

FX06 Field Controller

Introduction to FX06 Field Controller	3
Features.....	4
Installation.....	5
North American Emissions Compliance.....	7
Installation Procedures	8
Mounting the FX06 Controller	8
Electronic Circuit Isolation Diagram	12
Connection Details for FX06 Controller	15
Mounting the Communication Module	17
N2 Open Communication Module.....	18
LONWORKS Communication Module	19
RS-232C Communications Module.....	20
Connecting the Modem.....	21
Room Command Modules	26
Remote User Interfaces.....	35
FX Programming Key (N2 and RS-232C applications only)	37
Inputs and Outputs.....	39
Introduction	39
Inputs and Outputs Concepts.....	39
Detailed Inputs and Outputs Procedures.....	40
Analog Inputs	40
Digital Inputs	44
Analog Outputs	45
Digital Outputs	47
Operation.....	51
Operation Concepts.....	51

Communication Services	51
Event Management.....	51
Trend Logging.....	51
Time Scheduling	51
User Interfaces	51
Supervisory Option	52
Application Configuration and Commissioning	52
Security	53
Application Download	53
<i>Detailed Operation Procedures</i>	53
Communication Services	53
Event Management.....	54
Trend Logging.....	55
Time Scheduling	57
User Interfaces	59
Integral Display Operation	61
Supervisory Option	73
Application Configuration and Commissioning	75
Security	83
Application Download	85
Troubleshooting	91
Reading 9999 or Invalid from the Analog Inputs.....	91
Specifications and Technical Data.....	92
<i>Ordering Codes.....</i>	92
<i>Technical Specifications</i>	96
I/O Technical Details.....	96
FX06 Controller.....	98
N2 Open Communication.....	99
LON Communication	99
FX Programming Key.....	99
GSM Connection	100

Introduction to FX06 Field Controller



Figure 1: FX06 Field Controller

The FX06 Field Controller is a compact field controller in the Facility Explorer range of products. The controller is designed specifically for commercial Heating, Ventilating, Air Conditioning, and Refrigeration (HVACR) applications, such as small refrigeration compressors, close control units, rooftop air handlers, fan coil units, unit ventilators, and chilling or heating ceiling beam installations.

The controller has 17 physical inputs and outputs and supports a wide range of temperature sensors and actuating devices. Active sensors for the measurement of humidity, pressure, and other variables are also supported. The FX06 also includes an onboard real-time clock to support the start-stop scheduling of equipment and real-time based control sequences.

The FX06 has an attractive Liquid Crystal Display (LCD) with a set of graphic status icons used in the most common HVACR applications. The controller also supports a remote panel or wall mounted Medium User Interface (MUI).

Communication cards enable the controller to integrate into an N2 Open, or LONWORKS® network of a building automation system.

For applications where the FX06 is not integrated into a building automation network, the FX06 also features communications services to transmit event notification messages via Short Messaging Service (SMS) using an RS-232C Serial communication module and Global System for Mobile Communications (GSM) modem.

Using the FX Tools software package, you can fully configure and program the FX06 for a wide range of commercial HVACR applications.

Note: This document applies to the LP-FX06Pxx-020C models only.

Features

The features of the FX06 include:

- fully programmable controller using FX Tools software package
- RS-485 (N2 Open or LON TP/FT-10 [twisted pair/free topology]) plug-in communication module for connection to a supervisory system
- as an alternative, an RS-232C communications port for a modem (or null modem) connection in stand-alone applications
- compatible with Global System for Mobile Communications (GSM) modems
- Removable plug connectors for field wiring
- 17 physical inputs and outputs including relays and triacs
- wide range of analog sensor inputs:
 - passive temperature: A99, PT1000 Standard, PT1000 Extended Range, NTC 10k, and Ni1000 Johnson Controls® temperature sensor
 - active voltage: ratiometric and 0 - 10 VDC
- integral user interface
- real-time clock for time-based control sequences
- events displayed on user interface (up to 20 events)
- FX CommPro online software tool for commissioning and service operations
- FX Programming Key for easy application loading

Installation

This chapter takes you through the process of installing a FX06 Field Controller. Follow these step-by-step instructions to properly install, connect, and set up the FX06 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.

IMPORTANT: Use this FX06 controller only as an operating control. Where failure or malfunction of the FX06 controller could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the FX06 controller.

IMPORTANT: In North America, the controller is intended for installation with Class 2 inputs and outputs only where no special electrical safety mounting precautions are generally necessary. These controllers are UL Listed as Open Energy Management Equipment per UL 916.

IMPORTANT: Before specifying the FX06 controller for plenum applications, verify acceptance of exposed plastic materials in plenum areas with the local building authority. Building codes for plenum requirements vary by location. Some local building authorities accept compliance to UL 1995, Heating and Cooling Equipment, whereas others use different acceptance criteria.

IMPORTANT: Cables and wiring at Safety Extra-Low Voltage (SELV) and Class 2 wiring (North America) must be separated from power line voltage wiring. A minimum separation distance of 30 cm (12 in.) is recommended. Do not run extra low voltage cables parallel to power line voltage cables for long distances greater than 3 m (9.8 ft). Do not run extra low voltage wiring close to transformers or high frequency generating equipment.

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.

Installation Procedures



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.

AVERTISSEMENT: Risque de décharge électrique. Débrancher l'alimentation avant de réaliser tout branchement électrique. Tout contact avec des composants conducteurs de tensions dangereuses risque d'entraîner une décharge électrique et de provoquer des blessures graves, voire mortelles.

Mounting the FX06 Controller

Follow these instructions to properly install and connect the FX06 controller.

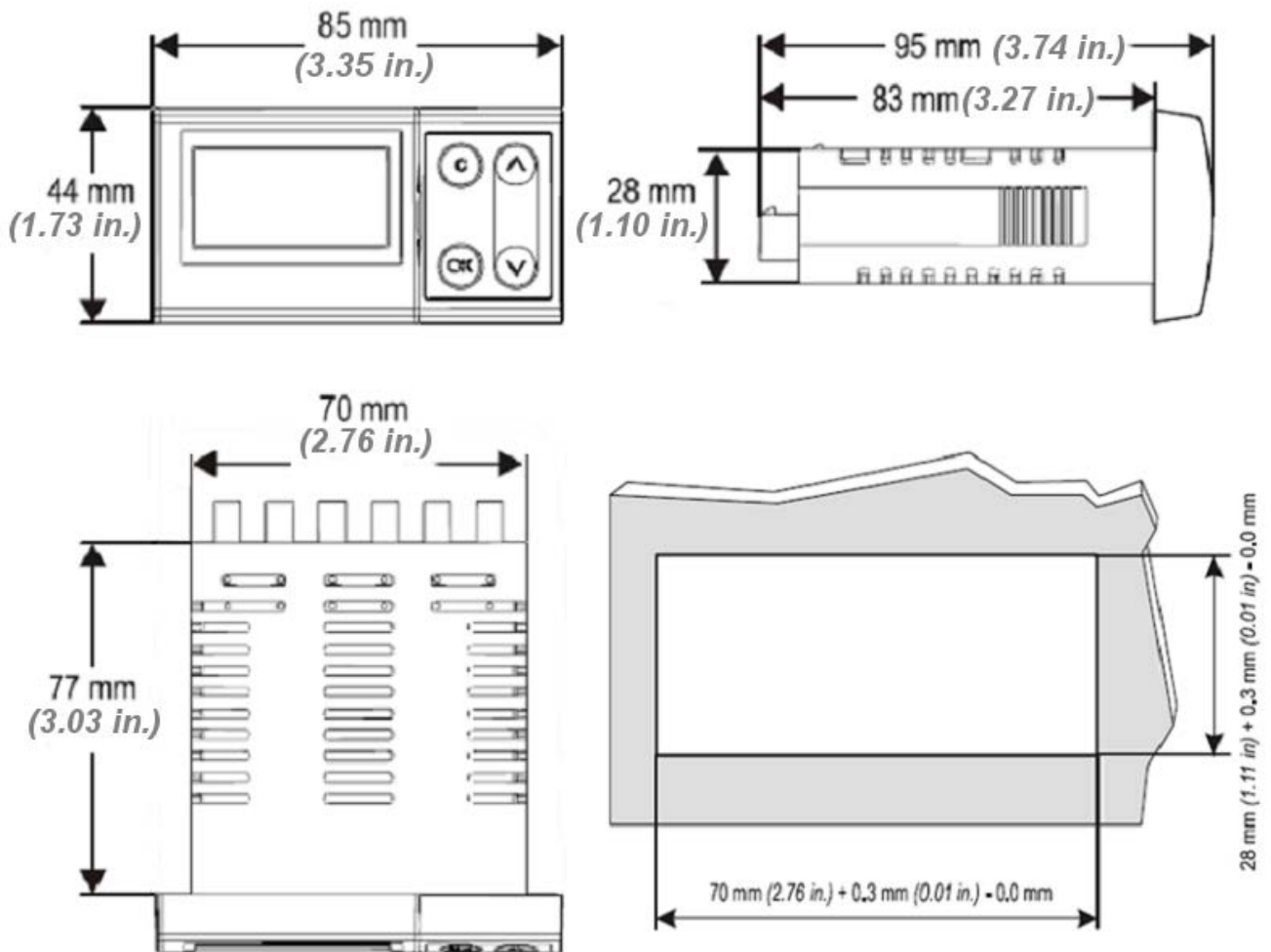


Figure 2: FX06 Controller Dimensions, mm (in.)

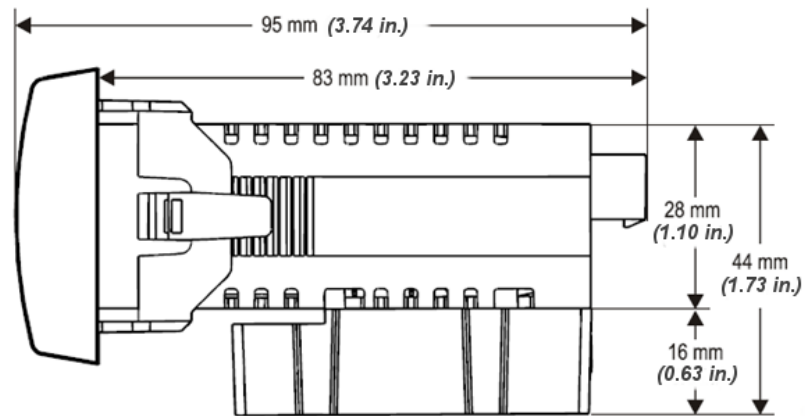


Figure 3: FX06 Dimensions Including Communication Module, mm (in.)

Communication Modules

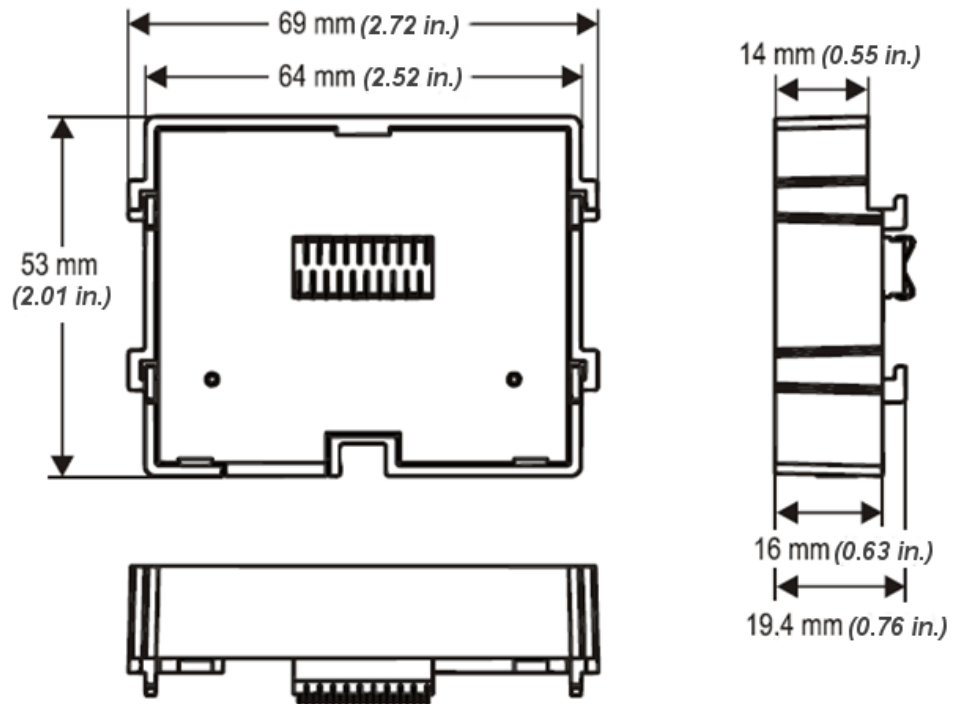


Figure 4: Communication Module Dimensions, mm (in.)

IMPORTANT: The Complementary Metal Oxide Semiconductor (CMOS) circuits in the controller are sensitive to static electricity. Take suitable precautions.

To mount the FX06 controller:

1. Cut a cutout in the mounting panel with the following dimensions (Figure 5).

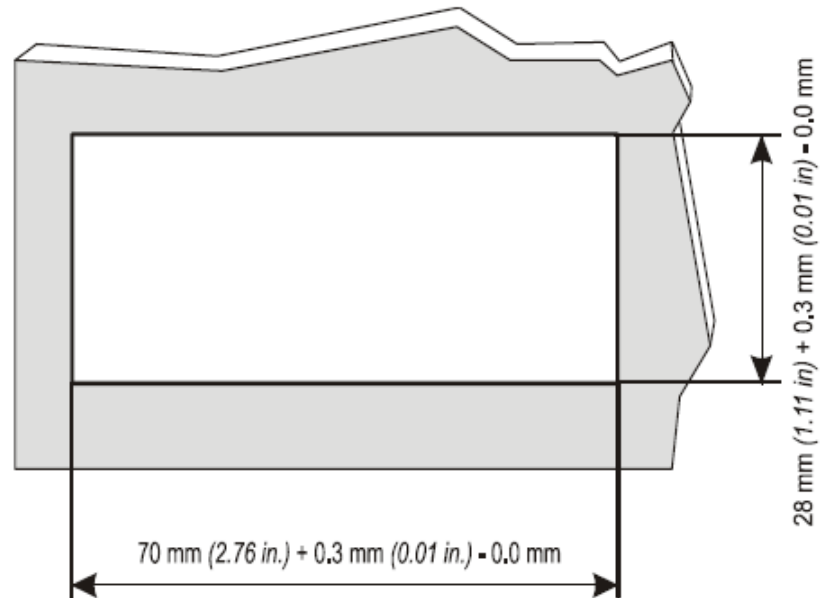


Figure 5: Panel Cutout, mm (in.)

2. Slide the communication module (if fitted) backwards towards the rear of the FX06 controller until the hooks disengage from the module (Figure 6).

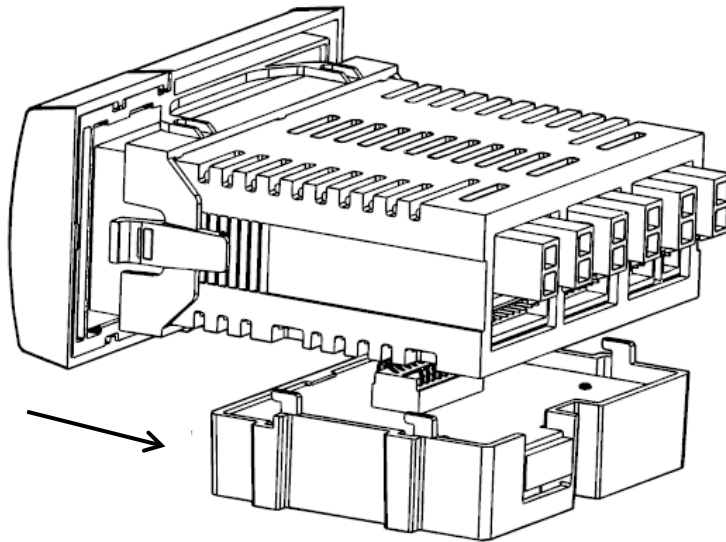


Figure 6: Removing Communication Module from the FX06 Controller

3. Remove the fixing bracket by pressing on the side tabs and sliding the bracket backwards, leaving the gasket in place around the front panel of the FX06 enclosure (Figure 7).

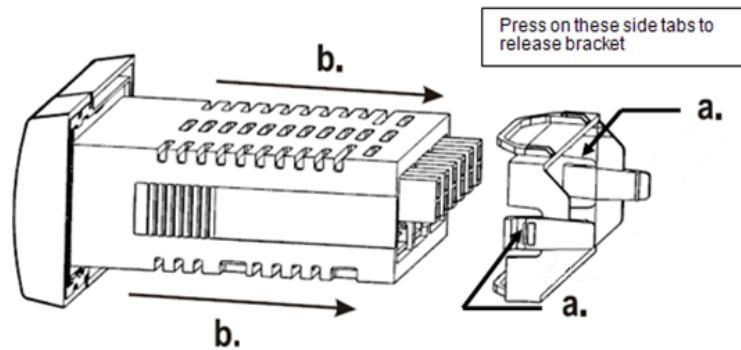


Figure 7: Fixing Bracket Removal

4. Insert the FX06 controller through the panel cut-out from the front side of the panel and secure it in place by replacing the fixing bracket from the back (Figure 8).

Wiring terminations are made by detachable, easy to plug connectors. A pre-assembled set of cables with connectors is provided with most controller models and a set of cables is also available for ordering separately. (See *Ordering Codes* section.)

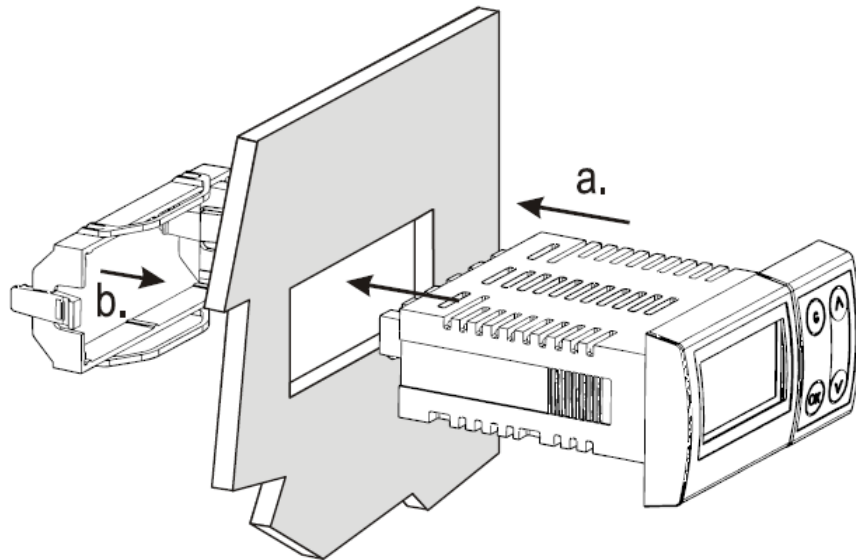


Figure 8: Panel Mounting

5. Complete the wiring connections and verify that the wiring has been correctly installed, and that voltage levels are appropriate for the various input signals according to the application.

Electronic Circuit Isolation Diagram

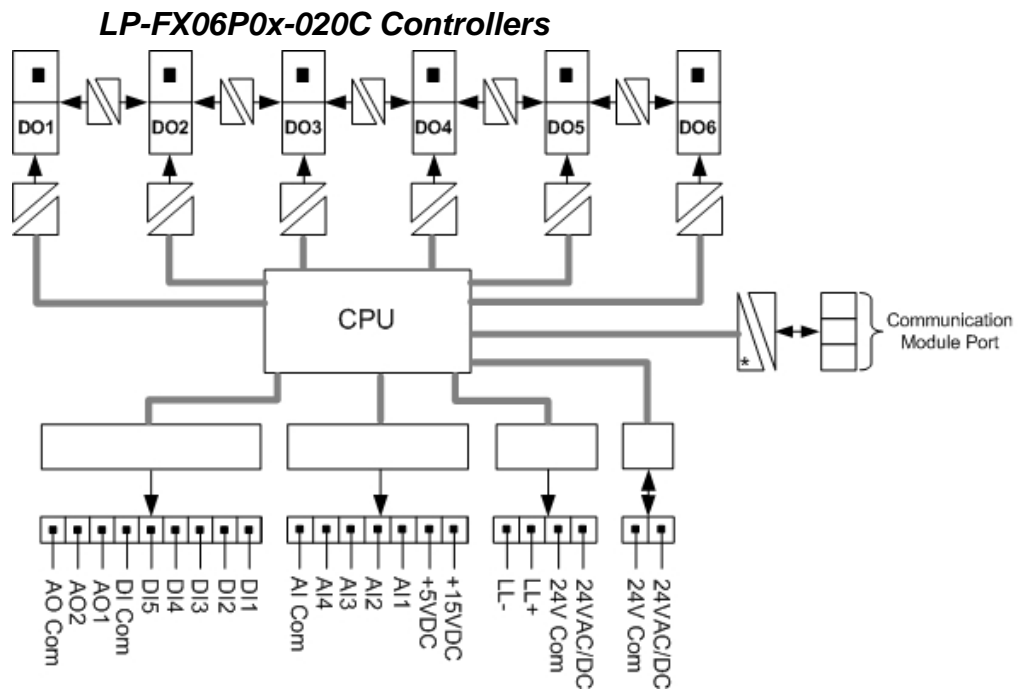





Figure 9: LP-FX06P0x-020C Isolation Diagram

Key to symbols:

-  Galvanic isolation up to 4000 V
-  (*) DC/DC isolation with dielectric strength of 500 V
-  Not isolated

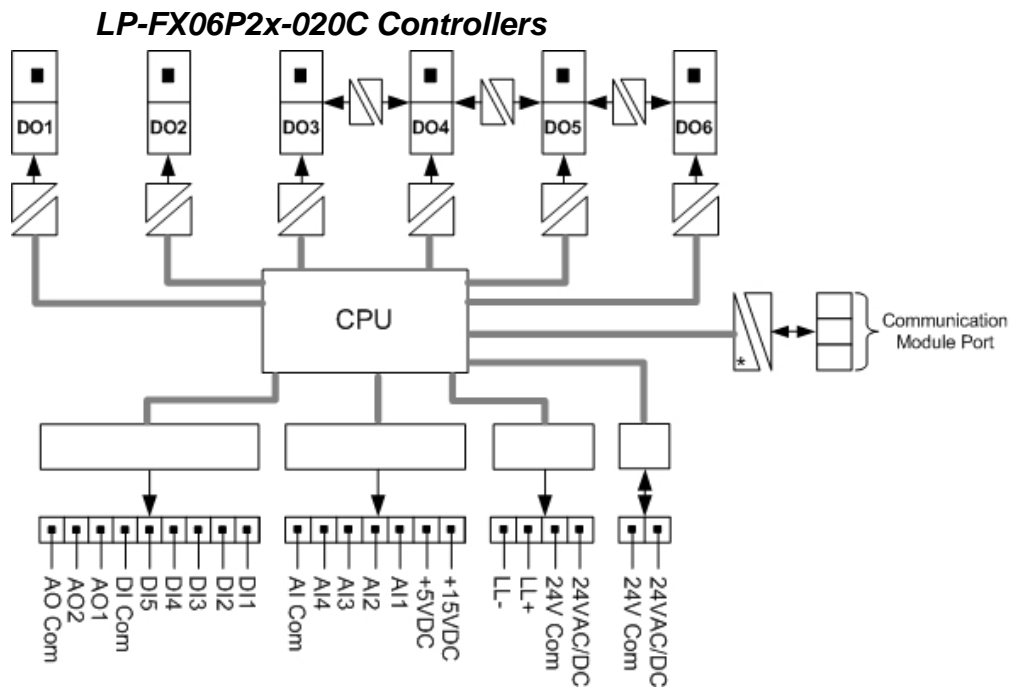


Figure 10: LP-FX06P2x-020C Isolation Diagram

Key to symbols:



Galvanic isolation up to 4000 V



(*) DC/DC isolation with dielectric strength of 500 V



Not isolated

Powering the FX06 Field Controller

FX06 Field Controller
Rear View

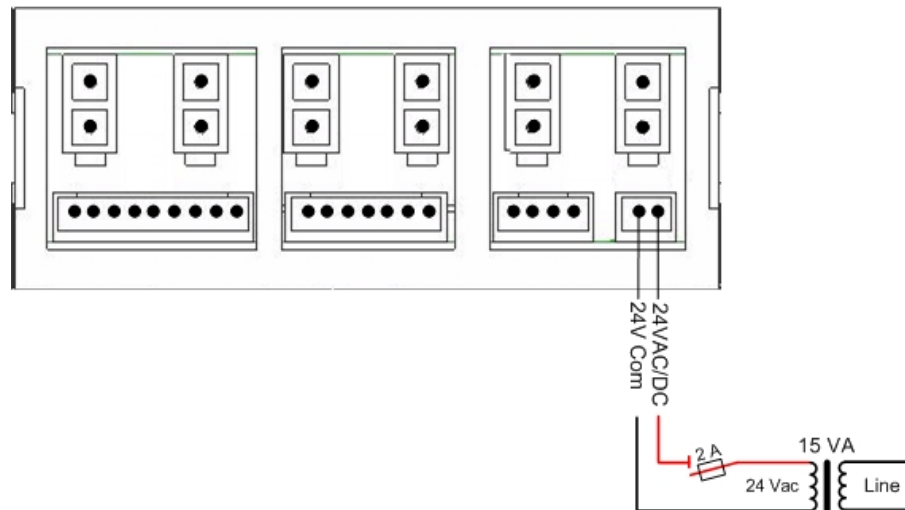


Figure 11: Powering the FX06 Controller

To power the FX06 Field Controller a transformer is needed with the following specification:

Input Voltage: 120 VAC or 230 VAC $\pm 15\%$ at 50/60 Hz

Output Voltage: 24 VAC $\pm 15\%$ at 50/60 Hz

VA rating: 10 to 15 VA

Add an external slow blow fuse (1 to 2 A) in the power supply circuit to protect the FX06 controller and wiring from over-current.

Connecting the Earth terminal to a clean electrical grounding point enhances the immunity of the FX06 to electromagnetic interference. If a clean ground is not available, leave the Earth terminal unconnected. The connection is not required for any safety reason.

Connection Details for FX06 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.

AI: Analog Input; **AO:** Analog Output; **DI:** Digital (Binary) Input; **DO:** Digital (Binary) Output

LP-FX06P0x-020C Controller

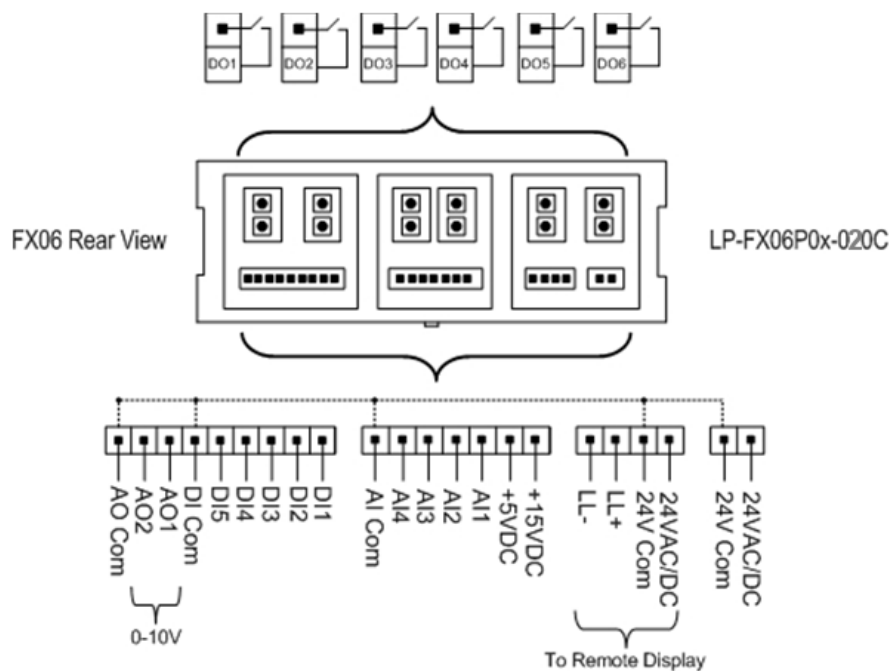


Figure 12: LP-FX06P0x-020C Wiring Diagram

LP-FX06P2x-020C Controller

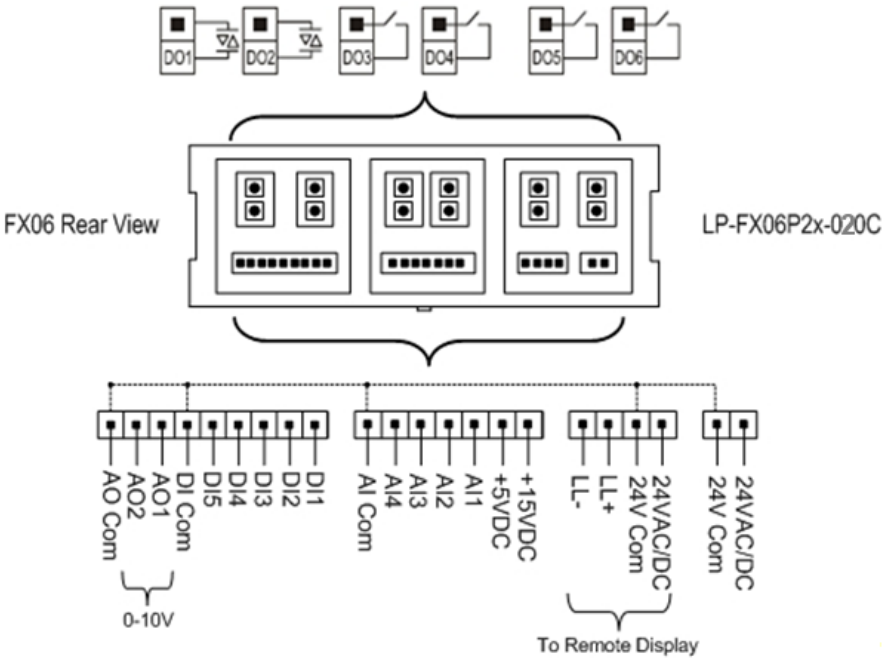


Figure 13: LP-FX06P2x-020C Wiring Diagram

Mounting the Communication Module

To mount the communication module to the FX06 controller:

1. Turn off the FX06 controller (hot plug-in not allowed).
2. Locate the four slots where the hooks of the communication module engage (on the bottom of the FX06 controller).

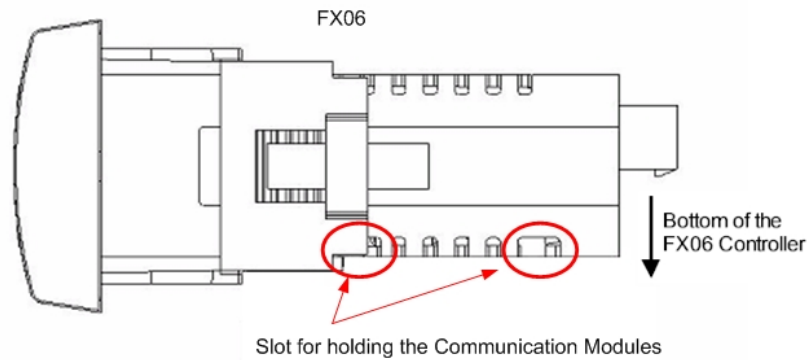


Figure 14: Communication Module Slots

3. Align the hooks of the communication module to the slots of the FX06 controller and press the module into the controller.

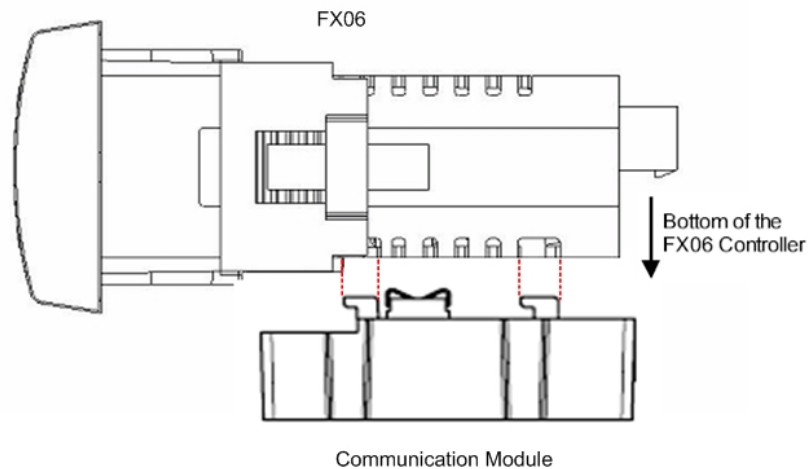


Figure 15: Module Insertion

4. Push the module forward towards the front panel of the FX06 controller until the hooks are fully and securely engaged.

N2 Open Communication Module

You can order the FX06 controller with the N2 Open communication module, or you can order the N2 Open communication module separately to insert the module at a later time. (See *Ordering Codes*.)

The N2 Open communication module allows the FX06 controller to connect to an N2 Open RS-485 network of a building automation system.

To attach the communication module to the controller, see *Mounting the Communication Module*.

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

Connecting the N2 Open Communication Module

The connection to the network is made by means of the 3-pin plug-in connector and cable provided with the module. The connections are polarity sensitive and must be made correctly.

Table 1: RS-485 N2 Bus Connections

Supervisory Link	N2 Bus
1	COM
2	RT -
3	RT +

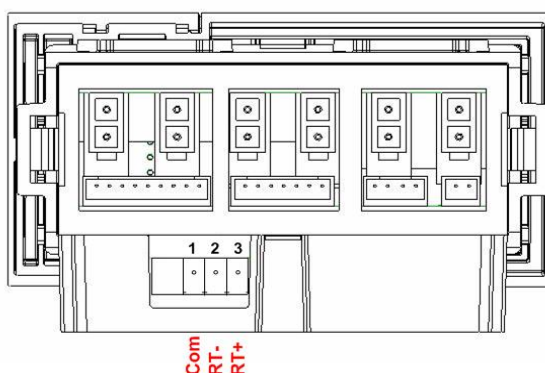


Figure 16: N2 Open Communication Module Connections

N2 Address Selection

The N2 address of an FX06 controller can be modified **only** through the local user interface. The default factory N2 address setting of the FX06 controller is **255**. See *N2 Address Selection* for detailed instructions.

N2 Network Layout

For details about how to lay out the N2 network, refer to the *N2 Communications Bus Technical Bulletin (LIT-636018)*.

LONWORKS Communication Module

You can order the FX06 controller with the LONWORKS communication module, or you can order the LONWORKS communication module separately to insert at a later time. (See *Ordering Codes*.)

The LONWORKS communication module allows the FX06 to connect to a LONWORKS free topology (FT-10) network.

To attach the communication module to the controller, see *Mounting the Communication Module*.

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

Connecting the LONWORKS Communication Module

The connection to the network is made by means of the 3-pin plug-in connector and cable provided with the module. The connections are not polarity sensitive; however, we recommend you make consistent connections for easier troubleshooting.

Table 2: RS-485 N2 Bus Connections

Supervisory Link	LON Network
1	COM
2	NET B
3	NET A

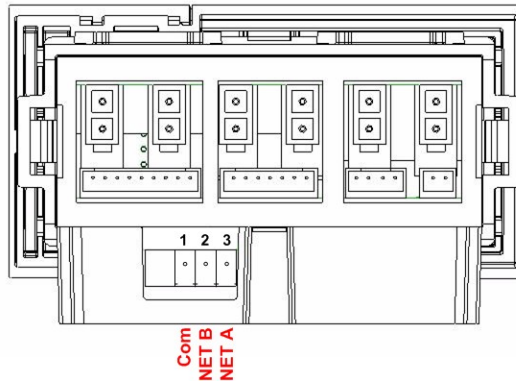


Figure 17: LON Module Connections

Getting the LON Neuron® ID

The FX06 controller sends its unique Neuron Identifier over the LON network at each powerup. The FX06 keypad can also be configured, using the FX Builder, to perform the Service Pin function (a hardware service pin is not provided). A label is also on the LON communications module with the Neuron ID (number and barcode).

LONWORKS Network Layout

Refer to the *LONWORKS® FTT-10A Free Topology Transceiver User's Guide (078-0156-01G)* for technical guidelines associated with free topology restrictions. Refer to the *Junction Box and Wiring Guideline 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).

RS-232C Communications Module

You can order the FX06 controller with the RS-232C communication module or you can order the RS-232C communication module separately to insert the module at a later time. (See *Ordering Codes*.)

The RS-232C communications module allows the FX06 controller to connect to a Global System for Mobile (GSM) communications modem.

To attach the communication module to the controller, see

Mounting the Communication Module.

Connecting the Modem

The FX06 controller can be connected only to a Global System for Mobile (GSM) Communications modem. The functions of the FX06 controller through the RS232C serial communications module are defined in the control application configuration of the controller and include alarm notification via Short Messaging Service (SMS) text messaging to a user or a group of users.

For the connection between the FX06 and the modem, a GSM modem cable is available (order code LP-KIT007-002C). The cable is 1.5 m (5 ft) long with a DB15 male connector for the GSM modem and an ampere connector for the FX06 controller. A spare ampere connector and crimp connectors are provided with the RS-232C communications module. For the connection pin-out, see Figure 18.

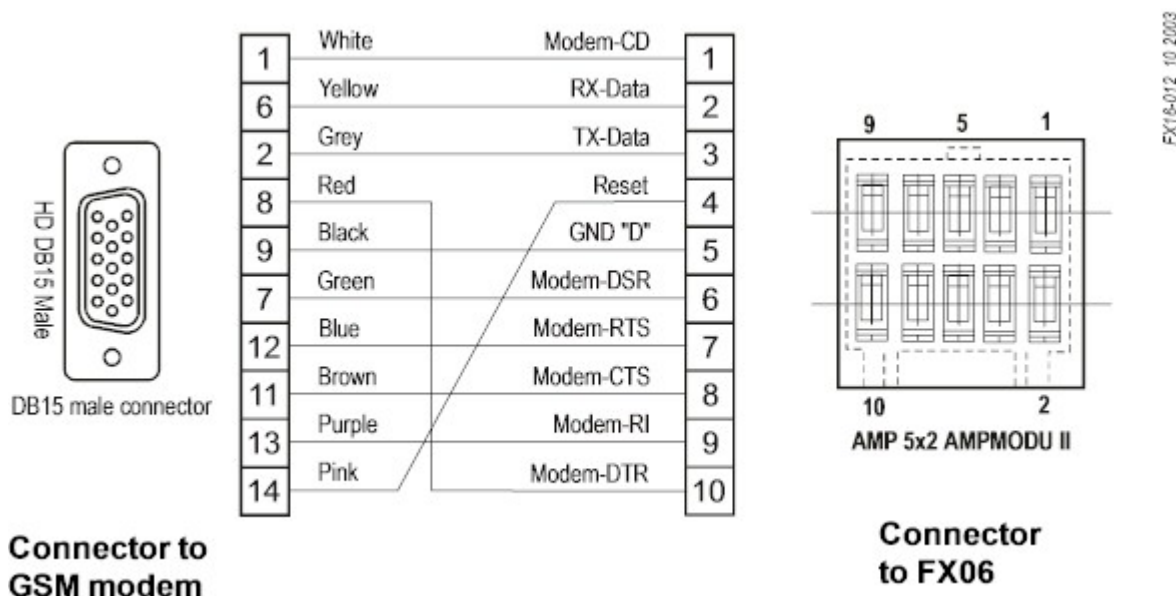


Figure 18: Connection Details of GSM Modem Cable

Consider the following guidelines when connecting the GSM modem:

- Run the modem cable separately from line voltage or power cables. Use a minimum of 30 cm (12 in.) separation for 230 V/30 A circuits.
- Do not run modem cable parallel to power cables for long distances (>3 m [9.8 ft]).
- Do not run modem cable close to transformers or high-frequency generating equipment.

GSM Modem Antenna

The GSM modem must be connected to an appropriate antenna with the characteristics in Table 3.

Table 3: GSM Modem Characteristics

Characteristic	Description
Frequency range	Dual-band GSM 900/1800 MHz
Impedance	50 ohms
Gain (antenna and cable)	0 dB
VSWR (Voltage Standing Wave Ratio) (antenna and cable)	-10 dB

You must install the antenna in a position where the GSM modem field is strong enough to ensure proper communication.

To verify the GSM signal strength, connect the modem using a null modem cable to a computer with a VT100 emulator program. Send the following AT command to the modem: **AT + CSQ**. Monitor the response. See Table 4.

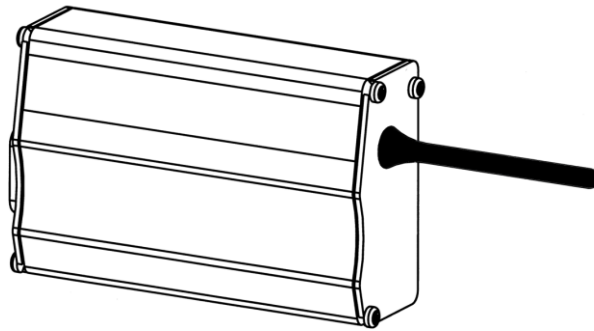
Table 4: GSM Signal Strength

AT+CSQ Radio Signal Strength Index (RSSI)	Signal Quality
11 to 31	Sufficient
0 to 10 and +99	Insufficient

Antenna Types

Three types of antenna are available:

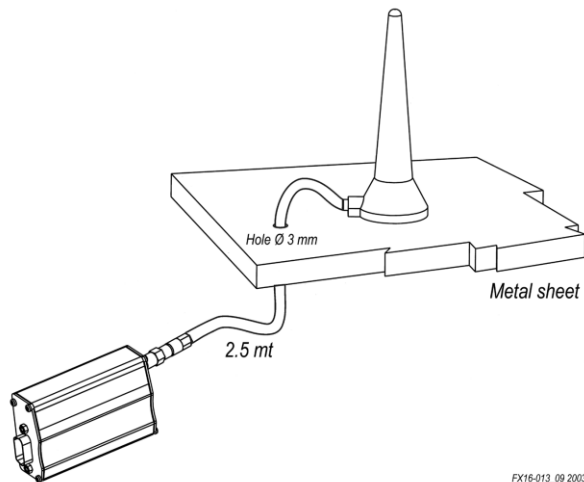
The **Unit Mount Antenna (LP-KIT90-001C)** plugs directly into the modem. The modem with antenna must be mounted in free space where it is always visible (not enclosed in a metal cabinet or electrical panel where the GSM field might not be strong enough, for example).



FX16-023_10 2003

Figure 19: Unit Mount Antenna

The **Remote Mount Antenna (LP-KIT090-003C)** has a permanent magnet in its base and is designed for mounting on a metal surface. It is supplied with a 2.5 m (8.2 ft) long cable and an adapter to connect the cable to the modem.



FX16-013_09 2003

Figure 20: Remote Mount Antenna (Magnetic)

The **Panel Mount Antenna (LP-KIT090-004C)** is designed for mounting through an 11mm (0.44 in.) hole in a panel. It is supplied with a 5 m (16.4 ft) long cable and adapters to connect the cable to the antenna and the modem.

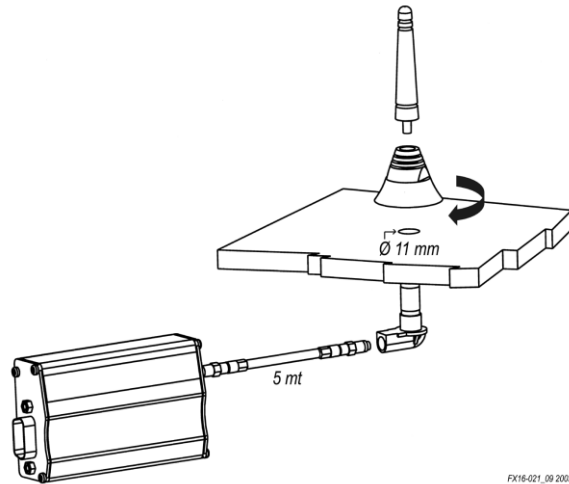


Figure 21 : Panel Mount Antenna

GSM Modem Power

The GSM modem requires 5 to 32 VDC power at 12 W maximum to operate.

The **GSM Modem Power Adapter (LP-KIT090-005C)** is a non-regulated AC/DC adapter with a wall plug for a Central European socket. The input is 230 VAC and the output is 9 VDC at 1,300 mA maximum. An equivalent adapter must be purchased locally in areas with other supply voltages and plugs.



Figure 22: GSM Modem Power Adapter

GSM Modem Interface

The modem contains a simple Light-Emitting Diode (LED) interface indicating the operating status. See Table 5.

Table 5: GSM Modem LED Operating Status

LED	Description
LED Off	Device switched off - not ready
LED On	Device switched on - connecting to network
LED Flashing Slowly	Device switched on - idle mode (connected to network)
LED Flashing Rapidly	Device switched on - transmission mode

Installing the Subscriber Identity Module (SIM) Card

You must obtain a SIM card from the local GSM mobile telephone service provider.

To install the SIM card:

1. Remove power from the GSM modem.
2. Push the yellow button next to the antenna connector on the GSM modem to remove the SIM card housing. See Figure 23.



Figure 23: SIM Card Installation

3. Place the SIM card into the housing.
4. Insert the housing with the SIM card back into the modem slot.
5. Restore power to the GSM modem.

SIM Card Configuration

The SIM Card has to be pre-configured by the GSM mobile telephone service provider. Use the following specifications:

- **DISABLE** for PIN request.
- **ENABLE** for Data Transmission.
- **ENABLE** for SMS Transmission with valid Service Center number.

Room Command Modules

TM-2100 Series



**Figure 24: TM-2100 Series Room Command Modules
(80 x 80 mm [3.15 x 3.15 in.]**

You can use the TM-2100 Series of Room Command Modules with the FX06 controller. The setpoint dial enables the room occupant to adjust the working setpoint of the controller within the range of 12 to 28°C (54 to 83°F) or \pm (warmer/cooler) according to the model code.

The occupancy button enables the occupant to request a **temporary occupied** (bypass) mode during **unoccupied** mode (night/weekend) operation. The **occupied** (comfort) mode may be shown by an LED indicator. The room command module is also available with a three-speed fan override switch. The occupancy functions are configured in the control application with FX Builder.

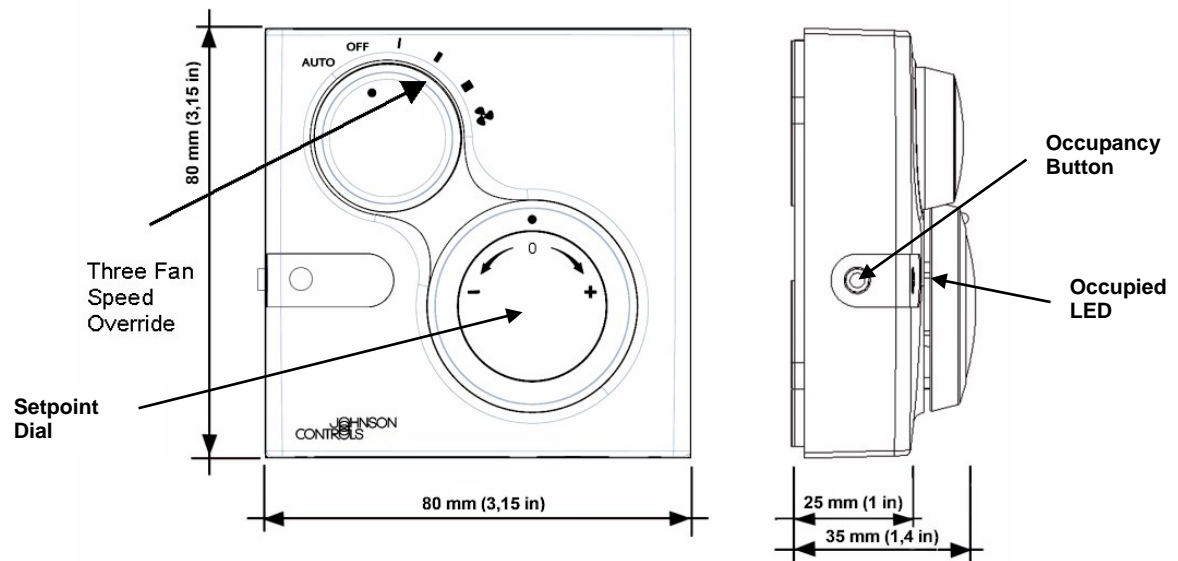
Table 6: Room Command Modules (80 x 80mm [3.15 x 3.15 in.], °C) (European Models)

Product Ordering Code	Three-Speed Fan Override	Occupancy Button	Temperature Setpoint Dial Scale	Built-in Sensor
TM-2140-0000	-	-	-	NTC 10K
TM-2150-0000	-	Yes	-	
TM-2160-0000	-	Yes	12 - 28°C	
TM-2160-0005	-	Yes	± (warmer/cooler)	
TM-2160-0002	Yes	Yes	12 - 28°C	
TM-2160-0007	Yes	Yes	± (warmer/cooler)	
TM-2190-0000	-	-	12 - 28°C	
TM-2190-0005	-	-	± (warmer/cooler)	

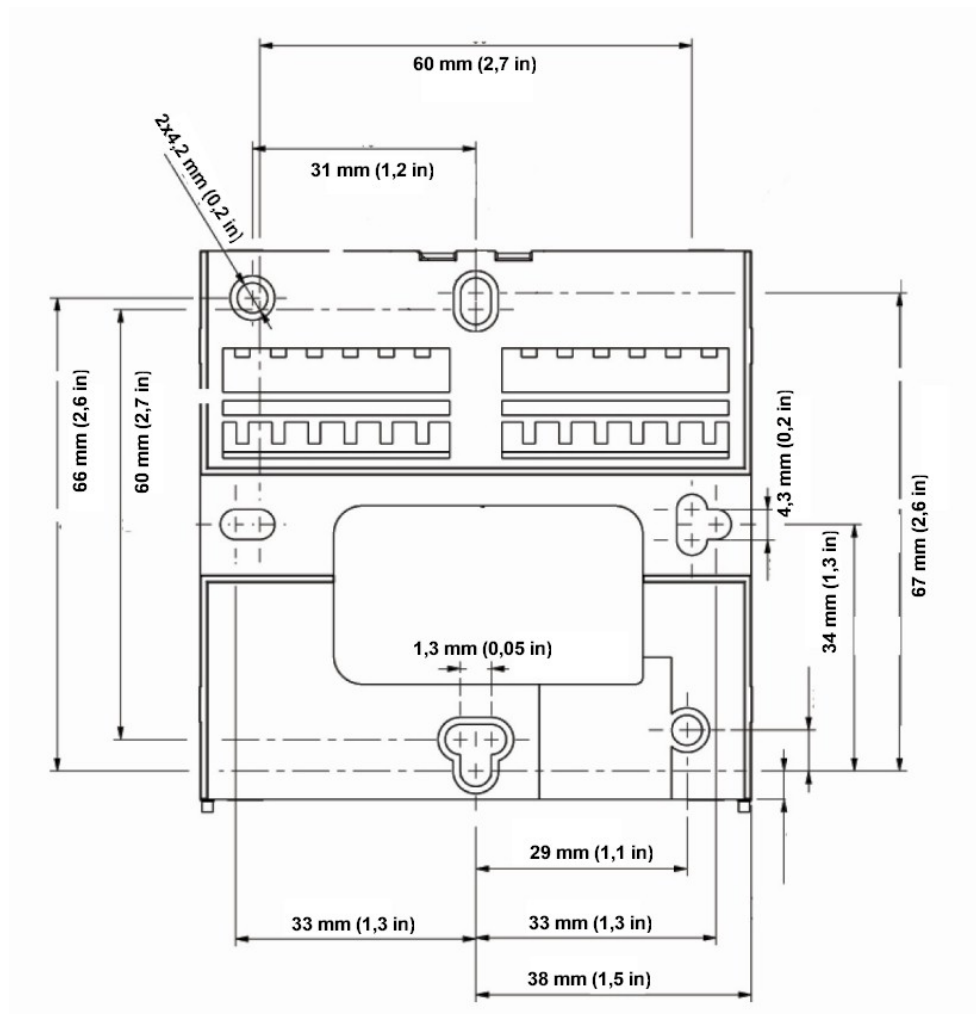
Table 7: Room Command Modules (120 x 80mm [4.72 x 3.15 in.], °C/°F) (North American Models)

Product Ordering Code	Three-Speed Fan Override	Occupancy Button	Temperature Setpoint Dial Scale	Built-in Sensor
TM-2141-0000	-	-	-	NTC 10K
TM-2151-0000	-	Yes	-	
TM-2161-0000	-	Yes	55 - 85°F	
TM-2161-0005	-	Yes	± (warmer/cooler)	
TM-2161-0002	Yes	Yes	55 - 85°F	
TM-2161-0007	Yes	Yes	± (warmer/cooler)	
TM-2191-0000	-	-	55 - 85°F	
TM-2191-0005	-	-	± (warmer/cooler)	

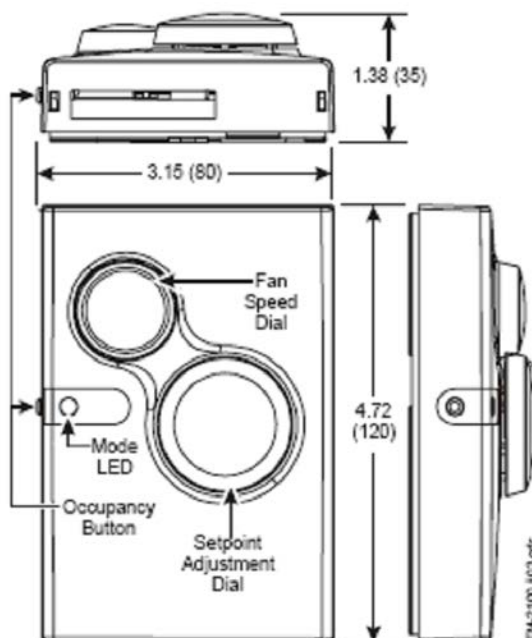
TM-2100 Room Command Module Dimensions



**Figure 25: Room Command Module Dimensions, mm (in.)
(80 x 80 mm Model)**



**Figure 26: Module Base Dimensions mm (in.)
(80 x 80 mm Model)**



**Figure 27 : Room Command Module Dimensions, in. (mm)
(120 x 80 mm Model)**

Mounting and Wiring the Room Command Modules

The TM-2100 or NRM Room Command Module is designed for wall mounting. You should place the module where occupants can easily read and adjust the setpoint dial or fan speed override switch. You should also place the module where the temperature is representative of the general room conditions. Avoid cold or warm air drafts, radiant heat, and direct sunlight.

Before connecting or disconnecting any wires, ensure that all power supplies have been turned off and all wires are potential-free to prevent equipment damage and avoid electric shock. Terminations are made on the terminal blocks in the base of the module, which accept one 1.5 mm² (16 AWG) wire or two 0.8 mm (20 AWG) wires.

All wiring to the module is at Safety Extra Low Voltage (SELV) (in Europe, and Class 2 in North America) and must be separated from power line voltage wiring. Do not run wiring close to transformers or high-frequency generating equipment. Complete and verify all wiring connections before applying power to the controller to which the module is connected.

The following wiring diagrams show typical, recommended connections between the FX06 controller and the room command module. The control application in the FX06 controller must be designed to support the connection configuration that has been actually implemented. Recommended use of physical inputs and outputs:

- AI1 Space temperature (NTC 10 K)
- AI2 Fan speed override (0 – 5 V)
- AI3 Space setpoint temperature (0 – 5 V)
- DI1 Occupancy button¹
- DO3 Occupancy LED (relay to switch 5 VDC)²

Note ¹: Alternatively, a short circuit to AI1 can be used to switch the Occupancy button when all the DIs are required as control inputs. The Analog Input SW object, of the FX Builder programming tool, can detect the occupancy button press from the **LogicUnreliable** output.

Note ²: Alternatively, an AO can be configured to switch 5VDC to the LED when DO3 is required as a control output.

Refer to the *TM-2100 Series Product Bulletin* for further technical information.

Table 8: Room Command Module Connection Details

Control Function	Component in TM Module	Terminal in TM	Connection to FX06 ³
Power Supply		22	+ 5 VDC
Common		21	AI Com
Space Temperature	NTC10k Sensor	20	Any AI (AI1 – AI4) configured in an AI object as NTC 10k
Setpoint	Potentiometer	23	Any AI (AI1 – AI4) configured in an AI object as active input for 0-5 V for desired setpoint range
Fan Speed Override Auto, OFF, Speed I, Speed II, Speed III	Potentiometer	51	Any AI (AI1 – AI4) configured as 0-5 V input channel in a Fan Command object or Any AI (AI1 – AI4) configured as active input for 0-5 V and selector logic for an input signal as follows: Auto = 0-0.25 V (0-5%) OFF 0 = 1.0-1.5 V (20-30%) Speed I = 2.25-2.75 V (45-55%) Speed II = 3.5-4.0 V (70-80%) Speed III = 4.7-5.0 V (95-100%)
Occupancy Button ¹	Switch contact	14	Any DI (DI1 – DI5)
Occupancy Status ²	LED (5 VDC)	15	Any DO switching 5 VDC

1. Alternatively, use the Occupancy button switch to short circuit the Space Temperature AI when all the DIs are required as a control inputs. The Analog Input object for the Space Temperature, configured in the FX Builder programming tool, can then report the occupancy button press from the LogicUnreliable output.
2. Alternatively, configure an AO of the FX06 controller in the FX Builder programming tool to provide an output of 0 or 5 VDC to the LED when all the DOs are required as control outputs.
3. See Figure 12 and Figure 13.

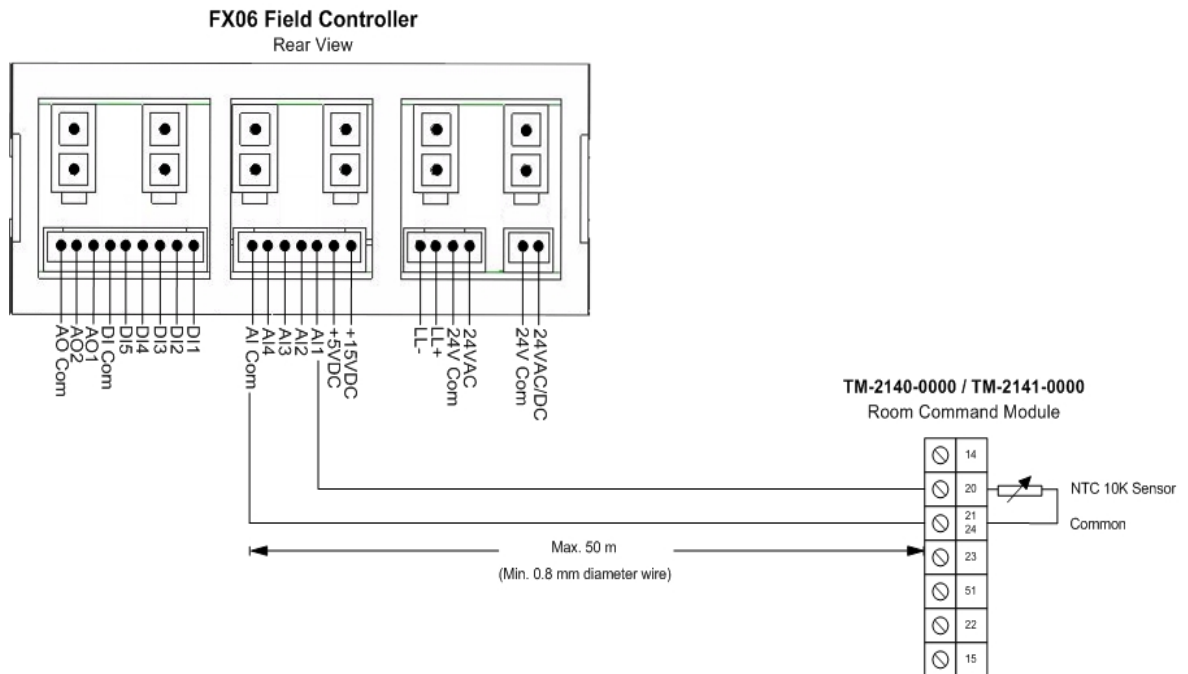


Figure 28: Wiring for TM-2140-0000/TM-2141-0000

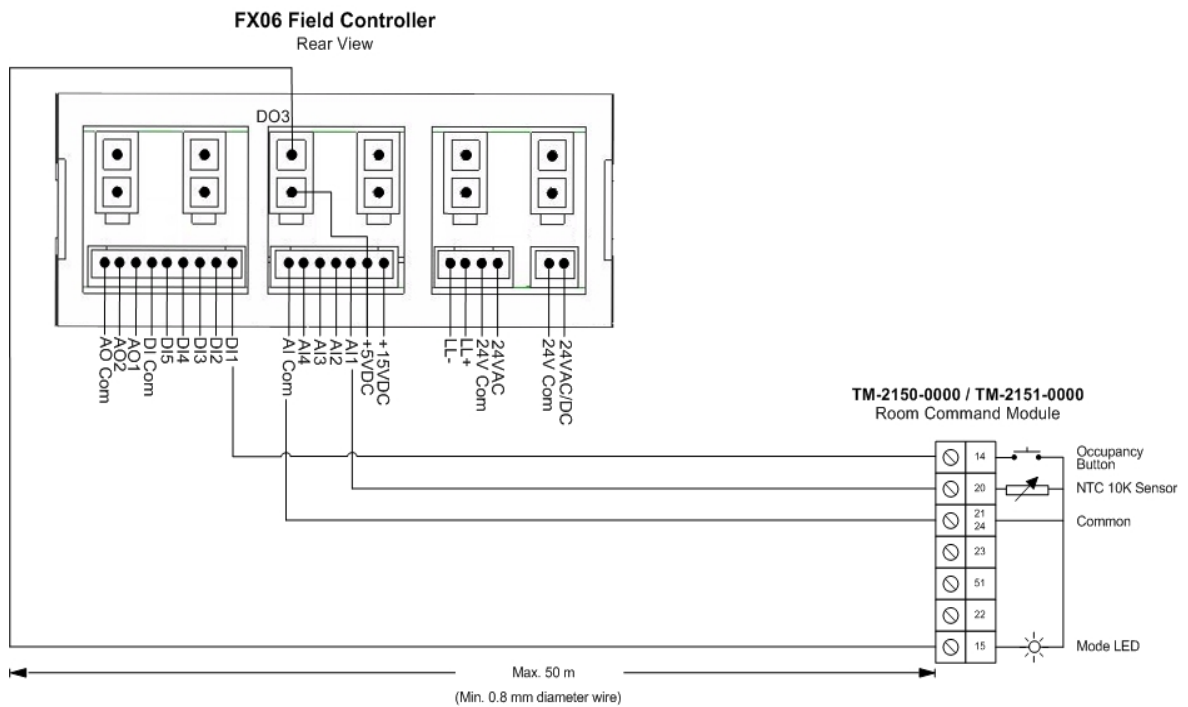


Figure 29: Wiring for TM-2150-0000/TM-2151-0000

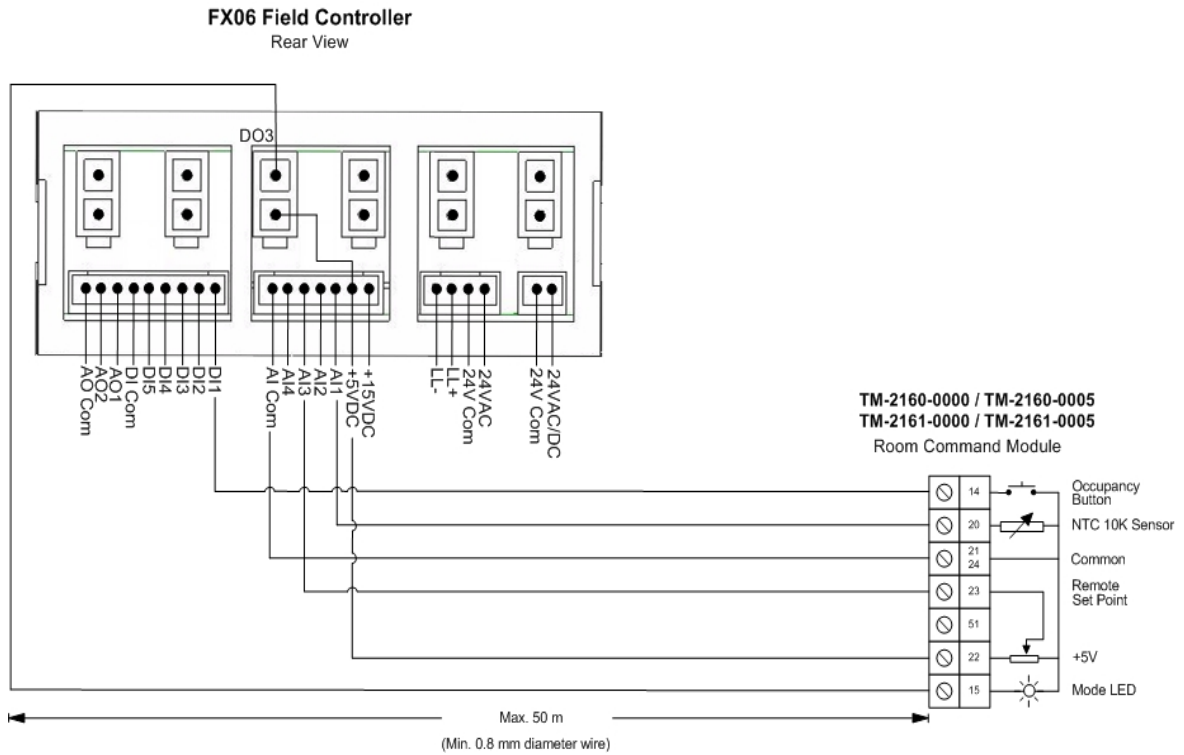


Figure 30: Wiring for TM-2160-0000/TM-2161-0000 and TM-2160-0005/TM-2161-0005

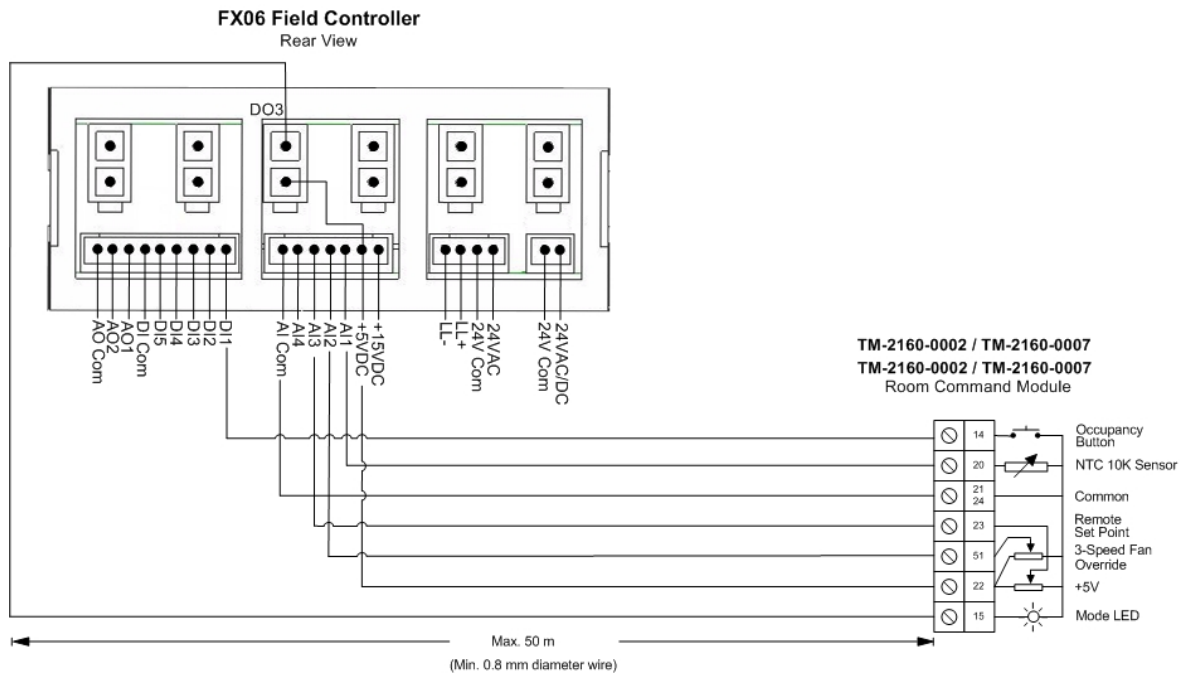


Figure 31: Wiring for TM-2160-0002/TM-2161-0002 and TM-2160-0007/TM-2161-0007

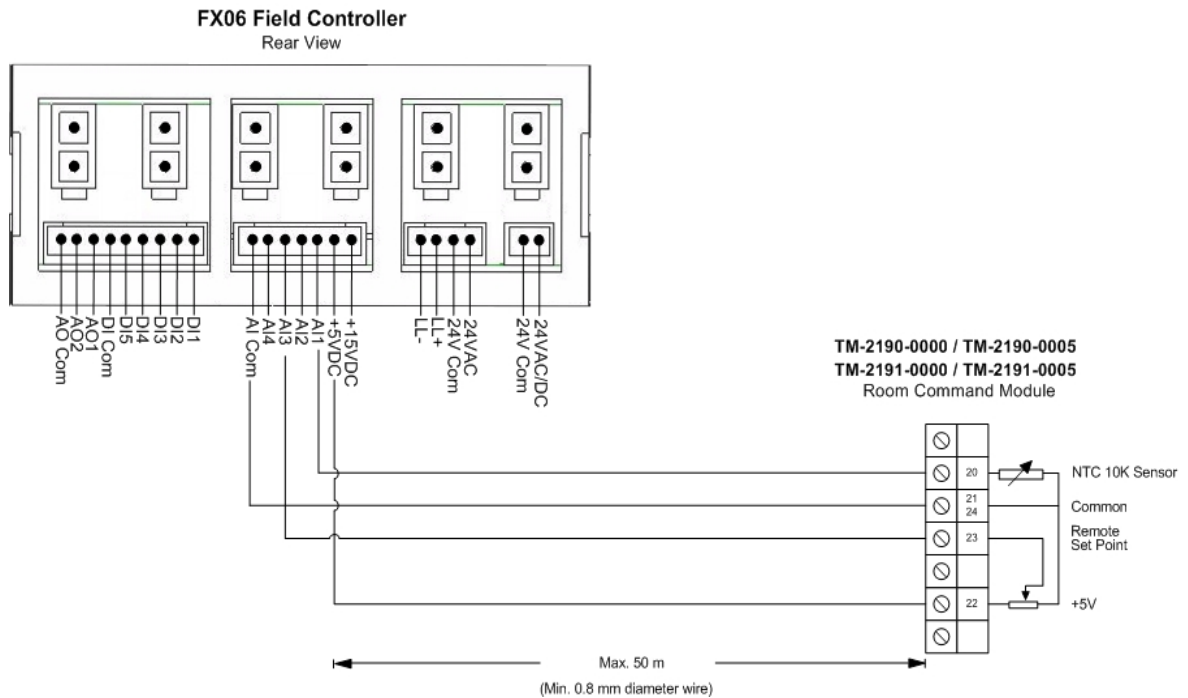


Figure 32: Wiring for TM-2190-0000/TM-2191-0000 and TM-2190-0005/TM-2191-0005

Network Room Module (NRM) Series

You can use the Network Room Module with LCD display with the FX06 controller. The LCD display, along with the dial and push button on the front of the module, allow you to view the room temperature, view and adjust the setpoint temperature in the controller, and manually override the automatic fan speed control operation. On models available in North America, you can toggle temperature units between °F and °C.

When you move the dial or press a button, a **temporary occupied** (bypass) mode is requested during **unoccupied** mode (night/weekend) operation. The **unoccupied** mode may appear by a flashing LCD display.



Figure 33: NRM Room Command Modules (80 x 80 mm [3.15 x 3.15 in.])



Figure 34: NRM Room Command Modules (120 x 80 mm [4.72 x 3.15 in.])

The NRM Network Room Module connects to the Remote Display terminals (local link bus) of the FX06 controller. The room command module accepts a power supply of 15 to 24 VDC or 24 VAC.

Refer to the *Network Room Module Technical Bulletin (LIT-12011258)* for details about the physical connections required between the room command module and the FX06 controller, and for details about the features and functions. A summary of the features of the Network Room Module (NRM) appears in Table 9 and Table 10.

Table 9: Network Room Modules - Available in Europe

Product Code	Features/Options						
	Size (mm)	Service Port Type	LCD Display	Temperature Adjustment Dial	Fan Speed Selector Button	°F/°C Button	Addressable
LP-NRM001-000C	80 x 80	Program Key	No	No	No	No	No
LP-NRM002-000C			Yes	Yes	No	No	No
LP-NRM003-000C			Yes	Yes	Yes	No	No
LP-NRM511-000C		MUI	No	No	No	No	Yes
LP-NRM502-000C			Yes	Yes	No	No	No
LP-NRM503-000C			Yes	Yes	Yes	No	No

Table 10: Network Room Modules - Available in North America

Product Code	Features/Options						
	Size, mm (inch)	Service Port Type	LCD Display	Temperature Adjustment Dial	Fan Speed Selector Button	°F/°C Button	Addressable
LP-NRM511-000C	80 x 80 mm (3.15 x 3.15 in.)	MUI	No	No	No	No	Yes
LP-NRM552-000C			Yes	Yes	No	Yes	No
LP-NRM553-000C			Yes	Yes	Yes	Yes	No
LP-NRM611-000C	120 x 80 mm (4.72 x 3.15 in.)	MUI	No	No	No	No	Yes
LP-NRM652-000C			Yes	Yes	No	Yes	No
LP-NRM653-000C			Yes	Yes	Yes	Yes	No

NRM Network Room Module Dimensions

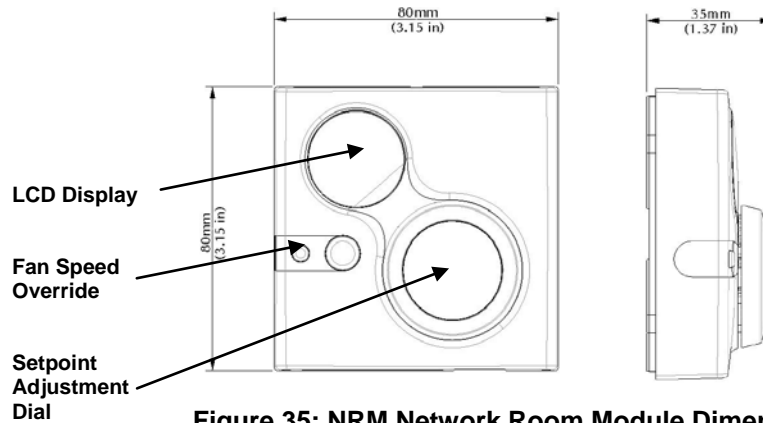
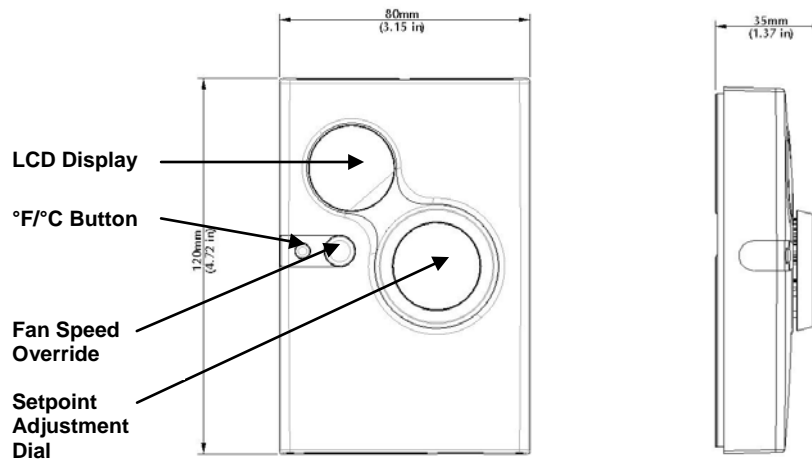


Figure 35: NRM Network Room Module Dimensions, mm (in.)



**Figure 36: NRM Network Room Module Dimensions, mm (in.)
(North American Model)**

Remote User Interfaces

In addition to the integral user display, the FX06 supports one MUI display. The MUI is available in two models: **panel mount** (up to 3 m [9.8 ft]) and **wall mount** (up to 300 m [1,000 ft]).

For the panel mount connection, use the pre-cabled connection kit (LP-KIT007-005C), 3 m (9.8 ft) long, with an RJ connector on the MUI side and a preassembled plug connector on the FX06 side. See Figure 37.

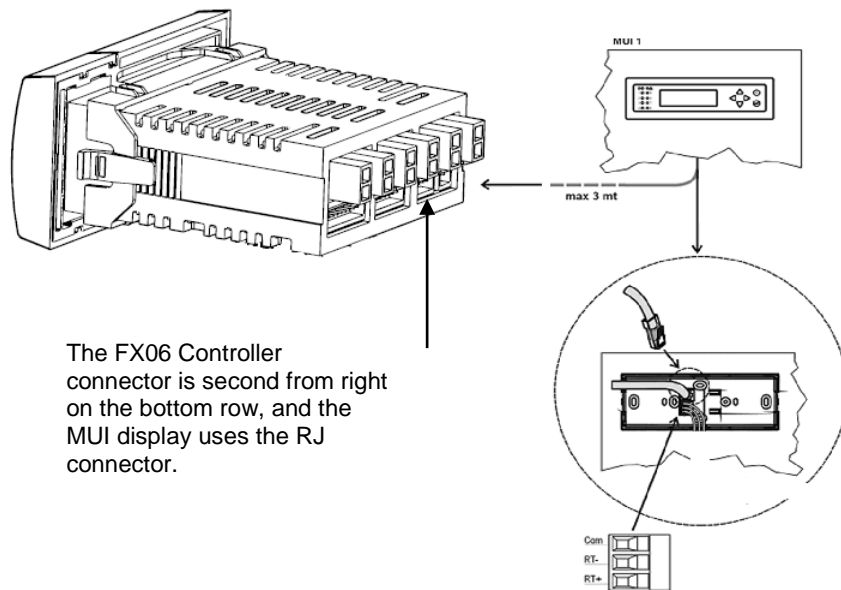


Figure 37: Installation of a Remote MUI

FX Programming Key (N2 and RS-232C applications only)

The Programming Key is used to download an application to the FX06 controller. You can load the Programming Key from a computer or from a preprogrammed FX06.



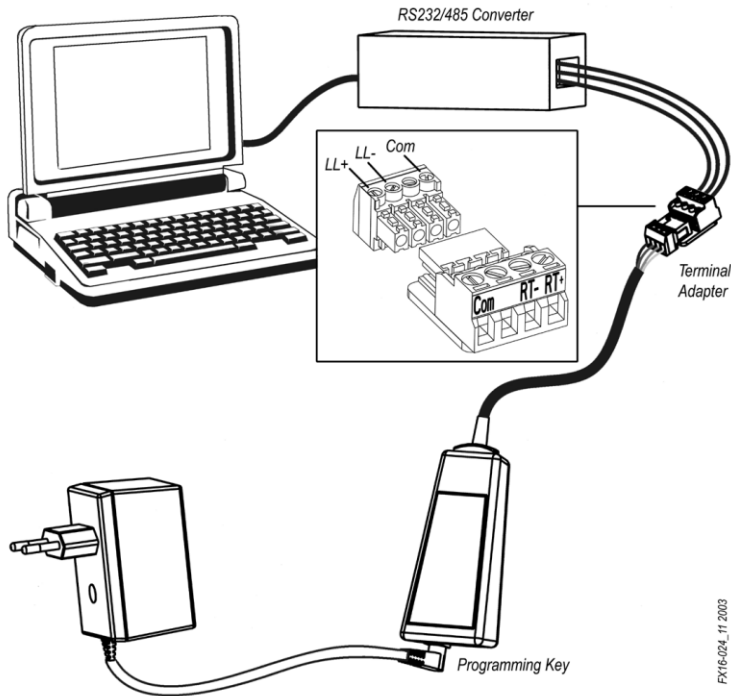
Figure 38: Programming Key

Connecting the Programming Key to an FX06

To connect the Programming Key to an FX06:

1. Remove power from the controller.
2. Slide the keypad section of the integral display to the right (use a small screwdriver to release the keypad) to expose the Programming Key connector port.
3. Plug the Programming Key into the connector port.
4. Restore power to the controller and download or upload the application.

Connecting the Programming Key to a Computer



FX16-024_11 2003

Figure 39: Programming Key Connection to a Computer

To connect the Programming Key to a computer:

1. Connect the Programming Key using the adapters (included in the Programming Key kit) to an RS-232C/485 converter connected to the computer. Use Table 12 as a reference.

Table 11: Programming Key Adapter Kit

Adapter Kit	Adapter	RS-232C/485 Converter
1 (Com)	1	Com
2 (+15VDC)	2	Not used
3 (LL-)	3	RT-
4 (LL+)	4	RT+

2. Power the Programming Key using an AC/DC power adapter.
3. Start FX Loader from the computer.
4. Upload the application.

Inputs and Outputs

Introduction

The FX06 Controller features the following physical Input/Output (I/O) channels. You can directly connect up to 17 physical inputs and outputs to the FX06.

- four Analog Inputs (AIs)
- five Digital (Binary) Inputs (DIs)
- six Digital (Binary) Outputs (DOs)
- two Analog Outputs (AOs)

Inputs and Outputs Concepts

Analog Inputs

The FX06 controller accepts up to four analog inputs. You can configure each one in the application software using FX Builder to read A99, NTC 10k, PT1000, Ni1000 passive temperature inputs, Ratiometric (0.5-4.5 V) or 0-10 V active inputs.

Digital Inputs

The FX06 accepts five digital (binary) inputs from free contacts. With the input filter set at 50 Hz, you can configure a transition counter (minimum 10 ms On and minimum 10 ms Off) in the control application for any one or more of the digital inputs.

Analog Outputs

The FX06 provides two analog outputs. They are configured in the application software.

Digital Outputs

The FX06 provides six digital (binary) outputs, available in two hardware configurations:

- six relays
- two triacs and four relays

Detailed Inputs and Outputs Procedures

Analog Inputs

The four FX06 analog inputs accept a wide range of analog input signals, either passive or active in the related Analog Input object setup configuration using FX Builder.

The voltage outputs from the FX06 controller can supply +15 VDC at 20 mA for all active 0-10 V sensors and +5 V at 15 mA for ratiometric sensors. These outputs limit the number of active sensors that can be powered by the controller. Check the sensor current consumption data before connecting any device.

The ranges of active sensor (voltage) inputs are set in configuration parameters within the application software using FX Builder. These parameters, HighRange and LowRange, define the equivalent values for reading at high (10 V, 4.5 V) and low (0 V, 0.5 V) signal inputs. Voltage 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 sensor (resistance) inputs have pre-configured linearization characteristics within the application software. For these sensors, the measurement range is fixed, but you can set the reliability range in software.

The input signal is converted by the FX06 according to the related Analog Input object setup configuration. The setup possibilities include the following:

- A99 temperature sensor
- Ni1000 Johnson Controls® temperature sensor
- Pt1000 temperature sensor
- NTC 10k ohm temperature sensor
- linear 0-10 V
- ratiometric sensor 0.5-4.5 V

The measurement unit of the analog value also enables the controller to transmit the measured value via the network in the appropriate format.

(This is particularly important for LONWORKS networks.) Available configurable units include the following:

- temperature
- percentage
- air pressure
- liquid pressure
- flow
- voltage

A configurable filter object is available in the FX06 application software for each analog input for the reduction of signal instability. You can configure an additional anti-spike filter to limit the rate of change of the input value.

Connecting Passive Resistive Sensors

The FX06 controller provides the power source. The controller also linearizes the signals from Resistive Temperature Device (RTD) sensors connected to analog inputs to provide a reading in temperature units.

You must configure the analog input to accept the correct passive sensor type in the control application software, which is loaded into the FX06 controller. See Figure 40.

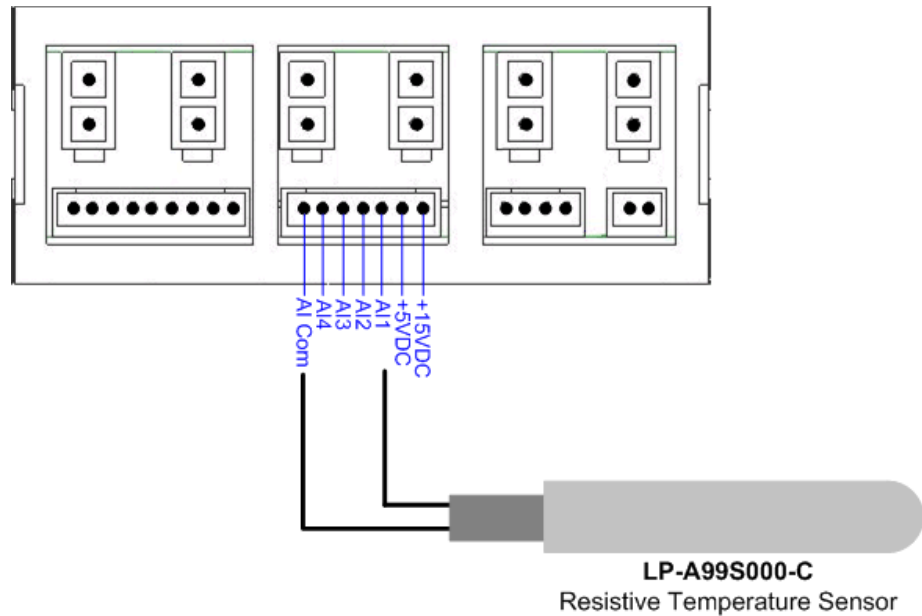


Figure 40: A99 Resistive Sensor Connection

IMPORTANT: The two passive sensor leads have no polarity; therefore, it is not necessary to respect any specific order when connecting to the terminal block.

Connecting Active 0-10 V Sensors

The FX06 accepts active temperature, pressure, flow, humidity, and other sensors that provide a voltage signal in the range of 0 - 10 VDC.

Figure 41 displays the connection between an FX06 and a sensor powered by the FX06 controller at 15 VDC.

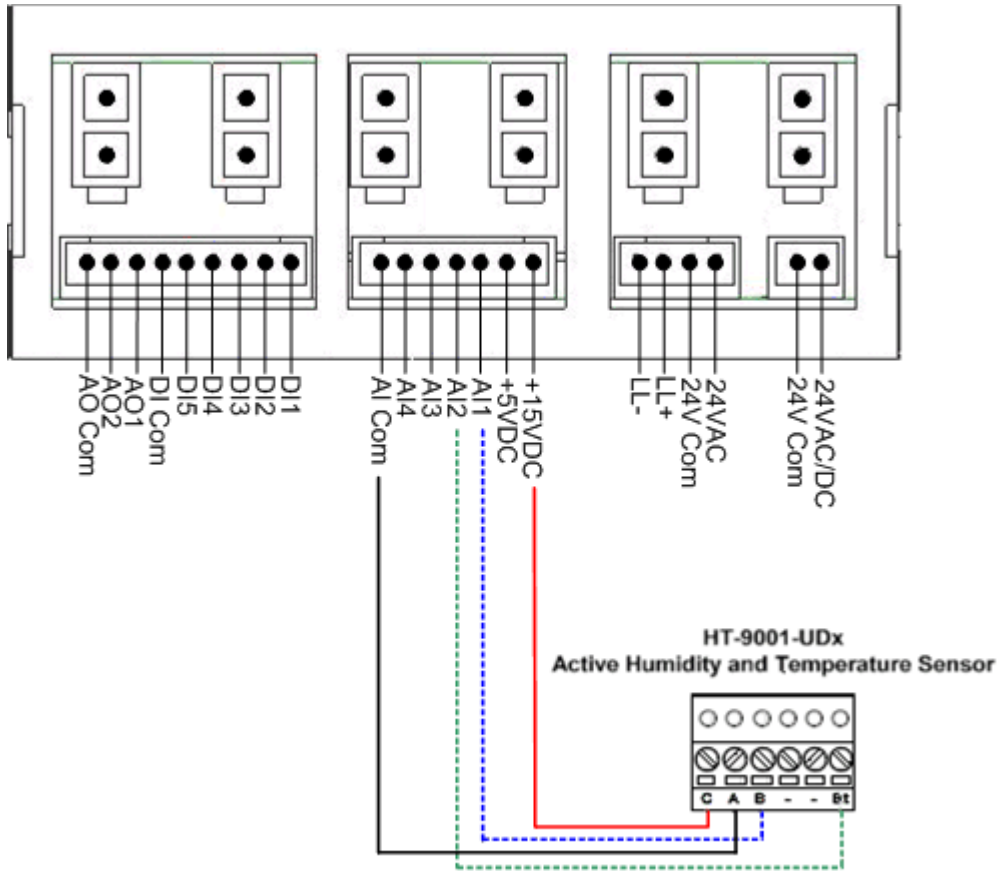


Figure 41: Active Sensor Connection

IMPORTANT: Respect connection polarities when wiring multiple sensors. Powering an active sensor with the same 24 VAC power supply as the FX06 Field Controller may affect the isolation between the microprocessor and the power supply. If you disregard the power supply and analog input polarity, a short circuit may result, causing the external fuse to blow.

Table 12: FX06 Connections to JCI HT-9001-UDx Outputs

FX06 Terminals	HT-9001 Terminals	Description
AI Com	A	Common Reference
+15 VDC	C	Sensor Power Supply 15 V, 20 mA
AI1	B	Humidity Output 0 - 10 V
AI2	Bt	Temperature Output 0 - 10 V

Digital Inputs

The FX06 controller accepts five digital (binary) inputs from voltage free contacts.

Note: There is one common terminal (DI Com) for all five digital inputs.

The Digital Input objects in the application software provide the interface between the hardware digital input channels and the control logic. A digital input is logically active (true) depending on its polarity setting. The default setting is **Normally Open** or **Direct**. This means the input is active (true) when the contact is closed. You can set the parameters in FX Builder.

Connecting Voltage-Free Contacts to Digital Inputs

The voltage-free contacts connect to the controller as shown in Figure 42.

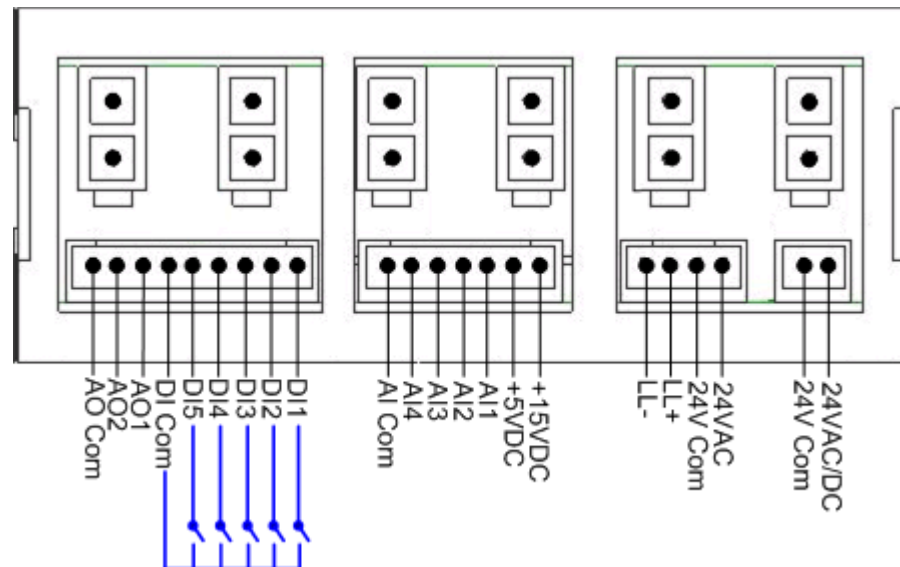


Figure 42: Connecting Voltage Free Contacts

Table 13: FX06 Connections Digital Inputs

FX06 Terminals	Description
DI1	Digital Input 1, Voltage-Free contact
DI2	Digital Input 2, Voltage-Free contact
DI3	Digital Input 3, Voltage-Free contact
DI4	Digital Input 4, Voltage-Free contact
DI5	Digital Input 5, Voltage-Free contact
DI Com	Common Reference, Voltage-Free contacts

Connecting the Transition Counter Input

The FX06 features a transition counter on one or more of the digital inputs that samples a pulse signal at 50 Hz maximum, with a minimum ON time of 10 ms and a minimum OFF time of 10 ms.

The Input Counter object in the application software provides the interface between the digital input, acting as a transition counter, and the control application. The totalized value is stored in nonvolatile memory during a power interruption to the FX06 controller and retrieved by the object after power restoration. Any pulses during the power interruption are not counted.

For example, the transition counter counts the number of times an item of equipment is started.

For informational purposes and energy management, you can also use the transition counter can as a totalizer for energy consumption measurement. For primary energy billing applications, a separate utility meter approved by local authorities is normally required.

Analog Outputs

The FX06 controller provides two analog outputs that you can configure as 0-10 VDC (each at 3 mA maximum). The Analog Output objects provide the software interface between the analog output channels and the control application.

You can configure the analog outputs for direct or reverse acting in the application software. You can limit by high limit (MaxOutput) and low limit (MinOutput) values.

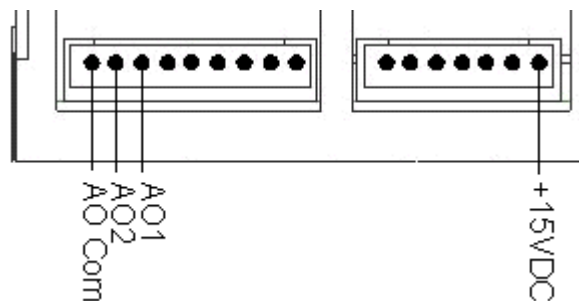


Figure 43: Analog Output Connection

Connecting the 0 – 10 V Analog Output

The FX06 analog outputs are commonly used to drive proportional devices and can be connected to drive any of the Johnson Controls, Inc. proportional valve actuators. See Figure 44.

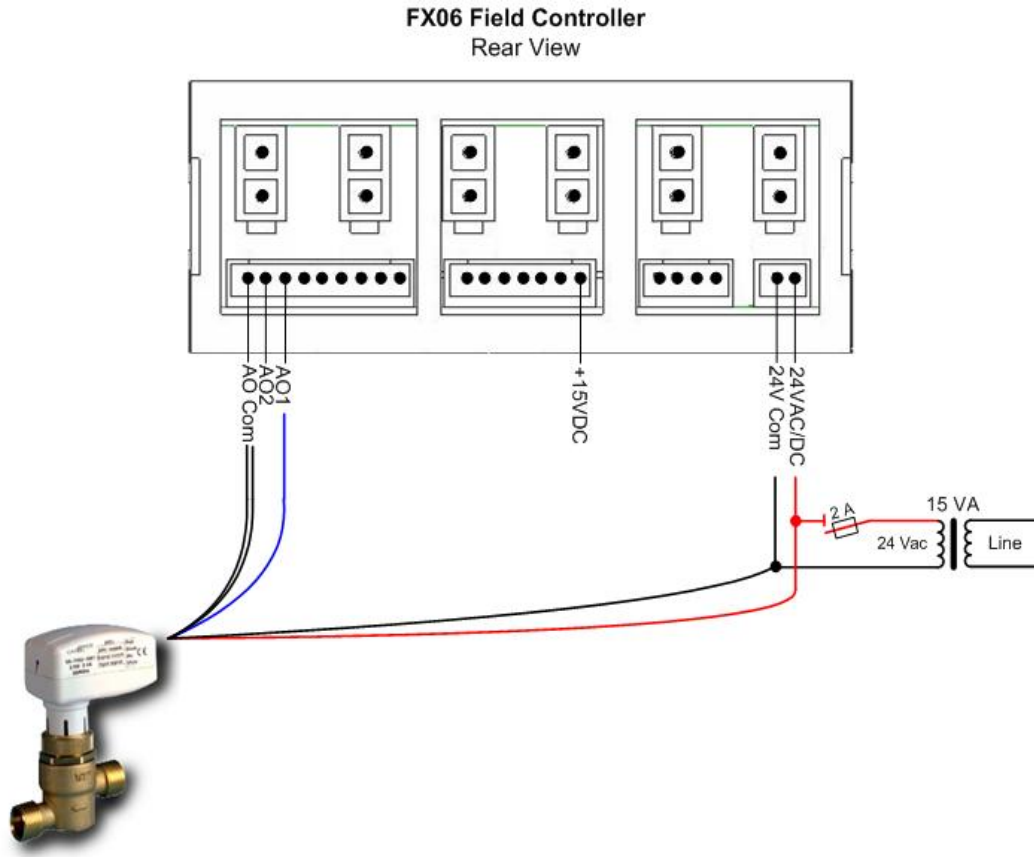


Figure 44: Connecting the Analog Output to a Valve Actuator

IMPORTANT: When the power supply to the actuating device uses the same common terminal on the device as the analog output, respect the same power supply connection polarity at any other device that is connected to the FX06 controller.

Digital Outputs

The FX06 features six digital (binary) outputs, available in two hardware configurations:

- six relays
- two triacs and four relays

The Digital Output objects in the application software provide the interface between the hardware digital output channels and the control application. You can set the parameters in FX Builder.

A digital output can be overridden and its value modified via a supervisory system if the control application is configured for this feature.

Using FX Builder, you can configure the Digital Output objects to provide the output types in Table 15.

Table 14: Output Types

Output	Description
On/Off Output	Commands the DO (triac or relay) to switch on or off depending on the input request.
Hermetic Compressor Output	Features all the functions required to switch a hermetic compressor. This output type provides the logic, interlocking, and timing features required for such an application.
Duration Adjusting Type (DAT) Output	Commands the DO (typically a triac) to drive on or off with a time based duty cycle proportional to the numeric input request. You may set a minimum On/Off time to avoid very short On pulses when the value is close to the low range value (Output at 0%) and very short Off pulses when the value is close to the high range value (Output at 100%).
Position Adjusting Type (PAT), Incremental Control Output	<p>Commands a pair of DOs (typically triacs) to drive a synchronous reversible electric actuator in one of two directions in response to a change in the numeric input request.</p> <p>A PAT output gives modulating control by using the configured actuator full-stroke (fully open to fully close) time to drive the actuator (for a part of that time base) in proportion to the change in the controlling numeric input. For example, for a 100-second actuator to achieve 40% open, the actuator runs 40 seconds from the fully closed position.</p> <p>You may set a deadband, in percent of full-stroke time, to avoid driving the actuator for very small changes in the output signal. This reduces unnecessary wear on the drive mechanism.</p> <p>The PAT object requires two digital output channels, typically triacs. One triac is switched on when the output must increase. The other triac is switched on when the output must decrease. The polarity of the PAT can change the increasing and decreasing physical channels without rewiring.</p> <p>At 0 or 100% position, the duration of switching increases by a configurable value (ResyncAmount). This ensures the valve or other controlled device is completely at its end position. If the estimated position remains fixed at 0 or 100% for a time equal to a configurable period (typically, 2 hours), a synchronization action occurs according to the ResyncAmount configurable parameter.</p> <p>If the output remains in a fixed position for more than another configurable period, the PAT output applies the anti-sticking function (if enabled) to exercise the device and the drive mechanism. This is particularly useful for water valves that require regular activity of the inner parts to keep them free to move.</p>

Connecting the Relays



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.

The FX06 features up to six digital outputs with electromechanical relays (see *Technical Specifications* for details of ratings).

Each relay contact has individual and separate terminals. Each relay also has double isolation between the contact and the relay coil and between relay contacts and triac outputs. Having separate terminals and double isolation allows the relays to connect to different voltage supply sources. See Figure 45 and Figure 46.

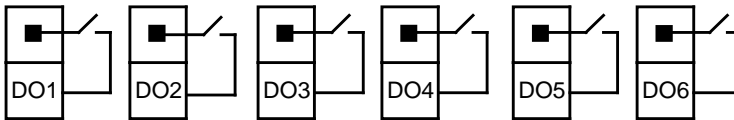


Figure 45 – LP-FX06P0x Relay Configuration



Figure 46 – LP-FX06P2x Relay Configuration

Figure 47: Three-Speed Fan Connection Diagram

Connecting the Triacs

The FX06 triac (0.5 A, 24 VAC only) digital outputs are commonly used to drive valve and damper actuators, and energize pilot relays. For example, the triac digital outputs can be configured for PAT mode to drive incremental valve actuators, such as the Johnson Controls VA-7450 actuator. The triac outputs have double isolation from the relay contacts. See Figure 48.

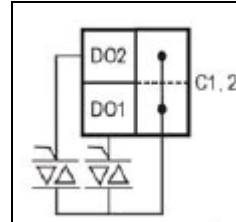


Figure 48: FX06P2x Triac Output Connection Diagram

Example of connection:

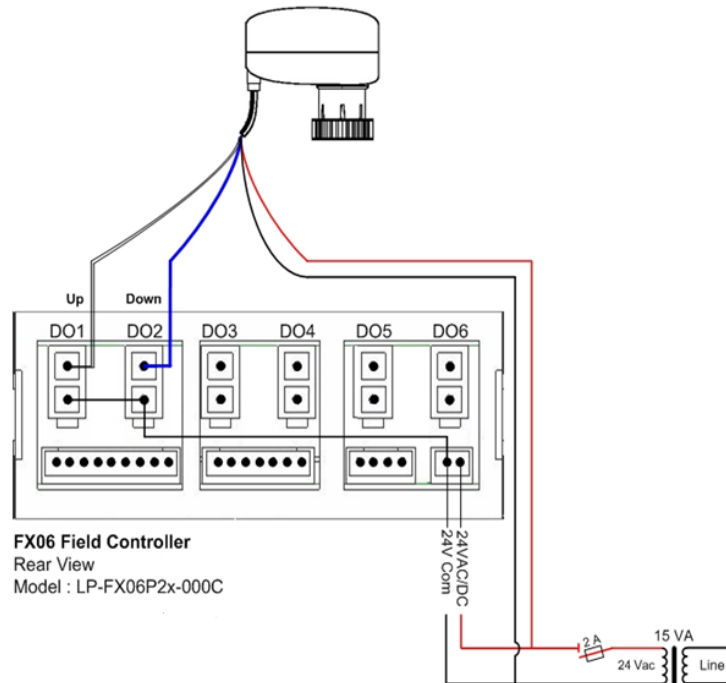


Figure 49: Connecting an Incremental VA-7450 Actuator

Table 15: FX06 Terminals

FX06 Terminals	VA-7450 Cable	Description
DO1	White	24 V ~ Up Command
DO2	Blue	24 V ~ Down Command
24 V ~ Hot	Red	24 V ~ Hot Reference
24 V ~ Com	Black	24 V ~ Common Reference

Operation

Operation Concepts

Communication Services

Using a GSM modem, the FX06 controller can send SMS text messages to mobile telephones to report alarms and events.

Event Management

The FX06 records events or errors generated by the operating system and events or alarms associated with data points or variables in the control application. You can view the active events and the event history log on the user interfaces. You can also configure the event to send a message to a mobile phone via an SMS text message.

Trend Logging

This feature enables the recording of four variables at intervals from 1 minute to 1 day for display on the remote user interface.

Time Scheduling

This feature allows on/off control actions based on a weekly time schedule with holiday exceptions. The real-time clock is backed up by a rechargeable capacitive battery for a minimum of 10 days at room temperature after a power failure.

User Interfaces

The FX06 controller has an integral interface to display and edit data points and configuration parameters of the running application. The user interface is fully configurable at design time.

You can design the user interfaces for the FX06 with up to five different languages that users can select from the remote user interface.

Supervisory Option

You can integrate the FX06 into a supervisory building automation system for continuous monitoring of the control system. Three methods of integration are supported:

- N2 Open
- LONWORKS TP/FT-10

Application Configuration and Commissioning

The FX06 design is based on an object and services oriented architecture that includes configurable input/output, control algorithm and real-time functions, and serial communication options. You can create control applications, download them into the FX06 controller, and commission the FX06 using the FX Tools software package.

The tools available in the FX Tools software package are as follows:

- **FX Builder:** Use FX Builder to program and configure Facility Explorer controllers using menus, navigation trees, and screens. The application 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 user interface display screens and navigation.
- **FX CommPro N2/LON Software:** Use FX CommPro N2/LON software to download and commission Facility Explorer controllers with parameter configuration for control sequence and loop tuning. Three versions of the FX CommPro tool support controllers on N2 Open, and LONWORKS protocol networks.

Security

The FX Tools software package and the Facility Explorer controllers come with embedded security features based on the use of two Identifiers (IDs):

- Family ID (embedded in the controller hardware at the factory)
- Customer ID (embedded in the application file by the user)

The Family ID and the Customer ID provide protection against downloading an application to the wrong controller. The Customer ID also prevents unauthorized access within the software tools to applications developed by other users.

Application Download

You can download applications to the FX06 controller with the following:

- FX CommPro N2/LON application software
- FX Programming Key (N2 applications only)

Detailed Operation Procedures

Communication Services

With a GSM modem connected, the FX06 controller can send SMS text messages to report alarms and events.

To configure communication (notification) services, select the Application > Notification Services > SMS menu of FX Builder (Figure 50).

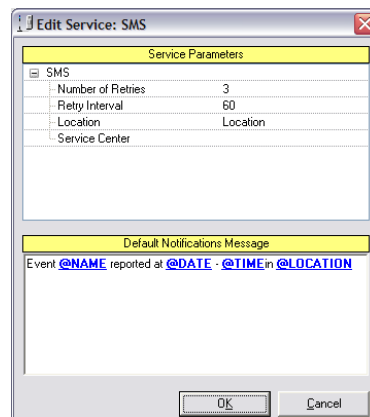


Figure 50: Edit Service: SMS Configuration Window

Refer to the *FX Tools Software Package - FX Builder User Guide (LIT-12011154)* for more information about how to configure these services.

Event Management

The FX06 manages and records events or errors that are generated by the operating system and events or alarms that are associated with data points or variables in the control application.

System events indicate that the control system requires some attention and include the following events:

- system powerup
- event log buffer full
- trend log buffer full
- communication message failure (SMS)
- application or display diagnostic error

Application events or alarms indicate that the controlled equipment requires attention or that the controlled conditions are not within the expected limits. These include the following:

- analog value is outside of a desired range
- status value represents a condition that has changed or is not in the normal condition

You can define up to of 20 binary or enumerated logic values for application event monitoring with or without the requirement for acknowledgement.

If an event goes into the active state, a message window appears on the display screen. You can also configure the event to send a message to a mobile phone by SMS. The event appears in the active event list and is only removed from the list when the event is no longer active and acknowledged (if required) through the user interface or by an SMS message from the mobile phone. The event is also entered into the event log with the time and date of occurrence. The event log contains up to 100 events. You can view the events on the user interface.

Events Plug-in

FX Builder includes an Events window (plug-in) that allows you to define and configure the system and application events and the messaging services to use. You can define a maximum of 20 events (Figure 51).

The **Events Icon**  opens the Events plug-in.

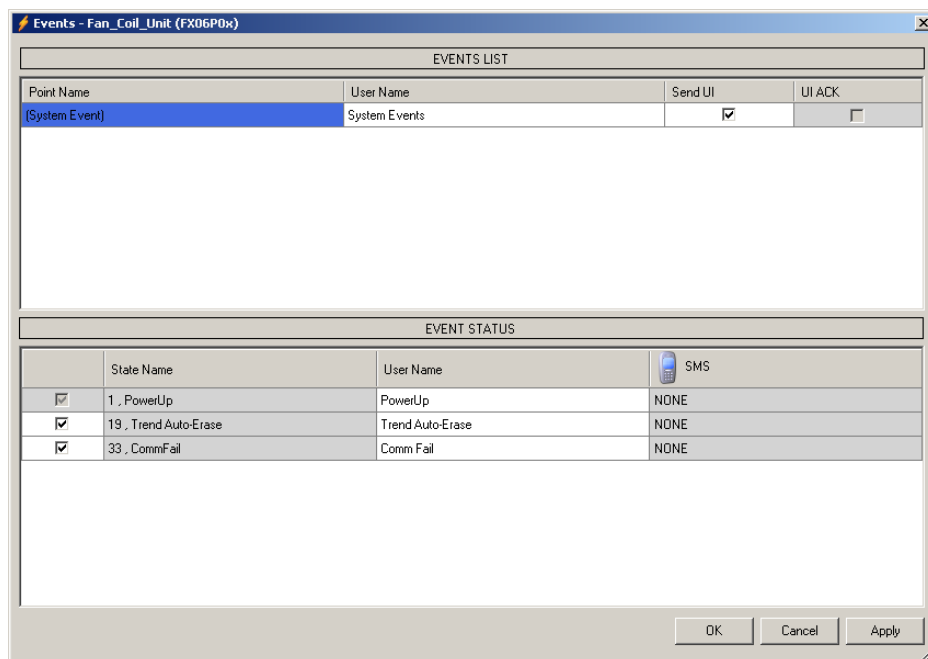


Figure 51: Events Plug-in

You can associate events with changes in binary or enumerated logic variables in the Network Profile or the Application Profile. System events are predefined conditions related to the execution of the application by the operating system.

The Events window allows you to select the mobile phone (SMS) destination for each event from the available Contacts or Groups defined in the Address Book. If you want to send notification to more than one contact, then you need to define a group from the address book containing all the contacts to notify.

Trend Logging

You can configure the FX06 Field Controller to record data samples at a defined interval from up to four variables within the control application. You can set the sample interval from every minute to once per day. For example, the onboard memory can hold a trend log of samples taken at 15-minute intervals on 4 variables for up to 30 days. You can view the trend data for each variable on the remote user interface (MUI). See Figure 52. You can also read the trend data using the FX CommPro N2 tool.

A system event message generates if the trend buffer is not configured in the circular recording mode and the buffer becomes full.

20/03/2008	17:34	▲
→ 20.7	°C	
20/03/2008	17:24	
→ 20.9	°C	▼

Figure 52: Trend Display on MUI

Trends Plug-in

The Trends window (plug-in) of FX Builder defines the variables logged in the controller memory.

Clicking on the Trends Icon  opens the Trends window. See Figure 53.

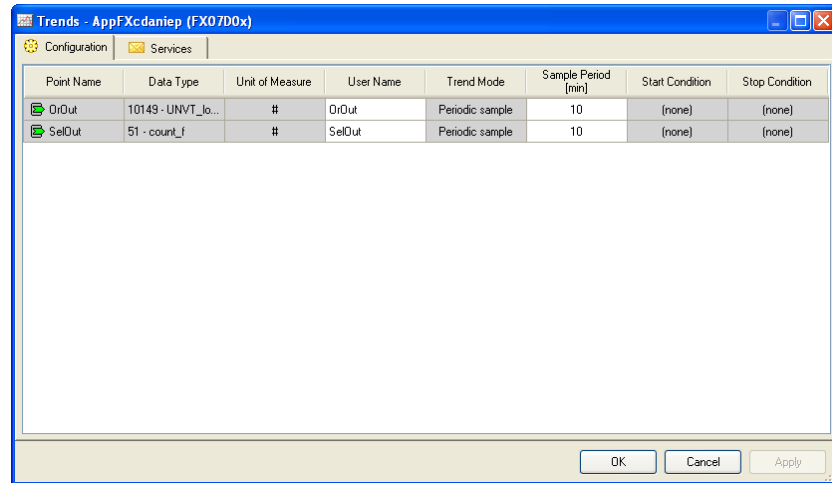


Figure 53: Trends Configuration Window

With the Trends plug-in in FX Builder, you can define trend logging for up to four analog or logic variables from the application profile inputs and outputs.

Trend Logging Memory Allocation

Table 16 shows the memory allocation for the trended values.

Table 16: Trend Logging Memory Allocation

Memory Allocated to Trends	Memory Usage for One Sample with Time Stamp	Maximum Number of Samples (with Four Variables)
64 KB	Float value = 4 Bytes Profile value = 2 Bytes Time stamp = 5 Bytes (for all samples at one time)	3,000 (30 days at 15 minute sample intervals)

Float values are the object outputs and the profile values are the Network Profile and Application Profile variables.

If one or more of the four variables are not used, the memory allocation can be used to increase the allocation of other variables.

Time Scheduling

The FX06 has a clock that supports all real-time functions. This includes the display of time and date on the user interface and the time stamping of each recorded event. After a power failure, a rechargeable capacitive battery (fully charged) can back up the real-time clock for a minimum of 10 days at 25°C (77°F).

The real-time clock also enables the time scheduling of start and stop commands and occupancy mode changes to the plant you want to monitor and control. You can display and edit time schedules on the integral user interface (On/Off Scheduler only) or on a remote MUI user interface.

On-Off Time Scheduler

The On-Off Time Scheduler object controls a binary (On-Off) output according to a configurable event schedule, real time, day of the week, and holidays (or exception days) in the calendar.

Use FX Builder to configure the scheduler. Use FX CommPro to modify the scheduler in a graphic format. You can modify the scheduler from the integral/remote interface if configured in the application.

You can also define a logic command to force the Time Scheduler object output to On or Off for a simple override function from a user interface.

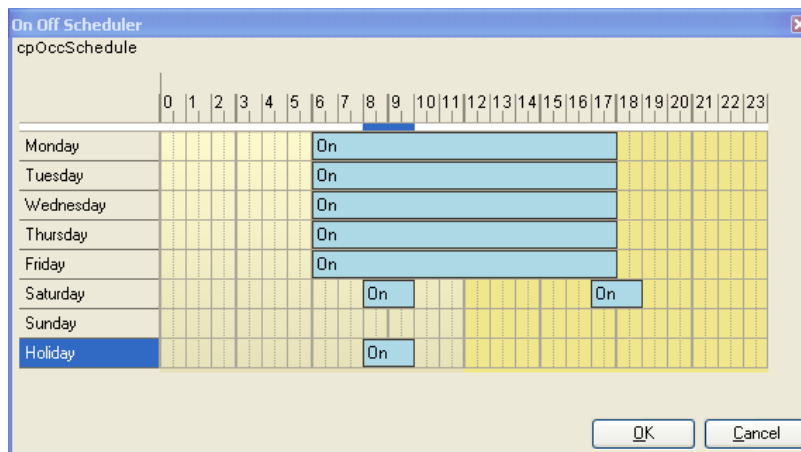


Figure 54: On-Off Scheduler Definition

Weekly Occupancy Scheduler

The Weekly Occupancy Scheduler object controls a multi-state output with the states of Occupied, Standby, and Unoccupied. This situation occurs according to a configurable event schedule, as well as real time, weekday, and holidays (exception days) in the calendar.

Use FX Builder to configure the scheduler and FX CommPro to modify the scheduler in a graphic format. You can modify the scheduler from the remote interface (MUI) if the scheduler was configured in the application.

You can also define a multi-state command to force the Time Scheduler object output to Occupied, Standby, or Unoccupied. This scenario can be used as a simple override function from a user interface.

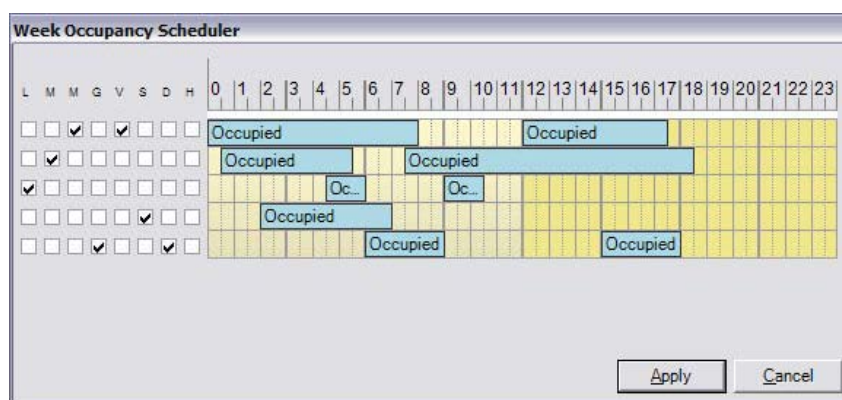


Figure 55: Weekly Occupancy Scheduler Definition

Exceptions Calendar

Use the Exceptions Calendar in FX Builder to define holidays or exception days in a graphic format. Use FX CommPro (or the integral or remote user interface if configured in the application) to modify the holidays.

User Interfaces

The FX06 supports one or two user interfaces, which enable you to display and edit data points and configuration parameters of the running application. The user interface is fully configurable at design time. The design and use of a user interface is optional and the controller can operate it without the display.

The FX06 has an **integral** user interface (see Figure 56) and can also support one **remote** user interface (MUI):

- **Panel mount MUI:** non-isolated version up to 3 m (9.8 ft) from the controller with power supply and data communication via the flat telephone cable with order code LP-KIT007-005C.
- **Wall mount MUI:** up to 300 m (1,000 ft) from the controller. The wall mount display must be independently powered and the data communication is transmitted over a three core shielded cable (not provided) connected to the Remote Display terminals of the FX06. You can also panel mount the wall mount version when the panel is further than 3 m (9.8 ft) from the controller.

Integral User Interface

The integral user interface is fully configurable within the application. See Figure 56.

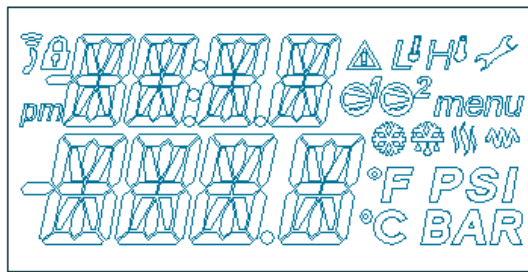


Figure 56: Detail of the FX06 Controller LCD User Interface

The integral user interface specifications are as follows:

- two display lines with 4 alpha-numeric characters (13-segment)
- blue or red background
- graphic status icons: compressor (2), alarm, high pressure, low pressure, maintenance, heat, cool, defrost and electric heat symbols
- four command buttons for user control functions
- navigation menu for user guidance

The integral user interface typically provides the following:

- display of status information

- display of active events and event log
- background lighting with red color when an alarm condition exists
- display and modification of setpoints
- display and modification of configuration parameters

The **remote user interface (MUI Version 3)** (Figure 57) provides the following:

- 4 x 26 character, backlit LCD display
- Panel mount, non-isolated version - LP-DIS60P20-0C
- Wall mount isolated version - LP-DIS60P21-0C
- IP54 protection rating when mounted in a panel



Figure 57: Medium User Interface

Integral Display Operation

Home Page

The home page (Figure 58) displays the value of one data point. If there is a text name for the data point, the text appears on the first line of the display. If the text has more than four characters, the name scrolls on the display. The maximum length for the text is 32 characters.

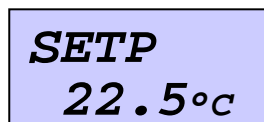


Figure 58: Example Home Page

Display and Keypad Modes

The action of the keypad depends on the mode of the display. Table 17 describes the keypad actions in the Selection mode.

Table 17: Keypad Actions in Selection Mode

Keypad	Description
△ / ▽	Scroll the displayed lines of text or data up and down (when more than two lines of text).
OK	Go to Edit mode and the selected value starts to blink.
C	Return to the Home Page.

Table 18 describes the keypad actions in the Edit mode.

Table 18: Keypad Actions in Edit Mode

Keypad	Description
△ / ▽	Increase/decrease the value.
OK	Confirm the edited value.
C	Cancel the operation and return to Selection mode.

Menu Page

To open the Menu Page, press the C button when the Home Page appears.

When the Menu Page appears, the **menu** icon also appears. The upper row displays a sequential index number and the lower row displays the menu item tag text. If the text has more than four characters, the tag scrolls from right to left on the display. See Table 19.

Table 19: Menu Page

Display	Menu Item
The display shows '-01-' in the top row, 'menu' in the top right, and 'PASS..' in the bottom row. The background is light blue.	Password (Standard)
The display shows '-02-' in the top row, 'menu' in the top right, and 'EVEN..' in the bottom row. The background is light blue.	Events (Standard)
The display shows '-03-' in the top row, 'menu' in the top right, and 'SCHE..' in the bottom row. The background is light blue.	Schedulers (Standard)
The display shows '-04-' in the top row, 'menu' in the top right, and 'TEMP..' in the bottom row. The background is light blue.	Temperatures (User Defined)
The display shows '-05-' in the top row, 'menu' in the top right, and 'FANS' in the bottom row. The background is light blue.	Fans (User Defined)

Table 20 describes the keypad actions on the Menu page.

Table 20: Keypad Actions on the Menu Page

Keypad	Description
△ / ▽	Scroll through the menu items.
OK	Go to the selected menu item page.
C	Return to the Home Page.

Password Menu

After you select the Password menu, the Log-in page appears (Figure 59).

The upper row displays the User IDs in the controller, and the user enters the required password in the lower row.



Figure 59: Password Menu

Table 21 describes the keypad actions on the Log-in Page.

Table 21: Keypad Actions on the Log-in Page

Keypad	Description
△ / ▽	Scroll through the list of User IDs.
OK	Confirm the user name. Displays and waits for the entry of first digit of password.
C	Abort password entry and return to the Home Page.

Table 22 describes the keypad actions on the Log-in Page (during password entry).

Table 22: Keypad Actions on the Log-in Page (During Password Entry)

Keypad	Description
△ / ▽	Increase or decrease the active digit.
OK	Confirm the digit value. Next digit becomes active. After entry of last digit, the password is verified. If the password is wrong, a warning message appears.
C	Return to previous digit.

Event Summary Menu

The Events Summary page appears after you select the Events menu item, or it appears automatically when an event becomes active.

When an event becomes active, the display appears with the red backlight. See Figure 60. The backlight changes to blue when the event returns to normal or after you press any key.

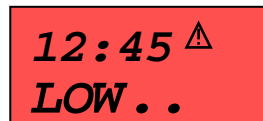


Figure 60: Event Example (LOW ROOM TEMP 12.45)

The upper row displays the time that the event became active. The lower row displays a scrolling text comprising an index, the event name (maximum 10 characters), the event state (maximum 10 characters), and the date of the event

The index indicates that more than one event is active and that other events can be displayed by scrolling up and down.

If the event requires acknowledgement, the Δ symbol flashes when the event appears on the screen. When the event is acknowledged (or does not require acknowledgement), the symbol appears steady when the event is still active and disappears when inactive. If an event becomes inactive but has not been acknowledged, the symbol continues to flash and disappears when acknowledged.

An event is acknowledged by pressing the OK key but this function is only active when you have already entered your password with at least level 1 access authority. See Table 23.

Table 23: Keypad Actions on the Event Summary Menu

Keypad	Description
Δ / ∇	Scroll through the active events.
C	Return to the Home Page.
OK	Acknowledge event (requires password with level 1 access).

Scheduler Menus

The FX06 display supports the On/Off Scheduler and the Exception Days Calendar.

When an On/Off Scheduler is defined in the control application, the Scheduler's menu item is automatically added to the display configuration.

The Scheduler's submenu page appears after you select the Scheduler's menu. See Figure 61 and Figure 62.

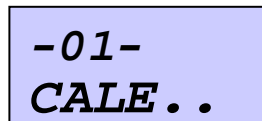


Figure 61: Scheduler's Submenu - Calendar

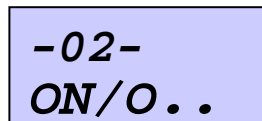


Figure 62: Scheduler's Submenu - On/Off Scheduler

Calendar (Month Selection)

After you select the Exception Days menu item, the Month Selection page appears. The upper row displays the current year and the lower row displays the current month. You can scroll through the next 11 months on the display. See Figure 63.



Figure 63: Month Selection Page Example

Table 24 describes the keypad actions on the Month Selection page.

Table 24: Keypad Actions on the Month Selection Page

Keypad	Description
△ / ▽	Scroll through the months of the year.
OK	Select the displayed month and display days of the month.
C	Return to Schedulers submenu.

Calendar (Day Programming)

After you select the month, the Day Programming page appears. The upper row displays the day of the week. The lower row displays the day number and its status. You can scroll through all the days of the month and set the status. See Figure 64.

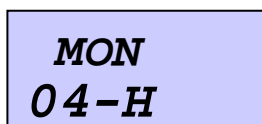


Figure 64: Day Programming Page Example

Table 25 describes the keypad actions on the Day Programming page.

Table 25: Keypad Actions on the Day Programming Page

Keypad	Description
△ / ▽	Scroll through the days of the month.
OK	Confirm the day and the status starts to blink.
C	Return to the Month Selection.

Table 26 describes the keypad actions on the Day Programming page (if the status blinks).

Table 26: Keypad Actions on the Day Programming Page (if the Status Blinks)

Keypad	Description
△ / ▽	Change the status. N= Normal Day, A= Alternate Day, H=Holiday
OK	Confirm the status. Status stops blinking.
C	Return to Day Programming page.

On/Off Scheduler (Scheduler Selections)

After you select the On/Off Scheduler menu item, the Scheduler's Selection page appears. The upper row displays the index and the lower row displays the scheduler name tag. If the name tag is longer than four characters, the text scrolls from right to left on the display.

See Figure 65.

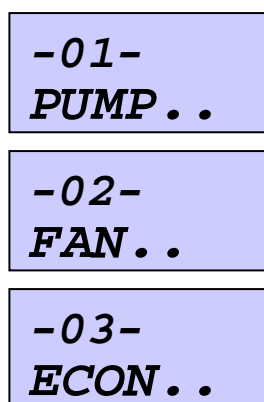


Figure 65: Scheduler's Selection Pages

Table 27 describes the keypad actions on the Schedule's Selection pages.

Table 27: Keypad Actions on the Scheduler's Selection Pages

Keypad	Description
△ / ▽	Scroll through the defined schedulers.
OK	Select the displayed scheduler and display Edit page.
C	Return to Scheduler's submenu.

On/Off Scheduler (Scheduler's View/Edit)

After you select the Scheduler, the Scheduler's View/Edit page appears. The upper row displays the index of the timed on/off event and the lower row displays the scrolling text: ENTER TO VIEW/EDIT. You can set up to 21 timed On/Off events for each Scheduler. See Figure 66.

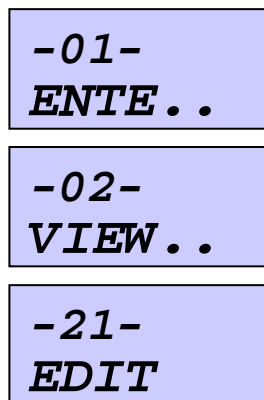


Figure 66: Scheduler's View/Edit Pages

Table 28 describes the keypad actions on the Scheduler's View/Edit pages.

Table 28: Keypad Actions on the Scheduler's View/Edit Pages

Keypad	Description
Δ / ∇	Scroll through the 21 timed On/Off events.
OK	Select the timed on/off event to view and edit, and the start time (FROM) page appears.
C	Return to Scheduler's Selection.

On/Off Scheduler (Stop/Start Time Editing)

After you select a timed On/Off event (1-21), the Start/Stop pages appear. The upper row displays the time of the event (hour:minute) and the lower row displays FROM (start time) or TO (stop time). See Figure 67.

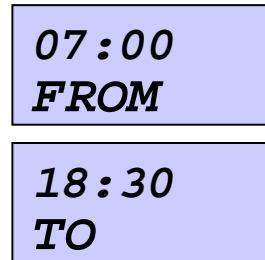


Figure 67: Stop/Start Time Editing Pages

Table 29 describes the keypad actions on the Stop/Start Time Editing pages.

Table 29: Keypad Actions on the Stop/Start Time Editing Pages

Keypad	Description
Δ / ∇	Select Start/Stop page: FROM or TO
OK	Enter edit mode for time. Field to edit blinks.
C	Return to Scheduler's View/Edit page.

Table 30 describes the keypad actions on the Stop/Start Time Editing pages (if the time field blinks).

Table 30: Keypad Actions on the Stop/Start Time Editing Pages (if the Time Field Blinks)

Keypad	Description
Δ / ∇	Increase or decrease the blinking number (hour or minute).
OK	Confirm the new number and move to next field.
C	Return to previous page.

On/Off Scheduler (Day of Week Editing)

You can scroll from the Start/Stop page to the Day of Week pages. The upper row shows the day of the week or HOL (holiday) and the selection status. The lower row shows WEEK. You can scroll through all the days of the week on the display and set the selection status. See Figure 68.



Figure 68: Day of Week Pages

Table 31 describes the keypad actions on the Day of Week pages.

Table 31: Keypad Actions on the Day of Week Pages

Keypad	Description
△ / ▽	Scroll through the days of the week and Holiday.
OK	Confirm the day and enter status edit mode.
C	Return to the Month Selection.

Table 32 describes the keypad actions on the Day of Week pages (in Status Edit mode).

Table 32: Keypad Actions on the Day of Week Pages (in Status Edit Mode)

Keypad	Description
△ / ▽	Change the status. * = selected day for timed event blank (no *) = day not selected for timed event
OK	Confirm the status and return to Day of Week page.
C	Return to Day of Week page without changing the status.

Setup Menu - N2 Baud Rate, N2 Address

The Setup menu on the integral user interface provides the only mechanism for you to view and adjust the FX06's N2 baud rate and address. The Setup menu does not appear in the Menu page. You activate the Setup menu by pressing the OK and C buttons together and then powering on the controller. The first display shows the protocol setting for the device as LON or N2. Press OK and the display for the selection of the baud rate for the N2 protocol appears.

N2 Baud Rate Selection

For N2 networks, the only valid baud rate is 9600.

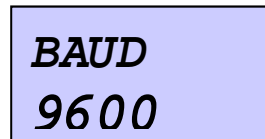


Figure 69: N2 Baud Rate Display

Table 33 describes the keypad actions for N2 Baud Rate Selection.

Table 33: Keypad Actions for N2 Baud Rate Selection

Keypad	Description
△ / ▽	Set the value to 9600 for the N2 bus.
OK	Confirm the selected baud rate and the address display appears.
C	Cancel the baud rate selection.

N2 Address Selection

The FX06 communicates as a slave device on the N2 network and must have an address of 255 or below. See Figure 70.

Note: On the field bus network of a Metasys NAE or NCE controller, addresses 0 to 3 are reserved for specific supervisory functions.

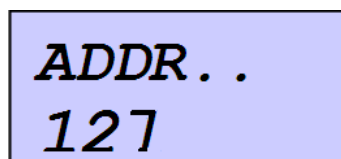


Figure 70: N2 Address Display

Table 34 describes the keypad actions for N2 Baud Rate Selection.

Table 34: Keypad Actions for N2 Address Selection

Keypad	Description
△ / ▽	Increase or decrease the N2 Address from 1 to 255.
OK	Confirm the selected N2 Address.
C	Cancel the N2 Address selection.

Multi-language Database

All the text on the screen is fully programmable and can be entered in up to five different languages using the table provided in the programming tool, which lists all the texts for translation. You can then select the preferred language from a screen menu when you log onto the system.

The user interface display configuration window (plug-in) allows you to develop the display application in the chosen primary language. The export feature then transfers all the different text strings and names of variables to a file for translation. The first language determines the length of each text and the other language translations cannot exceed this text length.

The import feature inserts the additional language databases into the display application and makes it ready to download.

This feature is designed for equipment manufacturers who export systems to many countries or for systems in areas where more than one language is spoken.

Supervisory Option

You can integrate the FX06 Field Controller into a supervisory building management system for continuous monitoring of the control system.

The FX06 supports two methods of integration:

- N2 Open network
- LONWORKS TP/FT-10 network

N2 Open Network

You can connect an FX06 with an N2 Open communication module to the N2 Open network of a supervisory system, such as a Building Automation System (BAS). The BAS then has access to the control network variables and parameters available in the network profile of the FX06.

The list of variables and parameters available to the network is defined in the N2 Open network profile. The N2 Open network profile is part of the application loaded to the controller. You can customize the network profile for each device.

The FX06, like every other controller in the Facility Explorer family, is an N2 Open Compatible Vendor Device (**VND**). FX Builder generates a file (**.prn**) that contains the relevant information from the control application for the integration of the FX06 controller into a supervisory system or controller with an N2 Open interface. The .prn file contains columns labeled Point Type and Point Address. This information generates the Network Point Type and Network Point Address in the supervisory system or controller.

N2 Open Network Profile Limits

The FX06 N2 Open interface exposes up to 62 volatile application points and up to 100 permanent application points as application points to the N2 Open Network Profile. The device application profile imposes this limitation.

Each application point may be mapped into one of the seven regions (data types) of the N2 Open protocol using FX Builder.

LONWORKS TP/FT-10 Network

You can order the FX06 controller with a LON communication module. The LON communication module enables the FX06 controller to send data to other LON controllers on a LONWORKS TP/FT-10 network. The FX06 controller can also send data to a supervisory system or controller fitted with a LONWORKS network interface module.

Use FX Builder to define both the control application and the LON network profile for the FX06. The Network Variable Input (NVI) and Network Variable Output (NVO) points in the network profile of the control application can be configured by a LONWORKS network configuration tool to transmit and receive data over the LONWORKS bus.

This capability allows a network of FX06 controllers fitted with the LON communication module to share data on a peer-to-peer basis. A network supervisory controller is not required unless you want a LON supervisory system to monitor the network.

LONWORKS Network Profile Limits

The FX06 LONWORKS interface can expose the following limits from the application points in the application profile to the LONWORKS network:

- up to 62 Network Variables (NVIs and NVOs). Three of the 62 NVs are automatically defined as part of the FX06's Node Object and include nviRequest, nvoStatus, and nvoFileDirectory. The remaining 59 NVs can be manually defined from the application points in the Application Profile.
- up to 100 Configuration Parameters (CPs)

These limits are imposed by the LONWORKS Neuron processor on the communication module.

Application Configuration and Commissioning

FX Builder

You can program and configure the FX06 controller using the menus, navigation trees, and graphic screens of FX Builder. FX Builder is part of the FX Tools Pro software package. The configuration includes the definition of the devices to connect; the physical inputs, outputs, and data points to monitor; and the format of the user interfaces.

You can generate applications in a graphic screen environment with features that help you build the application quickly and accurately. The applications are built from standard function modules. The applications control objects that nest in custom assemblies and can be saved for reuse in other applications. FX Builder offers complete flexibility in the generation of custom applications but has the features to reuse existing assemblies and standard applications where appropriate for an economic solution.

The configuration includes the definition of the physical inputs and outputs, the data point values to be monitored for supervisory, commissioning and servicing functions, and the format of the user interface displays.

You can define the communication parameters for supervisory functions and event messaging in FX Builder. You can define user profiles with passwords to protect the FX06 controller from unauthorized access. You also generate and configure trend logs and time schedules in FX Builder.

FX Builder builds the control functions that the FX06 controller executes, including the commands from the integral or remote display, SMS messages, or a supervisory system if connected to the controller via a communications module.

The FX06 controller arrives without an application, and the application is normally downloaded in the Original Equipment Manufacturer (OEM) factory or at the job site.

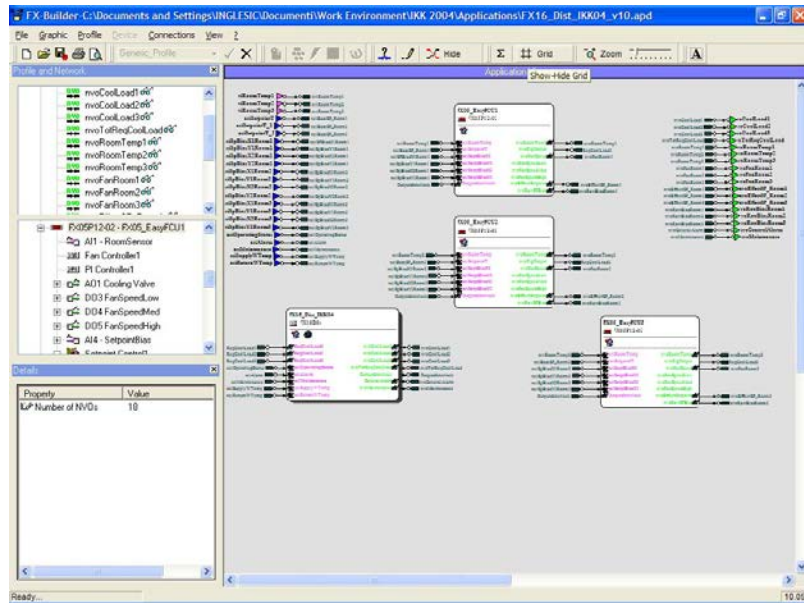


Figure 71: FX Builder

Control Application and Network Profile

Use FX Builder to build the control application that the FX06 controller executes when downloaded into the controller. You also use FX Builder to generate a network profile through which the controller communicates to other devices on a control system network. You can select the network profile for the N2 Open protocol or the LON protocol.

Use FX Builder to build control algorithms and logic on a graphical canvas by creating and connecting instances of the objects in the database of the controller. An object is a functional block with inputs, attributes, an internal processing method, and outputs.

By means of connections between inputs and outputs, values can pass between the objects or between the objects and the network profile. A connection always has the same direction: from the source to the destination. Sources can be the network variable inputs and configuration parameters in the network profile, and the object outputs. Destinations are the network variable outputs in the network profile and the object inputs.

The object inputs are used by the object to obtain values from other objects or from the control system network via the network profile.

The object uses the object outputs to present its results. The object outputs can then be used by other objects or they can be sent to other devices through the network profile and the control system network.

The objects also have some static values, set at design-time, known as attributes. These values are typically used to determine the behavior of an object or as default values if input values are missing or have invalid values.

When developing an application, a maximum of 200 instances of the available objects can be included. The available objects in the FX06 controller are shown in Table 35.

The control application and logic can also interact with the alarm and event management, user interfaces, and communication services to generate information and alarm messages for the user.

Distributed Application

In addition, use FX Builder to build a distributed application that encompasses the control functions of a master controller. The FX16 Master Controller supports 16 slave controllers and the MD20 Master Display supports 8 slave controllers on its local link bus. Any or all of the slave controllers can be an FX06 controller with an N2 Open communication card. The application is downloaded to the master controller, which then automatically downloads the appropriate part of the application to the slave controllers.

FX06 Object List

Table 35: FX06 Object List

Object Category	Object Name
Input	Analog Input ¹ Digital Input ¹ Occupancy Input ¹ Temporary Occupancy Fan Controller Command Input Counter
Output	LED Analog Output ¹ On/Off Output ¹ DAT Output ¹ PAT Output ¹ Hermetic Compressor (x3)
Numeric Functions	Extended Calculation Timer w/ Reset Timer Compare Constant Event Counter Butterworth Filter Integrator Average (8 input) Average (2 input) Maximum (8 input) Maximum (2 input) Minimum (8 input) Minimum (2 input) Selector (8 input) Selector (2 input) Psychrometric 1 Psychrometric 2 Ramp Sample and Hold Span ¹ Segment Time Counter ¹ Storage Element
Control Functions	Automatic Economizer Proportional Integral Derivative (PID) Controller On/Off Controller Fan Controller ¹
Continued on next page . . .	

Object Category (Cont.)	Object Name
Logic Functions	AND (8 input) AND (2 input) OR (8 input) OR (2 input) XOR (8 input) XOR (2 input) NOT Enumeration Override Enumeration Logic Output Override Logic Programmable Logic Controller (PLC)
Alarm	Analog Alarm (Auto Reset) Manual Reset Binary Alarm Out of Range Compressor Envelope
Special Functions	Emergency/Application Mode Binary Sequencer General Setpoint Occupancy Mode Sensor Failure Temperature Setpoint Load Manager Optimal Start Stop Array Sequencer (8 outputs) Sequencer (4 outputs) Source Mode Summer-Winter Compensation
Application Control	End Application
Schedulers	Exceptions Calendar On-Off Time Scheduler Weekly Occupancy Scheduler
Unit Conversion	Convert Format UNVT_logic to SNVT_state SNVT_state to UNVT_logic Enumeration to UNVT_logic SNVT_switch to UNVT_logic SNVT_hvac_status generator SNVT_chlr_status generator SNVT_lev_disc to SNVT_switch
Refrigeration	Accumulative Defrost Refrigeration Defrost Refrigeration Defrost Initiation Refrigerant Saturation Properties
Continued on next page . . .	

Object List (Cont.)	Object
Extension	Room Sensor (NRM)
System Functions	Clock and Date Set ² System Resource Real-Time Clock ²

1. New enhanced version of object in FX Platform at Release 2.0.

2. Real-Time Clock object was replaced by Clock and Date Set object.

Note: The previous versions of the enhanced objects that appear in FX Builder for the FX06 controller as Obsolete and are available only for older applications.

You can use several objects of the same type within one control application. Each copy of an object type is called an **instance** of the object, and you can configure each instance differently according to the application requirements. For example, to read the physical inputs AI1 and AI2 on a controller, the control application should include two instances of the Analog Input object, which differ in their configuration. One instance is configured to read Channel 1. The other instance should read Channel 2. The FX06 controller supports up to 200 object instances in the control application.

FX CommPro N2/LON Software

Use FX CommPro (available in the N2 Open and LON versions) to commission Facility Explorer devices including the FX06 controller.

In FX CommPro, you can display and monitor the network profile of the connected controller with its Inputs, Outputs, Values, and Configuration Parameters. See Figure 72.

Depending on the protocol used and the selection of objects and data types, some variables and parameters are read/write values, and you can modify them; however, other variables and parameters are for monitoring purpose only and you cannot modify them.

Use FX CommPro to download the control application into the FX06 controller. FX CommPro N2 monitors and downloads applications (using the N2 Open protocol) when the FX06 is equipped with an N2 Open or RS-232C communication module. FX CommPro LON monitors and downloads applications using the LON protocol when the FX06 is equipped with a LON communication module.

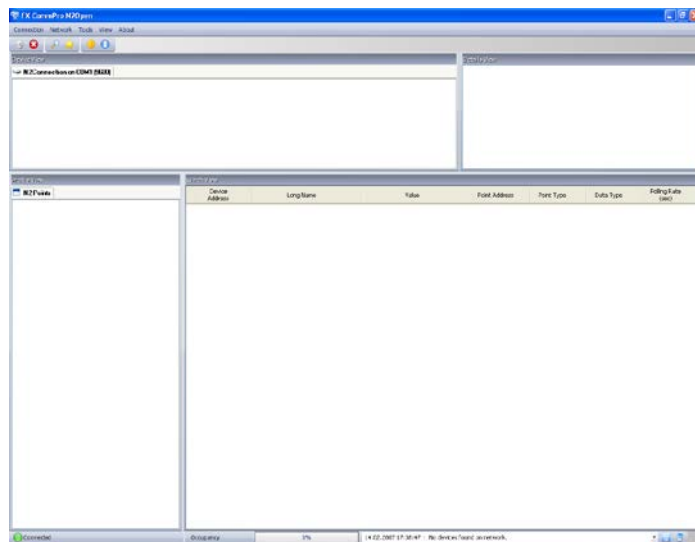


Figure 72: FX CommPro N2 Tool Main Screen

Use FX CommPro N2 software to also download updated firmware into the FX06 controller with an N2 communications module. To download new firmware to an FX06 controller with a LON communications module, the LON module must be replaced by an N2 or RS-232C communications module and downloaded using the N2 protocol.

FX Loader Utility

Use FX Loader to download an FX06 control application into the FX Programming Key (N2 protocol only).



Figure 73: FX Loader Utility

Security

The FX Tools Pro and Facility Explorer controllers have an embedded security feature based on the use of two identifiers: the **Family ID** and the **Customer ID**.

Family ID

The Family ID identifies the different controller hardware types and prevents the downloading of an application to the wrong controller.

Table 36: Family IDs

Facility Explorer Controller	FX Builder Code	Family ID
FX05 (Advanced) Controller	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
FX06 Compact Controller (Models FX06P0x, FX06P2x, and FX06P3x) Original and Rev. A	FX06P0x	0701
FX06 Compact Controller (Models FX06P1x) Original and Rev. A	FX06P1x	0700
FX07 Field Controller (Models FX07Dxx and FX07Axx) Original	FX07D0x	0900
FX14 Field Controller (Models FX14Dxx) Original and Rev. A	FX14D1x	0801
FX15 Field Controller (Models FX15D1x, FX15D2x, FX15D6x, FX15D7x, FX15X1x, FX15X2x, FX15X6x, FX15X7x) Original and Rev. A	FX15D1x	0402
FX15 Universal Controller (All models FX15D0x, FX15D5x) Original and Rev. A	FX15D0x	0401
FX16 Master Controller (All Models FX16Dxx and FX16Xxx) Original and Rev. A	FX16D0x	0501
Master Display	MD20D00	0600
	MD20D01	0601
	MD20D02	0602
	MD20D03	0603
	MD20D04	0604
	MD20D05	0605

Customer ID

The customer ID protects a custom developed application within a controller. The customer ID also prevents unauthorized users from editing the application source code in FX Builder. Three Customer ID types are used:

- Public ID (default)

Any user with the Public ID enabled in FX Builder can modify, download, and commission applications that are configured and saved with the Public ID. All controllers (except demo controllers) arrive from the factory with the Public ID as default.

- Demo ID

You can only download applications that are configured and saved with the Demo ID to demo controllers (with the Demo ID in their database) or to controllers with the Public ID. Only users with the Demo ID in FX Builder can modify applications with the Demo ID.

The FX Tools CD provides the Demo ID and is normally used in sales offices. Use the Demo ID to prevent demonstration equipment or product samples from being used for installations.

- Customer Specific/Private ID

Only users with the same Customer Specific ID enabled in FX Builder can read and modify source files for applications that are configured and saved with a Customer Specific ID. Once you download a controller with a Customer Specific ID, the controller becomes customer specific and only allows users with the same Customer Specify ID to download applications. Unique Customer IDs are available to branch offices on request. Special Customer ID files are not included on the FX Tools CD. You can only reset a controller with a Customer Specific ID to the Public ID by returning it to the Johnson Controls factory or repair center.

Application Download

With the FX06, you can download the control application to the controller via a computer with software in the FX Tools Suite. You can also download applications via the FX Programming Key (N2 applications only).

Computer Connection

To download an application via a connection to a computer, the FX06 needs to have a communication module (N2 Open, RS-232C, or LON) installed.

- **N2 Open or RS-232C Module**

Use an RS-232C to RS-485 converter (for example, IU-9100 or LP-KIT200-000C) to connect the computer to the Supervisory Link terminals of the N2 Open module of the FX06. Make sure the converter supports the Automatic Send Data Control and does not require Request To Send (RTS)/Clear To Send (CTS) control.

Use a null modem cable (see *Ordering Codes*) to connect the computer to the Supervisory Link terminals of the RS-232C module of the FX06.

Use FX CommPro N2 to download the application. Select N2 Open or Direct for RS-232C. The N2 Open network profile or communication service parameters are also downloaded to the FX06 controller.

- **LON Module**

Use an SLTA or a PCC10 LON interface converter to connect the computer to the Supervisory Link terminals of the LON module of the FX06 controller.

Use the FX CommPro LON to download the application. The LON network profile is also loaded into the LON module.

FX Programming Key (N2 Applications Only)

The FX Programming Key allows you to download an application to the FX06 controller. This scenario is convenient if you load multiple controllers with the same application on a construction site or in the factory at the end of the production line. To load the FX06, press a button. There is no need for a computer, communication module, or converter.

Before you use the FX Programming Key, you need to load it with the desired application. You can load the Programming Key via FX Loader (Version 3.1.3 and later), or you can load it from an already programmed FX06 controller.

Loading the Programming Key from a Preprogrammed FX06

To load the Programming Key from a preprogrammed FX06:

1. Remove power from the FX06 Controller.
2. Connect the Programming Key to the Remote Display terminals of the FX06 controller.

Note: The FX Programming Key also connects to the communication port in the integral display panel of the FX06. To access the programming key port, slide the keypad to the right, away from the display. You may need to use a small screwdriver to release the keypad section from the display section.

3. Restore power to the FX06 controller. The two LEDs on the Programming Key blink alternately. This blinking indicates that you have to select an operation.
4. Press the Programming Key button to move from uploading to downloading and vice-versa (the corresponding LED blinks quickly).
5. Make sure the green Upload LED is blinking, and then confirm the Uploading action by pressing the button for more than 3 seconds.

During the upload process, the LED blinks. When the operation successfully ends, the blinking stops and the green LED remains on. If the operation fails, the two LEDs blink together.

Note: If parameter values in the source FX06 controller have been changed by the user via the display or via a computer connection (using FX CommPro), these changes are not uploaded to the Programming Key. The application uploaded contains the parameter defaults that were saved by FX Builder at design time.

Once loaded, you can use the Programming Key to download the application to other FX06 controllers.

Loading the Programming Key from FX Loader

To load the Programming Key from FX Loader:

1. Connect the Programming Key to an RS-485/232 converter via the plug-adaptor.
2. Power the Programming Key with an AC/12 VDC power adapter.

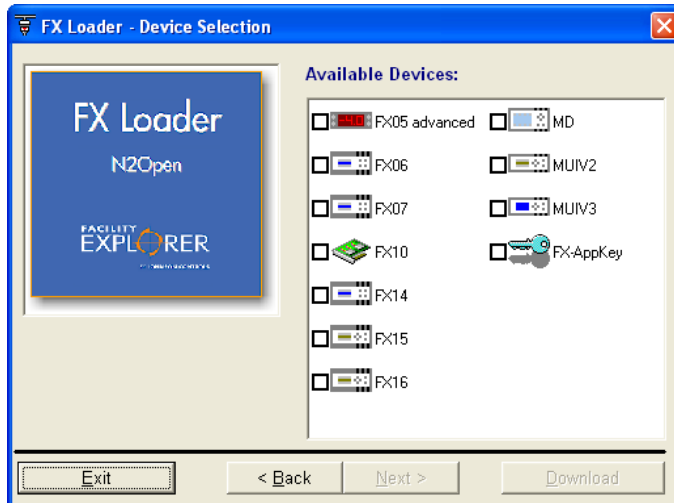


Figure 74: FX Loader - Device Selection Page

3. Start FX Loader.
4. Select N2 Open and the FX-AppKey icon (Figure 74).
5. Power the Programming Key via the AC/DC adapter. The two LEDs blink alternately, indicating that you need to select an operation.
6. Select the application in FX Loader to load (Figure 75).

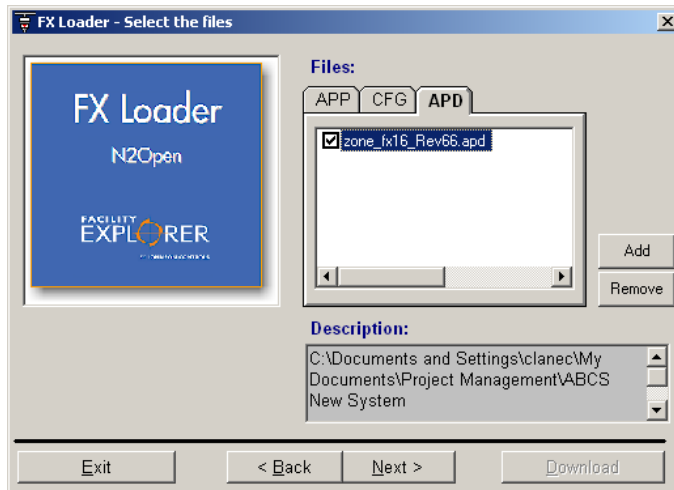


Figure 75: FX Loader - Application Selection

7. Press the Programming Key button until the green Upload LED blinks.

8. Press the button for 3 seconds to confirm the Upload action.
9. Click Next.
10. Click Download to transfer the application from FX Loader to the Programming Key.

If the key already contains an application, FX Loader asks you whether you want to keep or erase it. If you answer No, the operation ends. If you answer Yes, the application in the Programming Key is erased and the new application loads.

When the application loads, the LED blinks. When the operation ends successfully, the blinking stops and the green LED remains on. If the operation fails, the two LEDs blink together.

Downloading the Application from the Programming Key to the FX06 Controller

To download the application from the Programming Key to the FX06 controller:

1. Remove power from the FX06 controller.
2. Connect the Programming Key to the remote display port.

Note: The FX Programming Key can directly connect to the communication port in the integral display panel of the FX06. To access the programming key port, slide the keypad to the right, away from the display.

3. Restore power to the FX06 Controller. The Programming Key turns on and the two LEDs blink alternately. This blinking indicates that you need to select an operation.
4. Press the FX Programming Key button to move from upload to download mode and vice-versa (the relative LED blinks rapidly).
5. Make sure the yellow Download LED is blinking, and then press the buttons for more than 3 seconds to confirm the download.

During the download process, the yellow LED blinks. When the operation successfully ends, the 2 LEDs blink alternately and the controller starts running the new application. If the operation fails, the two LEDs blink together.

Security

Loading the Programming Key is always performed with no restrictions (such as Customer ID or Family ID). The program loads in a compiled format. You cannot download the program to a computer nor can you open or edit the program with FX Builder. Application privacy and security are not compromised.

The downloading process follows the security rules implemented via the Customer ID feature. See Table 37.

Table 37: Security

Customer ID of the Application in the Programming Key	Customer ID in the Controller	Download
Public ID	Public ID	Executed
Public ID	Private ID	Not Executed
Private ID	Private ID	Executed only if Customer IDs match
Private ID	Public ID	Executed Controller is given the Customer ID of the program in the Programming Key.

Performing a Programming Key Memory Erase

If the key is already loaded with an application and you want to replace it with a different application, you need to perform a memory erase.

FX Loader automatically performs the memory erase when the application is loaded from a computer. When the application is uploaded from another FX06, you need to perform the memory erase manually.

To perform a programming key memory erase:

1. Power the Programming Key, either by hot-plugging it to a FX06 already ON, or with an AC/12 VDC adapter.
2. Press the key button for more than 15 seconds to initiate the memory erase.

During the erase, the green LED slowly blinks. Then the green and the yellow LEDs blink twice alternately. Finally, the green remains steady ON to confirm that the flash memory is erased.

If the two LEDs blink simultaneously, then the erase process has failed. Retry. When the memory is completely erased, the LEDs stop blinking and the key is ready for a new upload. The memory erase is also necessary if the previous upload from the FX06 controller failed (for example, communication was interrupted or power failed).

Error Codes

The error codes appear on the FX06 integral LCD display.
See Table 38.

Table 38: Error Codes

Error Code	Meaning	Possible Cause	Action
51	Private ID mismatch	Controller and application in the key have different protection Customer IDs.	Save the application in FX Builder with the proper Customer 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.
53	Memory empty	Attempt to download an application from an empty key.	Upload the key with the target application.

Troubleshooting

Reading 9999 or Invalid from the Analog Inputs

- **Error/Condition:** The analog input is represented as an invalid value in network variables, or the user interface shows a value of 9999, or a customized tag shows an invalid value.
- **Possible causes:** The signal applied to the analog input channel does not match the software configuration of the Analog Input object or the signal is outside the configured reliability range.
- **Solution:** Check the sensor signal characteristics, and modify the Analog Input object configuration via FX Builder. Verify that the sensor is functioning correctly and that the wiring is correct.

Specifications and Technical Data

Ordering Codes

Table 39: FX06 Field Controller

Product Code Number	Description
LP-FX06P00-020C□	FX06 Compact Field Controller with new style wiring connector: Includes 4 Analog Inputs (AIs), 5 Binary Inputs (BIs), 2 0–10 VDC Analog Outputs, and 6 relay Binary Outputs (BOs)
LP-FX06P20-020C	FX06 Compact Field Controller with new style wiring connector: Includes 4 AIs, 5 BIs, 2 0-10 VDC Analog Outputs, 4 BOs, and 2 triac BOs

Table 40: Communication Module

Product Code Number	Description
LP-NET061-000C	N2 Open Communication Module for FX06
LP-NET062-000C	LONWORKS Communication Module for FX06
LP-NET063-000C	RS-232C Communication Module for FX06 (only for GSM modem)

Table 41: User Interfaces

Product Code Numbers	Description
LP-DIS60P20-0C	Remote Medium User Interface (MUI V3) for FX06 - Panel Mount
LP-DIS60P21-0C	Remote Medium User Interface (MUI V3) for FX06 - Wall Mount
LP-KIT007-005C	Link cable for the connection of the FX06 to the Panel Mount MUI display, 3 m (9.8 ft)

Table 42: Accessories

Product Code	Description
LP-KIT006-020C	Wiring Harness with new style wiring connector, 1.5 m length
LP-KIT006-025C	Wiring Harness with new style wiring connector, 5.0 m length
DT-9100-8901	Power Supply Adapter for Programming Key: 230 VAC/12 VDC (Europe only)
LP-KIT007-001C	Interface cable for standard landline modem, 1.5 m (4.9 ft)
LP-KIT007-013C	Null modem cable for computer connection, 3 m (9.8 ft)
LP-KIT007-014C	Null modem cable for computer connection, 15 m (49.2 ft)
LP-KIT007-020C	Bag of replacement communication wiring connectors.
LP-KIT200-000C	N2 Commissioning Adapter: Includes port powered RS-232C to RS-485 converter, 3 m (9.8 ft) cable, and mating connectors for FX05, FX06, FX07, FX14, FX15, FX16, and FXVMA.
IU-9100-8401	Converter RS-232C/RS-485 (N2) 230 VAC (Europe only)
NP-PWR1209	Power Supply Adapter for Programming Key 120 VAC/12 VDC (North America only)

Table 43: GSM Modem and Accessories

Product Code	Description
LP-KIT007-002C	Interface Cable for GSM modem to FX06, 1.5 m (4.9 ft)
LP-KIT090-000C	GSM 900/1800 Supreme 10 FastTrack Modem
LP-KIT090-001C	GSM Modem Plug-in Antenna
LP-KIT090-003C	GSM Modem Magnetic Mount Antenna with 2.5 m (8.2 ft) Cable
LP-KIT090-004C	GSM Modem Panel Mount Antenna with 5 m (16.4 ft) Cable
LP-KIT090-005C	GSM Modem Power Adapter, 230 VAC/12 VDC, Wall Plug

Table 44: Room Command Modules, TM Series without Display - 80 x 80 mm (3.15 x 3.15 in.), °C

Product Code Number	Description
TM-2140-0000	Room Sensor Module, temperature sensor only
TM-2150-0000	Room Sensor Module, occupancy button and LED
TM-2160-0000	Room Sensor Module, 12–28°C setpoint dial, occupancy button and LED
TM-2160-0002	Room Sensor Module, 12–28°C setpoint dial, occupancy button and LED, fan speed override
TM-2160-0005	Room Sensor Module, +/- setpoint dial, occupancy button and LED
TM-2160-0007	Room Sensor Module, +/- setpoint dial, occupancy button and LED, fan speed override
TM-2190-0000	Room Sensor Module, 12 - 28°C setpoint dial
TM-2190-0005	Room Sensor Module, +/- setpoint dial

Table 45: Room Command Modules - Available in North America - TM Series without Display - 120 x 80 mm (4.72 x 3.15 in.), °F/°C

Product Code Number	Description
TM-2141-0000	Room Sensor Module, temperature sensor only
TM-2151-0000	Room Sensor Module, occupancy button and LED
TM-2161-0000	Room Sensor Module, 54–82°F/12 - 28°C setpoint dial, occupancy button and LED
TM-2161-0002	Room Sensor Module, 54–82°F/12 - 28°C setpoint dial, occupancy button and LED, fan speed override
TM-2161-0005	Room Sensor Module, +/- setpoint dial, occupancy button and LED
TM-2161-0007	Room Sensor Module, +/- setpoint dial, occupancy button and LED, fan speed override
TM-2191-0000	Room Sensor module, 54–82°F/12 - 28°C setpoint dial
TM-2191-0005	Room Sensor module, +/- setpoint dial

Table 46: Network Room Modules - Available in Europe

Product Code	Features/Options						
	Size (mm)	Service Port Type	LCD Display	Temperature Adjustment Dial	Fan Speed Selector Button	°F/°C Button	Addressable
LP-NRM001-000C	80 x 80	Program Key	No	No	No	No	No
LP-NRM002-000C			Yes	Yes	No	No	No
LP-NRM003-000C			Yes	Yes	Yes	No	No
LP-NRM511-000C		MUI	No	No	No	No	Yes ¹
LP-NRM502-000C			Yes	Yes	No	No	No
LP-NRM503-000C			Yes	Yes	Yes	No	No

1. The FX06 controller only supports one connected NRM and therefore the addressing feature is not used.

Table 47: Network Room Modules - Available in North America

Product Code	Features/Options						
	Size, mm (inch)	Service Port Type	LCD Display	Temperature Adjustment Dial	Fan Speed Selector Button	°F/°C Button	Addressable
LP-NRM511-000C	80 x 80 mm (3.15 x 3.15 in.)	MUI	No	No	No	No	Yes ¹
LP-NRM552-000C			Yes	Yes	No	Yes	No
LP-NRM553-000C			Yes	Yes	Yes	Yes	No
LP-NRM611-000C	120 x 80 mm (4.72 x 3.15 in.)	MUI	No	No	No	No	Yes ¹
LP-NRM652-000C			Yes	Yes	No	Yes	No
LP-NRM653-000C			Yes	Yes	Yes	Yes	No

1. The FX06 controller only supports one connected NRM and therefore the addressing feature is not used.

Table 48: Sensor Accessories

Product Code	Description
NS-WALLPLATE-0	Wall plate kit used to mount an 80 x 80 mm (3.15 x 3.15 in.) sensor onto a 51 x 102 mm (2 x 4 in.) wall box.

Table 49: Software

Product Code	Description
LP-FXTPRO-0	FX Tools Pro CD-ROM (FX Builder, FX CommPro N2, FX CommPro LON, FX Loader, MD Loader) - New User Version
LP-FXTPRO-6	FX Tools Pro CD-ROM (FX Builder, FX CommPro N2, FX CommPro LON, FX Loader, MD Loader) - Upgrade Version

Technical Specifications

I/O Technical Details

IMPORTANT: In North America, the controller is intended for installation with Class 2 inputs and outputs only where no special electrical safety mounting precautions are generally necessary. These controllers are UL Listed as Open Energy Management Equipment per UL 916.

Table 50: Analog Inputs (AI)

Terminal/Channel	Type	Remark/Application
AI1, AI2, AI3, AI4	See Sensor Input Types in this table	Software configurable. Application: temperature, humidity, pressure. 16-bit ADC, 13-bit effective resolution.
AI Power	+5 V at 15 mA max.	To power active or ratiometric sensors directly from the controller
AI/AO Power	+15 V at 20 mA max.	To power active sensors directly from the controller.
Sensor Input Types		
Sensor Type	Full Linearization Range	Accuracy at 20°C (68°F) - Controller and Sensor (sensor accuracy not included)
A99	-50 to 100°C (-58 to 212°F)	±0.5°C (±1°F)
NTC 10k	-40 to 150°C (-40 to 300°F)	±0.5°C (±1°F)
PT1000 Extended	-50 to 160°C (-58 to 320°F)	±0.5°C (±1°F)
Ni1000 (Johnson Controls® temperature sensor)	-45 to 120°C (-49 to 248°F)	±0.5°C (±1°F)
Active Voltage	0-10 VDC	±0.05 VDC
Active Ratiometric	0.5-4.5 VDC	±0.05 VDC

Table 51: Digital (Binary) Input (DI)

Terminal/Channel	Type	Remark/Application
DI1, DI2, DI3, DI4, DI5	Potential-free contacts for status monitoring	Status and events.
	Transition Counter at 50 Hz max.	Minimum Time ON: 10 ms Minimum Time OFF: 10 ms

Table 52: Digital (Binary) Outputs (DO)

Digital (Binary) Outputs for Selected Models	Model	Channel	Type	Remark/ Application
	FX06P0x	DO1 – DO6	SPST 3(1)A, 250 VAC power relay	Each relay contact is independent with its own terminals
	FX06P2x	DO1, DO2	0.5A/24 VAC triacs	3-point incremental actuators, thermal actuators, and other actuators
		DO3 – DO6	SPST 3(1)A, 250 VAC power relay	Each relay contact is independent with its own terminals.
Relay Outputs	Dielectric strength coil-contacts: 4,000 V RMS for 1 minute Dielectric test voltage on open relay contact: 1,000 VAC RMS Maximum relay switching rate at maximum load: 6 operations/minute Average relay contact life: 30,000 operations at maximum load			

Table 53: Analog Output (AO)

Terminal/Channel	Type	Remark/Application
AO1, AO2	0-10 VDC (3 mA max.)	Actuators and control devices

FX06 Controller

Table 54: FX06 Controller

Product Codes	LP-FX06Pxx-xxxC	
Power Supply Requirements	24 VAC/VDC $\pm 15\%$, 50/60 Hz – SELV (Europe) – Class 2 North America	
Power Consumption	Controller: 7 VA maximum (Additional 3VA if MUI is connected)	
Housing Material	ABS + polycarbonate, self-extinguishing: UL 94-5VB flammability rating	
Protection Class	Front Plate (when mounted in panel) IP55; Rear Enclosure IP20, IEC 60529	
Ambient Operating Conditions	-40 to 50°C (-40 to 122°F), 10 to 95% RH (noncondensing) Note that the integral user interface does not operate below -20°C (-4°F).	
Ambient Storage Conditions	-40°C to +70°C (-40° to 158°F), 10 to 95 % RH (noncondensing)	
Dimensions (H x W x D)	See Figure 2, Figure 3, and Figure 4.	
Weight (with package)	0.32 kg (0.7 lb) including communication module 0.68 Kg (1.5 lb) including communication module and cable set	
Real-Time Clock	Accuracy: Better than ± 200 ms per day at constant ambient temperature of 25°C Backup: Minimum 10 days without power at 25°C	
Integral LCD Display Resolution	-999 to 999 or -99.9 to 99.9 (4 digits for each row)	
I/O Ratings	See <i>I/O Technical Details</i> .	
Power Supply Outputs	24 VAC/DC for panel mount MUI (from controller power supply input) 15 VDC 20 mA power supply for active sensors 5 VDC 15 mA power supply for ratio-metric sensors	
Connections	Removable plug connectors. Mating connectors and cables provided with controller or available to order. See <i>Ordering Codes</i> .	
Cable Length for Inputs	Max. 100 m (330 ft) with cables ≥ 0.6 mm, 22 AWG	
Agency Compliance	Europe	– 2004/108/EEC, EMC Directive: EN 61000-6-3, EN 61000-6-2 – 2006/95/EEC, Low Voltage Directive: EN 60730.
	Canada	– UL Listed (PAZX7), CAN/CSA C22.2 No. 205, Signal Equipment – Industry Canada, ICES-003
	United States	– UL Listed (PAZX), UL 916, Energy Management Equipment – FCC compliant to CFR 47, Part 15, Subpart B, Class A

N2 Open Communication

Table 55: N2 Open Network Specifications

RS-485 Bus - 9600 Baud	Maximum bus segment length without repeater: 1,200 m (4,000 ft), 0.8/0.6 mm diameter (20/22 AWG) 2 x twisted pair with shield. Use the same cable type throughout segment.
Number of Devices	Maximum of 32 devices on a bus segment without repeater
Repeaters	Maximum 2 repeaters between the master (supervisory) device and any slave (FX controller) device on the network. RP-9100 is recommended.
End-of-Line Termination	220 ohm at each end of segment >100 m (300 ft). For segment <100 m (300 ft), only one 220 ohm termination is required.
RS-485/RS-232C Converter for FX CommPro N2	IU-9100 or LP-KIT200-000C. (Other converters must support automatic Data Send Control [DSC]. RTS is not supported by FX CommPro.)
Electrical Isolation in FX06	500 V

LON Communication

Table 56: LON Network Specifications

LON Network Topology and Line Terminators	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 at a central point in network. Use the same cable type throughout bus or network.	
Number of Nodes	64 (if repeaters are not used), FTT-10 nodes only.	
Cable Type	Length with FTT-10 devices	
	Bus Topology	Free Topology
Belden® 85102	2,700 m (8,900 ft)	500 m (1,640 ft)
Belden 8471	2,700 m (8,900 ft)	500 m (1,640 ft)
Level IV 22 AWG	1,400 m (4,600 ft)	400 m (1,300 ft)

Note: For full technical details of LONWORKS networks, refer to the LONMARK® Guidelines at www.lonmark.org.

FX Programming Key

Table 57: Programming Key Specifications

Power Supply	Directly powered from the Display Bus port of the FX06 or from an AC/DC adapter 230V/12 to 15 VDC 2 VA minimum	
Memory Type and Size	Flash memory 1 Mbytes	
Connection to Controller	RS-485, not isolated. Cable (10 cm/4 in.) provided with connector for FX06 front display socket, and a screw terminal block for connection to an RS485 converter.	
Enclosure IP class	IP40	
Ambient Limits	Operating: 0 to 40°C (32 to 104°F), 10-95% RH (noncondensing) Storage: -20 to 70°C (-4°F to 158°F), 10-95% RH (noncondensing)	
Compliance	Europe	2004/108/EEC, EMC Directive: EN 61000-6-3, EN 61000-6-2

GSM Connection

Table 58: GSM Modem Specifications

GSM Modem – Supreme 10		GSM 900			GSM 1800/1900		
Voltage Range	5 to 32 VDC						
Power Supply @25°C		Min.	Typ.	Max.	Min.	Typ.	Max.
Input Supply Voltage		5	13.2	32	5	13.2	32
Input Peak Supply Current (in communication)	@5 V			1.8 A			1.1 A
	@13.2 V			0.7 A			0.4 A
	@32 V			0.4 A			0.2 A
Input Average Supply Current (in Communication)	@5 V			330 mA			220 mA
	@13.2 V			130 mA			95 mA
	@32 V			65 mA			50 mA
Input Average Supply Current (in Idle Mode)	@5 V			31.4 mA			31.4 mA
	@13.2 V			13.2 mA			13.2 mA
	@32 V			5.6 mA			5.6 mA
Ambient Operating Conditions	-20 to 55°C (-4°F to 131°F)						
Ambient Storage Conditions	-25 to 70°C (-13°F to 158°F)						
Housing Material	Aluminum profiled						
Volume	12.2 cm ³ (0.7 in. ³)						
Weight	< 130 g (0.3 lb)						
Dimensions	98 mm (3.9 in.) x 54 mm (2.1 in.) x 25 mm (1 in.) (excluding connectors)						
Overall Dimensions	110 mm (4.3 in.) x 54 mm (2.1 in.) x 25 mm (1 in.)						

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.



Building Efficiency
507 E. Michigan Street, Milwaukee, WI 53202

Johnson Controls® is a registered trademark of Johnson Controls, Inc.
All other marks herein are the marks of their respective owners. © 2014 Johnson Controls, Inc.