or EtherNet/IP networks.
8. Add operator interfaces to ControlNet or EtherNet/IP networks.

For detailed information to design and build an enhanced redundant system, see the ControlLogix Enhanced Redundancy System User Manual, publication 1756-UM535.

ControlNet Considerations in Redundant Systems

You can have as many as seven ControlNet communication modules in a redundant chassis.

IMPORTANT With each ControlNet network, you must have at least two nodes external to the redundant controller chassis to avoid timeouts on switchover.

The lowest node of each ControlNet network must be outside the redundant controller chassis.

For information on ControlNet considerations for enhanced redundant systems, see the ControlLogix Enhanced Redundancy System User Manual, publication 1756-UM535.

EtherNet/IP Considerations in Redundant Systems

You can have as many as seven EtherNet/IP modules in the redundant chassis.

In a redundant system, you can use EtherNet/IP for HMI communication or inter-controller messaging. HMI can communicate directly to with the primary controller. You no longer need RSLinx® Alias Topics.

ControlLogix redundancy supports EtherNet/IP for I/O control or to produce and consume data beginning with Enhanced Redundancy System revision 19.50, and can be used for the following:

- 1715 Redundant I/O
- Remote I/O modules
- HMI connections to the primary controller
- Producing and consuming data

For information on EtherNet/IP considerations for enhanced redundant systems, see the ControlLogix Enhanced Redundancy System User Manual, publication 1756-UM535.

IP Address Swapping

Firmware revision 13, and later, supports IP address swapping in redundant systems. With IP address swapping, you configure the primary and secondary EtherNet/IP modules with the same IP address. The primary EtherNet/IP module takes the IP address; the secondary module takes that address plus one in the last address segment.

On a switchover, the EtherNet/IP modules swap IP addresses. HMI devices automatically continue to communicate with the new primary controller because the IP addresses were swapped. Because of the way EtherNet/IP modules work, during a switchover, communication between the controller and an HMI device halts for several seconds, typically less than a minute.

Redundancy and Scan Time

At the end of each program, the primary controller synchronizes and crossloads fresh data to the secondary controller. This process keeps the secondary controller up-to-date and ready to take over. It also increases the scan time when compared to a nonredundant system.

The amount of time a crossload consumes depends on how much data the primary controller has to crossload:

- The primary controller synchronizes and crossloads any tag to which an instruction wrote a value, even the same value, since the last crossload.
- Crossloading also requires a small amount of overhead time (1 ms per crossload) to tell the secondary controller which program the primary controller is executing.

Redundancy firmware revision 16.53, or later, limits which programs precede synchronization and data crossloading. In many applications, changing this can reduce the overall impact to the task scan time by reducing the number of times a data area is synchronized. Removing a synchronization point results in 1 ms of overhead time that is saved and any time that was used to crossload the data.

For complete details about the scan time of a redundant system, see the ControlLogix Enhanced Redundancy System User Manual, publication 1756-UM535.

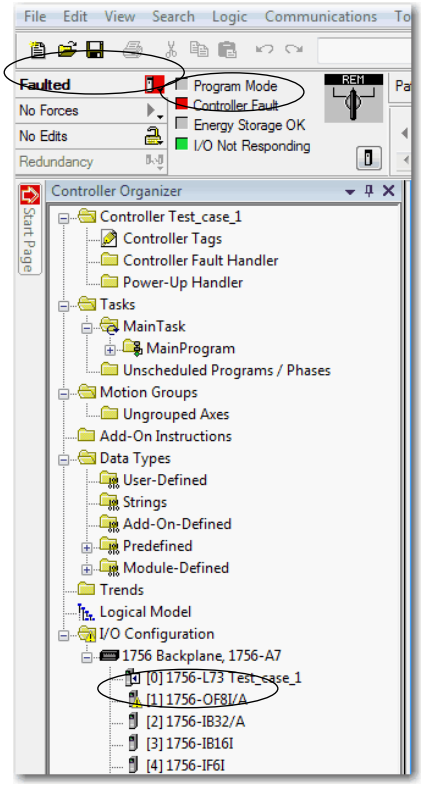
Notes:

Troubleshoot the Module

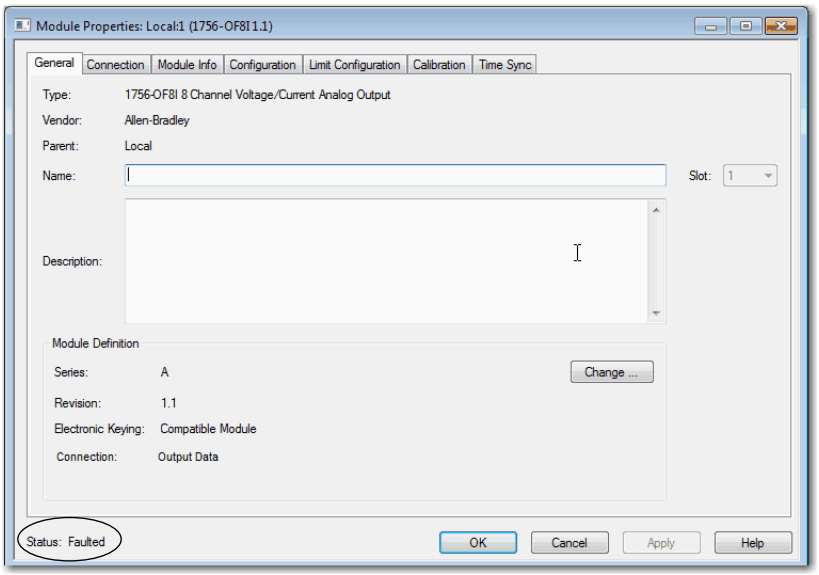
Use Logix Designer Application for Troubleshooting

The Studio 5000 Logix Designer® application indicates fault conditions in the following ways:

- **Warning signal** on the main screen next to the module - This occurs when the connection to the module is broken. The controller state also indicates Faulted and the Controller fault is illuminated in red.



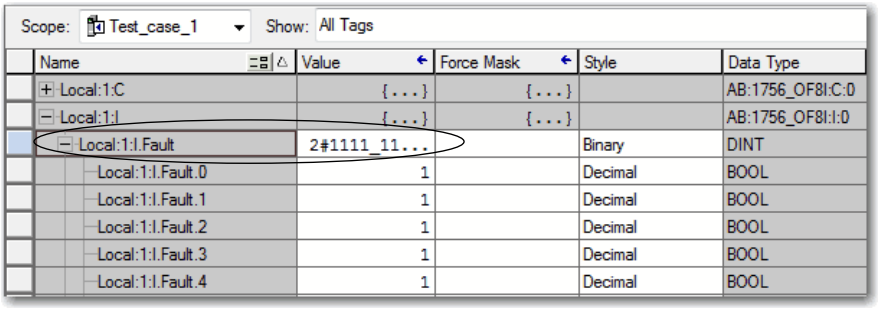
- Message in the **status line** of a screen.



On the Module Info tab, in the Status section, the Major and Minor Faults are listed along with the Internal State of the module.

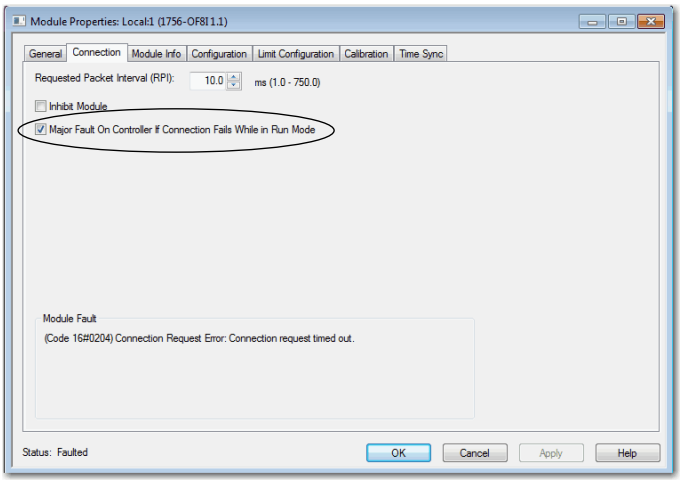
Notification in the Tag Editor - General module faults are also reported in the Tag Editor. Diagnostic faults are reported only in the tag editor.

The Value field indicates a fault with the number 1.

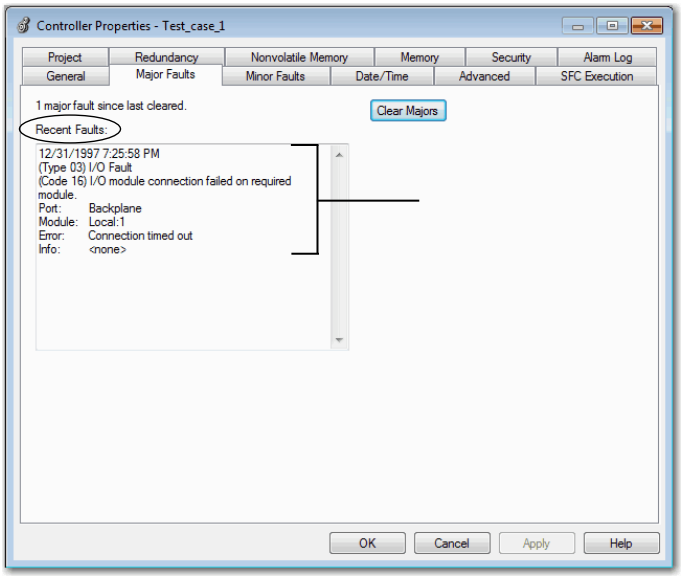


Fault Type Determination

To display recent fault information in the Major Faults tab of the Module Properties screen, you must check the Major Fault on Controller option in the Connection tab.



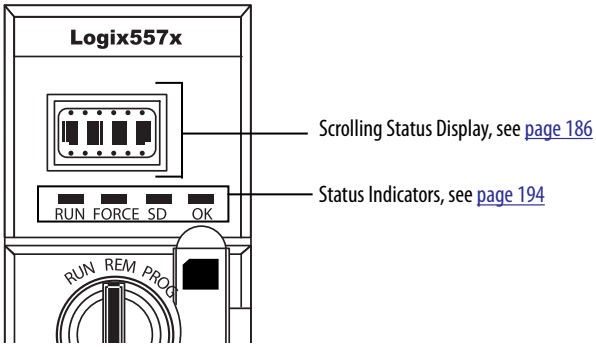
When you are monitoring the configuration properties of a module in the Logix Designer application and receive a Communication fault message, the Major Faults tab indicates the type of fault under Recent Faults.



1756-L7*x* Controller Status Display and Indicators

The 1756-L7*x* controllers have four status indicators and one four-character scrolling status display.

Figure 47 - 1756-L7*x* Status Display and Indicators



1756-L7*x* Controller Status Display

The 1756-L7*x* controller status display scrolls messages that provide information about the firmware revision, ESM status, project status, and major faults of the controller.

General Status Messages

The messages that are described in Table 56 are typically indicated upon powerup, powerdown, and while the controller is running to show the status of the controller and the ESM.

Table 56 - General Status Messages

Message	Interpretation
No message is indicated	The controller is Off. Check the OK indicator to determine if the controller is powered and determine the state of the controller.
TEST	The controller is conducting power-up tests.
PASS	Power-up tests have been successfully completed.
SAVE	A project is being saved to the SD card. You can also view the SD Indicator (see page 195) for more status information. Allow the save to complete before: • removing the SD card. • disconnecting power.
LOAD	A project is being loaded from the SD card at controller powerup. You can also view the SD Indicator (see page 195) for more status information. Allow the load to complete before doing the following: • Removing the SD card • Disconnecting power • Removing the ESM module
UPDT	A firmware upgrade is being conducted from the SD card upon powerup. You can also view the SD Indicator (see page 195) for more status information. If you do not want the firmware to update upon powerup, change the Load Image property of the controller.
CHRG	The capacitor-based ESM is being charged.
1756-L7*x*/*X*	The controller catalog number and series.

Table 56 - General Status Messages (Continued)

Message	Interpretation
Rev *XX.xxx*	The major and minor revision of the firmware of the controller.
No Project	No project is loaded on the controller. To load a project, do one of the following: • Use Logix Designer application to download the project to the controller • Use a SD card to load a project to the controller
Project Name	The name of the project that is currently loaded on the controller.
BUSY	The I/O modules that are associated with the controller are not yet fully powered. Allow time for powerup and I/O module self-testing.
Corrupt Certificate Received	The security certificate that is associated with the firmware is corrupted. Go to http://www.rockwellautomation.com/support/ and download the firmware revision you are trying to upgrade to. Replace the firmware revision that you have previously installed with that posted on the Technical Support website.
Corrupt Image Received	The firmware file is corrupted. Go to http://www.rockwellautomation.com/support/ and download the firmware revision you are trying to upgrade to. Replace the firmware revision that you have previously installed with that posted on the Technical Support website.
ESM Not Present	An ESM is not present and the controller cannot save the application at powerdown. Insert a compatible ESM, and, if using a capacitor-based ESM, do not remove power until the ESM is charged.
ESM Incompatible	The ESM is incompatible with the memory size of the controller. Replace the incompatible ESM with a compatible ESM.
ESM Hardware Failure	A failure with the ESM has occurred and the controller is incapable of saving of the program in the event of a powerdown. Replace the ESM before removing power to the controller so the controller program is saved.
ESM Energy Low	The capacitor-based ESM does not have sufficient energy to enable the controller to save the program in the event of a powerdown. Replace the ESM.
ESM Charging	The capacitor-based ESM is charging. Do not remove power until charging is complete.
Flash in Progress	A firmware upgrade initiated via ControlFLASH™ or AutoFlash utilities is in progress. Allow the firmware upgrade to complete without interruption.
Firmware Installation Required	The controller is using boot firmware (that is revision 1.*xxx*) and requires a firmware upgrade. Upgrade controller firmware.
SD Card Locked	An SD card that is locked is installed.

Fault Messages

If the controller displays a fault, these messages can be indicated on the status display.

Table 57 - Fault Messages

Message	Interpretation
Major Fault T*XX*:C*XX message*	A major fault of Type *XX* and Code *XX* has been detected. For example, if the status display indicates Major Fault T04:C42 Invalid JMP Target, a JMP instruction is programmed to jump to an invalid LBL instruction. For details about major recoverable faults, see the Logix5000™ Major, Minor, and I/O Fault Codes Programming Manual, publication 1756-PM014.
I/O Fault Local:*X #XXXX message*	An I/O fault has occurred on a module in the local chassis. The slot number and fault code are indicated along with a brief description. For example, I/O Fault Local:3 #0107 Connection Not Found indicates that a connection to the local I/O module in slot three is not open. Take corrective action specific to the type of fault indicated. For details about each I/O fault code, see the Logix5000 Major, Minor, and I/O Fault Codes Programming Manual, publication 1756-PM014.
I/O Fault *ModuleName #XXXX message*	An I/O fault has occurred on a module in a remote chassis. The name of the faulted module is indicated with the fault code and brief description of the fault. For example, I/O Fault My_Module #0107 Connection Not Found indicates that a connection to the module named My_Module is not open. Take corrective action specific to the type of fault indicated. For details about each I/O fault code, see the Logix5000 Major, Minor, and I/O Fault Codes Programming Manual, publication 1756-PM014.
I/O Fault *ModuleParent:X #XXXX message*	An I/O fault has occurred on a module in a remote chassis. The parent name of the module is indicated because no module name is configured in the I/O Configuration tree of Logix Designer application. In addition, the fault code is indicated with a brief description of the fault. For example, I/O Fault My_CNet:3 #0107 Connection Not Found indicates that a connection to a module in slot 3 of the chassis with the communication module named My_CNet is not open. Take corrective action specific to the type of fault indicated. For details about each I/O fault code, see the Logix5000 Major, Minor, and I/O Fault Codes Programming Manual, publication 1756-PM014.
X I/O Faults	I/O faults are present and *X* = the number of I/O faults present. If there are multiple I/O faults, the controller indicates that the first fault reported. As each I/O fault is resolved, the number of faults indicated decreases and the I/O Fault message indicates the next fault reported. Take corrective action specific to the type of fault indicated. For details about each I/O fault code, see the Logix5000 Major, Minor, and I/O Fault Codes Programming Manual, publication 1756-PM014.

Major Fault Messages

The Major Fault T*XX*:C*XX message* on the controller status display indicates major faults. Table 58 lists fault types, codes, and the associated messages as they are shown on the status display.

For detailed descriptions and suggested recovery methods for major faults, see the Logix5000 Major, Minor, and I/O Fault Codes Programming Manual, publication 1756-PM014.

Table 58 - Major Fault Status Messages

Type	Code	Message
1	1	Run Mode Powerup
1	60	Nonrecoverable
1	61	Nonrecoverable – Diagnostics Saved on CF Card
1	62	Nonrecoverable – Diagnostics and Program Saved on SD card
3	16	I/O Connection Failure
3	20	Chassis Failure
3	21	
3	23	Connection Failure
4	16	Unknown Instruction
4	20	Invalid Array Subscript
4	21	Control Structure LEN or POS < 0
4	31	Invalid JSR Parameter
4	34	Timer Failure
4	42	Invalid JMP Target
4	82	SFC Jump Back Failure
4	83	Value Out of Range
4	84	Stack Overflow
4	89	Invalid Target Step
4	90	Invalid Instruction
4	91	Invalid Context
4	92	Invalid Action
4	990	User-defined
4	991	
4	992	
4	993	
4	994	
4	995	
4	996	
4	997	
4	998	
4	999	

Table 58 - Major Fault Status Messages (Continued)

Type	Code	Message
6	1	Task Watchdog Expired
7	40	Save Failure
7	41	Bad Restore Type
7	42	Bad Restore Revision
7	43	Bad Restore Checksum
7	44	Failed to Restore Processor Memory
8	1	Keyswitch Change Ignored
11	1	Positive Overtravel Limit Exceeded
11	2	Negative Overtravel Limit Exceeded
11	3	Position Error Tolerance Exceeded
11	4	Encoder Channel Connection Fault
11	5	Encoder Noise Event Detected
11	6	Sercos Drive Fault
11	7	Synchronous Connection Fault
11	8	Servo Module Fault
11	9	Asynchronous Connection Fault
11	10	Motor Fault
11	11	Motor Thermal Fault
11	12	Drive Thermal Fault
11	13	Sercos Communications Fault
11	14	Inactive Drive Enable Input Detected
11	15	Drive Phase Loss Detected
11	16	Drive Guard Fault
11	32	Motion Task Overlap Fault
11	33	CST Reference Loss Detected
12	32	Disqualified Secondary Controller Cycle Power
12	33	Unpartnered Controller Identified in New Primary Chassis
12	34	Keyswitch Positions of Primary and Secondary Controllers Mismatched
14	1	Safety Task Watchdog Expired
14	2	Error In Routine of Safety Task
14	3	Safety Partner Missing
14	4	Safety Partner Unavailable
14	5	Safety Partner Hardware Incompatible
14	6	Safety Partner Firmware Incompatible
14	7	Safety Task Inoperable
14	8	Coordinated System Time (CST) Not Found
14	9	Safety Partner Nonrecoverable Controller Fault
18	1	CIP Motion Initialization Fault
18	2	CIP Motion Initialization Fault Mfg

Table 58 - Major Fault Status Messages (Continued)

Type	Code	Message
18	3	CIP Motion Axis Fault
18	4	CIP Motion Axis Fault Mfg
18	5	CIP Motion Fault
18	6	CIP Module Fault
18	7	Motion Group Fault
18	8	CIP Motion Configuration Fault
18	9	CIP Motion APR Fault
18	10	CIP Motion APR Fault Mfg
18	128	CIP Motion Guard Fault

I/O Fault Codes

The controller indicates I/O faults on the status display in one of these formats:

- I/O Fault Local:*X #XXXX message*
- I/O Fault *ModuleName #XXXX message*
- I/O Fault *ModuleParent*:*X #XXXX message*

The first part of the format is used to indicate the location of the module with a fault. How the location is indicated depends on your I/O configuration and the properties of the module that are specified in Logix Designer application.

The latter part of the format, #XXXX message, can be used to diagnose the type of I/O fault and potential corrective actions. For details about each I/O fault code, see the Logix5000 Major, Minor, and I/O Fault Codes Programming Manual, publication 1756-PM014.

Table 59 - I/O Fault Messages

Code	Message
#0001	Connection Failure
#0002	Insufficient Resource
#0003	Invalid Value
#0004	IOI Syntax
#0005	Destination Unknown
#0006	Partial Data Transferred
#0007	Connection Lost
#0008	Service Unsupported
#0009	Invalid Attribute Value
#000A	Attribute List Error
#000B	State Already Exists
#000C	Object Mode Conflict

Table 59 - I/O Fault Messages (Continued)

Code	Message
#000D	Object Already Exists
#000E	Attribute Not Settable
#000F	Permission Denied
#0010	Device State Conflict
#0011	Reply Too Large
#0012	Fragment Primitive
#0013	Insufficient Command Data
#0014	Attribute Not Supported
#0015	Data Too Large
#0100	Connection In Use
#0103	Transport Not Supported
#0106	Ownership Conflict
#0107	Connection Not Found
#0108	Invalid Connection Type
#0109	Invalid Connection Size
#0110	Module Not Configured
#0111	RPI Out of Range
#0113	Out of Connections
#0114	Wrong Module
#0115	Wrong Device Type
#0116	Wrong Revision
#0117	Invalid Connection Point
#0118	Invalid Configuration Format
#0119	Module Not Owned
#011A	Out of Connection Resources
#0203	Connection Timeout
#0204	Unconnected Message Timeout
#0205	Invalid Parameter
#0206	Message Too Large
#0301	No Buffer Memory
#0302	Bandwidth Not Available
#0303	No Bridge Available
#0304	ControlNet Schedule Error
#0305	Signature Mismatch
#0306	CCM Not Available
#0311	Invalid Port
#0312	Invalid Link Address
#0315	Invalid Segment Type
#0317	Connection Not Scheduled

Table 59 - I/O Fault Messages (Continued)

Code	Message
#0318	Invalid Link Address
#0319	No Secondary Resources Available
#031E	No Available Resources
#031F	No Available Resources
#0800	Network Link Offline
#0801	Incompatible Multicast RPI
#0814	Data Type Mismatch
#FD01	Bad Backplane EEPROM
#FD02	No Error Code
#FD03	Missing Required Connection
#FD04	No CST Master
#FD05	Axis or GRP Not Assigned
#FD06	Sercos Transition Fault
#FD07	Sercos Init Ring Fault
#FD08	Sercos Comm Fault
#FD09	Sercos Init Node Fault
#FD0A	Axis Attribute Reject
#FD1F	Safety I/O
#FD20	No Safety Task
#FE01	Invalid Connection Type
#FE02	Invalid Update Rate
#FE03	Invalid Input Connection
#FE04	Invalid Input Data Pointer
#FE05	Invalid Input Data Size
#FE06	Invalid Input Force Pointer
#FE07	Invalid Output Connection
#FE08	Invalid Output Data Pointer
#FE09	Invalid Output Data Size
#FE0A	Invalid Output Force Pointer
#FE0B	Invalid Symbol String
#FE0C	Invalid Scheduled Personal Computer Instance
#FE0D	Invalid Symbol Instance
#FE0E	Module Firmware Updating
#FE0F	Invalid Firmware File Revision
#FE10	Firmware File Not Found
#FE11	Firmware File Invalid
#FE12	Automatic Firmware Update Failed
#FE13	Update Failed - Active Connection
#FE14	Searching Firmware File

Table 59 - I/O Fault Messages (Continued)

Code	Message
#FE22	Invalid Connection Type
#FE23	Invalid Unicast Allowed
#FF00	No Connection Instance
#FF01	Path Too Long
#FF04	Invalid State
#FF08	Invalid Path
#FF0B	Invalid Config
#FF0E	No Connection Allowed

1756-L7*x* Controller Status Indicators

The status indicators are below the status display on the controller. They indicate the state of the controller as described in these tables.

RUN Indicator

Use the mode switch on the front of the controller or use the Controller Status menu in the Logix Designer application to change the controller mode that is shown by the RUN indicator.

Table 60 - RUN Indicator

State	Description
Off	The controller is in Program or Test mode.
Steady green	The controller is in Run mode.

FORCE Indicator

The Force indicator shows if I/O forces are enabled on the controller.

Table 61 - FORCE Indicator

State	Description
Off	No tags contain I/O force values.
Solid amber	I/O forces are active (enabled) though I/O force values and can be configured. **Use caution if you install (add) a force. If you install (add) a force, it immediately takes effect.**
Flashing amber	One or more input or output addresses have been forced to an On or Off state, but the forces have not been enabled. **Use caution if you enable I/O forces. If you enable I/O forces, all existing I/O forces also take effect.**

SD Indicator

The SD indicator shows if the SD card is in use.

Table 62 - SD Indicator

State	Description
Off	No activity is occurring with the SD card.
Flashing green	The controller is reading from or writing to the SD card. Do not remove the SD card while the controller is reading or writing.
Solid green	
Flashing red	The SD card does not have a valid file system.
Solid red	The controller does not recognize the SD card.

OK Indicator

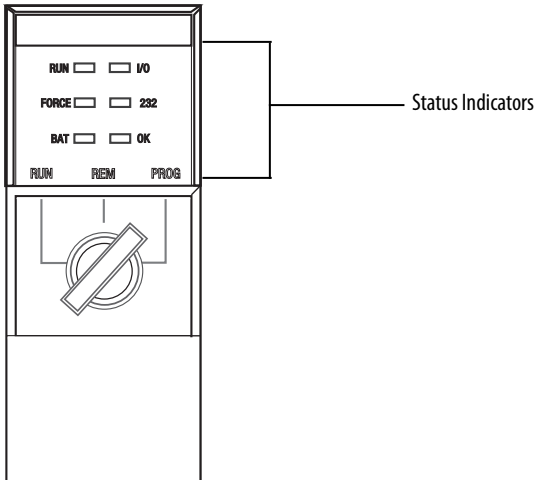
The OK indicator shows the state of the controller.

Table 63 - OK Indicator

State	Description
Off	No power is applied to the controller.
Flashing red	Either of the following is true: • It is a new controller, out of the box, and it requires a firmware upgrade. If a firmware upgrade is required, the status display indicates Firmware Installation Required. To upgrade firmware, see Upgrade Controller Firmware on page 50. • It is a previously used or in-use controller and a major fault has occurred. For details about major recoverable and nonrecoverable faults, see the Logix5000 Major, Minor, and I/O Fault Codes Programming Manual, publication 1756-PM014.
Solid red	One of the following is true: • The controller is completing power-up diagnostics. • The charge of the capacitor in the ESM is being discharged upon powerdown. • The controller is powered, but is inoperable. • The controller is loading a project to nonvolatile memory.
Solid green	The controller is operating normally.

1756-L6*x* Status Indicators

The 1756-L6*x* controllers have status indicators on the front of the controller that show the state of the controller.



RUN Indicator

Use the mode switch on the front of the controller or use the Controller Status menu in the Logix Designer application to change the controller mode that is shown by the RUN indicator.

Table 64 - RUN Indicator

State	Description
Off	The controller is in Program or Test mode.
Steady green	The controller is in Run mode.

I/O Indicator

The I/O indicator shows the status of I/O modules in the project of the controller.

Table 65 - I/O Indicator

State	Description
Off	Either of the following is true: • There are no devices are in the I/O configuration of the controller. If needed, add the required devices to the I/O configuration of the controller. • The controller does not contain a project (controller memory is empty). If prepared, download the project to the controller.
Solid green	The controller is communicating with the devices in its I/O configuration.
Flashing green	One or more devices in the I/O configuration of the controller are not responding. For more information, go online with the Logix Designer application to check the I/O configuration of the controller.
Flashing red	A chassis fault exists. Troubleshoot the chassis and replace it if necessary.

FORCE Indicator

The FORCE indicator shows if I/O forces are active or enabled.

Table 66 - FORCE Indicator

State	Description
Off	Either of the following is true: • No tags contain I/O force values. • I/O forces are inactive (disabled).
Steady amber	I/O forces are active (enabled) though I/O force values and can be configured. **Use caution if you install (add) a force. If you install (add) a force, it immediately takes effect.**
Flashing amber	One or more input or output addresses have been forced to an On or Off state, but the forces have not been enabled. **Use caution if you enable I/O forces. If you enable I/O forces, all existing I/O forces also take effect.**

RS232 Indicator

The RS232 indicator shows if the serial port is in use.

Table 67 - RS232 Status Indicator

State	Description
Off	There is no serial connection activity.
Flashing green	There is serial connection activity.

BAT Indicator

The BAT indicator shows the charge of the battery and if the program is being saved.

Table 68 - BAT Indicator

State	Controller Series	Description
Off	N/A	The controller is able to support memory.
Solid green	A	The series A controllers do not use this state.
	B	The series B controller is conducting a save of the program to internal-nonvolatile memory during a controller power down.
Solid red	N/A	Either of the following is true: • A battery is not installed. • The battery is 95% discharged and requires replacement. If the indicator is solid red before a power down, the indicator remains red while the controller is completing a program save to internal-nonvolatile memory.

OK Indicator

The OK indicator shows the state of the controller.

Table 69 - OK Indicator

State	Description
Off	No power is applied to the controller.
Flashing red	Either of the following is true: • It is a new controller, out of the box, and it requires a firmware upgrade. • It is a previously used or in-use controller and a major fault has occurred. • The controller is experiencing a nonrecoverable, major fault.
Steady red	• A nonrecoverable major fault occurred and the program was cleared from memory. • The controller is powered up, in diagnostics mode. • The controller is powered, but inoperable.
Steady green	The controller is operating normally.
Flashing green	The controller is storing or loading a project to or from nonvolatile memory. If using a CompactFlash card, leave the card in the controller until the OK status indicator turns solid green.

Numerics

A

B

C

D

E

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U

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	https://rockwellautomation.custhelp.com/
Local Technical Support Phone Numbers	Locate the phone number for your country.	http://www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	http://www.rockwellautomation.com/global/literature-library/overview.page
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	http://www.rockwellautomation.com/global/support/pcdc.page

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the How Are We Doing? form at http://literature.rockwellautomation.com/idc/groups/literature/documents/du/ra-du002_-en-e.pdf.

Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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Publication 1756-UM001P-EN-P - May 2017

Supersedes Publication 1756-UM0010-EN-P - October 2014

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Allen-Bradley

1756 ControlLogix Communication Modules Specifications

Standard ControlLogix Catalog Numbers: 1756-CN2, 1756-CN2R, 1756-CNB, 1756-CNBR, 1756-DNB, 1756-DHRIO, 1756-DH485, 1756-EN2F, 1756-EN2T, 1756-EN2TP, 1756-EN2TR, 1756-EN2TSC, 1756-EN3TR, 1756-EN4TR, 1756-ENBT, 1756-EWEB, 1756-RIO, 1756-SYNCH, 1756-TIME

ControlLogix 1756 Communication Module Conformal Coated Catalog Numbers: 1756-CN2RK, 1756-EN2FK, 1756-EN2TK, 1756-EN2TPK, 1756-EN2TRK, 1756-EN4TRK, 1756-ENBTK, 1756-TIMEK

ControlLogix-XT Catalog Numbers: 1756-CN2RXT, 1756-DHRIOXT, 1756-EN2TPXT, 1756-EN2TXT, 1756-EN2TRXT, 1756-EN4TRXT

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
EtherNet/IP Modules Installation Instructions, publication ENET-IN002	Provides information on installing EtherNet/IP™ modules.
EtherNet/IP Secure Communication User Manual, publication ENET-UM003	Provides information on system architecture, configuring secure communication, and diagnostics.
ControlNet Modules Installation Instructions, publication CNET-IN005	Provides instructions for installing ControlNet® modules.
ControlLogix System User Manual, publication 1756-UM001	Provides information on system architecture, configuring secure communication, and diagnostics.
ControlLogix Time Synchronization Module - Series B User Manual, publication 1756-UM542	Describes the functionality, installation, configuration, and operation of the 1756-TIME module.
DeviceNet Network Configuration User Manual, publication DNET-UM004	Provides information on system architecture, configuring communication, and diagnostics.
EtherNet/IP Network Devices User Manual, publication ENET-UM006	Describes how to use EtherNet/IP communication modules in Logix 5000™ control systems
ControlLogix DH-485 Communication Module User Manual, publication 1756-UM532	Provides information on system architecture, configuring communication, and diagnostics.
ControlLogix Data Highway Plus-Remote I/O Communication Interface Module User Manual, publication 1756-UM514	Provides information about programming, messaging, applying, and connecting the module.
ControlLogix SynchLink Module User Manual, publication 1756-UM521	Provides information about topologies, configurations, planning, and installing a Synchlink™ module.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Summary of Changes

This table contains the changes made in this revision.

Topic	Page
Catalog Numbers 1756-EN4TR, 1756-EN4TRK, and 1756-EN4TRXT added.	Throughout

Available Communication Modules

Network	Cat. No.	Description	Page
EtherNet/IP	1756-EN2F	EtherNet/IP bridge, fiber, 256 Logix connections	7
	1756-EN2T	EtherNet/IP bridge, copper, 256 Logix connections	7
	1756-EN2TSC	EtherNet/IP secure communication module	7
	1756-EN2TR, 1756-EN2TRK	EtherNet/IP bridge, embedded switch, copper Supports as many as 8 axis of motion	7
	1756-EN3TR	EtherNet/IP bridge, embedded switch, copper Supports as many as 128 axis of motion	7
	1756-EN2TP, 1756-EN2PK, 1756-EN2PXT	EtherNet/IP bridge with Parallel Redundancy Protocol Supports as many as 8 axis of motion	7
	1756-ENBT	EtherNet/IP bridge, copper, 128 Logix connections	7
	1756-EWEB	Ethernet web server, 128 Logix connections, Class 3 messaging only	7
	1756-EN2TXT	ControlLogix-XT™, EtherNet/IP bridge, copper, 256 Logix connections	7
	1756-EN2TRXT	ControlLogix-XT EtherNet/IP bridge module with embedded switch	7
	1756-EN4TR, 1756-EN4TRK, 1756-EN2TRXT	ControlLogix® EtherNet/IP with CIP Security™	7
	1756-EN4TRXT	ControlLogix-XT EtherNet/IP with CIP Security	7
ControlNet	1756-CN2/B, 1756-CN2/C, 1756-CN2R/B, 1756-CN2R/C, 1756-CN2RK	ControlNet bridge, 128 Logix connections(1)	15
	1756-CNB, 1756-CNBR	ControlNet bridge, 64 connections; recommend using only 40…48 Logix connections for I/O	15
	1756-CN2RXT	ControlLogix-XT, ControlNet bridge, 128 Logix connections(1)	19
DeviceNet®	1756-DNB/E	DeviceNet bridge	23
Data Highway Plus™	1756-DHRIO	Data Highway Plus/Remote I/O module	27
	1756-DHRIOXT	ControlLogix-XT, Data Highway Plus/Remote I/O module	29
Remote I/O	1756-DHRIO	Data Highway Plus/Remote I/O module	27
	1756-RIO/B	Remote I/O module	27
	1756-DHRIOXT	ControlLogix-XT, Data Highway Plus/Remote I/O module	29
DH-485 module	1756-DH485	DH-485 module	32
SynchLink	1756-SYNCH	SynchLink fiber-optic communication link	34
Time Synchronization	1756-TIME	Time synchronization on different interfaces by using Global Positioning System (GPS) technology	36

(1) 128 connections are available for standard use. An additional three connections are reserved for redundant control.

Communication Connections

A ControlLogix system uses connections to establish communication links between devices. The types of connections include the following:

- Controller-to-local I/O modules or local communication modules
- Controller-to-remote I/O or remote communication modules
- Controller-to-remote I/O (rack-optimized) modules
- Produced and consumed tags
- Messages
- Controller access with the Studio 5000™ environment
- Controller access with RSLinx® software for HMI or other applications

You indirectly determine the number of connections the controller uses by configuring the controller to communicate with other devices in the system. The limit of connections ultimately resides in the communication module you use for the connection. If a message path routes through a communication module, the connection that is related to the message also counts towards the connection limit of that communication module.

EtherNet/IP Network

The Ethernet Industrial (EtherNet/IP) network protocol is an open industrial-networking standard that supports both real-time I/O messaging and message exchange. The EtherNet/IP network uses off-the-shelf Ethernet communication chips and physical media.

If you need to	Select this interface
Control I/O modules and drives Act as an adapter for I/O on remote EtherNet/IP links Communicate with other EtherNet/IP devices (messages and HMI) Bridge EtherNet/IP links to route messages to devices on other networks	1756-EN2F, 1756-EN2FK 1756-EN2T, 1756-EN2TK, 1756-EN2TXT 1756-EN2TP, 1756-EN2TPK, 1756-EN2TPXT 1756-EN2TR, 1756-EN2TRK, 1756-EN2TRXT 1756-ENBT, 1756-ENBTK
Support device level ring (DLR) and linear topologies	1756-EN2TR, 1756-EN2TRK 1756-EN3TR, 1756-EN3TRK
Support for Parallel Redundancy Protocol	1756-EN2TP, 1756-EN2TPK 1756-EN2TPXT
Provide control in environments where temperatures range from -25…70 °C (-13…158 °F)	1756-EN2TPXT 1756-EN2TRXT 1756-EN2TXT 1756-EN4TRXT
Secure access to a control system from within the plant network	1756-EN2TSC 1756-EN4TR, 1756-EN4TRK
Use an Internet browser to remotely access tags in a ControlLogix controller Communicate with other EtherNet/IP or generic Ethernet devices (messaging only; no I/O control) Bridge EtherNet/IP links to route messages to devices on other networks	1756-EWEB, 1756-EWEBK web server

EtherNet/IP Network Specifications

Table 1 - ControlLogix EtherNet/IP Connections Specifications(1)

Cat. No.	Connections		CIP Unconnected Messages (backplane + Ethernet)
	TCP	CIP(2)	
1756-ENBT	64	128	64 + 64
1756-EN2F	128	256	128 + 128
1756-EN2T	128	256	128 + 128
1756-EN2TXT	128	256	128 + 128
1756-EN2TP	128	256	128 + 128
1756-EN2TPXT	128	256	128 + 128
1756-EN2TR	128	256	128 + 128
1756-EN2TRXT	128	256	128 + 128
1756-EN2TSC	128	256	128 + 128
1756-EN3TR	128	256	128 + 128
1756-EN4TR	512	1000 I/O 528 (3)	256+256
1756-EN4TRXT	512	1000 I/O 528 (3)	256+256
1756-EWEB	64	128	128 + 128

(1) Includes the K conformal coating catalog numbers.

(2) CIP™ connections can be used for all explicit or all implicit applications. For example, a 1756-ENBT module has a total of 128 CIP connections that can be used for any combination of connections.

(3) There are 1000 CIP I/O connections and 528 CIP messaging connections.

Table 2 - ControlLogix EtherNet/IP Data Specifications(1)

Cat. No.	Produced/Consumed Tags		Socket Services	SNMP Support (password required)	Duplicate IP Detection (starting revision)
	Number of Multicast Tags, Max(2)	Unicast Available in RSLogix 5000 Software			
1756-ENBT	32	Version 16.03.00 or later	No	Yes	Revision 3.3
1756-EN2F	32	Version 16.03.00 or later	Yes	Yes	Revision 1.*x*
1756-EN2T	32	Version 16.03.00 or later	Yes	Yes	Revision 1.*x*
1756-EN2TXT	32	Version 16.03.00 or later	Yes	Yes	Revision 1.*x*
1756-EN2TP	32	Version 24.00.00 or later	Yes	Yes	Revision 10.x
1756-EN2TR	32	Version 17.01.02 or later	Yes	Yes	Revision 1.*x*
1756-EN2TRXT	32	Version 20.01.00 or later	Yes	Yes	Revision 1.*x*
1756-EN2TSC	32	Version 20.01.00 or later	No	Yes	Revision 1.*x*
1756-EN3TR	32	Version 18.02.00 or later	Yes	Yes	Revision 3.*x*
1756-EN4TR	32	Version 24.00.00 or later	Yes	Yes	Revision 2.001
1756-EN4TRXT	32	Version 24.00.00 or later	Yes	Yes	Revision 2.001
1756-EWEB	N/A	N/A	Yes	Yes	Revision 2.2

(1) Includes the K conformal coating catalog numbers.

(2) Each controller can send a maximum of 32 produced tags to one single consuming controller. If these same tags are sent to multiple consumers, the maximum number is 31.

Table 3 - ControlLogix EtherNet/IP Packet Rates Specifications(1)

Cat. No.	Firmware Revision	RSLogix 5000 Software Version	RSLinx Software Version	Packet Rate Capacity (packets/second)(3)		Support for Extended Environment(4)	Integrated Motion on the EtherNet/IP Network Axes
				I/O	HMI/MSG		
1756-ENBT	Any	8.02.00 or later	2.30 or later	5000	900	No	N/A
1756-EN2F	2.*x*	15.02.00 or later	2.51 or later	10,000	2000	No	N/A
	3.6 or later	18.02.00 or later(2)		25,000			Up to 4 axes supported(5)
							Up to 8 axes supported(5)
1756-EN2T	2.*x* or earlier	15.02.00 or later	2.51 or later	10,000	2000	No	N/A
	3.6 or later	18.02.00 or later(2)		25,000(5)			Up to 8 axes supported(5)
1756-EN2TXT	2.*x*	15.02.00 or later	2.51 or later	10,000	2000	Yes	N/A
	3.6 or later	18.02.00 or later(2)		25,000(5)			Up to 8 axes supported(5)
1756-EN2TP	2.*x*	17.01.02 or later	2.55 or later	10,000	2000	No	N/A
	10.x or later	18.02.00 or later(2)	2.56 or later	25,000(5)			Up to 8 axes supported(5)
1756-EN2TPXT	10.x or later	20.01.00 or later	2.56 or later	25,000(5)	2000	Yes	N/A
1756-EN2TR	2.*x*	17.01.02 or later	2.55 or later	10,000	2000	No	N/A
	3.6 or later	18.02.00 or later(2)	2.56 or later	25,000(5)			Up to 8 axes supported(5)
1756-EN2TRXT	5.028 or later	20.01.00 or later	2.56 or later	25,000(5)	2000	Yes	N/A
1756-EN2TSC	5.028 or later	20.01.00 or later	2.56 or later	25,000(5)	• 1800 without encryption • 930 with encryption	No	N/A
1756-EN3TR	3.6 or later	18.02.00 or later(2)	2.56 or later	25,000(5)	2000	No	Up to 128 axes supported(5)
1756-EN4TR	Any	24.00.00 or later	4.10 or later	• 50,000 without CIP Security • 25,000 with integrity • 15,000 with integrity and confidentiality	• 3,700 without CIP Security • 2,700 with integrity • 1,700 with integrity and confidentiality	No	Up to 256 axes supported(5)
1756-EN4TRXT	Any	24.00.00 or later	4.10 or later	• 50,000 without CIP Security • 25,000 with integrity • 15,000 with integrity and confidentiality	• 3,700 without CIP Security • 2,700 with integrity • 1,700 with integrity and confidentiality	Yes	Up to 256 axes supported(5)

(1) Includes the K conformal coating catalog numbers.

(2) This version is required to use CIP Sync™ technology, Integrated Motion on the EtherNet/IP Network, or Exact Match keying.

(3) I/O numbers are maximums; they assume no HMI/MSG. HMI/MSG numbers are maximums, they assume no I/O. Packet rates vary depending on packet size. For more details, see Troubleshoot EtherNet/IP Application Technique, publication ENET-AT003, and the EDS file for a specific catalog number.

(4) Module operates in a broad temperature spectrum, -20…70 °C (-4…158 °F), and meets ANSI/ISA-S71.04-1985 Class G1, G2 and G3, as well as cULus, Class 1 Div 2, C-Tick, CE, ATEX Zone 2 and SIL 2 requirements for increased protection against salts, corrosives, moisture/condensation, humidity, and fungal growth.

(5) This value assumes the use of a 1756-L7*x* ControlLogix controller. For a 1756-L6*x* ControlLogix controller, see ControlLogix Controllers User Manual, publication 1756-UM001.

Table 4 - Technical Specifications - 1756 EtherNet/IP Modules(1)

Attribute	1756-EN2F/B 1756-EN2F/C	1756-EN2T/D, 1756-EN2TSC/B, 1756-EN2TP/A	1756-EN2TR/C, 1756-EN3TR/B	1756-EN4TR/A	1756-ENBT/A	1756-EWEB/B
EtherNet/IP communication rate	10/100 Mbps			10/100 Mbps 1 Gbps	10/100 Mbps	
Current draw @ 5.1V DC	1.2 A	1A			700 mA	
Current draw @ 24V DC	3 mA	—			3 mA	
Voltage and current ratings	5.1 V DC, 1.2A	—		5.1 V DC, 1.2A	—	
Power dissipation	6.2 W	5.1 W		6.12 W	3.7 W	
Thermal dissipation	21.28 BTU/hr	17.4 BTU/hr		20.9BTU/Hr	12.6 BTU/hr	
Isolation voltage	30V (continuous), Basic Insulation Type, USB to Backplane Type tested at980V AC for 60 s	30V (continuous), Basic Insulation Type, Ethernet to Backplane, USB to Backplane, and USB to Ethernet(4) Type tested at 980V AC for 60 s		30V (continuous), Basic Insulation Type, Ethernet to Backplane, USB to Backplane, and USB to Ethernet Type tested at 860V AC for 60 s	30V (continuous), basic insulation type, Ethernet network to backplane Type tested @ 707V DC for 60 s	
Slot width	1					
Module location	Chassis-based, any slot					
Chassis	1756-A4, 1756-A7, 1756-A10, 1756-A13, 1756-A17					
Power supply, standard	1756-PA72, 1756-PA75, 1756-PB72, 1756-PB75, 1756-PC75, 1756-PH75					
Power supply, redundant	1756-PA75R, 1756-PB75R, 1756-PSCA2					
Ethernet port	1 Ethernet fiber	1 Ethernet RJ45 Category 5	2 Ethernet RJ45 Category 5	Category 5E	1 Ethernet RJ45 Category 5	
Ethernet cable	Multimode fiber, LC connector	802.3 compliant shielded or unshielded twisted pair				
USB port(2)	USB 1.1, full speed (12 Mbps)				—	
Wiring category(3)	3 - on USB ports	2 - on Ethernet ports 3 - on USB ports			2 - on Ethernet ports	2 - on Ethernet ports
North American temp code	T4A					
ATEX temp code	T4					
IECEx temp code	T4					
Enclosure type rating	None (open-style)					
Transmitter launch power at Beginning of Life (BOL), min Allow -1 dB at End of Life (EOL)	-19 dBm into 62.5/125 µm fiber, N/A = 0.275 -22.5 dBm into 50/125 µm fiber, N/A = 0.20	—				

(1) Includes the K conformal coating catalog numbers.

(2) The USB port is intended for temporary local programming purposes only and not intended for permanent connection. Do not use the USB port in hazardous locations.

(3) Use this conductor category information for planning conductor routing as described in the system level installation manual. See the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

(4) Applies only to these modules/series: 1756-EN2T/D,1756-EN2TSC/B, 1756-EN2TR/C,1756-EN3TR/B.

Table 5 - Environmental Specifications - 1756 EtherNet/IP Modules[1]

Attribute	1756-EN2F/B 1756-EN2F/C	1756-EN2T/D, 1756-EN2TSC/B, 1756-EN2TP/A	1756-EN2TR/C, 1756-EN3TR/B	1756-EN4TR/A	1756-ENBT/A, 1756-EWEB/B
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold) IEC 60068-2-2 (Test Bd, Operating Dry Heat) IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0 °C < Ta < 60 °C (32 °F < Ta < 140 °F)			For Series C Chassis: • 0 ≤ Ta ≤ +60 °C (+32 ≤ Ta ≤ +140 °F) For Series B Chassis: • 0 ≤ Ta ≤ +50 °C (+32 ≤ Ta ≤ +122 °F)	0 °C < Ta < 60 °C (32 °F < Ta < 140 °F)
Temperature, surrounding air, max	60 °C (140 °F)			For Series C Chassis: • 60 °C (140 °F) For Series B Chassis: • 50 °C (122°F)	60 °C (140 °F)
Temperature, storage IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold) IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat) IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40 °C< Ta < 85 °C (-40 °F < Ta < 185 °F)				
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged damp heat)	5…95% noncondensing				
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz				
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g				
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g	30 g[2]	30 g[2]	30g	50 g
Emission CISPR 11 (IEC 61000-6-4)	Class A				
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges				
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz 3V/m with 1 kHz sine-wave 80% AM from 2700…6000 MHz			10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 1V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz
EFT/B immunity IEC 61000-4-4	—	±3 kV at 5 kHz on Ethernet ports[2]		±3 kV at 5 kHz on Ethernet ports	±2 kV at 5 kHz on Ethernet ports
Surge transient immunity IEC 61000-4-5	—	±2 kV line-earth (CM) on Ethernet ports			
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz				

(1) Includes the K conformal coating catalog numbers.

(2) Applies only to these modules/series: 1756-EN2T/D,1756-EN2TSC/B, 1756-EN2TR/C,1756-EN3TR/B.

Table 6 - Certifications - 1756 EtherNet/IP Modules(1)

Certification(2)	1756-EN2T/D 1756-EN2TP/A	1756-EN2F/B 1756-EN2F/C	1756-EN2TSC/B	1756-EN2TR/C, 1756-EN3TR/B	1756-ENBT/A	1756-EWEB/B	1756-EN4TR/A
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.						UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CSA	CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File LR69960C.		—			CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File LR69960C.	—
CE	European Union 2004/108/IEC EMC Directive, compliant with: EN 61326-1; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)						
RCM	Australian Radiocommunications Act, compliant with EN 61000-6-4; Industrial Emissions						
ATEX	European Union 94/9/EC ATEX Directive, compliant with the following: EN 60079-15; Potentially Explosive Atmospheres, Protection "n" EN 60079-0; General Requirements II 3 G Ex nA IIC T4 Gc X DEMKO13ATEX1325026X (1756-EN2T/C only)						European Union 2014/34/EU ATEX Directive, compliant with the following: EN IEC 60079-0 General Requirements; EN 60079-7 Explosive Atmospheres, Protection "e"; II 3 G Ex ec IIC T4 Gc DEMKO18ATEX2139X
FM	**All modules except 1756-EN2TSC:** FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations						
IECEx	—	IECEx System, compliant with: IEC 60079-15; Potentially Explosive Atmospheres, Protection "n" IEC 60079-0; General Requirements II 3 G Ex nA IIC T4 Gc IECEx UL 14.0008X	—		IECEx System, compliant with: IEC 60079-0; General Requirements IEC 60079-15; Potentially Explosive Atmospheres, Protection "n" IEC 60079-0; General Requirements II 3 G Ex nA IIC T4 Gc IECEx UL 14.0008X	—	IECEx System, compliant with the Standards IEC 60079-0, Edition 7 General Requirements, and 60079-7, Edition 5.1, Explosive Atmospheres, Protection "e"; II 3 G Ex ec IIC T4 Gc IECExUL 18.0130X
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3						
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation						
EtherNet/IP	ODVA conformance tested to EtherNet/IP specifications						

(1) Includes the K conformal coating catalog numbers.

(2) When product is marked. See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

Table 7 - Technical Specifications - 1756 EtherNet/IP-XT Modules

Attribute	1756-EN2TXT/D, 1756-EN2TRXT/C, 1756-EN2TPXT/A	1756-EN4TRXT/A
EtherNet/IP communication rate	10/100 Mbps	10/100 Mbps 1 Gbps
Logix communication connections	256	1000 I/O 528 (1)
TCP communication connections	128	512
Current draw @ 5.1V DC	1 A	1.2 A
Power dissipation	5.1 W 17.4BTU/Hr	6.12 W 20.9BTU/Hr
Thermal dissipation	17.4 BTU/hr	20.9BTU/Hr
Isolation voltage	30V (continuous), Basic Insulation Type, Ethernet to Backplane, USB to Backplane, and USB to Ethernet	
Slot width	1	
Module location	Chassis-based, any slot	
Chassis	1756-A4LXT, 1756-A5XT, 1756-A7XT, 1756-A7LXT	1756-A4LXT/C, 1756-A5XT/C, 1756-A7XT/C, 1756-A7LXT/C
Power supply, standard	1756-PAXT, 1756-PBXT	
Power supply, redundant	1756-PAXTR, 1756-PBXTR	
Ethernet port	2 Ethernet RJ45 Category 5	
Ethernet cable	802.3 compliant shielded or unshielded twisted pair	
USB port(2)	USB 1.1, full speed (12 Mbps)	
Wiring category (3)	2 - on Ethernet ports 3 - on USB ports	
North American temperature code	T4A	
ATEX temperature code	T4	
IECEx temperature code	T4	
Enclosure type rating	None (open-style)	

(1) There are 1000 CIP I/O connections and 528 CIP messaging connections.

(2) The USB port is intended for temporary local programming purposes only and not intended for permanent connection. Do not use the USB port in hazardous locations.

(3) Use this conductor category information for planning conductor routing as described in the system level installation manual. See the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Table 8 - Environmental Specifications - 1756 EtherNet/IP-XT Module

Attribute	1756-EN2TXT/D, 1756-EN2TRXT/C	1756-EN4TRXT/A
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold) IEC 60068-2-2 (Test Bd, Operating Dry Heat) IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	-25 ≤Ta ≤ +70 °C (-13 ≤ Ta ≤ +158 °F)	
Temperature, surrounding air, max	70 °C (158 °F)	
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat) IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…85 °C (-40…185 °F)	
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged damp heat)	5…95% noncondensing	

Table 8 - Environmental Specifications - 1756 EtherNet/IP-XT Module (Continued)

Attribute	1756-EN2TXT/D, 1756-EN2TRXT/C	1756-EN4TRXT/A
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz	
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g	
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g	
Emissions CISPR 11 (IEC 61000-6-4)	Class A	
ESD immunity IEC 61000-4-2	6 kV contact discharges 8k V air discharges	
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz 3V/m with 1 kHz sine-wave 80% AM from 2700…6000 MHz	
EFT/B immunity IEC 61000-4-4	±3 kV at 5 kHz on Ethernet ports(1)	
Surge transient immunity IEC 61000-4-5	±2 kV line-earth (CM) on Ethernet ports	
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz	

(1) Applies only to these modules/series: 1756-EN2TXT/D, 1756-EN2TRXT/C 1756-EN4TXT.

Table 9 - Certifications - 1756 EtherNet/IP-XT Module

Certification(1)	1756-EN2TXT/D, 1756-EN2TRXT/C	1756-EN4TRXT/A
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.	
CE	European Union 2004/108/IEC EMC Directive, compliant with the following: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)	
RCM	Australian Radiocommunications Act, compliant with EN 61000-6-4; Industrial Emissions	
Ex	European Union 94/9/EC ATEX Directive, compliant with the following: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements II 3 G Ex nA IIC T4 Gc X	European Union 2014/34/EU ATEX Directive, compliant with the following: • EN 60079-7; Explosive Atmospheres, Protection "e" • EN 60079-0; General Requirements II 3 G Ex ec IIC T4 Gc
FM	—	FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3	
EtherNet/IP	ODVA conformance tested to EtherNet/IP specifications	

(1) When product is marked. See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

EtherNet/IP Module Diagrams

Figure 1 - 1756-EN2T

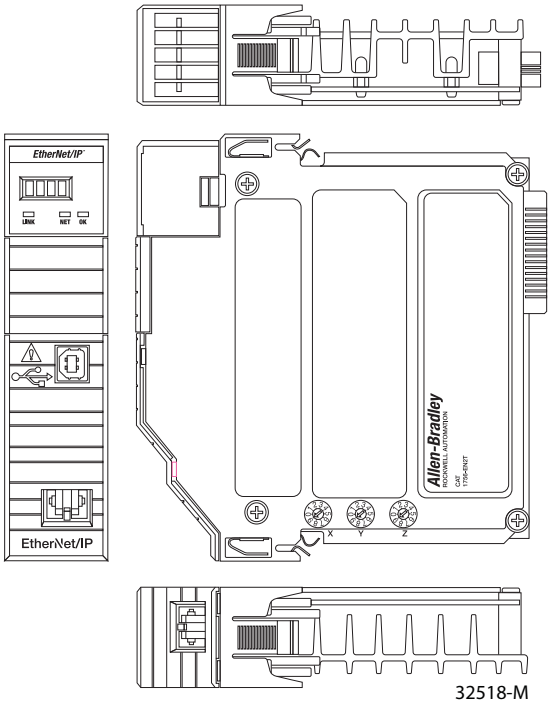


Figure 2 - 1756-EN2TP

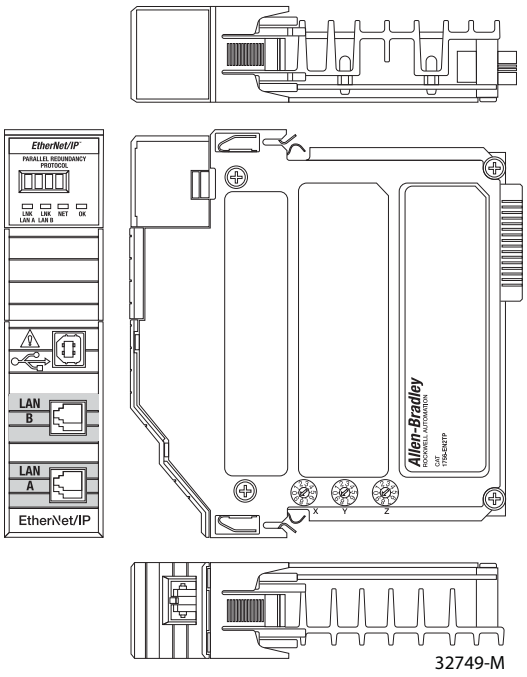


Figure 3 - 1756-EN2TR, 1756-EN3TR

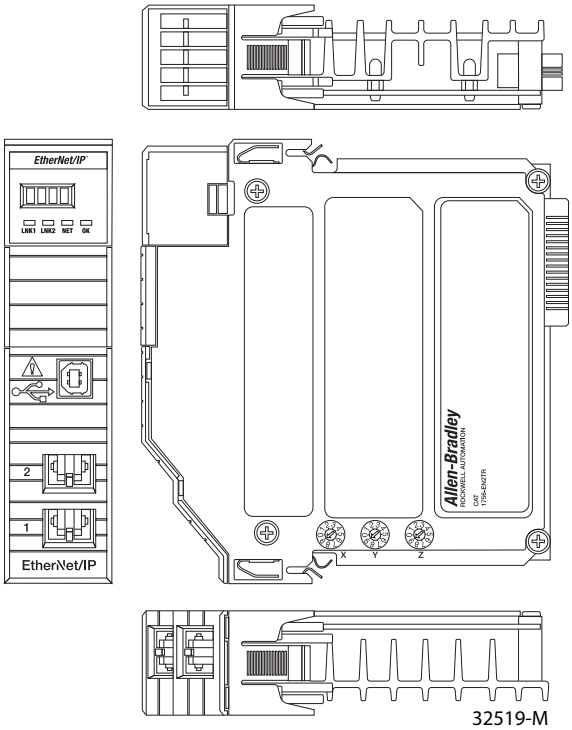


Figure 4 - 1756-EN2F

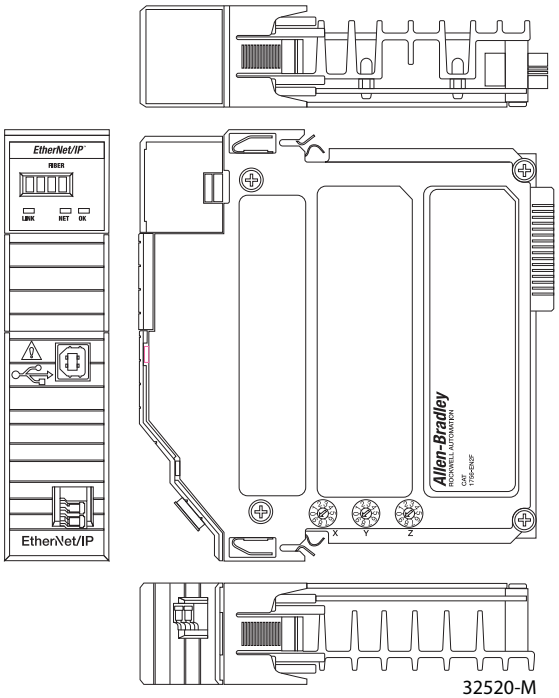
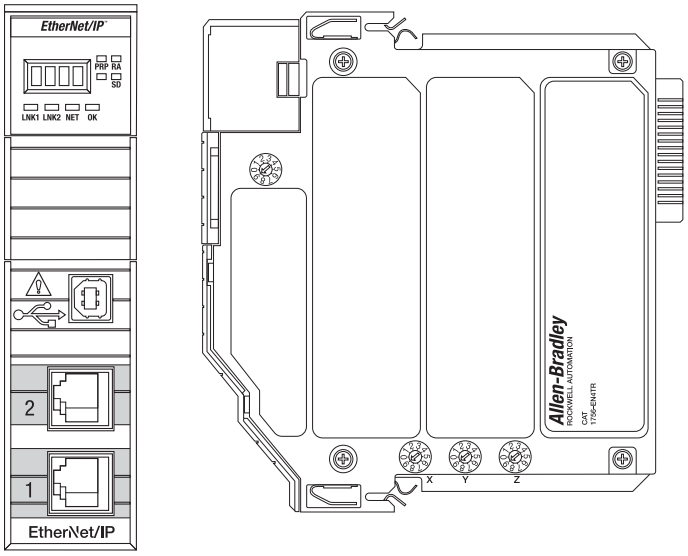


Figure 5 - 1756-EN4TR



Accessories—Ethernet Network

Cat. No.	Description	Specifications
1585J-M8PBJM-*x*	Ethernet RJ45 patchcord *x* = 2 (2 m), 5 (5 m), or 10 (10 m)	8-conductor, teal riser PVC cable (flex-rated cable also available)
1585J-M8CC-H	RJ45 insulation displacement connector (IDC)	0.128…0.325 mm^2 (26…22 AWG), Cat. 6, IDC, no tool required
1585J-M8CC-C	RJ45 crimp connector with boot, qty = 50 pieces	0.128…0.205 mm^2 (26…24 AWG), Cat. 5e, requires crimp tool for assembly
1585A-JCRIMP	Crimp tool	—
9300-RADES	Remote access dial-in kit	56 Kbps modem connection to devices on an Ethernet network

Stratix Switches

To effectively manage real-time control and information flow throughout the manufacturing and IT enterprise, Rockwell Automation offers a full portfolio of industrial Ethernet switches and media, including a line of Stratix® switches integrated with Cisco® technology. The Stratix line of switches includes modular managed, fixed managed, and unmanaged switches.

For detailed specifications for Stratix switches, see Stratix Ethernet Switch Specifications Technical Data, publication 1783-TD001.

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Publication 1756-TD003M-EN-E - March 2019
Supersedes Publication 1756-TD003L-EN-E - March 2019

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Installation Instructions

Original Instructions

Allen-Bradley

1756 EtherNet/IP Communication Modules

Catalog Numbers 1756-EN2T, 1756-EN2TP, 1756-EN2TPK, 1756-EN2TPXT, 1756-EN2TR, 1756-EN2TRK, 1756-EN2TRXT, 1756-EN2TSC, 1756-EN2TXT, 1756-EN3TR, 1756-EN3TRK, 1756-EN4TR, 1756-EN4TRK, 1756-EN4TRXT

ATTENTION: Read this document and the documents listed in the Additional Resources section about installation, configuration and operation of this equipment before you install, configure, operate or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

注意：在安装、配置、操作和维护本产品前，请阅读本文档以及 “ 其他资源 ” 部分列出的有关设备安装、配置和操作的相应文档。除了所有适用规范、法律和标准的相关要求之外，用户还必须熟悉安装和接线说明。

安装、调整、投运、使用、组装、拆卸和维护等各项操作必须由经过适当训练的专业人员按照适用的操作规范实施。

如果未按照制造商指定的方式使用该设备，则可能会损害设备提供的保护。

ATENCIÓN: Antes de instalar, configurar, poner en funcionamiento o realizar el mantenimiento de este producto, lea este documento y los documentos listados en la sección Recursos adicionales acerca de la instalación, configuración y operación de este equipo. Los usuarios deben familiarizarse con las instrucciones de instalación y cableado y con los requisitos de todos los códigos, leyes y estándares vigentes.

El personal debidamente capacitado debe realizar las actividades relacionadas a la instalación, ajustes, puesta en servicio, uso, ensamblaje, desensamblaje y mantenimiento de conformidad con el código de práctica aplicable.

Si este equipo se usa de una manera no especificada por el fabricante, la protección provista por el equipo puede resultar afectada.

ATENÇÃO: Leia este e os demais documentos sobre instalação, configuração e operação do equipamento que estão na seção Recursos adicionais antes de instalar, configurar, operar ou manter este produto. Os usuários devem se familiarizar com as instruções de instalação e fiação além das especificações para todos os códigos, leis e normas aplicáveis.

É necessário que as atividades, incluindo instalação, ajustes, colocação em serviço, utilização, montagem, desmontagem e manutenção sejam realizadas por pessoal qualificado e especializado, de acordo com o código de prática aplicável.

Caso este equipamento seja utilizado de maneira não estabelecida pelo fabricante, a proteção fornecida pelo equipamento pode ficar prejudicada.

ВНИМАНИЕ: Перед тем как устанавливать, настраивать, эксплуатировать или обслуживать данное оборудование, прочитайте этот документ и документы, перечисленные в разделе «Дополнительные ресурсы». В этих документах изложены сведения об установке, настройке и эксплуатации данного оборудования. Пользователи обязаны ознакомиться с инструкциями по установке и прокладке соединений, а также с требованиями всех применимых норм, законов и стандартов.

Все действия, включая установку, наладку, ввод в эксплуатацию, использование, сборку, разборку и техническое обслуживание, должны выполняться обученным персоналом в соответствии с применимыми нормами и правилами.

Если оборудование используется не предусмотренным производителем образом, защита оборудования может быть нарушена.

注意：本製品を設置、構成、稼動または保守する前に、本書および本機器の設置、設定、操作についての参考資料の該当箇所に記載されている文書に目を通してください。ユーザは、すべての該当する条例、法律、規格の要件に加えて、設置および配線の手順に習熟している必要があります。

設置調整、運転の開始、使用、組立て、解体、保守を含む諸作業は、該当する実施規則に従って訓練を受けた適切な作業員が実行する必要があります。

本機器が製造メーカにより指定されていない方法で使用されている場合、機器により提供されている保護が損なわれる恐れがあります。

ACHTUNG: Lesen Sie dieses Dokument und die im Abschnitt „Literaturverweise“ genannten Dokumente zur Installation, Konfiguration und Bedienung dieser Ausrüstung sorgfältig durch, bevor Sie dieses Produkt installieren, konfigurieren, bedienen oder instandsetzen. Benutzer müssen sich mit den Anweisungen zur Installation und Verdrahtung vertraut machen und müssen die Anforderungen aller geltenden Vorschriften, Gesetze und Normen kennen.

Aktivitäten wie Installation, Einstellung, Inbetriebnahme, Verwendung, Montage, Demontage und Instandsetzung müssen durch ausreichend geschultes Personal in Übereinstimmung mit den geltenden Durchführungsvorschriften ausgeführt werden.

Wenn diese Ausrüstung in einer Weise verwendet wird, die nicht vom Hersteller angegeben wurde, kann der von der Ausrüstung bereitgestellte Schutz beeinträchtigt sein..

ATTENTION : Lisez ce document et les documents listés dans la section Ressources complémentaires relatifs à l’installation, la configuration et le fonctionnement de cet équipement avant d’installer, configurer, utiliser ou entretenir ce produit. Les utilisateurs doivent se familiariser avec les instructions d’installation et de câblage en plus des exigences relatives aux codes, lois et normes en vigueur.

Les activités relatives à l’installation, le réglage, la mise en service, l’utilisation, l’assemblage, le démontage et l’entretien doivent être réalisées par des personnes formées selon le code de pratique en vigueur.

Si cet équipement est utilisé d’une façon qui n’a pas été définie par le fabricant, la protection fournie par l’équipement peut être compromise.

주의: 본 제품 설치, 설정, 작동 또는 유지 보수하기 전에 본 문서를 포함하여 설치, 설정 및 작동에 관한 참고 자료 섹션의 문서들을 반드시 읽고 숙지하십시오. 사용자는 모든 관련 규정 , 법규 및 표준에서 요구하는 사항에 대해 반드시 설치 및 배선 지침을 숙지해야 합니다 .

설치 , 조정 , 가동 , 사용 , 조립 , 분해 , 유지보수 등 모든 작업은 관련 규정에 따라 적절한 교육을 받은 사용자를 통해서만 수행해야 합니다 .

본 장비를 제조사가 명시하지 않은 방법으로 사용하면 장비의 보호 기능이 손상될 수 있습니다 .

ATTENZIONE Prima di installare, configurare ed utilizzare il prodotto, o effettuare interventi di manutenzione su di esso, leggere il presente documento ed i documenti elencati nella sezione “Altre risorse”, riguardanti l’installazione, la configurazione ed il funzionamento dell’apparecchiatura. Gli utenti devono leggere e comprendere le istruzioni di installazione e cablaggio, oltre ai requisiti previsti dalle leggi, codici e standard applicabili.

Le attività come installazione, regolazioni, utilizzo, assemblaggio, disassemblaggio e manutenzione devono essere svolte da personale adeguatamente addestrato, nel rispetto delle procedure previste.

Qualora l’apparecchio venga utilizzato con modalità diverse da quanto previsto dal produttore, la sua funzione di protezione potrebbe venire compromessa.

DİKKAT: Bu ürünün kurulumu, yapılandırılması, işletilmesi veya bakımı öncesinde bu dokümanı ve bu ekipmanın kurulumu, yapılandırılması ve işletimi ile ilgili İlave Kaynaklar bölümünde yer listelenmiş dokümanları okuyun. Kullanıcılar yürürlükteki tüm yönetmelikler, yasalar ve standartların gereksinimlerine ek olarak kurulum ve kablolama talimatlarını da öğrenmek zorundadır.

Kurulum, ayarlama, hizmete alma, kullanma, parçaları birleştirme, parçaları sökme ve bakım gibi aktiviteler sadece uygun eğitimleri almış kişiler tarafından yürürlükteki uygulama yönetmeliklerine uygun şekilde yapılabilir.

Bu ekipman üretici tarafından belirlenmiş amacın dışında kullanılırsa, ekipman tarafından sağlanan koruma bozulabilir.

注意事項：在安裝、設定、操作或維護本產品前，請先閱讀此文件以及列於 「其他資源」 章節中有關安裝、設定與操作此設備的文件。使用者必須熟悉安裝和配線指示，並符合所有法規、法律和標準要求。

包括安裝、調整、交付使用、使用、組裝、拆卸和維護等動作都必須交由已經過適當訓練的人員進行，以符合適用的實作法規。

如果將設備用於非製造商指定的用途時，可能會造成設備所提供的保護功能受損。

POZOR: Než začnete instalovat, konfigurovat či provozovat tento výrobek nebo provádět jeho údržbu, přečtěte si tento dokument a dokumenty uvedené v části Dodatečné zdroje ohledně instalace, konfigurace a provozu tohoto zařízení. Uživatelé se musejí vedle požadavků všech relevantních vyhlášek, zákonů a norem nutně seznámit také s pokyny pro instalaci a elektrické zapojení.

Činnosti zahrnující instalaci, nastavení, uvedení do provozu, užívání, montáž, demontáž a údržbu musí vykonávat vhodně proškolený personál v souladu s příslušnými prováděcími předpisy.

Pokud se toto zařízení používá způsobem neodpovídajícím specifikaci výrobce, může být narušena ochrana, kterou toto zařízení poskytuje.

UWAGA: Przed instalacją, konfiguracją, użytkowaniem lub konserwacją tego produktu należy przeczytać niniejszy dokument oraz wszystkie dokumenty wymienione w sekcji Dodatkowe źródła omawiające instalację, konfigurację i procedury użytkowania tego urządzenia. Użytkownicy mają obowiązek zapoznać się z instrukcjami dotyczącymi instalacji oraz oprzewodowania, jak również z obowiązującymi kodeksami, prawem i normami.

Działania obejmujące instalację, regulację, przekazanie do użytkowania, użytkowanie, montaż, demontaż oraz konserwację muszą być wykonywane przez odpowiednio przeszkolony personel zgodnie z obowiązującym kodeksem postępowania.

Jeśli urządzenie jest użytkowane w sposób inny niż określony przez producenta, zabezpieczenie zapewniane przez urządzenie może zostać ograniczone.

OBS! Läs detta dokument samt dokumentet, som står listat i avsnittet Övriga resurser, om installation, konfigurering och drift av denna utrustning innan du installerar, konfigurerar eller börjar använda eller utföra underhållsarbete på produkten. Användare måste bekanta sig med instruktioner för installation och kabeldragning, förutom krav enligt gällande koder, lagar och standarder.

Åtgärder som installation, justering, service, användning, montering, demontering och underhållsarbete måste utföras av personal med lämplig utbildning enligt lämpligt bruk.

Om denna utrustning används på ett sätt som inte anges av tillverkaren kan det hända att utrustningens skyddsanordningar försätts ur funktion.

LET OP: Lees dit document en de documenten die genoemd worden in de paragraaf Aanvullende informatie over de installatie, configuratie en bediening van deze apparatuur voordat u dit product installeert, configureert, bediend of onderhoudt. Gebruikers moeten zich vertrouwd maken met de installatie en de bedradingsinstructies, naast de vereisten van alle toepasselijke regels, wetten en normen.

Activiteiten zoals het installeren, afstellen, in gebruik stellen, gebruiken, monteren, demonteren en het uitvoeren van onderhoud mogen uitsluitend worden uitgevoerd door hiervoor opgeleid personeel en in overeenstemming met de geldende praktijkregels.

Indien de apparatuur wordt gebruikt op een wijze die niet is gespecificeerd door de fabrikant, dan bestaat het gevaar dat de beveiliging van de apparatuur niet goed werkt.

ATTENTION:
- Read this document and the documents listed in the Additional Resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards
- Installation, adjustments, putting into service, use, assembly, disassembly, and maintenance shall be carried out by suitably trained personnel in accordance with applicable code of practice. In case of malfunction or damage, no attempts at repair should be made. The module should be returned to the manufacturer for repair. Do not dismantle the module.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- This equipment is certified for use only within the surrounding air temperature range of 0…60 °(32…140 °F) [1756-EN2T, 1756-EN2TP, 1756-EN2TPK, 1756-EN2TR, 1756-EN2TSC, 1756-EN3TR, 1756-EN4TR (Series C Chassis only), 1756-EN4TRK (Series C Chassis only)], 0…50 °C (32…122 °F) [1756-EN4TR (Series B Chassis), 1756-EN4TRK (Series B Chassis)], or -25…+70 °C (-13…+158 °F) [1756-EN2TXT, 1756-EN2TRXT, 1756-EN2TPXT, 1756-EN4TRXT]. The equipment must not be used outside of this range.
- Use only a soft dry anti-static cloth to wipe down equipment. Do not use any cleaning agents.
- The USB port is intended for temporary local programming purposes only and not intended for permanent connection.
- The USB cable is not to exceed 3.0 m (9.84 ft) and must not contain hubs.

IMPORTANT Any illustrations, charts, sample programs, and layout examples that are shown in this publication are intended solely for the purposes of example. Since there are many variables and requirements that are associated with any particular installation, Rockwell Automation does not assume responsibility or liability for actual use based on the examples that are shown in this publication.

Environment and Enclosure

ATTENTION: This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC/EN 60664-1), at altitudes up to 2000 m (6562 ft) without derating.
This equipment is not intended for use in residential environments and may not provide adequate protection to radio communication services in such environments.
This equipment is supplied as open-type equipment for indoor use. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA or be approved for the application if non-metallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain more information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.
In addition to this publication, see the following:
- Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1, for more installation requirements.
- NEMA Standard 250 and IEC/EN 60529, as applicable, for explanations of the degrees of protection provided by enclosures.

North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations:
Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local authority having jurisdiction at the time of installation.

WARNING: EXPLOSION HAZARD
- Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.
- Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product.
- Substitution of components may impair suitability for Class I, Division 2.
- If this product contains batteries, they must be changed only in an area known to be nonhazardous.

Informations sur l'utilisation de cet équipement en environnements dangereux:
Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation

AVERTISSEMENT: RISQUE D'EXPLOSION
- Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement.
- Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit.
- La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2.
- S'assurer que l'environnement est classé non dangereux avant de changer les piles.

European Hazardous Location Approval

The following applies to products marked CE, Ex, II 3 G.
- Such modules are Equipment Group II, Equipment Category 3, and comply with the Essential Health and Safety Requirements relating to the design and construction of such equipment given in Annex II to Directive 2014/34/EU. See the EC Declaration of Conformity at http://www.rockwellautomation.com/products/certification for details.
- The type of protection for the 1756-EN2T, 1756-EN2TP, 1756-EN2TPXT, 1756-EN2TR, 1756-EN2TRXT, 1756-EN2TSC, 1756-EN2TXT, and 1756-EN3TR is "Ex nA IIC T4 Gc" according to EN 60079-15.
- The type of protection for the 1756-EN4TR, 1756-EN4TRK, and1756-EN4TRXT is "Ex ec IIC T4 Gc" according to EN 60079-0 and EN 60079-7.
- The modules 1756-EN2T, 1756-EN2TP, 1756-EN2TPXT, 1756-EN2TR, 1756-EN2TRXT, 1756-EN2TSC, 1756-EN2TXT, and 1756-EN3TR comply to standards: EN 60079-0:2012+A11:2013, EN 60079-15:2010, reference certificate number DEMK013ATEX1325026X.
- The modules 1756-EN4TR, 1756-EN4TRK, and 1756-EN4TRXT comply to standards: EN IEC 60079-0:2018, EN 60079-7:2015+A1:2018, reference certificate number DEMK018ATEX2139X.
- Such modules may have catalog numbers followed by a "K" to indicate conformal coating option.
- Such modules are intended for use in areas in which explosive atmospheres caused by gases, vapors, mists, or air are unlikely to occur, or are likely to occur only infrequently and for short periods. Such locations correspond to Zone 2 classification according to ATEX directive 2014/34/EU.

WARNING: Special Conditions for Safe Use:
- This equipment is not resistant to sunlight or other sources of UV radiation.
- This equipment shall be used within its specified ratings defined by Rockwell Automation.
- Provision shall be made to prevent the rated voltage from being exceeded by transient disturbances of more than 140% of the peak rated voltage when applied in Zone 2 environments.
- The instructions in the user manual shall be observed.
- This equipment must be used only with ATEX/IECEx certified Rockwell Automation backplanes.
- Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product.
- Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.
- The USB port is intended for temporary local programming purposes only and not intended for permanent connection. Do not use the USB port in hazardous locations.
- For the 1756-EN4TR, 1756-EN4TRK, and 1756-EN4TRXT:
  - The equipment shall only be used in an area of at least pollution degree 2, as defined in IEC/EN 60664-1.
  - The equipment shall be installed in an enclosure with tool removable door or cover that provides a degree of protection not less than IP 54 in accordance with IEC/EN 60079-0.

At the end of its life, this equipment should be collected separately from any unsorted municipal waste.

IEC Hazardous Location Approval

The following applies to products with IECEx certification:
- Such modules are intended for use in areas in which explosive atmospheres caused by gases, vapors, mists, or air are unlikely to occur, or are likely to occur only infrequently and for short periods. Such locations correspond to Zone 2 classification to IEC 60079-0.
- The type of protection for catalog numbers 1756-EN2T, 1756-EN2TP, 1756-EN2TR, 1756-EN2TPXT, 1756-EN2TRXT, 1756-EN2TSC, 1756-EN2TXT, and 1756-EN3TR is "Ex nA IIC T4 Gc" according to IEC 60079-15.
- The type of protection for catalog numbers 1756-EN4TR, 1756-EN4TRK, and 1756-EN4TRXT is "Ex ec IIC T4 Gc" according to IEC 60079-0 and IEC 60079-7.
- Such modules may have catalog numbers followed by a "K" to indicate the conformal coating option.
- The modules 1756-EN2T, 1756-EN2TP, 1756-EN2TR, 1756-EN2TPXT, 1756-EN2TRXT, 1756-EN2TSC, 1756-EN2TXT, and 1756-EN3TR comply to Standards IEC 60079-0:2011, IEC 60079-15:2010, reference IECEx certificate number IECExUL14.0008X.
- The modules 756-EN4TR, 1756-EN4TRK, and 1756-EN4TRXT comply to Standards IEC 60079-0, Edition 7, and IEC 60079-7, Edition 5.1, reference IECEx certificate number IECExUL18.0130X.

Prevent Electrostatic Discharge

ATTENTION:
- This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:
- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment
- Use a static-safe workstation, if available.
- Store the equipment in appropriate static-safe packaging when not in use.

Removal and Insertion Under Power (RIUP)

WARNING: When you insert or remove the module while backplane power is on, an electric arc can occur. This could cause an explosion in hazardous location installations.
Be sure that power is removed or the area is nonhazardous before proceeding. Repeated electric arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

Multi-point Network Communication

WARNING: If you connect or disconnect the communication cable with power applied to this module or any device on the network, an electric arc can occur. This could cause an explosion in hazardous location installations.
Be sure that power is removed or the area is nonhazardous before proceeding.

Install the Module

You can install or remove a module while chassis power is applied.

WARNING: When you insert or remove the module while backplane power is on, an electric arc can occur. The insertion or removal of the module while the backplane power is on can cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding. Repeated electric arcs can cause excessive wear to contacts on both the module and its mating connector. Worn contacts can create electrical resistance that can affect module operation.

For equipment with multi-point network communication connections.

WARNING: If you connect or disconnect the communication cable with power that is applied to this module or any device on the network, an electric arc can occur. This connection or disconnection of the module with applied power can cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

ATTENTION: If you are using the 1756-EN4TR or 1756-EN4TRK above 50 °C(122 °F), it must be installed in a Series C chassis.

ATTENTION: In order to operate over its full rated temperature range, the 1756-EN4TRXT must be used with a Series C XT Chassis.

Follow these steps to install the module.

1. Set the network IP address on a module.

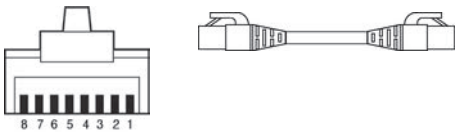
   For more information about how to configure an EtherNet/IP network, see the EtherNet/IP Network Configuration User Manual, publication ENET-UM001.

   Depending on the 1756 EtherNet/IP communication module, you can use some or all of these tools to set the network Internet Protocol (IP) address:

   - Rotary switches
   - Bootstrap Protocol (BOOTP)/Dynamic Host Configuration Protocol (DHCP) server
   - RSLinx® Classic software
   - The Studio 5000® environment

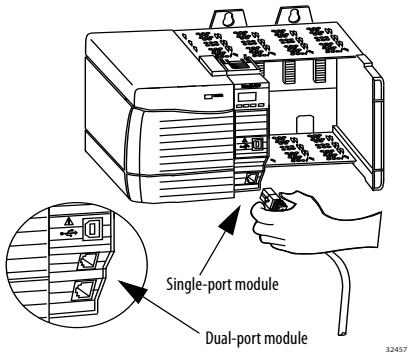
   The module uses these tools sequentially to set the IP address.
2. Determine module slot location.
3. Install the module.
   a. Align the circuit board with top and bottom guides in the chassis.
   b. Slide the module into the chassis.

   Make sure that the module backplane connector properly connects to the chassis backplane. The module is properly installed when it is flush with the power supply or other installed modules.
4. Connect the module to an EtherNet/IP network via an RJ45 connection.



Connector Number	Color	1585J 8-pin Cables with Support for 10/100/1000 Mbps	1585J 8-pin Cables with Support for 10/100 Mbps	1585J 4-pin Cables with Support for 10/100 Mbps
1	White/Orange	BI_DA+	TxData +	
2	Orange	BI_DA-	TxData -	
3	White/Green	BI_DB+	Recv Data +	
4	Blue	BI_DC+	Unused	N/A
5	White/Blue	BI_DC-	Unused	N/A
6	Green	BI_DB-	Recv Data -	
7	White/Brown	BI_DD+	Unused	N/A
8	Brown	BI_DD-	Unused	N/A

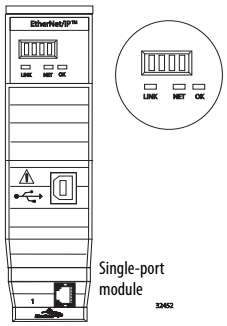
5. Attach the cable with the RJ45 connector to the Ethernet port on the module as shown.

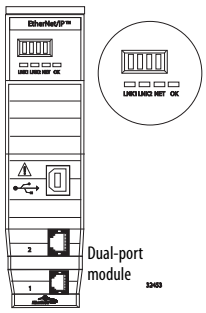


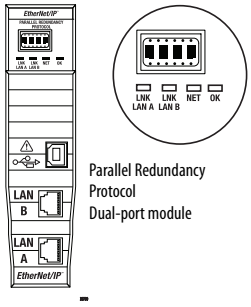
6. Download the Add-on Profile from the Product Compatibility and Download website at http://www.ab.com.
7. Connect to the module via the USB port (if the module is equipped with a USB port).
8. Download the firmware from the Product Compatibility and Download website at http://www.ab.com.
9. Apply chassis power and check status indicators.

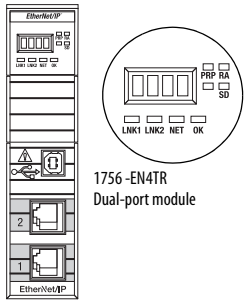
Status Indicators

These 1756 EtherNet/IP communication modules use the same status indicators. This graphic shows the front of the module for these modules (Extended-temperature modules not shown.)









For more information on the status indicators, see the EtherNet/IP Modules Installation Instructions, publication ENET-IN002.

Network Connectors and Cable

This product includes a USB port.

WARNING: The USB ports are intended only for temporary use and must not be connected or disconnected unless the area is nonhazardous. Do not use the USB port in hazardous locations.

The USB cable is not to exceed 3.0 m (9.84 ft) and must not contain hubs.

Modules	Ports	Requirements
EtherNet/IP	Copper Ethernet	Connector/cable: RJ45 connector according to IEC 60603-7, 2 or 4 pair Category 5e minimum cable according to TIA 568-B.1 or Category 5 cable according to ISO/IEC 11801-3. Connector/cable: For 1756-EN4TR, 1756-EN4TRK, and 1756-EN4TRXT, RJ45 connector according to IEC 60603-7, 4 pair Category 5e minimum cable according to TIA 568-B.1 or Category 5 cable according to ISO/IEC 11801-3.

Specifications

Attribute	1756-EN2T, 1756-EN2TK, 1756-EN2TP, 1756-EN2TPK, 1756-EN2TR, 1756-EN2TRK, 1756-EN2TSC, 1756-EN3TR, 1756-EN3TRK	1756-EN4TR, 1756-EN4TRK	1756-EN2TXT, 1756-EN2TRXT, 1756-EN2TPXT	1756-EN4TRXT
Voltage and current ratings	5.1V DC, 1 A	5.1V DC, 1.2 A	5.1V DC, 1 A	5.1V DC, 1.2 A
Temperature, operating • IEC 60068-2-1(Test Ad, Operating Cold) • IEC 60068-2-2 (Test Bd, Operating Dry Heat) • IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0 ≤ Ta ≤ +60 °C (+32 ≤ Ta ≤ +140 °F)	For Series C Chassis: • 0 ≤ Ta ≤ +60 °C (+32 ≤ Ta ≤ +140 °F) For Series B Chassis: • 0 ≤ Ta ≤ +50 °C (+32 ≤ Ta ≤ +122 °F)	-25 ≤Ta ≤ +70 °C (-13 ≤ Ta ≤ +158 °F)	
Temperature, surrounding air	60 °C (140 °F)	For Series C Chassis: • 60 °C (140 °F) For Series B Chassis: • 50 °C (122°F)	70 °C (158 °F)	
Enclosure type rating	None (open-style)			
Isolation voltage	30V (continuous), Basic Insulation Type, Ethernet to Backplane, USB to Backplane, and USB to Ethernet, Type tested at 860V AC for 60 s			
Wire size	Ethernet connections: RJ45 connector according to IEC 60603-7, 2 or 4 pair Category 5e minimum cable according to TIA 568-B.1 or Category 5 cable according to ISO/IEC 11801-3.	Ethernet connections: RJ45 connector according to IEC 60603-7, 4 pair Category 5e minimum cable according to TIA 568-B.1 or Category 5 cable according to ISO/IEC 11801-3.	Ethernet connections: RJ45 connector according to IEC 60603-7, 2 or 4 pair Category 5e minimum cable according to TIA 568-B.1 or Category 5 cable according to ISO/IEC 11801-3.	Ethernet connections: RJ45 connector according to IEC 60603-7, 4 pair Category 5e minimum cable according to TIA 568-B.1 or Category 5 cable according to ISO/IEC 11801-3.
North American temp code	T4A			
ATEX temp code	T4			
IECEx temp code	T4			

Additional Resources

These resources contain information about related products from Rockwell Automation.

Resource	Description
EtherNet/IP Modules Installation Instructions, publication ENET-IN002	Provides details on how to install and configure EtherNet/IP communication modules.
Ethernet Design Considerations Reference Manual, publication ENET-RM002	Provides details about how to use EtherNet/IP communication modules with Logix 5000™ controllers and communicate with other devices on the EtherNet/IP network.
EtherNet/IP Secure Communication User Manual, publication ENET-UM003	Provides information on system architecture, configuring secure communication, and diagnostics.
EtherNet/IP Network Configuration User Manual, publication ENET-UM001	Describes how you can use EtherNet/IP communication modules with your Logix 5000 controller and communicate with various devices on the Ethernet network.
EtherNet/IP Embedded Switch Technology Application Guide, publication ENET-AP005	Provides details about how to install, configure, and maintain linear and Device Level Ring (DLR) networks by using Rockwell Automation EtherNet/IP devices that are equipped with embedded switch technology.
EtherNet/IP Media Planning and Installation Manual This manual is available from the Open DeviceNet Vendor Association (ODVA) at http://www.odva.org	Provides details about how to use the required media components and provides information on how to plan for, install, verify, troubleshoot, and certify your EtherNet/IP network.

You can view or download Rockwell Automation publications at http://www.rockwellautomation.com/literature/.
To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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Publication 1756-IN050C-EN-P - December 2018 PN-504815
Supersedes Publication 1756-IN050B-EN-P - September 2017

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User Manual

Original Instructions

Allen-Bradley

EtherNet/IP Network Devices

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

Table of Contents

Send Email

Chapter 5

This manual describes how to use EtherNet/IP communication modules in Logix 5000™ control systems.

Make sure that you are familiar with the following:

- Use of a controller in a Logix 5000 control system, including these following controllers:
  - CompactLogix™ 5380 controllers
  - Compact GuardLogix® 5380 controllers
  - CompactLogix 5480 controller
  - ControlLogix® 5580 controllers
  - GuardLogix® 5580 controllers
- Use of an EtherNet/IP network
- Use of various software applications from Rockwell Automation

Additional Resources

These documents contain more information concerning related products from Rockwell Automation.

Table 1 - Additional Resources

Resource	Description
EtherNet/IP Media Planning and Installation Manual	Describes how to use the required media components and how to plan for, install, verify, troubleshoot, and certify your EtherNet/IP network. This manual is available from the Open DeviceNet Vendor Association (ODVA) at: http://www.odva.org.
Ethernet Design Considerations Reference Manual, publication ENET-RM002	Describes basic Ethernet concepts:
EtherNet/IP Socket Interface Application Technique, publication ENET-AT002	Describes the socket interface that you can use to program MSG instructions to communicate between a Logix 5000™ controller and Ethernet devices. In this case, the interface is used because the Ethernet devices that do not support the EtherNet/IP application protocol. Such devices include barcode scanners, RFID readers, or other standard Ethernet devices.
EtherNet/IP Embedded Switch Technology Application Guide, publication ENET-AP005	Describes how to install, configure, and maintain linear and Device Level Ring (DLR) networks by using Rockwell Automation® EtherNet/IP devices that are equipped with embedded switch technology.
EtherNet/IP Parallel Redundancy Protocol Application Technique, publication ENET-AT006	Describes how you can configure a Parallel Redundancy Protocol (PRP) network with the 1756-EN2TP EtherNet/IP communication module and a Stratix® 5400 or 5410 switch.
Integrated Architecture and CIP Sync Configuration Application Technique, publication IA-AT003	Provides information on CIP Sync and the IEEE 1588-2008 Precision Time Protocol.
Integrated Motion on the EtherNet/IP Network Reference Manual, publication MOTION-RM003	Reference descriptions of the AXIS_CIP_DRIVE attributes and the Studio 5000 Logix Designer® application Control Modes and Methods
Electronic Keying in Logix 5000 Control Systems Application Technique, publication LOGIX-AT001	Describes how to use electronic keying in Logix 5000 control system applications.

Table 1 - Additional Resources

Resource	Description
Network Technology webpage, http://www.rockwellautomation.com/rockwellautomation/products-technologies/network-technology/overview.page?	Provides information on reference architectures and white papers on networking.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation® industrial system.
Product Certifications website, http://www.rockwellautomation.com/rockwellautomation/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

EtherNet/IP Features in Allen-Bradley Network Devices

EtherNet/IP networks offer a comprehensive suite of messages and services for many automation applications. This open network standard uses standard Ethernet communication products to support real-time I/O messaging, information exchange, and general messaging. Other features to all EtherNet/IP network devices include the following:

- Support for messaging, produced/consumed tags, and distributed I/O
- DNS addressing
- Internet Group Management Protocol (IGMP) snooping (enabled by default) and querier (disabled by default)
- Port configuration and diagnostics
- Email server

EtherNet/IP networks also support CIP Safety applications. Such support makes the simultaneous transmission of safety and standard control data and diagnostics information over a common network possible.

EtherNet/IP Device-Specific Features

EtherNet/IP network devices can provide the following functionality. See the user manual for your device for details.

- Support for the following communication rates:
  - 10 Mbps
  - 100 Mbps
  - 1 Gbps

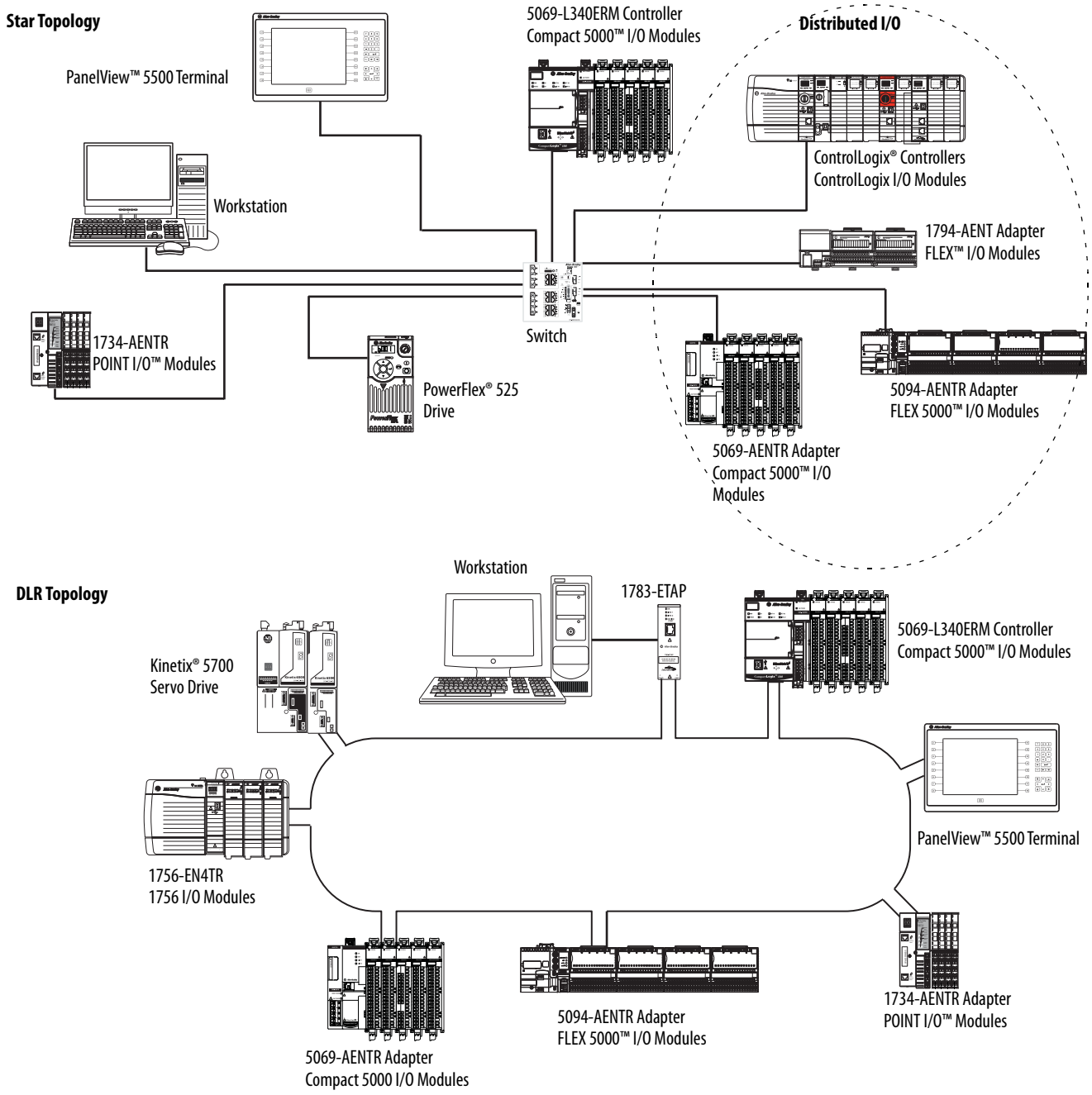
IMPORTANT
- When a device uses the 1 Gbps network communication rate, it supports only full-duplex mode.
- When a device uses the 10 Mbps or 100 Mbps network communication rate, it supports full-duplex and half-duplex mode.

- Linear network
- Device Level Ring protocol
- Option to operate as a Ring supervisor on a DLR network
- Parallel Redundancy Protocol
- Duplicate IP address detection
- Socket interface
- Email client

Figure 1 shows how Rockwell Automation® EtherNet/IP network devices fit into a control system. In this example, the following can occur over the EtherNet/IP network:

- Controllers produce and consume tags
- Controllers initiate MSG instructions that send and receive data
- Control of I/O modules
- Use of Integrated Motion over an EtherNet/IP network
- Workstations configure devices, and upload or download projects to the controllers

Figure 1 - EtherNet/IP Network Devices in a Control System



Duplicate IP Address Detection

Duplicate IP address detection verifies that an IP address does not match any other device IP address on the network when you perform either of these tasks:

- Connect the device to a EtherNet/IP network.
- Change the IP address on the device.

If the IP address matches that of another device on the network, the EtherNet/IP port on the device transitions to conflict mode. In conflict mode, these conditions exist:

- OK status indicator blinks red.
- Network (NET) status indicator is solid red.
- If the device has a text display, the following message scrolls across the 4-character display:

  <IP_address_of_this_device> Duplicate IP - <MAC_address_of_duplicate_node_detected>

  For example: 10.88.60.196 Duplicate IP - 00:00:BC:02:34:B4

Duplicate IP Address Resolution

This table describes how to resolve duplicate IP addresses.

Duplicate IP Address Detection Conditions	Resolution Process
• Both devices support duplicate IP address detection • Second device is added to the network after the first device is operating on the network	1. The device that began operation first uses the IP address and continues to operate without interruption. 2. The device that begins operation second detects the duplication and enters Conflict mode.
• Both devices support duplicate IP address detection • Both devices were powered up at approximately the same time	Both EtherNet/IP devices enter Conflict mode. To resolve this conflict, follow these steps: a. Assign a new IP address to one of the devices. b. Cycle power to the other device or disconnect and reconnect all Ethernet cables from the other device.
One device supports duplicate IP address detection and a second device does not	1. Regardless of which device obtained the IP address first, the device that does not support IP address detection uses the IP address and continues to operate without interruption. 2. The device that supports duplicate IP address detection detects the duplication and enters Conflict mode.

DNS Addressing

To qualify the device address further, use DNS addressing to specify a host name for a device. When you specify a host name for the device, you also specify a domain name and DNS servers. DNS addressing makes it possible to create similar network structures and IP address sequences under different domains.

DNS addressing is necessary only if you refer to the device by host name, such as in path descriptions in MSG instructions.

To use DNS addressing, follow these steps.

1. Assign a host name to the device.

   A network administrator can assign a host name. Valid host names must be IEC-1131-3 compliant.

2. Configure the device IP address:

   In the DNS server, the host name must match the IP address of the device.

IMPORTANT Make sure the DNS enable bit is set.

- If you use Logix Designer application, version 28 or later, to configure your device, the enable bit is set and DNS addressing is successful.
- If you use RSLinx® Classic software, version 2.41.00 or later, to configure your device, the enable bit is cleared and DNS addressing fails.

3. In the Logix Designer application, add the device to the I/O.

IMPORTANT	If a child device resides in the same domain as its parent device, type the host name. If the domain name of the child device differs from its parent device, type the host name and the domain name (host.domain)

IMPORTANT	You can also use DNS addressing in a device profile in the I/O configuration tree or in a message path. If the domain name of the destination device differs from the source device, use a fully qualified DNS name (hostname.domainname). For example, to send a message from AEN2TR1.location1.companyA to AEN2TR1.location2.company, the host names match, but the domains differ. Without the entry of a fully qualified DNS name, the device adds the default domain name to the specified host name.

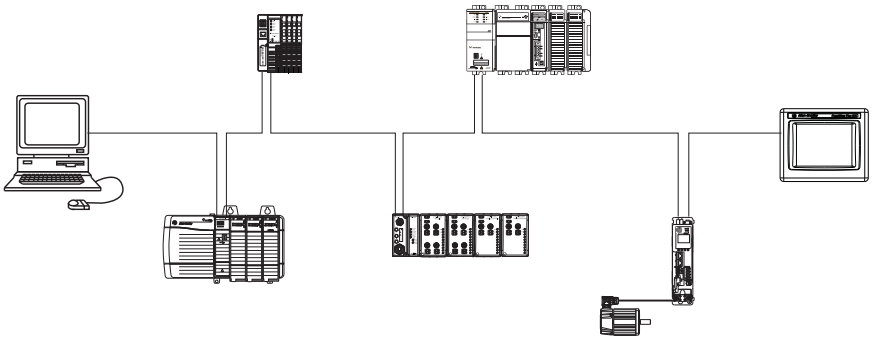
Socket Interface

Some EtherNet/IP devices support the use of a CIP Generic MSG instruction to request socket services. For more information, see EtherNet/IP Socket Interface Application Technique, ENET-AT002.

Linear Network

A linear network is a collection of devices that are daisy-chained together. The EtherNet/IP embedded switch technology lets you implement this topology at the device level. No additional switches are required.

Figure 2 - Example Linear Network



The following are advantages of a linear network.

- Simple installation
- Reduced wiring and installation costs
- No special software configuration required
- Improved CIP Sync application performance on linear networks

The primary disadvantage of a linear network is that any break of the cable disconnects all devices downstream from the break from the rest of the network.

Device Level Ring

Device Level Ring (DLR) is an EtherNet/IP protocol that is defined by the Open DeviceNet® Vendors' Association (ODVA). DLR provides a means to detect, manage, and recover from single faults in a ring-based network.

A DLR network includes the following types of ring nodes.

Node	Description
Ring supervisor	A ring supervisor provides these functions: • Manages traffic on the DLR network • Collects diagnostic information for the network A DLR network requires at least one node to be configured as ring supervisor. **IMPORTANT:** By default, the supervisor function is disabled on supervisor-capable devices, so they are ready to participate on a linear or star network or as a ring node on a DLR network. In a DLR network, you must configure at least one of the supervisor-capable devices as the ring supervisor before physically connecting the ring. If you do not, the DLR network does not work.
Ring participants	Ring participants provide these functions: • Process data that is transmitted over the network. • Pass on the data to the next node on the network. • Report fault locations to the active ring supervisor. When a fault occurs on the DLR network, ring participants reconfigure themselves and relearn the network topology.
Redundant gateways (optional)	Redundant gateways are multiple switches that are connected to one DLR network and also connected together through the rest of the network. Redundant gateways provide DLR network resiliency to the rest of the network.

Depending on their firmware capabilities, both devices and switches can operate as supervisors or ring nodes on a DLR network. Only switches can operate as redundant gateways.

For more information about DLR, see the EtherNet/IP Device Level Ring Application Technique, publication ENET-AT007.

Parallel Redundancy Protocol

Parallel Redundancy Protocol (PRP) is defined in international standard IEC 62439-3 and provides high-availability in Ethernet networks. PRP technology creates seamless redundancy by sending duplicate frames to two independent network infrastructures, which are known as LAN A and LAN B.

A PRP network includes the following components.

Component	Description
LAN A and LAN B	Redundant, active Ethernet networks that operate in parallel.
Double attached node (DAN)	An end device with PRP technology that connects to both LAN A and LAN B.
Single attached node (SAN)	An end device without PRP technology that connects to either LAN A or LAN B. A SAN does not have PRP redundancy.
Redundancy box (RedBox)	A switch with PRP technology that connects devices without PRP technology to both LAN A and LAN B.
Virtual double attached node (VDAN)	An end device without PRP technology that connects to both LAN A and LAN B through a RedBox. A VDAN has PRP redundancy and appears to other nodes in the network as a DAN.
Infrastructure switch	A switch that connects to either LAN A or LAN B and is not configured as a RedBox.

For more information about PRP topologies and configuration guidelines, see the EtherNet/IP Parallel Redundancy Protocol Application Technique, publication ENET-AT006.

EtherNet/IP Network Specifications

Table 2 - EtherNet/IP Network Specifications

Cat. No.	Connections		CIP Unconnected Messages (backplane + Ethernet)	Ethernet Node Count, Max	Packet Rate Capacity (packets/second)(5)		SNMP Support (password required)
	TCP	CIP			I/O	HMI and MSG	
1734-AENT, 1734-AENTR	32	20	32	—	5000	900	No
1738-AENT, 1738-AENTR	32	20	32	—	5000	900	No
1756-ENBT	64	128(3)	64 + 64	—	5000	900	Yes
1756-EN2F, 1756-EN2T, 1756-EN2TXT, 1756-EN2TR, 1756-EN2TRXT	128	256(3)	128 + 128	—	**IMPORTANT**: Packet rates for ControlLogix EtherNet/IP communication modules depend on series and firmware revision.	2000	Yes
1756-EN2TSC	128	256(3)	128 + 128	—		930 with encryption 1800 without encryption	Yes
1756-EN3TR	128	256(3)	128 + 128	—		2000	Yes
1756-EN4TR, 1756-EN4TRXT	512	1000 I/O 528 (4)	256+256	—	• 50,000 without CIP Security • 25,000 with integrity • 15,000 with integrity and confidentiality	• 3,700 without CIP Security • 2,700 with integrity • 1,700 with integrity and confidentiality	Yes
1756-EWEB	64	128(3)	128 + 128	—	—	900	Yes
1756-L81E	512	—	—	100	—	—	—
1756-L82E	512	—	—	175	—	—	—

Table 2 - EtherNet/IP Network Specifications (continued) (continued)

Cat. No.	Connections		CIP Unconnected Messages (backplane + Ethernet)	Ethernet Node Count, Max	Packet Rate Capacity (packets/second)[5]		SNMP Support (password required)
	TCP	CIP			I/O	HMI and MSG	
1756-L83E	512	—	—	250	—	—	—
1756-L84E	512	—	—	250	—	—	—
1756-L85E	512	—	—	300	—	—	—
1768-ENBT	32[1] 64[2]	64[3] 128	32 + 32	—	5000	960	Yes
1769-L3*x*E	64	32[3]	32 + 32	—	4000	760	Yes
1769-L16ER-BB1B, 1769-L18ER-BB1B, 1769-L18ERM-BB1B	120	256	256	4	6000 @ 500 bytes/packet	400 messages/s @ 20% comm. timeslice	Yes
1769-L24ER-QB1B, 1769-L24ER-QBFC1B	120	256	256	8	6000 @ 500 bytes/packet		Yes
1769-L27ERM-QBFC1B	120	256	256	16	6000 @ 500 bytes/packet		Yes
1769-L30ER, 1769-L30ERM, 1769-L30ER-NSE	120	256	256	16	6000 @ 500 bytes/packet		Yes
1769-L33ER, 1769-L33ERM	120	256	256	32	6000 @ 500 bytes/packet		Yes
1769-L36ERM	120	256	256	48	6000 @ 500 bytes/packet		Yes
1783-ETAP, 1783-ETAP1F, 1783-ETAP2F	64	—	—	—	—	900	No
1794-AENT	64	64	—	—	9500	—	Yes
5069-AENRT	32	16 (messaging)	16	—	100000	500	Yes
5069-AEN2TR		256 (messaging)	32	—	100000	2000	Yes
5094-AENTR, 5094-AENTRXT, 5094-AEN2TR, 5094-AEN2TRXT	32	16 (messaging)	16	—	100000	500	Yes
5069-L306ER, 5069-L306ERM	512	—	256	16	128000	2000	Yes
5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM	512	—	256	24	128000	2000	Yes
5069-L320ER, 5069-L320ERM	512	—	256	40	128000	2000	Yes
5069-L330ER, 5069-L330ERM	512	—	256	60	128000	2000	Yes
5069-L340ER, 5069-L340ERM	512	—	256	90	128000	2000	Yes
5069-L350ERM	512	—	256	120	128000	2000	Yes
5069-L380ERM	512	—	256	150	128000	2000	Yes
5069-L3100ERM	512	—	256	180	128000	2000	Yes
9300-ENA	—	—	—	—	—	—	—

(1) The 1768-ENBT communication module supports 32 TCP connections with firmware revision 1.

(2) The 1768-ENBT communication module supports 64 TCP connections with firmware revision 2 or later.

(3) CIP connections can be used for all explicit or all implicit applications. For example, a 1756-ENBT module has a total of 128 CIP connections that can be used for any combination of connections.

(4) There are 1000 CIP I/O connections and 528 CIP messaging connections.
(5) Total packet rate capacity = I/O Produced Tag, max + HMI/MSG, max. Packet rates vary depending on packet size. For more detailed specifications, see the EDS file for a specific catalog number.

Reserve 10% of the bandwidth (packets/second) of the network device for Explicit Messaging.

Time Synchronization

In certain situations, the I/O modules can synchronize with the adapter before the adapter synchronizes with the system Grandmaster clock. This synchronization occurrence leads to a time difference between the I/O and the Grandmaster clock until the adapter synchronizes with the Grandmaster clock.

In your logic, verify that the adapter is synchronized with the Grandmaster clock (CIPSyncValid) before you initiate time stamp requests or scheduled outputs from your I/O modules. A system with intermediate devices, such as network bridges and switches, can require that you insert a delay until the time stabilizes in the system.

For information on how to verify that the adapter is synchronized to a Grandmaster clock, see CIP Sync Diagnostics in the Integrated Architecture and CIP Sync Configuration Application Technique, publication IA-AT003. This publication also includes information on Time Sync Object Attributes.

Configure a Workstation to Operate on an EtherNet/IP Network

Before you can connect to the device via an Ethernet cable, you must install an EtherNet/IP driver on your workstation.

A communication driver is required to complete these tasks:

- Upload and download Logix Designer application projects to Logix 5000™ controllers over an EtherNet/IP network
- Collect controller data for electronic operator interfaces, for example, PanelView™ Plus terminals, and visualization software, for example, FactoryTalk® View software
- Update device firmware
- Set or change the IP address.
- Configure the device

Remember the following when you use the RSLinx® Classic software communication drivers:

- EtherNet/IP driver:
  - Supports runtime communications
  - Requires that the workstation is properly connected to the EtherNet/IP network
  - Supports communications over longer distances when compared to the USB driver
- Ethernet devices driver:
  - Requires that you configure the IP addresses to which the software browses and, therefore, the devices with which the device communicates
- USB driver:
  - Convenient method to connect to an unconfigured device and configure the Ethernet port
  - Convenient method to connect to a device when the Ethernet port configuration is unknown
  - Convenient method to update the device firmware
  - Not intended for runtime connections; it is a temporary-use only connection with a limited cabling distance

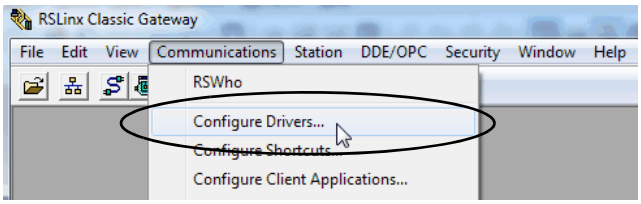
Configure the Ethernet Communication Driver in RSLinx Classic Software

Before you add an Ethernet driver, confirm that these conditions exist:

- The workstation is properly connected to the EtherNet/IP network.
- The workstation IP address and other network parameters are configured correctly.

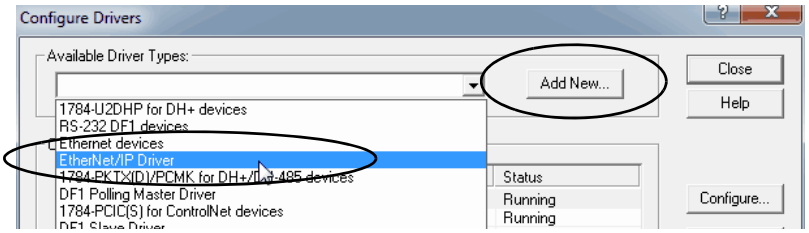
To configure the EtherNet/IP driver, follow these steps.

1. From the Communications menu, choose Configure Drivers.



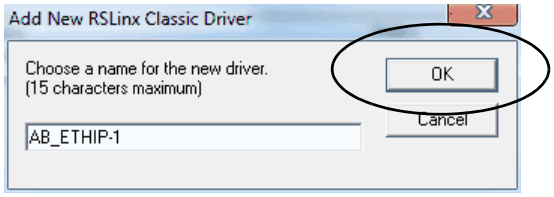
   The Configure Drivers dialog box appears.

2. From the Available Driver Types pull-down menu, choose EtherNet/IP Driver.
3. Click Add New.



   The Add New RSLinx® Driver dialog box appears.

4. Type a name for the new driver and click OK.

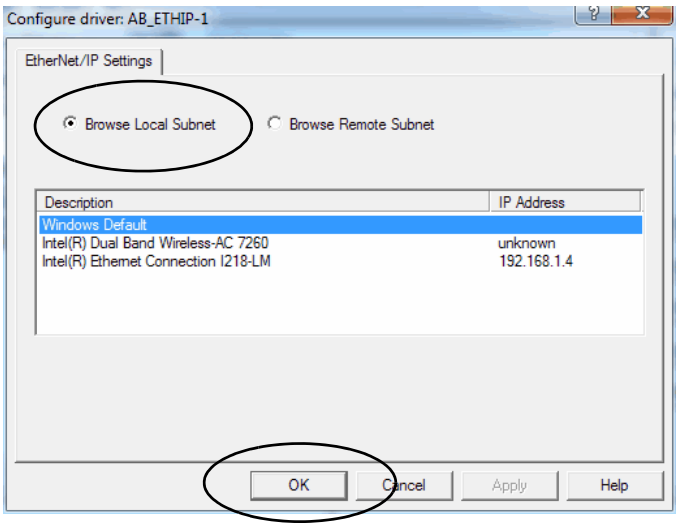


The Configure driver dialog box appears.

5. Click Browse Local Subnet.

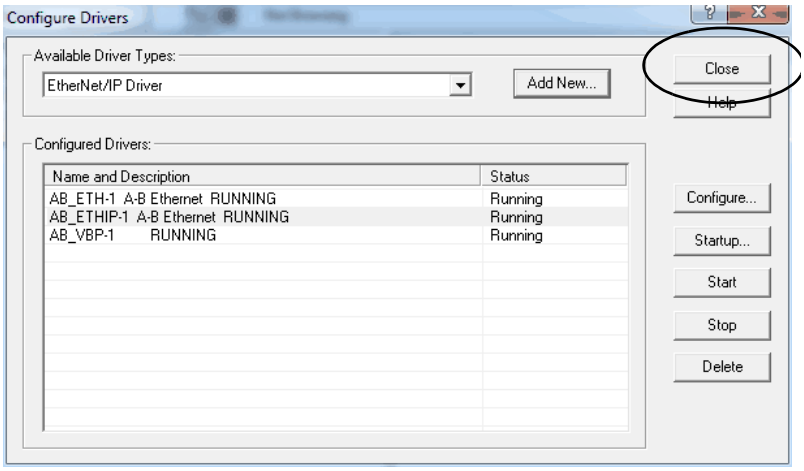
TIP To view devices on another subnet or VLAN from the workstation running RSLinx Classic software, click Browse Remote Subnet.

6. Select the desired driver, and click OK.



The new driver is available on the Configure Drivers dialog box.

7. Click Close.



Configure the USB Communication Driver in RSLinx Classic Software

In RSLinx Classic software, version 3.80.00 or later, a USB driver automatically appears in the software when you connect the USB cable from your workstation to the controller.

The USB driver can take a moment to appear in RSLinx Classic software.

IMPORTANT EtherNet/IP drivers remain visible in RSLinx Classic software after they are configured regardless of whether they are in use or not.

A USB driver appears in RSLinx Classic software only when a USB cable is connected between the workstation and the controller.

Once the cable is disconnected, the driver disappears from RSLinx Classic software.

ATTENTION: The USB port is intended for temporary, local programming purposes only and is not intended for permanent connection. The USB cable is not to exceed 3.0 m (9.84 ft) and must not contain hubs.

WARNING: Do not use the USB port in hazardous locations.

IMPORTANT Do not simultaneously load firmware for multiple devices through a USB port. If you do, one or more of the firmware loads can fail in the middle of the loading process.

If you use the RSLinx Classic software, version 3.80.00 or later, and a USB driver does not appear automatically, complete the following steps.

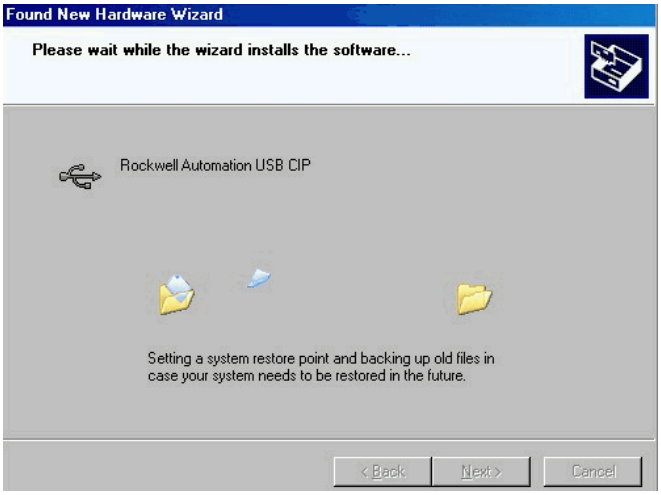
1. Connect one end of the USB cable to your workstation, and the other end to the USB port on the device.

   The RSLinx Found New Hardware Wizard dialog box appears.
2. Click Install the software automatically (recommended).

3. Click Next.

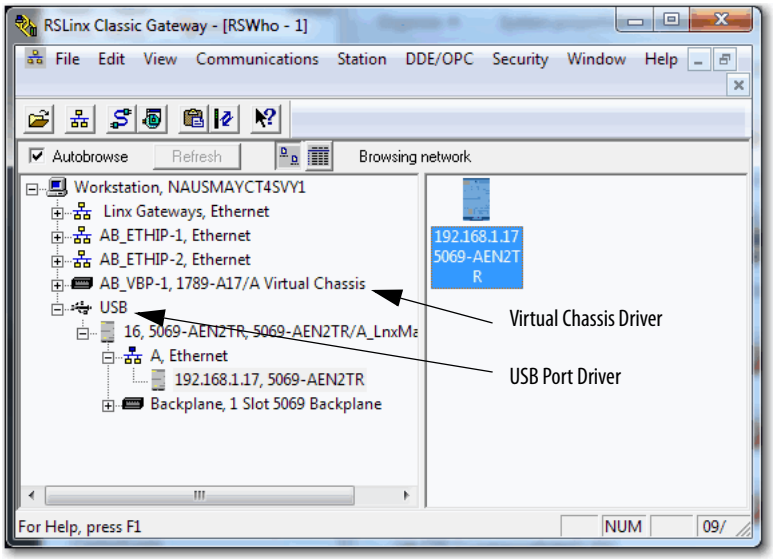
These dialog boxes appear consecutively.

4. Click Finish.



5. In RSLinx Classic software, from the Communications menu, click RSWho.

   The RSLinx Workstation organizer appears, and your device appears under two different drivers, a virtual chassis and the USB port.



Notes:

Set an IP Address

Set the IP Address with the BOOTP/DHCP Utility

The BOOTP/DHCP tool is a standalone server that you can use to set an IP address. The BOOTP/DHCP tool sets an IP address and other Transport Control Protocol (TCP) parameters.

You can use the BOOTP/DHCP tool to set the IP address when the device powers up in the out-of-box state. That is, the rotary switches are not set to a valid IP address, and the device is DHCP enabled.

Access the BOOTP/DHCP tool from one of these locations:

- Programs > Rockwell Software > BOOTP-DHCP Tool > BOOTP-DHCP Tool
- Tools directory on the Studio 5000® environment installation CD

IMPORTANT Before you start the BOOTP/DHCP tool, remember the following:

- Make sure that you have the hardware (MAC) address of the device.

  The hardware address is on a sticker on the side of the device and has a format similar to the following:

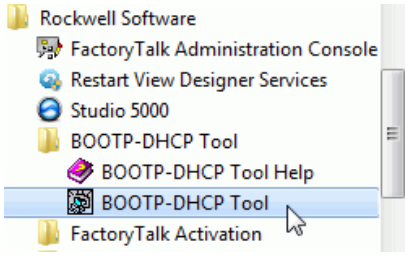
  00-00-BC-14-55-35

- Make sure that the workstation that you use to set the IP address has only one connection to the EtherNet/IP network on which the device resides.

  The BOOTP/DHCP tool can fail to work if your workstation has multiple connections to the EtherNet/IP network.

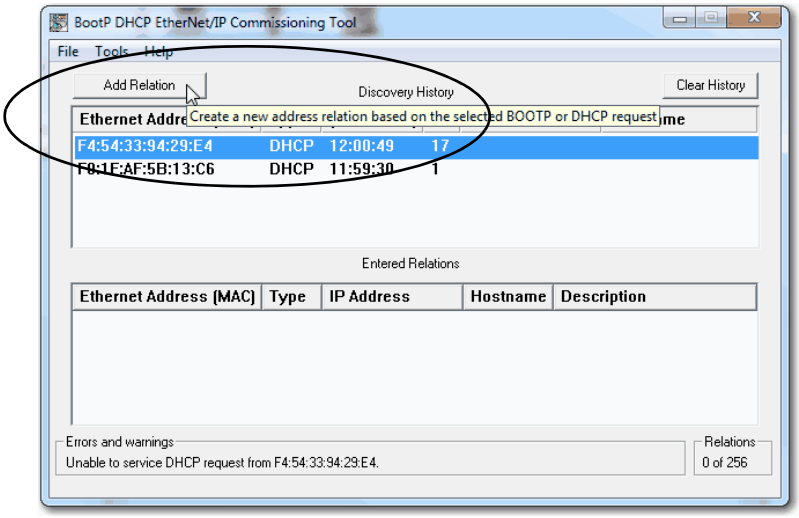
To set the IP address with BOOTP/DHCP tool, complete the following steps.

1. Confirm that the device is connected to the network.
2. Start the BOOTP-DHCP tool.



The MAC ID of the device appears in the Request History window.

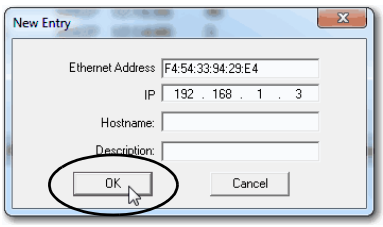
3. Select the appropriate device and click Add to Relation List.



The New Entry dialog box appears.

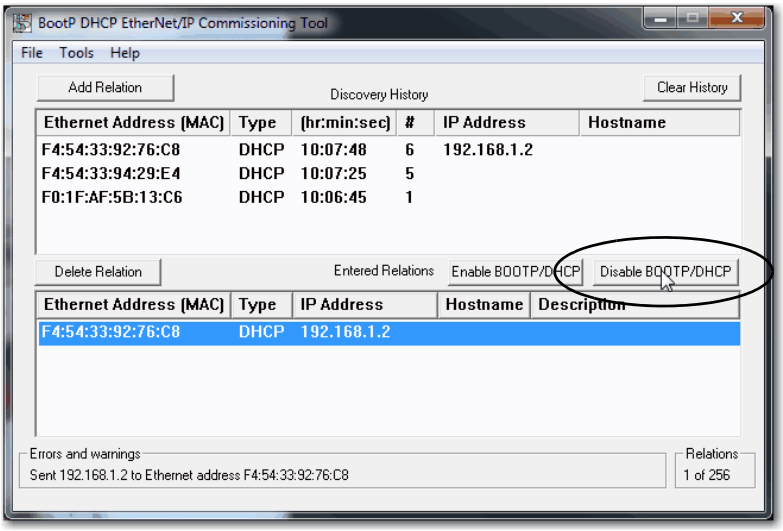
4. Type an IP address, Hostname, and Description for the device.

Hostname and Description are optional.



5. Click OK.
6. To assign this configuration on the device, wait for the device to appear in the Relation List panel and select it.

7. Click Disable BOOTP/DHCP.



The device now uses the assigned configuration and does not issue BOOTP or DHCP requests after power is cycled on the controller.

IMPORTANT Remember the following:

- If you do not click Disable BOOTP/DHCP, on future power cycles, the current IP configuration is cleared and the controller sends DHCP requests again.
- If you click Disable BOOTP/DHCP and it does not disable BOOTP/DHCP, you can use RSLinx® Classic software to disable BOOTP/DHCP.

For more information on how to use RSLinx Classic software to disable BOOTP/DHCP, see page 28.

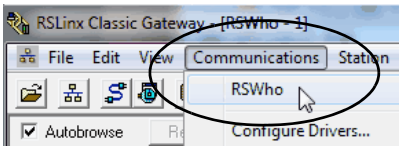
Disable BOOTP/DHCP with RSLinx Classic Software

To disable BOOTP/DHCP in RSLinx Classic software, complete the following steps.

1. Start RSLinx Classic software.

   After several seconds, an RSWho dialog box appears.

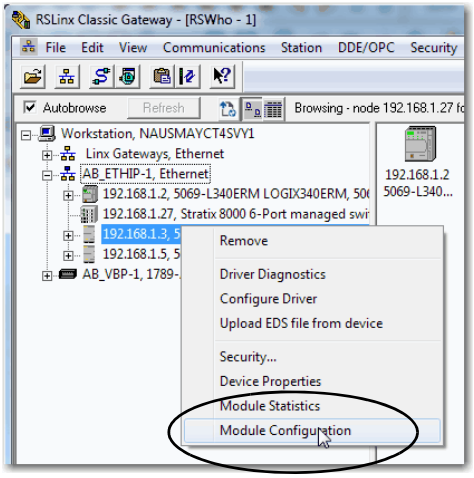
2. If no RSWho dialog box appears, from the Communications pull-down menu, choose RSWho.



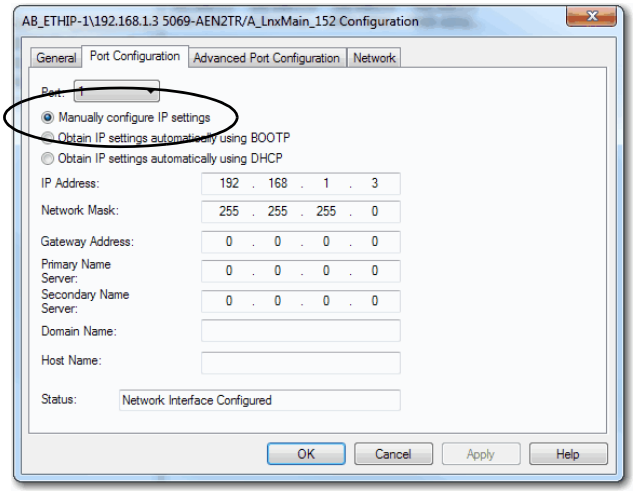
3. Navigate to the device.

   You can access the device via the USB or an EtherNet/IP driver.

4. Right-click on the device and choose Module Configuration.



5. Click the Port Configuration tab.
6. Click Manually configure IP settings.



7. Click OK.

DHCP Considerations

If the device is DHCP-enabled in the out-of-box condition, you can use a DHCP server to set the IP address.

The DHCP server automatically assigns IP addresses to client stations logging on to a TCP/IP network. DHCP is based on BOOTP and maintains some backward compatibility.

ATTENTION: You can use a DHCP server that is always configured to assign the same IP address to specific devices when they appear on the EtherNet/IP network and request an IP address.

If your system does not use a DHCP server that assigns the same IP address for specific devices, we **strongly recommend** that you assign the device a fixed IP address. Do not set the IP address dynamically. That is, do not use the Obtain IP settings automatically by using DHCP.

When a device uses Obtain IP settings automatically by using DHCP, the IP address for that device is cleared with each power cycle. If the same IP address is not automatically assigned to the device when it requests a new IP address, the device can be assigned another IP address than what was used before cycling power.

The use of a new IP address can result in such issues as a Duplicate IP address condition or configuration faults because the IP address differs from what is stored in a Logix Designer application project.

Failure to observe this precaution can result in unintended machine motion or loss of process control.

Set the IP Address with RSLinx Classic Software

To use RSLinx Classic software to set the IP address for the **first time**, after it powers up in the out-of-box state, you must connect to the device via the USB port.

If the device does not have a USB port, you cannot use RSLinx Classic software to set the IP address for the first time the device powers up in the out-of-box state.

IMPORTANT You can use RSLinx Classic software to configure the device, including to change the IP address after it has been set.

To change the IP address by using the RSLinx Classic software, the rotary switches on the device must be set to positions that are valid for DHCP address configuration (000...254).

You must access the device by browsing to it via an EtherNet/IP driver.

For more information on how to configure a device with RSLinx Classic software, see page 32.

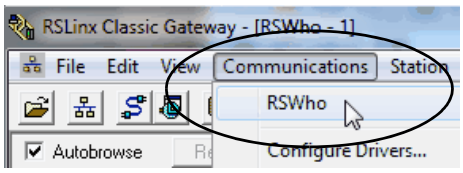
WARNING: Do not use the USB port in hazardous locations.

ATTENTION: The USB port is intended for temporary local programming purposes only and not intended for permanent connection. The USB cable is not to exceed 3.0 m (9.84 ft) and must not contain hubs.

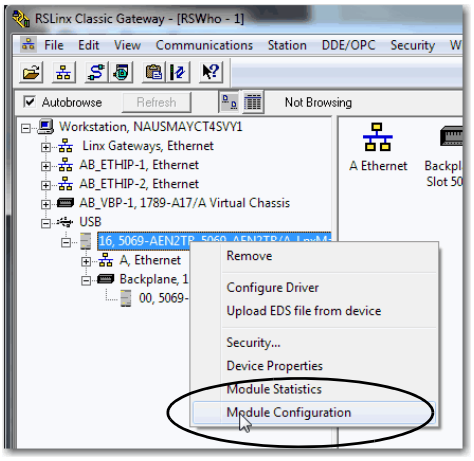
Complete these steps to set the IP address with RSLinx Classic software when the device is in the out-of-box state.

1. Confirm that your computer is connected to the device via a USB cable.
2. Start the RSLinx Classic software.

   After several seconds, an RSWho dialog box appears.
3. If the RSWho dialog box does not appear, from the Communications pull-down menu, choose RSWho.

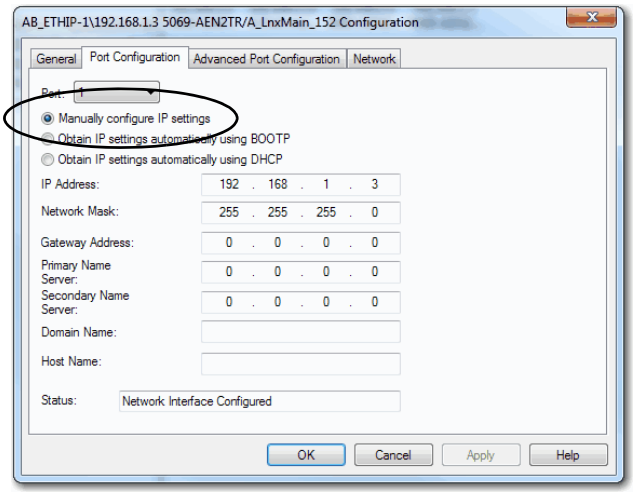


4. Right-click the device and choose Module Configuration.



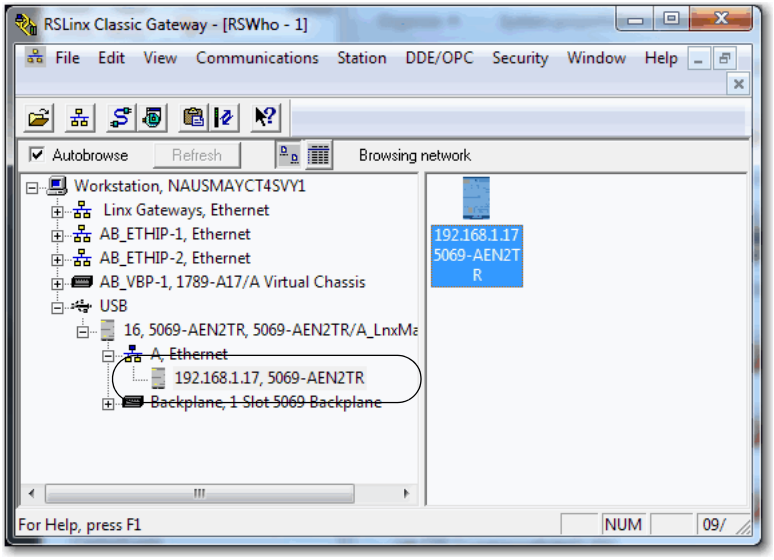
The Module Configuration dialog box appears.

5. Click the Port Configuration tab.
6. Click Manually configure IP settings and set the port configuration parameters.



7. Click OK.
8. Open the USB branch on the menu tree.

The device shows the IP address.



Configure Port Settings with RSLinx Classic Software

You can use RSLinx Classic software to configure a subset of the parameters available on the device.

Complete the following steps.

1. Right-click the device and then click Module Configuration.
2. Click the Advanced Port Configuration tab.

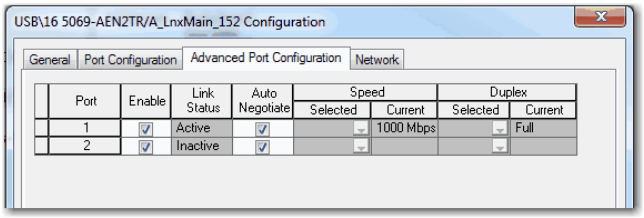
IMPORTANT Consider the following when you configure the port settings:

- When the device uses the 1 Gbps network communication rate, it supports only full-duplex mode.
- When the device uses the 10 Mbps or 100 Mbps network communication rate, it supports full-duplex and half-duplex mode.
- The speed and duplex settings for the devices on the same Ethernet network must be the same to avoid transmission errors.
- Fixed speed and full-duplex settings offer better reliability than autonegotiate settings and are recommended for some applications.
- If the device is connected to an unmanaged switch, leave Auto-negotiate checked or the device fails.
- If you force the port speed and duplex with a managed switch, the corresponding port of the managed switch must be forced to the same settings or the device fails.
- If you connect a manually configured device to an autonegotiate device (duplex mismatch), a high rate of transmission errors can occur.
- To disable a port, clear the Enable checkbox.

  You cannot disable both ports on a 5069-AENTR or FLEX 5000 EtherNet/IP adapter simultaneously in RSLinx Classic software. We recommend that before you disable a port, you confirm that the port is not in use.
- If you disable a port in RSLinx Classic software and the port is being used for network communication, the communication is interrupted.

  In this case, if the other Ethernet port is enabled, we recommend that you moved the Ethernet cable from the disabled port and connect it to the enabled port.

  After you re-enable the port that was unintentionally disabled, you can change the cable connection back to the first port



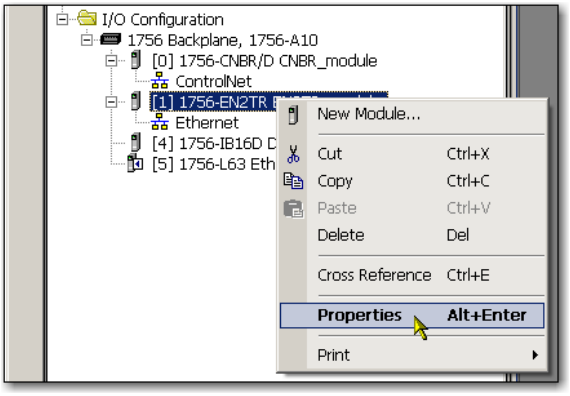
Task	Action
Let the device automatically set the port speed and duplex settings.	Leave the Auto-negotiate enabled.
Manually configure the port speed and duplex settings.	Follow these steps. 1. Clear the Auto-negotiate port speed and duplex checkbox. 2. From the Current Port Speed pull-down menu, choose a port speed. 3. From the Current Duplex pull-down menu, choose full-duplex.

3. On the Module Configuration dialog box, click OK.

Set the IP Address with Studio 5000 Logix Designer Application

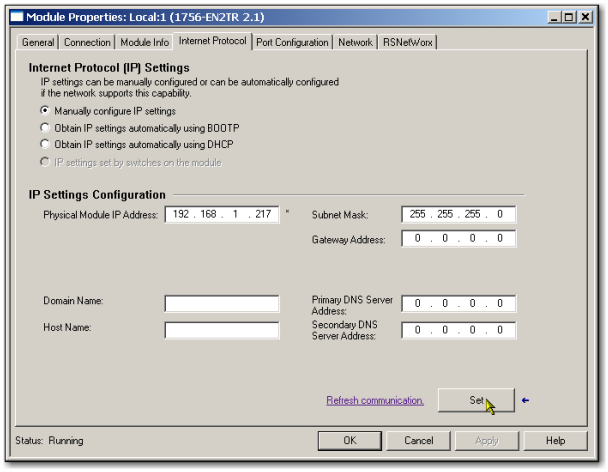
To use the Logix Designer application to set the IP address of the device, follow these steps.

1. In the Controller Organizer, right-click the device and choose Properties.



   The Module Properties dialog box appears.

2. Click the Port Configuration tab.



3. In the IP address field, type the IP address.
4. In the other fields, type the other network parameters, if needed.

IMPORTANT The fields that appear vary from one device to another.

5. Click Set.
6. Click OK.

Reset the IP Address to Factory Default Value

You can reset the IP address of the device to its factory default value with the following methods:

- If the device has rotary switches, set the switches to 888 and cycle power.
- If the device does not have rotary switches, use an MSG instruction to the reset the IP address.

Notes:

Configure the Device

After installing a device and setting the IP address, add the device to the Controller Organizer in a programming software project. This addition establishes I/O control.

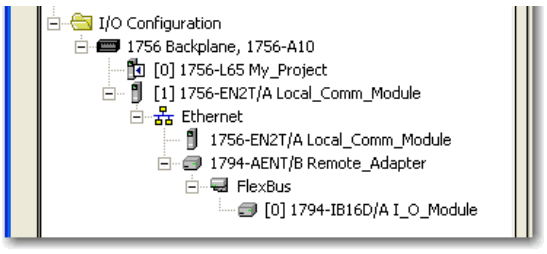
You must download that project to the host controller before operation can begin. When the controller begins operation, it establishes a connection with the device. The configuration of the device determines its behavior.

Add the Device to the Controller Organizer

To build the I/O configuration for a typical I/O network, follow these steps.

1. Add the device.
2. Add the remote device for distributed I/O.
3. Add the I/O modules.

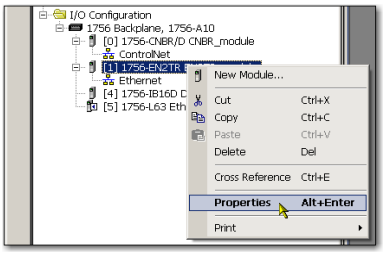
This graphic shows the I/O configuration of the consumer controller after distributed I/O modules are added.



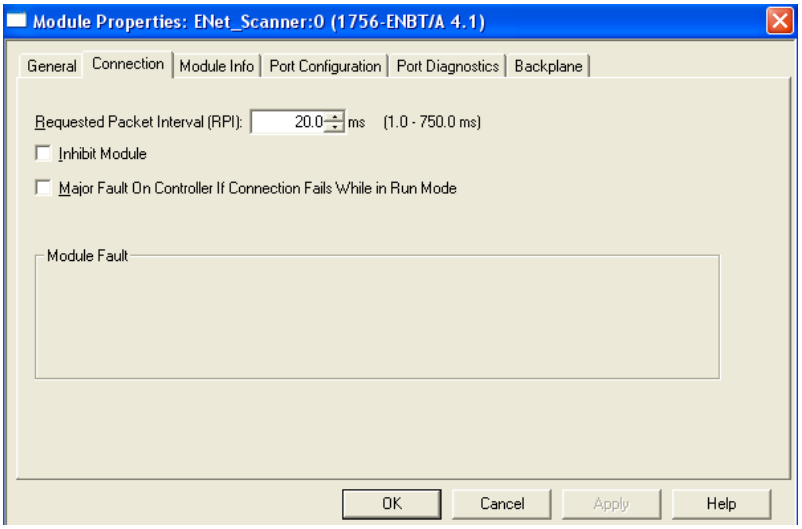
Configure EtherNet/IP Communication

To configure the device, follow these steps.

1. Make sure that the device is installed, started, and connected to the controller.
2. In the Controller Organizer, right-click the device and choose Properties.



The Module Properties dialog box appears.



3. Make configuration selections on the individual tabs.
4. Click OK.

Produced and Consumed Data

Logix controllers can produce (broadcast) and consume (receive) system-shared tags that are sent and received via the device. Produced and consumed tags each require connections.

Tag Type	Required Connections
Produced	The local controller (producing) must have one connection for the produced tag and the first consumer and one more connection for each additional consumer (heartbeat). The produced tag requires two connections. As you increase the number of controllers that can consume a produced tag, you also reduce the number of connections the controller has available for other operations. Example operations include communication and I/O.
Consumed	Each consumed tag requires one connection for the controller that is consuming the tag. **IMPORTANT**: When you configure a consumed tag, you must add a remote device to the programming software project for the producing controller to configure the consuming controller. The default Comm Format when adding a remote device to the project is rack-optimized. Change the Comm Format to None when adding the remote device.

All EtherNet/IP devices support as many as 32 produced multicast connections. Each tag that passes through an EtherNet/IP device uses one connection. Due to this feature, the number of available connections limits the total number of tags that can be produced or consumed. If the device uses all of its connections for I/O and other devices, no connections remain for produced and consumed tags.

IMPORTANT Depending on whether it is producing or consuming a tag, a Logix 5000™ controller uses its connections differently.

For more information, see Logix 5000 Controllers Produced and Consumed Tags Programming Manual, publication 1756-PM011.

Message Instructions

Messages transfer data to other devices, such as other controllers or operator interfaces. Each message uses one connection, regardless of how many devices are in the message path. To conserve connections, you can configure one message to read from or write to multiple devices.

For more information on programming MSG instruction, see the Logix 5000™ Controller General Instructions Reference Manual, publication 1756-RM003.

Notes:

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	https://rockwellautomation.custhelp.com/
Local Technical Support Phone Numbers	Locate the phone number for your country.	http://www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	http://www.rockwellautomation.com/global/literature-library/overview.page
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	http://www.rockwellautomation.com/global/support/pcdc.page

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the How Are We Doing? form at http://literature.rockwellautomation.com/idc/groups/literature/documents/du/ra-du002_-en-e.pdf.

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Publication ENET-UM006A-EN-P - March 2019
Supersedes Publication ENET-UM001P-EN-P, ENET-UM004D-EN-P - August 2017 and May 2018, respectively

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Technical Data

Original Instructions

Allen-Bradley

1756 ControlLogix I/O Specifications

AC Digital Catalog Numbers	1756-IA8D, 1756-IA16, 1756-IA16K, 1756-IA16I, 1756-IA16IK, 1756-IA32, 1756-IA32K, 1756-IM16I, 1756-IM16IK, 1756-IN16, 1756-OA8, 1756-OA8D, 1756-OA8E, 1756-OA16, 1756-OA16K, 1756-OA16I, 1756-OA16IK, 1756-ON8
DC Digital Catalog Numbers	1756-IB16, 1756-IB16K, 1756-IB16D, 1756-IB16DK, 1756-IB16I, 1756-IB16IK, 1756-IB16IF, 1756-IB16IFK, 1756-IB16ISOE, 1756-IB16ISOEK, 1756-IB32, 1756-IB32K, 1756-IC16, 1756-IG16, 1756-IH16I, 1756-IH16ISOE, 1756-IV16, 1756-IV16K, 1756-IV32, 1756-IV32K, 1756-OB8, 1756-OB8EI, 1756-OB8I, 1756-OB16D, 1756-OB16DK, 1756-OB16E, 1756-OB16EK, 1756-OB16I, 1756-OB16IEF, 1756-OB16IEFK, 1756-OB16IEFS, 1756-OB16IS, 1756-OB32, 1756-OB32K, 1756-OC8, 1756-OG16, 1756-OH8I, 1756-OV16E, 1756-OV32E
Safety Catalog Numbers	1756-IB16S, 1756-OBV8S
Contact Catalog Numbers	1756-OW16I, 1756-OX8I
Analog Catalog Numbers	1756-IF6CIS, 1756-IF6I, 1756-IF8, 1756-IF8K, 1756-IF8I, 1756-IF8IK, 1756-IF16, 1756-IF16K, 1756-IF4FXOF2F, 1756-IF4FXOF2FK, 1756-IR6I, 1756-IRT8I, 1756-IRT8IK, 1756-IR12, 1756-IR12K, 1756-IT6I, 1756-IT6I2, 1756-IT16, 1756-IT16K, 1756-OF4, 1756-OF4K, 1756-OF6CI, 1756-OF6VI, 1756-OF8, 1756-OF8K, 1756-OF8I, 1756-OF8IK
HART Interface Catalog Numbers	1756-IF8H, 1756-IF8HK, 1756-IF8IH, 1756-IF8IHK, 1756-IF16H, 1756-IF16HK, 1756-IF16IH, 1756-IF16IHK, 1756-OF8H, 1756-OF8HK, 1756-OF8IH, 1756-OF8IHK
Specialty Catalog Numbers	1756-CFM, 1756-CMS1B1, 1756-CMS1C1, 1756-HSC, 1756-LSC8XIB8I, 1756-LSC8XIB8IK, 1756-PLS

The ControlLogix® Architecture provides a wide range of input and output modules to span many applications, from high-speed digital to process control. The ControlLogix architecture uses Producer/Consumer technology, which allows input information and output status to be shared among multiple ControlLogix controllers.

Summary of Changes

This publication contains new and updated information as indicated in the following table.

Topic	Page
The 1756-IB16S and 1756-OBV8S modules are only compatible with a 1756 ControlLogix Chassis, Series C.	226, 234
Due to the higher internal power dissipation of the 1756-OBV8S module, do not install the 1756-OBV8S module next to any controller or communication module.	234

Available 1756 I/O Modules

Each 1756 ControlLogix standard and safety I/O module mounts in a ControlLogix chassis.

You can select these types of digital I/O modules.

Digital I/O Type	Description
Diagnostic	These modules provide diagnostic features to the point level. These modules have a **D** at the end of the catalog number.
Electronic fusing	These modules have internal electronic fusing to help prevent too much current from flowing through the module. These modules have an **E** at the end of the catalog number.
Individually isolated	These modules have individually isolated inputs or outputs. These modules have an **I** at the end of the catalog number.

Standard I/O Module Wiring

1756 ControlLogix standard I/O modules require either a Removable Terminal Block (RTB) or a 1492 interface module (IFM) to connect all field-side wiring. RTBs and IFMs are not included with the I/O modules. They must be ordered separately. See 1756 Removable Terminal Blocks on page 271 and Wiring Systems on page 272.

Safety I/O Module Wiring

1756-IB16S (1756 ControlLogix 16-point Sinking Safety Input Module) has been agency certified using only the ControlLogix RTBs (1756-TBCHS or 1756-TBS6HS). RTBs are not included with the I/O modules. They must be ordered separately. See 1756 Removable Terminal Blocks on page 271.

1756-OBV8S (ControlLogix 8-point Safety Bipolar/Sourcing Output Module) has been agency certified using only the ControlLogix RTBs (1756-TBNHS and 1756-TBSHS). RTBs are not included with the I/O modules. They must be ordered separately. See 1756 Removable Terminal Blocks on page 271.

Any application that requires agency certification of the ControlLogix system by using other wiring termination methods may require application-specific approval by the certifying agency. RTBs are not included with the I/O modules. They must be ordered separately.

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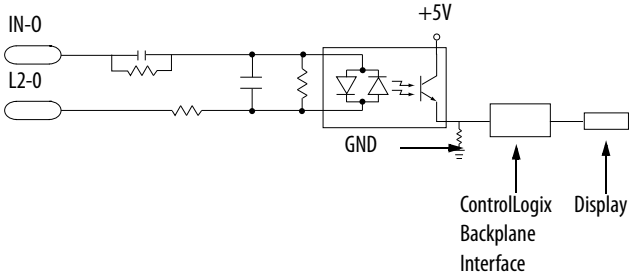
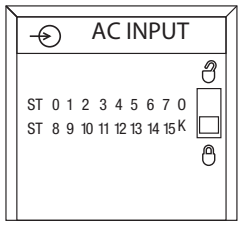
	1756-HSC	257		

1756-IA16I, 1756-IA16IK

ControlLogix 120V AC isolated input module

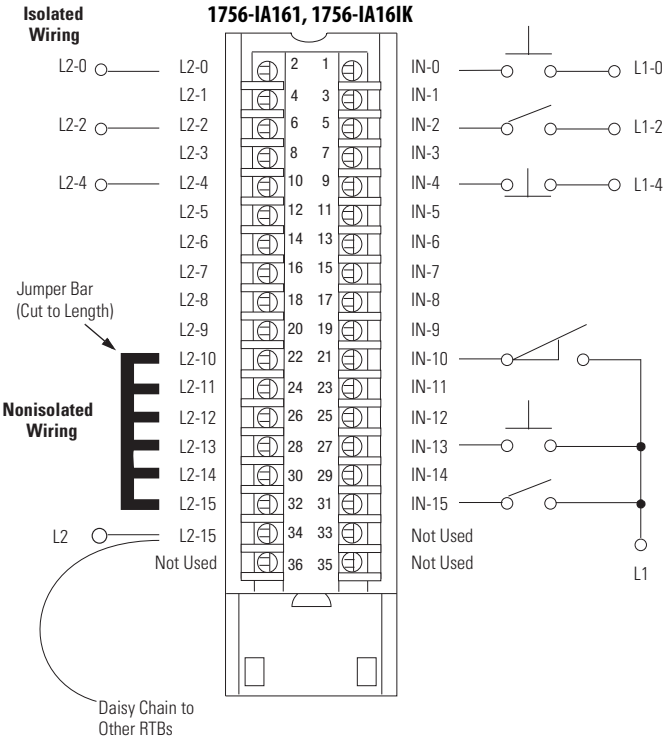
Simplified Schematic





Additional jumper bars are available as catalog number 1756-JMPR.

1756-IA161, 1756-IA16IK



Technical Specifications - 1756-IA16I, 1756-IA16IK

Attribute	1756-IA16I, 1756-IA16IK
Inputs	16 individually isolated
Voltage category	120V AC 50/60 Hz
Operating voltage range[1]	79…132V AC, 47…63 Hz
Input voltage, nom	120V AC 50/60 Hz
Input delay time (screw to backplane) Off to On On to Off	 Hardware delay: 10 ms max + filter time User-selectable filter time: 1 ms or 2 ms Hardware delay: 8 ms max + filter time User-selectable filter time: 9 ms or 18 ms
Current draw @ 5.1V	125 mA
Current draw @ 24V	3 mA
Total backplane power	0.71 W
Power dissipation, max	4.9 W @ 60 °C (140 °F)
Thermal dissipation	16.71 BTU/hr
Off-state voltage, max	20V

Technical Specifications - 1756-IA16I, 1756-IA16IK

Attribute	1756-IA16I, 1756-IA16IK
Off-state current, max	2.5 mA
On-state current, min	5 mA @ 79V AC, 47…63 Hz
On-state current, max	15 mA @ 132V AC, 47…63 Hz
Inrush current, max	250 mA
Input impedance, max	8.8 kΩ @ 132V AC, 60 Hz
Cyclic update time	200 µs…750 ms
Change of state	Software configurable
Time stamp of inputs	±200 µs
Isolation voltage	125V (continuous), basic insulation type, inputs-to-backplane, and input-to-input
Module keying	Electronic, software configurable
Removable terminal block housing	1756-TBCH 1756-TBS6H
RTB keying	User-defined mechanical
Slot width	1
Wire category(2)	1 - on signal ports
Enclosure type	None (open-style)
North American temperature code	T4A

(1) UL certification for 120V 50/60 Hz nominal. Rockwell Automation specified to 74…132V, 47…63 Hz.

(2) Use this conductor category information for planning conductor routing as described in the system-level installation manual. See the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Environmental Specifications - 1756-IA16I, 1756-IA16IK

Attribute	1756-IA16I, 1756-IA16IK
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0…60 °C (32…140 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test N/A, Unpackaged Nonoperating Thermal Shock)	-40…+85 °C (-40…+185 °F)
Relative humidity IEC 60068-2-30 (Test dB, Unpackaged Damp Heat)	5…95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges

Environmental Specifications - 1756-IA16I, 1756-IA16IK

Attribute	1756-IA16I, 1756-IA16IK
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz
EFT/B immunity IEC 61000-4-4	±4 kV at 5 kHz on signal ports
Surge transient immunity IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on signal ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz
Oscillatory surge withstand IEEE C37.90.1	3 kV

Certifications - 1756-IA16I, 1756-IA16IK

Certification (when product is marked)(1)	1756-IA16I, 1756-IA16IK
UL	UL Listed Industrial Control Equipment. See UL File E65584.
CSA	CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File LR69960C.
CE	European Union 2014/30/EU EMC Directive, compliant with: • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions European Union 2014/35/EU LVD Directive, compliant with: EN 61131-2; Programmable Controllers (Clause 11)
RCM	Australian Radiocommunications Act, compliant with: EN 61000-6-4; Industrial Emissions
FM	FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation

(1) See the Product Certification link at rok.auto/certifications for Declarations of Conformity, Certificates, and other certification details.

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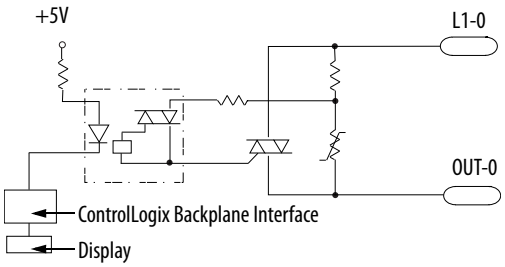
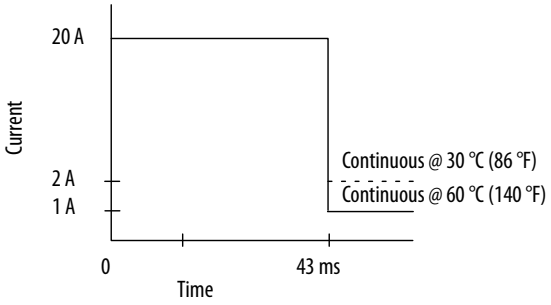
1756-OA16I, 1756-OA16IK

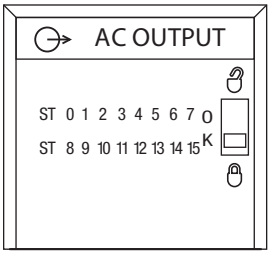
ControlLogix 120/240V AC isolated output module

Simplified Schematic

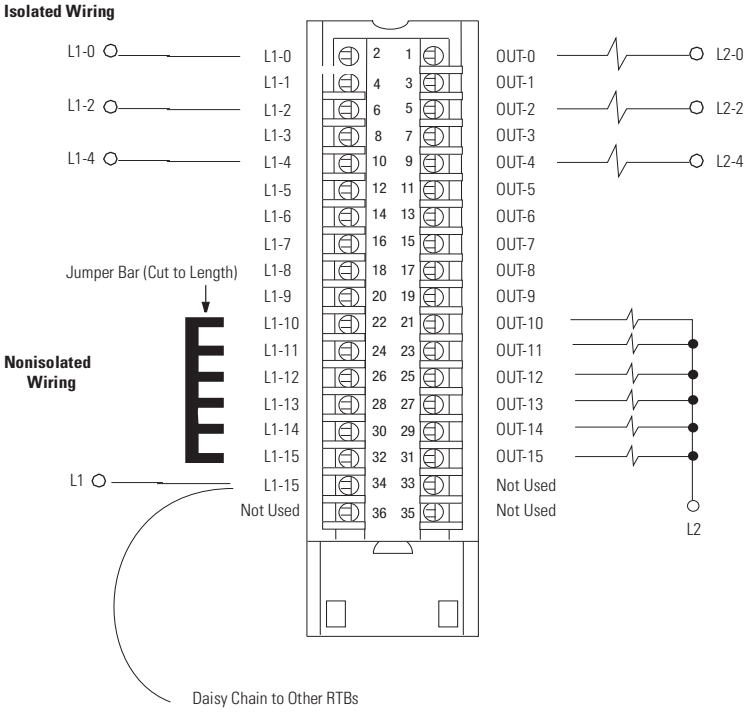


Surge Current Chart





1756-OA161, 1756-OA16IK



Additional jumper bars are available as catalog number 1756-JMPR.

Technical Specifications - 1756-OA16I, 1756-OA16IK

Attribute	1756-OA16I, 1756-OA16IK
Outputs	16 individually isolated
Pilot duty	Yes
Voltage category	120/240V AC 50/60 Hz
Operating voltage range[1]	74…265V AC 47…63 Hz
Output delay time Off to On	9.3 ms @ 60 Hz 11 ms @ 50 Hz
On to Off	9.3 ms @ 60 Hz 11 ms @ 50 Hz
Current draw @ 5.1V	300 mA
Current draw @ 24V	2.5 mA
Total backplane power	1.59 W
Power dissipation, max	5.5 W @ 60 °C (140 °F)

Technical Specifications - 1756-OA16I, 1756-OA16IK

Attribute	1756-OA16I, 1756-OA16IK
Thermal dissipation	18.76 BTU/hr
Off-state leakage current, max	3 mA per point
On-state voltage drop, max	1.5V peak @ 2 A 6V peak @ load current < 50 mA
Current per point, max	2 A @ 30 °C (86 °F) linear derating 1 A @ 60 °C (140 °F) linear derating
Current per module, max	5 A @ 30 °C (86 °F) linear derating 4 A @ 60 °C (140 °F) linear derating
Surge current per point	20 A for 43 ms per point, repeatable every 2 s @ 60 °C (140 °F)
Load current, min	10 mA per point
Commutating voltage	4 V/µs for loads > 50 mA 0.2 V/µs for loads < 50 mA(2)
Scheduled outputs	Synchronization within 16.7 s max, reference to the Coordinated System Time
States in Fault mode per point	Hold last state, On or Off (Off is default)
States in Program mode per point	Hold last state, On or Off (Off is default)
Isolation voltage	250V (continuous), basic insulation type, outputs-to-backplane, and output-to-output
Inhibit voltage, max	Zero crossing 60V peak
Module keying	Electronic, software configurable
Fusing	Not protected. A fused IFM is recommended to help protect outputs
Removable terminal block	1756-TBCH 1756-TBS6H
RTB keying	User-defined mechanical
Slot width	1
Wire category	1(3)
Enclosure type	None (open style)
North American temperature code	T4A

(1) UL certification for 120/240V 50/60 Hz nominal. Rockwell Automation specified to 74…265V, 47…63 Hz.

(2) The commutating dv/dt of the output voltage (OUTPUT to L2) should not exceed 0.2V/µs for loads under 50 mA. The commutating dv/dt rating of the module for loads 50…500 mA (OUTPUT to L2) is 4V/µs maximum. If the commutating dv/dt rating of the TRIAC is exceeded, the TRIAC could latch on. If the commutating dv/dt rating is exceeded in the 10…50 mA range, a resistor can be added AC across the output and L2. The purpose of this resistor is to increase the total output current to 50 mA (I=V/R). At 50 mA and above, the module has a higher commutating dv/dt rating. When adding a resistor for the output to L2, be sure it is rated for the power that it dissipates (P=(V**2)/R). If the commutating dv/dt rating is exceeded in the 50…500 mA range, the L1 AC waveform could be at fault. Be sure that the waveform is a good sinusoid, void of any anomalies such as distorted, or flattened sections.

(3) Use this conductor category information for planning conductor routing as described in the system-level installation manual. See the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Environmental Specifications - 1756-OA16I, 1756-OA16IK

Attribute	1756-OA16I, 1756-OA16IK
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0…60 °C (32…140 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…+85 °C (-40…+185 °F)

Environmental Specifications - 1756-OA16I, 1756-OA16IK

Attribute	1756-OA16I, 1756-OA16IK
Relative humidity IEC 60068-2-30 (Test dB, Unpackaged Damp Heat)	5…95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz
EFT/B immunity IEC 61000-4-4	±4 kV at 5 kHz on signal ports
Surge transient immunity IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on signal ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz
Oscillatory surge withstand IEEE C37.90.1	3 kV

Certifications - 1756-OA16I, 1756-OA16IK

Certification (when product is marked)(1)	1756-OA16I, 1756-OA16IK
UL	UL Listed Industrial Control Equipment. See UL File E65584.
CSA	CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File LR69960C.
CE	European Union 2014/30/EU EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2014/35/EU LVD, compliant with: EN 61131-2; Programmable Controllers (Clause 11)
RCM	Australian Radiocommunications Act, compliant with: EN 61000-6-4; Industrial Emissions
FM	FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation

(1) See the Product Certification link at rok.auto/certifications for Declarations of Conformity, Certificates, and other certification details.

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ControlLogix I/O Accessories

Place 1756 I/O modules in any slot in a 1756 chassis. Each chassis requires a power supply.

Product	Cat. No.
Chassis	1756-A4, 1756-A7, 1756-A10, 1756-A13, 1756-A17
Power supply, standard	1756-PA72/C, 1756-PA75/B, 1756-PB72/C, 1756-PB75/B, 1756-PC75/B, 1756-PH75/B
Power supply, redundant	1756-PA75R, 1756-PB75R, 1756-PSCA2 1756-CPR2 cable

- For more information on chassis specifications, see ControlLogix Chassis Specifications Technical Data, publication 1756-TD006.
- For more information on power supply specifications, see ControlLogix Power Supply Specifications Technical Data, publication 1756-TD005.
- For more information on how to choose the right power supply for your application, see the additional product documentation, for example, a user manual, for your 1756 ControlLogix I/O module.

1756 Removable Terminal Blocks

Removable terminal blocks (RTBs) provide a flexible interconnection between your plant wiring and 1756 I/O modules. The RTB plugs into the front of the I/O module. The type of module determines which RTB you need. You can choose screw-clamp or spring-clamp RTBs.

RTBs are not shipped with I/O modules. You must order them separately. The standard housing on the front of the wiring arm is not deep enough for 2.5 mm^2 (14 AWG) wiring. If you plan to use 2.5 mm^2 (14 AWG) wiring, also order the extended housing.

ATTENTION: If separate power sources are used, do not exceed the specified isolation voltage: referring to the specifications for each individual module on the preceding pages.

WARNING: Do not use the 1756-TBNHS, 1756-TBSHS, 1756-TBCHS, 1756-TBS6HS safety RTBs, and the 1756-TBES Extended-depth terminal block housing ,on non-safety I/O modules.

RTB Specifications - 1756-TBNH, 1756-TBNHS, 1756-TBSH, 1756-TBSHS, 1756-TBCH, 1756-TBCHS, 1756-TBS6H, 1756-TBS6HS, 1756-TBE, 1756-TBES

Attribute	1756-TBNH, 1756-TBNHS	1756-TBSH, 1756-TBSHS	1756-TBCH, 1756-TBCHS	1756-TBS6H, 1756-TBS6HS	1756-TBE, 1756-TBES
Description	20-position NEMA screw-clamp removable block	20-pin spring-clamp removable terminal block with standard housing	36-pin cage-clamp removable terminal block with standard housing	36-pin spring-clamp removable terminal block with standard housing	Extended depth terminal block housing
Screw torque	1.36 N•m (12 lb•in)	–	0.5 N•m (4.4 lb•in)	–	–
Wire size(1)	0.33…2.1 mm^2 (22…14 AWG) solid or stranded copper wire, rated at 90 °C (194 °F) or greater, 1.2 mm (3/64 in.) insulation max Do not wire more than two conductors on any single terminal.	0.33…2.1 mm^2 (22…14 AWG) solid or stranded copper wire, rated at 90 °C (194 °F) or greater, 1.2 mm (3/64 in.) insulation max Do not wire multiple conductors on any single terminal.	Single wire connection: 0.33…2.1 mm^2 (22…14 AWG) solid or stranded copper wire, rated at 90 °C (194 °F) or greater, 1.2 mm (3/64 in.) insulation max Double wire connection: 0.33…1.3 mm^2 (22…16 AWG) solid or stranded copper wire, rated at 90 °C (194 °F) or greater, 1.2 mm (3/64 in.) insulation max Do not wire more than two conductors on any single terminal.	0.33…2.1 mm^2 (22…14 AWG) solid or stranded copper wire, rated at 90 °C (194 °F) or greater, 1.2 mm (3/64 in.) insulation max Do not wire multiple conductors on any single terminal.	
Screwdriver width	8 mm (5/16 in.) Max	–	3.2 mm (1/8 in.)	–	–

(1) Maximum wire size requires extended housing, catalog number 1756-TBE.

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	www.rockwellautomation.com/knowledgebase
Local Technical Support Phone Numbers	Locate the phone number for your country.	www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	www.rockwellautomation.com/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	www.rockwellautomation.com/global/support/pcdc.page

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Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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Publication 1756-TD002M-EN-E - December 2019
Supersedes Publication 1756-TD002L-EN-E - June 2019

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Allen-Bradley

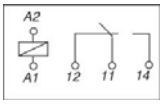
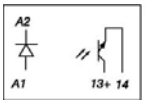
Relay and Timer Specifications

Bulletin Number 700

LISTEN. THINK. SOLVE.®

700-HL Terminal Block Relay

- Relay and socket assembled interface modules for high density interposing or isolation applications
- Screw terminal and spring-clamp bases
- 6 A relay, choice of silver or gold contacts
- 2 A solid-state relay — DC output
- 2 A solid-state relay — AC output
- SPDT (relay), 1 N.O. (solid-state)
- Built-in retainer clip and snap-in marker lever
- Standard LED, reverse polarity protection, and surge protection
- Externally replaceable relay modules
- Unique leakage current suppression version to address industry concerns of nuisance coil turn-on or contact non-drop out when connecting to PLCs with leakage current
- Available with hazardous location certification

Standard built-in Features: • LED • Reverse Polarity Protection for DC Inputs • Coil Surge Protection(1)				
	Cat. No. 700-HLT1Z24	**Cat. No. 700-HLT2Z24**	**Cat. No. 700-HLS1Z24**	**Cat. No. 700-HLS11Z24**
Specifications			(3) 	
Output Type	SPDT (1 C/O); I_{th} = 6A(2)		1 N.O. solid-state; I_{th} = 2 A, 24V DC or I_{th} = 2 A, 240V AC	
Recommended Tightening Torque	0.5 N• m max. (4.4 lb• in)			
Wire Range	Screw Terminal: 0.14 mm^2…2.5 mm^2 (#26…#14 AWG), Spring Terminal: 0.2 mm^2…2.5 mm^2 (#24…#14 AWG)			
Approvals	UL, cULus, cURus, ABS, CE			

(1) Diode surge protection provided.

(2) For Gold-plated contacts: Add the letter "X" at the end of the catalog number. For example: if Cat. No. 700-HLT1Z24 is required with gold plating, the new cat. no. is 700-HLT1Z24X.

(3) Reverse polarity on the output terminals of the solid-state relay will result in the output being "ON" regardless of the state of the input voltage.

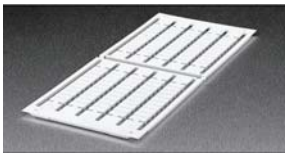
Input Voltage	Pkg. Qty.	Cat. No. (Screw Terminals)	Cat. No. (Spring Clamp Terminals)	Pkg. Quantity	Cat. No. (Screw Terminals) (DC Output)	Cat. No. (Spring Clamp Terminals) (DC Output)	Cat. No. (Screw Terminals) (AC Output)
12V DC	10	(2) 700-HLT1Z12	700-HLT2Z12	—	—	—	—
24V DC	10	(2) 700-HLT1Z24	700-HLT2Z24	10	(2) 700-HLS1Z24	700-HLS2Z24	700-HLS11Z24
48V DC	10	(2) 700-HLT1Z48	700-HLT2Z48	10	(2) 700-HLS1Z48	700-HLS2Z48	700-HLS11Z48
12V AC/DC	10	700-HLT1U12	700-HLT2U12	—	—	—	—
24V AC/DC	10	700-HLT1U24	700-HLT2U24	—	—	—	—
48V AC/DC	10	700-HLT1U48	700-HLT2U48	—	—	—	—
110/125V AC/DC	10	700-HLT1U1	700-HLT2U1	10	(2) 700-HLS1U1	700-HLS2U1	700-HLS11U1
220…240V AC/DC	10	700-HLT1U2	700-HLT2U2	10	(2) 700-HLS1U2	700-HLS2U2	700-HLS11U2
240V AC	10	700-HLT1A2	—	—	—	—	—

Input Voltage	Pkg. Qty.	Cat. No. (Screw Terminals)		Cat. No. (Spring Clamp Terminals)	Pkg. Quantity	Cat. No. (Screw Terminals) (DC Output)		Cat. No. (Spring Clamp Terminals) (DC Output)	Cat. No. (Screw Terminals) (AC Output)
Built-in LCSC (leakage current suppression circuit) 120V AC and 125V DC(1)	10	(2)	700-HLT1L1	—	10	(2)	700-HLS1L1	—	700-HLS11L1
Built-in LCSC (leakage current suppression circuit) 240V AC (1)	10	(2)	700-HLT1L2	—	10	(2)	700-HLS1L2	—	700-HLS11L2
Hazardous Location Certification 24V DC	10	700-HLT1Z24-EX		—	10	700-HLS1Z24-EX		—	—
Hazardous Location Certification 12V DC	10	700-HLT1Z12-EX		—	10	—		—	—
Hazardous Location Certification 110/125V AC/DC	10	700-HLT1U1-EX		—	10	700-HLS1U1-EX		—	—

(1) Leakage current suppression up to 2.2 mA off state current.
(2) Electromechanical relay to solid-state relay interchangeability is possible.

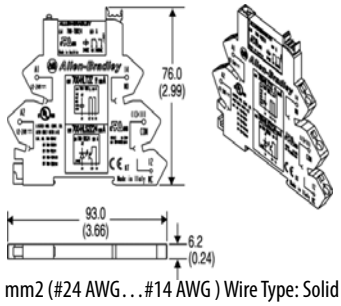
Accessories - 700-HLT, -HLS Relays

Photo	Description	Pkg. Quantity	Socket Input Voltage	Cat. No.
	**Replacement Relays**(1) Order must be for 20 relays or multiples of 20.	20	12V AC/DC	700-TBR12
			24V AC/DC	700-TBR24
			48V AC/DC	700-TBR48
			110/125V AC/DC 220…240V AC/DC	700-TBR60
	**Replacement SSR** 4-blade miniature relay for use with 1 N.O. SSR DC output. Order multiples of 20.	20	24V DC	700-TBS24
			48V DC, 110/125V AC/DC 220…240V AC/DC	700-TBS60
	Replacement SSR 4-blade miniature relay for use with 1 N.O. SSR AC output. Order multiples of 20.	20	24V DC	700-TBS124
	Replacement SSR 4-blade miniature relay for use with 1 N.O. SSR AC output. Order must be for 20 relays or multiples of 20.	20	48V DC 110/125V AC/DC 220…240V AC/DC	700-TBS160
	20-Way Jumper Can be cut to required length. I_{th} = 36 A max per 20-way jumper.	1	**Color**	
			Red	700-TBJ20R
			Grey	700-TBJ20G
			Blue	700-TBJ20B

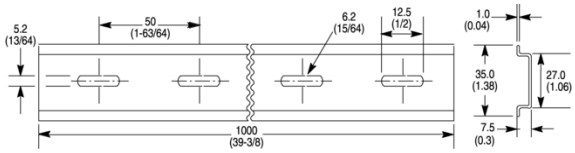
Photo	Description	Pkg. Quantity	Socket Input Voltage	Cat. No.
	**End Barrier** Used for visual inspection of groups, safe separation of neighboring 700-HL modules that end with jumpers.	10	Black	700-HN177
	**Snap-in Marker** These snap-in markers have a 6 x 10 mm surface and snap into the ejection lever for the relay. For custom markers, contact your local Rockwell Automation sales office or Allen-Bradley distributor for more information.	100	Blank	1492-MC6X10

(1) For gold-plated contacts: Add the letter "X" at the end of the catalog number. For example: if Cat. No. 700-TBR24 is required with gold plating, the new cat. no. is 700-TBR24X.

Dimensions - 700-HL Relays



700-HL Spring Terminal Design Single Wire: 0.2 mm2 . . . 2.5 mm2 (#24 AWG . . . #14 AWG) Wire Type: Solid or stranded, copper only.Strip Length: 9 mm (11/32 in.)



Cat. No. 199-DR1 DIN Mounting Rail Series B, Cat. No. 199-DR4 DIN Mounting Rail Series B has no mounting holes.

Specifications - 700-HLT Relays

Cat. No. 700-HLT... (Relay Output)							
Electrical Ratings							
Pilot Duty Rating	B 300, R 300						
Rated Thermal Current (I_{th})	1-Pole — 6 A						
Rated Insulation Voltage (U_i)	250V IEC, 300V UL/CSA						
Contacts	1-Pole						
	Inductive V AC	24V AC, 1-phase	30 A	►][◄ Make	5 A	◄][► Break	
		120V AC, 1-phase	30 A		3 A		
		240V AC, 1-phase	15 A		1.5 A		
	Inductive V DC	24V DC	DC-13, 1.0 A				
		125V DC	DC-13, 0.2 A				
		240V DC	DC-13, 0.1 A				
	Resistive Make, Break, and Continuous	24V DC	6.0 A				
		250V AC	6.0 A				
		240V DC	0.1 A				
Inductive Load	AC-15 250V, 3 A N.O. Contact, 1.5 A N.C. Contact DC-13 24V, 1 A N.O., *and* N.C. Contact						

Cat. No. 700-HLT… (Relay Output)							
Min. Permissible Contact Ratings	12V, 6 mA (72 mW) for Silver Contacts, 8V, 2.5 mA (20 mW) for Gold Contacts						
Permissible Coil Voltage Variation	Pickup:	85…110% of Nominal Voltage at 50 Hz 85…110% of Nominal Voltage at 60 Hz 80…110% of Nominal Voltage at DC			Must Dropout Voltage:	10% of Nominal Voltage at AC 5% of Nominal Voltage at DC	
Power Consumption ±10%	AC DC	0.3VA 0.2 W					
Design Specification / Test Requirements							
Dielectric Withstand Voltage	Pole to Pole (VRMS)	1000V					
	Contact to Coil (VRMS)	4000V					
Input Voltage	12V AC/DC	24V AC/DC	48V AC/DC	120V AC/DC	240V AC/DC	120V LCSC	240V LCSC
Impedance (Ohms)	1K	2 K	6 K	26 K	56 K	16 K	35 K
Mechanical							
Degree of Protection	IP20						
Mechanical Life Operations	1 x 10^7						
Electrical Life Operations	6 A Resistive: 100 000 min. 24V DC, 1 A Inductive: 200 000 min. 120V AC 1 A Inductive: 300 000 min.						
Switching Frequency Operations (no-load)	10 cycles/sec						
Coil Voltages	See Overview/Product Selection						
Operating Time at Nominal Voltage at 20 °C (ms)	Pickup	7 ms					
	Dropout	3 ms					
Maximum Operating Rate (full load = 6 A)	6 cycles/min.						
Coil Surge Protection	Per EN 61000-4.5; Surge Immunity (801-5) Class III: 2 kV common and 1 kV differential mode						
Environmental							
Temperature	Operating	–40…+55 °C					
	Storage	–40…+100 °C					
Altitude	2000 m (6560 ft)						
Construction							
Insulating Material	Molded High Dielectric Material						
Enclosure	Relay IP67						
Contact Material	Silver Tin Ox, $AgSnO_2$ or Silver with Gold Plating, $AgSnO_2$ + Au						
Terminal Markings on Socket	In accordance with EN50 0005						
Certifications	cULus Listed (File No. E3125, E14843 Guide NLDX/NLDX7) with Allen-Bradley socket, CE Marked, ABS (American Bureau of Shipping)						
Standards	EN 61810-1, CSA 22.2,UL 508,NEMA IEE MAC Compliant, ICS-2 Compliant						
Hazardous Location Approvals	Class 1, Zn 2, Groups IIC, Ex nC IIC T5 Ta < 55 °C						
	UL Listed (UL60079-15)	700-HLT1Z12-EX (12V DC supply) 700-HLT1Z24-EX, 700-HLS1Z24-EX (24V DC supply) 700-HLT1U1-EX, 700-HLS1U1-EX (110V/125V AC/DC supply)					
	CSA Certified (1) (CAN/CSA E60079-15)	700-HLT1Z12-EX (12V DC supply) 700-HLT1Z24-EX, 700-HLS1Z24-EX (24V DC supply)					

(1) Product shall be installed in an enclosure providing at least IP54 protection. Provisions shall be made to prevent the rated voltage from being exceeded by transient disturbances of more than 40%.

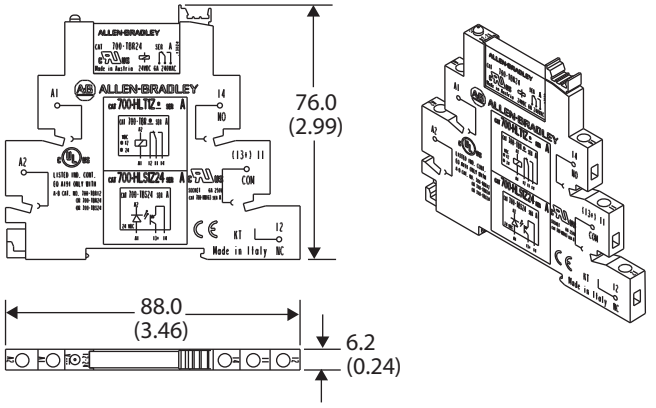
Cat. No. 700-HLS… (Solid-state Output)			
Electrical			
Rated Thermal Current (I_{th})		2 A (DC output)	2 A (AC output)
Rated Insulation Voltage (U_i)	250V IEC, 300V UL/CSA		

Cat. No. 700-HLS… (Solid-state Output)						
Control Circuit	Min. Control Voltage	80% nominal voltage				
	Maximum Control Voltage	110% nominal voltage				
	Control Current	9 mA ±10% (24V) 4 mA ±10% (120/240V)				
	Release Voltage	0.4 x nominal voltage (24V), 0.35 x nominal voltage (120/240V)				
	Min. Control Circuit Resistance	3200 ohms (24V), 16k ohms (120V), 32k ohms (240V)			2500 ohms (24V), 12k ohms (120V), 24k ohms (240V)	
Outputs	Load Voltage Range	0…24V DC			24…240V AC	
	Max. Repetitive Blocking Voltage	33V			600V	
	Max. Switching Current (inductive/ resistive)	2 A DC			1 A AC	
	On State Voltage Drop @ Max. Switching Current	<120 mV DC			<1V AC	
	Leakage Current	max. 100 µA (@U = 24V)				
Power Consumption ±10%	AC	0.6VA (120V), 1VA (240V)				
	DC	0.2 W			0.3 W	
Design Specification/Test Requirements						
Dielectric Withstand Voltage	Pole to Pole (VRMS)	2500V				
	Contact to Coil (VRMS)	2500V				
Input Voltage	24V DC	48V DC	120V AC/DC	240V AC/DC	120V LCSC	240V LCSC
Impedance (Ohms)	2K	9 K	26 K	58 K	16 K	35 K
Mechanical						
Degree of Protection	IP20					
Input Voltages	See Overview/Product Selection					
Operating Time at Nominal Voltage at 20 °C (ms)	Turn on Time	30 µs (DC only input voltage), 7 ms (AC/DC input voltage)				
	Drop Out Time	350 µs (DC only input voltage), 10 ms (AC/DC input voltage)				
Maximum Operating Rate	300 Hz					
Environmental						
Temperature	Operating	–20…+55 °C				
	Storage	–40…+70 °C				
Altitude	2000 m (6560 ft)					
Construction						
Insulating Material	Molded High-Dielectric Material					
Enclosure	Relay IP67					
Terminal Markings on Socket	In accordance with EN50 0005					
Certifications	cULus Listed (File No. E14843, Guide NLDX/NLDX7), CE Marked, ABS (American Bureau of Shipping)					
Standards	UL 508, CSA C22.2 No. 14, EN 61810-1					
Hazardous Location Approvals	Class 1, Zn 2, Groups IIC, Ex nC IIC T5 Ta < 55 °C					
	UL Listed (UL60079-15)	700-HLT1Z24-EX, 700-HLS1Z24-EX (24V DC supply) 700-HLT1U1-EX, 700-HLS1U1-EX (110V/125V AC/DC supply)				
	CSA Certified (1) (CAN/CSA60079-15)	700-HLT1Z24-EX, 700-HLS1Z24-EX (24V DC supply)				

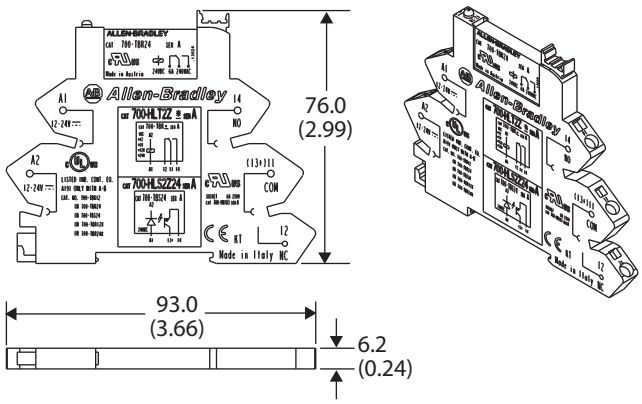
(1) Product shall be installed in an enclosure providing at least IP54 protection. Provisions shall be made to prevent the rated voltage from being exceeded by transient disturbances of more than 40%.

Dimensions - 700-HLT, -HLS Relays

Approximate dimensions are shown in millimeters (inches). Dimensions are not intended for manufacturing purposes.

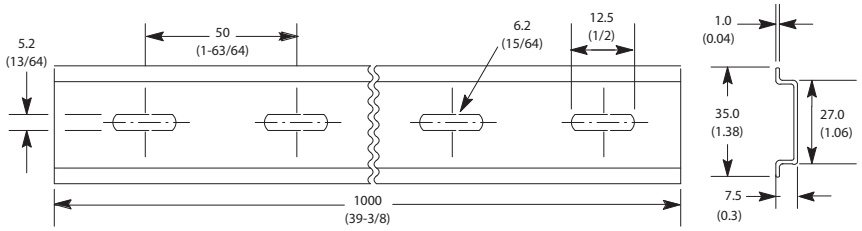


700-HLT / -HLS Screw Terminal Design
Single Wire: 0.14 mm^2…2.5 mm^2 (#26 AWG…#14 AWG)
Double Wire: 2 x 0.14 mm^2…2 x 1.5 mm^2 (2 x #26 AWG…2 x #16 AWG)
Wire Type: Solid or stranded, copper only
Strip Length: 9 mm (11/32 in). Torque: 0.5 N•m (4.4 lb•in)



700-HLT / -HLS Spring Terminal Design
Single Wire: 0.2 mm^2…2.5 mm^2 (#24 AWG…#14 AWG)
Wire Type: Solid or stranded, copper only
Strip Length: 9 mm (11/32 in.)

Dimensions - 700-HLT, -HLS Relay Accessories



Cat. No. 199-DR1 DIN Mounting Rail Series B
Cat. No. 199-DR4 DIN Mounting Rail Series B Has No Mounting Holes

Cat. No.	A	B	C	D	Approx. Shipping Wt.	Pkg. Qty.
199-DR1	35 (1-3/8)	27 (1-1/16)	7.5 (19/64)	1.02 (1/64)	1.85 kg (4.07 lb)	10/pkg
199-DR4	35 (1-3/8)	27 (1-1/16)	15 (19/32)	2.3 (3/32)	3.68 kg (8 lb)	5/pkg

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
General Purpose, Interposing, Solid-State and Specialty Relays Brochure publication 700-BR018	Provides product overview and applications for Bul 700 relay line.
Solid-state Relay Application Guide, publication 700-AT001	Provides methods for applying and troubleshooting Solid-state relays.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications.	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/global/literature-library/overview.page.

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	www.rockwellautomation.com/knowledgebase
Local Technical Support Phone Numbers	Locate the phone number for your country.	www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	www.rockwellautomation.com/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	www.rockwellautomation.com/global/support/pcdc.page

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Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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Publication 700-TD552D-EN-P - June 2019
Supersedes Publication 700-TD552C-EN-P - October 2018

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Allen-Bradley

Terminal Block Specifications

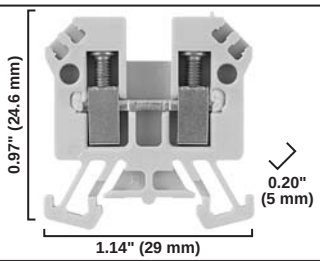
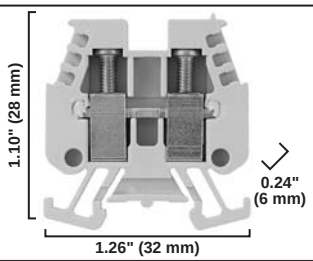
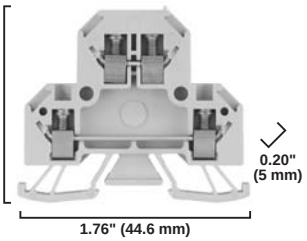
Bulletin Number 1492

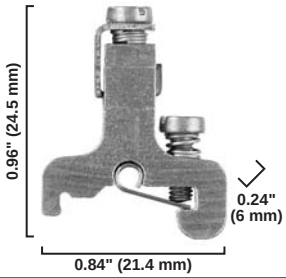
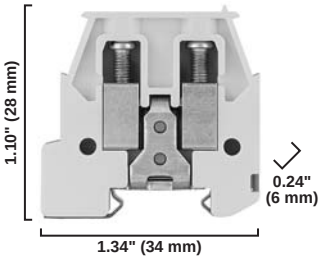
Additional Resources

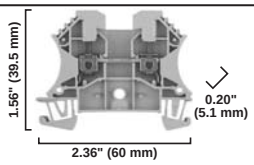
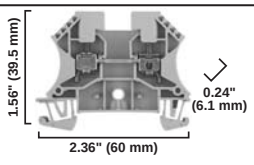
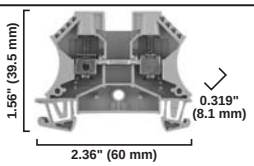
These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

	1492-WM3				1492-WM4				1492-WMD1		
Dimensions are not intended to be used for manufacturing purposes. **Note:** Height dimension is measured from top of rail to top of terminal block.											
Specifications	*Single-circuit mini terminal block.*				*Single-circuit mini terminal block.*				*Two-circuit mini terminal block.*		
Certifications		**IEC**	**CSA**	**ATEX**		**IEC**	**CSA**	**ATEX**		**CSA**	**IEC**
Voltage Rating	300V AC/DC	500V AC/DC	300V AC/DC	420V AC/DC	300V AC/DC	500V AC/DC	300V AC/DC	420V AC/DC	300V AC/DC	300V AC/DC	500V AC/DC
Maximum Current	15 A	24 A	15 A	24 A	20 A	32 A	20 A	32 A	15 A	15 A	17.5 A
Wire Range (Rated Cross Section)	#30…14 AWG	0.5…2.5 mm^2	#22…14 AWG	2.5 mm^2	#22…12 AWG	0.5…4.0 mm^2	#22…12 AWG	4.0 mm^2	#22…16 AWG		0.5…1.5 mm^2
Wire Strip Length	0.24 in. (6 mm)				0.39 in. (10 mm)				0.35 in. (9 mm)		
Recommended Tightening Torque	4.2…4.6 lb•in (0.47....0.52 N•m)				4.7…6.2 lb•in (0.53...0.70 N•m)				4.2…4.6 lb•in (0.47....0.52 N•m)		
Density	61 pcs/ft (200/m)				50 pcs/ft (166/m)				61 pcs/ft (200/m)		
Housing Temperature Range	-40…+195 °F (-40…+90 °C)				-40…+195 °F (-40…+90 °C)				-40…+195 °F (-40…+90 °C)		

	1492-WMG3		1492-WMG4		
Dimensions are not intended to be used for manufacturing purposes. **Note:** Height dimension is measured from top of rail to top of terminal block.					
Specifications	*Single-circuit mini grounding terminal block.*		*Single-circuit mini grounding terminal block.*		
Certifications	**IEC**				**IEC**
Maximum Current	Grounding		Grounding		
Wire Range (Rated Cross Section)	#14 AWG (2.5 mm^2)		#22…12 AWG		0.5…4.0 mm^2
Wire Strip Length	0.31 in. (8 mm)		0.39 in. (10 mm)		
Recommended Tightening Torque	6.2 lb•in (0.7 N•m)		5.3 lb•in (0.6 N•m)		
Density	50 pcs/ft (166 pcs/m)		50 pcs/ft (166 pcs/m)		
Housing Temperature Range	—		-40…+195 °F (-40…+90 °C)		

	1492-J3				1492-J4				1492-J6			
Dimensions are not intended to be used for manufacturing purposes. **Note:** Height dimension is measured from top of rail to top of terminal block.												
Specifications	*Feed-through terminal block*				*Feed-through terminal block*				*Feed-through terminal block*			
Certifications		**CSA**	**IEC**	**ATEX**		**CSA**	**IEC**	**ATEX**		**CSA**	**IEC**	**ATEX**
Voltage Rating	600V AC/DC		800V AC/DC	550V AC/DC	600V AC/DC		800V AC/DC	690V AC/DC	600V AC/DC		800V AC/DC	550V AC/DC
Maximum Current	25 A	20 A	24 A	21 A	35 A	25 A	32 A	28 A	50 A		41 A	36 A
Wire Range (Rated Cross Section)	#28…12 AWG	#26…12 AWG	2.5 mm^2	2.5 mm^2 (#20…14 AWG)	#22…10 AWG	#26…10 AWG	4 mm^2	4 mm^2 (#20…12 AWG)	#22…8 AWG		6 mm^2	6 mm^2 (#20…10 AWG)
Wire Strip Length	0.39 in. (10 mm)				0.39 in. (10 mm)				0.47 in. (12 mm)			
Recommended Tightening Torque	4.5…7.1 lb•in (0.5…0.8 N•m)				9.0 lb•in (1.0 N•m)				14.2 lb•in (1.6 N•m)			
Density	59 pcs/ft (196 pcs/m)				49 pcs/ft (163 pcs/m)				37 pcs/ft (123 pcs/m)			
Housing Temperature Range	-58…+248 °F (-50…+120 °C)				-58…+248 °F (-50…+120 °C)				-58…+248 °F (-50…+120 °C)			

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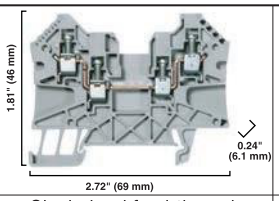
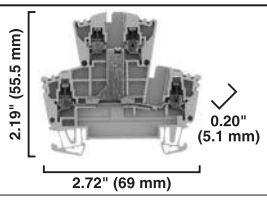
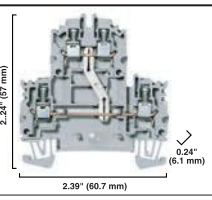
	1492-J4Q			1492-JD3C				1492-JD4C			
Dimensions are not intended to be used for manufacturing purposes. **Note:** Height dimension is measured from top of rail to top of terminal block.											
Specifications	*Single-level feed-through terminal block with 2 connection points on each side*			*Two-level feed-through terminal block with commoning bar*				*Two-level feed-through terminal block with commoning bar*			
Certifications		CSA	IEC		CSA	IEC	ATEX		CSA	IEC	ATEX
Voltage Rating	600V AC/DC		500V AC/DC	600V AC/DC	300V AC/DC	400V AC/DC	275V AC/DC	600V AC/DC	300V AC/DC	400V AC/DC	550V AC/DC
Maximum Current	30 A		32 A	20 A	10 A	24 A	21 A	35 A	30 A	32 A	28 A
Wire Range (Rated Cross Section)	#30…10 AWG		0.5…4 mm^2	#22…12 AWG	#26…12 AWG	2.5 mm^2	2.5 mm^2 (20…14 AWG)	#26…10 AWG		0.5…4 mm^2	4 mm^2 (20…12 AWG)
Wire Strip Length	0.39 in. (10 mm)			0.39 in. (10 mm)				0.28 in. (7 mm)			
Recommended Tightening Torque	6.2 lb•in (0.7 N•m)			4.5…7.1 lb•in (0.5…0.8 N•m)				4.5 lb•in (0.5 N•m)			
Density	49 pcs/ft (163 pcs/m)			59 pcs/ft (196 pcs/m)				49 pcs/ft (163 pcs/m)			
Housing Temperature Range	-58…+248 °F (-50…+120 °C)			-58…+248 °F (-50…+120 °C)				-58…+248 °F (-50…+120 °C)			
Short-Circuit Current Rating (SCCR)	See page 12-42										
Terminal Blocks	**Cat. No.**		**Pkg Qty.**	**Cat. No.**			**Pkg Qty.**	**Cat. No.**			**Pkg Qty.**
Color: Grey	**1492-J4Q**		50	1492-JD3C			100	**1492-JD4C**			100
Accessories	**Cat. No.**		**Pkg Qty.**	**Cat. No.**			**Pkg Qty.**	**Cat. No.**			**Pkg Qty.**
Mounting Rails: 1 m Symmetrical DIN (Steel)	**199-DR1**		10	**199-DR1**			10	**199-DR1**			10
1 m Symmetrical DIN (Aluminum)	**1492-DR5**		10	**1492-DR5**			10	**1492-DR5**			10
1 m Hi-Rise Sym. DIN (Aluminum)	**1492-DR6**		2	**1492-DR6**			2	**1492-DR6**			2
1 m Angled Hi-Rise Sym. DIN (Steel)	**1492-DR7**		2	**1492-DR7**			2	**1492-DR7**			2
End Barriers Grey	**1492-EBJ4Q**		50	**1492-EBJD3**			20	**1492-EBJD4**			20
Blue	—		—	**1492-EBJD3-B**			20	—			—
Yellow	**1492-EBJ4Q-Y**		50	**1492-EBJD3-Y**			20	—			—
End Anchors and Retainers: Screwless End Retainer	**1492-ERL35**		20	**1492-ERL35**			20	—			—
DIN Rail — Normal Duty	**1492-EAJ35**		100	**1492-EAJ35**			100	—			—
DIN Rail — Heavy Duty	**1492-EAHJ35**		50	**1492-EAHJ35**			50	**1492-EAHJ35**			50
Jumpers:* Screw Center Jumper — 41-pole	—		—	—			—	—			—
Screw Center Jumper — 10-pole	—		—	**1492-CJJ5-10**			20	—			—
Screw Center Jumper — 4-pole	—		—	**1492-CJJ5-4**			50	—			—
Screw Center Jumper — 3-pole	—		—	**1492-CJJ5-3**			50	—			—
Screw Center Jumper — 2-pole	—		—	**1492-CJJ5-2**			50	—			—
Plug-in Center Jumper — 41-Pole	**1492-CJLJ6-41**		10	—			—	**1492-CJLJ6-41**			10
Plug-in Center Jumper — 5-, 6-, 7-, 8-, 9-, 10-Pole	**1492-CJLJ6-10**		20	—			—	**1492-CJLJ6-10**			20
Plug-in Center Jumper — 2-, 3-, 4-Pole	**1492-CJLJ6-2**, -3, -4		60	—			—	**1492-CJLJ6-2**, -3, -4			60
Insulated Side Jumper — 24-Pole	—		—	**1492-SJ5A-24**			50	—			—
Insulated Side Jumper — 10-Pole	—		—	**1492-SJ5A-10**			50	—			—
Screw Type Jumper Notching Tool	—		—	**1492-T1**			1	—			—
Other Accessories: Partition Plate	—		—	**1492-PPJD3**			20	**1492-PPJD3**			20
Test Plug Socket	—		—	**1492-TPS23**			20	—			—
Test Plug	—		—	**1492-TP23**			20	—			—
Test Plug (Stackable)	—		—	—			—	—			—
Marking Systems: Snap-in marker card	**1492-MR6X12** (120/card)		5	**1492-M5X8** (144/card)			5	**1492-MR6X8** (120/card)			5
	1492-M6X12 (120/card)		5	**1492-M5X5** (200/card)			5	**1492-M6X5** (200/card)			5

* Use of center jumpers may affect spacings, requiring derating of terminal blocks; see page 12-83 for details.

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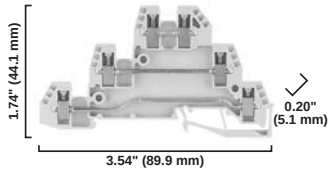
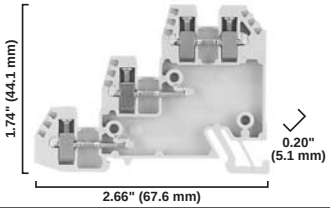
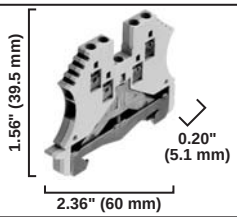
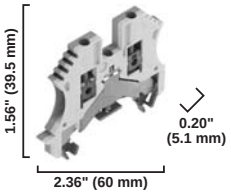
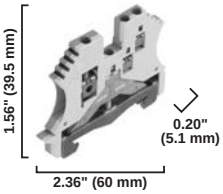
	1492-WTF3…			1492-WTS3…		
Dimensions are not intended to be used for manufacturing purposes. **Note:** Height dimension is measured from top of rail to top of terminal block.						
Specifications	*Three-circuit terminal block.*			*Three-level sensor block.*		
Certifications		**CSA**	**IEC**		**CSA**	**IEC**
Voltage Rating	300V AC/DC		250V AC/DC	300V AC/DC		250V AC/DC
Maximum Current	10 A		24 A	10 A		24 A
Wire Range (Rated Cross Section)	#26…14 AWG		0.5…2.5mm^2	#26…14 AWG		0.5…2.5 mm^2
Recommended Tightening Torque	4.2…4.6 lb•in (0.5 N•m)			4.2…4.6 lb•in (0.5 N•m)		
Density	60 pcs/ft (197 pcs/m)			60 pcs/ft (197 pcs/m)		
Housing Temperature Range	-40…+195 °F (-40…+90 °C)			-40…+195 °F (-40…+90 °C)		
Indicator Type WTF3/WTS3	No indicator			No indicator		
WTF3LP/WTS3LP	Red LED for PNP devices (10…50V)			Red LED for PNP devices (10…50V)		
WTF3LN/WTS3LN	Red LED for NPN devices (10…50V)			Red LED for NPN devices (10…50V)		
Leakage Current WTF3/WTS3	—			—		
WTF3LP/WTS3LP	2.69 mA @ 50V			2.69 mA @ 50V		
WTF3LN/WTS3LN	2.69 mA @ 50V			2.69 mA @ 50V		
Wire Strip Length	0.31 in. (8 mm)			0.31 in. (8 mm)		

	1492-JG2Q			1492-JG3				1492-JG3TW			
Dimensions are not intended to be used for manufacturing purposes. **Note:** Height dimension is measured from top of rail to top of terminal block.											
Specifications	*Feed-through grounding terminal block with 2 connection points on each side*			*Feed-through grounding terminal block*				*Feed-through grounding terminal block with 3 connection points, 2 on one side*			
Certifications		**CSA**	**IEC**		**CSA**	**IEC**	**ATEX**		**CSA**	**IEC**	**ATEX**
Voltage Rating	—	—	—	—	—	—	—	—	—	—	—
Maximum Current	Grounding			Grounding				Grounding			
Wire Range (Rated Cross Section)	#22…14 AWG		1.5 mm^2	#22…12 AWG		2.5 mm^2	2.5 mm^2 (#20…14 AWG)	Single Side: #22…12 AWG		2.5 mm^2	2.5 mm^2 (#20…14 AWG)
								Twin Side: #26…12 AWG		1.5 mm^2	1.5 mm^2 (#20…16 AWG)
Wire Strip Length	0.28 in. (7 mm)			0.39 in. (10 mm)				Single Side: 0.39 in. (10 mm) Twin Side: 0.28 in. (7 mm)			
Recommended Tightening Torque	5.0 lb•in (0.6 N•m)			7.1 lb•in (0.8 N•m)				Single Side: 7.1 lb•in (0.8 N•m)			
Mounting Torque — Center Screw	3.5…5.3 lb•in (0.4…0.6 N•m)			3.5…6.2 lb•in (0.4…0.6 N•m)				Twin Side: 4.5 lb•in (0.5 N•m)			
Density	59 pcs/ft (196 pcs/m)			59 pcs/ft (196 pcs/m)				59 pcs/ft (196 pcs/m)			
Housing Temperature Range	-58…+248 °F (-50…+120 °C)			-58…+248 °F (-50…+120 °C)				-58…+248 °F (-50…+120 °C)			

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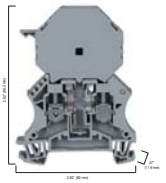
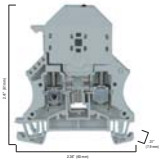
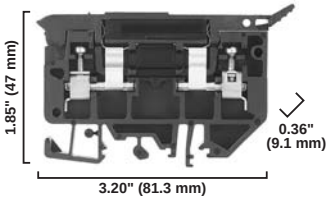
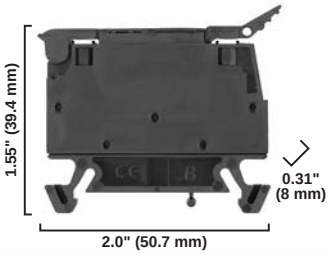
Fuse Blocks

	1492-J6FB1...			1492-J6FB2...		
Dimensions are not intended to be used for manufacturing purposes. **Note:** Height dimension is measured from top of rail to top of terminal block.						
Specifications	*Single-circuit fuse block with or without blown fuse indication*			*Single-circuit fuse block with or without blown fuse indication*		
Certifications	UL	**CSA**	**IEC**	UL	**CSA**	**IEC**
Voltage Rating J6FB1/J6FB2	600V AC/DC		500V AC/DC	600V AC/DC		500V AC/DC
Voltage Rating J6FB124/J6FB224	10…36V AC/DC			10…36V AC/DC		
Voltage Rating J6FB148/J6FB248	30…70V AC/DC			30…70V AC/DC		
Voltage Rating J6FB1120/J6FB2120	60…150V AC/DC			60…150V AC/DC		
Voltage Rating J6FB1250/J6FB2250	100…250V AC/DC			100…250V AC/DC		
Maximum Current	10 A	16 A	6.3 A	10 A	10 A	6.3 A
Wire Range (Rated Cross Section)	#22…8 AWG	#20…8 AWG	6 mm^2	#22…8 AWG	#20…8 AWG	6 mm^2
Wire Strip Length	0.47 in. (12 mm)			0.47 in. (12 mm)		
Recommended Tightening Torque	10.6 lb•in (1.2 N•m)			14.2 lb•in (1.6 N•m)		
Density	25 pcs/ft (84 pcs/m)			38 pcs/ft (126 pcs/m)		
Housing Temperature Range	-58…+248 °F (-50…+120 °C)			-58…+248 °F (-50…+120 °C)		
Leakage Current	≤ 0.5 mA at Nominal Voltage			≤ 0.5 mA at Nominal Voltage		
Fuse Size (not supplied)	1/4 x 1-1/4 in.			5 x 20 mm		

	1492-H...			1492-WFB4...		
Dimensions are not intended to be used for manufacturing purposes. **Note:** Height dimension is measured from top of rail to top of terminal block.						
Specifications	*Single-circuit fusible terminal block with or without fuse indication.*			*Single-circuit fuse block with or without fuse indication.*		
Certifications		**CSA**	**IEC**		**CSA**	**IEC**
Voltage Rating H6/WFB4	300V AC/DC		500V AC/DC	300V AC/DC		500V AC/DC
Voltage Rating H5/WFB424	10…57V AC/DC			10…57V AC/DC		
Voltage Rating H4/WFB4250	100…300V AC			85…264V AC		
Maximum Current	15 A			15 A		15 A ★
Wire Range (Rated Cross Section)	#30…12 AWG		0.5… 4 mm^2	#30…12 AWG		0.5…4 mm^2
Wire Strip Length	0.38 in. (9.7 mm)			0.31 in. (8 mm)		
Recommended Tightening Torque	7.1 lb•in (0.8 N•m)			2.65…5.3 lb•in (0.3…0.6 N•m)		
Density	33 pcs/ft (109pcs /m)			38 pcs/ft (125 pcs/m)		
Housing Temperature Range	-40…+195 °F (-40…+90 °C)			-40…+195 °F (-40…+90 °C)		
Indicator Type						
H6/WFB4	Non-Indicating			Non-Indicating		
H5/WFB424	Red LED			Red LED		
H4/WFB4250	Neon			Neon		
Leakage Current						
H6/WFB4	—			—		
H5/WFB424	2 mA @ 24V			2 mA @ 24V		
H4/WFB4250	2 mA @ 300V			2 mA @ 300V		
Fuse Size (Not Supplied)	1/4 x 1-1/4 in.			5 x 20 mm		

Short-Circuit Current Ratings
Fuse Ratings

Cat. No.	Wire Range Cu [AWG]		Overcurrent Protection Fuse Required Class/Max. Current Rating [A]						Maximum Voltage [V]	SCCR, RMS SYM [A]
	Line	Load	J	T	RK1	RK5	G	CC		
1492-J3	14…12	14…12	30	30	—	—	30	30	600	100,000
1492-J3P										
1492-JD3SS										
1492-JD3										
1492-JD3C										
1492-JG3TW										
1492-JDG3C										
1492-JG3										
1492-J3F	14…12	14…12	30	30	—	—	30	30	300	100,000
1492-J3TW										
1492-JC3										
1492-JDC3										
1492-JKD3										
1492-JD3FB										
1492-JD3F										
1492-JDG3FB										
1492-JD3PSSTP										
1492-JD3PTP										
1492-JDG3P										
1492-JDG3PSS										
1492-JDG3PSSTP										
1492-JDG3PTP										
1492-JDG3										
1492-JD3PSS										
1492-JD3P										
1492-J4	14…10	14…10	60	60	30	—	60	30	600	100,000
1492-JG4										
1492-JKD4										
1492-J4TW										
1492-J4Q										
1492-JG4TW										
1492-JG4Q										
1492-JKD4TW										
1492-JKD4Q										
1492-JKD4TP										
1492-JD4C										
1492-JD4										
1492-JKD4QTP										
1492-JKD4TWTP										
1492-JSD4	14…10	14…10	60	60	30	—	60	30	300	100,000
1492-JKD4										
1492-J4CTB										
1492-J6	14…8	14…8	100	100	60	30	60	30	600	100,000
1492-JG6										
1492-J10	14…6	14…6	100	100	60	30	60	30	600	100,000
1492-JG10										
1492-J16	14…4	14…4	100	100	60	30	60	30	600	100,000
1492-JG16										
1492-J16ND										
1492-J35	12…1/0	12…1/0	200	200	100	30	60	30	600	100,000
1492-JG35										
1492-J50	6…1/0	6…1/0	200	200	100	30	60	30	600	100,000
1492-JG50										
1492-J70	1/0...3/0	1/0...3/0	400	400	200	100	60	30	600	100,000
1492-JG70										
1492-J120	4…4/0	4…4/0	400	400	200	100	60	30	600	100,000
1492-JG120										

Overcurrent Ratings

Cat. No.	Wire Range Cu [AWG] (Line and Load)	Overcurrent Protection Device Required	Max. Current [A]	SCCR, RMS Sym A 480Y/277V	SCCR, RMS Sym. A 600Y/347V
1492-J3	14…12	140M-D8E-__	16	65,000	30,000
1492-JG3TW		140M-C2E-B10		65,000	30,000
1492-J3P		140M-C2E-B16		65,000	30,000
1492-J3		140M-C2E-B25		65,000	30,000
1492-JD3		140M-C2E-B40		65,000	25,000
1492-JD3C		140M-C2E-B63		65,000	★
1492-JD3SS		140M-C2E-A__		65,000	30,000
1492-JDG3C		140M-C2E-C10		65,000	★
1492-JG3		140MC2E-C16		30,000	★
1492-J4	14…10	140M-F8E-__	32	65,000	30,000
1492-JG4		140M-D8E-C10		65,000	30,000
1492-J4TW		140M-D8E-C16		65,000	30,000
1492-J4Q		140M-D8E-C20		65,000	★
1492-JG4TW		140M-D8E-C25		30,000	★
1492-JG4Q		140M-D8E-B__		65,000	30,000
1492-JKD4TW		140M-C2E-B10		65,000	30,000
1492-JKD4Q		140M-C2E-B16		65,000	30,000
1492-JKD4TP		140M-C2E-B25		65,000	30,000
1492-JD4C		140M-C2E-B40		65,000	25,000
1492-JD4		140M-C2E-B63		65,000	★
1492-JKD4QTP		140M-C2E-C10		65,000	★
1492-JKD4TWTP		140M-C2E-C16		30,000	★
		140M-C2E-A__		65,000	30,000
1492-J6	14…8	140M-F8E-__	32	65,000	30,000
1492-JG6		140M-D8E-C10		65,000	30,000
		140M-D8E-C16		65,000	30,000
		140M-D8E-C20		65,000	★
		140M-D8E-C25		30,000	★
		140M-D8E-B__		65,000	30,000
		140M-C2E-B10		65,000	30,000
		140M-C2E-B16		65,000	30,000
		140M-C2E-B25		65,000	30,000
		140M-C2E-B40		65,000	25,000
		140M-C2E-B63		65,000	★
		140M-C2E-C10		65,000	★
		140M-C2E-C16		30,000	★
		140M-C2E-A__		65,000	30,000

★ Bulletin 140M does not have ratings at this voltage.

Cat. No.	Wire Range Cu [AWG] (Line and Load)	Overcurrent Protection Device Required	Max. Current [A]	SCCR, RMS Sym A 480Y/277V	SCCR, RMS Sym. A 300V+
1492-J3TW	14…12	140M-D8E-__	16	65,000	30,000
1492-JC3		140M-C2E-B10		65,000	30,000
1492-JDC3		140M-C2E-B16		65,000	30,000
1492-J3F		140M-C2E-B25		65,000	30,000
1492-JD3F		140M-C2E-B40		65,000	25,000
1492-JKD3		140M-C2E-B63		65,000	★
1492-JD3FB		140M-C2E-A__		65,000	30,000
1492-JDG3FB		140M-C2E-C10		65,000	★
1492-JD3PSSTP		140MC2E-C16		30,000	★
1492-JD3PTP					
1492-JDG3P					
1492-JDG3PSS					
1492-JDG3PSSTP					
1492-JDG3PTP					
1492-JDG3					
1492-JD3P					
1492-JD3PSS					
1492-JKD4	14…10	140M-F8E-__	32	65,000	30,000
1492-JSD4		140M-D8E-C10		65,000	30,000
1492-J4CTB		140M-D8E-C16		65,000	30,000
		140M-D8E-C20		65,000	★
		140M-D8E-C25		30,000	★
		140M-D8E-B__		65,000	30,000
		140M-C2E-B10		65,000	30,000
		140M-C2E-B16		65,000	30,000
		140M-C2E-B25		65,000	30,000
		140M-C2E-B40		65,000	25,000
		140M-C2E-B63		65,000	★
		140M-C2E-C10		65,000	★
		140M-C2E-C16		30,000	★
		140M-C2E-A__		65,000	30,000

Cat. No.	Wire Range Cu [AWG] (Line and Load)	Overcurrent Protection Device Required	Max. Current [A]	SCCR, RMS Sym A 480V+	SCCR, RMS Sym. A 600Y 347V+
1492-J10	14…10	140M-H8P-__	50	50,000	30,000
1492-JG10					
1492-J16	14…4	140M-H8P-__	100	30,000	30,000
1492-JG16					
1492-J16ND					
1492-J35	12…2	140M-H8P-__	100	50,000	30,000
1492-JG35					
1492-J50	2…1/0	140M-H8P-__	150	65,000	30,000
1492-JG50					

Cat. No.	Wire Range Cu [AWG] (Line and Load)	Overcurrent Protection Device Required	Max. Current [A]	SCCR, RMS Sym A 480V+	SCCR, RMS Sym. A 600V+
1492-J70	4…1/0	140U-J0X3	175	65,000	★
	1/0	140U-J0X3		★	30,000
1492-J120	2…3/0	140U-J0X3	228	65,000	30,000

★ Bulletin 140M does not have ratings at this voltage.
+ Voltage terminal block was tested at for respective SCCR

Allen-Bradley spring-clamp terminal blocks generally have been designed to meet the requirements of one or more regulatory bodies. Most products have also been tested per additional standards. The following is a listing of some of the regulatory bodies and standards which apply to Allen-Bradley spring-clamp terminal block products. See the particular product description for information on specific certifications and ratings.

(Underwriters Laboratories) — Allen-Bradley spring-clamp terminal blocks with one of these ratings have been tested by Underwriters Laboratories and meet the requirements of one or more of the following United States Standards:

- UL 486E — Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
- UL 1059 — Standard for Terminal Blocks

Reference UL file E40735

(Underwriters Laboratories) — Allen-Bradley spring-clamp terminal blocks with this rating have been tested by Underwriters Laboratories and meet the requirements of one or more of the following Canadian Standards:

- CSA 22.2 No. 158 — Terminal Blocks

Reference UL file E40735

(Canadian Standards Association) — Allen-Bradley spring-clamp terminal blocks with this rating have been tested by the Canadian Standards Association and meet the requirements of the following Canadian Standard:

- CSA 22.2 No. 158 — Terminal Blocks

Reference CSA files 677896

Allen-Bradley spring-clamp terminal blocks listed in this catalog meet the requirements of the Low Voltage Directive put forth by the European Union. Devices have been tested and comply with one or more of the following European Norms:

- EN 60947-1 — Low Voltage Switchgear and Controlgear: General Rules
- EN 60947-7-1 — Low Voltage Switchgear and Controlgear: Terminal Blocks for Copper Conductors
- EN 60947-7-2 — Low Voltage Switchgear and Controlgear: Protective Conductor Terminal Blocks for Copper Conductors
- EN 60947-7-3 — Low Voltage Switchgear and Controlgear: Safety Requirements for Fuse Terminal Blocks

ATEX — Devices listed in this catalog with “ATEX” ratings meet the following European Norms per DEMKO or KEMA, Approval Certification Bodies for the European Union:

- EN 60079-0 — Electrical Apparatus for Potentially Explosive Atmospheres — General Requirements
- EN 60079-7 — Electrical Apparatus for Potentially Explosive Atmospheres — Increased Safety “e”

Contact your local Allen-Bradley distributor for a copy of the certificate.

Ex e II — Bulletin 1492-L terminal blocks in this catalog meet the following Canadian Standards per Underwriters Laboratories:

- CAN/CSA E60079-7 — Electrical Apparatus for Explosive Atmospheres — Part 0 — General Requirements
- CAN/CSA E60079-0 — Electrical Apparatus for Explosive Atmospheres — Part 7 — Increased Safety “e”

These products are suitable for Class I, Zone 1 Hazardous Locations. Reference UL file E187022. Contact your local Allen-Bradley distributor for more information.

AEx e II — Allen-Bradley spring-clamp terminal blocks with an “AEx e II” rating meet the following United States Standard per Underwriters Laboratories:

- UL 2279 — Standard for Electrical Equipment for Use in Class I, Zone 0, 1, and 2 Hazardous (Classified) Locations

These products are suitable for Class I, Zone 1 Hazardous Locations. Reference UL file E187022. Contact your local Allen-Bradley distributor for more information.

Lloyd’s Register — Bulletin 1492-L terminal blocks in this catalog have been certified for use in marine, off-shore, and industrial installations per the following standard:

- Lloyd’s Register Test Specification No. 1:1996

Contact your local Allen-Bradley distributor for a copy of the certificate.

The Allen-Bradley Line of Spring-Clamp Terminal Blocks…

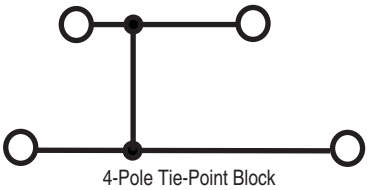
The Bulletin 1492-L line of internationally approved spring-clamp IEC-style terminal blocks offers a variety of products that can make any application:

- Fast — Reduces wiring time by more than 50%
- Practical — Requires only a flat-head screwdriver for easy installation. Maintenance-free, no need to retighten
- Reliable — Secure contact is durable under extreme conditions such as high-vibration applications

Products Available in the 1492-L Spring-Clamp Line

- **Feed-Through Blocks**, accommodating wire sizes from #30…#2 AWG (0.2…35 mm^2)
- **Grounding Blocks** for grounding a given circuit to the DIN Rail
- **Multi-Circuit Blocks** for doubling circuit wiring density
- **Isolation Blocks** for circuit isolation during testing and troubleshooting
- **Plug-In Style Terminal Blocks** accommodating component plugs, fuse plugs, and disconnect plugs
- **Sensor Blocks** for coordination of three-wire sensor groups with or without ground terminations
- **Electrical Component Blocks** which allow for the insertion of fixed components into control circuits. Components include diodes and surge suppression circuits

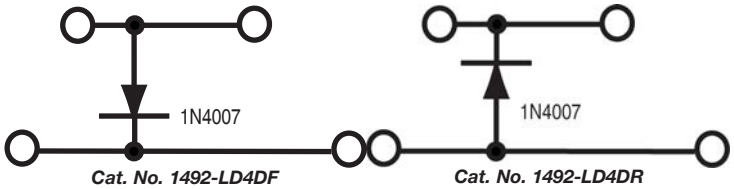
Tie-Point Block (Cat. Nos. 1492-LD2C, LD3C, LD4C)



4-Pole Tie-Point Block

Diode Block (Cat. Nos. 1492-LD4DF, 1492-LD4DR)

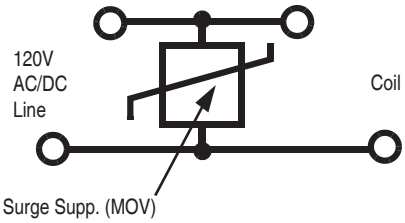
Uses a 1N4007 diode between the upper and lower levels for insertion into a control circuit. This block is useful in low voltage DC control circuits for directioning and suppression.



Cat. No. 1492-LD4DF *Cat. No. 1492-LD4DR*

Surge Suppression Block (Cat. No. 1492-LD4SS)

Provides a convenient means of incorporating transient suppression for relays, contactors and solenoids into a control system.



- **Test Blocks** for allowing a bank of pluggable terminal strips to be easily connected for test purposes
- A wide variety of snap-in markers are available for individual or group circuit identification
- A broad offering of accessories such as screwless end retainers, electrical warning plates, end barriers, protective stops and test plugs to provide exactly what the application requires
- Operating instructions (printed on an adhesive label), for fixing inside a panel
- **Mini-blocks** available in rail-mount or panel-mount configurations

Materials and Design Features

The 1492-L line is specially designed for safety, installation ease, and ruggedness. Features include:

- Tin-plated terminals and stainless steel spring clamps for resistance to corrosion and vibration
- Spring clamp design to minimize stress relaxation and maintain contact force, even under vibration
- Top wire entry for ease of installation
- Circuit testing with standard 2 mm diameter test probe or stackable test plugs on most spring-clamp blocks
- Insulation stops to ensure electrical connection when using smaller gauge wires
- Markers that are visible after terminal blocks are wired
- Multiple marking options
- Common profiles to minimize stocking of accessories
- Self-extinguishing, polymide 6.6 housing materials with a flammability rating UL 94-V0 (1492-R terminal blocks have a UL 94-V2 flammability rating)
- Screwless center jumpers to simplify jumpering terminals together

Note: To ensure proper wire termination, these blocks are designed to accept only **one** wire per terminal.

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End Barriers

End barriers are required to provide the necessary insulation for the last terminal block in a group.

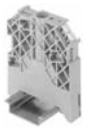
Dimensions Width x Length x Height	For Use With	Color	Pkg Qty.	Cat. No.
0.08 x 1.14 x 2.03 in. (2 x 28.9 x 51.5 mm)	1492-L2, LG2	Grey	50	**1492-EBL2**
		Blue	50	**1492-EBL2-B**
		Yellow	50	**1492-EBL2-Y**
0.08 x 1.14 x 2.48 in. (2 x 28.9 x 63 mm)	1492-L2T, LG2T	Grey	50	**1492-EBL2T**
		Blue	50	1492-EBL2T-B
		Yellow	50	**1492-EBL2T-Y**
0.08 x 1.14 x 2.95 in. (2 x 28.9 x 75 mm)	1492-L2Q, LG2Q	Grey	50	**1492-EBL2Q**
		Blue	50	**1492-EBL2Q-B**
		Yellow	50	1492-EBL2Q-Y
0.08 x 1.15 x 2.34 in. (2 x 29.1 x 59.5 mm)	1492-L3, LG3, LKD3, L3P	Grey	50	**1492-EBL3**
		Blue	50	**1492-EBL3-B**
		Yellow	50	**1492-EBL3-Y**
0.08 x 1.20 x 2.54 in. (2 x 30.6 x 64.5 mm)	1492-L3T, LG3T	Grey	50	**1492-EBL3T**
		Blue	50	**1492-EBL3T-B**
		Yellow	50	**1492-EBL3T-Y**
0.08 x 1.20 x 3.11 in. (2 x 30.6 x 79 mm)	1492-L3Q, L3QS, LG3Q	Grey	50	**1492-EBL3Q**
		Blue	50	**1492-EBL3Q-B**
		Yellow	50	**1492-EBL3Q-Y**
0.10 x 1.06 x 2.8 in. (2.5 x 27 x 71 mm)	1492-L31P, 1492-LG31P	Yellow	50	1492-EBL31P-Y
	1492-L3T1P, 1492-LG3T1P	Grey	50	1492-EBL3T1P
		Yellow	50	1492-EBL3T1P-Y
0.08 x 1.20 x 3.11 in. (2 x 30.6 x 79 mm)	1492-L3Q2P	Grey	50	1492-EBL3Q2P
0.10 x 1.76 x 3.17 in. (2.5 X 44.7 x 80.5)	1492-LD32P	Grey	50	1492-EBLD32P
0.08 x 1.37 x 2.44 in. (2 x 34.85 x 62 mm)	1492-L4, LG4	Grey	50	**1492-EBL4**
		Blue	50	**1492-EBL4-B**
		Yellow	50	**1492-EBL4-Y**
0.08 x 1.37 x 3.31 in. (2 x 34.85 x 84 mm)	1492-L4T, LG4T	Grey	50	**1492-EBL4T**
		Blue	50	1492-EBL4T-B
		Yellow	50	1492-EBL4T-Y
0.08 x 1.37 x 4.13 in. (2 x 34.85 x 105 mm)	1492-L4Q, LG4Q	Grey	50	**1492-EBL4Q**
		Blue	50	1492-EBL4Q-B
		Yellow	50	**1492-EBL4Q-Y**
0.08 x 1.45 x 2.56 in. (2 x 36.95 x 65 mm)	1492-L6, LG6	Grey	50	**1492-EBL6**
		Blue	50	1492-EBL6-B
		Yellow	50	**1492-EBL6-Y**
0.08 x 1.45 x 3.54 in. (2 x 36.95 x 90 mm)	1492-L6T, LG6T	Grey	50	**1492-EBL6T**
		Blue	50	1492-EBL6T-B
		Yellow	50	**1492-EBL6T-Y**
0.12 x 1.67 x 2.89 in. (3 x 42.5 x 73.5 mm)	1492-L10, LG10	Grey	20	**1492-EBL10**
		Blue	20	1492-EBL10-B
		Yellow	20	**1492-EBL10-Y**
0.12 x 1.71 x 3.25 in. (3 x 43.5 x 82.5 mm)	1492-L16, LG16	Grey	20	**1492-EBL16**
		Blue	20	1492-EBL16-B
		Yellow	20	**1492-EBL16-Y**
—	1492-LAFB6	Black	50	**1492-EBLAFB6**
0.08 x 1.65 x 2.95 in. (2 x 41.9 x 75 mm)	1492-LD2, LDG2, LD2C, LDG2C	Grey	50	**1492-EBLD2**
		Blue	20	1492-EBLD2-B
		Yellow	20	1492-EBLD2-Y
0.08 x 1.87 x 2.85 in. (2 x 47.5 x 72.5 mm)	1492-LD3, LD3C, LDG3, LDG3C	Grey	20	**1492-EBLD3**
		Blue	20	1492-EBLD3-B
		Yellow	20	**1492-EBLD3-Y**
0.08 x 2.05 x 2.99 in. (2 x 52 x 76 mm)	1492-LD4, LD4C, LDG4, LDG4C, LD4DF, LD4DR, LD4RB…, LD4SS	Grey	20	**1492-EBLD4**
		Blue	20	**1492-EBLD4-B**
		Yellow	20	1492-EBLD4-Y

End Barriers

Dimensions Width x Length x Height	For Use With	Color	Pkg Qty.	Cat. No.
0.20 x 0.94 x 1.31 in. (5.1 x 23.8 x 33.3 mm)	1492-LMP3, LMP3Q	Grey	50	**1492-EBLMP3**
		Blue	50	1492-EBLMP3-B
0.20 x 0.94 x 1.31 in. (5.1 x 23.8 x 33.3 mm)	1492-LM3, LM3Q, LMG3, LMP3E, LMP3QE	Grey	50	**1492-EBLM3**
0.06 x 0.97 x 1.38 in. (1.5 x 24.65 x 35 mm)	1492-LMJ3, LMJG3	Grey	50	**1492-EBLMJ3**
		Blue	50	1492-EBLMJ3-B
		Yellow	50	1492-EBLMJ3-Y
0.06 x 2.32 x 4.35 in. (1.5 x 59 x 110.5 mm)	1492-LTF3	Grey	20	**1492-EBLTF3**
0.06 x 2.69 x 1.77 in. (5 x 68.5 x 45 mm)	1492-LS2-3, LS2-3L, LSG2-3		50	**1492-EBLS2-3**
0.20 x 3.2 x 1.77 in. (5 x 81.5 x 45 mm)	1492-LS2-4, LS2-4L, LSG2-4		50	**1492-EBLS2-4**
0.06 x 1.81 x 3.74 in. (1.5 x 46 x 95 mm)	1492-LDAG3, LDG3P		20	**1492-EBLDAG3**
0.10 x 1.04 x 1.81 in. (2.5 x 26.4 x 46 mm)	1492-LC3		20	**1492-EBLC3**
0.10 x 1.65 x 2.72 in. (2.5 x 41.85 x 69 mm)	1492-LDC3		20	1492-EBLDC3
—	1492-LDG3ND, LD3N, LDG3N	Grey	20	**1492-BSPJLD3N**
—	1492-LDG3ND, LD3N, LDG3N	Blue	20	1492-BSPJLD3N-B

End Anchor/End Retainers

End anchors and end retainers mount at both ends of a group of terminal blocks to add rigidity to the terminal assembly and prevent sliding along the rails.

Photo	Dimensions Width x Length x Height	Tightening Torque	Markers	For Use With	Color	Pkg Qty.	Cat. No.
	0.31 x 2.20 x 1.85 in. (8 x 56 x 47 mm)	4.4 lb•in (0.5 N•m)	1492-M7X12 1492-M8X5	199-DR1, 199-DR2, 1492-DR4, 1492-DR5, 1492-DR6, 1492-DR7, 1492-DR8, 1492-DR9	Grey	100	**1492-EAJ35**
	0.48 x 2.20 x 2.48 in. (12.2 x 56 x 63 mm)	4.4 lb•in (0.5 N•m)	1492-M7X12 1492-M5X5	199-DR1, 199-DR2, 1492-DR4, 1492-DR5, 1492-DR6, 1492-DR7, 1492-DR8, 1492-DR9	Grey	50	**1492-EAHJ35**
	0.31 x 1.06 x 1.06 in. (8 x 27 x 27 mm)	3.5 lb•in (0.9 N•m)	1492-M5X5	1492-DR3	Grey	50	**1492-EAJ15**
	0.24 x 2.19 x 1.63 in. (6 x 55.6 x 41.5 mm)	—	1492-M5X10 1492-M5X5	199-DR1, 199-DR2, 1492-DR4, 1492-DR5, 1492-DR6, 1492-DR7, 1492-DR8, 1492-DR9	Grey	20	**1492-ERL35**
	0.20 x 0.96 x 0.75 in. (5 x 24.5 x 19 mm)	—	1492-M5X10 1492-M5X5	1492-DR3	Grey	20	**1492-ERL15**

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Publication 1492-TD015A-EN-P - August 2014

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CONTROL CIRCUIT AND LOAD PROTECTION DEVICES

TECHNICAL DATA

Rockwell Automation has Short Circuit Current Ratings on the list of products below per the specific UL Standard and Category Code.

BULLETIN 1489
BULLETIN 1492-CB
BULLETIN 1492-FB
BULLETIN 1492-GH
BULLETIN 1492-GS
BULLETIN 1492-MC
BULLETIN 1492-SP

These ratings are included in the UL acceptance file of the device and summarized on the UL Certification site per the Category Code for the specific product.

SHORT CIRCUIT CURRENT RATINGS

Per the requirements of the 2005 National Electric Code (NEC) and UL508A (effective April 25, 2006), many electrical panels must be rated for their Short Circuit Withstand Rating. Analyzing the SCCR of individual components, and the associated branch and feeder overcurrent devices is a method of determining the SCCR of an electrical assembly.

UL Standard 508A permits these devices to have a SCCR without any additional testing.

Device	SCCR
Circuit Breaker	5 kA
Circuit Breaker With GFCI	5 kA
Fuse Holder	10 kA
Supplementary Protector	200 A

The Allen-Bradley products far exceed those ratings (see page 2).

UL489 CIRCUIT BREAKERS – CAT. CODE DIVQ
UL 508 MANUAL MOTOR STARTERS – CAT. CODE NLRV
UL 1077 SUPPLEMENTARY PROTECTORS – CAT. CODE QVNU2
UL512 FUSE HOLDERS – CAT. CODE IZLT

STANDARD PRODUCT

Rockwell Automation has tested a number of the 1492-PD Power Terminal blocks to determine their SCCR related to the new testing requirements. These are the standard Power Terminal Blocks that have been used in Industrial Control Panels.

The new ratings for these blocks permit their continued use in panels where the higher SCCR ratings are required.

HIGH FAULT SCCR RATINGS – UP TO 200,000 A
CERTIFIED TO UL REQUIREMENTS
STANDARD PRODUCTS

Bulletin Number	Notes	UL508A Category Code	UL File Number	Poles	Current Rating	Max Voltage	SCCR	Application code/notes
1489	Circuit Breaker	DIVQ	E197878	1 pole	0.5 - 25(a) A	277 VAC	10 kA	----
					30 - 40 A	240 VAC		
				2, 3 pole	0.5 - 25(a) A	480Y/277 VAC		
					30 - 40 A	240 VAC		
1492-CB	When used as UL508 Manual Motor Controller	NLRV	E14841	1 pole	0.5 - 52A	277 VAC	5 kA	----
				2, 3 pole		480Y/277 VAC		
	Supplementary Protector	QVNU2	E65138	1, 2, 3 pole 1 + N pole 3 + N pole	0.5 - 50 A	125 VAC	10 kA	U2
						240 VAC	5 kA	U2
						480Y/277 VAC	3 kA	U2
						480Y/277 VAC	5 kA	U1
1492-FB	Fuse holder	IZLT	E34648	1, 2, 3 pole	0.1 - 30 A	1492-FB	200 kA (*)	Type CC & J (*) Interrupt rating of fuse
					35 - 60 A			Type J (*) Interrupt rating of fuse
					0.1 - 30 A		(*)	Type M (*) Interrupt rating of fuse
1492-GH	Supplementary Protector	QVNU2	E65138	1 pole	0.2 - 15 A	250 VAC	1 kA	U1
1492-GS	Supplementary Protector	QVNU2	E65138	1 pole	0.2 - 16 A	277 VAC	5 kA	C1
					20 - 25 A		3 kA	C1
					0.2 - 5 A		400 A	U1
					6 - 25 A		800 A	U1
				2, 3 pole	0.2 - 16 A	480Y/277 VAC	5 kA	C1
					20 - 25 A		3 kA	C1
					0.2 - 5 A		400 A	U1
					6 - 25 A		500 A	U1
1492-MC	Circuit Breaker	DIVQ	E197878	1, 2 pole	10 - 60 A	120/240 VAC	10 kA	1492-MCAAnnn
					70 - 100 A			1492-MCBAnnn
				2 pole	15 - 30 A	240 VAC		1492-MCAA2Hnn
					40 - 100 A			1492-MCBA2Hnn
				3 pole	15 - 30 A	240 VAC		1492-MCAA3nn
					40 - 100 A			1492-MCBA3nn
				1 pole	15 - 100 A	120 VAC	65 kA	1492-MCCA1nn
						277 VAC	14 kA	
				2 pole		240 VAC	65 kA	1492-MCCA2nn
						480Y/277 VAC	14 kA	
	Circuit Breaker with Ground Fault GFCI and GFEP			1 pole	15 - 50 A	120VAC	10 kA	1492-MCGA1nn 1492-MCEA1nn
				2 pole	15 - 50 A	120/240 VAC		1492-MCGA2nn 1492-MCEA2nn
1492-SP	Supplementary Protector	QVNU2	E65138	1 pole 1 + N pole	0.5 - 35 A	277 VAC	10 kA	U2 - B or C trip
					40 - 63 A		5 kA	U2 - B or C trip
					0.5 - 40 A		5 kA	U2 - D trip
				2, 3 pole 3 + N pole	0.5 - 35 A	480Y/277 VAC	10 kA	U2 - B or C trip
					40 - 63 A		5 kA	U2 - B or C trip
					0.5 - 40 A		5 kA	U2 - D trip

(a) Indicates 25 A @ 480Y/277 available November 2006

C1 Indicates that the short-circuit test was conducted with series overcurrent protection that is no greater than 400% of Supplementary Protector or 15 A whichever is greater. Indicates that a recalibration and dielectric test was not conducted as part of the short-circuit test.

U1 Indicates that the short-circuit test was conducted without series overcurrent protection. Indicates that a recalibration and dielectric test was not conducted as part of the short-circuit test.

U2 Indicates that the short-circuit test was conducted without series overcurrent protection. Indicates that a recalibration and dielectric test was conducted as part of the short-circuit test.

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Publication CCLP-TD001A-EN-E – September 2006

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Allen-Bradley

Stratix Ethernet Device Specifications

Stratix® 2000 Switches (1783-US), Stratix 2500 Switches (1783-LMS), Stratix 6000 Switches (1783-EMS)

Stratix 5400 Switches (1783-HMS), Stratix 5410 Switches (1783-IMS), Stratix 5700 Switches (1783-BMS)

ArmorStratix™ 5700 Switches (1783-ZMS), Stratix 8000 and 8300 Switches (1783-MS, 1783-RMS, 1783-MX)

Stratix 5800 Switches (1783-MMS, 1783-MMX)

Stratix 5100 Wireless Access Point/Workgroup Bridge (1783-WAP), Stratix 5900 Services Router (1783-SR)

Stratix 5950 Security Appliance (1783-SAD), Embedded Switch Technology (1783-ETAP), Configurable NAT Router (1783-NATR)

Summary of Changes

This publication contains new and updated information as indicated in the following table.

Topic	Page
Specifications for Stratix 5800 catalog numbers 1783-MMS10BE/B, 1783-MMS10E/B, 1783-MMS10ER/B, 1783-MMS10/B, 1783-MMS10R/B 1783-MMS10B/B 1783-MMS10EA/B, 1783-MMS10EAR/B, 1783-MMX8EA/A, 1783-MMX8SA/A	47…52
Ethernet tap catalog numbers 1783-ETAPK, 1783-ETAP1FK, 1783-ETAP2FK	75

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Configurable NAT Router User Manual, publication 1783-UM008	Describes how to install, configure, and troubleshoot the NAT router.
EtherNet/IP Industrial Protocol White Paper, publication ENET-WP001	Describes how to implement services and data objects on a TCP/UDP/IP based Ethernet network.
Stratix Managed Switches User Manual, publication 1783-UM007	Describes how to configure and troubleshoot Stratix 5400, 5410, 5700, 8000, 8300, and ArmorStratix 5700 switches.
Stratix 2000 Ethernet Unmanaged Switches User Manual, publication 1783-UM011	Describes how to use DIP switches and status indicators on Stratix 2000 switches.
Stratix 2500 Lightly Managed Switches User Manual, publication 1783-UM009	Describes how to configure and troubleshoot Stratix 2500 switches.
Stratix 5800 Ethernet Managed Switches User Manual, publication 1783-UM012	Describes how to configure and troubleshoot Stratix 5800 switches.
Stratix 6000 Ethernet Managed Switches User Manual, publication 1783-UM001	Describes how to configure and troubleshoot Stratix 6000 switches.
Stratix 5100 Wireless Access Point/Workgroup Bridge User Manual, publication 1783-UM006	Describes how to install, configure, and troubleshoot the wireless access point.
Stratix 5900 Services Router User Manual, publication 1783-UM005	Describes how to install, configure, and troubleshoot the router.
Stratix 5950 Security Appliance User Manual, publication 1783-UM010	Describes how to install, configure, and troubleshoot the security appliance.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Stratix 5700 Ethernet Managed Switches

Cat. No.	Total Ports	RJ45 Ports[1]	Combo Ports	PoE/PoE+ Ports	SFP Slots	Firmware Type	CIP Sync (IEEE 1588)	NAT	DLR	Conformal Coating
1783-BMS4S2SGL	6	—	—	—	4 FE + 2 GE	Lite	—	—	—	—
1783-BMS4S2SGA	6	—	—	—	4 FE + 2 GE	Full	—	—	—	—
1783-BMS06SL	6	4 FE	—	—	2 FE	Lite	—	—	—	—
1783-BMS06SA	6	4 FE	—	—	2 FE	Full	—	—	—	—
1783-BMS06TL	6	6 FE	—	—	—	Lite	—	—	—	—
1783-BMS06TA	6	6 FE	—	—	—	Full	—	—	—	—
1783-BMS06SGL	6	4 FE	—	—	2 GE	Lite	—	—	—	—
1783-BMS06SGA	6	4 FE	—	—	2 GE	Full	—	—	—	—
1783-BMS06TGL	6	4 FE + 2 GE	—	—	—	Lite	—	—	—	—
1783-BMS06TGA	6	4 FE + 2 GE	—	—	—	Full	—	—	—	—
1783-BMS10CL	10	8 FE	2 FE	—	—	Lite	—	—	—	—
1783-BMS10CA	10	8 FE	2 FE	—	—	Full	—	—	—	—
1783-BMS10CGL	10	8 FE	2 GE	—	—	Lite	—	—	—	—
1783-BMS10CGA	10	8 FE	2 GE	—	—	Full	—	—	—	—
1783-BMS10CGP	10	8 FE	2 GE	—	—	Full	Yes	—	Yes	—
1783-BMS10CGN	10	8 FE	2 GE	—	—	Full	Yes	Yes	Yes	—
1783-BMS12T4E2CGL	18	12 FE	2 GE	4 FE	—	Lite	—	—	Yes	—
1783-BMS12T4E2CGP	18	12 FE	2 GE	4 FE	—	Full	Yes	—	Yes	—
1783-BMS12T4E2CGNK	18	12 FE	2 GE	4 FE	—	Full	Yes	Yes	Yes	Yes
1783-BMS20CL	20	16 FE	2 FE	—	2 FE	Lite	—	—	Yes	—
1783-BMS20CA	20	16 FE	2 FE	—	2 FE	Full	—	—	Yes	—
1783-BMS20CGL	20	16 FE	2 GE	—	2 FE	Lite	—	—	Yes	—
1783-BMS20CGP	20	16 FE	2 GE	—	2 FE	Full	Yes	—	Yes	—
1783-BMS20CGN	20	16 FE	2 GE	—	2 FE	Full	Yes	Yes	Yes	—
1783-BMS20CGPK	20	16 FE	2 GE	—	2 FE	Full	Yes	—	Yes	Yes

(1) FE = Fast EthernetGE = Gigabit Ethernet.

Table 19 - Technical Specifications - Stratix 5700 Switches

Attribute	1783-BMS06SL, 1783-BMS06SA, 1783-BMS06TL, 1783-BMS06TA, 1783-BMS06SGL, 1783-BMS06SGA, 1783-BMS06TGL, 1783-BMS06TGA	1783-BMS10CL, 1783-BMS10CA, 1783-BMS10CGL, 1783-BMS10CGA	1783-BMS10CGN, 1783-BMS10CGP	1783-BMS20CL, 1783-BMS20CA, 1783-BMS20CGL, 1783-BMS20CGP, 1783-BMS20CGN, 1783-BMS20CGPK	1783-BMS4S2SGL, 1783-BMS4S2SGA
Alarm relay	1 A @ 30V DC or 0.5 A @ 48V DC				
Power input	0.5…2.0 A max @ 12…48V DC Class 2/SELV			0.5…3.0 A max @ 12…48V DC Class 2/SELV	0.5…2.0 A max @ 12…48V DC Class 2/SELV
Power consumption	9.5 W @ 24V DC @ 40 °C (104 °F) 15 W max	12.5 W @ 24V DC/ 40 °C (104 °F) 17 W max	15 W @ 24V DC/ 40 °C (104 °F) 20 W max	21 W @ 24V DC/40 °C (104 °F) 30 W max	12.5 W @ 24V DC/40 °C (104 °F) 14 W max
Power dissipation	15 W	17 W	20 W	30 W	14 W
Isolation voltage	50V (continuous), basic insulation type, DC power ports to ground, DC power ports to Ethernet ports, and DC power ports to alarm ports No isolation between individual Ethernet ports No isolation between console port and system Type tested at 850V DC for 60 s				60V (continuous), basic insulation type, DC power ports to ground, alarm ports to ground, and DC power ports to alarm ports No isolation between console port and system Type tested at 707V DC for 60 s
Wire size, Ethernet connection[1]	RJ45 connector according to IEC 60603-7, 2- or 4-pair Category 5e minimum cable according to TIA 568-B.1 or Category 5 cable according to ISO/IEC 24702				—
Wire size, DC power connection	0.5…0.8 mm^2 (20…18 AWG) solid or stranded copper wire rated at 75 °C (167 °F) or greater, 1.2 mm (3/64 in.) insulation max, 6.3 mm (0.25 in.) ±0.5 mm (0.02 in.) strip length				
Wire size, alarm connection	0.5…0.8 mm^2 (20…18 AWG) solid or stranded, UL/CSA-rated style 1007 or 1569 twisted-pair copper appliance wiring material (AWM) wire, 6.3 mm (0.25 in.) ±0.5 mm (0.02 in.) strip length				
Wire size, ground connection	4.0 mm^2 (12 AWG) min, stranded copper wire				
Screw torque, power and alarm terminals	0.23 N•m (2.0 in•lb)				0.23 N•m (2.0 in•lb)
Screw torque, ground terminal, max	0.96 N•m (8.5 in•lb)				0.4 N•m (3.5 in•lb)
Weight, approx	1.11 kg (2.45 lb)	1.25 kg (2.75 lb)	1.38 kg (3.05 lb)	2.04 kg (4.50 lb)	1.22 kg (2.69 lb)
Wiring category[2]	3 - on console and alarm ports 2 - on DC power ports 2 - on Ethernet ports				3 - on console ports 2 - on DC power and alarm ports
Enclosure type rating	None (open-style)				
Pilot duty rating	Alarm not rated				
North American temp code	T4				
IEC temp code	T4				

Table 19 - Technical Specifications - Stratix 5700 Switches (continued)

Attribute	1783-BMS06SL, 1783-BMS06SA, 1783-BMS06TL, 1783-BMS06TA, 1783-BMS06SGL, 1783-BMS06SGA, 1783-BMS06TGL, 1783-BMS06TGA	1783-BMS10CL, 1783-BMS10CA, 1783-BMS10CGL, 1783-BMS10CGA	1783-BMS10CGN, 1783-BMS10CGP	1783-BMS20CL, 1783-BMS20CA, 1783-BMS20CGL, 1783-BMS20CGP, 1783-BMS20CGN, 1783-BMS20CGPK	1783-BMS4S2SGL, 1783-BMS4S2SGA
SFP modules[3]	1783-SFP100FX 1783-SFP100LX 1783-SFP100EXC 1783-SFP100ZXC 1783-SFP100T[4] 1783-SFP1GSX[5] 1783-SFP1GLX(5) 1783-SFP1GEXE(5) 1783-SFP1GZX(5) 1783-SFP1GTE(5)				
Memory card	1784-SD1				
Industry standards	Substation KEMA (IEEE 1613, IEC 61850 - 3) IEEE 1613 Electric Power Stations Communications Networking IEC 61850-3 Electric Substations Communications Networking				

(1) See page 84 for recommended products.
(2) Use this conductor category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.
(3) SFP modules are supported only on switches with combo ports or SFP slots. For SFP specifications, see page 82.
(4) The 1783-SFP100T module requires Stratix 5700 firmware revision 8.001or later.
(5) Gigabit Ethernet (GE) SFP modules work only in GE SFP slots. For a list of Stratix 5700 catalog numbers with GE SFP slots, see page 32.

Table 20 - Environmental Specifications - Stratix 5700 Switches

Attribute	1783-BMS06SL, 1783-BMS06SA, 1783-BMS06TL, 1783-BMS06TA, 1783-BMS06SGL, 1783-BMS06SGA, 1783-BMS06TGL, 1783-BMS06TGA, 1783-BMS10CL, 1783-BMS10CA, 1783-BMS10CGL, 1783-BMS10CGA, 1783-BMS10CGN, 1783-BMS10CGP, 1783-BMS20CL, 1783-BMS20CA, 1783-BMS20CGL, 1783-BMS20CGP, 1783-BMS20CGN, 1783-BMS20CGPK	1783-BMS4S2SGL, 1783-BMS4S2SGA
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	-40…+60 °C (-40…+140 °F)	
Temperature, surrounding air, max	60 °C (140 °F)	
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…85 °C (-40…185 °F)	
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing	
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz	

Table 20 - Environmental Specifications - Stratix 5700 Switches (continued)

Attribute	1783-BMS06SL, 1783-BMS06SA, 1783-BMS06TL, 1783-BMS06TA, 1783-BMS06SGL, 1783-BMS06SGA, 1783-BMS06TGL, 1783-BMS06TGA, 1783-BMS10CL, 1783-BMS10CA, 1783-BMS10CGL, 1783-BMS10CGA, 1783-BMS10CGN, 1783-BMS10CGP, 1783-BMS20CL, 1783-BMS20CA, 1783-BMS20CGL, 1783-BMS20CGP, 1783-BMS20CGN, 1783-BMS20CGPK	1783-BMS4S2SGL, 1783-BMS4S2SGA
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g	
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	55 g	50 g
Emissions CISPR11 (IEC 61000-6-4)	Class A	
ESD immunity IEC 61000-4-2	8 kV contact discharges 15 kV air discharges	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	20V/m with 1 kHz sine-wave 80% AM from 80…1000 MHz 20V/m with 200 Hz 50% pulse 100% AM at 900 MHz 10V/m with 1 kHz sine-wave 80% AM from 1000…2700 MHz	20V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% pulse 100% AM at 900 MHz 10V/m with 200 Hz 50% pulse 100% AM at 1890 MHz 20V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz
EFT/B immunity IEC 61000-4-4	±4 kV at 5 kHz and ±2 kV at 100 kHz on DC power ports ±4 kV at 2.5 kHz, ±2 kV at 5 kHz, and ±1 kV at 100 kHz on alarm ports ±4 kV at 2.5 kHz, ±2 kV at 5 kHz, and ±1 kV at 100 kHz on Ethernet ports	±4 kV at 2.5, 5, and 100 kHz on DC power ports ±4 kV at 2.5, 5, and 100 kHz on alarm ports
Surge transient immunity IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on DC power ports ±2 kV line-earth (CM) on Ethernet ports	±1 kV line-line (DM) and ±2 kV line-earth (CM) on DC power ports ±1 kV line-line (DM) and ±2 kV line-earth (CM) on alarm ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz	
Magnetic field immunity IEC 61000-4-8	—	300A/m long duration at 50 and 60 Hz 1000A/m short duration at 50 and 60 Hz
Magnetic pulse immunity IEC 61000-4-9	—	300A/m pulse
Voltage variation IEC 61000-4-29	10 ms interruption on DC power ports	
Damped oscillatory wave immunity IEC 61000-4-18	±1 kV line-line (DM) and ±2.5 kV line-earth (CM) on power ports	±1 kV line-line (DM) and ±2.5 kV line-earth (CM) on DC power ports at 1 MHz and 100 kHz ±1 kV line-line (DM) and ±2.5 kV line-earth (CM) on alarm ports at 1 MHz and 100 kHz
Environmental rating	IP30	

Table 23 - Certifications - Stratix 5700 Switches

Certifications (when product is marked)[1]	Stratix 5700 Switches
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810. UL Listed for Class I, Zone 2 Hazardous Locations, certified for U.S. and Canada. See UL File E194810. AEx/Ex nA nC IIC T4 Gc X
CE	European Union 2004/108/EC EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2011/65/EU RoHS, compliant with: • EN 50581; Technical Documentation
RCM	Australian Radiocommunications Act, compliant with: • AS/NZS CISPR 11; Industrial Emissions
Ex	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements • II 3 G Ex nA nC IIC T4 Gc X
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: • Article 58-2 of Radio Waves Act, Clause 3
EtherNet/IP	ODVA conformance tested to EtherNet/IP specifications
Anatel	Brazilian regulations (Federal Law 9472/97)
EAC	Russian Customs Union TR CU 020 EMC Technical Regulation
BSMI	CNS 13438 (95); CNS14336-1 (99) Taiwan

(1) See the Product Certification link at http://www.ab.com for declarations of conformity, certificates, and other certification details.

Dimensions—Stratix 5700 Switches

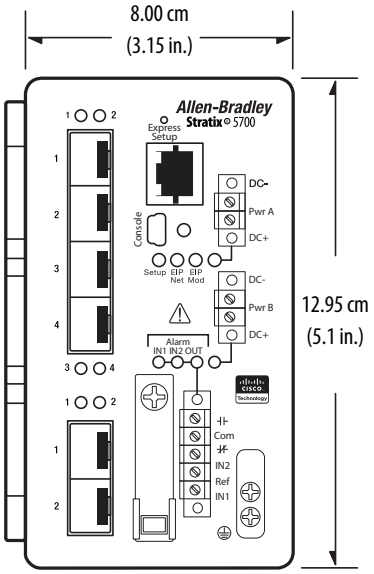
To prevent the switch from overheating, observe the following minimum clearances:

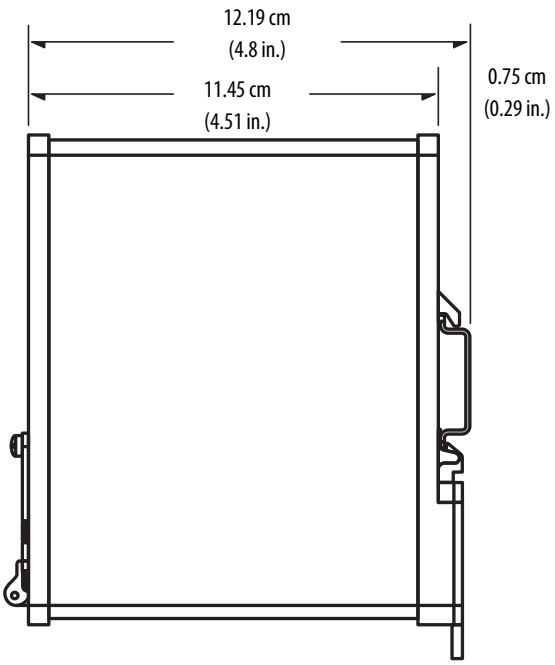
- Top and bottom: 50.8 mm (2.0 in.)
- Sides: 50.8 mm (2.0 in.)
- Front: 50.8 mm (2.0 in.)

These diagrams are representative of the Stratix 5700 switches. Actual faceplates vary depending on the catalog number.

6 SFP-port Switches

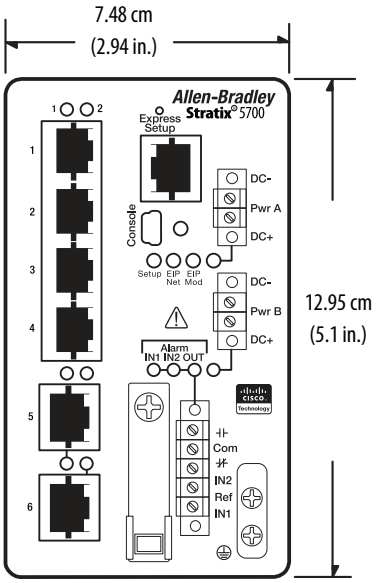
1783-BMS4S2SGL, 1783-BMS4S2SGA

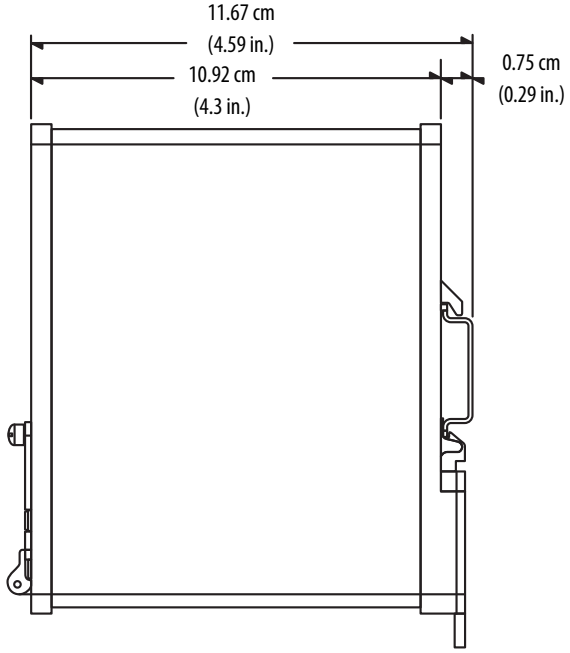




6-port Switches

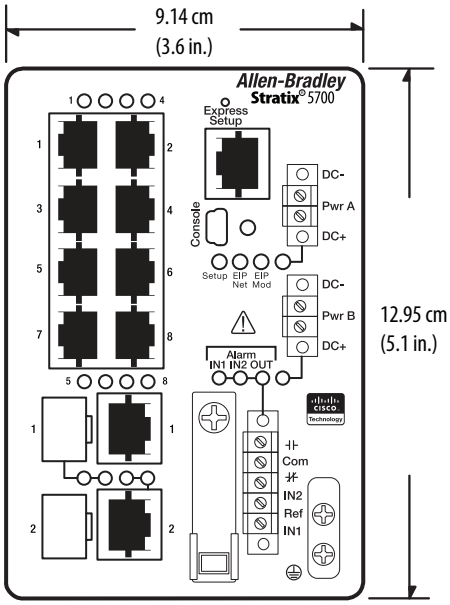
1783-BMS06SL, 1783-BMS06SA, 1783-BMS06TL, 1783-BMS06TA, 1783-BMS06SGL, 1783-BMS06SGA, 1783-BMS06TGL, 1783-BMS06TGA

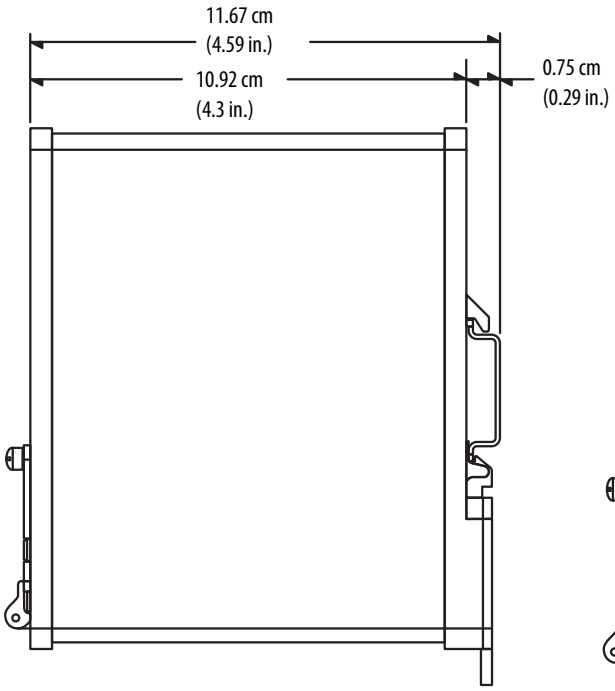




10-port Switches

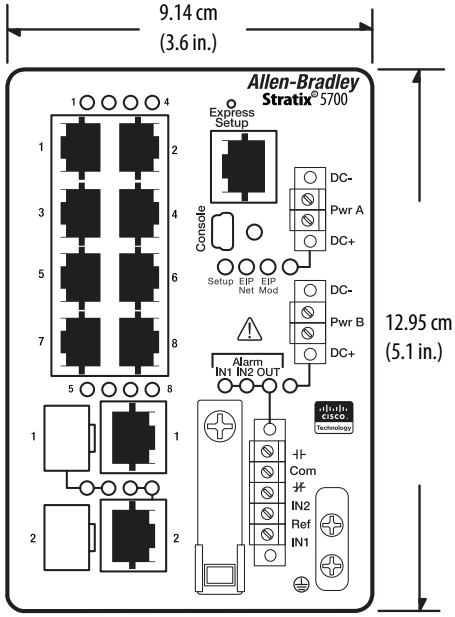
1783-BMS10CL, 1783-BMS10CA,
1783-BMS10CGL, 1783-BMS10CGA

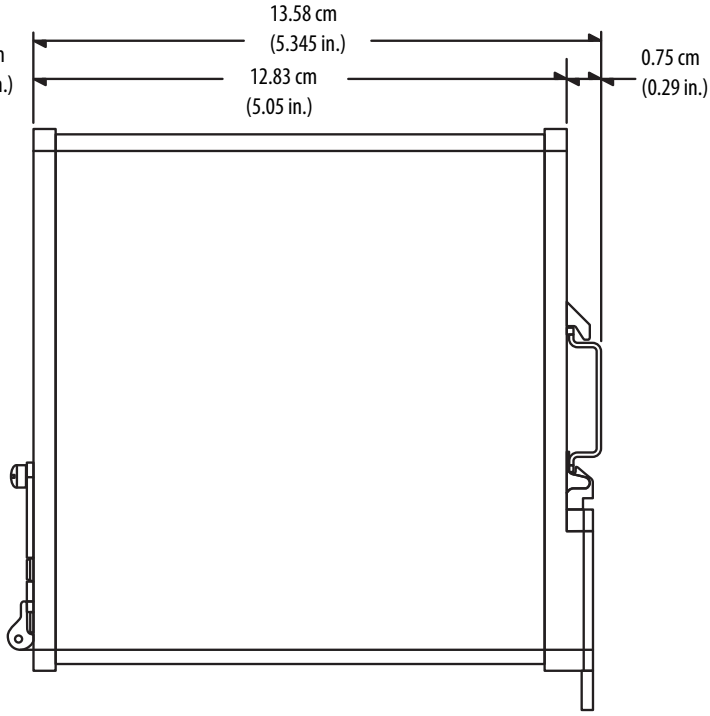




10-port Switch

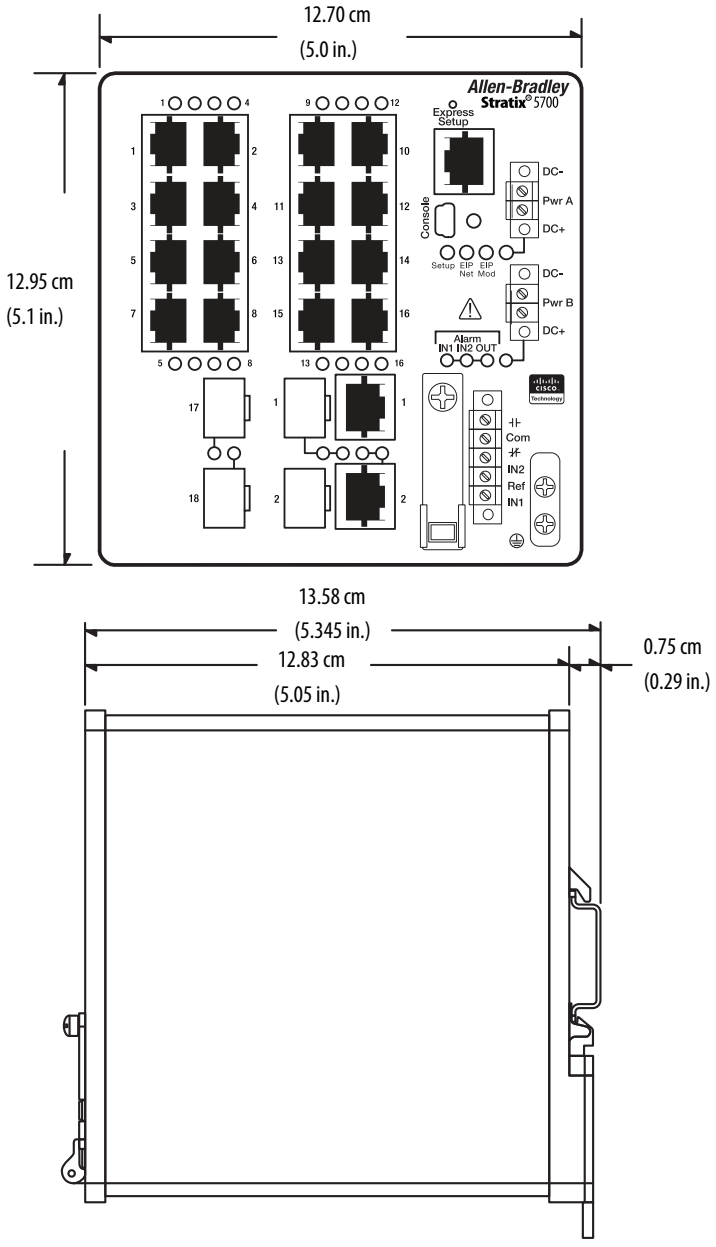
1783-BMS10CGP, 1783-BMS10CGN





18-port and 20-port Switches

1783-BMS12T4E2CGNK, 1783-BMS12T4E2CGP, 1783-BMS12T4E2CGL, 1783-BMS20CL, 1783-BMS20CA, 1783-BMS20CGL, 1783-BMS20CGP, 1783-BMS20CGN, 1783-BMS20CGPK



Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	www.rockwellautomation.com/knowledgebase
Local Technical Support Phone Numbers	Locate the phone number for your country.	www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	www.rockwellautomation.com/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	www.rockwellautomation.com/global/support/pcdc.page

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Rockwell Automation Support

For technical support, visit http://www.rockwellautomation.com/support/overview.page.

Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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Publication 1783-TD001V-EN-P - December 2019
Supersedes Publication 1783-TD001U-EN-P - September 2019

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Reference Manual

Original Instructions

Allen-Bradley

Basic Power Supply 5 A

Catalog Number 1606-XLB120E

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	**WARNING:** Identifies information about practices or circu mstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circu mstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

Table of Contents

Summary of Changes

This manual contains new and updated information as indicated in the following table.

Topic	Page
Corrected dimension information	23

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Switched Mode Power Supply Technical Data, publication 1606-TD002	Provides specifications and approximate dimensions for full line of switched mode power supplies.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation® industrial system.
Product Certifications website, http://www.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/global/literature-library/overview.page. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Terminology and Abbreviations

Term	Definition
230V AC	A figure with the unit (V AC) at the end is a momentary figure without any additional tolerances included.
50 Hz vs. 60 Hz	As long as not otherwise stated, AC 100V and AC 230V parameters are valid at 50 Hz mains frequency. AC 120V parameters are valid for 60 Hz mains frequency.
AC 230V	A figure that is displayed with the AC or DC before the value represents a nominal voltage with standard tolerances included. For example: DC 12V describes a 12V battery, whether it is full (13.7V) or flat (10V)
Earth, Ground	This document uses the term “earth” which is the same as the U.S. term “ground”.
PE and symbol	PE is the abbreviation for **P**rotective **E**arth and has the same meaning as the symbol.
PELV	Protection by extra-low voltage
SELV	Safety by extra-low voltage

Product Overview

1606-XLB Basic Power Supplies are compact, industrial grade power supplies that focus on the essential features needed in industrial applications.

The housing is made of a high-grade, reinforced molded material, which permits the units to be used in ambient temperatures up to 70 °C (158 °F).

This power supply features a wide input voltage range, which makes it suitable for global use.

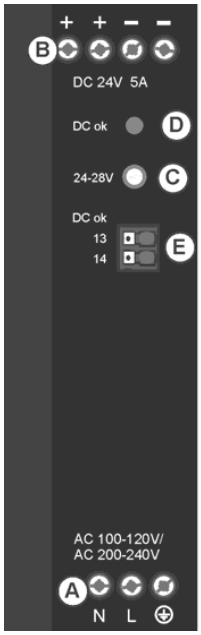
The addition of a DC-OK signal makes the power supply ideal for many industry applications such as: process, automation, and many other critical applications where preventive function monitoring can help to avoid long downtimes.

The 1606-XLB120E power supply offers these features:

- 100...120V/200...240V AC auto-select input
- Cost that is optimized without compromising the quality or reliability
- Small width of 39 mm (1.54 in.) takes up less space on the DIN rail
- Efficiency up to 92.3%
- Full power between -10...+55 °C (14...131 °F)
- DC-OK relay contact included
- 1-year warranty

Front Side and User Elements

Figure 1 - Front Side of DC-UPS



Letter	Description
A	**Input terminals - (**screw terminals) N, L - Line input PE - Protective earth input
B	**Output terminals** - (screw terminals, two pins per pole) + Positive output – Negative (return) output
C	**Output voltage potentiometer -** Guaranteed adjustment range: 24…28V Factory set: 24.1V
D	**DC-OK status indicator-** (green) On, when the output voltage is >18V
E	**DC-OK Relay Contact** (push-in terminals)

Protection Features

Attribute	1606-XLB120E	
Output protection	Electronically protected against overload, no-load, and short circuits	
Output overvoltage protection	typ 31V DC max 34V DC	In case of an internal power supply anomaly, a redundant circuit limits the maximum output voltage. In such a case, the output shuts down and stays down until the input voltage is turned off and on again for at least 1 minute or until the green status indicator went off.
Degree of protection	IP 20	EN/IEC 60529 Caution: For use in a controlled environment according to CSA 22.2 No 107.1-01.
Over-temperature protection	no	
Input transient protection	MOV (Metal Oxide Varistor)	
Internal input fuse	Included	Not user replaceable

Safety Features

Attribute	1606-XLB120E	
Input/output separation double or reinforced insulation	SELV	IEC/EN 60950-1
	PELV	IEC/EN 60204-1, EN 50178, IEC 62103, IEC 60364-4-41
Class of protection	I	PE (Protective Earth) connection required
Isolation resistance	> 100 MOhm	Input to output, 500V DC
Touch current (leakage current)	typ 0.21 mA/0.46 mA	100V AC, 50 Hz, TN-,TT-mains/IT-mains
	typ 0.30 mA/0.65 mA	120V AC, 60 Hz, TN-,TT-mains/IT-mains
	typ 0.33 mA/0.72 mA	230V AC, 50 Hz, TN-,TT-mains/IT-mains
	< 0.27 mA/0.56 mA	110V AC, 50 Hz, TN-,TT-mains/IT-mains
	< 0.38 mA/0.78 mA	132V AC, 60 Hz, TN-,TT-mains/IT-mains
	< 0.43 mA/0.90 mA	264V AC, 50 Hz, TN-,TT-mains/IT-mains

Installation Notes

- Use appropriate copper cables that are designed for minimum operating temperatures of:
  - 75 °C (167 °F) for ambient up to 55 °C (131 °F) minimum.
  - 90 °C (194 °F) for ambient up to 70 °C (158 °F) minimum.
- Follow national installation codes and installation regulations
- Verify that all strands of a stranded wire enter the terminal connection.
- Do not use the power supply without a PE connection.
- Secure unused terminal compartments tightly.
- Ferrules are allowed.

Terminals and Wiring

The terminals are IP20 Fingersafe constructed and suitable for field- and factory wiring.

Attribute	Input and Output Terminals	DC-OK Signal Terminal
Terminal type	Screw terminals	Push-in terminals
Solid wire, max	6 mm^2	1.5 mm^2
Stranded wire, max	4 mm^2	1.5 mm^2
American Wire Gauge	AWG 20-10	AWG 28-16
Wire diameter, max including ferrules)	2.8 mm (0.11 in.)	1.6 mm (0.06 in.)
Wire stripping length	7 mm (0.28 in.)	7 mm (0.28 in.)
Screwdriver	3.5 mm (0.14 in.) slotted or cross-head No 2	Not required
Recommended tightening torque	1 N•m (9 lb•in)	Not applicable

Input

Attribute		1606-XLB120E	
AC input	nom	100…120V/200…240V AC	Auto-select, suitable for TN-, TT- and IT mains networks
AC input range	min	90…132V AC/180…264V AC	continuous operation
	min	264…300V AC	< 500 ms
Allowed voltage L or N to earth	max	300V AC	continuous, IEC 62103
Input frequency	nom	50…60 Hz	±6%
External input protection		See recommendations in External Input Protection on page 16	

Attribute		AC 100V	AC 120V	AC 230V	
Input current	typ	2.0 A	1.72 A	1.05 A	at 24V, 5 A, see Figure 3
Power factor(1)	typ	0.66	0.64	0.54	at 24V, 5 A, see Figure 5
Crest factor(2)	typ	2.7	2.8	3.4	at 24V, 5 A
Turn-on voltage	typ	78V AC	78V AC	157V AC	at 24V 0 A, steady-state value, see Figure 2
Shut-down voltage	typ	68V AC	68V AC	68V AC	at 24V 5 A, steady-state value, see Figure 2
Start-up delay	typ	400 ms	400 ms	100 ms	see Figure 4
Rise time	typ	30 ms	30 ms	30 ms	at 24V, 5 A const. current load, 0mF load capacitance, see Figure 4
	typ	90 ms	90 ms	90 ms	at 24V, 5 A const. current load, 5mF load capacitance, see Figure 4
Turn-on overshoot	max	200 mV	200 mV	200 mV	see Figure 4

(1) The power factor is the ratio of the true (or real) power to the apparent power in an AC circuit.

(2) The crest factor is the mathematical ratio of the peak value to the T ms value of the input current waveform.

Figure 2 - Input Voltage Range, typ

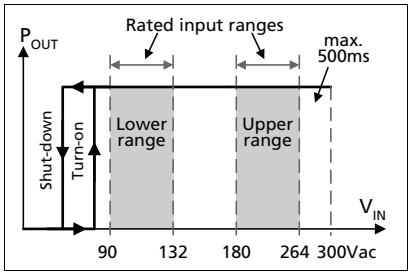


Figure 3 - Input Current vs. Output Load at 24V

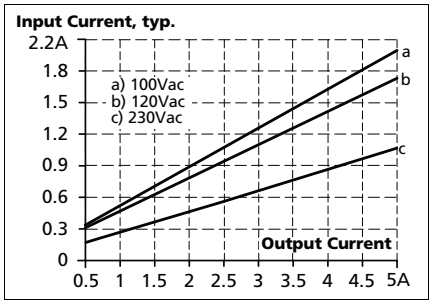


Figure 4 - Turn-on Behavior, Definitions

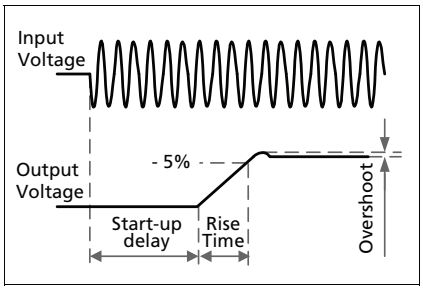
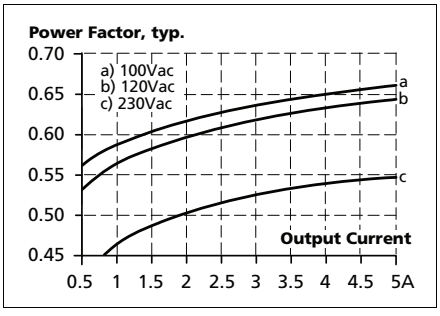


Figure 5 - Power Factor vs. Output Load



DC-Input

Do not operate the power supply with DC-input voltage.

Input Inrush Current

A NTC inrush limiter limits the input inrush current after turn-on of the input voltage.

Attribute		AC 100V	AC 120V	AC 230V	Notes
Inrush current	max	23 A peak	27 A peak	40 A peak	40 °C (104 °F) ambient, cold start
	typ	18 A peak	22 A peak	33 A peak	
Inrush energy	typ	13 A peak	16 A peak	30 A peak	25 °C (77 °F) ambient, cold start
	max	0.4 A^2s	0.5 A^2s	1.5 A^2s	40 °C (104 °F) ambient, cold start

Figure 6 - Input Inrush Current, Typical Behavior, 230V AC Input, 24V 5 A Output, 40 °C (104 °F) Ambient

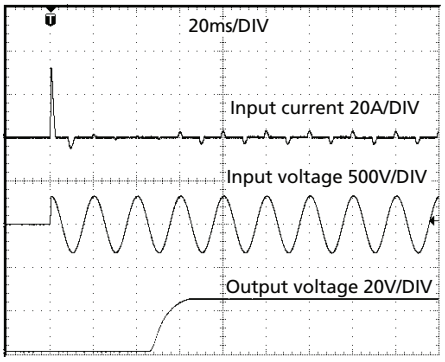
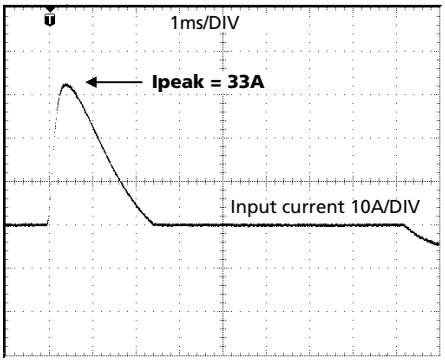


Figure 7 - Input Inrush Current, Zoom Into First Peak 230V AC Input, 24V 5 A Output, 40 °C (104 °F) Ambient



Output

Attribute		1606-XLB120E	Notes
Output voltage	nom	DC 24V	
Adjustment range	min	24…28V	guaranteed
	max	30V(1)	at clockwise end position of potentiometer
Factory settings	typ	24.1V	±0.2 %, at full load, cold unit
Line regulation	max	10 mV	90…132/180…264V AC
Load regulation	max	150 mV	static value, 0 A .. 5 A .. 0 A
Ripple and noise voltage	max	100 mVpp	20 Hz to 20 MHz, 50 Ohms
Output current	for AC 110…120/220…240V mains voltages (includes AC 208V mains):		
	nom	5 A	at 24V, below 55 °C (122 °F) ambient temperature
		4.3 A	at 28V, below 55 °C (122 °F) ambient temperature
		3.1 A	at 24V, at 70 °C (158 °F) ambient temperature
		2.7 A	at 28V, at 70 °C (158 °F) ambient temperature
		Derate linearly between +55 °C (122 °F) and +70 °C (158 °F)	
	for AC 100/200V mains voltages:		
	nom	5 A	at 24V, below 55 °C (122 °F) ambient temperature
		4.3 A	at 28V, below 55 °C (122 °F) ambient temperature
		2.5 A	at 24V, at 70 °C (158 °F) ambient temperature
		2.1 A	at 28V, at 70 °C (158 °F) ambient temperature
		Derate linearly 50 …70 °C (122…158 °F)	
Overload behavior		continuous current	output voltage > 10V DC, see Figure 8
		Intermittent	output voltage < 10V DC, see Figure 8
Short Circuit current	typ	3.5 A(2)	average (R.M.S.) current, load impedance 50mOhm
Output capacitance	typ	2 050 µF	included inside the power supply

(1) This is the maximum output voltage that can occur at the clockwise end position of the potentiometer due to tolerances. It is not guaranteed value that can be achieved. The typical value is about 28.5V.

(2) Discharge current of output capacitors is not included.

Figure 8 - Output Voltage vs. Output Current, R ms current, typ

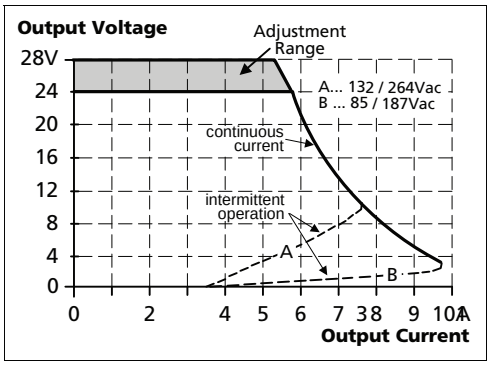
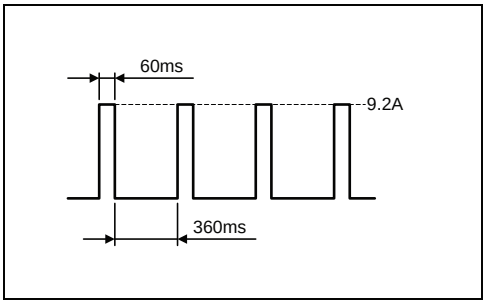


Figure 9 - Intermittent Operation at Shorted Output, typ



Hold-up Time

Type		AC 100V	AC 120V	AC 230V
24V, 2.5 A	typ	64 ms	108 ms	105 ms
	min	54 ms	91 ms	88 ms
24V, 5 A	typ	26 ms	51 ms	50 ms
	min	22 ms	43 ms	42 ms

Figure 10 - Hold-up Time vs. Input Voltage

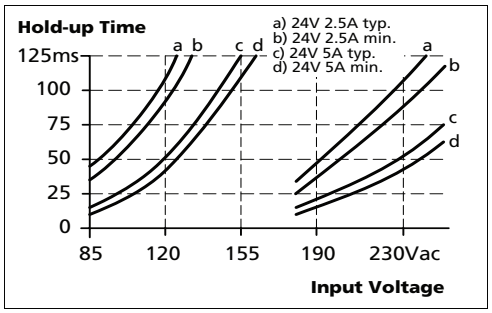
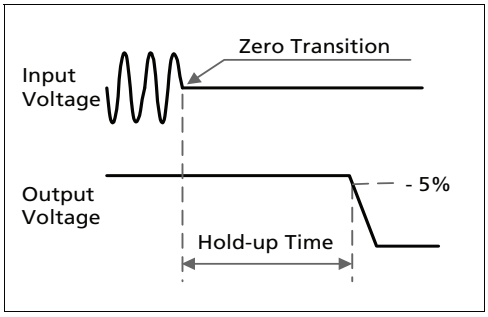


Figure 11 - Shut-down behavior, definitions

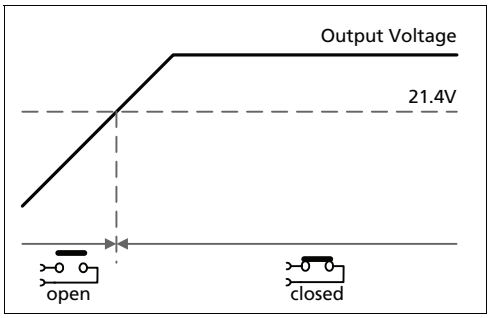


DC OK Relay Contact

This feature monitors the output voltage that is produced by the power supply itself. It is independent of a back-fed voltage from a unit that is connected in parallel to the power supply output (for example, redundant application).

Attribute	1606-XLB120E		
Contact closes	As soon as the output voltage reaches 21.4V		
Contact opens	As soon as the output voltage dips below 21.4V		
Contact ratings	max	60V DC 0.3 A, 30V DC 1 A, 30V AC 0.5 A	resistive load
	min	1 mA at 5V DC	minimum required load
Isolation voltage	See Dielectric Strength on page 21		

Figure 12 - DC-OK Relay Contact Behavior



Efficiency and Power Loss

Attribute		AC 100V	AC 120V	AC 230V	Notes
Efficiency	typ	90.7%	91.2%	92.3%	at 24V, 5 A
Average efficiency(1)	typ	89.2%	89.4%	90.6%	25% at 1.25 A, 25% at 2.5 A, 25% at 3.75 A. 25% at 5 A
Power losses	typ	1.4 W	1.5 W	0.7 W	at 24V, 0 A
	typ	7.0 W	7.4 W	6.0 W	at 24V, 2.5 A
	typ	12.3 W	11.6 W	10.0 W	at 24V, 5 A

(1) The average efficiency is an assumption for a typical application where the power supply is loaded with 25% of the nominal load for 25% of the time, 50% of the nominal load for another 25% of the time, 75% of the nominal load for another 25% of the time and with 100% of the nominal load for the rest of the time.

Figure 13 - Efficiency vs. Output Current, typ

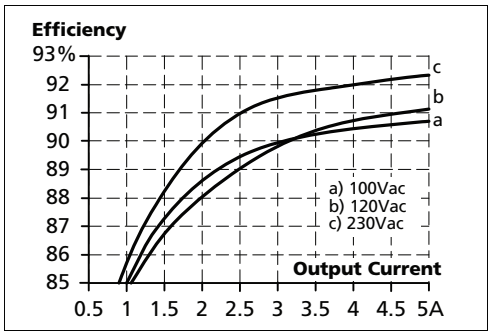


Figure 14 - Efficiency vs. Input Voltage at 24V, 5 A, typ

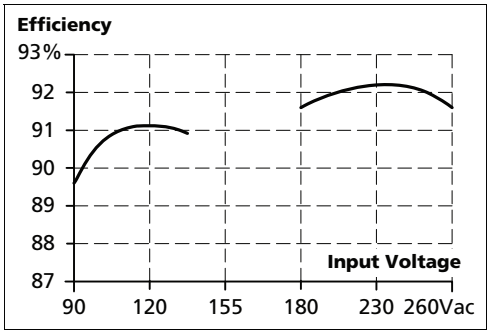


Figure 15 - Power Losses vs. Output Current at 24V, typ

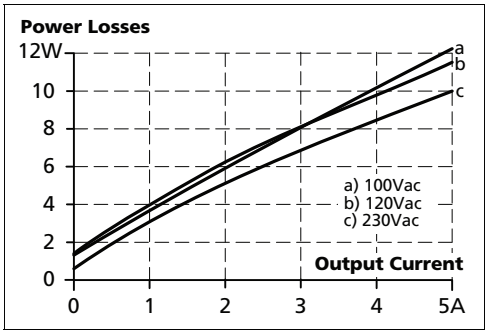
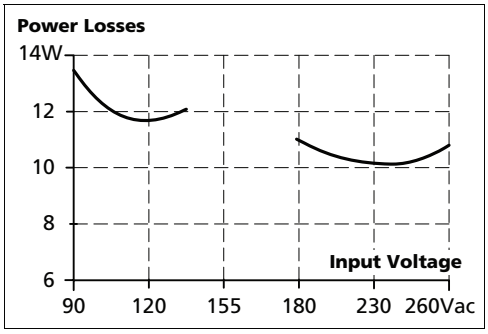


Figure 16 - Power Losses vs. Input Voltage at 24V, 5 A



Lifetime Expectancy and Mean Time between Failure (MTBF)

Attribute		AC 100V	AC 120V	AC 230V	Notes
Lifetime expectancy(1)		181 000 h	194 000 h	219 000 h	at 24V, 2.5 A and 40 °C (104 °F)
		511 000 h	548 000 h	621 000 h	at 24V, 2.5 A and 25 °C (77 °F)
		66 000 h	68 000 h	83 000 h	at 24V, 5 A and 40 °C (104 °F)
		188 000 h	193 000 h	234 000 h	at 24V, 5 A and 25 °C (77 °F)
MTBF (2)	SN 29500, IEC 61709	1 065 000 h	1 147 000 h	1 379 000 h	at 24V, 5 A and 40 °C (104 °F)
		2 038 000 h	2 166 000 h	2 519 000 h	at 24V, 5 A and 25 °C (77 °F)
	MIL HDBK 217 F	681 000 h	651 000 h	645 000 h	at 24V, 5 A and 40 °C (104 °F); Ground Benign GB40
		872 000 h	842 000 h	839 000 h	at 24V, 5 A and 25 °C (77 °F); Ground Benign GB25
		165 000 h	164 000 h	168 000 h	at 24V, 5 A and 40 °C(104 °F); Ground Fixed GF40
		206 000 h	205 000 h	211 000 h	at 24V, 5 A and 25 °C (77 °F); Ground Fixed GF25

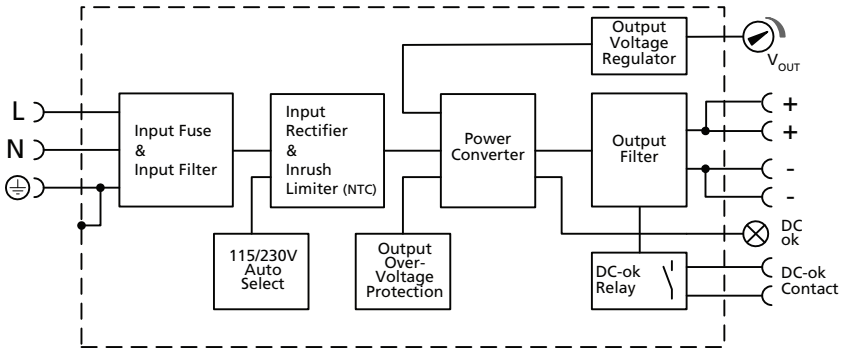
(1) The Lifetime expectancy that is shown in the table indicates the minimum operating hours (service life) and is determined by the lifetime expectancy of the built-in electrolytic capacitors. Lifetime expectancy is specified in operational hours and is calculated according to the capacitor's manufacturer specification. The manufacturer of the electrolytic capacitors only guarantees a maximum life of up to 15 years (131 400 h). Any number exceeding this value is a calculated theoretical lifetime which can be used to compare devices.

(2) MTBF stands for Mean Time Between Failure, which is calculated according to statistical device failures, and indicates reliability of a device. It is the statistical representation of the likelihood of a unit to fail and does not necessarily represent the life of a product.

The MTBF figure is a statistical representation of the likelihood of a device to fail. A MTBF figure of for example, 1 000 000 h means that statistically one unit fails every 100 hours if 10 000 units are installed in the field. However, it cannot be determined if the failed unit has been running for 50 000 h or only for 100 h.

Functional Diagram

Figure 17 - Functional Diagram



EMC

EMC Immunity	According to Generic Standards EN 61000-6-1 and EN 61000-6-2			Criterion[1]
Electrostatic discharge	EN 61000-4-2	contact discharge air discharge	8 kV 8 kV	Criterion A Criterion A
Electromagnetic RF field	EN 61000-4-3	80 MHz-2.7 GHz	20V/m	Criterion A
Fast transients (Burst)	EN 61000-4-4	input lines output lines DC-OK signal (coupling clamp)	4 kV 2 kV 2 kV	Criterion A Criterion A Criterion A
Surge voltage on input	EN 61000-4-5	L ->N L ->PE, N ->PE	2 kV 4 kV	Criterion A Criterion A
Surge voltage on output	EN 61000-4-5	+ ->- +/- ->PE	500V 1 kV	Criterion A Criterion A
Surge voltage on DC-OK	EN 61000-4-5	DC-OK signal… PE	1 kV	Criterion A
Conducted disturbance	EN 61000-4-6	0.15…80 M Hz	20V	Criterion A
Mains voltage dips	EN 61000-4-11	0% of 100V AC 40% of 100V AC 70% of 100V AC 0% of 200V AC 40% of 200V AC 70% of 200V AC	0V AC, 20 ms 40V AC, 200 ms 70V AC, 500 ms 0V AC, 20 ms 80V AC, 200 ms 140V AC, 500 ms	Criterion A Criterion C Criterion A[2] Criterion A Criterion C Criterion A
Voltage interruptions	EN 61000-4-11	0% of 220V AC (=0V)	5000 ms	Criterion C
Voltage sags	SEMI F47 0706	dips on the input voltage according to SEMI F47 standard		
		80% of 208V AC (166V AC) 70% of 208V AC (146V AC) 50% of 208V AC (104V AC) 80% of 120V AC (96V AC) 70% of 120V AC (84V AC) 50% of 120V AC (60V AC)	1000 ms 500 ms 200 ms 1000 ms 500 ms 200 ms	Criterion A Criterion A Criterion C Criterion A Criterion A Criterion C
Powerful transients	VDE 0160	over entire load range	750V, 1.3 ms	Criterion A

(1) Criterion A: Power supply shows normal operation behavior withing the defined limits.
Criterion C: Temporary loss of function is possible. Power supply can shut down and restart by itself. No damage or hazard for the power supply occurs.

(2) Below 4.5 A, Criterion C for currents above 5 A.

EMC Emission	According to Generic Standards: EN 61000-6-3, EN 610000-6-4	
Conducted emission input lines	EN 55011, EN 55022 FCC Part 15 CISPR 11, CISPR 22	Class B
Conducted emission output lines[1]	IEC/CISPR 16-1-2, IEC/CISPR 16-2-1	limits for DC power port according to EN 61000-6-3 not fulfilled
Radiated emission	EN 55011, EN 55022	Class B
Harmonic input current	EN 61000-3-2	Fulfilled for class A equipment
Voltage fluctuations, flicker	EN 61000-3-3	Fulfilled[2]
This device complies with FCC Part 15 rules. Operation is subjected to following two conditions: (1) this device cannot cause harmful interference, and (2) this device must accept any interference received, including interference that can cause undesired operation.		

(1) For information only, not mandatory for EN 61000-6-3.

(2) Tested with constant current loads, non-pulsing.

Application Notes

Peak Current Capability

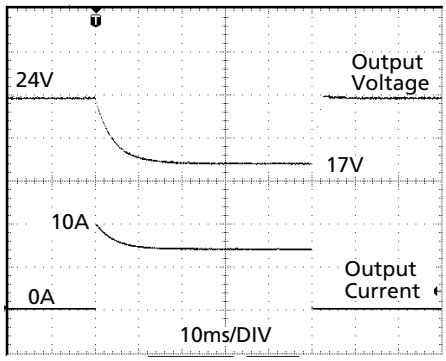
The unit can deliver peak currents (up to several milliseconds) which are higher than the specified short-term currents.

This helps to start current demanding loads. Solenoids, contactors, and pneumatic modules often have a steady state coil and a pick-up coil. The inrush current demand of the pick-up coil is several times higher than the steady-state current and usually exceeds the nominal output current. The same situation applies when starting a capacitive load.

The peak current capability also verifies the safe operation of subsequent circuit breakers of load circuits. The load branches are often individually protected with circuit breakers or fuses. If there is a short or an overload in one branch circuit, the fuse or circuit breaker need a certain amount of overcurrent to open in a timely manner. This avoids voltage loss in adjacent circuits.

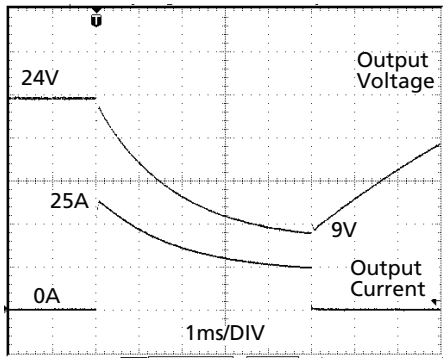
The extra current (peak current) is supplied by the power converter and the built-in large sized output capacitors of the power supply. The capacitors get discharged during such an event, which causes a voltage dip on the output. The following two examples show typical voltage dips:

Figure 18 - Peak Load with 2x the Nominal Current for 50 ms, typ



10 A Peak load (resistive) for 50 ms
Output voltage dips from 24V to 17V.

Figure 19 - Peak Load with 5x the Nominal Current for 5 ms, typ



25 A Peak load (resistive) for 5 ms
Output voltage dips from 24V to 9V.

Peak Current Capability		Voltage Dip	Peak Load
Peak current voltage dips	typ	24…17V	at 10 A for 50 ms, resistive load
	typ	24…13V	at 25 A for 2 ms, resistive load
	typ	24…9V	at 25 A for 5 ms, resistive load

Back Feeding Loads

Loads such as decelerating motors and inductors can feed voltage back to the power supply. This feature is also called return voltage immunity or resistance against Back- E.M.F. (Electro Magnetic Force).

This power supply is resistant and does not show malfunctioning when a load feeds back voltage to the power supply. It does not matter whether the power supply is on or off.

The maximum allowed feed-back-voltage is 35V DC. The absorbing energy can be calculated according to the built-in large sized output capacitor that is specified in Output on page 10.

External Input Protection

The unit is tested and approved for branch circuits up to 30 A (UL) and 32 A (IEC). An external protection is only required if the supplying branch has an ampacity greater than this. Check also local codes and local requirements. In some countries local regulations might apply.

If an external fuse is necessary or utilized, minimum requirements need to be considered to avoid nuisance tripping of the circuit breaker. A minimum value of 10 A, B-characteristic or 6 A, C-characteristic breaker should be used.

Parallel Use to Increase Output Power

Do not use the power supply in parallel to increase the output power.

Parallel Use for Redundancy

Power supplies can be paralleled for redundancy to gain higher system availability. Redundant systems require a certain amount of extra power to support the load in case one power supply unit fails. The simplest way is to put two power supplies in parallel. This is called a 1+1 redundancy. In case one power supply unit fails, the other one is automatically able to support the load current without any interruption.

This simple way to build a redundant system does not cover failures such as an internal short circuit in the secondary side of the power supply. In such a case, the defect unit becomes a load for the other power supplies and the output voltage cannot be maintained any more. This can only be avoided by utilizing decoupling diodes that are included in the redundancy module.

Recommendations for building redundant power systems:

- Use the DC-OK signal contact to monitor the individual power supply units.
- Use separate input fuses for each power supply.
- Use separate mains systems for each power supply whenever it is possible.
- It is desirable to set the output voltages of all units to the same value (± 100 mV) or leave it at the factory setting.

Series Operation

Power supplies of the same type can be connected in series for higher output voltages. It is possible to connect as many units in series as needed, providing the sum of the output voltage does not exceed 150V DC. Voltages with a potential above 60V DC are not SELV any more and can be dangerous. Such voltages must be installed with a protection against touching.

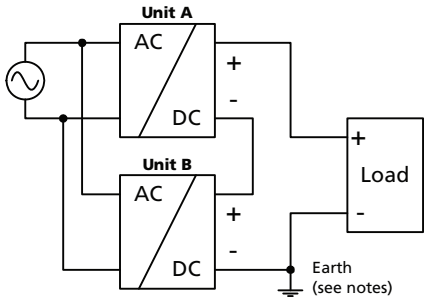
Earthing of the output is required when the sum of the output voltage is above 60V DC.

Avoid return voltage (for example, from a decelerating motor or battery) which is applied to the output terminals.

Keep an installation clearance (left/right) of 15 mm (0.59 in.)between two power supplies and avoid installing the power supplies on top of each other.

Pay attention that leakage current, EMI, inrush current, harmonics increase when using multiple power supplies.

Figure 20 - Series Operation



Inductive and Capacitive Loads

- No limitations for inductive loads.
- No limitations for capacitive loads in combination with an additional resistive type of load.
- Limitations apply for capacitive loads in combination with constant current type of loads:
  - 20 mF Max with an additional 2.5 A constant current load and
  - 10 mF max with an additional 5 A constant current load.

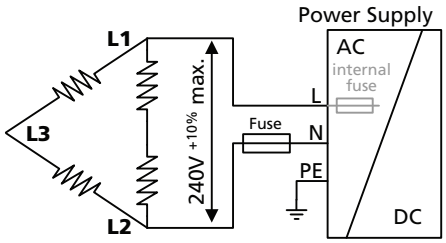
Charging of Batteries

Do not use the power supply to charge batteries.

Operation on Two Phases

The power supply can also be used on two-phases of a three-phase-system. Such a phase-to-phase connection is allowed as long as the supplying voltage is below $240V^{+10\%}$.

Figure 21 - Operation on Two Phases



Use in a Tightly Sealed Enclosure

When the power supply is installed in a tightly sealed enclosure, the temperature inside the enclosure is higher than outside. In such situations, the inside temperature defines the ambient temperature for the power supply.

The following measurement results can be used as a reference to estimate the temperature rise inside the enclosure.

The power supply is placed in the middle of the box; no other heat producing items are inside the box.

- Enclosure
  - Rittal Type IP 66 Box PK 9516 100
  - Plastic
  - 110 x 180 x 165 mm (4.33 x 7.09 x 6.50 in)
- Input
  - 230V AC

Attribute	Case A	Case B
Load(1)	24V, 5 A	24V, 4 A (=80 %)
Temperature inside the box(2)	41.5 °C (106.7 °F)	38.9 °C (102 °F)
Temperature outside the box	24.4 °C (75.9 °F)	24.2 °C (75.6 °F)
Temperature rise	17.1K	14.5K

(1) Load is placed outside the box.

(2) In the middle of the right side of the power supply with a distance of 1 cm (0.39 in.).

Specifications

Attribute		1606-XLB120E	Notes
Output voltage		DC 24V	
		24…28V DC	Adjustment range
Output	for AC 110…120/ 220…240V mains:	5.0...4.3 A 3.1...2.7 A	at 24…28V, <55 °C (122 °F) at 24…28V, <70 °C (158 °F)
	for AC 100/200V mains:	5.0...4.3 A 2.5...2.1 A	at 24…28V, <50 °C (122 °F) at 24…28V, <70 °C (158 °F)
Output ripple		< 100 mVpp	20 Hz to 20 MHz
AC Input voltage		AC 100…120V/ 200…240V	±10% Auto-Select
Mains frequency		50…60 Hz	±6 %
AC Input current		1.72 A/1.05 A	at 120/ 230V AC
Power factor		0.64/0.54	at 120/ 230V AC
AC Inrush current		22 A/33 A peak	at 120/ 230V AC, 40 °C (140 °F)
Efficiency		91.2 /92.3%	at 120/ 230V AC
Losses		11.6 W/10.0 W	at 120/ 230V AC
Temp. range		-10… +70 °C (14… 158 °F)	operational
Derating		3 W/°C	55…70 °C (131… 158 °F) (1)
Hold-up time		51 ms/50 ms	at 120/ 230V AC
Dimensions		39 x 124 x124 mm (1.53 x 4.88 x 4.88)	W x H x D
Weight		370 g/0.81 lb	

(1) 50…70 °C (122…158 °F) for AC 100 V/ 200V mains

Environment

Attribute	1606-XLB120E	Notes
Operational temperature(1)	-10… +70 °C (14… 158 °F)	reduce output power according to Figure 22
Storage temperature	-40… +85 °C (-40… 185 °F)	for storage and transportation
Output derating(2)	3W/°C (55…70 °C 131…158 °F) 3W/°C (50…70 °C; 122…158 °F)	for AC 110-120/220-240V mains systems for AC 100/200V mains systems
Humidity(3)	5...95% r.h.	IEC 60068-2-30
Vibration sinusoidal(4)	2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g 2 hours/axis	IEC 60068-2-6
Shock(5)	30g 6ms, 20g 11ms 3 bumps/direction, 18 bumps in total	IEC 60068-2-27
Altitude	0…2000 m (0…6 560 ft.)	without any restrictions
	2000…6000 m (6 560… 20 000 ft.)	reduce output power or ambient temperature, see Figure 22 IEC 62103, EN 50178, overvoltage category II
Altitude derating	7.5W/1000m or 5 °C/1000m	> 2000 m (6500 ft.), see Figure 23
Overvoltage category	III	IEC 62103, EN 50178, altitudes up to 2000m
	II	altitudes from 2000m to 6000m
Degree of pollution	2	IEC 62103, EN 50178, not conductive
LABS compatibility	The unit does not release any silicone or other LABS-critical substances and is suitable for use in paint shops.	

(1) Operational temperature is the same as the ambient or surrounding temperature and is defined as the air temperature 2cm below the unit.

(2) For AC 208V mains use AC 200…220V values.

(3) Do not energize while condensation is present.

(4) Tested on a DIN Rail with a thickness of 1.3 mm.

(5) Tested on a DIN Rail with a thickness of 1.3 mm.

Figure 22 - Output Current vs. Ambient Temperature

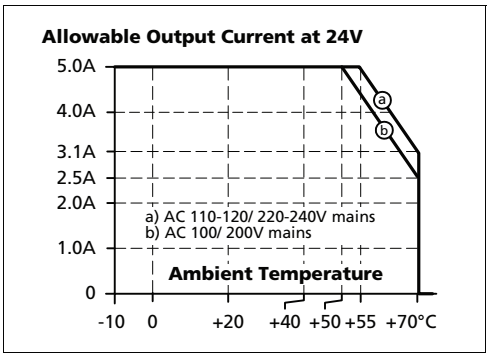
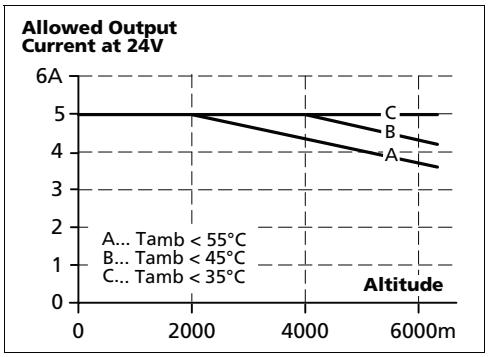


Figure 23 - Output Current vs. Altitude

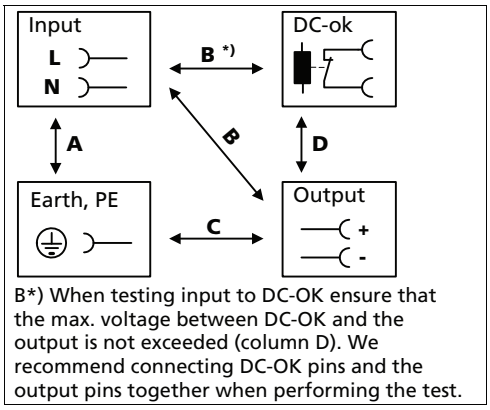


Dielectric Strength

The output voltage is floating and has no ohmic connection to the ground. Type and factory tests are conducted by the manufacturer. Field tests can be conducted in the field using the appropriate test equipment, which applies the voltage with a slow ramp (2 s up and 2 s down). Connect all input-terminals together and all output poles before conducting the test. When testing, set the cutoff current settings to the value in the following table.

		A	B	C	D
Type test	60 s	2500V AC	3000V AC	1000V AC	500V AC
Factory test	5 s	2500V AC	2500V AC	500V AC	500V AC
Field test	5 s	2000V AC	2000V AC	500V AC	500V AC
Cutoff current setting		> 10 mA	> 10 mA	> 15 mA	> 1 mA

Figure 24 - Dielectric Strength



To meet the PELV requirements according to EN60204-1 § 6.4.1, we recommend that either the + pole, the – pole or any other part of the output circuit be connected to the protective earth system. This helps to avoid situations in which a load starts unexpectedly or cannot be switched off when unnoticed earth faults occur.

Standards Compliance and Certifications

EC Declaration of Conformity		The CE Marking indicates conformance with the low voltage directive and EMC Directive. EN 60950-1, EN 61000-6
UL 508		Listed for use as Industrial Control Equipment ;U.S.A. (UL 508) and Canada (C22.2 No. 14-15); File: E56639
UL 60950-1		Recognized for use as Information Technology Equipment, U.S.A. (UL 60950-1) and Canada (C22.2 No. 60950); File: E 168663.
RCM Declaration of Conformity		C-tick is for products intended for sale and use within the Australian market.
EAC		EAC is for products intended for sale and use within the Russian market.

Approximate Dimensions and Weight

Attribute	1606-XLB120E
Width	39 mm (1.54 in.)
Height	125 mm (4.92 in.)
Depth[1]	128.95 mm (5.08 in.)
Weight	370 g (0.81 lb)
DIN Rail	Use 35 mm DIN rails according to EN 60715 or EN 50022 with a height of 7.5 or 15 mm.
Plastic Material of Housing	Flame retardant Polycarbonate (PC) - UL94-V0 Vicat softening temperature specified with 149 °C according to ASTM D1525
Installation Clearances	Keep the following installation clearances: 40 mm on top, 20 mm on the bottom, 5 mm on the left and right sides are recommended when the device is loaded permanently with more than 50% of the rated power. Increase this clearance to 15 mm in case the adjacent device is a heat source (for example, another power supply).

(1) The DIN rail height must be added to the unit depth to calculate the total required installation depth.

Dimensions are in mm (in).

Figure 25 - Front View

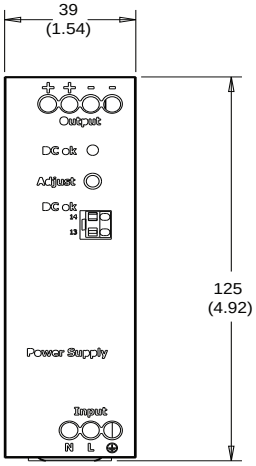
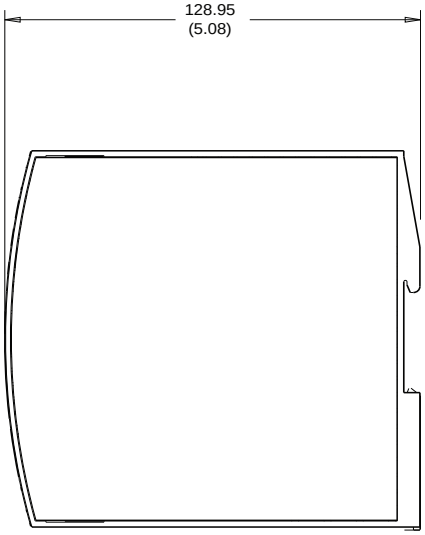


Figure 26 - Side View



Notes:

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	https://rockwellautomation.custhelp.com/
Local Technical Support Phone Numbers	Locate the phone number for your country.	http://www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	http://www.rockwellautomation.com/global/literature-library/overview.page
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	http://www.rockwellautomation.com/global/support/pcdc.page

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Publication 1606-RM055B-EN-P —February 2017
Supersedes Publication 1606-RM055A-EN-P— December 2016

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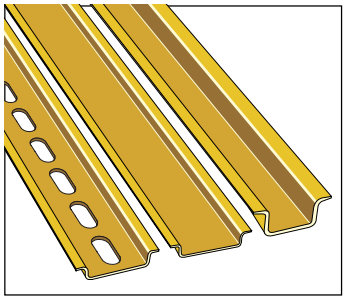
Mounting rails
Symmetrical - DIN 3



These rails are often used as grounding bars. The current carrying capacity of these rails and the copper wire sizes required to carry that current are given below.

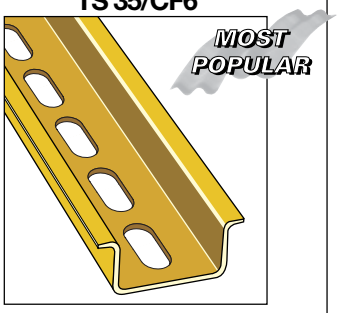
RAIL CURRENT CARRYING CAPACITY

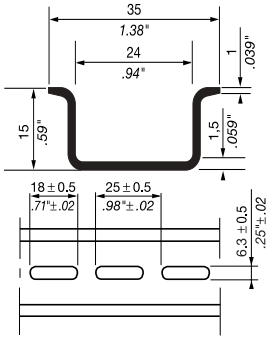
Rail	Material	Current (A)	Wire size AWG	Wire size mm²
TS 35/CF6	Steel	125	4	25
TS 35/C1	Steel	143	2	35
TS 35/C	Steel	125	4	25
TS 35/C ALU	Aluminum	265	000	95
High rail 90°	Steel	65	8	10
High rail 30°	Steel	65	8	10

All rails are in compliance with EN 50022 standard (DIN 46277-3 - NFC 63015) DIN 3.

Tolerances are ± unless otherwise noted.

TS 35/CF6





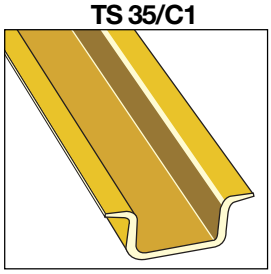
Type	P/N
PR5 (TS 35/CF6)	**0101 598.26**

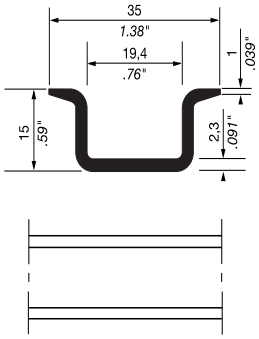
Zinc bichromate plated steel, prepunched length 2 m 6'6" (78") approx. The length and prepunched cut out dimensions are approximate.

Type	P/N
PR5 (TS 35/CF6)	**0101 509.05**

Length 1 m 3'3" (39") approx.

TS 35/C1





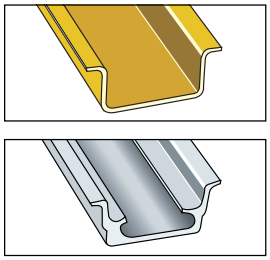
Type	P/N
PR4 (TS 35/C1)	**0168 500.12**

Zinc bichromate plated steel. Length 2 m 6'6" (78") approx.

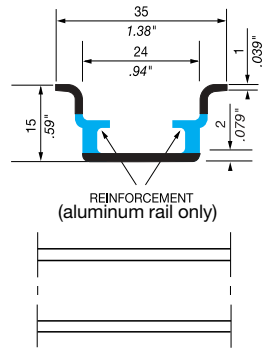
Type	P/N
PR4 (TS 35/C1)	**0101 517.14**

Length 1 m 3'3" (39") approx.

TS 35/C



TS 35/C ALU



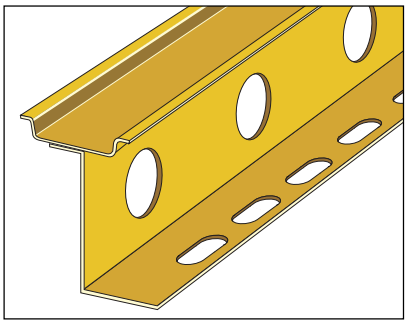
Type	P/N
PR5 (TS 35/C)	

Zinc bichromate plated steel.
Length 2 m 6'6" (78") approx. **0168 700.22**
Length 1 m 3'3" (39") approx. **0101 515.12**

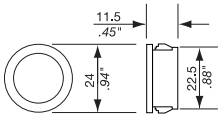
Type	P/N
PR5.A2 (TS 35/C ALU)	

Reinforced aluminum.
Length 2 m 6'6" (78") approx. **0101 502.26**
Length 1 m 3'3" (39") approx. **0101 899.24**

TS 35, High Rail 90°

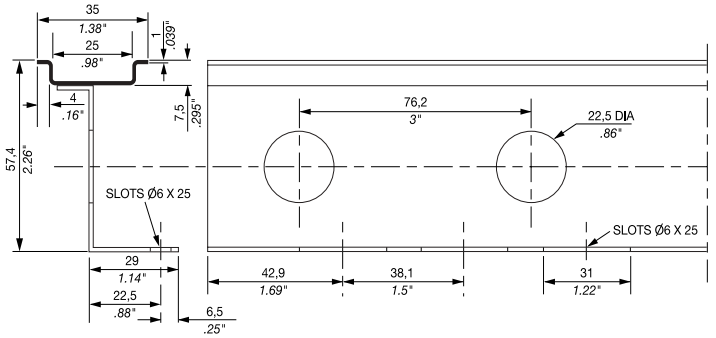


Sold in North America only.



Insert for rail knockout:

Open grommet, black	**0106 064.26**
Closed blind plug, black	**0106 083.12**



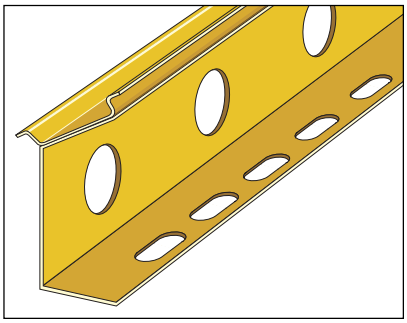
Type	P/N
PR3.Z2 HR90	**0101 571.02**

Zinc bichromate plated steel, prepunched length 2 m 6'6" (78") approx. The length and prepunched cut out dimensions are approximate.

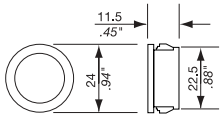
Type	P/N
PR3.Z2 HR90	**0101 570.01**

Zinc bichromate plated steel. Length 1 m 3'3" (39") approx.

TS 35, High Rail 30°

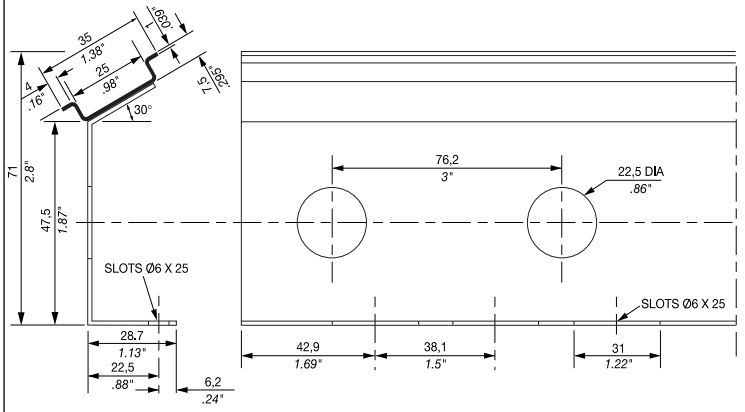


Sold in North America only.



Insert for rail knockout:

Open grommet, black	**0106 064.26**
Closed blind plug, black	**0106 083.12**



Type	P/N
PR3.Z2 HR30	**0101 875.23**

Zinc bichromate plated steel, prepunched length 2 m 6'6" (78") approx. The length and prepunched cut out dimensions are approximate.

Type	P/N
PR3.Z2 HR30	**0101 874.22**

Zinc bichromate plated steel. Length 1 m 3'3" (39") approx.

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PF

ATDR

Time Delay/Class CC

UL/CSA LISTED POWER FUSES

THE BEST PROTECTION FOR TODAY'S SMALL MOTORS

Amp-Trap 2000® ATDR small-dimension fuses can provide IEC Type 2 No Damage protection to your facility's increasingly sensitive branch circuit components and small motors – minimizing the risk of fault-related damage. ATDR Class CC fuses deliver the best time-delay characteristics in their class with excellent cycling ability for small motor loads.

FEATURES/BENEFITS:

- Time-delay for motor starting inrush currents without nuisance opening
- Highly current-limiting for low peak let-thru current
- Improved cycling ability for frequent motor starts/stops without nuisance fuse opening
- Rejection-style design prevents replacement errors (when used with recommended fuse blocks)
- High-visibility orange label ensures instant brand recognition, simplifies replacement
- Metal-embossed date and catalog number for traceability and lasting identification
- Fiberglass body provides dimensional stability in harsh industrial settings
- High-grade silica filler ensures fast arc quenching and optimum current-limitation

RATINGS:

Volts: 600VAC, 300VDC

Amps: 1/4 to 30A

IR: 200kA I.R. AC, 100kA I.R. DC

APPLICATIONS:

- Small motors
- Contactors
- Lighting, heating & general loads
- Branch circuit protection

Note: See motor fuse applications tables for more information

APPROVALS:

- UL listed to standard 248-4 File E2137
- CSA certified to standard C22.2 No. 248.4
- DC listed to UL standard 248

Mersen
Expertise, our source of energy

HIGHLIGHTS:

- Time-delay
- Best choice for small motor protection
- Highly current-limiting
- AC & DC rated

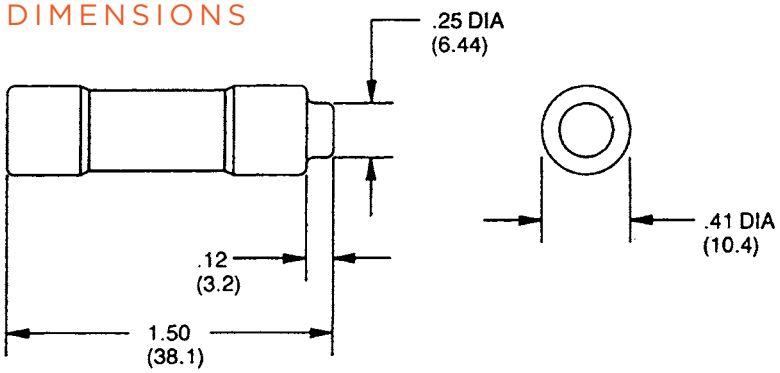
CATALOG NUMBERS (AMPS)

ATDR1/4	ATDR1-1/2	ATDR3	ATDR6	ATDR12
ATDR1/2	ATDR1-6/10	ATDR3-2/10	ATDR6-1/4	ATDR15
ATDR8/10	ATDR1-8/10	ATDR3-1/2	ATDR7	ATDR17-1/2
ATDR1	ATDR2	ATDR4	ATDR7-1/2	ATDR20
ATDR1-1/8	ATDR2-1/4	ATDR4-1/2	ATDR8	ATDR25
ATDR1-1/4	ATDR2-1/2	ATDR5	ATDR9	ATDR30
ATDR1-4/10	ATDR2-8/10	ATDR5-6/10	ATDR10	

RECOMMENDED FUSE BLOCKS FOR CLASS CC FUSES

Number of Poles	Catalog Numbers			
	UltraSafe™ Indicating Fuse Holder	Screw Connector w/ Double Quick Connects	Pressure Plate Connector w/ Double Quick Connects	Copper Box Connector
ADDER		30310R	30320R	30350R
1	USCC1I	30311R	30321R	30351R
2	USCC2I	30312R	30322R	30352R
3	USCC3I	30313R	30323R	30353R
3	USFMCCI			

DIMENSIONS



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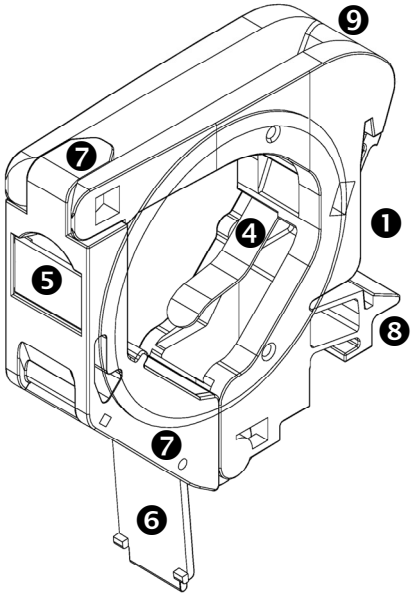
Keystone Industrial DIN-Rail Mounting Module

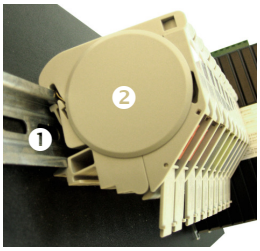
Signamax Keystone Industrial DIN-Rail Mounting Modules afford an opportunity to combine advantages of regular keystone jack design and transmission performance with simplicity and usability of industrial DIN-rail mounting systems.

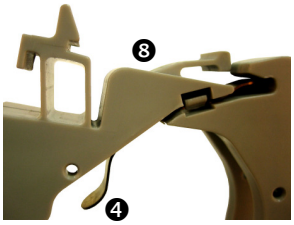
State-of-the-art module's design provides all kinds of features usually found in office work area solutions, – universal labeling, protection covers, "front access," "gravity compensation" for patch cords along with such important for the industrial applications aspects as toolless mounting and replacement of connector modules, quick access to any part of the assembly. Additionally, modules allow installing screened jacks without any extra efforts, parts, and tools.

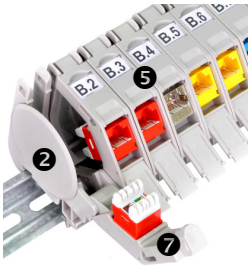
KEY FEATURES

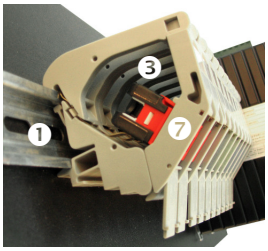
- Designed for standard 35-mm wide DIN rails ❶
- Side lids ❷ are removable facilitating installation of several modules in one continuous row ❸
- Accommodates all Signamax keystone jacks up to 17 mm (0.67 in) wide
- Bronze alloy spring ❹ serves two purposes – secure retention of all keystone jack types, and grounding contact and path for screened jacks
- Clear plastic labeling window ❺
- Front hinged hatch ❻ protects keystone jack from damage and contamination when it is not used
- Swinging cassette with latching mechanism ❼ allows quick and easy installation and removal of the keystone jack
- Installation does not require special tools or threaded fastening – the module snaps-on the DIN rail ❽
- Cable entry points are equipped with noses ❾ supporting required cable bend radii and protecting cables from deformation
- Equipment or patch cord connection angle provides for cord stress compensation caused by the cord's weight

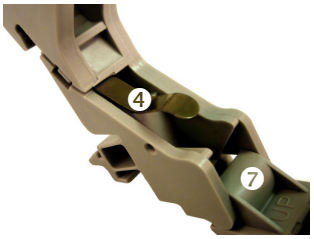


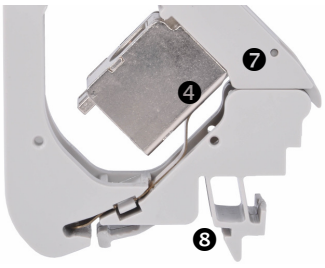












SPECIFICATIONS

Keystone Industrial DIN-Rail Mounting Module

ORDERING INFORMATION

Keystone Industrial DIN-Rail Mounting Modules

Part Number	Description
KI-DIN-RMM-SL	Keystone Industrial DIN-Rail Mounting Module, 2 Side Lids
KI-DIN-RMM	Keystone Industrial DIN-Rail Mounting Module, w/o Side Lids

Standard color is Gray

SPECIFICATIONS

- **CONSTRUCTION**
  Housing: high impact thermoplastic, UL94V-0 fire retardant
  Jack spring wire: bronze alloy
- **MECHANICAL**
  DIN rail: 35 mm (1.378 in)
  Keystone module width: 17 mm (0.669 in) max
- **MOUNTING DIMENSIONS**:
  KI-DIN-RMM-SL:

D 67.5 mm	H 70.5 mm	W 21.0 mm
D 2.66 in	H 2.78 in	W 0.83 in

  KI-DIN-RMM:

D 67.50 mm	H 70.50 mm	W 18.0 mm
D 2.66 in	H 2.78 in	W 0.71 in

- **ENVIRONMENTAL CONDITIONS**
  Storage: -40°C – +70°C (-40°F – +158°F)
  Operation: -10°C – +60°C (+14°F – +140°F)
  RH (operation): max non-condensing 93%
- **COMPATIBILITY**
  Signamax MT-series unscreened keystone jacks
  Signamax TL-series screened keystone jacks
  Signamax KRJ45/xS unscreened feed-thru couplers

RELATED PRODUCTS

Product/Product Group	Spec Sheet #	
Voice-Grade Unscreened High-Density MT-Series Keystone Jack	PSS.KJ126MT-C3U	(B-OCT-11)
Category 5e Unscreened High-Density MT-Series Keystone Jack	PSS.KJ458MT-C5E	(B-OCT-11)
Category 5e Screened Toolless Keystone Jack	PSS.KJS458TL-C5E	(A-JUN-10)
Category 6 Unscreened High-Density MT-Series Keystone Jack	PSS.KJ458MT-C6C	(B-OCT-11)
Category 6 Screened Toolless Keystone Jack	PSS.KJS458TL-C6C	(A-JUN-10)
Category 6A Unscreened High-Density MT-Series Keystone Jack	PSS.KJ458MT-C6AC	(A-JUL-10)
Category 6A Screened Toolless Keystone Jack	PSS.KJS458TL-C6AC	(A-JUL-10)
Category 6 Keystone Feed-Thru Couplers	PSS.C6SL-KFTC	(A-OCT-08)

SPECIFICATIONS

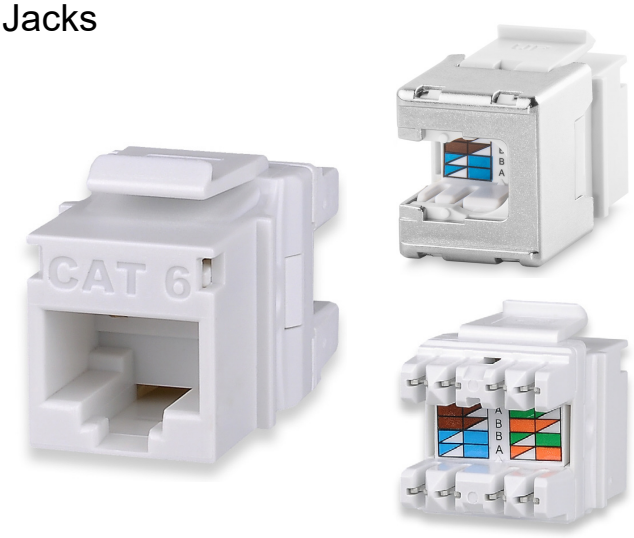
SIGNAMAX
Connectivity Solutions

Product Specifications

Category 6 MT-Series Unscreened Keystone Jacks

KEY FEATURES

- Exceeds TIA-568-C.2 component performance specifications
- Supports TIA-568-C.2 category 6 100 meter channel performance
- Slim profile for the highest density applications
- Improved wire retention and ease of termination with rear 110 type contacts
- Easy-to-read T568A/B wiring scheme color-coded label
- Compatible with Signamax screened snap-in patch panels and work area faceplates
- Circuit identification icons, dust covers, and 110 protection caps included in kit



The Signamax Category 6 Unscreened MT-Series Keystone Jacks have been designed to meet the need for today's high-bandwidth applications. These connectors are slim in profile for the highest density applications and have the ability to mount either color-coded icons for service identification or dust covers to protect unused jacks from dust and other contaminants.

The contact design provides enhanced plug-to-jack connection integrity, protects against damage caused by insertion of 4- or 6-position plugs. Special design features allow these jacks to be terminated with a standard 110 single-position tool or with the Signamax four-pair tool, and are rated for a minimum of 750 plug insertions providing for the highest level of system reliability.

ORDERING INFORMATION

PART NO.	DESCRIPTION
KJ458MT-C6C	Category 6 MT-Series Keystone Jack, T568A/B Wiring, Light Ivory
KJ458MT25-C6C	Category 6 MT-Series Keystone Jack, T568A/B Wiring, Light Ivory, 25-Pack

For other colors add the following to P/N: -WH -YE -OR -RD -BU -GN -GY -BK

SPECIFICATIONS

TRANSMISSION PERFORMANCE
ANSI/TIA-568-C.2: meets or exceeds category 6 (1–250 MHz) component specifications

TRANSMISSION MEDIA
Unscreened twisted pair (U/UTP)

JACK TYPE
8p8c (8-position, 8-contact) "RJ45" style

WIRING SCHEME (See Figure 1)
ANSI/TIA-568-C.2: T568A & T568B
ISO/IEC 11801 2nd Ed.: 8-position pin/pair assignment (1-2/3-6/4-5/7-8)

WIRE GAUGE
22 to 24 AWG (0.644 to 0.511 mm)

ELECTRICAL
Insulation Resistance: Min 500 MOhm @ 100 V_{dc}
Dielectric Withstanding Voltage:
1,000 $V_{dc/ac}$ peak contact-to-contact @ 60 Hz for 1 min
Spring Wire Contact Resistance: Max 20 mOhm
IDC Contact Resistance: Max 2.5 mOhm
Current Rating: See Figure 2

CONSTRUCTION
Housing: High impact thermoplastic, UL94V-0 fire retardant
Jack Spring Wire: Phosphor bronze alloy plated with 50 µin of gold over 70 to 100 µin of nickel
IDC: 110 type, phosphor bronze alloy with 100 µin 100% tin alloy

MECHANICAL
Total Contact Force: Min 800 g for 8 wire leads
Retention: 50 N (11 lbf) for 60 ± 5 s
Mating Cycle Life: Min 750 cycles

FOOTPRINT
Standard keystone footprint

MOUNTING DIMENSIONS:
1.18" D x 0.67" W x 0.76" H (30.0 mm x 16.9 mm x 19.3 mm)

ENVIRONMENTAL CONDITIONS
Operating Temperature: 14 °F to 140 °F (-10 °C to 60 °C)
Storage Temperature: -40 °F to 158 °F (-40 °C to 70 °C)
Operating RH: 93% Max (non-condensing)

COMPLIANCE
ANSI/TIA-568-C.2, IEC 60603-7, FCC Part 68 Subpart F, UL 94V-0

APPLICATIONS
X.21, V.11, S0, ISDN, CSMA/CD 10BASE-T, 100BASE-TX, 100BASE-T4, 100BASE-T2, 1000BASE-T, 10GBASE-T, TR 4/16/100, 100BASE-VG, ATM LAN 25/51/155, TP-PMD

WARRANTY
5 - Year Limited Component

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Figure 1: Wiring Schemes

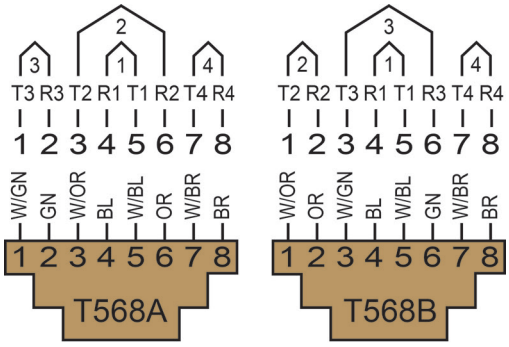
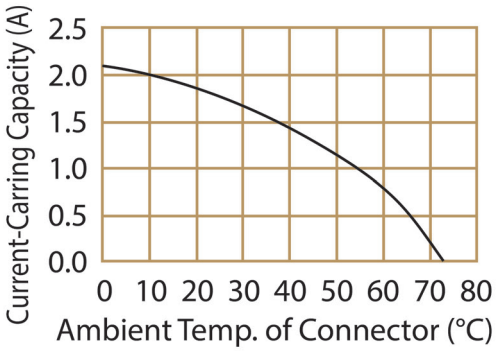


Figure 2: Current Rating



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Socket - EM-DUO/120/15/GFI - 5600462

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Rail-mounted dual power outlet with two 120 V AC/15 A receptacles equipped with ground fault circuit interruption (GFCI) for 35 mm DIN rail per EN 60715. GFCI protects against shock hazards associated with ground shorts. For enhanced safety, the grounding pin is located at the top to prevent shorting between the hot and neutral blades.
Housing color: ivory. National version: USA. Connection type: screw.

Key Commercial Data

Packing unit	1 pc
GTIN	4 046356 139526
GTIN	4046356139526
Weight per Piece (excluding packing)	280.000 g
Custom tariff number	85366990
Country of origin	United States

Technical data

Dimensions

Width	82 mm
Height	135 mm
Depth	49 mm

Ambient conditions

Ambient temperature (operation)	-35 °C ... 60 °C

General

Nominal voltage U_N	125 V AC
Nominal current I_N	15 A
For country-specific use in	USA

Socket - EM-DUO/120/15/GFI - 5600462

Technical data

General

	Canada
	Mexico
	Bahamas
	Bermuda
	Columbia
	Costa Rica
	Ecuador
	El Salvador
	Panama
	Puerto Rico
	Taiwan
	Venezuela
	Virgin Islands
Color	ivory
Insulating material	Polycarbonate & ABS blend
Standards/regulations	UL 508
	UL 943
	CSA 22.2
Response time	25 ms (6 mA)

Connection data

Conductor cross section solid max.	6 mm²
Conductor cross section flexible max.	4 mm²
Conductor cross section AWG max.	10
Connection method	Screw connection
Stripping length	8 mm
Screw thread	M3

Standards and Regulations

Standards/regulations	UL 508
	UL 943
	CSA 22.2

Environmental Product Compliance

REACh SVHC	Lead 7439-92-1
China RoHS	Environmentally Friendly Use Period = 50 years
	For details about hazardous substances go to tab “Downloads”, Category “Manufacturer's declaration”

Socket - EM-DUO/120/15/GFI - 5600462

Classifications

eCl@ss

eCl@ss 4.0	27142300
eCl@ss 4.1	27142300
eCl@ss 5.0	27142300
eCl@ss 5.1	27142300
eCl@ss 6.0	27142300
eCl@ss 7.0	27142305
eCl@ss 8.0	27142305
eCl@ss 9.0	27142305

ETIM

ETIM 2.0	EC001325
ETIM 3.0	EC001325
ETIM 4.0	EC001663
ETIM 5.0	EC001663
ETIM 6.0	EC001663
ETIM 7.0	EC001663

UNSPSC

UNSPSC 6.01	30211806
UNSPSC 7.0901	39121406
UNSPSC 11	39121406
UNSPSC 12.01	39121406
UNSPSC 13.2	39121406
UNSPSC 18.0	39121406
UNSPSC 19.0	39121406
UNSPSC 20.0	39121406
UNSPSC 21.0	39121406

Approvals

Approvals

Approvals

UL Listed / cUL Listed / cULus Listed

Ex Approvals

Socket - EM-DUO/120/15/GFI - 5600462

Approvals

Approval details

UL Listed		http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm	FILE E 238705

Nominal voltage UN	125 V
Nominal current IN	15 A
mm²/AWG/kcmil	30-10

cUL Listed		http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm	FILE E 238705

Nominal voltage UN	125 V
Nominal current IN	15 A
mm²/AWG/kcmil	30-10

cULus Listed	

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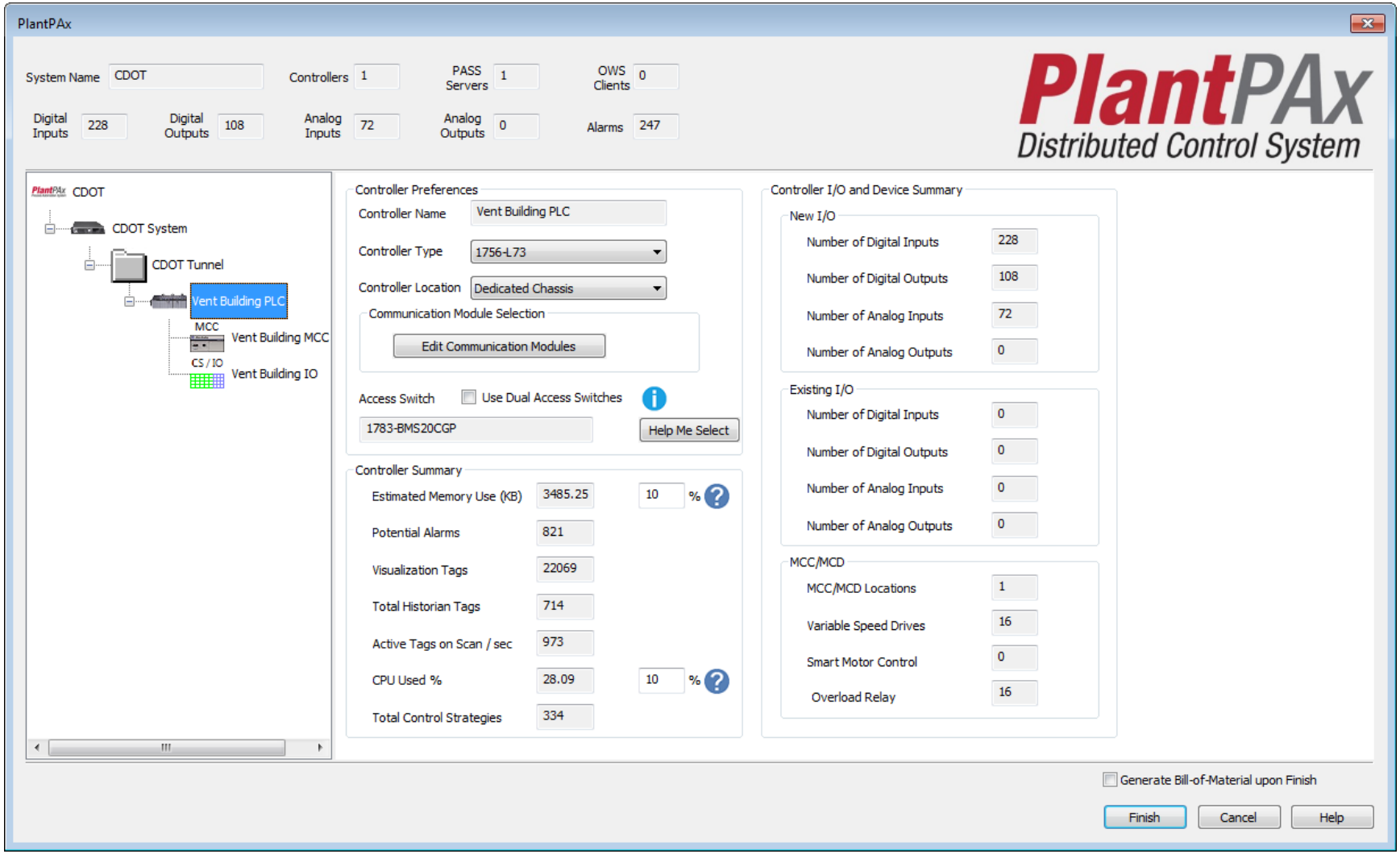
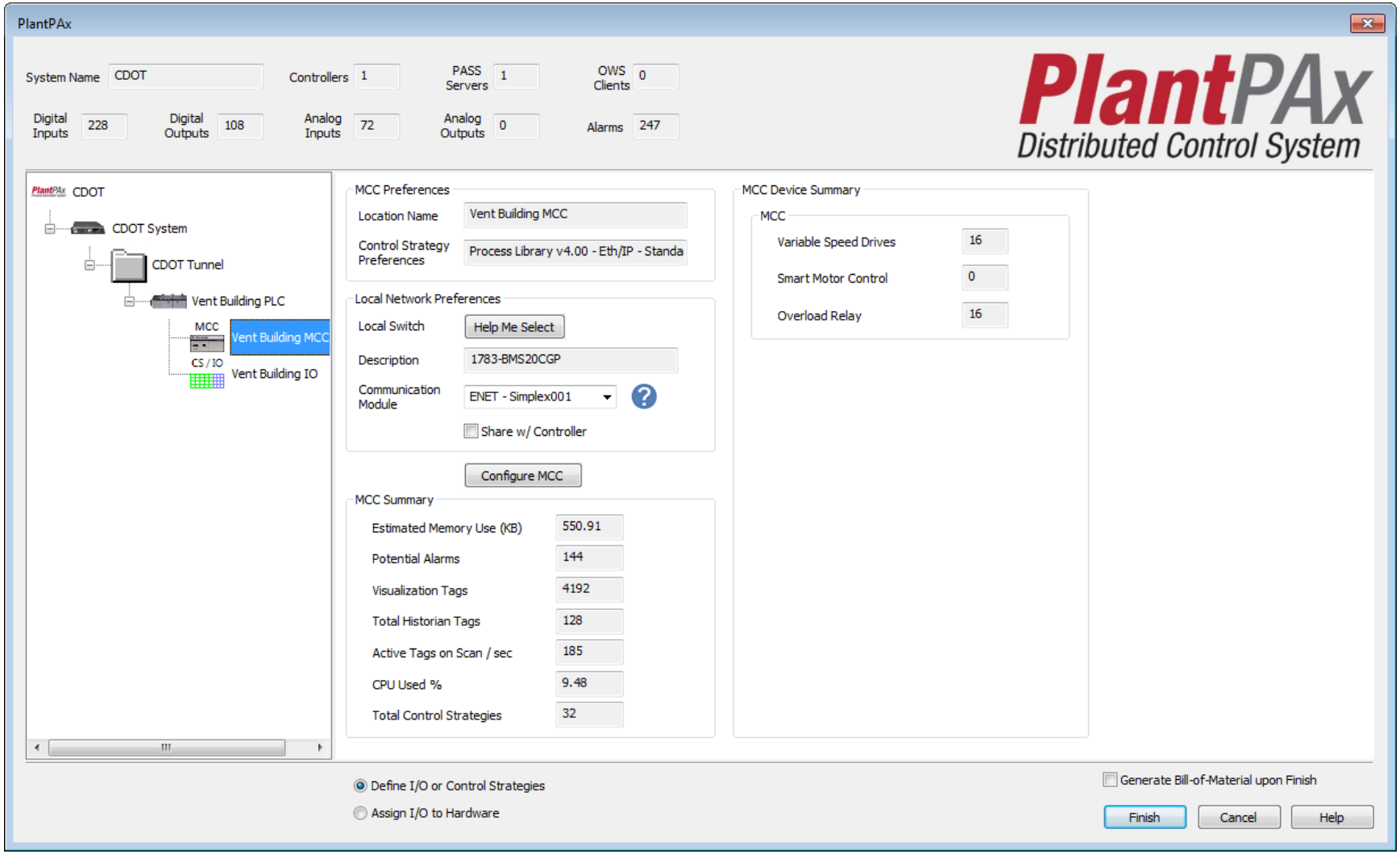
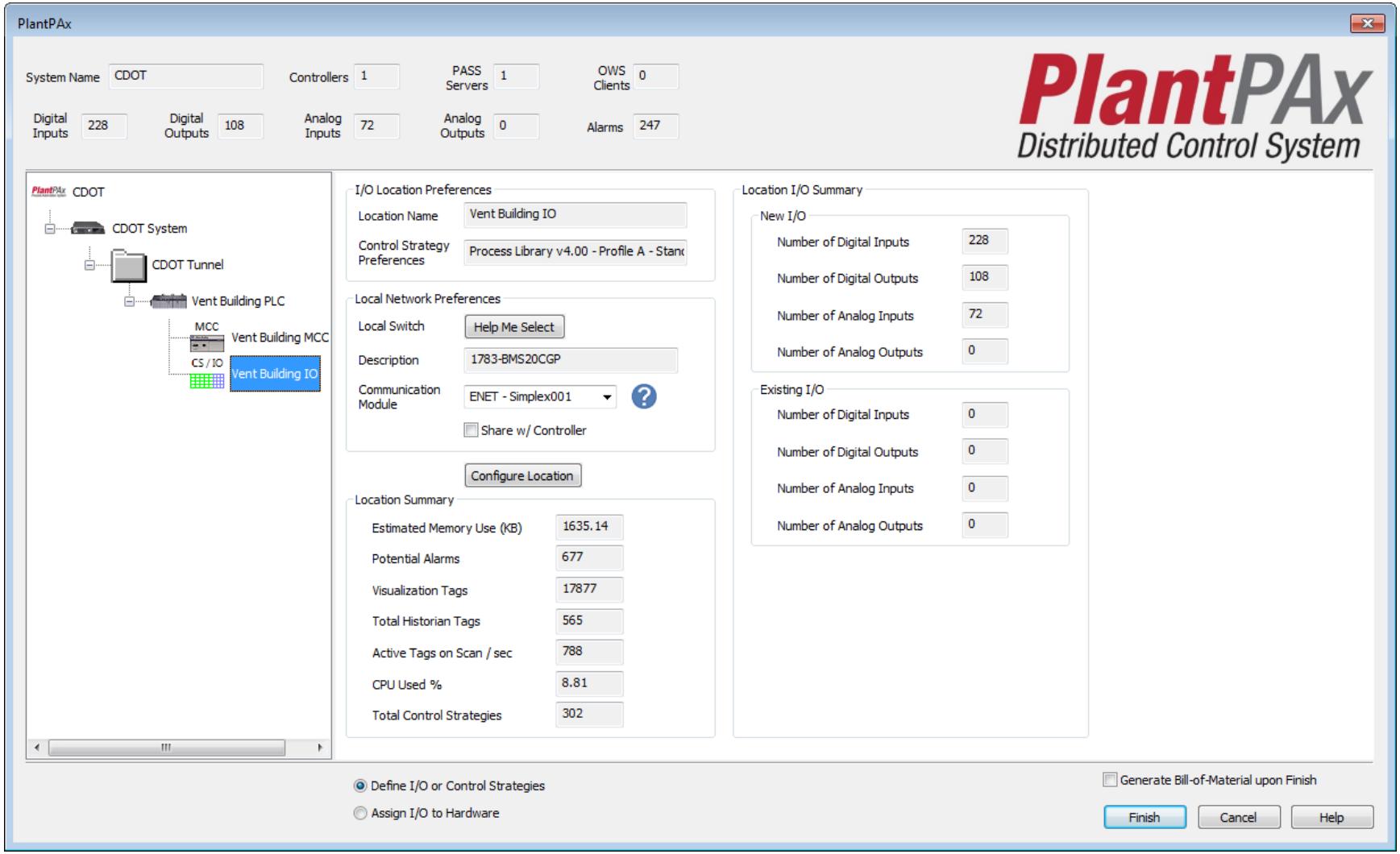

PlantPAx
System Name
CDOT
Controllers
1
PASS Servers
1
OWS Clients
0
Digital Inputs
228
Digital Outputs
108
Analog Inputs
72
Analog Outputs
0
Alarms
247
PlantPAx
Distributed Control System
CDOT
CDOT System
CDOT Tunnel
Vent Building PLC
MCC
Vent Building MCC
CS / IO
Vent Building IO
Controller Preferences
Controller Name
Vent Building PLC
Controller Type
1756-L73
Controller Location
Dedicated Chassis
Communication Module Selection
Edit Communication Modules
Access Switch
Use Dual Access Switches
1783-BMS20CGP
Help Me Select
Controller Summary
Estimated Memory Use (KB)
3485.25
10
%
Potential Alarms
821
Visualization Tags
22069
Total Historian Tags
714
Active Tags on Scan / sec
973
CPU Used %
28.09
10
%
Total Control Strategies
334
Controller I/O and Device Summary
New I/O
Number of Digital Inputs
228
Number of Digital Outputs
108
Number of Analog Inputs
72
Number of Analog Outputs
0
Existing I/O
Number of Digital Inputs
0
Number of Digital Outputs
0
Number of Analog Inputs
0
Number of Analog Outputs
0
MCC/MCD
MCC/MCD Locations
1
Variable Speed Drives
16
Smart Motor Control
0
Overload Relay
16
Generate Bill-of-Material upon Finish
Finish
Cancel
Help


PlantPAx
System Name
CDOT
Controllers
1
PASS Servers
1
OWS Clients
0
Digital Inputs
228
Digital Outputs
108
Analog Inputs
72
Analog Outputs
0
Alarms
247
PlantPAx
Distributed Control System
CDOT
CDOT System
CDOT Tunnel
Vent Building PLC
MCC
Vent Building MCC
CS / IO
Vent Building IO
MCC Preferences
Location Name
Vent Building MCC
Control Strategy Preferences
Process Library v4.00 - Eth/IP - Standa
Local Network Preferences
Local Switch
Help Me Select
Description
1783-BMS20CGP
Communication Module
ENET - Simplex001
Share w/ Controller
Configure MCC
MCC Summary
Estimated Memory Use (KB)
550.91
Potential Alarms
144
Visualization Tags
4192
Total Historian Tags
128
Active Tags on Scan / sec
185
CPU Used %
9.48
Total Control Strategies
32
MCC Device Summary
MCC
Variable Speed Drives
16
Smart Motor Control
0
Overload Relay
16
Define I/O or Control Strategies
Assign I/O to Hardware
Generate Bill-of-Material upon Finish
Finish
Cancel
Help


PlantPAx
System Name
CDOT
Controllers
1
PASS Servers
1
OWS Clients
0
Digital Inputs
228
Digital Outputs
108
Analog Inputs
72
Analog Outputs
0
Alarms
247
PlantPAx
Distributed Control System
CDOT
CDOT System
CDOT Tunnel
Vent Building PLC
MCC
Vent Building MCC
CS / IO
Vent Building IO
I/O Location Preferences
Location Name
Vent Building IO
Control Strategy Preferences
Process Library v4.00 - Profile A - Stanc
Local Network Preferences
Local Switch
Help Me Select
Description
1783-BMS20CGP
Communication Module
ENET - Simplex001
Share w/ Controller
Configure Location
Location Summary
Estimated Memory Use (KB)
1635.14
Potential Alarms
677
Visualization Tags
17877
Total Historian Tags
565
Active Tags on Scan / sec
788
CPU Used %
8.81
Total Control Strategies
302
Location I/O Summary
New I/O
Number of Digital Inputs
228
Number of Digital Outputs
108
Number of Analog Inputs
72
Number of Analog Outputs
0
Existing I/O
Number of Digital Inputs
0
Number of Digital Outputs
0
Number of Analog Inputs
0
Number of Analog Outputs
0
Define I/O or Control Strategies
Assign I/O to Hardware
Generate Bill-of-Material upon Finish
Finish
Cancel
Help