



PROGRAMMABLE CONTROLLERS

FP7 Fieldbus Master Units

Technical Manual

Before beginning

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One or more of the following warnings may be used in this documentation:

DANGER



Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING



Indicates a hazardous situation which, if not avoided, could result in serious or moderate injury.

CAUTION



Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates a property damage message.

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Chapter 1

Overview

1.1 Unit types

1.1.1 Fieldbus Master Units (FMU)

Fieldbus Master Units (FMU) are used together with FP7 PLCs. By exchanging the FMU, you can connect to various networking systems.

FMUs are currently available for four bus systems: PROFIBUS DP, DeviceNet, CANopen, and PROFINET. Others are planned for the future.

Name	Product no.
FP7 PROFIBUS DP Master	AFP7NPFBM
FP7 DeviceNet Master	AFP7NDNM
FP7 CANopen Master	AFP7NCANM
FP7 PROFINET IO-Controller	AFP7NPFNM

Software

Make sure you use at least version 7.1 of Control FPWIN Pro, into which the functions necessary for programming the FP-FMU blocks are integrated.

You can download convenient function blocks for Control FPWIN Pro to help you program the FMUs free of charge from the Panasonic Electric Works Europe AG Web site: <http://www.panasonic-electric-works.com>.

1.2 Restrictions on unit combination

1.2.1 Expansion restrictions for the FP7 FMU

The number of FP7-FMUs is restricted to 16.

1.2.2 Limitations on current consumption

The 24V DC power used to drive the internal circuit of each unit is supplied from the power supply unit of the FP7 through the internal bus of the backplane.

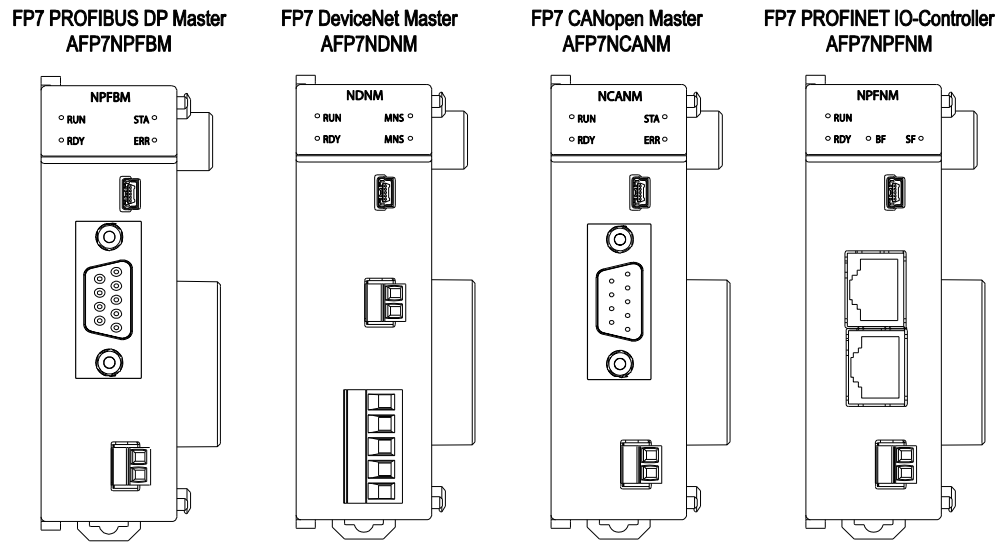
Pay attention to the combination of units so that the rated capacity of the power supply is not exceeded.

Chapter 2

Parts and functions

2.1 FP7 FMU

Various FP Fieldbus Master Units (FMUs) are available to meet your networking needs.



FP7 Fieldbus Master Units, front view

2.2 LEDs and Connectors

Four LEDs give you a quick overview of the FMU's status at a glance: RUN and RDY define the general status of the FMU. For the hardware, RDY means the self-test has been passed and the firmware loaded. RUN is used for application-oriented functions such as valid configuration loaded.

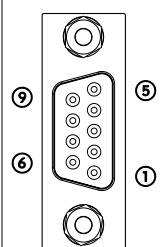
LED	Color	LED status	Description
RUN	●	On	Normal operation
RUN and RDY	●●	Flash	Bootloader is waiting for firmware download.
RDY	●	On	Bootloader is missing. Please contact the technical support.
RUN and RDY	○	Off	No power supply or hardware defect.

2.2.1 FP7 PROFIBUS DP Master

Operation status LEDs

LED	Color	LED status	Description
RUN	●	On	Normal operation
RUN and RDY	●●	Flash	Bootloader is waiting for firmware download.
RDY	●	On	Bootloader is missing. Please contact the technical support.
RUN and RDY	○	Off	No power supply or hardware defect.
STA	●	Flashes acyclically	No configuration or stack error.
		Flashes cyclically	PROFIBUS is configured, but bus communication is not yet released from the application.
		On	Communication to all slaves is established.
ERR	●	Flashes cyclically	Communication to at least one slave is disconnected.
		On	Communication to one/all slaves is disconnected.

PROFIBUS DP connector DB9F, 9-pin sub-D female connector

Connector	Pin	Signal	Description
	1	–	–
	2	–	–
	3	B Line	Positive RxD/TxD, RS485 level
	4	RTS	Request to send
	5	GND	Bus ground (isolated)
	6	+5V bus output (see note)	+5V termination power (isolated)
	7	–	–
	8	A Line	Negative RxD/TxD, RS485 level
	9	–	–
	Housing	Cable shield	FP7: Internally connected to the function earth connector of the FMU.

Note

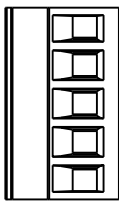
Any current drawn from pin 6, the +5V bus output pin, will affect the total power consumption.

2.2.2 FP7 DeviceNet Master

Operation status LEDs

LED	Color	LED status	Description
RUN	●	On	Normal operation
RUN and RDY	●●	Flash	Bootloader is waiting for firmware download.
RDY	●	On	Bootloader is missing. Please contact the technical support.
RUN and RDY	○	Off	No power supply or hardware defect.
MNS	● (green)	On	Device is online and has established one or more connections.
		Flashes	Device is online and has established no connection.
	● (red) ○	On (for 0.25s)	Self-test after power on: Green on for 0.25s, then red on for 0.25s, then off.
		Flashes	Connection timeout.
	● (red)	On	Critical connection failure; device has detected a network error: duplicate MAC-ID or severe error in CAN network (CAN-bus off).
		○	Off

DeviceNet connector








Connector	Pin	Signal	Description
	1	V-	Negative bus supply voltage (see note)
	2	CAN_L	CAN low bus line
	3	SHIELD	Cable shield
	4	CAN_H	CAN high bus line
	5	V+	Positive bus supply voltage (see note)

Note

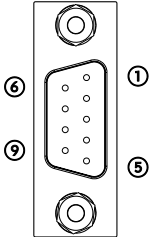
Mandatory 24V bus power.

2.2.3 FP7 CANopen Master

Operation status LEDs

LED	Color	LED status	Description	
RUN		On	Normal operation	
RUN and RDY		Flash	Bootloader is waiting for firmware download.	
RDY		On	Bootloader is missing. Please contact the technical support.	
RUN and RDY		Off	No power supply or hardware defect.	
STA		Off	The device is executing a reset	
			Flashes once	The device is in STOPPED state. The indicator shows one short flash (200ms) followed by a long off phase (1000ms).
		Flashes	The device is in the PREOPERATIONAL state. The indicator turns on and off with a frequency of 2.5Hz: on for 200ms, followed by off for 200ms.	
		On	Communication to all slaves is established.	
ERR		Flashes once	Warning limit reached: At least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames) The indicator shows one short flash (200ms) followed by a long off phase (1000ms).	
		Flashes twice	Error control event: A guard event (NMT slave or NMT master) or a heartbeat event (heartbeat consumer) has occurred. The indicator shows a sequence of two short flashes (each 200ms), separated by a short off phase (200ms). The sequence is finished by a long off phase (1000ms).	
		On	Bus off: The CAN controller bus is off.	

CANopen connector

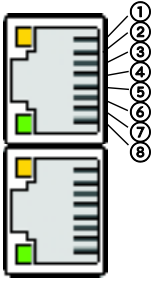


Connector	Pin	Signal	Description
	1		
	2	CAN_L	CAN low bus line (dominant low)
	3	CAN_GND	Negative bus power supply input
	4		
	5		
	6		
	7	CAN_H	CAN high bus line (dominant high)
	8		
	9		

2.2.4 FP7 PROFINET IO-Controller

Operation status LEDs

LED	Color	LED status	Description
RUN	●	On	Normal operation
RUN and RDY	●●	Flash	Bootloader is waiting for firmware download.
RDY	●	On	Bootloader is missing. Please contact the technical support.
RUN and RDY	○	Off	No power supply or hardware defect.
SF	●	On	Together with BF on: No valid master license.
		Flashes cyclically at 2Hz	System error: Invalid configuration, watch-dog error or internal error.
	○	Off	No error
BF	●	On	No connection Together with SF on: No valid master license.
		Flashes cyclically at 2Hz	Configuration fault: not all configured IO devices are connected.
	○	Off	No error

PROFINET connector

Connector	Pin	Signal	Description
	1	TX+	Transmit data positive
	2	TX-	Transmit data negative
	3	RX+	Receive data positive
	4	TERM	Connected and terminated to PE via RC combination*
	5	TERM	Connected and terminated to PE via RC combination*
	6	RX-	Receive data negative
	7	TERM	Connected and terminated to PE via RC combination*
	8	TERM	Connected and terminated to PE via RC combination*
LED		Description	
	RXTX	Data received or transmitted	
	LINK	Port connected	

* Bob Smith termination

Chapter 3

Installation and wiring

3.1 Installation environment and space

Operating environment

After installing the unit, make sure to use it within the range of the general specifications:

- Ambient temperature: 0–+55°C
- Ambient humidity: 10%–95% RH (at 25°C, non-condensing)
- Pollution degree: 2
- Maximum altitude: 2000m
- Equipment class: 1
- Overvoltage category: II

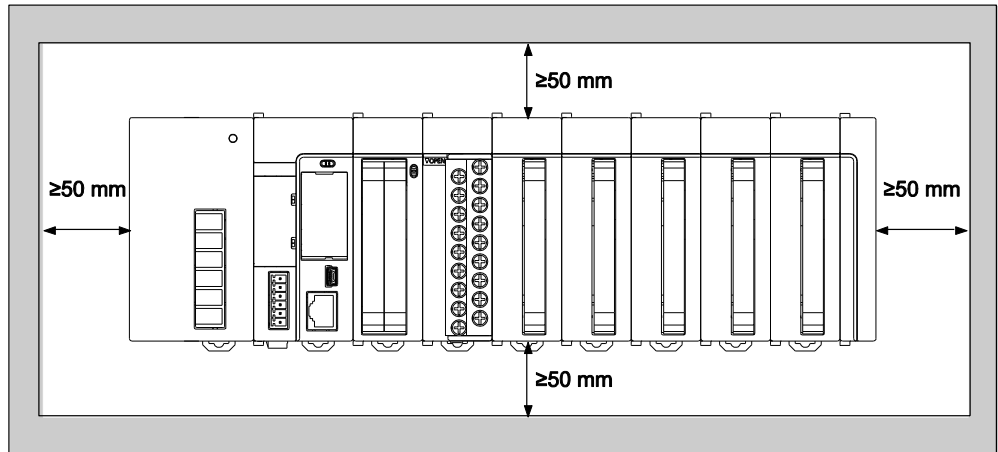
Be sure to install the unit in locations designed for electrical equipment, e.g. in a closed metal cabinet such as a switch cabinet.

Do not use the unit in the following environments:

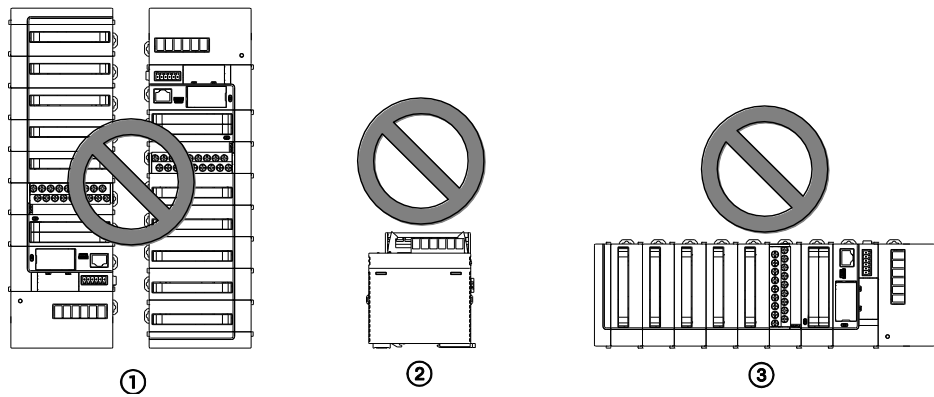
- Direct sunlight
- Sudden temperature changes causing condensation
- Inflammable or corrosive gases
- Excessive airborne dust, metal particles or salts
- Benzine, paint thinner, alcohol or other organic solvents, or strong alkaline solutions such as ammonia or caustic soda
- Vibration, shock, or direct drop of water
- Influence from power transmission lines, high voltage equipment, power cables, power equipment, radio transmitters, or any other equipment that would generate high switching surges. Maintain at least 100mm of space between these devices and the unit.

Installation space

- Leave at least 50mm of space between the wiring ducts of the unit and other devices to allow heat radiation and unit replacement.

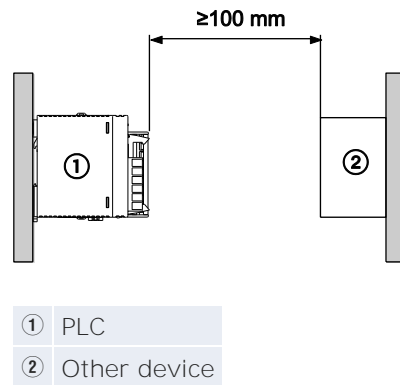


- Do not install the units stacked up, horizontally or upside down. Doing so will prevent proper cooling of the units and cause overheating inside.

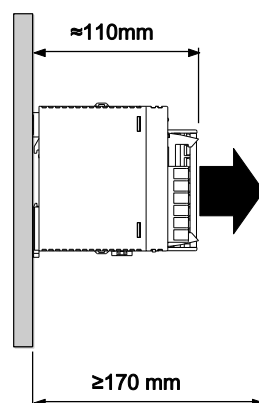


- ① Stacked up installation
- ② Horizontal installation of the unit
- ② Upside-down

- Do not install the unit above devices which generate heat such as heaters, transformers or large-scale resistors.
- Maintain a minimum of 100mm between devices to avoid adverse effects from noise and heat when installing a device or panel door to the front of the unit.



- Leave at least 170mm of space from the mounting surface for programming tool connections and wiring.



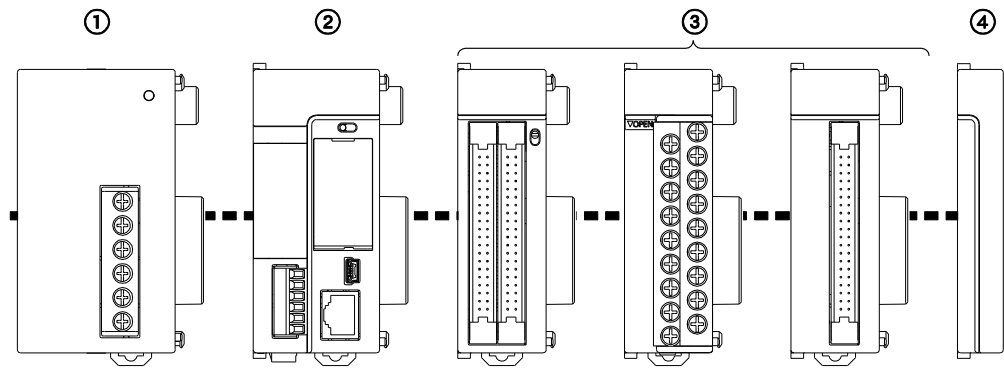
3.2 Attaching units

The expansion units are connected to the right side of the CPU. Use the expansion connectors and the expansion hooks on the side of each unit.

Make sure to connect an end unit to the right of the last unit. After attaching the units, attach the assembly to the DIN rail.

NOTICE

- Make sure to turn off the power supply before attaching a unit.
- Do not directly touch the expansion connector.
- Protect the expansion connector from stress.



- | | |
|---|---|
| ① | Power supply unit |
| ② | CPU |
| ③ | Up to 16 I/O units or intelligent units |
| ④ | End unit |

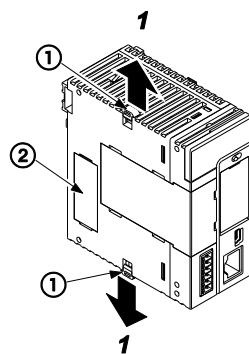
Procedure

Attachment

1. Raise expansion hooks on top and bottom of the unit

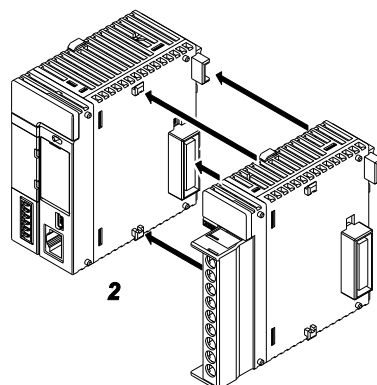
When attaching a power supply unit:

Remove expansion cover

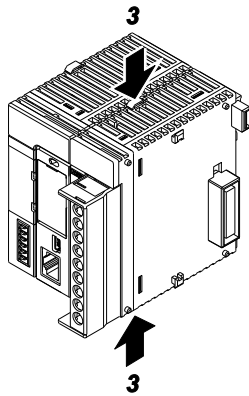


- | | |
|---|----------------|
| ① | Expansion hook |
| ② | Connector cap |

2. Attach expansion connectors on the side of each unit



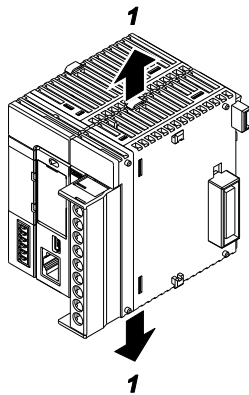
3. Push expansion hooks back into place



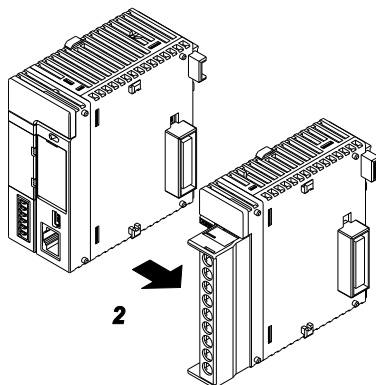
Procedure

Removal

1. Release expansion hooks on top and bottom of the unit



2. Slide unit horizontally to remove it

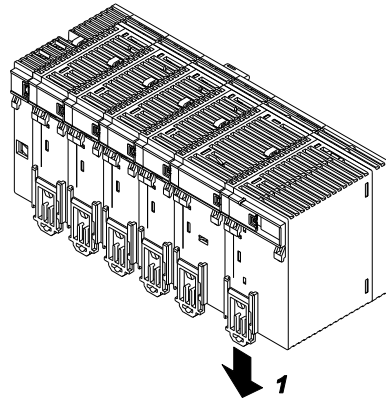


3.3 Using DIN rails

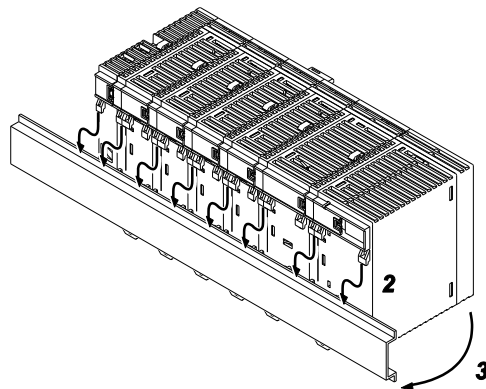
Procedure

Attachment

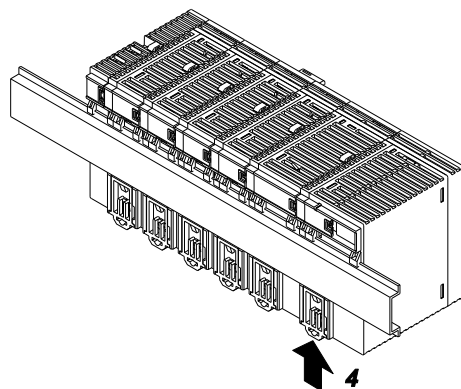
1. Pull out DIN rail attachment lever on unit's back



2. Fit upper hook of unit onto DIN rail
3. Without moving upper hook, press on lower hook to fit unit into position



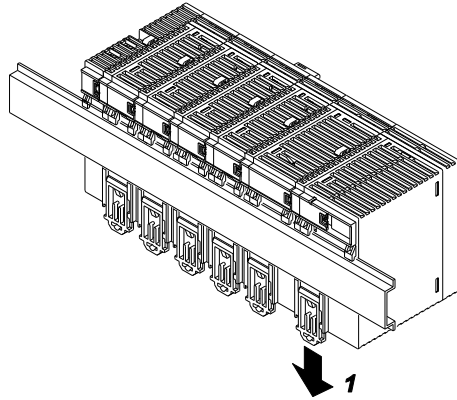
4. Push up DIN rail attachment lever on unit's back until it clicks into place



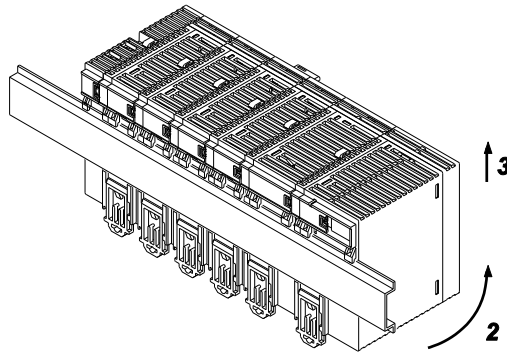
Procedure

Removal

1. Pull out DIN rail attachment lever on unit's back



2. Pull bottom of unit forward



3. Lift up unit and remove from rail

3.4 Wiring of the FP-FMU Connectors

3.4.1 FP7 PROFIBUS DP Master

Use a standard PROFIBUS cable and standard 9-pin Sub-D male PROFIBUS connectors.

3.4.2 FP7 DeviceNet Master

Open style connector/suitable wire

DeviceNet has a standard open style connector.

If additional connectors are needed, use the standard CAN 5-pin open style connectors manufactured by Phoenix Contact.

No. of contacts	Phoenix Contact model no.	Phoenix Contact product no.
5	MSTB 2,5/ 5-ST-5,08 ABGY AU	1849037

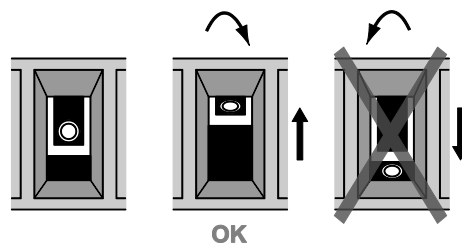


Terminal block for DeviceNet

Use a standard DeviceNet cable.

Precautions

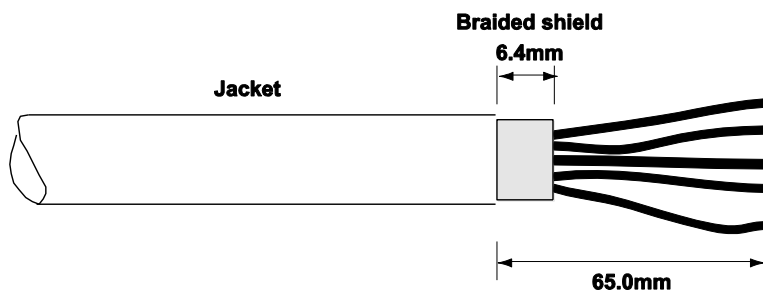
- When removing the wire's insulation, be careful not to scratch the core wire.
- Do not twist the wires to connect them.
- Do not solder the wires to connect them. The solder may break due to vibration.
- After wiring, make sure stress is not applied to the wire.
- If the socket in the terminal block closes upon counter-clockwise rotation, the connection is wrong. Disconnect the wire, check the terminal hole, and then re-connect the wire.



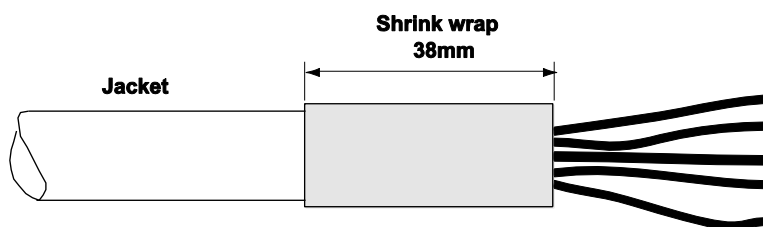
Wiring method

Procedure

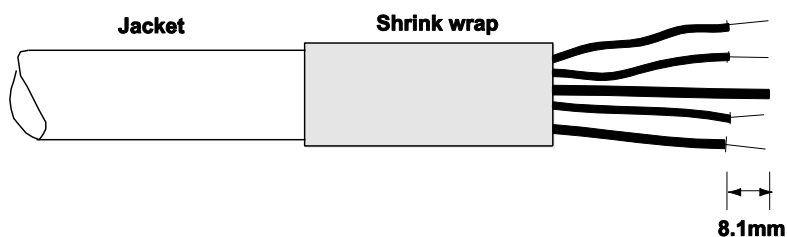
- Strip 65mm to 75mm of the outer jacket from the end of the cable, leaving no more than 6.4mm of the braided shield exposed



- Wrap the end of the cable with 38mm of shrink wrap, covering part of the exposed conductors and part of the trunk line insulation



- Strip 8.1mm of the insulation from the end of each of the insulated conductors



- Insert each conductor into the appropriate clamping cavity of the open style connector or the screw terminal on the device, according to the color of the cable insulation:

Wire color	Wire identity	Usage
White	CAN_H	Signal
Blue	CAN_L	Signal
Bare	Drain	Shield
Black	V-	Power
Red	V+	Power

- Tighten the clamping screws to secure each conductor

The male contacts of the device connector must match the female contacts of the connector.

3.4.3 FP7 CANopen Master

Use a standard CANopen cable and standard 9-pin Sub-D female CANopen connectors.

3.4.4 FP7 PROFINET IO-Controller

Use a standard PROFINET cable and standard Ethernet connectors.

3.5 Wiring of the FP7 FMU

The FP7-FMU has a screw terminal on its front side to connect to function earth. Use the following items for wiring.

Accessory terminal block

If additional connectors are needed, use the connector manufactured by Phoenix Contact.

No. of contacts	Phoenix Contact product ID	
	Model no.	Product no.
2	MC 1.5/2-ST-5.08	18 36 07 9

Suitable wire

No. of wires	Size	Cross-sectional area [mm ²]
1	AWG28-16	0.14-1.5mm ²

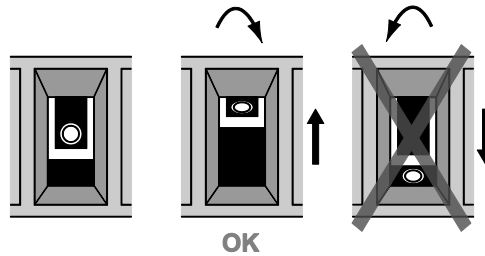
Note

Either fixed or flexible wires can be used to connect the function earth. Fixed wires with a diameter $>0.14\text{mm}^2$ and flexible wires with a wire end ferrule can be used.

Precautions

- When removing the wire's insulation, be careful not to scratch the core wire.
- Do not twist the wires to connect them.

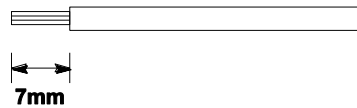
- Do not solder the wires to connect them. The solder may break due to vibration.
- After wiring, make sure stress is not applied to the wire.
- If the socket in the terminal block closes upon counter-clockwise rotation, the connection is wrong. Disconnect the wire, check the terminal hole, and then re-connect the wire.



Wiring method

Procedure

1. Remove a portion of the wire's insulation



2. Insert the wire into the terminal block until it contacts the back of the socket
3. Turn the screw clockwise to fix the wire in place

Chapter 4

Programming information

4.1 General information

For the FP7 FMU to function, you must program it with a function block for Control FPWIN Pro, version 7.1 or newer. The function blocks available for this version are used to configure the various FMUs and to start communication with the specific network.

You can download the function blocks free of charge from the Panasonic Electric Works Europe AG Web site.

Please refer to the Control FPWIN Pro online help for detailed information.

Chapter 5

Specifications

5.1 General specifications

Item	Description
Ambient temperature	0–+55°C
Storage temperature	-20–+70°C
Ambient humidity	30–85% RH (non-condensing)
Storage humidity	30–85% RH (non-condensing)
Vibration resistance	10–55Hz, 1 cycle/min: double amplitude of 0.75mm, 10min on 3 axes
Shock resistance	≥98m/s ² , 4 times on 3 axes
Operation conditions	Free from corrosive gases and excessive dust
Current consumption (24V)	AFP7NPFBM: 70mA AFP7NDNM: 80mA AFP7NCANM: 90mA AFP7NPFNM: 100mA
Weight	115g

5.2 FP7 PROFIBUS DP Master

Item	Description
Max. number of DP slaves	125
Max. number of process data per slave	244 input bytes, 244 output bytes
Max. number of process data	5712 input bytes, 5760 output bytes
Max. number of diagnostic bytes per slave	100
Max. number of configuration data bytes per slave	244
Max. number of parameter data bytes per slave	244
Baud rates supported	9.6kBaud, 19.2kBaud, 31.25kBaud, 45.45kBaud, 93.75kBaud, 187.5kBaud, 500kBaud, 1.5MBaud, 3MBaud, 6MBaud, 12MBaud

5.3 FP7 DeviceNet Master

Item	Description
No. of slaves	63
No. of bytes for I/O data	7168 (input 3584, output 3584)
Baud rates supported	150kBaud, 250kBaud, 500kBaud
Additional features	<ul style="list-style-type: none"> • Polling, bit-strobe • Cyclic, COS (change of state)

5.4 FP7 CANopen Master

Item	Description
Maximum number of CANopen nodes	126
Maximum number of cyclic input data	3584 bytes
Maximum number of cyclic output data	3584 bytes
Maximum number of receive PDOs	512
Maximum number of transmit PDOs	512
Exchange of process data	Via PDO transfer: <ul style="list-style-type: none"> • synchronized • remotely requested • event driven (change of date)
Functions	<ul style="list-style-type: none"> • Emergency message (consumer and producer) • Node guarding/life guarding, heartbeat • PDO mapping • NMT Master • SYNC protocol (producer) • Simple boot-up process, reading object 1000H for identification
Baud rates	10kbit/s, 20kbit/s, 50kbit/s, 100kbit/s, 125kbit/s, 150kbit/s, 500kbit/s, 800kbit/s, 1Mbit/s
Data transport layer	CAN Frames
CAN Frame type for CAN-open	11bit

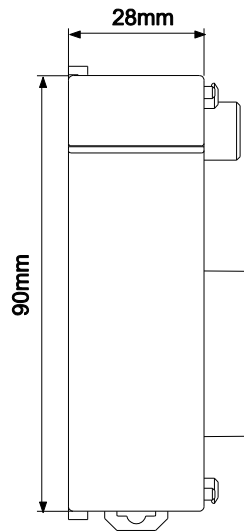
5.5 FP7 PROFINET IO-Controller

Item	Description
Maximum number of PROFINET IO devices	126
Maximum number of total cyclic input data	5712 bytes (including IOxS status bytes)
Maximum number of total cyclic output data	5760 bytes (including IOxS status bytes)

Item	Description
Maximum number of cyclic input data	1440 bytes per device (=IOCR data length including IOxS status bytes)
Maximum number of cyclic output data	1440 bytes per device (=IOCR data length including IOxS status bytes)
Diagnostic data	One 200-byte buffer per IO device
DCP functions via API	<ul style="list-style-type: none"> • Name assignment of IO devices (DCP SET NameOfStation) • Set IP address of IO device (DCP SET IP) • Set signal of IO device (DCP SET SIGNAL) • Reset IO device to factory settings (DCP Reset FactorySettings) • Bus scan (DCP IDENTIFY ALL)
Supported protocols	<ul style="list-style-type: none"> • RTC – Real Time Cyclic Protocol, Class 1 • RTA – Real Time Acyclic Protocol • DCP – Discovery and Configuration Protocol • CL-RPC – Connectionless Remote Procedure Call
Context management by CL-RPC	Supported
Minimum cycle time	1ms Different IO devices can be configured with different cycle times
Functions	Fast startup of PROFINET IO devices supported
Baud rate	100Mbit/s Full-duplex mode
Data transport layer	Ethernet II, IEEE 802.3
Configuration file	Maximum 1MB
Limitations	<ul style="list-style-type: none"> • RT over UDP not supported • Multicast communication not supported • DHCP is not supported (neither for IO controller nor for IO devices) • Only one IOCR per IO device • NameOfStation of IO controller CANNOT be set using the DCP SET NameOfStation service but only at start-up while configuring the IO controller • The buffer for IO device diagnosis data will be overwritten in case of multiple diagnostic events. Only one (the last) event is stored at the same time. If a single event produces more than 200 bytes of diagnosis data, only the first 200 bytes will be taken care of. • The usable (minimum) cycle time depends on the number of used IO devices, the number of used input and output data. The cycle time, the number of configured IO devices and the amount of IO data depend on each other. For example it is not possible due to performance reasons to have 128 IO devices communicate with a cycle time of 1ms. • The size of the bus configuration file is limited by the size of the RAM disk (1MB) • Write multiple record service is not supported

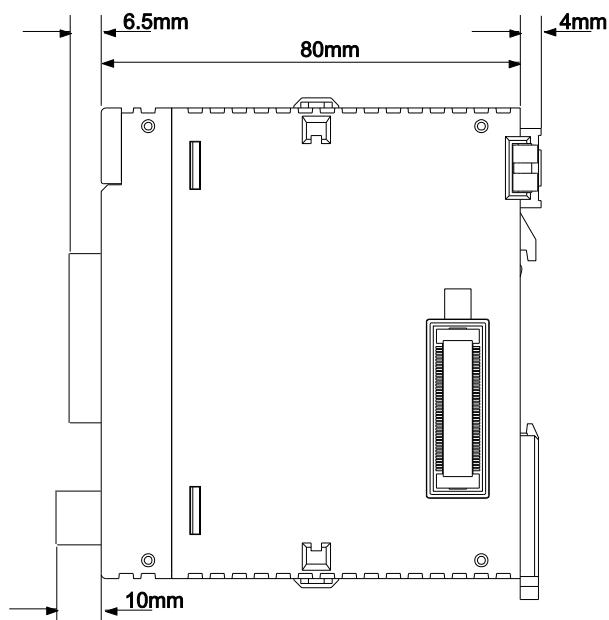
5.6 Dimensions

Front:

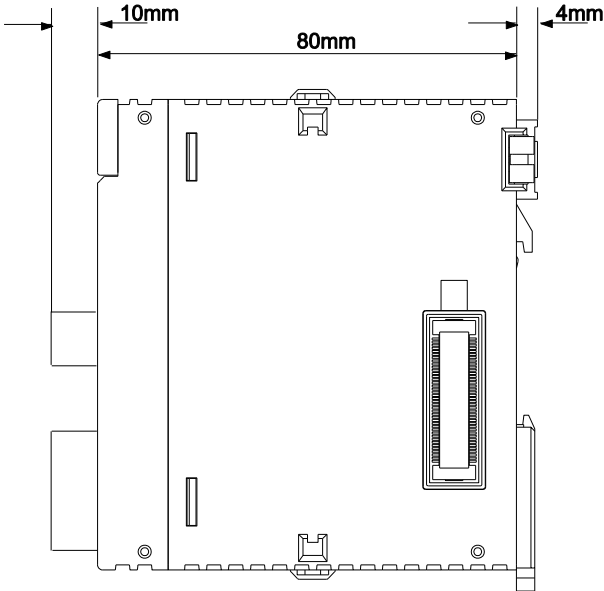


Side:

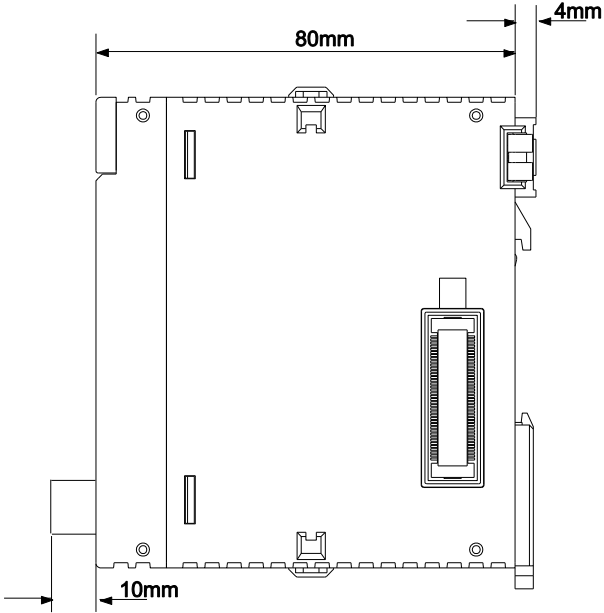
AFP7NPFBM, AFP7NCANM:



AFP7NDNM:



AFP7NPFNM:



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