FX15 Controller

Introduction to FX15

Figure 1: FX15 Classic

The FX15 is a high performance field controller of the Facility Explorer system, specifically designed for commercial Heating, Ventilating, Air Conditioning, and Refrigeration (HVACR) applications such as chillers and rooftops, indoor packaged air conditioning units, air handling units, and close control units.

The controller has 27 physical inputs and outputs and supports a wide range of temperature sensors and actuating devices. Additional physical inputs and outputs may be achieved by adding the XT/XP expansion modules on the local Extension bus.

The FX15 controller is fully programmable or configurable, using the FX Tools Pro software package, for a wide range of commercial environmental control applications.

The FX15 controller is also available with a serial communication card for integration into a Building Automation System with a LONWORKS® or N2 Open bus network.

For stand-alone applications an on-board, real-time clock circuit is also included to support the start-stop scheduling of equipment and real-time based control sequences.

The FX15 can be integrated, as a slave device, in a distributed control application managed by a master controller (FX16 Master Controller or Master Display).

Optional accessories make the FX15 controller the state of the art solution for the HVACR market:

- N2 Open, plug-in communication card
- LON, plug-in communication card
- user interface: Medium User Interface (MUI) and Large User Interface (LUI)

Key Concepts

FX15

Features

- fully programmable using FX Tools package
- interchangeable RS-485 - N2 Open or LON FTT10 communication cards for supervisory system
- DIN rail mounting
- female connector option: screw or spring clamp connectors
- Input/Output (I/O) expansion modules
- optional user interfaces: integrated, local, or remote
- events displayed on user interface (up to 12 events)
- easy commissioning via proprietary commissioning tool
- Programming Key for easy application uploading and downloading

Installation

This chapter takes you through the process of installing an FX15.

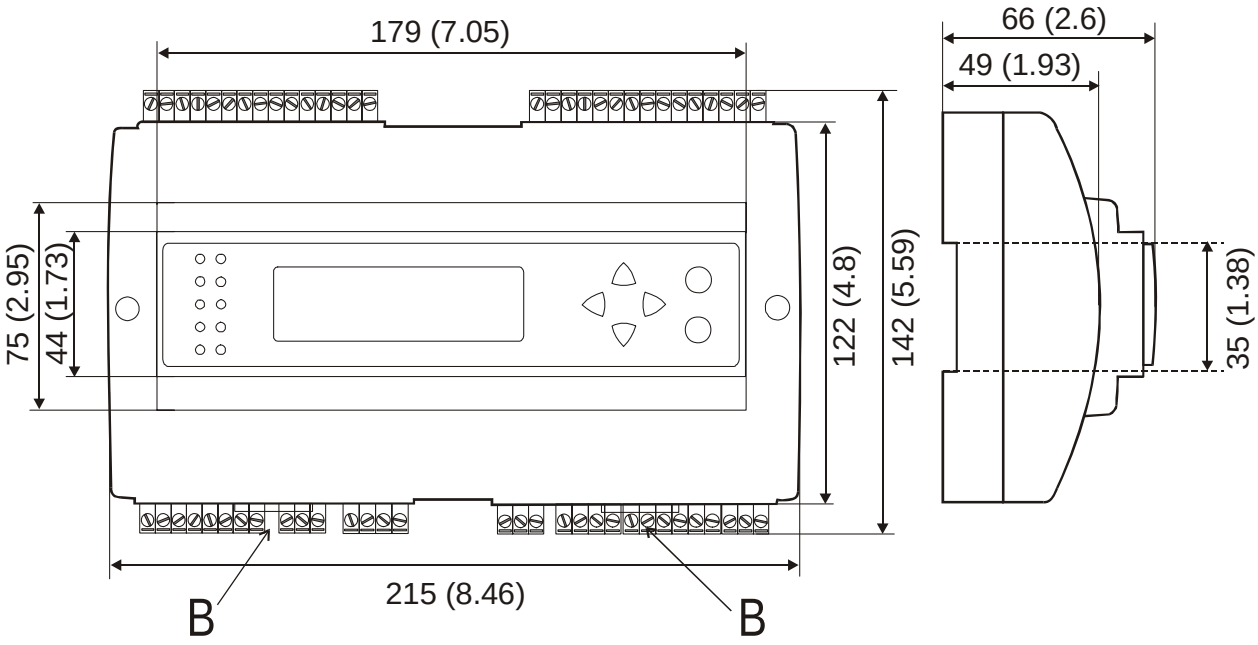


Figure 2: Mounting Dimensions for FX15 (Shown with Integral User Interface and Screw Connectors)

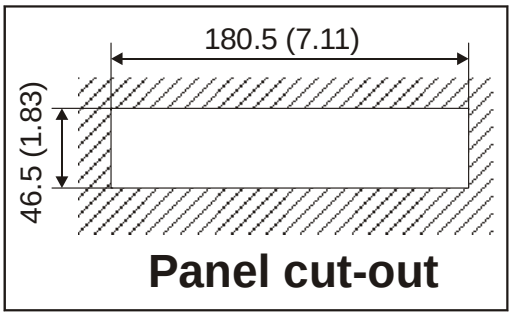


Figure 3: Panel Cut-Out Dimensions for User Interfaces

Two different types of terminal connectors are available: spring clamp or screw connectors. The screw connectors are included, while the spring clamp connectors must be ordered separately. For details, see *Ordering Codes*.

North American Emissions Compliance

United States

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his/her own expense.

Canada

This Class (A) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe (A) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Detailed Procedures

Follow these instructions to properly install and connect the FX15.

WARNING: Risk of Electric Shock. Disconnect power supply before making electrical connections. Contact with components carrying hazardous voltage can cause electric shock and may result in injury or death.

Mounting Instructions

To mount an FX15:

1. Snap the controller onto the 35 mm (1.38 in.) rail for DIN rail mounting. To release the controller, insert a screwdriver in Slots B and lift the retaining clip. Since the retaining clip is spring-loaded, you can also remove the controller without a screwdriver by carefully pushing the controller up against the clip and then tilting the top forward to release the top lug from the DIN rail.
2. Make wiring terminations with detachable connectors, which accept 1 x 1.5 mm^2 (0.002 $in.^2$)/14 AWG cable. There are two types available: screw and cage clamp connectors. For details, see *Ordering Codes*.

   Terminations of the Supervisor Link, Expansion Bus, and Remote Display are made via the connectors provided with the controller.

3. Verify that the wiring has been correctly installed and that voltage levels are appropriate for the various input signals according to the application.
4. Set the jumpers and address switches of the controller as required. For more information, see *Jumper Details*.

Assembling the Integrated MUI

To assemble the integrated MUI:

1. Remove the controller front cover.

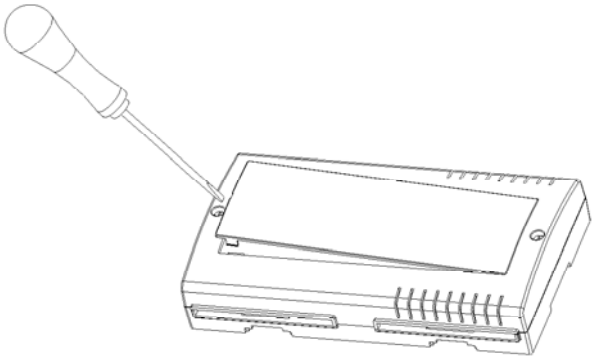


Figure 4: Open the Controller

2. Hook the display to the top FX15 cover.

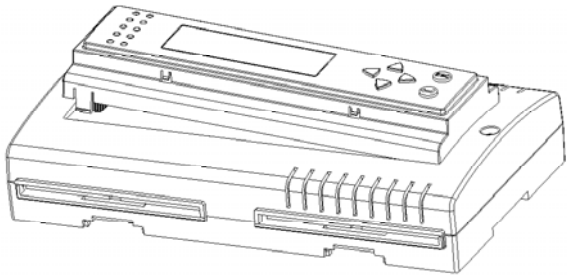


Figure 5: Display Installation

3. Push down until it locks.

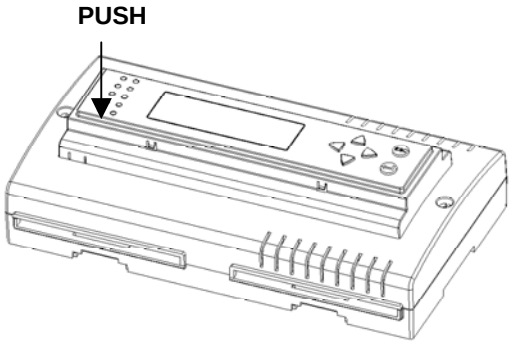


Figure 6: Display Locking

4. Open the controller.

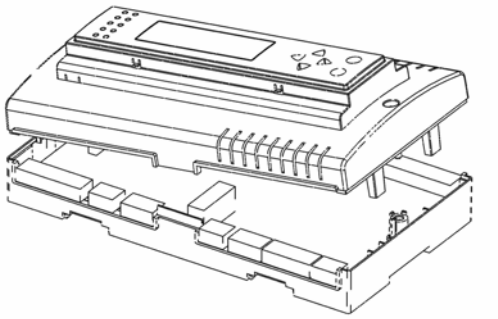


Figure 7: Open the Controller

5. Insert the flat in the specific holes.

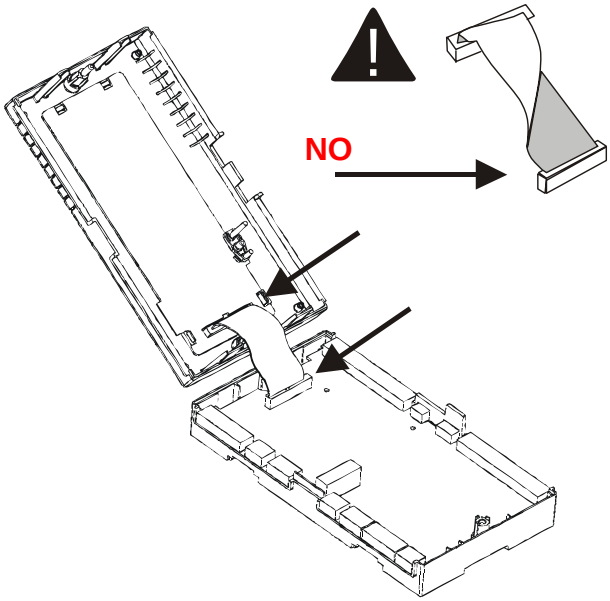


Figure 8: Flat Cable Inserting

6. Close the controller and secure it with the two screws.

Connection Details

LP-FX15D2x and LP-FX15D7x Wiring Diagram

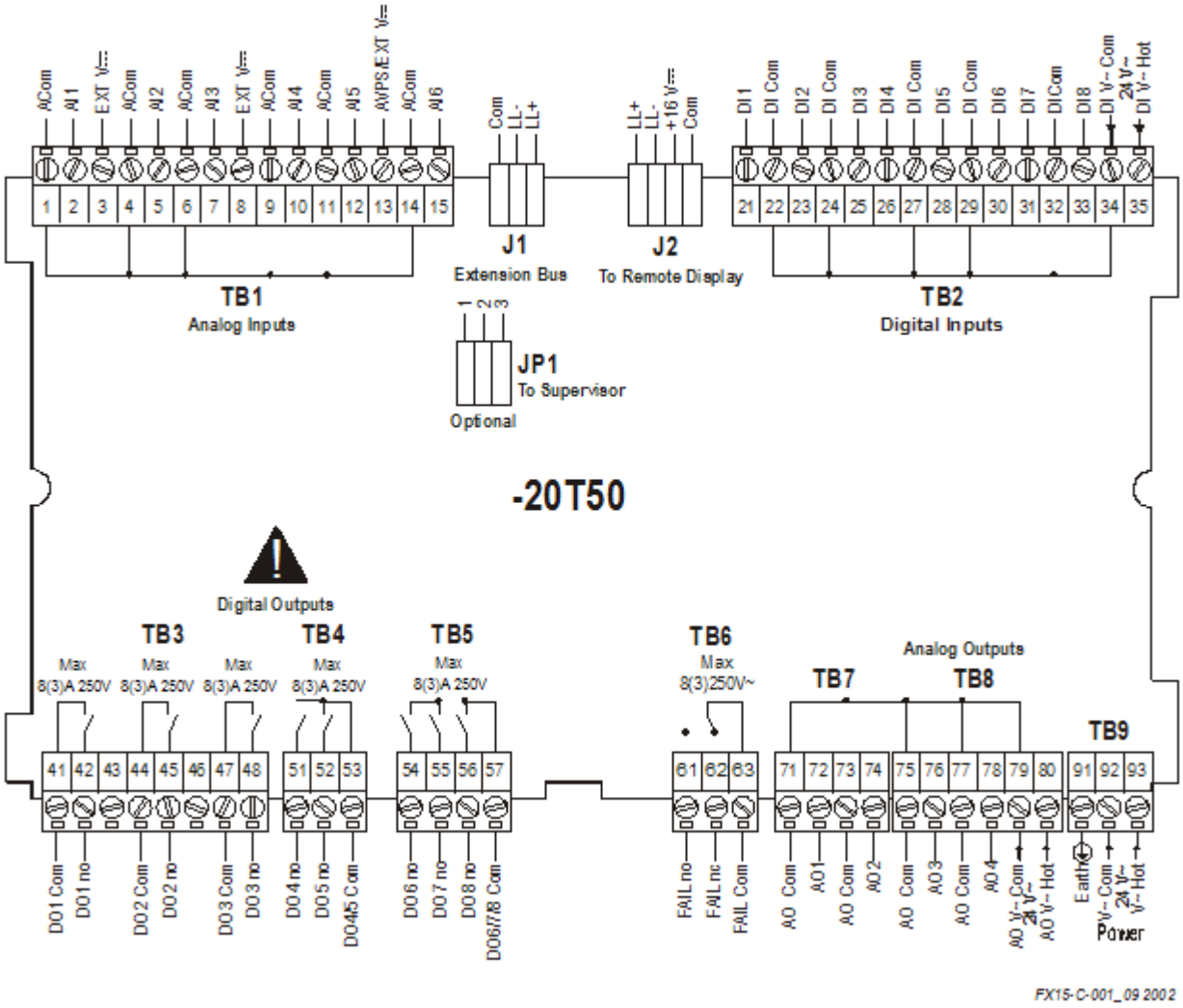


Figure 9: Connection Details for the FX15 (9 Relays)

LP-FX15D1x and LP-FX15D6x Wiring Diagram

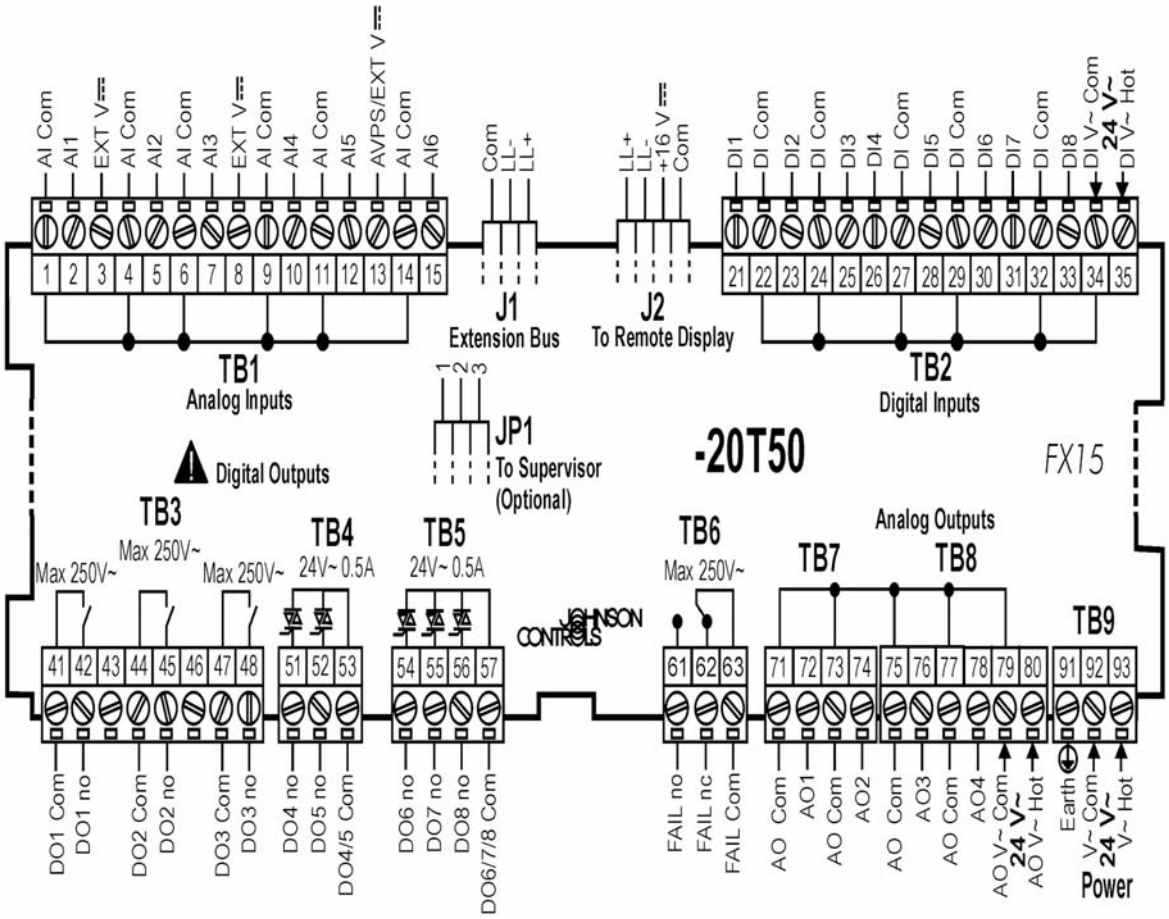


Figure 10: Connection Details for the FX15 (5 Triacs+4 Relays)

Consider the following information when you work with the connections details for the FX15:

- All commons are electrically dependent.
- Analog outputs are opto-isolated and are externally powered at 24 VAC. In order to maintain the opto-isolation, a separate power supply (3 VA) must be used only for the analog outputs.
- Digital inputs are opto-isolated and are externally powered at 24 VAC. In order to maintain the opto-isolation, a separate power supply (3 VA) must be used only for the digital inputs.

Jumper Details

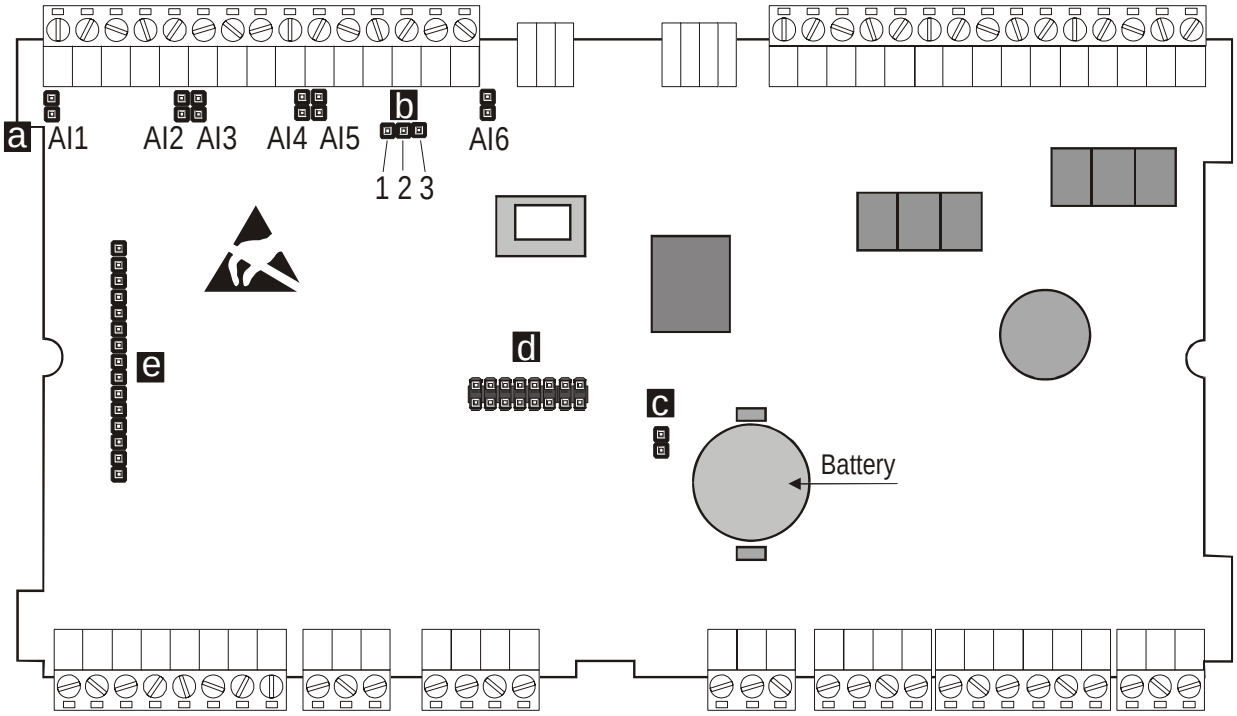


Figure 11: Jumper Connections

Table 1: Jumper Connections

	Analog Input (AI)	**0-20/4-20 mA**	**Resistive, 0-10 V or Ratiometric**
a	AI1-AI6	Jumpers Closed	Jumpers Open (Default configuration)
	Sensors Power Supply	**AVPS +5 V**	**EXT VDC+16 V**
b	Terminal Number 13	Pins closed between 1 and 2	Pins closed between 2 and 3 (Default configuration)
c	Battery Type CR2032, average life time: 3 years, dispose OFF		
d	Pin strip closed: battery backup enabled Pin strip open: battery excluded (to preserve charge) Jumper d is set to ON at the factory and should only be set to OFF if the controllers are to be kept in storage without power for an extended period of time. The jumper must be set to ON before the controllers is installed and powered up; otherwise back-up RAM and RTC will not be enabled.		
e	Plug-in connector for optional cards insertion		

Connection Details for I/O Expansion (XT-XP Modules) on Local Extension Bus

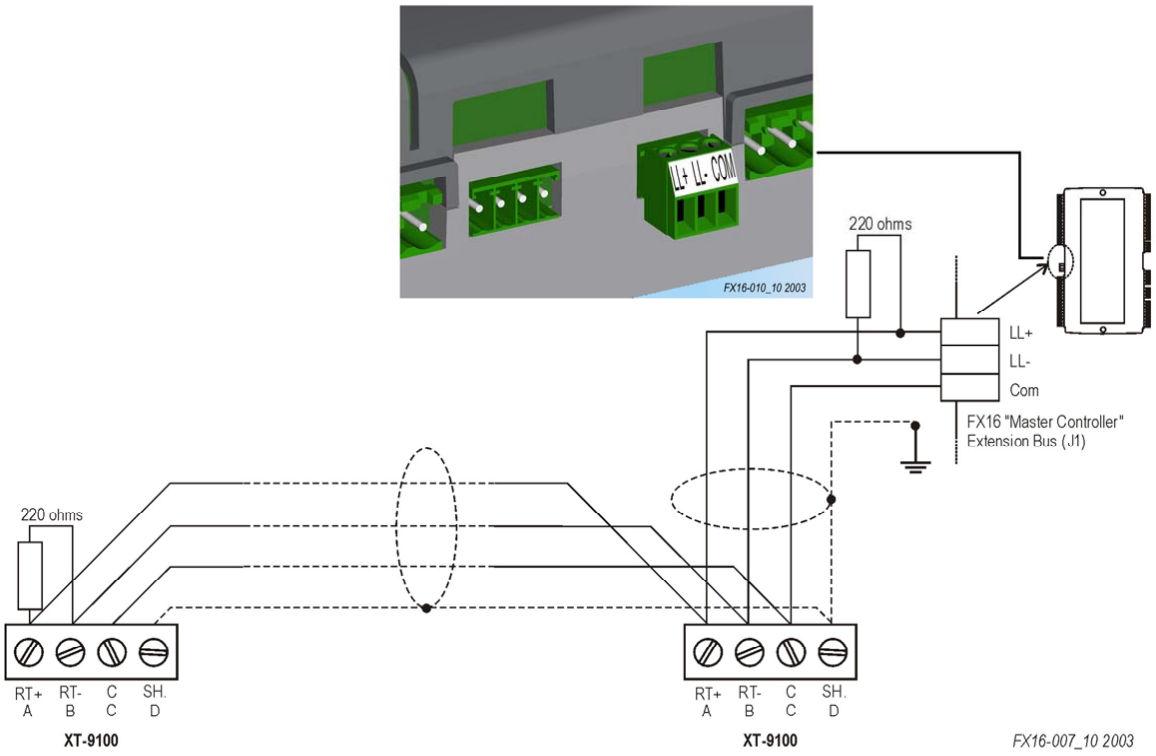


Figure 12: Connection Details for the XT/XP Modules

Consider the following information when you work with the connections details for the XT/XP Modules:

- maximum XT modules: 4 XT91D00s
- maximum bus length: 1.2 m (4.0 ft)
- Install a repeater (for example, RP-9100-810x) to regenerate the RS-485 signal in case more than 31 N2 devices have to be connected on the same N2 bus trunk and/or the N2 bus trunk length is more than 1,200 m (4,000 ft).
- Install 220 ohm end-of-line resistors at each end of the XT-Bus line when the bus length is greater than 100 m (330 ft). When the bus length is less than 100 m (330 ft), insert only one 220 ohm resistor at the FX15 end only.

Connection Details for the N2 Open Card

The FX15 comes either with the N2 Open Card preassembled or the card can be assembled at a later time in the field. For details, see *Ordering Codes*.

The N2 Open plug-in serial card allows the FX15 to be connected to an N2 Open serial network through the RS-485 standard.

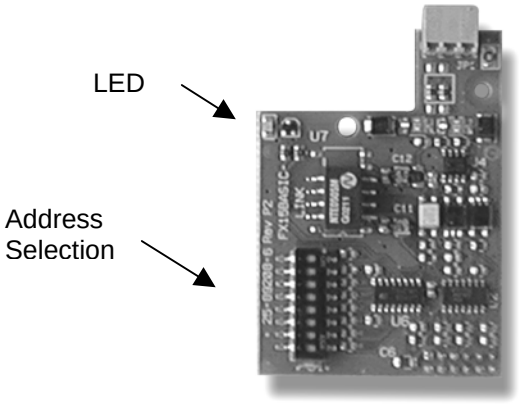


Figure 13: N2 Open Plug-in Communication Card

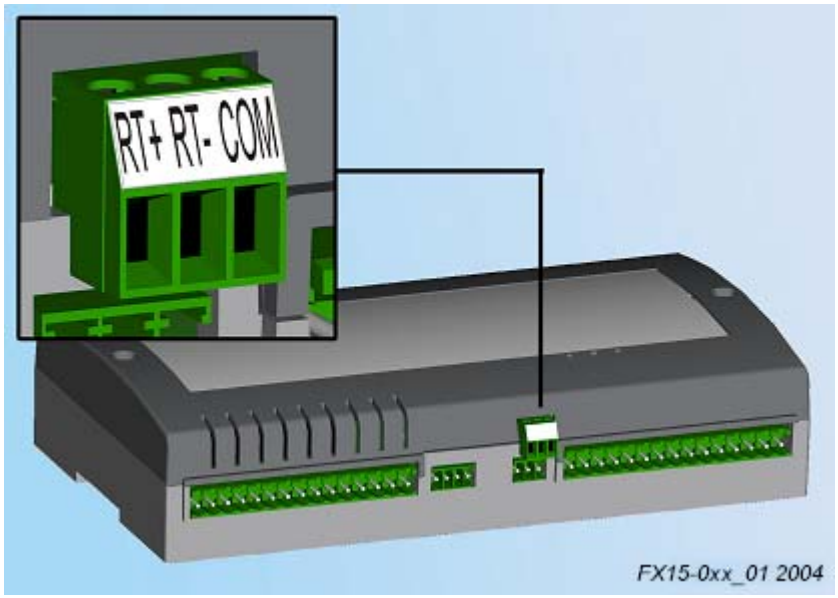


Figure 14: N2 Open Card Connection

Assembling the N2 Communication Card

To assemble the N2 communication card:

1. Power off the controller (hot plug-in not allowed).
2. Open the controller. See Figure 15.

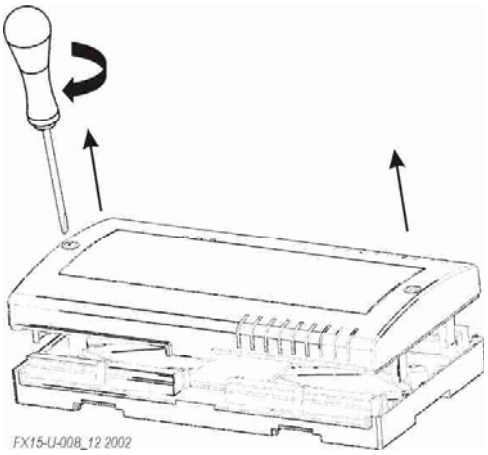


Figure 15: Open the Controller

3. Insert the card. See Figure 16.

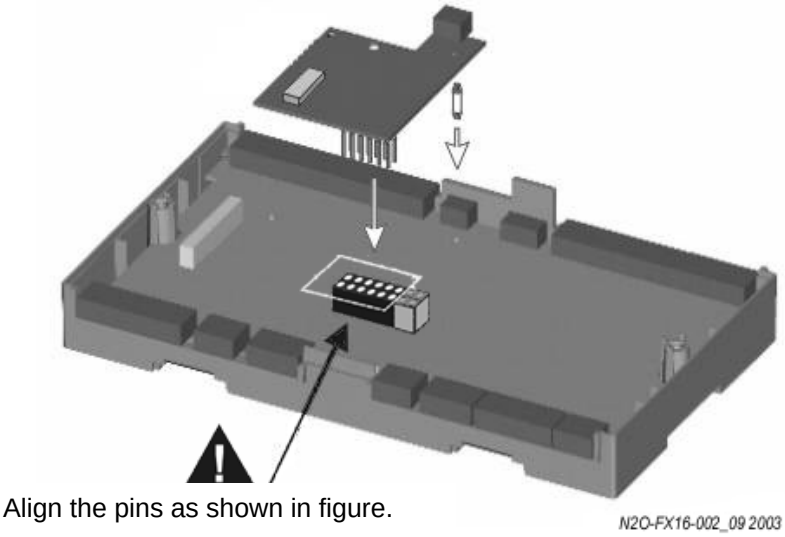


Figure 16: Insertion of the N2 Open Card

4. Set the address DIP switches.
5. Replace the lid and close it.

IMPORTANT: The Complementary Metal Oxide Semiconductor (CMOS) integrated circuit in the controller and on the communication card are sensitive to static current discharges. Take suitable precautions.

Address Selection

Through the DIP switches (see Figure 13*)*, select the serial address of the controller in the N2 Open network. The address selection is done in binary mode.

Example.:• 1st ON, all others open
address = $2^0 + 0^1 + \ldots = 1$

• 1st ON, 4th ON, all others open
address = $2^0 + 0^1 + 0^2 + 2^3 = 9$

The address zero is not allowed. The factory default address configuration is 1.

IMPORTANT: Cycle the controller power in order for new serial address to become active.

Network Layout

Refer to the *N2 Communication Bus Technical Bulletin (LIT-636018).*

Connection Details for the LON Card

The FX15 comes either with the LON card preassembled or communication-less and the card can be optionally assembled later in the field. For details, see *Ordering Codes*.

The LON plug-in serial card allows the FX15 to be connected to a LONWORKS network.

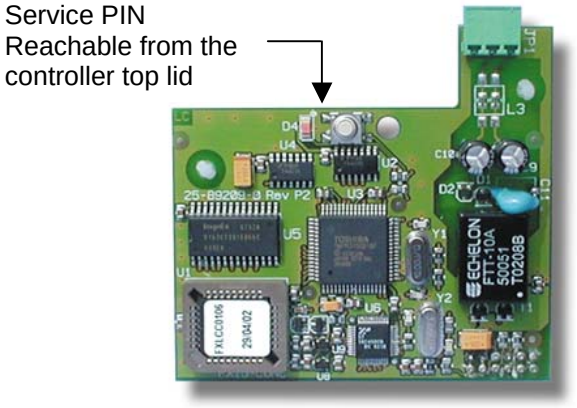


Figure 17: LON Plug-in Communication Card

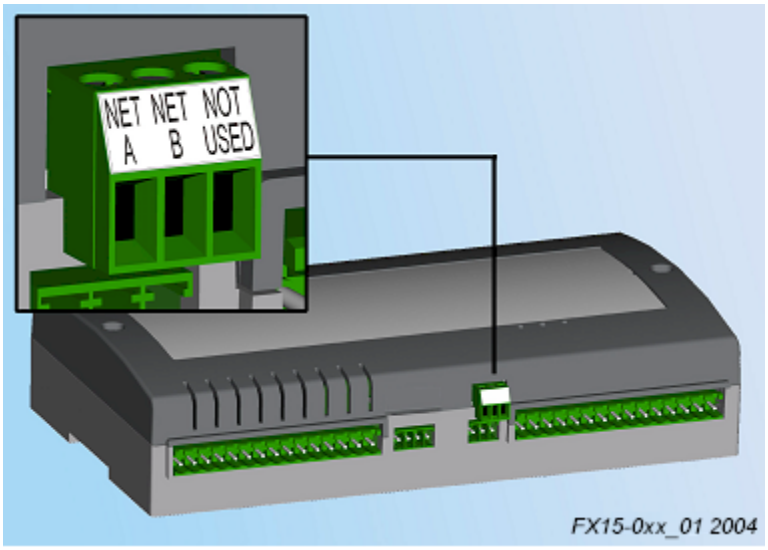


Figure 18: LON Card Connection

Assembling the LON Communication Card

To assemble the LON communications card:

1. Power off the controller (hot plug-in not allowed).
2. Open the controller. See Figure 19.

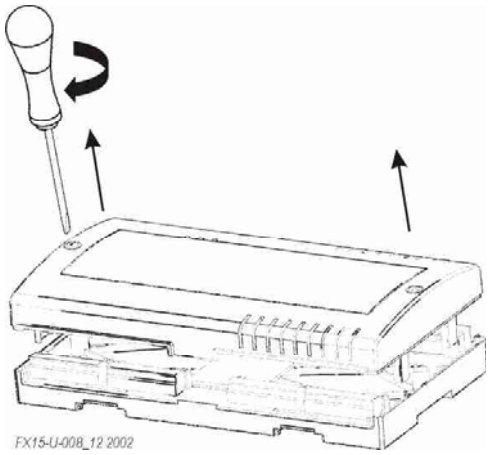
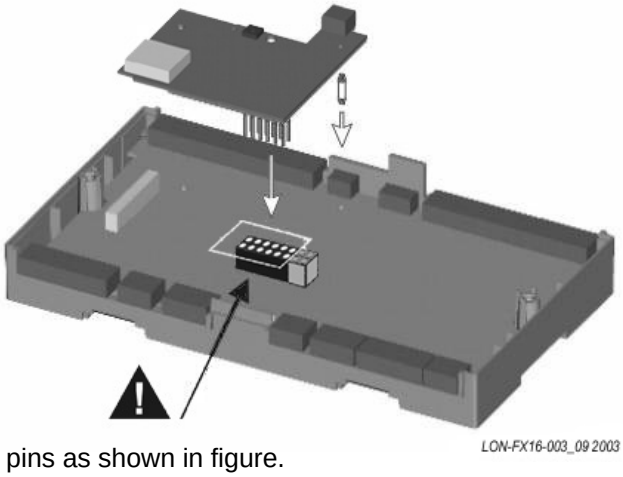


Figure 19: Open the Controller

3. Insert the card. See Figure 20.



Align the pins as shown in figure.

Figure 20: Insertion of the LON Card

4. Replace the lid and close it.

IMPORTANT: The CMOS integrated circuit in the controller and on the communication card are sensitive to static current discharges. Take suitable precautions.

Refer to the LONWORKS FTT-10A Free Topology User's Guide (078-0156-01F) for technical guidelines associated with free topology restrictions. Refer to the Junction Box and Wiring Guidelines for Twisted Pair LONWORKS Networks (005-0023-01) for more detailed information on wiring specification. These documents are available on the Echelon® Web site (www.echelon.com).

Connection Details for the Remote User Interface

The FX15 can support up to two Medium User Interfaces (MUIs) at the same time.

The MUI is available in 2 models: **panel mount** (up to 3 m [9.8 ft]) and **wall mount** (up to 1 km [0.6 mi]). The FX15 can support 1 panel mount MUI plus 1 wall mount MUI or 2 wall mount MUIs (see Figure 21 and Figure 22).

For the panel mount connection use the pre-cabled connection kit (LP-KIT007-000C), 3 m (9.8 ft) long, with a phone jack on the MUI side and a preassembled screw connector on the FX15 side.

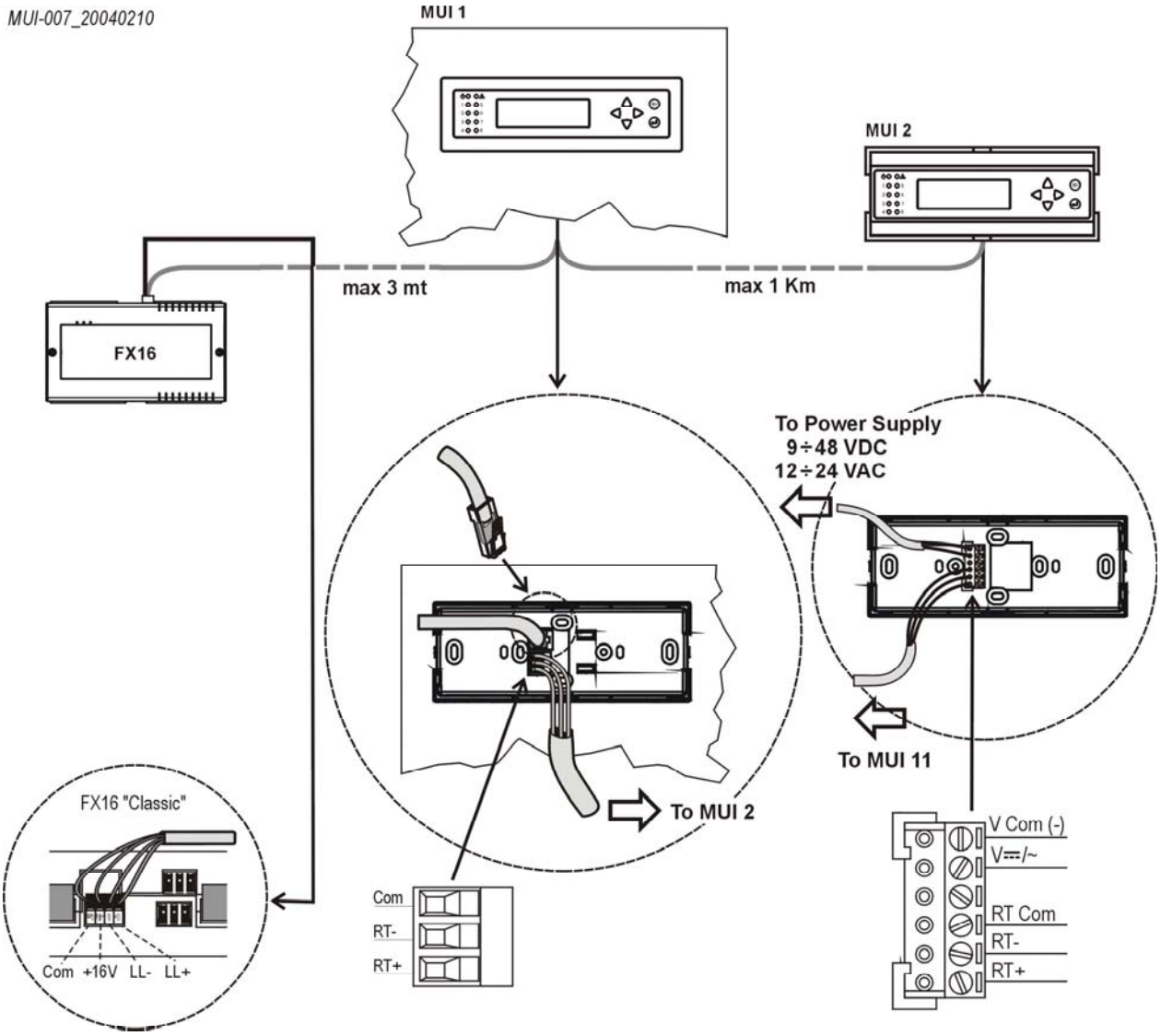


Figure 21: Installation for One Local and One Remote MUI

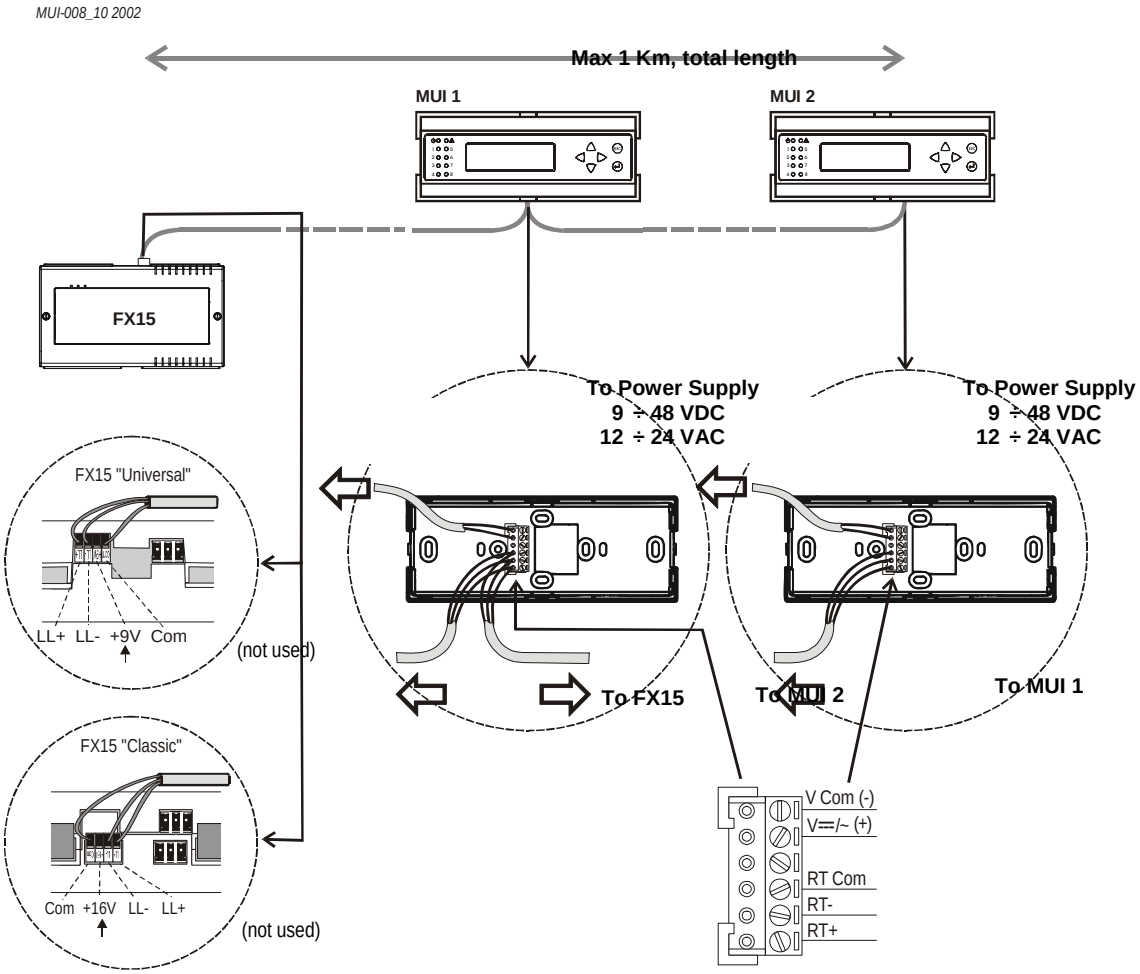


Figure 22: Installation for Two Wall Mount MUIs

Assigning the Medium User Interface's N2 Address in Case of Multiple Connections

At power up, the MUI automatically has a default N2 address equal to **1**.

If you connect multiple MUIs, the second MUI N2 Address must be changed to avoid communication conflicts.

When the second MUI displays **Device Offline**, as shown in Figure 23, press the ESC and ↵ keys simultaneously to switch the N2 Address to **2**. See Figure 24.

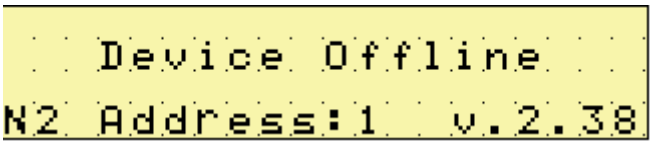


Figure 23: MUI N2 Address Selection

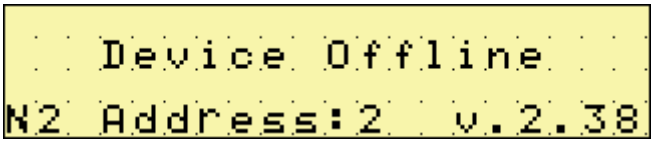


Figure 24: MUI N2 Address Changed

Connection Details for the Programming Key

The Programming Key is used to upload an application from a computer or from a preprogrammed FX15. The application is then downloaded to other FX15 controllers.

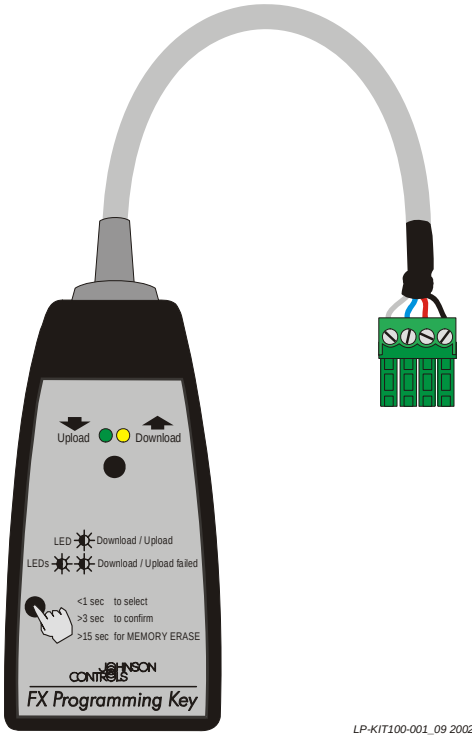


Figure 25: Programming Key

Connecting the Programming Key to an FX15

To connect the Programming Key to an FX15:

1. Power off the controller.
2. Detached any connect user interfaces from the Remote Display Port JP2.
3. Plug the Programming Key into the Display Port (see Figure 26).

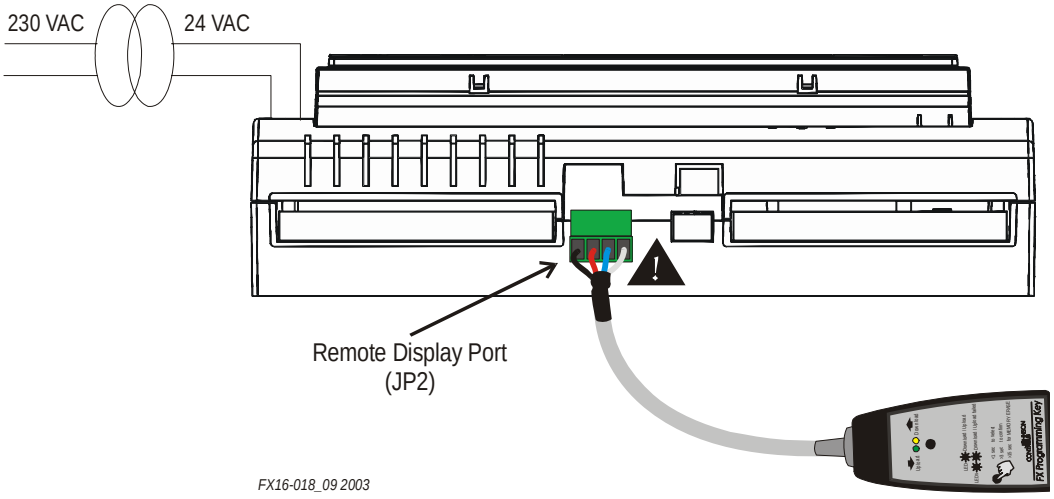


Figure 26: Programming Key Connection to FX15

4. Power the controller and download/upload the application.

Connecting the Programming Key to a Computer

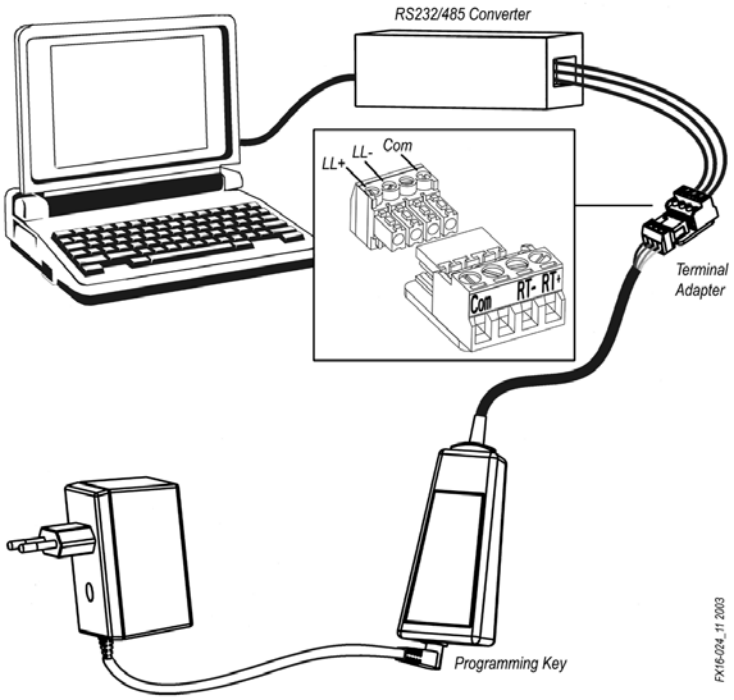


Figure 27: Programming Key Connection to a Computer

To connect the Programming Key to a computer:

1. Connect the terminal adapter (included in the programming key kit) to the RS-232/485 converter connected to the computer.

Table 2: Terminal Adapters

Adapter	RS-232/485 Converter
1	Com
2	Not used
3	RT-
4	RT+

2. Power the key via AC/DC adapter.
3. Launch FX Loader.
4. Upload the application.

Performing a Programming Key Memory Erase

If the key is already loaded with an application and there is the necessity to substitute it with a different application, the user has to do a memory erase.

The memory erase is automatically performed by FX Loader. However, in the case where the application is loaded from a computer or where the application has to be loaded from another FX15, the user has to manually perform the memory erase.

To perform a Programming Key memory erase:

1. Power up the key, either by hot-plugging it to an FX15 (already on) or with an AC/DC adapter.
2. Initiate the memory erase by pressing the Programming Key button for 15 seconds.

   During the erase, the green Light-Emitting Diode (LED) slowly blinks. Then the green and the yellow LED blinks, two times alternatively, and finally the green LED remains steady on. The flash erases.

If the two LEDs blink simultaneously, it means that the erase process has failed. Retry. When the memory is completely erased, the LEDs stop blinking. The key is now ready for a new upload. The memory erase is also necessary if the previous upload from the FX15 goes wrong (communication has been interrupted).

Error Codes

The error codes can only be seen if the FX15 has been mounted with an integrated MUI display (LP-DIS60U10-C).

Table 3: Error Codes

Error Code	Meaning	Possible Cause	Action
51	Private ID mismatch	Controller and application in the key have different protection IDs	Save the application with the proper ID (if available) and retry the download.
52	Memory full	Attempt to upload an application to a key already loaded	Proceed with the memory erase and retry uploading.
52	Memory empty	Attempt to download an application from an empty key	Upload the key with the target application.

Inputs and Outputs

Introduction

The FX15 features the following I/O Channels:

- six high resolution Analog Inputs (13 bit, A/D Converter)
- eight opto-isolated Digital Inputs from potential free contacts, each with transition counter
- nine Digital Outputs (4 Relays and 5 optionally Relays or triacs)
- four opto-isolated Analog Outputs

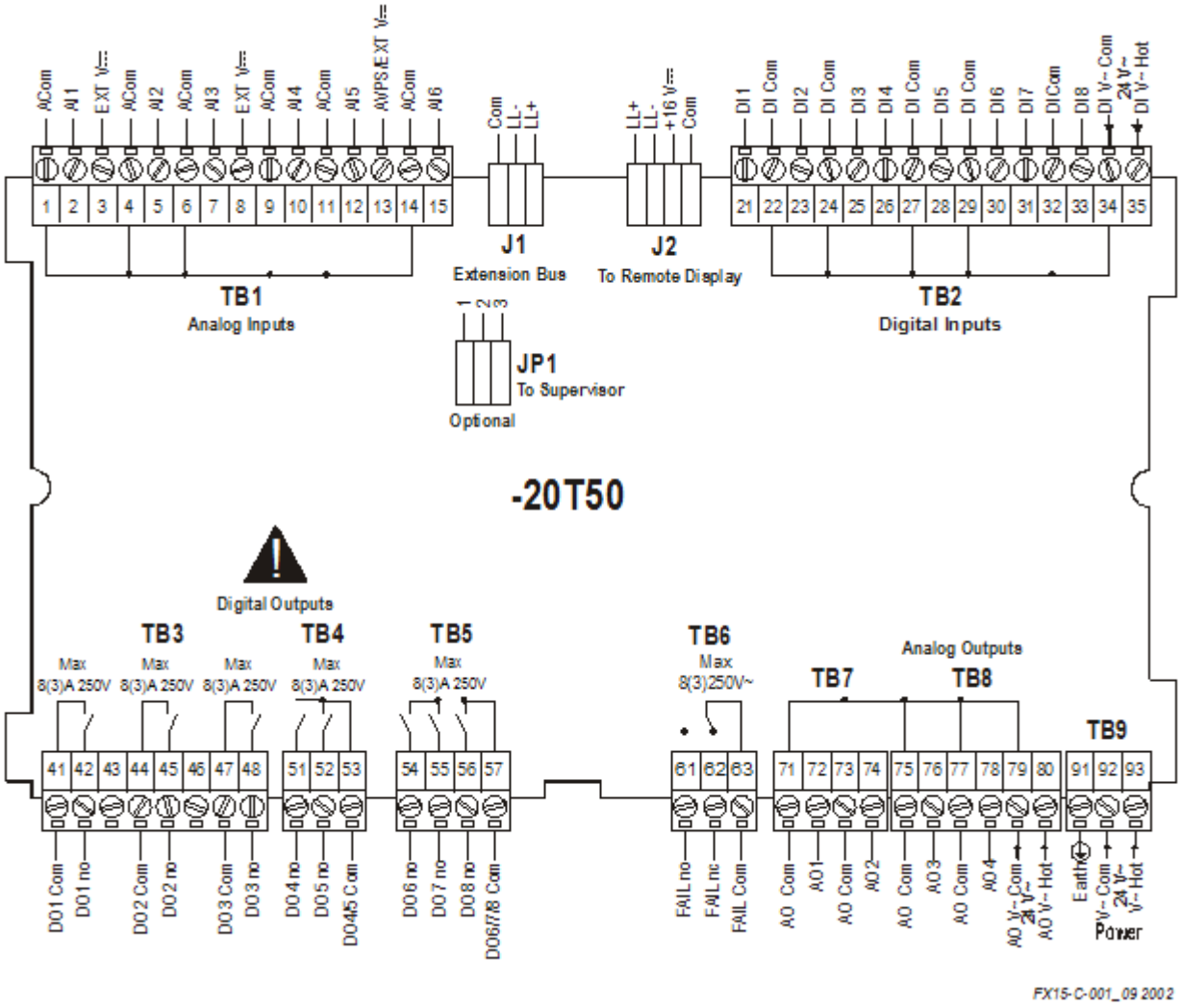


Figure 28: FX15 I/Os

Key Concepts

Analog Inputs

The FX15 accepts six high resolution, universal analog inputs; each of them can be configured as active or passive by application software and jumper configurations.

Digital Inputs

The FX15 accepts eight opt-isolated digital inputs from voltage free contacts.

Analog Outputs

The FX15 provides up to four 0-10 VDC opto-isolated analog outputs.

Digital Outputs

The FX15 provides nine digital outputs, available in two hardware configurations with 9 Relays or 4 Relays and 5 triacs.

Detailed Procedures

Isolation Diagram

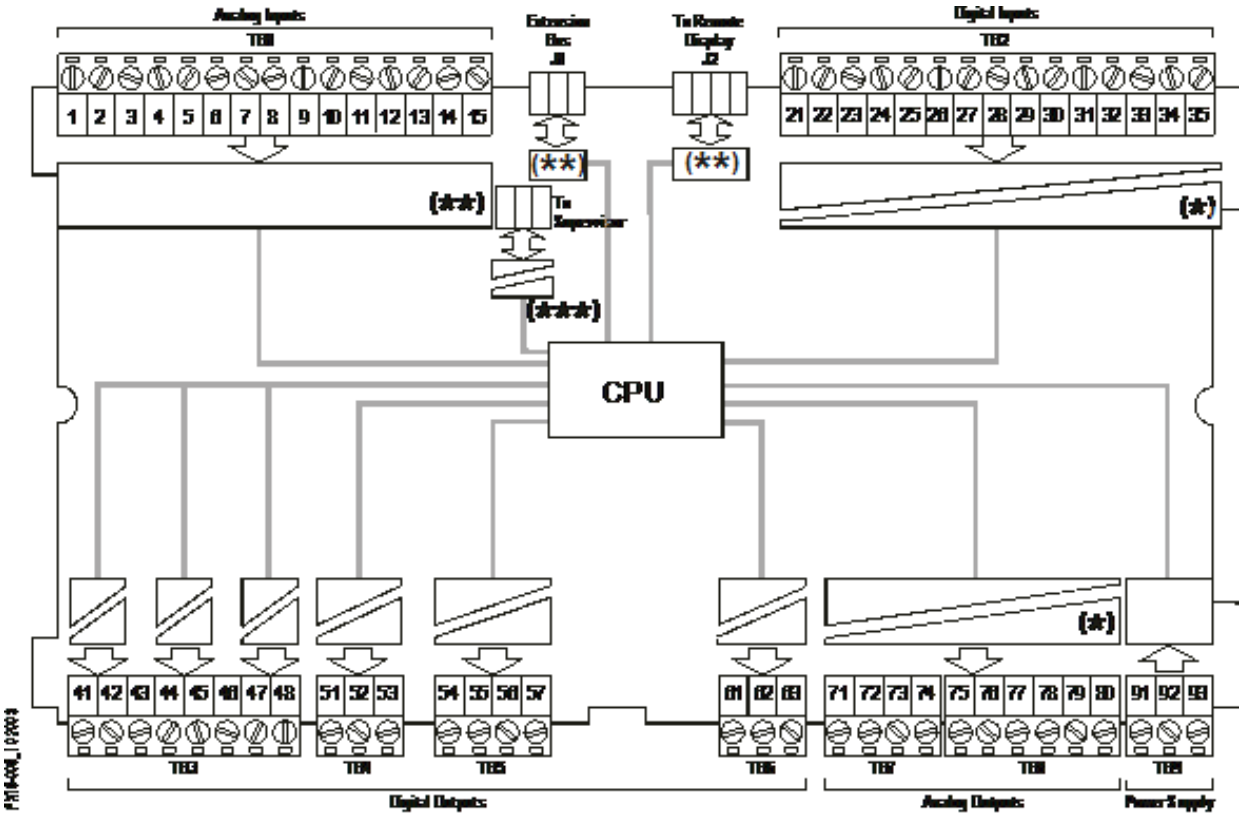


Figure 29: Insulation Diagram

(*) Opto-isolated (maximum 500 V) if an additional separated power supply is used

(**) Not isolated

(***) DC/DC converted with dielectric strength up to 1000 V

FX15 I/Os Powered at 24 VAC

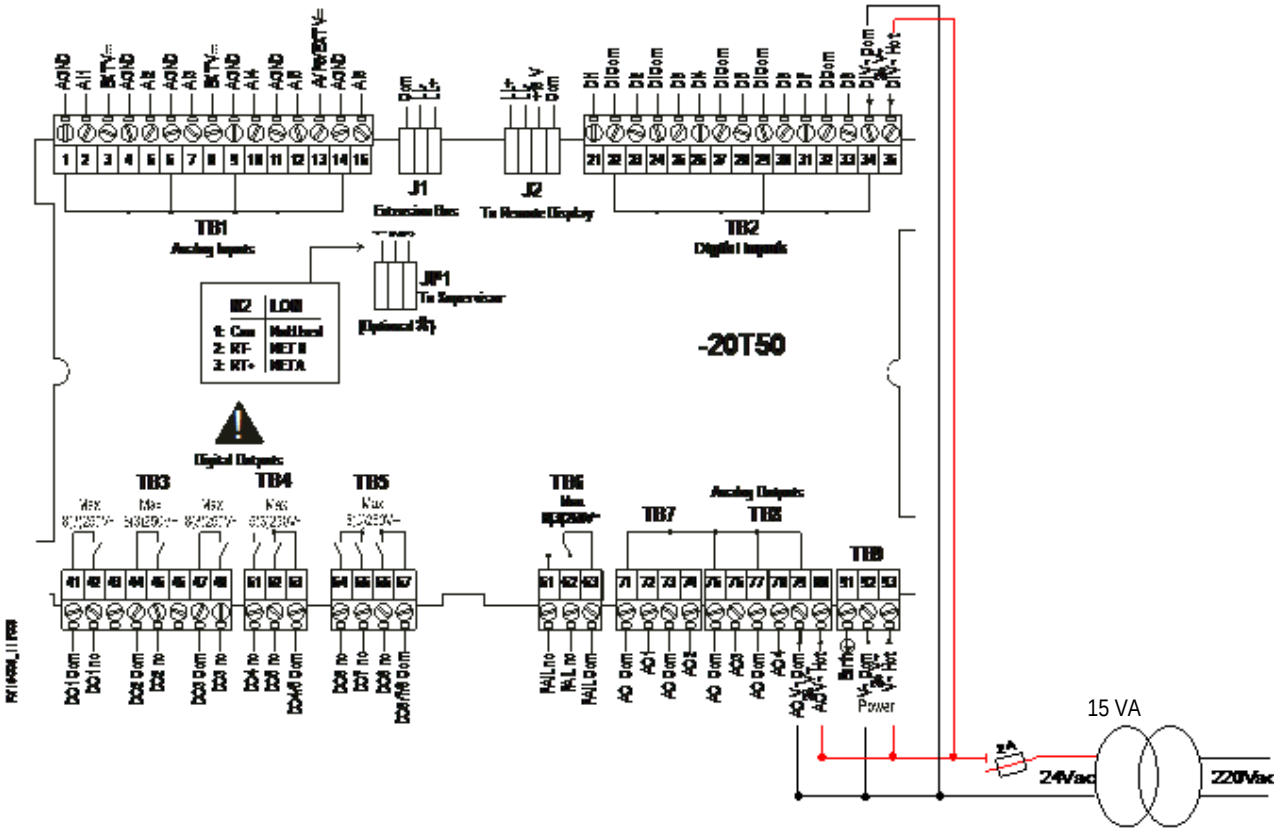


Figure 30: Powering FX15 I/Os

To maintain the insulation between the FX15 power supply and the I/Os, run the power supply cable respecting the polarity as shown in Figure 30, adding an External Protection fuse (2 A) to avoid mis-wiring.

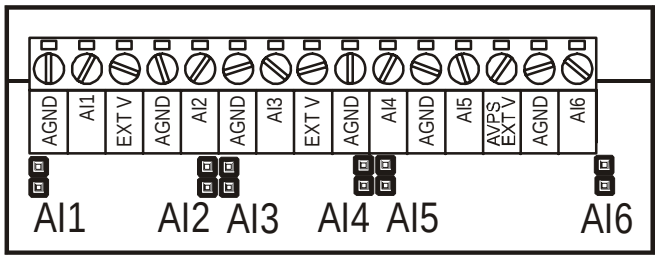
IMPORTANT: Not respecting the power supply polarity will result in a short circuit causing the blowing of the external fuse.

Analog Inputs

The six high-resolution analog inputs can be configured to accept a wide range of voltage, current and resistive input signals.

See *I/O Technical Details* for the complete FX15 I/O table.

A dedicated jumper is placed on board for each analog input. This jumper should be installed in its closed position if the connected sensor provides a current signal (0-20/4-20 mA). This jumper should be installed in its open position if the connected sensor provides a resistive, ratiometric, or voltage (0-2/0-10 V) input signal.



FX16-025_10 2003

Figure 31: Analog Input Jumpers

The active sensor (voltage or current) inputs are ranged using programmable range parameters within the application software. These parameters, HighRange and LowRange, define the equivalent values for reading at High (10 V, 20 mA) and Low (0 V, 4 mA, 0 mA) signal input. Voltage and current inputs from differential pressure transducers can be linearized by a square root function (SQRT), which operates over the complete range of the input.

The passive sensors (resistance) have a preprogrammed linearization curves within the application software. For these sensors, the measurement range is fixed. The user can set the reliability range via software.

The read signal is converted by the FX15 according to the related Analog Input object setup, available setup are:

- Linear 0-10 V
- SQRT 0-10 V
- Linear 0-10 V, 20% suppression (2-10 V)
- Linear 0-2 V
- SQRT 0-2 V
- Linear 0-2 V, 20% suppression (0.4-2 V)
- Linear 0-20 mA
- SQRT 0-20 mA
- Linear 0-20 mA, 20% suppression (0.4-2 mA)
- Resistance 2k ohm

- A99
- NTC 2k2 ohm
- Ni1000 JC
- Ni1000 JC Extended
- Ni1000 Landis and Gyr
- Ni1000 DIN
- Pt1000
- Ratiometric

The measurement unit is also configurable to enable the controller to propagate via network the measured value according to the appropriate scale unit. Available configurable units are:

- Temperature
- Percentage
- Air Pressure
- Liquid Pressure
- Flow
- Concentration
- Ampere
- Voltage

A configurable filter constant in seconds is performed by the FX15 on its Analog Inputs for the reduction of signal instability. An additional Anti-Spike filter can be configured to limit the rate of change of the input values to the value indicated by this attribute.

The FX15 provides a jumper configurable (Terminal 13) +5V AVPS (Analog Voltage Power Supply) or a +16V External VDC, supply for active analog input sensors (See *Jumper Details at page 12*)

The EXT VDC can supply up to 80 mA for a maximum of four 0/4-20 mA active sensors. The AVPS can supply up to 10 mA for ratiometric sensors.

Connecting Active 0-10 V Sensors

The FX15 can accept all the active temperature, pressure, flow and humidity sensors providing 0-10 VDC signals.

Figure 32 shows the connection between an FX15 and an HT-9001 probe.

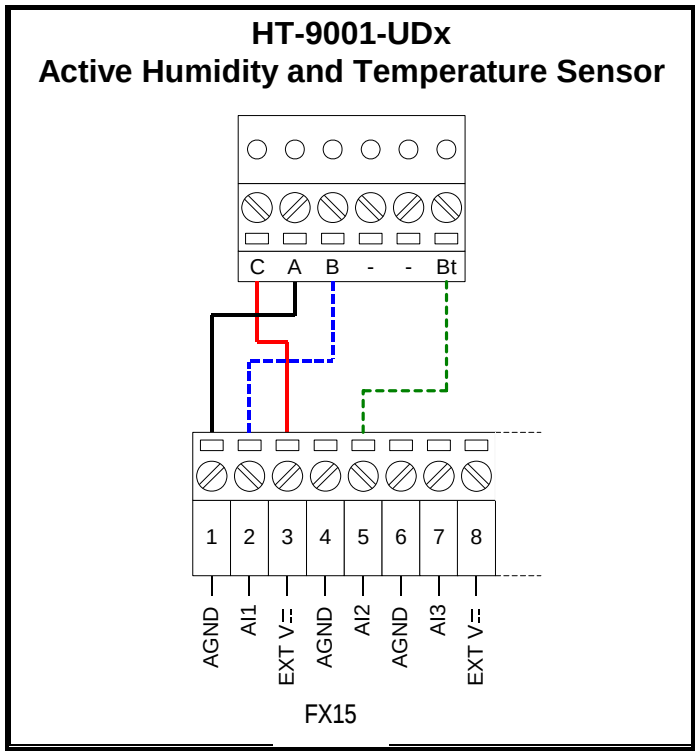


Figure 32: Active 0-10 V Probe, Connection Diagram

The inputs must be pre-configured in order to accept 0-10 V signals by the application software resident in the FX15. The AI Jumpers must be opened (factory default setting) in order to accept voltage inputs.

Table 4: Active 0-10 V Sensors

FX15 Terminals	HT-9001 Terminals	Description
AGND (1)	A	Common Reference
EXT V (3)	C	Sensor Power Supply 16 V, 80mA
AI1 (2)	B	Humidity Output 0-10 V
AI2 (5)	Bt	Temperature Output 0-10 V

Note: The numbers between the brackets are the FX15 terminal numbers.

Connecting Passive Resistive Sensors

The FX15 analog inputs accept linear resistive signals as the **Resistive 2kΩ**. The Analog Input software can also linearize signals provided by the most common sensors as Ni1000, A99, Pt1000, and NTC 2k2.

The inputs must be preconfigured in order to accept A99 resistive signals by the application software resident in the FX15. The AI Jumpers must be opened in order to accept resistance input (Factory default setting). Figure 33 shows an A99 wiring diagram. The resistive sensors have to be connected in the same way.

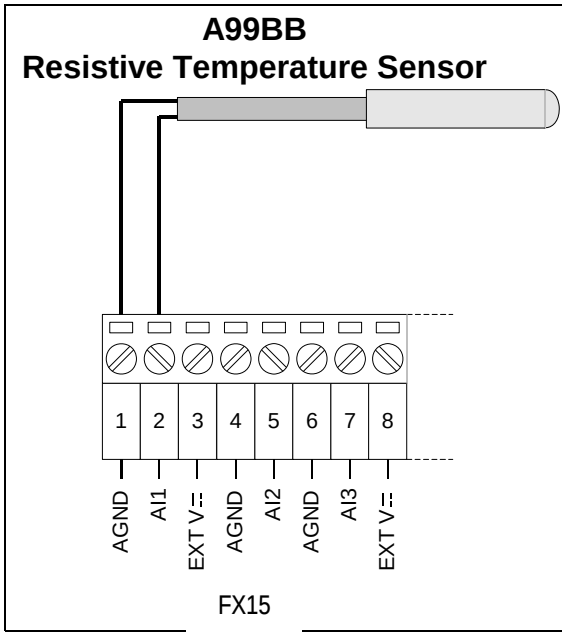


Figure 33: A99 Resistive Sensor Connection Diagram

IMPORTANT: The two resistive probe leads are the same, in that they have no polarity; therefore, it is not necessary to respect any specific order when connecting to the terminal block.

Connecting Active Current Sensors

The FX15 analog inputs can accept a maximum of four active current sensors, powered by the FX15 itself, in the range 0-20 mA or 4-20 mA. The AI has to be configured via software (and hardware jumpers) in order to accept current signals. If a 4-20 mA sensor has to be connected, the specific hardware jumpers has to be closed (see Figure 31) and the application can be configured through the FX Builder, setting **0-20 mA, 20% suppression**.

The FX15 can be connected to P299xAx series of Johnson Controls® pressure sensors which generate a 4-20 mA signal.

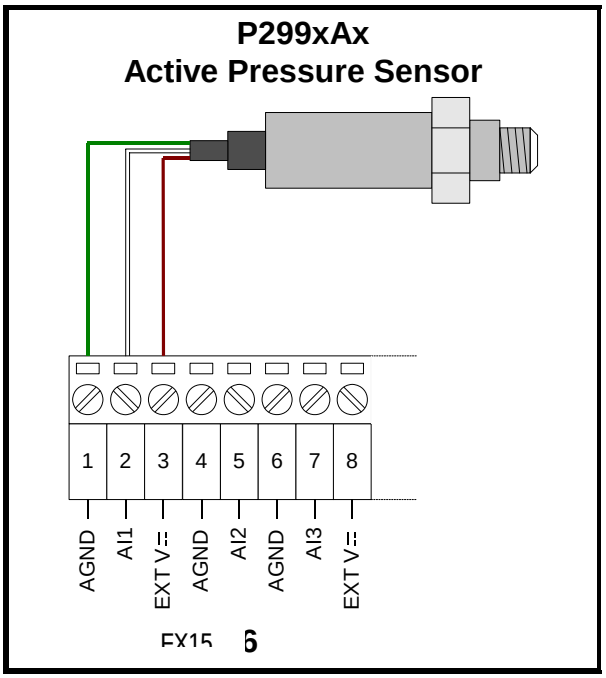


Figure 34: Pressure Sensor Connection Diagram

Table 5: Active Current Sensors

FX15 Terminals	P299xAx Cable	Description
AGND (1)	Green	Common Reference
EXT V (3)	Brown	Sensor Power Supply 16 V, 80 mA
AI1 (2)	White	Pressure Output 4-20 mA

Note: The numbers between the brackets are the FX15 terminal numbers.

Connecting Active Sensors Powered by 24 VAC

The FX15 can accept active temperature, pressure, flow, and humidity sensors providing 0-10 V or current signals powered by 24 VAC.

A second transformer (24 VAC/24 VAC, 3 VA maximum) powering only the Analog Input is required in order to maintain the insulation from the microprocessor.

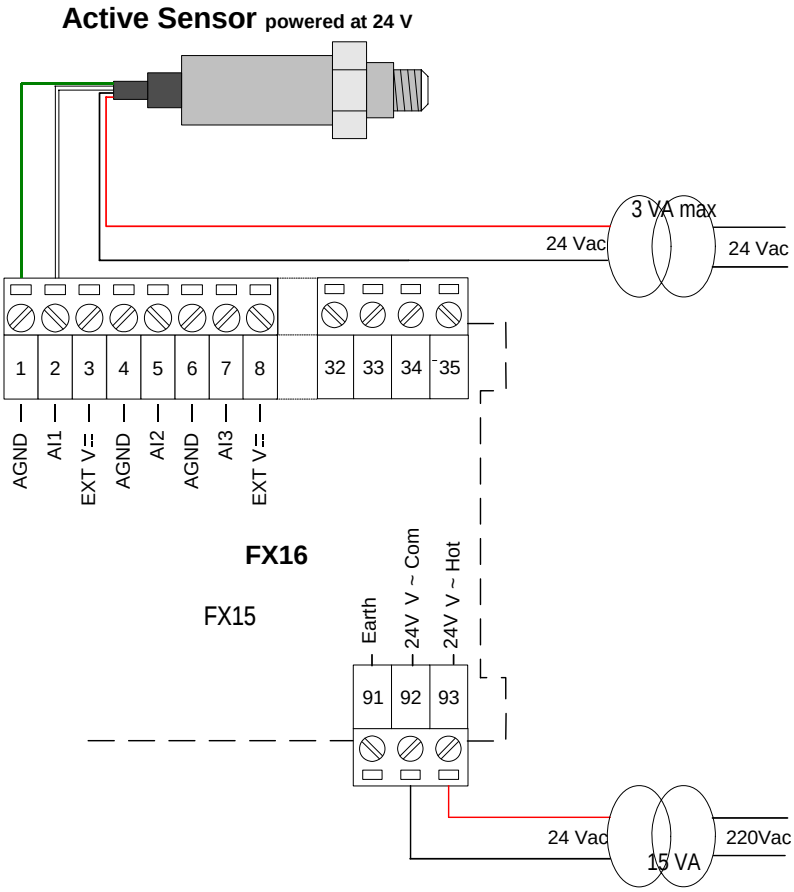


Figure 35: Active Sensor powered at 24 VAC Connection Diagram

Table 6: Active Sensors Powered by 24 VAC

FX15 Terminals	Sensor Cable	Description
AGND (1)	Green	Common Reference
AI1 (2)	White	Signal Output

Note: The numbers between the brackets are the FX15 terminal numbers.

IMPORTANT: Not powering the Analog Input with a second transformer or powering the AI with the power supply on another FX controller, will result in a short circuit causing the failure of the FX15.

Digital Inputs

The FX15 features eight opto-isolated digital inputs from potential free contacts. A digital input is active depending on its polarity setting. The default setting is **Direct**, which means that it is active (true) when closed.

See *I/O Technical Details* for the complete FX15 I/O table.

Digital Inputs Powered by 24 VAC

The eight FX15 Digital Inputs must be 24V powered, through terminals 34 and 35, both AC or DC voltage can be used, if DC is used then the power supply of the DIs will have to be necessarily independent from the controller power supply, being the FX15 compatible with VAC power only. The digital inputs can use the same FX15 voltage supply or they can be separately powered, in order to maintain the microprocessor opto-isolation from the controller voltage supply.

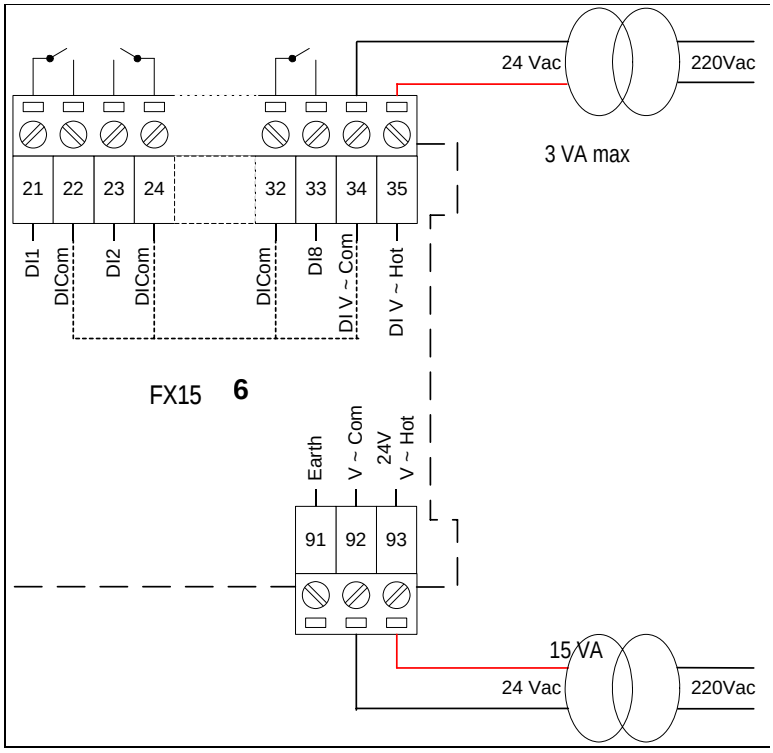


Figure 36: Powering Digital Inputs Maintaining Opto-Isolation

Table 7: Digital Inputs Powered by 24 VAC

FX15 Terminals	Description
DI V ~ Hot (35)	24 VAC, Digital Inputs Power Supply
DI V ~ Com (34)	Digital Inputs Power Supply Common
DI8 (33)	Digital Input 8, Voltage-Free contact
DICom (32)	Common Reference, Voltage-Free contact

Note: The numbers between the brackets are the FX15 terminal numbers.

Using Analog Inputs as Digital Inputs

In case the user needs more than the 8 digital inputs available, the FX15 allows you to use an analog input as digital input.

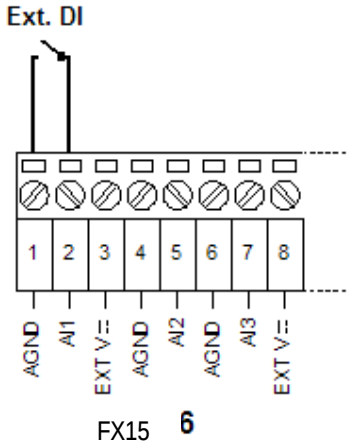


Figure 37: Digital Input Connection Diagram

The Analog Input needs to be properly configured in FX Tools to read the digital input.

Analog Outputs

The FX15 provides up to four, 0-10 VDC, 2A maximum, opto-isolated analog outputs. The Analog Output objects provide the interface between the four hardware Analog Output channels and the control application. See *I/O Technical Details at page 54* for the complete FX15 I/O table.

The analog outputs can be configured for direct or reverse acting in the application software.

The output signal can be limited by high limit (MaxOutput) and low limit (MinOutput) values.

Powering and Connecting the Analog Outputs

The analog outputs can be separately powered, through Terminals 79 and 80, in order to ensure microprocessor isolation from the controller power supply (see Figure 39).

The FX15 analog outputs are commonly used to drive proportional devices and can be connected to all the Johnson Controls Proportional Valve Actuators.

The following figure represents the connection diagram.

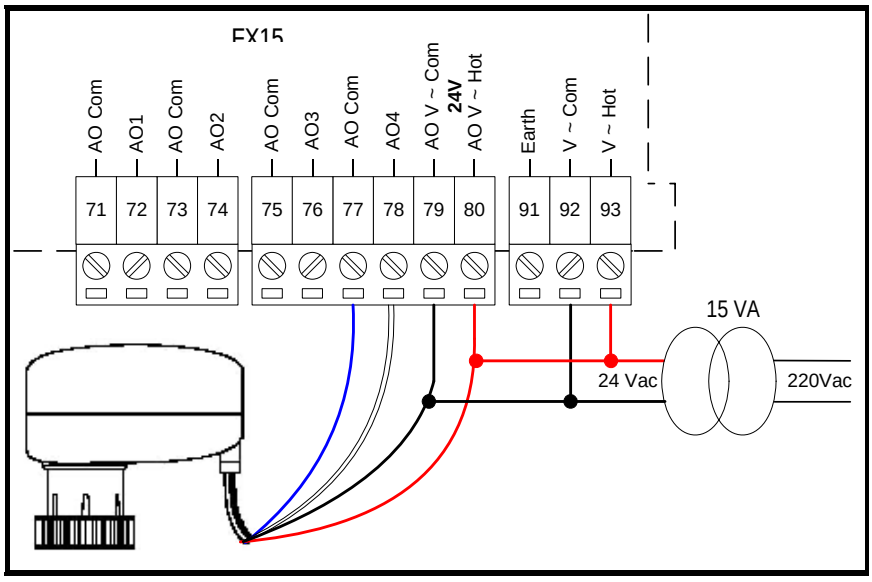


Figure 38: Connecting the Analog Output without Opto-isolation

IMPORTANT: Make sure to respect connection polarities.

FX15 Terminals	Description
AO Com (77)	Common Reference
AO4 (78)	Analog Output 0-10 V
AO V~ Com (79)	Common Reference
AO V~ Hot (80)	Power Supply 24 VAC

Note: The numbers between the brackets are the FX15 terminal numbers.

The insulation from the microprocessor is achieved if a different 24 VAC power supply from the one used to power the controller is used to power the analog outputs (through Terminals 79 and 80).

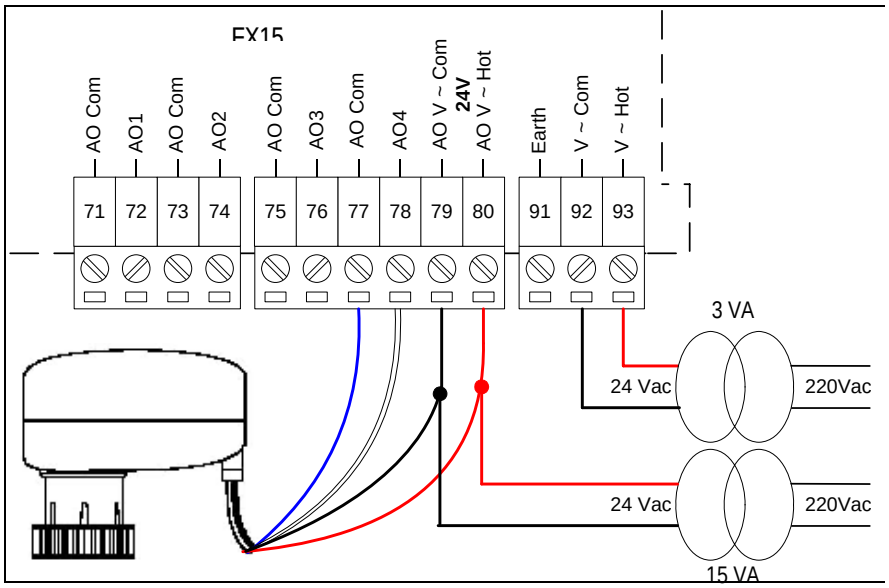


Figure 39: Separately Powering Analog Outputs

FX15 Terminals	Description
AO Com (77)	Common Reference
AO4 (78)	Analog Output 0-10 V
AO V~ Com (79)	AO Common Reference
AO V~ Hot (80)	AO Power Supply 24 VAC
V~ Hot (93)	FX15 Power Supply 24 V
V~ Com (92)	FX15 Common Reference

Note: The numbers between the brackets are the FX15 terminal numbers.

Digital Outputs

The FX15 features 9 digital outputs, available in two hardware configurations: all 9 Relays or 4 Relays and 5 triacs.

The Digital Outputs can be configured for direct acting or reverse acting in the application software.

WARNING: Risk of Electric Shock and Property Damage.
Disconnect each of multiple power supplies before making electrical connections. More than one disconnect may be required to completely de-energize equipment. Contact with components carrying hazardous voltage can cause electric shock and may result in severe personal injury or death.

Connecting the Relays

The FX15 features up to nine Digital Outputs with electromechanical relays. To simplify assembly, the common terminals of some relays have been grouped together. The relays are divided into six groups, according to the distance of insulation.

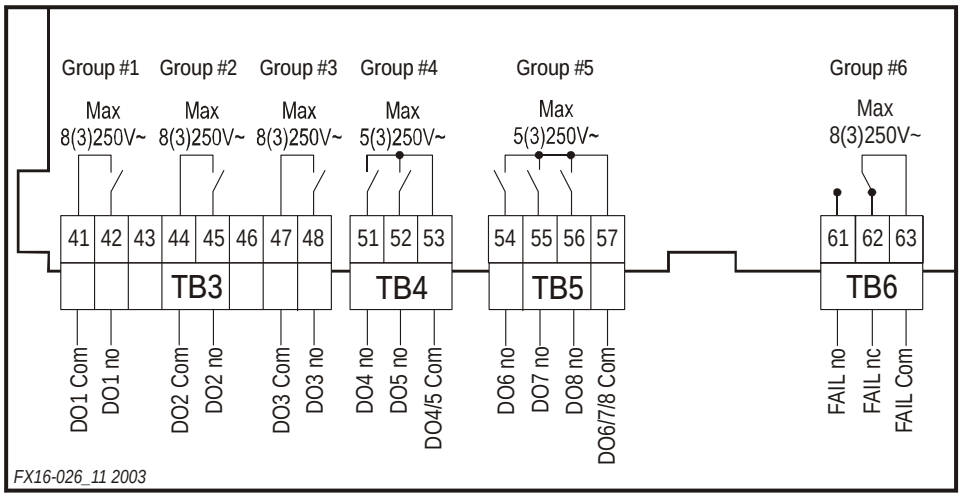


Figure 40: Relay Groups

Inside each group, the relays have just single isolation and thus must be connected to the same voltage supply. Between the groups, there is a double isolation and thus the groups can be connected to different voltage supplies.

Figure 41 displays a typical application of the relay outputs as connection example.

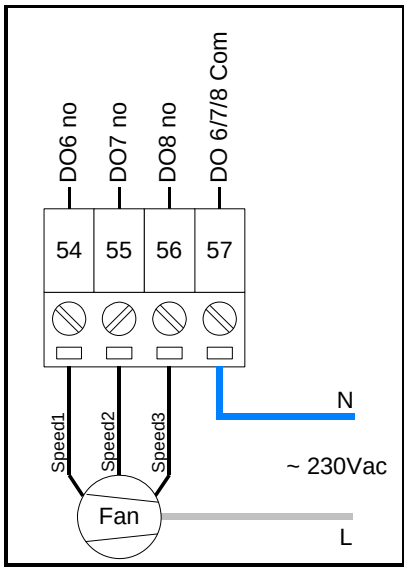


Figure 41: Connecting a Three-Speed Fan Motor

Note: Relays DO6-DO8 are not hardware interlocked and incidental energization of more than one relay at the same time might lead to fan motor damaging.

Connecting the Triacs

The FX15 triac (0.5 A, 24 VAC) digital outputs are commonly used to operate in PAT and DAT modes.

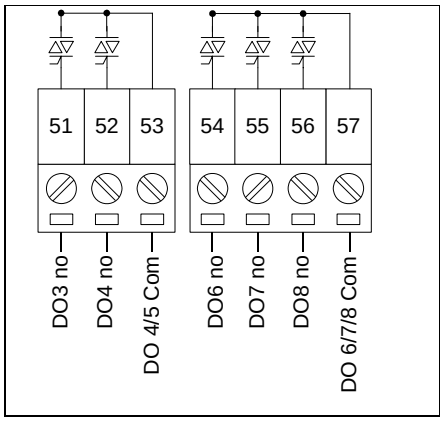


Figure 42: Triac Groups

In particular the Digital Outputs PAT mode can be used through the triac outputs to drive Incremental Valve Actuators.

Figure 43 displays an example of a triac connection.

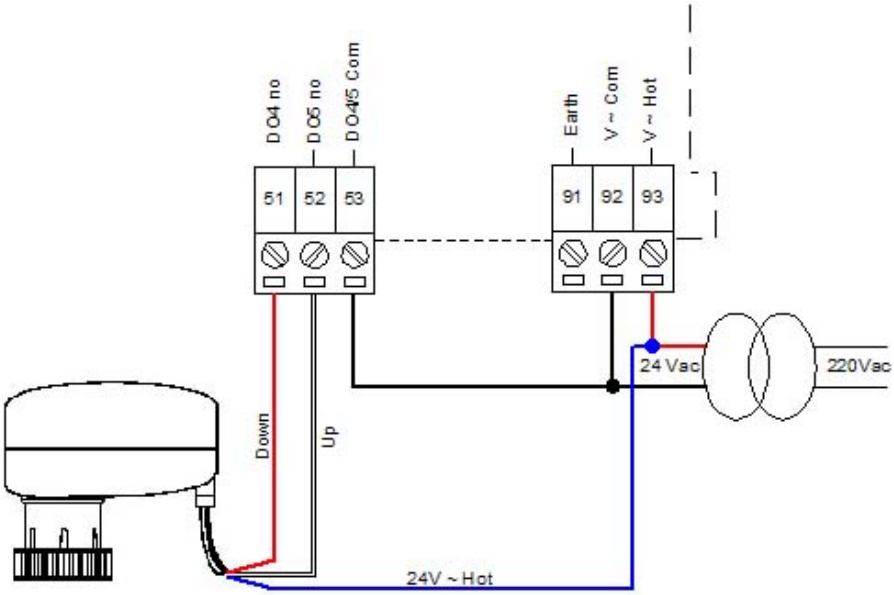


Figure 43: Connecting an Incremental Actuator

FX15 Terminals	Description
DO4 (51)	24V ~ Down command
DO5 (52)	24V ~ Up command
V ~ Hot (93)	24V ~ Hot Reference
DO 4/5 Com (53)	24V ~ Common Reference

Note: Between round brackets are reported the FX15 terminal numbers.

Extension Modules

The input/output capacity of the FX15 may be extended by connecting up to four extension modules via the Extension Bus (XT-Bus, terminal J1).

An extension module if formed by an XT91D00 processor/communications module and one or more XP expansion modules. The expansion modules provide input/output capability for the extension modules. The following are available for the XT91D00 extension module:

- XP91D02: six analog inputs and two analog outputs
- XP91D03: eight digital outputs (triac)
- XP91D04: four digital inputs and four digital outputs (triac)
- XP91D05: eight digital inputs
- XP91D06: four digital outputs 230 VAC (relay) (EU only)
- XP91D07: four digital outputs 24 VAC (relay) (NA only)

Analog inputs to extension modules may be 0-10 V, 0-20 mA or passive RTD-Ni1000 (Johnson Controls characteristic only), Pt1000 or A99 sensors.

Analog inputs to the XPA-421-5 module only may additionally be RTD-Ni1000 (LandG and DIN), Pt100 and NI100 sensors or a 5 K ohm potentiometer.

Voltage and current inputs from differential pressure transducers can be linearized by a square root function.

Digital inputs to extension modules are potential-free contacts. The input is active (true) when the contact is closed.

Digital counters are available in extension modules, which do not have analog inputs or outputs. Digital counters are associated with digital inputs. The number of positive transitions of the physical digital input required to increment the counter can be programmed in the extension module.

Note: Counter values are saved in EEPROM by XT/XP only at the power down, in the particular situation of an application downloading to the FX15 the increments occurred from the last XT/XP power-up and the download are lost. The problem can be overcome if a power down of the XT/XP module of interest is executed right before proceeding with the program download.

Analog outputs in extension modules can be configured to provide 0-10 V, 0-20 mA or 4-20 mA signals. The output is ranged by low range and high range variables to provide a 0-100% signal to the extension module.

Digital outputs in extension modules can only be configured as on/off or pulse type, and the physical output may be a triac or a relay contact. Pulse type outputs switch on for a configurable period (1 to 1275 ms) for each transition of the connected variable.

An XT91D00 can be combined with its expansion modules to provide the following configurations:

- 8 analog inputs/outputs
- 8 digital inputs/outputs, with digital counters associated with the digital inputs
- 8 analog inputs/outputs and eight digital inputs/outputs
- 16 digital inputs/outputs, with digital counters associated with the digital inputs within the first eight input/output points

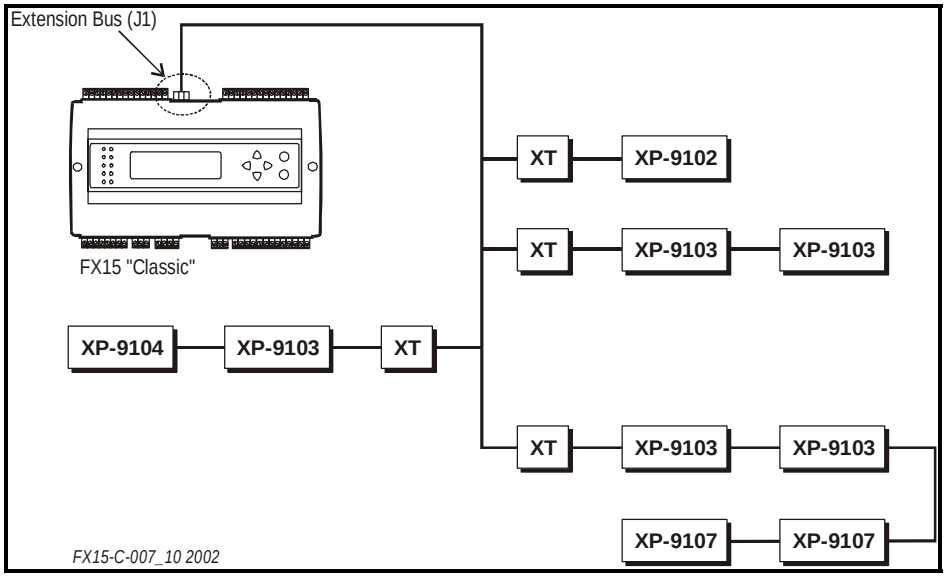


Figure 44: Example of Maximum Configuration

Troubleshooting

Reading 9999 or Invalid from the Analog Inputs

- **Error/Condition:** The Analog Input object retrieves an Invalid value through network variables or the User Interface Unit shows 9999 or Invalid customized tag;
- **Problem:** Happens in the case the signal applied to the Analog Input channel does not match with the one configured via software on the Analog Input Object. The read signal is outside the configured reliability range. The problem can be due to the Jumper configuration of the Analog Input channel, which can not be set according to the signal provided by the sensor.

- **Solution:** In case the signal does not match with the configured, change the Analog Input Object configuration via FX Builder. If the software is properly configured but the problem still happens, check the analog inputs jumpers are properly set in order to accept the sensor signal and verify the probe functioning and wirings.

Can Not Properly Read Current Sensors

- **Error/Condition:** Connecting an active, current sensor to an Analog Input channel, the AI Object retrieves an Invalid value.
- **Problem:** In the case the AI Object is properly configured and the probe is correctly wired and functioning, the problems may be due to a wrong AI Jumper configuration.
- **Solution:** A dedicated Jumper is placed on board for each Analog Input Channel. This Jumper is used in its close configuration in the case the connected sensor provides a Current signal (0-20/4-20 mA). Its open configuration has to be used for Resistive, Ratio-Metric or Voltage (0-2/0-10 V) input signals.

Operation

Introduction

The FX15 is a high performance field controller and it has been designed to respond to a wide range of applications including dual compressor chillers and rooftops, close control units, packaged air handling units, unit vents, and water source heat pumps.

The FX15 has 27 physical input/output points on board and can be further expanded by connecting the XT91D00/XP91Dxx Series expansion modules.

Parameters in the control application can be displayed and modified from the optional user interface.

Key Concepts

Software Programming and Application Configuration

The FX15 provides configurable control algorithm, memory and connectivity services, real-time functions, and I/O expansion through its customizable, objects and services oriented, architecture. The device configurations can be created and downloaded into the target controllers via the FX Tools Pro software package.

The tools available in the package are:

- **FX Builder**: The programming and configuration of the Facility Explorer controllers is done using the menus, navigation trees, and graphic screens of the FX Builder tool. The configuration includes the definition of the controllers to be connected, the physical inputs and outputs and data points to be monitored and the format of the display screen of the controller.
- **FX Builder Express**: A simplified version of the FX Builder, called FX Builder Express, is also available to configure a library of standard applications specifically designed for Facility Explorer controllers. The configuration is done using the specific graphic user interfaces of the FX Builder Express.

- **FX CommPro N2/LON**: Parameter configuration, machine tuning, default parameters saving for successive configurations are all things possible with the FX CommPro tool with two protocols supported: N2 Open, LONWORKS.

Alarm and Event Management

The FX15 manages and records events or alarms that are associated with data points or variables in the control application.

The table of active events and the event history log may be viewed on the user interfaces.

Time Scheduling

This feature allows introducing functions based on a weekly time schedule. The clock is battery backed up with an average duration time of 2 years.

User Interfaces

The FX15 can have different user interface options (integrated, local, or remote) proving the possibility to display and edit all the data point and information of the running application. The user interface is fully configurable at design time.

Security

The FX Tools and the FX controllers come with an embedded security features based on the use of two IDs: the Family ID and the Customer ID. This security feature prevents tampering with the applications and provides source code protection.

Supervisory Option

The FX15 can be integrated into a supervisory building automation system for continuous monitoring of the control system. The FX15 supports two methods of integration:

- N2 Open Integration
- LONWORKS Integration

Application Upload/Download

The FX15 is a fully programmable controller and the application can be downloaded to the controller with the FX Tools or uploaded/downloaded via Programming Key.

User Interface

The FX15 can be connected to up to two remote user interfaces with the possibility to display/edit all the data point and information of the running application. The user interface application is fully configurable at design time. The user interface must be of the same type. The user interfaces are optional, which means that the controller can work also without any display plugged-in.

The configuration is **integrated**, **local**, for example: panel mount (up to 3 m [9.8 ft]) or **remote**, for example: wall mount (up to 1km [0.6 mi]):

- **integrated:** directly plugged on top of the controller
- **local:** up to 3 m (9.8 ft) from the controller, power supply and data communication via the flat telephone cable included in the LP-KIT007-000C
- **remote:** up to 300 m (984 ft) from the controller.

  The display must be independently powered; the data communication is done via a 3 pole shielded cable (not provided) connected to the Remote Display Connection of the FX15.

The FX15 can support 1 integrated user interface or 1 panel mount or wall mount user interface or 1 panel mount display + 1 wall mount user in or 2 wall mount ones. For the panel mount connection use the pre-cabled connection kit (LP-KIT007-000C), 3 m (9.8 ft) long, with a phone jack on the MUI side and a preassembled screw connector on the FX15 side.

The user interface models connectable to the FX15 are:

- **LP-DIS65P10-0C:** Large User Interface (LUI), panel, flush mount or hand held, 4x20 backlit LCD, IP54, extended temperature range: -20 to +50°C (68 to 122°F), standard JCI front-plate. The front-plate is fully customizable upon minimum order.

Figure 45 : Large User Interface (LUI)

- **LP-DIS60U10-C:** Integrated Medium User Interface, Integrated, 4x20 backlit Lighting Control Data (LCD), IP54, extended temperature range: -20°C (68°F) to 50°C (122°F)

Figure 46 : Integrated Medium User Interface (MUI)

- **LP-DIS60P10-0C/LP-DIS60P11-0C**: Medium User Interface, 4x20 backlit LCD, IP54, extended temperature range: -20°C (68°F) to 50°C (122°F). Panel mount, non-isolated version, and wall mount isolated version

Figure 47 : Medium User Interface (MUI)

For more details about the connection possibilities, refer to the specific user interface technical bulletin.

Security

The FX Tools Pro and the Facility Explorer controllers come with an embedded security feature based on the use of two IDs: the Family ID and the Customer ID.

Family ID

Family ID differentiates different hardware types and prevents the downloading of the wrong application to the wrong controller.

Table 8: Family ID

Facility Explorer Controller	FX Builder Code	Family IDs
FX05 Advanced	FX05P11-02	0218
	FX05P11-12	0210
	FX05P11-22	0211
	FX05P12-02	0212
	FX05P12-12	0214
	FX05P12-22	0215
	FX05P13-02	0213
	FX05P13-12	0216
	FX05P13-22	0217
FX10 Standard	FX10B1x	0301
FX10 Advanced	FX10B3x	0311
FX15	FX15D1x	0402
FX15 Universal	FX15D0x	0401

Customer ID

Customer ID protects a controller downloaded with a custom developed application and protects the application source code from editing by unauthorized users. Three Customer ID types are used:

- **Public ID**: applications that are saved with Public ID can be downloaded and commissioned by any user with the Public ID enabled in FX Tools.
- **Demo ID**: applications that are saved with the Demo ID can only be downloaded to demo controllers.
- **Customer/Private Specific ID**: Applications that are saved with a specific customer/private ID will make those applications source files readable only by users who have the same ID enabled in FX Tools. Once a controller has been downloaded with a specific Customer ID, the controller will become customer specific and only allow downloading of application with the same customer specific ID.

Specifications and Technical Data

Ordering Codes

Table 9: FX15 Controller

Ordering Codes	Description
LP-FX15D10-000C	FX15, 4 Relays + 5 triacs, without the application
LP-FX15D11-000C	FX15, 4 Relays + 5 triacs, N2 Open card preassembled, without the application
LP-FX15D12-000C	FX15, 4 Relays + 5 triacs, LONWORKS card preassembled, without the application
LP-FX15D60-000C	FX15, 4 Relays + 5 triacs, integrated MUI display, without the application
LP-FX15D61-000C	FX15, 4 Relays + 5 triacs, N2 Open card preassembled, integrated MUI, without the application
LP-FX15D62-000C	FX15, 4 Relays + 5 triacs, LONWORKS card preassembled, integrated MUI, without the application
LP-FX15D20-000C	FX15, 9 Relays, without the application
LP-FX15D21-000C	FX15, 9 Relays, N2 Open card preassembled, without the application
LP-FX15D22-000C	FX15, 9 Relays, LONWORKS card preassembled, without the application
LP-FX15D70-000C	FX15, 9 Relays, integrated MUI display, without the application
LP-FX15D71-000C	FX15, 9 Relays, N2 Open card preassembled, integrated MUI, without the application
LP-FX15D72-000C	FX15, 9 Relays, LONWORKS card preassembled, integrated MUI, without the application

Table 10: FX15 Extended Range Controller

Ordering Codes	Description
LP-FX15X10-000C	FX15, 4 Relays + 5 triacs, without the application
LP-FX15X11-000C	FX15, 4 Relays + 5 triacs, N2 Open card preassembled, without the application
LP-FX15X12-000C	FX15, 4 Relays + 5 triacs, LONWORKS card preassembled, without the application
LP-FX15X20-000C	FX15, 9 Relays, without the application
LP-FX15X21-000C	FX15, 9 Relays, N2 Open card preassembled, without the application
LP-FX15X22-000C	FX15, 9 Relays, LONWORKS card preassembled, without the application

Table 11: Communication Card

Ordering Codes	Description
LP-NET151-010C	N2 Open communication card
LP-NET152-010C	LONWORKS communication card. On-field commissioning

Table 12: User Interface Displays

Ordering Codes	Description
LP-DIS65P10-0C	Large User Interface V.2, (4x20 character) LCD backlit display (LUI with std JCI front plate)
LP-DIS60P10-0C	Medium User Interface V.2, (4 x20 character) LCD backlit display, panel mount version
LP-DIS60P11-0C	Medium User Interface V.2, (4 x20 character) LCD backlit display, wall mount isolated version
LP-DIS60U10-C	Integrated MUI, (4 x 20) LCD backlit display for FX15

Table 13: Accessories

Ordering Codes	Description
LP-KIT007-000C	Link cable for the connection of the FX15 to the MUI/LUI display –3 m (19 ft)
LP-KIT015-000C	Kit of female screw connectors
LP-KIT015-001C	Kit of female cage clamp connectors
LP-KIT100-000C	FX Programming Key
DT-9100-8901	Power Supply for Programming Key and LUI: 230 VAC/12 VDC
LP-KIT100-001C	Power Supply for Programming Key and LUI: 230 VAC/12 VDC

Table 14: Room Command Modules Available Only in Europe

Ordering Codes	Description
LP-TR23024-10VA	Transformer for FX05, 10 VA
LP-KIT006-000C	Room Sensor module for FX05 +/- dial, occupancy button, fan speed, service port
LP-KIT006-001C	Room Sensor module for FX05 12-28°C dial
LP-KIT006-002C	Room Sensor module for FX05 12-28°C dial, occupancy button, service port
LP-KIT006-003C	Room Sensor module for FX05 +/- dial, occupancy button, service port

Table 15: Room Command Modules Available Only in North America

Ordering Codes	Description
LP-KIT006-004C	Room Sensor module for FX05, warm/cool adjustment dial, occupancy button, fan speed selector switch, service port, US mounting kit
LP-KIT006-005C	Room Sensor module for FX05 warm/cool adjustment dial, occupancy button, US mounting kit
LP-KIT006-006C	Room Sensor module for FX05 setpoint (54-82°F) adjustment dial, occupancy button, fan speed selector switch, service port, US mounting kit
LP-KIT006-007C	Room Sensor module for FX05 setpoint (54-82°F) adjustment dial, occupancy button, service port, US mounting kit

Table 16: Expansion Modules

Ordering Codes	Description
LP-XT91D00-000C	Extension module
LP-XP91D02-000C	Expansion board: 6 AI, 2 AO
LP-XP91D03-000C	Expansion board: 8 DO (triacs)
LP-XP91D04-000C	Expansion board: 4 DI, 4 DO (triacs)
LP-XP91D05-000C	Expansion board: 8 DI
LP-XP91D06-000C	Expansion board: 4 DO (relays) 230 VAC (Europe only)
LP-XP91D07-000C	Expansion board: 4 DO (relays) 24 VAC (North America only)

Table 17: Demo Cases and Controllers

Ordering Codes	Description
DEMO-FX15-071	Demo case FX15 + N2 Open communication, 230 V
DEMO-FX15-072	Demo case FX15 + LON communication, 230 V
DEMO-FX15-081	Demo case FX15 + N2 Open communication, 120 V
DEMO-FX15-082	Demo case FX15 + LON communication, 120 V
LP-FX15DEM-010C	FX15 controller + Integrated display + N2 Open comm. Card with DEMO ID
LP-FX15DEM-011C	FX15 controller + Integrated display + LON comm Card with DEMO ID

Table 18: Software

Ordering Codes	Description
LP-FXTPRO-0	FX Tools Pro CD-Rom (FX Builder, FX Builder Express, FX CommPro N2, FX CommPro LON)
LP-FXTEXP-0	FX Tools Express CD-Rom (FX Builder Express, FX CommPro N2)

Technical Specifications

I/O Technical Details

Table 19: Analog Input (AI)

Terminals	Channel	Type	Remark/Application
TB1 (1-15)	AI1, AI2, AI3, AI4, AI5, AI6	See Figure 30.	Software configurable. Application: temperature, humidity, pressure
TB1 (3, 8)	EXT-VDC	+16 V, 80 mA	Directly power from the controller. Maximum four 0-20/4-20 mA sensors
TB1 (13)	AVPS/EXT-VDC	AVPS = +5 V, 20 mA EXT-VDC = +16 V, 80 mA	To directly power ratiometric sensors, with AVPS **or** 0-10 V, 0/4 - 20 mA Sensors with EXT-VDC. The selection between AVPS and EXT-VDC is done through jumpers.

List of Available Sensor Input

Sensor Type	Linearization Range	Accuracy @ 20°C (68°F) ambient
Ni1000 JCI	-45 to 120 °C (-49 to 248°F)	+/- 0.5° C (0.9°F)
Ni1000 JCI Extended	20 to 287°C (68° to 548.6°F)	+/- 0.5° C (0.9°F)
Ni1000 Siemens™	-50 to 160°C (-58 to 320°F)	+/- 0.5° C (0.9°F)
Ni1000 DIN	-60 to 180°C (-76 to 356°F)	+/- 0.5° C (0.9°F)
Pt1000	-50 to 605°C (-58°F to 1121°F)	+/- 0.6° C (1.08°F)
A99	-50 to 110°C (-58 to 230°F)	+/- 0.5° C (0.9°F)
NTC 2.2K	-40 to 150°C (-40 to 302°F)	+/- 0.5° C (0.9°F)
0 to 5 VDC ratiometric	10 to 90% of supply voltage	0.3%
0 to 10 VDC	0 to 10 Volts	0.3%
0 to 20 mA	0 to 20 mA	0.3%

Table 20: Digital Input (DI)

Terminals	Channel	Type	Remark/Application
TB2 (21-33)	DI1, DI2, DI3, DI4, DI5, DI6, DI7, DI8	Potential free contacts	
TB2 (34, 35)	DI V~ Hot DI V~ Com	24 VAC/DC	Power supply for the Digital Inputs. Must be used in order to maintain the opto-isolation a separate power supply from the one used for the controller.

Table 21: Digital Output (DO)

Terminal	Channel	Type	Remark/Application
TB3	DO1, DO2, DO3	SPST 8(3)A power relays	Maximum switching power: 2000VA, 240W, 0.5HP, 250 VAC UL/CUR rating: 8A 250 VAC 8A 30 VDC VDE rating: 8A 250 VAC Expected electrical life min. operations: 1 x 105 operations (360 ops x hour) Dielectric strength: coil-contacts 4000 Vrms
TB4	DO4, DO5	SPST 5(3)A power relays **or** 0.5A/24 VAC triacs	Maximum switching power: 1.250 VA, 150 W Rating (resistive): 10 A 125 VAC, 5A 250 VAC, 5 A 30 VDC
TB5	DO6, DO7, DO8	SPST 5(3)A power relays **or** 0.5A/24 VAC triacs	Expected electrical life (min operations): 10A 125 VAC 5x104 5A 250 VAC 5x104 5A 30 VDC 105 Dielectric strength: coil-contacts 4000 Vrms for 1 min
TB6	DO9	SPDT NC 8(3)A 250V relay	Same as TB3 relays Fail relay for enhanced security. The relay will return to its NC position not only at power fail but also in case the microprocessor should fail: watch-dog, brown-out, etc.

Table 22: Analog Output (AO)

Terminals	Channel	Type	Remark/Application
TB7	AO1, AO2	0-10 VDC (maximum 1.5 mA)	Used to drive motor actuators, power triacs, frequency drives. 16-bit resolution.
TB8	AO3, AO4	0-10 VDC (maximum 1.5 mA)	Used to drive motor actuators, power triacs, frequency drives. 16-bit resolution.
TB8 (79, 80)	AO V~ Hot AO V~ Com	24 VAC	Power supply for the Analog Outputs. In order to maintain the opto-isolation a separate power supply from the one used for the controller, must be used.

N2 Open Card

Table 23: N2 Open Card

RS-485 line	Maximum length without repeater: 1200 m (4000 ft), AWG26 twisted pair with shield.
Devices	Maximum of 32 per 1200 m (4000 ft) bus segment.
RS-485/232 Converter	IU-9100 if third party converter is used then make sure it supports automatic DSC (Data Send Control)
Electrical Isolation	1500 V

LON Connection

Table 24: LON Connection

LON network and Line Terminators	Daisy chained Bus Topology: two terminators of 100 ohm required, one at each end of the bus. Free (start) topology: single terminator of 50 ohm required.	
Nodes	64 (if repeaters are not used), FTT-10 nodes only.	
Cable type:	**Length with FTT-10 devices**	
	Bus Topology	**Free Topology**
Belden® 85102	2700 m (1.7 mi)	500 m (0.3 mi)
Belden 8471	2700 m (1.7 mi)	500 m (0.3 mi)
Level IV 22 AWG	1400 m (0.9 mi)	400 m (0.3 mi)

Programming Key

Table 25: Programming Key

Power Supply	Directly powered from the Display Bus port of the FX15 or from an AC/DC adapter 230V to 12 VAC ÷ 15 VDC min 2 VA
Memory type and size	Flash memory 1 Mbytes
Connection to controller	Via RS-485, not isolated, 10 cm cable provided with the key
Enclosure IP class	IP40
Ambient Limits	Operating: 0°C (32°F) – 40°C (104°F), 10-95% rH (noncondensing) Storage: -20°C (-4°F) – 70°C (158°F), 10-95% rH (noncondensing)
Compliance	**Europe** - 89/336/EEC, EMC Directive: EN 61000-6-3, EN 61000-6-1

FX15 Controller

Table 26: FX15 Controller

Product	FX15
Power Supply Requirements	24 VAC ±15%, 50/60 Hz - Class 2 Power Supply
Power Consumption	15 VA at maximum load
Protection Class	IP20 controller IP40 integrated MUI
Isolation	See Isolation Diagram.
Ambient Operating Conditions	-20 to +50°C (-4 to 122°F), 10 to 95% rH (noncondensing)
Ambient Storage Conditions	-20 to +70°C (-4° to 158°F), 10 to 95% rH (noncondensing)
Dimensions (H x W x D)	142 mm (5.6 in.) x 215mm (8.5 in.) x 49 mm (1.9 in.)
Weight (with package)	0.74 Kg (1.6 lb)
I/O ratings	See *I/O Technical Details*.
Connection terminals for signals and power supply	Screw terminals for maximum 1 x 1.5 mm^2 (0.002 $in.^2$) wires or Cage clamp connectors 1 x 1.5 mm^2 (0.002 $in.^2$) wires **To be ordered separately**
LON/N2 Open bus connection terminals	Screw terminals, cable size 0.05 to 1.5 mm^2 (0.002 $in.^2$), AWG30 to AWG14 Belden cable, 2-core twisted pair with shield
Connection terminals for extension bus and remote display	Screw terminals, cable size 0.05 to 1.5 mm^2 (0.002 $in.^2$), AWG30 to AWG14
Continued on next page…	

Single cable lengths	Maximum 100 m (328.1 ft) with diameters ≥ 0.6 mm (0.02 in.)
Digital Inputs DI1 - DI8	Maximum 100 m (328.1 ft) with diameters ≥ 0.6 mm (0.02 in.)
Analog Inputs AI1 - AI6	Maximum 100 m (328.1 ft) where A ≥ 1.5 mm^2 (0.002 $in.^2$)
Triac outputs (when present)	Maximum 100 m (328.1 ft) where A ≥ 1.5 mm^2 (0.002 $in.^2$)
Analog Outputs AO1 - AO4	Maximum 3 m (9.8 ft) if display is powered by controller. Maximum 1km (1.9 mi) if display independently powered
Remote Display	Maximum 1km (0.6 mi)
Extension Modules	Belden 4-core, twisted pair, shielded
Display and Extensions cable type	
Compliance	**Europe** – 89/336/EEC, EMC Directive: EN 50081-1 (EN 61000-6-3), EN 50082-1 (EN 61000-6-1), 72/23/EEC, Low Voltage Directive: EN 60730.
	Canada – UL Listed (PAZX7), CAN/CSA C22.2 No. 205, Signal Equipment. UL Recognized (XAPX8), CAN/CSA C22.2 No. 24, Temperature Indicating and Regulating Equipment. Industry Canada, ICES-003.
	United States – UL Listed (PAZX), UL 916, Energy Management Equipment. UL Recognized (XAPX2), UL 873, Temperature Indicating and Regulating Equipment. FCC compliant to CFR 47, Part 15, Subpart B, Class A.

FX15 Extended Range

Table 27: FX15 Extended Range

Product	FX15 extended range
Power Supply Requirements	24 VAC ±15%, 50/60 Hz - Class 2 Power Supply
Power Consumption	15 VA at maximum load
Protection Class	IP20 controller IP40 integrated MUI
Isolation	See Isolation Diagram.
Ambient Operating Conditions	**-40 to 60°C (-40 to 140°F)**, 10 to 95% rH (noncondensing)
Ambient Storage Conditions	-20 to +70°C (-4 to 158°F), 10 to 95% rH (noncondensing)
Dimensions (H x W x D)	142 mm (5.6 in.) x 215 mm (8.5 in.) x 49 mm (1.9 in.)
Weight (with package)	0.74 Kg (1.6 lb)
I/O ratings	See I/O Technical Details.
Connection terminals for signals and power supply	Screw terminals for a maximum 1 x 1.5 mm^2 (0.002 in^2) wires, included in the package.
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LON/N2 Open bus connection terminals	Screw terminals, cable size 0.05 to 1.5 mm^2 (0.002 $in.^2$), AWG30 to AWG14, included in the package. Belden cable, 2-core twisted pair with shield
Connection terminals for extension bus and remote display	Screw terminals, cable size 0.05 to 1.5 mm^2 (0.002 $in.^2$), AWG30 to AWG14, included in the package.
Single cable lengths	
Digital Inputs DI1 - DI8 *Analog Inputs AI1 - AI6*	Maximum 100 m (328.1 ft) with diameters ≥ 0.6 mm (0.02 in.)
Triac outputs (when present)	Maximum 100 m (328.1 ft) with diameters ≥ 0.6 mm (0.02 in.)
Analog Outputs AO1 - AO4 *Remote Display*	Maximum 100 m (328.1 ft) where A ≥ 1.5 mm^2 (0.002 $in.^2$)
Extension Modules	Maximum 100 m (328.1 ft) where A ≥ 1.5 mm^2 (0.002 $in.^2$)
Display and Extensions cable type	Maximum 3 m (9.8 ft) if display is powered by controller. Maximum 1 km (1.9 mi) if display independently powered
	Maximum 1km (0.6 mi)
	Belden 4-core, twisted pair, shielded
Compliance	**Europe** – 89/336/EEC, EMC Directive: EN 61000-6-3, EN 61000-6-1 – 72/23/EEC, Low Voltage Directive: EN 60730
	Canada – UL Listed (PAZX7), CAN/CSA C22.2 No. 205, Signal Equipment
	– UL Recognized (XAPX8), CAN/CSA C22.2 No. 24, Temperature Indicating and Regulating Equipment
	– Industry Canada, ICES-003.
	United States – UL Listed (PAZX), UL 916, Energy Management Equipment
	– UL Recognized (XAPX2), UL 873, Temperature Indicating and Regulating Equipment
	– FCC compliant to CFR 47, Part 15, Subpart B, Class A

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

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