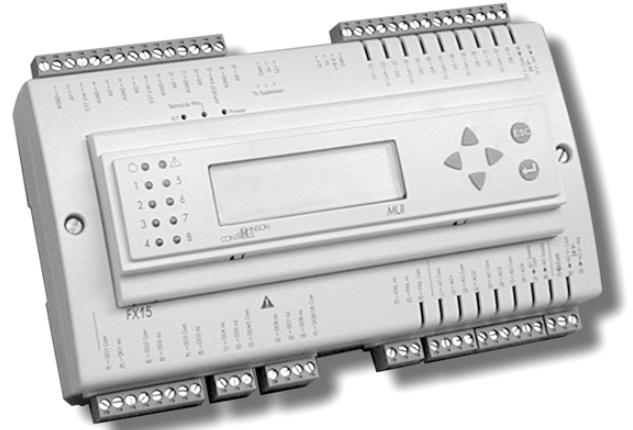# FX15 "Classic"
HVAC/R Controller

The FX15 "Classic" is a high performance controller intended for applications such as chillers and rooftops, indoor packaged air conditioning units, Air Handling Units, Close Control Units, etc…

The FX15 is a protocol independent controller and can adapt to protocols such as LON, Johnson Controls N2Open.

The controller is freely configurable and can adapt to virtually any applications, thanks to the FX-Tools configuration package.

The controller allows up to 27 inputs / outputs with the additional possibility to expand its I/O count through the standard XT/XP modules.

FX15 "Classic" with integrated MUI display

Features and Benefits	
❏ **LON or N2Open cards (optional)**	Compatible with standard BAS protocols
❏ **Freely programmable**	Adaptable to any application
❏ **A99 / NTC k10, 2k2** **4-20 mA** **0-10 V** **0-5 V Ratiometric**	Wide range of sensor inputs available
❏ **Real Time Clock**	Real Time Scheduling of Control activities
❏ **User Interface, integrated or remote**	User friendliness

Controller Overview

Input / Output

- 6 analogue inputs (AI)
- 8 digital inputs (DI)
- 9 digital outputs (DO)
- 4 analog outputs (AO)

I/O expansion (optional)

Should the I/O count of the FX15 be not enough, the standard XT / XP modules of the System 91 can be connected to the FX15 XT bus. The connectable expansions are:

XP-9102	6 universal AIs + 2 AOs
XP-9103	8 DOs (triacs)
XP-9104	4 DIs + 4 DOs (triacs)
XP-9105	8 DIs
XP-9106	4 DOs (Relays)
XT-9100	Communication module to FX15

The maximum I/O expansion capacity that the FX15 can manage is given by 4 XTs and maximum 16 I/Os per each XT, i.e. max 64 I/O on the expansion bus.

User Interface (optional)

The FX15 "Classic" has two types of user-interfaces: integrated or remote. The integrated user-interface is 4x20 LCD backlit display. The remote user-interface is a display unit (that can be chosen within the FX display range) that can be connected to the "Remote Display" plug from which it takes the power supply as well as the serial data.
The two configuration must be used in alternative, i.e. if the integrated display is chosen than the remote display cannot be connected and vice versa.

For more information please refer to the relative display Product Bulletin.

Communication Interface (Optional)

The FX15 "Classic" has two communication links. One is called the Supervisor Link: N2Open or LON, and is used to interface to a supervisory unit. The other link is called the Extension Bus and is used to expand the FX15 input/output capability by interfacing up to 4 XT-9100 extension modules. The FX15 input/output can be extended by up to 64 remote input/outputs, analog or digital, depending on the type of the connected extension modules and XP expansion modules. Point connections are made on XP modules, which are monitored and controlled by the XT-9100. Refer to the *XT-9100 Technical Bulletin* for more details.

LON Network (Optional)

The FX15 can be optionally fitted, on the Supervisor Link, with a LON communication card, which enables the FX15 controllers to pass data from one to another and to send event-initiated data to the NCM300 or NCM350 (NCM311 or NCM361 in Europe) Network Control Module in the Metasys system or to any other, off the shelf, LON supervisory systems. The NCM300 or NCM350 (NCM311 or NCM361 in Europe) must be fitted with a LonWorks (Echelon) driver card. Thanks to the LON features the FX15 controllers have "network" input and output points which can be configured to transmit and receive data over the LonWorks Bus. The transmission of point data is managed by the LonWorks Network and is independent of the supervisory functions of the Metasys Network Control Module. A network of FX15 controllers fitted with the LON communication card can be installed to share analog and digital data between controllers on a peer-to-peer basis; a Network Control Module is not required unless the network is to be supervised by a Metasys system. Complex control strategies may now be performed in multiple FX15 controllers without the need for network data exchange routines in a supervisory controller. Applications include the control of multiple, interdependent air handling units, and large hot water or chilled water generating plants with components distributed in various locations within the building. Further information about compatibility and interoperability with other LonMark devices may be requested from your local Johnson Controls office.

Real Time Clock

This feature allows introducing functions based on a weekly time schedule.

Sensor Input

This series of controllers is compatible with Johnson Controls A99 temperature sensor. Its accuracy is within 0.5°C between -15 and 75°C. Its tolerance increases with temperatures outside this range, as shown below.
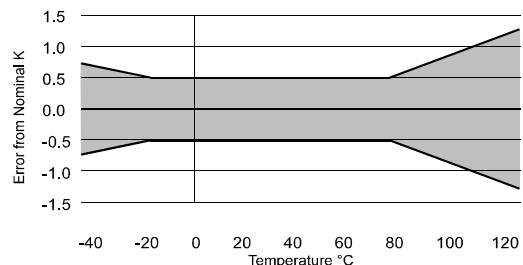
Its gas tight packaging (IP68) makes it the best sensor for refrigeration applications. For details please refer to A99 documentation.
Further more the AI are compatible with other passive and active sensor typologies. For the AI types supported please refer to the table *"List of available sensor inputs"* on page 5.

Software and configuration

The FX15 "Classic" is fully programmable with the Johnson Controls **FX-Tools** configuration software. The configuration is object oriented and free from any programming language. Several object libraries are available to quickly develop and/or customise an application. The software will be available under a license fee and will allow the full configuration of the control strategy and display application.

The applications available with the FX-TOOLS are:

FX-AppMaker: to develop and customise the control application and the network profile.

FX-UIMaker: to decide how to display data with one of the FX displays. Preview features included.

FX-Simulator: to test and debug the application on a PC before proceeding with the real hardware.

FX-Loader: to download to the target controller the developed control application and display configuration at the click of a button. N2open, LON, BACnet MSTP protocol supported.

FX-CommPro: for the complete control of the network profile of the connected unit. Parameter configuration, machine tuning, default parameters saving for successive configurations are things all possible with the CommPro with the 3 protocol supported: N2Open, LON, BACnet MSTP

The software package can also be tested and evaluated in demo version. This version allows the complete use and testing of the software package but it will allow to download the developed strategy only to a demo case or to a demo controller.

Security

The FX-TOOLS and the FX controllers comes with an embedded security features based on the use of two IDs: the family ID and the customer ID.

Family ID: permits to discriminate among an FX05, FX10 or FX15. The first thing that an FX designer does when he starts developing an application is to choose the target device (target controller). An application developed for an FX15 will not be downloadable to an FX05, the family ID of the controller and the one of the application do not match. Of course, in order to be able to reuse the work done with one controller with another controller of the family, the AppMaker allows to re-edit the application so to make it compatible with a different FX controller from the original one.

Customer ID: the licensed tools will come with 2 customer IDs, a *public* one and a *private* one. The application saved with the public ID will be downloadable to all standard FX controllers (provided the family ID matches). These public applications will also be readable and editable by whoever has the FX-TOOLs and access to these source application files (note that it is not possible to upload the application file from the controller).

The application saved with the private customer ID will also be downloadable to all FX standard controllers but, from that moment on, the controller is automatically baptised with the specific private ID. From that moment on that controller will only be downloadable with applications that has a matching private ID. Moreover the application source files saved with the private ID can only be read and edited by FX designers that have installed in their PC the very same private ID.

The DEMO ID is a particular private ID that is only compatible with the demo controllers or the demo cases (see *"Ordering Codes"* on page 29).

⚠️ **WARNING**

Shock Hazard

When servicing make sure that:

- **The electrical supply to the controller is switched off to avoid possible damage to the equipment, personal injury or shock.**

- **You do not touch or attempt to connect or disconnect wires.**

I/O Details

Terminals		Type	Remark/Application
Analog Input (AI)			
TB1	AI1, AI2, AI3, AI4, AI5, AI6	See table below 16 bit resolution	Software configurable. For the 0-20 / 4-20 mA configuration see *"Jumper Configuration"* on page 6. Application: temperature, humidity, pressure, etc.
3, 8	EXT-VDC	+16 V, 80 mA	0-10 V Sensors **or** max no. 4 0/4 - 20 mA Sensors
13	AVPS / EXT-VDC	AVPS = +5 V, 20 mA EXT-VDC = +16 V, 80 mA	To power direcly from the FX15 ratiometric sensors, with AVPS **or** 0-10 V, 0/4 - 20 mA Sensors with EXT-VDC. The selection between AVPS and EXT-VDC is done through jumpers. See *"Jumper Configuration"* on page 6.
Digital Input (DI)			
TB2	DI1, DI2, DI3, DI4, DI5, DI6, DI7, DI8	Potential free contacts	The insulation from the microprocessor is achieved if a different 24 VAC power supply from the one used to power the controller is used to power the digital inputs (through terminals 34, 35). Transition counter function maximum 1Hz. For quicker counter function use the XP-9105 module.
Digital Output (DO)			
TB3	DO1, DO2, DO3	SPST 8(3)A, 250V power relays	There is double insulation between the relays and they can be used at different voltages from one another.
TB4	DO4, DO5	SPST 5(3)A, 250V power relays **or** 0.5A, 24Vac triacs	This group is double insulated from the other relays but they share the same common between them and therefore they have to be connected at the same voltage.
TB5	DO6, DO7, DO8	SPST 5(3)A, 250V power relays **or** 0.5A, 24Vac triacs	This group is double insulated from the other relays but they share the same common between them and therefore they have to be connected at the same voltage.
TB6	FAIL	SPDT 8(3)A, 250V power relay	Fail relay for enhanced security. The relay will return to its NC position not only at power fail but also in case the microprocessor should fail: watch-dog, brown-out, etc.
Analogue Outputs (AO)			
TB7	AO1, AO2	0…10 VDC 16 bit resolution	The insulation from the microprocessor is achieved if a different 24 VAC power supply from the one used to power the controller is used to power the analog outputs.
TB8	AO3, AO4	0…10 VDC 16 bit resolution	The insulation from the microprocessor is achieved if a different 24 VAC power supply from the one used to power the controller is used to power the analog outputs (through terminals 79, 80).
Serial Ports			
J1	Com, LL-, LL+	RS485 downlink **Extension Bus**	Expansion bus to field devices and/or expansion I/O boards.
J2	LL+, LL-, +16V, Com	RS485 downlink + power supply **Remote Display Bus**	Serial connection and power supply to remote display and Programming Key.
JP1	1: RT+ 2: RT- or NETA 3: Com or NETB	Connection to supervisory system, either N2Open or LON	The communication card is optional, in case it is not installed the terminal will be missing.

List of available sensor input

Sensor Type	Range	Accuracy @ 20°C ambient (*)
JCI Nickel Standard range	-45,42 °C to -121,46 °C	+/- 0.5° C
JCI Nickel Extended range	21,11 °C to 287,78 °C	+/- 0.5° C
Siemens Nickel	-50,00 °C to 160,04 °C	+/- 0.5° C
DIN Nickel	-60,00 °C to 180,00 °C	+/- 0.5° C
DIN Std Platinum 1000 ohm	-50,01 °C 605 °C	+/- 0.6° C
NTC 10K	-20 °C to 150 °C	+/- 0.5° C
NTC 2,2K	-40 °C to 150 °C	+/- 0.5° C
A99	-45 °C to 126 °C	+/- 0.5° C
0 to 5 VDC ratio-matrix	10% to 90% of supply voltage	0.3%
0 to 10 VDC	0 to 10 Volts	0.3%
0 to 20 mA	0 to 20 mA	0.3%

Jumper Configuration

Figure a

Figure a

	Analog Input	0 ÷ 20 / 4 ÷ 20 mA	Resistive, 0 ÷ 10 V or Ratiometric
a	AI1 ÷ AI6	Jumpers Closed	Jumpers Open

	Sensors Power Supply	AVPS +5V	EXT VDC +16V
b	Terminal no.13	Pins closed between 1 & 2	Pins closed between 2 & 3

	Battery Type CR2032, average life time: 3 years, dispose OFF
c	• Pin strip closed: battery backup enabled • Pin strip open: battery excluded (to preserve charge) • **Jumper b is set to ON at the factory and should only be set to OFF if the controllers is to be kept in storage without power for an extended period of time. The jumper must be set to ON before the controllers is installed and powered up otherwise back-up RAM and RTC will not be enabled.**

d	Plug-in connector for optional cards insertion

e	Integrated display connection

Note: For the opening and closing of the FX15 cover, please refer to the *"Opening the FX15 "Classic"* on page 27.

Wiring Diagram

In accordance to EN 60730 the FX15 "Classic" is an incorporated electronic controller of type 1B action.
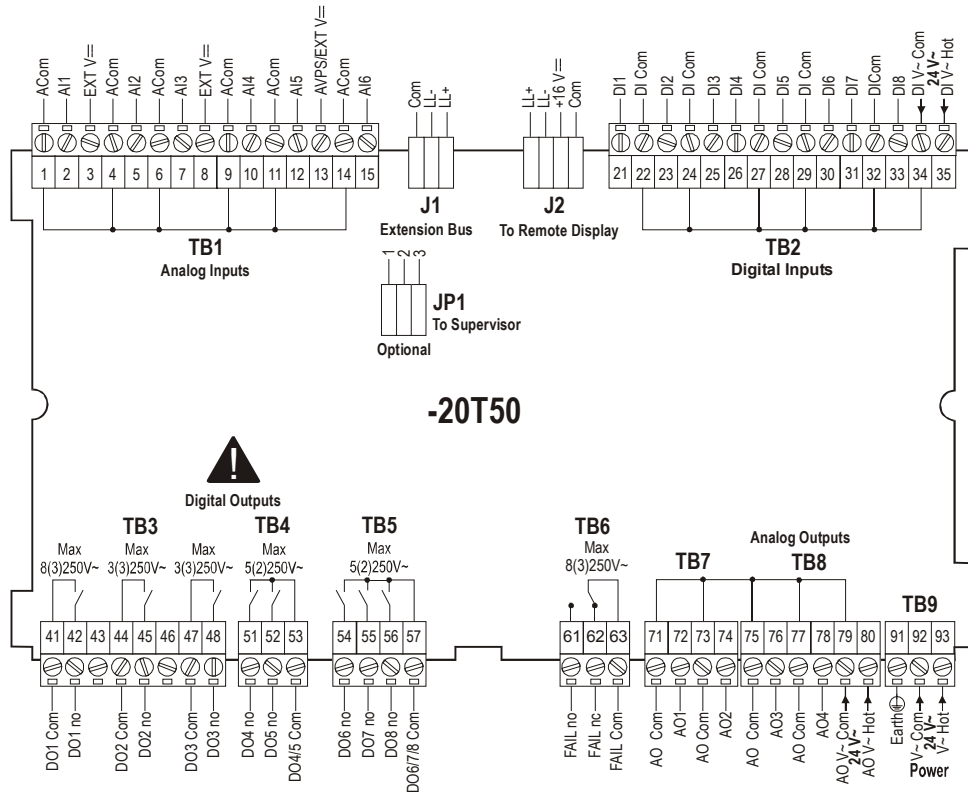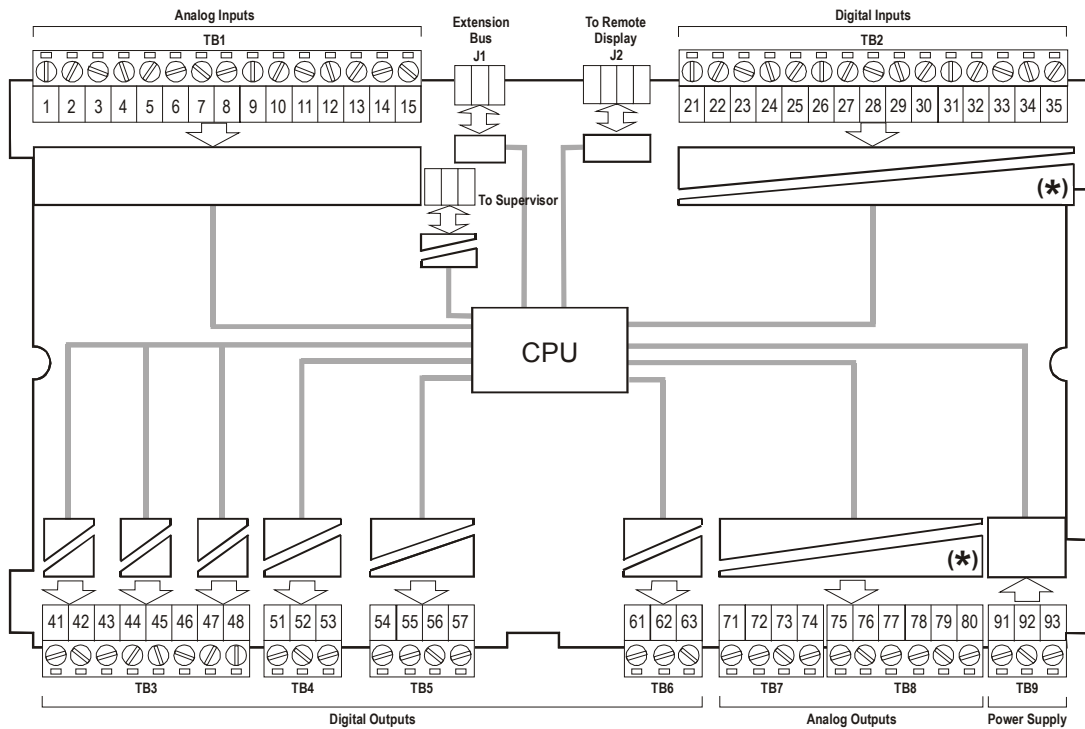

FX15-C-001_09 2002

AI: Analog Input; **DI**: Digital Input; **DO**: Digital Output.
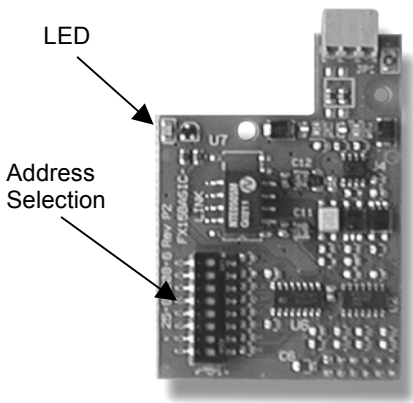
Insulation Diagram

(*) For the insulation a separate power supply must be used.

Accessories

N2Open - Serial Card Installation

LED

Address
Selection

N2Open Serial Card

The N2Open serial card is a plug-in, optional card, which allows the FX15 "Classic" controllers to be connected in a N2Open serial network through the RS485 standard. The N2Open board provides LED signalling on the front cover of FX15.
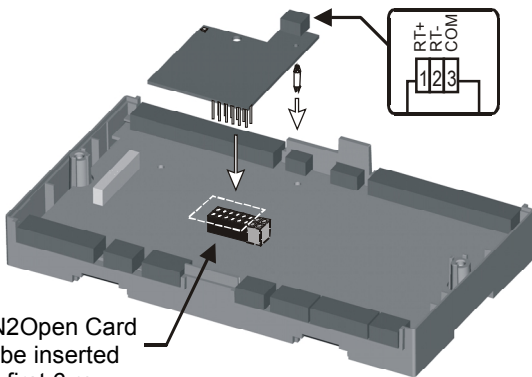
Card Insertion

The communication card can either be factory assembled or field mounted later (see *"Ordering Codes"* on page 29).
In order to mount the communication card, switch off the power supply before opening the FX15 and insert the plug-in card as shown in the figure.

Wiring

Once the FX15 has been re-closed the N2Open connection is made available through the 3 pin detachable connector. The meaning of pins is as written in the relative label.

Pin	RS485
1	RT+
2	RT-
3	COM

The N2Open Card
must be inserted
in the first 6 row
columns

Card Insertion

Address Selection

Select through the dip-switches the serial address of the controller in the N2Open network. The address selection is done in binary mode.(*)

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

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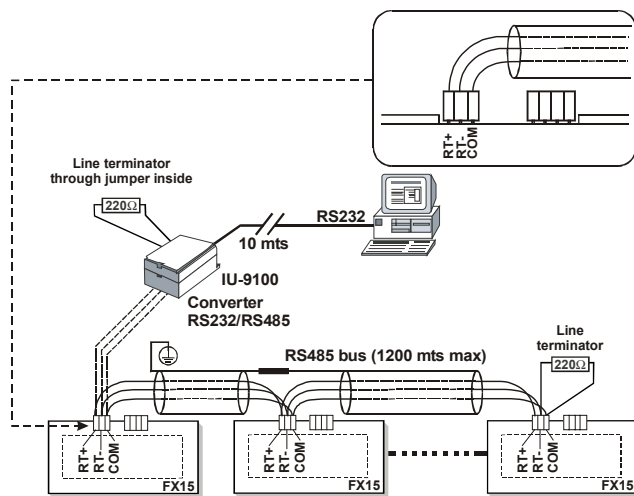address = $2^0 + 0^1 + 0^2 + 2^3 = 9$

RS485 line: maximum length without repeater: 1200 mts, AWG26 twisted pair with shield.

Devices: maximum of 32 per 1200 mts bus segment.

(*) Address zero not allowed.
Default address for pre-assembled cards: 1

**Note:** It is necessary to cycle the controller power supply for a newly configured serial address to become valid.

Line terminator
through jumper inside

220Ω

RS232
10 mts

IU-9100
Converter
RS232/RS485

RS485 bus (1200 mts max)

Line
terminator
220Ω

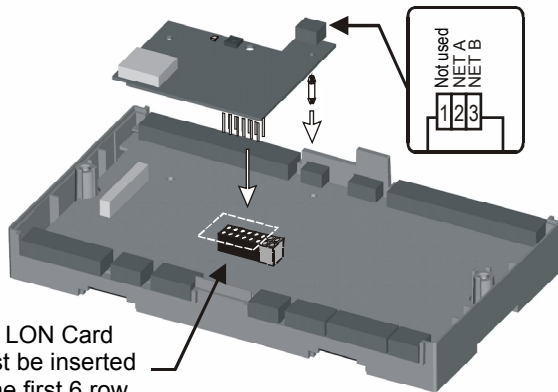FX15   FX15   FX15

Network lay-out

LON – Serial Card Installation

Service Pin push button
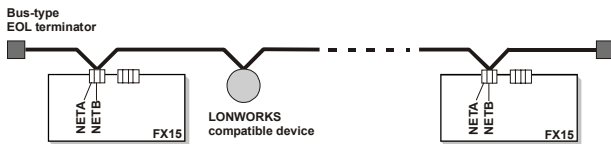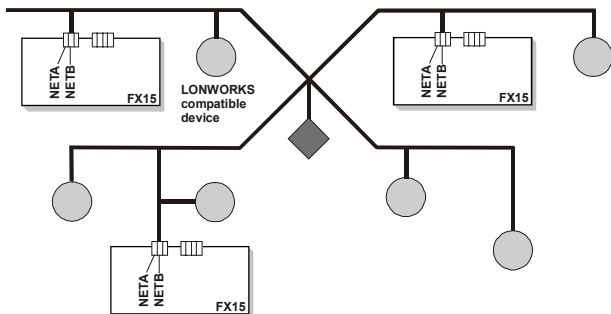*(see Service Pin hole on the FX front cover)*
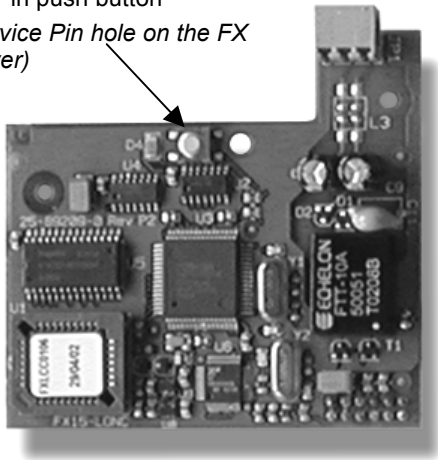
LON Serial Card

The LON Card must be inserted in the first 6 row columns

Card Insertion

Daisy-chained bus topology layout

Free topology layout

The LON Serial Card is a plug-in, optional card, that allows the FX15 controllers to be connected in a LON network.

Card Insertion

The FX15 comes either with the communication card pre-assembled or it can be mounted later (see *"Ordering Codes"* on page 29).
In order to mount the communication card, switch off the power supply before opening the FX15 and insert the plug-in card as shown in picture.

Wiring

Once the FX15 has been re-closed, the LON connection is made available through the 3 pin detachable connector. The meaning of each pin is as follows:

Pin	Meaning
1	Not used
2	NET A
3	NET B

Network layout

The network cable must be laid along a low voltage cable path. It must be placed at least at 30 cm from cables carrying high voltages or currents (>230V or >30A). If strong interference fields are expected, the cable must be located at the greatest distance possible from the source and the use of signal repeaters is strongly advised. The TP/FT-10 network is designed to support free topology wiring, and will accommodate bus, star, loop or any combination of these topologies. FTT-10A transceivers can be located at any point along the network wiring.

LON network: Doubly-Terminated Bus Topology
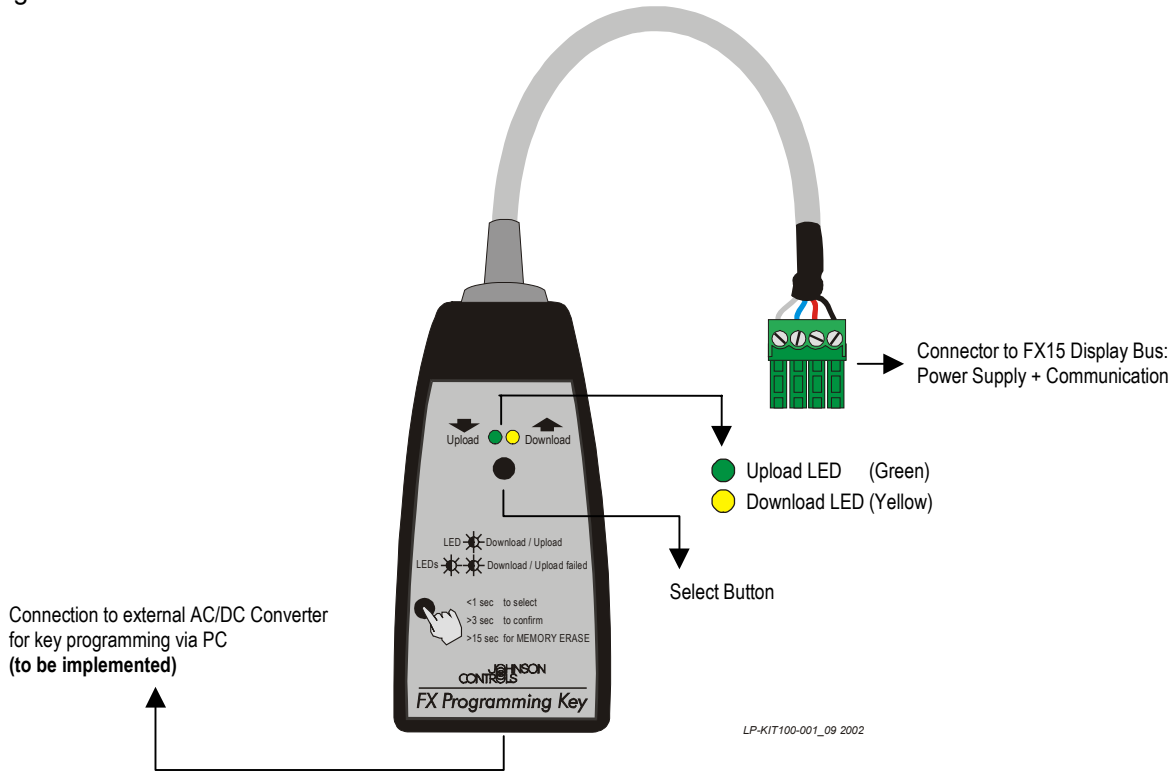Free topology (single terminator required).

Nodes: 64 (if repeaters are not used), FTT-10 nodes only.

Cable type	Length with FTT-10 devices	
	Bus topology	Free topology
Belden 85102	2700 m	500 m
Belden 8471	2700 m	500 m
Level IV 22 AWG	1400 m	400 m

Power link topology supported.

Programming Key

The programming key permits to sequentially download a stored application to FX15 controllers. Especially useful at the end of the production line: the FX15 Controller can be programmed at the pressure of a button with no need of a computer. The key is also useful to personalise the specific application by choosing different defaults for the same applications. In fact, most of the times a single general application covers more machine configurations, the choice between one or the other machine made at commissioning time by setting specific parameters.
With the programming key this parameter configuration will be no longer necessary, the application will be saved within different key with different parameter defaults so that the specific key will be used for the specific machine configuration.

Connector to FX15 Display Bus:
Power Supply + Communication

● Upload LED (Green)
● Download LED (Yellow)

Select Button

Connection to external AC/DC Converter
for key programming via PC
(to be implemented)

LP-KIT100-001_09 2002

Application Uploading

Before the programming key can be used to program FX15 controllers it has to be uploaded with the target application. The target application has to be first downloaded to an FX15 controller (via PC with the FX-Loader or FX-CommPro software) and then from the programmed FX15 it can be uploaded to the key.
The procedure to upload the application to the programming key is:
1. Power off the FX15 Controller.
2. Connect the Programming Key to the Remote Display Port (JP2).
3. Power up the FX15 Controller: the two LEDs start blinking alternatively indicating that an operation has to be selected. The integrated MUI display (if present) will show "Polling Key".
4. By shortly pressing the button the user has the possibility to move from uploading to downloading and vice-versa (the relative LED will blink fastly), make sure the green UPLOADING LED is blinking and then confirm the UPLOADING action by pressing the button for more than 3 seconds. The integrated MUI display (if present) will show "Key write".
During the upload the LED will blink. When the operation ends successfully the blink will stop and the green LED

will remain steady ON. If the operation fails the two LEDs will blink together. In this case the FX15 integrated MUI display (if mounted) will show the code and description of the fault.

Note: If parameter values of the programmed source FX15 controller are changed by the user, via display or via PC connection (FX-CommPro), these changes will NOT be uploaded to the programming key. The application uploaded will contain the parameter defaults that are saved by the FX-AppMaker at design time.
If more instances of the same application are needed, i.e. the same application saved with different defaults, the operation will have to be done via FX-AppMaker. The specific application instance downloaded to the source FX15 controller and from there to the Programming Key.
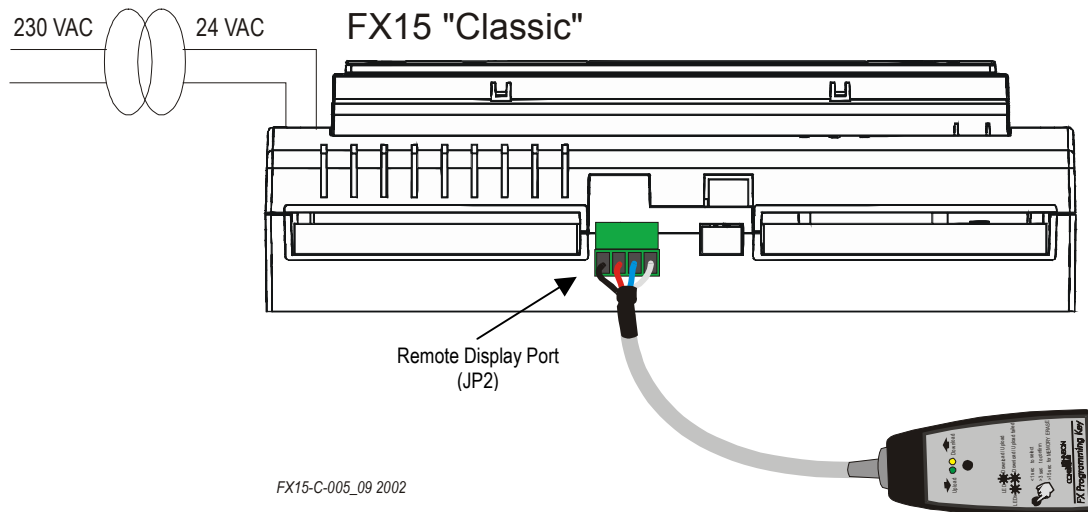
Application Downloading

The key so programmed can be used to download the application to other FX15 Controllers.
The steps to follow are:

1. Power off the FX15 Controller.
2. Connect the Programming Key to the Remote Display Port (JP2).
3. Power up the FX15 Controller: the Programming Key powers up, the two LEDs start blinking alternatively indicating that an operation has to be selected.
4. By shortly pressing the button the user has the possibility to move from uploading to downloading and vice-versa (the relative LED will blink), make sure the yellow DOWNLOADING LED is blinking and then confirm the DOWNLOADING action by pressing the button for more than 3 seconds. The integrated MUI Display (if present) will show "Key read".

During the download the yellow LED will blink. When the operation ends successfully the 2 LEDs will re-start to blink alternatively and the controller will start running the new application. If the operation fails the two LEDs will blink together. In this case the FX15 integrated MUI display (if mounted) will show the code and description of the fault.

Connection

Remote Display Port
(JP2)

FX15-C-005_09 2002

Security

The uploading to the programming key is always performed, there are no restrictions such us Customer ID or Family ID. The program uploaded is in compiled format and cannot be download to a PC or opened / edited by the FX-AppMaker. Application privacy and security is not compromised.

The downloading process follows the security rules implemented via the customer ID. See the table below:

Customer ID of the application Loaded in the prog, 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 Cust IDs match
Private ID	Public ID	Executed and Controller baptised with customer ID of the program in the Programming Key.

Programming Key Memory Erase

If the key is already loaded with an application and there is the necessity to substitute it with a different application the user has to perform a memory erase. The memory erase is initiated by pressing down the key button for more then 15 seconds. During the erase the green LED will slowly blink, then the green and the yellow, 2 times alternatively, and finally the green will remain steady on. The flash is erased. If the 2 LEDs blink simultaneously it means that the erase process has failed. Re-try. When the memory is completely erased the LEDs will stop blinking, the key is now ready for a new upload. The memory erase is also necessary is the previous upload from the FX15 has gone wrong (communication interruption).

Error Codes

The error codes can only be seen if the FX15 has been mounted with an integrated MUI display (LP-DIS60U00-C).

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

Technical Specifications

|	
Power Supply	Directly powered from the Display Bus port of the FX15 controller
Memory type and size	Flash memory 1 MByte
Connection to FX15	Via RS485, not isolated, 10 cm cable provided with the key
Enclosure IP class	IP40
Ambient Limits	Operating: 0°C – 40°C, 10-95% rH (not condensing)
	Storage: -20°C – 70°C, 10-95% rH (not condensing)
Agency Listing	73/23 EEC directive: EN 60730

I/O Expansions

The input/output capacity of the FX15 Controller may be extended by connecting up to four extension modules via the Local Link.

An extension module comprises an XT-9100 processor/communications module and one or more XP expansion modules. The expansion modules provide input/output capability for the extension modules. The following are available for the XT-9100 extension module:

XP-9102	six analog inputs and two analog outputs
XP-9103	eight digital outputs (triac)
XP-9104	four digital inputs and four digital outputs (triac)
XP-9105	eight digital inputs
XP-9106	four digital outputs (5A, 250V relays)
XP-9107	four digital outputs (3A, 250V relays)

Refer to the *XT-9100 Technical Bulletin* for full details of these modules.
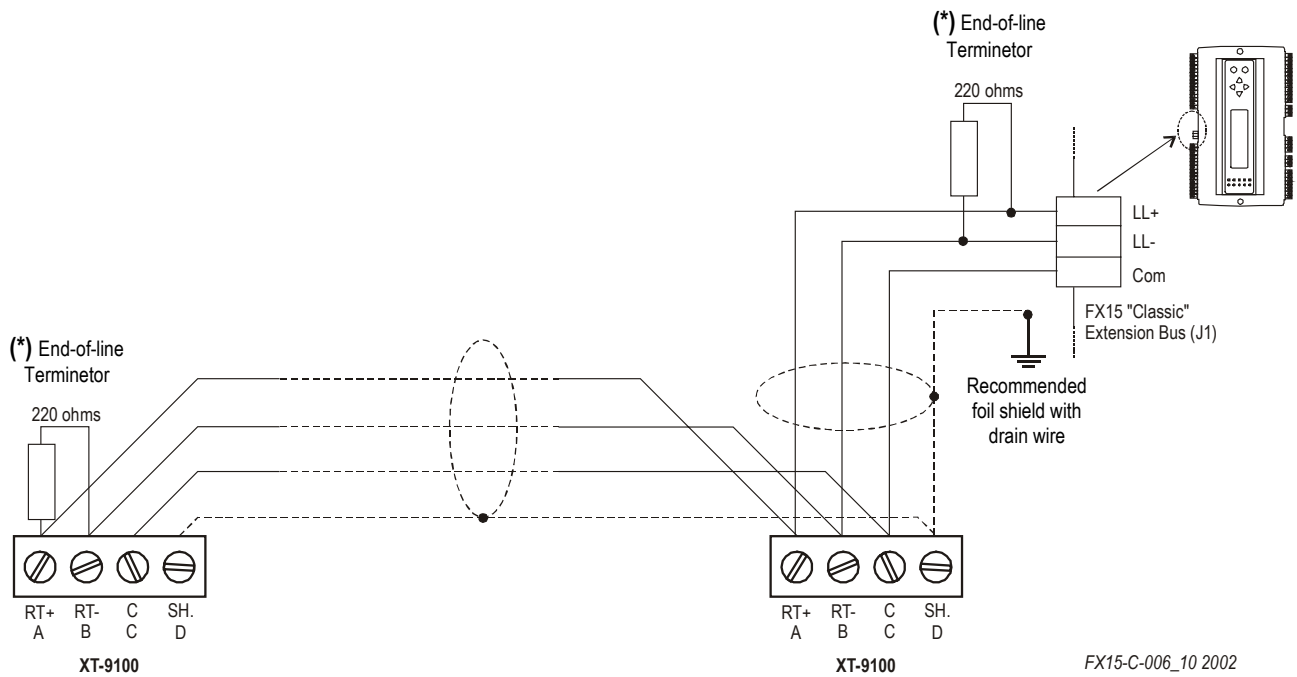

Connection Details for the XT-Bus

Maximum XT modules: 4 XT-9100s

Maximum bus length: 1,200 meters/4,000 feet

(*) Install 220-ohm end-of-line resistors at each end of the XT-Bus line when the bus length is greater than 100 meters/330 feet. When the bus length is less than 100 meters/330 feet, no external resistors are required.

An XT-9100 can be combined with its expansion modules to provide the following configurations:

- 8 analog inputs/outputs.
  or
- 8 digital inputs/outputs, with digital counters associated with the digital inputs.
  or
- 8 analog inputs/outputs and eight digital inputs/outputs.
  or
- 16 digital inputs/outputs, with digital counters associated with the digital inputs within the first eight input/output points.
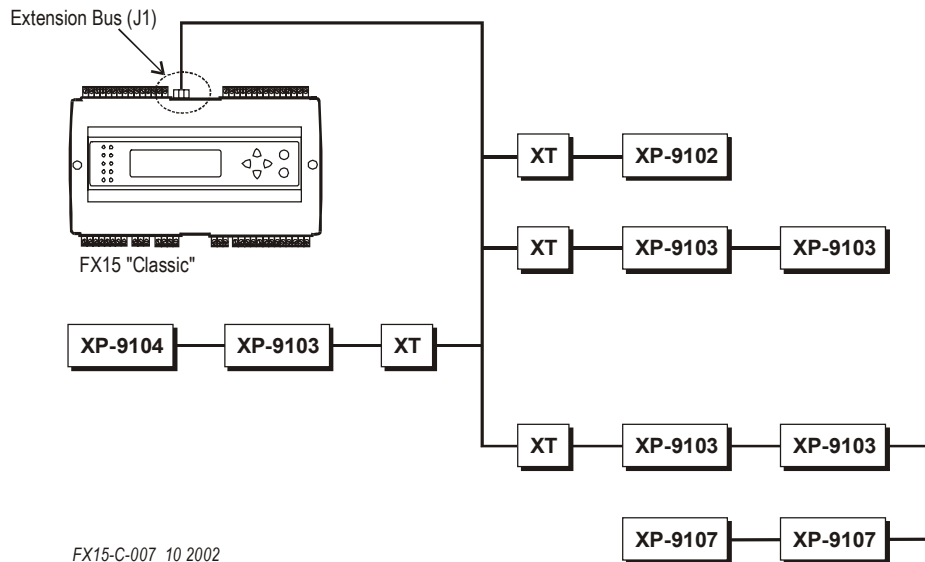
Example of max configuration

FX15-C-007_10 2002

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

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

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

Note: Counter values are saved in EEPROM by XT/XP only at the power down, in the particular situation of an application downloading to the FX15, the increments occurred from the last XT/XP power-up and the download are lost. The problem can be overcome if a power down of the XT/XP module of interest is executed right before proceeding with the program download.
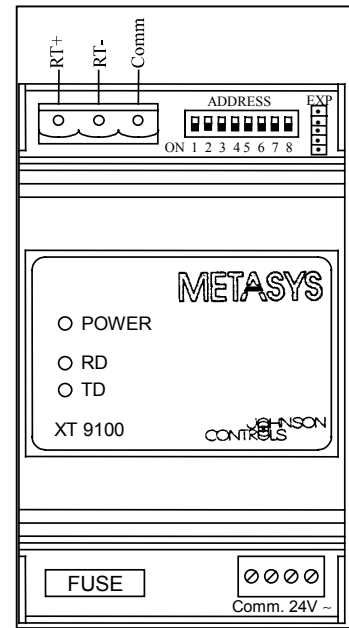
Analog outputs in extension modules can be configured to provide 0-10V, 0-20mA or 4-20mA. The output is ranged by low range and high range variables to provide a 0-100% signal to the extension module.

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

Note: For further information about extension modules, refer to the *XT-9100 Technical Bulletin,* the *XT-9100 Configuration Guide.*

XT-9100

|	
Electrical Requirements	24 VAC, 50/60 Hz
Power Consumption	5.5 VA
Terminations	**Power supply:** 1x1.5 mm^2 / 14 AWG cable max. **Serial link:** RS485 cable **XP-bus:** Connectors provided with XP module
Serial Link	9600 baud, RS485, opto-isolated
LED Indications	Power ON Receive Data Transmit Data
Operating Environment	0 to +50 °C / +32° to 122 °F 10 to 90 % RH, non condensing
Storage Environment	-20 to +70 °C / -4° to 158 °F

XP-9102

Electrical Requirements	24 VAC, 50/60 Hz
Power Consumption	3 VA
Terminations	**Power supply:** 1x1.5 mm^2 / 14 AWG cable max. **Inputs / Outputs:** 1x1.5 mm^2 / 14 AWG cable max. **XP-bus:** Connectors provided.
Analog Inputs	6 Inputs, 10-bit resolution: Inputs jumper selectable: - 0-10 V, > 300kΩ impedance - 0/4-20 mA, 100Ω impedance - RTD (Ni 1000, Pt 1000, A 99)
Analog Outputs	2 Outputs, jumper selectable: - 0-10 VDC, (10 mA) - 0/4-20 mA, 500Ω max
LED Indications	Each output level indicated by 2 LEDs, one for 0% and one for 00%. The LEDs are equally bright at 50% output.
Active Sensor Supply	15 VDC, 30 mA
Operating Environment	0 to +50 °C / +32° to 122 °F 10 to 90 % RH, non condensing
Storage Environment	-20 to +70 °C / -4° to 158 °F

Hardware Setting

ANALOG INPUT SELECTION

ANALOG OUTPUT SELECTION
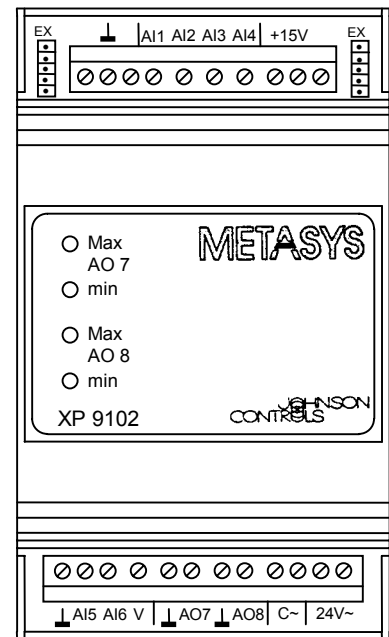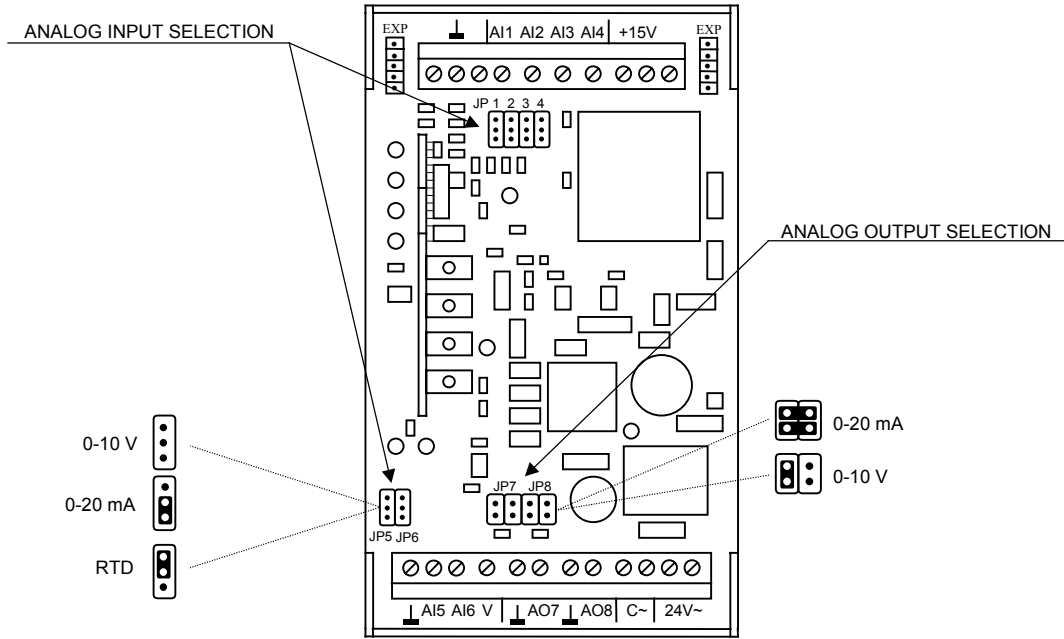
Jumper Details

Note: All jumper selections must be made **before** installing the module and **before** power is applied to the Module.

For jumper selections proceed as follows:

1. Remove the cover of the Module.

2. Select **Analog Input Type** (Jumpers JP1, JP2, JP3, JP4,JP5 and JP6) using jumpers position as follows (See Figure above):

- One per input in the respective position RTD .

- One per input in the respective position 0-20 mA inputs .

- Remove the jumper completely to select 0-10 V .

A maximum of 30 mA is available from the 15V supply of the Module.

3. Select **Analog Output Type** (Jumpers JP7 and JP8) using jumpers position as follows (See Figure above):
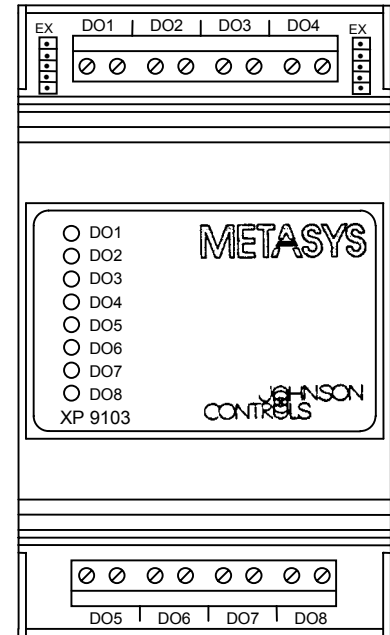
- Two jumpers are required for 0-20 mA .

- One jumper for 0-10 V output .

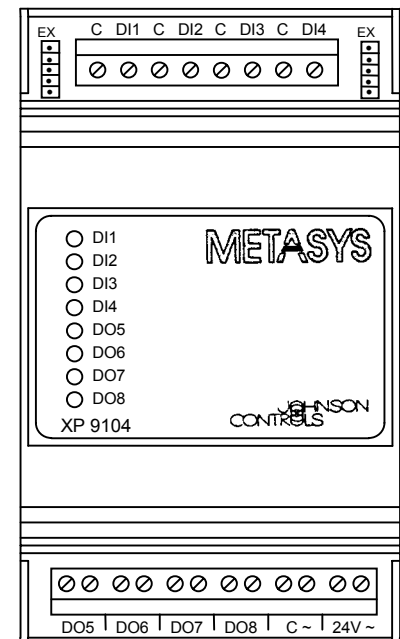**4.** Reposition the cover of the Module and give power.

XP-9103

Electrical Requirements	Powered from XT-9100
Terminations	**Outputs:** 1x1.5 mm^2 cable max. **XP-bus:** Connectors provided **Digital Outputs:** 8 Triac Outputs, 500 mA RMS, ON/OFF or PULSE Type.
LED Indications	Each output indicated by a LED
Operating Environment	0 to +50 °C / +32° to 122 °F 10 to 90 % RH, non condensing
Storage Environment	-20 to +70 °C / -4° to 158 °F

XP-9104

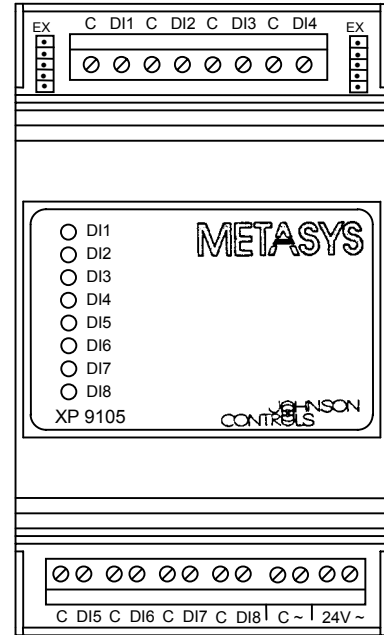|	
Electrical Requirements	24 VAC, 50/60 Hz
Power Consumption	0.5 VA
Terminations	**Power supply:** 1x1.5 mm^2 / 14 AWG cable max. **Inputs / Outputs:** 1x1.5 mm^2 / 14 AWG cable max. **XP-bus:** Connectors provided.
Digital Inputs	4 Digital Inputs from potential-free contacts, maintained or PULSE TYPE.
Digital Outputs	4 triac outputs, 500 mA RMS, ON/OFF or PULSE TYPE.
LED Indications	Each intput indicated by a LED Each output indicated by a LED.
Operating Environment	0 to +50 °C / +32° to 122 °F 10 to 90 % RH, non condensing.
Storage Environment	-20 to +70 °C / -4° to 158 °F

XP-9105

Electrical Requirements	24 VAC, 50/60 Hz
Power Consumption	1 VA
Terminations	**Power supply:** 1x1.5 mm^2 / 14 AWG cable max. **Inputs:** 1x1.5 mm^2 / 14 AWG cable max. **XP-bus:** Connectors provided.
Digital Inputs	8 Digital Inputs from potential-free contacts, maintained or PULSE TYPE.
LED Indications	Each intput indicated by a LED.
Operating Environment	0 to +50 °C / +32° to 122 °F 10 to 90 % RH, non condensing
Storage Environment	-20 to +70 °C / -4° to 158 °F

XP-9106

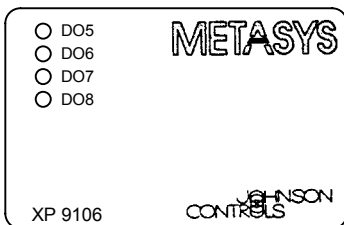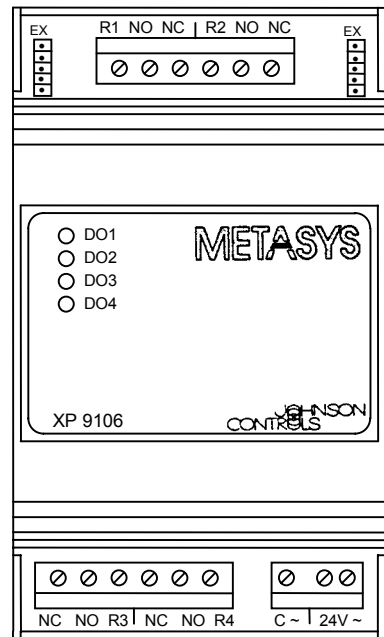|	
Electrical Requirements	24 VAC, 50/60 Hz
Power Consumption	4 VA
Terminations	**Power supply:** 1x1.5 mm^2 / 14 AWG cable max. **Outputs:** 1x1.5 mm^2 / 14 AWG cable max. **XP-bus:** Connectors provided.
Digital Outputs	4 Relay outputs, SPDT relay: 250 VAC / 5 A 30 VDC / 5 A ON/OFF or PULSE Type
LED Indications	Each output indicated by a LED
Operating Environment	0 to +50 °C / +32° to 122 °F 10 to 90 % RH, non condensing
Storage Environment	-20 to +70 °C / -4° to 158 °F

Note: Apply the label with "DO5 ÷ DO8" point tags (supplied in the package) when the Module is the second of two XP-9106 Modules in position XP1 or XP2.

XP-9107

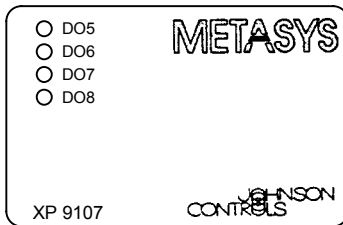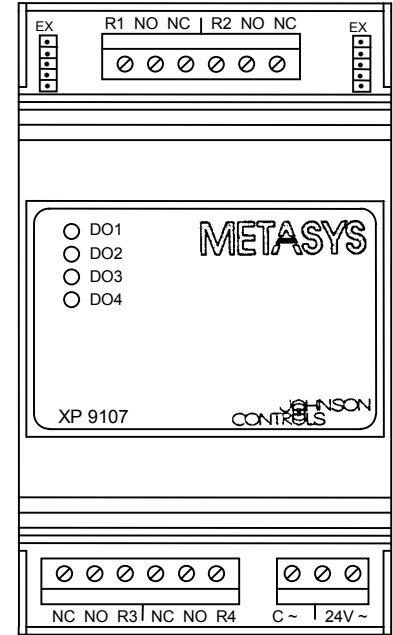|	
Electrical Requirements	24 VAC, 50/60 Hz
Power Consumption	4 VA
Terminations	**Power supply:** 1x1.5 mm^2 / 14 AWG cable max. **Outputs:** 1x1.5 mm^2 / 14 AWG cable max. **XP-bus:** Connectors provided.
Digital Outputs	4 Relay outputs, SPDT relay: 24 VAC / 3 A 24 VDC / 3 A ON/OFF or PULSE Type
LED Indications	Each Output indicated by a LED
Operating Environment	0 to +50 °C / +32° to 122 °F 10 to 90 % RH, non condensing
Storage Environment	-20 to +70 °C / -4° to 158 °F

Note: Apply the label with "DO5 ÷ DO8" point tags (supplied in the package) when the Module is the second of two XP-9107 Modules in position XP1 or XP2.

⚠ **CAUTION**

Before installing this unit, refer to the XT-9100 technical and configuration manuals for installation, wiring and configuration instructions.

Displays

The FX15 "Classic" can have different display configurations, *built-in*, *local* or *remote*.
The display is optional, which means that the controller can work also without any display plugged-in.

- **BUILT-IN:** directly plugged on top of the controller.
- **LOCAL:** up to 3 mt from the controller, power supply and data communication via the flat telephone cable included in the LP-KIT007-000C.
- **REMOTE:** up to 300 mt from the controller. The display must be independently powered, the data communication is done via a 3 pole shielded cable (not provided) connected to the Remote Display Connection of the FX15.

For more details about the connection possibilities please refer to the specific display product bulletin.

The display models connectable to the FX15 "Classic" are:

- **LP-DIS65P00-0C: L**arge **U**ser **I**nterface, panel, flush mount or hand held, 4x20 backlit LCD, IP54, extended temperature range: -20° C to +50° C, standard JCI front-plate. The front-plate is fully customisable upon minimum order, see *"LUI display"* product bulletin for more information.

- **LP-DIS60U00-C: Integrated M**edium **U**ser **I**nterface, built-in, 4x20 backlit LCD, IP54, extended temperature range: -20°C to +50°C.

- **LP-DIS60P00-0C / LP-DIS60P01-0C: M**edium **U**ser **I**nterface, 4x20 backlit LCD, IP54, extended temperature range: -20°C to +50°C. Panel mount, non-isolated version, wall mount isolated version.

- **LP-DIS50P00-0C: S**mall **U**ser **I**nterface, panel mount, 3 LED digits. IP54. Temperature range: -20°C to +60°C

Software Details

The FX15 controller is a fully programmable controller of the FX family. The tools that allows programming, testing and downloading the FX controllers are the FX-Tools.

The FX15 can come application-less or with a standard JCI application already pre-loaded.

The application building philosophy is based on the object structure: basic blocks of basic functions that inter-connected among them build the application.

The object list available in a controller is specified by the code extension after the dash. There is one unique list for the FX15.

Example:
LP-FX15D20-**000**C
(it's an FX15 with the 000 object list)

The device to be used in the AppMaker to program the FX15 "Classic" controllers is:

Device	Models	Object List
FX15D1x	LP-FX15D1x-xxx LP-FX15D2x-xxx LP-FX15D6x-xxx LP-FX15D7x-xxx	000FX15AM

For the development of an application, maximum 255 instances of the objects available in the chosen list, can be used.

Object Lists

000FX15AM – General purpose list
Each object performs a basic function.

Input
- Analog Input
- Fan Command
- Digital Input
- Occupancy Input
- Temporary Occupancy

Output
- Analog Output
- LED
- Fail safe Relay Output
- On\Off Output
- DAT
- Damper
- PAT
- Hermetic Compressor

Numeric
- Average
- Calculation
- Compare
- Event Counter
- Butterworth Filter
- Integrator
- Maximum
- Minimum
- Psychrometric 1
- Psychrometric 2
- Ramp
- Sample & Hold
- Selector
- Span
- Segment
- Time Counter
- Timer
- Storage element
- EWMA

Control
- Economizer
- Fan Controller
- On\Off Controller
- PI controller
- Summer Winter Compensation

Logic
- And
- Or
- Enumeration Override
- Enumeration Logic
- Output override logic
- PLC

Alarm
- Analog Alarm
- Compressor Envelope
- Manual Reset Binary Alarm
- Out of range

Special
- Emergency/Application mode
- Exception Days
- Binary Sequencer
- General Setpoint
- Occupancy mode
- Real Time Clock
- Real Time Clock Enhanced
- Sensor Failure
- System Resource
- Temperature Setpoint
- Load Manager
- Occupancy Time Scheduler
- Optimal start Stop
- Semi-hermetic Compressor
- Sequencer
- Time scheduler
- Source Mode

Extension Modules
- XT-9100 (only for FW version 1.10 and above)

Defrost
- Accumulative Defrost
- Refrigeration Defrost
- Refrigeration Defrost Initiation

Refrigeration
- Refrigerant Saturation Properties

Unit conversion
- Convert Format
- UNVT_logic to SNVT_state
- Enumeration to UNVT_logic
- SNVT_switch to UNVT_logic
- SNVT_hvac_status generator
- SNVT_chlr_status generator
- SNVT_lev_disc to SNVT_switch

*Max number of **executable** objects: **255***

Metasys Integration

The FX15 is fully programmable and customisable both in terms of control application and network profile. The **network profile** in particular, i.e. the list of variables and parameters available through the network, is not univocally determined but depends on the **application** loaded to the controller.

For this reason the FX15, as well as all the other controllers of the FX family, are integrated to Metasys as **VND** - N2-Compatible Vendor Device.

The FX-Tools, that are used to develop the controller strategy, automatically print out a file (.PRN) that contains all the relevant information to integrate the controller load with a specific application to an N30 or NCM supervisory controller. The PRN file contains a column labelled Point Type and a column labelled Point Address. This information have to be used when specifying Network Point Type and Network Point Address in an N30 or NCM.

Note: When you name points in an N30 or NCM, you can use the names shown in the Long Name column (for example, Zone TEMP) for consistency, or you can create new names.

The following table shows a portion of a configuration printout (.PRN file) for a Single compressor chiller (printed from the FX-App Maker software).

```
STANDARD CONFIGURATION PRINT - SHORT FORM
-----------------------------------------

PROJECT INFORMATION
Configuration File  : C:\Documents\Applications\851_demo\851_v1_0_demo.prn
Configuration date  : 06/03/02
Operator Name       : John
Job Name            : 851_v1_0_demo
Engineering Units   : International System
Device Group        :
Device Name         : FX15D00


QUESTION AND ANSWER SESSION
--------------------------
(NONE)


SIDELOOP DEFINITION
------------------
(NONE)


ANALOG INPUTS (* Denotes OPERATOR-DEFINED AI)
(NONE)


BINARY INPUTS (* Denotes OPERATOR-DEFINED BI)
(NONE)


ANALOG OUTPUTS (* Denotes OPERATOR-DEFINED AO)
(NONE)
```

```
PARAMETERS (* Denotes MONITOR ONLY Parameters)
 Point  Point
 Type   Address  Long Name                Short Name  Value
 -----  -------  ------------------------ ----------  -------
 *ADF   0        nvoOnOff                 adf-1       |
 *ADF   1        nvoActiveSetpt           adf-2       |
 *ADF   2        nvoEntCHWTemp            adf-3       |
 *ADF   3        nvoLvgCHWTemp            adf-4       |
 *ADF   4        nvoCndTemp               adf-5       |
 *ADF   5        nvoComprRunT             adf-6       |
 *ADF   6        nvoEffectSetpt           adf-7       |
 *ADF   7        nvoLocalOffset           adf-8       |
  ADF   8        nviChillerEnable         adf-9       |
  ADF   9        nviCoolSetpt             adf-10      |
  ADF   10       nviHeatSetpt             adf-11      |
  ADF   11       nciChillerEnable         adf-12      |
  ADF   12       nciCoolSetpt             adf-13      |
  ADF   13       nciHeatSetpt             adf-14      |

  ADI   0        nciPumpOffCycle          adi-1       |
  ADI   1        nciComprNcycle           adi-2       |
  ADI   2        nciComprRunT             adi-3       |
  ADI   3        nciAuxMin                adi-4       |

 *BD    0        nvoOnOff                 bd-1        |
 *BD    1        nvoChillerStat           bd-2        |
 *BD    2        nvoChillerStat           bd-3        |
 *BD    3        nvoChillerStat           bd-4        |
  BD    4        nviChillerEnable         bd-5        |
  BD    5        nviMode                  bd-6        |
  BD    6        nciChillerEnable         bd-7        |
```

Application Coding

Standard JCI applications are build by Johnson Controls application engineers. The standard application can come pre-loaded in the controller or in a library CD and downloaded in the field.

The application code, as for example the general AHU application, **900FX1500-000AM**, contains in itself all the information to select the target controller:

900: application code number;

FX15: target controller family;

00: minimum hardware configuration required,
see *"Ordering Codes"* on page 29;

000: target object list

AM: built-in + local/remote display driver

If the application is pre-loaded, the controller code will take the extension that specify the application itself.
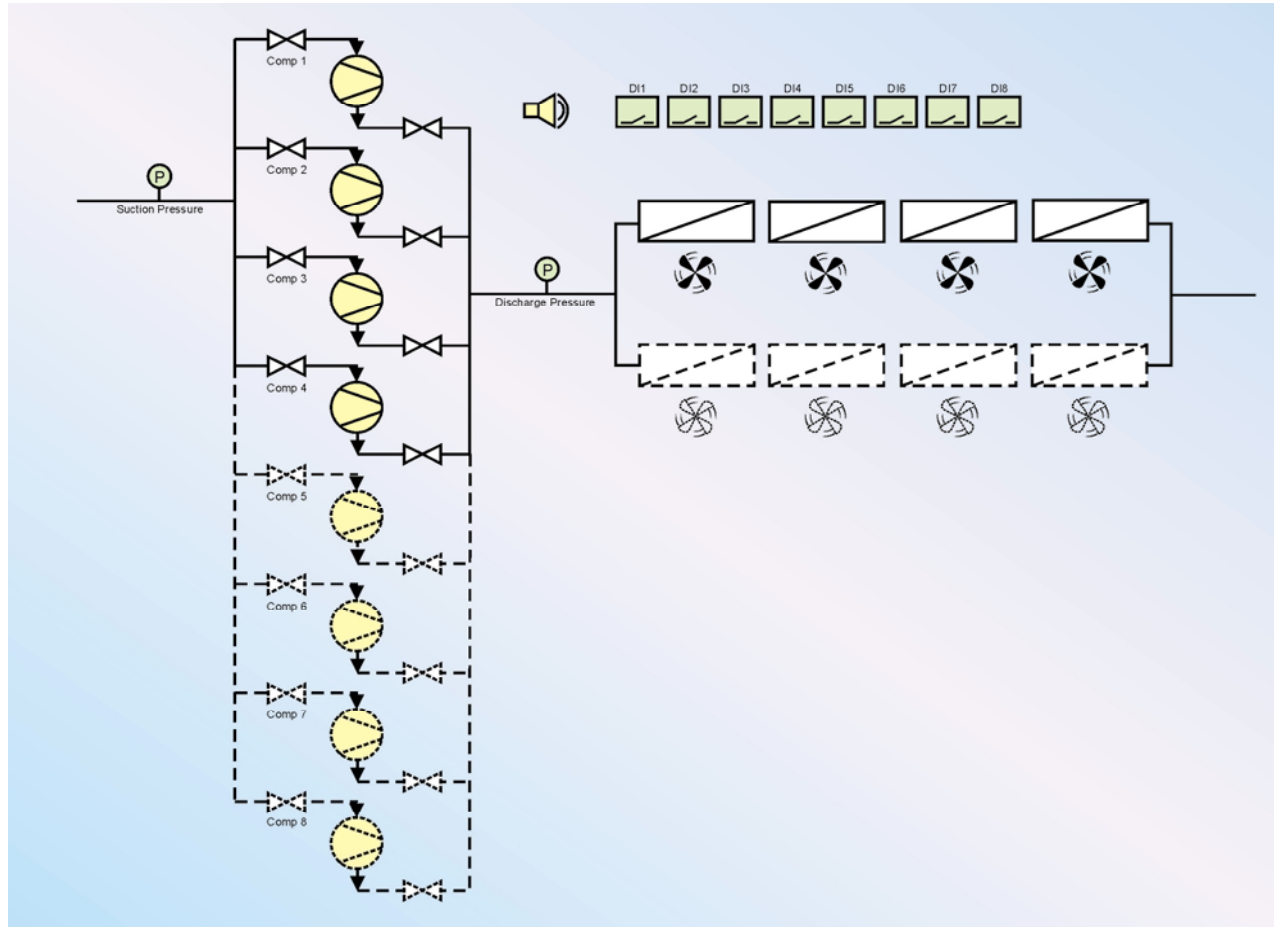
Example:
LP-FX15D20-**901**C is an FX15 "Classic" with the **901FX1500-000AM** application pre-loaded.

Example of Standard Application

**Standard Compressor Rack – Application Code: 901FX1500-510AM**

For more information about this standard application please refer to the relative Application Note.

I/O Code	Description
AI1	Suction Pressure
AI2	Discharge Pressure
DI1	Alarm stop relative Compressor / Fan
DI2	Alarm stop relative Compressor / Fan
DI3	Alarm stop relative Compressor / Fan
DI4	Alarm stop relative Compressor / Fan
DI5	Alarm stop relative Compressor / Fan
DI6	Alarm stop relative Compressor / Fan
DI7	Alarm stop relative Compressor / Fan
DI8	Alarm stop relative Compressor / Fan
DO1	Fan / Compressor 1 output
DO2	Fan / Compressor 2 output
DO3	Fan / Compressor 3 output
DO4	Fan / Compressor 4 output
DO5	Fan / Compressor 5 output
DO6	Fan / Compressor 6 output
DO7	Fan / Compressor 7 output
DO8	Fan / Compressor 8 output
DO9	Alarm

Installation

Dimensions in mm (inch).
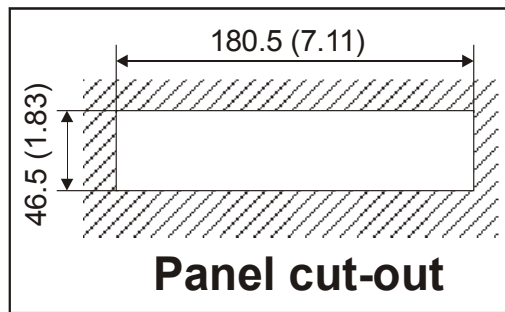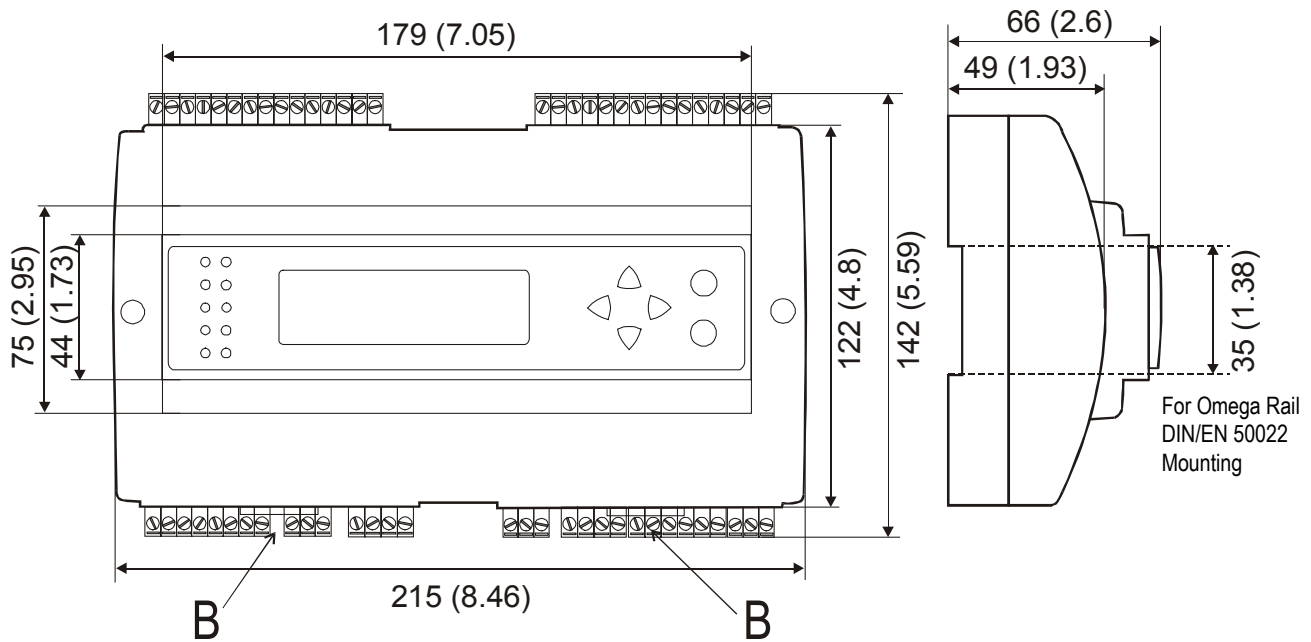
FX15 controller with optional displays

Mounting Instructions

1. *DIN rail mounting:*
   Snap the controller onto the 35 mm (1.38 inch) rail. To release the controller insert a screwdriver in Slots B and lift the retaining clip. Since the retaining clip is spring-loaded, you can also remove the controller without a screwdriver by carefully pushing the controller up against the clip and then tilting the top forward to release the top lug from the DIN rail.

2. Wiring terminations are made by detachable connectors, which accept 1 x 1.5mm^2/16 AWG cable, two types available: screw and cage clamp connectors. Terminations of the Supervisor Link. Expansion Bus and Remote Display are made via the connectors provided with the controller.

3. Verify that the wiring has been correctly installed, and that voltage levels are appropriate for the various input signals according to the application.

4. Set the jumpers and address switches of the controller as required.
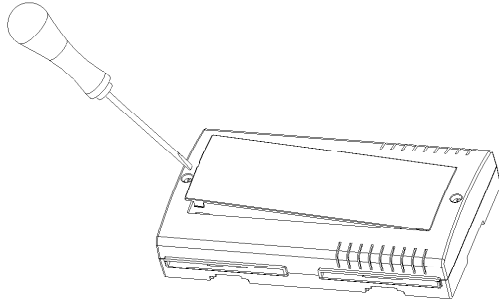   See *"Jumper Configuration"*, page 6.

> ⚠ **CAUTION**
>
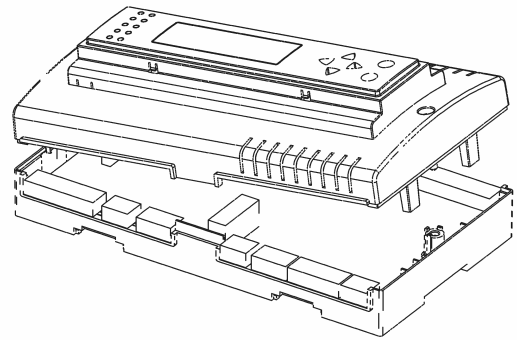> - **The CMOS circuits in the controller are sensitive to static electricity. Take suitable precautions.**

Opening the FX15 "Classic"
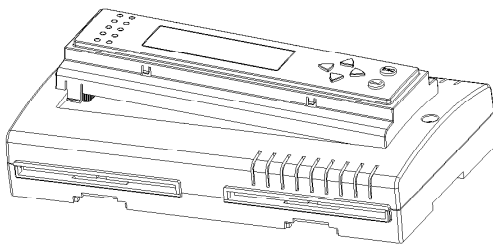
Assembling the display

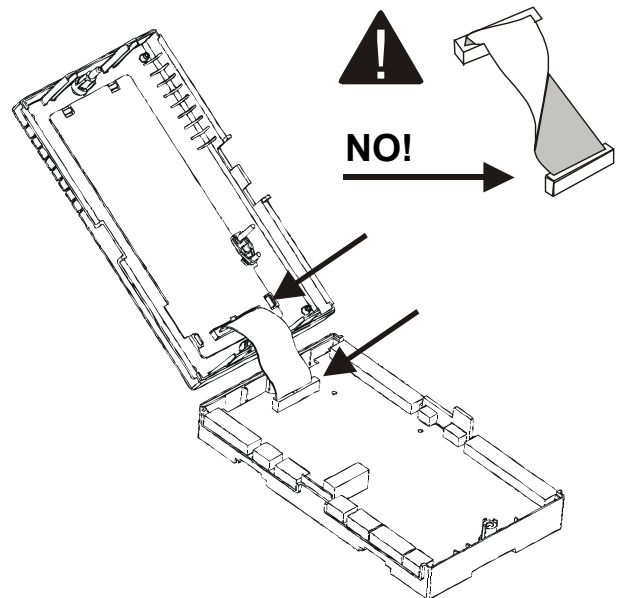- First remove the controller front cover.

- Hook the display to the top FX15 cover.

- Push down until it locks.

Push

- Open the controller

- Insert the flat in the specific holes.

NO!
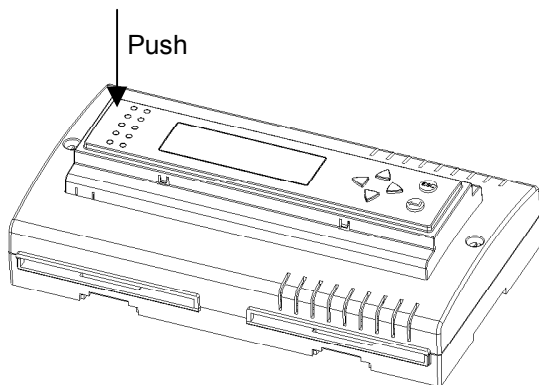
- Close the controller and secure it with the two screws.

General Wiring Guidelines

While every reasonable precaution has been taken to prevent electrical disturbances from adversely affecting the operation of the controller, and the controller complies with appropriate local codes for electromagnetic compatibility (EMC), lack of attention to generally accepted control wiring installation practices can lead to controller problems in high electromagnetic field environments. In general, follow the guidelines below.

- Do not mount the controller in heavy-duty switchgear cabinets or in cabinets with frequency-converting or phase-cutting equipment.

- Low voltage wiring in electrical cabinets must be physically separated from line voltage and power wiring, and a distinctive colour (e.g. white or pink) is recommended.

- To avoid electrical interference in field cables:

    - Keep input and output point cable runs as short as possible (<50 m/165 feet).

    - Use twisted pair cables.

    - Run low voltage cables separately from line voltage/power cables, and use a minimum of 30 cm / 12 inches separation for 230V, 30A circuits.

    - Do not run low voltage cables parallel to power cables for long distances (> 3m / 10 feet).

    - Do not run cables close to transformers or high frequency generating equipment.

    - In high electromagnetic field environments, use shielded cable, grounding the drain wire at the controller cabinet only.

    - Use a cable recommended for RS 485 transmission for the Supervisor Link and Local Link (communications buses), and to the XT-Bus (extension module bus). If the cable is shielded, it must be grounded at one point only (normally at one end of the bus). (See the technical bulletin on the Metasys N2 Bus or System 91 Bus Converter and Repeater).
    If a two-wire cable is installed, the shield may be used for the RS 485 common (or reference) signal.

- Do not connect switched inductive loads to the
24 V transformer that supplies the controller. When multiple loads are connected to one transformer, cable each connected load from the transformer separately so that any possible disturbances from one load will have minimal affect on other loads.

The first diagram below shows the correct way to wire the controller to the transformer. The second diagram illustrates the incorrect way.
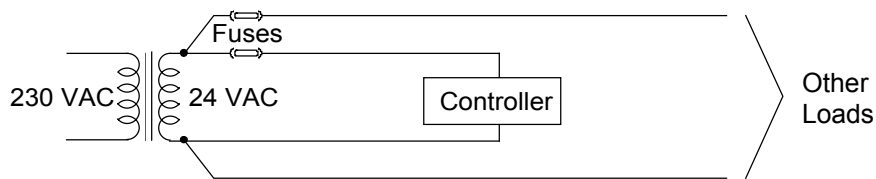
Correct **Wiring of Controller to 24 V Transformer**
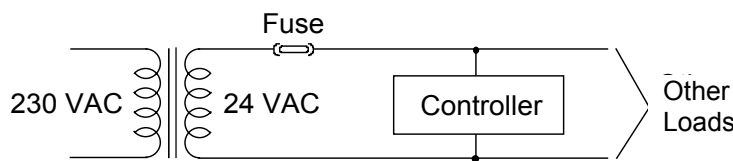
Incorrect **Wiring of Controller to 24 V Transformer**

Ordering Codes

Controllers

Item Code	Description
LP-FX15D10-000C	FX15 "Classic", 4 Relays + 5 Triacs, Application-Less.
LP-FX15D11-000C	FX15 "Classic", 4 Relays + 5 Triacs, N2Open card pre-assembled, Application-Less.
LP-FX15D12-000C	FX15 "Classic", 4 Relays + 5 Triacs, LON card pre-assembled, Application-Less.
LP-FX15D60-000C	FX15 "Classic", 4 Relays + 5 Triacs, integrated MUI display, Application-Less.
LP-FX15D61-000C	FX15 "Classic", 4 Relays + 5 Triacs, N2Open card pre-assembled, integrated MUI, Application-Less.
LP-FX15D62-000C	FX15 "Classic", 4 Relays + 5 Triacs, LON card pre-assembled, integrated MUI, Application-Less.
LP-FX15D20-000C	FX15 "Classic", 9 Relays, Application-Less.
LP-FX15D21-000C	FX15 "Classic", 9 Relays, N2Open card pre-assembled, Application-Less.
LP-FX15D22-000C	FX15 "Classic", 9 Relays, LON card pre-assembled, Application-Less.
LP-FX15D70-000C	FX15 "Classic", 9 Relays, integrated MUI display, Application-Less.
LP-FX15D71-000C	FX15 "Classic", 9 Relays, N2Open card pre-assembled, integrated MUI, Application-Less.
LP-FX15D72-000C	FX15 "Classic", 9 Relays, LON card pre-assembled, integrated MUI, Application-Less.

Accessories

Item Code	Description
LP-NET151-010C	N2Open communication interface
LP-NET152-010C	Advanced LON communication interface. On-field commissioning.
LP-NET152-xxxC	Advanced LON communication interface. Specific application profile.
LP-KIT007-000C	Link cable for the connection of the FX15 "Classic" to the MUI / LUI display - 3 mt.
LP-KIT015-000C	Kit of female screw connectors
LP-KIT015-001C	Kit of female cage clamp connectors.
LP-KIT100-000C	Programming Key
U215LR-9110	Condenser fan speed controller single-phase, 3Amps.

Expansion Boards

Item Code	Description
XT-9100-8304	Extension module DX.
XP-9102-8304	Expansion board: 6AI, 2AO.
XP-9103-8304	Expansion board: 8DO (triacs).
XP-9104-8304	Expansion board: 4DI, 4DO (triacs).
XP-9105-8304	Expansion board: 8DI.
XP-9106-8304	Expansion board: 4DO (relays).

Displays

Item Code	Description
LP-DIS65P00-0C	Remote Large User Interface, (4x20) LCD backlit display (LUI with standard JCI front plate).
LP-DIS60P00-0C	Remote Medium User Interface, (4 x20) LCD backlit display, **panel mount** version.
LP-DIS60P01-0C	Remote Medium User Interface, (4 x20) LCD backlit display, **wall mount** isolated version.
LP-DIS60U10-C	Integrated medium size LCD (4 x 20) display (plug-in MUI) for FX15 "Classic".
LP-DIS50P00-0C	Remote Small User Interface, 3 digit LED display (SUI).

Sensors

Item Code	Description
LP-A99S000-C	A99 temperature sensor -40…+100°C.
TS-9104 series TE-9100-8502	NTC (K10) temperature sensor -10…+100°C.
HT-9000 series	Humidity sensor (0…5V) 0…100%.
P299 series	Ratiometric pressure sensor (0…5V) 10 to 90% of supply voltage.

Demos

Item Code	Description
DEMO-FX15-071	Demo case FX15 "Classic" + N2Open communication, 230V.
DEMO-FX15-072	Demo case FX15 "Classic" + LON communication, 230V.
DEMO-FX15-081	Demo case FX15 "Classic" + N2Open communication, 120V.
DEMO-FX15-082	Demo case FX15 "Classic" + LON communication, 120V.
LP-FX15DEM-010C	FX15 "Classic" controller + built-in display + N2Open comm. Card with DEMO ID.
LP-FX15DEM-011C	FX15 "Classic" controller + built-in display + LON comm. Card with DEMO ID.

Configuration Software

Item Code	Description
LP-FXTOOLS-DEMO	FX Tools package DEMO version.
LP-FXTOOLS	FX Tools package.
LP-FIELDSERVICE	FX Field Service package.

Note

Technical Specifications

Product	FX15 "Classic"
Power Supply Requirements	24 VAC ±15%, 50/60 Hz
Power Consumption	15 VA at max load
Protection Class	**IP 40** MUI display **IP 20** FX15 controller
Insulation	(See *"Insulation Diagram"* on page 7).
Ambient Operating Conditions	-20°C to +50°C10 to 95% RH (non condensing)
Ambient Storage Conditions	-20°C to +70°C10 to 95% RH (non condensing)
Dimensions (H x W x D)	142 x 215 x 49/66 mm, with built-in display
I/O ratings	See values and characteristics on page 4 and 5 of the Product Bulletin
Connections	Screw terminals for max 1 x 1.5 mm^2 wires or Cage clamp connectors 1 x 1.5 mm^2 wires
C € **Compliance**	89/336 EEC directive: EN 50081-1, EN 50082-1 73/23 EEC directive: EN 60730

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

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