

Standard Field Bus Gateway
for Safety Compact Controller

PROTECT-PSC Universal-Gateway

Instruction Manual

ELAN Schaltelemente GmbH & Co. KG

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Preface

Thank you for deciding in favour of our programmable safety controller.

This Instruction Manual contains a description of PROTECT-PSC Universal-Gateway with the currently available standard field bus connections.

Descriptions, technical correlations, details on external control units, installation and operating information or similar have been provided to the best of our knowledge. However, this does not mean that warranted characteristics or other properties under liability law may be assumed which extend beyond the "General Terms of Delivery for Products and Services of the Electrical Industry". We trust you will understand that the user must therefore check our information and recommendations before using the equipment.

In order to guarantee the safe operation of the products these and all associated instruction manuals must be read thoroughly and understood. They must be stored in a safe place after reading and be accessible at the workplace at any time.

Please ensure that this Instruction Manual is made accessible to the end users of the equipment.

We reserve the right to modify specifications and similar for the purpose of technical extension/improvement.

We would like to point out that, under the provisions of the law on foreign currency and commercial transactions, an export approval is to be obtained from the Japanese Government for the export of products and services for strategic use.

In the event of a defect occurring within the warranty period for which the manufacturer is responsible, the repair or replacement of the defective part shall be performed at our discretion and at our expense. We trust you will understand that the manufacturer is not liable for damage of a direct or indirect nature for which others are responsible.

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Subject to technical amendments and error. The data used in this document are carefully checked for typical standard values.

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1 Overview

This chapter describes the structure of the Instruction Manual, and describes in brief the basic mode of operation and the structure of the PROTECT-PSC Universal-Gateway.

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1.1 Preliminary Remarks

We have prepared this document with due care to the best of our knowledge and belief. Despite careful checking, the possibility of it containing one or two errors cannot be ruled out, however.

Before reading this Instruction Manual thoroughly, please read through Chapter 2 carefully. Understanding the information and procedures described in this chapter is essential for the correct use of the PROTECT-PSC Universal-Gateway described in the following. Please always remember that faulty installation or programming can lead to serious injuries/damage to man and machine.

The terms and abbreviations used in this document are standard terms used in electrical engineering insofar as not described in more detail.

The basic operating functions of a computer with Microsoft Windows operating system (as from Windows 2000) are assumed as generally known.

1.2 Definition of Terms

The definition of the terms and abbreviations used most frequently in this document are described below.

Module	In this document a module is described as an individual physical unit which is part of the PROTECT-PSC safety compact controller.
Active module	A module which is actively involved in the change of state of the PROTECT-PSC (corresponding to active components in electronics).
Assembly	An assembly consists of several individual modules.
Standard field bus-Adapter / Bus coupler	Network interface for communication with standard field bus
Channel	A physical input or output of a module
A contact	Name of an NO contact
B contact	Name of an NC contact
User program	The control program of the PROTECT-PSC created by the programmer
PS program	The user program for the safety-oriented applications in the CPU module for processing of the safe I/O modules
PN program	The user program for non safety-oriented (operational) applications in the CPU module for the processing of operational I/O modules
PSV	The PSV (Program Specific Value) is the hash total of the user program.
Firmware FB	Secure function block in the PROTECT-PSC
FB library	Library of function blocks
Authorised person	Person from the group of persons described more closely in Chapter 2.1.4
Cat	Abbreviation for category (B, 1 to 4 in accordance with DIN EN 954-1)
PL	Performance Level, see DIN EN ISO 13849-1
SIL	Safety Integrity Level, see DIN EN 61508

1.3 Structure of the Document

This Manual is subdivided into 7 chapters. There is an additional Table of Contents preceding every chapter in which the individual sections are shown separately.

1.3.1 Page Layout

All pages have the same layout in principle.

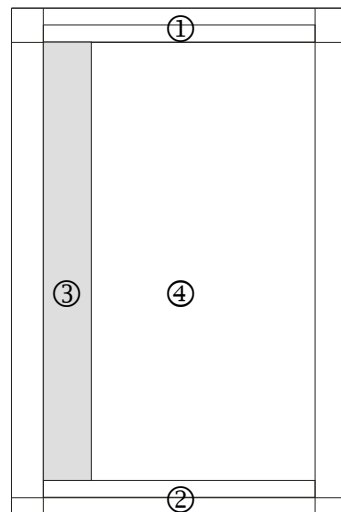


Figure 1-1 Page layout of the document

① **Headline**

The number and the name of the respective chapter are located top-right and top-left respectively.

② **Baseline**

The document name, version number and creation date are located bottom left. The page number within the chapter is shown bottom right.

③ **Margin**

This area contains important information, cross-references to other parts of the text and bibliographic references and the information content of text passages.

④ **Text / Pictures / Tables**

Texts, pictures and tables are named within a chapter with the chapter number and an additional index and, if necessary, a brief accompanying text.

1.3.2 Explanation of symbols



Safety warnings

Text passages with a STOP symbol contain important warnings which must be heeded under all circumstances. Failure to heed these warnings may place the controller in a state which no longer provides adequate protection for man and/or machine. Please read through such text sections with particular care.



Warnings

A CAUTION sign gives you important information and warnings which guarantee the trouble-free operation of the PROTECT-PSC Universal-Gateway. Failure to heed these warnings does not restrict the safe operation of the PROTECT-PSC.



Information

This symbol indicates useful information intended to facilitate the commissioning/servicing of the PROTECT-PSC Universal-Gateway or to provide a deeper insight into the mode of operation of the gateway.

Cross-references

x.x.x / x-xx



This symbol refers to other text passages within the document which contain additional information. The first digit describes the chapter and the second the page within the chapter.

Additional information

x.x.x / xx



This symbol refers to external literature that contains additional information on a specific topic. You will find the exact title of the additional information in the Annex (Chapter 6.3) using the number next to the symbol.

1.4 Product Description

The PROTECT-PSC Universal-Gateway is an additional module to the PROTECT-PSC safety compact controller to facilitate the non safety-oriented data exchange via a standard field bus with other control and operating units. Using this module an adjustable number of I/O data can be transferred in both directions.

1.5 Mode of Operation

1.5.1 Hardware

The PROTECT-PSC Universal-Gateway has two interfaces. The first creates the connection to the safety compact controller PROTECT-PSC and the second is the standard field bus adapter (see further below).

Adjustments are made using DIP switches which are accessible on the front side.

There are also 2 bicolour LEDs which signalise operating status and errors.

1.5.2 Software

The programmer describes or reads EL flags in his PROTECT-PSC user program, the values/status of which are transferred via the PROTECT-PSC Universal-Gateway via the standard field bus to other bus participants and vice versa.

The gateway appears as so-called slave at the standard field bus. The participant address and a few bus settings may be set using the DIP switches on the front side depending on bus type.

1.6 Safety Function

No safety functions may be realised using the PROTECT-PSC Universal-Gateway because a transmission of safety-oriented data by a standard field bus does not satisfy the requirements placed on a safety field bus.

2 Important Information

This chapter contains important warnings and information for the safe and correct use of the PROTECT-PSC Universal-Gateway.

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2.1 Safety Warnings

Graded safety warnings

Safety warnings are marked in this Instruction Manual by a symbol and the keyword CAUTION or WARNING in the margin of the page. The safety warnings are printed in bold type and in a box.

2.1.1 Definitions



Safety warnings

Text passages with a STOP symbol contain important warnings which must be heeded under all circumstances. Failure to heed these warnings may place the controller in a state which no longer provides adequate protection for man and/or machine. Please read through such text sections with particular care.



Warnings

A CAUTION sign gives you important information and warnings which guarantee the trouble-free operation of the PROTECT-PSC Universal-Gateway. Failure to heed these warnings does not restrict the safe operation of the PROTECT-PSC.

2.1.2 Danger through Misuse



The consequences of incorrect use (see Chapter 2.1.9 and 2.2) may be personal injury to the user or third parties as well as damage to the controller, the product or environmental damage. Only use the PROTECT-PSC Universal-Gateway for its intended purpose!

2.1.3 Dangers from Modification and Retrofitting



The PROTECT-PSC Universal-Gateway has been designed and constructed by us to operate safely.

It is not therefore permitted to make modifications or to retrofit the equipment.

This may affect the correct operation of the PROTECT-PSC Universal-Gateway with the consequence of personal injury, property or environmental damage and loss of any liability.

2.1.4 Authorised Persons

Only sufficiently qualified and instructed persons may operate the PROTECT-PSC Universal-Gateway!

The user software may only be handled and modified by authorised and instructed persons (programmers)!

An electrical technician must perform commissioning!

Only qualified personnel may perform service, maintenance, troubleshooting and error correction work!

Operator

An operator is a duly instructed person.

The operator switches the system on and off.

The operator is the actual beneficiary of the safety function.

Programmer

The programmer is a specially authorised and instructed person.

The programmer

- creates or
- modifies

the user programs

Commissioner

The commissioner is an electrical technician.

The commissioner

- performs commissioning under increased safety measures,
- sets the device parameters and
- performs the requisite tests.

Maintenance technician

The maintenance technician is a qualified skilled worker. He

- services the electrical and mechanical components of the controller,
- performs maintenance work, and
- looks for errors and eliminates them.

2.1.5 Electrical Connections

The PROTECT-PSC Universal-Gateway must be connected to an electrical power supply.



CAUTION: electrical voltage

An electrician must connect the system to the mains.

The power supply (24 VDC) of the PROTECT-PSC Universal-Gateway and all components electrically connected to the gateway must satisfy DIN EN 61000-6-2 and one of the following requirements:

- Safety mains transformer to DIN EN 61558/VDE 0570 Part 2-6: "Special Requirements Placed on Safety Transformers for General Applications (IEC 61558-2-6:1997)"

- Switching mains pack according to DIN EN 60950-1: "Equipment of Information Technology Safety" and in accordance with DIN EN 50178: "Equipment of Heavy Current Equipment with Electronic Resources". Furthermore the power pack must be suitable to supply SELV power circuits in accordance with DIN EN 60950-1.

The mains must be appropriately fused!

The information in Chapters 3 to 5 must be taken into consideration in particular for the operation of the PROTECT-PSC Universal-Gateway.

6.1.2 / 6-2



The PROTECT-PSC Universal-Gateway satisfies the pertinent provisions of the EMC Directive.

2.1.6 Shock-Hazard Protection



The PROTECT-PSC Universal-Gateway is intended for use in control circuits to DIN EN 60204 for a rated voltage of 24 VDC. The appropriate requirements placed on shock hazard protection must be satisfied for the applications.

For reasons of shock hazard protection, all connections must be assigned to the appropriate mating connectors.

2.1.7 Maintenance



Maintenance work

Incorrect maintenance could lead to death, injury, damage or environmental damage. Only qualified persons may perform maintenance, troubleshooting and error elimination work! Switch off the power supply to the PROTECT-PSC Universal-Gateway! Directly after completing maintenance work replace all protective cladding and safety equipment and check that they function correctly!



Spare parts

The use of unsuitable spare parts could lead to death, injury, damage or environmental damage. Spare parts must comply with the technical requirements of the manufacturer. Only use original ELAN spare parts!

2.1.8 Disposal

Electrical waste (components, screens etc.) can damage the environment. Dispose of electrical resources correctly or commission a specialised company to do so!

2.1.9 Liability

The contents of the following Instruction Manual are subject to technical modification which may arise particularly due to constant development of the products from ELAN. ELAN assumes no liability for any printing errors or any other inaccuracies which may be contained in this Instruction Manual unless these are serious faults which ELAN demonstrably already knew about. The applicable national and international standards and provisions must be observed under all circumstances in addition to the instructions contained in the Instruction Manual.

**NB****Incorrect use/liability exclusion**

ELAN shall not be liable for damage caused through incorrect use or application of the products.

The exact knowledge of the contents of this Instruction Manual is similarly viewed to be correct use. In particular, the information and safety warnings contained in this Instruction Manual must be heeded.

If products are used in connection with other components such as safety modules, controllers or sensors, the respective user information must be heeded.

2.2 Correct Use

2.2.1 Application

The PROTECT-PSC Universal-Gateway is an additional module in order to transport exclusively non safety-oriented information of the PROTECT-PSC safety compact controller from and to a standard field bus.



Design, implementation and operating errors may affect the correct operation of the PROTECT-PSC Universal-Gateway, resulting in injury, damage or environmental damage. This is why only sufficiently qualified persons may operate the PROTECT-PSC Universal-Gateway!

The PROTECT-PSC Universal-Gateway is exclusively intended for use in machines within the scope of DIN EN 60204-1 (Electrical Equipment of Machinery).



Additional requirements arising from other provisions and regulations are not necessarily satisfied by the PROTECT-PSC Universal-Gateway.

The PROTECT-PSC Universal-Gateway may not be used in potentially explosive areas.

2.2.2 Categories, Prototype Tests etc.

- Not applicable –

3 System Description

This chapter describes the individual components of the PROTECT-PSC Universal-Gateway.

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3.1 Overview

3.1.1 Product Range

Component	Name	Description
Gateway	- PROTECT-PSC-UNI-GATEWAY PROFIBUS DP V1	Article No.: 1209346
	- PROTECT-PSC-UNI-GATEWAY DEVICENET	Article No.: 1209347
	- PROTECT-PSC-UNI-GATEWAY CANOPEN	Article No.: 1209350
	- PROTECT-PSC-UNI-GATEWAY MODBUS RTU	Article No.: 1209349
	- PROTECT-PSC-UNI-GATEWAY MODBUS TCP	Article No.: on request
	- PROTECT-PSC-UNI-GATEWAY PROFINET IO	Article No.: 1209352
	- PROTECT-PSC-UNI-GATEWAY ETHERNET IP	Article No.: 1209353
	- PROTECT-PSC-UNI-GATEWAY ETHERCAT	Article No.: 1209351
	- PROTECT-PSC-UNI-GATEWAY CC-LINK	Article No.: 1209348
Power connection	Phoenix FRONT-MSTB 2,5/ 3-ST-5,08	
Communication connection	Phoenix FRONT-MSTB 2,5/ 4-ST-5,08	
SN-I/F communication cable	Part of scope of delivery	Communication cable between PROTECT-PSC safety compact controller and PROTECT-PSC Universal-Gateway

Table 3-1 Product Range

Information on the individual modules can be found in the following chapters.

3.1.2 Module Structure

The module has a plastic housing made of PPE. It has an installed width of 45mm. There is a slot on the back for mechanical fixing. The front area is subdivided into a display area, a connection area and an operating area.

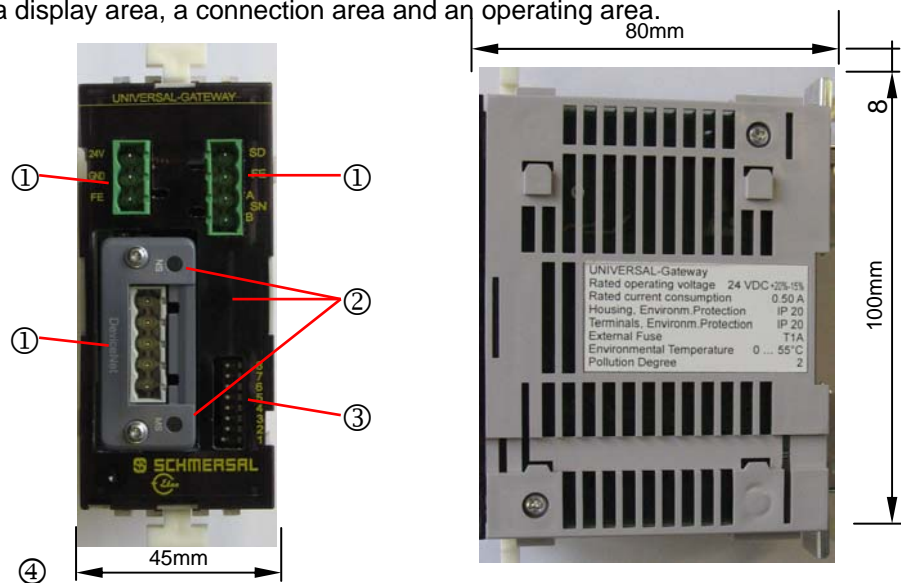


Figure 3-1 Basic module structure

- ① **Connection area:**
 - Standard field bus adapter (bus coupler)
 - Power supply
 - SN-I/F (PROTECT-PSC)
- ② **Display area for:**
 - error messages
 - communication
- ③ **Operating area for:**
 - DIP switch address setting etc.
- ④ **Module width**
 - 45mm

3.2 Power Supply

3.2.1 General Description

The supply voltage for the PROTECT-PSC Universal-Gateway is 24 volt DC.

3.2.2 Technical Data

Position	Description
Name	PROTECT-PSC Universal-Gateway
Supply voltage	24 Volt DC +20 % -15%
Power consumption	0.5 A
Wattage	max. 12 W
Fusing	external slow glow fuse 0.5A
Dimensions / weight	30×100×80 (B/H/D) / 280g

Table 3-2 Technical data of the gateway module

3.2.3 External Power Supply Units

2.1.5 / 2-3



The power supply units used for power supply must comply with the requirements of DIN EN 61000-6-2 and the requirements set out in chapter 2.1.5.

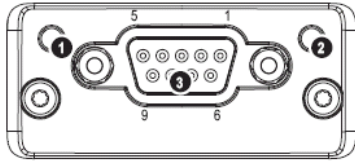
3.3 Connection of a Standard Field Bus Adapter (Bus Coupler)

The standard field bus adapter (bus coupler) provides the physical connection to the respective standard field buses. The connection is made typically via a network-specific plug and cable.

3.3.1 PROFIBUS DP V1

Front View

#	Item
1	Operation Mode
2	Status
3	PROFIBUS Connector



Operation Mode

State	Indication	Comments
Off	Not online / No power	-
Green	On-line, data exchange	-
Flashing Green	On-line, clear	-
Flashing Red (1 flash)	Parametrization error	See 2-7 "Parametrization Data Handling"
Flashing Red (2 flashes)	PROFIBUS Configuration error	See 2-8 "Configuration Data Handling"

Status

State	Indication	Comments
Off	No power or not initialised	Anybus state = 'SETUP' or 'NW_INIT'
Green	Initialised	Anybus module has left the 'NW_INIT' state
Flashing Green	Initialised, diagnostic event(s) present	Extended diagnostic bit is set
Red	Exception error	Anybus state = 'EXCEPTION'

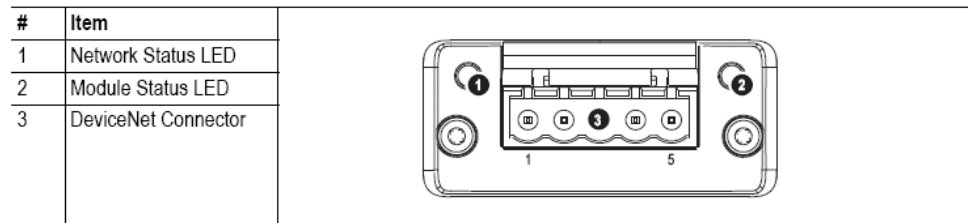
PROFIBUS Connector (DB9F)

Pin	Signal	Description
1	-	-
2	-	-
3	B Line	Positive RxD/TxD, RS485 level
4	RTS	Request to send
5	GND Bus	ground (isolated)
6	+5V Bus Output ^a	+5V termination power (isolated, short-circuit protected)
7	-	-
8	A Line	Negative RxD/TxD, RS485 level
9	-	-
Housing	Cable Shield	Internally connected to the Anybus protective earth via cable shield filters according to the PROFIBUS standard.

Figure 3-2 Front view bus coupler PROFIBUS DP V1

3.3.2 DeviceNet

Front View



Network Status

State	Indication
Off	Not online / No power
Green	On-line, one or more connections are established
Flashing Green (1 Hz)	On-line, no connections established
Red	Critical link failure
Flashing Red (1 Hz)	One or more connections timed-out
Alternating Red/Green	Self test

Module Status

State	Indication
Off	No power
Green	Operating in normal condition
Flashing Green (1 Hz)	Missing or incomplete configuration, device needs commissioning
Red	Unrecoverable Fault(s)
Flashing Red (1 Hz)	Recoverable Fault(s)
Alternating Red/Green	Self test

DeviceNet Connector

This connector provides DeviceNet connectivity.

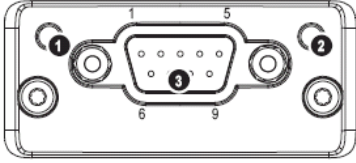
Pin	Signal	Description
1	V-	Negative bus supply voltage ^a
2	CAN_L	CAN low bus line
3	SHIELD	Cable shield
4	CAN_H	CAN high bus line
5	V+	Positive bus supply voltage ^a

Figure 3-3 Front view bus coupler DeviceNet

3.3.3 CANopen

Front View

#	Item
1	RUN LED ^a
2	ERROR LED ^a
3	CANopen Interface



a. The flash sequences for these LEDs are defined in DR303-3 (CiA).

RUN LED

LED State	Indication	Description
Off	-	No power.
Green	OPERATIONAL	The module is in the 'operational' state.
Green, blinking	PRE-OPERATIONAL	The module is in the 'pre-operational' state.
Green, single flash	STOPPED	The module is in the 'stopped' state.
Green, flickering	Autobaud	Baudrate detection in progress.
Red ^a	EXCEPTION state (Fatal Event)	The module has shifted into the EXCEPTION state.

a. If both LEDs turns red, this indicates a fatal event; the bus interface is shifted into a physically passive state.

ERROR LED

LED State	Indication	Description
Off	-	No power - or - device is in working condition.
Red, single flash	Warning limit reached	A bus error counter reached or exceeded its warning level.
Red, flickering	LSS	LSS services in progress.
Red, double flash	Error Control Event	A guard- (NMT-Slave or NMT-master) or heartbeat event (Heartbeat consumer) has occurred.
Red ^a	Bus off (Fatal Event)	Bus off.

a. If both LEDs turns red, this indicates a fatal event; the bus interface is shifted into a physically passive state.

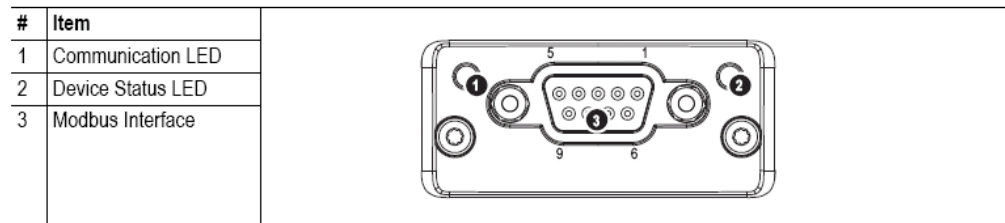
CANopen Interface

Pin	Signal	Comments
1	-	-
2	CAN_L	-
3	CAN_GND	-
4	-	-
5	CAN_SHLD	-
6	-	-
7	CAN_H	-
8	-	-
9	-	-
Housing	CAN_SHIELD	-

Figure 3-4 Front view bus coupler CANopen

3.3.4 Modbus RTU

Front View



Communication LED

LED State	Description
Off	No power - or - no traffic
Yellow	Frame reception or transmission
Red	A fatal error has occurred

Device Status LED

LED State	Description
Off	Initialising - or - no power
Green	Module initialised, no error
Red	Internal error - or - major unrecoverable fault
Red, single flash	Communication fault or configuration error Case 1: Invalid settings in Network Configuration Object. Case 2: Settings in Network Configuration Object has been changed during runtime (i.e. the settings does not match the currently used configuration)
Red, double flash	Application diagnostics available

Modbus Interface

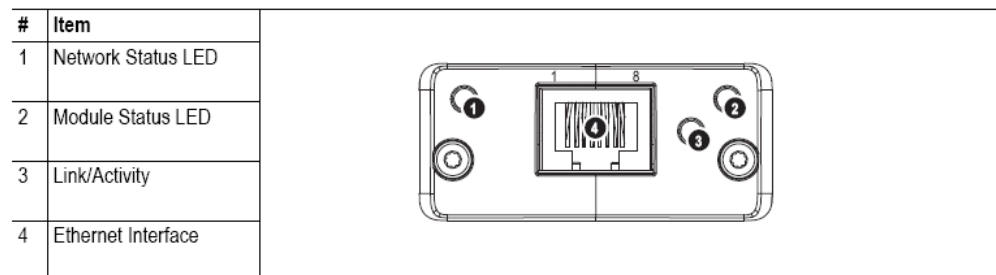
The Modbus interface is galvanically isolated, and provides both RS-232 and RS-485.

Pin	Direction	Signal	Comment
Housing	-	PE	Protective Earth
1	-	GND	Bus polarisation, ground (isolated)
2	Output ^a	5V	Bus polarisation power +5V DC (isolated)
3	Input	PMC	Connect to pin #2 for RS-232 operation. Leave unconnected for RS-485 operation.
4	-	-	-
5	Bidirectional	B-Line	RS-485 B-Line
6	-	-	-
7	Input	Rx	RS-232 Data Receive
8	Output	Tx	RS-232 Data Transmit
9	Bidirectional	A-Line	RS-485 A-Line

Figure 3-5 Front view bus coupler Modbus RTU

3.3.5 Modbus TCP

Front View



Network Status LED

Note: A test sequence is performed on this LED during startup.

LED State	Description
Off	No power or no IP address
Green	Module is in Process Active or Idle state
Green, flashing	Waiting for connections
Red	Duplicate IP address, or FATAL event
Red, flashing	Process Active Timeout.

Module Status LED

Note: A test sequence is performed on this LED during startup.

LED State	Description
Off	No power
Green	Normal operation
Red	Major fault; module is in state EXCEPTION (or FATAL event)
Red, flashing	Minor fault; the present IP settings differs from the settings in the net.cfg.ob

LINK/Activity LED

LED State	Description
Off	No link, no activity
Green	Link established
Green, flickering	Activity

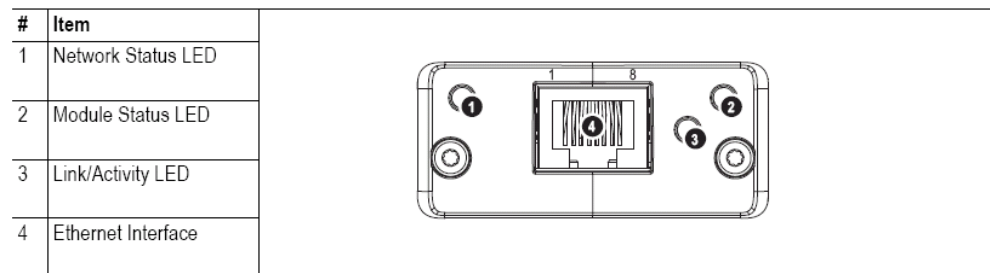
Ethernet Interface

The ethernet interface supports 10/100Mbit, full or half duplex operation.

Figure 3-6 Front view bus coupler Modbus TCP

3.3.6 PROFINET IO

Front View



Network Status LED

Note: A test sequence is performed on this LED during startup.

LED State	Description	Comments
Off	Offline	- No power - No connection with IO Controller
Green	Online (RUN)	- Connection with IO Controller established - IO Controller in RUN state
Green, flashing	Online (STOP)	- Connection with IO Controller established - IO Controller in STOP state

Module Status LED

Note: A test sequence is performed on this LED during startup.

LED State	Description	Comments
Off	Not Initialized	No power - or - Module in 'SETUP' or 'NW_INIT' state
Green	Normal Operation	Module has shifted from the 'NW_INIT' state
Green, 1 flash	Diagnostic Event(s)	Diagnostic event(s) present
Green, 2 flashes	Blink	Used by engineering tools to identify the node on the network
Red	Exception Error	Module in state 'EXCEPTION'
Red, 1 flash	Configuration Error	Expected Identification differs from Real Identification
Red, 2 flashes	IP Address Error	IP address not set
Red, 3 flashes	Station Name Error	Station Name not set
Red, 4 flashes	Internal Error	Module has encountered a major internal error

LINK/Activity LED

LED State	Description	Comments
Off	No Link	No link, no communication present
Green	Link	Ethernet link established, no communication present
Green, flickering	Activity	Ethernet link established, communication present

Ethernet Interface

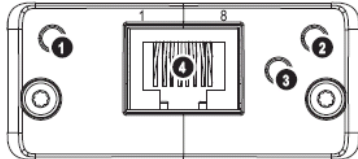
The ethernet interface operates at 100Mbit, full duplex, as required by PROFINET.

Figure 3-7 Front view bus coupler PROFINET IO

3.3.7 EtherNet / IP

Front View

#	Item
1	Network Status LED
2	Module Status LED
3	Link/Activity
4	Ethernet Interface



Network Status LED

Note: A test sequence is performed on this LED during startup.

LED State	Description
Off	No power or no IP address
Green	On-line, one or more connections established (CIP Class 1 or 3)
Green, flashing	On-line, no connections established
Red	Duplicate IP address, FATAL error
Red, flashing	One or more connections timed out (CIP Class 1 or 3)

Module Status LED

Note: A test sequence is performed on this LED during startup.

LED State	Description
Off	No power
Green	Controlled by a Scanner in Run state
Green, flashing	Not configured, or Scanner in Idle state
Red	Major fault (EXCEPTION-state, FATAL error etc.)
Red, flashing	Recoverable fault(s)

LINK/Activity LED

LED State	Description
Off	No link, no activity
Green	Link established
Green, flickering	Activity

Ethernet Interface

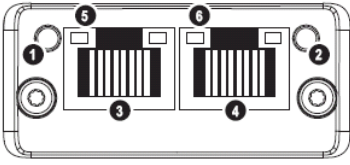
The ethernet interface supports 10/100Mbit, full or half duplex operation.

Figure 3-8 Front view bus coupler EtherNet / IP

3.3.8 EtherCAT

Front View

#	Item
1	RUN LED ^a
2	ERROR LED ^a
3	EtherCAT (port 1)
4	EtherCAT (port 2)
5	Link/Activity (port 1)
6	Link/Activity (port 2)



a. The flash sequences for these LEDs are defined in DR303-3 (CiA).

RUN LED

This LED reflects the status of the CoE (CANopen over EtherCAT) communication.

LED State	Indication	Description
Off	INIT	CoE device in 'INIT'-state (or no power)
Green	OPERATIONAL	CoE device in 'OPERATIONAL'-state
Green, blinking	PRE-OPERATIONAL	CoE device in 'PRE-OPERATIONAL'-state
Green, single flash	SAFE-OPERATIONAL	CoE device in 'SAFE-OPERATIONAL'-state
Red ^a	EXCEPTON state (Fatal Event)	-

a. If RUN and ERR turns red, this indicates a fatal event, forcing the bus interface to a physically passive state. Contact HMS technical support.

ERR LED

This LED indicates EtherCAT communication errors etc.

LED State	Indication	Description
Off	No error	No error (or no power)
Red, blinking	Invalid configuration	State change received from master is not possible due to invalid register or object settings.
Red, single flash	Unsolicited state change	Slave device application has changed the EtherCAT state autonomously; parameter 'Change' in the AL status register is set to 01h (change/error).
Red, double flash	Application watchdog timeout	Sync manager watchdog timeout
Red ^a	PDI watchdog timeout	Anybus module in EXCEPTION

a. If RUN and ERR turns red, this indicates a fatal event, forcing the bus interface to a physically passive state. Contact HMS technical support.

Link/Activity

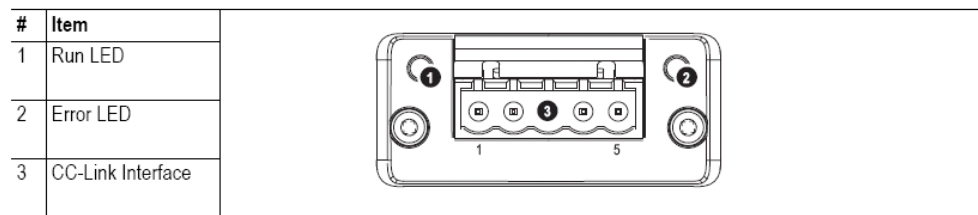
These LEDs indicate the EtherCAT link status and activity.

LED State	Indication	Description
Off	No link	Link not sensed (or no power)
Green	Link sensed, no activity	Link sensed, no traffic detected
Green, flickering	Link sensed, activity detected	Link sensed, traffic detected

Figure 3-9 Front view bus coupler EtherCAT

3.3.9 CC-Link

Front View



Run LED

State	Meaning
Off	- No network participation, timeout status (no power)
Green	- Participating, normal operation
Red	- Major fault (FATAL error)

Error LED

State	Meaning
Off	- No error detected (no power)
Red	- Major fault (Exception or FATAL event)
Red, flickering	- CRC error (temporary flickering)
Red, flashing	- Station Number or Baud rate has changed since startup (flashing)

CC-Link Interface

Pin	Signal	Comment
1	DA	Positive RS485 RxD/TxD
2	DB	Negative RS485 RxD/TxD
3	DG	Signal Ground
4	SLD	Cable Shield
5	FG	Protective Earth

Figure 3-10 Front view bus coupler CC-Link

3.4 Connection of Power Supply


+24 Volt power supply	
GND earth supply	
Functional earth	

Figure 3-11 Front view plug power supply

3.5 Connection SN-I/F (PROTECT-PSC)


N.A. (SD-Bus)	
Functional earth; shielding	
On Protect PSC – A (SN-I/F)	
On Protect PSC – B (SN-I/F)	

Figure 3-12 Front view plug SN-I/F (PROTECT-PSC)

3.6 Displays / Display Area

Displays are provided via LEDs. These are located in the areas marked red in Figure 3-13.

Bus coupler LEDs

The 2 or 3 LEDs on the bus coupler show the status of the standard field bus connection. Details on the different standard field buses are provided in chapter 3.3.

Status LEDs

The 2 Status-LEDs display the status of the most important functions of the PROTECT-PSC Universal-Gateway. These are the state of operating and error of the gateway.

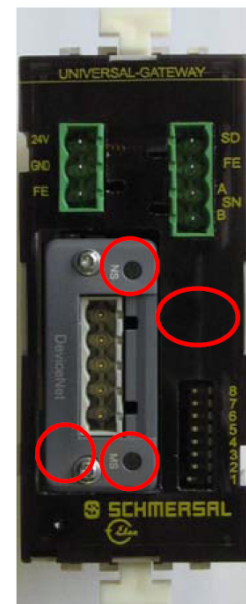


Figure 3-13 Displays of the gateway

Name	Colour	Description
Normal operation	Green/red/yellow	LED displays of the bus couplers are copied because these may be concealed by bus plugs
Top LED flashes	Red	Communication to PROTECT-PSC has failed
Bottom LED flashes	Red	Communication to the bus coupler has not started. Is shown after switching on and during configuration changes.

Table 3-3 States of the status LEDs

3.7 Operating Elements / Operating Area

3.7.1 DIP Switches

The DIP switch strip is located on the bottom right of the device. If the top switch (8) is in the ON position, the DIP switches (1-7) are used for address setting. If the top (8) switch is in the OFF position, the DIP switches (1-7) are used for bus setting. The standard field bus settings are independent of the bus coupler module used and may therefore also be used without function in part.

All settings are stored in the internal flash memory and therefore remain after switching off.

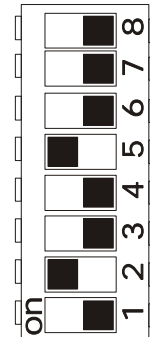


Figure 3-14
DIP switches

3.7.2 Operation

First bring the DIP switch (8) to the required position so as then to use DIP switches (1-7) to set the address or I/O & bus position.

DIP switch 8	Meaning
ON	Setting of the bus address
OFF	Setting of the transferred I/Os Setting of bus speed, data format

Table 3-4 DIP switch (8)

The DIP switches (1-7) may be brought to the required combination in any order. *10 seconds after last altering the switch positions* the current settings are stored in the flash and the gateway conducts a *warm start*. This causes the standard field bus connection to first be separated and then restarted with the new settings.

If the *DIP switch (8) is in the ON position*, the bus address (if one can/must be set) results directly from the binary code of the DIP switches (1-7), whereby switch (7) assumes the highest value.

DIP switch	1	2	3	4	5	6	7
Address value	1	2	4	8	16	32	64

Table 3-5 DIP switches (1-7) – setting of the bus address



Information: in the case of Modbus RTU the address set with the DIP switches must be multiplied by 2 to achieve the effective address.

Information: depending on bus type certain addresses may be forbidden/reserved. These may not then be used as slave address to avoid faults.

If the *DIP switch (8)* is in the *OFF* position the *DIP switches 1-2* are used for the number of transferred I/Os.

Switch DIP switches 2..1	combination	Meaning
0 0		8 bytes 4 words (16bit) 64 bit
0 1		16 bytes 8 words (16bit) 128 bit
1 0		32 bytes 16 words (16bit) 256 bit
1 1		64 bytes 32 words (16bit) 512 bit

Table 3-6 DIP switches (1-2) – number of I/Os to be transferred



Information:

The data volume stated applies to both transmission directions. The *INPUT* and *OUTPUT* areas are to be understood from the point of view of an external system. The *INPUT area is the input area (input data)*; the *OUTPUT area is the output area (output data)* of the external system.

The status of the PROTECT-PSC is transferred in the last byte of the *INPUT* area.

Meaning of the bits in the status of the PROTECT-PSC:

Bit	Value	Meaning
0	0x01; 1	Communication between Protect PSC CPU and gateway 1=OK, 0=interrupted
1	0x02; 2	Protect PSC RUN-Status 1=program running, 0=no program running
2	0x04; 4	Slight error
3	0x08; 8	Serious error
4	0x10; 16	Alarm
5-7	0x20,0x40,0x80; 32,64,128	Status

Table 3-7 Status bits of the PROTECT-PSC

Furthermore the *DIP switches 3-7* are used to set the transmission parameters if the *DIP switch (8)* is in the *OFF* position.

DIP switch 7..3	Profibus	DeviceNet	CANopen	Modbus RTU	Modbus TCP	ProfiNet IO	Ethernet IP	EtherCat	CC-Link
00000	-	125k	10k	2400, 8E1	-	-	-	-	156k
00001	-	250k	20k	2400, 8O1	-	-	-	-	625k
00010	-	500k	???	2400, 8N2	-	-	-	-	2.5M
00011	-	Autobaud	100k	2400, 8N1	-	-	-	-	5M
00100	-	-	125k	4800, 8E1	-	-	-	-	10M
00101	-	-	250k	4800, 8O1	-	-	-	-	-
00110	-	-	500k	4800, 8N2	-	-	-	-	-
00111	-	-	800k	4800, 8N1	-	-	-	-	-
01000	-	-	1M	9600, 8E1	-	-	-	-	-
01001	-	-	Autobaud	9600, 8O1	-	-	-	-	-
01010	-	-	-	9600, 8N2	-	-	-	-	-
01011	-	-	-	9600, 8N1	-	-	-	-	-
01100	-	-	-	19200, 8E1	-	-	-	-	-
01101	-	-	-	19200, 8O1	-	-	-	-	-
01110	-	-	-	19200, 8N2	-	-	-	-	-
01111	-	-	-	19200, 8N1	-	-	-	-	-
10000	-	-	-	38400, 8E1	-	-	-	-	-
10001	-	-	-	38400, 8O1	-	-	-	-	-
10010	-	-	-	38400, 8N2	-	-	-	-	-
10011	-	-	-	38400, 8N1	-	-	-	-	-
10100	-	-	-	57600, 8E1	-	-	-	-	-
10101	-	-	-	57600, 8O1	-	-	-	-	-
10110	-	-	-	57600, 8N2	-	-	-	-	-
10111	-	-	-	57600, 8N1	-	-	-	-	-
11000	-	-	-	76800, 8E1	-	-	-	-	-
11001	-	-	-	76800, 8O1	-	-	-	-	-
11010	-	-	-	76800, 8N2	-	-	-	-	-
11011	-	-	-	76800, 8N1	-	-	-	-	-
11100	-	-	-	115.2k, 8E1	-	-	-	-	-
11101	-	-	-	115.2k, 8O1	-	-	-	-	-
11110	-	-	-	115.2k, 8N2	-	-	-	-	-
11111	-	-	-	115.2k, 8N1	-	-	-	-	-
	*1				*1	*1	*1	*1	

*1 Automatically set; the DIP switches have no effect

Table 3-8 DIP switches (3-7) – transmission parameters


4 Installation / Project Planning

This chapter contains the description of the assembly and wiring of the PROTECT-PSC Universal-Gateway.

4.1	Assembly	4-2
4.1.1	Ambient Conditions	4-2
4.1.2	Assembly of the Safety Compact Controller PROTECT-PSC	4-2
4.1.3	Assembly / Dismantling of the Gateway	4-4
4.2	Wiring	4-6
4.2.1	General Information on Wiring	4-6
4.2.2	Fusing	4-6
4.2.3	Connection to PROTECT PSC	4-7

4.1 Assembly

4.1.1 Ambient Conditions

Fehler! Verweisquelle konnte nicht gefunden werden. / Fehler! Textmarke nicht definiert.  The following ambient conditions must be observed for the perfect operation of the PROTECT-PSC Universal-Gateway. Complete information is contained in chapter 6.1.1.

Position	Description
Temperature range	0 to 55°C
Air humidity	30 to 85 % RH
Air pressure	86 kPa to 106 kPa
Degree of pollution	2 to DIN EN 50178 (VDE 0160)
Place of installation	Earthed, lockable metal switch cabinet with degree of protection IP 54 minimum

Table 4-1 Admissible ambient conditions

4.1.2 Assembly of the Safety Compact Controller PROTECT-PSC

Installation position

In order to guarantee sufficient ventilation and comfortable assembly/dismantling of the individual modules, please leave a free space of at least 50mm above and beneath the system. A distance of 50mm must similarly be maintained to the left, right and to the front. The unit must installed exclusively as shown below (horizontally suspended).

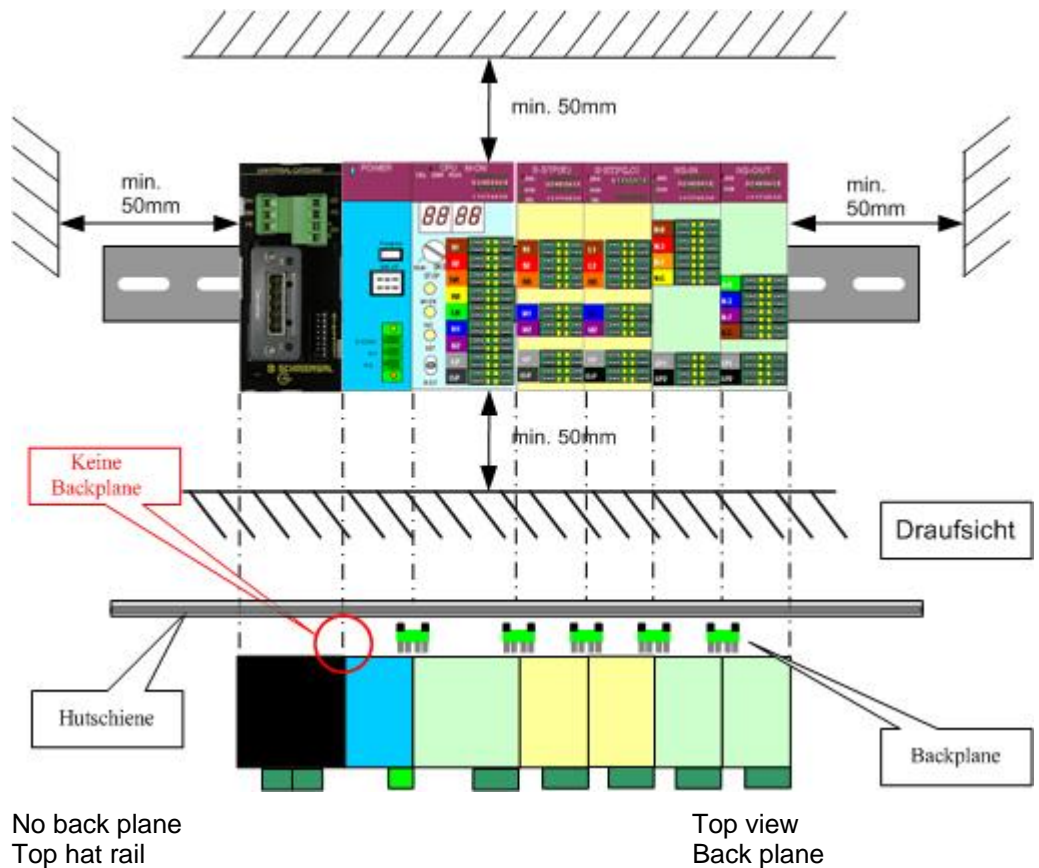


Figure 4-1 Installed position and position of the PROTECT-PSC Universal-Gateway

Installation Site

Select an installation site that is located as far away as possible from the power level and other interfering radiation and heat sources of the switch cabinet.

4.1.3 Assembly / Dismantling of the Gateway



Assembly / dismantling work may only be performed in a de-energised state.

Assembly

The module shown in the following figures is representative of the PROTECT-PSC Universal-Gateway.

1. It is recommended to install the gateway on the left next to the PROTECT-PSC System. The supplied SN-I/F communication cable is intended for this purpose.
2. Attach an earthed DIN top hat rail with a maximum distance between the bore holes of 10 cm. The two white interlocks must be pulled out for attachment of the module to the top hat rail.



Figure 4-2 Assembly of a module (1/3)

3. Then press the module carefully against the top hat rail until a click is heard. Ensure that the module has been inserted into the side guide groove of the adjacent module.

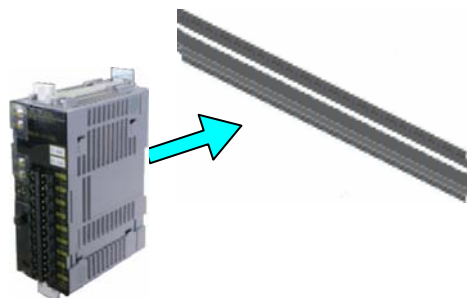


Figure 4-3 Assembly of a module (2/3)

4. Check that the module is fitted correctly and push back the interlocks.



Figure 4-4 Assembly of a module (3/3)

5. After assembly of all modules the system must be secured on both sides using fixing clamps or comparable measures.

Dismantling

Pull out the two interlocks before removing the module. Then carefully pull the module from the side guide grooves to the front.



Figure 4-5 Dismantling of a module

4.2 Wiring

4.2.1 General Information on Wiring

This chapter contains important information on wiring of the PROTECT-PSC Universal-Gateway which must be followed for safe and trouble-free operation.



The electrical equipment must be wired in agreement with IEC 60439-1, 7.8.3.
The maximum admissible suspended length of the cables is 30cm.

Power supply

2.1.5 / 2-3



The power supply units used for the power supply must satisfy the requirements set out in Chapter 2.1.5.



The maximum cable length between the power supply units and the PROTECT-PSC Universal-Gateway may not exceed 15m.

Power supply cables



Ensure that power supply cables are at least 50mm away from the modules.

Connector strips

Connector strip			Recommended cable cross-section
Supply	3 pole	Phoenix FRONT-MSTB 2.5/ 3-ST-5,08	For all connecting cables (apart from earth) 0.75 mm ²
Communication	4 pole	Phoenix FRONT-MSTB 2.5/ 4-ST-5,08	

Table 4-2 Connector strips used for the modules



For reasons of shock hazard protection all connections must be fitted with the appropriate mating plugs.

Internal fusing

The gateway has internal fusing. After destruction of the internal fuse the module no longer functions. The fuse cannot be replaced.

4.2.2 Fusing

An external pre-fuse of 0.5 A slow-blowing must be incorporated in the supply lines.

4.2.3 Connection to PROTECT PSC

General

The communication line (SN-I/F) for the gateway must satisfy the following requirements:

- Cross-section minimum 0.25 mm²
- Stranded in pairs (>3 transpositions per metre)
- Shield of copper wire with at least 80% coverage
- Wave resistance 100 - 180 Ohm

For example, cable of the type UL 2464-2SB.

3.5 / 3-14



Ensure that terminals A and B are correctly poled when connecting. The shield must be applied to terminal FE of the PROTECT-PSC Universal-Gateway. If A/B are confused, no communication will come about and the top LED will flash red permanently.



The maximum cable length of the SN-I/F line may not exceed 3m. If present, the SN-I/F communication cable enclosed with the gateway must be used.

SN-I/F communication cable

Connect the PROTECT-PSC Universal-Gateway to the power module using the SN-I/F communication cable (Figure 4-6) as shown in Figure 4-7.



Figure 4-6 SN-I/F communication cable



Figure 4-7 Connection of the Universal-Gateway to the power module

5 Programming / Parameter Assignment

This chapter contains the description of the memory mapping and of the configuration of the PROTECT-PSC Universal-Gateway in the target system.

5.1	Overview	5-2
5.2	Memory Mapping in the PROTECT-PSC	5-2
5.3	Memory Mapping in External Systems	5-2
5.4	Configuration of the PROTECT-PSC Universal-Gateway in the Target System	5-4
5.4.1	PROFIBUS DP V1	5-4
5.4.2	DeviceNet	5-5
5.4.3	CANopen	5-5
5.4.4	Modbus RTU	5-5
5.4.5	Modbus TCP	5-5
5.4.6	PROFINET IO	5-5
5.4.7	Ethernet / IP	5-5
5.4.8	EtherCAT	5-5
5.4.9	CC-Link	5-6

5.1 Overview

PROTECT-PSCsw will provide assistance in the programming of the non safety-oriented data exchange via a standard field bus with other control and operating units.

Irrespective of the realisation of data exchange in the user program, the standard field bus parameters described in chapter 3.7.2 must be set corresponding to the bus coupler module used.

The actual data exchange in the PROTECT-PSC user program is performed by *writing* and *reading* of the “EL” communication flag (see chapter 5.2 below). The *writing* and *reading* is generated in the *graphic programming language* “Contact Plan” by using coil and NO/NC contacts.

5.2 Memory Mapping in the PROTECT-PSC

Data exchange takes place via the “EL” memory area (“EL” communication flag) of the PROTECT-PSC. It occupies the following addresses.

The assignment of the “EL” memory area is divided as follows:

Direction	Bit address	Word address	Data access in the PROTECT-PSC
Gateway ← CPU	EL 000 - 0FF	EL 00 - 0F	Writing / coil
Gateway → CPU	EL 100 - 1FF	EL 10 - 1F	Reading / NO/NC
Gateway ← CPU	EL 200 - 2FF	EL 20 - 2F	Writing / coil
Gateway → CPU	EL 300 - 3FF	EL 30 - 3F	Reading / NO/NC

Table 5-1 Assignment of the “EL” memory area

The entire EL memory area is divided into 2 blocks each of 256 bit / 16 words for reading and writing.

Access from the PROTECT-PSC user program is currently only possible via bit addresses.



The delay time of the PROTECT-PSC Universal-Gateway for the transmission of the “EL” data area is 47.8ms.

5.3 Memory Mapping in External Systems

Convince yourself how the communication sequence must be implemented for the target system used. You will usually find detailed information for your target system in the instruction manual.

It is assumed that you are familiar with the communication process.

In principle a corresponding address in the connected external system must be assigned to every address in the PROTECT-PSC.

The blocks of 256 bit / 16 words of the “EL” memory area separated by addresses are shown contiguously in the target system, i.e. the “EL 000 – EL 0FF” and “EL 200 – EL 2FF” is a contiguous block in the target system of 512 bit or 64 byte or 32 double words.

Depending on the standard field bus used, the following aspects must be observed for functioning communication and correct mapping:

- **Node address**

A clear node ID must be assigned to every participant (Slave). A network scan is frequently helpful if this help is offered by the target system that presents the participants who may be reached graphically or in text form.
- **Transmission rate**

Ensure that the correct transmission rate is set. You may also be able to use "Auto-Detect".
- **Transmission profile**

A few standard field buses (e.g. CANopen) provide different transmission profiles. Find out about the profile suitable for your application.
- **GSD, EDS, XML files**

The following bus systems use files that describe transmission properties of the connected participants:

 - GSD: PROFIBUS (file ext.: gsd) and PROFINET IO (file ext.: xml)
 - EDS: DeviceNet, CANopen, EtherNet /IP
 - XML: EtherCat

These must usually be registered in the target system frequently using a network configurator.
- **Number of I/O data**

The transmitted IO number must agree with the number expected by the target system. Observe in particular any possible restrictions with respect to the number transmitted and the organisational form (bit, byte, word, double or long) of the data.
- **Data consistency**

If more than the known organisational forms (to long) are required to be transmitted consistently, some field buses have provided for special transmission functions for this purpose. Information on this is provided in the instruction manual of the target system.
- **I/O address / offset / mapping in the target system**

This is a particularly important point. Convince yourself which addresses have been used to map the I/O data in your target system. These addresses may frequently be stipulated directly or as offset to a base address.
- **Type and timing of the data refresh**

There may possibly be configuration options here too. The nature and timing of the data refresh have a decisive influence on the bus load and therefore of course on the reaction behaviour.
- **Device name / slave name**

In a few bus systems a name may be assigned to the participant. It may be then symbolically addressed using this name.

The following points must be heeded for Ethernet-based systems exclusively:

- **MAC address**
The MAC address (Media-Access-Control address) is the hardware address of every individual network adaptor which serves the clear identification of the device (slaves) in a network.
It is usually only read out and can frequently not be edited or only edited with special aids.
- **IP address / DHCP server / host name / DNS**
An IP address can be manually set or procured from a DHCP server.
A host name and therefore a clear identification may be assigned to the slave in the network. The realisation of the host name in a machine-readable address is typically assumed by a DNS service.
- **Subnet mask / default gateway**
The subnet mask is a bit mask which specifies in the network protocol in the description of IP networks how many bits signify the network prefix at the start of the IP address shown.
A network address is described as a default gateway to which clients send their packets if the target address is outside their own network and no other information is available as to how the target network can be reached.

5.4 Configuration of the PROTECT-PSC Universal-Gateway in the Target System

Detailed descriptions on the configuration of the gateway in frequently used target systems are provided in the following.

Any configuration files required for the target system as well as the GSD, EDS or XML files are available in the corresponding sub-directories on the CD.

The standard field bus adapter used is the Anybus-CompactCom-Module (Anybus-CC) from HMS Industrial Networks. Please observe the configuration information on this module type in the descriptions.

All descriptions and configuration files of the target system are tested original versions of the company:

HMS Industrial Networks AB
Stationsgatan 37
302 45 Halmstad
Sweden

For configurations in other target systems please only use these as support. Exact descriptions are provided in the operating instructions of the target systems.

5.4.1 PROFIBUS DP V1

Configuration description:

[1 PROFIBUS DP V1\PROFIBUS Slave Step7 2.1.pdf](#)

Sub-directory configuration files:

[2 DeviceNet\DeviceNet_RSNetWorx 1_03.pdf](#)

5.4.2 DeviceNet

Configuration description:

[_2 DeviceNet\DeviceNet_RSNetWorx_1_03.pdf](#)

Sub-directory configuration files:

[_2 DeviceNet\324-8066-DeviceNet_RSNetworx_1_03](#)

5.4.3 CANopen

Configuration description:

[_3 CANopen\CANOpen_slave_Twidosof_1.01.pdf](#)

Sub-directory configuration files:

[_3 CANopen\334-5947-CANOpen_slave_Twidosof_1.01](#)

5.4.4 Modbus RTU

Configuration description:

[_4 ModbusRTU\ModbusRTU_slave_Unity_1.03.pdf](#)

Sub-directory configuration files:

[_4 ModbusRTU\335-5635-ModbusRTU_slave_Unity_1.03](#)

5.4.5 Modbus TCP

Configuration description:

[_5 ModbusTCP\ModbusTCP_UnityProL_1_03.pdf](#)

Sub-directory configuration files:

[_5 ModbusTCP\367-3980-ModbusTCP_UnityProL_1_03](#)

5.4.6 PROFINET IO

Configuration description:

[_6 PROFINET IO\PROFINETIO_Slave_Step7_1.11.pdf](#)

Sub-directory configuration files:

[_6 PROFINET IO\341-8256-PROFINETIO_Slave_Step7_1.11](#)

5.4.7 Ethernet / IP

Configuration description:

[_7 Ethernet IP\EtherNetIP_adapter_RSLogix_2.03.pdf](#)

Sub-directory configuration files:

[_7 Ethernet IP\368-0063-EtherNetIP_adapter_RSLogix_2.03](#)

5.4.8 EtherCAT

Configuration description:

[_8 EtherCAT\EtherCAT_slave_TwinCAT_1.04.pdf](#)

5.4.9 CC-Link

Configuration description:

[9 CC-Link\AppNote CCLink configuration 1_02.pdf](#)

Sub-directory configuration files:

[9 CC-Link\342-5250-CCLink GX 1_02](#)

[9 CC-Link\342-2959-HMS-ABCC-CCL.CSP example](#)

6 Annex

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6.1 Technical Data

6.1.1 General Data

Position	Description				
Supply voltage	24V DC +20% -15%				
Power input	max. 0.5 A				
Wattage	max. 12W				
Ambient temperature	0 – 55°C				
Air humidity	30 – 85%RH (non-condensing)				
Air pressure	86 kPa to 106 kPa				
Ambient atmosphere	No aggressive gases permitted				
Degree of pollution	2 to DIN EN 50178				
Rated isolation voltage	Protective class I ($50\text{ V} * \sqrt{2} = 71\text{ V}$)				
Area of use	II : Average environmental or operational influences are to be expected; the assembly site (e.g. the electrical installation room) protects the installation from strong environmental influences (e.g. vibration-dampened site of installation of the switch cabinet).				
Installation site	Earthed lockable metal switch cabinet Protective class at least IP 54				
Oscillations	DIN EN 60068-2-6	Frequency	Beschl.	Amplitude	Runs
		10...57Hz	-	0,35 mm	20 cycles (1 octave/min)
		57...150Hz	5,0 g	-	
Shock impact	DIN EN60068-2-29. (10g 1000 ±10 times, X,Y,Z direction)				
Voltage interruption	Maximum 10ms at intervals of minimum 1 second				

Table 6-1 General technical data for all modules

6.1.2 Electromagnetic Compatibility

The functional safety is guaranteed for the interference levels specified.

Position	Standard	Specification
Discharge of static electricity	IEC6100-4-2	Contact discharge : ±6 kV Air discharge : ±8 kV
Electromagnetic HF field	IEC6100-4-3	Housing : 80 ... 2000MHz / 10V/m
Fast transient	IEC6100-4-4	Signal connections : ±1kV Direct current network inputs : ±1kV Function ground : ±1kV
Surge voltages	IEC6100-4-5	Signal connections : ±1kV Direct current network inputs : ±1kV
High frequency	IEC6100-4-6	Signal connections : Direct current network inputs : Function ground : 0.15 ... 80MHz / 10 V

Table 6-2 Electromagnetic compatibility

6.2 Considered Standards

Standard	Name
DIN EN 61508; 1-7	Functional Safety of Safety-Related Electrical, Electronic/Programmable Electronic Systems
DIN EN 954-1:1997-03	Safety of Machines – Safety-Related Parts of Control Systems – Part 1: General Design Principles; German version EN954-1:1996
DIN EN ISO 13849-1:2007-07	Safety of Machines – Safety-Related Parts of Control Systems – Part 1: General Design Principles (ISO 13849-1:2000); German version EN ISO 13849-1:2006
DIN EN ISO 13849-2:2003-12	Safety of Machines – Safety-Related Parts of Control Systems - Part 2: Validation (ISO 13849-2:2003); German version EN ISO 13849-2:2004
DIN EN 60204-1:2007-06	Safety of Machines – Electrical Equipment of Machines – Part 1: General Requirements (IEC 60204-1:2005,modified); German version EN 60204-1:2006
DIN EN 61000-2-5:1995	Electromagnetic Compatibility

Table 6-3 Considered standards

6.3 Literature References

In progress!

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