

FX10 "Advanced" Programmable Electronic Controller for HVAC and Refrigeration Applications

The FX10 "Advanced" is a high performance, programmable controller specifically designed for applications such as Scroll Compressor Chillers and Rooftops, Close Control Units, Indoor Packaged, Unit Vents, Water Source Heat Pump, etc..

The FX10 is a protocol independent controller and can adapt to protocols such as LONMARK™ and Johnson Controls N2Open.

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

The controller allows up to 29 I/Os in the base + 12 I/Os in Expansion board with several configuration of triacs / relays, active / passive inputs.

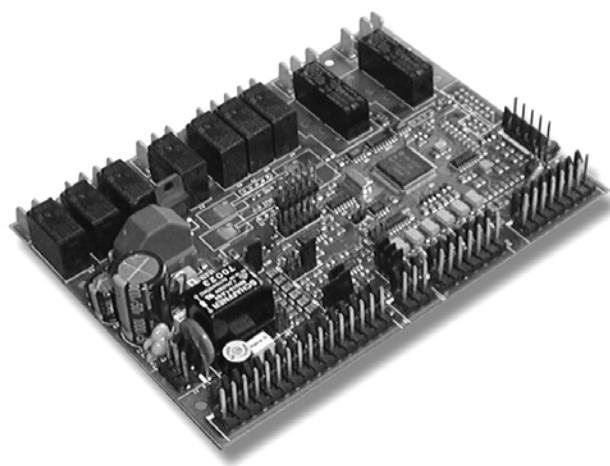


Figure 1: FX10 Controller

Features and Benefits	
☐ Protocol independent	Adapts to virtually any Building Automation Systems (BAS)
☐ LON, N2Open and BACnet MSTP communication cards (optional)	Compatible with standard BAS protocols
☐ Free programmable	Adapts to any application
☐ A99 NTC K10, Ratiometric 0-10 V	Wide range of sensor inputs available
☐ Real Time Clock (optional)	Real Time Scheduling of Control activities
☐ Expansion board (optional)	Should the I/O count of the base be not enough
☐ Choice of connection terminals	Possibility to choose between Molex® and WAGO cage clamp connectors
☐ User Interface	User friendliness

Controller Overview

Input / Output

Main board:

- 6 analogue inputs (AI)
- 12 digital inputs (DI)
- Up to 9 relays (DO) or 7 relays and 2 triacs
- 2 Pulse Width Modulation Outputs (PWM)

Expansion board:

- 4 analogue inputs (AI)
- 4 relays + 4 triacs (DO)

User Interface (optional)

Up to 2 displays can be connected to the FX10 “Advanced” for value monitoring and keyboard operations. The two displays must be of the same kind.

A display link interface is necessary for the connection, see “Accessories” codes on page 25.

Communication Interface (optional)

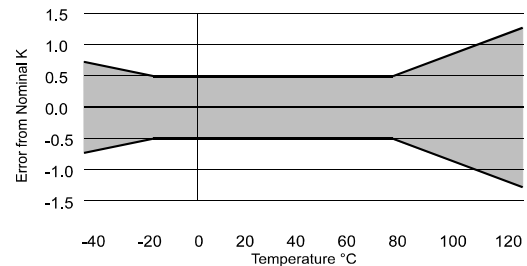
The FX10 can be integrated in supervisory systems thanks to plug-in communication cards. Several cards are available depending on the supported protocol: LON, N2Open, BACnet MSTP.

Real Time Clock (optional)

This Plug-in card allows the introduction of 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 AI1, AI2 and AI3 are also configurable, via jumpers as NTC (K10), or as Ratiometric inputs (for pressure, humidity, etc.). On the expansion board AI1 EXP and AI2 EXP can be configured, through jumpers, either as A99 or ratiometric inputs, AI3 EXP and AI4 EXP as A99 or 0-10V inputs.

Software and configuration

The FX10 “Advanced” 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 25).



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

	Type	Remark/Application
Analog Input (AI) - Main Board		
AI1, AI2, AI3	A99 Range: -40 to 100°C Accuracy: $\pm 0.5^{\circ}\text{C}$ @ 20°C ambient (sensor not included) NTC (K10) Range: 0 ÷ 100°C Accuracy: $\pm 0.5^{\circ}\text{C}$ @ 20°C ambient (sensor not included) Ratiometric Range: 0.5 to 4.5 V Resolution: 10 mV	Software configurable and jumper selectable. See “ <i>Jumper Configuration</i> ” on page 7. Application: temperature, humidity or pressure
AI4, AI5, AI6	A99 Range: -40 to 100°C Accuracy: $\pm 0.5^{\circ}\text{C}$ @ 20°C ambient (sensor not included)	Application: temperature, humidity or pressure (through Input Converter)
Analog Input (AI) – Expansion Board		
AI1, AI2	A99 Range: -40 to 100°C Accuracy: $\pm 0.5^{\circ}\text{C}$ @ 20°C ambient (sensor not included) Ratiometric Range: 0.5 to 4.5 V Resolution: 10 mV	Application: temperature, humidity or pressure
AI3, AI4	A99 Range: -40 to 100°C Accuracy: $\pm 0.5^{\circ}\text{C}$ @ 20°C (sensor not included) 0-10 V Range: 0 to 10 V Resolution: 10 mV	Application: temperature, humidity or pressure
Digital Input (DI) - Main Board		
DI1, DI2	Voltage free contacts with safety control feature	Disconnect respectively DO1 and DO2 relay outputs. Function selectable through jumpers. See “ Note ” on next page. Application: high temperature/pressure cut out
DI3, DI4, DI5, DI6	Voltage free contacts	
DI7, DI8, DI9, DI10, DI11, DI12	24 VAC externally powered contacts	See ▲ Mandatory wiring next page
Digital Output (DO) - Main Board		
DO1, DO2	SPST 8(3)A, 250 VAC relays (low power relay version) or SPST 25A, 250 VAC relays (high power relay version)	
DO3, DO4, DO5, DO7, DO8, DO9	SPST 5(2)A, 250 VAC relays or 0,5A / 24 VAC triacs	
DO6	SPDT 5(2)A, 250 VAC relays or 0,5A / 24 VAC triacs	
Outputs DO3 ÷ DO9 can be freely specified either as relay or as triac. The specific hardware code will be created upon minimum order.		

I/O Details (continued)

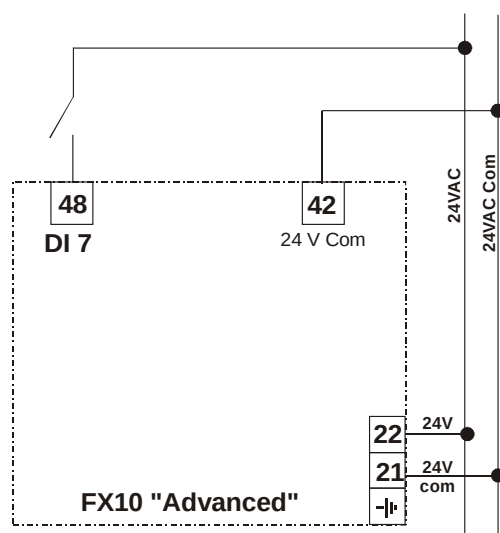
	Type	
Digital Output (DO)	Expansion Board	
DO1, DO2	SPST 5(2)A, 250 VAC relays	
DO7, DO8	SPST 8(3)A, 250 VAC relays (low power relay version) or SPST 25A, 250 VAC relays (high power relay version)	
DO3...DO6	0,5A / 24 VAC triacs	
Other Outputs - Main Board		
	PWM	9V (supplied by FX10), 50 mA max, 100 Hz
	LED	Signal to LED of a JC room command module 10 mA at 2 V



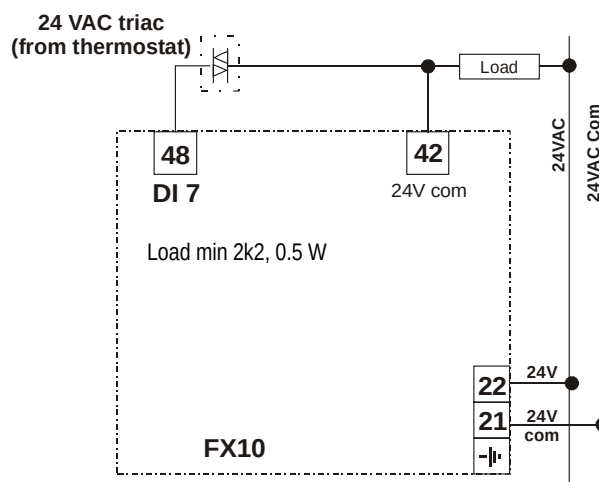
WARNING

MANDATORY WIRING DI7 ÷ DI12 Digital Inputs

- A particular attention must be given to the 24 V line polarity if the line supplies both the FX10 and its digital inputs.



Standard wiring (with relays)



Wiring with 24 VAC triac outputs of a thermostat

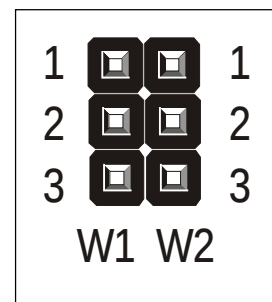
Note: DI1 and DI2 safety feature

Close to the DI1 and DI2 terminals you will find the two rows of jumpers W1 and W2. These are used to enable or disable the hardware safety features on DO1 and DO2.

- If the bridge is between pins 1 and 2 (default) the safety feature is disabled.
- If the bridge is placed between pins 2 and 3 the safety feature is enable.

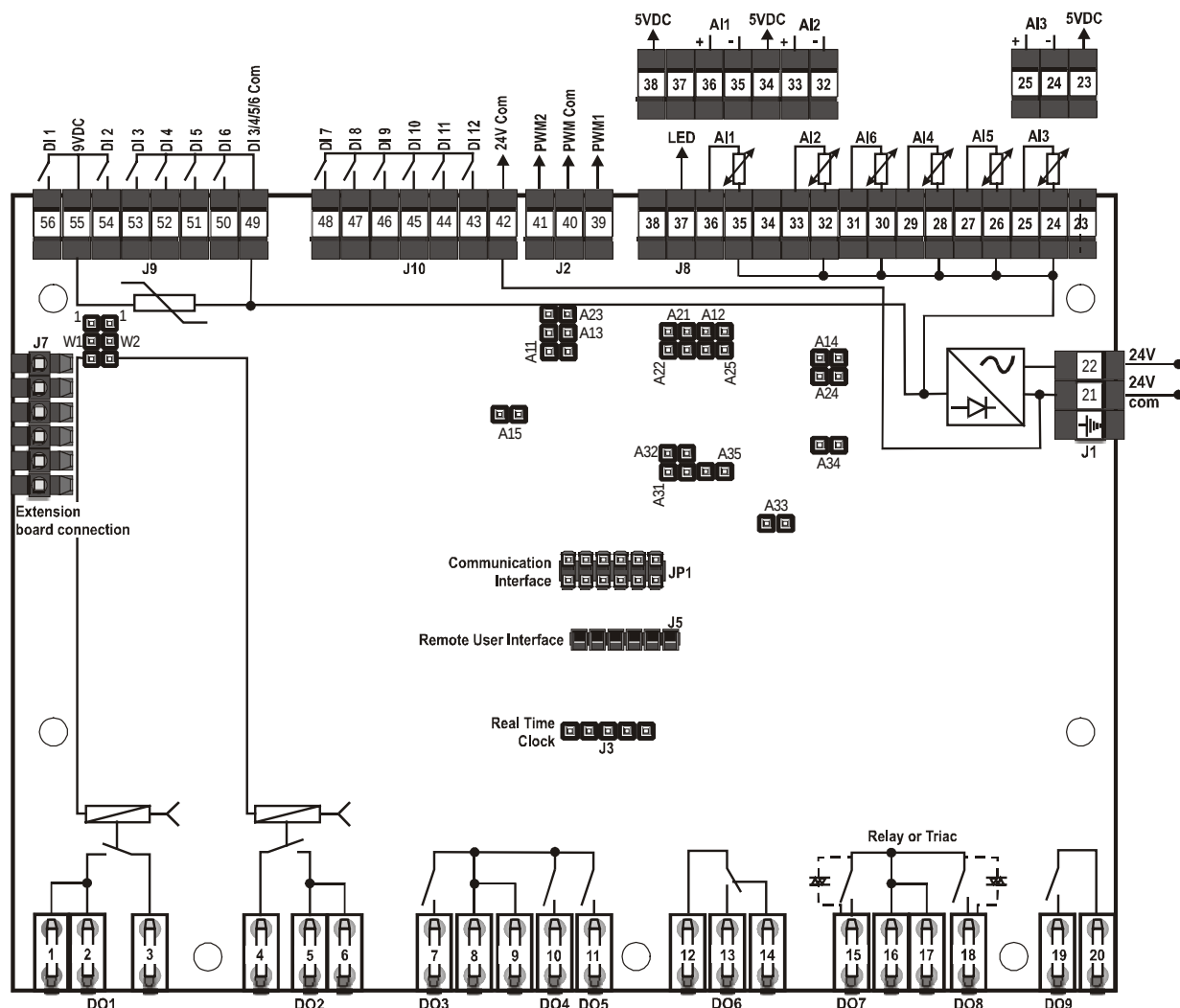
Functionality with safety enabled:

- DI1 and DI2 configured as normally closed contacts: if the digital inputs are closed then relays DO1 and DO2 are normally piloted by the application program. If for whatever reason DI1 and DI2 inputs open, the respective DO will immediately open, regardless of the commands it receive from the software. The feature is hard wired.
- DI1 and DI2 configured as normally open contacts: in this case the safety feature on DO1 and DO2 will be activated only if DI1 and/or DI2 will close. DI1 and DI2 has to be defined, through the FX-AppMaker, with reverse polarity, to be used in normally open mode.



Main Board Wiring Diagram

In accordance to EN 60730 the FX10 is an incorporated electronic controller of type 1B action.



FX10-001_01 2003

Jumper Configuration

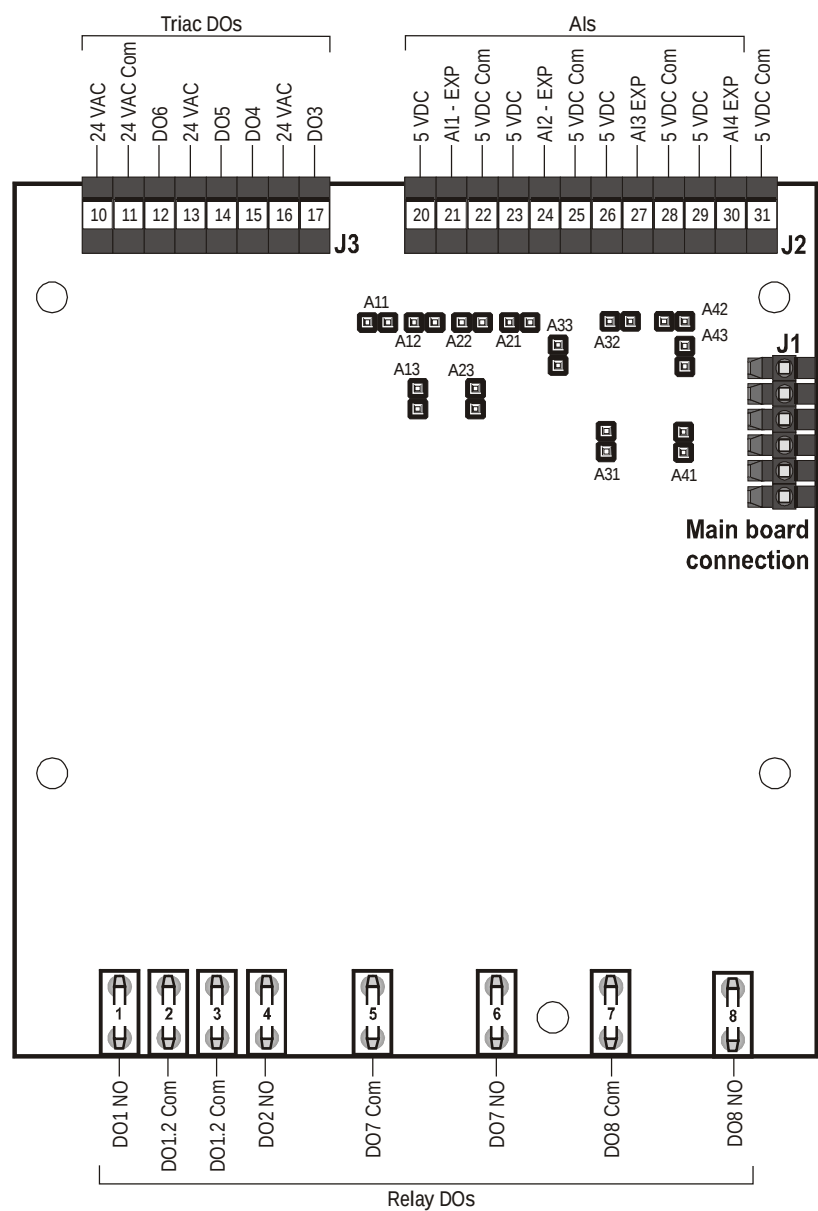
Safety Jumper Configuration

	Pins	
W1	1 & 2	Safety DO1 disabled
	2 & 3	Safety DO1 enabled
W2	1 & 2	Safety DO2 disabled
	2 & 3	Safety DO2 enabled

Analog Input Jumper Configuration

Input	A99	NTC	Ratiometric
AI1	A11, A12, A13: closed A14, A15: open	A11, A12, A13, A14, A15: closed	A11, A12, A13, A14, A15: open
AI2	A21, A22, A23: closed A24, A25: open	A21, A22, A23, A24, A25: closed	A21, A22, A23, A24, A25: open
AI3	A31, A32, A33: closed A34, A35: open	A31, A32, A33, A34, A35: closed	A31, A32, A33, A34, A35: open

Expansion Board Wiring Diagram



EX-FX10-A-002_01 2003

Jumper Configuration

Analog Input Pin-strip Configuration

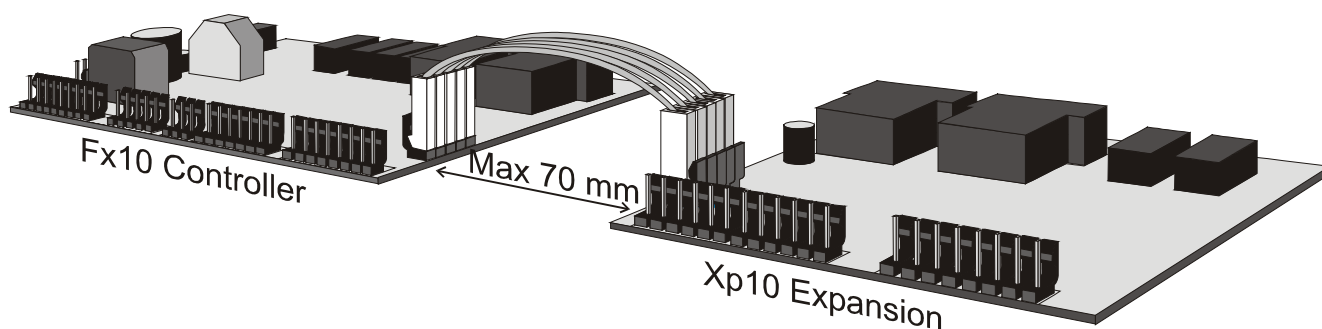
Input	A99	Ratio	0 - 10V
AI1	A11, A12, A13: closed	A11, A12, A13: open	Not avail
AI2	A21, A22, A23: closed	A21, A22, A23: open	Not avail
AI3	A31: open; A32, A33: closed	Not avail	A31: closed; A32, A33: open
AI4	A41: open; A42, A43: closed	Not avail	A41: closed; A42, A43: open

Accessories

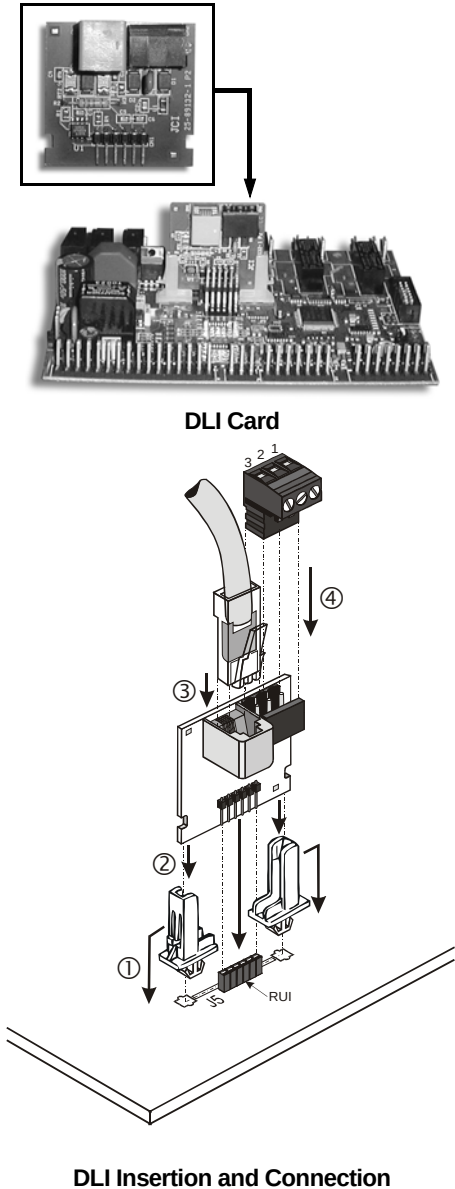
XP10 Expansion – Expansion Board Connection

The expansion board is connected to the main board via jumper (provided with the expansion board). Max distance between the main board and the expansion is about 7 cm. The jumper provide for data communication (I2Cbus) and for the expansion board power supply.

Should the expansion board be connected the power requirement of the control system has to be increased of about 6 VA, see “*Technical Specifications*” on page 28, for more details.



DLI - Display Link Card Installation



The DLI card is a plug-in, optional card, that allows to connect a display from the FX range to the FX10 controller.

Mounting

Insert the holding stands in the holes at both side of the RUI connector -J5- (①).
Slide in the DLI card until is securely fasten (②).

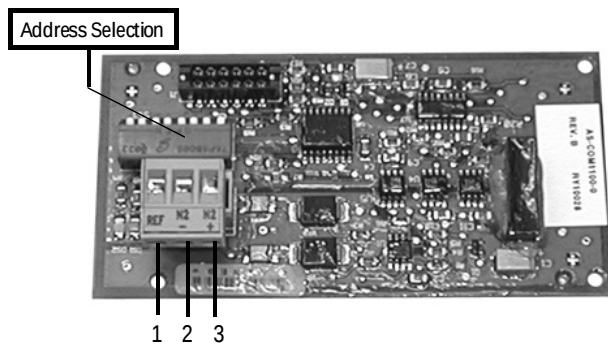
Display connection

In case the display has to be installed within 3 mt from the regulator, the provided flat cable can be used (③).
Communication and power supply to the display is provided through the flat cable.
If the display has to be installed remotely the connection has to be carried out through a 3 lead shielded cable (not provided) and the screw connector (④).
The display has to be independently powered.
See the table below for the pin-out of the screw

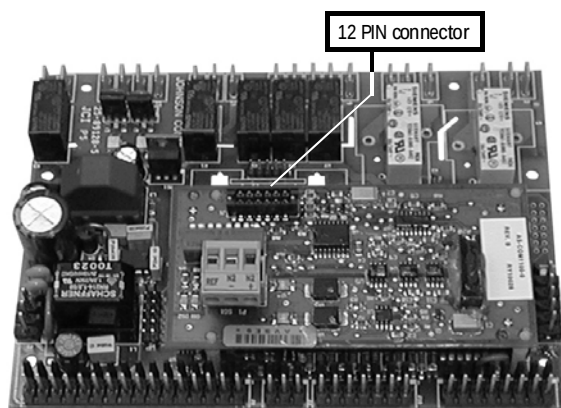
Pin	RS485
1	COM
2	LL-
3	LL+

For more detailed information please refer to the specific Display Product Bulletin.

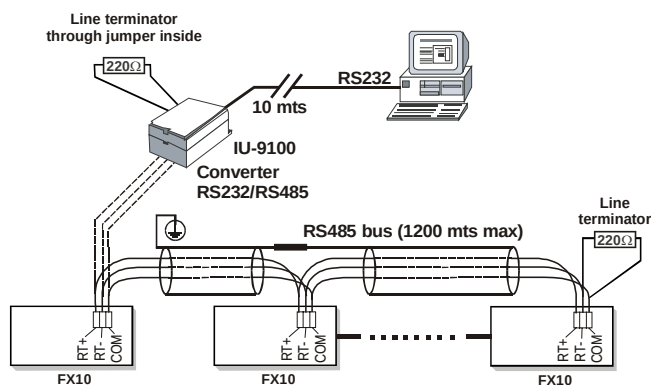
N2Open - Serial Card Installation



N2Open Serial Card for FX10



Card Insertion



Network lay-out

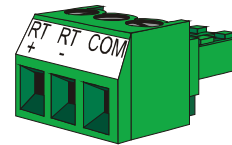
The N2Open serial card is a plug-in, optional card, that allows the FX10 controllers to be connected in a N2Open serial network through the RS485 standard.

Card Insertion

The card must be inserted on the 12 pin connector on top of the FX10 board.

Wiring

The connection to the network is made by means of the 3 pins on the plug-in connector. The meaning of each pin is as follows:



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. The communication line must be laid out on the multi-drop line principle, i.e. from one controller to the next until the last controller has been connected. The line must be terminated at both ends with a 220 Ohm resistor between RT+ and RT-.

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 closed, all others open
 $\text{address} = 2^0 + 0^1 + \dots = 1$
 • 1st closed, 4th closed, all others open
 $\text{address} = 2^0 + 0^1 + 0^2 + 2^3 = 9$

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

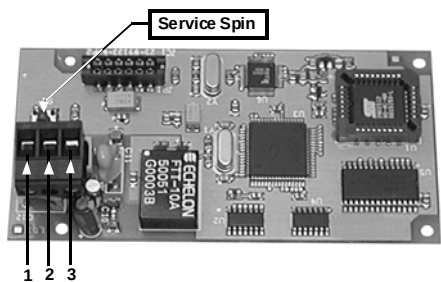
RS232C line: maximum length: 10 mts.

Devices: maximum of 32 per 1200 mts bus segment.

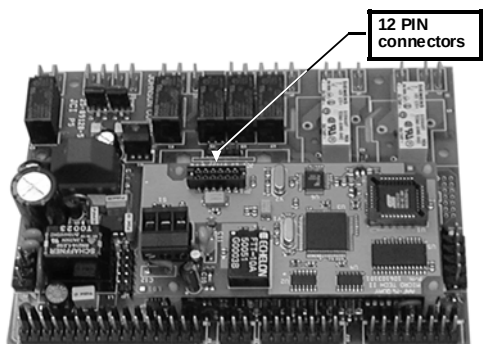
Technical Specifications

Insulation	Opto-insulated signals
CE Compliance	89/336 EEC directive: EN 61000-6-3 (EN 50081-1) EN 61000-6-1 (EN 50082-1) 73/23 EEC directive: EN 60730

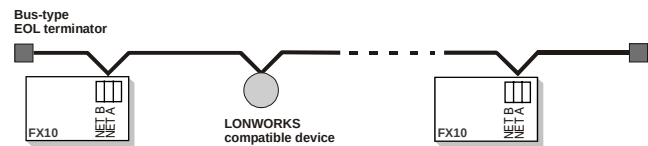
LON - Serial Card Installation



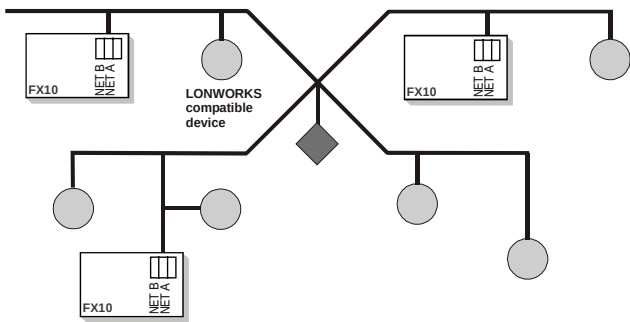
LON Serial Card for FX10



Card Insertion



Daisy-chained bus topology layout



Free topology layout

LON-FX10-001_01 2003

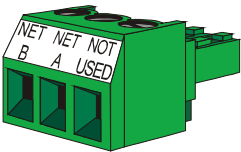
The LON Serial Card is a plug-in, optional card, that allows the FX10 controllers to be connected in a LON network.

Card Insertion

The card must be inserted on the 12 pin connector on top of the FX10 board.

Wiring

The connection to the network is made by means of the 3 pins on the plug-in connector. The meaning of each pin is as follows:



Example of network lay-out

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. 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.

Technical Specifications

Transceiver type	FTT-10A
Compliance	89/336 EEC directive: EN 61000-6-3 (EN 50081-1) EN 61000-6-1 (EN 50082-1) 73/23 EEC directive: EN 60730

Input Converter Module

4 - 20 mA to A99



Figure 1: Input Converter Module

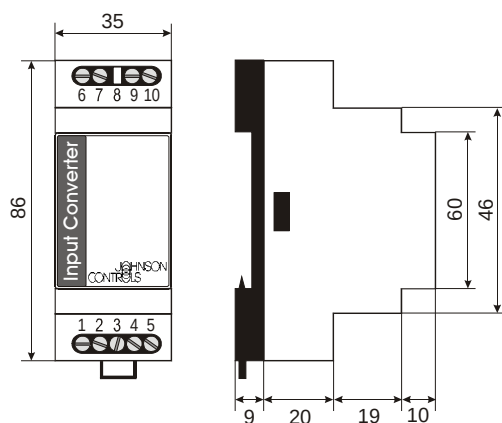
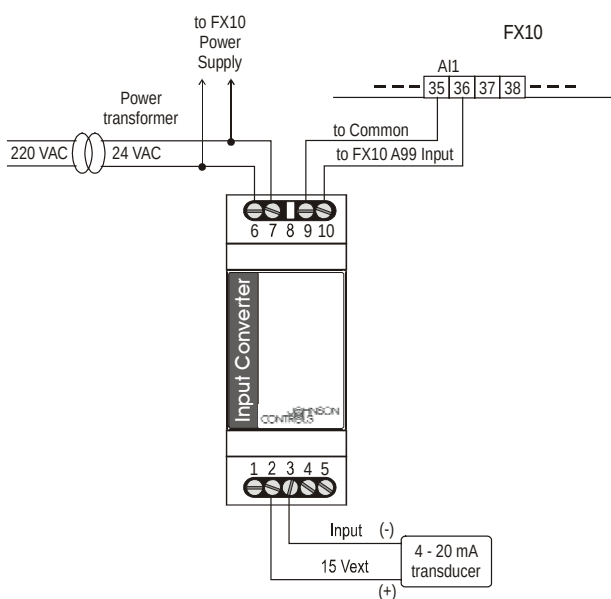


Figure 2: Dimensions (mm)



INP-CONV001-001_11 2002

Figure 3: Wiring

The Input Converter Module allows to connect an active 4 - 20 mA signal to an A99 resistive input of the FX Controllers.

Wiring (Figure 3)

The connection between an FX10 and a Input Converter Module is shown in Figure 3. The Input Converter Module can be connected indifferently to any analog input of the FX Controllers, the software has to be configured accordingly, the hardware has to be configured as A99. For the right connection please follow the table below:

PIN	Meaning
1	Not connected
2	+15 VDC ($\pm 0.75V$) sensor power supply
3	Signal Input (max allowed level 30 mA)
4	Signal Common
5	Signal Common
6	24 VAC Common
7	24 VAC power supply
9	To FX10 A99 Common (max 2 mt)
10	To FX10 A99 Input (max 2 mt)

Note: Make sure to respect polarities in connecting the 24 VAC power supply.

Technical Specifications

Power Requirements	24 VAC/DC $\pm 15\%$; 50/60 Hz
Power Consumption	1,9 VA
Insulation	No insulation between power supply, input and output signals
Ambient Operating Conditions	-20°C to +50°C, 10 to 95% RH (non condensing)
Ambient Storage Conditions	-30°C to +80°C 10 to 95% RH (non condensing)
Accuracy	1%
Drift	1%
Linearity	1% @ 25°C
Supply Voltage Influence	1%
Dimensions (H x W x L)	58 x 35 x 86 mm
Compliance	89/336 EEC directive: EN 61000-6-3 (EN 50081-1) EN 61000-6-1 (EN 50082-1)

Input Convert Module 0 - 10 V to A99



Figure 1: Input Converter Module

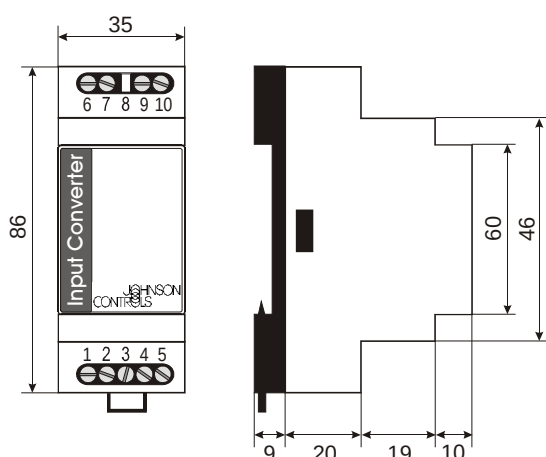
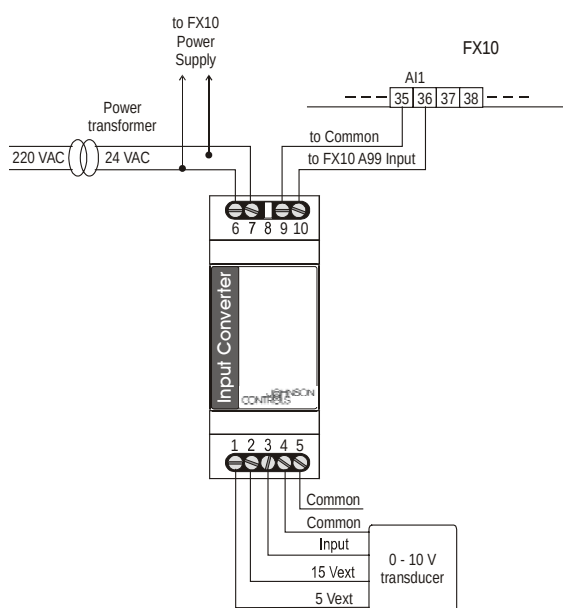


Figure 2: Dimensions (mm)



INP-CONV004-001_11 2002

Figure 3: Wiring

The Input Converter Module allows to connect an active 0 - 10 V signal to an A99 resistive input of the FX controllers.

Wiring (Figure 3)

The connection between an FX05 and a Input Converter Module is shown in Figure 3. The Input Converter Module can be connected indifferently to any analog input of the FX controllers, the software has to be configured accordingly, the hardware has to be configured as A99. For the right connection please follow the table below:

PIN	Meaning
1	Not connected
2	+15 VDC ($\pm 0.75V$, 25 mA max) sensor supply
3	Signal input
4	Signal Common
5	Signal Common
6	24 VAC Common
7	24 VAC power supply
9	To FX A99 Common (max 2 mt)
10	To FX A99 Input (max 2 mt)

Note: Make sure to respect polarities in connecting the 24 VAC power supply.

Technical Specifications

Power Requirements	24 VAC/DC $\pm 15\%$; 50/60 Hz
Power Consumption	1,2 VA
Insulation	No insulation between power supply, input and output signals
Ambient Operating Conditions	-20°C to +50°C, 10 to 95% RH (non condensing)
Ambient Storage Conditions	-30°C to +80°C 10 to 95% RH (non condensing)
Accuracy	0,1%
Drift	0,7%
Linearity	0,1% @ 25°C
Supply Voltage Influence	0,2%
Dimensions (H x W x L)	58 x 35 x 86 mm
Compliance	89/336 EEC directive: EN 61000-6-3 (EN 50081-1) EN 61000-6-1 (EN 50082-1)

Output Converter
PWM to 0-10 V



Figure 1: Output Converter

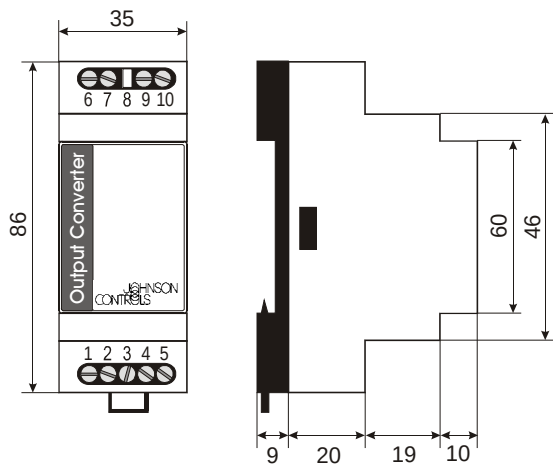


Figure 2: Dimensions (mm)

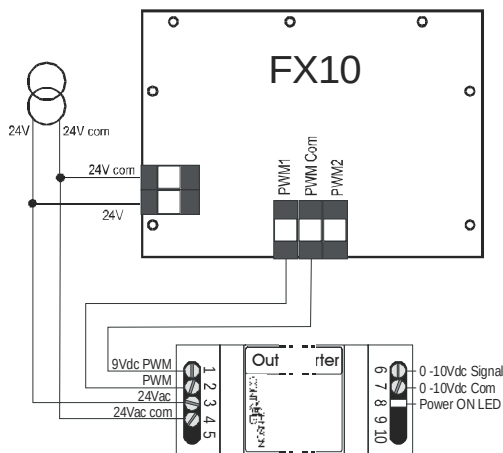


Figure 3: Wiring

The Output Converter Module allows to convert the PWM signal of the FX10 AO1 or AO2 into a universal 0 - 10 VDC signal.

Wiring (Figure 3)

The connection between an FX10 and an Output Converter Module is shown in Figure 3. Make sure to respect polarities in connecting the 24 VAC power supply. Converter and controller must share the same transformer. The Output Converter Module can be connected indifferently to PWM1, PWM2 or two converters, one for each output. For the right connection please follow the table below:

PIN	Meaning
1	From FX10 PWM Com terminal
2	From FX10 PWM1 or PWM2 terminal
3	24 VAC
4	24 VAC Com
6	0-10 VDC signal to actuator
7	0-10 VDC Com to actuator

Technical Specifications

Power Requirements	24 VAC/DC $\pm 15\%$; 50/60 Hz or DC voltage
Power Consumption	1.2 VA
Insulation	No insulation between power supply, input and output signals
Ambient Operating Conditions	-20°C to +70°C, 10 to 95% RH (non condensing)
Ambient Storage Conditions	-30°C to +80°C 10 to 95% RH (non condensing)
Accuracy	± 250 mV over the whole 0-10V range
Output	10 VDC, 5 mA max
Dimensions (H x W x L)	58 x 35 x 86 mm
Compliance	89/336 EEC directive: EN 61000-6-3 (EN 50081-1) EN 61000-6-1 (EN 50082-1)

LP-KIT006-xxx - Room Command Module Connections

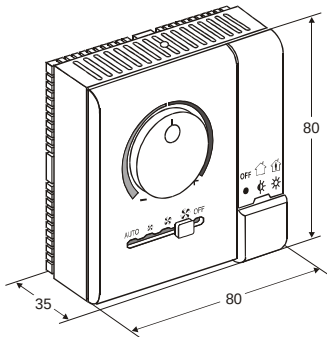


Figure 4: Dimensions (mm)

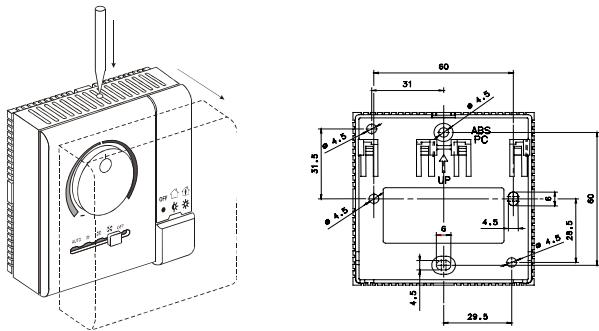


Figure 5: Mounting

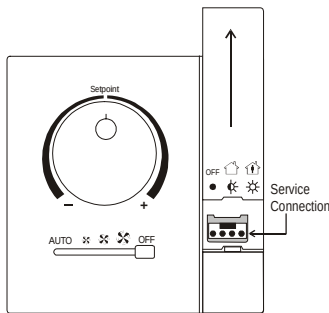


Figure 6: Connection to the serial interface

The LP-KIT006-xxx series of Room Command Modules are designed for use with the FX10 Controllers. The setpoint dial enables the room occupant to adjust the working setpoint of the controller within the range of 12 to 28 °C or -3 to +3 K, according to the model number. The occupancy button enables the occupant to change the mode of operation of the controller from “COMFORT” to “STANDBY”. The current operating mode is shown by an LED indicator. For Fan Coil Unit controllers, a Room Command Module with a three-speed fan override adjuster is available.

Occupancy push button with LED indicator

	LED on	Comfort (Occupied) mode	
	LED blinking	Stand-by (Economy) mode	
	LED off	Off	

Override for fan speed control

AUTO	Automatic
OFF	OFF
	Low fan speed
	Medium fan speed
	High fan speed

Mounting (Figure 5)

The LP-KIT006-xxx Series Room Command Module is designed for wall mounting in the room to be controlled. It should be located where the occupant can easily read and adjust the set point dial or fan speed override adjust. If the module has an A99 temperature sensor, it should be placed where the temperature is representative of the general room conditions. Cold or warm air draughts, radiant heat and direct sunlight should be avoided. The installation of electrical wiring must conform to local codes and should be carried out by authorized personnel only. Users should ensure that all Johnson Controls products are used safely and without risk to health or property. Remove the base of the module from the cover by inserting a pointed tool (a special tool, Ordering Code TM-9100-8900, is available from Johnson Controls) into the small hole at the center top of the cover. While pressing down gently, prise the base away from the cover. As the two parts separate, remove the tool and continue to pull the cover away from the base until the cover is free. Mount the base on the wall to cover the electrical output and secure with at least two screws.

Wiring (Figure 6, 7)

Before connecting or disconnecting any wires, ensure that all power supplies have been switched off and all wires are potential-free to prevent equipment damage and avoid electrical shock. Terminations are made on the terminal blocks in the base of the module, which accept up to 1.5 mm² (AWG 16) wires. Follow the wiring diagrams shown in figure 7. All wiring to the module is at extra low (safe) voltage 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 serial connection through the service connector pins under the lateral cover (Figure 6) is available if the optional serial card (N2Open or LON) is mounted on the FX10 and properly connected to the LP-KIT pins 10, 11, 12.

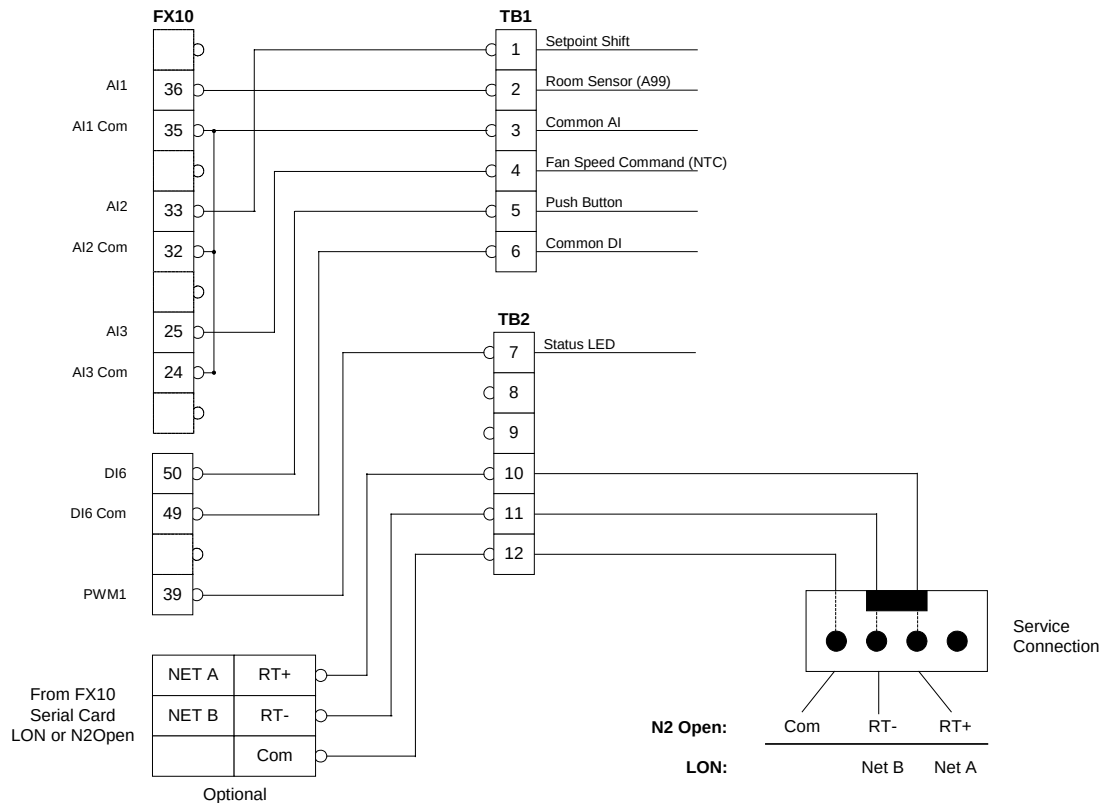


Figure 7: FX10 Wiring Connections

Displays

The FX10 "Advanced" can have up to **two** displays, either one *local* and one *remote* or two *remotes*. In case of a 2 display configuration the 2 displays must be of the same kind. In order for the controller to be able to recognise a dual display configuration the power of the controller has to be cycled on/off. The display is optional, which means that the controller can work also without any display plugged-in.

- **LOCAL:** up to 3 mt from the controller, power supply and data communication via the flat telephone cable included in the DLI kit (LP-KIT000-000C).
- **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 additional screw connector on the DLI kit.

For more details about the connection possibilities please refer to the specific display *Product Bulletin*.

The display models connectable to the FX10 "Advanced" are:

- **LP-DIS65P00-0C:** Large User Interface, 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-DIS60P00-0C / LP-DIS60P01-0C:** Medium User Interface, 4x20 backlit LCD, IP54, extended temperature range: -20°C to +50°C. Panel mount, non-isolated version / wall mount isolated version.



Software Details

The FX10 "Advanced" 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 FX10 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. Thanks to a bigger memory size of the Advanced version there is only one list of objects that comprehend both lists of the Standard FX10. The object list available in a controller is specified by the code extension after the dash.

Example:

LP-FX10B31-002C

(it's an FX10 with the 002 object list)

For the development of an application, maximum 200 instances of the objects available in the chosen list, can be used.

The device to be used in the AppMaker to program the FX10 "Advanced" Controllers is:

Device	Models	Object List
FX10B3x	LP-FX10B2x-xxx LP-FX10B3x-xxx	002

Object Lists

002FX10AR – General purpose list

Each object performs a basic function

Input

- Analog Input
- Digital Input
- LED
- Occupancy Input
- Temporary Occupancy

Numeric

- Calculator
- Compare
- Integrator
- Span
- Timer
- Maximum
- Minimum
- Selector
- Psychrometric 1

Control

- PI
- On\Off Controller
- Fan Controller
- General Setpoint
- Temperature Setpoint

Logic

- And
- Or
- Plc
- Enumeration Override
- Enumeration Logic
- Output override logic
- Xor

Alarm

- Analog Alarm
- Automatic reset alarm
- Compressor Envelop

Special

- Emergency/Application mode
- Economizer
- Occupancy mode
- Real Time Clock
- Source Mode
- System Resource
- Time Counter
- Time Scheduler

Defrost

- Accumulative Defrost

Application Control

- End of application

Unit conversion

- Convert
- Enumeration to logic
- Switch to logic
- SNVT_hvac_status generator
- UNVT_logic to SNVT_state
- Chiller status

Output

- Analog Output
- On\Off Output
- DAT
- Damper
- Fan Command
- PAT
- Hermetic Compressor

Max number of **executable** objects: **200**

Metasys Integration

The FX10 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 FX10, 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 : FX10B1x

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 Type	Point 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 2 compressor chiller / HP one, **702FX1021-002AR**, contains in itself all the information to select the target controller:

- **702:** application code number;
- **FX10:** target controller family;
- **21:** minimum hardware configuration required, see *"Ordering Codes"* on page 25;
- **002:** target object list
- **A:** FX10 "Advanced" version
- **R:** remote display supported by the application.

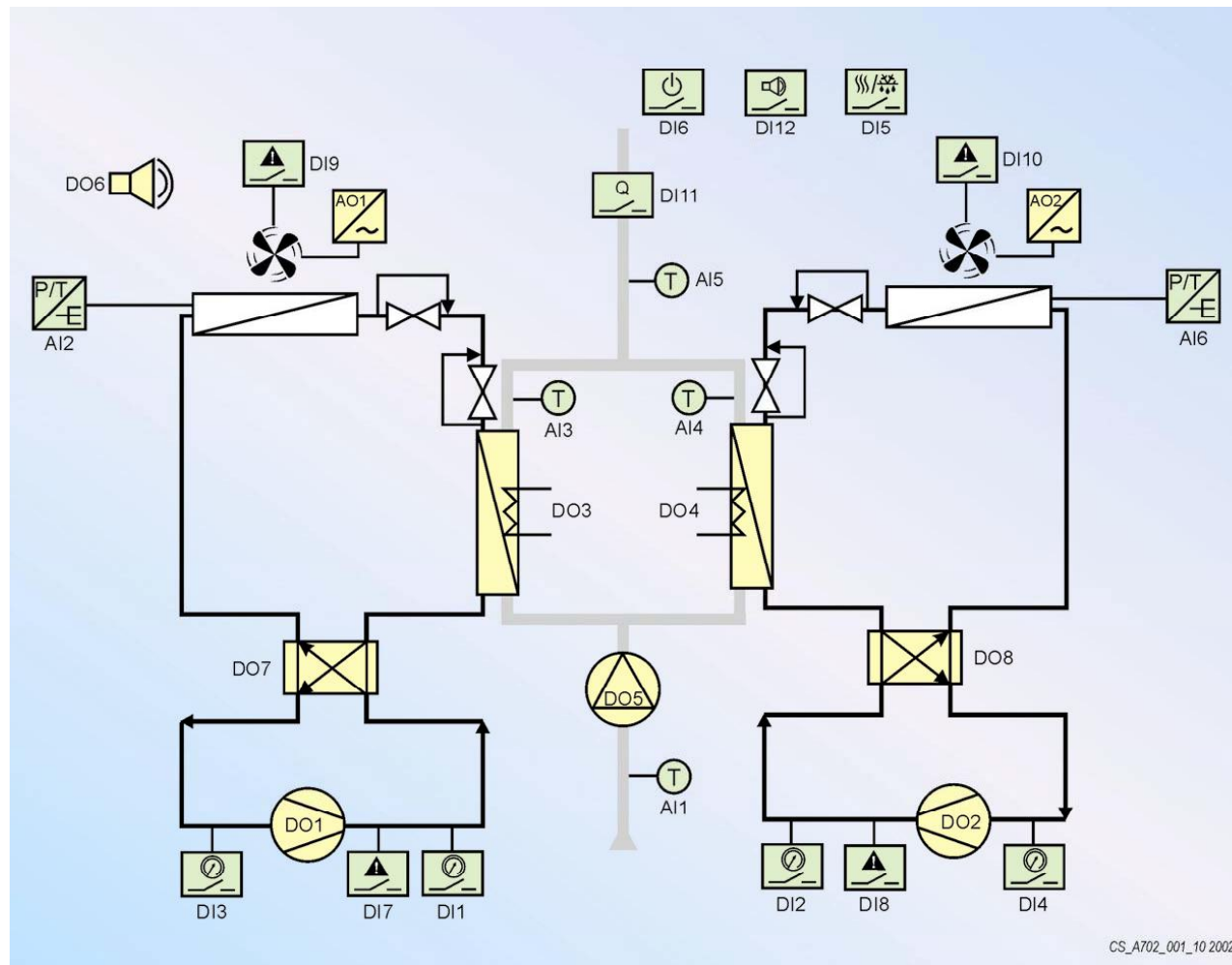
If the application is pre-loaded, the controller code will take the extension that specify the application itself.

Example:

LP-FX10B11-**702C** is an FX10 "Advanced" with the **702FX1021-002AR** application pre-loaded.

Example of Standard Application

2 Compressors / 2 Circuits, Air to Water Chiller / HP with LUI remote display – Application Code: 702FX1021-002AR

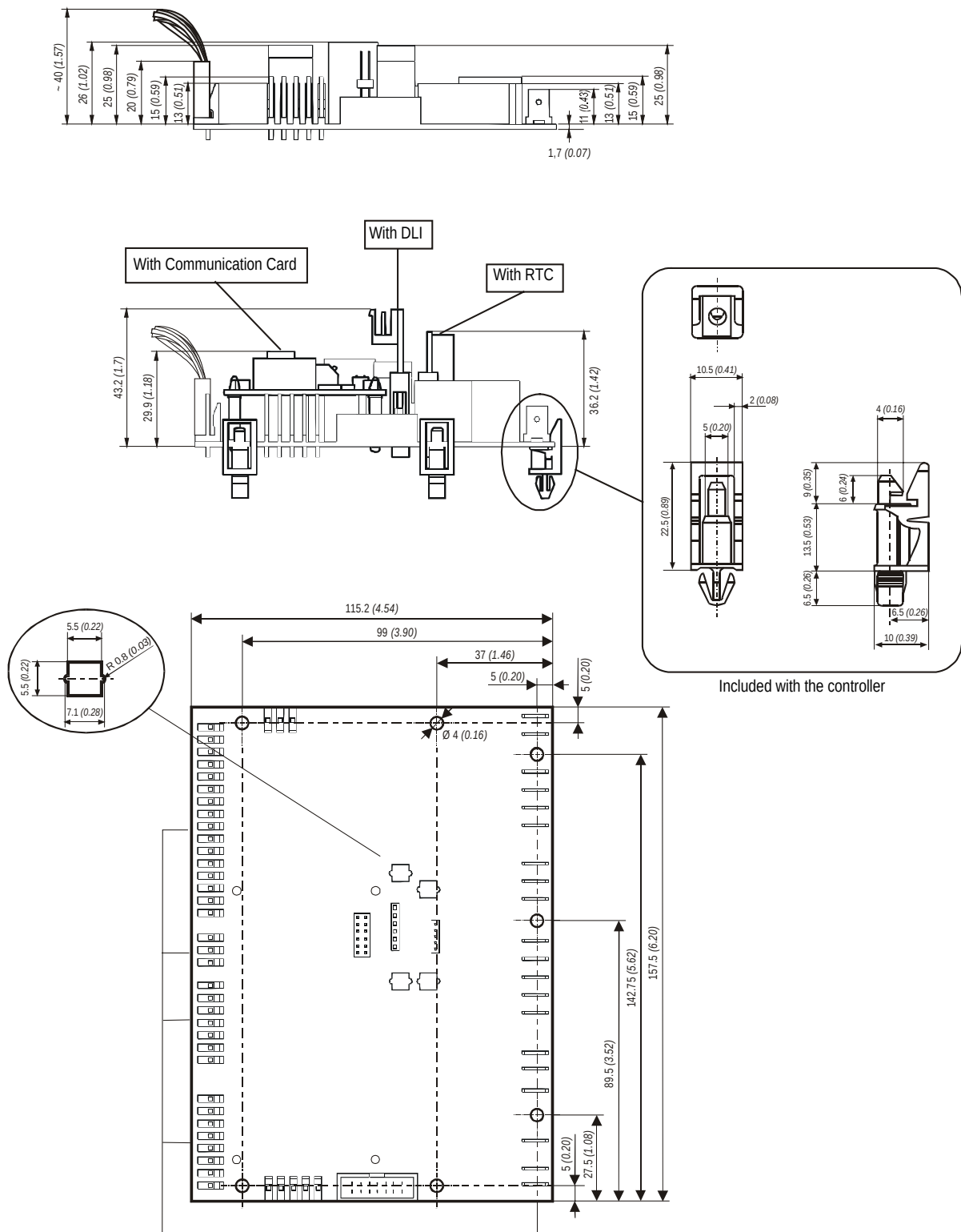


Analog Input	
AI1	Entering water temperature
AI2	Air coil 1 T/P
AI3	Air coil 2 T/P
AI4	Water temperature
AI5	Leaving water temperature
AI6	Water temperature
Analog Output	
AO1	Regulation fan 1
AO2	Regulation fan 2
Digital Input	
DI1	High press switch 1
DI2	High press switch 2
DI3	Low press switch 1
DI4	Low press switch 2
DI5	Mode setting: Cooling / Heating
DI6	ON / OFF
DI7	Overload protect comp 1
DI8	Overload protect comp 2
DI9	Overload protect fan 1
DI10	Overload protect fan 2
DI11	Flow switch
DI12	General alarm
Digital Output	
DO1	Compressor 1
DO2	Compressor 2
DO3	Electric heater 1
DO4	Electric heater 2
DO5	Water pump
DO6	Alarm
DO7	Reversing valve 1
DO8	Reversing valve 2

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

Dimensions mm (inch)

Main Board



Connectors Molex® 41671 use with:

- Housing: 3069
- Crimp terminals: 2478/2578/8818
- Cable: AWG 18

or

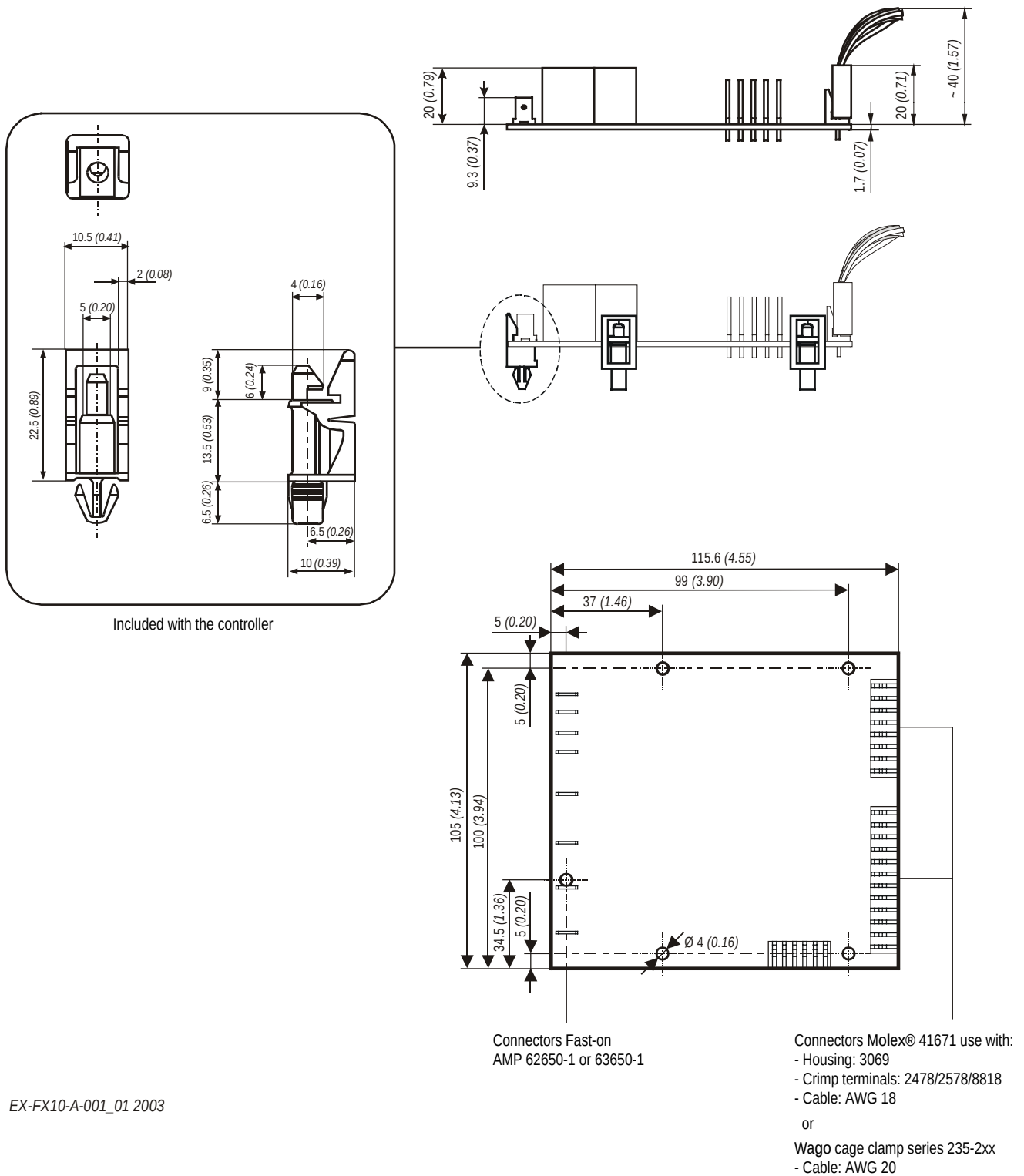
- Wago cage clamp series 235-2xx
- Cable: AWG 20

Connectors Fast-on
AMP 62650-1 or 63650-1

FX10-002_01 2003

Dimensions mm (inch)

Expansion Board



EX-FX10-A-001_01 2003

Mounting Instructions

- 1. Electrical panel mounting:**
Prepare the holes on the electrical panel in order to fit the board holders.
See "*Dimensions*" on page 23 and 24.
- 2.** Insert the board holders within the appropriate holes in the PCB and snap the controller on the electrical panel. Make sure that all board holders snap in place.
- 3.** Wiring terminations are made by detachable connectors, which accept 18 AWG cable in case the Molex[®] type is selected or 20 AWG, in case the cage clamp connection model is chosen.
- 4.** Verify that the wiring has been correctly installed, and that voltage levels are appropriate for the various input signals according to the application.



CAUTION

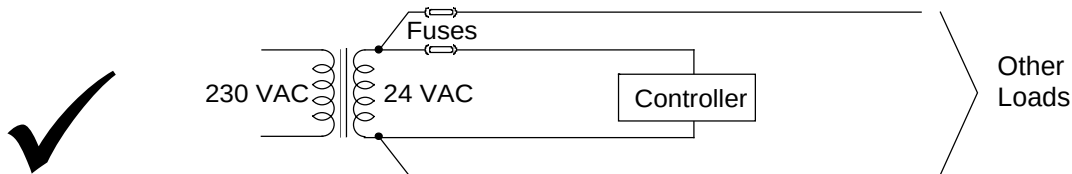
The CMOS circuits in the controller are sensitive to static electricity. Take suitable precautions.

General Wiring Guidelines

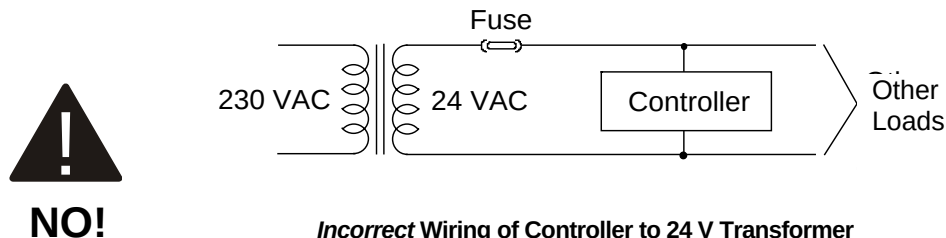
While every reasonable precaution has been taken to prevent electrical disturbances from adversely affecting the operation of the controller, and the controller complies with appropriate local codes for electromagnetic compatibility (EMC), lack of attention to generally accepted control wiring installation 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 switch gear 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-FX10B31-002C	FX10 "Advanced", 9 low power relays, Molex [®] connectors, app-less
LP-FX10B32-002C	FX10 "Advanced", 7 low power relays + 2 triacs, Molex [®] connectors, app-less
LP-FX10B33-002C	FX10 "Advanced", 9 low power relays, Wago connectors, app-less
LP-FX10B34-002C	FX10 "Advanced", 7 low power relays + 2 triacs, Wago connectors, app-less

Expansion

Item Code	Description
LP-XP10B10-000C	XP Expansion, 4 low power relays + 4 triacs + 4 AI, Molex [®] connectors
LP-XP10B11-000C	XP Expansion, 4 low power relays + 4 triacs + 4 AI, Wago connectors

Accessories

Item Code	Description
LP-RTC10-000C	Real Time Clock plug-in card
LP-NET101-000C	N2Open communication interface
LP-NET102-001C	LON communication interface. On-field commissioning
LP-NET102-xxxC	LON communication interface. Specific application profile
LP-KIT000-000C	Display Link Interface for display connection (SUI / MUI / LUI)
LP-KIT001-000C	Input Converter Module 4 – 20 mA to A99
LP-KIT003-000C	Converter module PWM to 0 – 10 V output
LP-KIT004-000C	Input Converter Module 0 – 10 V to A99
LP-KIT006-000C	TM module for FX05/10 +/-3k, occupancy, fan speed, service
LP-KIT006-001C	TM module for FX05/10 +/-3k
LP-KIT006-002C	TM module for FX05/10 +/-3k, occupancy, service
LP-KIT010-000C	Kit of pre-crimped cables and terminals for Molex [®] connectors of main controller (complete set for 2 controllers in each kit)
LP-KIT010-001C	Kit of pre-crimped cables and terminals for Molex [®] connectors of expansion board (complete set for 5 boards in each kit)
U215LR-PWM1	Condenser fan speed controller single-phase, 3Amps

Displays

Item Code	Description
LP-DIS65P00-0C	Large size LCD (4x20) display (LUI with standard JCI front plate)
LP-DIS60P00-0C	Medium size LCD (4x20) display, panel mount non-isolated version (MUI)
LP-DIS60P01-0C	Medium size LCD (4x20) display, wall mount isolated version (MUI)

Sensors

Item Code	Description
LP-A99S000-C	A99 temperature sensor -40...+100°C, 6 x 50 mm bulb, 2 mt cable
TS-9104 series TE-9100-8502	NTC (K10) temperature sensor -10...+100°C
P299 series	Ratiometric pressure sensor (0...5V) 10 to 90% of supply voltage

Demos

Item Code	Description
DEMO-FX10-001	Demo case FX10 with Expansion Board, N2Open and LON spare comm. Cards, 230 V
DEMO-FX10-011	Demo case FX10 with Expansion Board, N2Open and LON spare comm. Cards, 120 V
LP-FX10DEM-002C	FX10 with DEMO ID to be used with the FX-Tools demo version

Configuration Software

Item Code	Description
LP-FXTOOLS-DEMO	FX Tools package DEMO version
LP-FXTOOLS	FX Tools package

Technical Specifications

Product	Expansion Board for FX10 “Advanced”
Power Requirements	Powered by FX10 controller (9 VDC)
Power Consumption	6 VA
Insulation	Analog input: Not insulated Relay output: Insulated Triac output: Opto – insulated
Ambient Operating Conditions	-20°C to +70°C (-4°F to +158°F) 10 to 95 % RH (non condensing)
Ambient Storage Conditions	-30° to +80°C (-22°F to +176°F) 10 to 95 % RH (non condensing)
Connections	Relay outputs: Fast-on AMP (62650-1 or 63650-1); Inputs and triac outputs: Molex® (41671) use with: Housing: 3069 Crimp Terminals: 2478 / 2578 / 8818 Cable: AWG 18 OR Wago Cage clamp series 235-2xx Min cable cross section: 0.5 mm ² , AWG 20
Dimensions (H x W x D)	105 x 115.6 x 20 mm
CE Compliance	89/336 EEC directive: EN 61000-6-3 (EN 50081-1); EN 61000-6-1 (EN 50082-1) 73/23 EEC directive: EN 60730 UL 873

Technical Specifications

Product	FX10 “Advanced”
Power Requirements	24 VAC/DC ±15%, 50/60Hz
Power Consumption	11 VA at max load (17 VA if Expansion connected)
Insulation	Digital Input: Not insulated Analog Input: Not insulated PWM Output: Not insulated Relay Output: Insulated Triac Output: Opto – insulated
Ambient Operating Conditions	-20°C to +70°C (-4°F to +158°F) 10 to 95 % RH (non condensing)
Ambient Storage Conditions	-30° to +80°C (-22°F to +176°F) 10 to 95 % RH (non condensing)
I/O Ratings	See “I/O Details” on page 5.
Connections	Relay / triac outputs: Fast-on AMP (62650-1 or 63650-1); Inputs and PWM outputs: Molex® (41671) use with: Housing: 3069 Crimp Terminals: 2478/2578/8818 Cable: AWG 18 OR Wago Cage clamp series 235-2xx Min cable cross section: 0.5 mm ² , AWG 20
Dimensions (H x W x D)	157.5 x 115.2 x 26 mm (without plug-in cards)
CE Compliance	89/336 EEC directive: EN 61000-6-3 (EN 50081-1); EN 61000-6-1 (EN 50082-1) 73/23 EEC directive: EN 60730 UL 873

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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