



PROGRAMMABLE CONTROLLERS

FP7 Fieldbus Master Units

User's Manual

Before beginning

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Warnings used in this manual

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.

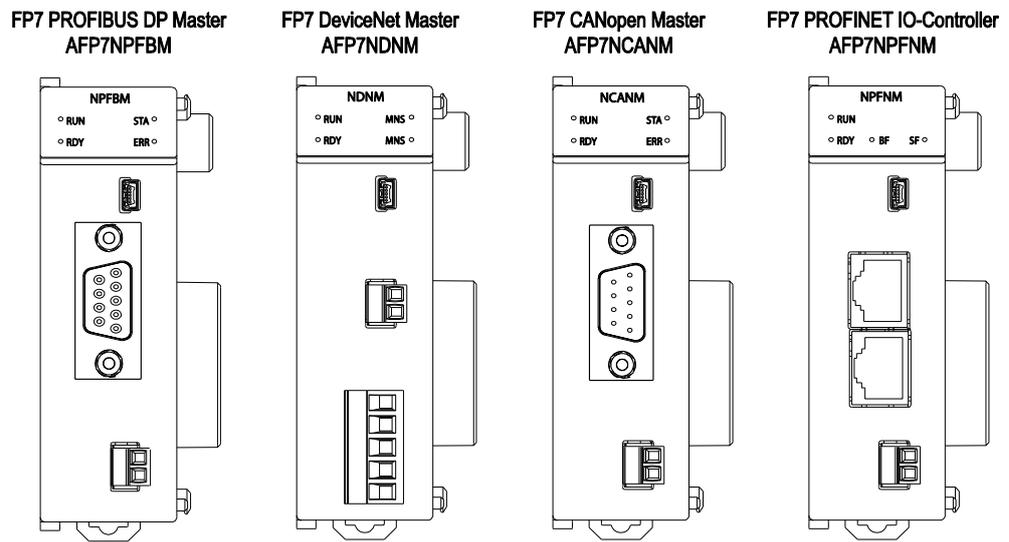
Pay attention to the combination of units so that the rated capacity of the power supply is not exceeded.

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.

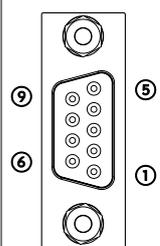
| LED | Color | LED status | Description |
|-------------|-------|------------|--|
| RUN | ● | On | Normal operation |
| RUN and RDY | ●● | Flash | Bootloader is waiting for firmware download. |
| RDY | ● | On | Bootloader is missing. Please contact the technical support. |
| RUN and RDY | ○ | Off | 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

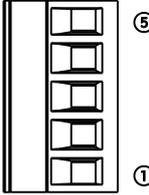
Any current drawn from pin 6, the +5V bus output pin, will affect the total power consumption.

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. |
| |  | On | Critical connection failure; device has detected a network error: duplicate MAC-ID or severe error in CAN network (CAN-bus off). |
| | | Off | After start of the device and during duplicate MAC-ID check. |

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

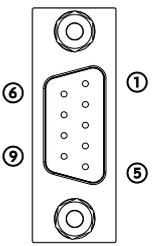
Mandatory 24V bus power.

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. |
| ERR | ● | On | Communication to all slaves is established. |
| | | 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

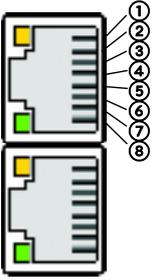
| Connector | Pin | Signal | Description |
|---|-----|---------|-----------------------------------|
|  | 1 | | |
| | 2 | CAN_L | CAN low bus line (dominant low) |
| | 3 | CAN_GND | Negative bus power supply input |
| | 4 | | |
| | 5 | | |
| | 6 | | |
| | 7 | CAN_H | CAN high bus line (dominant high)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

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

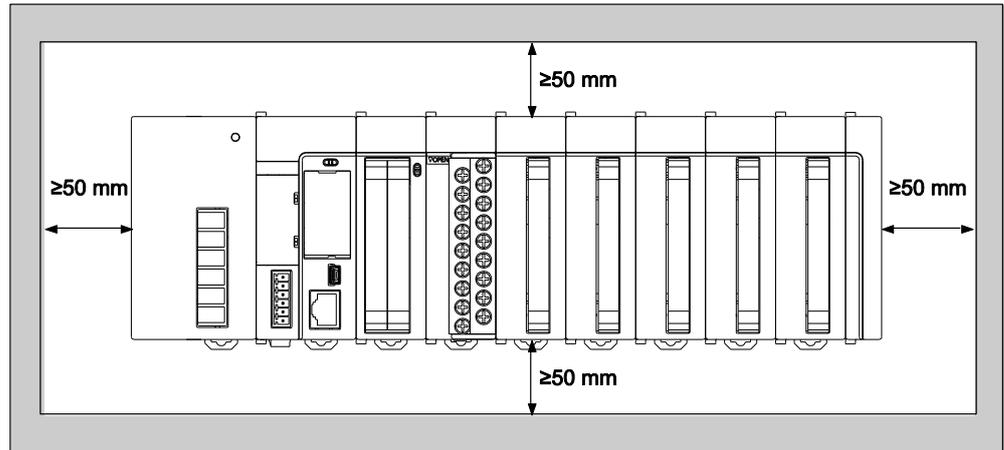
Be sure to install the unit in locations designed for electrical equipment, e.g. in a closed metal cabinet such as a switch cabinet.

Do not use the unit in the following environments:

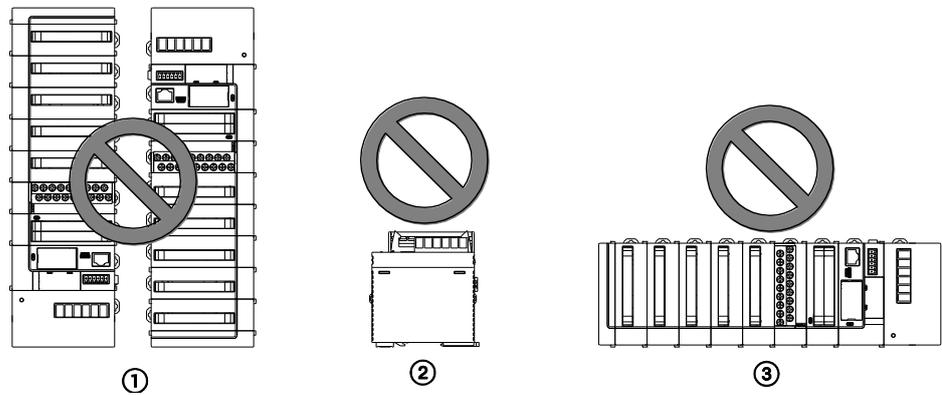
- Direct sunlight
- Sudden temperature changes causing condensation
- Inflammable or corrosive gases
- Excessive airborne dust, metal particles or salts
- Benzine, paint thinner, alcohol or other organic solvents, or strong alkaline solutions such as ammonia or caustic soda
- Vibration, shock, or direct 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.

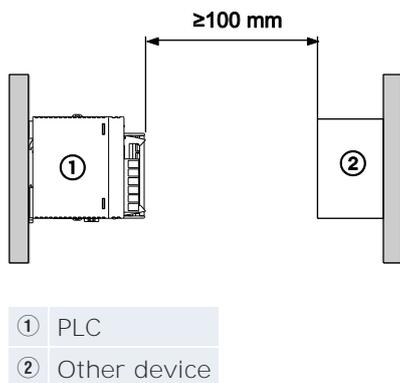


- Do not install the units stacked up, horizontally or upside down. Doing so will prevent proper cooling of the units and cause overheating inside.

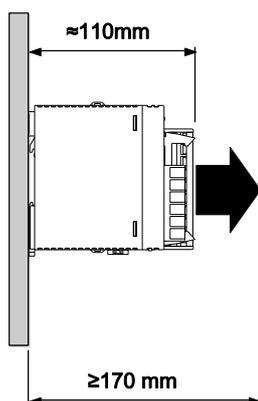


- ① Stacked up installation
- ② Horizontal installation of the unit
- ② Upside-down

- 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.



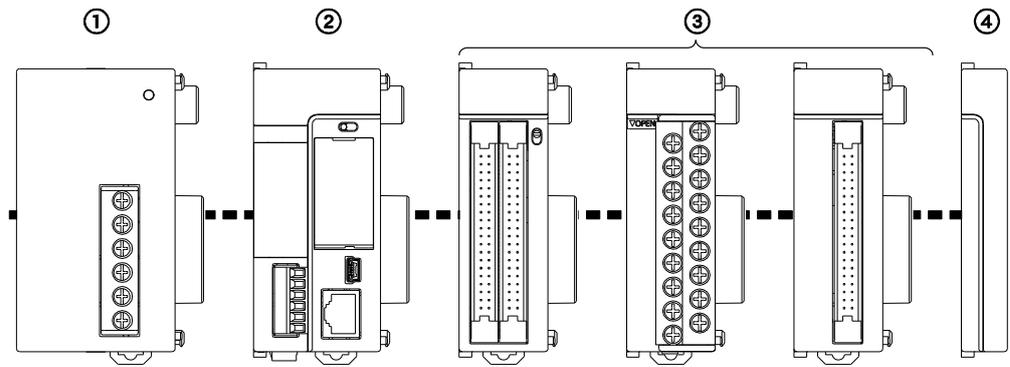
3.2 Attaching units

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.



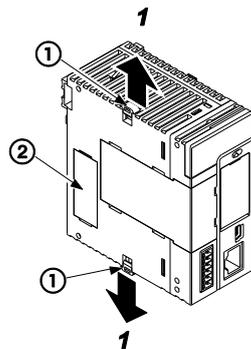
- ① Power supply unit
- ② CPU
- ③ Up to 16 I/O units or intelligent units
- ④ End unit

Procedure

Attachment

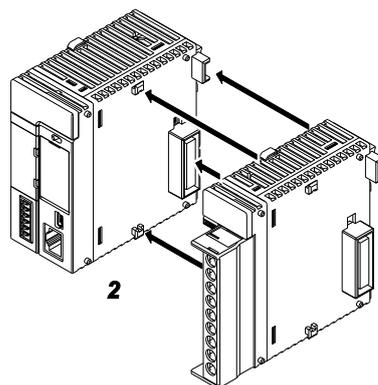
1. Raise expansion hooks on top and bottom of the unit

When attaching a power supply unit:
Remove expansion cover

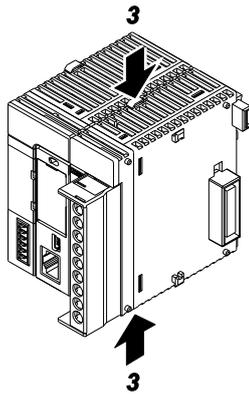


- ① Expansion hook
- ② Connector cap

2. Attach expansion connectors on the side of each unit



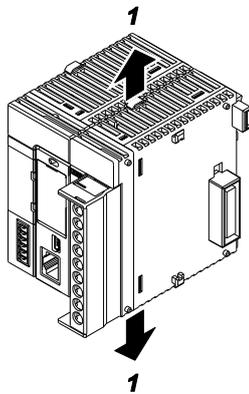
3. Push expansion hooks back into place



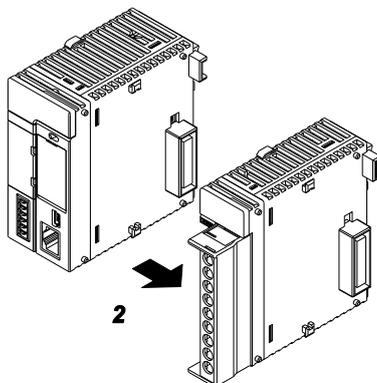
Procedure

Removal

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



2. Slide unit horizontally to remove it

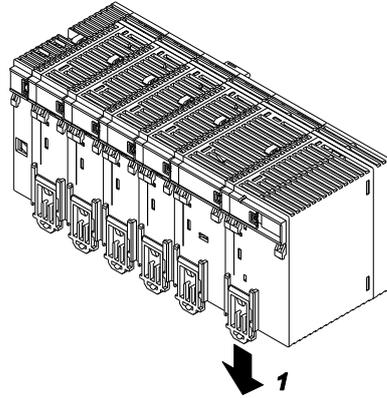


3.3 Using DIN rails

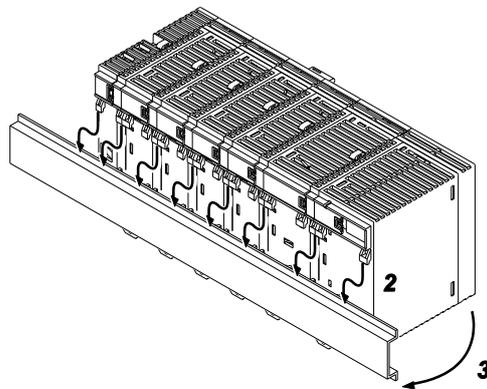
Procedure

Attachment

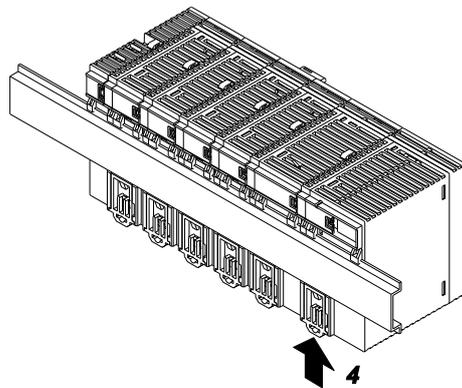
1. Pull out DIN rail attachment lever on unit's back



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



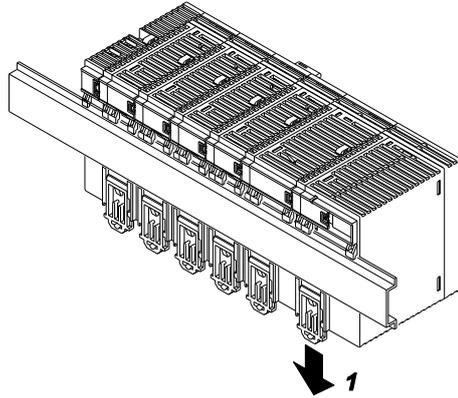
4. Push up DIN rail attachment lever on unit's back until it clicks into place



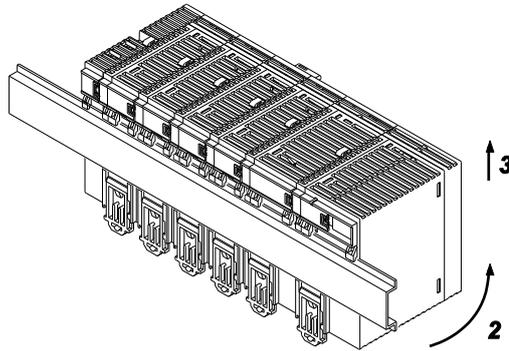
Procedure

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 |



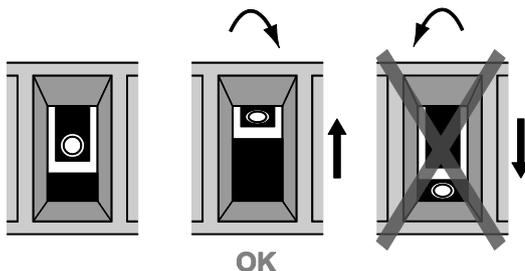
Terminal block for DeviceNet

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 no wire is under stress.

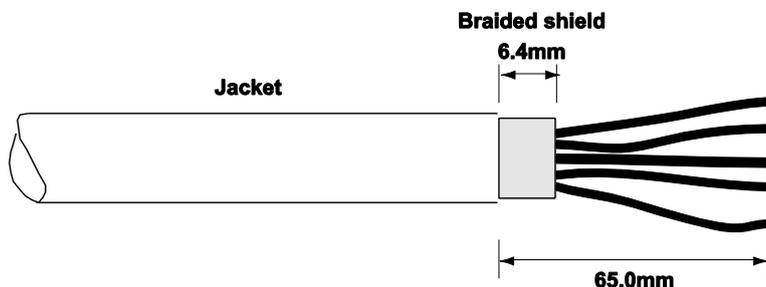
- If the socket in the terminal block closes upon counter-clockwise rotation, the connection is wrong. Disconnect the wire, check the terminal hole, and then re-connect the wire.



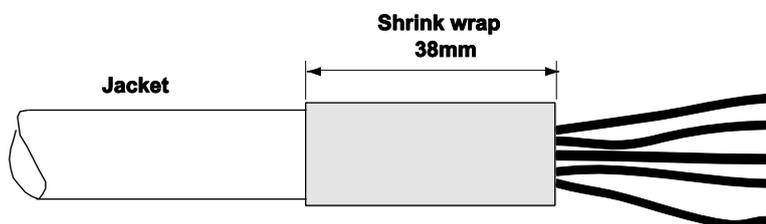
Wiring method

Procedure

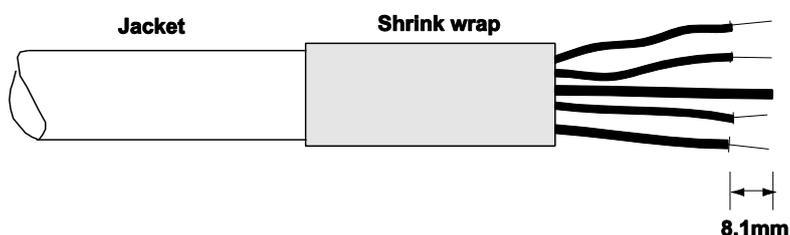
1. Strip 65mm to 75mm of the outer jacket from the end of the cable, leaving no more than 6.4mm of the braided shield exposed



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



3. Strip 8.1mm of the insulation from the end of each of the insulated conductors



4. 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 |

5. 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 | |
|-----------------|----------------------------|-------------|
| 2 | Model no. | Product no. |
| | MC 1.5/2-ST-5.08 | 18 36 07 9 |

Suitable wire

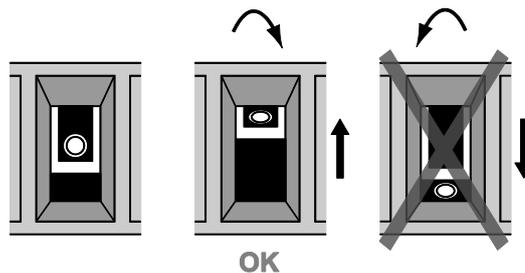
| No. of wires | Size | Cross-sectional area [mm ²] |
|--------------|----------|---|
| 1 | AWG28-16 | 0.14-1.5mm ² |

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

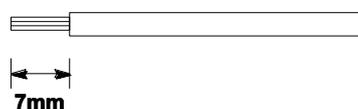
- When removing the wire's insulation, be careful not to scratch the core wire.
- Do not twist the wires to connect them.
- Do not solder the wires to connect them. The solder may break due to vibration.
- After wiring, make sure no wire is under stress.
- If the socket in the terminal block closes upon 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 touches 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.

4.2 GetPointer Function

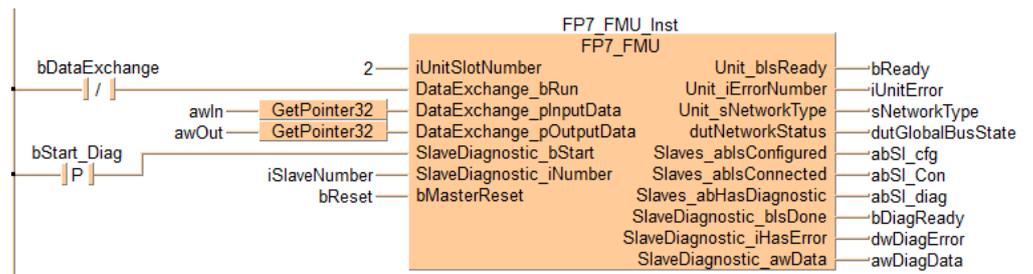
— GetPointer32 —

The GetPointer32 function outputs the size, area and offset of the input variable and writes it to the output variable of the type POINTER. Connect the output of this function directly to the respective input of the function block.

Reference

Please refer to the Control FPWIN Pro online help for details and a programming example.

4.3 FMU_DataExchange



The FMU_DataExchange function block is used to start communication with the network. It has to be supplied with information about the input and output size, and network-specific data.

Just leave the pins unconnected that you do not require.

PLC types: available for FP7.

Variables of this function block have to be of one of the following data types:

Inputs

| Data type | Input | Function |
|-----------|--------------------------|--|
| INT | iUnitSlotNumber | Installation position of the FMU. |
| BOOL | DataExchange_bRun | If true, network communication runs. |
| POINTER | DataExchange_pInputData | Pointer to the input's process data table. |
| POINTER | DataExchange_pOutputData | Pointer to the output's process data table. |
| BOOL | SlaveDiagnostic_bStart | If rising edge, slave diagnostic starts on time. |
| INT | SlaveDiagnostic_iNumber | Node number for diagnostic. |
| BOOL | bMasterReset | If true, the unit is in reset stage. |

Outputs

| Data type | Output | Function |
|-----------|-------------------------|---------------------------|
| BOOL | Unit_blsReady | ON if unit is ready. |
| INT | Unit_ErrorNumber | Unit is in error. |
| STRING | Unit_sNetworkType | Type of network detected. |
| DUT | dutNetworkStatus | Depends on the network. |
| BOOL[128] | Slaves_ablsConfigured | Depends on the network. |
| BOOL[128] | Slaves_ablsConnected | Depends on the network. |
| BOOL[128] | Slaves_abHasDiagnostic | Depends on the network. |
| BOOL | SlaveDiagnostic_blsDone | ON if done. |

| Data type | Output | Function |
|-----------|---------------------------|-------------------------|
| INT | SlaveDiagnostic_iHasError | Depends on the network. |
| WORD[10] | SlaveDiagnostic_awData | Depends on the network. |

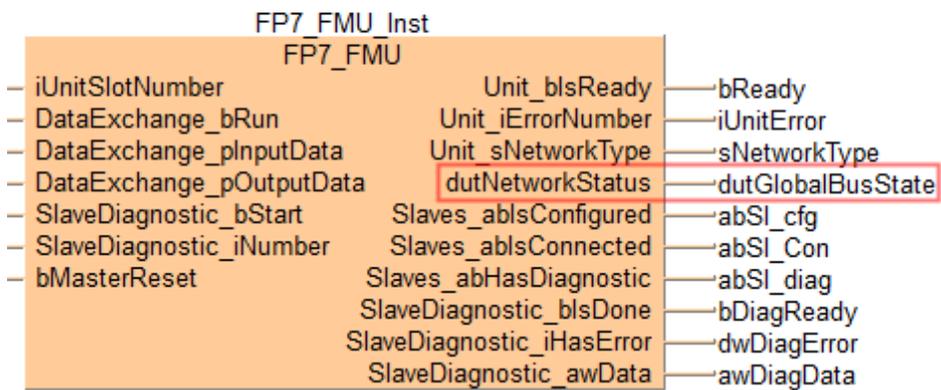
List of error codes for the function block FMU_DataExchange

| Error code | Indication |
|------------|---|
| 16#0000 | No error. |
| 16#0001 | The address specified for DataExchange_pInputData is not in the DT area. |
| 16#0002 | The address specified for DataExchange_pOutputData is not in the DT area. |
| 16#0003 | The slot number is outside the range of 1 to 16. |
| 16#0004 | Unknown network unit. |
| 16#0005 | Not a network unit. |

4.3.1 dutNetworkStatus output

Connected to the output pin **dutNetworkStatus** is the variable **Global-BusState**, which in turn is part of the DUT **GlobalBusStateField** included in the FP7_FMU library for Control FPWIN Pro.

| | Class | Identifier |
|----|-------|-------------------|
| 12 | VAR | dutGlobalBusState |



Data unit type:
GlobalBusStateField

| | | |
|--------------------|------|---|
| GlobBit_Status | WORD | 0 |
| ErrRemAdr_ErrEvent | WORD | 0 |
| BusErrorCnt | INT | 0 |
| TimeOutCount | INT | 0 |

This DUT is used for all network types, but the information stored in the DUT is nevertheless network-specific:

- PROFIBUS (see p. 27)
- DeviceNet (see p. 30)
- CANopen (see p. 35)
- PROFINET IO (see p. 37)

4.3.1.1 GlobalBusStateField for PROFIBUS

| Data unit type: | | |
|---------------------|------|---|
| GlobalBusStateField | | |
| GlobBit_Status | WORD | 0 |
| ErrRemAdr_ErrEvent | WORD | 0 |
| BusErrorCnt | INT | 0 |
| TimeOutCount | INT | 0 |

| Identifier part | Identifier | Explanation |
|----------------------|---------------------|---|
| Global bits | GlobBit_Status | Lower byte of the WORD. Details follow the table. |
| Status | GlobBit_Status | Higher byte of the WORD. The master system can be in one of the following states: <ul style="list-style-type: none"> • 16#00: OFFLINE • 16#40: STOP • 16#80: CLEAR • 16#C0: OPERATE |
| Error remote address | ErrRemAddr_ErrEvent | Lower byte of the WORD. Some of the global bits indicate errors in the network or in the FMU itself that require a more detailed explanation. In these cases, "ErrRemAddr" represents the source of the error and can arise from either the FMU itself (value = 255), or be detected and reported by a network device. In this case, the lower byte represents the station address. Range: 0 to 125. |
| Error event | ErrRemAddr_ErrEvent | Higher byte of the WORD. Each error is assigned a number. The errors are explained following the table. |
| Bus error count | BusErrorCnt | Counts severe bus errors, e.g. bus short circuits. |
| Timeout count | TimeOutCount | Counts the number of rejected PROFIBUS telegrams due to severe bus errors. |

Global bits

The bit field serves as collective display of global notifications. Errors can either occur at the FMU itself or at the slaves. To distinguish between the different errors, the variable part ErrRemAddr contains the error location (bus address), while the variable part ErrEvent lists the corresponding error number. If more than one error is determined, the error location will always show the lowest faulty bus address.

| | | | | | | | | |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|

| Bit | Explanation |
|-----|--|
| 0 | Control error. Parameterization error. |
| 1 | Auto-clear error. FMU stopped communication to all slaves and reached the auto-clear end state. |
| 2 | Non-exchange error. At least one slave has not reached the data exchange state, hence no process data can be exchanged. |
| 3 | Fatal error. Due to severe bus error, no further bus communication is possible. |
| 4 | Event error. The FMU has detected bus short circuits. The number of detected events is fixed in the BusErrorCnt variable. The bit is set when the first event is detected. |
| 5 | Host not ready notification. If the bit is set, the host program is NOT ready to communicate. |
| 6 | Timeout error. The FMU has detected an overstepped timeout supervision time due to rejected PROFIBUS telegrams. It indicates bus short circuits while the master interrupts the communication. The number of detected timeouts are fixed in the TimeOutCount variable. The bit is set when the first timeout is detected. |
| 7 | Reserved. |

Errors

The following error numbers are valid for the error event if "Error remote address" is 255.

| ErrEvent | Explanation | Source of error | Recommendation |
|----------|------------------------------------|------------------|----------------------------|
| 0 | No errors | | |
| 50 | User interface task not found. | FMU | Contact technical support. |
| 51 | No global data field. | FMU | Contact technical support. |
| 52 | Fieldbus data link task not found. | FMU | Contact technical support. |
| 53 | PLC task not found. | FMU | Contact technical support. |
| 54 | Non-existent master parameters. | FMU | Download database again. |
| 55 | Faulty master parameter value. | Project planning | Contact technical support. |
| 56 | Non-existent slave parameter. | Project | Download database again. |

| ErrEvent | Explanation | Source of error | Recommendation |
|----------|--|------------------|---|
| | ters. | planning | |
| 57 | Faulty slave parameter value in data file. | Project planning | Contact technical support. |
| 58 | Double slave address. | Project planning | Check projected addresses. |
| 59 | Projected send process data offset of participant's address outside allowable range of 0-255. | Project planning | Check projected addresses. |
| 60 | Projected receive process data offset of participant's address outside allowable range of 0-255. | Project planning | Check projected addresses. |
| 61 | Slaves' data areas overlapping for send process data. | Project planning | Check projected addresses. |
| 62 | Slaves' data areas overlapping for receive process data. | Project planning | Check projected addresses. |
| 63 | Unknown process data handshake. | Warm start | Check warm start parameters. |
| 64 | Free RAM exceeded. | FMU | Contact technical support. |
| 65 | Faulty slave parameter data sets. | Project planning | Contact technical support. |
| 202 | No segment for treatment free. | FMU | Contact technical support. |
| 212 | Faulty reading of database. | FMU | Download database again. |
| 213 | Structure surrender to operating system faulty. | FMU | Contact technical support. |
| 220 | Software watchdog error. | Host | Check host program. |
| 221 | No data acknowledgement in process data handshake mode 0. | Host | Host program did not acknowledge the last handshake in time. |
| 222 | Master in auto-clear mode. | Slave | Auto-clear mode was activated because one slave was missing during runtime. |
| 225 | No further segments. | FMU | Contact technical support. |

The following error numbers are valid for the error event if "Error remote address" is not equal to 255.

| ErrEvent | Explanation | Source of error | Recommendation |
|----------|--|-----------------|---|
| 2 | Station reports overflow. | Master telegram | Check length of configured slave configuration or parameter data. |
| 3 | Request function of master not activated in the station. | Master telegram | Check slave if PROFIBUS DP norm compatible.. |
| 9 | No answer even though slave must respond. | Slave | Check configuration data of the station and compare it with the physical I/O data length. |
| 17 | No response from station. | Slave | Check bus cable. Check bus address of slave. |

| ErrEvent | Explanation | Source of error | Recommendation |
|----------|---------------------------------------|-----------------|---|
| 18 | Master not in the logical token ring. | FMU | Check master's fieldbus data link address or the highest station address of other master systems. Check bus cable for short circuits. |
| 21 | Faulty parameter in request. | Master telegram | Contact technical support. |

4.3.1.2 GlobalBusStateField for DeviceNet

Data unit type:
GlobalBusStateField

| | | |
|--------------------|------|---|
| GlobBit_Status | WORD | 0 |
| ErrRemAdr_ErrEvent | WORD | 0 |
| BusErrorCnt | INT | 0 |
| TimeOutCount | INT | 0 |

| Identifier part | Identifier | Explanation |
|----------------------|---------------------|---|
| Global bits | GlobBit_Status | Lower byte of the WORD. Details follow the table. |
| Status | GlobBit_Status | Higher byte of the WORD. The master system can be in one of the following states: <ul style="list-style-type: none"> • 16#00: OFFLINE • 16#40: STOP • 16#80: CLEAR • 16#C0: OPERATE |
| Error remote address | ErrRemAddr_ErrEvent | Lower byte of the WORD. If the global bits "control error, auto-clear error or non-exchange error" are set, this variable indicates the address of the device. If the error occurs in the FMU, the value is 255. Otherwise the faulty device address = MAC ID is stored. |
| Error event | ErrRemAddr_ErrEvent | Higher byte of the WORD. Each error is assigned a number. The errors are explained following the table. |
| Bus error count | BusErrorCnt | This variable is incremented whenever the error frame counter of the Philips CAN chip used has reached the warning limit due to disturbed bus communication. |
| Timeout count | TimeOutCount | This variable is incremented when the CAN chip reports that it is no longer involved in bus activities because the bus error frame counter has been exceeded. The chip must be reinitialized, which is done automatically by the FMU. |

Global bits

The bit field serves as collective display of global notifications. Errors can either occur at the FMU itself or at the slaves. To distinguish between the different errors, the variable part ErrRemAddr contains the error location (address = MAC ID), while the variable part ErrEvent lists the corresponding error number. If more than one error is detected, the error location will always show the device with the lowest MAC ID.

| | | | | | | | | |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|

| Bit | Explanation |
|-----|--|
| 0 | Control error. Parameterization error. |
| 1 | Auto-clear error. FMU stopped communication to all slaves and reached the auto-clear end state. |
| 2 | Non-exchange error. At least one slave has not reached the data exchange state, hence no process data can be exchanged. |
| 3 | Fatal error. Due to severe bus error, no further bus communication is possible. |
| 4 | Event error. The FMU has detected bus short circuits. The number of detected events are fixed in the BusErrorCnt variable. The bit is set when the first event is detected. |
| 5 | Host not ready notification. If the bit is set, the host program is NOT ready to communicate. |
| 6 | Duplicate MAC ID detected. The FMU has detected another device in the network with the same MAC ID. |
| 7 | Duplicate MAC ID check in progress. As long this bit is set, the FMU is checking for duplicate MAC IDs. |

Errors

The following error numbers are valid for the error event if "Error remote address" is 255.

| ErrEvent | Explanation | Source of error | Recommendation |
|----------|--|---|----------------------------|
| 52 | Unknown process data handshake mode configured. | Configuration. | |
| 53 | Baud rate out of range. | Configuration. | |
| 54 | FMU MAC ID address out of range. | Configuration. | |
| 57 | Duplicate FMU MAC ID address detected in the network | Configuration or network. | |
| 58 | No device entry found in the current configuration database. | Download error in the current database. | Contact technical support. |
| 210 | No database found in the system. | Configuration not downloaded. FMU is not configured by Control Configurator FM. | |

| ErrEvent | Explanation | Source of error | Recommendation |
|----------|---|-----------------|----------------------------|
| 212 | Failure reading the database. | | Contact technical support. |
| 220 | User watchdog failed. | Application. | |
| 221 | No data acknowledgment from user. | Application. | |
| 223 | Master has stopped bus communication due to CAN-based bus off error. In the Control Configurator FM for the bus parameters under "Error handling", "Auto Clear" is activated. | Network error. | |
| 226 | Master firmware downloaded to slave EC1 device. | User error. | |

The following error numbers are valid for the error event if "Error remote address" is not equal to 255.

| ErrEvent | Explanation | Source of error | Recommendation |
|----------|---|----------------------|--|
| 0 | No errors. | | |
| 1 | Device guarding failed after device was operational. | Device | Check if device is still running. |
| 30 | Device access timeout. | Device | Device does not respond. Check the baud rate and MAC ID. |
| 32 | Device rejects access with unknown error code. | Device | Use single-device diagnostic to get reject code. |
| 35 | Device response in allocation phase with connection error. | Device | Use single-device diagnostic to get additional reject code. |
| 36 | Connection produced (process data input length from the FMU's point-of-view) is different from the one configured. | Device/configuration | Use single-device diagnostic to get true produced connection size. |
| 37 | Size of connection consumed (process data output length from the FMU's point-of-view) is different from the one configured. | Device/configuration | Use single-device diagnostic to get true consumed connection size. |
| 38 | Device service response telegram unknown and not handled. | Device/configuration | Use single-device diagnostic to get true consumed connection size. |
| 39 | Connection already requested. | Device | Connection will be automatically released. |
| 40 | Number of CAN message data bytes read in the produced or consumed connection size | Device | Device cannot operate with the FMU and norm description. |

| ErrEvent | Explanation | Source of error | Recommendation |
|----------|--|----------------------|--|
| | response unequal to 4. | | |
| 41 | Predefined master-slave connection already exists. | Device/FMU | Connection will be automatically released. |
| 42 | Length in polling device response unequal to produced connection size. | Device | |
| 43 | Sequence error in device polling response. | Device | Two initial segments in multiplexed transfer were received. |
| 44 | Fragment error in device polling response. | Device | Fragmentation counter during multiplexed transfer differs from the one expected. |
| 45 | Sequence error in device polling response. | Device | Middle or last segment was received before the first segment. |
| 46 | Length in bit strobe device response unequal to produced connection size. | Device | |
| 47 | Sequence error in device COS or cyclic response. | Device | Two initial segments in multiplexed transfer were received. |
| 48 | Fragment error in device COS or cyclic response. | Device | Fragmentation counter during multiplexed transfer differs from the one expected. |
| 49 | Sequence error in device COS or cyclic response. | Device | Middle or last segment was received before the first segment. |
| 50 | Length in COS or cyclic device response unequal to produced connection size. | Device | |
| 51 | UCMM group not supported. | Device | Change the UCMM group. |
| 52 | Device keying failed: vendor ID mismatch. | Device/configuration | Check vendor ID configured with device's vendor ID. |
| 53 | Device keying failed: device type mismatch. | Device/configuration | Check device type configured with device's device type. |
| 54 | Device keying failed: product code mismatch. | Device/configuration | Check product code configured with device's product code. |
| 55 | Device keying failed: revision mismatch. | Device/configuration | Check revision configured with device's revision. |
| 59 | Double device address configured in current configuration. | Configuration | Each device in DeviceNet must have its own MAC ID. |
| 60 | Whole size indicator of one device data set is corrupt. | Configuration | Download error in the current database. Contact technical support. |

| ErrEvent | Explanation | Source of error | Recommendation |
|----------|--|-----------------|---|
| 61 | Size of the additional table for predefined master-slave connections is corrupt. | Configuration | Download error in the current database. Contact technical support. |
| 62 | Size of predefined master-slave I/O configuration table is corrupt. | Configuration | Download error in the current database. Contact technical support. |
| 63 | Predefined master-slave I/O configuration does not correspond to the additional table. | Configuration | Number of I/O units and the number of configured offset addresses are different. |
| 64 | Size indicator of parameter data table is corrupt. | Configuration | Value of size indicator too small. |
| 65 | Number of inputs declared in the additional table does not correspond to the number in the I/O configuration table. | Configuration | Each entry in the I/O configuration must have only one entry in the additional table. |
| 66 | Number of outputs declared in the additional table does not correspond to the number in the I/O configuration table. | Configuration | Each entry in the I/O configuration must have only one entry in the additional table. |
| 67 | Unknown data type in I/O configuration detected. | Configuration | Data types supported: BOOL, BYTE, WORD, DWORD and STRING only. |
| 68 | Data type of a defined I/O unit in a connection does not correspond with the defined data size. | Configuration | The following types and size are valid: <ul style="list-style-type: none"> • BOOLEAN = 1 byte • Unit 8 = 1 byte • Unit 16 = 2 bytes • Unit 32 = 4 bytes |
| 69 | Output address configured for one unit exceeds the possible address range of 3584 bytes. | Configuration | The process data image is limited to 3584 bytes. |
| 70 | Input address configured for one unit exceeds the possible address range of 3584 bytes. | Configuration | The process data image is limited to 3584 bytes. |
| 71 | One predefined connection type is unknown. | Configuration | Support of cyclic, polled, change of state, or bit strobe connections only. |
| 72 | Multiple connections defined in parallel. | Configuration | Supports only one type of connection to one device. |
| 73 | The value configured for the expected packet rate value configured is | Configuration | The value for the expected packet rate must be larger than the pro- |

| ErrEvent | Explanation | Source of error | Recommendation |
|----------|--|-----------------|--|
| | less than the value for production inhibit time. | | duction inhibit time. In Control Configurator FM, check the settings for the slave's poll connection configuration. |

4.3.1.3 GlobalBusStateField for CANopen

| Data unit type: | | |
|---------------------|------|---|
| GlobalBusStateField | | |
| GlobBit_Status | WORD | 0 |
| ErrRemAdr_ErrEvent | WORD | 0 |
| BusErrorCnt | INT | 0 |
| TimeOutCount | INT | 0 |

| Identifier part | Identifier | Explanation |
|----------------------|---------------------|--|
| Global bits | GlobBit_Status | Lower byte of the WORD. Details follow the table. |
| Status | GlobBit_Status | Higher byte of the WORD. The master system can be in one of the following states: <ul style="list-style-type: none"> • 16#00: OFFLINE • 16#40: STOP • 16#80: CLEAR • 16#C0: OPERATE |
| Error remote address | ErrRemAddr_ErrEvent | Lower byte of the WORD. If the global bits "control error, auto-clear error or non-exchange error" are set, indicates the address of the node. If the error occurs in the FMU, the value is 255. Otherwise the faulty node address is stored. |
| Error event | ErrRemAddr_ErrEvent | Higher byte of the WORD. Each error is assigned a number, which are explained following the table. |
| Bus error count | BusErrorCnt | Counts how many times bus error limits are exceeded. |
| Timeout count | TimeOutCount | Counts the number of CAN chip reinitializations. |

Global bits

The bit field serves as collective display of global notifications. Errors can either occur at the FMU itself or at the nodes. To distinguish between the different errors, the variable part ErrRemAddr contains the error location (address), while the variable part ErrEvent lists the corresponding error number. If more than one error is determined, the error location will always show the lowest faulty bus address.

| | | | | | | | | |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|

| Bit | Explanation |
|-----|--|
| 0 | Control error. Parameterization error. |
| 1 | Auto-clear error. FMU stopped communication to all nodes and reached the auto-clear end state. |
| 2 | Non-exchange error. At least one node has not reached the data exchange state, hence no process data can be exchanged. |
| 3 | Fatal error. Due to severe internal error, no further bus communication is possible. |
| 4 | Event error. The FMU has detected transmission errors. The number of detected events are fixed in the BusErrorCnt variable. The bit is set when the first event is detected. |
| 5 | Host not ready notification. If the bit is set, the host program is NOT ready to communicate. |
| 6 | Timeout error. The FMU has detected an overstepped timeout supervision time of at least one CAN message to be sent. The transmission of this message was aborted. The data is lost. It indicated that no other CAN device was connected or could not acknowledge the message sent. The number of timeouts detected are stored in the message timeout variable. The bit is set when the first timeout is detected. |
| 7 | Reserved. |

Errors

The following error numbers are valid for the error event if "Error remote address" is 255.

| ErrEvent | Explanation | Source of error | Recommendation |
|----------|--|------------------|--|
| 0 | No errors | | |
| 52 | Unknown handshake mode was configured. | Initialization | If you use the function block, please use the default handshake settings. |
| 56 | Baud rate out of range. | Project planning | Contact technical support. |
| 60 | Double node address was configured. | Project planning | Contact technical support. |
| 63 | Invalid parameter for SYNC mode. | Project planning | In Control Configurator FM under bus parameters, check the SYNC Master settings. |

| ErrEvent | Explanation | Source of error | Recommendation |
|----------|-------------------------------|------------------|---------------------------------------|
| 210 | No database. | Project planning | Download database again. |
| 212 | Faulty reading of a database. | Device | Download database again. |
| 220 | Host watchdog error. | Host program | Check user program or watchdog timer. |

The following error numbers are valid for the error event if "Error remote address" is not equal to 255.

| ErrEvent | Explanation | Source of error | Recommendation |
|----------|---|------------------|--|
| 30 | Guarding failed. | Node | Check whether node is connected. |
| 31 | Node has changed its state and is no longer operational. | Node | Reset node. |
| 32 | Sequence error in guarding protocol. | Node | Reset node. |
| 33 | No response to a configured remote frame PDO. | Node | Check whether node can handle remote frames. |
| 34 | No response of the node while being configured. | Node | Check whether node is connected and operational. |
| 35 | The node profile number configured in the master differs from the actual node profile number. | Project planning | Check the supported profile number of the node: I/O, encoder, etc. |
| 36 | The device type configured in the master differs from the actual node device type. | Project planning | Check the supported services of the node. |
| 37 | Unknown SDO response received. | Node | Node not compatible with CiA protocol specification. |
| 38 | Length indicator of received SDO message does not equal 8. | Node | Node not compatible with CiA protocol specification. |
| 39 | Node not handled. Node stopped. | Device | Activated auto-clear mode or host is not ready. |

4.3.1.4 GlobalBusStateField for PROFINET IO

| Data unit type: | | | |
|---------------------|------|---|--|
| GlobalBusStateField | | | |
| GlobBit_Status | WORD | 0 | |
| ErrRemAdr_ErrEvent | WORD | 0 | |
| BusErrorCnt | INT | 0 | |
| TimeOutCount | INT | 0 | |

| Identifier part | Identifier | Explanation |
|-----------------|---------------------|--|
| Global bits | GlobBit_Status | Lower byte of the WORD. Details follow the table. |
| Status | GlobBit_Status | Higher byte of the WORD. The master system can be in one of the following states: <ul style="list-style-type: none"> • 16#00: UNKNOWN • 16#01: NOT CONFIGURED • 16#02: STOP • 16#03: IDLE • 16#04: OPERATE |
| Error event | ErrRemAddr_ErrEvent | Each error is assigned a number. The errors are explained following the table. |
| Bus error count | BusErrorCnt | This variable is incremented whenever an error is detected after power-up or reset. |
| Timeout count | TimeOutCount | Not used. |

Global bits

The bit field contains information about the current operating status of the communication channel and its firmware.

Bit:

| | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----------|----------|----------|----------|----------|----------|----------|----------|

| Bit | Explanation |
|-----|----------------------|
| 0 | Ready |
| 1 | Running |
| 2 | Bus ON |
| 3 | Configuration locked |
| 4 | Configuration new |
| 5 | Restart required |
| 6 | Restart enabled |
| 7 | Not used; set to 0 |

Errors

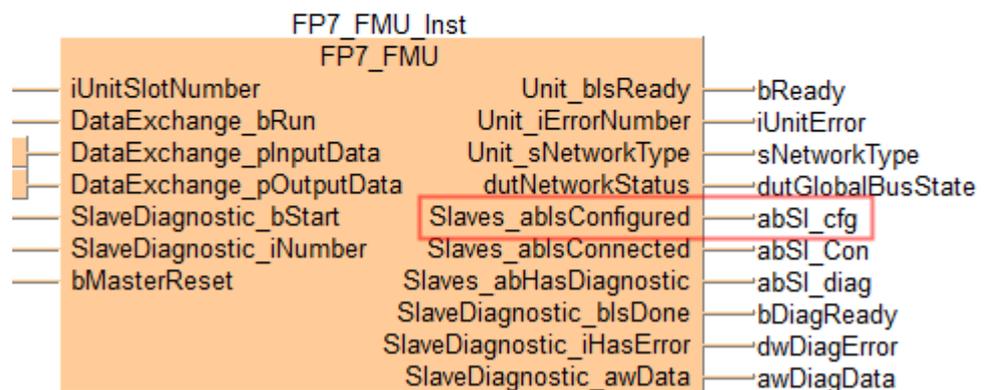
| ErrEvent | Explanation |
|----------|--------------------------------|
| 16#0000 | Success |
| 16#000C | Watchdog timeout |
| 16#0100 | (General) initialization fault |
| 16#0101 | Database access failed |
| 16#0119 | Not configured |
| 16#0120 | (General) configuration fault |
| 16#0121 | Inconsistent data set |
| 16#0122 | Data set mismatch |
| 16#0123 | Insufficient license |

| ErrEvent | Explanation |
|----------|-------------------------|
| 16#0124 | Parameter error |
| 16#0125 | Invalid network address |
| 16#0126 | No security memory |
| 16#0140 | (General) network fault |
| 16#0141 | Connection closed |
| 16#0142 | Connection timed out |
| 16#0143 | Lonely network |
| 16#0144 | Duplicate node |
| 16#0145 | Cable disconnected |

4.3.2 Slaves_abIsConfigured output

Connected to the output pin **Slaves_abIsConfigured** is a variable of the type ARRAY [0...127] of BOOL.

| | Class | Identifier | Type | Initial |
|---|-------|------------|-----------------------|--------------|
| 1 | VAR | abSI_cfg | ARRAY [0..127] OF ... | [128(FALSE)] |
| 2 | VAR | abSI_Con | ARRAY [0..127] OF ... | [128(FALSE)] |
| 3 | VAR | abSI_diag | ARRAY [0..127] OF ... | [128(FALSE)] |



In this example, the identifier is **abSI_cfg**. This variable is used for all network types, but the information stored in the variable is nevertheless network-specific:

- abSI_cfg for PROFIBUS (see p. 40)
- abSI_cfg for DeviceNet (see p. 40)
- abSI_cfg for CANopen (see p. 40)
- abSI_cfg for PROFINET IO (see p. 40)

4.3.2.1 abSI_cfg for PROFIBUS

This variable is an ARRAY [0...127] of BOOL, i.e. a field of 8 words, and contains the parameterization state of each FMU slave.

The bit for the corresponding slave is logical:

- 1 = the slave is configured in the FMU.
- 0 = the slave is not configured in the FMU.

4.3.2.2 abSI_cfg for DeviceNet

This variable is an ARRAY [0...127] of BOOL, i.e. a field of 8 words, and contains the parameterization state of each FMU slave. For DeviceNet, bits 0 to 63 are available.

The bit for the corresponding slave is logical:

- 1 = the slave is configured in the FMU.
- 0 = the slave is not configured in the FMU.

4.3.2.3 abSI_cfg for CANopen

This variable is an ARRAY [0...127] of BOOL, i.e. a field of 8 words, and contains the parameterization state of each FMU node.

The bit for the corresponding node is logical:

- 1 = the node is configured in the FMU.
- 0 = the node is not configured in the FMU.

4.3.2.4 abSI_cfg for PROFINET IO

This variable is an ARRAY [0...127] of BOOL, i.e. a field of 8 words, and contains the parameterization state of each FMU slave.

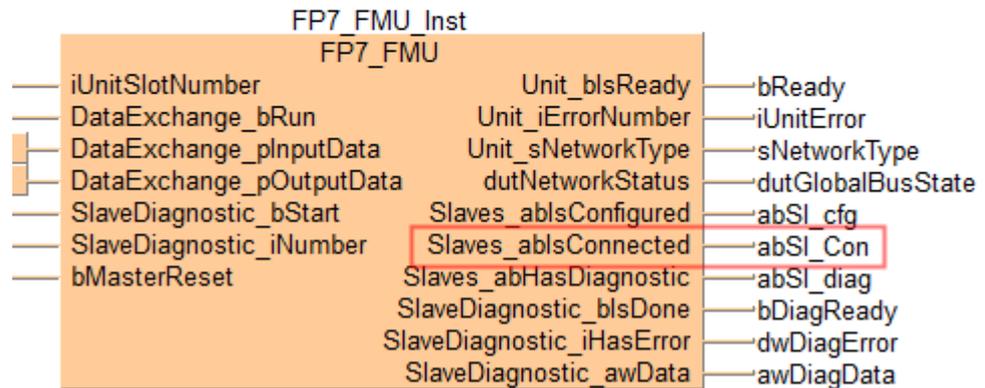
The bit for the corresponding slave is logical:

- 1 = the slave is configured in the FMU.
- 0 = the slave is not configured in the FMU.

4.3.3 Slaves_abIsConnected output

Connected to the output pin **Slaves_abIsConnected** is a variable of the type ARRAY [0...127] of BOOL.

| | Class | Identifier | Type | Initial |
|---|-------|------------|-----------------------|--------------|
| 1 | VAR | abSI_cfg | ARRAY [0..127] OF ... | [128(FALSE)] |
| 2 | VAR | abSI_Con | ARRAY [0..127] OF ... | [128(FALSE)] |
| 3 | VAR | abSI_diag | ARRAY [0..127] OF ... | [128(FALSE)] |



In this example, the identifier is **abSI_Con**. This variable is used for all network types, but the information stored in the variable is nevertheless network-specific:

- abSI_Con for PROFIBUS (see p. 41)
- abSI_Con for DeviceNET (see p. 42)
- abSI_Con for CANopen (see p. 42)
- abSI_Con for PROFINET IO (see p. 42)

4.3.3.1 abSI_Con for PROFIBUS

This variable is an ARRAY [0...127] of BOOL, i.e. a field of 8 words, and contains the parameterization state of each FMU slave.

The bit of the corresponding slave is logical:

- 1 = the slave and the master are exchanging I/O data.
- 0 = the slave and the master are not exchanging I/O data.

The values in the variable abSI_Con are only valid if the master is in the OPERATE state.

4.3.3.2 abSI_Con for DeviceNet

This variable is an ARRAY [0...127] of BOOL, i.e. a field of 8 words, and contains the parameterization state of each FMU slave.

The lower 4 words, ARRAY [0...63] of BOOL, store the state for the device's explicit connection. The bit of the corresponding device is logical:

- 1 = the device's explicit connection is in the established state
- 0 = the device's explicit connection is not in the established state

The values in the variable abSI_Con are only valid if the master is in the OPERATE state.

The higher 4 words, ARRAY [64...127] of BOOL, store the state for the device's I/O connection. The bit of the corresponding device is logical:

- 1 = the device's I/O connection is in the established state
- 0 = the device's I/O connection is not in the established state

4.3.3.3 abSI_Con for CANopen

This variable is an ARRAY [0...127] of BOOL, i.e. a field of 8 words, and contains the parameterization state of each FMU node.

The bit of the corresponding node is logical:

- 1 = node is operating; node guarding reports no error
- 0 = node is not operating because it is not configured or an error has occurred

The values in the variable abSI_Con are only valid if the master is in the OPERATE state.

4.3.3.4 abSI_Con for PROFINET IO

This variable is an ARRAY [0...127] of BOOL, i.e. a field of 8 words, and contains the parameterization state of each FMU slave.

The bit of the corresponding device is logical:

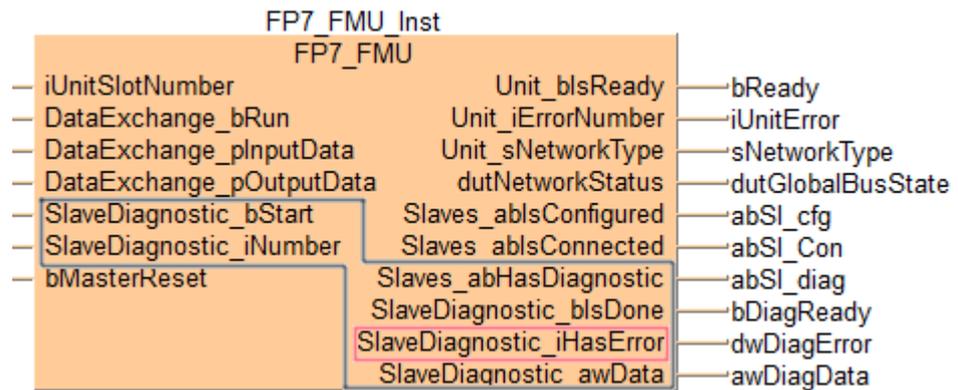
- 1 = the slave and the master are exchanging I/O data
- 0 = the slave and the master are not exchanging I/O data

The values in the variable abSI_Con are only valid if the master is in the OPERATE state.

4.3.4 Slaves_abHasDiagnostic output

The inputs and outputs found on the lower half of the function block help you diagnose problems.

Connected to the output pin **Slaves_abHasDiagnostic** is a variable of the type ARRAY [0...127] of BOOL.



In this example, the identifier is **abSI_diag**. This variable is used for all network types, but the information stored in the variable is nevertheless network-specific:

- abSI_diag for PROFIBUS (see p. 43)
- abSI_diag for DeviceNET (see p. 44)
- abSI_diag for CANopen (see p. 45)
- abSI_diag for PROFINET IO (see p. 45)

4.3.4.1 SI_diag for PROFIBUS

This variable is an ARRAY [0...127] of BOOL, i.e. a field of 8 words, and contains the diagnostic bit for each FMU slave.

The bit of the corresponding slave station is logical:

- 1 = latest received slave diagnostic data is available in the internal diagnostic buffer. If the bit is set to 1, you can enter the corresponding slave station number at the input **Slave_Diagnostic_iNumber**, and FPWIN Pro will tell you what the error is.
- 0 = since the last diagnostic buffer read access of the host, no values have changed in this buffer.

The values in the variable abSI_Con are only valid if the master is in the OPERATE state.

The following table shows the relationship between the **abSI_Con** bit and the **abSI_diag** bit.

| | abSI_Con = 0 | abSI_Con = 1 |
|---------------|---|---|
| abSI_diag = 0 | <ul style="list-style-type: none"> No data I/O exchange between master and slave. Perhaps this slave is not configured or not responsive. | <ul style="list-style-type: none"> Slave is present on the bus. Data I/O exchange between master and slave. |
| abSI_diag = 1 | <ul style="list-style-type: none"> The master and the corresponding slave are not exchanging I/O data. The master holds newly received diagnostic data in the internal diagnostic buffer. | <ul style="list-style-type: none"> Slave is present on the bus. The master and the corresponding slave are exchanging I/O data. The master holds newly received diagnostic data in the internal diagnostic buffer. |

4.3.4.2 abSI_diag for DeviceNet

This variable is an ARRAY [0...127] of BOOL, i.e. a field of 8 words, and contains the diagnostic bit of each device. For DeviceNet, bits 0 to 63 are available.

The bit of the corresponding device is logical:

- 1 = newly received diagnostic values are available in the internal diagnostic buffer or one of the diagnostics bit of the device has changed. If the bit is set to 1, you can enter the corresponding slave station number at the input **Slave_Diagnostic_iNumber**, and FPWIN Pro will tell you what the error is.
- 0 = since the last diagnostic buffer read access of the host, no values have changed in the internal diagnostic buffer.

The values in the variable abSI_Con are only valid if the master is in the OPERATE state.

The following table shows the relationship between the **abSI_Con** bit and the **SI_diag** bit.

| | abSI_Con = 0 | abSI_Con = 1 |
|---------------|---|--|
| abSI_diag = 0 | <ul style="list-style-type: none"> Device not operative, no process data exchange between FMU and device. Device is not configured. | <ul style="list-style-type: none"> Device is present on the network, device guarding active. Process data exchange between FMU and device happening as configured. |
| abSI_diag = 1 | <ul style="list-style-type: none"> Device is not operating, device guarding failed or configuration fault detected. New diagnostic data provided by the FMU in the internal diagnostic buffer to be read by host. | <ul style="list-style-type: none"> Device is present on the bus, device guarding is active, process data exchange. New diagnostic data provided by the FMU in the internal diagnostic buffer to be read by host. |

4.3.4.3 abSI_diag for CANopen

This variable is an ARRAY [0...127] of BOOL, i.e. a field of 8 words, and contains the diagnostic bit of each node. The bit of the corresponding node is logical:

- 1 = newly received emergency message are available in the internal diagnostic buffer or one of the diagnostics bit of the node has changed. If the bit is set to 1, you can enter the corresponding node number at the input **Slave_Diagnostic_iNumber**, and FPWIN Pro will tell you what the error is.
- 0 = since the last diagnostic buffer read access of the host, no values have changed in this buffer.

The values in the variable abSI_Con are only valid if the master is in the OPERATE state.

The following table shows the relationship between the **abSI_Con** bit and the **abSI_diag** bit.

| | abSI_Con = 0 | abSI_Con = 1 |
|---------------|--|--|
| abSI_diag = 0 | <ul style="list-style-type: none"> • Node not in operation, no data I/O exchange between master and node. Perhaps this slave is not configured. | <ul style="list-style-type: none"> • Node is present on the bus; node guarding is active. • PDO exchange between master and node is happening as configured. |
| abSI_diag = 1 | <ul style="list-style-type: none"> • Node is not operating; node guarding failed. • The master holds newly received diagnostic data in the internal diagnostic buffer. | <ul style="list-style-type: none"> • Node is present on the bus, node guarding is active, PDO exchange. • The master holds newly received diagnostic data in the internal diagnostic buffer. |

4.3.4.4 abSI_diag for PROFINET IO

This variable is an ARRAY [0...127] of BOOL, i.e. a field of 8 words, and contains the diagnostic bit of each device.

The of the corresponding device is logical:

- 1 = newly received diagnostic values are available in the internal diagnostic buffer or one of the diagnostics bit of the device has changed. If the bit is set to 1, you can enter the corresponding slave station number at the input **Slave_Diagnostic_iNumber**, and FPWIN Pro will tell you what the error is.
- 0 = since the last diagnostic buffer read access of the host, no values have changed in the internal diagnostic buffer.

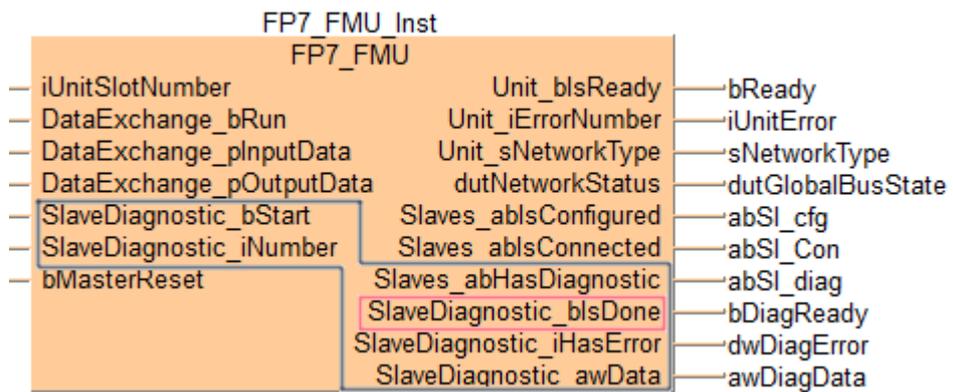
The values in the variable `abSI_Con` are only valid if the master is in the OPERATE state.

4.3.5 SlaveDiagnostic_bIsDone Output

The inputs and outputs found on the lower half of the function block help you diagnose problems.

Connected to the output pin **SlavesDiagnostic_bIsDone** is a variable of the type BOOL.

- 1 = diagnosis of the slave (node) complete.
- 0 = diagnosis of the slave (node) not complete.

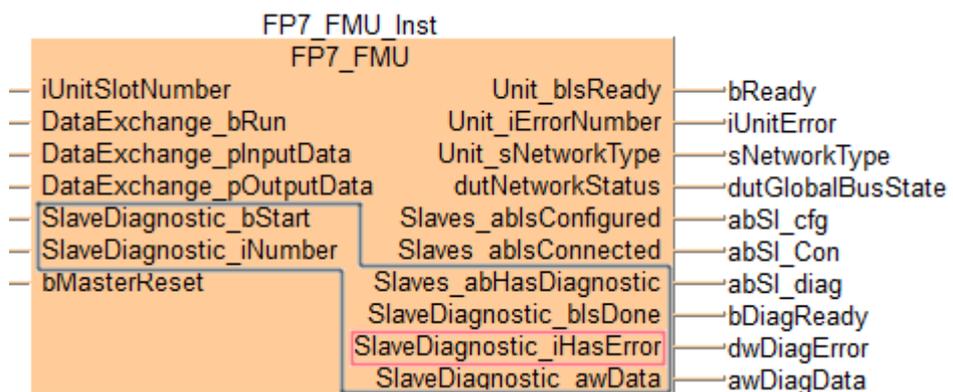


As long as the bit is set to 0, check at **SlaveDiagnostic_iHasError** to find out where the error is.

4.3.6 SlaveDiagnostic_iHasError Output

The inputs and outputs found on the lower half of the function block help you diagnose problems.

Connected to the output pin **SlavesDiagnostic_iHasError** is a variable of the type INTEGER.



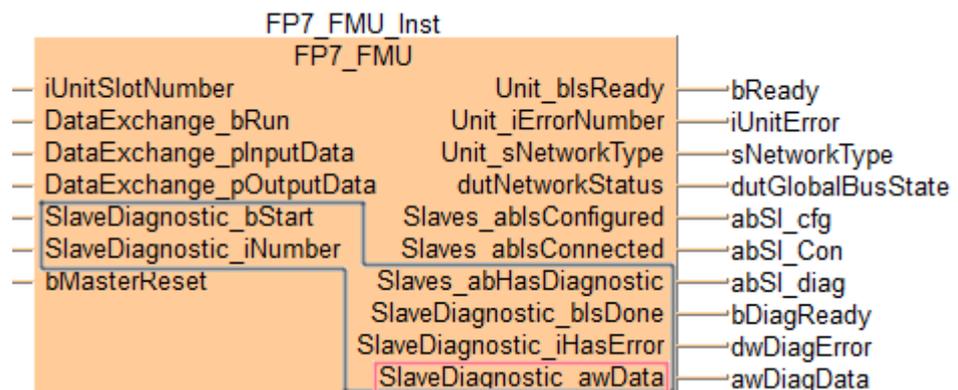
The integer stores the error code.

| Error | Indication | Network | Source | Recommendation |
|-------|--|-------------|--------------------|---|
| 0 | No error. | All | | |
| 17 | No response from slave. | PROFIBUS | Slave | <ul style="list-style-type: none"> • Check network wiring. • Check bus address of slave. • Check baud rate setting. |
| 18 | Master not in logical token ring. | PROFIBUS | Network in general | <ul style="list-style-type: none"> • Check master DP address or high-station address of other masters. • Examine bus wiring for short circuits. |
| 161 | Remote address requested out of range. | All | Master | Check slave/node address in request message. |
| NOT 0 | Remote address requested out of range | PROFINET IO | Master | Check slave/node address in request message. |

4.3.7 SlaveDiagnostic_awData Output

The inputs and outputs found on the lower half of the function block help you diagnose problems.

Connected to the output pin **SlaveDiagnostic_awData** is a variable of the type ARRAY [0...9] of WORD.



In this example, the identifier is **DiagData**. This variable is used for all network types, but the information stored in the variable is nevertheless network-specific:

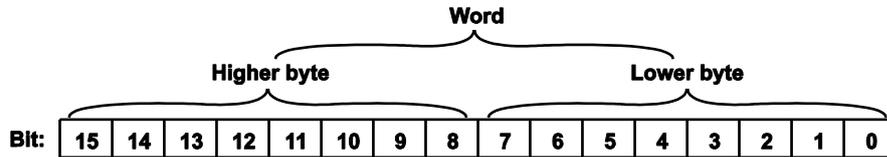
- awDiagData for PROFIBUS (see p. 48)
- awDiagData for DeviceNet (see p. 49)
- awDiagData for CANopen (see p. 52)
- awDiagData for PROFINET IO (see p. 54)

4.3.7.1 awDiagData for PROFIBUS

The ARRAYS of WORD contain the following diagnostic information.

ARRAY [0]: slave status

For ARRAY [0], slave status is stored as logical bits.



| Bit | Description |
|-----|--|
| 0 | Slave not responding. |
| 1 | Slave not ready. |
| 2 | Slave parameterized improperly. |
| 3 | Extended diagnostic area in ARRAY [3] of WORD used. |
| 4 | Unknown command detected by slave. |
| 5 | Implausible response from slave. |
| 6 | Last parameter telegram faulty. |
| 7 | Slave parameterized by another master. |
| 8 | Slave must be parameterized. |
| 9 | Get diagnostic from slave until the bit is set to OFF (16#0000). |
| 10 | 1 |
| 11 | Watchdog activated. |
| 12 | Freeze command activated. |
| 13 | Sync command activated. |
| 14 | Reserved by system. |
| 15 | Slave not projected. |

ARRAY [1]: additional slave status

For ARRAY [1], the lower byte contains additional slave status information. The higher byte contains the master address for the master that parameterized the slave.

| Bit | Description |
|------|---|
| 0-6 | Reserved by system. |
| 7 | The slave has more diagnostic data available than it can send. |
| 8-15 | The higher byte contains the master address for the master that parameterized the slave. If a slave is not parameterized, the value is 255. |

ARRAY [2]: slave ID number

In ARRAY [2], the slave reports its ID number.

ARRAY [3]: extended diagnostic buffer

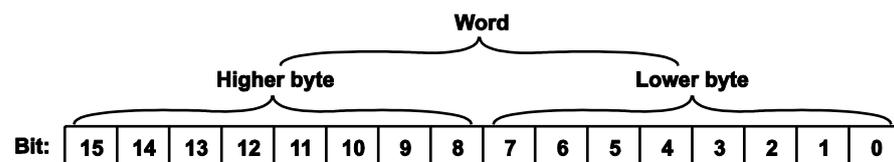
ARRAY [3] is an extended diagnostic buffer. The values therein are fixed in the manual of the slave station or can be found in the PROFIBUS specifications.

4.3.7.2 awDiagData for DeviceNet

The ARRAYS of WORD contain the following diagnostic information.

ARRAY [0], lower byte: device status

For ARRAY [0], the lower byte stores device status as logical bits.



| Bit | Description |
|-----|---|
| 0 | Device not responding. |
| 1 | Reserved by system. |
| 2 | Device had denied access to at least one configured attribute to write in. |
| 3 | Difference between device produced and consumed connection size to the resulting configured ones. |
| 4-6 | Reserved by system. |
| 7 | Device is deactivated in current configuration and not handled. |

ARRAY [0], higher byte: state of device

For each device, the FMU has a "state machine handler". For ARRAY [0], the higher byte stores values that correspond to a state in the device.

| Value | Description |
|-------|---|
| 0 | State machine enter. |
| 1 | Device inactive, not handled. |
| 2 | Own MAC ID, state waiting for all incoming duplicate MAC ID requests. |
| 3 | Initialize internal predefined master slave structures. |
| 4 | Allocated predefined master slave connection set request. |
| 5 | Wait for predefined master slave allocation connection response. |
| 6 | Release predefined master slave connection set request. |
| 7 | Wait for predefined master slave release connection response. |
| 8 | Initialize internal I/O configured structures. |
| 9 | Allocate configured I/O connection request. |
| 10 | Wait for I/O allocation response. |
| 11 | Release I/O connection request. |
| 12 | Wait for I/O connection release response. |

| Value | Description |
|-------|--|
| 13 | Read consumed connection size. |
| 14 | Wait for read consumed connection size response. |
| 15 | Compare consumed connection size with internal configured one. |
| 16 | Read produced connection size. |
| 17 | Wait for read produced connection size response. |
| 18 | Compare produced connection size with internal configured one. |
| 19 | Configure the I/O connection structures and register it. |
| 20 | Set expected packet rate. |
| 21 | Wait for set expected packet rate response. |
| 22 | I/O poll request 1st time. |
| 23 | Wait for I/O poll response. |
| 24 | I/O poll request 2nd time. |
| 25 | Wait for I/O poll response. |
| 26 | I/O poll request 3rd time. |
| 27 | Wait for I/O poll response. |
| 28 | Heart beat timeout to the device. |
| 30 | Open unconnected explicit connection request 1st time. |
| 31 | Wait for unconnected explicit connection response. |
| 32 | Open unconnected explicit connection request 2nd time. |
| 33 | Wait for unconnected explicit connection response. |
| 34 | Close unconnected connection request. |
| 35 | Wait for close unconnected connection response |
| 36 | Release all established connections request. |
| 37 | Wait for connection release response. |
| 38 | Open user unconnected explicit connection request. |
| 39 | Wait for user explicit connection response. |
| 40 | User predefined master slave allocate connection request |
| 41 | Wait for user allocation response. |
| 42 | User close unconnected connection request. |
| 43 | Wait for user close unconnected response. |
| 44 | Get or set user defined attribute request. |
| 45 | Wait for user defined get or set attribute response. |
| 46 | Send or wait fragmented get or set attribute. |

ARRAY [1], lower byte: online error

The lower byte of ARRAY [1] contains the actual online error of the device station is stored. See the table Err_Event of the global bus status field for possible entries.

ARRAY [1], higher byte: general error codes

The higher byte ARRAY [1] provides more detailed general error codes if the value for Err_Event is 35.

| Value | Description |
|-------|--------------------------|
| 2 | Resources unavailable. |
| 8 | Service not supported. |
| 9 | Invalid attribute value. |
| 11 | Already in request mode. |
| 12 | Object state conflict. |
| 14 | Attribute cannot be set. |
| 15 | Privilege violation. |
| 16 | Device state conflict. |
| 17 | Reply data too large. |
| 19 | Not enough data. |
| 20 | Attribute not supported. |
| 21 | Too much data. |
| 22 | Object does not exist. |

ARRAY [2], lower byte: additional code

The lower byte of ARRAY [2] contains additional code.

This additional error information is only valid if value listed for general error codes in the higher byte of ARRAY [1] is not equal to 0. The value for the "additional code is filled transparently, just as with the general error codes, with the additional error code of each incoming error response message of the device.

ARRAY [2], higher byte and ARRAY [3], lower byte: timeout information

The higher byte of ARRAY [2] and the lower byte of ARRAY [3] contain timeout information.

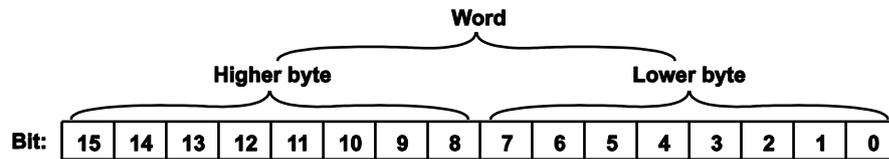
If a device is supervised by the expected packet rate of a connection and times out, the timer will be incremented. The actual value gives an overview of how good the transmission quality to this device is and how often a timeout has happened. After a device times out, the FMU always tries to reestablish the connection immediately.

4.3.7.3 awDiagData for CANopen

The ARRAYS of WORD contain the following diagnostic information.

ARRAY [0], lower byte: node status

For ARRAY [0], the lower byte stores node status as logical bits.



| Bit | Description |
|-----|--|
| 0 | Node not responding. |
| 1 | Emergency buffer overflow. |
| 2 | Difference between master and node configuration data. |
| 3 | Node guarding protocol for this node is active. |
| 4-6 | Reserved by system. |
| 7 | Node is deactivated and not handled by the master. |

ARRAY [0], higher byte and ARRAY [1], lower byte: extended information

These two bytes are read out from the node during startup. In the draft CiA specification, this word is declared as extended information of the node type. For example, whether the node supports digital input or outputs, etc. is fixed in this word.

ARRAY [1], higher byte and ARRAY [2], lower byte: profile number

These two bytes are read out from the node during startup. Several predefined profile numbers exist, each described in its own specification manual. Here is an extract:

- Device profile for I/O modules: 401, 16#0191.
- Device profile for drives and motion control: 402, 16#0192.
- Device profile for encode: 406, 16#0196.

ARRAY [2], higher byte: node state

If the node guarding protocol is active for this node, node status register read is written into this variable. The following values are defined in the CANopen specification.

| Value | Description |
|-------|------------------|
| 1 | Disconnected. |
| 2 | Connecting. |
| 3 | Preparing. |
| 4 | Prepared. |
| 5 | Operational. |
| 127 | Pre-operational. |

ARRAY [3], lower byte: current error

In this byte the actual online error of this node station is held down. See the table containing "Err_Event" of the global bus status field for possible entries.

ARRAY [3], higher byte: number of emergency messages saved

This byte contains the number of emergency messages saved in the following data area.

ARRAY [4...9]: emergency messages

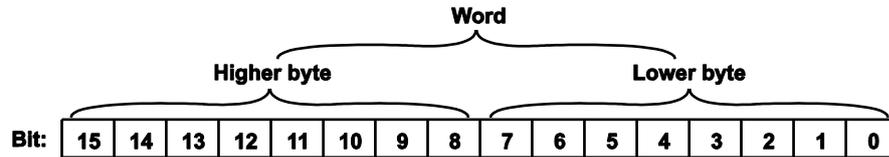
In this area the emergency messages are saved.

4.3.7.4 awDiagData for PROFINET IO

The ARRAYS of WORD contain the following diagnostic information.

ARRAY [0]: device status

For ARRAY [0], the word stores device status as logical bits.



| Bit | Description |
|---------|--------------------------------------|
| 0 | IO device does not exist |
| 1 | IO device not ready |
| 2 | IO device configuration fault |
| 3 | IO device invalid response |
| 4 | IO device parameter fault |
| 5 | IO device deactivated |
| 6 | Diagnosis data present for IO device |
| 7 | Diagnosis disappeared |
| 8 | Diagnosis buffer overflow |
| 9 | Diagnosis buffer overwritten |
| 10 | Packet too small |
| 11 | ModuleDiffBlock present |
| 12...15 | Not used; set to 0 |

ARRAY [1]: length of diagnosis

ARRAY [3...9]: diagnosis data

This buffer contains the raw diagnosis data directly taken from the bus. No swapping is done by the firmware.

Chapter 5

Specifications

5.1 General specifications

| Item | Description |
|---------------------------|--|
| Operating temperature | 0–+55°C |
| Storage temperature | -20–+70°C |
| Operating 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 | 150kBaund, 250kBaund, 500kBaund |
| 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 |

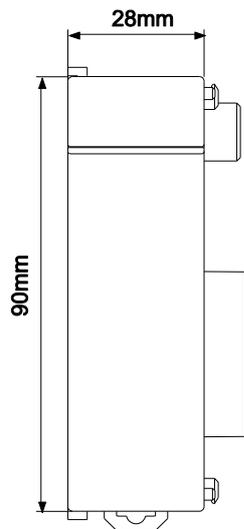
5.5 FP7 PROFINET IO-Controller

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

| Item | Description |
|--|---|
| Maximum number of total cyclic output data | 5760 bytes (including IOxS status bytes) |
| 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 |

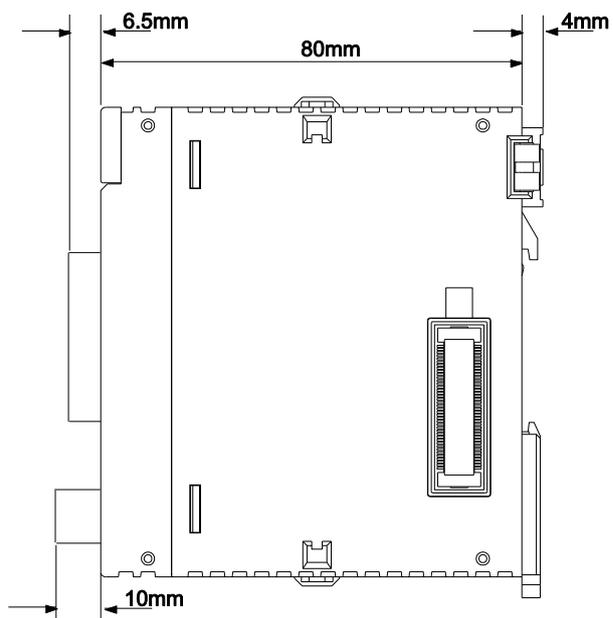
5.6 Dimensions

Front:

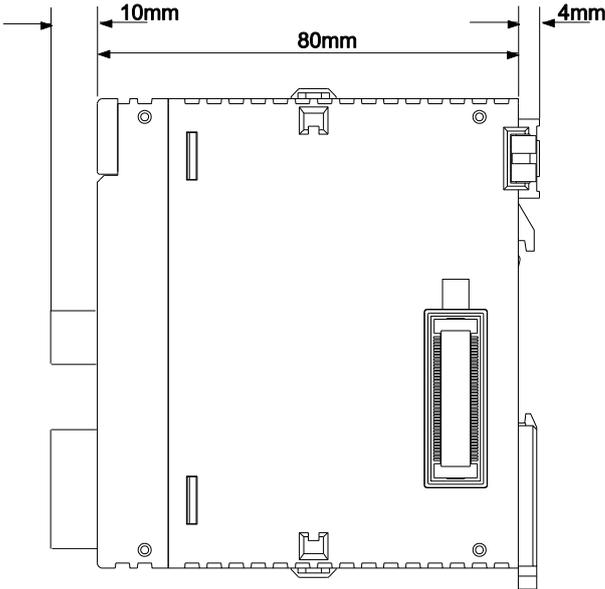


Side:

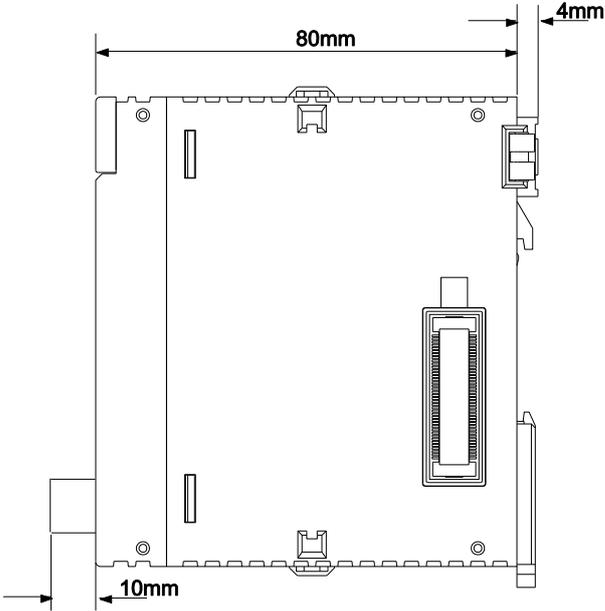
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