

# FX15 Controller

<b>Introduction to FX15 Controller .....</b>	<b>3</b>
<b><i>Key Concepts</i> .....</b>	<b>4</b>
FX15 Controller.....	4
<b>Installation.....</b>	<b>5</b>
North American Emissions Compliance.....	6
<b><i>Detailed Procedures</i> .....</b>	<b>7</b>
Mounting Instructions.....	7
Assembling the Integrated MUI.....	8
Connection Details.....	10
Connection Details for I/O Expansion (XT-XP Modules) on Local Extension Bus.....	13
Connection Details for the N2 Open Card .....	13
Connection Details for the LONWORKS Card.....	17
Connection Details for the Remote User Interface .....	19
Connection Details for the FX Programming Key .....	22
<b>Inputs and Outputs .....</b>	<b>26</b>
<b><i>Introduction</i> .....</b>	<b>26</b>
<b><i>Key Concepts</i> .....</b>	<b>27</b>
<b><i>Detailed Procedures</i> .....</b>	<b>28</b>
Isolation Diagram.....	28
FX15 Controller I/Os Powered at 24 VAC.....	29
Analog Inputs.....	30
Digital Inputs.....	36
Analog Outputs.....	37
Digital Outputs .....	39
Extension Modules .....	42
<b><i>Troubleshooting</i>.....</b>	<b>44</b>
Reading 9999 or Invalid from the Analog Inputs.....	44
Cannot Properly Read Current Sensors .....	44

<b>Operation.....</b>	<b>45</b>
<b><i>Introduction.....</i></b>	<b>45</b>
<b><i>Key Concepts.....</i></b>	<b>45</b>
Software Programming and Application Configuration .....	45
Alarm and Event Management .....	46
Time Scheduling .....	46
User Interfaces .....	46
Security.....	46
Supervisory Option .....	46
Application Upload/Download.....	46
User Interface .....	47
Security.....	49
<b>Specifications and Technical Data.....</b>	<b>50</b>
<b><i>Ordering Codes.....</i></b>	<b>50</b>
<b><i>Technical Specifications.....</i></b>	<b>53</b>
I/O Technical Details.....	53
N2 Open Card.....	55
LONWORKS Connection.....	55
Programming Key .....	56
FX15 Controller.....	56
FX15 Extended Range Controller .....	57

# Introduction to FX15 Controller



**Figure 1: FX15 Classic Controller**

The FX15 controller 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 FX15 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 onboard, real-time clock circuit is also included to support the start-stop scheduling of equipment and real-time based control sequences.

The FX15 controller 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
- LONWORKS plug-in communication card
- user interface: Medium User Interface (MUI) and Large User Interface (LUI)

## ***Key Concepts***

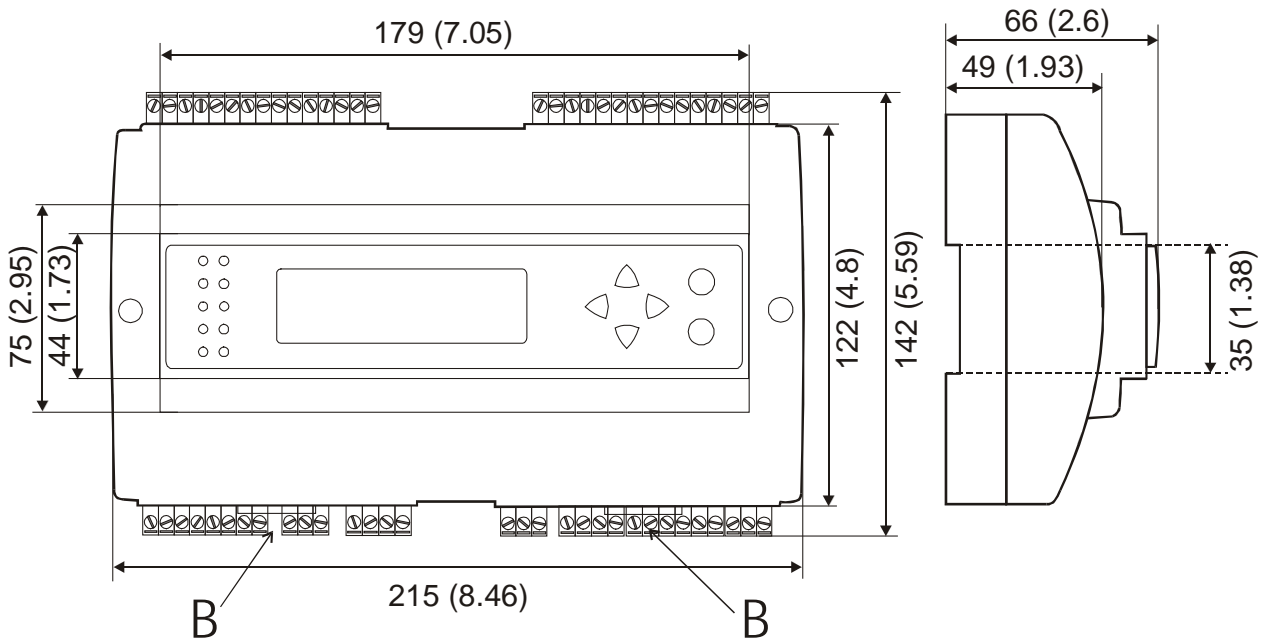
### **FX15 Controller**

#### ***Features***

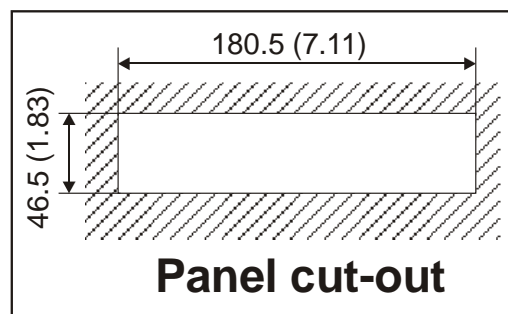
- fully programmable using FX Tools package
- interchangeable RS-485, N2 Open, or LONWORKS FTT10 communication cards for supervisory system
- DIN rail mounting
- female connector option: screw or spring clamp connectors
- Input/Output (I/O) expansion modules
- optional user interfaces: integrated, local, 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 describes the process of installing an FX15 controller.



**Figure 2: Mounting Dimensions for FX15 Controller, mm (in.)  
(Shown with Integral User Interface and Screw Connectors)**



**Figure 3: Panel Cut-Out Dimensions for User Interfaces, mm (in.)**

Two different types of terminal connectors are available: spring clamp or screw connectors. The screw connectors are included, whereas 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 controller.



**WARNING: Risk of Electric Shock.** Disconnect or isolate all power supplies before making electrical connections. More than one disconnect or isolation 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.

**AVERTISSEMENT: Risque de décharge électrique.** Débrancher ou isoler toute alimentation avant de réaliser un branchement électrique. Plusieurs isolations et débranchements sont peut-être nécessaires pour couper entièrement l'alimentation de l'équipement. Tout contact avec des composants conducteurs de tensions dangereuses risque d'entraîner une décharge électrique et de provoquer des blessures graves, voire mortelles.

## Mounting Instructions

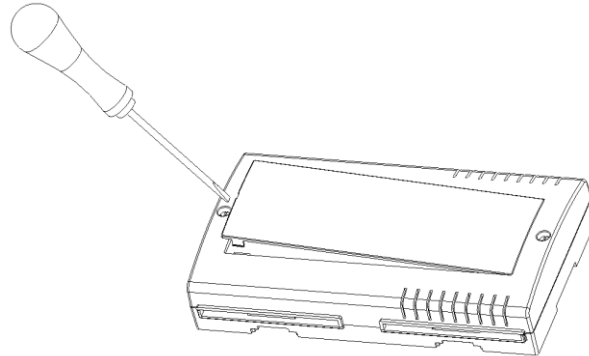
To mount an FX15 controller:

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<sup>2</sup> (0.002 in.<sup>2</sup>)/14 AWG cable. Two types are available: screw and cage clamp connectors. For details, see *Ordering Codes*.  
  
Make terminations of the Supervisor Link, Expansion Bus, and Remote Display 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

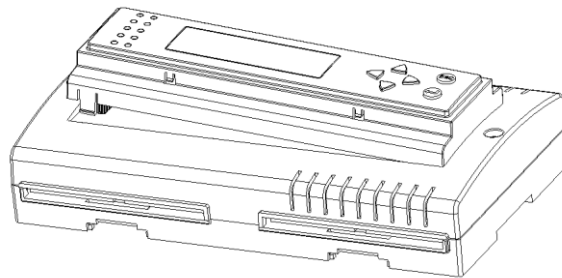
To assemble the integrated MUI:

1. Remove the FX15 controller front cover screws.



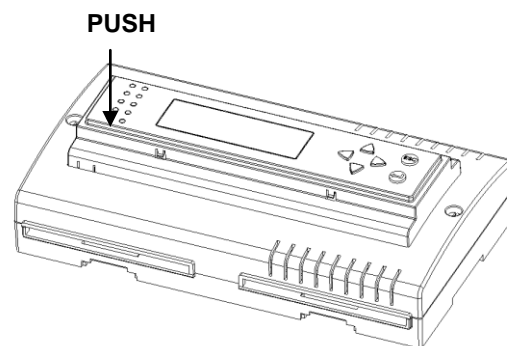
**Figure 4: Open the FX15 Controller**

2. Hook the display to the top of the FX15 controller cover.



**Figure 5: Display Installation**

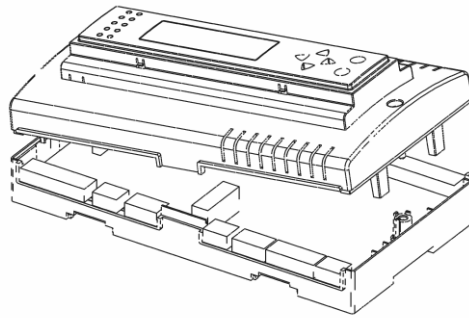
3. Push the display down until it locks into the FX15 controller.



**Figure 6: Display Locking**

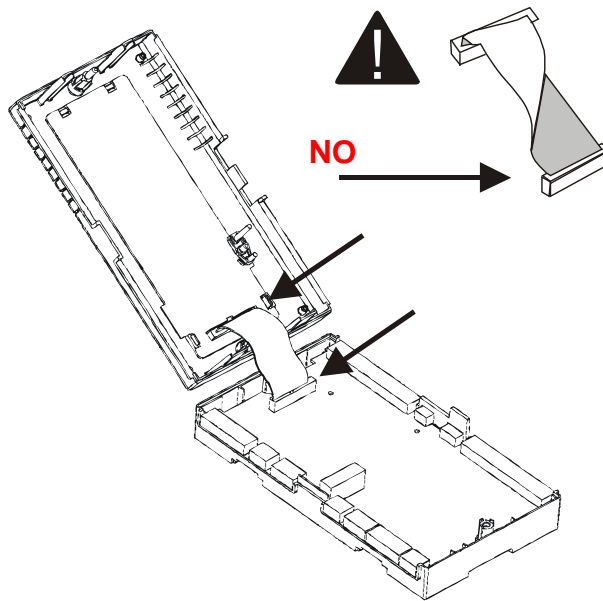


4. Open the FX15 controller.



**Figure 7: Open the FX15 Controller**

5. Install the ribbon cable. Do not twist the ribbon cable; keep the ribbon cable flat.

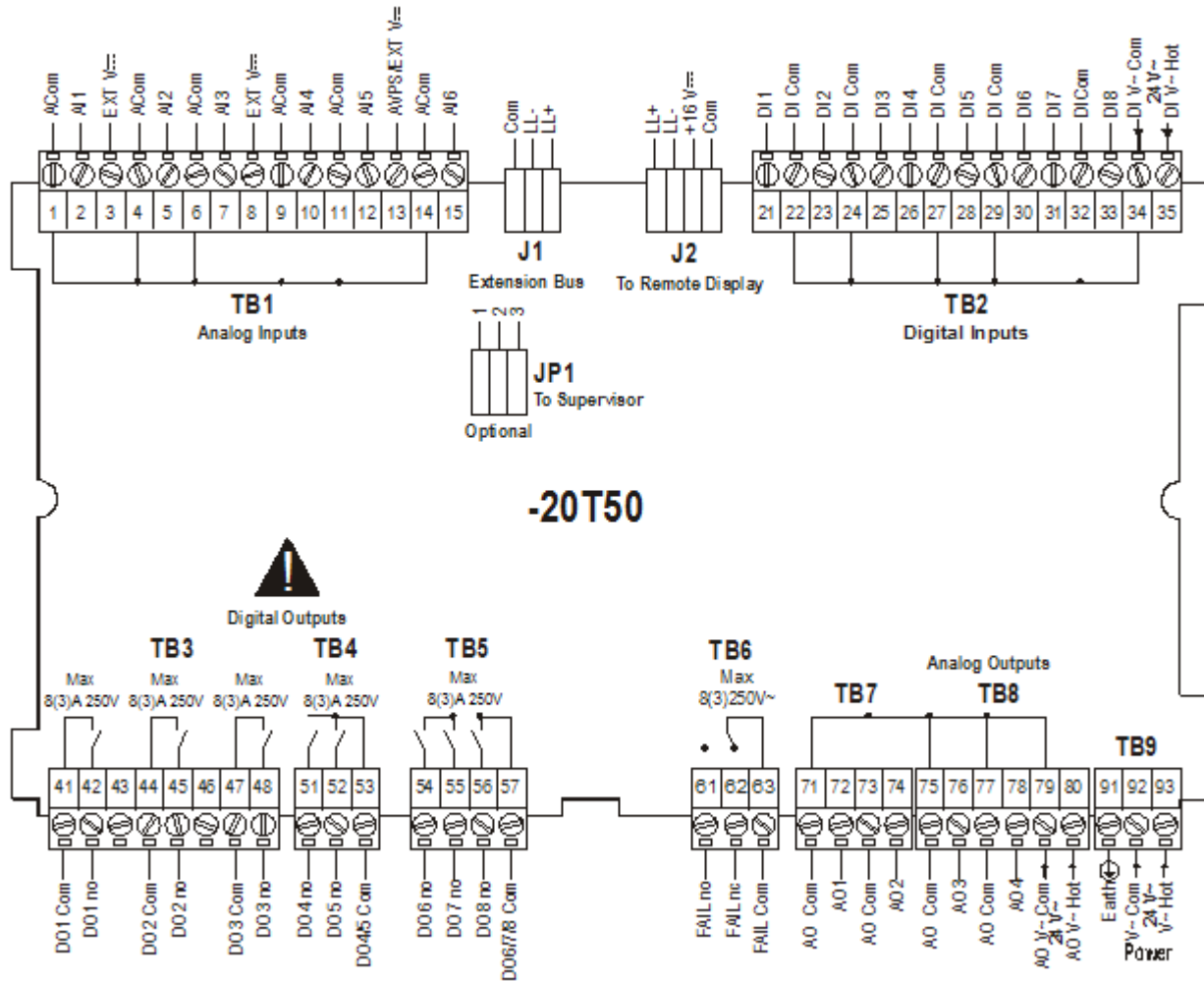


**Figure 8: Ribbon Cable Installation**

6. Close the FX15 controller and secure the two front cover screws.

## Connection Details

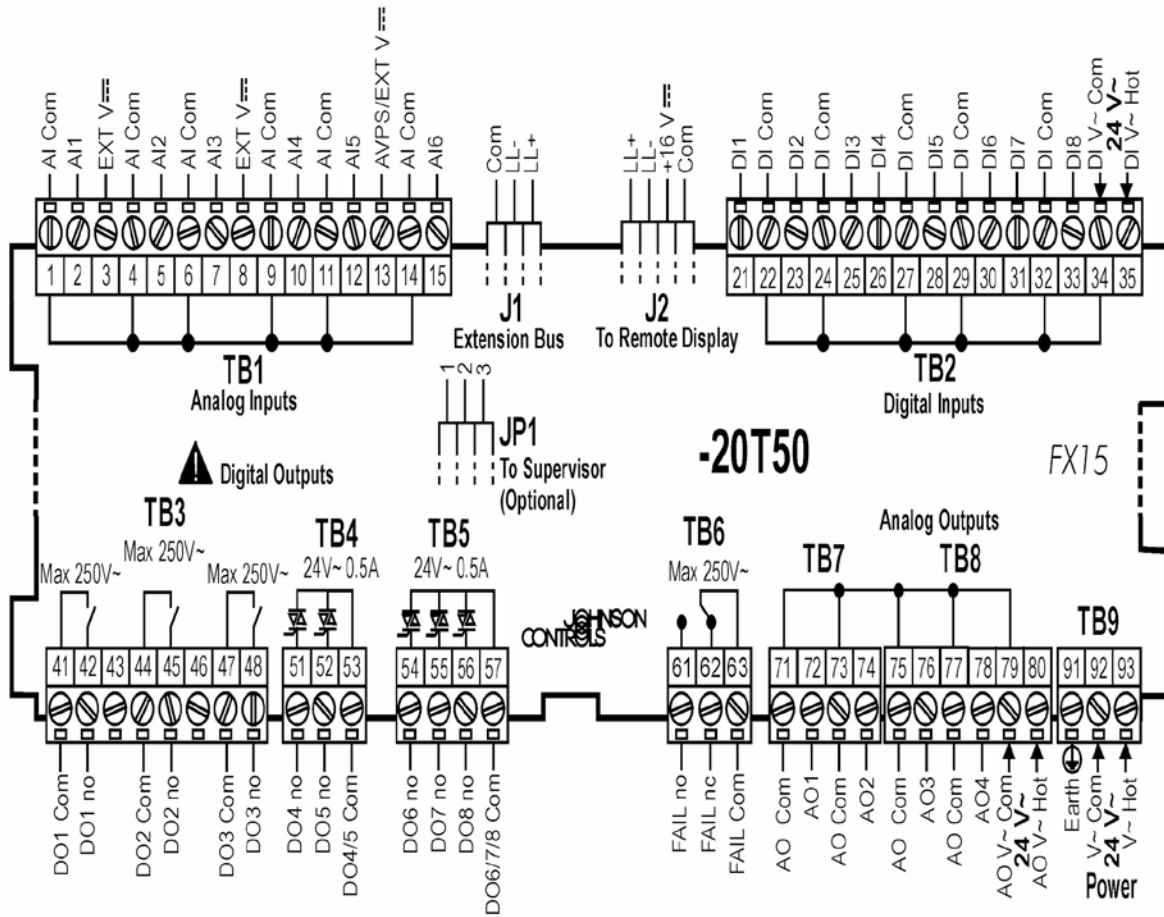
### LP-FX15D2x and LP-FX15D7x Wiring Diagram



FX15-C-001\_09 2002

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

**LP-FX15D1x and LP-FX15D6x Wiring Diagram**



**Figure 10: Connection Details for the FX15 Controller (5 Triacs and 4 Relays)**

Consider the following information when working with the connection details for the FX15 controller:

- All commons are electrically dependent.
- Analog outputs are opto-isolated and are externally powered at 24 VAC. To maintain the opto-isolation, use a separate power supply (3 VA) for the analog outputs.
- Digital inputs are opto-isolated and are externally powered at 24 VAC. To maintain the opto-isolation, use a separate power supply (3 VA) for the digital inputs.

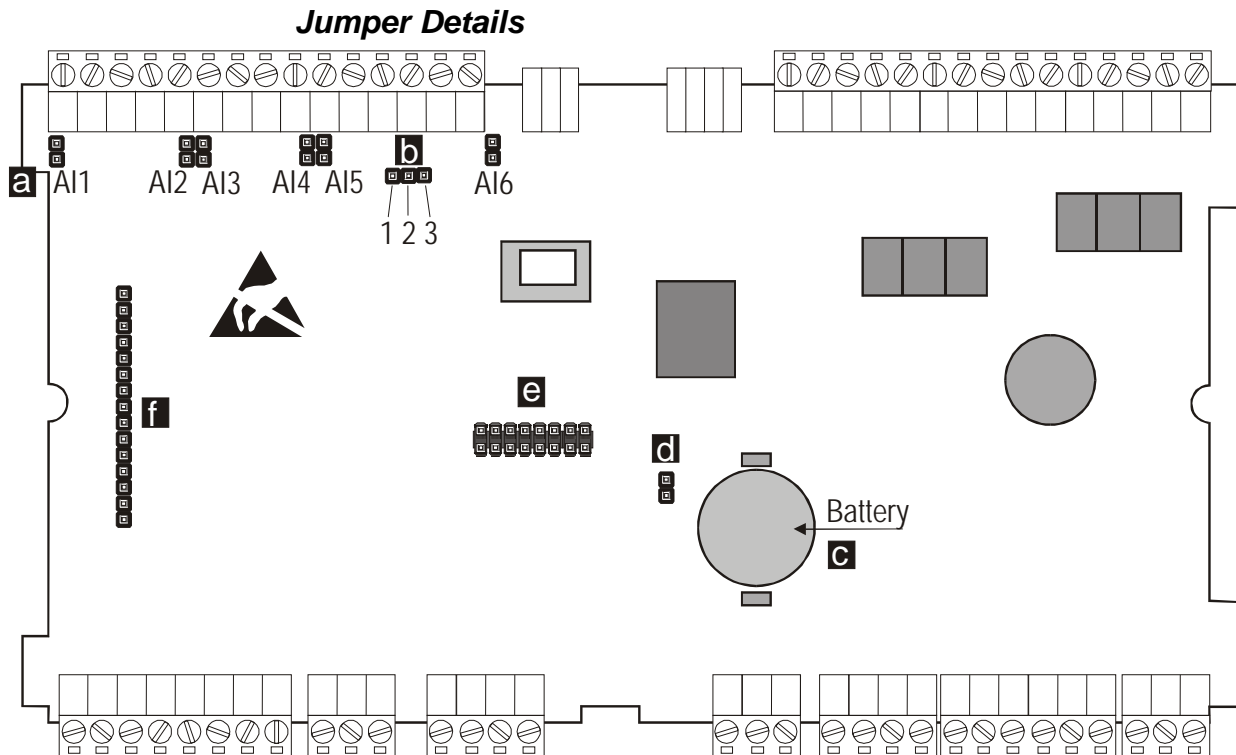
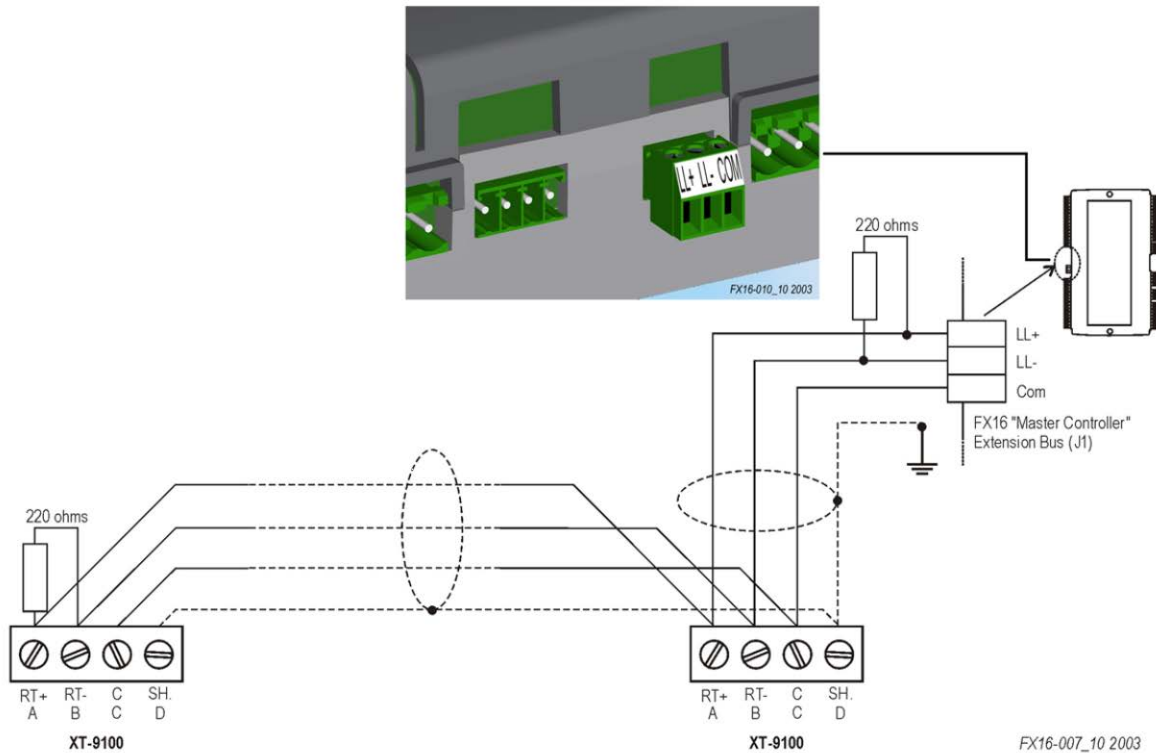


Figure 11: Jumper Connections

Table 1: Jumper Connections

	Analog Input (AI)	0-20/4-20 mA	Resistive, 0-10 V or Ratiometric
<b>a</b>	AI1-AI6	Jumpers Closed	Jumpers Open (Default configuration)
	<b>Sensors Power Supply</b>	<b>AVPS +5 V</b>	<b>EXT VDC +16 V</b>
<b>b</b>	Terminal Number 13	Pins closed between 1 and 2	Pins closed between 2 and 3 (Default configuration)
<b>c</b>	Battery Type CR2032, average life time: 3 years. <b>Note:</b> Batteries removed from this device must be recycled or disposed of in accordance with local, national, and regional regulations. Only certified technicians or qualified building maintenance personnel should service Johnson Controls® products.		
<b>d</b>	Pin strip closed: battery backup enabled Pin strip open: battery excluded (to preserve charge)  Jumper <b>d</b> 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. Set the jumper to ON before the controllers are installed and powered up; otherwise, back-up RAM and the Real-Time Clock (RTC) are not enabled.		
<b>e</b>	Plug-in connector for the optional communication card.		
<b>f</b>	Plug-in connector for the optional display ribbon cable.		

## 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 working with the connection details for the XT/XP Modules:

- maximum XT modules: four XT91D00s
- maximum bus length: 1,200 m (4,000 ft)
- Install a repeater (for example, RP-9100-810x) to regenerate the RS-485 signal if more than 31 N2 devices are 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 controller end only.

## Connection Details for the N2 Open Card

The FX15 controller comes with the N2 Open card either installed or not installed. If the N2 Open card is not installed, you can install the N2 Open card at a later time in the field. For details, see *Ordering Codes*.

The N2 Open plug-in serial card allows you to connect the FX15 controller to an N2 Open serial network through the RS-485 standard.

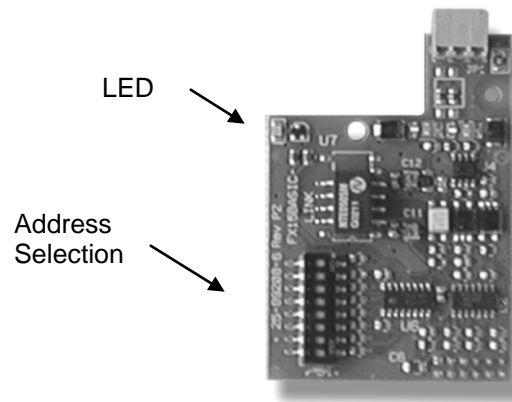


Figure 13: N2 Open Plug-in Communication Card

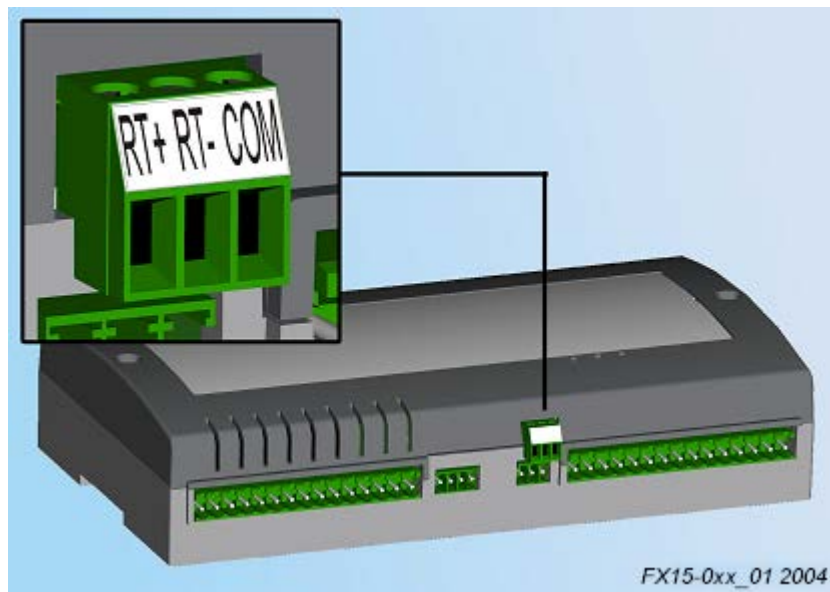
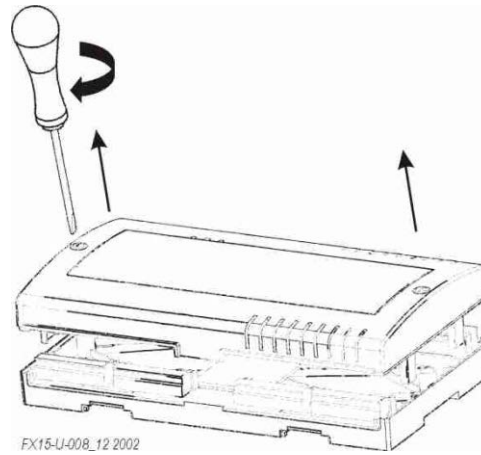


Figure 14: N2 Open Card Connection

### ***Assembling the N2 Communication Card***

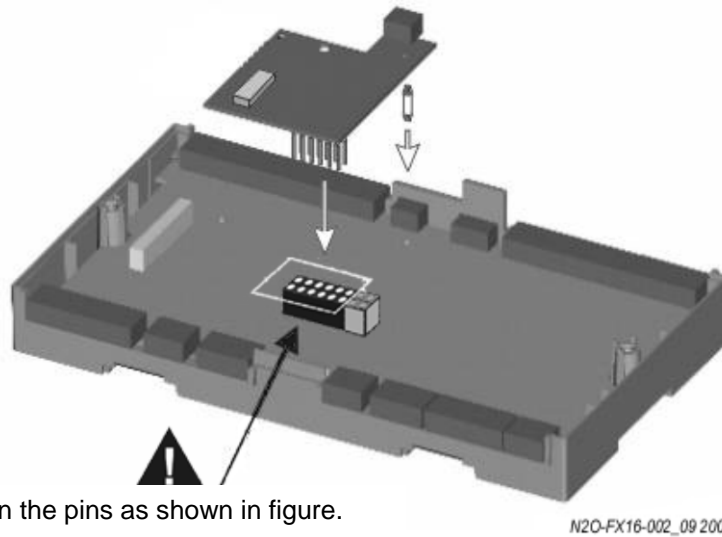
To install the N2 communication card:

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.



Align the pins as shown in figure.

**Figure 16: Insertion of the N2 Open Card**

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

**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**

Use the DIP switches (see Figure 13) to select the serial address of the FX15 controller in the N2 Open network. The address selection occurs in binary mode.

Examples:

- 1<sup>st</sup> ON, all others open  
address =  $2^0 + 0^1 + \dots = 1$
- 1<sup>st</sup> ON, 4<sup>th</sup> 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.

<b>IMPORTANT:</b> Cycle the controller power to activate the new serial address.
--

**Network Layout**

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



## Connection Details for the LONWORKS Card

The FX15 controller comes with the LONWORKS card either installed or not installed. If the LONWORKS card is not installed, you can install the LONWORKS card at a later time in the field. For details, see *Ordering Codes*.

The LONWORKS plug-in serial card allows you to connect the FX15 controller to a LONWORKS network.

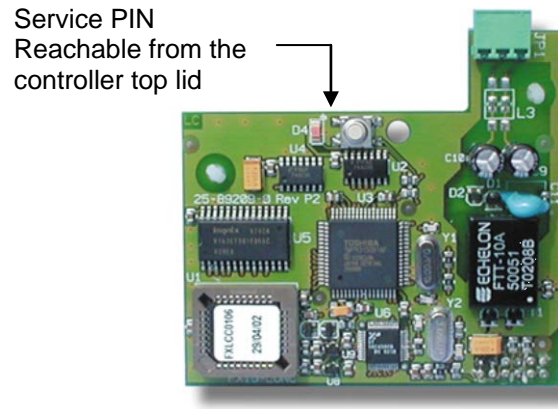


Figure 17: LONWORKS Plug-in Communication Card

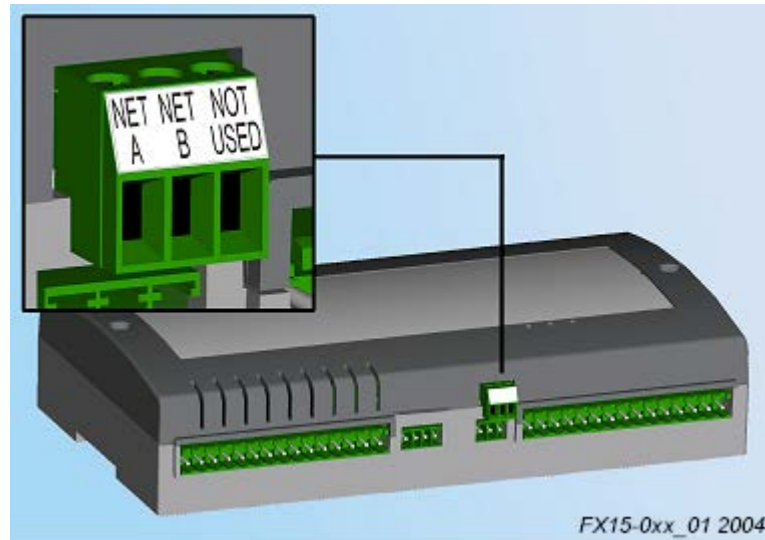
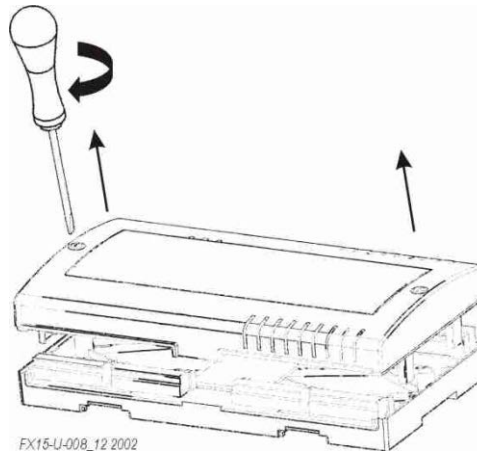


Figure 18: LONWORKS Card Connection

### ***Assembling the LONWORKS Communication Card***

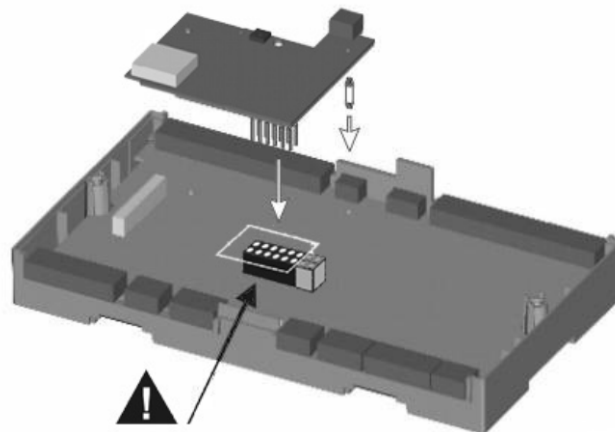
To assemble the LONWORKS communications card:

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 LONWORKS Card**

4. Replace and close the lid.

**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](http://www.echelon.com)).

## Connection Details for the Remote User Interface

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

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

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

MUI-007\_20040210

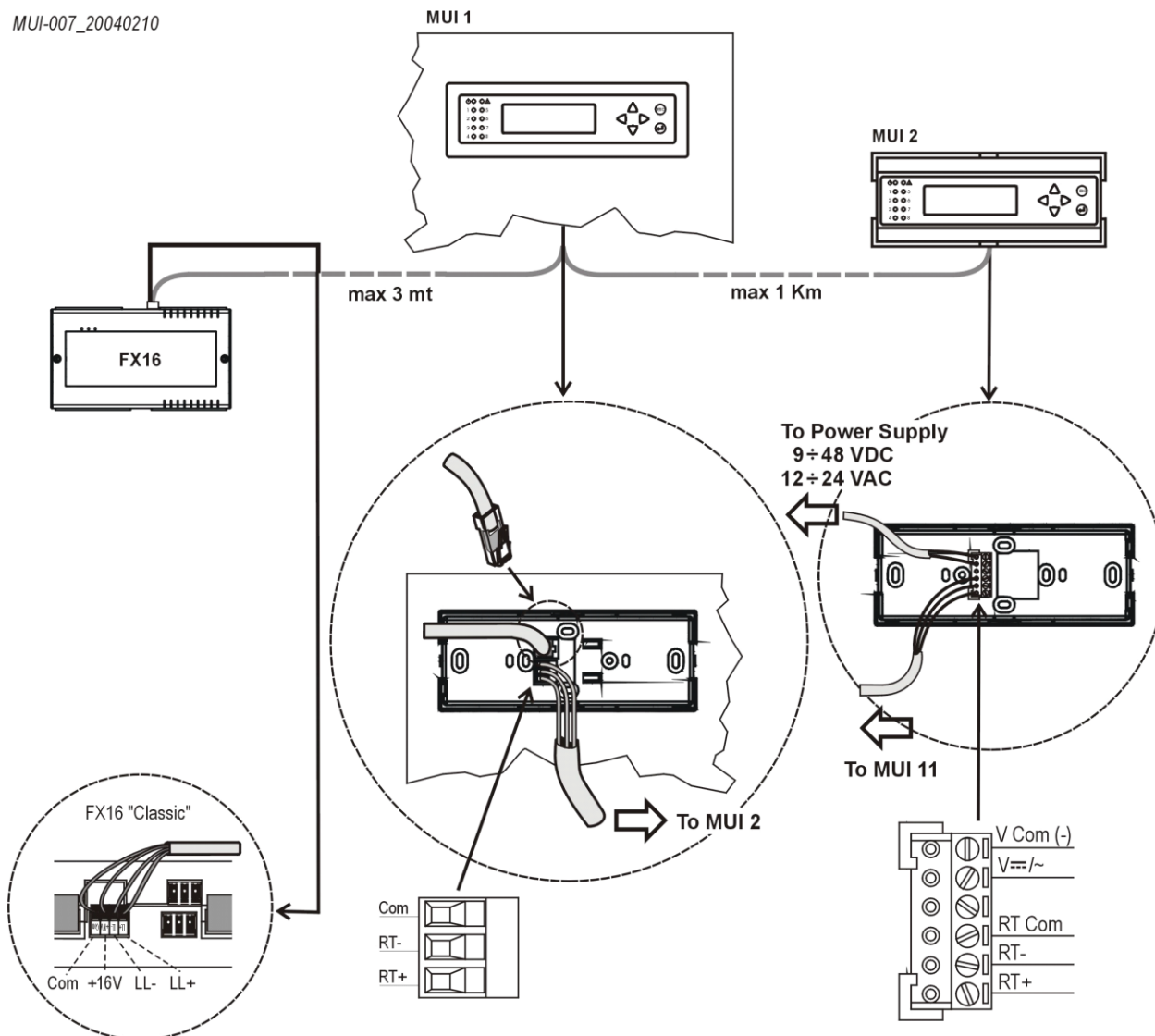


Figure 21: Installation for One Local and One Remote MUI

MUI-008\_10 2002

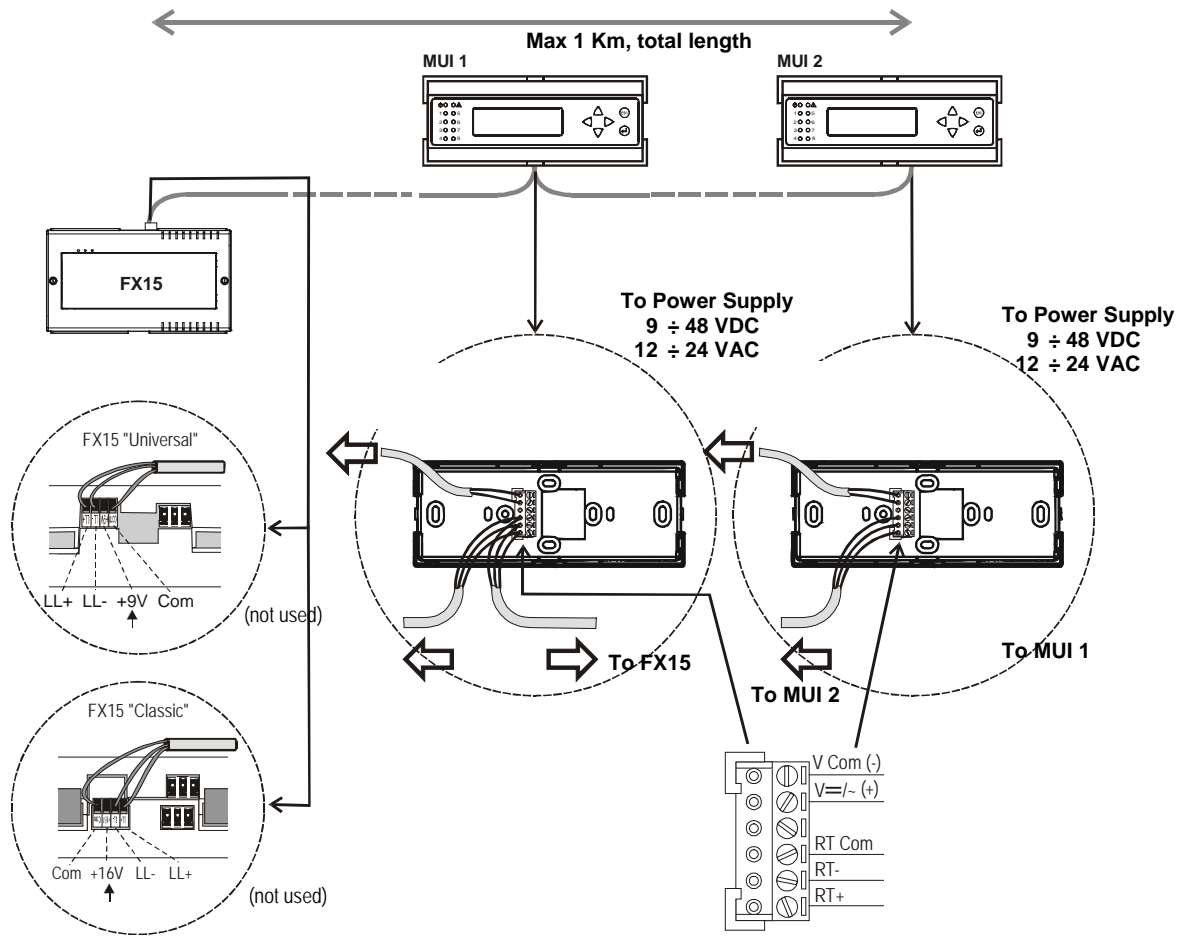


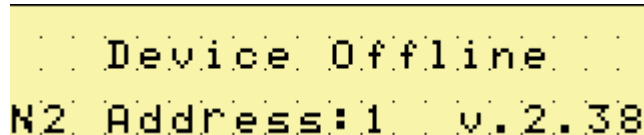
Figure 22: Installation for Two Wall Mount MUIs

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

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

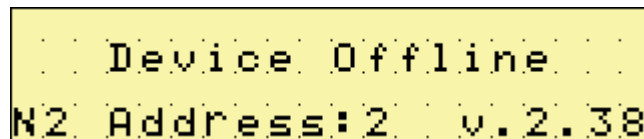
If you connect multiple MUIs, change the second MUI N2 Address to avoid communication conflicts.

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.

A screenshot of a terminal window with a yellow background. The text displayed is: "Device Offline" on the first line, and "N2 Address:1 v.2.38" on the second line.

```
Device Offline
N2 Address:1 v.2.38
```

Figure 23: MUI N2 Address Selection

A screenshot of a terminal window with a yellow background. The text displayed is: "Device Offline" on the first line, and "N2 Address:2 v.2.38" on the second line.

```
Device Offline
N2 Address:2 v.2.38
```

Figure 24: MUI N2 Address Changed

## Connection Details for the FX Programming Key

Use the FX Programming Key to upload an application from a computer or from a preprogrammed FX15 controller, then download that application to other FX15 controllers.

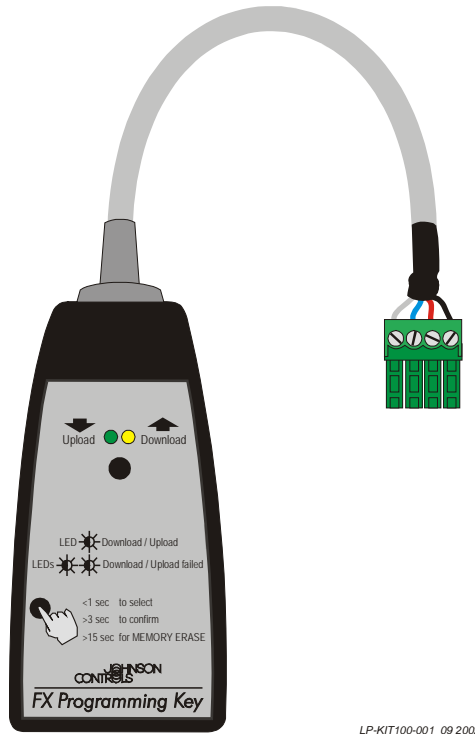
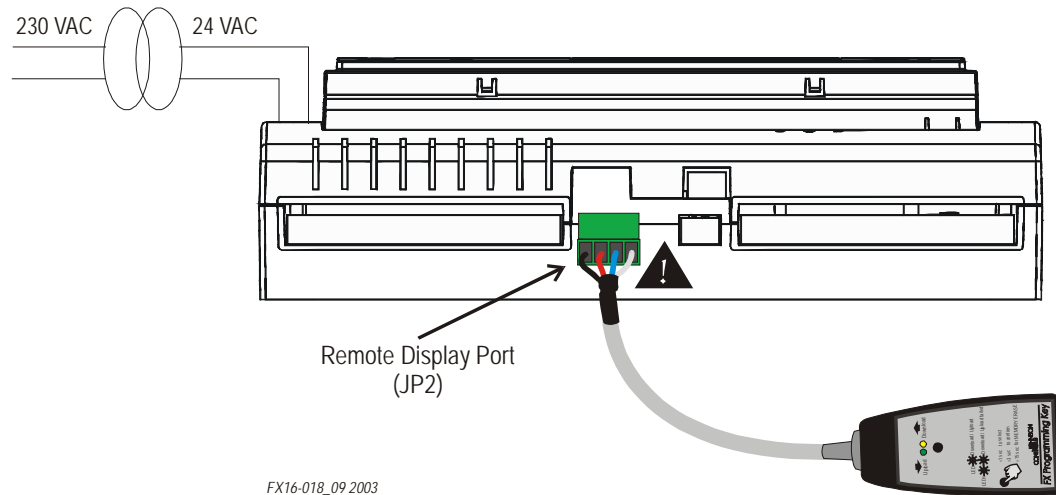


Figure 25: FX Programming Key

### **Connecting the Programming Key to an FX15 Controller**

To connect the Programming Key to an FX15 controller:

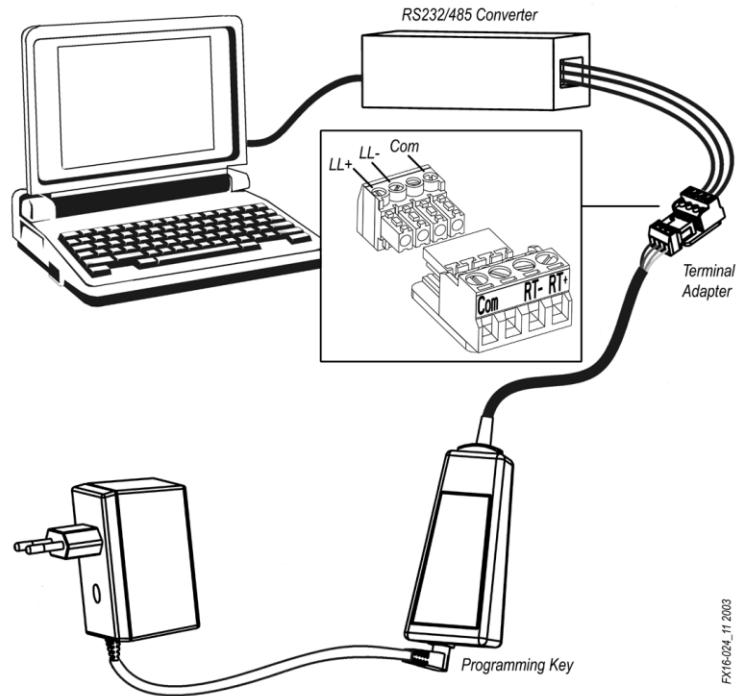
1. Power off the controller.
2. Remove any connected user interfaces from the Remote Display Port (JP2).
3. Plug the Programming Key into the Display Port (JP2) (see Figure 26).



**Figure 26: Programming Key Connection to FX15 Controller**

4. Power up 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 Adapter**

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

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



### ***Performing a Programming Key Memory Erase***

If an application is loaded on the Programming Key, and you want to use a different application, you have to erase the Programming Key memory.

The Programming Key memory is erased automatically when you use FX Loader. However, when an application is loaded from a computer, or when the application is loaded from another FX15 controller, you must manually perform erase the Programming Key memory.

To erase the Programming Key memory:

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

During the memory erase, the green Light-Emitting Diode (LED) blinks slowly. Then the green and the yellow LEDs blink twice alternately, and then the green LED remains on indicating the memory is erased.

If the green and the yellow LEDs blink simultaneously, it means that the erase process has failed. Retry. When the memory is completely erased, the LEDs stop blinking. The Programming Key is now ready for a new upload. The memory erase is also necessary if the previous upload from the FX15 controller fails (communication has been interrupted).

### ***Error Codes***

You can view the error codes only when an integrated MUI display (LP-DIS60U10-C) is mounted to the FX15 controller.

**Table 3: Error Codes**

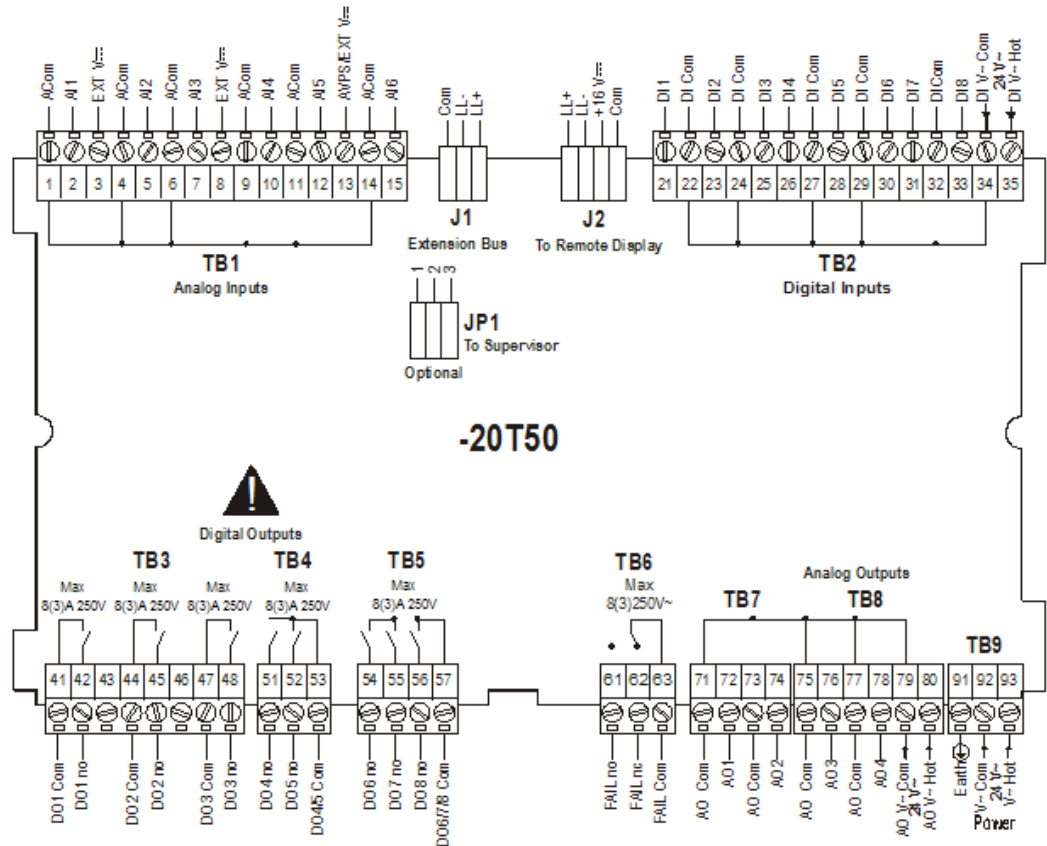
<b>Error Code</b>	<b>Meaning</b>	<b>Possible Cause</b>	<b>Action</b>
<b>51</b>	Private ID mismatch	Controller and application in the key have different protection IDs.	Save the application with the proper ID (if available) and retry the download.
<b>52</b>	Memory full	Attempting to upload an application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

# Inputs and Outputs

## Introduction

The FX15 controller features the following I/O Channels:

- six high resolution Analog Inputs (AIs) (13 bit, A/D Converter)
- eight opto-isolated Digital Inputs (DIs) from potential free contacts, each with transition counter
- nine Digital Outputs (DOs) (four relays, and five optional relays or triacs)
- four opto-isolated Analog Outputs (AOs)



FX15-C-001\_09 2002

Figure 28: FX15 Controller I/Os

---

## ***Key Concepts***

### ***Analog Inputs***

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

### ***Digital Inputs***

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

### ***Analog Outputs***

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

### ***Digital Outputs***

The FX15 controller provides nine digital outputs, available in two hardware configurations with nine relays, or four relays and five triacs.

# Detailed Procedures

## Isolation Diagram

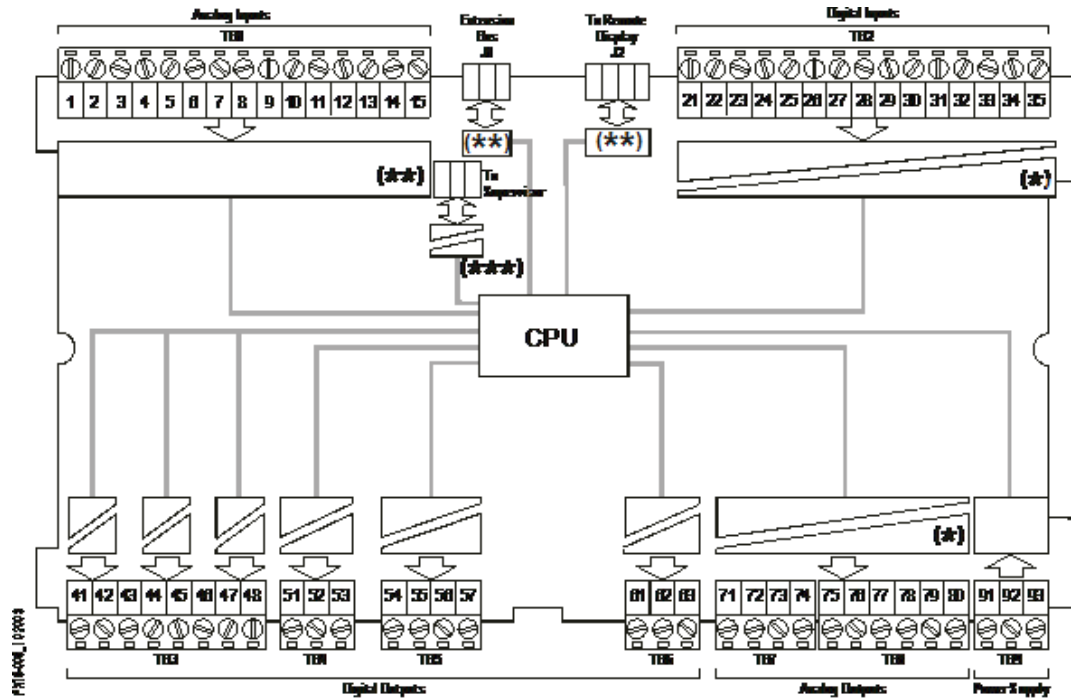


Figure 29: Insulation Diagram

(\*) 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 Controller I/Os Powered at 24 VAC

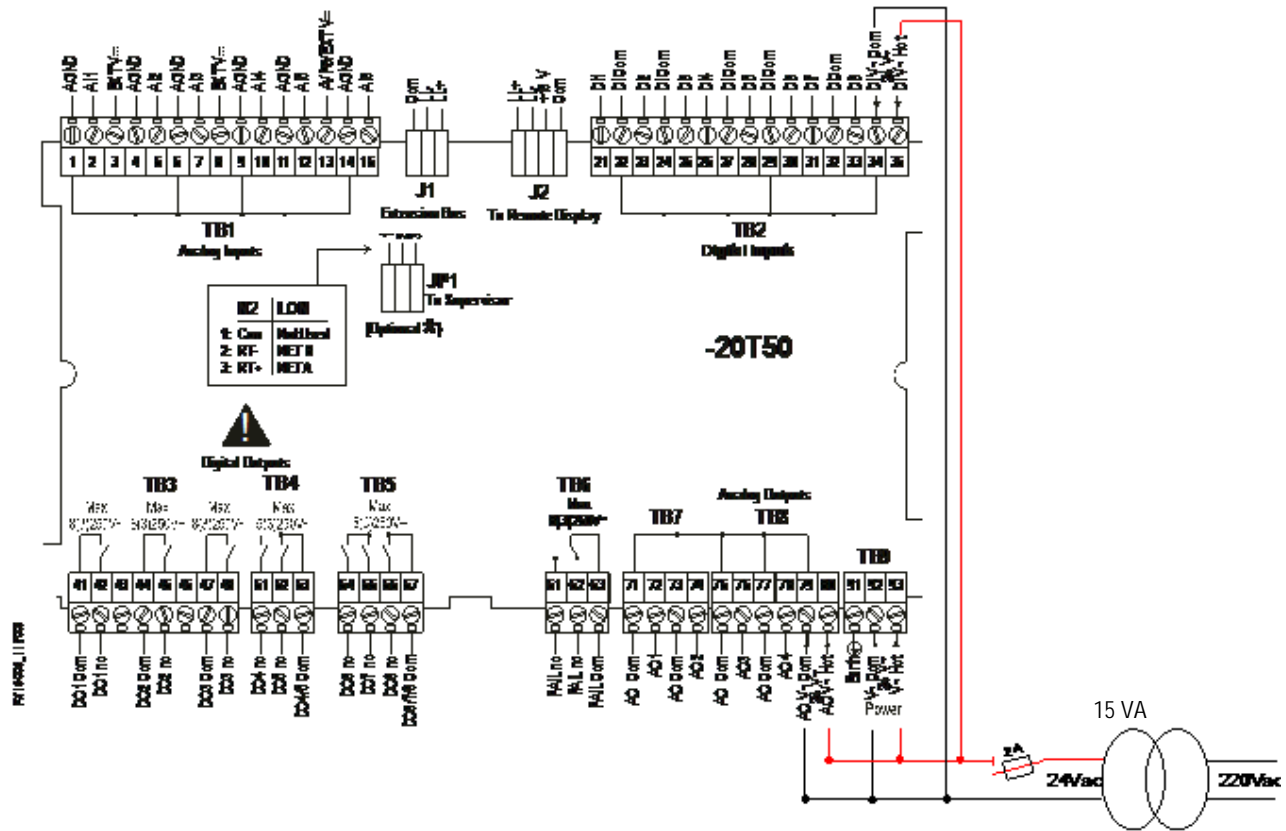


Figure 30: Powering FX15 Controller I/Os

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

**IMPORTANT:** Maintain proper polarity and voltage or current ratings. Improper polarity or exceeding the voltage or current ratings will void the warranty.

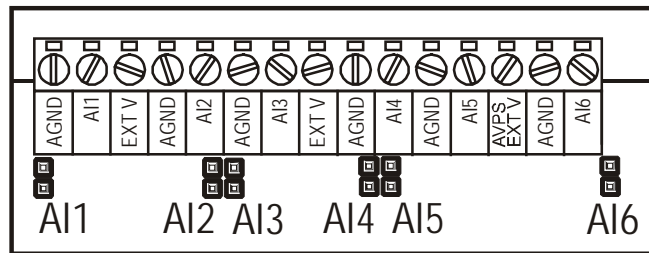
## Analog Inputs

You can configure the six high-resolution analog inputs to accept a wide range of voltage, current, and resistive input signals.

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

A dedicated jumper is available for each analog input.

- Install this jumper in its **closed** position if the connected sensor provides a **current signal** (0-20/4-20 mA).
- Install this jumper 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 have programmable range parameters within the application software. These parameters, HighRange and LowRange, define the equivalent values for reading at High (10 V and 20 mA) and Low (0 V, 4 mA, and 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 preprogrammed linearization curves within the application software. For these sensors, the measurement range is fixed. You can set the reliability range via software.

The read signal is converted by the FX15 controller according to the related Analog Input object setup. Available setups 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 Johnson Controls
- Ni1000 Johnson Controls Extended
- Ni1000 Landis and Gyr®
- Ni1000 DIN
- Pt1000
- Ratiometric

The measurement unit is also configurable, enabling the controller to propagate the measured value according to the appropriate scale unit via the network. 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 controller on its Analog Inputs for the reduction of signal instability. You can configure an additional Anti-Spike filter to limit the rate of change of the input values to the value indicated by this attribute.

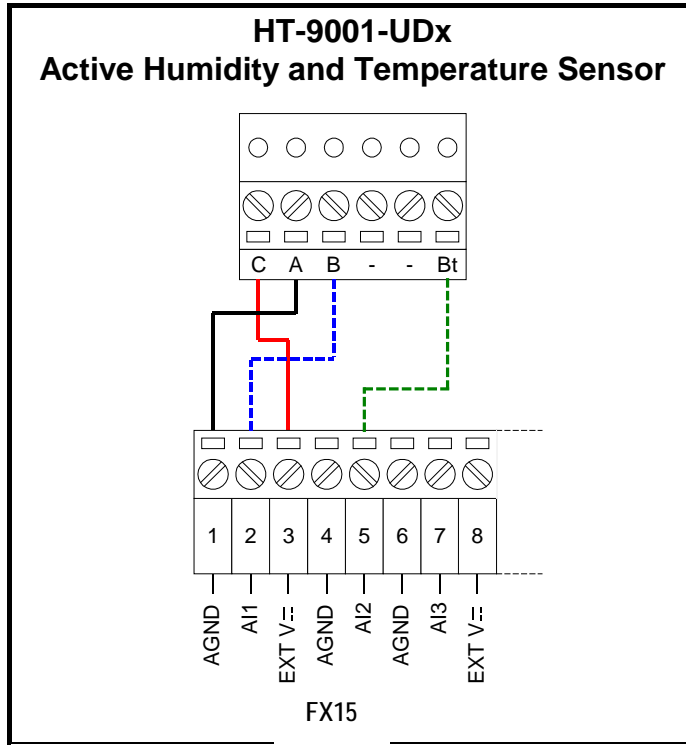
The FX15 controller provides a configurable jumper for (Terminal 13) +5 V Analog Voltage Power Supply (AVPS), or a +16 V External VDC supply, for active analog input sensors (see *Jumper Details*.)

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

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



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

The inputs must be configured to accept 0-10 V signals by the application software in the FX15 controller. The AI Jumpers must be opened (factory default setting) 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, 80 mA
AI1 (2)	B	Humidity Output 0-10 V
AI2 (5)	Bt	Temperature Output 0-10 V

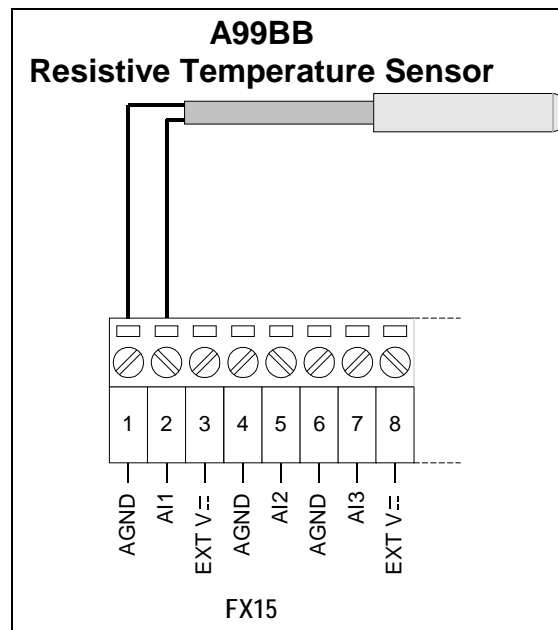
**Note:** The numbers inside the parentheses are the FX15 controller terminal numbers.



### Connecting Passive Resistive Sensors

The FX15 controller analog inputs accept linear resistive signals as the **Resistive 2k ohm**. 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 configured to accept A99 resistive signals by the application software in the FX15 controller. The AI Jumpers must be opened to accept resistance input (Factory default setting). Figure 33 shows an A99 wiring diagram. Connect the resistive sensors 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 controller analog inputs can accept a maximum of four active current sensors, powered by the FX15 controller itself, in the range 0-20 mA or 4-20 mA. The AI has to be configured via software (and hardware jumpers) to accept current signals. If a 4-20 mA sensor is connected, the specific hardware jumpers must be closed (see Figure 31) and the application can be configured through the FX Builder, setting **0-20 mA, 20% suppression**.

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

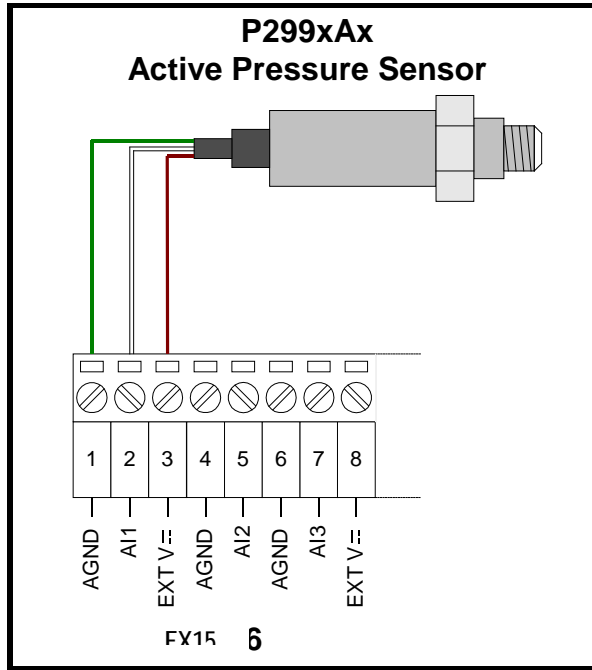


Figure 34: Pressure Sensor Connection Diagram

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 inside the parentheses are the FX15 controller 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 to maintain the insulation from the microprocessor.

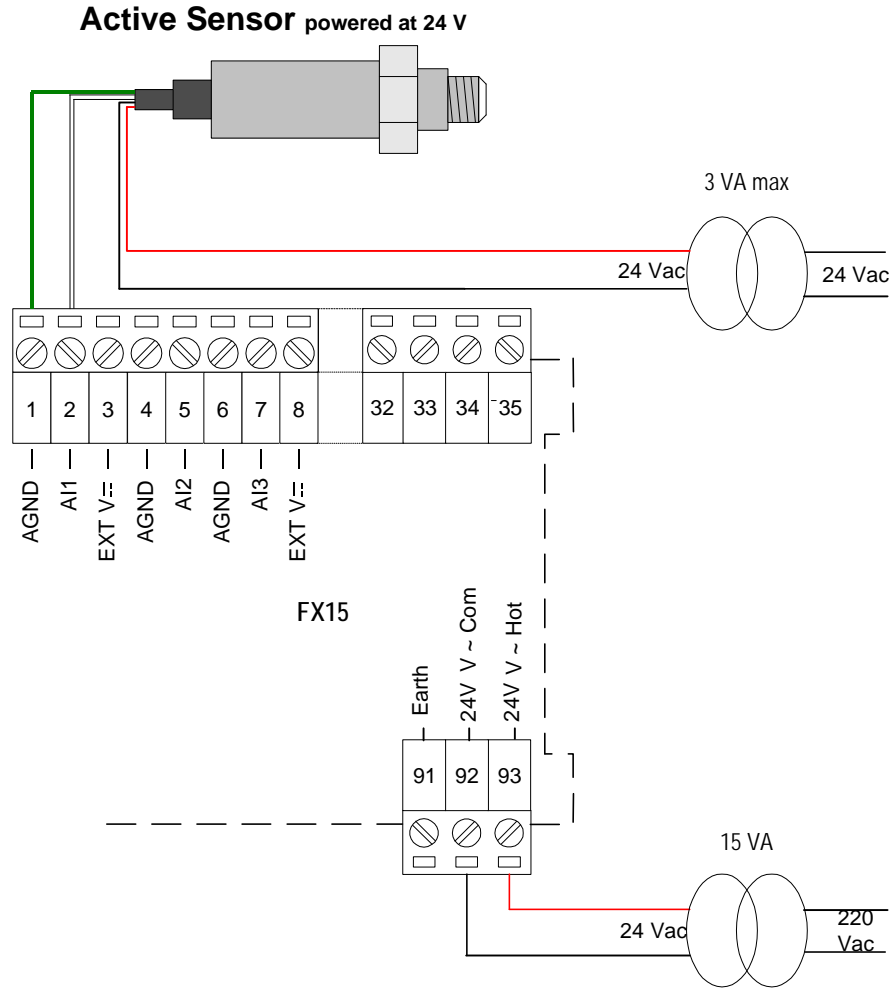


Figure 35: Active Sensor powered at 24 VAC Connection Diagram

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 inside the parentheses are the FX15 controller terminal numbers.

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

## Digital Inputs

The FX15 controller 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**, meaning it is active (true) when closed.

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

### Digital Inputs Powered by 24 VAC

The eight FX15 controller Digital Inputs must be 24 V 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 must be independent from the controller power supply (FX15 controller is compatible with VAC power only). The digital inputs can use the same FX15 controller voltage supply, or they can be separately powered in order to maintain the microprocessor opto-isolation from the controller voltage supply.

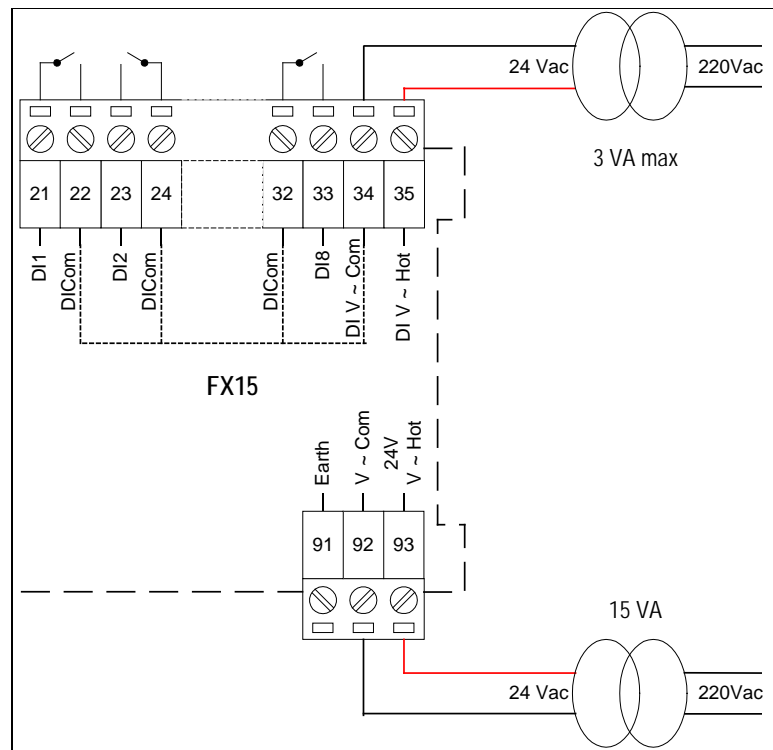


Figure 36: Powering Digital Inputs Maintaining Opto-Isolation

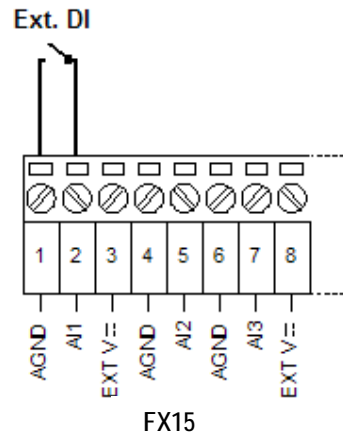
**Table 7: Digital Inputs Powered by 24 VAC**

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 inside the parentheses are the FX15 controller terminal numbers.

**Using Analog Inputs as Digital Inputs**

If you need more than 8 digital inputs, the FX15 controller allows you to use an analog input as a 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 controller provides up to four, 0-10 VDC, 1.5 mA 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* for the complete FX15 controller I/O table.

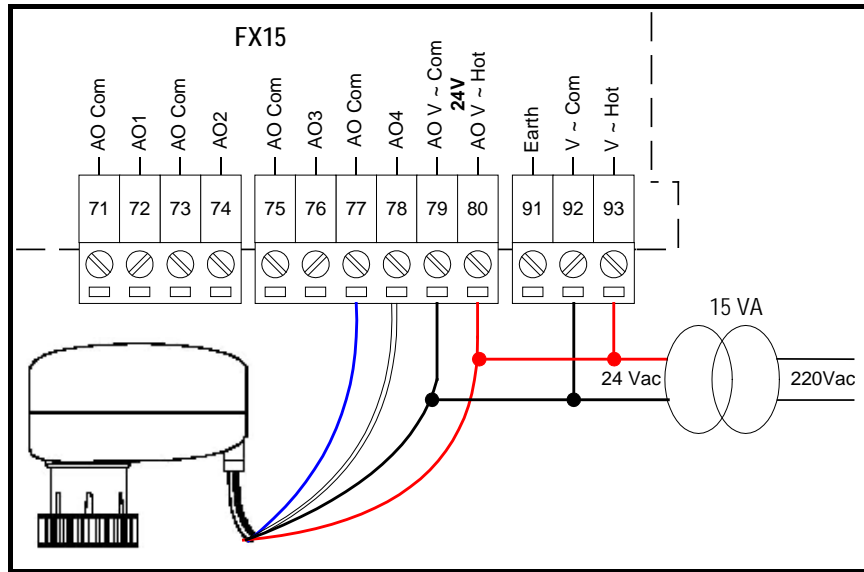
Use the application software to configure the analog outputs for direct acting or reverse acting.

Use the high limit (MaxOutput) and low limit (MinOutput) values to limit the output signal.

**Powering and Connecting the Analog Outputs**

Power the analog outputs separately, through Terminals 79 and 80, to ensure microprocessor isolation from the controller power supply (see Figure 39).

The FX15 controller analog outputs are commonly used to drive proportional devices and can be connected to all the Johnson Controls Proportional Valve Actuators (Figure 38).



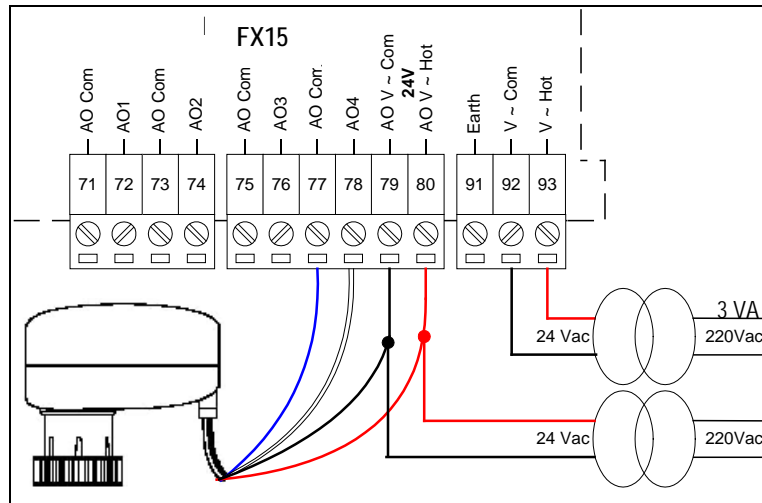
**Figure 38: Connecting the Analog Output without Opto-isolation**

**IMPORTANT:** Maintain proper polarity and voltage or current ratings. Improper polarity or exceeding the voltage or current ratings will void the warranty.

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 inside the parentheses are the FX15 controller terminal numbers.

To achieve insulation from the microprocessor, use different 24 VAC power supplies to power the controller, and to power the analog outputs (through Terminals 79 and 80).



**Figure 39: Separately Powering Analog Outputs**

FX15 Terminals	Description	15 VA
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 inside the parentheses are the FX15 controller terminal numbers.

## Digital Outputs

The FX15 controller features nine digital outputs, available in two hardware configurations: all nine relays, or four relays and five triacs.

Use the application software to configure the Digital Outputs for direct acting or reverse acting.

**⚠ WARNING: Risk of Electric Shock.** Disconnect or isolate all power supplies before making electrical connections. More than one disconnect or isolation 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.

**AVERTISSEMENT: Risque de décharge électrique.** Débrancher ou isoler toute alimentation avant de réaliser un branchement électrique. Plusieurs isolations et débranchements sont peut-être nécessaires pour couper entièrement l'alimentation de l'équipement. Tout contact avec des composants conducteurs de tensions dangereuses risque d'entraîner une décharge électrique et de provoquer des blessures graves, voire mortelles.

### Connecting the Relays

The FX15 controller 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.

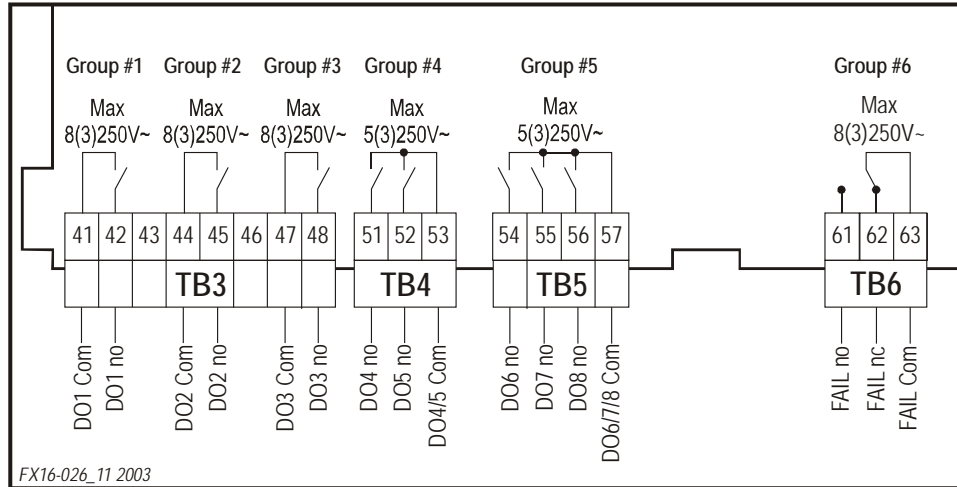


Figure 40: Relay Groups

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

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

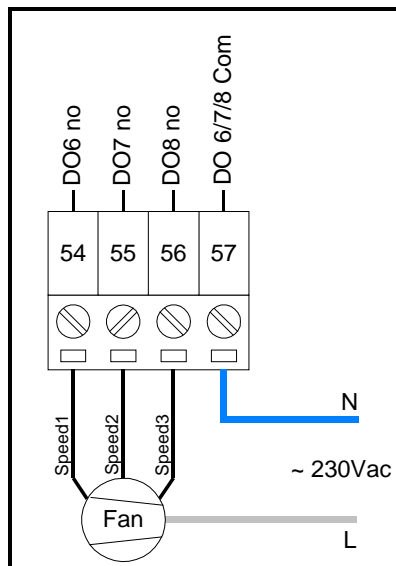


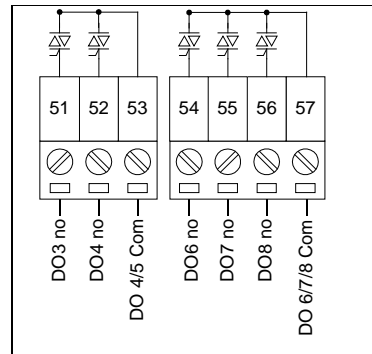
Figure 41: Connecting a Three-Speed Fan Motor



**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 damage.

**Connecting the Triacs**

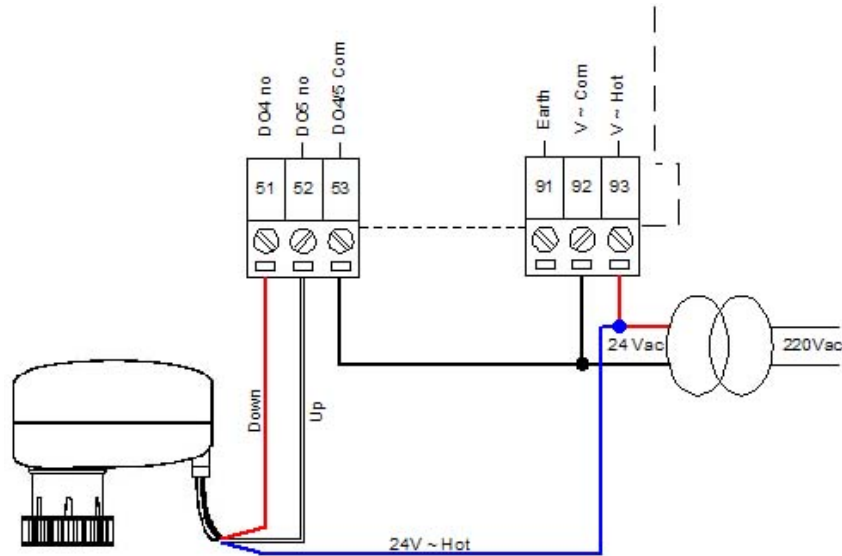
The FX15 controller triac (0.5 A, 24 VAC) digital outputs are commonly used to operate in Position Adjust Type (PAT) and Duration Adjust Type (DAT) modes.



**Figure 42: Triac Groups**

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

Figure 43 is an example of a triac connection.



**Figure 43: Connecting an Incremental Actuator**

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

**Note:** The numbers inside the parentheses are the FX15 controller terminal numbers.

## Extension Modules

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

An extension module is 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 5K 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.

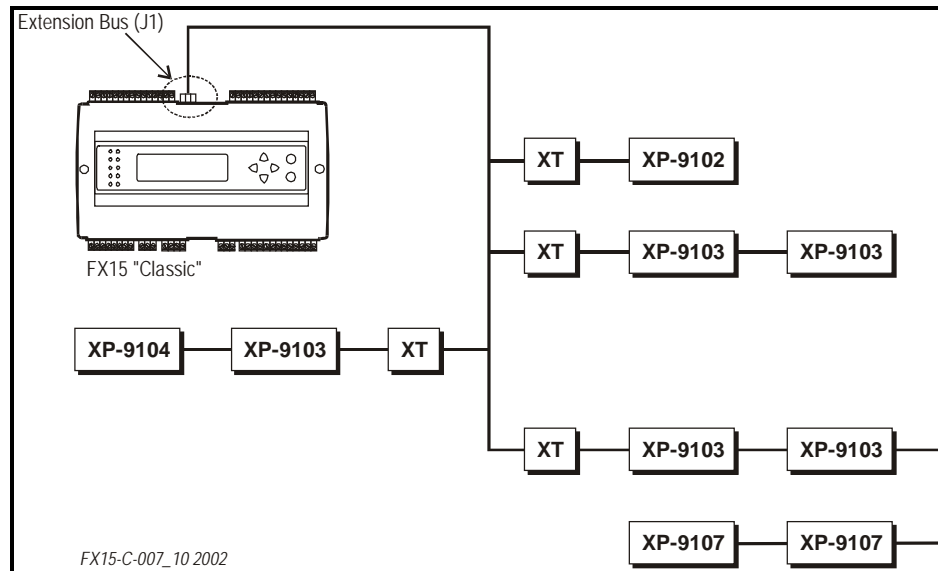
**Note:** Counter values are saved in Electrically Erasable Programmable Read-Only Memory (EEPROM) by the XT/XP only when you shut the XT/XP down. Sometimes, when an application downloads to the FX15 controller, increments occur after the last XT/XP powerup; the download is then lost. To fix this problem, shut down the XT/XP module and then proceed 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 has 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 1,275 ms) for each transition of the connected variable.

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

- eight analog inputs/outputs
- eight digital inputs/outputs, with digital counters associated with the digital inputs
- eight 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 an Invalid customized tag.
- **Problem:** Happens when 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 cannot be set according to the signal provided by the sensor.
- **Solution:** In case the signal does not match the configuration, change the Analog Input Object configuration via FX Builder. If the software is properly configured but the problem still occurs, ensure the analog inputs jumpers are properly set to accept the sensor signal and verify the probe functioning and wirings.

### **Cannot Properly Read Current Sensors**

- **Error/Condition:** Connecting an active, current sensor to an Analog Input channel, and the AI Object retrieves an Invalid value.
- **Problem:** When 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 a closed configuration when 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 controller is a high-performance field controller and 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 controller 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 controller provides configurable control algorithm, memory and connectivity services, real-time functions, and I/O expansion through its customizable, object- and service-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/LONWORKS:** Parameter configuration, machine tuning, and saving default parameters for successive configurations are all possible with the FX CommPro tool with N2 Open and LONWORKS protocol support.

## Alarm and Event Management

The FX15 controller 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-operated with an average battery lifespan of 3 years.

**Note:** Batteries removed from this device must be recycled or disposed of in accordance with local, national, and regional regulations. Only certified technicians or qualified building maintenance personnel should service Johnson Controls products.

## User Interfaces

The FX15 controller can have different user interface options (integrated, local, or remote) so you can 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 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 controller can be integrated into a supervisory building automation system for continuous monitoring of the control system. The FX15 controller supports two methods of integration:

- N2 Open Integration
- LONWORKS Integration

## Application Upload/Download

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

## User Interface

The FX15 controller can be connected to two remote user interfaces, with the capability 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 without any display plugged-in.

The configuration is **integrated, local**; for example: panel mount (up to 3 m [9.8 ft]). Or the configuration is **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 occurs via a 3-pole shielded cable (not provided) connected to the Remote Display Connection of the FX15 controller.

The FX15 controller can support one integrated user interface or one panel mount (or wall mount) user interface. Or it can support one panel mount display and one wall mount user interface. For the panel mount connection, use the cable connection kit (LP-KIT007-000C), 3 m (9.8 ft) long, with a phone jack on the MUI side and a screw connector on the FX15 controller side.

The user interface models connectable to the FX15 controller are:

- **LP-DIS65P10-0C:** Large User Interface (LUI), panel, flush mount or hand-held, 4x20 backlit LCD, IP54, extended temperature range of -20 to +50°C (68 to 122°F), standard 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, and extended temperature range of -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, and extended temperature range of -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 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
<b>FX05 Advanced Controller</b>	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
<b>FX10 Standard Controller</b>	FX10B1x	0301
<b>FX10 Advanced Controller</b>	FX10B3x	0311
<b>FX15 Controller</b>	FX15D1x	0402
<b>FX15 Universal Controller</b>	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.
- **Specific Customer/Private ID:** Applications that are saved with a specific customer/private ID 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 becomes customer specific and only allows the application with the same customer specific ID to be downloaded.

# Specifications and Technical Data

## Ordering Codes

Table 9: FX15 Controller

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

Table 10: FX15 Extended Range Controller

Ordering Codes	Description
LP-FX15X10-000C	FX15 controller, 4 relays and 5 triacs, without the application
LP-FX15X11-000C	FX15 controller, 4 relays and 5 triacs, N2 Open card preassembled, without the application
LP-FX15X12-000C	FX15 controller, 4 relays and 5 triacs, LONWORKS card preassembled, without the application
LP-FX15X20-000C	FX15 controller, 9 relays, without the application
LP-FX15X21-000C	FX15 controller, 9 relays, N2 Open card preassembled, without the application
LP-FX15X22-000C	FX15 controller, 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 standard Johnson Controls front plate)
LP-DIS60P10-0C	Medium User Interface V.2, (4x20 character) LCD backlit display, panel mount version
LP-DIS60P11-0C	Medium User Interface V.2, (4x20 character) LCD backlit display, wall mount isolated version
LP-DIS60U10-C	Integrated MUI, (4x20) LCD backlit display for FX15 controller

**Table 13: Accessories**

Ordering Codes	Description
LP-KIT007-000C	Link cable for the connection of the FX15 controller to the MUI/LUI display, 3 m (10 ft)
LP-KIT007-020C	Kit of five replacement communication wiring connectors
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**

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

**Table 16: Expansion Modules**

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

**Table 17: Software**

<b>Ordering Codes</b>	<b>Description</b>
<b>LP-FXTPRO-0</b>	FX Tools Pro CD (Includes the FX Builder, FX CommPro N2, and LONWORKS Software) – New User
<b>LP-FXTPRO-6</b>	FX Tools Pro CD (Includes the FX Builder, FX CommPro N2, and LONWORKS Software) – Upgrade

## Technical Specifications

### I/O Technical Details

Table 18: 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 <b>or</b> 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 Johnson Controls	-45 to 120 °C (-49 to 248°F)	+/- 0.5° C (0.9°F)
Ni1000 Johnson Controls 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 19: 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 to maintain the opto-isolation of a separate power supply from the one used for the controller.

Table 20: Digital Output (DO)

Terminals	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 10 <sup>5</sup> 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 5x10 <sup>4</sup> 5A 250 VAC 5x10 <sup>4</sup> 5A 30 VDC 10 <sup>5</sup> 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 returns to its NC position not only during a power failure but also in case the microprocessor should fail: watch-dog, brown-out, and so on.

Table 21: 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. To maintain the opto-isolation, a separate power supply from the one used for the controller must be used.

## N2 Open Card

Table 22: N2 Open Card

<b>RS-485 line</b>	Maximum length without repeater: 1,200 m (4,000 ft), AWG26 twisted pair with shield.
<b>Devices</b>	Maximum of 32 per 1,200 m (4,000 ft) bus segment.
<b>RS-485/232 Converter</b>	IU-9100 if a third-party converter is used then make sure it supports automatic DSC (Data Send Control)
<b>Electrical Isolation</b>	1,500 V


## LONWORKS Connection

Table 23: LONWORKS Connection

<b>LONWORKS network and Line Terminators</b>	Daisy chained Bus Topology: two terminators of 100 ohm required, one at each end of the bus. Free (star) topology: single terminator of 50 ohm required.	
<b>Nodes</b>	64 (if repeaters are not used), FTT-10 nodes only.	
<b>Cable type:</b>	<b>Length with FTT-10 devices</b>	
	<b>Bus Topology</b>	<b>Free Topology</b>
<b>Belden® 85102</b>	2,700 m (1.7 mi)	500 m (0.3 mi)
<b>Belden 8471</b>	2,700 m (1.7 mi)	500 m (0.3 mi)
<b>Level IV 22 AWG</b>	1,400 m (0.9 mi)	400 m (0.3 mi)

## Programming Key

Table 24: Programming Key

<b>Power Supply</b>	Directly powered from the Display Bus port of the FX15 controller or from an AC/DC adapter 230 V to 12 VAC ÷ 15 VDC min 2 VA
<b>Memory type and size</b>	Flash memory 1 MB
<b>Connection to controller</b>	Via RS-485, not isolated, 10 cm (3.9 in.) cable provided with the key
<b>Enclosure IP class</b>	IP40
<b>Ambient Limits</b>	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)
<b>Compliance</b>	 <b>Europe</b> CE Mark – Johnson Controls, Inc., declares that the Programming Key is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.

## FX15 Controller

Table 25: FX15 Controller

<b>Product</b>	FX15 controller
<b>Power Supply Requirements</b>	24 VAC ±15%, 50/60 Hz - Class 2 Power Supply
<b>Power Consumption</b>	15 VA at maximum load
<b>Protection Class</b>	IP20 controller IP40 integrated MUI
<b>Isolation</b>	See Isolation Diagram.
<b>Ambient Operating Conditions</b>	-20 to +50°C (-4 to 122°F), 10 to 95% RH (noncondensing)
<b>Ambient Storage Conditions</b>	-20 to +70°C (-4° to 158°F), 10 to 95% RH (noncondensing)
<b>Dimensions (H x W x D)</b>	142 mm (5.6 in.) x 215mm (8.5 in.) x 49 mm (1.9 in.)
<b>Weight (with package)</b>	0.74 Kg (1.6 lb)
<b>I/O ratings</b>	See <i>I/O Technical Details</i> .
<b>Connection terminals for signals and power supply</b>	Screw terminals for maximum 1 x 1.5 mm <sup>2</sup> (0.002 in. <sup>2</sup> ) wires or Cage clamp connectors 1 x 1.5 mm <sup>2</sup> (0.002 in. <sup>2</sup> ) wires <b>Ordered separately.</b>
<b>LONWORKS /N2 Open bus connection terminals</b>	Screw terminals, cable size 0.05 to 1.5 mm <sup>2</sup> (0.002 in. <sup>2</sup> ), AWG30 to AWG14 Belden cable, 2-core twisted pair with shield
<b>Connection terminals for extension bus and remote display</b>	Screw terminals, cable size 0.05 to 1.5 mm <sup>2</sup> (0.002 in. <sup>2</sup> ), AWG30 to AWG14
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<p><b>Single cable lengths (Cont.)</b>  <i>Digital Inputs DI1 - DI8</i>  <i>Analog Inputs AI1 - AI6</i>  <i>Triac outputs (when present)</i>  <i>Analog Outputs AO1 - AO4</i>  <i>Remote Display</i></p> <p><i>Extension Modules</i>  <b>Display and Extensions cable type</b></p>	<p>Maximum 100 m (328.1 ft) with diameters <math>\geq 0.6</math> mm (0.02 in.)                  Maximum 100 m (328.1 ft) with diameters <math>\geq 0.6</math> mm (0.02 in.)                  Maximum 100 m (328.1 ft) where <math>A \geq 1.5</math> mm<sup>2</sup> (0.002 in.<sup>2</sup>)                  Maximum 100 m (328.1 ft) where <math>A \geq 1.5</math> mm<sup>2</sup> (0.002 in.<sup>2</sup>)                  Maximum 3 m (9.8 ft) if display is powered by controller.                  Maximum 1km (1.9 mi) if display independently powered                  Maximum 1km (0.6 mi)                  Belden 4-core, twisted pair, shielded</p>	
<p><b>Compliance</b></p> <p style="text-align: center;"><b>CE</b></p>	<p><b>Europe</b></p>	<p>CE Mark – Johnson Controls, Inc., declares that the FX15 Controllers are in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC and the Low Voltage Directive 2006/95/EC.</p>
	<p><b>Canada</b></p>	<p>– 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.</p>
	<p><b>United States</b></p>	<p>– 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.</p>

## FX15 Extended Range Controller

Table 26: FX15 Extended Range Controller

<b>Product</b>	FX15 extended range controller
<b>Power Supply Requirements</b>	24 VAC $\pm 15\%$ , 50/60 Hz - Class 2 Power Supply
<b>Power Consumption</b>	15 VA at maximum load
<b>Protection Class</b>	IP20 controller IP40 integrated MUI
<b>Isolation</b>	See Isolation Diagram.
<b>Ambient Operating Conditions</b>	-40 to 60°C (-40 to 140°F), 10 to 95% RH (noncondensing)
<b>Ambient Storage Conditions</b>	-20 to +70°C (-4 to 158°F), 10 to 95% RH (noncondensing)
<b>Dimensions (H x W x D)</b>	142 mm (5.6 in.) x 215 mm (8.5 in.) x 49 mm (1.9 in.)
<b>Weight (with package)</b>	0.74 Kg (1.6 lb)
<b>I/O ratings</b>	See I/O Technical Details.
<b>Connection terminals for signals and power supply</b>	Screw terminals for a maximum 1 x 1.5 mm <sup>2</sup> (0.002 in <sup>2</sup> ) wires, included in the package.
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<b>LonWORKS /N2 Open bus connection terminals (Cont.)</b>	Screw terminals, cable size 0.05 to 1.5 mm <sup>2</sup> (0.002 in. <sup>2</sup> ), AWG30 to AWG14, included in the package. Belden cable, 2-core twisted pair with shield	
<b>Connection terminals for extension bus and remote display</b>	Screw terminals, cable size 0.05 to 1.5 mm <sup>2</sup> (0.002 in. <sup>2</sup> ), AWG30 to AWG14, included in the package.	
<b>Single cable lengths</b> <i>Digital Inputs DI1 - DI8</i> <i>Analog Inputs AI1 - AI6</i> <i>Triac outputs (when present)</i> <i>Analog Outputs AO1 - AO4</i> <i>Remote Display</i>  <i>Extension Modules</i> <b>Display and Extensions cable type</b>	Maximum 100 m (328.1 ft) with diameters ≥ 0.6 mm (0.02 in.) Maximum 100 m (328.1 ft) with diameters ≥ 0.6 mm (0.02 in.) Maximum 100 m (328.1 ft) where A ≥ 1.5 mm <sup>2</sup> (0.002 in. <sup>2</sup> ) Maximum 100 m (328.1 ft) where A ≥ 1.5 mm <sup>2</sup> (0.002 in. <sup>2</sup> ) 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	
<b>Compliance</b>  	<b>Europe</b>	CE Mark – Johnson Controls, Inc., declares that the FX15 Extended Range Controllers are in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC and the Low Voltage Directive 2006/95/EC.
	<b>Canada</b>	– 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
	<b>United States</b>	– 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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