Panasonic®

PROGRAMMABLE LOGIC CONTROLLER

FMU

Technical Manual

BEFORE BEGINNING

Liability and Copyright for the Hardware

This manual and everything described in it are copyrighted. You may not copy this manual, in whole or part, without written consent of Panasonic Electric Works Europe AG (PEWEU).

PEWEU pursues a policy of continuous improvement of the design and performance of its products. Therefore we reserve the right to change the manual/product without notice. In no event will PEWEU be liable for direct, special, incidental, or consequential damage resulting from any defect in the product or its documentation, even if advised of the possibility of such damages.

We invite your comments on this manual. Please email us at:

tech-doc@eu.pewg.panasonic.com.

Please direct support matters and technical questions to your local Panasonic representative.

LIMITED WARRANTY

If physical defects caused by distribution are found, PEWEU will replace/repair the product free of charge. Exceptions include:

- When physical defects are due to different usage/treatment of the product other than described in the manual.

- When physical defects are due to defective equipment other than the distributed product.

- When physical defects are due to modifications/repairs by someone other than PEWEU.

- When physical defects are due to natural disasters.

Important Symbols

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

Warning!

- **The warning triangle indicates especially important safety instructions. If they are not adhered to, the results could be fatal or critical injury.**

◆CAUTION

Indicates that you should proceed with caution. Failure to do so may result in injury or significant damage to instruments or their contents, e.g. data.

◆NOTE

Contains important additional information.

◆EXAMPLE

Contains an illustrative example of the previous text section.

◆Procedure

Indicates that a step-by-step procedure follows.

◆REFERENCE

Indicates where you can find additional information on the subject at hand.

◆KEY POINTS

Summarizes key points in a concise manner.

◆SHORTCUTS

Provides helpful keyboard shortcuts.

◆EXPLANATION

Provides brief explanation of a function, e.g. why or when you should use it.

☛ next page

Indicates that the text will be continued on the next page.

Table of Contents

Chapter 1

Features and Restrictions

1.1 Fieldbus Master Units (FMU)

Fieldbus Master Units (FMU) are used together with the programmable controllers FP2/FP2SH and FPΣ. By exchanging the FMU, you can connect to various networking systems.

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

Name	Specifications	Part no.
FP2 PROFIBUS Master	PROFIBUS DP Master Expansion for FP2	FP2-DPV1-M
FP2 DeviceNet Master	DeviceNet Master Expansion for FP2	FP2-DEV-M
FP2 CANopen Master	CANopen Master Expansion for FP2	FP2-CAN-M
FPΣ PROFIBUS Master	PROFIBUS DP Master Expansion for FPΣ	FPG-DPV1-M
FPΣ DeviceNet Master	DeviceNet Master Expansion for FPΣ	FPG-DEV-M
FPΣ CANopen Master	CANopen Master Expansion for FPΣ	FPG-CAN-M

Software

Make sure you use at least version 5.3 of FPWIN Pro, into which the functions necessary for programming the FP-FMU blocks are integrated. You will require the add-on software "Control Configurator FM" (part no. AFPS35510) for Control FPWIN Pro in order to configure the fieldbus master units.

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 Expansion Restrictions and Current Limitations

1.2.1 Expansion Restrictions for the FP2 FMU

The number of FP2-FMUs is restricted by the size of the FP2 backplane.

1.2.2 Expansion Restrictions for the FPΣ FMU

The FPΣ FMUs are connected to the left side of the control unit via the FPΣ expansion connector. Up to 2 expansion units can be connected to the left side of the control unit.

1.2.3 Limitations on Current Consumption

The 5V DC power used to drive the internal circuit of each unit is supplied from the power supply unit of the FP2 through the internal bus of the backplane or from the FPΣ control unit through the expansion connector.

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 FP2 FMU

FP2 PROFIBUS DP Master Unit
FP2-DPV1-M (AFP27971)
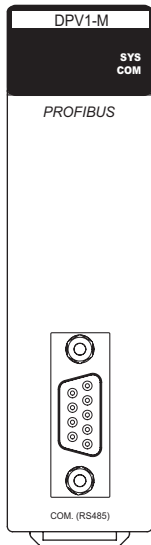
FP2 DeviceNet Master Unit
FP2-DEV-M (AFP27972)
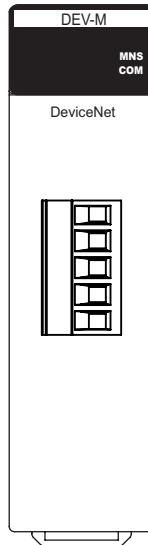
FP2 CANopen Master Unit
FP2-CAN-M (AFP27973)
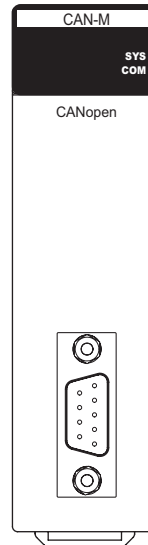
FP2 Fieldbus Master Units, front view
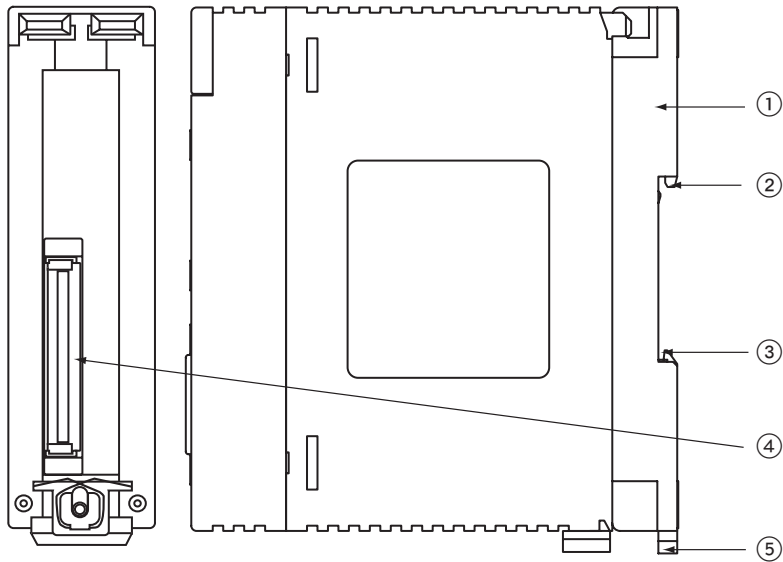
FP2 Fieldbus Master Units, back view, side view on backplane

① **Backplane**

② **DIN rail attachment lever**

③ **DIN standard rail attachment**

④ **Connector to the slot on the backplane**

⑤ **Expansion hook**

2.2 FPΣ FMU

FPΣ PROFIBUS DP Master Unit
FPG-DPV1-M (AFPG7971)
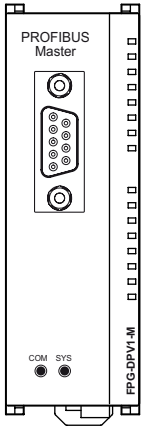
FPΣ DeviceNet Master Unit
FPG-DEV-M (AFPG7972)
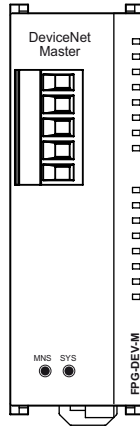
FPΣ CANopen Master Unit
FPG-CAN-M (AFPG7973)
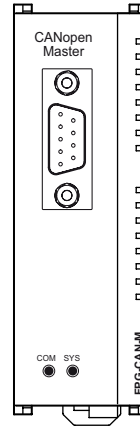
FPΣ Fieldbus Master Units, front view
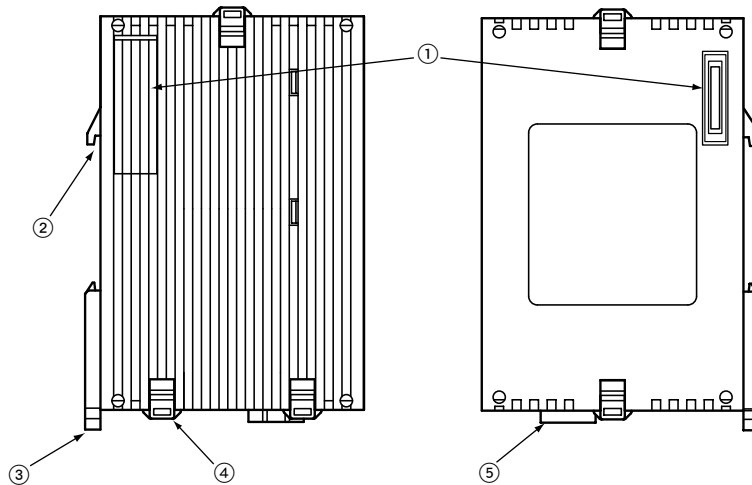
FPΣ Fieldbus Master Unit, side views

① **FPΣ expansion connector**

Used to connect the unit to the **control unit or other expansion units.**

② **DIN standard rail attachment**

③ **DIN rail attachment lever**

Used for easy attachment to a DIN rail. The lever is also used for installation on the FP0 slim 30 type mounting plate (part no. AFP0811).

④ **Expansion hook**

Used to secure an expansion unit. The hook is also used for installation on the FP0 flat type mounting plate (part no. AFP0804).

⑤ **Function earth connector**

At least one of the 2 pins must be connected to function earth to achieve proper EMC behavior.

The FPΣ-FMU is connected to the left side of the control unit via the FPΣ expansion connector.

2.3 FP-FMU LEDs and Connectors
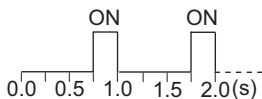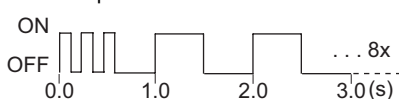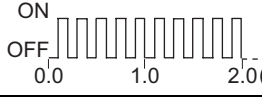
Various FP Fieldbus Master Units (FMUs) are available to meet your networking needs.

LEDs

Two dual-color LEDs give you a quick overview of the FMU's status at a glance:

- **SYS** (for DeviceNET **MNS**). Defines the general status of the FMU. For the hardware, yellow means the self-test has been passed and the firmware loaded. Green is used for application oriented functions such as valid configuration loaded.

- **COM**. Shows communication errors or status and communication activities. See subsequent sections for details.

SYS/MNS LED

Color	State	Indication
Off	No power.	
Yellow	Flashing (1Hz).	FMU is in bootloader mode and is waiting for firmware download.
	Flashing (5Hz).	Firmware download in progress.
	Acyclic flashing. (3 times fast at 5Hz, 8 times between 0.5Hz and 1Hz.) For example:	Hardware or severe runtime error detected. FMU or firmware needs replacement. Contact your Panasonic representative.
Green	ON.	FMU has established at least one configured fieldbus connection.
	Flashing (5Hz).	No error in configuration found. The FMU is online and ready for fieldbus communication, but connection to a fieldbus device has not been established.
	Acyclic flashing. (3 times fast at 5Hz, 8 times between 0.5Hz and 1Hz.) For example:	• Power up. Configuration missing and FMU needs commissioning. • Runtime. Firmware has found a critical link problem, e.g. host watchdog timeout.
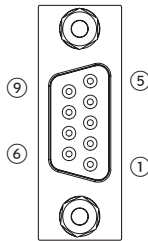
2.3.1   FP-PROFIBUS DP

SYS LED (see page 10)

COM LED

Color	State	Indication
Yellow	ON.	FMU is holding the PROFIBUS token and is able to transmit PROFIBUS telegrams.
	Acyclic flashing. (Between 0.5Hz and 100Hz.)	FMU is sharing the PROFIBUS token with other master devices in the PROFIBUS network.
	OFF.	FMU is not configured or has not received permission to hold the token in the PROFIBUS network.
Red	ON.	FMU has detected a communication problem with at least one PROFIBUS slave device. Connection timeout.

PROFIBUS connector, DB9F, 9-pin Sub-D female

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	• FPΣ: Internally connected to the function earth connector of the FMU. • FP2: Internally connected to the earth terminal of the power unit.

☞ ◆**NOTE**

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

2.3.2   FP-DeviceNet

MNS LED (see page 10)

COM LED

Color	State	Indication
Green	ON	FMU is operational and online, connections established. • FMU is allocated to another master. • FMU has established a connection to a slave.
	Flashing (1Hz) ON ON 0.0 0.5 1.0 1.5 2.0(s)	FMU is operational and online, no connection established. • Configuration missing. • FMU has passed the duplicate MAC ID check but has not established connection to another device.
Red	ON	FMU cannot access the network. • BUS off because of severe CAN faults. • Duplicate MAC ID detected.
OFF	—	FMU is not online. • Duplicate MAC ID test not completed. • Power may not be supplied.

DeviceNet Connector

Connector	Pin	Signal	Description
⑤ ①	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.
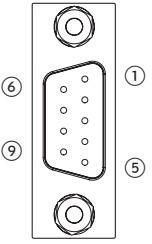
2.3.3   FP-CANopen

SYS LED (see page 10)

COM LED

Color	State	Indication
Yellow	ON	FMU is currently sending a CAN telegram.
	OFF	FMU has finished sending a CAN telegram.
Red	ON	FMU has detected a communication problem with at least one CANopen node device. Connection timout.

CANopen Interface

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		

Chapter 3

Specifications

3.1 FMU General Specifications

Item	Description
Operating temperature	0 to +55°C/32 to +131°F
Storage temperature	-20 to +70°C/-4 to +158°F
Operating humidity	30 to 85% RH (non-condensing)
Storage humidity	30 to 85% RH (non-condensing)
Vibration resistance	10 to 55Hz, 1 cycle/min: double amplitude of 0.75mm/0.030in., 10 min. on 3 axes
Shock resistance	Shock of 98m/s$_2$ or more, 4 times on 3 axes
Operation condition	Free from corrosive gases and excessive dust
Current consumption (5V)	FP2-DPV1-M: 450mA FP2-CAN-M: 450mA FP2-DEV-M: 150mA
Current consumption (24V)	FPΣ-DPV1-M: 135mA FPΣ-CAN-M: 135mA FPΣ-DEV-M: 45mA
Weight	FP2-DPV1-M: 118g FP2-CAN-M: 118g FP2-DEV-M: 118g FPΣ-DPV1-M: 95g FPΣ-CAN-M: 95g FPΣ-DEV-M: 95g

3.2 FP-PROFIBUS DP Communication Specifications

The following table lists limits for communication when using the FP-PROFIBUS DP FMU.

Item	Limit
No. DP slaves	127 (address range 0-126) Address 127 = broadcast address Address 126 = slave with changeable default address Address 0 = Master class 2 default address
No. of process data per slave	244 input and 244 output bytes
Max. number of process data	3584 bytes input, 3584 bytes output
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
Max. number of modules per modular slave	244
Baud rates supported	9.6kBaud, 19.2kBaud, 31.25kBaud, 45.45kBaud, 93.75kBaud, 187.5kBaud, 500kBaud, 1.5MBaud, 3MBaud, 6MBaud, 12MBaud
Min. DP scan cycle time	350μs

3.3 FP-DeviceNet Communication Specifications

Item	Limit
No. of slaves	63
No. of bytes for I/O data	7168 (input 3584, output 3584)
Baud rates supported	150kBaud, 250kBaud, 500kBaud
Additional features	- Polling, bit-strobe - Cyclic, COS (change of state) - UCMM via groups 1, 2, 3 - Predefined connection set

3.4 FP-CANopen Communication Specifications

Technical compliance to specification DS 301 version 4.01

Services supported	Services not supported
Physical layer	Bootup protocol, no reaction to bootup events of a node.
CAN frame types 11 bits	Optional high resolution synchronization protocol
Read/Write PDO protocol	Optional SDO block up/download protocol
Trigger for PDO transmission, event driven and remotely requested, transmission modes synchronous and asynchronous.	Timer triggered PDO transmission
PDO mapping in accordance with DS 301, V3.0 and V4.01	Dynamic SDO establishment
Emergency message collection	Multiplexed PDOs, MPDO protocol
NMT functionality, supporting Reset_Communication, Start_Remote_Node, Stop_Remote_Node and Enter_Preoperational.	Reading identity object of a node for identification
SYNC protocol	TIME protocol
Node guarding protocol	Verify configuration boot-up process
Optional heartbeat protocol	Boot-up process in accordance with DS 302, NMT master
SDO up/download protocol	Coexistence of a second NMT master
Simple boot-up process, reading object 1000H for identifying	Modular devices
	Synchronous counter for SYNC protocol

Limits of the implementation

The following device-specific limitations apply to the CANopen implementation.

Item	EC1-based product
Max. size for complete dynamic configuration via message interface	59000 bytes
Max. size for node parameter data set via message interface	9600 bytes
Max. number of PDOs per node (send and receive)	64
Max. number of receive PDOs per node (master sends PDO to node)	32
Max. number of transmit PDOs requested via RTR per node (node sends PDO to master)	20
Max. SDO configuration per node	9000 bytes
I/O area size for CANopen network for each direction	3584 bytes
Baud rates supported	10kBaud, 20kBaud, 50kBaud, 100kBaud, 125kBaud 250kBaud, 500kBaud, 800kBaud, 1MBaud

The following limitations apply to the CANopen specification.

Item	EC1-based product
Max. number of devices in CANopen network	127
Max. data count per PDO	8 bytes

PDO data sent from a node will not be cleared in the receive process data interface of the CANopen master if the node disappears from the network.

Additional features for the CANopen master

- 127 nodes

- 7168 bytes I/O data

- Min. boot-up

- COB ID distribution: default/via SDO

- Emergency message

- Node/life guarding, heartbeat

- Event trigger

- PDO: cyclic, acyclic, asynchronous

- Remote request

Chapter 4

Installation and Wiring

4.1 Installation of the FP2/FPΣ Unit

Warning!
Read the following notes carefully before installing the unit!

Failure to follow these instructions could lead to fire or damage the equipment.

Installation environment

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

Avoid installing the unit in the following locations:

- Ambient temperatures outside the range of 0°C to 55°C/32°F to 131°F

- Ambient humidity outside the range of 30% to 85% RH (at 25°C, non-condensing)

- 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

- Excessive vibration or shock

- Direct sunlight

- Water or oil in any form including spray or mist

Static electricity

- Before touching the unit or equiprment, always touch some grounded metal to discharge any static electricity you may have generated (especially in dry locations). The discharge of static electricity can damage parts and equipment.

Avoid noise interference from the following sources:

- Influence from power transmission lines, high voltage equipment, power cables, power equipment, radio transmitters, or any other equipment that would generate high switching surges.

- If noise occurs in the power supply line even after the above countermeasures are taken, it is recommended to supply power through an insulation transformer, noise filter, or the like.

Cleaning

- Do not use thinner based cleaners because they deform the unit case and fade the

colors.

Measures regarding heat discharge

- Always install the CPU orientated with the TOOL port facing outward on the bottom in order to prevent the generation of heat.
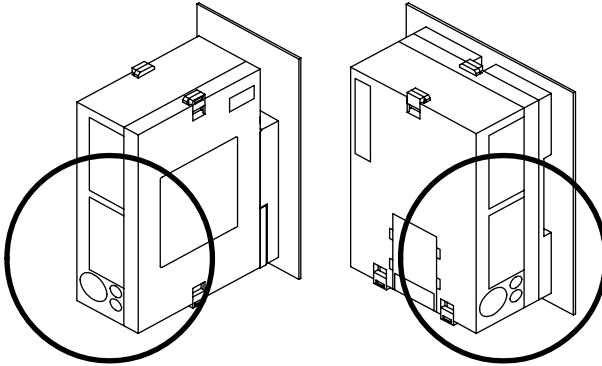
- Do **NOT** install the CPU as shown below.
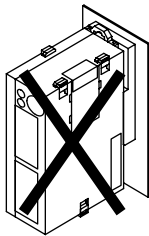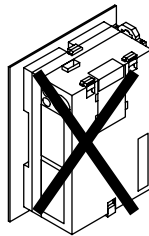
Upside-down   Air duct blocked
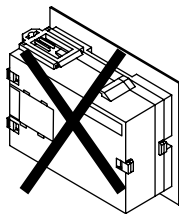
Input and output
connectors face down
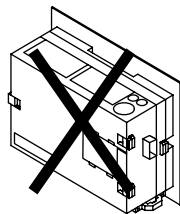
Input and output
connectors on top
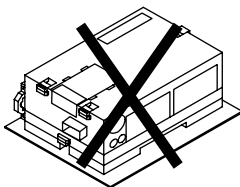
Horizontal
installation of the unit

- Do not install the unit above devices which generate heat such as heaters, transformers

or large scale resistors.

Installation space

- Leave at least 50mm/1.97in. of space between the wiring ducts of the unit and other devices to allow heat radiation and unit replacement.

50 mm/1.97 in. or more

50 mm/1.97 in. or more
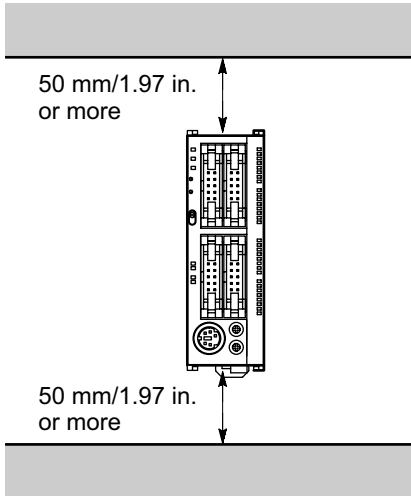
- Maintain a minimum of 100mm/3.937in. between devices to avoid adverse affects from noise and heat when installing a device or panel door to the front of the unit.

100 mm/ 3.937 in. or more

PLC unit

Other device

Panel door
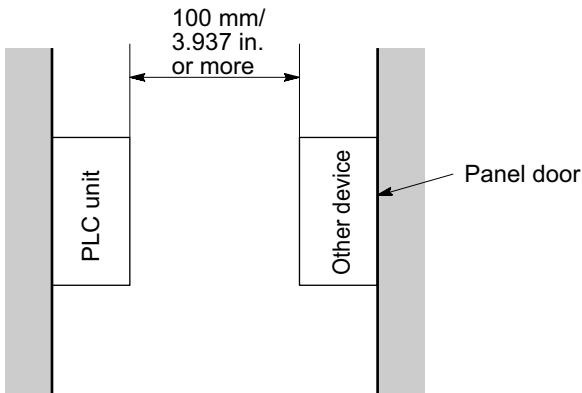
- For the FP2/FP2SH, keep the first 170mm from the PLC front surface clear of objects to allow the connecting of programming tools. For the FPΣ, the distance should be at least 130mm.

Approx. 110mm

CPU

FP PC cable

170mm or more
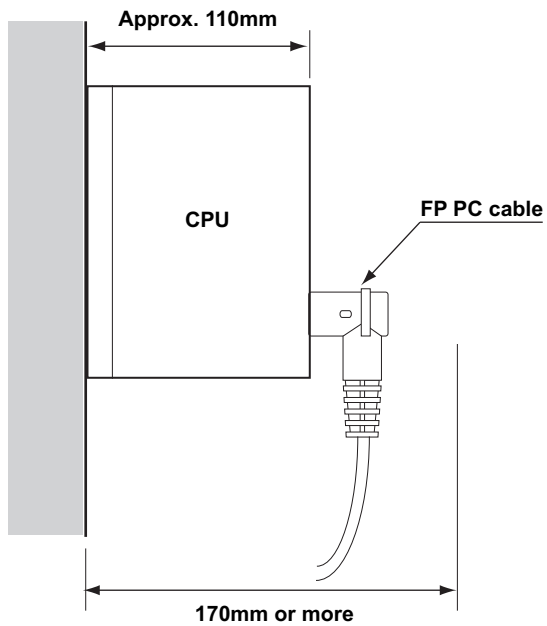
4.2 Mounting Methods

FPΣ-FMU

You can attach up to 4 expansion units, including the FPΣ-FMU (max. FMUs = 2), to the left side of the FPΣ CPU. You can mount all units on a DIN rail.

♦**REFERENCE**

> **For more information, please refer to the FPΣ User's Manual.**

FP2-FMU

Install the FP2-FMU on the FP2 backplane. You can mount the backplane on a DIN rail.

♦**REFERENCE**

> **For more information, please refer to the FP2 Hardware Manual.**

4.3 Cable Selection

Select a cable suitable for the network used.

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

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

DeviceNet
Use a standard DeviceNet cable.
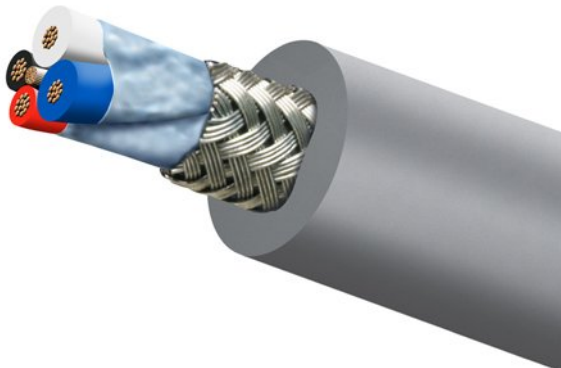
The round cable contains five wires: one twisted pair (red and black) for 24V DC power, one twisted pair (blue and white) for signal, and a drain wire (bare).

You can find proposals for standard cables on the Open DeviceNet Vendor Association's Web site (ODVA): http://www.odva.org. (http://www.odva.org/default.aspx?tabid=84)

4.4 Wiring of the FP-FMU Connectors

4.4.1 PROFIBUS DP Wiring

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

4.4.2 DeviceNet Wiring

Open style connector/suitable wire
DeviceNet has a standard open style connector.

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

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

Terminal block for DeviceNet

For a suitable wire, please refer to cable selection (see page 27).

Wiring method
Attach a plug-in, open style connector to a cable.

◆**Procedure**

1. **Strip 65mm (2.6in.) to 75mm (3in.) of the outer jacket from the end of the cable, leaving no more than 6.4mm (0.25in.) of the braided shield exposed.**
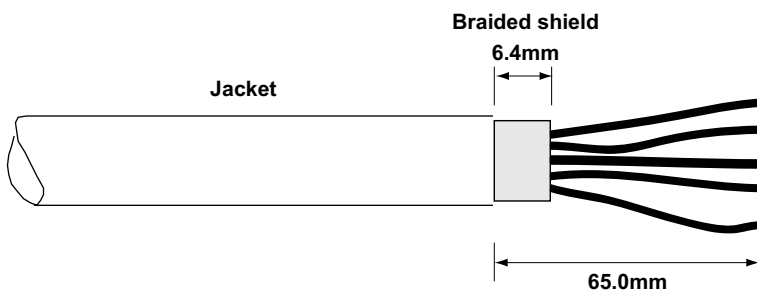
2. **Wrap the end of the cable with 38mm (1.5in.) of shrink wrap, covering part of the exposed conductors and part of the trunk line insulation.**
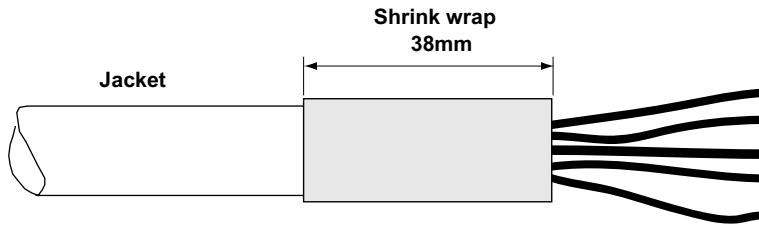
3. **Strip 8.1mm (0.32in.) of the insulation from the end of each of the insulated conductors.**
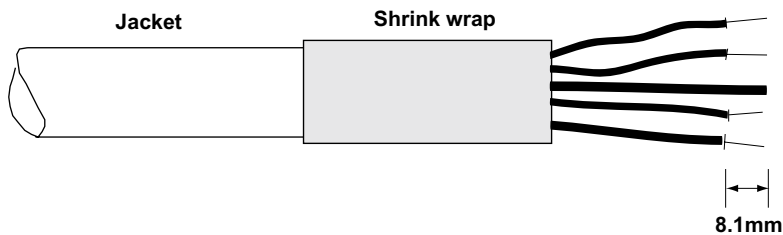
4. **Insert each conductor into the appropriate clamping cavity of the open style connector or the screw terminal on the device, according to the color of the cable insulation:**

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.**

☞ ◆**NOTES**

- **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.**

- **In the terminal block socket, make sure to clamp the wire in place by turning the tightening screw clockwise.**

OK
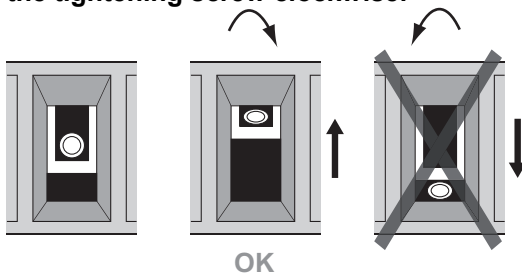
4.4.3 CANopen Wiring

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

4.5 Wiring of the FPΣ FMU

The FPΣ-FMU has a screw terminal on its lower 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-3.5	18 40 36 6

Suitable wire

No. of wires	Size	Cross-sectional area
1	AWG 28-16	0.14-1.5 mm²

☞ **◆NOTE**

Either fixed or flexible wires can be used to connect the function earth.

Fixed wires with a diameter>0.14mm² and flexible wires with a wire end ferrule can be used.

Wiring method

◆CAUTION

- **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 from vibrations.**

- **After wiring, make sure stress is not applied to the wire.**

◆**Procedure**

1.   **Remove a portion of the wire's insulation.**

7mm

2.   **Insert the wire into the screw terminal.**

3.   **Clamp the wire in place by turning the tightening screw clockwise.**

OK
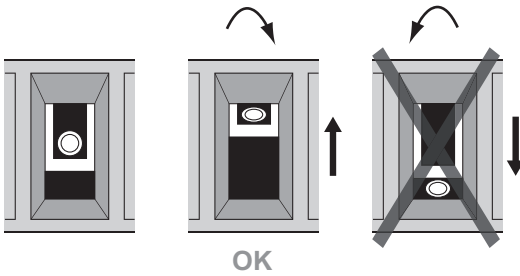
Chapter 5

Programming Information for Control FPWIN Pro

5.1 General Information

Make sure you use at least version 5.3 of FPWIN Pro, which includes the functions necessary for programming the FP-FMUs. The function blocks described in this section are used to configure the various FMUs and to start communication with the specific network.

The functions and function blocks can be used for either the FP2-FMU or FPΣ-FMU unit.

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

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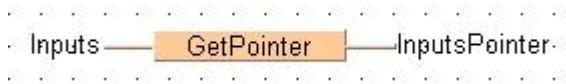
The GetPointer function outputs the size, area and offset of the input variable and writes it to the output variable of the type POINTER. Connect the output of this function directly to the respective input of the function block.

◆**REFERENCE**

For more information about the GetPointer function, please refer to the FPWIN Pro online help.

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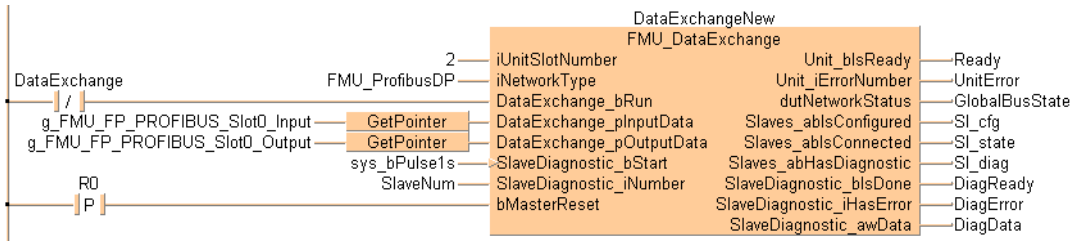
The FMU_DataExchange function block is used to start communication with the network. It has to be supplied with information about the input and output size, and network-specific data.

Just leave the pins unconnected that you do not require.

PLC types: available for FP2/FP2SH and FPΣ.

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.
INT	NetworkType	Use: • FMU_ProfibusDP • FMU_DeviceNet • FMU_CANopen Defined in the library as VAR_GLOBAL_CONSTANT.
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_bIsReady	ON if unit is ready.
INT	Unit_ErrorNumber	Unit is in error.
DUT	dutNetworkStatus	Depends on the network (see "dutNetworkStatus Output" on page 37).
BOOL[128]	Slaves_abIsConfigured	Depends on the network (see "Slaves_abIsConfigured Output" on page 48).
BOOL[128]	Slaves_abIsConnected	Depends on the network (see "Slaves_abIsConnected Output" on page 49).
BOOL[128]	Slaves_abHasDiagnostic	Depends on the network (see "Slaves_abHasDiagnostic Output" on page 50).

Data type	Output	Function
BOOL	SlaveDiagnostic_bIsDone	ON if done.
INT	SlaveDiagnostic_iHasError	Depends on the network (see "SlaveDiagnostic_iHasError Output" on page 53).
WORD[4]	SlaveDiagnostic_awData	Depends on the network (see "SlaveDiagnostic_awData Output" on page 54).

List of error codes for the function block FMU_DataExchange

Error code	Indication
16#0000	No error.
16#0001	Input data variable is too big.
16#0002	Output data variable is too big.
16#0003	Unit not available.

5.3.1   dutNetworkStatus Output

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

	Class	Identifier	Type	Initial
6	VAR	GlobalBusState	GlobalBusStateField	

DataExchangeNew
FMU_DataExchange

Input	Output
iUnitSlotNumber	Unit_bIsReady ── Ready
iNetworkType	Unit_iErrorNumber ── UnitError
DataExchange_bRun	dutNetworkStatus ── GlobalBusState
DataExchange_pInputData	Slaves_abIsConfigured ── SI_cfg
DataExchange_pOutputData	Slaves_abIsConnected ── SI_state
SlaveDiagnostic_bStart	Slaves_abHasDiagnostic ── SI_diag
SlaveDiagnostic_iNumber	SlaveDiagnostic_bIsDone ── DiagReady
bMasterReset	SlaveDiagnostic_iHasError ── DiagError
	SlaveDiagnostic_awData ── DiagData

GlobalBusStateField [DUT]

	Identifier	Type	Initial
0	GlobBit_Status	WORD	0
1	ErrRemAddr_ErrEvent	WORD	0
2	BusErrorCnt	INT	0
3	TimeOutCount	INT	0
4	MoreInformation	ARRAY [0..3] OF W...	[4(0)]

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

- PROFIBUS (see page 38)

- DeviceNET (see page 41)

- CANopen (see page 45)

5.3.1.1   GlobalBusStateField for PROFIBUS

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: • 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.
Current master address	MoreInformation	Lower byte of ARRAY [0] of WORD. Contains the current active master address.
Master protocol chip online	MoreInformation	Higher byte of ARRAY [0] of WORD. This variable reflects the current status of the master protocol chip. If the value is 0, the chip is in the offline state; if the value is 1, the chip is on the online state. The variable is updated cyclically.

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 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 ist NOT ready to communicate.
6	**Timeout error**. The FMU has detected an overstepped timout supervision time due to rejected PROFIBUS telegramms. 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 parameters.	Project planning	Download database again.
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	Project planning	Check projected addresses.

ErrEvent	Explanation	Source of error	Recommendation
	receive process data.		
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.
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.

5.3.1.2   GlobalBusStateField for DeviceNet

	Identifier	Type	Initial
	GlobalBusStateField [DUT]		
	Identifier	Type	Initial
0	GlobBit_Status	WORD	0
1	ErrRemAddr_ErrEvent	WORD	0
2	BusErrorCnt	INT	0
3	TimeOutCount	INT	0
4	MoreInformation	ARRAY [0..3] OF W...	[4(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: • 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.
Server status	MoreInformation	Lower byte of ARRAY [0] of WORD. The FMU is able to be a I/O server and master simultaneously. The status of the server poll I/O connection and the explicit connection can be read from this variable. • Bit 0 = current status of the server explicit connection. • Bit 1 = current status of the server poll I/O connection. • Bits 2-7 are reserved.

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 ist 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.	
212	Failure reading the database.		Contact technical support.
220	User watchdog failed.	Application.	
221	No data acknowledgement 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 response unequal to 4.	Device	Device cannot operate with the FMU and norm description.
41	Predefined master-slave connection already exits.	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.

ErrEvent	Explanation	Source of error	Recommendation
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.
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: • 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.

ErrEvent	Explanation	Source of error	Recommendation
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, bit strobed 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 less than the value for production inhibit time.	Configuration	The value for the expected packet rate must be larger than the production inhibit time. In Control Configurator FM, check the settings for the slave's poll connection configuration.

5.3.1.3 GlobalBusStateField for CANopen

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: • 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.
Message Time Out	MoreInformation	ARRAY [0] of WORD. Number of cancelled CAN messages because partner did not acknowledge.

Identifier part	Identifier	Explanation
Receive message overflow	MoreInformation	ARRAY [1] of WORD. Number of receive message overflows indicated from the CAN chip.

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 ist 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.
210	No database.	Project planning	Download database again.
212	Faulty reading of a database.	Device	Download database again.

ErrEvent	Explanation	Source of error	Recommendation
220	Host watchdog error.	Host program	Check user program or watchdog timer.

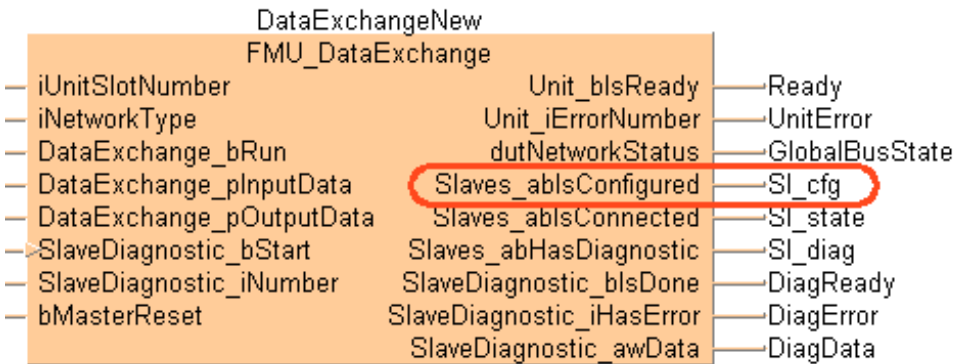The following error numbers are valid for the error event if "Error remote address" is not equal to 255.

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.

5.3.2   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	Comment
4	VAR	SI_cfg	ARRAY [0..127] OF BOOL	[128(FALSE)]	
5	VAR	SI_state	ARRAY [0..127] OF BOOL	[128(FALSE)]	
6	VAR	SI_diag	ARRAY [0..127] OF BOOL	[128(FALSE)]	

```
                     DataExchangeNew
                    FMU_DataExchange
─ iUnitSlotNumber                    Unit_bIsReady ──── Ready
─ iNetworkType                   Unit_iErrorNumber ──── UnitError
─ DataExchange_bRun                 dutNetworkStatus ──── GlobalBusState
─ DataExchange_pInputData        Slaves_abIsConfigured ──── SI_cfg
─ DataExchange_pOutputData       Slaves_abIsConnected ──── SI_state
─ SlaveDiagnostic_bStart          Slaves_abHasDiagnostic ──── SI_diag
─ SlaveDiagnostic_iNumber         SlaveDiagnostic_bIsDone ──── DiagReady
─ bMasterReset                   SlaveDiagnostic_iHasError ──── DiagError
                                 SlaveDiagnostic_awData ──── DiagData
```

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

- SI_cfg for PROFIBUS (see page 48)
- SI_cfg for DeviceNet (see page 48)
- SI_cfg for CANopen (see page 49)

5.3.2.1   SI_cfg for PROFIBUS

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

5.3.2.2   SI_cfg for DeviceNet

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

5.3.2.3   SI_cfg for CANopen

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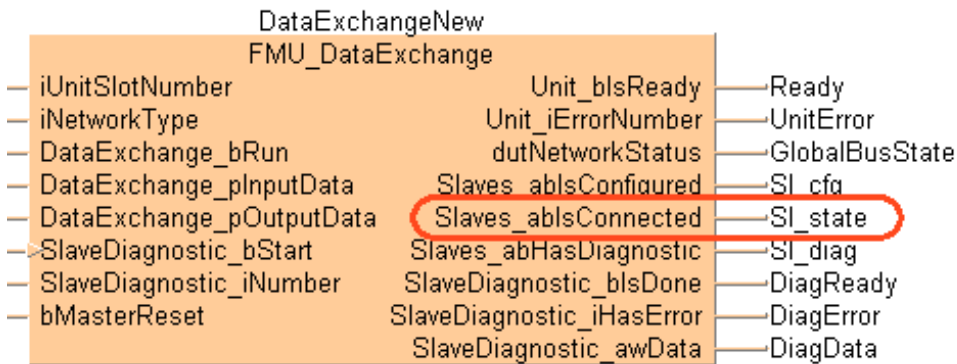
The bit for the corresponding node is logical:

- 1 = the node is configured in the FMU.

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

5.3.3   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	Comment
4	VAR	SI_cfg	ARRAY [0..127] OF BOOL	[128(FALSE)]	
5	VAR	SI_state	ARRAY [0..127] OF BOOL	[128(FALSE)]	
6	VAR	SI_diag	ARRAY [0..127] OF BOOL	[128(FALSE)]	

```
                    DataExchangeNew
                  FMU_DataExchange
 — iUnitSlotNumber                    Unit_bIsReady    ——Ready
 — iNetworkType                    Unit_iErrorNumber   ——UnitError
 — DataExchange_bRun                dutNetworkStatus   ——GlobalBusState
 — DataExchange_pInputData      Slaves_abIsConfigured  ——SI_cfg
 — DataExchange_pOutputData      Slaves_abIsConnected  ——SI_state
 —▷SlaveDiagnostic_bStart       Slaves_abHasDiagnostic ——SI_diag
 — SlaveDiagnostic_iNumber       SlaveDiagnostic_bIsDone——DiagReady
 — bMasterReset                SlaveDiagnostic_iHasError——DiagError
                                SlaveDiagnostic_awData  ——DiagData
```

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

5.3.3.1   SI_state for PROFIBUS

This variable is an ARRAY [0...127] of BOOL, i.e. a field of 8 words, and contains the parametrization 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 SI_state are only valid if the master is in the OPERATE state.

5.3.3.2   SI_state for DeviceNet

This variable is an ARRAY [0...127] of BOOL, i.e. a field of 8 words, and contains the parametrization 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 SI_state 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

5.3.3.3   SI_state for CANopen

This variable is an ARRAY [0...127] of BOOL, i.e. a field of 8 words, and contains the parametrization 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 SI_state are only valid if the master is in the OPERATE state.

5.3.4   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.

	Class	Identifier	Type	Initial	Comment
4	VAR	SI_cfg	ARRAY [0..127] OF BOOL	[128(FALSE)]	
5	VAR	SI_state	ARRAY [0..127] OF BOOL	[128(FALSE)]	
6	VAR	SI_diag	ARRAY [0..127] OF BOOL	[128(FALSE)]	
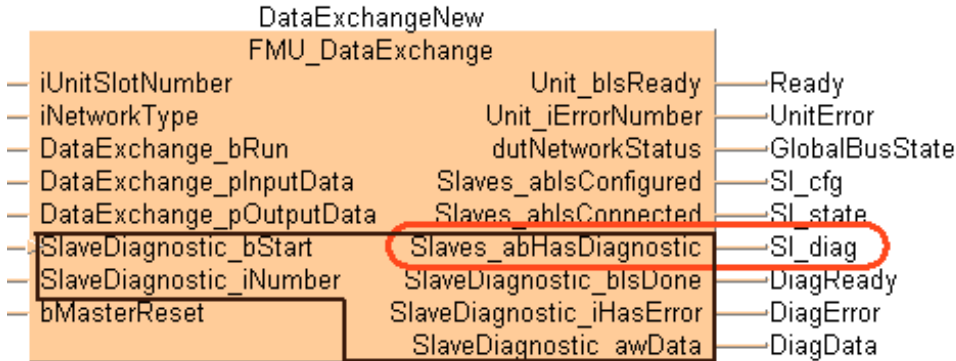
In this example, the identifier is **SI_diag**. This variable is used for all network types, but the information stored in the variable is nevertheless network-specific:

- SI_diag for PROFIBUS (see page 51)

- SI_diag for DeviceNET (see page 52)

- SI_diag for CANopen (see page 51)

5.3.4.1 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 SI_state are only valid if the master is in the OPERATE state.

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

	SI_state = 0	SI_state = 1
SI_diag = 0	• No data I/O exchange between master and slave. Perhaps this slave is not configured or not responsive.	• Slave is present on the bus. • Data I/O exchange between master and slave.
SI_diag = 1	• The master and the corresponding slave are not exchanging I/O data. • The master holds newly received diagnostic data in the internal diagnostic buffer.	• 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.

5.3.4.2 SI_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 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 SI_state are only valid if the master is in the OPERATE state.

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

	SI_state = 0	SI_state = 1
SI_diag = 0	• Device not operative, no process data exchange between FMU and device. • Device is not configured.	• Device is present on the network, device guarding active. • Process data exchange between FMU and device happening as configured.
SI_diag = 1	• 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.	• 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.

5.3.4.3 SI_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 SI_state are only valid if the master is in the OPERATE state.

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

	SI_state = 0	SI_state = 1
SI_diag = 0	• Node not in operation, no data I/O exchange between master and node. Perhaps this slave is not configured.	• Node is present on the bus; node guarding is active. • PDO exchange between master and node is happening as configured.
SI_diag = 1	• Node is not operating; node guarding failed. • The master holds newly received diagnostic data in the internal diagnostic buffer.	• Node is present on the bus, node guarding is active, PDO exchange. • The master holds newly received diagnostic data in the internal diagnostic buffer.

5.3.5   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.
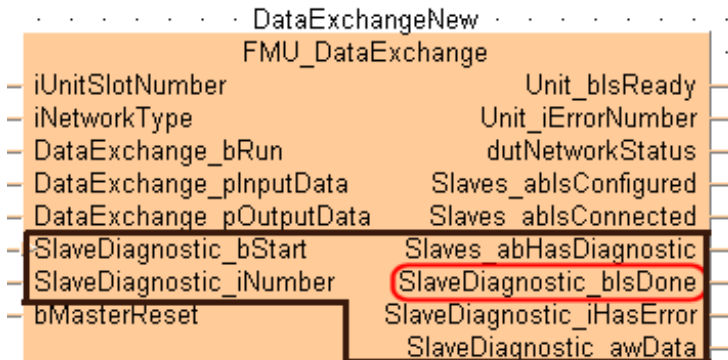
As long as the bit is set to 0, check at **SlaveDiagnostic_iHasError** (see "SlaveDiagnostic_iHasError Output" on page 53) to find out where the error is.

5.3.6   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.
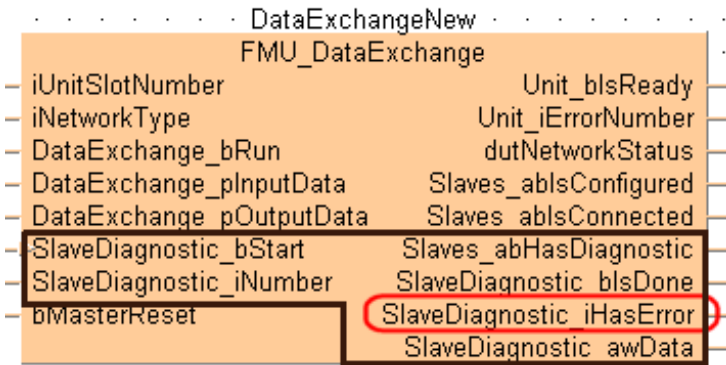
The integer stores the error code.

Error	Indication	Network	Source	Recommendation
0	No error.	All		
17	No response from slave.	PROFIBUS	Slave	• Check network wiring. • Check bus address of slave. • Check baud rate setting.
18	Master not in logical token ring.	PROFIBUS	Network in general	• Check master DP address or highest-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.

5.3.7   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...3] of WORD.
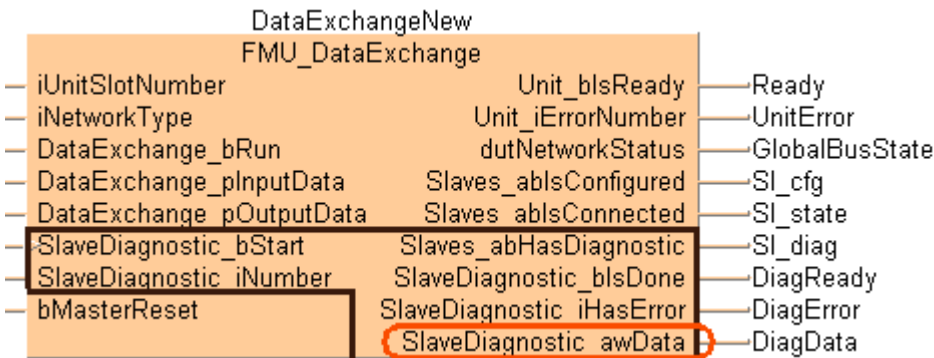
In this example, the identifier is **DiagData**. This variable is used for all network types, but the information stored in the variable is nevertheless network-specific:

- DiagData for PROFIBUS (see page 55)

- DiagData for DeviceNET (see page 56)

- DiagData for CANopen (see page 58)

5.3.7.1 DiagData 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.
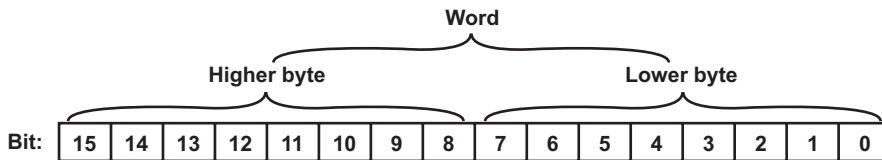
Bit	Description
0	Slave not responding.
1	Slave not ready.
2	Slave parameterized improperly.
3	Extended diagnostic area in ARRAY [3] of WORD used.
4	Unknown command detected by slave.
5	Inplausible response from slave.
6	Last parameter telegram faulty.
7	Slave parameterized by another master.
8	Slave 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]: addtional 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 doagnostic 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.

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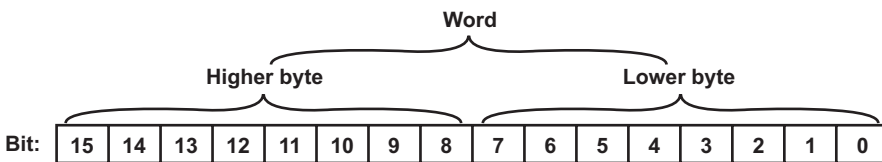
Bit	Description
0	Device not responding.
1	Reserved by system.
2	Device had denied access to at least one configured attribute to write in.
3	Difference between device produced and consumed connection size to the resulting configured ones.
4-6	Reserved by system.
7	Device is deactivated in current configuration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

Value	Description
12	Wait for I/O connection release response.
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 (see page 41).

ARRAY [1], higher byte: general error codes

The higher byte ARRAY [1] provides more detailed general error codes if the value for Err_Event (see page 41) 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.

5.3.7.3 DiagData 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.
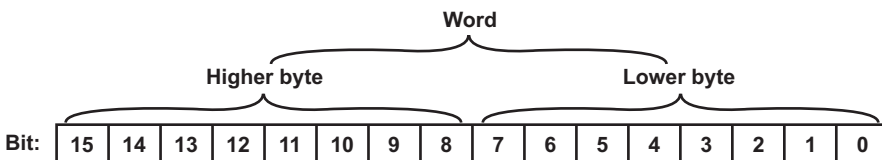
Bit	Description
0	Node not responding.
1	Emergency buffer overflow.
2	Difference between master and node configuration data.

Bit	Description
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 (see page 45) 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...23]: emergency messages

In this area the emergency messages are saved.

5.4 FMU_GetUnitInfo

The FMU_GetUnitInfo function block is used to obtain information about the specified unit in the network.
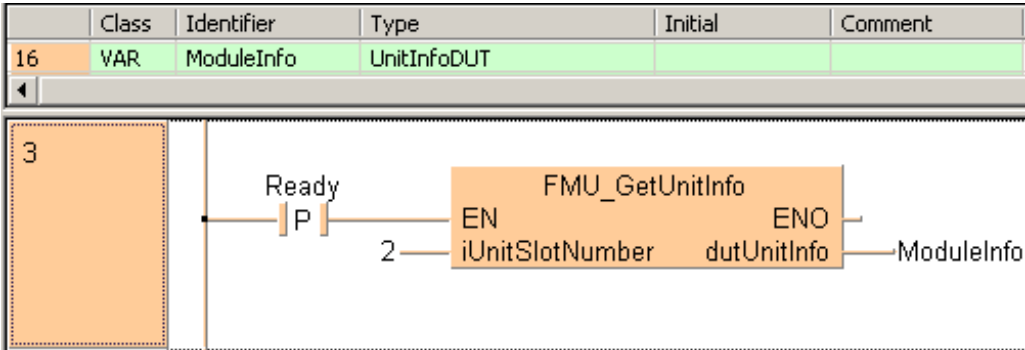
	Class	Identifier	Type	Initial	Comment
16	VAR	ModuleInfo	UnitInfoDUT		

PLC types: available for FP2/FP2SH and FPΣ.

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

Pin

Data type	Input/Output	Function
INT	iUnitSlotNumber	Installation position of the unit.
DUT	dutUnitInfo	The DUT attached consists of several variables of the data type STRING that contain information about the unit specifed.

Connected to the output pin **dutUnitInfo** is the variable **ModuleInfo**, which in turn is part of the DUT **UnitInfo** included in the FMU library for Control FPWIN Pro.

UnitInfoDUT [DUT]

	Identifier	Type	Initial	Comment
0	sProductionDate	STRING[8]	"	
1	sDeviceNumber	STRING[8]	"	
2	sSerialNumber	STRING[8]	"	
3	sFirmwareName	STRING[16]	"	
4	sFirmwareVersion	STRING[16]	"	

This DUT is used for all network types

Chapter 6

Outline Dimensions

6.1 Outline Dimensions of the FP2 FMU

Front

Side

6.2 Outline Dimensions of the FPΣ FMU

Front

Side

Index

Record of Changes

Manual No.	Date	Description of changes
ACGM0161V10EN	July 2008	First edition

Panasonic Electric Works Global Sales Companies

Europe

▶ Headquarters	**Panasonic Electric Works Europe AG**	Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. +49(0)8024648-0, Fax +49(0)8024648-111, www.panasonic-electric-works.com
▶ Austria	**Panasonic Electric Works Austria GmbH**	Rep. of PEWDE, Josef Madersperger Str. 2, 2362 Biedermannsdorf, Tel. +43(0)223626846, Fax +43(0)223646133, www.panasonic-electric-works.at
	PEW Electronic Materials Europe GmbH	Ennshafenstraße 9, 4470 Enns, Tel. +43(0)7223883, Fax +43(0)722388333, www.panasonic-electronic-materials.com
▶ Benelux	**Panasonic Electric Works Sales Western Europe B.V.**	De Rijn 4, (Postbus 211), 5684 PJ Best, (5680 AE Best), Netherlands, Tel. +31(0)499372727, Fax +31(0)499372185, www.panasonic-electric-works.nl
▶ Czech Republic	**Panasonic Electric Works Czech s.r.o.**	Prumtyslová 1, 34815 Planá, Tel. (+420-)374799990, Fax (+420-)374799999, www.panasonic-electric-works.cz
▶ France	**Panasonic Electric Works Sales Western Europe B.V.**	French Branch Office, B.P. 44, 91371 Verrières le Buisson CEDEX, Tél. +33(0)16013 5757, Fax +33(0)1 6013 5758, www.panasonic-electric-works.fr
▶ Germany	**Panasonic Electric Works Deutschland GmbH**	Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. +49(0)8024648-0, Fax +49(0)8024648-555, www.panasonic-electric-works.de
▶ Hungary	**Panasonic Electric Works Europe AG**	Magyarországi Közvetlen Kereskedelmi Képviselet, 1117 Budapest, Neumann János u. 1., Tel. +36(0)14829258, Fax +36(0)14829259, www.panasonic-electric-works.hu
▶ Ireland	**Panasonic Electric Works UK Ltd.**	Dublin, Tel. +353(0)14600969, Fax +353(0)14601131, www.panasonic-electric-works.co.uk
▶ Italy	**Panasonic Electric Works Italia s.r.l.**	Via del Commercio 3-5 (Z.I. Ferlina), 37012 Bussolengo (VR), Tel. +390456752711, Fax +390456700444, www.panasonic-electric-works.it
	PEW Building Materials Europe s.r.l.	Piazza della Repubblica 24, 20154 Milano (MI), Tel. +39022900-5391, Fax +39022900-3466, www.panasonic-building-materials.com
▶ Nordic Countries	**Panasonic Electric Works Nordic AB**	Sjöängsvägen 10, 19272 Sollentuna, Sweden, Tel. +4659476680, Fax +46859476690, www.panasonic-electric-works.se
	PEW Fire & Security Technology Europe AB	Citadellsvägen 23, 21118 Malmö, Tel. +46406977000, Fax +46406977099, www.panasonic-fire-security.com
▶ Poland	**Panasonic Electric Works Polska sp. z o.o.**	Przedstawicielstwo w Polsce, Al. Krakowska 4/6, 02-284 Warszawa, Tel. +48 22 338-11-33, Fax +48 22 338-12-00, www.panasonic-electric-works.pl
▶ Portugal	**Panasonic Electric Works España S.A.**	Portuguese Branch Office, Avda Adelino Amaro da Costa 728 R/C J, 2750-277 Cascais, Tel. +351 214812520, Fax +351 214812529
▶ Spain	**Panasonic Electric Works España S.A.**	Barajas Park, San Severo 20, 28042 Madrid, Tel. +34 91 3293875, Fax +34 91 3292976, www.panasonic-electric-works.es
▶ Switzerland	**Panasonic Electric Works Schweiz AG**	Grundstrasse 8, 6343 Rotkreuz, Tel. +41(0)417997050, Fax +41(0)417997055, www.panasonic-electric-works.ch
▶ United Kingdom	**Panasonic Electric Works UK Ltd.**	Sunrise Parkway, Linford Wood, Milton Keynes, MK14 6LF, Tel. +44(0) 1908 231555, +44(0) 1908 231599, www.panasonic-electric-works.co.uk

North & South America

▶ USA	**PEW Corporation of America**	629 Central Avenue, New Providence, N.J. 07974, Tel. +1-908-464-3550, Fax +1-908-464-8513, www.pewa.panasonic.com

Asia Pacific / China / Japan

▶ China	**Panasonic Electric Works (China) Co., Ltd.**	2013, Beijing Fortune, Building No. 5, Dong San Huan Bei Lu, Chaoyang District, Beijing Tel. +86-10-6590-8646, Fax : + 86-10-6590-8647, www.cmew.com.cn
▶ Hong Kong	**Panasonic Electric Works (Hong Kong) Co., Ltd.**	RM1205-9, 12/F, Tower 2, The Gateway, 25 Canton Road, Tsimshatsui, Kowloon, Hong Kong, Tel. +852 2956-3118, Fax +852 2956-0398, www.panasonic.hk
▶ Japan	**Matsushita Electric Works, Ltd.**	1048 Kadoma, Kadoma-shi, Osaka 571-8686, Japan, Tel. +81-6-6908-1050, Fax +81-6-6908-5781 www.mew.co.jp/e-acg/
▶ Singapore	**Panasonic Electric Works Asia Pacific Pte. Ltd.**	101 Thomson Road, #25-03/05, United Square, Singapore 307591, Tel. +65-6255-5473, Fax +65-6253-5689