SIEMENS

SIMATIC

Distributed I/O
SIMATIC Compact Field Unit (CFU)
CFU PA; CFU DIQ

System Manual

Cybersecurity information 1

Digital nameplate 2

What is a Compact Field Unit? 3

Product overview 4

System planning 5

Functions 6

Installation 7

Connecting 8

Commissioning 9

Diagnostics of the CFU 10

Servicing and maintenance 11

Compact Field Unit in the housing for use in a hazardous area 12

Technical specifications 13

Appendix A

6ES7655-5PX11-1XX0
6ES7655-5PX11-1AX0
6ES7655-5PX31-1XX0
6ES7655-5PX31-1AX0

04/2024
A5E39252870-AG

Legal information

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⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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A5E39252870-AG
Ⓟ 04/2024 Subject to change

Table of contents

1 Cybersecurity information 11

2 Digital nameplate 13

3 What is a Compact Field Unit? 15

4 Product overview 21

4.1 Inclusion in the automation environment 21

4.2 Overview of the components 22
4.2.1 Overview of CFU PA 23
4.2.2 Overview of CFU DIQ 24
4.2.3 Mounting rail 25
4.2.4 BusAdapter 25

4.3 Front view of the CFU 26

4.4 2D Matrix code (QR code / EAN code) 28

5 System planning 29

5.1 Useful information 29
5.1.1 Rules for the operation 29
5.1.2 System change during operation 31
5.1.3 Use in hazardous areas 31
5.1.3.1 Deployment zones of the CFU types 32
5.1.3.2 Use in hazardous areas 33
5.1.3.3 Installation work in hazardous areas 34
5.1.4 PROFIBUS PA connectors: Voltage relationships (galvanic isolation) 36

5.2 Interfaces of the CFU types 36
5.2.1 Interfaces of the CFU PA 36
5.2.2 Interfaces of the CFU DIQ 37

6 Functions 39

6.1 Functions of the CFU types 39

6.2 Functions of DIQ channels 39
6.2.1 DIQ channel 39
6.2.2 Actuator shutdown 40
6.2.3 "Counter" and "Frequency measurement" operating modes 41
6.2.4 Counting 43
6.2.4.1 Gate control 44
6.2.4.2 Counter in operation (startup and stop) 45
6.2.4.3 Reaction to violation of the high counting limit 46
6.2.4.4 Behavior when the comparison value is reached (status bit STS_DQ and output DQ) 47
6.2.4.5 Loading the count value 50
6.2.5 Measure frequency 51

6.3 Functions of PROFIBUS PA channels 52
6.3.1 PROFIBUS PA channel 52

6.3.2 Function of the PROFIBUS PA channels (fieldbus FB) ... 52
6.3.3 PA profiles for field devices on PROFIBUS PA ... 53
6.3.4 IO and "Selected IO" for field devices ... 53
6.3.5 Service port ... 54
6.4 Time synchronization ... 54
7 Installation ... 57
7.1 Installation rules ... 57
7.2 Installing the mounting rail ... 58
7.3 Mounting the CFU ... 61
7.4 Removing the CFU ... 63
8 Connecting ... 65
8.1 Hardware-settings ... 65
8.2 Wiring rules ... 65
8.3 Connecting the power supply to the CFU ... 66
8.4 Connecting the cables ... 69
8.4.1 Selecting connection system ... 69
8.4.2 Preparing cables ... 69
8.4.3 Connecting the cable using push-in terminals ... 70
8.4.4 Connecting cables using screw terminals ... 71
8.5 Connecting the PROFIBUS PA field device ... 71
8.5.1 PROFIBUS PA field device: Connecting the cable shield to the CFU ... 72
8.6 Connecting digital sensor or actuator to the DIQ channel ... 72
8.7 Connecting the functional grounding to the CFU ... 75
8.8 Communication over PROFINET ... 76
8.8.1 Connecting the CFU to PROFINET IO ... 76
9 Commissioning ... 79
9.1 Switching on the CFU ... 79
9.2 Commissioning (overview of procedure) ... 80
9.3 PA field devices ... 82
9.3.1 PROFIBUS PA field device: Startup depending on the configuration ... 82
9.4 Sensors and actuators on DIQ channels ... 83
9.4.1 Configuration of the DIQ channels: Startup depending on the configuration ... 83
9.5 Configuring with PDM ... 84
9.5.1 Using the wizard for CFU configuration ... 84
9.5.2 "Commissioning Wizard: Complete" dialog ... 85
9.5.3 "Commissioning Wizard: Only add/remove/replace field devices" ... 87
9.5.4 "Maintenance Overview" dialog ... 87
9.5.5 "Help" dialog ... 88
9.6 Preparing the CFU for commissioning ... 88
9.6.1 Rules for device names ... 88
9.6.2 Assigning device names with existing configuration from HW Config ... 89

9.6.3 Configuring the topology 90
9.6.4 Assigning the CFU parameters without configuration 91

9.7 Requirement for the startup of the CFU 93

9.8 Commissioning (offline) 93
9.8.1 Configuring 93
9.8.1.1 Overview of configuring and assigning parameters 93
9.8.2 Configuration 94
9.8.2.1 Introduction to configuring 94
9.8.2.2 Configuring the CFU 94
9.8.2.3 Configuring a digital channel (DIQ) 96
9.8.2.4 Configuring a PROFIBUS PA field device (offline) 98
9.8.3 Parameter assignment 100
9.8.3.1 Introduction to assigning parameters 100
9.8.3.2 Setting parameters for the CFU (hardware configuration: Slot 0) 104
9.8.3.3 Configuring DIQ channels (parameter overview - DIQ) 105
9.8.3.4 PROFIBUS PA field device: Assigning parameters to the master (parameter overview - FB M) 107
9.8.3.5 PROFIBUS PA field device: Show DPV0 interrupts on CFU LEDs 108
9.8.3.6 PROFIBUS PA field device: Compare tags 108
9.8.3.7 PROFIBUS PA field device: Service port 109
9.8.3.8 PROFIBUS PA field device: Manual field device integration 109
9.8.3.9 Detection of new field devices 110
9.8.3.10 Enabling/disabling write protection of the CFU device parameters 110

9.9 PROFIBUS PA field device: Online commissioning 111
9.9.1 Assigning parameters to the CFU for PROFIBUS PA field device online via SIMATIC PDM 111
9.9.2 Performing simplified commissioning for PROFIBUS PA field devices 112
9.9.3 Reading back IO with the PROFIBUS PA field device 113
9.9.4 Parameter assignment of a PROFIBUS PA field device (online) 114
9.9.5 Bus fault correction with the PROFIBUS PA field device 115

9.10 Configuring with PDM Stand alone 116

10 Diagnostics of the CFU 119

10.1 Performing diagnostics for the CFU 119

10.2 Diagnostics via LED displays 119

10.3 Diagnostics with the Maintenance Station 124

10.4 Interrupts 127

10.5 Saving service data 127

11 Servicing and maintenance 129

11.1 Identification and maintenance data 129

11.2 Maintenance 129

11.3 CFU PA: Export/import device description 130
11.3.1 CFU PA: EDD: Exporting parameters 130
11.3.2 CFU PA: EDD: Importing parameters 130

11.4 PROFINET connector 131
11.4.1 Removing or inserting the BusAdapter 131
11.4.2 Inserting and removing the fiber-optic cable on the BusAdapter 131
11.4.3 Installation of fiber-optic cables in the enclosure 132

11.5 PROFIBUS PA field device to connection FB<n> ... 133
11.5.1 Replacing the PROFIBUS PA field device ... 133
11.5.2 PROFIBUS PA field device: Changing a configuration ... 134
11.5.3 Adding a PROFIBUS PA field device ... 135
11.5.4 PROFIBUS PA field device: Re-reading data or restarting the field device ... 135
11.5.5 Using the service port for a PROFIBUS PA field device ... 136

11.6 Reading back the parameters ... 137

11.7 Sensor/actuator at connection DIQ<n> ... 137
11.7.1 Replacing/modifying a digital sensor/actuator ... 137
11.7.2 Overload of freely configurable channels (DIQ<n>) ... 138

11.8 CFU ... 139
11.8.1 Replacing the CFU ... 139
11.8.2 Upgrading the CFU ... 141
11.8.3 Restoring the state of delivery ... 141

12 Compact Field Unit in the housing for use in a hazardous area ... 145

12.1 CFU in hazardous areas ... 145

12.2 Grounding for configuration of the CFU with aluminum housing ... 146

12.3 Configuration of the CFU with aluminum housing ... 148
12.3.1 Introduction ... 148
12.3.1.1 Installation instructions ... 149
12.3.1.2 Design-dependent types of protection of the CFU ... 150
12.3.1.3 Explosion protection ... 151
12.3.2 Installation ... 151
12.3.2.1 Design with CFU ... 151
12.3.2.2 Installation ... 151
12.3.2.3 Installation rules ... 152
12.3.2.4 Installing CFU with aluminum housing on the mounting surface ... 153
12.3.2.5 Mounting the CFU ... 154
12.3.2.6 Connecting the cables ... 155
12.3.2.7 Connecting the PROFIBUS PA cable to CFU in aluminum housing ... 158
12.3.2.8 Connecting cable shields of the PROFIBUS PA cables to CFU in aluminum housing ... 159
12.3.2.9 Grounding CFU with aluminum housing ... 160
12.3.3 Care and maintenance ... 161
12.3.3.1 Information on care and maintenance ... 161
12.3.3.2 Permitted activities in hazardous areas ... 162
12.3.3.3 Maintenance during operation ... 163
12.3.3.4 Cleaning ... 163
12.3.3.5 Replace pressure compensation element ... 163

13 Technical specifications ... 165

13.1 General technical specifications ... 165
13.1.1 Standards and approvals for CFU PA ... 165
13.1.1.1 Safety instructions on use of the CFU PA ... 166
13.1.1.2 CE conformity ... 167
13.1.1.3 CCC marking ... 168
13.1.1.4 UKCA marking ... 169
13.1.1.5 ATEX Approval ... 169
13.1.1.6 IECEx approval ... 170

13.1.1.7 INMETRO approval ... 171
13.1.1.8 UL / CSA approval ... 171
13.1.1.9 FM Approval ... 172
13.1.1.10 Tick mark for Australia and New Zealand ... 173
13.1.1.11 Standards for communication connections ... 173
13.1.1.12 Safety regulations and special requirements ... 173
13.1.2 Standards and approvals for CFU DIQ ... 173
13.1.2.1 Safety instructions on use of the CFU DIQ ... 174
13.1.2.2 CE conformity ... 175
13.1.2.3 CCC marking ... 176
13.1.2.4 UKCA marking ... 177
13.1.2.5 ATEX approval for CFU DIQ (6ES7655-5PX31-1AX0) with and without aluminum housing (6ES7655-5PX31-1XX0) ... 177
13.1.2.6 IECEx approval for CFU DIQ (6ES7655-5PX31-1AX0) with and without aluminum housing (6ES7655-5PX31-1XX0) ... 178
13.1.2.7 UL approval for CFU DIQ without aluminum housing (6ES7655-5PX31-1XX0) ... 179
13.1.2.8 FM approval for CFU DIQ without aluminum housing (6ES7655-5PX31-1XX0) ... 179
13.1.2.9 Standards for communication connections ... 180
13.1.2.10 Safety regulations and special requirements ... 180
13.1.3 Electromagnetic Compatibility ... 180
13.1.4 Shipping and storage conditions ... 182
13.1.5 Mechanical and climatic ambient conditions for operation ... 183
13.1.6 Specifications for insulation tests, protection class and degree of protection ... 186
13.1.7 Rated voltage ... 186
13.2 Technical specifications of the CFU PA ... 187
13.3 Technical specifications of the CFU PA with aluminum housing ... 194
13.4 Technical specifications of the CFU DIQ ... 200
13.5 Technical specifications of the CFU DIQ with aluminum housing ... 206
A Appendix ... 213
A.1 Article numbers (accessories / spare parts) ... 213
A.2 CFU PA: Terminal assignment ... 215
A.3 CFU DIQ: Terminal assignment ... 215
A.4 Mounting rules ... 216
A.4.1 Minimum clearances in the control cabinet ... 216
A.4.2 Tools and tightening torques ... 217
A.4.3 Cable cross-sections and ferrules ... 218
A.5 Dimensional diagrams ... 219
A.5.1 Dimension drawings of the mounting rails ... 219
A.5.2 Dimension drawings of the CFU ... 221
A.5.3 Dimension drawings of the housing of the CFU ... 222
A.6 Basics of PROFINET ... 223
A.6.1 Pin assignment of the RJ45 connection plug ... 223
A.7 CFU PA: Basics of PROFIBUS PA ... 223
A.7.1 Overview of Contents ... 223
A.7.2 CFU PA: PROFIBUS addresses of the PROFIBUS PA field devices on the CFU (FBn) ... 224
A.7.3 Intrinsic safety ... 224

A.8 Use of the CFU with GSDML ... 225
A.8.1 General ... 225
A.8.2 DI/DQ; Counter; Measure frequency ... 226
A.8.3 CFU PA: CFU and field devices ... 226
A.9 Drivers, parameters, diagnostic messages and address space ... 227
A.9.1 Concept of the driver and diagnostics blocks in PCS 7 ... 227
A.9.2 Parameters, diagnostic messages and address space without PCS 7 ... 228
A.9.2.1 CFU PA: Address space of the submodule DIQ8 DC24V/0.5A ... 228
A.9.2.2 CFU PA: Address space of the submodule DIQ8 DC24V/0.5A, Counter ... 229
A.9.2.3 CFU DIQ: Address space of the submodule DIQ16 DC24V/0.5A ... 231
A.9.2.4 CFU DIQ: Address space of the submodule DIQ16 DC24V/0.5A, Counter ... 232
A.9.2.5 Hardware interrupts ... 233
A.9.2.6 Supplementary information on the address space of a CFU ... 234
A.10 Contact ... 235
Glossary ... 237

Tables

Table 4-1 CFU PA (article numbers: 6ES7655-5PX11-1XX0, 6ES7655-5PX11-1AX0) ... 23
Table 4-2 CFU DIQ (article numbers: 6ES7655-5PX31-1XX0, 6ES7655-5PX31-1AX0) ... 24
Table 4-3 Mounting rail ... 25
Table 4-4 BusAdapter ... 25
Table 5-1 Deployment zone of the CFU types in hazardous areas ... 33
Table 6-1 Functions of DIQ channels ... 39
Table 6-2 Functions of PA channels ... 39
Table 6-3 Activating the hardware gate ... 44
Table 6-4 Reaction to violation of the high counting limit ... 47
Table 6-5 "Set output DQ" parameter ... 48
Table 6-6 Outputting status bit STS_DQ ... 49
Table 6-7 Hardware interrupt ... 50
Table 7-1 Required accessories ... 59
Table 8-1 Supply voltage connection with CFU ... 67
Table 8-2 Example for FB0 to FB7 ... 72
Table 8-3 Wiring variant "Digital input with 1-wire interface" ... 74
Table 8-4 Wiring variant "Digital input with 2-wire interface" ... 74
Table 8-5 Wiring variant "Digital input with 3-wire interface" ... 74
Table 8-6 Wiring variant "Digital output with 1-wire interface" ... 75
Table 8-7 Wiring variant "Digital output with 2-wire interface" ... 75
Table 9-1 Legend for the "**Configuration & Maintenance (CFU ... V2.0)**" wizard ... 85
Table 9-2 "Configuration & Maintenance Wizard (CFU ... V2.0)" wizard ... 85
Table 9-3 Parameters for operating mode: Counter or frequency measurement ... 106
Table 9-4 FB M ... 107

Table 9-5 Parameters + Diagnosis ... 107
Table 9-6 Status + Notifications ... 107
Table 10-1 Legend for the following tables: ... 120
Table 10-2 Status and error display ... 121
Table 10-3 Status display "LK1" and "LK2" ... 122
Table 10-4 Area: DIQ ... 122
Table 10-5 Area: Fieldbus ... 123
Table 12-1 Types of protection ... 150
Table 13-1 ATEX certification ... 170
Table 13-2 IECEx certification ... 170
Table 13-3 Factory Mutual Research (FM) Certification ... 172
Table 13-4 ATEX certification ... 177
Table 13-5 IECEx certification ... 178
Table 13-6 Underwriters Laboratories (UL) Certification ... 179
Table 13-7 Factory Mutual Research (FM) Certification ... 179
Table 13-8 Interference emission of electromagnetic fields according to EN 55016: Limit Class A, Group 1 ... 182
Table 13-9 Interference emission of electromagnetic fields according to EN 55016: Limit Class A, Group 1 ... 182
Table 13-10 Disturbance via supply lines according to EN 55016: Limit Class A, Group 1 ... 182
Table 13-11 Transport and storage conditions ... 182
Table 13-12 Mechanical ambient conditions ... 183
Table 13-13 Checking mechanical ambient conditions ... 184
Table 13-14 Climatic ambient conditions ... 184
Table 13-15 Derating when devices are used at an altitude above sea level ... 185
Table 13-16 Test voltages ... 186
Table 13-17 Nominal voltage for operation ... 187
Table A-1 SIMATIC CFU PA ... 213
Table A-2 SIMATIC CFU DIQ ... 213
Table A-3 BusAdapter for PROFINET ... 213
Table A-4 Media converter ... 214
Table A-5 Accessory ... 214
Table A-6 Push-in terminals ... 214
Table A-7 Screw terminals ... 214
Table A-8 Cables ... 214
Table A-9 Pin assignment of the inputs/outputs of the CFU PA ... 215
Table A-10 Pin assignment of the inputs/outputs of the CFU DIQ ... 216
Table A-11 Pin assignment of the RJ45 connector ... 223
Table A-12 Address space of the CFU PA with submodule "DIQ8 DC24V/0.5A" ... 229
Table A-13 Address space of the CFU PA with submodule "DIQ8 DC24V/0.5A" ... 229
Table A-14 Address space of the CFU PA with submodule "DIQ8 DC24V/0.5A, Counter" ... 230

Table A-15 Address space of the CFU PA with submodule "DIQ8 DC24V/0.5A, Counter" 230
Table A-16 Address space of the CFU DIQ with submodule "DIQ16 DC24V/0.5A" 231
Table A-17 Address space of the CFU DIQ with submodule "DIQ16 DC24V/0.5A" 231
Table A-18 Address space of the CFU DIQ with submodule "DIQ16 DC24V/0.5A, Counter" 232
Table A-19 Address space of the CFU DIQ with submodule "DIQ16 DC24V/0.5A, Counter" 233
Table A-20 Submodule dependency of the bytes in the input and output address space 234
Table A-21 Example for CFU PA: CFU PA with counting functionality without field devices 234

Figures

Figure 3-1 Basic integration of a CFU in the automation environment (CFU PA is given as an example here) 15
Figure 6-1 Counters and frequency meters working in parallel to the digital input 42
Figure 6-2 Example: Counting process with gate control (without influencing the count value) 46
Figure 6-3 STS_DQ bit between comparison value and high counting limit 48
Figure 6-4 STS_DQ bit between comparison value and low counting limit 49
Figure 6-5 Example: Counting process controlled via user program (load value) and effects on the comparison event 51
Figure 9-1 Dialog box: PLC > Edit Ethernet node 92
Figure 10-1 CFUPA LEDs 120
Figure 12-1 Basic integration of a CFU in the automation landscape with field devices in a hazardous area (CFU PA by way of example here) 146
Figure 12-2 Example: CFU PA with aluminum housing (here without housing cover for a clear illustration) 148
Figure 12-3 Connecting the field devices: Spur lines and cable shield connection with FB0 to FB<n> 158
Figure 12-4 Permissible type of connection (left) and impermissible type of connection (right) 161
Figure 12-5 Different types of implementation 161
Figure 12-6 Position of the pressure compensation element on the aluminum housing (view from below) 164

Cybersecurity information

1

Siemens provides products and solutions with industrial cybersecurity functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial cybersecurity concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial cybersecurity measures that may be implemented, please visit
https://www.siemens.com/cybersecurity-industry.

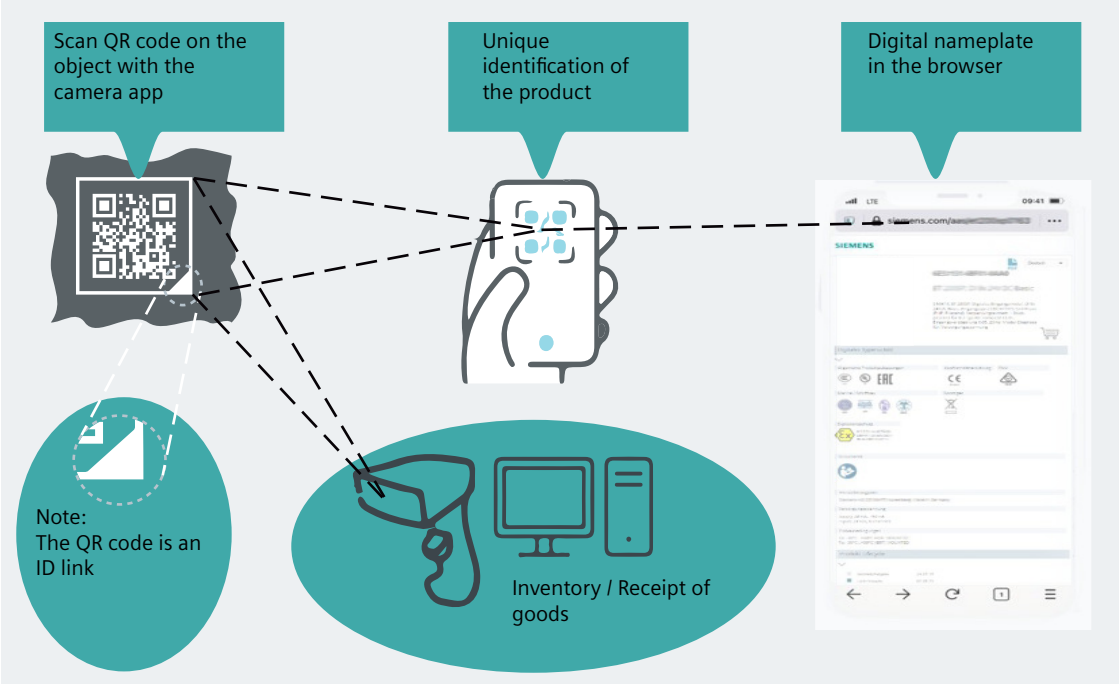
Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under
https://new.siemens.com/cert.

Digital nameplate

2

Identification link - easy application



QR code

The QR code on the front of this product and on the packaging uniquely identifies the product.

The QR code is also an identification link to IEC 61406-1.

If you scan the QR code (e.g. with a smartphone) you directly open the digital nameplate.

Digital nameplate

The digital nameplate is:

- A contribution from SIEMENS to reduce the CO_2 footprint and to conserve resources.
- The efficient way to access the product information provided on the Internet. This information remains up-to-date over the entire product life cycle.
  For your plant documentation, you have the option of linking the download or downloading the following information:
  - Technical specifications
  - Certifications and Declaration of Conformity
  - Manufacturer information
  - Product identification
  - User documentation
  - Replacement
  - Responsive web design
  - Other information

What is a Compact Field Unit?

3

The SIMATIC Compact Field Unit (CFU) is a field unit for use as an IO device on the PROFINET IO network of an automation system.

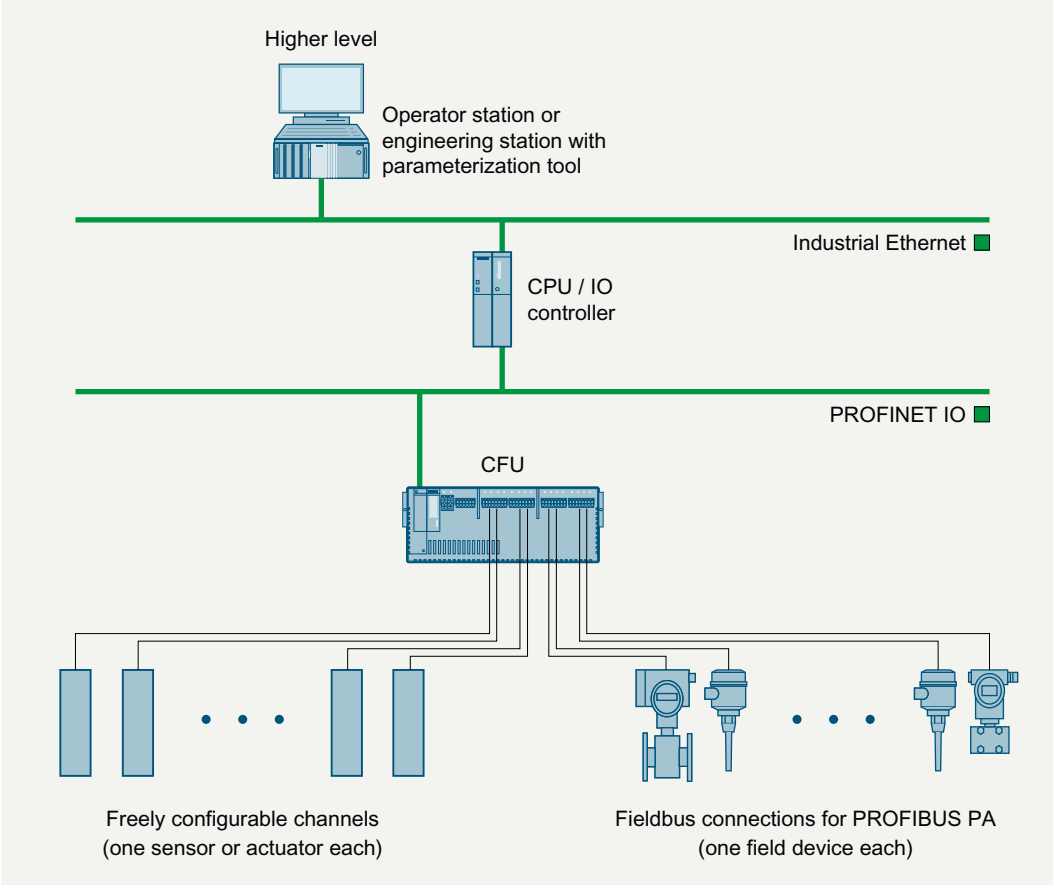


Figure 3-1 Basic integration of a CFU in the automation environment (CFU PA is given as an example here)

- You can find information on the CFU functions in section "Interfaces of the CFU types (Page 36)".
- You can find information on the components required to use a CFU in an automation system in section "Overview of the components (Page 22)".

Purpose of the documentation

This documentation provides the information you need to plan, install, wire and commission a Compact Field Unit in automation systems.

Validity of the documentation

This documentation is valid for the following products:

Product	Article number	As of firmware version
SIMATIC CFU PA	6ES7655-5PX11-1XX0	V1.2.1
SIMATIC CFU PA with aluminum housing	6ES7655-5PX11-1AX0	V1.2.1
SIMATIC CFU DIQ	6ES7655-5PX31-1XX0	V1.2.1
SIMATIC CFU DIQ with aluminum housing	6ES7655-5PX31-1AX0	V1.2.1

You can find information on the product versions in section "Article numbers (accessories / spare parts) (Page 213)".

This commissioning manual contains a description of the components that was valid at the time the commissioning manual was published. We reserve the right to include product information with information updates with new components and components with a new product status.

Basic knowledge required

This commissioning manual requires general knowledge of automation engineering.

Basic knowledge in the following areas is also required:

- Commissioning of electrical components
- Configuring and planning of Ethernet networks and fieldbus systems (PROFINET IO, PROFIBUS PA)
- SIEMENS engineering software (e.g. STEP 7; SIMATIC PDM)

If the Compact Field Unit is to be used in a hazardous area, you require the following additional knowledge:

- Basics of explosion protection
- Identification of explosion-proof devices
- Legal basics of explosion protection

Configuring the Compact Field Unit

The following table shows the minimum requirements for the configuration of a Compact Field Unit (CFU):

Type of the CFU	Freely configurable channels (digital inputs/outputs for sensors and actuators)	Connections for PA field devices	Note
SIMATIC CFU PA *)	Select one of the following options: • **SIMATIC PCS 7** as of V9.1 SP2 and Update Collection 5 • **STEP 7** as of V5.6 + Update 2 with HSP278 and HSP285 • **TIA Portal** as of V19 and Update 2	SIMATIC PDM as of V9.3 and Fixes with EDD CFU PA	Only field devices with a PROFIBUS PA profile equal to or greater than V3.x can be operated with the Compact Field Unit PA. We recommend "SIMATIC PDM" with EDD CFU PA as the optimal tool for the configuration and diagnostics of connected field devices.
SIMATIC CFU DIQ *)	Select one of the following options: • **SIMATIC PCS 7** as of V9.1 SP2 and Update Collection 5 • **STEP 7** as of V5.6 + Update 2 with HSP278 and HSP285 • **TIA Portal** as of V19 and Update 2	No	We recommend "SIMATIC PDM" with EDD CFU DIQ as the ideal tool for configuring additional diagnostics (e.g. temperature warning limits).

*) Applicable to all products with an integrated CFU.

Note

HUP for SIMATIC CFU

You can find the software packages for supplementing the suitable configuration tools as download on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109749357).

Position in the overall information structure

In addition to this commissioning manual, you will need the following manuals, depending on the hardware and software used:

- System and standard functions for S7-300/400 (http://support.industry.siemens.com/cs/ww/en/view/1214574) Reference Manual
- Programming with STEP 7 (http://support.industry.siemens.com/cs/ww/en/view/18652056) manual
- Configuring hardware and connections with STEP 7 (http://support.industry.siemens.com/cs/ww/en/view/18652631) manual
- SIMATIC PROFINET - system description (http://support.industry.siemens.com/cs/ww/en/view/19292127) System Manual
- SIMATIC NET Industrial Ethernet / PROFINET Industrial Ethernet (http://support.industry.siemens.com/cs/ww/en/view/27069465) manual

- SIMATIC PDM (http://support.industry.siemens.com/cs/ww/en/view/109482406) manual
- SIMATIC Principles of Explosion Protection (https://support.industry.siemens.com/cs/ww/en/view/12521844) manual

You can find information on explosion protection in the corresponding directives and standards.

Using documentation, app and PUD manager

Documentation updates and CFU product information can be found on the CFU on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109749357).

Information on the app and its download is available on the internet (see section "2D Matrix code (QR code / EAN code) (Page 28)").

When using the PUD Manager to display the online help, you can integrate the appropriate documentation into your downloaded help files.
Information about the PUD Manager can be found in the corresponding FAQ (https://support.industry.siemens.com/cs/ww/en/view/109748882).

Conventions

The following terms are used as synonyms in this document:

Term in the manual	Synonyms	Notes
CFU	Compact Field Unit	Applies, if not otherwise specified, to all types of SIMATIC CFU described in this manual.
CFU PA	Compact Field Unit PA	This applies to the product SIMATIC CFU PA unless otherwise specified. If the section name or a paragraph starts with "CFU PA:", the content is relevant exclusively for SIMATIC CFU PA, even if only CFU is in this part of the documentation.
CFU DIQ	Compact Field Unit DIQ	This applies to the product SIMATIC CFU DIQ unless otherwise specified. If the section name or a paragraph starts with "CFU DIQ:", the content is relevant exclusively for SIMATIC CFU DIQ, even if only CFU is in this part of the documentation.
Fieldbus	PROFIBUS PA	Applies, if not otherwise specified, to the PROFIBUS PA as fieldbus of the SIMATIC CFU PA.
Fieldbus connection	Port or spur line	The interface or spur line to a PROFIBUS PA field device on the SIMATIC CFU PA.
SIMATIC CFU with aluminum housing	SIMATIC CFU with housing	Applies, if not otherwise specified, to the CFU products with aluminum housing.

Observe the notes that are marked as follows:

Note

A note contains important information about the product described, about handling the product or about a specific section of the documentation that requires particular attention.

Recycling and disposal

The described components are ecologically compatible, and thus suitable for recycling. For environmentally sound recycling and disposal of your old devices please contact a certified disposal service company for electronic scrap.

Changes compared to the previous version

The following is an overview of the key changes in the documentation compared to the previous version:

As of SIMATIC CFU firmware V2.0:

- SIMATIC CFU PA support PA Profile 4.x
- Humidity measurement (SIMATIC CFU DIQ)
- Saving service data
- Configurable Reset button
- Write protection (PDM)
- Time synchronization by means of SIMATIC method
- Number of service interfaces increased

As of SIMATIC CFU firmware V1.2:

- SIMATIC CFU DIQ available
  Digital version with 16 digital inputs and outputs (without fieldbus connections)
- "Counter" and "Frequency measurement" operating modes for digital inputs (CFU PA: Channel 0; CFU DIQ: Channel 0 and channel 1)
- Actuator shutdown

As of CFU firmware V1.1:

- Service interface for field devices
- Setting the fieldbus connections is simplified by using the freeze function
- Field device name can be adjusted via the commissioning wizard
- Manual integration of a field device is possible

Additional support

- You can reach the Technical Support for all the Industry Automation products via the Web form for the Support Request (http://support.industry.siemens.com/My/ww/en/requests).
- Should you have any questions on the products described in this documentation for which you cannot find any answers here,
  contact your Siemens representative: Representatives and offices (http://support.industry.siemens.com/aspa_app/)
- The technical documentation for the various SIMATIC products and systems is available on the Internet (http://support.industry.siemens.com/My/ww/en/requests).

- You can find the online catalog and online ordering system on the Internet (http://www.siemens.com/automation/mall).
- You can obtain access to product-related information after entering the article number on the Internet (https://www.industry-mobile-support.siemens-info.com/#/en/search/product/6ES7655).

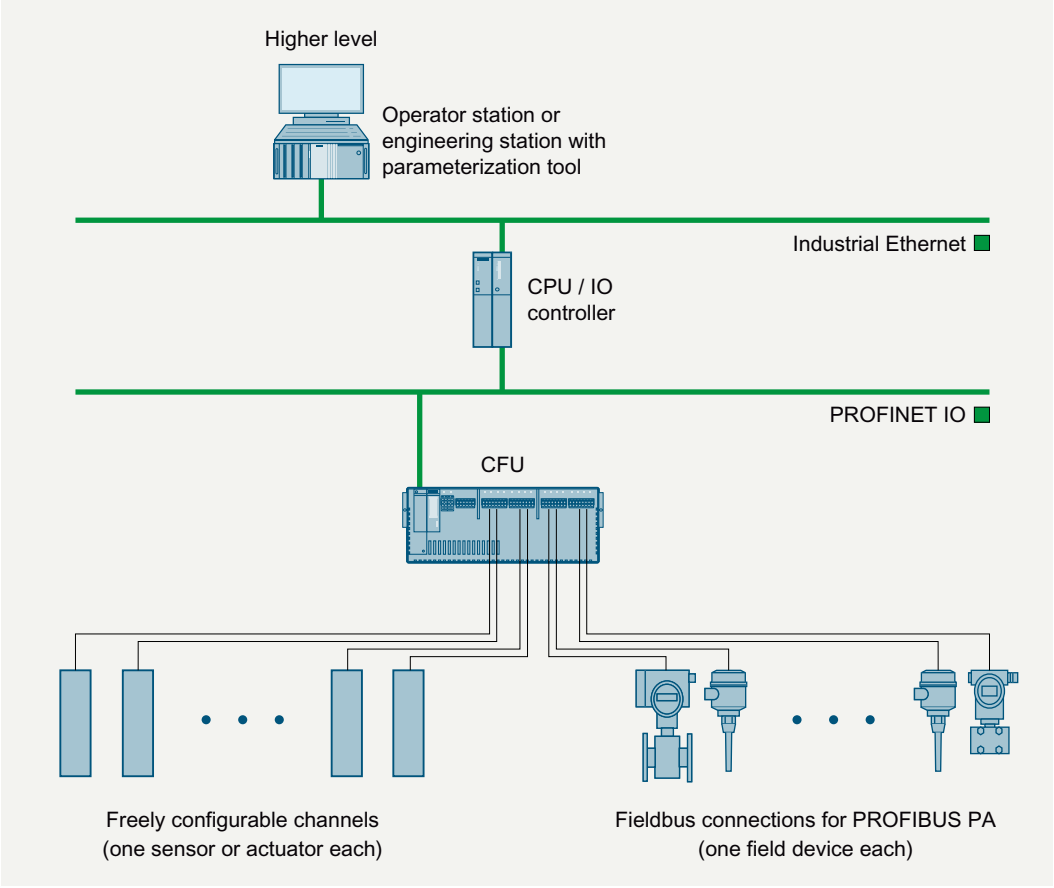
Product overview

4

4.1 Inclusion in the automation environment

Basic integration of a CFU in the automation environment

The following figure demonstrates the basic integration of a CFU in the automation environment using the example of a CFU PA.



Distributed I/O devices - field of use

When structuring a system the inputs and outputs from or to the process are often integrated centrally into the automation system.

In the case of large distances of the inputs and outputs from the automation system the wiring can become very extensive and unstructured. Electromagnetic interferences can impair the reliability. The flexibility of a central installation is also limited.

The use of distributed I/Os is suitable for such systems:

- The automation system is located at a central position.
- The I/O devices (inputs and outputs) operate decentrally on site.
- CFU PA: The CFU with its integrated BusLink between PROFINET IO and PROFIBUS PA enables decentralized connection of PA field devices to the CPU of the automation system.

4.2 Overview of the components

Basic components of CFU types

The following basic components are available for the CFU types:

- CFU types
  - Overview of CFU PA (Page 23)
  - Overview of CFU DIQ (Page 24)
- Mounting rail (Page 25)
- BusAdapter (Page 25)

⚠ WARNING

Open equipment

The CFU is open equipment. This means that it may only be installed in housings, cabinets or in electrical equipment rooms. These may only be accessible via keys or a tool. The housings, cabinets or electrical equipment rooms may only be accessed by instructed or approved personnel.

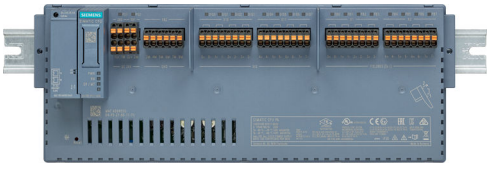
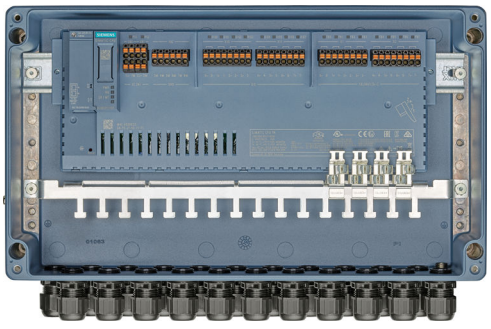
More information

Article numbers of these and other components are available in section "Article numbers (accessories / spare parts) (Page 213)".

4.2.1 Overview of CFU PA

The following information is valid for all types of CFU PA.

Table 4-1 CFU PA (article numbers: 6ES7655-5PX11-1XX0, 6ES7655-5PX11-1AX0)

Function	Figure
The CFU PA: • Integrate the CFU PA in the automation system as an IO device on PROFINET IO. • Interfaces: – 8 fieldbus connections for each field device on PROFIBUS PA (FIELDBUS). – 8 freely configurable channels (DIQ). • LED displays at the interface dome indicate the device status. • The LED display on the channels shows the individual channel value/channel state. Supplementary information: • Section "Interfaces of the CFU PA (Page 36)" • Section "Diagnostics via LED displays (Page 119)" In the aluminum housing, the housing lid (on the right, not shown) has an inspection window in the interface dome area.	 CFU PA  CFU PA with aluminum housing

Terminal set required

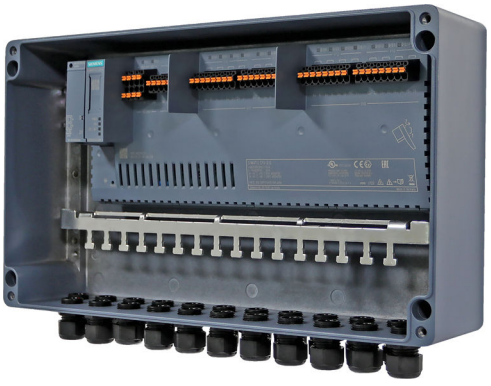
You need an approved terminal set to operate the CFU PA.

Type and use	Quantity	Area	Connection
2-pin double terminals for connection of power supply (PS)	2	24 V DC	X80 and X81
6-pin terminals for reference potential (ground)	1	GND	X82
8-pin terminals	2	DIQ	X10 and X11
• for connecting sensors and/or actuators • for connecting field devices	2	FIELDBUS	X1 and X2

4.2.2 Overview of CFU DIQ

The following information is valid for all types of CFU DIQ.

Table 4-2 CFU DIQ (article numbers: 6ES7655-5PX31-1XX0, 6ES7655-5PX31-1AX0)

Function	Figure
The CFU DIQ: • Integrate the CFU DIQ in the automation system as an IO device on PROFINET IO. • The CFU DIQ has the following interfaces: – 16 freely configurable channels (DIQ). • LED displays at the interface dome indicate the device status. • The LED display on the channels shows the individual channel value/channel state. Supplementary information: • Section "Interfaces of the CFU DIQ (Page 37)" • Section "Diagnostics via LED displays (Page 119)" In the aluminum housing, the housing lid (on the right, not shown) has an inspection window in the interface dome area.	 CFU DIQ  CFU DIQ with aluminum housing

Terminal set required

You need an approved terminal set to operate the CFU DIQ.

Type and use	Quantity	Area	Connection
2-pin double terminals for connection of power supply (PS)	2	24 V DC	X80 and X81
6-pin terminals for reference potential (ground)	1	GND	X82
8-pin terminals for connecting sensors and/or actuators	4	DIQ	X10 to X13

4.2.3 Mounting rail

The mounting rail can be used for all CFU types.

Table 4-3 Mounting rail

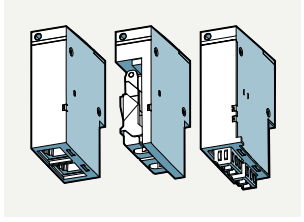
Function	Figure
The mounting rail is the component on which the CFU is fastened. Types: DIN rail TH 35 in accordance with EN 60715 The article number can be found in section "Article numbers (accessories / spare parts) (Page 213)".	

4.2.4 BusAdapter

You can use the BusAdapters for the following CFU types:

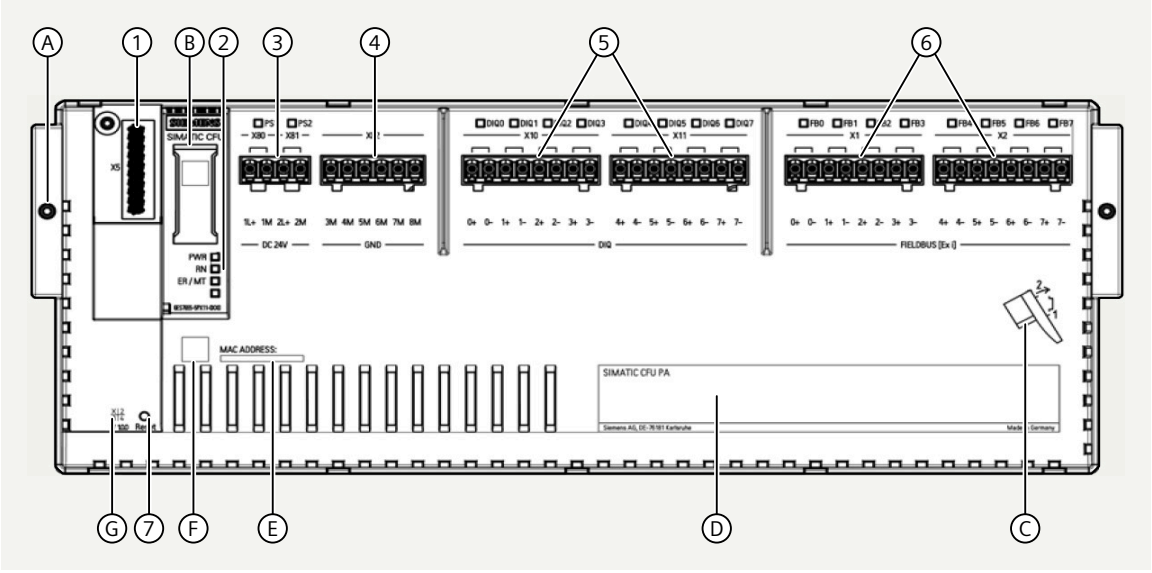
- CFU DIQ
- CFU PA

Table 4-4 BusAdapter

Function	Figure
The BusAdapters give you flexibility in selection of the connection technology for PROFINET IO. The figure shows some typical device implementations of the BusAdapter. There are BusAdapters for pre-fabricated specific bus cables and BusAdapters for special media (fiber-optic cable, electrically conductive cables). Each BusAdapter has two PROFINET IO connectors. The approved BusAdapter variants can be found in section "Article numbers (accessories / spare parts) (Page 213)".	

4.3 Front view of the CFU

Front view of the CFU PA



Functional elements

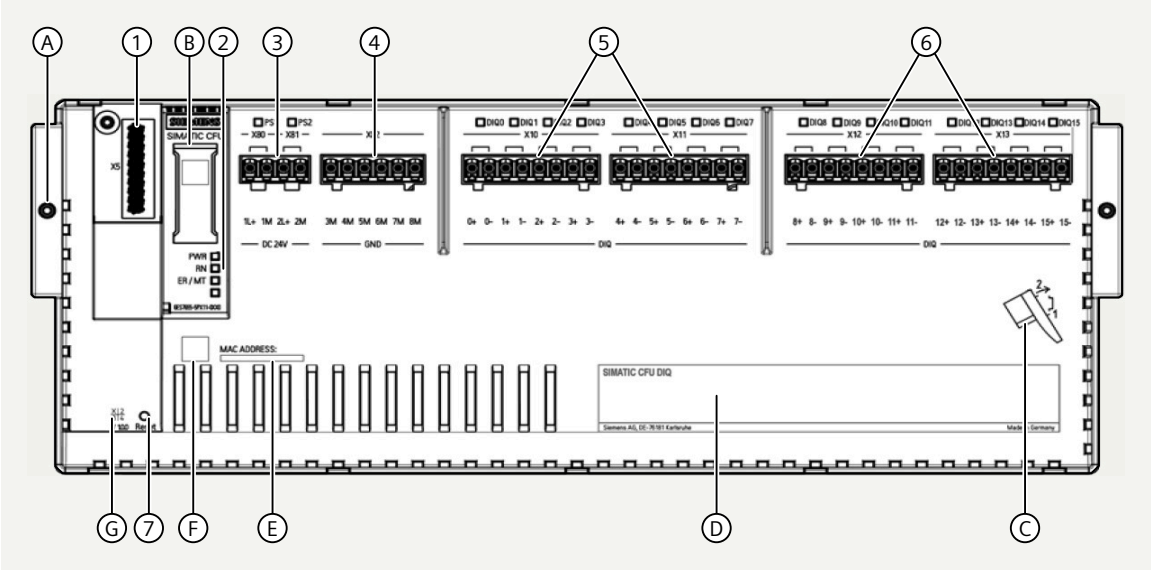
1 Slot X5: Connection for a BusAdapter
2 Diagnostic LED on interface dome
3 Slots X80 and X81: 24 V DC; power supply PS1/PS2 (redundant connection possible)
4 Slot X82: GND: Connections for reference potential (ground)
5 Slot X10/X11: DIQ; Connections of freely configurable channels DIQ<n>
6 Slot X1/X2: FIELDBUS; connections for one field device each.
7 Reset: Restore delivery state - reset to factory settings

Additional elements

A Locking the CFU on the mounting rail
B Labeling strips on interface dome
C Assembly instruction (latch onto the mounting rail from below)
D Nameplate
E MAC address
F 2D matrix code (QR code / EAN code)
G Product version

Connections	Wiring
Connections for freely configurable channels DIQ<n>	Signal line • <n>+ signal line • <n>- signal line
Connections for one field device each	Spur line (FB<n> with automatic bus termination) • <n>+ data cable (red) • <n>– data cable (green)

Front view of the CFU DIQ



Functional elements

1 Slot X5: Connection for a BusAdapter
2 Diagnostic LED on interface dome
3 Slots X80 and X81: 24 V DC; power supply PS1/PS2 (redundant connection possible)
4 Slot X82: GND: Connections for reference potential (ground)
5 Slot X10/X11: DIQ; Connections of freely configurable channels DIQ<n>
6 Slot X12/X13: DIQ; Connections of freely configurable channels DIQ<n>
7 Reset: Restore delivery state - reset to factory settings

Additional elements

A Locking the CFU on the mounting rail
B Labeling strips on interface dome
C Assembly instruction (latch onto the mounting rail from below)
D Nameplate
E MAC address
F 2D matrix code (QR code / EAN code)
G Product version

Connections	Wiring
Connections for freely configurable channels DIQ<n>	Signal line • <n>+ signal line • <n>- signal line

More information

- Section "Functions of the CFU types (Page 39)"
- Section "CFU DIQ: Terminal assignment (Page 215)"
- Section "CFU PA: Terminal assignment (Page 215)"
- Section "Connecting the power supply to the CFU (Page 66)"
- Section "Connecting the PROFIBUS PA field device (Page 71)"

- Section "Connecting cable shields of the PROFIBUS PA cables to CFU in aluminum housing (Page 159)"
- Section "Connecting digital sensor or actuator to the DIQ channel (Page 72)"
- Section "2D Matrix code (QR code / EAN code) (Page 28)"
- Reset: You can find information on this in section "Restoring the state of delivery (Page 141)".

4.4 2D Matrix code (QR code / EAN code)

The 2D matrix code on the product is a coded representation of the product-specific article number.

Access to product-related information

For reading the 2D matrix code, SIEMENS offers an app for mobile use.
Information about the app and the download can be found on the Internet: "Mobile use via app (https://support.industry.siemens.com/cs/ww/en/sc/2067)".

The app provides direct access to the technical forum and product-related posts, such as:

- FAQs
- Application examples
- Manuals
- Certificates
- Product notices

System planning

5

5.1 Useful information

5.1.1 Rules for the operation

Topology

- **PROFINET IO**
  On the PROFINET IO, you can integrate the CFU in the following structures:
  Line, star and ring topology (MRP), as well as PROFINET system redundancy (S2): Max. number of nodes: 256
- Freely configurable channels (DIQ)
  The following configuration is possible at digital inputs/outputs:
  Line topology (per channel "DIQ; DIQ<n>": 1 sensor or 1 actuator)
- **CFU PA:**PROFIBUS PA
  The following configuration is possible at PROFIBUS PA connections:
  Line topology (per fieldbus connection "FIELDBUS; FB<n>": 1 field device)

Distances

The permissible distance between the bus nodes depends on the type of connection:

- Fiber-optic cable: Up to 3000 m
- RJ45 / Fast Connect: Up to 100 m
- VD BusAdapter: Up to 500 m

Dependency on the ambient temperature

- **Load current**
  The load current is the sum of the currents of the encoder supplies "DI" and the outputs "DQ". The total permissible load current of all freely configurable channels of a CFU depends on the ambient temperature and mounting position.
  You can find information on this in section "Mechanical and climatic ambient conditions for operation (Page 183)".
- **Cable temperature**
  You can find information on this in section "Mechanical and climatic ambient conditions for operation (Page 183)".
- **BusAdapter**
  Ensure that the BusAdapter is suitable for use at the respective ambient temperature.
  You can find information about this in the documentation "SIMATIC; Distributed I/O; BusAdapters for Distributed I/O (https://support.industry.siemens.com/cs/de/en/view/109804897)".

Note

Configuring messages

You can configure alarms for monitoring power supply and electronics temperature in the "CFU Configuration; Commissioning Wizard" dialog of SIMATIC PDM.

You can find information on this in section "Using the wizard for CFU configuration (Page 84)".

Installing the enclosure outdoors

Take the following additional protective measures depending on the environment of the installation location:

- Avoid subjecting the enclosure permanently to precipitation (for example, snow).
- Direct sunlight can cause excessive temperatures in the enclosure.
  Avoid overheating by providing additional protective measures, for example, through suitable roofing.
- Note that opening the housing at ambient temperatures below 0 °C can damage the seal as a result of freezing.
- Before use in aggressive environmental conditions, ensure that the suitability of the materials is confirmed (relates to, for example, fixing, housing and cables).

More information

- You can find information about the technical specifications in section "Technical specifications (Page 165)".
- Section "Use in hazardous areas (Page 31)"
- Section "Connecting the power supply to the CFU (Page 66)"

See also

Connecting (Page 65)

5.1.2 System change during operation

During operation of the CFU, you can carry out the following functions:

- Adding components
- Replacing components
- Deleting components
- Changing parameters
  Parameters that you can set in HW Config.

Requirement for configuring

The required device description is installed.

Information about installation with the Device Integration Manager is available in the help for SIMATIC PDM.

Basic procedure

You can find more information on the procedure in section "Servicing and maintenance (Page 129)".

More information

Refer to section "Use in hazardous areas (Page 31)".

5.1.3 Use in hazardous areas

Hazardous areas are classified into zones. The zones are distinguished according to the probability of the existence of an explosive atmosphere.

⚠ WARNING

Open equipment

The CFU is open equipment. This means that it may only be installed in housings, cabinets or in electrical equipment rooms. These may only be accessible via keys or a tool. The housings, cabinets or electrical equipment rooms may only be accessed by instructed or approved personnel.

Useful information

Deployment zones of the CFU types (Page 32)

Use in hazardous areas (Page 33)

Installation work in hazardous areas (Page 34)

More information

- The product information is made available with the product or on the Internet under specification of the article number: Service & Support (https://support.industry.siemens.com/cs/us/en/).
- For more information, refer to the Fundamentals of Explosion Protection (https://support.industry.siemens.com/cs/ww/en/view/12521844) system manual.
- Section "Compact Field Unit in the housing for use in a hazardous area (Page 145)"

5.1.3.1 Deployment zones of the CFU types

Deployment zones of the CFU types

WARNING

Danger of explosion by working in hazardous areas of Zones 2/22.

When maintaining electrical equipment in hazardous areas, observe the national regulations and applicable standards EN 60079-17.

When the CFU has been switched on, it is not allowed to open the aluminum housing of the CFU within an explosive atmosphere.

CAUTION

Use in hazardous areas

- All CFU with aluminum housing can be used as bus nodes in Zone 2 and Zone 22 hazardous areas.
  Products:
  - Compact Field Unit PA with aluminum housing
  - Compact Field Unit DIQ with aluminum housing

Read the information on approval in the product information.

The table shows if it is permitted to operate a CFU in the hazardous area.

Table 5-1 Deployment zone of the CFU types in hazardous areas

CFU type	Safe area or Zone 2:	Zone 22	Zone 1/21	Zone 0/20
CFU PA	Yes	Yes *)	No	No
CFU DIQ	Yes	Yes *)	No	No

*) In this zone, only the CFU with aluminum housing is permitted.

CFU PA: Intrinsic safety of the CFU

The following degrees of protection are supported:

Fieldbus connections of the CFU	Design
CFU PA	With type of protection Ex ic

It is not permissible to operate field devices with different types of protection on a CFU.

You can find more information on intrinsic safety in the product information:

Labeling of the CFU

The CFU is equipped with markings for the hazardous area. These markings indicate in which explosion-prone environments the equipment can be used.

Certificates for the CFU

The EU prototype test certificate and the EU certificates of conformity for the CFU are available under Service & Support on the Internet.

5.1.3.2 Use in hazardous areas

WARNING

Open equipment

The CFU is open equipment. This means that it may only be installed in housings, cabinets or in electrical equipment rooms. These may only be accessible via keys or a tool. The housings, cabinets or electrical equipment rooms may only be accessed by instructed or approved personnel.

CFU PA: Intrinsic safety of the CFU at the fieldbus connections

The CFU limits the energy on the fieldbus line to the intrinsically safe PA field devices and electrically isolates them from the live parts of the CFU (for example, power supply).

Fieldbus connections of the CFU	Design
CFU PA	Ex ic type of connection for PROFIBUS PA connections

You can find more information on intrinsic safety in the product information:

More information

- The product information is made available with the product or on the Internet under specification of the article number: Service & Support (https://support.industry.siemens.com/cs/us/en/).
- Section "Compact Field Unit in the housing for use in a hazardous area (Page 145)"
- Section "Technical specifications (Page 165)"

See also

Technical specifications of the CFU PA with aluminum housing (Page 194)

Technical specifications of the CFU DIQ with aluminum housing (Page 206)

5.1.3.3 Installation work in hazardous areas

Installation work

- Connecting and disconnecting the cables to the CFU during operation
- Working on the housing

Connecting and disconnecting the cables to the CFU during operation

DANGER

Explosion hazard

It is forbidden to open the housing during operation in **Zone 22** hazardous areas.

Disconnect the CFU from the power supply before starting work.

DANGER

Explosion hazard

In **Zone 2** hazardous areas, it is forbidden to connect or disconnect the following cables to/from the CFU during operation:

- Power supply/Open power supply connection cover
- PROFINET cables, except fiber-optic cables (PROFINET connection of the CFU)
- Freely configurable channels

Disconnect the CFU from the power before carrying out work on these cables.

Hazardous area - Zone 2:

CFU PA: The fieldbus connections are implemented as intrinsically-safe connections (Ex ic) and may be inserted or removed during operation.

Requirements for connecting and disconnecting non-intrinsically safe power circuits:

- The atmosphere is not explosive.
  or
- You have ensured that the CFU is disconnected from the power supply.

Sealing the housing

DANGER

Explosion hazard

Cable glands ensure sealing between the cables and the housing.

Make sure that strain relief is available for all cables before they are inserted into the housing.

- Only permanently installed cables and lines may be inserted.
- Strain on the CFU cable glands can affect the degree of protection and is not permitted. The operator has to ensure the appropriate strain relief.
- Cable glands do not serve as strain relief.

CAUTION

Equipment protection type

The device protection type is only guaranteed if the housing is closed.

- The cover must be mounted; necessary cable glands must be mounted with proper tightening torque.
- Unused openings for cable glands must be closed.

CAUTION

Seal protection

Contamination or cable residues may lead to malfunctions or short circuits. Before mounting, check the housing, the seals on the cover, the cable glands, the screw plugs and the pressure compensation element.

- Ensure that all components are undamaged and clean.
- Ensure that all components are correctly seated before and after mounting.
- Tighten screws and cable glands to the correct tightening torque. See section "Tools and tightening torques (Page 217)".

A CFU with aluminum housing contains cable glands. Ensure that the cable glands fit the cable cross-section.

You can find more information in the following sections:

- Section "Technical specifications of the CFU PA with aluminum housing (Page 194)"
- Section "Technical specifications of the CFU DIQ with aluminum housing (Page 206)"
- For cable inlets with Ex tc or Ex tb protection class, make sure that the seals are approved for the temperature range used.
- It is possible to install specially certified cable and conductor glands, as well as blanking and sealing plugs.

5.1.4 PROFIBUS PA connectors: Voltage relationships (galvanic isolation)

CFU PA:
There is galvanic isolation between the fieldbus and all other circuit components of the CFU (see section "Technical specifications (Page 165)").

5.2 Interfaces of the CFU types

5.2.1 Interfaces of the CFU PA

The CFU is an IO device on the higher-level PROFINET IO system.

Interfaces

The CFU PA has the following interfaces:

Interface	Quantity	Supplementary note
Interfaces for bus systems:		
PROFINET IO X5	1 connection	BusAdapter with 2 ports (X1) for redundant connection to PROFINET IO or forwarding the PROFINET IO. Redundant connection is possible: • Media redundancy (MRP) • Singular system redundancy (S2) The approved BusAdapter variants for connecting the CFU to PROFINET IO are listed in section "Article numbers (accessories / spare parts) (Page 213)".
PROFIBUS PA X1/X2	8 fieldbus connections **FIELDBUS (FB<n>)**	One field device per connection (FB<n>). Maximum current per connection/channel: 40 mA
Channels (freely configurable: Digital inputs / outputs)		
Channel configured as input X10/X11	Max. 8 channels **DIQ (DIQ<n>)**	• Input voltage: Max. 30 V • Integrated encoder supply Maximum current per channel: 500 mA • Channel 0 (with "Counter ..." submodule): "Counter" and "Frequency measurement" operating modes
Channel configured as output X10/X11	Max. 8 channels **DIQ (DIQ<n>)**	• Signal voltage: Max. 30 V • Maximum current per channel: 500 mA **Note:** The parallel connection of the DQ channels is impermissible. A DQ channel can be used as comparison value, for example for the "Count" function at the input.
Power supply PSx		
24 V terminal X80/X81	**PSx**	Redundant supply possible
Connection for reference potential (ground) X82	6 connections for reference potential (ground)	For optional connection of a sensor to ground.

More information

Section "Technical specifications (Page 165)"

5.2.2 Interfaces of the CFU DIQ

The CFU is an IO device on the higher-level PROFINET IO system.

Interfaces

The CFU DIQ has the following interfaces:

Interface	Quantity	Supplementary note
Interfaces for bus systems:		
PROFINET IO X5	1 connection	BusAdapter with 2 ports (X1) for redundant connection to PROFINET IO or forwarding the PROFINET IO. Redundant connection is possible: • Media redundancy (MRP) • Singular system redundancy (S2) The approved BusAdapter variants for connecting the CFU to PROFINET IO are listed in section "Article numbers (accessories / spare parts) (Page 213)".
Channels (freely configurable: Digital inputs / outputs)		
Channel configured as input X10/X11	Max. 16 channels **DIQ (DIQ<n>)**	• Input voltage max. 30 V • Integrated encoder supply Maximum current per channel: 500 mA • Channel 0 and Channel 1 (with "Counter ..." submodule): "Counter" and "Frequency measurement" operating modes
Channel configured as output X10/X11	Max. 16 channels **DIQ (DIQ<n>)**	• Signal voltage max. 30 V • Maximum current per channel: 500 mA **Note:** The parallel connection of the DQ channels is impermissible. Free channel possible as output for the comparison value status (when using the "Counting" function).
Power supply PSx		
24 V terminal X80/X81	**PSx**	Redundant supply possible
Connection for reference potential (ground) X82	6 connections for reference potential (ground)	For optional connection of a sensor to ground.

More information

- Section "Technical specifications (Page 165)"

Functions

6

6.1 Functions of the CFU types

The functions described below are not available for all CFU types or on all channels.

Functions on CFU types

Table 6-1 Functions of DIQ channels

Function	CFU PA	CFU DIQ
DIQ channel (Page 39)	YES	YES
Actuator shutdown (Page 40)	YES	YES
Counting (Page 43)	Only channel 0	Only channels 0 and 1
Measure frequency (Page 51)	Only channel 0	Only channels 0 and 1

Table 6-2 Functions of PA channels

Function	CFU PA
PROFIBUS PA channel (Page 52)	YES
Function of the PROFIBUS PA channels (fieldbus FB) (Page 52)	YES
PA profiles for field devices on PROFIBUS PA (Page 53)	YES
IO and "Selected IO" for field devices (Page 53)	YES
Service port (Page 54)	Up to 4 PA channels

6.2 Functions of DIQ channels

6.2.1 DIQ channel

DIQ

If there are freely configurable DIQ channels on a CFU, the switchover between digital input and digital output is configurable on these channels.

Digital input

Encoders that are supplied via the CFU can be connected to a CFU.

Digital output

Actuators that are supplied via the CFU can be connected to a CFU.

See also

Actuator shutdown (Page 40)

6.2.2 Actuator shutdown

Actuator shutdown

The actuator shutdown is a function that allows digital outputs DQ to be set to a digital low level via a monitoring channel (DI channel) of the CFU. This is done directly by the CFU without coordination or time delay through the CPU.

Actuator shutdown in the CFU

The actuator shutdown of the CFU uses a monitoring channel (DI channel) to rapidly set all the digital outputs to a digital low level.

When the actuator shutdown shuts down the digital outputs, the CFU generates a diagnostic interrupt.

CFU PA: The function has no effects on the PROFIBUS PA channels (FB<n>).

Note

Connection to the CPU

Actuator shutdown takes effect independently of the connection to the CPU (STOP/RUN, connection interrupted) and the configured substitute values.

"Monitoring channel" parameter

Selection of the monitoring channel used to control the digital outputs.

- None
- Channel 0
- Channel 1
- ...
- Channel n

Ensure that the selected channel is activated and is the "Digital input" type.

"Switch off at signal level" parameter

Selection of the signal level at which the function acts on the digital outputs.

Settings:

- High
- Low

Substitute values

Note

Substitute values

While the selected signal level is pending on the channel for the actuator disconnection, substitute values are also set to low level by the actuator disconnection.

Configuring an actuator shutdown

1. Open HW Config.
2. Select the CFU.
3. In the index list, double-click the "DIQ" slot.
   The "Properties - DIQ..." dialog box opens.
4. In the "Parameters" tab, select the submenu "Actuator shutdown" and configure a monitoring channel and the signal level for the shutdown.

Shutdown time

The maximum shutdown time is 10 ms.

6.2.3 "Counter" and "Frequency measurement" operating modes

Operating modes for selected digital inputs

You can activate the following functions for selected digital inputs depending on the CFU type:

- "Counter" operating mode
- "Frequency measurement" operating mode

Both operating modes are based on counting detected pulses.

The function of the DI channel is processed independently of the operating mode.

You can find information on the digital inputs in the following sections:

- Section "Interfaces of the CFU PA (Page 36)"
- Section "Interfaces of the CFU DIQ (Page 37)"

Requirements for use of the "Counter" and "Frequency measurement" operating modes

If you want to activate the "Counter" or "Frequency measurement" operating mode for DI channels, the required submodule must be configured with the parameterization tool (see table below).

The operating mode of the digital outputs can be selected at the following channels:

CFU type	Required submodule	Channel for "Counter" or "Frequency measurement" operating mode
CFU PA	DIQ8 DC24V/0.5A, Counter	• Channel 0
CFU DIQ	DIQ16 DC24V/0.5A, Counter	• Channel 0 • Channel 1

Overview of channel functions

The digital channels configured as DI channels continue to operate as digital inputs regardless of the operating mode.

The following figure shows the available functions for a channel on which the configuration of the counter/frequency measurement operating modes is possible:

- In "Counter" operating mode, a 32-bit up counter works in parallel to the digital input.
  You can find information on this in section "Counting (Page 43)".
- In "Frequency measurement" operating mode, a frequency meter works in parallel to the digital input.
  You can find information on this in section "Measure frequency (Page 51)".

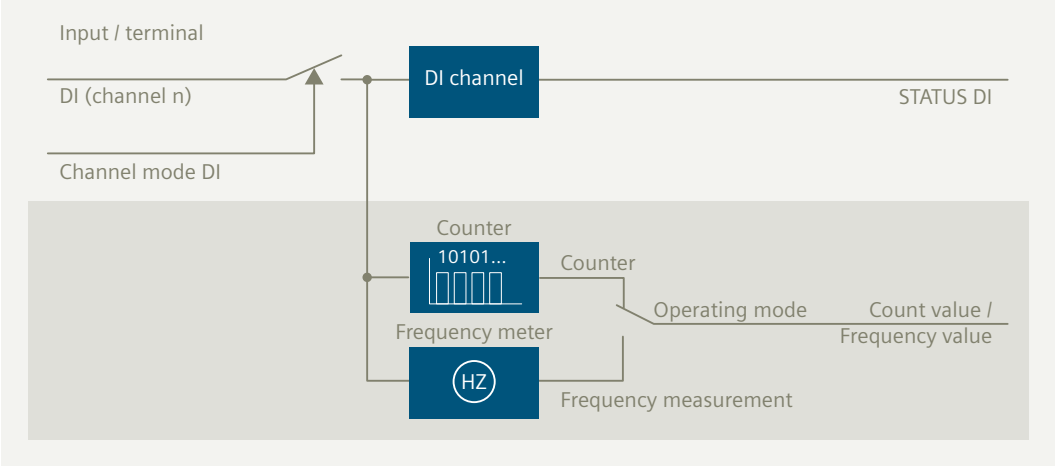


Figure 6-1 Counters and frequency meters working in parallel to the digital input

Depending on the operating mode, the process picture shows the counter reading or the frequency value.
You can find information on the process image in section "Parameters, diagnostic messages and address space without PCS 7 (Page 228)".

You can find more information in section "Technical specifications (Page 165)".

6.2.4 Counting

"Counter" operating mode

In "Counter" operating mode, a 32-bit up counter works in parallel to the digital input. The functions of the digital input remain available.

Operating principle in "Counter" operating mode

You can find information on the counter parameters in the section "Drivers, parameters, diagnostic messages and address space (Page 227)".

You can read the count value in the feedback interface. The count value is displayed in S7 format.

Function	Explanation	Note
Set count value	The count value is set to 0 when the following events occur: • CFU starts up • Count value exceeds the high counting limit • Restart of the CPU (STOP -> RUN) • CPU/CFU connection restored	-
Record and evaluate pulses	The pulses at the digital input are recorded and evaluated according to the parameter assignment.	"Edge evaluation" parameter: • On rising edge • On falling edge • On rising and falling edge
High counting limit	The high counting limit is configurable.	"High counting limit" parameter: Range *: 1 ... 4294967295 (2^{32}–1)
Reaction to violation of the high counting limit	When the count value violates the high counting limit, the further behavior of the counter depends on the configuration.	Parameter "Reaction to violation of the high counting limit (Page 46)": • Stop counting • Continue counting
Stop counting	The counter stops at the following events: • Internal gate closed (SW gate/HW gate) • CPU in STOP • CPU/CFU connection terminated (e.g. PN cable disconnected)	Note: If the HW gate is to be used, you must select a free channel of the CFU for this at the "HW gate channel" parameter.
Load counter	A count value can be loaded via the control interface.	Section "Loading the count value (Page 50)" • Control bit (LD_SLOT) • "Load value" parameter: Range *: 0 ... 4294967295 (2^{32}–1)
Comparison value	A comparison value can be configured.	"Comparison value" parameter: Range *: 1 ... 4294967295 (2^{32}–1)

Function	Explanation	Note
Show range of count value	The range in which the current count value is located as compared to the count limits and the comparison value can be queried via the STS_DQ status bit (bit in the feedback interface).	The status of STS_DQ depends on the setting of the "Set output DQ (Page 47)" parameter: • Between comparison value and high limit • Between comparison value and low limit
Hardware interrupt	It is possible to generate a hardware interrupt when status bit STS_DQ changes from 0 to 1.	"Hardware interrupt" parameter: • Lock • Comparison event for DQ occurred
Output comparison event at the digital output	It is possible to output the STS_DQ status bit directly at a digital output of the CFU.	"DQ channel" parameter: To output the comparison event on a digital output, select a free channel of the CFU at the "DQ channel" parameter.

* **Note on use with PCS 7:** The parameter permits values up to 32 bits without sign. The maximum value is FFFF FFFF$_H$ (4 294 967 295).
In PCS 7, the representation is limited to 2^{31}–1 by the DINT data type.

6.2.4.1 Gate control

One software gate is available per counter channel for controlling the counter.

If a hardware gate is activated, it has an effect on the counting function.

Software gate

The software gate can be set via the control interface of the CFU (SW_GATE control bit).
You can find information on this in the following sections:

- Section "CFU PA: Address space of the submodule DIQ8 DC24V/0.5A, Counter (Page 229)"
- Section "CFU DIQ: Address space of the submodule DIQ16 DC24V/0.5A, Counter (Page 232)"

Hardware gate

If the hardware gate is to be used, you must select a free channel of the CFU for controlling the counting processes at the "HW gate channel" parameter.

Table 6-3 Activating the hardware gate

Function	Parameters and setting	Example
Digital input (counter): • for CFU PA Channel n = 0 • for CFU DIQ Channel n = 0 and 1	Channel type: DI	Channel 0
Hardware gate	HW gate channel = free DI	Channel 2

Gate control and status bit STS_GATE

The gate control performs AND linking of the following signals:

- Software gate (SW gate): Control bit SW_GATE
- Hardware gate (HW gate): Input signal at hardware gate

The result of the AND logic operation of the software gate and hardware gate is displayed as the status of the internal gate via the status bit STS_GATE.

If the hardware gate is not enabled, the status bit STS_GATE shows the status of the control bit SW_GATE.

Controlling the counting process

	SW gate = closed	**SW gate = open**
HW gate = closed	Internal gate closed; counting process stopped	Internal gate closed; counting process stopped
HW gate = open	Internal gate closed; counting process stopped	The internal gate is open. The pulses are detected by the counter. The behavior when the high limit is violated depends on the setting of the parameter "Reaction to violation of the high counting limit (Page 46)".

6.2.4.2 Counter in operation (startup and stop)

The following behavior applies to the configured and parameterized CFU.

Start

The counter starts at 0 after the following events:

- CFU starts up
- Count value exceeds the high counting limit
- Restart of the CPU (STOP -> RUN)
- CPU/CFU connection is restored

Stop

The count value is frozen after the following events:

- Internal gate closed
- CPU in STOP
- CPU/CFU connection is disconnected (e.g. PN cable disconnected)

Behavior of the counter during operation

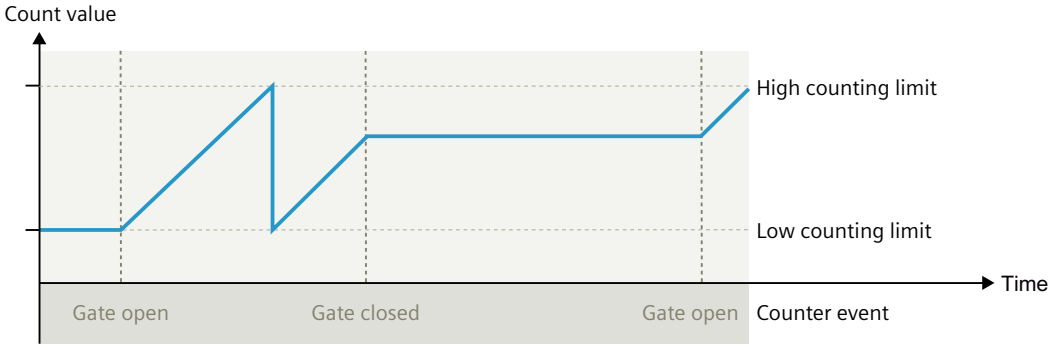


Figure 6-2 Example: Counting process with gate control (without influencing the count value)

6.2.4.3 Reaction to violation of the high counting limit

Introduction

If "Counter" operating mode has been configured for a digital input, you can configure the counting range.

Note

Counting range

For the CFU, only the high counting limit of the counting range can be configured.

Requirements

- The SW gate is open.
- When the HW gate is used: The HW gate is open.

Behavior

The following table shows the dependence of the counting behavior on the setting of the "Reaction to violation of the high counting limit" parameter.

Table 6-4 Reaction to violation of the high counting limit

Parameter	Setting	Description
Reaction to violation of the high counting limit	Stop counting	With this parameter setting, the counter records the pulses until the high counting limit is exceeded. The internal gate is closed automatically. Note: You have the following possibilities to restart the counting process: • Close and open SW gate. • When the HW gate is activated, close and open the HW gate.
	Continue counting	With this parameter setting, the counter records the pulses. When the high counting limit is exceeded, the counter reading is automatically set to 0. The counter continues the counting process with the next pulse. The internal gate remains open.

More information

Section "Loading the count value (Page 50)"

6.2.4.4 Behavior when the comparison value is reached (status bit STS_DQ and output DQ)

You can specify a value within the counting range for which a comparison with the counter reading is carried out.

Parameters for comparison

You can configure the following for the counter:

- **Parameter "Set output DQ":**
  Evaluation of the comparison value:
  For settings, see table ""Set output DQ" parameter" below
- **Parameter "DQ channel"**
  Output the status at a DQ channel (parameter requires a free channel for the output).
- **Parameter "Hardware interrupt comparison result DQ"**
  Generate a hardware interrupt when the status bit STS_DQ changes from 0 to 1 (see table ""Set output DQ" parameter" below).

Configure evaluation of the comparison value

With the "Set output DQ" parameter, you determine when the STS_DQ status bit is set.

The parameter acts **only** on the status bit STS_DQ.

Table 6-5 "Set output DQ" parameter

Value	Setting	Behavior; condition
1	"Between comparison value and high limit"	• Status bit STS_DQ = 0; when count ≤ comparison value • Status bit STS_DQ = 1; when count > comparison value See following figure "STS_DQ bit between comparison value and count high limit"
2	"Between comparison value and low limit"	• Status bit STS_DQ = 1; when count ≤ comparison value • Status bit STS_DQ = 0; when count > comparison value See following figure "STS_DQ bit between comparison value and count low limit"

Setting the status bit STS_DQ between the comparison value and high counting limit

When "Between comparison value and high limit" is set for the parameter "Set output DQ", the status bit STS_DQ is set in the following case:

- Counter reading > Comparison value

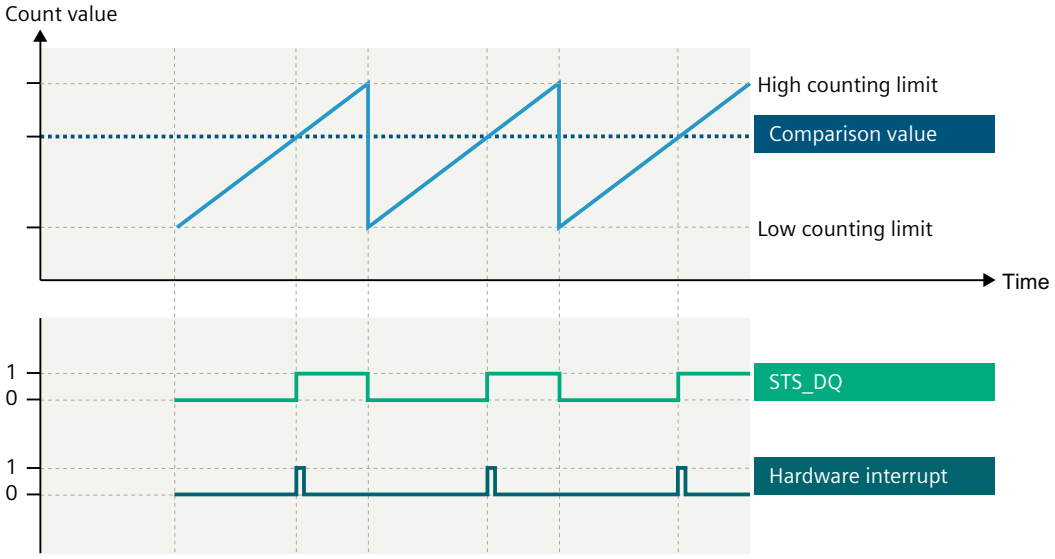


Figure 6-3 STS_DQ bit between comparison value and high counting limit

Setting the status bit STS_DQ between the comparison value and low counting limit

When "Between comparison value and low limit" is set for the parameter "Set output DQ", the status bit STS_DQ is set in the following case:

- Counter reading ≤ Comparison value

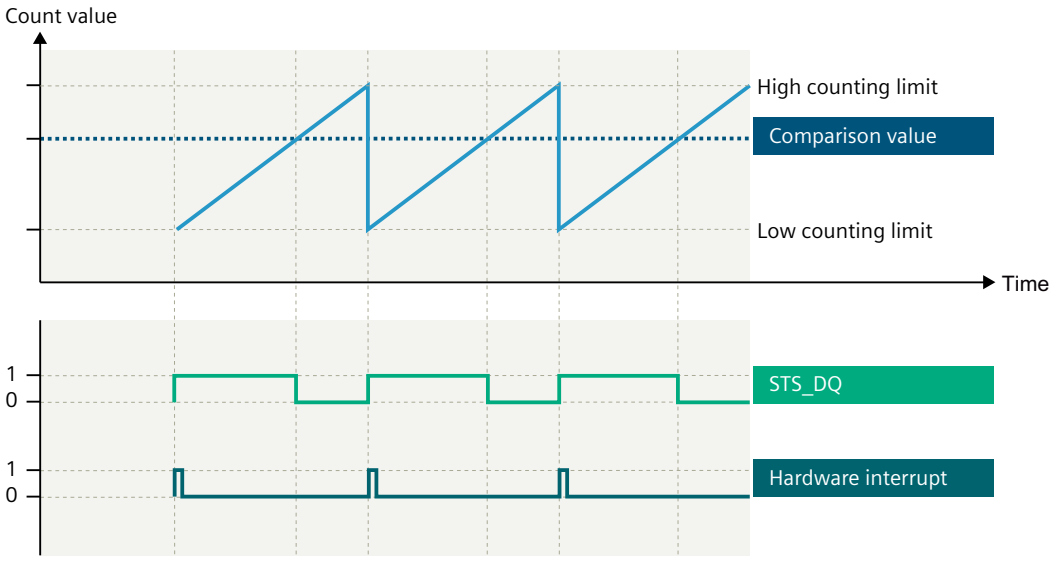


Figure 6-4 STS_DQ bit between comparison value and low counting limit

Outputting status bit STS_DQ

The comparison result of the counter controls the status bit STS_DQ. You can link the status bit STS_DQ with a digital output. To do this, you have to specify a free channel as the digital output for the comparison result in the parameters of the counter channel.

Table 6-6 Outputting status bit STS_DQ

Parameter	Setting of the parameter	Behavior
DQ channel	The DQ channel for the comparison event must be a free digital output of the CFU.	The DQ channel is assigned to the status bit STS_DQ. The user program can no longer control this DQ channel. The status of the status bit STS_DQ is output via the assigned DQ channel.

The remaining functionality of the DQ channel continues to be available. This affects the reaction to the following events, for example:

- Behavior at CPU stop
- Actuator shutdown
- Diagnostics
- Error recognition

Note

- Errors of the DQ channel have no influence on the counting function.
- If STS_DQ has been linked with a DQ channel, this link is retained even when the DI channel is deactivated.
- If a slot with counting functionality is disabled, the count value and the status bit STS_DQ are retained. In addition, any defined output DQ retains its value and still cannot be controlled by the PLC.

Generate hardware interrupt by comparison

With the "Hardware interrupt" parameter you determine whether a hardware interrupt is generated.

Table 6-7 Hardware interrupt

Parameter	Setting of the parameter	Behavior
Hardware interrupt	• 1 = Comparison event for DQ occurred • 0 = Lock	If the parameter has been set to 1, a hardware interrupt is generated when the status bit STS_DQ changes from 0 to 1.

6.2.4.5 Loading the count value

Introduction

You can specify the value from which counting is continued for a digital input parameterized as a counter.

Load counter

You can specify the load value for counting via the user program.

You can find information on the address space in the following sections:

- Section "CFU PA: Address space of the submodule DIQ8 DC24V/0.5A, Counter (Page 229)"
- Section "CFU DIQ: Address space of the submodule DIQ16 DC24V/0.5A, Counter (Page 232)"

You can find the following parameters in the control interface:

- Load value
- LD_SLOT: Apply load value as current count value on rising edge of LD_SLOT
- SW_GATE: 0 = Stop counting / 1 = Continue counting

Applying the load value takes effect directly and is independent of whether the counter is currently running.

The following figure shows the change of the count value with control via the user program (load value) and the effects on the comparison event.

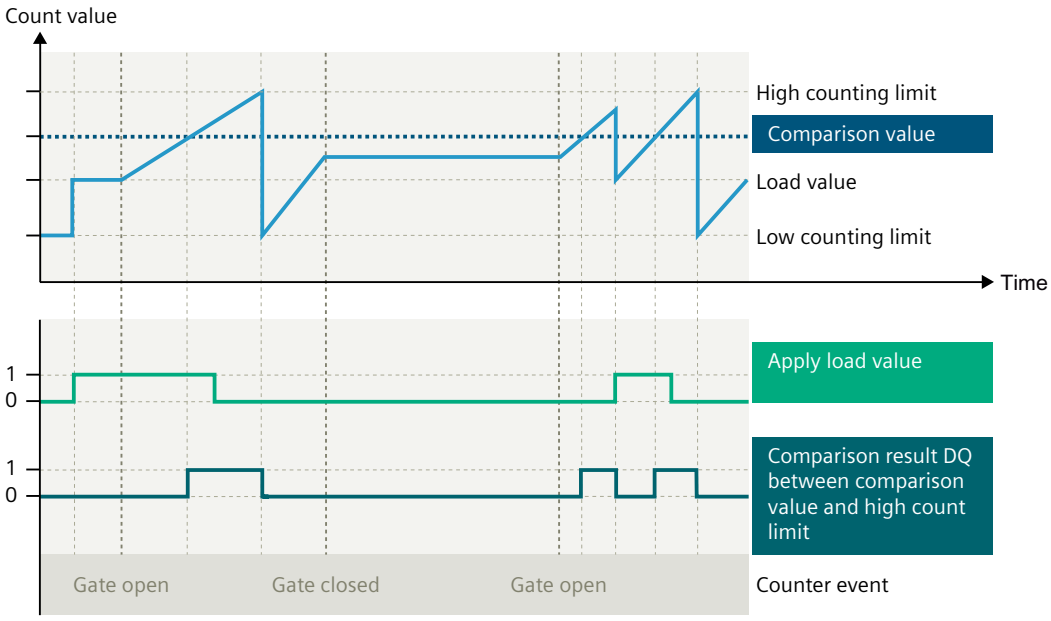


Figure 6-5 Example: Counting process controlled via user program (load value) and effects on the comparison event

6.2.5 Measure frequency

In "Frequency measurement" operating mode, the function works in parallel to the digital input. The functions of the digital input remain available.

Operating principle in "Frequency measurement" operating mode

The CFU determines the frequency applied in Hz. The frequency value is displayed in the unit Hz in REAL format.

You can read the frequency value in the feedback interface.

The interval from the beginning of measuring to the end of measuring is called the measuring window. Within the measuring window, the measured values are updated cyclically.

The measuring window is calculated automatically by the CFU and adapted according to the frequency. Different update rates result from this.

The frequency is determined with the following formula:

Frequency [Hz] = (Number of rising edges at digital input) / (measuring window [s])

Note

Detection of the input signal

If frequency values are outside the measuring range, the status is undefined.

- Frequencies above 1 kHz cannot be resolved correctly (minimum pulse length 500 µs).
- Frequencies below 0.1 Hz cannot be resolved correctly (pulse length greater than 10 s).

A statement on the actual values is not possible.

6.3 Functions of PROFIBUS PA channels

6.3.1 PROFIBUS PA channel

PROFIBUS PA

Field devices with profiles 3.x and 4.x can be operated on the CFU PA.

6.3.2 Function of the PROFIBUS PA channels (fieldbus FB)

CFU PA: FIELDBUS

The CFU translates the protocols between the PROFINET IO and the PROFIBUS PA.

With regard to the field devices, the CFU operates like a BusLink (PROFINET IO to PROFIBUS PA) with connected field distributors for PA field devices.

You connect the PA field devices to the "FIELDBUS; FB<n>" connections on the CFU. CFU and PA field devices form a common, self-contained PROFIBUS PA system.

Parameters

You can find more information on parameter assignment of the field devices in the documentation of the field device.

Availability

- For the "FIELDBUS; FB<n>" connections, the following applies when physical faults occur (such as wire break or short circuit):
  - Faulty connections are automatically deactivated as long as the fault exists.
  - The bus is automatically terminated
- Repairs and extensions at the individual "FIELDBUS; FB<n>" connections are possible during operation.

More information

- Section "PROFIBUS PA connectors: Voltage relationships (galvanic isolation) (Page 36)"
- Section "Diagnostics via LED displays (Page 119)"
- Section "Using the service port for a PROFIBUS PA field device (Page 136)"
- You can find information on configuring and assigning parameters in section "Commissioning (offline) (Page 93)".

6.3.3 PA profiles for field devices on PROFIBUS PA

PROFIBUS PA profiles and GSD files

For connection of field devices, you must choose between the use of PA profiles and device-specific GSD files.

PROFIBUS PA profiles enable simpler field device replacement than when device-specific GSD files of the manufacturer are used.

Reasons for this are:

- The replacement device does not have to be identical.
- The replacement device only has to support the set PA profile.
- If you are using SIMATIC PDM, you can find the PROFIBUS PA profiles in the following folder: **PROFIBUS-PA > Profile > Siemens AG**.

If PROFIBUS PA profiles are integrated in the engineering tool, you find the potential PA profiles in the catalog folder for the hardware configuration.

PROFINET IO > I/O > Compact Field Unit > Compact Field Unit PA ... > PROFIBUS-PA Profiles.

6.3.4 IO and "Selected IO" for field devices

IOs in the field device

A field device can have multiple IOs. IOs describe the behavior of the field device. The term IO corresponds to a PROFIBUS ID number.

When you use PA profiles, the ID number is replaced by readable text (e.g. 0x9701 corresponds to "Transmitter 2 AI").

Selected IO

A "Selected IO" identifies the behavior of the IO that the CFU sets in the field device (examples: "Transmitter 2 AI", "Discrete Output 1", manufacturer-specific IOs). The configuration in HW Config normally defines the "Selected IO".

- The setting of the "IO" in the EDD of the field device is **not** permitted.
- If you use HW Config or SIMATIC PDM for configuring the field devices and the CFU, the CFU stores the PA profiles read from the field device and the selected IO.

6.3.5 Service port

Function of a PA channel as service port

In a CFU with PA channels, a service port is a PA channel that is used for service and diagnostics of field devices.

The service port enables physical movement of a field device to another PA channel without the need for adjustments in the engineering.

- The "Service port" function can be enabled for every PROFIBUS PA port of a CFU with PROFIBUS PA channels.
- No more than half of all PA ports can be enabled as service port at the same time.
- Settings on the engineering system or on the field device are not required.
- If a PA channel is enabled as service port, you can calibrate field devices connected to this PA channel.
  The field device behaves the same when connected to the service port as when connected to the PA channel and continues supplying process values to the previous address.

A field device connected to the service port is automatically detected if it was last in operation on this CFU at one of the other PA channels.

- It is automatically routed (mapped) to the original PA channel of the CFU.
- The original PA channel is deactivated when the field device is detected at the service port until you disconnect the field device from the service port or deactivate the service port.
- Pending diagnostic messages continue to be sent for the original PA channel.
- Current and voltage of the field device connected to the service port are not monitored.

See also

Using the service port for a PROFIBUS PA field device (Page 136)

6.4 Time synchronization

Time synchronization is a function via which the nodes in the network can keep the internal time synchronous. It is necessary here to enable the "Time synchronization in SIMATIC mode" as master in the controller. You can find information about this in the documentation of the CPU.

Time synchronization is only used for the diagnostic buffer.

Installation 7

7.1 Installation rules

DANGER

Risk of explosion in the hazardous area

During mounting, observe the guidelines according to EN 60079-14 as well as national regulations.

DANGER

Explosion hazard

Under some circumstances, sparks capable of ignition or unacceptable surface temperatures can occur during installation.

Never install when an explosive atmosphere is present!

WARNING

Open equipment

The CFU is open equipment. This means that it may only be installed in housings, cabinets or in electrical equipment rooms. These may only be accessible via keys or a tool. The housings, cabinets or electrical equipment rooms may only be accessed by instructed or approved personnel.

NOTICE

Risk of injury due to heavy weight of the CFU with aluminum housing

The CFU with aluminum housing weighs approx. 5.5 kg. Hold the device securely in your hand during installation.

Mounting position

NOTICE

Damage to property

Strain on the cable gland is not permitted. Ensure that the installed cables are fixed at the cable entry.

The CFU is installed horizontally or vertically:

- With horizontal installation, the PROFINET bus connection is on the left.
- With vertical installation, the PROFINET bus connection is at the bottom.

Technical setup

The CFU is mounted on a mounting rail.
You can find information about the mounting rail in section "Overview of the components (Page 22)".

For trouble-free mounting, provide clearance above and below the CFU.
You can find more information in section "Minimum clearances in the control cabinet (Page 216)".

If you integrate the "CFU with aluminum housing" into the system, the required distances are taken into account.

Electromagnetic compatibility (EMC)

To maintain the EMC, note the following:

- EMC-compliant routing of the cables (including within cabinets!)
- Route signal cables separately from cables with voltages > 60 V or high currents
- Avoid proximity to large electrical installations.

Installing the CFU in hazardous areas

- Refer to section "Use in hazardous areas (Page 31)".
- Read the information in the Product Information of the CFU.
  You can find the Product Information for the CFU as a product insert and on the Internet Customer Support (http://support.industry.siemens.com/cs/) using the article number of the CFU (see section "Article numbers (accessories / spare parts) (Page 213)").

Ambient temperature

You can find information about the ambient temperature in section "Rules for the operation (Page 29)".

7.2 Installing the mounting rail

You mount the CFU on a mounting rail (DIN rail TH 35 in accordance with EN 60715).

You can find article numbers for mounting rails of different lengths in section "Article numbers (accessories / spare parts) (Page 213)".

Lengths and drill holes

The mounting rails are available in the following lengths:

- 483 mm (19 inches)
  The 483 mm mounting rail has two drill holes for fixing screws.
  A set of screws for grounding is included.
- 2000 mm
  The 2000 mm mounting rail is designed for assemblies with special lengths and does not have holes for fixing screws.
  Screws for grounding are not included with the mounting rail.

The specifications of the maximum offsets between two drill holes can be found in the section "Dimension drawings of the mounting rails (Page 219)".

Tools required

- Suitable metal saw
- Drill ∅ 6.5 mm
- Screwdriver
- Size 10 adjustable screw-wrench or socket wrench for grounding cable connection
- Adjustable screw-wrench, matching the selected fixing screws
- Stripping tool and crimp tool for the grounding cable

Required accessories

You can use the following screw types for fastening of the mounting rails:

Table 7-1 Required accessories

For ...	you can use ...	Explanation
outer fixing screws	Cylinder head screw M6 according to ISO 1207/ISO 1580 (DIN 84/DIN 85)	Choose a suitable screw length for your assembly. You also need washers for cylinder head screws with an internal diameter of 6.4 mm and an external diameter of 11 mm according to ISO 7092 (DIN 433).
Additional fixing screws (for mounting rails > 483 mm)	Cylinder head screw M6 according to ISO 4017 (DIN 4017)	

Additional fixing screws (for mounting rails > 530 mm)

In the case of mounting rails > 530 mm, we recommend using fixing screws at distances of ≤ 500 mm.

Preparing mounting rails for installation (for mounting rails > 530 mm)

To prepare the 2000 mm mounting rail for the CFU, follow these steps:

1. Shorten the 2000 mm rail to the required dimensions.
2. Mark the holes. You can find these dimensions in the "Dimension drawings of the mounting rails (Page 219)" section:
   - Two drill holes at the beginning and end of the mounting rail (15 mm interval)
   - Additional drill holes at equal intervals of 500 mm maximum
3. Drill the marked holes according to the selected type of fastening.
4. Ensure that there are no burrs or shavings on the mounting rail.

Note

For the CFU to be mounted correctly, you must ensure the following:

- Ensure that the drill holes are positioned centered on the mounting rail (17.5 mm - corresponds to the center of a mounting rail: partially with an identification groove),
- and that only screws up to the maximum size are used.

Installing the mounting rail

Note

Minimum clearances

Observe the minimum distances in the control cabinet.
You can find more information in section "Minimum clearances in the control cabinet (Page 216)".

1. Screw the rail onto the mounting surface.

More information

- You can find more information about the exact dimensions of the mounting rails in the section "Dimension drawings of the mounting rails (Page 219)".
- You can find information on the tightening torques in section "Tools and tightening torques (Page 217)".
- You can find information about grounding in section "Connecting the functional grounding to the CFU (Page 75)".

7.3 Mounting the CFU

Tools required

You can find information on this in section "Tools and tightening torques (Page 217)".

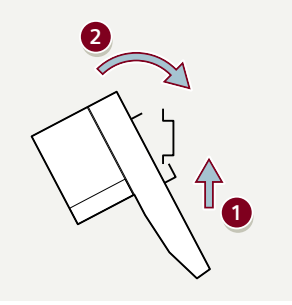
Requirement

- The mounting surface must be level, stable and free from vibrations.
- Select the mounting material that best suits the mounting surface.
- All the connecting cables are prepared.
- Clearance of at least 60 mm below the CFU:
  For connecting cables to the sensors and actuators at the freely configurable channels or the equipotential bonding spur lines.
- Pay attention to using suitable cable cross-sections and tightening torques for the cable glands.

Mounting Compact Field Unit

Observe the minimum distances and the bending radii of the cables used during the installation.

You can find information on the tightening torques in section "Tools and tightening torques (Page 217)".

Step	
1	**Only CFU with aluminum housing:** If you are using the CFU in the housing, you must observe the following section: "Compact Field Unit in the housing for use in a hazardous area (Page 145)". Install the housing. The drill holes in the aluminum housing of the CFU are designed for cylinder head screws with 6 mm nominal diameter.
2	Install the mounting rail (see the section "Installing the mounting rail (Page 58)") or the housing depending on the installation type.
3	Latch the CFU onto the mounting rail **from below**.  Press the CFU upward until the supports latch into the mounting rail. Tighten the fixing screws at both sides of the CFU (see "Front view of the CFU (Page 26)"; Position A).

Step	
Assembling the cable The basic procedure applies to all cables (power supply, FB<n> and DIQ<n>), bus cables for PROFINET IO and bus cables for PROFIBUS PA).	
4	**Only CFU with aluminum housing:** When you use the CFU in the housing, loosen the screw caps of the cable glands for the positions at which cables are to be routed through the housing. Check the seals for damage and correct seating. If necessary, replace the cable gland. It is possible to install specially certified cable and conductor glands, reducing inserts as well as blanking and sealing plugs. Remove unused blanking plugs and reducing inserts from the cable glands. Route the cables through the cable glands and then into the housing (thread side to the housing). Only permanently installed cables and lines may be inserted. **Note:** Ensure that the cables are correctly sealed (see section "Tools and tightening torques (Page 217)").
5	Connect the cables to the connections of the CFU (FB<n> and DIQ<n>). Observe the pin assignment on the plug: • See section "Connecting digital sensor or actuator to the DIQ channel (Page 72)" • See section "Connecting the PROFIBUS PA field device (Page 71)" • See section "CFU DIQ: Terminal assignment (Page 215)" • See section "CFU PA: Terminal assignment (Page 215)"
6	Fasten/insert the bus cables on the BusAdapter/plug for the PROFINET IO connection. **Recommendation:** Note the pin assignment on the BusAdapter/plug. You can find information about this in the documentation "SIMATIC; Distributed I/O; BusAdapters for Distributed I/O (https://support.industry.siemens.com/cs/de/en/view/109804897)". When installing the CFU in a housing, use cables that are suitable for a FastConnect Ethernet connection. You can fasten them at any time to a PROFINET BusAdapter with a FastConnect Ethernet connection (e.g. BusAdapter BA 2×FC).
7	Insert and screw the selected BusAdapter on the CFU (terminal X5).
8	**Only CFU PA:** When you use the CFU, ensure that the shielded lines of the fieldbus cables are connected correctly. You can find information on this in section "Connecting the PROFIBUS PA cable to CFU in aluminum housing (Page 158)". If available and necessary, you can fasten the cables to the shielding bus using cable ties.
9	**Only CFU with aluminum housing:** When you use the CFU in the housing, the cable glands ensure sealing between the cables and the housing. Ensure that the required reducing inserts and blanking plugs are installed in the cable glands to seal the housing. Tighten the cap nuts of the cable glands. Ensure that the pressure compensation element is correctly installed in the housing. **Note**: Ensure there is strain relief for the cables outside the housing. Even when installed in the housing, the cable glands do not serve as strain relief.
10	Fasten the grounding cable to the mounting rail or housing.

Step	
11	Connect the cables of the power supply (PS1 to X80/PS1 PS2 to X81/PS2). Observe the pin assignment on the plug connector (see section "Connecting the CFU to PROFINET IO (Page 76)").
12	**Only CFU with aluminum housing:** If you are using the CFU in the housing, check the housing (housing lid). • Make sure the housing and all seals are not damaged and correctly installed. • Ensure that there are no foreign bodies between the housing parts (e.g. between the housing cover and the housing base). • Close the housing.

See also

Removing the CFU (Page 63)

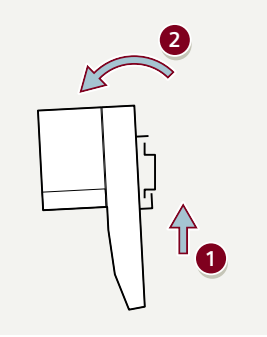
7.4 Removing the CFU

Tools required

You can find information on this in section "Tools and tightening torques (Page 217)".

Uninstalling the Compact Field Unit

1. If the Compact Field Unit is already in operation, switch off the power supply (24 V DC) of the Compact Field Unit before removing the CFU.
2. CFU with aluminum housing:
   Open the housing.
3. Unplug the plug connectors from the CFU or, if necessary, disconnect the cables from the connector / BusAdapter.
4. Loosen the screws on the BusAdapter.
5. Remove the BusAdapter.
6. Loosen the fixing screws at both sides of the CFU.



Push the CFU up and pull the CFU out to the front.

Connecting

8

8.1 Hardware-settings

No hardware settings are required on the CFU.

You can find information on this in section "Restoring the state of delivery (Page 141)".

8.2 Wiring rules

8-pin plugs of the CFU

The 8-pin plugs of a CFU are slot-coded. The coding prevents an incorrect placement, for example, when replacing the CFU.

TWIN wire end ferrules for the wires

Due to the space required by TWIN wire end ferrules with 0.75 mm^2 cross-section, you must ensure a correct angle for the conductor arrangement when crimping the TWIN wire end ferrule so that the wires are optimally arranged.

Note

CFU PA: Connecting field devices to FB<n>

Refer to section "Connecting the PROFIBUS PA field device (Page 71)".

Rules on current consumption and power loss of a CFU

The power loss **of all** utilized components in a housing must not exceed the maximum power that can be dissipated in the housing.

Tip:

When sizing the housing, ensure there is always sufficient heat dissipation (even at high outside temperatures).

- You can find more information in section "Mechanical and climatic ambient conditions for operation (Page 183)".
- You can find information on current consumption and power loss of the CFU in section "Technical specifications (Page 165)".

More information

- Refer to section "Use in hazardous areas (Page 31)".
- You can find information about required tools in section "Tools and tightening torques (Page 217)".
- You can find information about cables and wire end ferrules in section "Preparing cables (Page 69)".

8.3 Connecting the power supply to the CFU

Introduction

The power supply of the CFU is fed via two 2-pin connection plugs that are capable of feed-through wiring and are located on the front of the CFU.

You can find information on the supply voltage of the CFU variant used in the "Technical specifications (Page 165)" section.

Power supply unit

⚠ WARNING

Safety extra-low voltage

Only use power supply units of type SELV/PELV with safe electrically isolated functional extra low voltage (≤ 28.8 V DC).

CFU PA:
The SELV/PELV power supply unit must also comply with at least one of the following requirements:

- The power supply unit supplies safety extra low voltage (SELV) with power limitation (Limited Power Source, LPS) in accordance with the following standards: IEC 60950-1, EN 60950-1, VDE 0805-1.
- The power supply unit of the device complies with NEC Class 2 according to the National Electrical Code (r) (ANSI / NFPA 70).

NOTICE

Potentials

The freely configurable channels of the CFU are connected to the potential of the power supplies (not isolated).

- CFU PA: In case of polarity reversal of the power supply, a short circuit is possible via the ground connections.
- CFU DIQ: The power supply connections are protected against polarity reversal.

Read section "Use in hazardous areas (Page 31)" if needed.

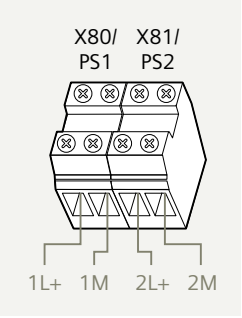
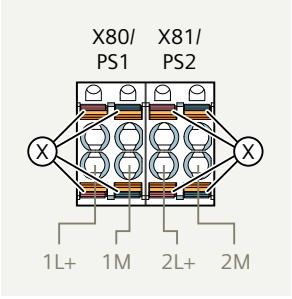
Note

NE 21 and IEC 61131-2

For compliance with NAMUR recommendation NE 21 and with IEC 61131-2, use only power supply units/power packs (230 V AC --> 24 V DC) with bridging of power failures of at least 20 ms. You can find up-to-date information on PS components on the Internet (http://mall.automation.siemens.com).

Connecting the power supply (X80/PS1 and X81/PS2)

Table 8-1 Supply voltage connection with CFU

Connection with screw-type terminals	Connection with push-in terminals
	
1L+: Supply voltage: 24 V DC 1M: Supply voltage: Ground 2L+: Supply voltage: 24 V DC 2M: Supply voltage: Ground x: Spring opener	

Connect the M and L+ wires of a power supply to the plugs X80/PS1 and X81/PS2.

- The power supply is connected using two 2-pin plugs (pluggable terminal blocks).
- A redundant power supply can be connected (plug connectors X80/PS1 and X81/PS2).
  - CFU DIQ: Both inputs are decoupled.
  - The ground connections of the plugs (1M and 2M) are connected to each other in the CFU.
  - There is no load distribution.
  - When a redundant power supply is used, the power supply unit with the higher output voltage supplies the device.
- Two contacts each are located over each other for each potential (L+ and M). This ensures that the power supply can be looped through (current: maximum 10 A).
- The power supply has a high-impedance connection with the housing to enable an ungrounded installation.
- Observe the Wiring rules (Page 65).
- The maximum cross-section of the connection is 2.5 mm^2. A strain relief is not present.

Note

Diagnostics of the redundant power supply

Diagnostics can be enabled for the redundant power supply in the commissioning wizard of the CFU. You can find information on this in section "Using the wizard for CFU configuration (Page 84)".

Requirements

- The plugs are present (X80/PS1 or X81/PS2, section "Article numbers (accessories / spare parts) (Page 213)").
- Only wire the plugs when the power supply is switched off.
- Refer to section "Wiring rules (Page 65)".

Tools required

You need a screwdriver with a 3 mm to 3.5 mm blade width to loosen or connect cables.

Fastening the cable to the plug

You can find information on connecting the cables in section "Selecting connection system (Page 69)".

Slot for the power supply of the CFU

Insert the plug into the CFU (X80/PS1 or X81/PS2).

Display of the supply voltage

The "PS1" and "PS2" LEDs indicate whether a power supply is connected (see section "Diagnostics via LED displays (Page 119)"):

- X80/PS1: "PS1" LED lights up green
- X81/PS2: "PS2" LED lights up green

Removing a wire

Plug with screw-type terminals	Plug with push-in terminals
1. Open the terminal with the screwdriver.	1. Using the screwdriver, press the spring opener as far as it will go and pull the cable out the terminal.
2. Remove the cable from the plug.	2. Pull the screwdriver out of the spring release.

8.4 Connecting the cables

8.4.1 Selecting connection system

Terminal types

The following terminal types are available for the CFU for connecting the cables to the sensor and actuators and the power supply.

- Push-in terminals (included in scope of delivery of the CFU)

More information

- Section "Preparing cables (Page 69)"
- Section "Connecting the cable using push-in terminals (Page 70)"
- Section "Connecting cables using screw terminals (Page 71)"
- Section "Connecting the power supply to the CFU (Page 66)"
- Section "Connecting the PROFIBUS PA field device (Page 71)"
- Section "Connecting digital sensor or actuator to the DIQ channel (Page 72)"
- Section "Tools and tightening torques (Page 217)"

8.4.2 Preparing cables

To connect a cable, follow these steps:

Step number:	Step	Cable (you can find more information in section "Cable cross-sections and ferrules (Page 218)")	
		Flexible (stranded), without wire end ferrule, unprepared	**Solid without wire end ferrule, flexible (stranded) with wire end ferrule or ultra-sonically sealed**
1	Remove cable sheath and shielding	• Length 60 mm • CFU PA with aluminum housing Also remove the sheath of the PA bus cables in the area of the shield terminals: – Bottom terminals: Remove the sheath in the area between 150 mm and 165 mm – Top terminals: Remove the sheath in the area between 140 mm and 155 mm	
2	Strip cables	• Strip cable for plug with screw-type terminal: 7 mm • Strip cable for plugs with push-in terminals: 10 mm	

Step number:	Step	Cable (you can find more information in section "Cable cross-sections and ferrules (Page 218)")	
		Flexible (stranded), without wire end ferrule, unprepared	**Solid without wire end ferrule, flexible (stranded) with wire end ferrule or ultrasonically sealed**
3	Additional preparation	Compress the wires or use wire end ferrules. Refer to section "Cable cross-sections and ferrules (Page 218)".	None
4	Wire the plugs	Connect the cables to the plug. • Section "Connecting the cable using push-in terminals (Page 70)" • Section "Connecting cables using screw terminals (Page 71)"	

8.4.3 Connecting the cable using push-in terminals

Note

Cable cross-sections

With small conductor cross-sections and stranded cables, there is a risk that the cable will be bent when it is plugged into the terminal.

Recommendation
Use wire end ferrules to prevent contact problems or short circuits.

You can find information on preparing the cables in section "Preparing cables (Page 69)".

Connecting the cable

Procedure

1. Prepare the cables.
2. For stranded wire:
   Press the screwdriver against the spring release.
   The spring bracket opens.
3. Insert the wire into the round opening as far as it will go.
4. For stranded wire:
   Remove the screwdriver from the spring release.

Result

The cable is contacted firmly in the connector.

8.4.4 Connecting cables using screw terminals

Note

Cable cross-sections

With small conductor cross-sections and stranded cables, there is a risk that the cable will be bent when it is plugged into the terminal.

Recommendation
Use wire end ferrules to prevent contact problems or short circuits.

- You can find information on preparing the cables in section "Preparing cables (Page 69)".
- You can find information on tools in section "Tools and tightening torques (Page 217)".

Connecting the cable

Procedure

1. Prepare the cables.
2. Open the screw terminal using the screwdriver.
3. Insert the cable into the opening as far as it will go.
4. Tighten the screw terminal on the cable using a screwdriver.
   Pay attention to compliance with the required tightening torques.

Result

The cable is contacted firmly in the connector.

8.5 Connecting the PROFIBUS PA field device

Note

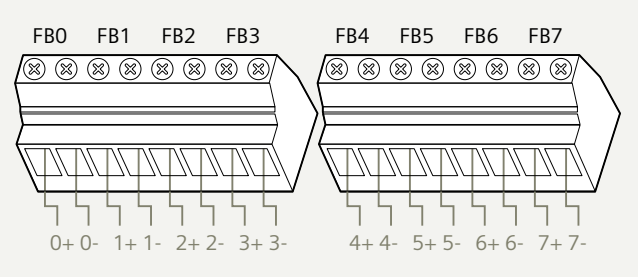
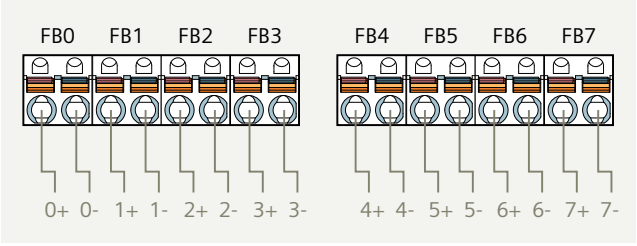
Field devices with hardware-coded address

Refer to section "Configuring a PROFIBUS PA field device (offline) (Page 98)".

You can connect one PROFIBUS PA field device to each fieldbus connection (fieldbus connections FB0 to FB<n>):

- Information on the terminal pin assignment:
  - Section "CFU PA: Terminal assignment (Page 215)"
- You can find information on connecting the cables in section "Selecting connection system (Page 69)".

Table 8-2 Example for FB0 to FB7

Terminals for the bus cable to the field device <n>+ and <n>-	
Plug with screw-type terminals	Plug with push-in terminals
CFU PA	CFU PA
	

Wiring

Note

Grounding

The shielding of the PROFIBUS PA cables must be connected to functional grounding case.

Refer to section "Preparing cables (Page 69)".

More information

- Section "Technical specifications of the CFU PA (Page 187)"
- Section "Tools and tightening torques (Page 217)"

8.5.1 PROFIBUS PA field device: Connecting the cable shield to the CFU

Introduction

The shields of the fieldbus cables must be connected to the functional earth FE. Guide the shield as far as possible onto the connections of the CFU.

Shielding of fieldbus cables for CFU with aluminum housing

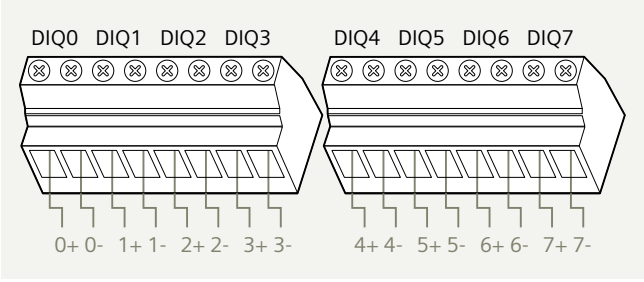
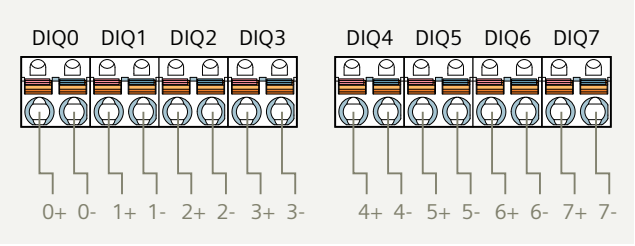
Refer to section "Connecting cable shields of the PROFIBUS PA cables to CFU in aluminum housing (Page 159)".

8.6 Connecting digital sensor or actuator to the DIQ channel

Read section "Use in hazardous areas (Page 31)" if needed.

The CFU offers freely configurable channels (DIQ; DIQ<n>). You can connect one sensor or actuator to each freely configurable channel of the CFU.

- You can find information on the terminal pin assignment in the following sections:
  - Section "CFU DIQ: Terminal assignment (Page 215)"
  - Section "CFU PA: Terminal assignment (Page 215)"
- You can find information on the tightening torques in section "Tools and tightening torques (Page 217)".

Terminals for the freely configurable channels (DIQ<n>) for one sensor or actuator each	
Plug with screw-type terminals	Plug with push-in terminals
	

Wiring

CAUTION

Current carrying capacity of the CFU

Observe the total maximum permissible load current of all channels together (total current U_s+DQ) and temperature-dependent limits.
You can find information on this in the section "Rules for the operation (Page 29)".

Parallel connection not permitted

- Parallel connection of sensor supplies is not permitted.
- Parallel connection of digital outputs is not permitted.

Sensor supply

- An external power supply as DI sensor supply is not permitted. This error case is recognized by the CFU during ramp-up or during re-parameterization and triggers a diagnostic interrupt. **All freely configurable channels are disabled until the error has been remedied**.

You can find more information in the following sections:

- Section "Technical specifications of the CFU DIQ (Page 200)"
- Section "Technical specifications of the CFU PA (Page 187)"
- Section "Configuring DIQ channels (parameter overview - DIQ) (Page 105)"

The following tables show the wiring schemes, depending on how the freely configurable channels are used.

- Digital input
- Digital output

You can find information on connecting the cables in section "Selecting connection system (Page 69)".

Note

Diagnostics, wire break

If you use simple encoder contacts, you must observe the following:

In order to detect a wire break, you must connect a resistor parallel to the encoder contact (encoder resistance for wire break diagnostics: 15 kΩ to 18 kΩ).

Digital input

Table 8-3 Wiring variant "Digital input with 1-wire interface"

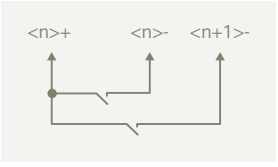
Wiring scheme	Terminals	Connection
	• <n>+: Sensor supply, channel DI<n>+ • <n>–, <n+1>–, ... Multiple input signals DI<n>-, DI<n+1>-,....	One sensor supply for multiple channels

Table 8-4 Wiring variant "Digital input with 2-wire interface"

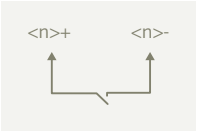
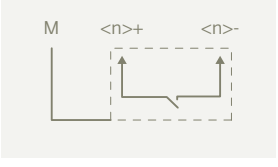
Wiring scheme	Terminals	Connection
	• <n>+: Associated sensor supply, channel DI<n>+ • <n>–: Input signal, channel DI<n>–	One sensor supply for one channel

Table 8-5 Wiring variant "Digital input with 3-wire interface"

Wiring scheme	Terminals	Connection
	• M: Reference potential for the sensor supply • <n>+: Associated sensor supply, channel DI<n>+ • <n>–: Input signal, channel DI<n>–	One sensor supply for one channel

Digital output

Table 8-6 Wiring variant "Digital output with 1-wire interface"

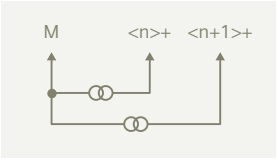
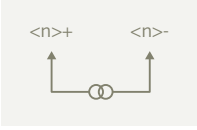
Wiring scheme	Terminals	Connection
	• <n>+, <n+1>+, ... Multiple output signals DQ<n>+, DQ<n+1>+, ... • M or <n>–: Ground	One common ground connection for multiple channels (X82): • M terminal block or • Channel ground <n>–

Table 8-7 Wiring variant "Digital output with 2-wire interface"

Wiring scheme	Terminals	Connection
	• <n>+: Output signal, channel DQ<n>+ • <n>–: Associated ground, channel DQ<n>–	One ground connection for one channel

8.7 Connecting the functional grounding to the CFU

The CFU must be connected to the functional grounding.

If the CFU is mounted on the mounting rail, there is a conductive connection to the DIN rail via the clamp attachment.

Note

Alternative grounding

You can dispense with the additional ground conductor for the CFU described below, provided that:

- The CFU is mounted on the recommended mounting rail.
- The mounting rail is permanently connected to the protective conductor system using an equivalent installation that complies with standards (for example, by attachment to a grounded control cabinet wall).

Recommendations for connecting the functional grounding

You can find information on suitable terminals at SENTRON accessories 8WA range (https://mall.industry.siemens.com/mall/en/b1/Catalog/Products/10033769?tree=CatalogTree).

Requirements

- Perform wiring when the supply voltage is switched off.
- Observe the Wiring rules (Page 65).
- Attachment of the grounding cable:
  Zone 2 or safer area: Terminal or cable lug

Cross-section of grounding cable

To prevent possible interference, the cross-section of the ground conductor for the mounting rail must be greater than the cross-section of the ground conductor at the power supply of the CFU.

Note: The grounding conductor must have a cross-section of at least 4 mm^2.

Tools required

- Screwdriver for fastening the connection terminal onto the mounting rail (typically 3 mm)
- Screwdriver for fastening the grounding wire onto the mounting rail
- Wire stripping tool
- Possibly cable lug pliers

Grounding the mounting rail

1. Strip insulation from the grounding cable.
2. Attach the grounding cable securely to the mounting rail.
   Recommendation: To connect the grounding cable in the explosion-prone area and in the safe area, select the following connectors: Connection terminal or cable lug.
3. Attach the other end to the functional grounding.

More information

Section "Article numbers (accessories / spare parts) (Page 213)"

8.8 Communication over PROFINET

8.8.1 Connecting the CFU to PROFINET IO

Dependency

The connection options depends on the type of the CFU.

Connection options

The following possibilities are available for connecting the CFU to the PROFINET IO:

- Connect cable to BusAdapter with plug connector:
  - PROFINET cable with RJ45 BusAdapter
  - Fiber-optic connection with LC BusAdapter
- Direct cable connection in the case of:
  - BusAdapter with FastConnect connection
  - Variable distance BusAdapter
  - Connect a FastConnect cable directly to the BusAdapter

More information

- Section "Basics of PROFINET (Page 223)"
- You can find more information on approved BusAdapters in section "Article numbers (accessories / spare parts) (Page 213)".
- You can find information about installing the BusAdapters in the documentation "Industrial Ethernet / PROFINET Passive Network Components".
  You can find this documentation on the Internet at http://support.industry.siemens.com/cs/ww/de/view/84922825 (http://support.industry.siemens.com/cs/ww/en/view/84922825).

Commissioning

9

9.1 Switching on the CFU

⚠ DANGER

Explosion hazard

It is forbidden to open the housing during operation in **Zone 22** hazardous areas.

In **Zone 2** hazardous areas, it is forbidden to connect or disconnect the following cables to/from the CFU during operation:

- Power supply
- PROFINET cables, except fiber-optic cables (PROFINET connection of the CFU)
- Freely configurable channels

Disconnect the CFU from the power supply before starting work.

The fieldbus connections are implemented as intrinsically-safe connections (Ex ic) and may be removed and inserted during operation.

Observe the diagnostics on wire break.

If the supply voltage is connected, the CFU is switched on.

Delivery state

In the delivery state, the CFU has no device name and no IP address.

Device name is transferred from the BusAdapter

If a device name is stored in the newly inserted BusAdapter, the device name is transferred from the BusAdapter when the CFU is switched on.

Refer to section "Removing or inserting the BusAdapter (Page 131)".

Automatic name assignment and setting of the IP address on device replacement

If the following conditions are met prior to installation of the CFU, the CPU automatically restores the IO device name and IP address based on neighborhood relationships after installation of the new CFU:

- The new CFU is reset to factory settings.
- The topology of the PROFINET IO system is configured and downloaded to the CPU.

Refer to section "Replacing the CFU (Page 139)".

More information

Section "Restoring the state of delivery (Page 141)"

9.2 Commissioning (overview of procedure)

Procedure

Note the following in the steps below:

- You can configure freely configurable channels on CFU DIQ and CFU PA.
- You can only configure field devices and fieldbus connections on CFU PA.

	Offline commissioning with project	Online commissioning with project	PDM stand alone without project
Advantages	Engineering is possible without hardware. You perform the commissioning as a last step.	Fast commissioning through efficient determination of devices present in the system and direct assignment of parameters in the system	Advance commissioning with real devices and correct parameters without a project in PCS 7 or STEP 7
Procedure	1. CFU: Configuring (Page 93) 2. Optional (if you perform this step, step 8 can be omitted) Topology: Configuring (Page 90) If you perform a topology configuration, this enables automatic name assignment on device replacement in PCS 7 systems through use of neighborhood relationships. 3. Freely configurable channels: Configuring (Page 96) and assigning parameters (Page 105) 4. Field devices: Configuring (Page 98) 5. Compile the configuration. 6. Establish the online connection to the automation system. 7. Download the configuration to the automation system. 8. Assigning device name (Page 89) 9. LED status: check (Page 119) If necessary, open the module information in order to receive more precise diagnostic information. 10. Optional: CFU: Assigning parameters via SIMATIC PDM (Page 111) 11. Field devices: Assigning parameters via SIMATIC PDM (Page 114)	1. Online: Assigning device name (Page 89) 2. CFU: Configuring (Page 94) 3. Optional: Configuring the topology (Page 90) If you perform a topology configuration, this enables automatic name assignment on device replacement in PCS 7 systems through use of neighborhood relationships. 4. Compile the configuration. 5. Download the configuration to the automation system. 6. Using the wizard for CFU configuration (Page 84) 7. Reading back IO with the PROFIBUS PA field device (Page 113) Assigning parameters for freely configurable channels 8. Optional: CFU: Assigning parameters via SIMATIC PDM (Page 111) 9. Field devices: Assigning parameters via SIMATIC PDM (Page 111)	Requirements: The online device must be reachable via an IP address. 1. Online: Assigning device name (Page 91) 2. Process devices network view: Creating networks and inserting a CFU (Page 116) 3. Using the wizard for CFU configuration (Page 84) 4. Reading back IO with the PROFIBUS PA field device (Page 113) 5. CFU PA field devices: Assigning parameters via SIMATIC PDM (Page 114)
Result	All steps up to step 6 can be performed without hardware. Commissioning is performed starting from step 7.		• CFU and field device parameters are assigned. • CFU is not incorporated in any project.

The CFU is in data exchange mode with the IO Controller.

CFU PA: Activating PROFIsafe operation mode for field devices

If you want to connect field devices to the CFU that support PROFIsafe operation mode (mode: S4), you must consider the following:

PROFIsafe operation mode may only be activated after commissioning of the field devices. In the PROFIsafe mode S4, the field device prohibits changes of any kind.

- S4 = PROFIsafe operation mode
- S3 = Prepared for safe mode, check completed
- S2 = Prepared for safe mode, not checked

9.3 PA field devices

9.3.1 PROFIBUS PA field device: Startup depending on the configuration

You can find information on the PROFIBUS PA profiles and Selected IO in section "PA profiles for field devices on PROFIBUS PA (Page 53)".

Field device detected at the CFU startup

The power supply of the field devices is enabled in the default parameter assignment of the CFU.

- During the startup phase of the field device, the green LED flashes on the fieldbus connection.
- When the startup phase is successfully completed, the green LED is lit.
  Communication between the CFU and field device is then possible.

Diagnostics

If the field device does not support the configured IO, a diagnostic interrupt is triggered.
To eliminate the error, you have to change the configuration.

Section "Diagnostics via LED displays (Page 119)" contains the following information for a fieldbus connection:

- Information for analysis of the cause of errors
- Information on the status

Field device replacement

- During a field device replacement, the Selected IO of the CFU overwrites the profile set in the field device.
- If the field device does not have this profile, this is signaled by an error message.
  You then have the option of changing the Selected IO to a value available in the field device.
  The Selected IO of the CFU is **never** automatically overwritten by the PA profile active in the field device.

Configuring an IO

The PA profiles offered by the field device are read in again by the CFU only after a field device replacement.

For connected field devices, the CFU automatically attempts to set the PROFIBUS PA address on the field device.
You can find the assignment of fieldbus connections to the addresses of the PROFIBUS PA field devices in section "CFU PA: PROFIBUS addresses of the PROFIBUS PA field devices on the CFU (FBn) (Page 224)".

You have the following options for configuring an IO:

- **Configuring IO in HW Config (offline)**
  Insert PROFIBUS PA profiles via drag-and-drop from the catalog.
  You can find information on this in section "Configuring a PROFIBUS PA field device (offline) (Page 98)".
- **Configuring IO in the "Configuration & Maintenance (CFU ... V2.0)" wizard (online)**
  Set PROFIBUS PA profiles in SIMATIC PDM using the commissioning wizard of the CFU.
  You can find information on this in section "Parameter assignment of a PROFIBUS PA field device (online) (Page 114)".

Disabling fieldbus connections.

You can disable individual fieldbus connections in SIMATIC PDM using the commissioning wizard of the CFU. This switches off the power supply on the channel.

9.4 Sensors and actuators on DIQ channels

9.4.1 Configuration of the DIQ channels: Startup depending on the configuration

Diagnostics

You can configure the diagnostics via HW Config for a sensor/actuator connected to a DIQ channel.

To eliminate the error, you have to change the configuration.

Section "Diagnostics via LED displays (Page 119)" contains the following information about a DIQ channel:

- Information for analysis of the cause of errors
- Information on the status

Configuring a DIQ channel

Automatic detection is not possible for the sensors and actuators connected to a DIQ channel.

You can find the assignment of DIQ channels to the addresses in the following sections:

- Section "CFU DIQ: Terminal assignment (Page 215)"
- Section "CFU PA: Terminal assignment (Page 215)"

Configuring DIQ in HW Config (offline)

- Activate DIQ channel and set the parameters.
- You can find information on this in section "Configuring a digital channel (DIQ) (Page 96)".

See also

Configuring DIQ channels (parameter overview - DIQ) (Page 105)

Counter in operation (startup and stop) (Page 45)

9.5 Configuring with PDM

9.5.1 Using the wizard for CFU configuration

Using the "Configuration & Maintenance (CFU ... V2.0)" wizard

The CFU can be commissioned using the wizard.

Compared to commissioning of the CFU with STEP 7 alone, additional options and functions in the CFU are available with the wizard.

- You can find information on this in section ""Commissioning Wizard: Complete" dialog (Page 85)".

Requirement

Online connection to the CFU

Opening the wizard

1. Select the CFU in the component view.
2. Select the shortcut menu command **Edit > Start SIMATIC PDM**.
   SIMATIC PDM opens.
3. In SIMATIC PDM, select the menu command **Device > Configuration & Maintenance (CFU ... V2.0)**.
   The **Configuration & Maintenance (CFU ... V2.0)** dialog window opens.

You can find detailed information on the use of the wizard in its individual dialog windows.

Table 9-1 Legend for the "**Configuration & Maintenance (CFU ... V2.0)**" wizard

CFU PA	**CFU DIQ**
"Commissioning Wizard: Complete" dialog (Page 85)	
"Commissioning Wizard: Only add/remove/replace field devices" (Page 87)	
"Maintenance Overview" dialog (Page 87)	
Help ... ("Help" dialog (Page 88))	

See also

Configuring a PROFIBUS PA field device (offline) (Page 98)

Reading back IO with the PROFIBUS PA field device (Page 113)

9.5.2 "Commissioning Wizard: Complete" dialog

You can find detailed information on the use of the wizard in the respective dialog window.

Table 9-2 "Configuration & Maintenance Wizard (CFU ... V2.0)" wizard

Step	Function in commissioning wizard
1	**Specify I&M data** of the **CFU** • For the CFU: – Display of article number, serial number, bootloader version, hardware and firmware version – Setting the I&M data • For the BusAdapter – Display of the article number and the serial number – Setting of the installation date
2	**Configure power supply and monitoring the temperature/humidity of the electronics** • Monitor redundant power supply – The CFU allows connection of 2 power supplies. – If the power supply is configured as "redundant", a diagnostic interrupt is triggered if one power supply is missing. • Monitor power supply faults – A diagnostic interrupt can be configured for short-term faults. • Monitor the electronic temperature of the CFU **Recommendation:** Configure the warning thresholds for signaling the temperature according to the configuration situation, in particular when the CFU is installed in a housing or is mounted vertically. The electronics temperature can be higher than the permissible ambient temperature of the CFU. When the permissible electronics temperature is exceeded, an alarm is signaled. • **CFU DIQ** Monitor the electronics humidity of the CFU

Step	Function in commissioning wizard
3	**Verify freely configurable channels (DIQ<n>)** • Display of the hardware parameters for the freely configurable channels (DIQ) transferred from HW Config. • In addition for counter channels: – Display of an assigned DQ channel – Display of an enabled HW gate – Display of the operating mode ("Counter" or "Frequency measurement") • With active actuator shutdown: Display of the monitoring channel
4	**CFU PA: State of automatic addressing on PROFIBUS PA** • Enabling and disabling of individual fieldbus connections. • Status: Display for commissioning of field devices (automatic addressing, reading out of supported IOs) • Display of an active service port. A configured service port is marked with "On".
5	**CFU PA: Configure type of field devices on PROFIBUS PA (FB<n>)** • Selection of how a connected PROFIBUS PA device is to behave: – Profile (recommendation) – Vendor-specific device description You can find more information on this in section "Configuring a PROFIBUS PA field device (offline) (Page 98)". • Assigning/changing field device names • Information on field devices • Select the desired field device profile in the "Change IO to ..." drop-down list. • Lock/Freeze function Prevents unintentional changes to the configuration in the CFU. • Display of an active service port: Note: If a fieldbus connection is configured as a service port, the port designation changes from "**FB<n>**" to "**FBx --> FBy**".
6	**CFU PA: Configure extended diagnostic possibilities for PROFIBUS PA** Extended fieldbus diagnostics • Voltage monitoring for the fieldbus connection (Min alarm) Fixed low alarm limit for each fieldbus connection. • Voltage monitoring for the fieldbus connection (Min warning) User-defined warning limit for each fieldbus connection. • Spur line current deviation (valid for all fieldbus connections): Permissible percentage deviation from the set reference current value • Reference current value Set a reference current value corresponding to the technical specifications of the field device after commissioning.
7	**Commissioning overview** Shows the status of the CFU and the connected components: • Commissioning status • Electronic temperature (EBTM - Electronic Board Temperature Monitoring) • Power supply X80/PS1 and X81/PS2 • **CFU DIQ:** Freely configurable channels (DIQ0 to DIQ15) • **CFU PA:** Freely configurable channels (DIQ0 up to DIQ7); fieldbus connections (FB0 to FB7)

9.5.3 "Commissioning Wizard: Only add/remove/replace field devices"

If you click the "Commissioning Wizard: Only add/remove/replace field devices" button, you go directly to the step of the commissioning wizard:

- CFU PA: Step 4/6

Simplified commissioning of connected field devices

You can find information on this in section "Performing simplified commissioning for PROFIBUS PA field devices (Page 112)".

9.5.4 "Maintenance Overview" dialog

The overall status of the CFU is displayed in this dialog window. The dialog window contains the following tabs:

- CFU state
- DI/DO channels
- PROFIBUS PA
- Expert functions
- Diagnostics buffer
- Commissioning History

Expert functions

You can do the following in this tab:

Function of	Button	Function
CFU	Reset over-temperature alarm	Reset thermal overload alarm of the freely configurable channels (DIQ reset)
CFU PA	Reading out field device data again	All supported IOs of a PROFIBUS PA device are read out again.
CFU PA	Restart the field device	The power supply to the field device is briefly switched off and on again. Automatic addressing is then triggered and all supported IOs of a PROFIBUS PA device are read out again.

Diagnostics buffer

The history of all diagnostics interrupts is shown in this tab.

The memory is volatile.

Commissioning History

The history of changes made with the "**Configuration & Maintenance (CFU ... V2.0)**" wizard is shown in this tab.

The memory is non-volatile.

9.5.5 "Help" dialog

Opens the help for the wizard.

9.6 Preparing the CFU for commissioning

9.6.1 Rules for device names

A CFU must have a device name so that an IO controller can address the CFU as an IO device.

This approach was chosen for PROFINET because names are easier to understand than complex IP addresses.

The device name must be unique in the PROFINET IO system.

The assignment of a device name for the CFU corresponds to the setting of the PROFIBUS address for a DP device.

Rules for specifying the device name (in accordance with IEC 61158-6-10)

- A device name may have a maximum length of 240 characters (letters, numbers, hyphen or dot).
- A device name must consist of at least one character.
- In a device name a character string between two dots forms a label. Such a label could, for example, be ".device-a.".
- A label may have a maximum length of 63 characters.
- The minimum length of a label is one character, for example ".a.".
- A device name has one or more labels.
- A label may only contains the letters a to z (no umlauts), the numbers 0 to 9 as well as the hyphen.
- A label must not contain any special characters such as brackets, underscore, slash or blank.
- Umlauts (such as "ä" or "ü") must not be used.
- The hyphen ("-") is the only special character that is allowed.
- A label must not begin with a hyphen, however.
- A label must not end with a hyphen either.
- A device name may not have the form n.n.n.n (n = 0...999).

- A device name must not begin with the character string "port-xyz-" (x,y,z = 0...9).
- A device name must not begin or end with a dot. For example, the character string ".device-a." is not permitted as the device name (only as a component of a device name, as a label).

Automatic addition of suffix to device name (offline configuration)

- If a PROFINET IO system contains multiple devices of the same type, STEP 7 automatically adds a consecutive number to the end of the device name originating from the GSD file. The second device has the suffix "-1", the third device the suffix "-2", etc.
- STEP 7 gives you the option of having the name of the IO system automatically added as a name component of the device name. To do this, select the "Use name in device/controller" option in the properties of the IO system. The device name then has the form: [Name from GSD file].[Name of IO system]

You can find more information om address and name assignment for PROFINET IO devices in the STEP 7 online help.

Automated name assignment during device replacement

If the topology is configured in PCS 7, when individual devices are replaced the device name is automatically transferred to the replacement device based on neighborhood detection.

You can find more information on this in following sections:

- Section "Configuring the topology (Page 90)"
- Section "Removing or inserting the BusAdapter (Page 131)"

9.6.2 Assigning device names with existing configuration from HW Config

Refer to section "Removing or inserting the BusAdapter (Page 131)".

If you have performed the steps in section "Configuring the topology (Page 90)", the configuration from HW Config is not required.

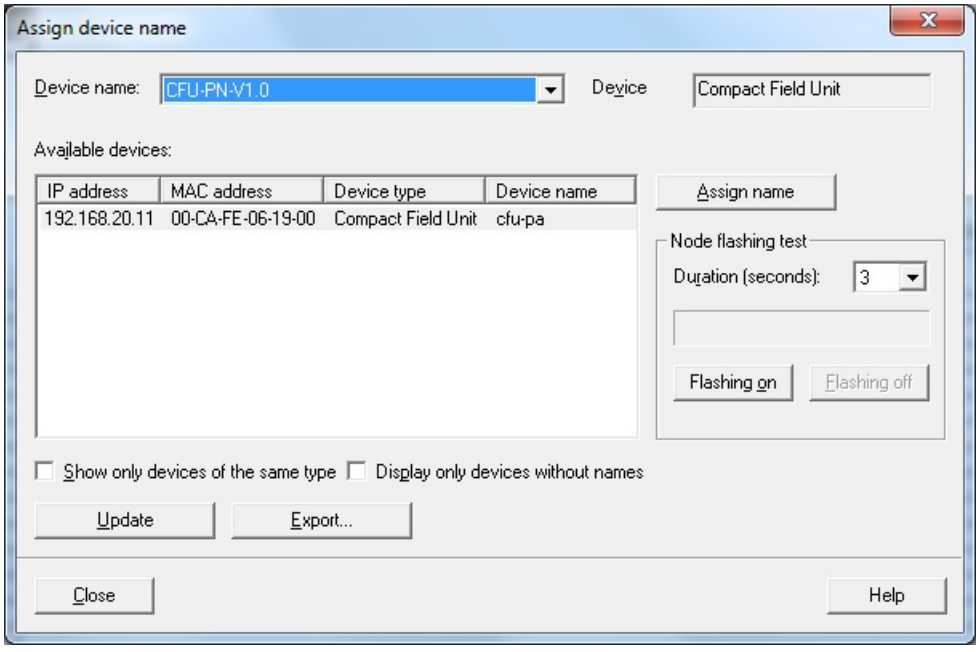
Requirement

- The device name must be unique in the PROFINET IO system.
- The programming device interface must be connected directly to the PROFINET IO system.
- The device name has been provided in HW Config in the properties dialog of the CFU.
- The MAC address of the CFU is known.

Procedure

1. Select the CFU in HW Config.
2. Select the menu command **PLC > Ethernet > Assign Device Name**.

3. For the first assignment of the device name, ensure that the following check boxes are selected:
   - Only show devices of the same type
   - Display only devices without names
4. In the "Available devices" list, select the CFU whose name you want to change.
5. If you want to check whether you have selected the desired CFU, click the "Flashing on" button.
   The following LEDs flash on the selected device:
   - PWR
   - RN
   - ERR
6. Click the "Assign name" button.
   The device name is assigned directly to the device.



9.6.3 Configuring the topology

Automatic name assignment during device replacement is possible in PCS 7 systems.

The automatic name assignment is only possible if the topology is configured. The downloaded topology enables the required device name for a replacement device to be determined and set based on neighborhood relationships on the PROFINET IO system.

Requirement

All components on the PROFINET IO system are created in HW Config.

Procedure

1. Select the PROFINET IO system to which the CFU is connected.
2. Select the menu command **Edit > PROFINET IO > Topology**.
   The "Topology editor" dialog box opens.
3. Select the "Graphic view" tab.
4. Position the objects according to the order of the cables in the system.

   Note

   You can move the displayed objects. You can use the miniature view to select the section to be displayed.

5. Using drag-and-drop, connect the connections of the CPU, the CFU and other components on the PROFINET IO system (green rectangles) according to the order of the cables in the system.
   In the "Table view" tab, you can make other system-specific settings (e.g. lengths of cables). You can find more information about this in the online help of the dialog box.

More information

Online help for STEP 7

9.6.4 Assigning the CFU parameters without configuration

Requirement

- The device name must be unique in the PROFINET IO system.
- The programming device interface must be connected directly to the PROFINET IO system.
- The MAC address of the CFU is known.
- SIMATIC PDM is used for parameter assignment.

Assigning the CFU parameters without a project

1. Select the menu command **PLC > Edit Ethernet node**.
2. Click the "Browse..." button in the "Ethernet node" area.
3. Select the CFU.
   Set the following in the dialog:
   - IP configuration of the CFU ("Set IP configuration" area)
   - Device name ("Device name" area)

   You can find more information in the STEP 7 online help.

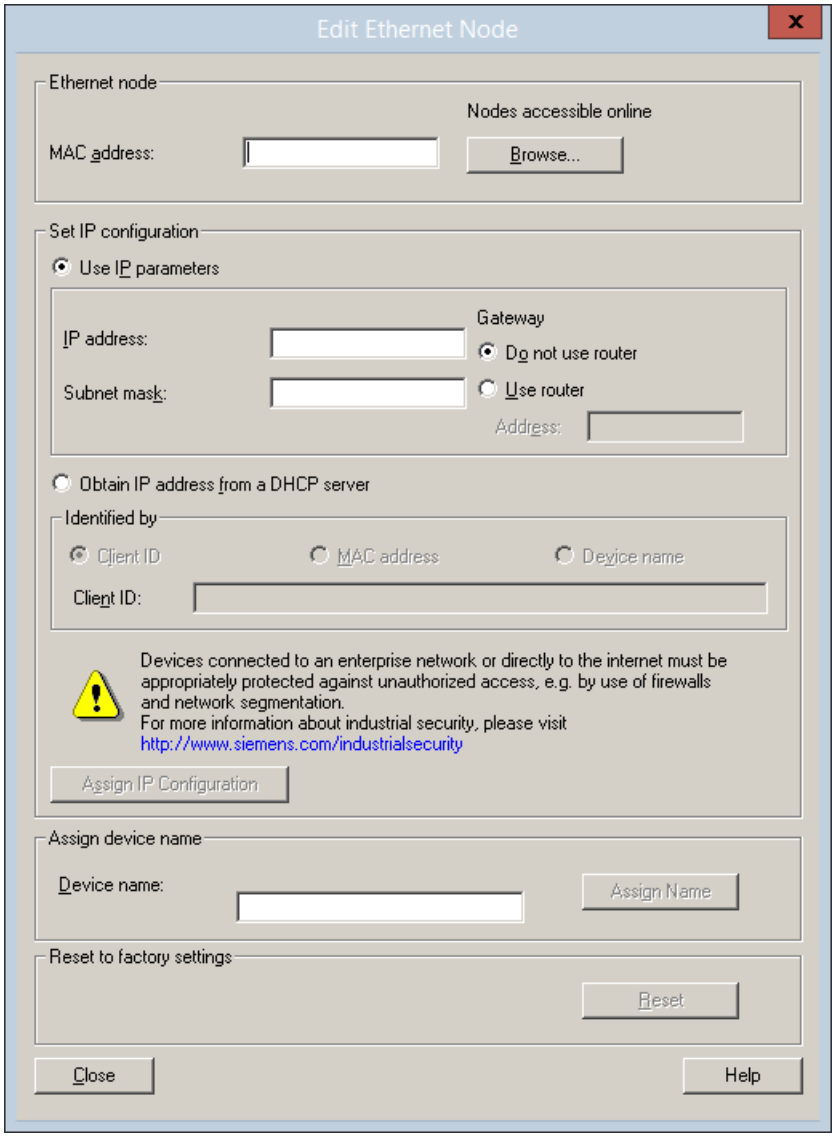


Figure 9-1 Dialog box: PLC > Edit Ethernet node

More information

Section "PROFIBUS PA field device: Online commissioning (Page 111)"

9.7 Requirement for the startup of the CFU

- The CFU has a valid PROFINET name (station name).
- The CFU has been configured correctly.

See also

Diagnostics via LED displays (Page 119)

Diagnostics with the Maintenance Station (Page 124)

9.8 Commissioning (offline)

9.8.1 Configuring

9.8.1.1 Overview of configuring and assigning parameters

You configure the CFU using the engineering system.

The configuration is divided into configuring and assigning parameters:

- Configuration (Page 94)
  The term "Configuring" is used for the layout, setting and networking of devices and modules within an environment (device or network view).
- Parameter assignment (Page 100)
  The term "Parameter assignment" refers to the specification of the hardware parameters and the settings for the data exchange.

Configuring the CFU

Take the following information sources for configuring into account:

- "Industrial Ethernet / PROFINET Passive network stations (https://support.industry.siemens.com/cs/ww/en/view/84922825)" manual
- Online help for the engineering system
- Help for the topology editor
- Readme (online)
- Current Product Information

9.8.2 Configuration

9.8.2.1 Introduction to configuring

Configuration of the components is carried out in HW Config. In the device view, you place the CFU on a PROFINET IO system using drag-and-drop.

When the CFU is placed in the automation system, the following data is entered automatically in the configuration table:

- Name of the component (module):
  Can be modified subsequently.
- Data from the hardware catalog:
  - Article number
  - Firmware version (in accordance with the planning)
- IP address and IO addresses:
  Can be modified subsequently.

9.8.2.2 Configuring the CFU

Requirement

- SIMATIC PDM is installed on the engineering station.
- The device description for the CFU is integrated in the PDM device manager.
- A CPU with PROFINET IO has been created in HW Config as a fieldbus.
- The type of network cable for connecting the CPU to the PROFINET IO is specified.
  This means that the type of required BusAdapter is also specified.

Procedure

1. In the component view, select the SIMATIC station and double-click the "Hardware" object in the detail window.
   HW Config opens.
2. If the hardware catalog is not visible, select the menu command View **> Catalog**.
   The hardware catalog opens.
3. Select the fieldbus (PROFINET IO).

Inserting the CFU

1. In the current PCS 7 profile, open the folder **PROFINET IO > I/O > Compact Field Unit.**
2. Double-click on the desired CFU variant:
   - **Compact Field Unit PA**
   - **Compact Field Unit DIQ**

   The CFU is inserted on the PROFINET IO.

3. Select the added CFU.
4. Select the shortcut menu command **Object Properties ...** .
5. Open the "General" tab.
   – Enter the system-specific device name for this CFU.
   – The following check boxes are selected by default in the "Node in PROFINET IO System" area:
   - "Assign IP address via IO controller" check box
   - "Configuration via PDM" check box
   You can also define the address manually.
6. If the Maintenance Station is used or recommendation:
   Open the "Identification" tab. Enter the system-specific data.

Selecting the BusAdapter

An RJ45 BusAdapter is inserted by default.

1. Select the BusAdapter to be changed in the CFU.
2. Open the following folder in the current PCS 7 profile:
   PROFINET IO > I/O > Compact Field Unit > Compact Field Unit (variant) **> BusAdapter >** <"type of the BusAdapter">.
3. Double-click the type of the required BusAdapter.
   The BusAdapter is inserted at both ports of the CFU.
   The BusAdapter type can be changed for the selected CFU. To do so click the required BusAdapter in the hardware catalog.

Requirements for loading the CFU

The following requirements must be met for the CFU:

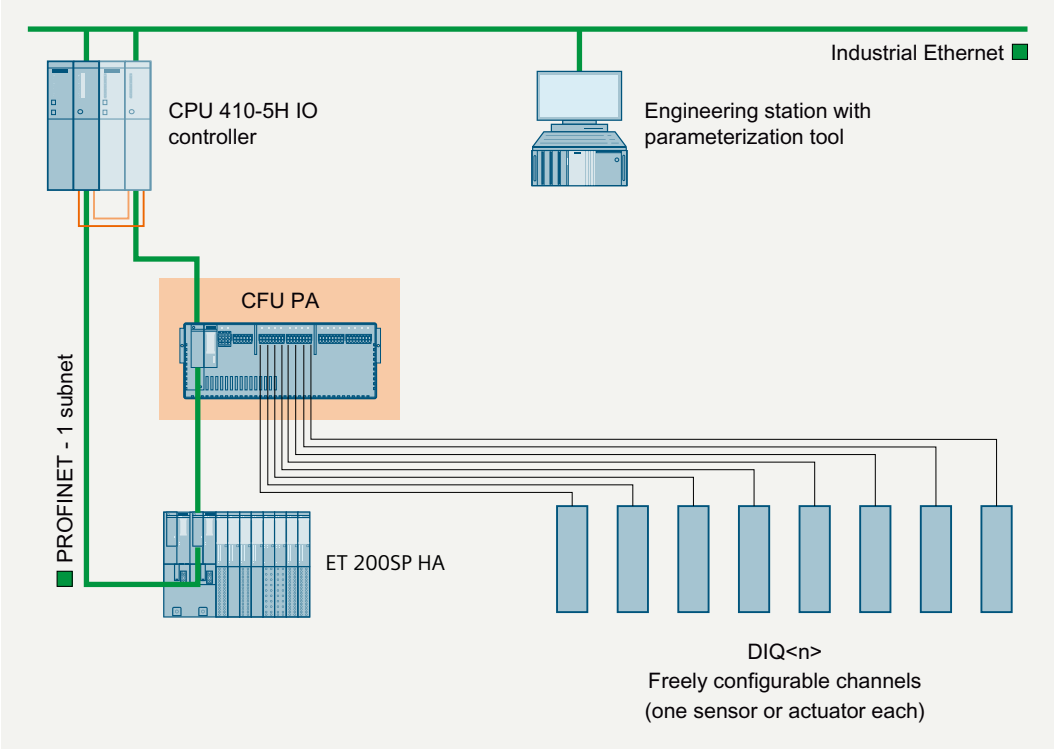
- The device name of the CFU (online) must match the device name from the configuration.
- The article number of the configured CFU must be identical to the article number of the CFU present in the system.
- The firmware version of the configured CFU must not be higher than the firmware version of the CFU present in the system.

More information

- Section "Configuring a digital channel (DIQ) (Page 96)"
- Section "Configuring a PROFIBUS PA field device (offline) (Page 98)"

9.8.2.3 Configuring a digital channel (DIQ)

In the following configuration the CFU is shown, as an example, with configured channels at a redundant IO controller.



Requirement

The CFU has been created in the automation system.

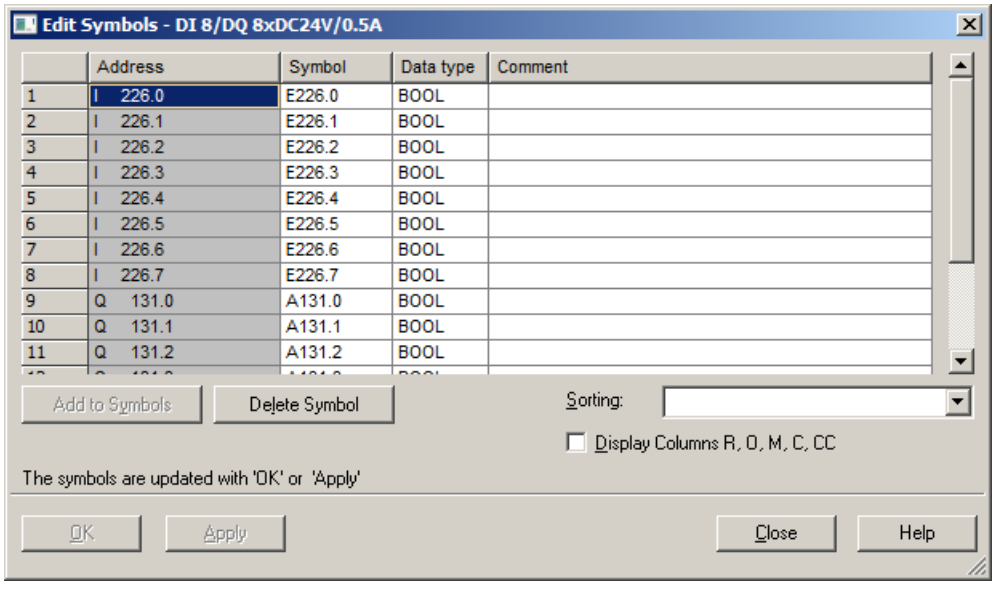
Configuring freely configurable channels

1. Open HW Config.
2. Select the CFU.
3. On slot 1, check whether the required DIQ submodule is configured (DIQ / DIQ with counter submodule).
   If necessary, delete the DIQ submodule and insert the required DIQ submodule.
   The counter submodule must be configured to use the "Counter" and "Frequency measurement" operating modes.
4. In the index list, double-click the "DIQ" slot.
   The "Properties - DIQ..." dialog box opens.
5. Enter a name for the "freely configurable channels" in the "General" tab.

6. You can modify addresses manually in the "Addresses" tab.
   Note: If PCS 7 is used, the engineering system applies correct parameter assignment. Modification is not required
7. You specify the properties of the freely configurable channels in the "Parameters" tab.
   You can find more information on assigning parameters in section "Configuring DIQ channels (parameter overview - DIQ) (Page 105)".

Specifying names for freely configurable channels

1. In HW Config, select the "DIQ" slot in the index list.
2. Select the shortcut menu command **Edit Symbols...** .
   The "Edit Symbols - DIQ..." dialog box opens.
3. Adapt the signal names manually or assign the names automatically using the "Add to symbols" function.
   Note: Even if all symbols are assigned, you can use an IO channel only once as an input or output.

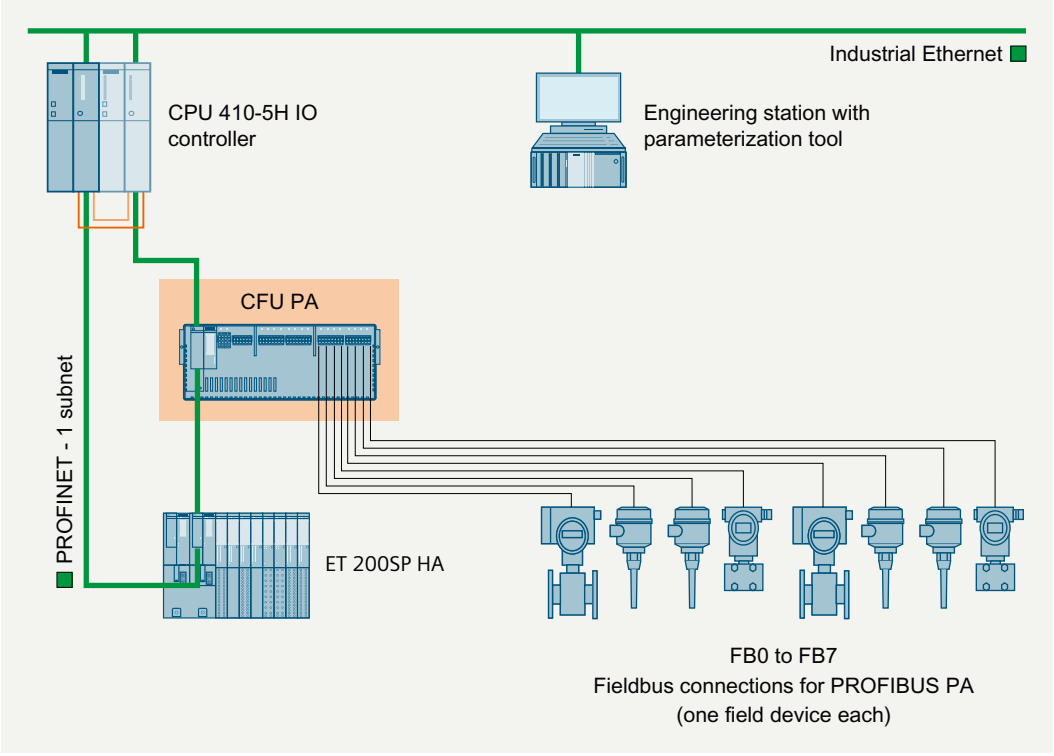


More information

You can find more information on assigning parameters in section "Configuring DIQ channels (parameter overview - DIQ) (Page 105)".

9.8.2.4 Configuring a PROFIBUS PA field device (offline)

The following configuration shows the connection of a CFU with field devices to a redundant IO controller as an example.



Recommendation: Use the PROFIBUS PA profile for the field device

PROFIBUS PA profiles enable simpler field device replacement than when device-specific GSD files of the manufacturer are used.

You can find information on the behavior of the CFU in section "PROFIBUS PA field device: Startup depending on the configuration (Page 82)".

When the PROFIBUS PA profile of the CFU is integrated, you can find the PA profile of the PA field devices in the catalog in HW Config in folder:

- Profile 3.0:
  PROFINET IO > I/O > Compact Field Unit > Compact Field Unit PA ... > PROFIBUS-PA Profiles
- Profile 4.0:
  PROFINET IO > I/O > Compact Field Unit > Compact Field Unit PA ... > PROFIBUS-PA Profiles

If you are using SIMATIC PDM, you can find the PROFIBUS PA profiles in the folder:

- Profile 3.0:
  PROFIBUS-PA > Profile > Siemens AG
- Profile 4.0:
  PROFIBUS-PA > Profile > Siemens AG

Select fieldbus address

A fieldbus address is usually automatically assigned to the connected field devices by the CFU.

Note

Fieldbus addresses 2 and 3

Fieldbus addresses 2 and 3 are used internally.

- If you connect field devices to the CFU using these addresses, automatic addressing of the field devices is not possible.
- To prevent malfunctions of the CFU, avoid connecting field devices with these addresses to the CFU.

Note

Field devices with hardware-coded address

For field devices with hardware-coded address setting, automatic assignment of a fieldbus address is not possible.

Set the fieldbus devices in such a way that the field device receives the address via the software.

If this is not possible, set the fieldbus address of the field device to the address suitable for the fieldbus connection before connecting it to the CFU. You can find information on the fieldbus addresses of the CFU in section "CFU PA: PROFIBUS addresses of the PROFIBUS PA field devices on the CFU (FBn) (Page 224)".

Procedure (offline configuration)

Note

Recommendation: Detecting field devices online with the CFU ... commissioning wizard

If an online connection to the CFU is available, you can read out and set the data of the field devices using the commissioning wizard of SIMATIC PDM. The transfer to the configuration can be performed later.

You can find information on this in section "Performing simplified commissioning for PROFIBUS PA field devices (Page 112)".

1. Open HW Config.
2. Select the CFU.
3. If the hardware catalog is not visible, select the menu command View **> Catalog**.
   The hardware catalog opens.
4. Double-click "PROFIBUS PA" in the library.
   Search for the required field device in the catalog.
5. Use drag-and-drop to move the field device onto the slot (FIELDBUS; FB<n>) to which you connect the field device.
   Observe the note "Recommendation: Detecting field devices online with the CFU ... commissioning wizard".

6. Optional: Assign the CFU parameters using SIMATIC PDM (redundant power supply and extended fieldbus diagnostics).
7. Optional: Assign parameters of the field devices using SIMATIC PDM.

Dependency on configuration of the CFU

The configuration using HW Config takes effect if the "Change configuration" check box is **not selected** in the "Verify or re-configure type of PROFIBUS PA I/Os" step of the "Configuration & Maintenance (CFU ... V2.0); Commissioning Wizard".

(default setting):

- The field device is **not** configured on the CFU.
  The CFU automatically sets the lowest PA profile available for the field device in the field device.
  You can find information on this in section "PROFIBUS PA field device: Manual field device integration (Page 109)".
- The field device is configured on the CFU.
  The configuration determines the "Selected IO". The CFU sets a "Selected IO" in the field device.

More information

- You can find more information on parameters of the field devices in the documentation of the field device.
- You can find more information on using SIMATIC PDM in the SIMATIC PDM help.
- Online help for STEP 7
- Section "Parameter assignment of a PROFIBUS PA field device (online) (Page 114)"

9.8.3 Parameter assignment

9.8.3.1 Introduction to assigning parameters

The term "Parameter assignment" refers to the specification of the hardware parameters and the settings for the data exchange.

Online parameter assignment

You can find more information on online parameter assignment in the following sections:

- Section "Assigning parameters to the CFU for PROFIBUS PA field device online via SIMATIC PDM (Page 111)"
- Section "Parameter assignment of a PROFIBUS PA field device (online) (Page 114)"

Parameters for the CFU

You set the parameters for the CFU and the connections to the IO controller at different objects in HW Config.

Object in HW Config	Tab [1]	Explanations	Supplementary information
PROFINET IO system	General	Name for the PROFINET IO system; settings for automatic name assignment	
	Update time	Calculated or configured update time	
CFU	General	Names and addresses of the CFU as nodes on PROFINET IO • PROFINET IO system information [1] • Setting PROFINET IO system addresses – Subnet information – Subnet redundancy information [1]	
	Identification	Higher level designation; location designation; installation date; supplementary information	
Slot **0** (parameter for the CFU)	General	Name and description of the CFU	Used to display the station name and set the diagnostic address.
	Addresses	Diagnostic address for the CFU	
Slot **0/X1** (parameter for interface to the PROFINET IO system)	General	Name for the interface of the BusAdapter to the PROFINET IO system	
	Addresses	Diagnostic address for the interface to the PROFINET IO system	
	Synchronization	Synchronization parameter for the interface to the PROFINET IO system	
	IO cycle	Update time and watchdog timer for the interface to the PROFINET IO system	**PROFINET installation > Isochronous mode > PROFINET functions > Isochronous mode > Engineering > Configuring**
	Media redundancy	Network configuration for the PROFINET IO system	**PROFINET functions > Media redundancy**
Slot **0/X1 Pn R** (parameter for a port on the BusAdapter)	General	Name for the PN/IO port on the BusAdapter (Pn = P1 = Port 1 or Pn = P2 = Port 2)	
	Addresses	Diagnostic address for the PN/IO port on the BusAdapter	
	Identification	Higher level designation; location designation; installation date; supplementary information	
	Topology	Partner port; line data **Recommendation**: Set these parameters in the topology editor.	**PROFINET installation > Topology** **PROFINET functions > Topology and STEP 7**
	Options	• Transmission medium with transmission rate • Autonegotiation • Boundaries: End of sync domain, End of detection of accessible nodes, End of topology discovery	

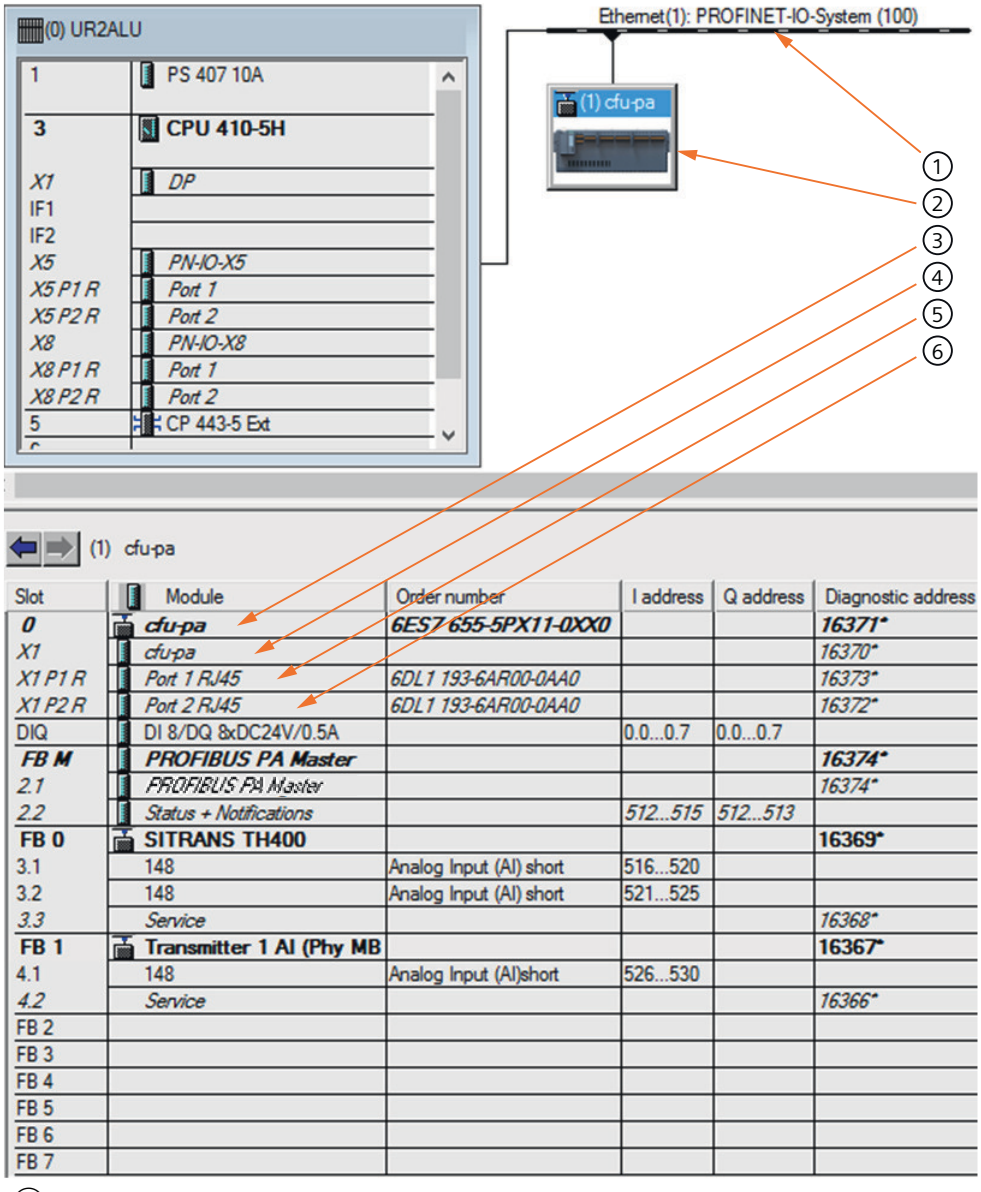
Object in HW Config	**Tab** [1]	**Explanations**	**Supplementary information**
Slot **DIQ** (Freely configurable channels)	General	Name for the freely configurable channels of the CFU	Section "Configuring DIQ channels (parameter overview - DIQ) (Page 105)"
	Addresses	Inputs, outputs You can specify the address range by entering a start address.	
	Parameters	For example channel type (input/output), diagnostics	
CFU PA: Slot **FB M**	General	Name of the "PROFIBUS PA Master" interface	Section "PROFIBUS PA field device: Assigning parameters to the master (parameter overview - FB M) (Page 107)"
CFU PA: Parameters + Diagnosis	General	• Name of the parameter interface of the PROFIBUS PA Master	
	Addresses	• Setting the diagnostic address	
	Parameters	• Show DPV0 interrupts on CFU LEDs • Compare tags • Service interface • Manual field device integration • 1-to-1 field device replacement	
CFU PA: Status + Notifications	General	Name of the status interface of the PROFIBUS PA Master	
	Addresses	Addresses used internally (these must not be changed)	
CFU PA: Slot **FB<n>** (configuration places for field devices on PROFIBUS PA [2])	General	Name for the respective field device in the "Addresses" area: Diagnostic addresses for the field device	
	Parameter assignment	Set via SIMATIC PDM.	

[1] You can find information on the tabs in the STEP 7 online help.

[2] For information only / no modification of the function possible, you can only enter comments.

Basic procedure

1. In HW Config, select the object (see figure below by way of example for CFU PA) that is to have parameters assigned to it.
   All objects on the CFU:



Slot	Module	Order number	I address	Q address	Diagnostic address
0	cfu-pa	6ES7 655-5PX11-0XX0			16371*
X1	cfu-pa				16370*
X1 P1 R	Port 1 RJ45	6DL1 193-6AR00-0AA0			16373*
X1 P2 R	Port 2 RJ45	6DL1 193-6AR00-0AA0			16372*
DIQ	DI 8/DQ 8xDC24V/0.5A		0.0...0.7	0.0...0.7	
FB M	PROFIBUS PA Master				16374*
2.1	PROFIBUS PA Master				16374*
2.2	Status + Notifications		512...515	512...513	
FB 0	SITRANS TH400				16369*
3.1	148	Analog Input (AI) short	516...520		
3.2	148	Analog Input (AI) short	521...525		
3.3	Service				16368*
FB 1	Transmitter 1 AI (Phy MB				16367*
4.1	148	Analog Input (AI)short	526...530		
4.2	Service				16366*
FB 2					
FB 3					
FB 4					
FB 5					
FB 6					
FB 7					

① PROFINET IO system (fieldbus system)
② Setting CFU parameters for PROFINET IO:
③ Slot 0 of the CFU: Parameters for the CFU (Slot 0)
④ Slot 0/X1: Parameters for the PROFINET IO (PROFINET IO interface of the CFU X5)
⑤ Slot 0/X1 P1 R: Parameters for BusAdapter (port 1 of the PROFINET IO interface X1)
⑥ Slot 0/X1 P2 R: Parameters for BusAdapter (port 2 of the PROFINET IO interface X1)

The further steps are shown using the setting of the PROFINET node IP address on the CFU② as an example:

1. Select the menu command **Edit > Object Properties** ... .
2. Enter a unique designation for the interface module in the "Device name" entry field of the "General" tab.
   The unique designation is mandatory for the PROFINET node.

   Note

   Device name

   You must also enter this device name locally on the PROFINET device.

   You can find information on this in section "Assigning device names with existing configuration from HW Config (Page 89)".
3. Click the "Ethernet" button in the "Node of PROFINET IO system" area.
   The "Properties - Ethernet interface ..." dialog box opens.
4. Enter the IP address of the CFU as a node on the PROFINET IO in the "Parameters" tab.
   Assign a unique IP address in the PROFINET IO system.
5. In the "Subnet" area, select the network.
   If a subnet has not yet been created: Click the "New" button.
   Further settings are not required for the CFU.
6. Click the "OK" button to apply the settings.

Parameters for the PROFINET IO system

You can find more information in the STEP 7 online help on configuring the PROFINET IO system in the "General" tab.

9.8.3.2 Setting parameters for the CFU (hardware configuration: Slot 0)

Tab in HW Config

Object in HW Config	Tab	Explanations
Slot **0**	General	Name and description of the CFU
(parameter for the CFU)	Addresses	Diagnostic address for the CFU

Name and description of the CFU

Display only: The name of the CFU is set at the CFU object.

Setting the diagnostic address

The diagnostic address is assigned by the engineering system by default.

9.8.3.3 Configuring DIQ channels (parameter overview - DIQ)

Setting parameters

The following parameter tables contain an overview of all the parameters of the freely configurable channels of the Compact Field Unit.

Tab in HW Config

Tab	Settings in the "Properties ..." dialog box of the DIQ area
General	You can enter a name for the DIQ area.
Addresses (no change necessary in PCS 7)	You can adapt the following parameters: • Start Addresses: Areas for inputs and outputs • Process image • HW Interrupt Triggers
Parameters	**Module-specific parameters** • Diagnostics Missing Supply Voltage • Actuator shutdown (module-specific - requires a free DI channel) – Monitoring channel – Switch off at signal level
Parameters	**Cross-channel parameters *** • Channel activated • Channel type • Diagnostics Wire Break • Diagnostics Short-Circuit to Ground • Diagnostics Short-Circuit to L+ • Reaction to CPU STOP
Parameters	**Parameters for the DIQ channels** • Channel activated • Channel type: Selection **DI / DQ** • Diagnostics Wire Break • Diagnostics Short-Circuit to Ground • Diagnostics Short-Circuit to L+ (only relevant for channel type "DQ") • Reaction to CPU STOP (only relevant for channel type "DQ") • Operating mode: Counter or frequency measurement (see ""Counter" and "Frequency measurement" operating modes (Page 41)") (CFU DIQ: Channels 0 and 1; CFU PA: Channel 0) You will find the parameters for this in the following table "Parameters for operating mode: Counter or frequency measurement".

You can find more information in the glossary.

* Cross-channel settings have no effect on channels with special functions (counter channels, monitoring channel of the actuator shutdown).

Note

Diagnostics Wire Break

If you use a simple encoder contact, you must observe the following:
In order to detect a wire break, you must connect a resistor parallel to the encoder contact (sensor resistance for wire break diagnostics: 15 kΩ to 18 kΩ).

Table 9-3 Parameters for operating mode: Counter or frequency measurement

Operating mode	Parameter
Frequency measurement	(operating mode only)
Counter	• High counting limit (1...4 294 967 295*) • Comparison value (1...4 294 967 295*) • Reaction to violation of the high counting limit: Continue counting / Stop counting • Edge evaluation: On rising edge/ On falling edge/ On rising and falling edge • Set output DQ: Between comparison value and low limit / Between comparison value and high limit • DQ channel (for comparison result - requires a free DQ channel): Use by user program / Channel <n> • Hardware interrupt (for comparison result): Lock; Comparison event for DQ occurred • HW gate channel (requires a free DI channel): None / Deactivated; Channel <n>

* **Note on use with PCS 7:** The parameter permits values up to 32 bits without sign. This means the maximum value is FFFF $FFFF_H$ (4 294 967 295). In PCS 7, the representation is limited to 2^{31}–1 by the DINT data type.

Procedure

1. Open HW Config.
2. In the index list, double-click the "DIQ" slot.
   The "Properties - DIQ..." dialog box opens.
3. Make the system-specific settings.

Standard behavior (non-activated channel)

A channel that is not activated always behaves like a "digital input" without sensor supply.

See also

Connecting digital sensor or actuator to the DIQ channel (Page 72)

9.8.3.4 PROFIBUS PA field device: Assigning parameters to the master (parameter overview - FB M)

Objects in HW Config

Table 9-4 FB M

Tab	Settings in the "PROFIBUS PA Master" dialog box
General	You can enter a name for the PROFIBUS PA Master.

Table 9-5 Parameters + Diagnosis

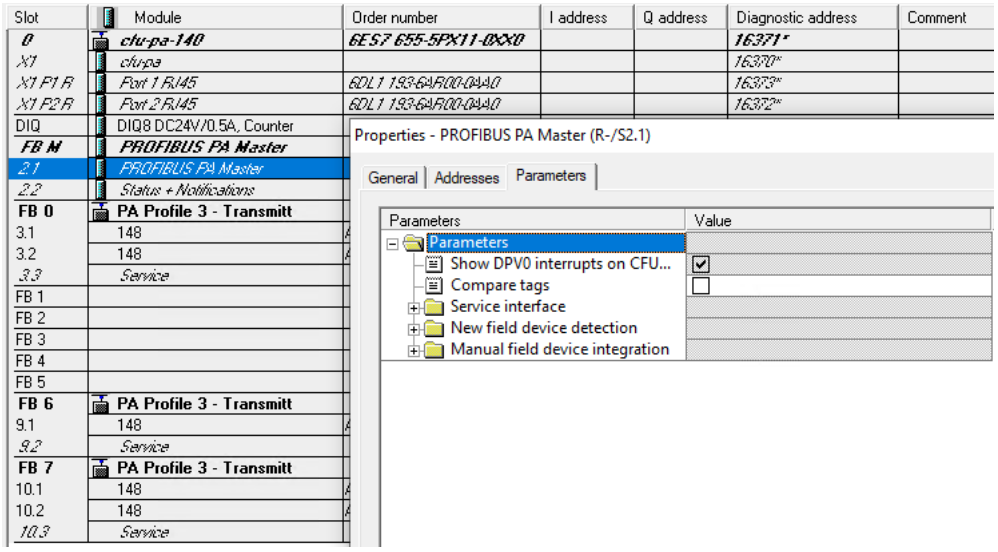
Tab	Settings in the "Properties ..." dialog box for Parameters + Diagnosis
General	Name of the interface of the PROFIBUS PA Master
Addresses	Setting the diagnostic address
Parameters	• Show DPV0 interrupts on CFU LEDs (Page 108) • Compare tags (Page 108) • Service interface (Page 136) • Detection of new field devices (Page 110) • Manual field device integration (Page 109)

Table 9-6 Status + Notifications

Tab	Settings in the "Properties ..." dialog box for Status + Notifications
General	Name for the status interface of the PROFIBUS PA Master
Addresses	Addresses used internally (these must not be changed)

Setting parameters

1. Open HW Config.
2. Select the CFU.
3. In the index list, double-click the object slot (e.g. Parameters + Diagnosis).
   The dialog box opens.
4. Select the appropriate tab (e.g. "Parameters").
   Note: If PCS 7 is used, the engineering system applies correct parameter assignment of the addresses. The name in the "General" tab can be applied unchanged.
5. Make the required settings.
6. Load the parameters into the CFU.



9.8.3.5 PROFIBUS PA field device: Show DPV0 interrupts on CFU LEDs

The CFU can signal DPV0 interrupts via the following LEDs:

- LED of the fieldbus connections
- "ERR" LED

The display is enabled in HW Config by default and cannot be changed by the user.

You can find information on this in section "PROFIBUS PA field device: Assigning parameters to the master (parameter overview - FB M) (Page 107)".

You can find information on the LED displays in section "Diagnostics via LED displays (Page 119)".

9.8.3.6 PROFIBUS PA field device: Compare tags

The CFU can automatically compare the name of the field device (TAG) with HW Config.

- If the display of inconsistencies is required, you must activate the parameter in HW Config. You can find information on this in section "PROFIBUS PA field device: Assigning parameters to the master (parameter overview - FB M) (Page 107)".
- You can find information on the LED displays in section "Diagnostics via LED displays (Page 119)".

9.8.3.7 PROFIBUS PA field device: Service port

You can configure **one** fieldbus connection of the CFU as a service port for the field devices of this CFU (e.g. for calibrating the field devices in a defined environment).

- Settings on the engineering system or on the field device are not required.
- If the service port is enabled, you can calibrate field devices connected to the service port. The field device behaves the same when connected to the service port as when connected to the original fieldbus connection and continues supplying process values to the previous address.

A field device connected to the service port is automatically detected if it was last in operation on this CFU at one of the other fieldbus connections.

- It is automatically routed (mapped) to the original fieldbus connection of the CFU.
- The original fieldbus connection is deactivated when the field device is detected at the service port until you disconnect the field device from the service port or deactivate the service port.
- Current and voltage of the field device connected to the service port are not monitored.

Behavior of a field device at the service port

⚠ WARNING
Process operation If the field device is connected to the service port, values for the field device continue to be transferred to the process. Make sure that the field device is **not** used in the process mode at the time of calibration.

More information

You can find information on the use of the service interface in the section "Using the service port for a PROFIBUS PA field device (Page 136)".

9.8.3.8 PROFIBUS PA field device: Manual field device integration

The CFU attempts to read the supported IO from the field device.
If the attempt of the CFU to read the IOs from the field device fails, you can manually connect the field device to the CFU.

Manual integration is necessary for the earlier PA profiles (smaller than 3.0x) to operate the field device.

Note

Manual integration enabled for a fieldbus connection

When manual integration is enabled for a fieldbus connection, the following functions are disabled for this fieldbus connection:

- Automatic reading of the identification numbers (IOs) from the field device by the CFU
- Automatic assignment of the identification numbers (IOs) by the CFU in the field device

Basic procedure

1. Enable the "Manual field device integration" parameter in HW Config for the fieldbus connection of the CFU.
   You can find information on this in section "PROFIBUS PA field device: Assigning parameters to the master (parameter overview - FB M) (Page 107)".
2. Set the IO in the field device such that it matches the configuration.

9.8.3.9 Detection of new field devices

This option enables information about a newly connected field device to be output by means of a diagnostic message.

Requirements: The field device has not been assigned parameters via the configuration or via PDM.

9.8.3.10 Enabling/disabling write protection of the CFU device parameters

With this function, you protect the parameter assignment of the CFU from unintended changes via the EDD, i.e. via the PA Master parameters mentioned in section Introduction to assigning parameters (Page 100).

This function is available as of firmware V2.0 (EDD 4.x).

Procedure

1. Open the parameter assignment of the CFU in SIMATIC PDM via HW Config.
2. In the menu, select **Device > Write protection on/off**.
   The change is immediately displayed in the "Write protection" (write-protected) check box, which is set to "On".

9.9 PROFIBUS PA field device: Online commissioning

9.9.1 Assigning parameters to the CFU for PROFIBUS PA field device online via SIMATIC PDM

Startup phase of a field device

The power supply of the field devices is enabled in the default parameter assignment. You can disable individual fieldbus connections in the parameter assignment in the "Configuration & Maintenance (CFU ... V2.0); Commissioning Wizard" dialog of SIMATIC PDM.

- During the startup phase of the field device, the green LED flashes.
- When the startup phase is successfully completed, the green LED is continuously lit.

You can find more information on this in section "PROFIBUS PA field device: Startup depending on the configuration (Page 82)".

Communication with the field device is then possible via SIMATIC PDM.

If commissioning of the field device fails, communication with the PROFIBUS PA field device cannot be established.

- You can find information for analysis of the cause in section "Diagnostics via LED displays (Page 119)".
- If the field device is configured using HW Config, a diagnostics interrupt is generated.

Communication between a field device and the CFU

Following connection of a field device, the CFU automatically attempts to set the PROFIBUS PA address on the field device.

You can find information on the assignment of fieldbus connections to the addresses of the PROFIBUS PA field devices in section "CFU PA: PROFIBUS addresses of the PROFIBUS PA field devices on the CFU (FBn) (Page 224)".

The supported profiles of the PROFIBUS PA field device are read out and made available for selection in the commissioning wizard.

You can find information on this in section "PROFIBUS PA field device: Startup depending on the configuration (Page 82)".

Requirements

- The device name is downloaded online to the CFU.
  Automatic address assignment is only successful when the device name is set correctly.

  Note

  Configuring the device name of the CFU locally

  Refer to section "Assigning device names with existing configuration from HW Config (Page 89)".

- An online connection can be established between the ES and the CFU.
- The electrical wiring is complete (PS, DIQ, FB).
- The PDM packet and the firmware version must match one another:
  - For EDD V1.0, use firmware as of V1.0.
  - For EDD V2.0, use firmware as of V1.1.
  - For EDD V3.0, use firmware as of V1.2.

Procedure

1. Select the CFU in HW Config.
2. Select the menu command **Edit > SIMATIC PDM > Open**.
   SIMATIC PDM opens.
3. In SIMATIC PDM, select the menu command **Device > Configuration & Maintenance (CFU ... V2.0).**
   The "**Configuration & Maintenance (CFU ... V2.0)**" dialog window opens.
4. Click the "Commissioning Wizard: Complete" button.
   The commissioning wizard opens.
5. Follow the instructions in the commissioning wizard.
   You can find information on this in section "Using the wizard for CFU configuration (Page 84)".

9.9.2 Performing simplified commissioning for PROFIBUS PA field devices

If you click the "Commissioning Wizard: Only add/remove/replace field devices" button, you go directly to the required step of the commissioning wizard, depending on the CFU type.

Procedure

1. Open the "**Configuration & Maintenance (CFU ... V2.0)**" wizard.
   You can find information on this in section "Using the wizard for CFU configuration (Page 84)".
2. Click the "Commissioning Wizard: Only add/remove/replace field devices" button.
   The commissioning wizard opens in "Show State of Automatic addressing of PROFIBUS PA".
3. Perform the commissioning.
4. Configure the CFU in HW Config (without field devices).

5. Download the configuration to the CFU.
6. Run the "Read back IOs" function in HW Config. You can find information on this in section "Reading back IO with the PROFIBUS PA field device (Page 113)".

Result: The configuration is adopted from the wizard and is consistent.

9.9.3 Reading back IO with the PROFIBUS PA field device

The CFU enables easy detection of connected field devices with the commissioning wizard and subsequent transfer of the configuration to the configuration.

Note

Configuration with and without commissioning wizard

- The CFU returns the IO set in the commissioning wizard.
- Without using the commissioning wizard, the CFU automatically sets the lowest available PA profile in the field device and returns it to HW Config.
- As of STEP 7 V5.6 SP1 HF3, "Read back IOs" returns all available IOs of the field device. The currently set IO is the default.

Requirements

- The CFU device name is loaded to the CFU online.
- An online connection exists between the ES and CFU.
- The electrical wiring of the field devices is complete.

Transferring the configuring results to the configuration

1. Open STEP 7/HW Config.
2. Compile the configuring results and download the configuration.
3. Click the "Read back IOs" button in the slot table in HW Config.
4. Transfer this to the configuration.
5. Assign parameters of the freely configurable channels.
6. Compile the configuring results and download the configuration.
7. Optional: Assign parameters of the field devices using SIMATIC PDM.

More information

- You can find more information on parameter assignment of the field devices in the documentation of the field device.
- You can find more information on using SIMATIC PDM in the SIMATIC PDM help.
- Section "Using the wizard for CFU configuration (Page 84)"

9.9.4 Parameter assignment of a PROFIBUS PA field device (online)

Status of the field devices

You can determine the status of the field devices in the "Configuration & Maintenance (CFU ... V2.0); Commissioning Wizard" dialog of SIMATIC PDM. You can find information on this in section "Configuring with PDM (Page 84)".

Requirement

A profile is assigned to the field device in HW Config.

The configuration of the CFU using the commissioning wizard of SIMATIC PDM takes effect if the "Change configuration" check box **is selected** in the "Verify or re-configure type of PROFIBUS PA I/Os" step of the commissioning wizard (check box is not selected by default).

Note

"Change configuration" check box

The configuration in HW Config and the selection of the "Selected IO" in the commissioning wizard are performed independent of each other.
The two configurations need to match; otherwise, a diagnostic interrupt is output.

If, at any point in time, the configuration in HW Config and the configuration of the "Selected IO" in the "Configuration & Maintenance (CFU ... V2.0); Commissioning Wizard" in SIMATIC PDM are the same for all field devices, the "Change configuration" check box is automatically reset.

Procedure

1. Select the CFU in HW Config.
2. Double-click the field device in the slot list.
   SIMATIC PDM opens.
3. Assign the field device parameters using SIMATIC PDM.

Dependency on configuration of the CFU

- The field device is **not** configured on the CFU.
  The CFU automatically sets the lowest PA profile available for the IO in the field device.
  You can change the selection at any time. You can find more information on this in section "Using the wizard for CFU configuration (Page 84)".
- The field device is configured using the Commissioning Wizard.
  The "Selected IO" is selected (for example: a "Transmitter 2 AI" is selected for FB 2).

Note

Field device not detected correctly

If a connected field device is not detected correctly (e.g. not all expected profiles are displayed), you can read out the field device data again:

1. To do this, select the menu command **Device > Configuration & Maintenance (CFU ... V2.0) > Maintenance overview > Expert functions**.
2. Read the field device data again or restart the field device.

More information

- You can find more information on parameter assignment of the field devices in the documentation of the field device.
- You can find more information on using SIMATIC PDM in the SIMATIC PDM help.

9.9.5 Bus fault correction with the PROFIBUS PA field device

Check the diagnostic information in **HW Config > Module information (online) > IO Device Diagnostics.**

Errors and troubleshooting

You can find information about the LED displays of the CFU for status display in section "Diagnostics via LED displays (Page 119)".

Problem	Possible cause	Solution
Automatic addressing failed	Incorrect device address set (device address 2 or 3 set)	Set device address locally via PROFIBUS PA
	Field device is set to hardware addressing	Change the device address to software addressing, or to the correct fieldbus address, and restart the fieldbus connection via the "Expert functions".
Reading out ID numbers failed	Field device does not supply valid ID numbers. The field device data (I/Os) cannot be recognized.	• Read the field device data again via the "Expert functions". • Use manual field device integration.
ID number assignment failed	Field device does not support the set profile.	Start the commissioning wizard again (step 5 - change configuration) Column "Change I/O to ...": Adjust the suggested profiles.
PDM Selected I/O differs from HW Config for field device at FB<n>	Difference between the configuration in HW Config and the configuration in the PDM commissioning wizard	• HW Config - run the function "Read back I/O" Apply changes • Customizing the configuration

Problem	Possible cause	Solution
TAG comparison / difference between expected and real TAG for field device at FB<n>	The "Compare tags" function is active. A difference has been detected between the name of the real field device and the name configured in the HW Config.	Start the commissioning wizard again (step 5 - change configuration) • Real TAG is incorrect: Adapt the real TAG. • Expected TAG is incorrect: Adjust in HW Config.
DP diagnostics available slot <n> (Slot number in HW Config)	Errors in the field device	Use the diagnostic functions of SIMATIC PDM for the field device.

More information

- Section "Using the wizard for CFU configuration (Page 84)"
- Section ""Maintenance Overview" dialog (Page 87)"
- Section "PROFIBUS PA field device: Show DPV0 interrupts on CFU LEDs (Page 108)"
- Section "PROFIBUS PA field device: Re-reading data or restarting the field device (Page 135)"

9.10 Configuring with PDM Stand alone

Creating a network

1. Open the process device network view in the SIMATIC Manager.
2. In the left window, select the "Networks" folder in the tree structure, and select the shortcut menu command **Insert New Object > Object**.
   The "Insert Object" dialog opens.
3. Click the "Assign Device Type" button.

Inserting the CFU

Follow the steps below to insert objects one at a time in higher-level objects.

Higher level object	Object to be inserted
"Networks" folder	**Communication network**
"Communication network" folder	Type of network over which the CFU is connected to the automation system: **PROFINET > PROFINET networks > PROFINET network**
PROFINET network	CFU Enter the following parameters in the dialog window: • Object name • IP address

1. In the right-hand window, select the higher-level object in the tree structure.
2. Select the shortcut menu command Insert New Object > Object.
   The "Insert SIMATIC PDM Object(s)" dialog opens.
3. Enter the name of the tag in the opened dialog.

Note

The address of the CFU that you set in the "Insert SIMATIC PDM Object(s)" dialog can be changed later on the "Communication" tab of the "Object Properties" dialog.

CFU PA: Configuring CFU with SIMATIC PDM

1. Select the CFU in the tree structure.
2. Select the shortcut menu command **Open Object**.
   SIMATIC PDM opens.
   You can find information on the next steps in section "Assigning parameters to the CFU for PROFIBUS PA field device online via SIMATIC PDM (Page 111)".

See also

Using the wizard for CFU configuration (Page 84)

Diagnostics of the CFU 10

10.1 Performing diagnostics for the CFU

A wide range of information and tools is available for diagnosing the status of the CFU.

Diagnostic possibilities

- **Displays**
  Several LED displays are located on the front of the CFU. This provides you with an overview of the status of the CFU. You can find information on this in section "Diagnostics via LED displays (Page 119)".
- **Tools**
  Information about the most important tools for diagnosing PCS 7 systems is available in the Service Manual PCS 7 Process Control System; Service Support and Diagnostics (www.siemens.com/pcs7-documentation).
  - **Maintenance Station**
    With the Maintenance Station, PCS 7 offers you the possibility to call up information about the status of all the PCS 7 components in hierarchically structured diagnostics screens. For this, the data of a component is analyzed with the existing online functions of the associated tools. You can access the ES data from the diagnostics screens (can be controlled via access protection mechanisms).
  - **Module information**
    Select the CFU in HW Config.
    Select the menu command **PLC > Module information ... .**
  - **Connection status**
    Call from Start menu Siemens SIMATIC programs: **STEP 7 > NCM S7 > Diagnostics**
  - **Inventory data**
    Called up via Siemens SIMATIC program: **SIMATIC > SIMATIC Management Console** (license required) **> Plant view >** shortcut menu command "Determine inventory data"
  - **CFU PA: Status of field devices and bus lines**
    Call via SIMATIC PDM
    The CFU does not undertake any detailed diagnostics of field devices and bus cables. Detailed diagnostics are possible, provided that the required device descriptions are available in suitable programs (e.g. SIMATIC PDM).
    Open **SIMATIC PDM > Device > CFU <V...> Configuration**.

10.2 Diagnostics via LED displays

Below, you will find tables containing information on the status and error messages of the Compact Field Unit.

Compact Field Unit LEDs

The following LEDs are located on the front of the CFU.

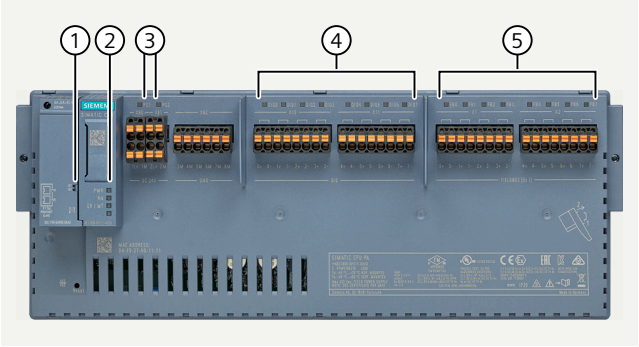


Figure 10-1 CFU PA LEDs

	Identification	Color	Meaning	Brief description
①	**LK1 and LK2**	Green	LED for status display on the BusA-dapter	Connection status
②	• **PWR**	Green	Power supply (Power)	Diagnostics of the CFU (LEDs on the interface dome)
	• **RN**	Green	Operating mode (RUN)	
	• **ER/MT**	Red/yellow	Error indication (Error/Mainte-nance)	
③	**PS1 and PS2**	Green	Supply voltage PS<n> is available	Power supply
		Red	Problem with supply voltage PS <n> (missing or faulty)	
④	**CFU PA: DIQ0 to DIQ7** LED display on channel (DIQ<n>)	Green or OFF	Signal status 1 or 0	Signal OK
		Red	Error display (Error)	Error
	CFU DIQ: DIQ0 to DIQ7 LED display on channel (DIQ<n>)	Green or OFF	Signal status 1 or 0	Signal OK
		Red	Error display (Error)	Error
⑤	**CFU PA: FB0 to FB7** LED display on fieldbus con-nection (FB<n>)	Green	Field device connected and OK	Field device connected
		Yellow	Status display (Maintenance)	Maintenance required or mainte-nance demanded
		Red	Error display (Error)	Error
	CFU DIQ: DIQ8 to DIQ15 LED display on channel (DIQ<n>)	Green or OFF	Signal status 1 or 0	Signal OK
		Red	Error display (Error)	Error

Table 10-1 Legend for the following tables:

Green	Yellow	Red	LED display
■ On	▲ On	● On	Illuminates
Off	Off	Off	Does not illuminate

Green	Yellow	Red	LED display
*	*	*	Any
Flashes	Flashes	Flashes	Flashes

LED displays on the interface dome of the Compact Field Unit

Table 10-2 Status and error display

LEDs			Meaning	Solution
PWR (supply)	**RN (operation)**	**ER/MT (error/ maintenance)**		
On	On	Off	Good status: The CFU has established a connection to the IO controller.	
Off	Off	Off	No or insufficient supply voltage.	Check the supply voltage.
On	On	On	Startup of the CFU (approx. 5 s)	-
*	*	On	Maintenance required (after startup of the CFU)	Evaluate the diagnostics and eliminate the error.
(~2 Hz)	(~2 Hz)	(~2 Hz)	Serious internal error. PS1 and PS2 flash simultaneously.	Check whether a firmware update is available and perform the update. If the error persists, contact Siemens Industry Online Support.
(~2 Hz)	(~2 Hz)	(~2 Hz)	Serious internal error. PS1 and PS2 flash alternately. Data is written about the crash. Note: This process may take a few minutes. If PS1 and PS2 flash asynchronously, wait until PS1 and PS2 flash synchronously before switching off.	Check whether a firmware update is available and perform the update. If the error persists, contact Siemens Industry Online Support.
On	(~1 Hz)	(~1 Hz)	BusAdapter not supported.	Replace the BusAdapter with a supported variant.
On	(~1 Hz)	(~1 Hz)	After a firmware update, updates of the extended fieldbus diagnostics are running (duration: approx. 30 s). Note: Not relevant for CFU DIQ. Note: Does not occur after a firmware update to the same version.	Wait until the update has been completed. The CFU subsequently starts up automatically.
On	Flashes	*	No connection to the CPU	Wait a few seconds until the connection is established. If the connection is not established, check the configuration (device name and IP address of the CFU). Check the LEDs on the BusAdapter
Flashes	Flashes	Flashes	Node flashing test	-

LEDs			Meaning	Solution
PWR (supply)	**RN (operation)**	**ER/MT (error/ maintenance)**		
*	*	Flashes	Group fault and group fault channels.	Evaluate the diagnostics and eliminate the error.
			Configured structure does not match the actual structure of the CFU .	Check the structure of the CFU and whether a channel fault or an error at the fieldbus exists.
			Parameter assignment error on PROFIBUS PA or DIQ.	Evaluate the display of the channels and fieldbus connections in STEP 7 and eliminate the error.
*	*	(~2 Hz)	• Warning limits for fieldbus connection exceeded • Service port enabled	Maintenance required

LED displays on the BusAdapter

Table 10-3 Status display "LK1" and "LK2"

LEDs "LK1" and "LK2"	Meaning	Solution
■ On	There is an Ethernet connection between the PROFINET IO interface of the CFU and a communication partner (for example, an IO controller).	-
Off	There is no Ethernet connection between the PROFINET IO interface of the CFU and a communication partner (for example IO controller).	Check whether the bus cable to the switch/IO controller is interrupted.

LED display on channel (DIQ<n>)

Table 10-4 Area: DIQ

ER/MT (error/maintenance)	DIQ<n> - LED	Maintenance	Message
Off	■ On	Good status (signal on)	-
Off	Off	Good status (signal off)	-
(~2 Hz)	● On	Interrupt	• Wire break
(~2 Hz)	(~0.5 Hz)	Interrupt	• Short-circuit to L+ • Short-circuit to M

ER/MT (error/maintenance)	DIQ<n> - LED	Maintenance	Message
(~2 Hz)	(~2 Hz)	Interrupt	• Actuator shutdown detected
Flashes	*	Interrupt	• Temperature rise • Missing load voltage • External power supply detected • CFU DIQ: Communication error

CFU PA: LED display on fieldbus connection (FB<n>)

Table 10-5 Area: Fieldbus

ER/MT (error/maintenance)	FB<n> - LED	Maintenance	Message
Off	On	Good status: Device connected and ready for operation	
Off	Off	Good status: No device connected and configured	
Off	Flashes	-	Startup phase of the field device, automatic addressing/ detection in progress
(~2 Hz)	On	Interrupt	• Wire break
(~2 Hz)	(~0.5 Hz)	Interrupt	• Short-circuit
(~2 Hz)	(~2 Hz)	Interrupt	• Signaling of pending DPV0 alarms of the field device You can find information on this in section "PROFIBUS PA field device: Show DPV0 interrupts on CFU LEDs (Page 108)".

ER/MT (error/maintenance)	FB<n> - LED	Maintenance	Message
(~2 Hz)	(~2 Hz)	Maintenance required	• Warning limit exceeded • Service port enabled
On	On	Maintenance demanded	• Alarm limit for voltage and/or current exceeded/fallen below • Error during the startup phase of the field device – No communication possible – Automatic addressing failed – Reading out of IOs failed – Setting of Selected IO failed – The configured field device and the selected IO in PDM are not compatible • Name of the field device (TAG) does not match HW Config. You can find information on this in section "PROFIBUS PA field device: Compare tags (Page 108)". • Error while using the service interface (service port enabled) – You can find information on this in section "Using the service port for a PROFIBUS PA field device (Page 136)". – A field device is identified as unknown if it was not the last one in operation on this CFU at one of the other fieldbus connections. • PROFIBUS PA address in the CFU and in the field device do not match. You can find more information on this in section "PROFIBUS PA field device: Startup depending on the configuration (Page 82)".

LED display for the power supply

ER/MT (error/maintenance)	PSx	Maintenance	Message
On	(~2 Hz)	Maintenance demanded	• Redundant power supply 1 missing • Redundant power supply 2 missing
(~2 Hz)	On	Maintenance required	• Fault of power supply 1 • Fault of power supply 2

10.3 Diagnostics with the Maintenance Station

The device diagnostics indicates the maintenance states of the individual channels of the CFU on the PCS 7 Maintenance Station:

A faulty IO device (sensor, actuator or field device) does not trigger indication of a faulty CFU. The CFU signals the respective status for each channel or for each PROFIBUS PA field device (only for CFU PA).

Display maintenance states

The view is displayed for the Compact Field Unit from the Field devices area.

Note

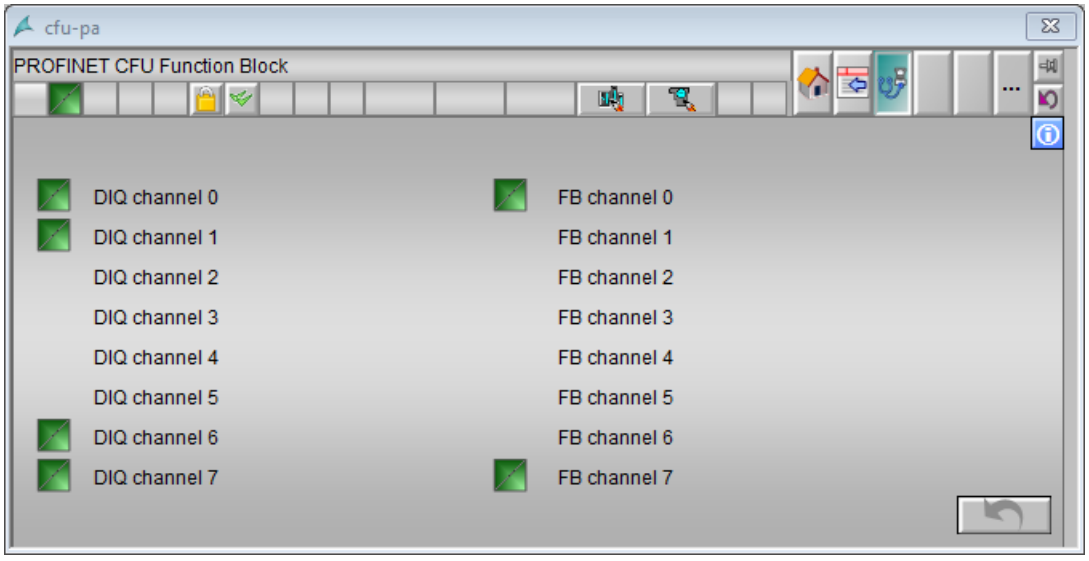
This view is available for the MS Standard version of the Maintenance Station.

Maintenance states

In this view, the maintenance states of the individual channels of the CFU are displayed.

CFU type	Left half of the window	Right half of the window
CFU PA	Status of eight binary input/output channels: 8 connections for sensors and/or actuators (DIQ: DIQ0 to DIQ7)	Status of the eight fieldbus connections: 8 fieldbus connections (FIELDBUS; FB0 to FB7)
CFU DIQ	Status of eight binary input/output channels: 8 connections for sensors and/or actuators (DIQ: DIQ0 to DIQ7)	Status of eight binary input/output channels: 8 connections for sensors and/or actuators (DIQ: DIQ8 to DIQ15)

The figure below shows an example of the CFU PA view:



Display

The status of the CFU is identified with the maintenance symbols.

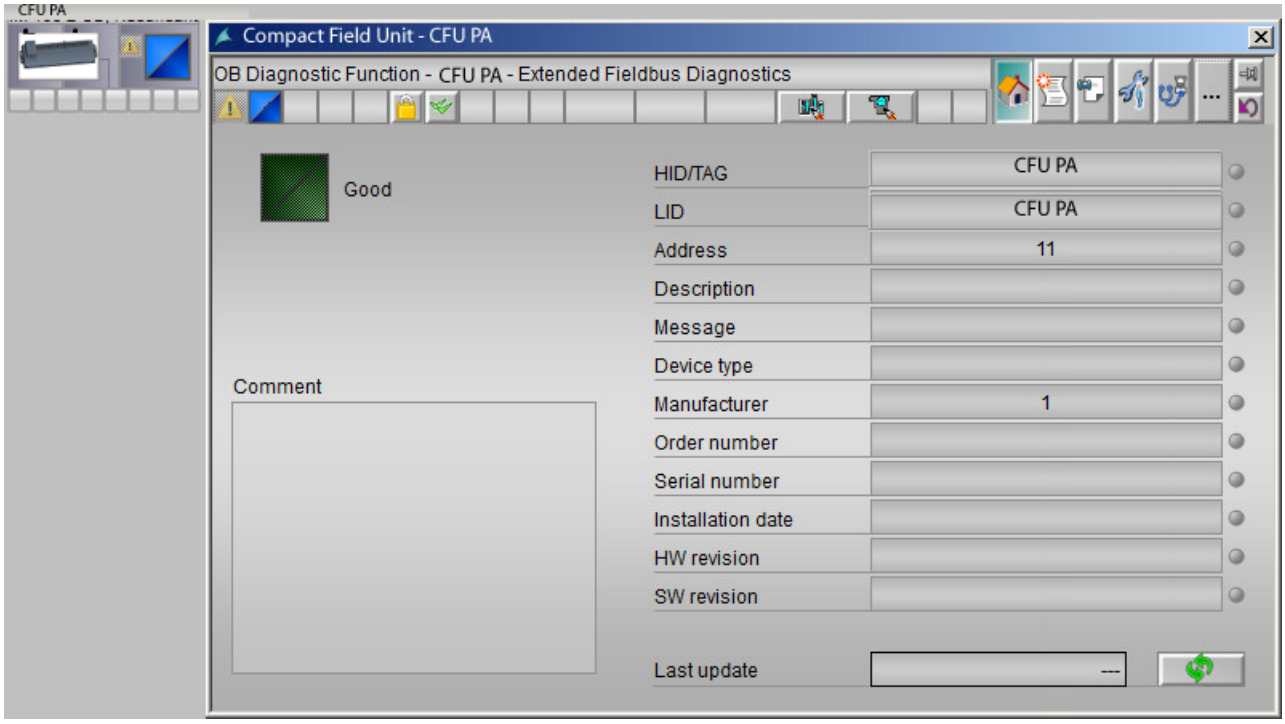
The following table shows the symbolic representation of the statuses:

Representation	Meaning
	Maintenance required is pending
	Maintenance demanded is pending
	Maintenance alarm is pending
	Good status
	Maintenance state available and not yet reset
No symbol	The channel is not being used.

Operator controls

Button	Explanation	Authorization
	Clicking the button opens the legend. The legend shows the symbolic identification of the possible statuses and their meaning.	No access protection
	Clicking the button resets the stored maintenance states.	"Process operations" for the diagnostics area

Call in the operator control and monitoring system



10.4 Interrupts

The CFU supports hardware interrupts. You can find more information on hardware interrupts in the section "Hardware interrupts (Page 233)".

10.5 Saving service data

If there is a problem with your CFU that you cannot solve via the diagnostics buffer, you have the option of reading the service data of your CFU and sending this data to Customer Support. If the service data is requested as part of a service request, you can store the data as follows.

Procedure

1. Open HW Config.
2. Select the menu command **PLC > Save service data**.
3. Specify a file name.
   The service data for all CFUs is stored in STEP 7 (TIA Portal) in a DMP file with the following naming convention:
   "<Article number> <Serial number> <Time stamp>.dmp"
   Example: 6ES7_655-5PX11-0XX_SC-S_VPJ819022_20231110.dmp

Servicing and maintenance 11

11.1 Identification and maintenance data

Definition and properties

Identification and maintenance (I&M) data is data that is stored in the CFU that supports you in the following actions:

- Checking the system configuration
- Finding the hardware changes of a system
- Troubleshooting in a system

Identification data (I-data) is data about the CFU, such as the article number and serial number, some of which is also printed on the housing of the CFU. I-data is manufacturer data about the CFU and can only be read.

Maintenance data (M data) are system-dependent data, such as the installation location and installation date. M-data is created during configuration and is written to the CFU.

The I&M data allows the CFU to be unambiguously identified online.

Reading and writing the I&M data with the PCS 7 and STEP 7

The I&M data is displayed in HW Config in the "Module Information – CFU" tabs (see STEP 7 online help).

11.2 Maintenance

- **Maintaining CFU**
  Regular maintenance of the CFU itself is not necessary.
- **Maintaining terminals**
  Maintenance is only required with screw-type terminals. Push-in terminals are maintenance-free.
- **Maintaining field devices**
  During maintenance of a field device according to EN 60079-17, it may be useful to disable the fieldbus connection for the respective field device.
- **Maintaining sensors/actuators**
  During maintenance of a sensor/actuator, it can make sense to disable the respective channel. This ensures that faults cannot influence the system.

11.3 CFU PA: Export/import device description

11.3.1 CFU PA: EDD: Exporting parameters

You can use this function to export the parameters set in a CFU to an EDD (data backup).

The functionality is available as of firmware V1.2 (EDD 3.x).

Procedure

1. Open the parameter assignment of the CFU in SIMATIC PDM via HW Config.
2. Read back the configuration for the CFU in SIMATIC PDM: **"Load to PG/PC...".**
3. Select the **"Import/Export Mode"** check box.
4. Export the data of the CFU.
5. Clear the **"Import/Export Mode"** check box.

11.3.2 CFU PA: EDD: Importing parameters

With this function you overwrite the set device parameters with exported data.

Application:

- Restoring the parameters of the CFU
- Applying the parameters of another CFU

The functionality is available as of firmware V1.2 (EDD 3.x).

Requirement

The exported data of a CFU is available.

Procedure

1. Open the parameter assignment of the CFU in SIMATIC PDM via HW Config.
2. Select the **"Import/Export Mode"** check box.
3. Import the data of the CFU.
4. Clear the **"Import/Export Mode"** check box.

11.4 PROFINET connector

11.4.1 Removing or inserting the BusAdapter

Note

Replacing a BusAdapter (removing/inserting)

Removing/inserting the BusAdapter under voltage in prohibited.

Automated name assignment during device replacement

The automatic saving of the device name on the BusAdapter and the CFU results in the following scenarios when one of the two components is replaced:

	CFU not programmed (without device name)	**Interface with device name**
BusAdapter non-programmed (without device name)	Device names not programmed	When the supply voltage is switched on, the device name is copied from the CFU to the BusAdapter.
BusAdapter with device name	When the supply voltage is switched on, the device name is copied from the BusAdapter to the CFU. **Note:** When a faulty BusAdapter is replaced, make certain that the replacement BusAdapter has no device name.	

11.4.2 Inserting and removing the fiber-optic cable on the BusAdapter

Cable pulling

Observe the following points when pulling fiber-optic cables:

- Note the permissible pull forces for the respective fiber-optic cable in the associated data sheet and adhere to them.
- Avoid laying cable out (longer unwinding) before pulling in the cable.
- If possible, lay the fiber-optic cable directly from the cable reel.
- Do not unwind the fiber-optic cable laterally over the reel flange (risk of twisting).
- If possible, use a cable pull sock when pulling in the fiber-optic cable.

- Observe the specified bending radii when laying the cable.
- Do not use lubricants containing grease or oil.
  You can use the lubricants listed below to facilitate pulling in the fiber-optic cables.
  - Yellow ground (wire-pulling, lubricant from Klein Tools; 51000)
  - Soft soap
  - Dishwashing liquid
  - Talcum powder
  - Detergent

Pressure

Do not exert any pressure on the cable, for example, by the inappropriate use of clamps (cable quick-mount) or cable ties. Furthermore, you must prevent anyone from stepping on the fiber-optic cables.

Exposure to heat

The cables are sensitive to direct heat effects, i.e., the fiber-optic cable must not be worked on with a hot air gun or gas burner, as is practiced, for example, with shrink-on sleeve technology.

11.4.3 Installation of fiber-optic cables in the enclosure

Permissible bending radii for assembled cables

When laying the cables (6XV1847-2C) assembled by SIEMENS, the bending radii must not fall below the following values:

- When pulling in: 88 mm (multiple times)
- After pulling in: 59 mm (once)

Use cable glands to avoid damage to the edges.

Note

When routing the cables, make sure that the two fiber-optic cables in a redundant system are always routed separately. The separate routing increases the availability and protects against possible double faults, e.g. in case of simultaneous interruption of the fiber-optic cables.

11.5 PROFIBUS PA field device to connection FB<n>

11.5.1 Replacing the PROFIBUS PA field device

The fieldbus connections are implemented as intrinsically-safe connections (CFU PA: Ex ic).

If you are using the CFU in a hazardous area, you must observe the following sections:

- Section "Use in hazardous areas (Page 31)"
- Section "Compact Field Unit in the housing for use in a hazardous area (Page 145)"

Preparation

Note

Replacing a field device in process mode (AS in RUN / CiR)

Interrupt OBs must be configured in the automation system so that you can replace a field device in process mode.

The power supply of the field devices is enabled in the default parameter assignment of the CFU.

You can disable the fieldbus connection for a selected field device with the commissioning wizard of the CFU.

Software addressing is recommended for optimal operation on the CFU. In this case, the CFU adopts the parameter assignment.

Using hardware addressing:

You must choose the hardware address in accordance with the fieldbus connection to which you want to connect the field device.

Ensure that the correct hardware address is set before you connect the field device to the CFU.

You can find information on this in section "CFU PA: PROFIBUS addresses of the PROFIBUS PA field devices on the CFU (FBn) (Page 224)".

Configuring profiles for field devices

If you configure profiles for field devices, a field device can be replaced by a compatible field device without changing the configuration.

Replacing a field device (same manufacturer and same type)

1. Disconnect the field device to be replaced.
2. Connect the new field device.
3. Wait until the field bus LED lights up in static green: The new field device is ready for operation.
4. Reload the system-specific field device parameters using SIMATIC PDM.

Replacing a field device (different manufacturer and same type (when using profiles))

1. Disconnect the field device to be replaced.
2. Connect the new field device.
3. Wait until the field bus LED lights up in static green: The new field device is ready for operation.
4. In the HW Config, assign the correct EDD to the field device. To do this, select the **SIMATIC PDM > Device Selection (Reassign)...** menu command in the shortcut menu.
5. Reload the system-specific field device parameters using SIMATIC PDM.

Replacing a field device (different type)

1. Remove the field device from the configuration in HW Config.
2. Download the configuration.
3. Connect the new field device to the CFU.
4. Reassign parameters of the fieldbus connection of the CFU (FIELDBUS; FB<n>).
   You can find information on this in section "Configuring a PROFIBUS PA field device (offline) (Page 98)".
5. Download the configuration.
6. Reload the system-specific field device parameters using SIMATIC PDM.

More information

You can find information on the tightening torques in section "Tools and tightening torques (Page 217)".

11.5.2 PROFIBUS PA field device: Changing a configuration

The change to the configuration of a field device does not affect the other field devices on the CFU.

Configuration change of a PA field device in RUN

Effect-free change to the configuration of a field device is not possible in RUN.

- If you change the submodules of a field device, this device is reinitialized after loading. Reinitialization is the cause for the short-term failure of the process values of this field device.
- If you ensure that the short-term failure of the process values does not have an effect, a change to the submodules of a specific field device can be made.
- Plugging and pulling IO submodules of a PA field devices by means of (H)CiR is not bumpless.

11.5.3 Adding a PROFIBUS PA field device

CFU in hazardous areas

If you are using the CFU in a hazardous area, you must observe the following sections:

- Section "Use in hazardous areas (Page 31)"
- Section "Compact Field Unit in the housing for use in a hazardous area (Page 145)"

Requirement

- The new field device (without necessary hardware addressing) has been reset to the factory state.
  You can find information about this in section "Restoring the state of delivery (Page 141)".
- The field device is not connected to the service port of the CFU.
- The field device is connected to a port of the CFU that has not yet been configured in the CFU.
- The spur line to the field device is enabled.

Basic procedure

Observe the following:

- If the spur line to the field device is not active, the power supply is deactivated via the fieldbus. The field device is not detected.
- The user must configure the correct field device and download the configuration to the CFU in SIMATIC PDM.
  When the configuration is downloaded, the connection to the field device can be enabled.

After the new field device has been connected (and the spur line to the field device has been activated again using SIMATIC PDM), the CFU can communicate with the field device.

11.5.4 PROFIBUS PA field device: Re-reading data or restarting the field device

The commissioning wizard "**Configuration & Maintenance (CFU ... V2.0)**" integrated in SIMATIC PDM offers the relevant expert functions for the individual fieldbus connection (FIELDBUS; FB<n>).

The power supply to the fieldbus connection (FIELDBUS; FB<n>) is briefly switched off and on again.

Procedure

1. Double-click the CFU in HW Config.
   SIMATIC PDM opens.
2. Open the commissioning wizard.
3. Click the "Maintenance overview".

4. Click the "Expert functions".
5. Click the relevant button.

NOTICE
The field device is disconnected from the process mode The warning at resetting has to be confirmed since the field device is disconnected from process operation at a reset (fails).

Then the commissioning phase of the field device starts again.

More information

- Section "Using the wizard for CFU configuration (Page 84)"
- Section ""Maintenance Overview" dialog (Page 87)"

11.5.5 Using the service port for a PROFIBUS PA field device

Enabling service port

If using the service port is required, you must activate the parameter in HW Config.
You can find information on this in section "PROFIBUS PA field device: Assigning parameters to the master (parameter overview - FB M) (Page 107)".

Requirements

- The port is enabled as service port in HW Config.
- The field device was last connected to this CFU in process mode.
- The field device is connected to the service port.
- The field device was detected correctly at the service port. The green LED on the fieldbus connection (service port) lights up.

Diagnostics

You can find information on the LED displays in section "Diagnostics via LED displays (Page 119)".

Calibrating field devices

A diagnostic interrupt is generated for the original fieldbus connection of the CFU. This alarm indicates that the field device has been routed through the service port.

In the commissioning wizard of the CFU, all dialogs in which the fieldbus connections are listed show that the field device previously connected to another port is currently connected to the service port.

1. Calibrate the field device.
   Set any required correction parameters in the field device.
2. Disconnect the field device from the service port.
3. Connect the field device to the original fieldbus connection of the CFU in the system.
4. Activate any separate process functions.

⚠ CAUTION
Process data
Note that the process data from the field device at the service port continues to flow into the process.

See also

Service port (Page 54)

11.6 Reading back the parameters

"Upload to PG/PC..." function

The reading back of parameters is possible using this function. Observe the information in the online help for STEP 7 and SIMATIC PDM.

11.7 Sensor/actuator at connection DIQ<n>

11.7.1 Replacing/modifying a digital sensor/actuator

NOTICE
Replacing sensors/actuators during process operation (AS in RUN)
Interrupt OBs must be configured in the automation system so that sensors/actuators can be replaced during process mode (implemented as a standard feature in PCS 7).

Read section "Use in hazardous areas (Page 31)" if needed.

Preparation

1. Before replacement (in HW Config), disable the sensor/actuator.
2. Download the parameters to the CFU.
   The sensor/actuator is de-energized.

Replacing a sensor/actuator (with one of the same type)

1. Connect the new sensor/actuator to the CFU.
   The new sensor/actuator is ready for operation.

Once the new sensor/actuator is connected, you can enable the sensors/actuators again.

Replacing a sensor/actuator (with one of a different type)

1. Reassign the parameters of the channel (DIQ<n>)
   You can find more information in section "Configuring DIQ channels (parameter overview - DIQ) (Page 105)".
2. Ensure that the configured sensor/actuator is connected to the CFU.
3. Download the parameters to the CFU.
4. Enable the sensor/actuator (in HW Config).

More information

Section "Tools and tightening torques (Page 217)"

11.7.2 Overload of freely configurable channels (DIQ<n>)

At a thermal overload, **all** configurable channels of the CFU are disabled.

Options for enabling the channels (DIQ<n>)

The channels can be enabled again in the following ways:

- Open the "Configuration & Maintenance (CFU ... V2.0)" wizard. Click the "Maintenance overview" and then the "Expert functions" in the initial dialog. Click the "Reset over-temperature alarm" button.
- Restart of the CFU by disconnecting the power supply for at least 1 s.

11.8 CFU

11.8.1 Replacing the CFU

Requirements

- The CFU is disconnected from the power.
- The separate supply of connected field devices is switched off.
- The replacement device is in delivery state. You can find information on this in section "Restoring the state of delivery (Page 141)".

Replacing the CFU in process mode

If you are using the CFU in a hazardous area, you must observe the following sections:

- Section "Use in hazardous areas (Page 31)"
- Section "Compact Field Unit in the housing for use in a hazardous area (Page 145)"

Note

Replacement of a CFU without disturbing other parts of the system

If one of the following variants is selected for the structure of a CFU, you can replace this CFU without affecting other parts of the system:

- CFU in a star topology
- CFU in a ring topology when MRP is used

Note

Firmware versions are backward compatible

Downgrading the firmware (e.g. from V1.2.0 to a previously existing V1.0.1) is not necessary.

Downgrading the firmware is only recommended in exceptional cases, because the firmware is subject to continuous further development with respect to security and compatibility with field devices.

Procedure

You can find information on the tightening torques in section "Tools and tightening torques (Page 217)".

Carry out the following steps to replace a CFU:

1. Replace the CFU.
   Recommendation:
   - Observe the information in the requirements for automatic name assignment and setting of the IP address on device replacement.
   - Configure the new CFU before installing it in the system.
     If the CFU has at least the same IO device name as the replaced CFU, the CPU automatically writes the IP address to the CFU.
   - If the existing BusAdapter is still being used, the existing station name is adopted by the new CFU.
2. Insert the plugs of the sensors/actuators and field devices to the connections of the CFU (FB<n> and DIQ<n>).
   Switch on the separate supply of connected field devices.
3. If necessary, fasten the shield connection of the cables.
   If available and necessary, you can fasten the cables to the shielding bus using cable ties.
4. Insert the BusAdapter (terminal X5 of the CFU).
5. Insert the plugs of the power supply (PS1 to X80/PS1, PS2 to X81/PS2).
6. Open SIMATIC PDM.
7. Open the EDD.
8. **If "Change configuration" is enabled:**
   Transfer the configuration for the field devices from the rows "Selected I/O" to the rows "Change I/O to".
9. Download the parameters to the CFU.

Result

The CFU is completely replaced.

Note

Recommendation

Upgrade the CFU to the latest version
You can find information on this in the section "Upgrading the CFU (Page 141)".

11.8.2 Upgrading the CFU

Requirement

- Project conditions:
  - Firmware: Outdated version (e.g. V1.0.1)
  - EDD: Outdated version (e.g. EDD version 1.x)
- A connection between the new CFU and CPU is active.
- For the engineering system:
  - HSP is installed
  - EDD integrated in SIMATIC PDM
  - Firmware is available

Procedure

1. Download the new firmware version to the CFU.
2. Open HW Config.
3. In the shortcut menu of the CFU, select the menu command **"Switch object..."**. Select the current CFU.
4. Download the configuration "**Download to Module".**
5. Open the EDD of the CFU in SIMATIC PDM via HW Config.
6. Read back the parameters: **"Load to PG/PC...".**
7. Save the parameters in SIMATIC PDM.

Result

New functionalities are now available in HW Config and in the EDD.

11.8.3 Restoring the state of delivery

⚠ **CAUTION**
STOP of the CFU can cause dangerous system states The following action must **never** be performed during system operation. Ensure that no dangerous system state can result from failure of a CFU.

Note
Resetting to factory settings

A reset to factory settings deletes the device name in the CFU and BusAdapter.

You have the following possibilities to reset to the factory setting:

- Resetting via the software
- Resetting using the Reset button

Resetting via the software

1. Select the menu command **PLC > Edit Ethernet Node...**.
2. Click the **"Browse..."** button in the "Ethernet node" area.
3. Select the CFU and click the **"OK"** button.
4. Click the **"Reset"** button in the "Reset to factory settings" area.

Resetting using the Reset button

DANGER

CFU PA in Zone 22

Resetting via the reset button is not possible because the housing must be opened for this purpose.

Note
Cannot be reset without BusAdapter

A reset without BusAdapter is not possible because startup of the CFU is prevented.

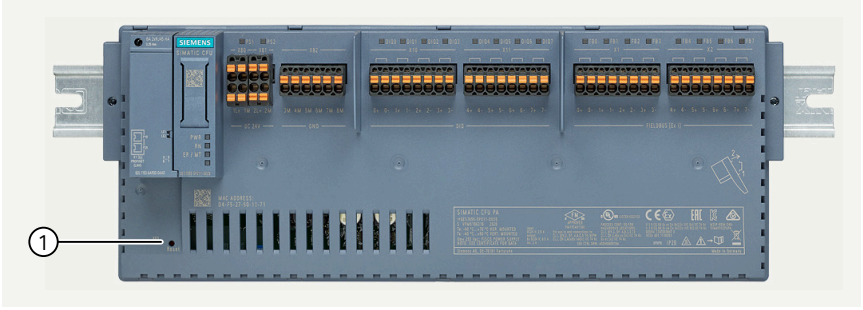
You can reset the CFU to factory settings.

Select a pin with the following dimensions for the reset (e.g. a paper clip):

- Diameter 0.8 mm
- Length at least 10 mm

If the reset function has been locked in the software, you must first disable the reset lock in the software.

The Reset button is located on the front of the CFU (see figure below).



① Reset button

Procedure

1. Press and hold down the Reset button until the ER/MT LED begins to flash (approx. 3 seconds).
2. Release the Reset button.
   The CFU is reset to factory settings and restarts.

Result

The current firmware version remains unchanged.

The following data are deleted:

- Settable I&M data
- IP address, station name, etc.
- Parameter assignment of the CFU (e.g. parameters set with SIMATIC PDM)
- Configuration data of the CFU for field devices (FB<n>)
  The parameter assignment of the field devices remains unchanged.
- Configurations and stored data of freely configurable channels (DIQ<n>)
- Commissioning history and diagnostics buffer

After the reset, the CFU executes a restart automatically.
The subsequent reaction depends on whether or not the **PROFINET topology** has been **configured** in HW Config:

- If the **PROFINET topology has been configured** in HW Config:
  After the reset, the CFU automatically receives the device name and IP address by means of neighborhood detection.
- If the **PROFINET topology has not been configured**:
  You must reenter the device name and IP address at the CFU and download all data of the CFU.
  You can find more information about this in section "Preparing the CFU for commissioning (Page 88)".

Configuring the Reset button

Disabling the Reset button prevents unintentional disturbances during operation by the service engineer.

When the Reset button is disabled, its functionality can only be used at startup by the service engineer.

Procedure

1. Open the HW Config.
2. Double-click the CFU whose Reset button you wish to configure.
3. In the "Object properties" window, go to the "Parameters" tab.
4. In the "Configurable reset switch" field, set or remove the check mark for "Enabled".

Compact Field Unit in the housing for use in a hazardous area

12

12.1 CFU in hazardous areas

CFU in the housing with field devices in the hazardous area (up to Zone 2/22)

The housing serves to integrate a CFU in the automation environment with field devices in a hazardous area (up to zone 2/22).

- The CFU can be pre-assembled in the housing. The "CFU PA product with aluminum housing" has been developed specifically for use in hazardous areas up to Zone 2/22.
  Ordering information can be found in section "Article numbers (accessories / spare parts) (Page 213)".
- When installing in other housings (including in control cabinets), you must ensure that the housing, including the CFU, is approved for use in hazardous areas.

The cable shields must be placed in the housing so that they are connected to the functional earth. Cable glands and sealing plugs are included with the "CFU PA with aluminum housing" product. The sealing plugs are attached by default. Unused openings in the housing must be closed at all times.

Basic integration of a Compact Field Unit (CFU) in the automation environment

The following figure shows the basic integration of a CFU PA in the automation landscape.

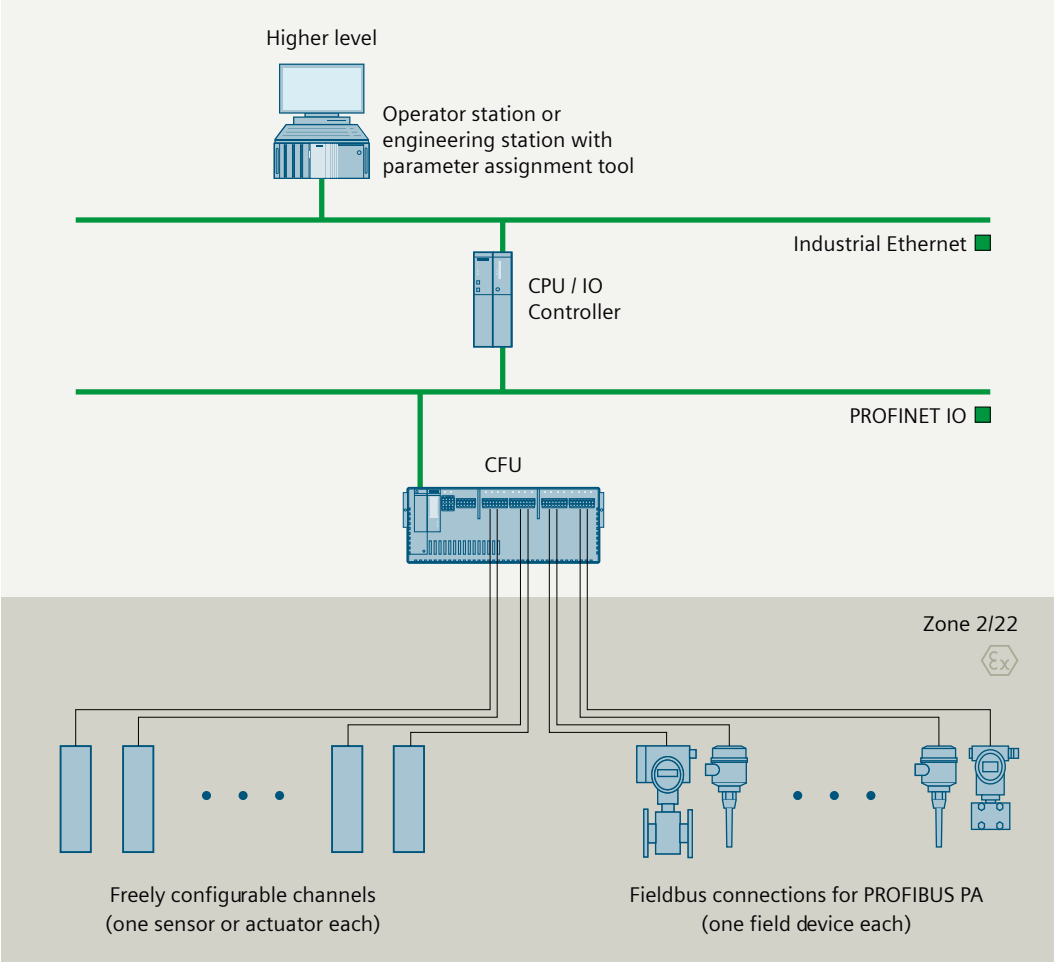


Figure 12-1 Basic integration of a CFU in the automation landscape with field devices in a hazardous area (CFU PA by way of example here)

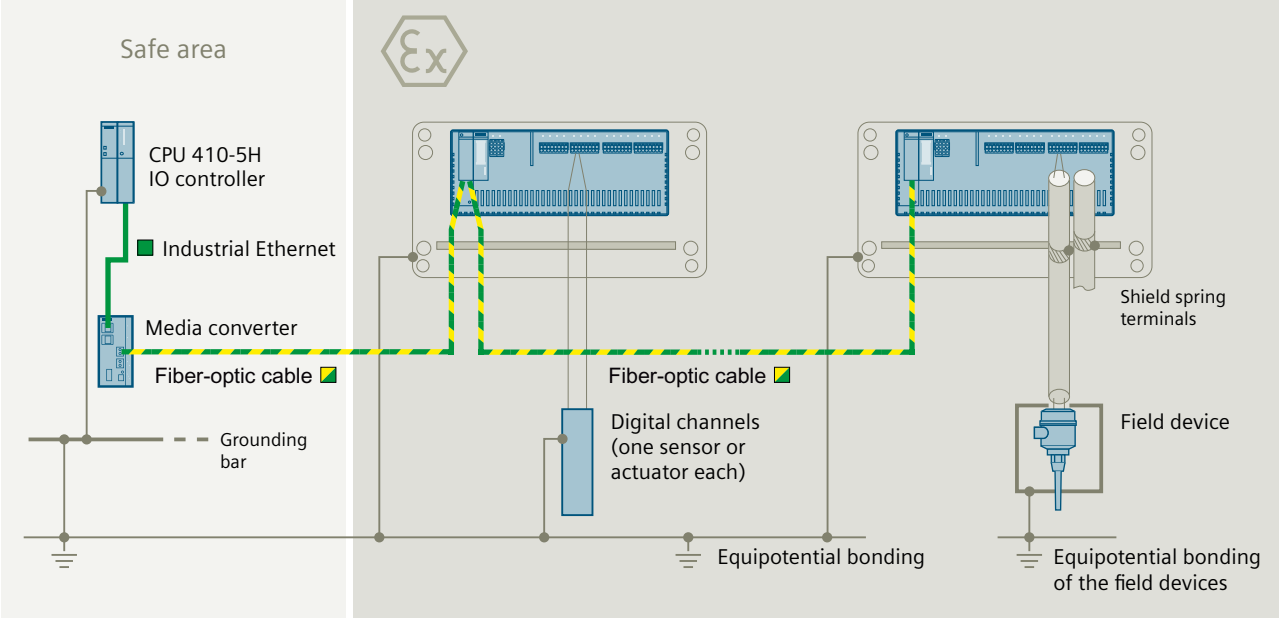
12.2 Grounding for configuration of the CFU with aluminum housing

Equipotential bonding

You must provide equipotential bonding in accordance with IEC 60079-14 in hazardous areas.

- By mounting the CFU on the DIN rail, a conductive connection to the aluminum housing is made via the clamp attachment.
- CFU PA: The shields of the fieldbus cables must be connected to the shield terminals.

Direct grounding



If equipotential bonding (e.g. equipotential bonding line) is routed between explosion-prone areas and safe areas, direct grounding can be implemented.

Note

CFU PA: Direct grounding

The protective braided shield of the fieldbus cables must be grounded.

More information

- Section "Grounding CFU with aluminum housing (Page 160)"
- Section "Connecting cable shields of the PROFIBUS PA cables to CFU in aluminum housing (Page 159)"

12.3 Configuration of the CFU with aluminum housing

12.3.1 Introduction

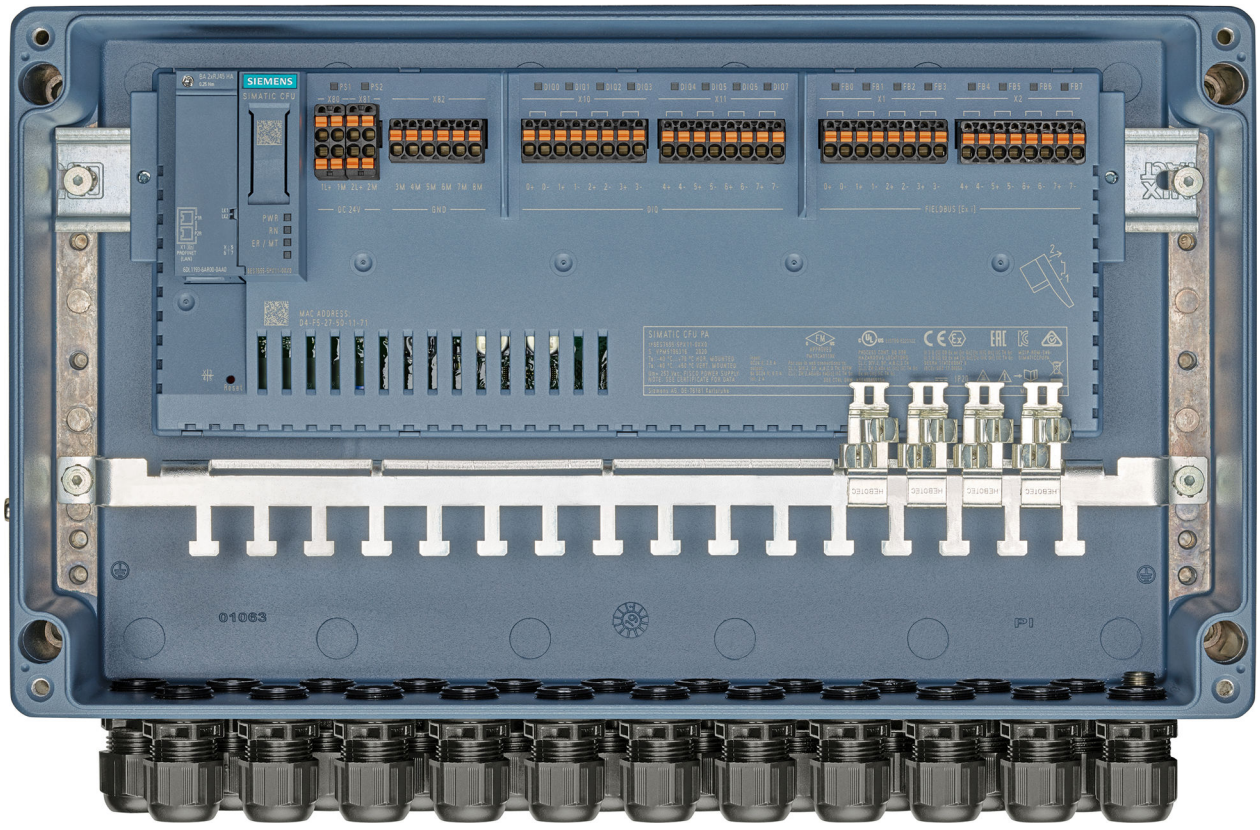


Figure 12-2 Example: CFU PA with aluminum housing (here without housing cover for a clear illustration)

Housing configuration

The housing is made of impact-resistant, powder-coated die-cast aluminum AlSi12. It consists of a base and a cover. It is dustproof and waterproof according to protection class IP 66.

Installing cables in the housing

- Observe the installation regulations during installation in accordance with EN 60079-14.
- The CFU with aluminum housing contains cable glands with an M20x1.5 thread for cable diameters from 7 mm to 13 mm (with a reducing insert: Cable 4 mm to 8 mm)
- It is possible to install specially certified cable and conductor glands, as well as blanking and sealing plugs.

Equipotential bonding

It is possible to connect an equipotential bonding cable. The cross-section of the ground connection must consist of a copper conductor with at least 4 mm^2.

12.3.1.1 Installation instructions

Installation location in hazardous areas

You can find information on this in section "Use in hazardous areas (Page 31)".

Mounting position

The CFU with aluminum housing is installed horizontally or vertically:

- With horizontal installation, the PROFINET bus connection is on the left.
- With vertical installation, the PROFINET bus connection is at the bottom.

More information

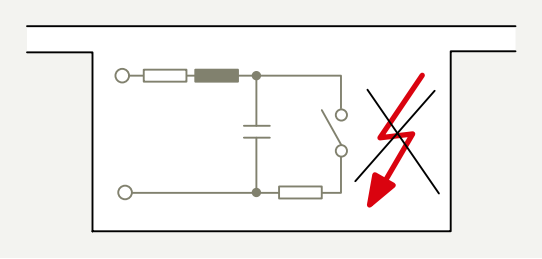
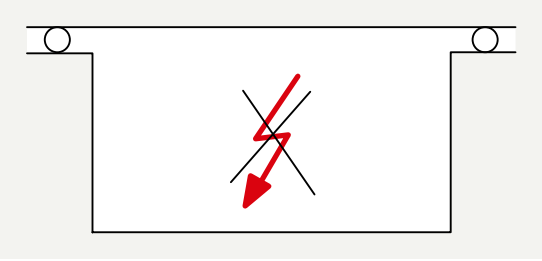
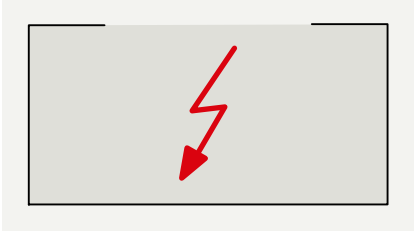
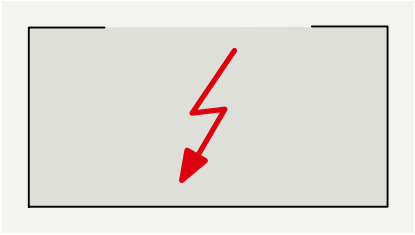
You can find technical information in the following sections:

- Section "Technical specifications of the CFU PA with aluminum housing (Page 194)"
- Section "Technical specifications of the CFU DIQ with aluminum housing (Page 206)"
- You can find information on derating in section "Mechanical and climatic ambient conditions for operation (Page 183)".

12.3.1.2 Design-dependent types of protection of the CFU

The types of protection include design and electrical measures relating to the equipment to achieve explosion protection in the hazardous areas. The following types of protection are used in the CFU:

Table 12-1 Types of protection

Type of protection	Meaning	Representation
Intrinsic safety i	All voltages, currents, inductance and capacitance occurring are limited by electrical measures (intrinsically safe) - sparks or thermal effects capable of causing ignition cannot occur. The spur line connections of the CFU fieldbus cables have an intrinsically safe design [ic]. **CAUTION** The following applies when the CFU is used in hazardous areas: The spur line connections of the freely configurable channels of the CFU may only be changed in a DE-ENERGIZED state.	
Increased-safety housing e	The housing of the CFU and the main line terminals of the CFU feature the increased safety Ex e type of protection. This type of protection is an additional measure to prevent high temperatures, sparks and arcing from forming with a higher degree of certainty.	
Protection by housing t	The CFU is installed in the aluminum housing, which ensures better protection against explosive dust environments. This type of protection is an encapsulation to prevent the CFU from igniting conductive or non-conductive dust.	
Encapsulation "m"	With the CFU, the internal circuits of the power supply are embedded in a potting compound. This means that an explosive atmosphere surrounding this electronic part can be ignited neither by sparks nor by unacceptable heating.	

12.3.1.3 Explosion protection

Housing configuration

The CFU housing is approved for use in hazardous areas according to EN 60079-0.

- Intrinsically safe circuits may be connected in explosion-prone areas.
- If EN 60079-14 is complied with, non-intrinsically safe current circuits may also be connected to the CFU with aluminum housing.

⚠ WARNING

When using in hazardous areas, observe the following:

- The regulations applicable in the country of application for the installation and operation of devices in explosion-prone areas.
- In the countries of the European Union, the national implementation of the EU Directive 1999/92/EC.
- In Germany, this is the BetrSichV [Operational Safety Ordinance].
- The provision for the installation of electrical systems in hazardous areas DIN EN 60079-14 (VDE 0165) or DIN EN 1127-1.
- The EU prototype test certificate.

All work on electrical circuits for explosion-prone systems must be carried out by qualified personnel.

12.3.2 Installation

12.3.2.1 Design with CFU

Introduction

The CFU with aluminum housing is approved as a combination of housing and CFU.

For explosion-prone areas, approval is valid up to zone 2/22.

12.3.2.2 Installation

The CFU with aluminum housing must be installed and connected by qualified personnel.

12.3.2.3 Installation rules

NOTICE
Risk of injury due to heavy weight of the CFU with aluminum housing
The CFU with aluminum housing weighs approx. 5.5 kg. Hold the device securely in your hand during installation.

Technical setup

The CFU is pre-assembled in the housing.

Maintenance

- In case of the CFU with aluminum housing, the included CFU may be replaced.
- Functional checks shall be carried out in accordance with EN 60079-17.
- The CFU must be sent to the manufacturing location for repairs. Repairs may only be carried out there.

Installation location in Zone 2/22 hazardous areas

⚠ DANGER
Installation regulations and country-specific regulations
Always adhere to the installation regulations in accordance with EN 60079-14 and any regulations specific to your country.
Documentation for installation of PROFINET IO and PROFIBUS PA is available from PROFIBUS & PROFINET International (PI) (https://www.profibus.com/):
• PROFIBUS PA: Technical Guideline "PROFIBUS PA, User and Installation Guideline"
• PROFINET: Guideline "PROFINET Installation Guideline for Cabling and Assembly"

⚠ DANGER
Explosion hazard
In some cases, ignitable sparks or unacceptable surface temperatures may be generated during connection.
• Never perform mounting under explosive conditions!
• Use a **non-magnetic** screwdriver when connecting the cables!

⚠ WARNING

Risk for intrinsic safety

CFU PA: When a connection is mixed up on the CFU (e.g. connection of a field device in a non-intrinsically safe area to the intrinsically safe spur outlets) or if the cable is connected incorrectly to the PA field devices, intrinsic safety is at risk.

- Only connect Ex i circuits (intrinsically-safe PA field devices) to the spur lines!
- Check the wiring to the PA field devices.
- Do not mix the used zones of the field devices on a CFU.

Installing the housing

In order to operate the equipment, you must ensure that the assembly work is carried out correctly.

You can find information on this in section "Mounting the CFU (Page 61)".

- Before connecting them, the cables must be stripped over the entire length specified in the manual.
- When fastening the screws and cable glands, observe the required tightening torques; see section "Tools and tightening torques (Page 217)".

More information

- You can find information about the power supply in section "Connecting the power supply to the CFU (Page 66)".
- You can find information about the ambient temperature in section "Mechanical and climatic ambient conditions for operation (Page 183)".
- System manual Principles of Explosion Protection (https://support.industry.siemens.com/cs/ww/en/view/12521844); section "Installation in hazardous areas"

12.3.2.4 Installing CFU with aluminum housing on the mounting surface

Requirement

- The mounting surface must be level, stable and free from vibrations.
- Select the mounting material that best suits the mounting surface.

Tools required

- 4 fixing screws M6; dowels depending on the mounting surface
- Screwdriver suitable for the screws used
- For housing screws: Screwdriver PH2 or 9 mm blade width

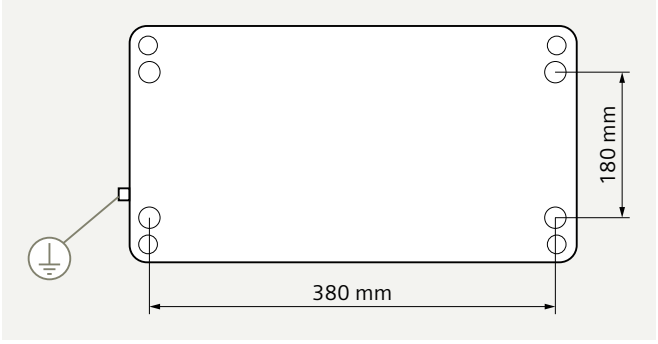
Installing the housing

Note

Note on installation direction

Refer to section "Installation instructions (Page 149)".

1. Loosen the 4 screws of the housing cover with the cross-tip screwdriver.
2. Fasten the housing in accordance with the requirements of the plant.
   - Observe the minimum distances and the bending radii of the cables used during the installation.
   - For use of the CFU, observe the information in the following sections:
     - Section "Technical specifications (Page 165)"
     - Section "Technical specifications of the CFU PA with aluminum housing (Page 194)"
     - Section "Technical specifications of the CFU DIQ with aluminum housing (Page 206)"
   - Fasten the lower part of the housing to the mounting surface using fixing screws. Torque is dependent on the fixing screws used.
     Information on drill hole distances can be found on the back of the lower part of the housing.



More information

You can find information about housing grounding in section "Grounding CFU with aluminum housing (Page 160)".

12.3.2.5 Mounting the CFU

The CFU is pre-assembled with the "CFU with aluminum housing" product.

Safety information

DANGER

Explosion hazard

Under some circumstances, sparks capable of ignition or unacceptable surface temperatures can occur during installation.

Never carry out mounting under explosive conditions!

See also

Use in hazardous areas (Page 31)

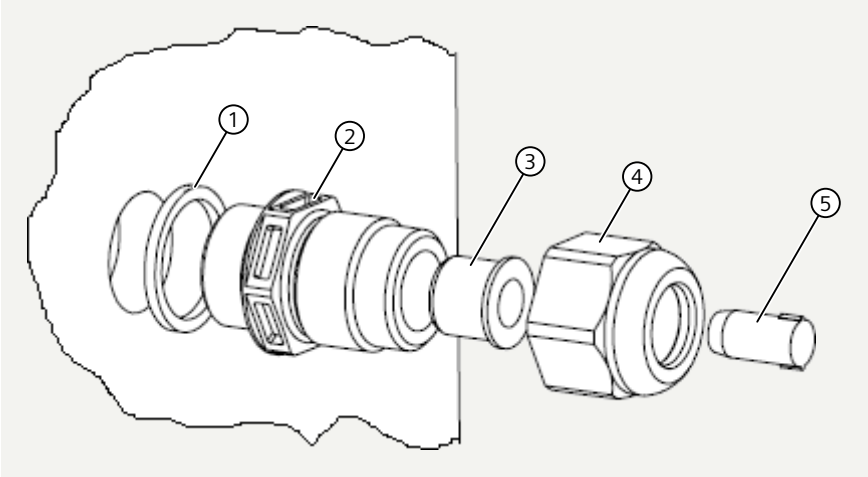
Mounting the CFU (Page 61)

12.3.2.6 Connecting the cables

All cables on the housing must be effectively clamped to prevent dragging or twisting.

Cable and conductor glands

Upon delivery of the CFU with aluminum housing, all cable and conductor glands with the components shown in the figure are present.



Configuration of cable and conductor glands upon delivery

No.	Component of the cable and conductor gland	**Configuration**		
		without cable	Cable 4-8 mm	Cable 7-13 mm
1	Housing sealing	remains	remains	remains
2	Body (thread M20x1.5)	remains	remains	remains
3	Reducing insert	remains	remains	remove
4	Cap nut	remains	remains	remains
5	Blanking plugs	remains	remove	remove

Depending on the application, you may need to remove or reinstall the reducing insert and/or the blanking plugs. Whenever possible, set aside any components that you have removed so that you can use them again if the configuration changes.

It is possible to install specially certified cable and conductor glands, as well as blanking and sealing plugs in the aluminum housing.

Connecting and disconnecting the cables to and from the CFU

- When laying cables and wiring, observe the following:
  - Area of use
  - Installation regulations in accordance with EN 60079-14
  - Country-specific regulations.
- Ensure that intrinsically safe and non-intrinsically safe cables are completely separate during wiring. Install these cables in separate cable conduits.
- Use cable type A, for example PB FC Process/Ethernet APL Cable GP (blue), 6XV1830-5EH10, as the bus cable.

- Before connecting them, the cables must be stripped over the specified length.
- Observe the regulations in your country during commissioning.

CFU PA: Rules for connecting a spur line on FB<n>

⚠ DANGER

Explosion hazard

It is forbidden to open the housing during operation in **Zone 22** hazardous areas.

Disconnect the CFU from the power supply before carrying out any work on it and make sure that no explosive dusts are present.

More information

You can find more information on sealing the housing in the following sections:

- Section "Use in hazardous areas (Page 31)"
- Section "Tools and tightening torques (Page 217)"
- Section "Permitted activities in hazardous areas (Page 162)"

12.3.2.7 Connecting the PROFIBUS PA cable to CFU in aluminum housing

Introduction

The PROFIBUS PA cables are introduced into the housing via cable glands.

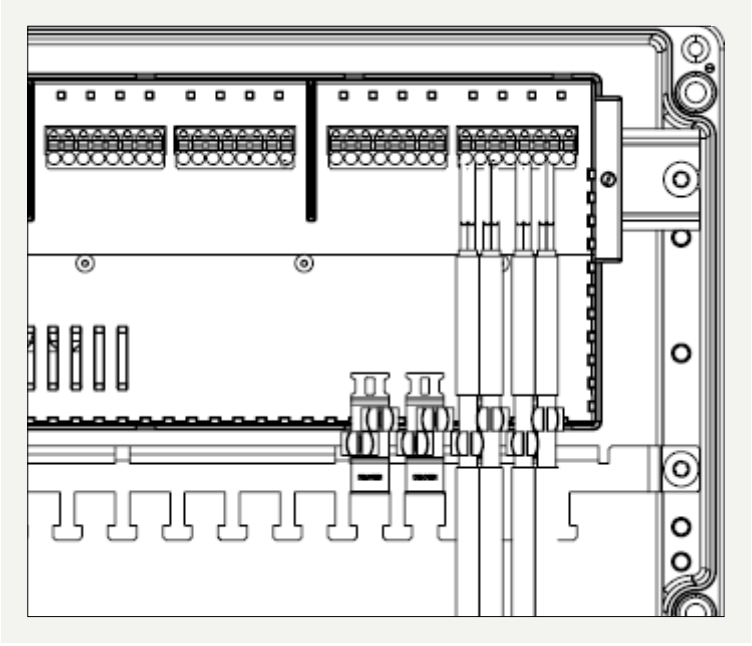


Figure 12-3 Connecting the field devices: Spur lines and cable shield connection with FB0 to FB<n>

Basic procedure

You can find information on this in section "Connecting the PROFIBUS PA field device (Page 71)".

1. Preparing the cables (Page 69)
2. Connecting the cables
   - Opening the housing
   - Connecting spur lines to the terminal block (Page 69)
   - Connecting cable shields (Page 159)
3. Closing the housing
4. Ensure that there is an appropriate strain relief for the cables outside the housing. Even when installed in the housing, the cable glands do not serve as strain relief.

Note

Secure fieldbus cable with screw terminals (according to approval)

When screw terminals are used to secure the fieldbus cables, the following wiring direction must be adhered to:

The FB connections may only be wired from below (from the direction of the rating plate).

12.3.2.8 Connecting cable shields of the PROFIBUS PA cables to CFU in aluminum housing

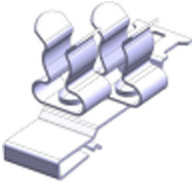
The shielding of the fieldbus cables must be connected to the functional grounding. Use the shield spring terminals mounted in the housing for this.

Pay attention to the bending radius of the fieldbus cables.

Shield spring terminals

One shield spring terminal can hold 2 fieldbus cables. With no load, securing with cable ties is sufficient.

The shield spring terminal is suitable for cables with a diameter of 6 to 8 mm.



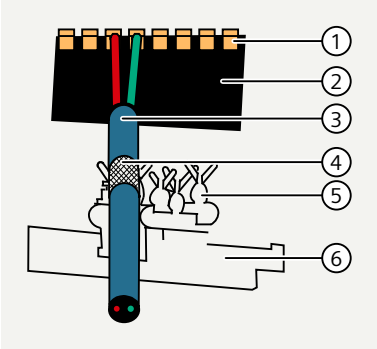
Tools required

Wire stripping tool

Procedure

To connect the cable shield, follow these steps:

1. Ensure that the insulation material of the fieldbus cable is removed in the area of the shield spring terminal.
   You can find information on this in the section "Preparing cables (Page 69)".
2. Connect the fieldbus cable to the CFU and press the fieldbus cable into the shield spring terminal.
3. Secure the fieldbus cable with cable ties to the dedicated area of the shield spring terminal.



① Terminals (screw terminal or push-in terminal)
② Terminal block 8x1
③ Fieldbus cable to field device
④ Insulating material removed (approx. 20 mm)
⑤ Shield spring terminal
⑥ Shielding bus

See also

Article numbers (accessories / spare parts) (Page 213)

12.3.2.9 Grounding CFU with aluminum housing

Required accessories

- Grounding cable, at least 4 mm^2 (copper)
- Screwdriver with 8 mm blade width

Grounding the housing

1. Strip the insulation of the grounding cable to 8 mm.
2. Fasten the grounding cable to the ground terminal (left side of the housing).

DANGER

CFU

Connect the grounding cable to the equipotential bonding terminal in accordance with EN 60079-14.

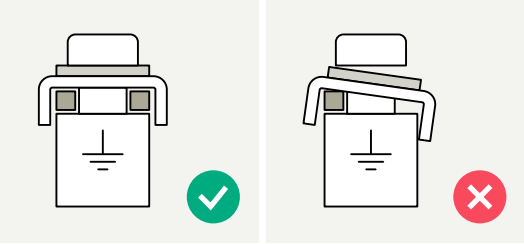


Figure 12-4 Permissible type of connection (left) and impermissible type of connection (right)

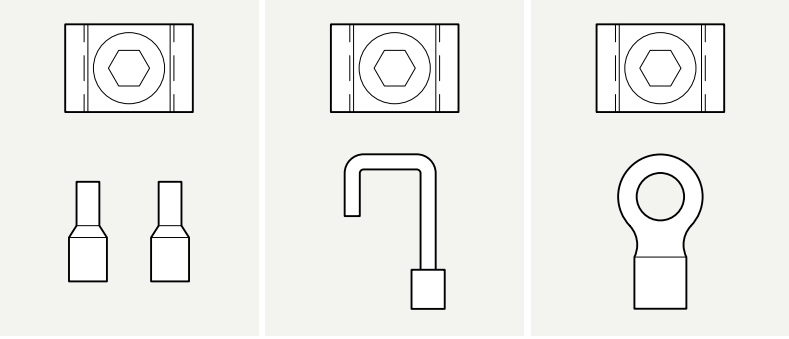


Figure 12-5 Different types of implementation

12.3.3 Care and maintenance

12.3.3.1 Information on care and maintenance

DANGER

Explosion hazard

Observe the safety information in section "Use in hazardous areas (Page 31)".

The spring-loaded terminals are maintenance-free. The clamping force of the spring terminals of the push-in connectors remains constant over time.

Maintenance of the CFU is essentially limited to **visual inspections**. The CFU can be in operation for this.

- Before installing the cover, check the seal for damage and proper fit.
- Tighten screws and cable glands to the correct tightening torque.
- The pressure compensation element is maintenance-free. If a pressure compensation element is damaged, it must be replaced immediately.

Observe the following sections:

- Section "Permitted activities in hazardous areas (Page 162)"
- Section "Maintenance during operation (Page 163)"
- Section "Replace pressure compensation element (Page 163)"

12.3.3.2 Permitted activities in hazardous areas

⚠ DANGER

Explosion hazard

Observe the safety information in section "Use in hazardous areas (Page 31)".

Activities during operation	Zone 2	Zone 22
Maintenance of the closed housing during operation (visual checks)	Permitted	Permitted
Damp cleaning of the closed housing	Permitted	Permitted
Opening the housing	Temporarily permitted for the permitted maintenance work	Not permitted
Maintenance during operation (visual checks with housing opened)	Permitted	Not permitted
CFU PA: Wiring of fieldbus connections	Permitted	Not permitted
Wiring except fieldbus connections (e.g. power supply)	Not permitted	Not permitted
Replace cable glands (cable gland can only be used by removing the cables)	Not permitted Only allowed with the intrinsically safe connections	Not permitted
Replace pressure compensation element	Permitted	Not permitted
Plug and pull fiber-optic cable	Permitted	Permitted
Replace the BusAdapter cable	Not permitted	Not permitted
Press reset button during operation	Permitted	Not permitted

12.3.3.3 Maintenance during operation

DANGER

Explosion hazard

Observe the safety information in section "Use in hazardous areas (Page 31)".

Carry out maintenance every 6 months in the hazardous area.

WARNING

Zone 22

The housing of the CFU must not be opened while the CFU is switched on.

Zone 2	Zone 22
Check that the cable inlets, the grounding terminal, the pressure compensation element, and the seals of the housing are sealed and intact.	Check that the cable inlets, the grounding terminal, and the seals of the housing are sealed and intact.
Check whether there are any foreign particles (liquids or dust). Check the cause. Replace damaged parts.	
Check that the wiring is secure (connectors, cables).	

12.3.3.4 Cleaning

WARNING

Hazardous area

Cleaning the CFU with aluminum housing

- You must clean the housing only with a damp cloth, as electrostatic charging may occur when wiping the housing using a dry cloth.
- Do not expose the housing to the direct jet of a pressure cleaner (a maximum direct jet pressure of 3 bar is permissible).

Note

After the cleaning, run a functional check of the CFU.

12.3.3.5 Replace pressure compensation element

The pressure compensation element of the CFU with aluminum housing is maintenance-free.

The following figure shows the position of the pressure compensation element.

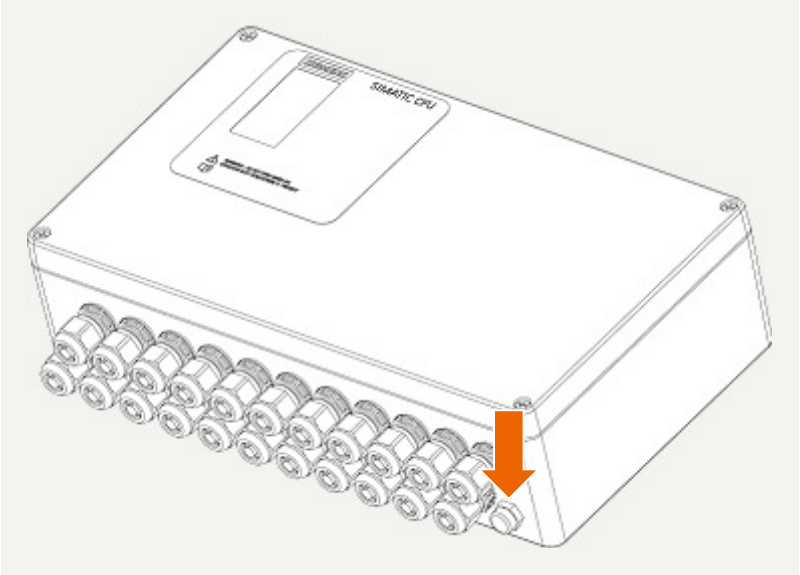


Figure 12-6 Position of the pressure compensation element on the aluminum housing (view from below)

Excess pressure or low pressure inside the housing

The following errors could be responsible for excess pressure or low pressure in the housing:

Error	Solution
The pressure compensation element is contaminated.	Clean the pressure compensation element. You can find information on this in section "Cleaning (Page 163)".
The pressure compensation element is defective.	Replace the pressure compensation element. Pay attention to the correct mounting.

More information

Section "Tools and tightening torques (Page 217)"

Technical specifications

13

13.1 General technical specifications

What are general technical specifications?

The technical specifications contain:

- The standards and test values that observe and fulfil the described components.
- The test criteria used to test the described components.

13.1.1 Standards and approvals for CFU PA

Validity of the information on the device

Note

Markings and approvals

In the manual you can find the markings and approvals which are generally possible or planned in the system.

The identification or approval that is printed on the device continues to be exclusively valid!

The currently valid markings and approvals are printed on the component.

You can find information about the certificates on the Internet by specifying the article number: Certificates (https://support.industry.siemens.com/cs/ww/en/ps/cert).

Enter the following information on the website for the search:

- Product <article number>
- Entry type "Certificate"

The product information is made available with the product or on the Internet by specifying the article number: Service & Support (https://support.industry.siemens.com/cs/ww/en/ps).

13.1.1.1 Safety instructions on use of the CFU PA

⚠ WARNING

Explosion hazard

If the electric circuit is live, the following must be observed:

- Do not disconnect the device in a flammable or combustible atmosphere.
- Do not open the housing in a flammable or combustible atmosphere.

⚠ WARNING

Area of application

- Type: 6ES7655-5PX11-1XX0
  The device is only suitable for use in the following environments:
  - Environments of Class I, Division 2, Groups A, B, C, D; Class I, Zone 2, Group IIC
  - Non-hazardous area
- Type: 6ES7655-5PX11-1AX0
  The device is only suitable for use in the following environments:
  - Environments of Class I, Division 2, Groups A, B, C, D; Class I, Zone 2, Group IIC and Zone 22 Dust Group IIIC
  - Non-hazardous area

⚠ WARNING

Ambient conditions

Type: 6ES7655-5PX11-1XX0
The device may only be used in areas with a pollution degree of no more than 2 according to IEC 60664-1.

⚠ WARNING

Housing and cables

The device is intended for installation in a housing / control cabinet. The internal operating temperature of the housing / control cabinet corresponds to the maximum permissible ambient temperature of the device.

Cables must be used whose maximum permissible operating temperature is at least 30 °C above the maximum permissible ambient temperature.

⚠ WARNING

Ambient temperature of the device

The temperature of the device housing can be higher than 50 °C if the device is operated at an ambient temperature of more than 70 °C. The device must therefore be installed so that it is only accessible to service technicians or users who are aware of the reason for the restricted access and the necessary safety measures at an ambient temperature of over 50 °C.

⚠ WARNING

Safety extra-low voltage

The device is designed for operation with safety extra-low voltage (SELV) from a limited power source (LPS).

Only power supplies that meet the following requirements may be connected to the power supply terminals:

- SELV/LPS (current source with limited power), according to standards IEC 60950-1, UL 60950-1, EN 60950-1, VDE 0805-1
  or
- Power supply for the NEC Class 2 device as described in the National Electrical Code (r) (ANSI / NFPA 70).

If the device is connected to a redundant power supply (two separate power sources), both must meet these requirements.

NOTICE

Removal and replacement

- Type: 6ES7655-5PX11-1XX0
  - If you replace components, the suitability for Class I, DIV. 2 becomes invalid.
  - Replacing components may affect the usability of the device.
- Type: 6ES7655-5PX11-1AX0
  - It is prohibited to open the aluminum housing of the device during operation in a Zone 22 hazardous area. De-energize the device before carrying out any work on it.

NOTICE

Risk of injury

Read the manual before use to avoid injury.

13.1.1.2 CE conformity

Introduction

CE

The CFU fulfils the requirements and protective aims of the following EU directives and conforms with the harmonized European standards (EN) that have been published for programmable logic controllers in the Official Journals of the European Union:

- Low-Voltage Directive
- EMC Directive

- Explosion Protection Directive
- RoHS Directive

Low-Voltage Directive

2014/35/EU "Electrical equipment designed for use within certain voltage limits" (Low-Voltage Directive)
The components of the CFU that fall under the Low-Voltage Directive have been tested according to the requirements of EN 61010-2-201.

EMC Directive

2014/30/EU "Electromagnetic Compatibility" (EMC Directive)
You can find more information in section "Electromagnetic Compatibility (Page 180)".

- **Use in industrial areas**
  SIMATIC products are designed for operation in industrial areas.

Area of application	Requirements for interference emission	Requirements for interference immunity
Industry	EN 61000-6-4	EN 61000-6-2

- **Use in residential areas**
  The CFU is intended for use in industrial areas.
  If used in residential areas, it may interfere with radio/TV reception.
  If you use the CFU in residential areas, you must ensure adherence to the limits regarding emission of radio frequency interference according to EN 61000-6-3.
  Suitable measures to achieve Limit Class B for radio frequency interference include:
  - Installation of the CFU in grounded control cabinets/switch boxes
  - Use of interference filters in the supply lines

Explosion Protection Directive

2014/34/EU "Explosion Protection" (ATEX Directive)
You can find more information in section "ATEX Approval (Page 169)".

RoHS Directive

(RoHS = Restrictions of the use of certain Hazardous Substances)
2011/95/EU "Restriction of the use of certain hazardous substances in electrical and electronic equipment"
According to the requirements of EN 63000, the product does not contain any dangerous substances.

13.1.1.3 CCC marking

6ES7655-5PX11-1XX0 and 6ES7655-5PX11-1AX0

CCC

2020322310003012

According to GB 3836.1 (Explosive atmospheres - Part 1: Equipment - General requirements)

According to GB 3836.4 (Explosive atmospheres - Part 4: Equipment protection by intrinsic safety "i")

According to GB 3836.8 (Explosive atmospheres - Part 8: Equipment protection by type of protection "n")

According to GB 12476.1 (Electrical apparatus for use in the presence of combustible dust - Part 1: General requirements)

According to GB 12476.4 (Electrical apparatus for use in the presence of combustible dust - Part 4: Protection by intrinsic safety "iD")

According to GB 12476.5 (Electrical apparatus for use in the presence of combustible dust - Part 5: Protection by enclosures "tD")

6ES7655-5PX11-1XX0

Ex nA [ic Gc] IIC T4 Gc

Ex nA [icD] IIC T4 Gc

6ES7655-5PX11-1AX0

Ex nA [ic Gc] IIC T4 Gc

Ex nA [icD] IP66 T80°C

13.1.1.4 UKCA marking

UKCA

6ES7655-5PX11-1XX0 and 6ES7655-5PX11-1AX0

DEKRA 21UKEX0022 X

Importer UK:

Siemens plc

Manchester M20 2UR

13.1.1.5 ATEX Approval

Table 13-1 ATEX certification

Type examination certificate (number)	DEKRA 17ATEX0047 X
Standards	• EN 60079-0 • EN 60079-7 • EN 60079-11 • EN 60079-31

Type: 6ES7655-5PX11-1XX0

II 3 G (3) GD Ex ec [ic Gc] [ic IIIC Dc] IIC T4 Gc

Type: 6ES7655-5PX11-1AX0

II 3 G Ex ec [ic] IIC T4 Gc

II 3 D Ex tc [ic] IIIC T80 °C Dc

⚠ WARNING

Personal injury and material damage can be incurred.

In potentially explosive atmospheres, personal injury and material damage can be incurred if plug connections are disconnected during operation.

Refer to section "Use in hazardous areas (Page 31)".

13.1.1.6 IECEx approval

Table 13-2 IECEx certification

Certificate number	IECEx DEK 17.0025X
Standards	• IEC 60079-0 • IEC 60079-7 • IEC 60079-11 • IEC 60079-31

Type: 6ES7655-5PX11-1XX0

Ex ec [ic Gc] [ic IIIC Dc] IIC T4 Gc

Type: 6ES7655-5PX11-1AX0

Ex ec [ic] IIC T4 Gc

Ex tc [ic] IIIC T80°C Dc

WARNING

Personal injury and material damage can be incurred.

In potentially explosive atmospheres, personal injury and material damage can be incurred if plug connections are disconnected during operation.

Refer to section "Use in hazardous areas (Page 31)".

13.1.1.7 INMETRO approval

INMETRO

The components described satisfy the requirements of the following standards:

- ABNT NBR IEC 60079-0
- ABNT NBR IEC 60079-7
- ABNT NBR IEC 60079-11
- ABNT NBR IEC 60079-31

13.1.1.8 UL / CSA approval

c UL us
HAZ. LOC.

Underwriters Laboratories Inc. in accordance with

Ordinary locations

- UL 61010-2-201; First Edition, Dated January 24, 2014; IEC 61010-2-201:2017 (**Note**: This standard is supplemented by UL 61010-1, Third Edition, Dated May 11, 2012)
- CSA C22.2 No. 142 (Process Control Equipment)

Hazardous locations

- ISA 12.12.01
- CSA C22.2 No. 213

APPROVED for use in
Class I, Division 2, Group A, B, C, D Tx;
Class I, Zone 2, Group IIC Tx

Note the following information:

Note

This product must be installed according to the NEC (National Electric Code) stipulations.

When used in environments according to class I, division 2 (see above), the CFU must be mounted in a housing that corresponds to at least IP54 according to EN 60529.

Installation instructions according to cULus

⚠ WARNING

Installation instructions according to cULus

WARNING – Explosion Hazard - Do not connect or disconnect the device while circuit is live unless area is known to be non-hazardous.

WARNING – Explosion Hazard - Substitution of components can impair suitability for Class I, Division 2 or Class I, Zone 2.

This equipment is suitable for use in Class I, Division 2, Groups A, B, C or D; Class I, Zone 2, Group IIC, or non-hazardous locations only.

13.1.1.9 FM Approval

Table 13-3 Factory Mutual Research (FM) Certification

Classification	NI, Class I, Div 2, Groups A, B, C, D Tx;
	NI, Class I, Zone 2, Groups IIC Tx
Standards	Class No. 3600
	Class No. 3611
	Class No. 3810

Installation instructions according to cFMus

⚠ WARNING

Installation instructions according to cFMus

WARNING – Explosion Hazard - Do not connect or disconnect the device while circuit is live unless area is known to be non-hazardous.

WARNING – Explosion Hazard - Substitution of components can impair suitability for Class I, Division 2 or Class I, Zone 2.

This equipment is suitable for use in Class I, Division 2, Groups A, B, C or D; Class I, Zone 2, Group IIC, or non-hazardous locations only.

13.1.1.10 Tick mark for Australia and New Zealand

The components described satisfy the requirements of the following standard:
EN 61000-6-4: 2007 + A1: 2011

13.1.1.11 Standards for communication connections

The components described satisfy the requirements of the following standards:

- IEC 61158
- IEC 61784
  - The following applies to communication with the automation system via PROFINET: **Compliance with IEC 61784 Ed.2:2007 CPF 3/5**
  - The following applies to communication with field devices over PROFIBUS PA: **Compliance to IEC 61784 Ed.2:2007 CPF 3/2**

13.1.1.12 Safety regulations and special requirements

The components described satisfy the requirements and criteria of the following standard:

IEC 61010-2-201:2017 (Second Edition) / EN 61010-2-201:2017
(Note: These standards were supplemented by IEC 61010-1:2010 (Third Edition) / EN 61010-1:2010)

13.1.2 Standards and approvals for CFU DIQ

Validity of the information on the device

Note

Markings and approvals

In the manual you can find the markings and approvals which are generally possible or planned in the system.

The identification or approval that is printed on the device continues to be exclusively valid!

The currently valid markings and approvals are printed on the component.

You can find information about the certificates on the Internet by specifying the article number: Certificates (https://support.industry.siemens.com/cs/ww/en/ps/cert).

Enter the following information on the website for the search:

- Product <article number>
- Entry type "Certificate"

The product information is made available with the product or on the Internet by specifying the article number: Service & Support (https://support.industry.siemens.com/cs/ww/en/ps).

13.1.2.1 Safety instructions on use of the CFU DIQ

⚠ WARNING

Explosion hazard

If the electric circuit is live, the following must be observed:

- Do not disconnect the device in a flammable or combustible atmosphere.
- Do not open the housing in a flammable or combustible atmosphere.

⚠ WARNING

Area of application

- Type: 6ES7655-5PX31-1XX0
  The device is only suitable for use in the following environments:
  - Environments of Class I, Division 2, Groups A, B, C, D; Class I, Zone 2, Group IIC
  - Non-hazardous area
- Type: 6ES7655-5PX31-1AX0
  The device is only suitable for use in the following environments:
  - Environments of Class I, Division 2, Groups A, B, C, D; Class I, Zone 2, Group IIC and Zone 22 Dust Group IIIC
  - Non-hazardous area

⚠ WARNING

Ambient conditions

Type: 6ES7655-5PX31-1XX0
The device may only be used in areas with a pollution degree of no more than 2 according to IEC 60664-1.

⚠ WARNING

Housing and cables

The device is intended for installation in a housing / control cabinet. The internal operating temperature of the housing / control cabinet corresponds to the maximum permissible ambient temperature of the device.

Cables must be used whose maximum permissible operating temperature is at least 30 °C above the maximum permissible ambient temperature.

⚠ WARNING

Ambient temperature of the device

The temperature of the device housing can be higher than 50 °C if the device is operated at an ambient temperature of more than 70 °C. The device must therefore be installed so that it is only accessible to service technicians or users who are aware of the reason for the restricted access and the necessary safety measures at an ambient temperature of over 50 °C.

⚠ WARNING

Safety extra-low voltage

Only use power supply units of type SELV/PELV with safe electrically isolated functional extra low voltage (≤ 28.8 V DC).

NOTICE

Removal and replacement

- Type: 6ES7655-5PX31-1XX0
  - If you replace components, the suitability for Class I, DIV. 2 becomes invalid.
  - Replacing components may affect the usability of the device.
- Type: 6ES7655-5PX31-1AX0
  - It is prohibited to open the aluminum housing of the device during operation in a Zone 22 hazardous area. De-energize the device before carrying out any work on it.

NOTICE

Risk of injury

Read the manual before use to avoid injury.

13.1.2.2 CE conformity

Introduction

CE

The CFU fulfils the requirements and protective aims of the following EU directives and conforms with the harmonized European standards (EN) that have been published for programmable logic controllers in the Official Journals of the European Union:

- Low-Voltage Directive
- EMC Directive
- Explosion Protection Directive
- RoHS Directive

Low-Voltage Directive

2014/35/EU "Electrical equipment designed for use within certain voltage limits" (Low-Voltage Directive)
The components of the CFU that fall under the Low-Voltage Directive have been tested according to the requirements of EN 61010-2-201.

EMC Directive

2014/30/EU "Electromagnetic Compatibility" (EMC Directive)
You can find more information in section "Electromagnetic Compatibility (Page 180)".

- **Use in the industrial sector**
  SIMATIC products are designed for industrial applications.

Area of application	Requirements for interference emission	Requirements for interference immunity
Industry	EN 61000-6-4	EN 61000-6-2

- **Use in residential areas**
  The CFU is intended for use in industrial areas.
  If used in residential areas, it may interfere with radio/TV reception.
  If you use the CFU in residential areas, you must ensure adherence to the limits regarding emission of radio frequency interference according to EN 61000-6-3.
  Suitable measures to achieve Limit Class B for radio frequency interference include:
  - Installation of the CFU in grounded control cabinets/switch boxes
  - Use of interference filters in the supply lines

Explosion Protection Directive

2014/34/EU "Explosion Protection" (ATEX Directive)
You can find more information in section "ATEX approval for CFU DIQ (6ES7655-5PX31-1AX0) with and without aluminum housing (6ES7655-5PX31-1XX0) (Page 177)".

RoHS Directive

(RoHS = Restrictions of the use of certain Hazardous Substances)
2011/95/EU "Restriction of the use of certain hazardous substances in electrical and electronic equipment"
According to the requirements of EN 63000, the product does not contain any dangerous substances.

13.1.2.3 CCC marking

6ES7655-5PX31-1XX0 and 6ES7655-5PX31-1AX0

CCC

2020322310003010

According to GB 3836.1 (Explosive atmospheres - Part 1: Equipment - General requirements)

According to GB 3836.8 (Explosive atmospheres - Part 8: Equipment protection by type of protection "n")

According to GB 12476.1 (Electrical apparatus for use in the presence of combustible dust - Part 1: General requirements)

According to GB 12476.5 (Electrical apparatus for use in the presence of combustible dust - Part 5: Protection by enclosures "tD")

Ex nA IIC T4 Gc

Ex tD A22 IP66 T80°C

13.1.2.4 UKCA marking

UKCA

6ES7655-5PX31-1XX0 and 6ES7655-5PX31-1AX0

DEKRA 21UKEX0023 X

Importer UK::

Siemens plc

Manchester M20 2UR

13.1.2.5 ATEX approval for CFU DIQ (6ES7655-5PX31-1AX0) with and without aluminum housing (6ES7655-5PX31-1XX0)

Table 13-4 ATEX certification

Type examination certificate (number)	DEKRA 18ATEX0134 X
Standards	• EN IEC 60079-0 • EN 60079-7 • Only 6ES7655-5PX31-1AX0: EN 60079-31

II 3 G Ex ec IIC T4 Gc	Type: 6ES7655-5PX31-1XX0 and 6ES7655-5PX31-1AX0
II 3 D Ex tc IIIC T80 °C Dc	Only type: 6ES7655-5PX31-1AX0

Note

Special conditions

Applies only to type 6ES7655-5PX31-1XX0.

- The device must be installed in a suitable housing that provides a degree of protection of at least IP54 according to EN IEC 60079-0, taking into account the ambient conditions in which the device is used.

Use in areas that require use of devices with EPL Gc:

- The device may only be used in areas with a pollution degree of no more than 2 according to the specification in EN 60664-1.
- Measures must be taken to prevent exceeding the rated operating voltage by more than 119 V due to transient disturbance voltages.

13.1.2.6 IECEx approval for CFU DIQ (6ES7655-5PX31-1AX0) with and without aluminum housing (6ES7655-5PX31-1XX0)

Table 13-5 IECEx certification

Certificate number	IECEx DEK 18.0086X
Standards	• IEC 60079-0 • IEC 60079-7 • Only 6ES7655-5PX31-1AX0: IEC 60079-31

II 3 G Ex ec IIC T4 Gc	Type: 6ES7655-5PX31-1XX0 and 6ES7655-5PX31-1AX0
II 3 D Ex tc IIIC T80 °C Dc	Only type: 6ES7655-5PX31-1AX0

Note

Special conditions

- You must ensure that measures are taken to protect against exceeding the rated operating voltage by transient interference voltages of more than 119 V.
- Device without aluminum housing (type: 6ES7655-5PX31-1XX0):
  - The device may only be used in areas with a pollution degree of no more than 2 according to IEC 60664-1.
  - The device must be installed in a suitable housing which meets the following requirements:
    The housing shall provide a degree of protection of at least IP54 in accordance with IEC 60079-7, taking into account the ambient conditions of use.
- Device with aluminum housing (type: 6ES7655-5PX31-1AX0):
  - The device provides IP66 degree of protection according to IEC 60079-31.

13.1.2.7 UL approval for CFU DIQ without aluminum housing (6ES7655-5PX31-1XX0)

Table 13-6 Underwriters Laboratories (UL) Certification

Certificate number	20190214-E248953
Standards	UL61010-1
	UL61010-2-201
	CAN/CSA C22.2 No. 61010-1-12
	CAN/CSA C22.2 No. 61010-2-201:18
	(COMPACT FIELD UNIT CFU DIQ) for use in Class I, Division 2, Groups A, B, C and D Hazardous Locations

Certificate number	20190307-E223122
Standards	CSA C22.2 NO 213
	UL 121201

13.1.2.8 FM approval for CFU DIQ without aluminum housing (6ES7655-5PX31-1XX0)

Table 13-7 Factory Mutual Research (FM) Certification

Classification	NI, Class I, Div 2, Groups A, B, C and D
	NI, Class I, Zone 2, Groups IIC
Standards	FM Class 3600
	FM Class 3611
	FM Class 3810
	ANSI/UL 61010-1
	ANSI/UL 121201
	CAN/CSA C22.2 No. 0-10
	CSA-C22.2 No. 213
	CSA-C22.2 No. 61010-1

13.1.2.9 Standards for communication connections

The components described satisfy the requirements of the following standards:

- IEC 61158
- IEC 61784
  - The following applies to communication with the automation system via PROFINET: **Compliance with IEC 61784 Ed.2:2007 CPF 3/5**

13.1.2.10 Safety regulations and special requirements

The components described satisfy the requirements and criteria of the following standard:

IEC 61010-2-201:2017 (Second Edition) / EN 61010-2-201:2017
(Note: These standards were supplemented by IEC 61010-1:2010 (Third Edition) / EN 61010-1:2010)

13.1.3 Electromagnetic Compatibility

Introduction

This chapter provides you with information on the immunity to interference of the described components as well as on radio interference suppression.

The described components meet, among others, the requirements of the EMC legislation of the European single market.

Definition: EMC

Electromagnetic compatibility (EMC) is the capacity of an electrical installation to function satisfactorily in its electromagnetic environment without affecting that environment.

EMC in accordance with NE21

The S7 CPU 410-5H automation system with connected CFU meets the EMC requirements according to NAMUR Guideline NE21.

Pulse-shaped Interference

The table below shows the electromagnetic compatibility of the described components with regard to pulse-shaped interference. The prerequisite for this is that the system complies with the relevant requirements and guidelines relating to electrical equipment.

Pulse-shaped disturbance	Tested at
Electrostatic discharge in accordance with IEC 61000-4-2	8 kV 6 kV
Burst pulses (fast transients) in accordance with IEC 61000-4-4	2 kV (supply line) 2 kV (signal line)
High-energy current surge according to IEC 61000-4-5 The following information on protective wiring applies to the following **unshielded** connection cables to the CFU: • Power cable • Freely configurable channels Protection element selection: See the documentation "SIMATIC; S7-1500, ET 200MP, ET 200SP, ET 200AL; Designing interference-free controllers (http://support.industry.siemens.com/cs/document/59193566)"; Section "Lightning protection and overvoltage protection"	
• Asymmetric interference	• 1 kV (without protective element) • 2 kV (with protective elements)
• Symmetric interference	• 0.5 kV (without protective element - only power cable tested) • 1 kV (with protective elements)
High-energy current surge according to IEC 61000-4-5 The following information applies to the following shielded connection cables to the CFU: • PROFINET cable • Fieldbus cable	
Coupling (to shield)	• 2 kV (without protective element)

Sinusoidal disturbance

EMC performance of the described components in relation to sinusoidal disturbance variables: The prerequisite for this is that the system complies with the relevant requirements and guidelines relating to electrical equipment.

Sinusoidal disturbance variable	Tested at
HF radiation according to IEC 61000-4-3 Electromagnetic HF field, amplitude-modulated	• 80 to 1000 MHz; 1.4 to 2 GHz • 10 V/m • 80 % AM (1 kHz)
HF coupling in accordance with IEC 61000-4-6	• 0.15 to 80 MHz • 10 V_{rms} unmodulated • 80 % AM (1 kHz) • 150 Ω source impedance

Emission of radio interferences

The following tables show the limits of the emission of electromagnetic fields to which the described components adhere.

Table 13-8 Interference emission of electromagnetic fields according to EN 55016: Limit Class A, Group 1

From 30 to 230 MHz	< 40 dB (µV/m)Q
From 230 to 1000 MHz	< 47 dB (µV/m)Q
measured at a distance of 10 m	

Table 13-9 Interference emission of electromagnetic fields according to EN 55016: Limit Class A, Group 1

From 30 to 230 MHz	< 52 dB (µV/m) to 45 dB (µV/m) quasi-peak
From 230 to 1000 MHz	< 52 dB (µV/m) quasi-peak
measured at a distance of 3 m	

Table 13-10 Disturbance via supply lines according to EN 55016: Limit Class A, Group 1

from 0.15 to 0.5 MHz	< 79 dB (µV)Q < 66 dB (µV)M
From 0.5 to 5 MHz	< 73 dB (µV)Q < 60 dB (µV)M
From 5 to 30 MHz	< 73 dB (µV)Q < 60 dB (µV)M

13.1.4 Shipping and storage conditions

Transport and storage of modules

The described components fulfill the requirements of IEC 61131 Part 2 with regard to transport and storage conditions. The following specifications apply for modules that are transported or stored in their product packaging.

Table 13-11 Transport and storage conditions

Type of condition	Permitted range
Free fall (in product packaging)	≤0.3 m
Temperature	From –40 °C to +70 °C
Air pressure	From 1080 hPa to 606 hPa (corresponds to an altitude of –1000 m to 4000 m)
Relative humidity	From 10 to 95 %, without condensation

Type of condition	Permitted range
Sinusoidal oscillations according to IEC 60068-2-6	5 - 8.4 Hz: Constant amplitude 3.5 mm 8.4–500 Hz: Constant acceleration 9.8 m/s^2
Impact to IEC 60068-2-27	250 m/s^2, 6 ms, 1000 shocks

13.1.5 Mechanical and climatic ambient conditions for operation

Conditions of use

The CFU with aluminum housing variants are designed for use in a fixed, non-sheltered location.

Use with additional measures

The described components must not be operated without additional measures:

- at locations with a high degree of ionizing radiation
- in aggressive environments caused, for example, by
  - the development of dust
  - corrosive vapors or gases
  - strong electric or magnetic fields
- in installations requiring special monitoring, for example
  - elevators
  - electrical plants in potentially hazardous areas

An additional measure can be installation in a cabinet or in a housing, for instance.

Mechanical ambient conditions

The mechanical ambient conditions for the described components are specified in the table below for sinusoidal vibrations.

Table 13-12 Mechanical ambient conditions

Frequency range in Hz	Permitted range
$5 \leq f \leq 8.4$	Amplitude 3.5 mm
$8.4 \leq f \leq 150$	Constant acceleration 9.8 m/s^2

Reduction of vibrations

If the described components are subject to big shocks or vibrations appropriate measures must be taken to reduce the acceleration or the amplitude.

We recommend fixing the described components on damping materials (rubber-metal anti-vibration mountings, for example).

Checking mechanical ambient conditions

The following table provides information on the type and scope of checks regarding mechanical ambient conditions.

Table 13-13 Checking mechanical ambient conditions

Tests for ...	Test standard	Remark	
Vibrations	Vibration test to IEC 60068-2-6 (sine)	Type of vibration:	Frequency sweeps with a rate of change of 1 octave/minute. • 5 Hz ≤ f ≤ 8.4 Hz, 3.5 mm constant amplitude • 8.4 Hz ≤ f ≤ 150 Hz, 9.8 m/s² constant acceleration
		Period of oscillation:	10 frequency sweeps per axis in each of the 3 axis which are vertical to each other.
Shock	Shock, tested to IEC 60068-2-27	Type of shock:	• half-sine
		Strength of shock:	• Peak value 150 m/s² • Duration 11 ms
		Direction of the shock:	• 3 shocks each in +/– direction in each of the 3 mutually vertical axes

Climatic ambient conditions

The described components can be used in the following climatic ambient conditions:

Table 13-14 Climatic ambient conditions

Ambient conditions	Permitted range	Remarks		
		Mounting requirement	Ambient temperature of the CFU	Permissible load current
Temperature of the CFU PA (without housing)	–40 °C ≤ T ≤ 70 °C	Horizontal installation (PROFINET bus connection left)	60 °C < T ≤ 70 °C [1)]	Max. 1 A
			–40 °C ≤ T ≤ 60 °C [1)]	Max. 2 A
		Vertical installation (PROFINET bus connection bottom)	–40 °C ≤ T ≤ 60 °C [1)]	Max. 2 A
Temperature of the CFU DIQ (without housing)	–40 °C ≤ T ≤ 70 °C	Horizontal installation (PROFINET bus connection left)	60 °C < T ≤ 70 °C [1)]	Max. 4 A
			–40 °C ≤ T ≤ 60 °C [1)]	Max. 5 A
		Vertical installation (PROFINET bus connection bottom)	–40 °C ≤ T ≤ 60 °C [1)]	Max. 5 A
CFU PA in housing also SIMATIC CFU PA in aluminum housing	–40 °C ≤ T ≤ 60 °C	Horizontal installation (PROFINET bus connection left)	50 °C < T ≤ 60 °C [1)]	Max. 1 A
			–40 °C ≤ T ≤ 50 °C [1)]	Max. 2 A
		Vertical installation (PROFINET bus connection bottom)	–40 °C ≤ T ≤ 50 °C [1)]	Max. 2 A
CFU DIQ in housing also SIMATIC CFU DIQ in aluminum housing	–40 °C ≤ T ≤ 60 °C	Horizontal installation (PROFINET bus connection left)	50 °C < T ≤ 60 °C [1)]	Max. 4 A
			–40 °C ≤ T ≤ 50 °C [1)]	Max. 5 A
		Vertical installation (PROFINET bus connection bottom)	–40 °C ≤ T ≤ 50 °C [1)]	Max. 5 A

Ambient conditions	Permitted range	Remarks		
		Mounting requirement	Ambient temperature of the CFU	Permissible load current
Air pressure	• From 1080 hPa (corresponds to a depth of approx. –1000 m) • Up to 606 hPa (corresponds to a height of approx. 4000 m)	The density of air decreases with increasing altitude. The cooling effect of air in accordance with the elevation is shown in the following table on derating. [1]		
Relative humidity	From 10 to 95 % Max. 95 % at +25 °C	No condensation, corresponds to relative humidity (RH) exposure level 2 according to IEC 61131 Part 2		
Contaminant concentration	• SO_2: <0.5 ppm • RH: <60 %, no condensation	Check 10 ppm; 4 days		
	• H_2S: <0.1 ppm • RH: <60 %, no condensation	Check 1 ppm; 4 days		
	ISA-S71.04 severity level G1; G2; G3	All PCBs treated with protective lacquer.		

[1] Observe the information on installation in a housing and the following table on derating. Use in Ex Zone 2/22 only permitted at elevations up to 2000 m.

Derating

The cooling effect of air is reduced at higher altitudes due to lower density.

The table shows the derating factor for the maximum permissible ambient temperature depending on the use of the devices at a height above sea level.

Table 13-15 Derating when devices are used at an altitude above sea level

Altitude above sea level	Derating factor for ambient temperature [1]
(–1000 m) to 2000 m	1.0
3000 m	0.9
4000 m	0.8

[1] Maximum permissible ambient temperature in °C for 2000 m

Cable temperature

Note that the temperature properties of the cables must correspond to the actual measured temperatures:

- When a temperature of 70 °C is reached on the cable or at the cable entry of the housing under operating conditions.
- When the temperature at the wire junction can be > 80 °C under operating conditions.

You specify other connection types and material requirements based on the following:

- Electrical characteristic data of the circuits you are using
- Installation environment

See also

Rules for the operation (Page 29)

13.1.6 Specifications for insulation tests, protection class and degree of protection

Test voltages

Table 13-16 Test voltages

Circuits with a rated voltage of U_e relative to other circuits or ground	Test voltage
0 V < U_e ≤ 50 V	500 V AC, 60 s

Protection class

Protection class I in compliance with IEC 61140; this means that a grounding terminal to the rail is required!

Protection against foreign bodies and water

IP 20 degree of protection according to IEC 60529; that is protection against contact with standard probes.

There is no protection from penetration by water.

13.1.7 Rated voltage

Nominal voltage for operation

The Compact Field Unit operates with the nominal voltage that is shown in the following table.

- Observe the tolerance range of the nominal voltage.
- When selecting the nominal voltage take into account the permissible supply voltage of the respective module.

Table 13-17 Nominal voltage for operation

Nominal voltage	Tolerance range
24 V DC	19.2 to 28.8 VDC [1]
	18.5 to 30.2 VDC [2]

[1] Static value: Generation as a functional extra low voltage with safe electrical isolation to IEC 60364-4-41

[2] Dynamic value: Including ripple, e.g. three-phase current bridge rectification

13.2 Technical specifications of the CFU PA

Note

Mechanical and climatic ambient conditions for operation

Observe section "Mechanical and climatic ambient conditions for operation (Page 183)".

Article number	**6ES7655-5PX11-1XX0**
General information	
Product type designation	CFU PA
HW functional status	FS02
Firmware version	V2.0
• FW update possible	Yes
Vendor identification (VendorID)	002AH
Device identifier (DeviceID)	060DH
Number of channels	16
Product function	
• I&M data	Yes; I&M0 to I&M3
• Isochronous mode	No
• The user can configure digital channels as input/output as required	Yes
• Digital channels can be parameterized	Yes
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	V19 Update 2
• STEP 7 configurable/integrated from version	STEP 7 V5.6 HF2
• PCS 7 configurable/integrated from version	V9.1 SP2 UC5
• PROFIBUS from GSD version/GSD revision	- / -
• PROFINET from GSD version/GSD revision	GSDML V2.43
Operating mode	
• DI	Yes
• Counter	Yes
• DQ	Yes
CiR - Configuration in RUN	
Reparameterization possible in RUN	Yes
Installation type/mounting	
Mounting	on 35 mm DIN rail, 2 spacing units wide
Mounting position	Horizontal, vertical
Supply voltage	
Type of supply voltage	24 V DC
Rated value (DC)	24 V
permissible range, lower limit (DC)	19.2 V
permissible range, upper limit (DC)	28.8 V
Reverse polarity protection	Yes
Short-circuit protection	Yes
Redundant power supply	Yes
Mains buffering	
• Mains/voltage failure stored energy time	5 ms; Bridging for field devices and communication
Input current	
Current consumption (rated value)	2.5 A

Article number	6ES7655-5PX11-1XX0
Current consumption, max.	2.55 A
Inrush current, max.	8 A
I^2t	0.3 $A^2 \cdot s$
Encoder supply	
Number of outputs	8
Output voltage, min.	18.2 V
Short-circuit protection	Yes; Electronic
Output current	
• up to 60 °C, max.	2 A
• up to 70 °C, max.	1 A
Power loss	
Power loss, typ.	8.2 W; Depending on the type of BusAdapter used (typ. RJ45)
Address area	
Address space per station	
• Address space per station, max.	1 440 byte; Dependent on configuration
Digital inputs	
Number of digital inputs	8
Digital inputs, parameterizable	Yes
Source/sink input	Yes; P-reading
Input characteristic curve in accordance with IEC 61131, type 1	Yes
Input characteristic curve in accordance with IEC 61131, type 2	No
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Pulse extension	No
Number of simultaneously controllable inputs	
horizontal installation	
– up to 60 °C, max.	8; Total current must be observed, see DQ
– up to 70 °C, max.	8; Total current must be observed, see DQ
vertical installation	
– up to 60 °C, max.	8; Total current must be observed, see DQ
Digital input functions, parameterizable	
• Counter	Yes
– Number, max.	1
– Counting frequency, max.	1 kHz
– Counting width	32 bit
– Counting direction up/down	Yes; Up
Input voltage	
• Rated value (DC)	24 V
• for signal "0"	-30 to +5 V
• for signal "1"	+11 to +30V
Input current	

Article number	**6ES7655-5PX11-1XX0**
• for signal "1", typ.	2.5 mA; Typical
Input delay (for rated value of input voltage) for standard inputs	
– parameterizable	No
– at "0" to "1", max.	3.2 ms; for counter function 0,1 ms
– at "1" to "0", max.	3.2 ms; for counter function 0,1 ms
Cable length	
• shielded, max.	1 000 m
• unshielded, max.	600 m
Digital outputs	
Type of digital output	Transistor
Number of digital outputs	8
Current-sinking	No
Current-sourcing	Yes
Short-circuit protection	Yes
• Response threshold, typ.	0.7 to 1.3 A
Open-circuit detection	Yes
Limitation of inductive shutdown voltage to	Typ. L+ (-50 V)
Controlling a digital input	Yes
Switching capacity of the outputs	
• with resistive load, max.	0.5 A
• on lamp load, max.	5 W
Load resistance range	
• lower limit	48 Ω
• upper limit	12 kΩ
Output voltage	
• Type of output voltage	DC
• for signal "1", min.	Ue minus 1 V
Output current	
• for signal "1" rated value	0.5 A
• for signal "0" residual current, max.	0.1 mA
Output delay with resistive load	
• "0" to "1", max.	50 µs
• "1" to "0", max.	100 µs
Parallel switching of two outputs	
• for uprating	No
• for redundant control of a load	No
Switching frequency	
• with resistive load, max.	100 Hz
• with inductive load, max.	2 Hz
• on lamp load, max.	10 Hz
Total current of the outputs	

Article number	6ES7655-5PX11-1XX0
• Current per channel, max.	0.5 A
horizontal installation	
– up to 60 °C, max.	2 A
– up to 70 °C, max.	1 A
vertical installation	
– up to 60 °C, max.	2 A
Cable length	
• shielded, max.	1 000 m
• unshielded, max.	600 m
Encoder	
Connectable encoders	
• 2-wire sensor	Yes
– permissible quiescent current (2-wire sensor), max.	1.5 mA
Interfaces	
Number of PROFINET interfaces	1
Number of PROFIBUS interfaces	0
PROFIBUS PA	
• Transmission rate, max.	31.25 kbit/s
• Number of connectable PA field devices	8; isolated between power supply and PROFINET interface
• Current output to PA field devices, max.	320 mA
• permissible current per spur line	40 mA
• Automatic addressing	Yes
• System-supported integration of field devices via PA profiles	Yes
• Extended fieldbus diagnostics	Yes
1. Interface	
Interface type	PROFINET
Isolated	Yes
Interface types	
• Number of ports	2; via BusAdapter
• integrated switch	Yes
• BusAdapter (PROFINET)	Yes
Protocols	
• PROFINET IO Device	Yes
• PROFIBUS DP slave	No
• Media redundancy	Yes; as MRP client
Interface types	
RJ 45 (Ethernet)	
• 100 Mbps	Yes
• Autonegotiation	Yes
• Autocrossing	Yes

Article number	**6ES7655-5PX11-1XX0**
Protocols	
Supports protocol for PROFINET IO	Yes
PROFINET IO Device	
Services	
– Shared device	No
Redundancy mode	
• PROFINET system redundancy (S2)	Yes; Type S2
Media redundancy	
– MRP	Yes
Open IE communication	
• LLDP	Yes
Interrupts/diagnostics/status information	
Status indicator	Yes
Alarms	Yes
Diagnostics function	Yes
Alarms	
• Diagnostic alarm	Yes
• Maintenance interrupt	Yes
• Limit value alarm	Yes
• Hardware interrupt	Yes
Diagnoses	
• Monitoring the supply voltage	Yes
• Wire-break	Yes
• Short-circuit	Yes
Diagnostics indication LED	
• RUN LED	Yes; green LED
• ERROR LED	Yes; red LED
• MAINT LED	Yes; Yellow LED
• Monitoring of the supply voltage (PWR-LED)	Yes; green/red LED
• Channel status display	Yes; green/red LED
• Status indicator digital input (green)	Yes
• Status indicator digital output (green)	Yes
• Connection display LINK TX/RX	Yes; 2x green LEDs on BusAdapter
• Spur line status/fault	Yes
Potential separation	
between the channels and PROFINET	Yes
Potential separation digital inputs	
• between the channels	No
• between the channels and the power supply of the electronics	No
Potential separation digital outputs	
• between the channels	No

Article number	6ES7655-5PX11-1XX0
• between the channels and the power supply of the electronics	No
Isolation	
Isolation tested with	1 500 V AC between PROFINET and other electronics
Degree and class of protection	
IP degree of protection	IP20
Ambient conditions	
Ambient temperature during operation	
• min.	-40 °C
• max.	70 °C
• horizontal installation, min.	-40 °C
• horizontal installation, max.	70 °C; Observe derating
• vertical installation, min.	-40 °C
• vertical installation, max.	60 °C; Observe derating
Ambient temperature during storage/transportation	
• min.	-40 °C
• max.	70 °C
Relative humidity	
• Operation, max.	95 %
connection method	
Design of electrical connection	Connection plug
connection method / spur line / header	
• Number of spur lines	8
• Type of cable	Type A
• Cable diameter, min.	6 mm
• Cable diameter, max.	12 mm
• Conductor cross-section, min.	0.2 mm^2
• Conductor cross-section, max.	2.5 mm^2
• Cable length, max.	120 m
• total current output to field devices, max.	320 mA
• Number of connectable field devices	8
• Current limitation per field device, max.	40 mA
• No-load voltage, max.	15.3 V
• short-circuit proof	Yes
• Short-circuit current (test current); max.	8 mA
• intrinsically safe according to FISCO model	Yes
• Debounce logic	Yes
Dimensions	
Width	329 mm
Height	123 mm
Depth	74 mm

Article number	6ES7655-5PX11-1XX0
Weights	
Weight, approx.	650 g

13.3 Technical specifications of the CFU PA with aluminum housing

Use in zone 2/22 hazardous areas

The information in the CFU product information has priority over the information in this documentation.

Certifications

Note

You can find the valid approvals on the rating plate of the respective module. This information may differ from the approvals specified in the manual!

Information on certificates can be found in the product information.

The product information is made available with the product or on the Internet by specifying the article number: Service & Support (https://support.industry.siemens.com/cs/ww/en/ps).

Technical specifications

Article number	6ES7655-5PX11-1AX0
General information	
Product type designation	PA Bundle
Firmware version	
• FW update possible	Yes
Vendor identification (VendorID)	002AH
Device identifier (DeviceID)	060DH
Number of channels	16
Product function	
• I&M data	Yes; I&M0 to I&M4
• Isochronous mode	No
• The user can configure digital channels as input/output as required	Yes
• Digital channels can be parameterized	Yes
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	V17
• STEP 7 configurable/integrated from version	V5.6 HF2 and higher
• PCS 7 configurable/integrated from version	V9.0 SP2 and higher
• PCS neo can be configured/integrated from version	V3.0
• PROFIBUS from GSD version/GSD revision	- / -
• PROFINET from GSD version/GSD revision	GSDML V2.3
Operating mode	
• Counter	Yes
Installation type/mounting	
Mounting position	Horizontal, vertical
Recommended mounting position	horizontal set up
Supply voltage	
Type of supply voltage	24 V DC
Rated value (DC)	24 V
permissible range, lower limit (DC)	19.2 V
permissible range, upper limit (DC)	28.8 V
Reverse polarity protection	Yes
Short-circuit protection	Yes
Redundant power supply	Yes
Mains buffering	
• Mains/voltage failure stored energy time	5 ms; Bridging for field devices and communication
Input current	
Current consumption (rated value)	2.5 A
Current consumption, max.	2.55 A
Inrush current, max.	8 A
I^2t	0.3 $A^2 \cdot s$

Article number	**6ES7655-5PX11-1AX0**
Encoder supply	
Number of outputs	8
Output voltage, min.	18.2 V
Short-circuit protection	Yes; Electronic
Output current	
• up to 60 °C, max.	2 A
• up to 70 °C, max.	1 A
Power loss	
Power loss, typ.	8.2 W; Depending on the type of BusAdapter used (typ. RJ45)
Address area	
Address space per station	
• Address space per station, max.	1 440 byte; Dependent on configuration
Digital inputs	
Number of digital inputs	8
Source/sink input	Yes; P-reading
Input characteristic curve in accordance with IEC 61131, type 1	Yes
Input characteristic curve in accordance with IEC 61131, type 2	No
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Pulse extension	No
Number of simultaneously controllable inputs	
horizontal installation	
– up to 60 °C, max.	8; Total current must be observed, see DQ
– up to 70 °C, max.	8; Total current must be observed, see DQ
vertical installation	
– up to 60 °C, max.	8; Total current must be observed, see DQ
Digital input functions, parameterizable	
• Counter	Yes
– Number, max.	1
– Counting frequency, max.	1 kHz
– Counting width	32 bit
– Counting direction up/down	Yes; Up
Input voltage	
• Rated value (DC)	24 V
• for signal "0"	-30 to +5 V
• for signal "1"	+11 to +30V
Input current	
• for signal "1", typ.	2.5 mA; Typical
Input delay (for rated value of input voltage)	
for standard inputs	
– parameterizable	No

Article number	6ES7655-5PX11-1AX0
– at "0" to "1", max.	3.2 ms; for counter function 0,1 ms
– at "1" to "0", max.	3.2 ms; for counter function 0,1 ms
Cable length	
• shielded, max.	1 000 m
• unshielded, max.	600 m
Digital outputs	
Type of digital output	Transistor
Number of digital outputs	8
Current-sinking	No
Current-sourcing	Yes
Short-circuit protection	Yes
• Response threshold, typ.	0.7 to 1.3 A
Limitation of inductive shutdown voltage to	Typ. L+ (-50 V)
Controlling a digital input	Yes
Switching capacity of the outputs	
• on lamp load, max.	5 W
Load resistance range	
• lower limit	48 Ω
• upper limit	12 kΩ
Output voltage	
• Type of output voltage	DC
• for signal "1", min.	Ue minus 1 V
Output current	
• for signal "1" rated value	0.5 A
• for signal "0" residual current, max.	0.1 mA
Output delay with resistive load	
• "0" to "1", max.	50 µs
• "1" to "0", max.	100 µs
Parallel switching of two outputs	
• for uprating	No
• for redundant control of a load	No
Switching frequency	
• with resistive load, max.	100 Hz
• with inductive load, max.	2 Hz
• on lamp load, max.	10 Hz
Total current of the outputs	
• Current per channel, max.	0.5 A
Cable length	
• shielded, max.	1 000 m
• unshielded, max.	600 m
Encoder	
Connectable encoders	

Article number	**6ES7655-5PX11-1AX0**
• 2-wire sensor	Yes
– permissible quiescent current (2-wire sensor), max.	1.5 mA
Interfaces	
Number of PROFINET interfaces	1
Number of PROFIBUS interfaces	0
PROFIBUS PA	
• Transmission rate, max.	31.25 kbit/s
• Number of connectable PA field devices	8; electrically isolated from other interfaces, isolation tested at 2 500 V DC
• Current output to PA field devices, max.	320 mA
• permissible current per spur line	40 mA
• Automatic addressing	Yes
• System-supported integration of field devices via PA profiles	Yes
• Extended fieldbus diagnostics	Yes
1. Interface	
Interface type	PROFINET
Isolated	Yes
Interface types	
• Number of ports	2
• integrated switch	Yes
• BusAdapter (PROFINET)	Yes
Protocols	
• PROFINET IO Device	Yes
• PROFIBUS DP slave	No
Interface types	
RJ 45 (Ethernet)	
• 100 Mbps	Yes
• Autonegotiation	Yes
• Autocrossing	Yes
Protocols	
Supports protocol for PROFINET IO	Yes
Redundancy mode	
• PROFINET system redundancy (S2)	Yes; Type S2
Media redundancy	
– MRP	Yes
Open IE communication	
• LLDP	Yes
Interrupts/diagnostics/status information	
Status indicator	Yes
Alarms	Yes
Diagnostics function	Yes

Article number	6ES7655-5PX11-1AX0
Diagnoses	
• Monitoring of encoder power supply	Yes
• Wire-break	Yes
• Short-circuit	Yes
Diagnostics indication LED	
• RUN LED	Yes; green LED
• ERROR LED	Yes; red LED
• MAINT LED	Yes; Yellow LED
• Monitoring of the supply voltage (PWR-LED)	Yes
• Status indicator digital input (green)	Yes
• Status indicator digital output (green)	Yes
• Spur line status/fault	Yes
Potential separation	
between the channels and PROFINET	Yes
Potential separation digital inputs	
• between the channels	No
• between the channels and the power supply of the electronics	No
Potential separation digital outputs	
• between the channels	No
• between the channels and the power supply of the electronics	No
Isolation	
Isolation tested with	1 500 V AC between PROFINET and electronics
Degree and class of protection	
IP degree of protection	IP66
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-40 °C
• horizontal installation, max.	60 °C; max. 1 A load current; 50 °C to max. 2 A load current
• vertical installation, min.	-40 °C
• vertical installation, max.	50 °C
Ambient temperature during storage/transportation	
• min.	-40 °C
• max.	70 °C
Relative humidity	
• Operation, max.	95 %
connection method	
Design of electrical connection	Connection plug
connection method / spur line / header	
• Number of spur lines	8

Article number	6ES7655-5PX11-1AX0
• Type of cable	Type A
• Cable diameter, min.	6 mm
• Cable diameter, max.	12 mm
• Conductor cross-section, min.	0.2 mm²
• Conductor cross-section, max.	2.5 mm²
• Cable length, max.	120 m
• total current output to field devices, max.	320 mA
• Number of connectable field devices	8
• Current limitation per field device, max.	40 mA
• No-load voltage, max.	15.3 V
• short-circuit proof	Yes
• Short-circuit current (test current); max.	8 mA
• intrinsically safe according to FISCO model	Yes
• Debounce logic	Yes
Dimensions	
Width	414 mm
Height	266 mm
Depth	111 mm
Weights	
Weight, approx.	5.5 kg

Observe the following sections:

- Section "Technical specifications of the CFU PA (Page 187)"
- Section "Mechanical and climatic ambient conditions for operation (Page 183)"

Cable glands

You can find information on the following cable glands in the section"Tools and tightening torques (Page 217)".

- Cable glands
- Cap nut
- Pressure compensation element

13.4 Technical specifications of the CFU DIQ

Note

Mechanical and climatic ambient conditions for operation

Refer to section "Mechanical and climatic ambient conditions for operation (Page 183)".

Article number	6ES7655-5PX31-1XX0
General information	
Product type designation	CFU DIQ
HW functional status	FS01
Firmware version	V2.0
• FW update possible	Yes
Vendor identification (VendorID)	002AH
Device identifier (DeviceID)	060FH
Number of channels	16
Product function	
• I&M data	Yes; I&M0 to I&M3
• Isochronous mode	No
• The user can configure digital channels as input/output as required	Yes
• Digital channels can be parameterized	Yes
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	V19 Update 2
• STEP 7 configurable/integrated from version	STEP 7 V5.6 HF2
• PCS 7 configurable/integrated from version	V9.1 SP2 UC5
• PROFIBUS from GSD version/GSD revision	- / -
• PROFINET from GSD version/GSD revision	GSDML V2.43
Operating mode	
• DI	Yes
• Counter	Yes
• DQ	Yes
CiR - Configuration in RUN	
Reparameterization possible in RUN	Yes
Installation type/mounting	
Mounting	on 35 mm DIN rail, 2 spacing units wide
Mounting position	Horizontal, vertical
Supply voltage	
Type of supply voltage	24 V DC
Rated value (DC)	24 V
permissible range, lower limit (DC)	19.2 V
permissible range, upper limit (DC)	28.8 V
Reverse polarity protection	Yes
Short-circuit protection	Yes
Redundant power supply	Yes
Mains buffering	
• Mains/voltage failure stored energy time	5 ms; For communication
Input current	
Current consumption (rated value)	5.12 A

Article number	**6ES7655-5PX31-1XX0**
Current consumption, max.	5.13 A
Inrush current, max.	4.8 A
I^2t	0.073 $A^2 \cdot s$
Encoder supply	
Number of outputs	16
Output voltage, min.	18.2 V
Short-circuit protection	Yes; Electronic
Output current	
• up to 60 °C, max.	5 A
• up to 70 °C, max.	4 A
Power loss	
Power loss, typ.	2.88 W; Depending on the type of BusAdapter used (typ. RJ45)
Address area	
Address space per station	
• Address space per station, max.	1 440 byte; Dependent on configuration
Digital inputs	
Number of digital inputs	16
Digital inputs, parameterizable	Yes
Source/sink input	Yes; P-reading
Input characteristic curve in accordance with IEC 61131, type 1	Yes
Input characteristic curve in accordance with IEC 61131, type 2	No
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Pulse extension	No
Number of simultaneously controllable inputs	
horizontal installation	
– up to 60 °C, max.	16; Total current must be observed, see DQ
– up to 70 °C, max.	16; Total current must be observed, see DQ
vertical installation	
– up to 60 °C, max.	16; Total current must be observed, see DQ
Digital input functions, parameterizable	
• Counter	Yes
– Number, max.	2
– Counting frequency, max.	1 kHz
– Counting width	32 bit
– Counting direction up/down	Yes; Up
Input voltage	
• Rated value (DC)	24 V
• for signal "0"	-30 to +5 V
• for signal "1"	+11 to +30V
Input current	

Article number	6ES7655-5PX31-1XX0
• for signal "1", typ.	2.5 mA; Typical
Input delay (for rated value of input voltage) for standard inputs	
– parameterizable	No
– at "0" to "1", max.	3.2 ms; for counter function 0,1 ms
– at "1" to "0", max.	3.2 ms; for counter function 0,1 ms
Cable length	
• shielded, max.	1 000 m
• unshielded, max.	600 m
Digital outputs	
Type of digital output	Transistor
Number of digital outputs	16
Current-sinking	No
Current-sourcing	Yes
Short-circuit protection	Yes
• Response threshold, typ.	0.7 to 1.3 A
Open-circuit detection	Yes
Limitation of inductive shutdown voltage to	Typ. L+ (-50 V)
Controlling a digital input	Yes
Switching capacity of the outputs	
• with resistive load, max.	0.5 A
• on lamp load, max.	5 W
Load resistance range	
• lower limit	48 Ω
• upper limit	12 kΩ
Output voltage	
• Type of output voltage	DC
• for signal "1", min.	Ue minus 1 V
Output current	
• for signal "1" rated value	0.5 A
• for signal "0" residual current, max.	0.1 mA
Output delay with resistive load	
• "0" to "1", max.	50 µs
• "1" to "0", max.	100 µs
Parallel switching of two outputs	
• for uprating	No
• for redundant control of a load	No
Switching frequency	
• with resistive load, max.	100 Hz
• with inductive load, max.	2 Hz
• on lamp load, max.	10 Hz
Total current of the outputs	

Article number	**6ES7655-5PX31-1XX0**
• Current per channel, max.	0.5 A
horizontal installation	
– up to 60 °C, max.	5 A
– up to 70 °C, max.	4 A
vertical installation	
– up to 60 °C, max.	5 A
Cable length	
• shielded, max.	1 000 m
• unshielded, max.	600 m
Encoder	
Connectable encoders	
• 2-wire sensor	Yes
– permissible quiescent current (2-wire sensor), max.	1.5 mA
Interfaces	
Number of PROFINET interfaces	1
Number of PROFIBUS interfaces	0
1. Interface	
Interface type	PROFINET
Isolated	Yes
Interface types	
• Number of ports	2; via BusAdapter
• integrated switch	Yes
• BusAdapter (PROFINET)	Yes
Protocols	
• PROFINET IO Device	Yes
• PROFIBUS DP slave	No
• Media redundancy	Yes; as MRP client
Interface types	
RJ 45 (Ethernet)	
• 100 Mbps	Yes
• Autonegotiation	Yes
• Autocrossing	Yes
Protocols	
Supports protocol for PROFINET IO	Yes
PROFINET IO Device	
Services	
– Shared device	No
Redundancy mode	
• PROFINET system redundancy (S2)	Yes; Type S2
Media redundancy	
– MRP	Yes
Open IE communication	

Article number	6ES7655-5PX31-1XX0
• LLDP	Yes
Interrupts/diagnostics/status information	
Status indicator	Yes
Alarms	Yes
Diagnostics function	Yes
Alarms	
• Diagnostic alarm	Yes
• Maintenance interrupt	Yes
• Limit value alarm	Yes
• Hardware interrupt	Yes
Diagnoses	
• Monitoring the supply voltage	Yes
• Wire-break	Yes
• Short-circuit	Yes
Diagnostics indication LED	
• RUN LED	Yes; green LED
• ERROR LED	Yes; red LED
• MAINT LED	Yes; Yellow LED
• Monitoring of the supply voltage (PWR-LED)	Yes; green/red LED
• Channel status display	Yes; green/red LED
• Status indicator digital input (green)	Yes
• Status indicator digital output (green)	Yes
• Connection display LINK TX/RX	Yes; 2x green LEDs on BusAdapter
Potential separation	
between the channels and PROFINET	Yes
Potential separation digital inputs	
• between the channels	No
• between the channels and the power supply of the electronics	No
Potential separation digital outputs	
• between the channels	No
• between the channels and the power supply of the electronics	No
Isolation	
Isolation tested with	1 500 V AC between PROFINET and other electronics
Degree and class of protection	
IP degree of protection	IP20
Ambient conditions	
Ambient temperature during operation	
• min.	-40 °C
• max.	70 °C
• horizontal installation, min.	-40 °C

Article number	6ES7655-5PX31-1XX0
• horizontal installation, max.	70 °C; Observe derating
• vertical installation, min.	-40 °C
• vertical installation, max.	60 °C; Observe derating
Ambient temperature during storage/transportation	
• min.	-40 °C
• max.	70 °C
Relative humidity	
• Operation, max.	95 %
connection method	
Design of electrical connection	Connection plug
Dimensions	
Width	329 mm
Height	123 mm
Depth	74 mm
Weights	
Weight, approx.	610 g

13.5 Technical specifications of the CFU DIQ with aluminum housing

Use in zone 2/22 hazardous areas

The information in the CFU product information has priority over the information in this documentation.

Certifications

Note

You can find the valid approvals on the rating plate of the respective module. This information may differ from the approvals specified in the manual!

Information on certificates can be found in the product information.

The product information is made available with the product or on the Internet by specifying the article number: Service & Support (https://support.industry.siemens.com/cs/ww/en/ps).

Technical specifications

Article number	6ES7655-5PX31-1AX0
General information	
HW functional status	FS01
Firmware version	V1.2
• FW update possible	Yes
Vendor identification (VendorID)	002AH
Device identifier (DeviceID)	060FH
Number of channels	16
Product function	
• I&M data	Yes; I&M0 to I&M3
• Isochronous mode	No
• The user can configure digital channels as input/output as required	Yes
• Digital channels can be parameterized	Yes
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	V17
• STEP 7 configurable/integrated from version	V5.6 HF2 and higher
• PCS 7 configurable/integrated from version	V9.0 SP2 and higher
• PCS neo can be configured/integrated from version	V3.1
• PROFIBUS from GSD version/GSD revision	- / -
• PROFINET from GSD version/GSD revision	GSDML V2.3
Operating mode	
• Counter	Yes
Installation type/mounting	
Mounting	For horizontal and vertical mounting
Mounting position	Horizontal, vertical
Supply voltage	
Type of supply voltage	24 V DC
Rated value (DC)	24 V
permissible range, lower limit (DC)	19.2 V
permissible range, upper limit (DC)	28.8 V
Reverse polarity protection	Yes
Short-circuit protection	Yes
Redundant power supply	Yes
Mains buffering	
• Mains/voltage failure stored energy time	5 ms; For communication
Input current	
Current consumption (rated value)	5.12 A
Current consumption, max.	5.13 A
Inrush current, max.	4.8 A
I^2t	0.073 $A^2 \cdot s$

Article number	**6ES7655-5PX31-1AX0**
Encoder supply	
Number of outputs	16
Output voltage, min.	18.2 V
Short-circuit protection	Yes; Electronic
Output current	
• up to 60 °C, max.	5 A
• up to 70 °C, max.	4 A
Power loss	
Power loss, typ.	2.88 W; Depending on the type of BusAdapter used (typ. RJ45)
Address area	
Address space per station	
• Address space per station, max.	1 440 byte; Dependent on configuration
Digital inputs	
Number of digital inputs	16
Source/sink input	Yes; P-reading
Input characteristic curve in accordance with IEC 61131, type 1	Yes
Input characteristic curve in accordance with IEC 61131, type 2	No
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Pulse extension	No
Number of simultaneously controllable inputs	
horizontal installation	
– up to 60 °C, max.	16; Total current must be observed, see DQ
– up to 70 °C, max.	16; Total current must be observed, see DQ
vertical installation	
– up to 60 °C, max.	16; Total current must be observed, see DQ
Digital input functions, parameterizable	
• Counter	Yes
– Number, max.	2
– Counting frequency, max.	1 kHz
– Counting width	32 bit
– Counting direction up/down	Yes; Up
Input voltage	
• Rated value (DC)	24 V
• for signal "0"	-30 to +5 V
• for signal "1"	+11 to +30V
Input current	
• for signal "1", typ.	2.5 mA; Typical
Input delay (for rated value of input voltage)	
for standard inputs	
– parameterizable	No

Article number	6ES7655-5PX31-1AX0
– at "0" to "1", max.	3.2 ms; for counter function 0,1 ms
– at "1" to "0", max.	3.2 ms; for counter function 0,1 ms
Cable length	
• shielded, max.	1 000 m
• unshielded, max.	600 m
Digital outputs	
Type of digital output	Transistor
Number of digital outputs	16
Current-sinking	No
Current-sourcing	Yes
Short-circuit protection	Yes
• Response threshold, typ.	0.7 to 1.3 A
Limitation of inductive shutdown voltage to	Typ. L+ (-50 V)
Controlling a digital input	Yes
Switching capacity of the outputs	
• on lamp load, max.	5 W
Load resistance range	
• lower limit	48 Ω
• upper limit	12 kΩ
Output voltage	
• Type of output voltage	DC
• for signal "1", min.	Ue minus 1 V
Output current	
• for signal "1" rated value	0.5 A
• for signal "0" residual current, max.	0.1 mA
Output delay with resistive load	
• "0" to "1", max.	50 µs
• "1" to "0", max.	100 µs
Parallel switching of two outputs	
• for uprating	No
• for redundant control of a load	No
Switching frequency	
• with resistive load, max.	100 Hz
• with inductive load, max.	2 Hz
• on lamp load, max.	10 Hz
Total current of the outputs	
• Current per channel, max.	0.5 A
horizontal installation	
– up to 60 °C, max.	5 A
– up to 70 °C, max.	4 A
vertical installation	
– up to 60 °C, max.	5 A

Article number	**6ES7655-5PX31-1AX0**
Cable length	
• shielded, max.	1 000 m
• unshielded, max.	600 m
Encoder	
Connectable encoders	
• 2-wire sensor	Yes
– permissible quiescent current (2-wire sensor), max.	1.5 mA
Interfaces	
Number of PROFINET interfaces	1
Number of PROFIBUS interfaces	0
1. Interface	
Interface type	PROFINET
Isolated	Yes
Interface types	
• Number of ports	2
• integrated switch	Yes
• BusAdapter (PROFINET)	Yes
Protocols	
• PROFINET IO Device	Yes
• PROFIBUS DP slave	No
Interface types	
RJ 45 (Ethernet)	
• 100 Mbps	Yes
• Autonegotiation	Yes
• Autocrossing	Yes
Protocols	
Supports protocol for PROFINET IO	Yes
Redundancy mode	
• PROFINET system redundancy (S2)	Yes; Type S2
Media redundancy	
– MRP	Yes
Open IE communication	
• LLDP	Yes
Interrupts/diagnostics/status information	
Status indicator	Yes
Alarms	Yes
Diagnostics function	Yes
Diagnoses	
• Monitoring of encoder power supply	Yes
• Wire-break	Yes
• Short-circuit	Yes
Diagnostics indication LED	

Article number	6ES7655-5PX31-1AX0
• RUN LED	Yes; green LED
• ERROR LED	Yes; red LED
• MAINT LED	Yes; Yellow LED
• Monitoring of the supply voltage (PWR-LED)	Yes
• Status indicator digital input (green)	Yes
• Status indicator digital output (green)	Yes
Potential separation	
between the channels and PROFINET	Yes
Potential separation digital inputs	
• between the channels	No
• between the channels and the power supply of the electronics	No
Potential separation digital outputs	
• between the channels	No
• between the channels and the power supply of the electronics	No
Isolation	
Isolation tested with	1 500 V AC between PROFINET and electronics
Degree and class of protection	
IP degree of protection	IP66
Ambient conditions	
Ambient temperature during operation	
• min.	-40 °C
• max.	60 °C
• horizontal installation, min.	-40 °C
• horizontal installation, max.	60 °C; Max. 4 A load current; up to 50 °C max. 5 A load current
• vertical installation, min.	-40 °C
• vertical installation, max.	50 °C
Ambient temperature during storage/transportation	
• min.	-40 °C
• max.	70 °C
Relative humidity	
• Operation, max.	95 %
connection method	
Design of electrical connection	Connection plug
Dimensions	
Width	414 mm
Height	266 mm
Depth	111 mm
Weights	
Weight, approx.	5.5 kg

Observe the following sections:

- Section "Mechanical and climatic ambient conditions for operation (Page 183)"
- Section "Technical specifications of the CFU DIQ (Page 200)"

Cable glands

You can find information on the following cable glands in the section"Tools and tightening torques (Page 217)".

- Cable glands
- Cap nut
- Pressure compensation element

Appendix

A

A.1 Article numbers (accessories / spare parts)

Compact Field Unit (CFU)

By default, the CFU is supplied with SIMATIC CFU push-in terminals.

The CFU with die-cast aluminum housing comes with cable glands, shield bus and shield connection clamps.

Table A-1 SIMATIC CFU PA

Product	Product name	Packing unit	Article number
SIMATIC CFU PA	Compact Field Unit PA	1 unit	6ES7655-5PX11-1XX0
SIMATIC CFU PA with aluminum housing	Compact Field Unit PA with Aluminum housing	1 unit	6ES7655-5PX11-1AX0

Table A-2 SIMATIC CFU DIQ

Product	Product name	Packing unit	Article number
SIMATIC CFU DIQ	Compact Field Unit DIQ	1 unit	6ES7655-5PX31-1XX0
SIMATIC CFU DIQ with aluminum housing	Compact Field Unit DIQ with Aluminum housing	1 unit	6ES7655-5PX31-1AX0

Table A-3 BusAdapter for PROFINET

Product	Packing unit	Article number
PROFINET BusAdapter with standard Ethernet socket (BA 2×RJ45)	1 unit	6DL1193-6AR00-0AA0
PROFINET BusAdapter with FastConnect Ethernet connection (BA 2×FC)	1 unit	6DL1193-6AF00-0AA0
PROFINETBusAdapter with glass fiber-optic cable connection (BA 2xLC)	1 unit	6DL1193-6AG00-0AA0
PROFINETBusAdapter with glass fiber-optic cable connection and standard Ethernet socket (BA LC/RJ45)	1 unit	6DL1193-6AG20-0AA0
PROFINETBusAdapter with glass fiber-optic cable connection and FastConnect Ethernet connection (BA LC/FC)	1 unit	6DL1193-6AG40-0AA0
PROFINET VD BusAdapter	1 unit	6GK5991-2VA00-8AA2

Observe the applications areas of the BusAdapters and the use of suitable PROFINET cables. You can find information about this in the documentation "SIMATIC; Distributed

I/O; BusAdapters for Distributed I/O (https://support.industry.siemens.com/cs/de/en/view/109804897)".

Table A-4 Media converter

Product	Product name	Packing unit	Article number
Media converter	SCALANCE XC206-2SFP	1 unit	6GK5206-2BS00-2AC2

Table A-5 Accessory

Product	Packing unit	Article number
Aluminum mounting rails		
• for 19" rack (length: 483 mm)	1 unit	6ES5710-8MA11
• Length: 2000 mm	1 unit	6ES5710-8MA41

Table A-6 Push-in terminals

Slot	Weidmüller article	Quantity per device	Order number
X80/PS1, X81/PS2	BLDF 5.08/02/180 SN BK BX	2	1000860000
X82	BLF 5.08HC/06/180 SN BK BX	1	1013470000
X11–X26	BLF 5.08HC/02/180 SN BK BX	16	1013430000

Table A-7 Screw terminals

Slot	Weidmüller article	Quantity per device	Order number
X80/PS1, X81/PS2	BLZP 5.08HC/02/90 SN BK BX	2	1948240000
X82	BLZP 5.08HC/06/90 SN BK BX	1	1948280000
X11–X26	BLZP 5.08HC/02/90 SN BK BX	16	1948240000

Table A-8 Cables

Product	Product name	Typical cables
Power cable	Standard cable	1x2x1.5 mm² 24 V powering cable
PROFINET cable	Dependent on the BusAdapter	
PROFIBUS PA cable	Fieldbus cable	PROFIBUS FC Process Cable GP Type A
Standard cable (inputs and outputs)	Standard cable	• 1x2x0.8 mm² signal wire • 1x3x0.8 mm² signal wire

Components for lightning protection (lightning protection zone transition 0_B to 1, 1 to 2 and 2 to 3)

You must use surge protection devices as lightning protection measures for the Compact Field Unit. You can find more information in section "Electromagnetic Compatibility (Page 180)".

Online catalog

Further article numbers for the Compact Field Unit can be found in the online catalog and the online ordering system:

http:\\mall.industry.siemens.com (https://mall.industry.siemens.com)

A.2 CFU PA: Terminal assignment

You configure the connections of the Compact Field Unit PA in HW Config.

Pin assignment

You can find more information on this in the section "Connecting the power supply to the CFU (Page 66)".

Table A-9 Pin assignment of the inputs/outputs of the CFU PA

Area / Plug	Connection	Plug Pin	Identification	Plug Pin	Identification	Explanations
BusAdapter / X5	**X5**					BusAdapter
DC 24V / X80	PS1	**1**	1L+	**2**	1M	Supply voltage 1
DC 24V / X81	PS2	**1**	2L+	**2**	2M	Supply voltage 2
GND / X82	Ground	**1-6**	3M; 4M; 5M; 6M; 7M; 8M			6 terminals for ground (M)
DIQ / X10	DIQ0	**1**	0+	**2**	0–	Channel 0 (DIQ0)
	DIQ1	**3**	1+	**4**	1–	Channel 1 (DIQ1)
	DIQ2	**5**	2+	**6**	2–	Channel 2 (DIQ2)
	DIQ3	**7**	3+	**8**	3–	Channel 3 (DIQ3)
DIQ / X11	DIQ4	**1**	4+	**2**	4–	Channel 4 (DIQ4)
	DIQ5	**3**	5+	**4**	5–	Channel 5 (DIQ5)
	DIQ6	**5**	6+	**6**	6–	Channel 6 (DIQ6)
	DIQ7	**7**	7+	**8**	7–	Channel 7 (DIQ7)
FIELDBUS / X1	FB0	**1**	0+	**2**	0–	Fieldbus spur 0 (FIELDBUS - FB0)
	FB1	**3**	1+	**4**	1–	Fieldbus spur 1 (FIELDBUS - FB1)
	FB2	**5**	2+	**6**	2–	Fieldbus spur 2 (FIELDBUS - FB2)
	FB3	**7**	3+	**8**	3–	Fieldbus spur 3 (FIELDBUS - FB3)
FIELDBUS / X2	FB4	**1**	4+	**2**	4–	Fieldbus spur 4 (FIELDBUS - FB4)
	FB5	**3**	5+	**4**	5–	Fieldbus spur 5 (FIELDBUS - FB5)
	FB6	**5**	6+	**6**	6–	Fieldbus spur 6 (FIELDBUS - FB6)
	FB7	**7**	7+	**8**	7–	Fieldbus spur 7 (FIELDBUS - FB7)

A.3 CFU DIQ: Terminal assignment

You configure the connections of the Compact Field Unit DIQ in HW Config.

Pin assignment

You can find more information on this in the section "Connecting the power supply to the CFU (Page 66)".

Table A-10 Pin assignment of the inputs/outputs of the CFU DIQ

Area / Plug	Connection	Plug Pin	Identification	Plug Pin	Identification	Explanations
BusAdapter / X5	**X5**					BusAdapter
DC 24V / X80	PS1	**1**	1L+	**2**	1M	Supply voltage 1
DC 24V / X81	PS2	**1**	2L+	**2**	2M	Supply voltage 2
GND / X82	Ground	**1-6**	3M; 4M; 5M; 6M; 7M; 8M			6 terminals for ground (M)
DIQ / X10	DIQ0	**1**	0+	**2**	0–	Channel 0 (DIQ0) (counter, frequency measurement)
	DIQ1	**3**	1+	**4**	1–	Channel 1 (DIQ1) (counter, frequency measurement)
	DIQ2	**5**	2+	**6**	2–	Channel 2 (DIQ2)
	DIQ3	**7**	3+	**8**	3–	Channel 3 (DIQ3)
DIQ / X11	DIQ4	**1**	4+	**2**	4–	Channel 4 (DIQ4)
	DIQ5	**3**	5+	**4**	5–	Channel 5 (DIQ5)
	DIQ6	**5**	6+	**6**	6–	Channel 6 (DIQ6)
	DIQ7	**7**	7+	**8**	7–	Channel 7 (DIQ7)
DIQ / X12	DIQ8	**1**	8+	**2**	8–	Channel 8 (DIQ8)
	DIQ9	**3**	9+	**4**	9–	Channel 9 (DIQ9)
	DIQ10	**5**	10+	**6**	10–	Channel 10 (DIQ10)
	DIQ11	**7**	11+	**8**	11–	Channel 11 (DIQ11)
DIQ / X13	DIQ12	**1**	12+	**2**	12–	Channel 12 (DIQ12)
	DIQ13	**3**	13+	**4**	13–	Channel 13 (DIQ13)
	DIQ14	**5**	14+	**6**	14–	Channel 14 (DIQ14)
	DIQ15	**7**	15+	**8**	15–	Channel 15 (DIQ15)

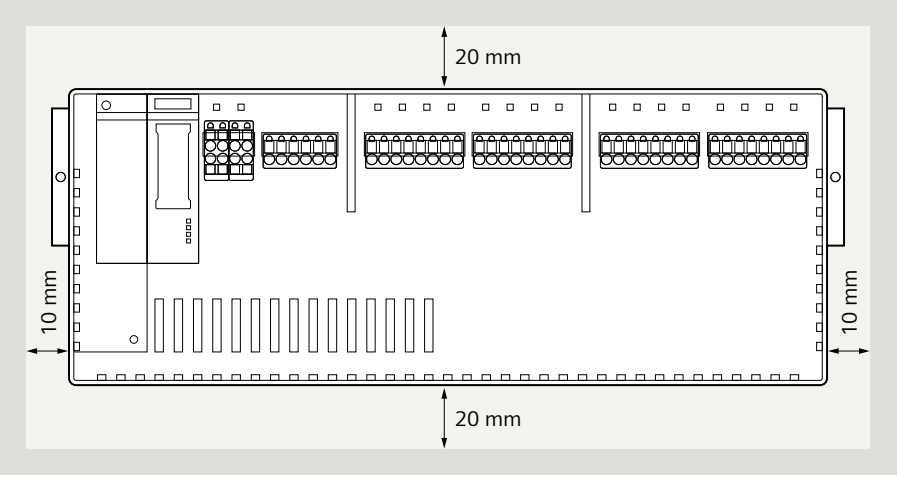
A.4 Mounting rules

A.4.1 Minimum clearances in the control cabinet

Install the mounting rail so that sufficient space remains for the installation and heat removal of the Compact Field Unit remains.

Observe the following points if you plan to install the Compact Field Unit:

- Ensure that the space in the control cabinet or from components in the surrounding area is sufficient for the heat to be removed.



- When mounting on a mounting rail, pay attention to the distance between the fixing points: Maximum distance 500 mm - measured between the first and last fixing points
- Leave sufficient space for the wiring and the communication cable connections.
- Route the cables away from the CFU as follows:
  - Horizontal installation (see figure below):
    Route cables downwards.
  - Vertical installation (interface dome at bottom; rotated 90° counterclockwise compared to the figure above):
    Route cables to the right.

A.4.2 Tools and tightening torques

Fastening/unfastening components

Component	Fastening/unfastening	Tool	Tightening torque
Mounting rail	Drill hole: Diameter 6.4 mm Screw M6	Wrench for screw M6	4 Nm to 6 Nm
CFU	Fixing screws on both sides of the CFU	TORX T15 screwdriver	0.5 Nm
BusAdapter	Screw is located in the BusAdapter	Screwdriver with 3 to 3.5 mm blade width	0.25 Nm
Cables on the plugs You can find more information on this in the section "Preparing cables (Page 69)".	Fixing screw on the screw terminal	Screwdriver with 3 to 3.5 mm blade width	Min. 0.4 Nm / max. 0.5 Nm
	Stranded wires without wire end ferrule with push-in terminal	Screwdriver with approx. 3 mm blade width	Not applicable

Component	Fastening/unfastening	Tool	Tightening torque
CFU PA only**:** Shield connection for process cable (shield terminal)	Spring terminals	Not required	Not applicable
CFU in aluminum housing			
Cover screws	M6 (Screws are fitted in the cover)	Screwdriver PH2 or with 9 mm blade width	2.5 Nm to 3 Nm
Mounting rail	Drill hole: Diameter 6.4 mm Screw M6	Wrench for screw M6	Pre-assembled
Cable glands (connection thread of the cable gland)	M20x1.5: Approved for cable diameters from 7 mm to 13 mm (with a reducing insert: 4 mm to 8 mm)	Wrench for SW24 cable glands	Preassembled (2.3 Nm)
Cable glands (cap nuts)	M20x1.5 with gasket ring	Wrench for SW24 cable glands	1.5 Nm
Functional earth	Functional earth on the housing (left part of the housing without penetration of its wall - cross-section acc. to EN 60079-14)	Screwdriver with 8 mm blade width	2.5 Nm to 3 Nm
Pressure compensation element	M12	Wrench for screw SW17	Pre-assembled (1 Nm)

A.4.3 Cable cross-sections and ferrules

Cables with and without wire end ferrule

Rule for ...		Connections PS<n>	Connections FB<n> and DIQ<n>
Permitted cable cross-sections for solid cables		0.2 to 2.5 mm^2	
		AWG*: 24 to 13	
Permitted cable cross-sections for flexible cables	Without ferrule	0.2 to 2.5 mm^2	
		AWG*: 24 to 13	AWG*: 24 to 14
	With ferrule (with plastic sleeve)***	0.25 mm to 1.5 mm^{2**}	0.14 mm to 1.5 mm^2
		AWG*: 24 to 16	AWG*: 26 to 16
	With TWIN ferrule***	0.5 mm to 1 mm^2	0.5 to 0.75 mm^2 (see below)
		AWG*: 20 to 17	AWG*: 20 to 18
Stripped length of the cables		7 to 10 mm	
Wire end ferrules in accordance with DIN 46228 with plastic sleeve***		7 and 10 mm long	

* AWG: American Wire Gauge

** Ferrules without plastic sleeve: 0.25 to 2.5 mm^2/AWG: 24 to 13

*** See note on ferrules

Note

Ferrules

You can achieve optimum results with respect to a high-quality and durable electrical connection with maximum conductor extraction forces through the use of crimp shapes, preferably with smooth surfaces, as is ensured for example with rectangular and trapezoidal crimp cross-sections.

Due to the variety of crimp shapes used in industry, we recommend other shapes on request. Crimping dies with a pronounced wave profile are unsuitable.

A.5 Dimensional diagrams

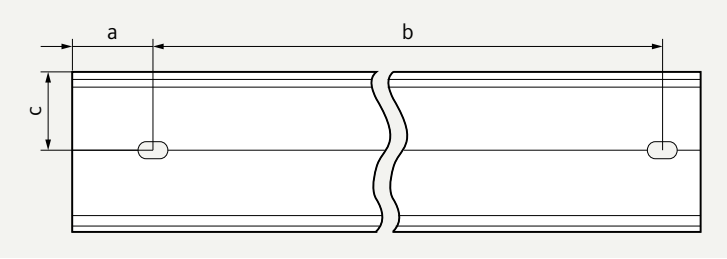
A.5.1 Dimension drawings of the mounting rails

Dimensions for the drill holes

Mounting rails can be ordered in the lengths 483 mm and 2000 mm.

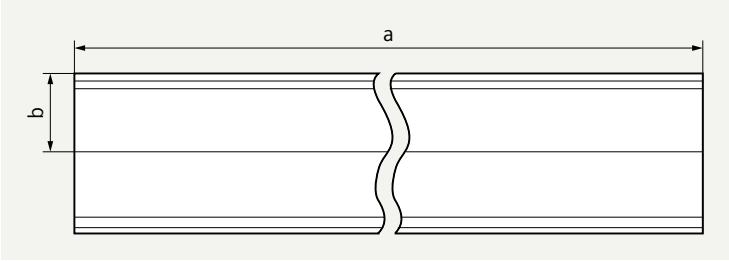
Mounting rails

Mounting rail 483 mm

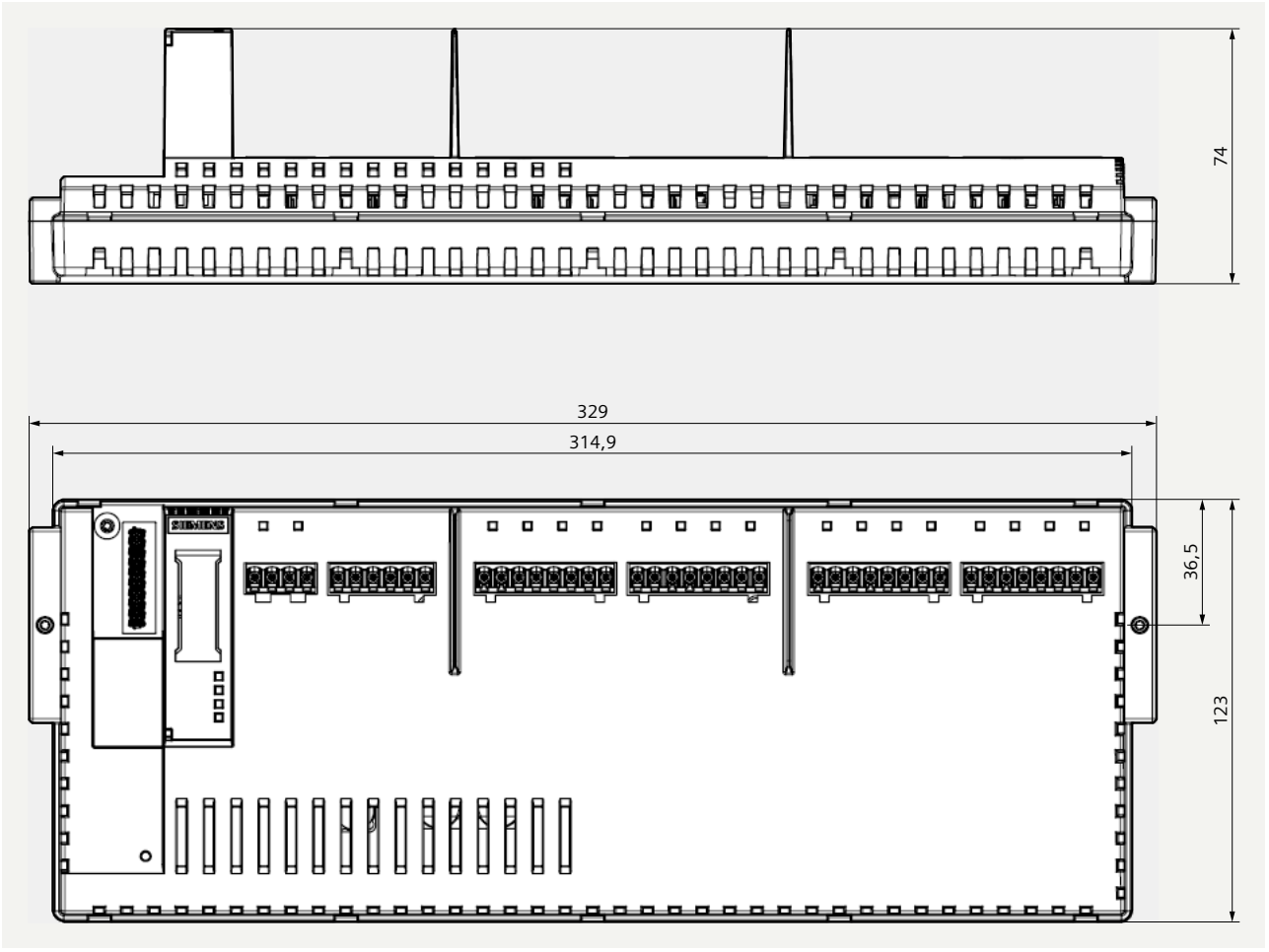


Length of the mounting rail	Distance a (at the beginning and end of the mounting rail)	Distance b (to the next drill hole)	Width (to drill hole: distance c)
483 mm	8.8 mm	465 mm	35 mm (17.5 mm)

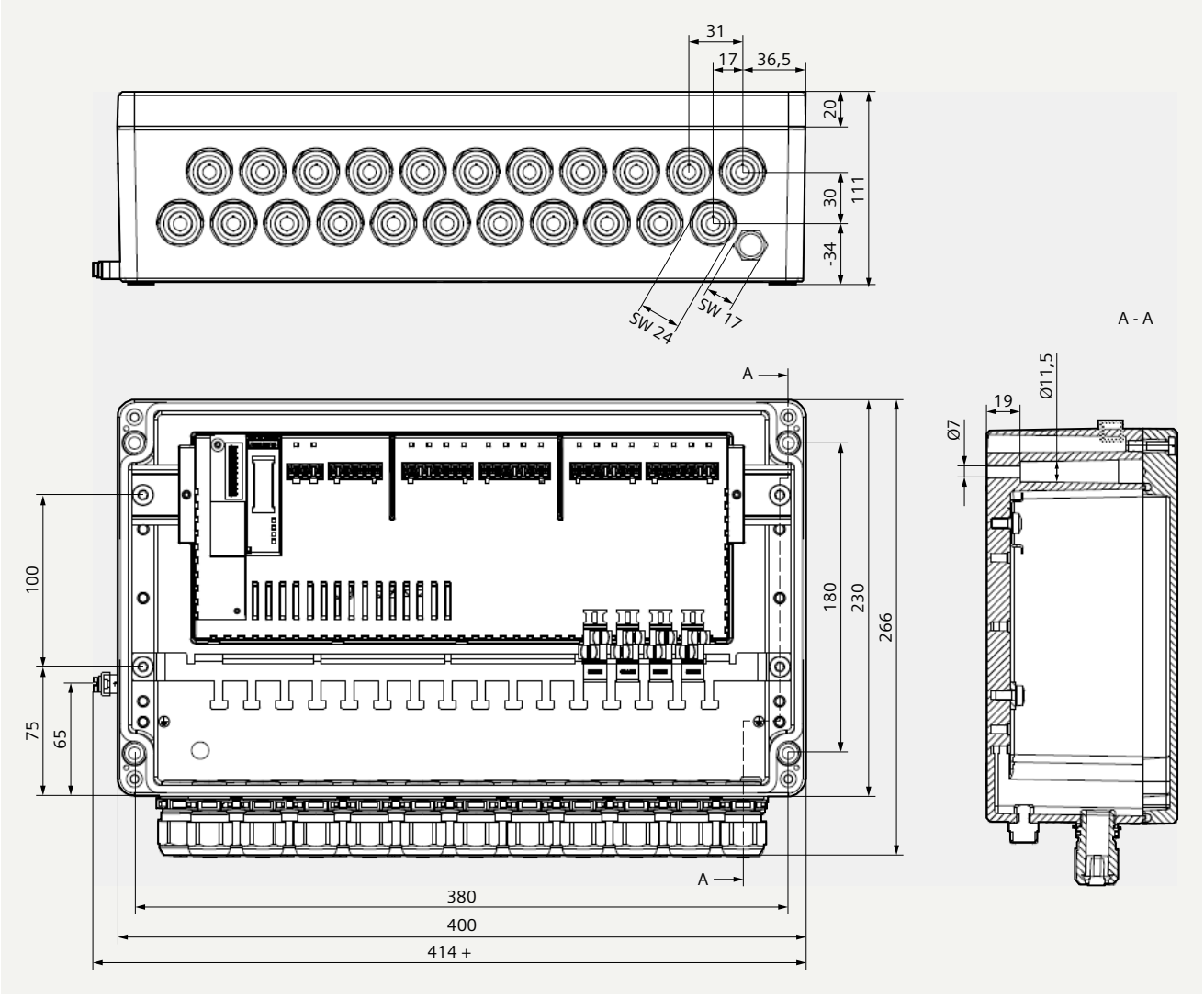
The following table shows the spacing of the required drill holes for the 2000 mm mounting rail.

Mounting rail 2000 mm			
			
Length of the mounting rail (a)	**Width (to drill hole: distance b)**	**Distance (at the beginning and end of the mounting rail)**	**Distance (to the next drill hole)**
2000 mm	35 mm (17.5 mm)	15 mm	Approx. every 500 mm

A.5.2 Dimension drawings of the CFU



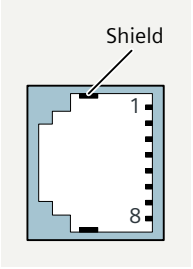
A.5.3 Dimension drawings of the housing of the CFU



A.6 Basics of PROFINET

A.6.1 Pin assignment of the RJ45 connection plug

Table A-11 Pin assignment of the RJ45 connector

View RJ45-plug socket	Contact	assignment
	1	RD (Receive Data +)
	2	RD_N (Receive Data –)
	3	TD (Transmit Data +)
	4	Ground
	5	Ground
	6	TD_N (Transmit Data –)
	7	Ground
	8	Ground

A.7 CFU PA: Basics of PROFIBUS PA

A.7.1 Overview of Contents

PROFIBUS PA

PROFIBUS PA is the PROFIBUS for **P**rocess **A**utomation (PA) and is based on IEC 61784-1:2002 Ed1 CPF 3/2 for transmission technology and protocol and on the PA profile.

PROFIBUS PA = PROFIBUS DP communication protocol
+ Synchronous transmission technology
+ Power supply of the PA field devices

Connectable field devices

You can connect all field devices that are suitable for CFU to the PROFIBUS PA.

- Measuring transducers, valves, actuators etc.
- For use in the chemicals industry and process engineering
- With field device feed via the data cable
- Also for applications in hazardous areas (protection type Ex [ic])

A.7.2 CFU PA: PROFIBUS addresses of the PROFIBUS PA field devices on the CFU (FBn)

You can connect field devices that are suitable for PROFIBUS PA as of profile 3.0 to the CFU.

The PROFIBUS addresses are permanently assigned to the fieldbus connections FB<n>.

CFU type	Fieldbus connection	PROFIBUS PA address
CFU PA	**FB0**	20
CFU PA	**FB1**	21
CFU PA	**FB2**	22
CFU PA	**FB3**	23
CFU PA	**FB4**	24
CFU PA	**FB5**	25
CFU PA	**FB6**	26
CFU PA	**FB7**	27

A.7.3 Intrinsic safety

Intrinsic safety

The basis for the intrinsic safety type of ignition protection consists in the necessity for a specific amount of ignition energy for ignition to take place in a potentially explosive atmosphere. In an intrinsically safe power circuit this minimum ignition energy is not present, neither in normal operation nor in case of fault. The intrinsic safety of a power circuit is achieved by limiting current and voltage so as to avoid sparks and high temperatures as possible sources of ignition. As a result of this, the intrinsically safe protection type is limited to electric circuits with low power.

Spark ignition

So-called spark ignition is excluded because sparks that can normally occur owing to short circuit or ground fault during operation when a power circuit is opened or closed are excluded because current and voltage are limited as well as owing to the avoidance of major inductivities.

Heat ignition

In normal operation and in case of failure heat ignition is not possible because excessive heating of the equipment and leads in the intrinsically safe power circuit is excluded.

More information

For more information on the topics intrinsic safety and explosion protection please refer to:

- Automation Systems S7-300, ET 200M Ex I/O Modules manual (https://support.industry.siemens.com/cs/ww/en/view/1096709)
- *Investigation of intrinsic safety for field bus systems*; PTB Report W-53, Braunschweig, March 1993
- *PROFIBUS PA Commissioning Guide*, Notes on using the IEC 61158-2 technology for PROFIBUS, (German art. no. 2.091, English art. no. 2.092)
  PROFIBUS User Organization (https://www.profibus.com/)

A.8 Use of the CFU with GSDML

The following information applies to the use of the SIMATIC Compact Field Unit with integration via GSDML.
Note the following restrictions compared to integration of the CFU when using SIMATIC PCS 7 V9.0 or higher.

- General (Page 225)
- DI/DQ; Counter; Measure frequency (Page 226)
- CFU PA: CFU and field devices (Page 226)

A.8.1 General

- **Replace BusAdapter**
  The BusAdapter must be replaced in two steps (each port separately). Only related port pairs may be replaced.
- **Replace Object**
  Objects (modules, submodules) cannot be replaced
- **Firmware update**
  Use the firmware update function of your engineering system for the firmware update.
  The firmware update is possible with standard SIMATIC mechanisms.
  A firmware update can take a longer period.

CFU PA

Note

Read back parameters

The "Read back IOs" function is not available.

Example: Firmware update with SIMATIC STEP 7

1. Select the menu command **PLC > Show accessible devices**.
2. Select the CFU.
3. Execute the firmware update with the following menu command:
   PLC > Update Firmware

A.8.2 DI/DQ; Counter; Measure frequency

- **Configuring channels**
  Each channel must be configured separately. The use of the GSDML does not provide the option of simultaneously processing all channels.
- **Channel configured as "DI"**
  When a channel is configured as DI, the following parameters are ignored:
  - Parameter "Diagnostics Short-Circuit to L+"
  - Parameter "Reaction to CPU stop"
- **Parameter check**
  A parameter check (e.g. DQ channel is configured as output) does not take place at the compilation moment.
  Incorrect parameter assignment is rejected by the CFU with a "Parameterization error" diagnostic interrupt.

A.8.3 CFU PA: CFU and field devices

- **Use SIMATIC PDM**
  Parameter assignment of the field devices and the CFU PA is only possible using SIMATIC PDM.
- **Plan the network for the engineering**
  The engineering system must be located in the subnet of the CFU PA.
- **Use SIMATIC PDM for access to the field devices and configuration**
  The field devices must be created directly in SIMATIC PDM.
  Open SIMATIC PDM manually. Only in this way can the configuration and the field devices be accessed.
  Automatic opening of SIMATIC PDM from the engineering system (e.g. by double-clicking on the field device) is not possible.
- **Connecting field devices**
  You can connect field devices by using PA profiles (16 PA profiles). Manufacturer-specific GSDs cannot be used.
- **Labeling the field devices**
  An "Expected TAG" is not displayed in the EDD Wizard.

A.9 Drivers, parameters, diagnostic messages and address space

A.9.1 Concept of the driver and diagnostics blocks in PCS 7

Use with PCS 7

The following information shows you the benefits of using PCS 7. PCS 7 carries out many important parameter assignments and interconnections of blocks automatically.

If you want to use the CFU outside of the PCS 7 environment, pay attention to the next sections.

Tasks of the driver and diagnostics blocks (driver blocks)

In process control systems, certain demands are placed on the diagnostics/signal processing. This includes the monitoring of modules, IO devices and IO controllers for malfunctions and failures.

To enable this, blocks are available in the PCS 7 library that implement the interface to the hardware including test functions.

These blocks perform two basic tasks:

- They provide signals from the process to the AS for further processing.
- They monitor modules, IO devices and IO controllers for failure.

When the process signals are read in, these blocks access the process image input (or process image partition) (PII) and when the process signals are output, they access the process image output (or process image partition) (PIQ).

Concept

The concept of the driver and diagnostics blocks of PCS 7 is characterized by the following:

- The separation between user data processing (CHANNEL blocks) and diagnostics data processing (MODULE blocks)
- The symbolic addressing of the I/O signals
- The automatic generation of the MODULE blocks by CFC

This block concept supports all modules from the list of approved modules.
When new Siemens or non-Siemens module types are integrated, the meta-knowledge for the driver generator can be extended by additional XML files (object and action lists).

Note

Driver and diagnostics blocks

- The library with the driver blocks has to be installed using the Setup program on the PC. This is the only method of ensuring that the meta-knowledge required for the driver generator is available. You must not copy the library from another computer.
- You can also use driver blocks from another library (for example, your own blocks from your own library). You can specify this additional library in the "Generate module drivers" dialog box. The driver generator then searches for the block to be imported in the library specified here. If the block is not found here, it is searched for in the library specified in the control file (XML file).
- If the S7 program contains a signal-processing block but not from one of the PCS 7 libraries, you must specify the version of the driver library from which the driver blocks are to be imported in the "Generate module drivers" dialog box.

Time-optimized processing

For time-optimized processing of the user program at runtime, PCS 7 automatically carries out the following programming tasks:

- Divide organization blocks for error handling (for example, OB 85, OB 86) into runtime groups
- Installing driver blocks into the corresponding runtime groups

If an error occurs, the SUBNET block, for example, activates the relevant runtime group, the RACK block or MODULE block contained in the runtime group detects the error, evaluates it and outputs a process control message to the OS.

The diagnostics information of the MODULE block (OMODE_xx output) is also transferred to the corresponding CHANNEL block (MODE input).

If necessary, this information can be displayed using a PCS 7 block that supports operator control and monitoring on the OS or a user block in a process picture (color change of the measured value or flashing display, etc.).

A.9.2 Parameters, diagnostic messages and address space without PCS 7

A.9.2.1 CFU PA: Address space of the submodule DIQ8 DC24V/0.5A

Abbreviations

- "IB" stands for input byte, that is, the submodule start address in the input area
- "QB" stands for output byte, that is, the submodule start address in the output area

- "DI" stands for digital input
- "DQ" stands for digital output

Address space

The following tables show the allocation of the CFU PA address space (DIQ submodule without extended function).

Input area

The table shows the allocation of the address space of the feedback interface.

Table A-12 Address space of the CFU PA with submodule "DIQ8 DC24V/0.5A"

IB x +	7	6	5	4	3	2	1	0
0	DI7	DI6	DI5	DI4	DI3	DI2	DI1	DI0

Output area

The table shows the allocation of the address space of the control interface.

Table A-13 Address space of the CFU PA with submodule "DIQ8 DC24V/0.5A"

QB x +	7	6	5	4	3	2	1	0
0	DQ7	DQ6	DQ5	DQ4	DQ3	DQ2	DQ1	DQ0

A.9.2.2 CFU PA: Address space of the submodule DIQ8 DC24V/0.5A, Counter

Abbreviations

- "IB" stands for input byte, that is, the submodule start address in the input area
- "QB" stands for output byte, that is, the submodule start address in the output area
- "DI" stands for digital input
- "DQ" stands for digital output
- "-" stands for reserved (unused)

Address space

The following tables show the allocation of the address space of the CFU PA with the digital input Channel 0 as counter without evaluation of the status.

Input area

The table shows the allocation of the address space of the feedback interface.

Table A-14 Address space of the CFU PA with submodule "DIQ8 DC24V/0.5A, Counter"

IB x +	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	DI7	DI6	DI5	DI4	DI3	DI2	DI1	DI0
1	Count value 0 / Frequency value 0							
2								
3								
4								
5	LD_ERROR_0	LD_STS_SLOT_0	STS_M_INTER-VAL_0	STS_SW_GATE_0	-	-	STS_GATE_0	STS_DQ_0
Count value in DINT format Frequency value in floating-point format (REAL)								

IB 5	**Action**	**Meaning**
1xxx xxx	LD_ERROR_<x>	Error in the control byte or load value is greater than high counting limit
x1xx xxx	LD_STS_SLOT_<x>	A status change of LD_STS_SLOT_<x> shows that a valid load request (LD_SLOT) has been detected and executed.
xx1x xxx	STS_M_INTER-VAL_<x>	Only in "Frequency measurement" operating mode (channel 0) Status of the frequency value: (0 = frequency value is invalid; 1 = frequency value is valid)
xxx1 xxx	STS_SW_GATE_<x>	Status of SW_GATE mirrored
xxxx xx1x	STS_GATE_<x>	State of the internal gate (0 = gate closed, 1 = gate open), depending on the SW and HW gate, when the HW gate is activated.
xxxx xxx1	STS_DQ_<x>	Logic for the comparison result DQ from the parameters

Output area

The table shows the allocation of the address space of the control interface.

Table A-15 Address space of the CFU PA with submodule "DIQ8 DC24V/0.5A, Counter"

QB x +	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	DQ7	DQ6	DQ5	DQ4	DQ3	DQ2	DQ1	DQ0
1	Load value 0							
2								
3								
4								
5	-	-	-	-	SW_GATE_0	LD_SLOT_0		

QB 5	Action	Meaning
xxxx 0000	STOP (SW_GATE=0)	Stop counting
xxxx 0**001**	Apply load value; STOP (SW_GATE=0)	The load value is applied with a rising edge of bit 0 when the counter is stopped
xxxx 1001	Apply load value; START (SW_GATE=1)	The load value is applied with a rising edge of bit 0; counting continues
xxxx x**000**	NOP	No action

A.9.2.3 CFU DIQ: Address space of the submodule DIQ16 DC24V/0.5A

Abbreviations

- "IB" stands for input byte, that is, the submodule start address in the input area
- "QB" stands for output byte, that is, the submodule start address in the output area
- "DI" stands for digital input
- "DQ" stands for digital output

Address space

The following tables show the allocation of the CFU DIQ address space (DIQ submodule without extended function).

Input area

The table shows the allocation of the address space of the feedback interface.

Table A-16 Address space of the CFU DIQ with submodule "DIQ16 DC24V/0.5A"

IB x +	7	6	5	4	3	2	1	0
0	DI7	DI6	DI5	DI4	DI3	DI2	DI1	DI0
1	DI15	DI14	DI13	DI12	DI11	DI10	DI9	DI8

Output area

The table shows the allocation of the address space of the control interface.

Table A-17 Address space of the CFU DIQ with submodule "DIQ16 DC24V/0.5A"

QB x +	7	6	5	4	3	2	1	0
0	DQ7	DQ6	DQ5	DQ4	DQ3	DQ2	DQ1	DQ0
1	DQ15	DQ14	DQ13	DQ12	DQ11	DQ10	DQ9	DQ8

A.9.2.4 CFU DIQ: Address space of the submodule DIQ16 DC24V/0.5A, Counter

Abbreviations

- "IB" stands for input byte, that is, the submodule start address in the input area
- "QB" stands for output byte, that is, the submodule start address in the output area
- "DI" stands for digital input
- "DQ" stands for digital output
- "-" stands for reserved (unused)

Address space

The following tables show the allocation of the CFU DIQ address space with the digital inputs Channel 0 and Channel 1 as counters without evaluation of the status.

Input area

The table shows the allocation of the address space of the feedback interface.

Table A-18 Address space of the CFU DIQ with submodule "DIQ16 DC24V/0.5A, Counter"

IB x +	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	DI7	DI6	DI5	DI4	DI3	DI2	DI1	DI0
1	DI15	DI14	DI13	DI12	DI11	DI10	DI9	DI8
2	Count value 0 / Frequency value 0							
3								
4								
5								
6	LD_ERROR_0	LD_STS_SLOT_0	STS_M_INTER-VAL_0	STS_SW_GATE_0	-	-	STS_GATE_0	STS_DQ_0
7	Count value 1 / Frequency value 1							
8								
9								
10								
11	LD_ERROR_1	LD_STS_SLOT_1	STS_M_INTER-VAL_1	STS_SW_GATE_1	-	-	STS_GATE_1	STS_DQ_1
Count value in DINT format Frequency value in floating-point format (REAL)								

IB 6 / IB 11	**Action**	**Meaning**
1xxx xxx	LD_ERROR_<x>	Error in the control byte or load value is greater than high counting limit
x1xx xxx	LD_STS_SLOT_<x>	A status change of LD_STS_SLOT_<x> shows that a valid load request (LD_SLOT) has been detected and executed.

IB 6 / IB 11	Action	Meaning
xx1x xxx	STS_M_INTER-VAL_<x>	Only in "Frequency measurement" operating mode (channels 0 and 1) Status of the frequency value: (0 = frequency value is invalid; 1 = frequency value is valid)
xxx1 xxx	STS_SW_GATE_<x>	Status of SW_GATE mirrored
xxxx xx1x	STS_GATE_<x>	State of the internal gate (0 = gate closed, 1 = gate open), depending on the SW and HW gate, when the HW gate is activated.
xxxx xxx1	STS_DQ_<x>	Logic for the comparison result DQ from the parameters

Output area

The table shows the allocation of the address space of the control interface.

Table A-19 Address space of the CFU DIQ with submodule "DIQ16 DC24V/0.5A, Counter"

QB x +	7	6	5	4	3	2	1	0
0	DQ7	DQ6	DQ5	DQ4	DQ3	DQ2	DQ1	DQ0
1	DQ15	DQ14	DQ13	DQ12	DQ11	DQ10	DQ9	DQ8
2	Load value 0							
3								
4								
5								
6	-	-	-	-	SW_GATE_0	LD_SLOT_0		
7	Load value 1							
8								
9								
10								
11	-	-	-	-	SW_GATE_1	LD_SLOT_1		

QB 6 / QB 11	Action	Meaning
xxxx 0000	STOP (SW_GATE=0)	Stop counting
xxxx 0**001**	Apply load value; STOP (SW_GATE=0)	The load value is applied with a rising edge of bit 0 when the counter is stopped
xxxx 1001	Apply load value; START (SW_GATE=1)	The load value is applied with a rising edge of bit 0; counting continues
xxxx x**000**	NOP	No action

A.9.2.5 Hardware interrupts

Hardware interrupts

A hardware interrupt is generated for the following event:

- Comparison event for DQ occurred

Structure of the additional interrupt information

The hardware interrupt can only be triggered in "Counter" operating mode.

Name of the data block		Contents	Remark	Bytes
USI (User Structure Identifier)		W#16#0001 or W#16#0010	Additional interrupt information for hardware interrupts of the CFU	2
The channel that triggered the hardware interrupt is shown.				
	Channel	B#16#00 to B#16#0F	Number of the channel that triggered the hardware interrupt.	1
An error event that triggered the hardware interrupt follows.				
	Event	B#16#05	Comparison event for DQ occurred	1

A.9.2.6 Supplementary information on the address space of a CFU

The input and output address space (user data + PROFINET user data qualifier) of the CFU is 1440 bytes in each case. However, only 1000 bytes are available in each case in S2 mode or when using CiR.

Each submodule also allocates 1 byte in addition to the process data in the input and output address space for the user data qualifier (IOXS).

Table A-20 Submodule dependency of the bytes in the input and output address space

Submodule has...	Allocated bytes in the input address space	Allocated bytes in the output address space
Diagnostics address	1	1
Input address with x bytes of process data	x+1	1
Output address with x bytes of process data	1	x+1
Input and output address with x bytes of process data in each case	x+1	x+1

Calculation of the free bytes in the address space

Table A-21 Example for CFU PA: CFU PA with counting functionality without field devices

Slot	Type	Allocated bytes in the input address space	Allocated bytes in the output address space
0	Diagnostics address	1	1
X1	Diagnostics address	1	1
X1 P1 R	Diagnostics address	1	1
X1 P2 R	Diagnostics address	1	1
1	Input and output address	6+1	6+1
2.1	Diagnostics address	1	1

Slot	Type	Allocated bytes in the input address space	Allocated bytes in the output address space
2.2	Input and output address	4+1	2+1
	Total:	**17**	**15**

Free bytes in the process image (for field devices):
Input address space: 1440–17 = 1423 bytes (or 983 bytes in S2/CiR mode)
Output address space: 1440–15 = 1425 bytes (or 985 bytes in S2/CiR mode)

A.10 Contact

Area	Contact
Repair service Repair Service Facility	Siemens AG DI PA GFE MF-K QM 1 Östliche Rheinbrückenstraße 50 D-76187 Karlsruhe, Germany Contact person: Mr. C. Caspers Tel.: +49 172 891 9858
Manufacturer	Siemens AG DI PA GFE MF-K QM 1 Östliche Rheinbrückenstraße 50 D-76187 Karlsruhe, Germany Contact person: Mr. C. Caspers Tel.: +49 172 891 9858

Glossary

Actuator

Actuators can be power relays or contactors for switching on loads, or they can be loads themselves (e.g., directly controlled solenoid valves).

Automation system

Programmable logic controller for the open-loop and closed-loop control of process sequences of the process engineering industry and manufacturing technology. The automation system consists of different components and integrated system functions depending on the automation task.

Availability

Availability is the probability that a system is functional at a specific point in time. Availability can be increased by redundancy, e.g., by using multiple -> sensors at the same measuring point.

Bus

Joint transmission path to which all nodes of a bus system are connected.

BusAdapter

Enables free selection of the connection system for the PROFINET fieldbus.

Channel number

Channel numbers are used to uniquely identify the inputs and outputs of a module (device - CFU) and to assign channel-specific diagnostic messages.

Channel type

Selection of the channel type (for one DIQ channel or all DIQ channels)

- Digital DI
- Digital output DQ

Comparison value

You can configure a comparison value within the count limits. When the count value reaches the comparison value, the counter reacts according to the parameterization.

Configuration control

Function that enables flexible adaptation of the actual configuration based on a defined maximum configuration via the user program. Input, output and diagnostic addresses remain unchanged.

Configuring

Systematic arrangement of the individual modules (configuration).

Connection plug

Physical connection between device and cable.

Count limits

The count limits define the value range of the count value. The count limits are configurable and can be changed during runtime.

Crimping

Procedure whereby two components joined together, e.g. wire end sleeve and cable, are connected with one another through plastic strain.

Dark period

Dark periods occur during shutdown tests and complete bit pattern tests. The fail-safe output module switches test-related 0-signals to the active output. This output is then briefly disabled (= dark period). An adequate carrier → actuator will not respond to this and will remain activated.

DD (Device Description)

Device description for field devices

Derating

→ *Temperature derating*

Device names

Before an IO device can be addressed by an IO controller, it must have a device name.
In its delivery state, an IO device has no device name. An IO device can only be addressed by the IO controller after it has been assigned a device name via the PG/PC or via the topology, e.g. for the transfer of configuration data (such as IP address) during startup or for the exchange of user data during cyclic operation.

Device station

A device may only exchange data with a master after being requested to do so by the master.

Diagnostics

Monitoring functions for the recognition, localization, classification, display and further evaluation of errors, faults and alarms. They run automatically during plant operation. This increases the availability of systems by reducing commissioning times and downtimes.

Diagnostics Missing Supply Voltage

Diagnostics for missing or insufficient supply voltage L+.

Diagnostics Short-Circuit to Ground

Enable diagnostics (for one DIQ channel or all DIQ channels).

You can enable diagnostics for an activated digital output.

Diagnostics monitors the digital output and signals when a short-circuit of the digital output to M occurs.

A short-circuit to ground is only recognized for an output value = 1 (output is switched on).

Note on short-circuit signal

If the output at the active short-circuit is deactivated (output value = 0), the diagnostics "Short-circuit to ground" is reset.

Diagnostics Short-Circuit to L+

Enable diagnostics (for one DIQ channel or all DIQ channels).

You can enable diagnostics for an activated digital output.

Diagnostics monitors the digital output and signals when a short-circuit of the digital output to L+ occurs.

Diagnostics Wire Break

Enable diagnostics (for one DIQ channel or all DIQ channels).

You can enable diagnostics for an activated DIQ channel.

The diagnostics monitors the DIQ channel and signals when the line to the actuator is interrupted.

Distributed I/O system

System with input and output modules that are configured on a distributed basis, far away from the CPU controlling them.

DP

→ *Distributed I/O system*

DQ channel

For "Counter" mode, enables the selection of a free channel to output the comparison result.

EDD (Electronic Device Description)

Device description for field devices based on the EDDL (Electronic Device Description Language)

EDDL (Electronic Device Description Language)

Device descriptions had to be standardized In order to enable intelligent field devices from different manufacturers to be integrated into different control systems. This standard (IEC 61804-2) was developed in collaboration with the following organizations:

- PROFIBUS User Organization (PNO)
- Hart Communication Foundation (HCF)
- Fieldbus FOUNDATION (FF)
- OPC Foundation

The device descriptions are based on the EDDL (Electronic Device Description Language) standard IEC 61804-3.

Edge evaluation

For the "Counter" operating mode, specifies the edge direction of pulses to be counted at the counting input.

Requirements: The "Counter" operating mode is enabled.

Modes:

- On rising edge
- On falling edge
- On rising and falling edge

Enable channel

Enable/disable (for one DIQ channel or all DIQ channels)

Equipotential bonding

Electrical connection (potential equalization conductor) that brings the bodies of electrical equipment and other conductive bodies to the same or almost the same potential, in order to prevent disruptive or dangerous voltages between these bodies.

Fiber-optic cable

Possibility for transferring data across large distances. A major advantage of fiber-optic cables compared to electrical lines is that the data transfer cannot be influenced by electrical or magnetic fields.

The optical interfaces are specified in the following standards:

- ISO/IEC 9314-3 (multimode)
- ISO/IEC 9314-4 (single-mode)

You can use both multimode fiber-optic cables and single-mode fiber-optic cables as fiber-optic cables for PROFINET networks. Typical manufacturer variants are:

- GOF - *Glass Optical Fibers*
- POF - *Plastic Optical Fibers* or *Polymer Optical Fibers* are fiber-optic cables made of plastic.

Firmware update

Upgrade of firmware for devices or modules (interface modules, I/O modules etc.) to the newest firmware version (update), for example after enhancement of functions.

Functional grounding

Functional grounding is a low-impedance current path between electric circuits and ground. It is not designed as a safety measure but instead, for example, as a measure to improve interference immunity.

Gate control

The gate control system determines when pulses are acquired. The behavior of the gate control system depends on the operating mode of the counter.

- "Counter" mode: The gate control system determines when count pulses are acquired.
- "Frequency measurement" operating mode: The measuring window in which the pulses are captured is defined with the gate control system.

GOF

→ *Fiber-optic cable*

Ground

Conductive earth whose electrical potential can be set equal to zero at any point.

All interconnected, inactive parts of a piece of equipment that cannot accept any dangerous contact voltage, even in the event of a fault.

Ground

Conductive earth whose electrical potential can be set equal to zero at any point.

All interconnected, inactive parts of a piece of equipment that cannot accept any dangerous contact voltage, even in the event of a fault.

Grounding

Grounding means connecting an electrically conductive part to a grounding arrangement by means of a grounding system.

GSD file

The file contains all properties of a PROFIBUS device that are necessary for its configuration.

GSDML file

The file contains all properties of a PROFINET device that are necessary for its configuration.

Hardware interrupt

Defines for the "Counter" operating mode whether a hardware interrupt is generated when the comparison result is reached.

Modes:

- Lock (deactivation of hardware interrupt)
- Comparison result for DQ occurred (activation of hardware interrupt)

HW Config

Hardware configuration in the engineering system

HW gate channel

For the "Counter" operating mode, enables the selection of a free channel as hardware gate to control the counting processes.

If the hardware gate is activated, it has an effect on the gate control system via a logical AND link with the software gate. When the internal gate is open, the count pulses are processed.

I/O modules

All modules that can be operated with a CPU or an interface module.

Identification data

Information that is saved in modules and that supports the user in checking the plant configuration and locating hardware changes.

Interface module

Module in the distributed I/O system. The interface module connects the distributed I/O system via a fieldbus to the CPU (IO controller) and prepares the data for and from I/O modules.

LLDP

LLDP (*Link Layer Discovery Protocol*) is a network protocol that is described in the international standard IEEE-802.1AB. As a manufacturer-independent Layer 2 protocol for the recognition of the topology in a network, it serves to transfer information to neighboring devices.

Devices that support LLDP send device-specific information via an LLDP agent (software component) to the multicast address 01:80:C2:00:00:0E with the type 0x88C at periodic intervals. Neighboring LLDP-compatible devices store received information in the Management Information Base (MIB) and thus recognize neighboring devices.

Load current supply

Supply of modules like the interface module, power supply modules, I/O modules, and (if applicable) sensors and actuators.

MAC address

Device identification unique worldwide, which is already assigned to each PROFINET device in the factory. Its 6 bytes are divided into 3 bytes for the manufacturer ID and 3 bytes for the device ID (serial number). The MAC address is usually legible on the device.

Measuring window

The measuring window is the interval at which the I/O module updates the measured values cyclically.

Module fault

Module faults can be external faults (e.g. missing load voltage) or internal faults (e.g. processor failure). Internal faults always require module replacement.

Node

Device that can send, receive or amplify data via the bus, e.g. IO device via PROFINET IO.

Operating mode

Parameters for selected digital inputs (only available with submodule COUNTER)

Selection of operating mode:

- Counter
- Frequency measurement

Parameter assignment

Parameter assignment is the transfer of parameters from the IO controller to the IO device.

PELV

Protective **E**xtra **L**ow **V**oltage

Performance Level

Performance Level (PL) to ISO 13849-1:2006 or EN ISO 13849-1:2008

POF

→ *Fiber-optic cable*

Potential group

Group of I/O modules that are jointly supplied with voltage.

Prewiring

Wiring the electrics on a mounting rail before the I/O modules are connected.

Principle of frequency measurement

Frequency measurement is carried out by counting the number of pulses (only positive edges) per period. A time measurement between two edges is not supported.
Frequency [Hz] = Number of positive edges at the digital input/Measuring window [sec]

Process image (I/O)

The CPU transfers the values from the input and output modules to this memory area. At the start of the cyclic program, the signal states of the input modules are transmitted to the process image of the inputs. At the end of the cyclic program, the process image of the outputs is transmitted as signal state to the output modules.

Product version (ES) = Functional status (FS)

The product version or functional status provides information on the hardware version of the module.

PROFIBUS

PROcess **FI**eld **BUS**, process and fieldbus standard that is specified in the standard IEC 61158 Type 3. It specifies functional, electrical and mechanical properties for a bit-serial fieldbus system.
PROFIBUS is available with the following protocols: DP (= Distributed Periphery), FMS (= Fieldbus Message Specification), PA (= Process Automation) or TF (= Technological Functions).

PROFINET

PROcess **FI**eld **NET**work, open Industrial Ethernet standard which continues PROFIBUS and Industrial Ethernet. A cross-manufacturer communication, automation and engineering model by PROFIBUS International e.V., defined as an automation standard.

PROFINET IO controller

Device used to address connected I/O devices (e.g. distributed I/O systems). This means: The IO controller exchanges input and output signals with assigned I/O devices. The IO controller often corresponds to the CPU in which the user program is running.

PROFINET IO device

Distributed field device that can be assigned to one or more IO controllers (e.g. distributed I/O system, valve terminals, frequency converters, switches).

PROFINET IO

Communication concept for the realization of modular, distributed applications within the scope of PROFINET.

PROFIsafe

PROFIsafe (**PRO**cess **FI**eld **safe**ty) is specified for PROFIBUS and PROFINET in the standard IEC 61784-3.

PROFIsafe is a current standard for secure communication between safety-related devices and the automation system via the employed fieldbus. The PROFIsafe profile includes both the format of the user data and the protocol for secure communication. PROFIsafe enables the realization of safety-related automation tasks up to SIL3 (Safety Integrity Level).

Proof-test interval

Period after which a component has to be placed in an error-free state. The component is either replaced with an unused component, or is proven faultless.

Provider-Consumer principle

Principle of data communication on the PROFINET IO: In contrast to PROFIBUS, both partners are independent providers when sending data.

Push-in terminal

Terminal for the tool-free connection of wires.

Reaction to CPU STOP

Determines the reaction of the digital outputs to CPU STOP or to failure of communication between the CFU and CPU.

Modes:

- Turn off
- Keep last value
- Output substitute value 1

Reaction to violation of the high counting limit

For the "Counter" operating mode, specifies the reaction of the counter when the counting limit is reached.

Modes:

- "Continue counting"
  With the "Continue counting" setting, the counter jumps back to 0 and continues counting when the high counting limit is exceeded.
- "Stop counting"
  With the "Stop counting" setting, the counter jumps back to 0 and stops when the high counting limit is exceeded. The internal gate needs to be closed and opened again to continue counting.

Redundancy, availability-enhancing

Multiple instances of components with the objective of maintaining component functionality in the event of hardware faults.

Reference potential

Potential from which the voltages of the participating circuits are considered and/or measured.

SELV

Safety **E**xtra **L**ow **V**oltage

Sensors

Sensors are used for accurate detection of digital and analog signals as well as routes, positions, velocities, rotational speeds, masses, etc.

Set output DQ

For the "Counter" operating mode, specifies the range in which the DQ output is set.

Requirements: A free channel is assigned to the counting channel as DQ output.

Modes for activated range (corresponds to DQ = 1):

- Between comparison value and low limit (0 ... Comparison value-1)
- Between comparison value and high limit (Comparison value ... High counting limit)

A hardware interrupt can be configured.

SNMP

SNMP (Simple Network Management Protocol) is the standardized protocol, for diagnosing and also configuring the Ethernet network infrastructure.

In the office setting and in automation engineering, devices from many different manufacturers support SNMP on the Ethernet.

SNMP-based applications can be operated on the same network in parallel to applications with PROFINET.

Spur

Spur line to a field device

Switch

PROFIBUS is a linear network. The communication nodes are linked by means of a passive cable - the bus.

By contrast, the Industrial Ethernet consists of point-to-point connections: Each communication node is directly connected to exactly one communication node.

If a communication node is connected with several communication nodes, this communication node is connected to the port of an active network component - the switch. Additional communication nodes (including switches) can now be connected to the other ports of the switch. The connection between a communication node and the switch remains a point-to-point connection.

A switch thus has the task of regenerating and distributing received signals. The switch "learns" the Ethernet address(es) of a connected PROFINET device or additional switches and only forwards those signals that are intended for the connected PROFINET device or switch.

A switch has a specific number of connections (ports). You connect at most one PROFINET device or one additional switch to each port.

Technology object

A technology object supports you in the configuration and commissioning of a technological function.

The properties of real objects are represented by technology objects in the controller. Real objects can be, for example, controlled systems or drives.

The technology object contains all data of the real object required for its open-loop or closed-loop control, and it signals back status information.

Temperature derating

The derating describes the maximum permissible heat dissipation of components depending on the ambient temperature.

TIA Portal

Totally Integrated Automation Portal

The TIA Portal is the key to the full performance capability of Totally Integrated Automation. The software optimizes operating, machine and process sequences.

Total current

Sum of currents of all freely configurable channels.

Transmission rate

Speed during the data transfer and specifies the number of transferred bits per second (transfer rate = bit rate).

TWIN end ferrule

Wire end ferrule for two cables

Value status

The value status is the binary additional information of a digital signal. The value status is entered in the process image of the input and provides information on the validity of the signal.