

Programmable Systems

The H41q and H51q System Families

Catalog



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Industrial Automation

HI 800 263 CEA

Caution

The safety-related H41q/H51q systems as described in this manual can be used for several different purposes. The knowledge of regulations and the technically perfect transfer carried out by qualified staff are prerequisites for the safe installation, start-up and for the safety during operation and maintenance of the H41q/H51q systems.

In case of unqualified interventions into the automation devices, de-activating or bypassing safety functions, or if advices of this manual are neglected (causing disturbances or impairments of safety functions), severe personal injuries, property or environmental damage may occur for which we cannot take liability.

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All listed modules are CE certified and meet the requirements of the EMC Guideline of the European Community.

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The H41q and H51q System Families

Notes to the Manual

This manual contains the description of the Programmable Electronic Systems (PES) of the HIMA system families H41q and H51q.

Beside this manual and the data sheets you will find further informations to the system families H41q and H51q on the ELOP II CD.

The first part contains general notes to the PES and is followed by the description of the individual types. All the descriptions have the same structure so that they can each be used independently as device documentation.

The descriptions are followed by general information about both system families, e.g. technical data, test standards, applications, start-up and maintenance.

The second part of the manual contains all data sheets of the systems and the modules. Each type of PES has a corresponding assembly kit.

After the descriptions of the systems and the assembly kits the data sheets are arranged in alphanumerical order according to their type numbers.

HIMA Automation Devices are developed, manufactured and tested according to the relevant safety standards. They must only be used for the applications described in the instructions and with specified environmental conditions, and only in connection with approved external devices.

In case of unqualified interventions into the automation devices, de-activating or bypassing safety functions, or if advices of this manual are neglected (causing disturbances or impairments of safety functions), severe personal injuries, property or environmental damage may occur for which we cannot take liability.

1 The HIMA PES

The HIMA PES described here consists of the H41q and H51q system families. Both system families are based on the same hardware and software, and they are the third generation of the field-proven HIMA PES to control preferably process engineering plants. PCs (PADT)* are used for programming, configuration, data logging, operation and trend recording.

Digital and analog inputs can be processed. Some input modules are designed for intrinsically safe circuits as well as for electric position sensors (proximity switches) according to DIN EN 60947-5-6. Digital and analog outputs are also available.

The HIMA PES are installed in 19-inches subracks. The H41q system family is a compact system consisting of *one* subrack, holding all components such as central unit, interface extensions, communication modules, power supplies, fusing and power distribution, as well as input/output modules.

The H51q system has a modular structure. A central rack contains the central unit(s), interface extensions, communication modules, monitoring and power supplies, and it can have up to 16 associated input/output subracks.

*PADT = Programming and Debugging Tool

2 Concept of the HIMA PES

The HIMA PES of the H41q and H51q system families consist of 19 inches subracks for central devices 5 HU and modules for binary and analog input/output signals which are assembled in H51q systems within 19 inches subracks, 4 HU.

The HIMA PES use PCs (PADTs) with the tool **ELOP II** for programming, configuration, monitoring, operation and documentation. The entry of the user program and the compilation into the machine code is made only on the PC without connected PES. To load, test and to monitor the PES the PC is connected via a serial interface RS 485 or a bus system to the PES.

2.1 Safety and Availability

HIMA PES are designed both for safety-related applications up to SIL 3 (definition according to IEC 61508) and for high availability. Depending on the required safety and availability, HIMA PES can be supplied as one-channel or two-channel (redundant) devices with the same modules in the central device as well as in the input/output level. Redundant modules increase the availability, as in case of an error in a safety-related module this is automatically switched off while the redundant module continues the operation.

The following table gives an overview:

Safety	SIL 3	SIL 3	SIL 3
Availability	normal (MS)	high (HS)	very high (HRS)
Central module	mono	redundant	redundant
I/O modules	mono ¹⁾	mono ¹⁾	redundant
I/O bus	mono	mono	redundant

Table 1: Safety and Availability

¹⁾ Individual I/O modules can also be used as redundant modules or connected to sensors in a 2-out-of-3 voting to increase the availability.

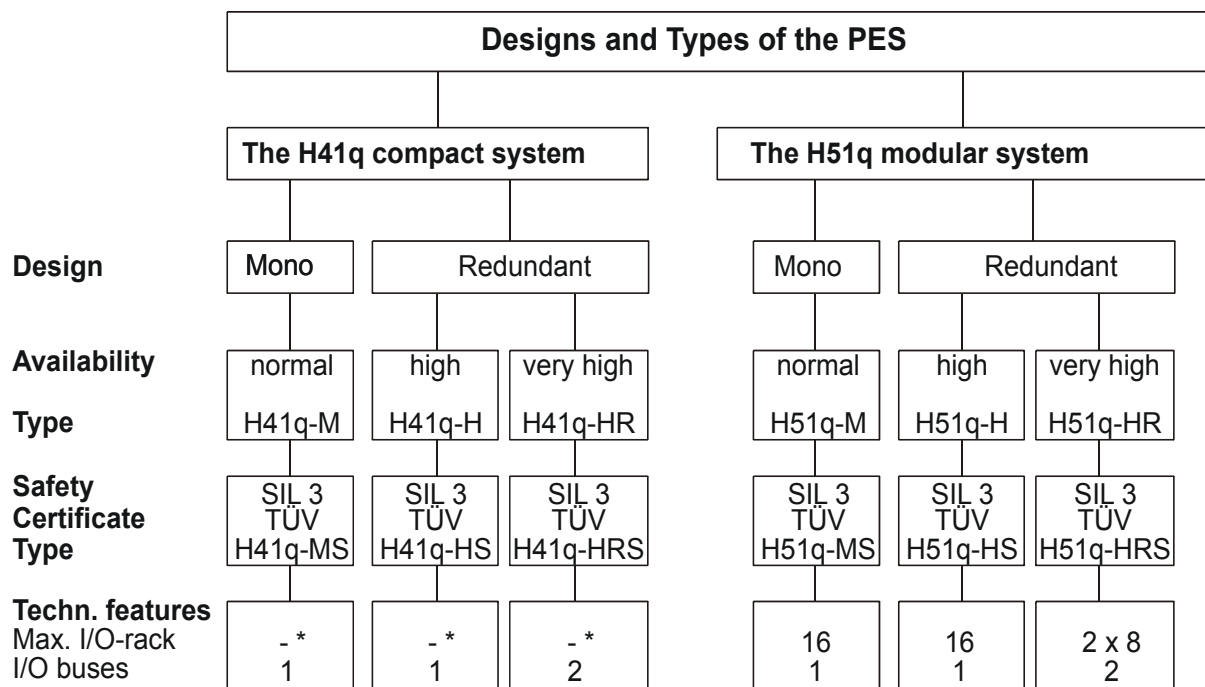
The inputs have to be therefore configured on 3 different I/O modules.

Mono = single channel system structure

Redundant = redundant central modules and/or separated I/O bus system structure

2.2 Designs and Types of the PES

The controls can be adapted to the requirements of the plant by equipping them with the appropriate central modules. The following structures are possible with the H41q or H51q system family:



* Central modules, communication modules and I/O modules are installed in the system sub-rack.

Figure 1: Designs and Types of the PES

Notes:

Mono = single channel system structure

Redundant = redundant central modules and/or separated I/O bus system structure

SIL = Safety Integrity Level according to IEC 61508

I/O = input and output

2.2.1 Concept of H41q-M, MS / H51q-M, MS

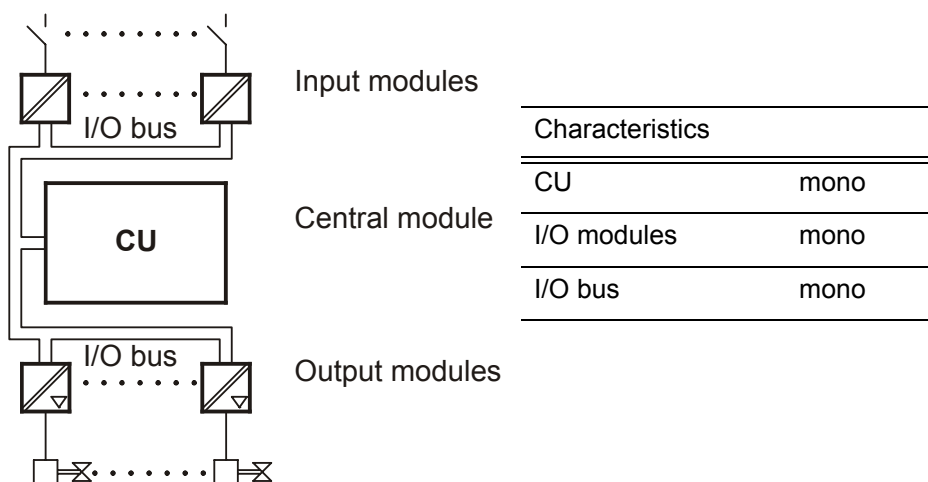


Figure 2: Concept of H41q-M, MS / H51q-M, MS

H41q-M / H51q-M

single channel central module and single channel I/O bus



H41q-MS / H51q-MS

with double processors, safety-related

single channel central module and single channel I/O bus with TÜV certificate up to SIL 3 according to IEC 61508

2.2.2 Concept of H41q-H, HS / H51q-H, HS

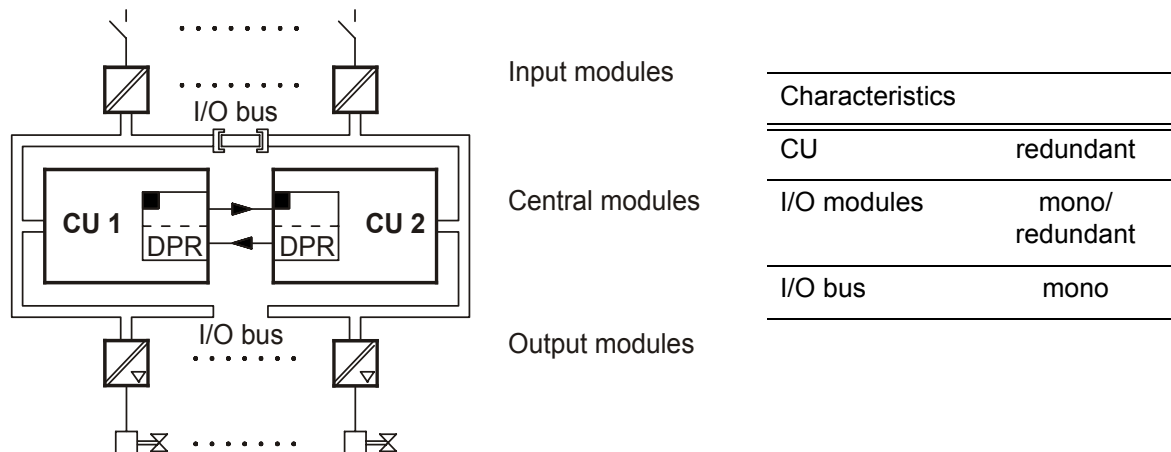


Figure 3: Concept of H41q-H, HS / H51q-H, HS

H41q-H / H51q-H

redundant central modules and a single channel I/O bus for highly available PES



H41q-HS / H51q-HS with double processors, safety-related

redundant central modules and a single channel I/O bus for highly available and safety related PES with TÜV certificate up to SIL 3 according to IEC 61508

2.2.3 Concept of H41q-HR, HRS / H51q-HR, HRS

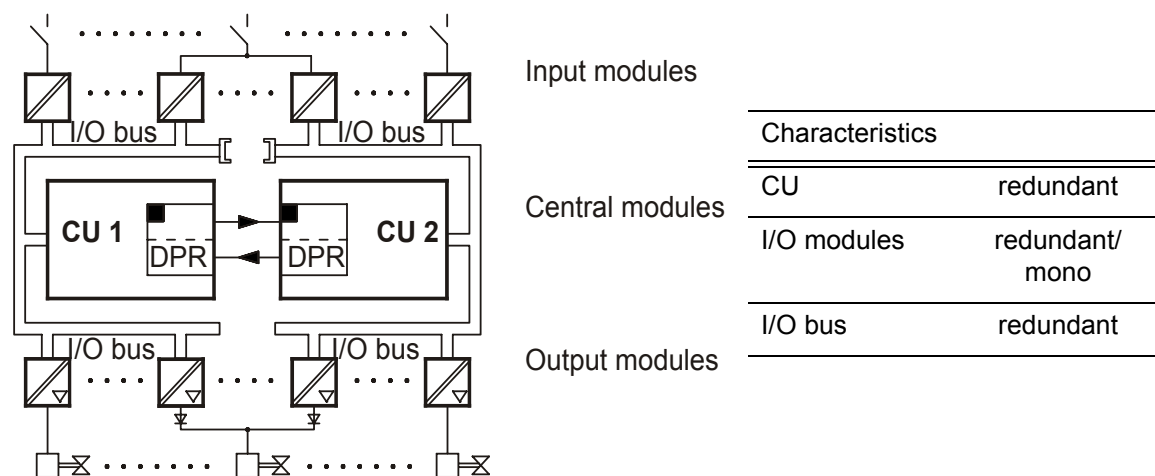


Figure 4: Concept of H41q-HR, HRS / H51q-HR, HRS

H41q-HR / H51q-HR

Redundant central modules and two channel I/O bus for highly available PES.



H41q-HRS / H51q-HRS with double processors, safety-related

redundant central modules and redundant I/O bus for highly available and safety-related PES with TÜV certificate up to SIL 3 according to IEC 61508

Remarks to the drawings:

CU = central module

I/O modules = input / output modules

I/O bus = bus system for inputs and outputs

DPR = Dual Port RAM

3 The H41q System Family

The H41q system family comprises compact designed PES in single channel and redundant models, also with TÜV safety certificate.

All input/output modules can be used with both redundant and single channel models of the central modules.

All modules of the H41q system family meet the requirements for electromagnetic compatibility and immunity according to article 10 of the EG guideline 89/336/EEG for the electromagnetic conformity. This is demonstrated with the CE sign within the data sheets of the modules. Also the systems and modules are wearing a label with this sign.

All models of the H41q system family have all the components required for control tasks in one 19 inches subrack, 5 units high, with an integrated cable tray (see also data sheets of H41q systems or assembly kits).

3.1 Overview Assembly Kits H41q

The components required for a working system are included in assembly kits:

System	H41q-M	H41q-H	H41q-HR	H41q-MS	H41q-HS	H41q-HRS
Safety	–	–	–	SIL 3	SIL 3	SIL 3
Quantity/type CU	1 x F 8653X	2 x F 8653X	2 x F 8653X	1 x F 8652X	2 x F 8652X	2 x F 8652X
Quantity/type CM *	1 x F 8621A	(2 x) 1 x F 8621A	(2 x) 1 x F 8621A	1 x F 8621A	(2 x) 1 x F 8621A	(2 x) 1 x F 8621A
Quantity/type CoM (Fast Ethernet) *	1 x F 8627/ F 8627X	(2 x) 1 x F 8627/ F 8627X	(2 x) 1 x F 8627/ F 8627X	1 x F 8627/ F 8627X	(2 x) 1 x F 8627/ F 8627X	(2 x) 1 x F 8627/ F 8627X
Quantity/type CoM (Profibus-DP) *	1 x F 8628/ F 8628X	(2 x) 1 x F 8628/ F 8628X	(2 x) 1 x F 8628/ F 8628X	1 x F 8628/ F 8628X	(2 x) 1 x F 8628/ F 8628X	(2 x) 1 x F 8628/ F 8628X
Quantity/type power supply	1 x F 7130A	2 x F 7130A	2 x F 7130A	2 x F 7130A	2 x F 7130A	2 x F 7130A
Quantity I/O buses	1	1	2	1	1	2
max. quantity I/O modules	13	13	7 + 6	13	13	7 + 6
Assembly kit number	B 4234	B 4236-1	B 4236-2	B 4235	B 4237-1	B 4237-2

Table 2: Overview Assembly Kits H41q

* Options

Abbreviations:	CM	Coprocessor Module
	CoM	Communication Module
	CU	Central Module
	I/O	Input/Output

3.2 Concepts of the Safety Switch-Off at H41q

In the system descriptions of the safety-related PES H41q-MS, -HS, -HRS the ways for shut-down if a fault occurs are shown. Depending on the fault location the reactions of the systems are fixed or they can be defined in the user program.

Parameters are set

- in the resource properties I/O parameter
- by activating of a system variable for emergency shutdown
- via function block H8-STA-3.

An overview of the system variables including the corresponding error code you will find in the operating system manual.

Reaction to faults of safety related digital I/O modules during operation:

Location of fault	I/O parameter in the properties of the resource	Reaction of the system
Output modules Single error (also voltage failure)	- display only or - normal operation	Module switch-off
	- normal operation and one function block H8-STA-3 per group	Group shutdown
	- Emergency off	WD switch-off of the appertaining CU
I/O bus or double fault of output modules	- display only	Slot with error code in I/O bus display of the CPU, WD is still switched on
	- normal operation or - Emergency off	WD switch-off of the appertaining CU
Central modules	independent of the I/O parameter	WD switch-off of the appertaining CU
Input modules	independent of the I/O parameter	Operation of 0-signal for all inputs of this module
Independent of a fault of the output module	System variable for emer- gency switch-off activated, independent of the I/O parameter	WD switch-off of the appertaining CU

Table 3: Concepts of the Safety Switch-Off at H41q

Definition:

Double fault = fault within an output channel and the switch-off electronic part of this testable output module.

Abbreviations used in the table:

CU	Central Module
I/O bus	Input/output bus
WD	Watchdog signal

More explanations on the following page.

Explanations to the table:

Parameter “Display only“

Switch-off by means of the integrated safety shutdown inside the output amplifier. If not possible then shutdown of the watchdog signal in the I/O rack by means of the coupling module (only in systems H51q). No shutdown of the watchdog signal of the appertaining central unit. This parameter is permissible only up to SIL 1.

Parameter “Normal operation“

Reaction as with parameter “Display only“, additionally switch-off of the watchdog signal of the appertaining central unit if necessary. Parameterization required from SIL 2. Normal and recommended parameter.

Parameter “Emergency off“

Switch-off of the watchdog signal of the appertaining central unit and thus shutdown of the output amplifiers in case of a fault in the output module.

The watchdog signal is not switched off at faults in the input modules.

Module switch-off

A faulty testable output module with integrated safety shutdown will be switched automatically to the safe de-energized status.

Group shutdown

If it is requested, a group shutdown may be defined in the user program in a way that all testable output modules appertaining to the group with the faulty module are also switched off.

Inside the user program up to 10 testable output modules can be assigned to one group by means of the function block H8-STA-3.

WD switch-off of the appertaining CPU

In case of a fault the watchdog signal (WD) of the appertaining central module is switched off. If systems with redundant central modules and a common I/O bus are used then the output modules are related to both central modules. In case of a fault both the watchdog signals of the central modules are switched off. That means all the I/O modules are switched off (only at H41q-H/HS).

If systems with redundant central modules and redundant I/O bus are used then the output modules are related to one central module and one I/O bus. In case of a fault only the watchdog signal of the related central module is switched off. That means only the related I/O modules are switched off (only at H41q-HR/HRS). The redundant central module is still in operation.

3.3 The Input/Output Level

In the subrack, slots 1 to 13 are provided for the input/output modules. Any arrangement of I/O module types is possible. In PES with redundant I/O bus, the modules on slots 1 to 7 are assigned to the first I/O bus and 8 to 13 to the second I/O bus.

There is an integrated cable tray under the subrack. It is equipped with a receptacle for the label which can be flapped open to provide easy access to the cables.

3.3.1 24 VDC Supply and Distribution

For 24 VDC supply and distribution we recommend to use the K 7212, K 7213, K 7214, K 7215 subassemblies or fuse distributor K 7915.

They include all components for the fusing of up to 18 individual supply circuits with circuit breakers.

The K 7212 is additionally equipped with decoupling diodes and filters with monitoring relays for mains supply.

Additionally you could use also a power supply of the PS1000 series (see ELOP II CD).

3.3.2 I/O Modules

The I/O modules are used for signal transfer and signal matching between the plant and the central modules. The input and output circuits are always fed into the I/O modules via cable plugs on the front side. The status of the digital output signals is shown on the LEDs of the cable plugs. The power supply is either via the cable plugs or via the I/O bus board. The order of the different I/O module types does not matter.

All I/O modules can be removed or inserted during operation (see chapter 8.1.1).

3.3.3 ATEX (Ex)i-Modules



The current **(Ex)i modules** exist in 2 construction models:

- non-varnished, with PCB covering
- varnished, with PCB covering

Any models can be equipped together without empty slots between them.

Non-varnished (Ex)i modules may combined together with non-(Ex)i modules without any restrictions. There are no free slots necessary on the left or on the right.

With varnished (Ex)i modules with PCB covering the right slot has to remain free in combination with non-(Ex)i modules, or has to be equipped with a front plate with partition plate (M 2214). This is also valid for slot no. 15. The slot left to the (Ex)i module may be equipped with any other module. Spare slots have to be covered by front plates M 2215 (4 spacing units SU) or M 2217 (8 spacing units SU).

Usable front plates with partition or front plates:

M 2214	Front plate with partition plate 100 x 160 mm
M 2215	Front plate 4 SU
M 2217	Front plate 8 SU

Cable plugs for intrinsically safe circuits are marked and have coded pins, so that they can only be plugged into the appropriate modules.

3.3.4 Safety-Related Output Modules for SIL 3



All the safety-related output modules meet the requirements of SIL 3.

The safety-related output modules have three semiconductors connected in series. That means that more than the required second independent component for safety shutdown is now integrated in the output module.

In case of a fault of an output module the requirements of SIL 3 are valid without time limit. In the following this feature is called the integrated safety shutdown.

If a safety-related output module should fail during operation then it will be automatically switched off by the integrated safety shutdown to get the safe de-energized status.

3.3.5 Special Features of the Output Modules

All output modules have the following special features:

- To increase the availability the outputs of the safety-related output modules can be switched in parallel without external diodes.
Decoupling diodes are already integrated on the module (see the corresponding data sheets).
- No output voltage is generated if the supply voltage L- is cut at the output module.
- The connection of inductive loads can be done without using protection diodes at the coil. However, it is recommended to connect a diode directly at the inductive load avoiding noise voltages.
- The LED signaling the output status is controlled separately.

- The design of the cable plugs enables the two-pole connection of the actuators. Together with a two-pole supply of the output module an earth fault detection will be simplified by means of a totalizing current transformer.
The cable plugs are available in two specifications:
- L- in cable plug, one-pole with common L-
- L- in 2-pole type, 2-pole with L- per channel
see also chapter 10.13.6 , “Description of the Order Code for Cable Plugs”, option P2
- No time-limited operation in case of a faulty output module.

3.4 System Voltage 24 VDC

HIMA systems will be connected to 24 VDC. The connection terminals are labelled with L+ and L-. The power supply units made available by HIMA, e.g. the power supply PS1000, meet the requirements according to CE for electrical safety and EMC.

All used power supplies must fulfill the requirements SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage). See also chapter 6.4.

The power supply units meet the requirements of the NAMUR recommendation NE 21 for the safety during short-time voltage dips up to 20 ms.

For the supply of 24 V sources, which cannot guarantee a buffering during voltage dips of at least 20 ms, the following measures must be taken in the H41q system family:

- decoupling of the power supply for the central units and
- noise blanking (parameterizable).

Note

Due to the high inrush current of lamps the correct dimensioning of the power supply units for lamp loads must be regarded.

4 The H51q System Family

The H51q system family comprises modular designed PES in single channel and redundant models, also with TÜV safety certificate.

All input/output modules can be used with both redundant and single channel models of the central devices.

All modules of the H51q system family meet the requirements for electromagnetic compatibility and immunity according to article 10 of the EU guideline 89/336/EEG for the electromagnetic conformity. This is marked with the CE sign within the data sheets of the modules. Also the systems and modules are wearing a label with this sign.

The H51q system family consists of one 19 inches central rack, 5 units high, and up to 16 input/output racks in the 19 inches size, 4 units high (see also data sheets for H51q systems or assembly kits).

4.1 Overview Assembly Kits H51q

The components required for a working system are included in assembly kits:

System	H51q-M	H51q-H	H51q-HR	H51q-MS	H51q-HS	H51q-HRS
Safety	–	–	–	SIL 3	SIL 3	SIL 3
Quantity/type CU	1 x F 8651X	2 x F 8651X	2 x F 8651X	1 x F 8650X	2 x F 8650X	2 x F 8650X
Quantity/type CM *	3 x F 8621A	2 x 3 F 8621A	2 x 3 F 8621A	3 x F 8621A	2 x 3 F 8621A	2 x 3 F 8621A
Quantity/type CoM (Fast Ethernet) *	5 x F 8627/ F 8627X	2 x 5 F 8627/ F 8627X	2 x 5 F 8627/ F 8627X	5 x F 8627/ F 8627X	2 x 5 F 8627/ F 8627X	2 x 5 F 8627/ F 8627X
Quantity/type CoM (Profibus-DP) *	5 x F 8628/ F 8628X	2 x 5 F 8628/ F 8628X	2 x 5 F 8628/ F 8628X	5 x F 8628/ F 8628X	2 x 5 F 8628/ F 8628X	2 x 5 F 8628/ F 8628X
Quantity/type power supplies	2 (+1*) x F 7126A	3 x F 7126A	3 x F 7126A	2 (+1*) x F 7126A	3 x F 7126A	3 x F 7126A
5 V monitoring	F 7131	F 7131	F 7131	F 7131	F 7131	F 7131
Battery buffering	F 7131 + F 8651X	F 7131 + F 8651X	F 7131 + F 8651X	F 7131 + F 8650X	F 7131 + F 8650X	F 7131 + F 8650X
Quantity I/O buses	1	1	2	1	1	2
max. quantity I/O modules	256 in 16 I/O subracks	256 in 16 I/O subracks	2 x 128 in 2 x 8 I/O subracks	256 in 16 I/O subracks	256 in 16 I/O subracks	2 x 128 in 2 x 8 I/O subracks
Assembly kit number	B 5230	B 5232-1	B 5232-2	B 5231	B 5233-1	B 5233-2

Table 4: Overview Assembly Kits H51q

* Options (max. 5 communication slots per central module)

Abbreviations:

CM	Coprocessor Module
CoM	Communication Module
CU	Central Module
I/O	Input/Output

4.2 Concepts of the Safety Switch-Off at H51q

In the system descriptions of the safety related PES H51q-MS, -HS, -HRS the ways for shut-down if a fault occurs are shown. Depending on the fault location the reactions of the systems are fixed or they can be defined in the user program.

Parameters are set

- in the resource properties I/O parameter
- by activating of a system variable for emergency shutdown
- via function block H8-STA-3.

An overview of the system variables including the corresponding error code you will find in the operating system manual.

Reaction to faults of safety-related modules during operation:

Location of fault	I/O parameter in the properties of the resource	Reaction of system
Output modules single error (also voltage failure)	- display only or - normal operation	Module switch-off
	- normal operation and one function block H8-STA-3 per group	Group shutdown
	- Emergency off	WD switch-off of the appertaining CU
I/O bus within I/O subrack or double fault in output modules	- display only	Slot with error code in I/O subrack display of the CPU, WD is still switched on
	- normal operation	WD switch-off of the apper- taining coupling module
	- Emergency off	WD switch-off of the appertaining CU
Central modules (CU) or I/O bus between CU and cou- pling modules	independent of the I/O parameter	WD switch-off of the appertaining CU
Input modules	independent of the I/O parameter	Operation of 0-signal for all inputs of this module
Independent of a fault of the output module	System variable for emer- gency switch-off activated, independent of the I/O parameter	WD switch-off of the appertaining CU

Table 5: Concepts of the Safety Switch-Off at H51q

Definitions:

Double fault = fault within an output channel and the electronic switch-off part of a testable out-put module

Abbreviations in the table:

CU	Central Module
I/O bus	Input/output bus
I/O subrack	Input/output subrack
WD	Watchdog signal

More explanations on the following page.

Explanations to the table:

Parameter “Display only“

Switch-off by means of the integrated safety shutdown inside the output amplifier. If not possible then shutdown of the watchdog signal in the I/O subrack by means of the coupling module (only in systems H51q). No shutdown of the watchdog signal of the appertaining central unit. This parameter is permissible only up to SIL 1.

Parameter “Normal operation“

Reaction as with parameter “Display only“, additionally switch-off of the watchdog signal of the appertaining central unit if necessary. Parameterization required from SIL 2. Normal and recommended parameter.

Parameter “Emergency off“

Switch-off of the watchdog signal of the appertaining central unit and thus shutdown of the output amplifiers in case of a fault in the output module.

The watchdog signal is not switched off at faults in the input modules.

Module switch-off

A faulty testable output module with integrated safety shutdown will be switched automatically to the safe de-energized safe status.

Group shutdown

If it is requested, a group shutdown may be defined in the user program so that all testable output modules belonging to one group with the faulty module are also switched off.

Inside the user program up to 10 testable output modules can be assigned to one group by means of the function block H8-STA-3.

WD switch-off of the appertaining CPU

In this case the watchdog signal (WD) of the appertaining central module will be switched off.

If systems with redundant central modules and a common I/O bus are used then the output modules are assigned to both central modules. In case of a fault both watchdog signals of the central modules are switched off, that means all the I/O modules are switched off (only at H51q-H/HS).

If systems with redundant central modules and redundant I/O bus are used then the output modules are related to one central module and one I/O bus. In case of a fault only the watchdog signal of the related central module is switched off, that means only the related I/O modules are switched off (only at H51q-HR/HRS).

Switch-off of the appertaining coupling module

In this case the watchdog signal (WD) of the appertaining coupling module will be switched off, that means that all I/O modules related to this coupling module will be switched off.

4.3 The Input/Output Level

The input/output subracks holding the input/output modules with their fusings, power distribution and I/O bus coupling can be connected to the central racks. Up to 16 input/output subracks can be assigned to one PLC.

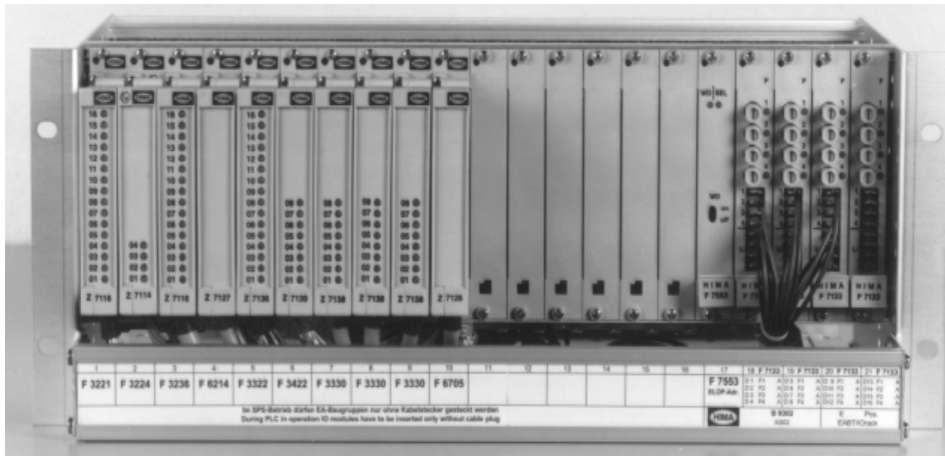


Figure 5: View of the I/O subrack 4 units high

4.3.1 The I/O Subrack

The I/O subrack fulfills the safety requirements of the SIL 3.

Slots 1 to 16 are provided for any type of input/output modules of the HIMA automation system. Slot 17 is provided for the coupling module F 7553 for the I/O bus.

Slots 18 to 21 keep the power distribution modules F 7133. They are non-interactive and have a fuse monitoring with failure signalization by an LED and a contact. The power distribution module F 7133 can be used to fuse the I/O modules as well as the sensor and the actuator circuits.

There is a cable tray under the input/output subrack. It is equipped with a receptacle for the label which can be hinged to provide easy access to the cables.

4.3.2 24 VDC Power Supply and Distribution

Standard design: The 24 VDC power is distributed via a fuse and power distribution drawer. For the input/output subracks max. 16 A back-up fuses are provided for L+. The power for the input/output modules is fed in at the rear side of the power distribution modules F 7133 via XG. 7/8/9/10.

Each I/O module is assigned to a fuse on the module F 7133 (refer also to the description of the assembly kit B 9302).

The relation between the power distribution modules with 4 fuses each and the slots of the I/O modules is as follows:

- F 7133 in slot 18 supplies the I/O slots 1...4,
- F 7133 in slot 19 supplies the I/O slots 5...8,
- F 7133 in slot 20 supplies the I/O slots 9...12,
- F 7133 in slot 21 supplies the I/O slots 13...16.

The supply of the I/O modules is made either via the cable plug on the front side or via the connection already integrated in the I/O bus board (for (Ex)i modules and partly analog input modules).

The potential distributor XG. 11 is connected to the L- of the power distribution drawer. So all

power distribution modules F 7133 are internal connected with L-. Via the front side of the power distribution modules the L- is also fed to the input/output modules via the cable plugs. The circuit feeding of the sensors is fused by the front of the F 7133 module. The input module and the appertaining sensors use the same power supply circuit of the power distribution module F 7133.

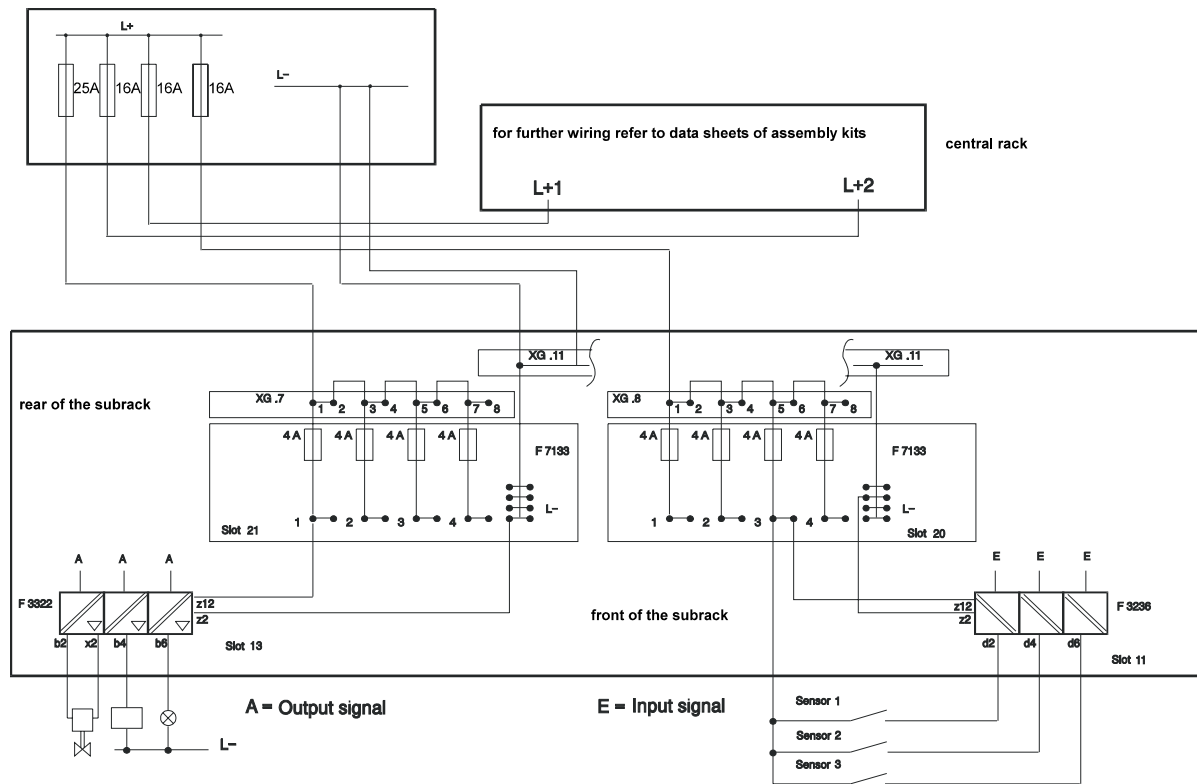


Figure 6: Feeding and distribution 24 VDC

4.3.3 5 VDC Distribution

The 5 VDC system voltage for the I/O subracks is taken from the flat pin plugs of the distributors XG .2 and XG .3 on the rear side of the central rack in star shape.

The power is connected to the I/O subracks on the accordingly marked flat pin plugs XG .4 for +5 VDC and XG .12 for GND on the rear side of the I/O subracks.

The power is internally distributed to the I/O modules via the bus board.

4.3.4 Extension of the 5 VDC Power Supply

If the power requirements of the 5 V circuits is > 18 A an additional power supply has to be used. For this purpose the B 9361 assembly kit can be used which provides the possibility of applying three power supplies F 7126 together with the monitoring module F 7131 in an additional subrack.

The 5 V output circuits of the additional power supply must not be switched in parallel with the ones from the central rack. Apart from them they supply their own circuits. The reference poles GND have to be connected together.

The power supply units of the additional power supply (assembly kit B 9361) emit monitoring signals. These signals can be taken from the XG .1 terminal block on the rear side of the subrack (see B 9361 assembly kit). They can be fed into the PLC via digital input modules. In the logic of the PLC the signals are used to trigger an error message.

4.3.5 The I/O Bus

With the I/O subrack, the connection element for the I/O bus is the F 7553 coupling module plugged into slot 17. The connection of the I/O bus between the individual I/O module subracks is established at the rear side via the BV 7032 data cable which is connected to the plugs XD .1 and XD .2. The I/O bus in the I/O module subracks is integrated in the bus board. An F 7546 bus termination module is plugged into the XD .2 connector of the last I/O module subrack to terminate the I/O bus.

4.3.6 I/O Modules

The I/O modules are used for signal transfer and signal matching between the plant and the central devices. The input and output circuits are always fed into the I/O modules via cable plugs on the front side. The status of the digital signals is shown on the LEDs of the cable plugs. The power supply is either via the cable plugs or via the I/O bus board. The order of the different I/O module types does not matter.

All I/O modules can be pulled out or inserted during operation (see chapter 8.1.1)

4.3.7 ATEX (Ex)i-Modules



The current **(Ex)i modules** exist in two construction models:

- non-varnished, with PCB covering
- varnished, with PCB covering

Any models can be equipped together without free slots between.

Non-varnished (Ex)i modules may combined together with non-(Ex)i modules without any restrictions. Also no free slots are necessary on the left or on the right.

With varnished (Ex)i modules with PCB covering the right slot has to remain free in combination with non-(Ex)i modules or has to be equipped with a front plate including partition plate (M 2214). This is also valid for slot 15. The slot left to the (Ex)i module may be equipped with any other module. Spare slots have to be covered by front plates M 2215 (4 spacing units SU) or M 2217 (8 spacing units SU).

Usable partition plates and front plates:

M 2214	Front plate with partition plate 100 x 160 mm
M 2215	Front plate 4 SU
M 2217	Front plate 8 SU

Cable plugs for intrinsically safe circuits are marked and have coded pins, so that they can only be plugged into the appropriate modules.

4.3.8 Safety-Related Output Modules for SIL 3



All the safety-related output modules meet the requirements of the SIL 3.

The safety-related output modules have three semiconductors connected in series. That means that more than the required second independent component for safety shutdown is now integrated in the output module.

In case of a fault of an output module the requirements of the SIL 3 are valid without time limit. In the following this feature is called the integrated safety shutdown.

If a safety-related output module should fail during operation then it will be automatically switched off with the integrated safety shutdown to get the safe de-energized status.

The coupling module F 7553, which has to be installed in each I/O subrack, is able to switch off the watchdog signal (WD) of the I/O subrack. Even in case of a very seldom double fault only the related I/O subrack will be switched off but not the entire system.

4.3.9 Special Features of the Output Modules

All output modules have the following special features:

- To increase the availability the outputs of the safety-related output modules can be switched in parallel without external diodes.
Decoupling diodes are already integrated on the module (see the corresponding data sheets).
- No output voltage is generated if the supply voltage L- is cut at the output module.
- The connection of inductive loads can be done without using protection diodes at the coil. However, it is recommended to connect a diode directly at the inductive load avoiding noise voltages.
- The LED signaling the output status is controlled separately.
- The design of the cable plugs enables the two-pole connection of the actuators. Together with a two-pole supply of the output module an earth fault detection will be simplified by means of a totalizing current transformer.
The cable plugs are available in two specifications:
 - L- in cable plug, one-pole with common L-
 - L- in 2-pole type, 2-pole with L- per channel
see also chapter 10.13.6, "Description of the Order Code for Cable Plugs", option P2
- No time-limited operation in case of a faulty output module.

4.4 System Voltage 24 VDC

HIMA systems will be connected to 24 VDC. The connection terminals are labelled with L+ and L-. The power supply units made available by HIMA, e.g. the power supply PS1000, meet the requirements according to CE for electrical safety and EMC.

All used power supplies must fulfill the requirements SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage). See also chapter 6.4.

The power supply units meet the requirements of the NAMUR recommendation NE 21 for the safety during short-time voltage dips up to 20 ms.

For the supply of 24 V sources, which cannot guarantee a buffering during voltage dips of at least 20 ms, the following measures must be taken in the H51q system family:

- decoupling of the power supply for the central units and
- noise blanking (parameterizable).

Note	Due to the high inrush current of lamps the correct dimensioning of the power supply units for lamp loads must be regarded.

5 Technical Data

5.1 Mechanical Design

Structure of the compact devices H41q

1 subrack 482.6 mm (19-inches technology), 5 HU for central modules and I/O modules

Modules in the I/O area: 4 or 8 SU, 3 HU,
max. 13 I/O modules with width 4 SU

Structure of the modular devices H51q

subracks 482.6 mm (19-inches technology), 1 central subrack 5 HU,
max. 16 I/O subracks 4 HU

Modules in the central area: width 4 and 8 SU, 3 HU,
Modules in the I/O area: width 4 or 8 SU, 3 HU,
max. 256 I/O modules with width 4 SU

Explanation: 1 SU (spacing unit) = 5.08 mm (= 1 TE)
1 HU (height unit) = 44.45 mm (= 1 HE)

The connection of the external signal cables is made at the front plate of the I/O modules via cable plugs with LED displays (no LEDs for analog modules).
For the wiring fire-retardant wires and cables are used.

5.2 System Data

Operating voltages	24 VDC (peripherals) 5 VDC (microprocessor system)
Supply voltage	24 VDC / -15 %...+20 %, $r_{pp} \leq 15\%$
Ambient conditions	0...+60 °C, according to IEC 61131-2 pollution degree II according to DIN VDE 0160
Storage temperature	-40...+85 °C (without batteries) -40...+75 °C (central module and central subrack with battery)

5.3 Data of the Central Module (CU)

Type of processor	INTEL 386 EX
Clock frequency	25 MHz
Program memory	Flash-EPROM for operating system and function blocks Flash-EPROM for user program CMOS-RAM for variables
Battery backup for CMOS-RAM	Lithium battery on the central module
Battery monitoring	Measuring circuit in the central module
Diagnostic system	in the central module with 4 digit alphanumeric display and 2 LEDs
Diagnoses/displays	information of the user program Errors in the central device, I/O bus, in safety-related I/O modules, interfaces
Memory capacity for user	320 kbyte (logic, parameters, variables)
Basic cycle time	5 ms for single channel systems, 27 ms for redundant systems

5.4 Interfaces

5.4.1 RS 485 Interfaces

Interface type	Two-wire bus interface with passive coupling (RS 485)
Central module	2 interfaces
Quantity H41q	max. 4 interfaces on 2 coprocessor modules
Interface extensions	
Quantity H51q	max. 12 interfaces on 6 coprocessor modules
Interface extensions	
Baud rate	300 bps up to 57600 bps (except 38400 bps)
Connection to programming device	by RS 485 / RS 232C converter, type H 7505 or cable BV 7043

5.4.2 Ethernet Interfaces

Interface type	Ethernet according to IEEE 802.3 with 100BaseT connection via RJ 45
Quantity H41q	max. 2 interfaces on 2 communication modules
Interface extensions	(with redundant CUs up to 4 interfaces)
Quantity H51q	max. 5 interfaces on 5 communication modules
Interface extensions	(with redundant CUs up to 10 interfaces)
Baud rate	max. 100 Mbit/s

5.4.3 Profibus-DP interfaces

Interface type	Profibus-DP Slave coupling with RS 485
Quantity H41q	max. 2 interfaces on 2 communication modules
Interface extensions	(with redundant CUs up to 4 interfaces)
Quantity H51q	max. 5 interfaces on 5 communication modules
Interface extensions	(with redundant CUs up to 10 interfaces)
Baud rate	up to 12 MBit/s

5.5 Definition of Signals

The signal definitions of the H41q and H51q systems are according to IEC/EN 61131-2:

Input signals

L-signal (0-signal)	-3...+5 V or open input
H-signal (1-signal)	+13...+33 V
	typ. switching point: approx. 9 V

Output signals

L-signal (0-signal)	0...+2 V
H-signal (1-signal)	+16...+30 V

6 Operating Conditions

The devices were developed in compliance with the requirements of the following standards for EMC, climate and environment:

IEC/EN 61131-2	Programmable Controllers, Part 2 Equipment Requirement and Tests
IEC/EN 61000-6-2	EMC Generic Standards, Part 6-2 Immunity for Industrial Environments
IEC/EN 61000-6-4	EMC Generic Emmission Standard Industrial Environment

For the use of the safety-related control systems the following common conditions have to be met:

Protection class	Protection class II according to IEC/EN 61131-2
Pollution	Pollution degree II
Altitude	< 2000 m
Enclosure	Standard: IP 20 If requested by the relevant application standards (e.g. EN 60204, EN 954-1), the device must be installed in a required enclosure.

6.1 Climatic Conditions

The most important tests and limit values for climatic conditions are listed in the following table:

IEC/EN 61131-2 Chapter 6.3.4	Climatic Tests
	Temperature, ambient: 0...60 °C (Test limits -10...+70 °C)
	Storage Temperature: -40...85 °C (with battery only -30 °C)
6.3.4.2	Dry heat and cold withstand test: 70 °C / -25 °C, 96 h, EUT power supply unconnected
6.3.4.3	Change of temperature, withstand and immunity test: -25 °C / 70 °C and 0 °C / 55 °C, EUT power supply unconnected
6.3.4.4	Cyclic damp heat withstand test: 25 °C / 55 °C, 95 % relative humidity EUT power supply unconnected

6.2 Mechanical Conditions

The most important tests and limit values for mechanical conditions are listed in the following table:

IEC/EN 61131-2 Chapter 6.3.5	Mechanical Tests
	Vibration test, operating: 5...9 Hz / 3.5 mm 9...150 Hz / 1 g
6.3.5.1	Immunity vibration test: 10...150 Hz, 1 g, EUT operating, 10 cycles per axis
6.3.5.2	Immunity shock test: 15 g, 11 ms, EUT operating, 2 cycles per axis

6.3 EMC Conditions

The most important tests and limit values for EMC conditions are listed in the following tables:

IEC/EN 61131-2 Chapter 6.3.6.2	Noise Immunity Tests
6.3.6.2.1 IEC/EN 61000-4-2	ESD test: 4 kV contact / 8 kV air discharge
6.3.6.2.2 IEC/EN 61000-4-3	RFI test (10 V/m): 26 MHz...1 GHz, 80 % AM
6.3.6.2.3 IEC/EN 61000-4-4	Burst test: 2 kV power supply / 1 kV signal lines
6.3.6.2.4 IEC/EN 61000-4-12	Damped oscillatory wave immunity test: 1 kV

IEC/EN 61000-6-2	Noise Immunity Tests
IEC/EN 61000-4-6	Radio frequency common mode: 10 V, 150 kHz...80 MHz, AM
IEC/EN 61000-4-3	900 MHz pulses
IEC/EN 61000-4-5	Surge: 1 kV, 0.5 kV

IEC/EN 61000-6-4	Noise Emission Tests
EN 50011 Class A	Emission test: radiated, conducted

All modules of the systems H41q and H51q meet the requirements of the EMC directive of the European Union and have the CE sign.

With interferences exceeding the limits mentioned above all the systems have a safety-related reaction.

6.4 Voltage Supply

The most important tests and limit values for the voltage supply of the equipment are listed in the following table:

IEC/EN 61131-2 Chapter 6.3.7	Verification of DC Power Supply Characteristics
	The power supply must meet alternatively the following standards: IEC/EN 61131-2 or SELV (Safety Extra Low Voltage, EN 60950) or PELV (Protective Extra Low Voltage, EN 60742)
	The fusing of the control devices must be in accordance to the statements of this manual.
6.3.7.1.1	Voltage range test: 24 VDC, -20 %...+25 % (19.2 V...30.0 V)
6.3.7.2.1	Momentary interruption immunity test: DC, PS 2: 10 ms
6.3.7.4.1	Reversal of DC power supply polarity test
6.3.7.5.1	Backup duration withstand test: Test B, 1000 h, Lithium battery is used for backup

7 Application Notes

7.1 Configuration Notes

7.1.1 Programming System ELOP II and Operating System

For programming and operation of the H41q/H51q PES the version ≥ 3.0 of ELOP II is required.

Required operating system: $\geq$ BS 41q/51q V 7.0-8.

7.1.2 Cabinet Engineering

In ELOP II: After RT declaration (RT = resource type), the cabinet can be configured within the resource.

7.1.3 Usable Function Blocks

All standard function blocks of HIMA are included in the operating system. Therefore the user program only contains the call of the function block and not the code itself.

For information to the current status of the function blocks refer to the most recent state of the ELOP II online help.

7.2 System Extensions

If an existing H51 system is changed in an H51q system and I/O racks out of the assembly kit B 9301 are still part of the system it could be extended always with I/O racks out of the assembly kit B 9302. These extensions are covered through the TÜV certificate. The control in operation is protected for continued existence also after the end of the certificate.

7.3 Installation of the Output Modules of the H50 Family

The following modules may only be installed in the I/O subrack B 9301 assembly kit: F 3311, F 3312, F 3313, F 3314, F 3321, F 3323, F 3412, F 3413, F 6701. There are many specialties (watchdog shutdown etc.) with installation in the I/O subrack B 9302, so it is urgently advised against the use of this kit with these modules. The faultless operation of the modules in B 9302 kit is not guaranteed.



The TÜV certificate of the testable, SIL 3 modules (F 3313, F 3314 and F 3323) is expired cause of changing of the corresponding standard.

Therefore an application for new plants is not admissible.

Because of the new designed realization of the shutdown in the B 9302 assembly kit the supply voltage of an old output module can not be switched off automatically in case of a defective central module and so the outputs of the corresponding module can not be reset independent from the CPU.

7.4 Update from F 865. to F 865.X

When F 865. central modules are updated to F 865.X, also the fan conception must be modified:

Former fan concept:

Z 6012: one integrated fan with fan run monitoring and fuse monitoring

New fan concept:

Z 6018: fan run monitoring for 4 fans and fuse monitoring

K 9212: fan unit (4 fan units for H41, 3 fan units for H51).

See also data sheets of the assembly kits.

7.5 Replacement of F 865.A by F 865.X

F 865.A central modules can be replaced by F 865.X modules after changing to the new fan concept and using the unaltered user program, but with the new operating system (BS41q/51q V7.0-8).

7.6 Use of Coprocessor and Communication Modules

System H41q

To the right of each central module one coprocessor module (F 8621A) or one communication module (Ethernet: F 8627/F 8627X, Profibus-DP: F 8628/F 8628X) can be installed. If they are operated in redundant mode, the same type has to be used.

System H51q

To the right of each central module up to three coprocessor modules or up to five communication modules can be installed additionally.

Restrictions

Coprocessor modules:

Max. 3 for each central module, only the slots reserved for the coprocessor modules can be used (slots 10, 11, 12 or 17, 18, 19).

Ethernet or Profibus-DP communication modules:

Max. 5 for each central module, each of the five slots right of the central modules can be used (slots 10, 11, 12, 13, 14 or 17, 18, 19, 20, 21). The different types can be mixed.

If they are operated in redundant mode, the redundant coprocessor or communication modules must be installed in the according slots.

8 Installation and Connections

8.1 ESD Protection

Only personnel who have the knowledge of ESD protective measures are permitted to carry out system modifications/upgrades to the system wiring.



An electrostatic discharge can damage the built-in electronic components.

- Touch an earthed object to discharge any static in your body.
- When carrying out the work, make sure to use an ESD protected working area and wear an earthing strip.
- When the module is not in use, ensure it is protected from electrostatic discharges, e.g. keep it in its packaging.

8.2 How to Insert and to Remove Modules



The modules of the HIMA PES H41q and H51q may be removed and inserted if the following rules are observed. The modules must be removed from the bus board uninterruptedly by means of the ejection lever (front label) to prevent faulty signals in the system, which can trigger a shutdown.

The modules may not be cant by a screwdriver or by vibrations.

HIMA takes no responsibility for damages resulting from insertion and removing of the modules.

8.2.1 I/O Modules

Remove:

1. Remove both screws of the module,
2. remove the module together with the cable plug,
3. screw off the cable plug and remove it.

Insert:

1. Insert and fix the module without cable plug,
2. plug in the cable plug and fix it by the screws,
3. for safety-related modules and modules with slot detection (see overview of modules in chapter 10):
Refresh the display by pressing the ACK key on the central module.

8.2.2 Coupling Modules

Remove:

1. Switch off the module (**WD switch to “OFF” position**),
2. remove fixing screws of the module,
3. remove the module,
4. corresponding I/O subrack is completely switched off.

Note	If the module is removed without switching off, the watchdog signal for all I/O subracks is shut down. This results in an error stop for MS and HS systems.

Insert:

1. Setting the decode switch on the module according to the note in data sheet of F 7553,
2. insert and fix the module,
3. switch on the module (**WD switch to "ON" position**),
4. press ACK key on the central module until message RUN appears in display.

8.2.3 Central Modules (CU)

Remove:

1. Remove the screws of the data cable plugs,
2. remove the data cable,
3. detach the fixing screws of the module completely, they must be freely movable!
4. Separate the module from the bus board uninterruptedly by means of the ejection lever (front label) to prevent faulty signals in the system which can trigger a shutdown.
Then the module can be removed.
5. Do not touch the components of the module! Watch for the ESD rules for CMOS components.

Insert:

1. Check the settings of the switches and jumpers according to the data sheet,
2. remove the fixing screws of the front plate completely until to the limit,
3. set the module onto its connector and then insert it uninterruptedly until to the stop to prevent faulty signals in the system,
4. fix the screws,
5. plug in the data cables and fix their screws.

Note	At redundant systems the new inserted central module must have the same operating system version as the already plugged central module. If this is not the case, an error message appears in the display of the new plugged central module and this module will go into the STOP state. Then the corresponding operating system version must be loaded. Please regard therefore the informations in the operating system manual.

8.2.4 Power Supplies

Remove:

1. Check the LEDs on the power supplies F 7126, F 7130A and of the monitoring modules F 7127, F 7131 (luminated LEDs indicate correct modules, dark LED indicate defective module. Change only defective module, otherwise the PES will switch off!)
2. If the LED is off check the 24 VDC feeding.
3. Before removing the faulty power supply F 7126, F 7130A check the output voltages of all other power supplies (cf. data sheets).
4. Screw off the faulty power supply and remove it.

Insert:

1. Insert power supply and fix it by screws,
2. Check the output voltage (cf. data sheet).

8.2.5 Communication and Coprocessor Modules

Remove:

1. Disconnect the communication cable.
2. Important: **At first** remove the appertaining central module after removing the fixing screws,
3. remove communication module (Ethernet module **with** HSR cable connected, if existing) after removing the fixing screws,
4. Ethernet module: Remove HSR cable.

Insert:

1. Check settings of the switches according to the data sheet,
2. insert module without cable and fix it,
3. Ethernet module: Connect HSR cable (only at HIPRO-S, but not at HIPRO-S-DIRECT),
4. connect communication cable,
5. insert appertaining central module and fix it by screws.

8.3 Earthing of the 24 VDC System Voltage

Please regard the requirement of the SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage). To improve the electromagnetic compatibility an instrument earth is provided. The instrument earth is designed within the cabinet in such a way that it fulfills the requirements of a protection earth.

All H41q/H51q systems can be operated with earthed L- or not earthed.

8.3.1 Floating Supply

With several undetected earth faults faulty control signals may be triggered. To prevent this, with floating operation in any case an earth fault monitoring system must be provided (ref. also to e.g. VDE 0116). The earth fault monitoring must be installed outside the control cabinet.

An earth fault can only be located by switching off a partial function (separation of lines). An earth fault can be detected if both poles are feed to supply an output circuit.

8.3.2 Earthed Operation

It is premised that the earthing conditions are excellent and there is a separate earth connection (if possible) through which no external currents flow. Only the earthing of the negative pole (L-) is permitted. Earthing of the L+ positive pole is not admissible, as any earth fault on a sensor line would result in an overriding of the sensor concerned.

L- may only be earthed at one point within the system. Generally L- is earthed directly behind the power supply (e.g. on the bus bar). The earthing should be easy to access and disconnect. The earthing resistance must be $\leq 2 \Omega$.

8.4 Measures to Install a Cabinet According to the CE Requirements

According to the guideline 89/336/EEG of the European Council (also law for EMC in the Federal Republic of Germany), since January 1st, 1996 all electrical equipments have to be provide with the CE symbol for Electromagnetic Compatibility (EMC) within the European Union.

All modules of the HIMA system families H41q/H51q are supplied with the CE symbol.

To prevent also EMC problems with the installation of controls (PLCs) in cabinets and frames, the following measures are required:

- Installation of the **H 7013** HIMA module as power supply filter directly at the 24 VDC feed-

ing. The filter is not required if power supplies with the CE symbol are used, e. g. the HIMA standard power supplies.

- Correct and interference-free electrical installation in the ambient of the control, e. g. no power current cables should run together with the 24 V cables.
- No filter H 7013 is necessary if the 24 V feeding is installed in an own power supply cabinet installed side by side to the cabinets with PLCs.
- Furthermore please notice the notes within the PES catalog concerning earthing, shielding and cable run to sensors and actuators.

8.5 Earthing in the HIMA PES

Reliable earthing and thus the fulfillment of the valid EMC regulations in HIMA systems is achieved by the measures described below.

8.5.1 Earthing Connections

All touchable plates of the 19-inches HIMA components (e. g. blind plates and subracks) are electrically conductive passivated (ESD protection, ESD = Electrostatic Discharge). The safe electrical connection between built-in components, such as subracks, and the cabinet is made via captive nuts with claws. The claws penetrate the surface of the swing frame (1) and thus guarantee a safe electrical contact. The screws and washers used are made of high-grade steel to avoid electrical corrosion (2).

The parts of the cabinet framework (3) are welded together and therefore they make up an electrically conductive constructional element. Swing frame, door, mounting rails and mounting plates (if existing) are conductively connected to the cabinet framework via short earthing straps with a cross section of 16 mm² or 25 mm². The earthing straps are covered with a yellow/green identifying sheath (5).

The top plate is screwed to the cabinet framework via four lifting eyes. Side panels and rear panel are conductively connected via earthing clamps (7) (see Figure 8) to the cabinet framework as well as the bottom plate via screws

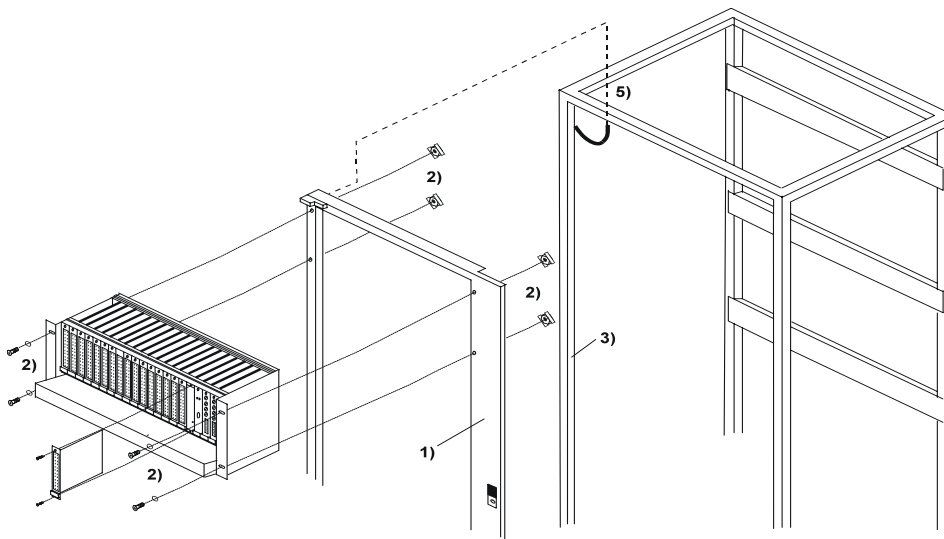


Figure 7: Earthing connections for subracks

As a standard, two M 2500 (4) bus bars are already installed in the cabinet and are connected to the cabinet framework via 25 mm² earthing straps (5). Additionally, the bus bars (4) can be used for potentials separated from the earth just by removing the earthing straps (e.g. for the screens of field cables). For the connection of the customers earthing an M 8 screw bolt is provided at the cabinet framework (6).

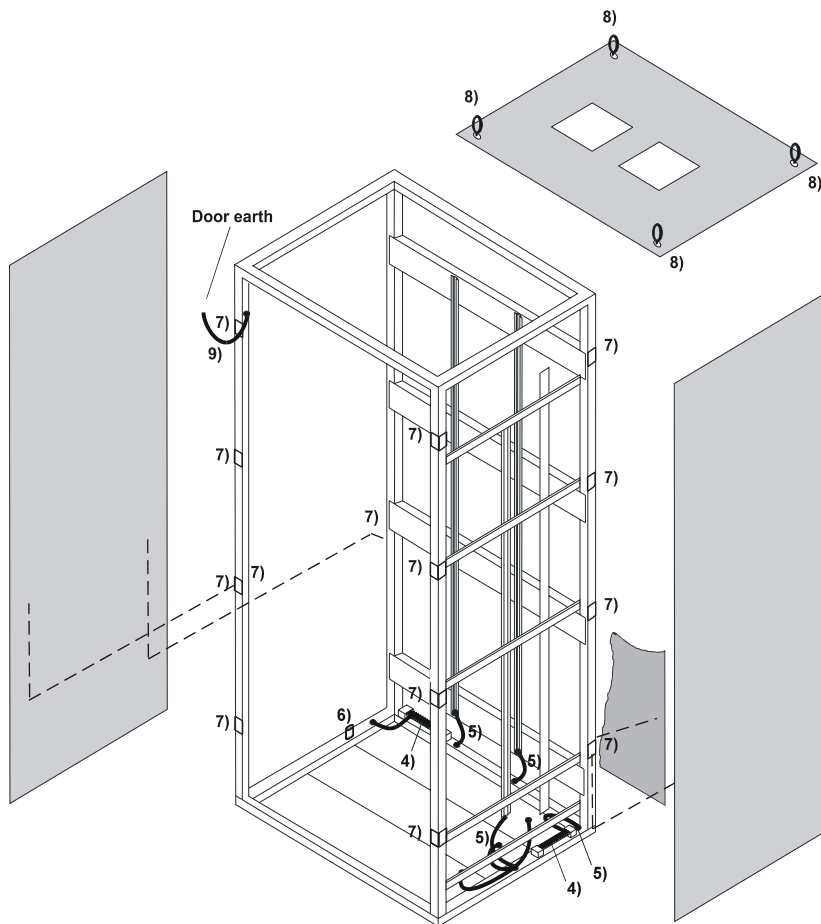


Figure 8: Earthing connections in cabinet

Size of the Earthing Straps/Earthing Cables

Location of installation	Position in Figure 8	Cross section	Length
Mounting rails (single-sided with connector sleeve)	5)	16 mm ²	300 mm
Door	9)	16 mm ²	300 mm
Swing frame		25 mm ²	300 mm
M 2500 bus bar (single-sided with connector sleeve)	4)	25 mm ²	300 mm

Table 6: Earthing straps, earthing cables

Earthing clamps (position 7 in figure 8)

- Side panels, rear panel, bottom plate

Central earthing bolt (position 6 in figure 8)

Lifting eyes (position 8 in figure 8)

- Top plate connected to the cabinet framework via four lifting eyes

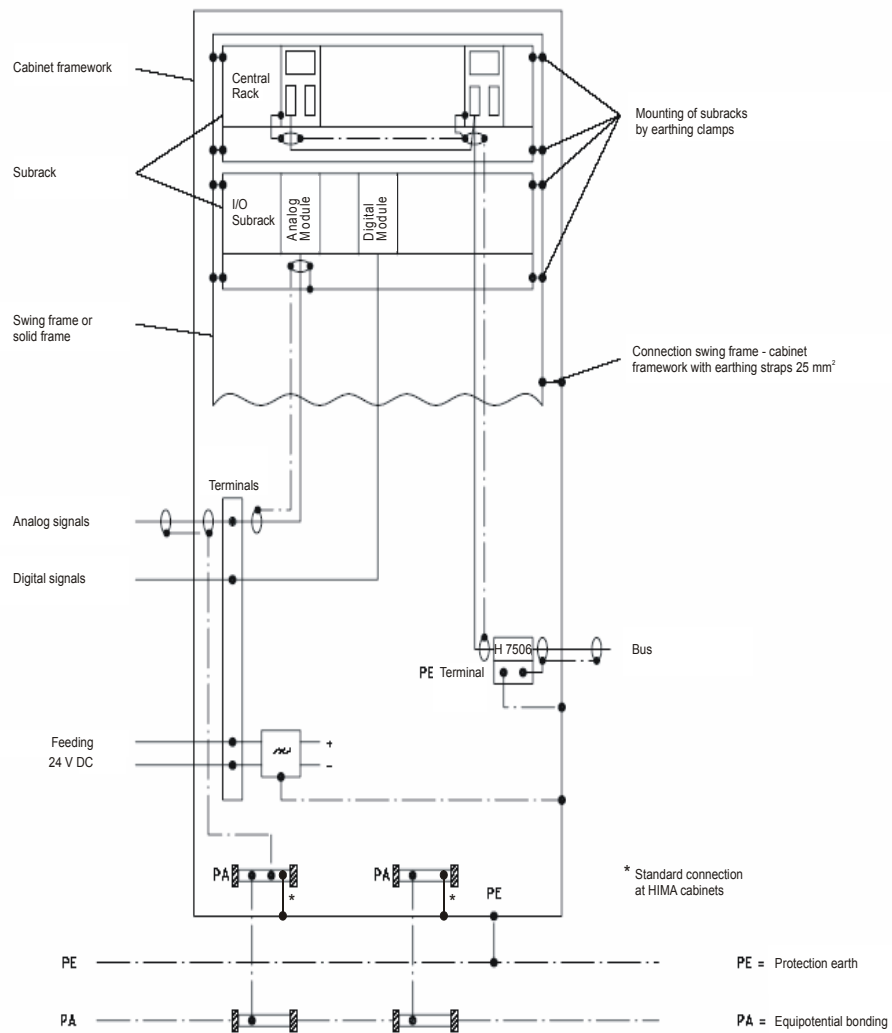


Figure 9: Earthing and shielding concept of the system cabinet

8.5.2 Fastening of the Earthing Straps

Regard the correct connection of the earthing straps!

8.5.3 Interconnecting the Earth Terminals of Multiple Switchgear Cabinets

The earth must be with less interference voltage as possible. If this cannot be achieved, a separate earth for the control has to be installed.

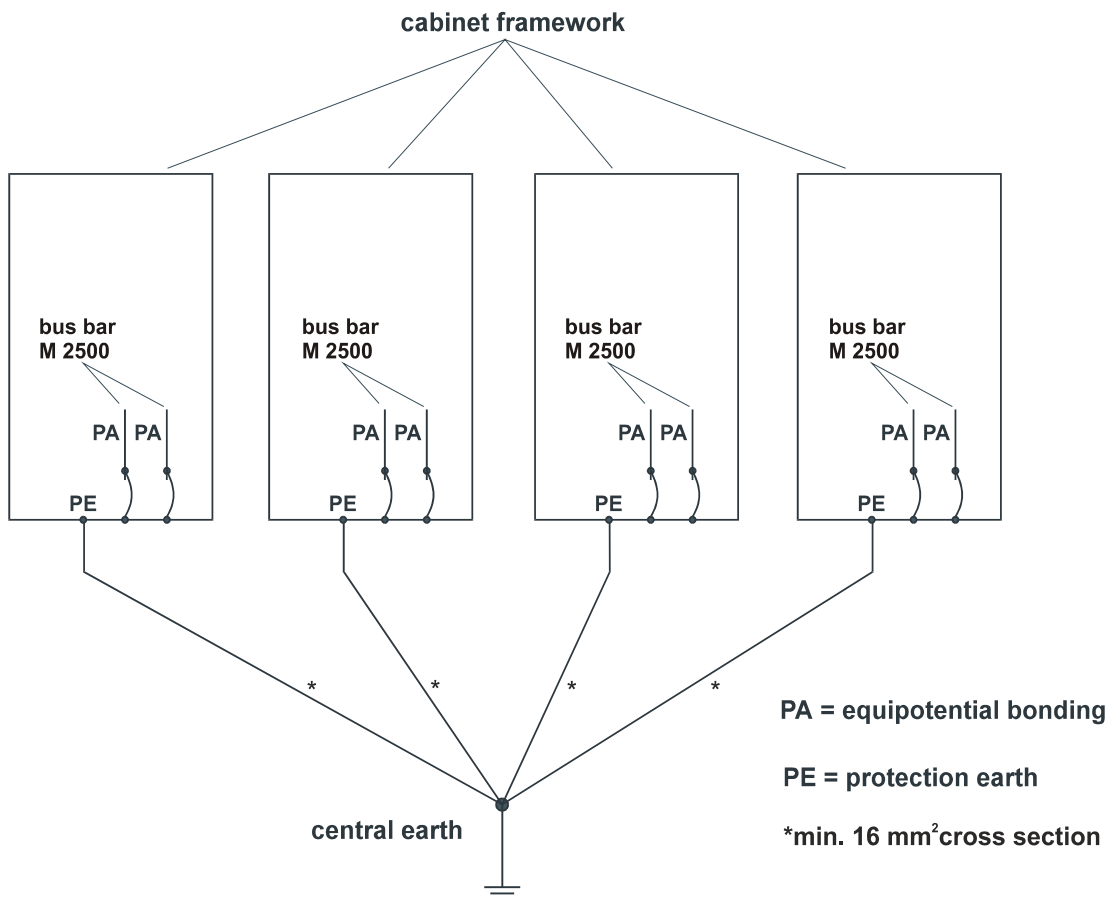


Figure 10: Connection of earth terminals

8.6 Shielding of Data Lines in the HIMA Communication Systems

Reliable shielding of data lines in HIMA communication systems is achieved by the following measures:

The connection ¹⁾ of the cable shield from the bus subscriber's (H41q, H51q) to the bus terminals (H 7506) is established on the bus subscriber's side. Via the plug case and the metal front plate a connection is established via the PCB layout to the PE cabinet earth. The other side of the cable shield is not connected.

The connection ²⁾ of the H 7505 interface converter is also established on one side via the plug case. The connection to the top hat rail is established via the X2/1 ⁵⁾ connection. According to HIMA earthing principles the top hat rail itself is connected to the cabinet earth or optionally, to an instrument earth ⁶⁾.

The connection ⁴⁾ of the cable shield between the individual H 7506 bus terminals is established on one side via a terminal. The terminal is located on a top hat rail to which it is also conductively connected.

The shield of the BV 7044 cable for the connection ³⁾ of the H 7505 interface converter is earthed on the PC (PADT) side.

The measures ¹⁾, ²⁾, ³⁾ are standardized already finished in HIMA. The connections ⁴⁾, ⁵⁾, ⁶⁾ have to be performed during the installation on site. The shielding connection using a special cable ⁷⁾ does already exist or has to be performed depending on the special cable.

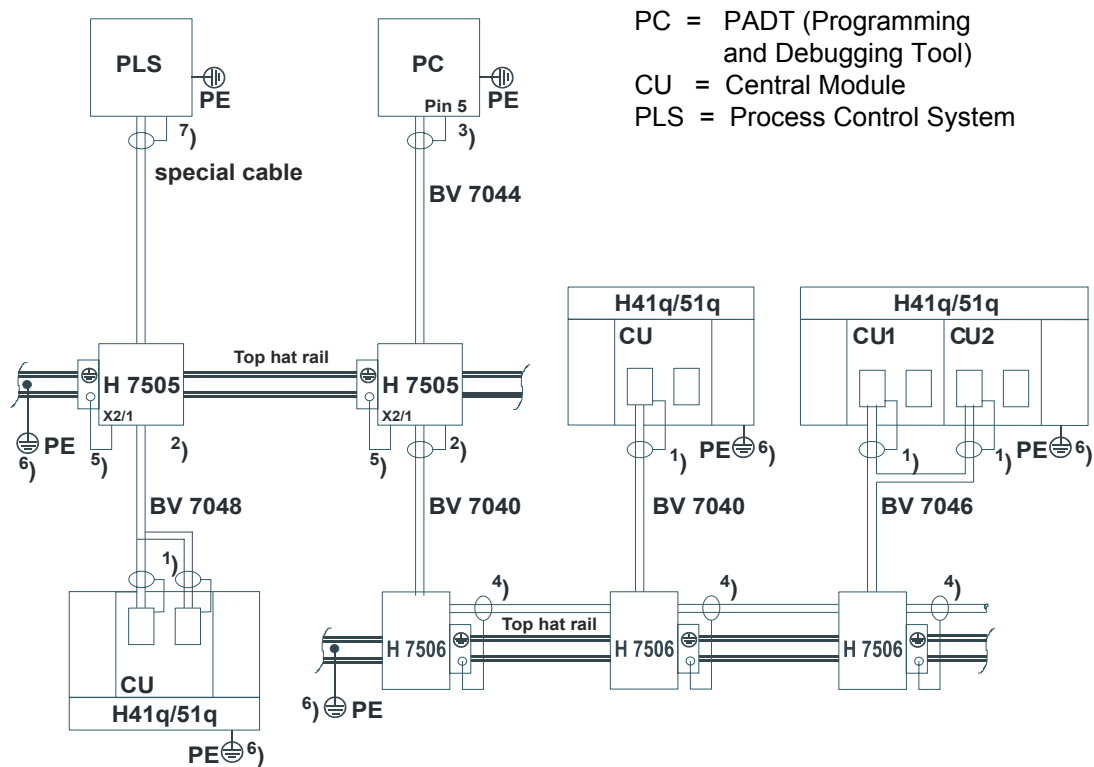


Figure 11: Connection of the cable shields

8.7 Shielding in the Input/Output Area

At installation of the field cables pay attention to the fact, that the cables to sensors and actuators are separated from power supply cables and in a sufficient distance from electromagnetic active devices (motors, transformers).

Cables to the input modules of the H41q/H51q systems have to be installed interference-free as possible e. g. as shielded cables.

This applies especially to cables with analog signals and for proximity switches.

With cable connectors having a shield termination line this has to be connected to the bus bar of the I/O rack below the slot of the module.

Further informations on the requirements of shielding and earthing you will find in the data sheets of the modules.

8.8 Lightning Protection in HIMA Communication Systems

System earthing problems caused by a flash of lightning could be minimized due to the following methods:

- complete shielding of the field wiring of HIMA communication systems
- correct installation of the system earthing.

In especially exposed environments outside of buildings it could be advisable to provide lightning protection by using special lightning protection modules. For this the module of type MTRS 485 "DATA-MODUTRAB" from Phoenix company is used. The module is provided for coarse protection (influences up to 10 kA) and fine protection (influences up to 400 A).

The connection of the lightning protection modules is according to the sketch below:

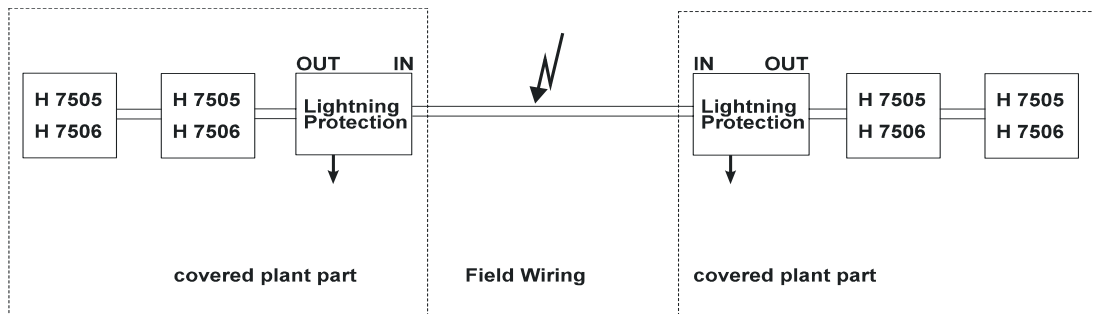


Figure 12: Connection of lightning protection tools

Planning notes:

The using of this lightning protection module reduces the max. possible transmission length because of its series resistance of 4.4 Ω. Two modules are necessary per channel.

For HIBUS-2 the max. transmission length is 1200 m with 0.25 mm² wiring cross section. The loop resistance is 180 Ω in this case (with regard of the specific line resistance of copper and the double transmission length). The calculation of the remaining length of the bus refers on a continuous wiring with the same cross-section according to the formula:

$$L_R = ((180 \Omega - n * 4.4 \Omega) / (2 * R_L)) * 1000$$

L_R = remaining length in m

n = number of line protection modules per channel

R_L = line resistance in Ω/km

The result is a remaining length of 1141 m (2 modules, $R_L = 75 \Omega/\text{km}$) for 0.25 mm² cross section.

Note

The line protection modules should not be installed in the same cabinet as the PES.

The use of fiber optics cable is advisable at large distances for lightning protection and protection of EMC influences.

8.9 Cable Colors

The system wiring of H41q/H51q specifies colors and color codes for cables and wires regarding the relevant international standards.

Deviant from the HIMA standard the customer can also use different cable colors for wiring based on national normative requirements. These deviations shall be documented and verified.

9 Startup and Maintenance

The tests and recommended measures for the startup, maintenance and fault detection are briefly summarized.

To limit the scope of the documentation, the chapters concerned in this catalog and in the other printouts of the HIMA system documentation are referred to.

9.1 Recommended Devices for Startup and Maintenance

- PC, for the work on site as portable computer (laptop). All projects of the system in their current state and the HIMA system software should be on the hard disk,
- High resistance multimeter with resistance meter,
- Sensors to simulate analog signals.

9.2 Installing the System

The control cabinets are delivered with the modules plugged in and fixed with screws, and with free connectors. They have been tested with these modules in the factory, so that the following tests concentrate on the correct external installation.

9.3 Earthing the 24 VDC System Voltage

Refer to chapter 8.2.

9.4 Starting up the Control Cabinet

9.4.1 Testing All Inputs and Outputs for External Voltage

Impermissible external voltages (especially e.g. 230 VAC to earth or L-) can be measured with a multimeter. We recommend checking each connection for impermissible external voltage.

9.4.2 Testing All Inputs and Outputs for Earth Faults

When testing the external cables for insulating resistance, short-circuits and wire breaks, the cables must be disconnected at both ends in order to avoid damaging or destroying the modules with excessive voltage.

The testing for earth faults is carried out after the disconnection of the free connectors for the sensors and control elements. The voltage connections of the free connectors on the potential distributors must also be disconnected. The supplies of the sensors must be disconnected as well as the negative pole must be separated at the control elements.

If the negative pole is set up for earthed operation, the earth connection must be interrupted while testing for earth faults. This also applies for the earth connection of possibly existing earth fault testing facilities.

Any connection can be tested to earth with a resistance meter or a special testing device.

Note	In this state the system is set up for testing if individual lines or a group of lines are insulated against earth, but not if two lines are insulated against each other. Otherwise there is a risk of damage. The guideline for test voltages and insulating resistance is IEC/EN 61131-2 or DIN VDE 0160/EN 50178.

9.5 Switching on Power Supply

The input/output modules and their appertaining cable connectors are fixed with screws. The 24 VDC operation voltage has to be checked for correct polarity, level and ripple before it is connected.

In case of reverse polarity a fuse protects the I/O module of damages.

9.6 Functional Testing

9.6.1 Preparing Functional Testing

For functional testing check the equipment of the control cabinet completely with help of the label and/or documentation printout "I/O subrack". All free connectors of the input/output modules have to be connected to the allocated input/output racks, and the voltage connections of the cable connectors to the allocated voltage distributors. All control elements (control devices) must be released by the factory management or be driven without auxiliary power.

9.6.2 Testing in the Central Devices

The essential tests in the central devices of the H41q/H51q system are:

Central modules	switch positions for bus station no. and transfer rate, version of the operation system via display
Coprocessor module F 8621A	operating system EPROM switch positions for RS 485 interface
Communication modules	switch positions for different operating modes for modules F8627/F8627X and F8628/F8628X, see cor- responding data sheet
I/O bus connection	refer to the data sheet of the appertaining assembly kit

We recommend marking all required switch positions etc. in copies of the data sheets of the respective control cabinet and keeping the copies in the pocket of the cabinet door. Should modules have to be exchanged, the necessary information will thus be immediately available.

9.6.3 Testing in the Input/Output Subracks

The essential tests in the input/output subracks are:

Coupling module F 7553 (only H51q systems)

switch position for coding the rack according to the resource type

Wiring, especially the watchdog signal, refer to data sheets of the assembly kits and the safety manual

For the construction of the I/O bus refer to the data sheets of the B 9302 assembly kit and of the H41q assembly kits.

The input/output modules themselves have no coding. Only the correct position of the modules and the corresponding cable connector must be regarded. The existing fuse modules including fuses have to be checked for completeness. Also the correct assignment of the 24 V supply to the slots of such modules, which need the feeding via the rear PCB bus, has to be checked.

9.6.4 Switching on the HIMA PES

After the operating voltage has been connected, the HIMA PES goes into RUN operation, if the user program has been loaded and no error has been found in the system.

If STOP is displayed the program can be started via ELOP II (RUN state). There is an error if this is not possible. Only after the correction of the error, e.g. setting the correct switch position, correct connecting lines, or possibly after the exchange of a module etc. the RUN operation is started.

Error displays can be called on the diagnostic display of the central module via two buttons or after the start of the communication to the programming device via OLT window. Refer to the documentation of the operating system.

9.6.5 Starting the Communication between Programming Device and PES

For construction and startup of the communication between programming device and PES: refer to the documentations first steps ELOP II, user manual operating system and user manual ELOP II Resource Type.

Communication faults can be checked by means of a program (HIKA) for monitoring, logging and analyzing of the data communication.

For more informations about the tool "HIKA" refer to the HIMA service.

9.7 Maintenance



Maintenance on supply, signal and data lines may only be executed by qualified personnel with consideration of all ESD protection measures. Before direct contact of these lines the maintenance personnel has to be electrostatically discharged!

At safety-related applications, e.g. using of relay output modules, the modules have to be overhauled at regular intervals (every 3 years for relay modules, for all other modules every 10 years, OFFLINE proof test, see IEC/EN 61508-4, paragraph 3.8.5).

We recommend exchanging electrolytic capacitors in the power supply every five years.

9.7.1 Exchange of the Buffering Batteries

For buffering lithium batteries are used.

Lifetime of the buffer batteries (CPU not in operation, modules *without* voltage feeding):

1000 days at $T_A = 25\text{ }^{\circ}\text{C}$,

200 days at $T_A = 60\text{ }^{\circ}\text{C}$

It is recommended to change the buffer batteries (CPU in operation, modules *with* voltage feeding) at the latest after 6 years.

Changing of external batteries of the systems H41q/H51q:

1. Battery without soldering lug:
CR-1/2 AA-CD, HIMA part no. 440000019.
Remove battery cap, loose battery out of the holder and plug in new battery. Check the polarity!
2. Battery with soldering lug: CR-1/2 AA-CD, HIMA part no. 440000016
Solder battery out of holder (first + pole then - pole). At solder in check the correct polarity and first solder the - pole then the + pole.

External batteries of the systems H41q: Backplane of the bus plate

Dependent on the battery type changing as described above.

External batteries of the systems H51q: Power supply monitoring module F 7131

The module can be pulled out in the energized state. Then change the battery as described above. Check the polarity!

Central modules: F 8650E / F 8650X, F 8651E / F 8651X, F 8652E / F 8652X, F 8653E / F 8653X

Battery: CR 2477N, HIMA part no. 44 0000018

It is recommended to change the buffer battery (CPU in operation, modules *with* voltage feeding) at the latest after 6 years, or with display BATI within three months.



For battery change the central module has to be pulled out of the sub-rack!

Further informations you will find in chapter "How to Insert and to Remove Modules". For single channel systems this results of course in a shutdown of the plant, in redundant systems the system reaction depends on the configuration.

Coprocessor module F 8621A

This module may be installed as an option within the central rack of the H41q/H51q system family. At H41q system the coprocessor module is buffered via the batteries on the backplane, at H51q system this is done by batteries on the F 7131 power supply monitoring module. A coprocessor module is needed to hold the master program for controlling the communication between PES systems (slaves).

9.8 Faults

9.8.1 Faults in the Central Device

If there are faults in PES with redundant central modules, the device without failure takes over the operation without interruption. The diagnosis display on the functioning central module indicates MONO.

If there is a faulty central module in PES with one central module only, this mostly results in a switch-off of the PES.

The diagnosis display of the faulty central module shows STOP.

If the buttons on the front of the faulty central module are pressed, the error codes of the faults are displayed (refer to the manual operating system).

Note:

Before pushing the Ack button, the history of the registered faults (Control Panel, Display of the error status of the CPU) can be saved in a file. By pushing the Ack button the RAM memory of the CPU with all saved error messages will be deleted!

When the programming device is connected it offers the possibility to display the occurred errors. These values are stored in the RAM (memory) of the PES. These values are important to get a clear analysis of the errors. They should be stored with "Print" or "Export" (refer to the online help of ELOP II).

If the central module is replaced, the correct switch positions and correct version of the operating system (on the display) have to be regarded (for insertion and removing of modules within the central rack refer to chapters 8.1.3 and 8.1.4).

If the user program has to be loaded after exchanging the central module at redundant systems the following has to be regarded:

- the user program can be loaded at redundant systems via the procedure "Self-education" (see also the description in the operating system manual and the corresponding data sheet of the CPU).
- make sure that the correct central module will be loaded
- additionally the code version of the existing user program in the running central module and the user program to be loaded in the changed module must be the same.

9.8.2 Faults in the Input/Output Modules

Faults in **safety-related** input/output modules are recognized automatically by the PES during operation, and they are displayed on the diagnosis display by I/O error with the indication of the faulty position.

If an input/output module has a line monitoring also the feeding lines to sensors and actuators are checked and faults are indicated on the diagnosis display additionally with the defective channel number. In this case also the external wiring has to be checked but the module must not be changed.

The effect of faulty channels of **not safety-related** input/output modules will be the difference between the signal status in the logic and of the appertaining LEDs on the cable connectors. If the logic signal does not match the LED display, the respective input/output module must be exchanged. For output modules you should first check whether the control element works or there is a line disturbance.

Input/output modules can be inserted and pulled out during operation. For insertion and removing of input/output modules refer to chapter 8.1.1.

9.8.3 Faults in the Coprocessor and Communication Modules

Faults of the modules are signaled by front LEDs (interface LED or ERR LED). The corresponding function block informs the user program via system variables. In order to maintain the **redundancy** of the H41q and H51q systems faulty coprocessor or communication modules have to be changed immediately. To change faulty modules in a redundant system (two central modules) during operation of the system the following procedure must be observed:

1. Remove fixing screw of the central module.
2. The related central module has to be removed.
3. Remove fixing screw of the module to be changed.
4. The defective coprocessor module or communication module has to be removed.
5. All interface cables including cable for redundancy have to be unplugged.
6. On the module in exchange for the defective module all switches have to be set exactly to the same positions.
7. All interface cables including cable for redundancy have to be plugged in.
8. The coprocessor or communication module in exchange has to be plugged in.
9. Fix the mounting screw of the changed module.
10. The related central module has to be plugged in.
11. Fix the mounting screw of the central module.

9.8.4 Repair of Modules

A repair by the user is not possible as the legal regulations for intrinsically safe and safety-related modules cannot be complied.

Additionally special testing programs are necessary for repairing.

Therefore defective modules should be sent to HIMA for repair with a short fault description after they have been checked on the customer's premises. The fault description of central modules and for input and output modules should contain:

- ID no. (total) of the module e.g. at a F 8650E module: 01.064894.022
- measurements to repair up till now,
- detailed fault diagnosis from error state view (refer to the user manual ELOP II and the user manual ELOP II Resource Type), in case of redundant PES the diagnosis of both central modules should be included.

The fault description should contain the measurements taken up till now (checking the power supply, exchange of the module).

9.8.5 HIMA Service, Training and Hotline

Appointments can be made with the Service Department concerning start-up, testing or modifying of the control cabinets, dates as well as the extent of the work to be done.

HIMA makes special trainings based on the current training program for its software programs and the hardware of the PES. This training usually takes place at HIMA. Please ask for the training program as well as for the dates of the internal trainings at HIMA.

We also offer training on site on the customer's premises. On request the trainings can be arranged also as external or special trainings.

Important phone numbers and email addresses

HIMA reception	Phone:	049 - 06202 - 709 - 0
	Fax:	049 - 06202 - 709 - 107
	email:	info@hima.com
HIMA hotline	Phone:	049 - 06202 - 709 - 258 (or 255)
	Fax:	049 - 06202 - 709 - 199
	email:	hotline@hima.com

Further contact persons at HIMA you will find at HIMA homepage
www.hima.com.

10 Data Sheets

In the second part you can find the data sheets for the assembly kits, the data connection cables and the modules in alphanumerical order. The following lists and tables gives you an overview.

10.1 Assembly Kits

B 4234	System H41q-M 19 inches, 5 HU
B 4235	System H41q-MS 19 inches, 5 HU
B 4236-1	System H41q-H 19 inches, 5 HU
B 4236-2	System H41q-HR 19 inches, 5 HU
B 4237-1	System H41q-HS 19 inches, 5 HU
B 4237-2	System H41q-HRS 19 inches, 5 HU
B 5230	System H51q-M central rack 19 inches, 5 HU
B 5231	System H51q-MS central rack 19 inches, 5 HU
B 5232-1	System H51q-H central rack 19 inch, 5 HU
B 5232-2	System H51q-HR central rack 19 inches, 5 HU
B 5233-1	System H51q-HS central rack 19 inches, 5 HU
B 5233-2	System H51q-HRS central rack 19 inches, 5 HU
B 9302	for all systems H51q I/O subrack 19 inches, 4 HU
B 9361	for all systems H51q additional power supply 5 VDC, 19 inches, 5 HU

10.2 Data Connection Cables

BV 7002	H 7505 <--> printer with serial interface
BV 7032	Data cable of the I/O bus
BV 7040	H 7506 <--> H 41q/H51q-M/MS (single channel) H 7505 <--> H 7506

BV 7043	H 41q/51q <--> V.24 without additional power supply
BV 7044	V.24 <--> H 7505
BV 7045	HICA connection cable
BV 7046	H 7506 <--> H41q/H51q redundant
BV 7048	H 7505 <--> H41q/H51q redundant
BV 7049	H41q/H51q redundant <--> optical fibre
BV 7050	H41q/H51q single channel <--> optical fibre
BV 7051	H 7506 <--> optical fibre
BV 7052	H 7505 <--> HIMA systems single channel
BV 7053	HSR cable for redundant communication module F 8627 / F 8627 X
BV 7055	H 7506 <--> Edgeport/2i (USB)
BV 7201	H 7015A <--> H 7018 connection cable terminal module

10.3 Central Modules

F 8650E / F 8650X	H51q-MS, -HS, -HRS	SIL 3	1002D processor
F 8651E / F 8651X	H51q-M, -H, -HR		
F 8652E / F 8652X	H41q-MS, -HS, -HRS	SIL 3	1002D processor
F 8653E / F 8653X	H41q-M, -H, -HR		

10.4 Power Supplies

F 7126	Power supply 24 VDC / 5 VDC, for systems H51q
F 7130A	Power supply 24 VDC / 5 VDC, for systems H41q

10.5 Current Distribution Modules and Drawers

F 7132	4-channel power distribution L+ or EL+ and L-
F 7133	4-channel power distribution with fuse monitoring

10.6 Additional Devices for Power Supply

F 7131	Power supply monitoring with buffer batteries for H51q
H 7013	Power supply filter 24 VDC
H 7021	Power supply filter 48 VDC

The additional devices listed below are now described in the catalog "Cabinets and Power Supplies".

K 7212	Feeding and current distribution (with mains filter)
K 7213	Feeding and current distribution, up to 35 A
K 7214	Feeding and current distribution, up to 150 A
K 7215	Feeding and current distribution, up to 150 A, graphical display
K 7216	Feeding and current distribution, up to 63 A, for SELV and PELV
K 7901	Feeding and current distribution, up to 63 A, with two mains filters Z 6015
K 7915	Fuse distributor for lead fuse with certificate of Factory Mutual Research Corporation

10.7 Modules for I/O Bus Coupling

F 7553	Coupling module for H51q

10.8 Communication Modules

F 8621A	H41q/51q coprocessor module
F 8627 /	Fast Ethernet communication
F 8627X	
F 8628 /	Profibus-DP communication
F 8628X	

10.9 Relays in Terminal Block Housing

H 4116	Relay in terminal block housing, safety-related, 4 A, SIL 2
H 4135	Relay in terminal block housing, safety-related, SIL 3
H 4136	Relay in terminal block housing, safety-related, operating voltage 48 VDC, SIL 3

10.10 Bus Connection Modules for HIBUS

H 7505	data signal converter V.24 / 20 mA, 2-wire / 4-wire (HIBUS)
H 7506	Bus terminal module for 2-wire buses

10.11 Accessories

H 7014	Electronic fuses
H 7015A	Terminal module
H 7016	Terminal module
H 7017	Shunt with low-pass filter
H 7018	Terminal module
H 7020	Terminal module
RS485 PCI	Interface card

10.12 Input and Output Modules

For the appertaining software function blocks refer to the description of the used operating system.

10.12.1 Digital Input Modules

Con- tact	Prox. switch	safety- related SIL 3	Line Control	(Ex)i	Coun- ter	Space require- ment	Type	Chan- nels	Slot detec- tion
•						4 SU	F 3221	16	-
•	•					4 SU	F 3222	8	-
•	•			•		4 SU	F 3224A	4	-
•		•				4 SU	F 3236	16	•
	•	•	•			4 SU	F 3237	8	•
	•	•	•	•		8 SU	F 3238	8	•
•	•	•				4 SU	F 3240	16	•
• 48 V		•				4 SU	F 3248	16	•
•					•	4 SU	F 5203	1	-
	•	•			•	4 SU	F 5220	2	•

Table 7: Digital Input Modules

SU = spacing units (width)

10.12.2 Analog Input Modules

0/4... 20 mA	Voltage	safety- related SIL 3	Pt 100	(Ex)i	Space require- ment	Type	Chan- nels	Slot detec- tion
•	0...1/5/10 V	•			4 SU	F 6214	4	•
•	0...1/5/10 V		•		4 SU	F 6215	8	-
•	0...1/5/10 V		•		8 SU	F 6216A	8	-
•	0...5/10 V	•			4 SU	F 6217	8	•
	TC, -100...100 mV	•	•	•	4 SU	F 6220	8	•
•	0...1 V	•		•	4 SU	F 6221	8	•

Table 8: Analog Input Modules

TC = Thermocouple

SU = spacing units (width)

10.12.3 Digital Output Modules

24 VDC	> 24 V	safety-related SIL 3	Line Control	Load	Space requirement	Type	Channels	Slot detection
•				≤ 0.5 A	4 SU	F 3322	16	•
		only with F 6221 •		Transmitter supply (Ex)i ≤ 22 V, ≤ 60 mA	4 SU	F 3325	6	-
•		•		≤ 0.5 A	4 SU	F 3330	8	•
•		•	•	≤ 0.5 A	4 SU	F 3331	8	•
•				≤ 2 A	4 SU	F 3332	4	•
•		•		≤ 2 A	4 SU	F 3333	4	•
•		•	•	≤ 2 A	4 SU	F 3334	4	•
		•		(Ex)i ≤ 24 V, 12 mA	4 SU	F 3335	4	•
	•	•		≤ 0.5 A, 48 V	4 SU	F 3348	8	•
•	•	•	•	≤ 0.5 A, 24 V or 48 V	4 SU	F 3349	8	•
	•			≤ 4 A, ≤ 60 V	4 SU	F 3422	8	•
	•	•		≤ 4 A, ≤ 110 VDC, ≤ 250 VAC	4 SU	F 3430	4	•

Table 9: Digital Output Modules

SU = spacing units (width)

10.12.4 Analog Output Modules

24 VDC	> 24 V	safety-related SIL 3	Line Control	Load	Space requirement	Type	Channels	Slot detection
		•		0...20 mA	4 SU	F 6705	2	•
				0...20 mA	4 SU	F 6706	2	•

Table 10: Analog Output Modules

SU = spacing units (width)

10.13 General Notes on the Data Sheets

10.13.1 I/O Modules

The block diagrams in the data sheets always show the direction of signal flow from top to bottom.

For input modules the input signal (from sensor, proximity switch etc.) is lead via the cable connector and input module to the I/O bus or in the mechanical principle from the front to the rear side of the I/O subrack.

For output modules the result of the logic operation in the user program is connected from the I/O bus to the output amplifier via the cable connector to the actuator (relay, solenoid valve etc.). The mechanical principle is from the rear to the front side of the I/O subrack.

In the block diagrams the 5 V and 24 V operating voltages connections are shown.

10.13.2 Modules within the Central Subrack

Here you can see the essential components and the positions of switches and jumpers. Additionally the front plate is shown. The essential functions are described in the system descriptions (chapter 3 for the H41q and chapter 4 for the H51q as well as the data sheets of the systems/assembly kits).

10.13.3 Communication Modules

Applications for the using of the communication modules are described in the appertaining data sheets.

10.13.4 Symbols in the Data Sheet Diagrams



Function unit and signal converter



Function unit and signal converter with galvanic isolation



Function unit and signal converter with safe isolation



Trigger stage (threshold input)



Amplifier in direction of signal flow



DC/DC converter



Transmitter



Analog/Digital converter



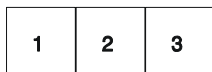
Digital/Analog converter



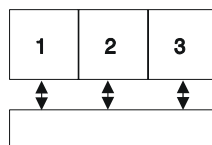
Automatic testing for operation



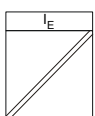
Signal contraction



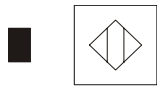
Channel numbers according to "Modify Cabinet" in ELOP II



Module with automatical test functions



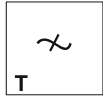
Threshold input for line break and line short-circuit monitoring



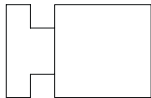
Proximity switch without attenuation, high current to the amplifier



Proximity switch with attenuation, low current to the amplifier



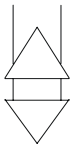
Input filter, testable



Control block for registers



Multiplexer



I/O bus



02



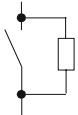
Indicator light (LED), off
no. of the channel
Indicator light (LED), on (in function tables)



or



Current source



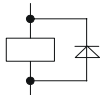
Sensor with resistor as near as possible at the contact



Diode



Light-emitting diode (LED)



Relay with reverse current diode



Resistance thermometer Pt 100



Fuse



Power source



$4 F$	At inputs: Load of the signal 4 F = 8 mA at 24 V signal range: +13...+33 V
$100 F$	At outputs: Loadability of the signal 100 F = 200 mA
$\leq 15 W$	Loadability of the output $\leq 15 W$
L+	Positive pole of the 24 VDC supply voltage
L-	Reference pole of the 24 VDC supply voltage
+5 V	Positive pole of the microprocessor system
GND	Reference pole of the microprocessor system

10.13.5 Color Code for Lead Marking in Accordance to DIN IEC 60757

BK	black	VT	violet
BN	brown	GY	gray
RD	red	WH	white
OG	orange	PK	pink
YE	yellow	GD	gold
GN	green	TQ	turquoise
BU	blue	SR	silver

10.13.6 Description of the Order Code for Cable Plugs

Standard cable plugs: see HIMA price list

Z7nnn/nnnn/nnn/A/B	
R1	= plug 1 redundant inputs
R2	= plug 2 redundant inputs
S	= (order includes drawing, special design)
I	= 0/4...20mA active transmitter
IT	= 0/4...20 mA passive transmitter
ITI	= 0/4...20mA active & passive transmitter
U60mV	= 0...60 mV
U1V	= 0...1V
U5V	= 0...5 V
U10V	= 0...10 V
2P	= Pt 100 two-wire technique
3P	= Pt 100 three-wire technique
U>65V	= voltage >65 V and single wires
P2	= 2-pole connection
24P2	= 2-pole connection 24 VDC
48P2	= 2-pole connection 48 VDC
C	= cable LiYY or LIYCY, nn = length in m
W	= single cores, nn = length in m
ExW	= single cores blue Ex, nn = length in m
ExC	= cable with blue cover Ex, nn = length in m
	number of the according F module



B 4234: Assembly Kit / H41q-M: System

System H41q-M in K 1409 system subrack, 5 HU, 19 inches with single channel central module, power supply 24/5 V, I/O level, communication module (optional), coprocessor module (optional) and four fans

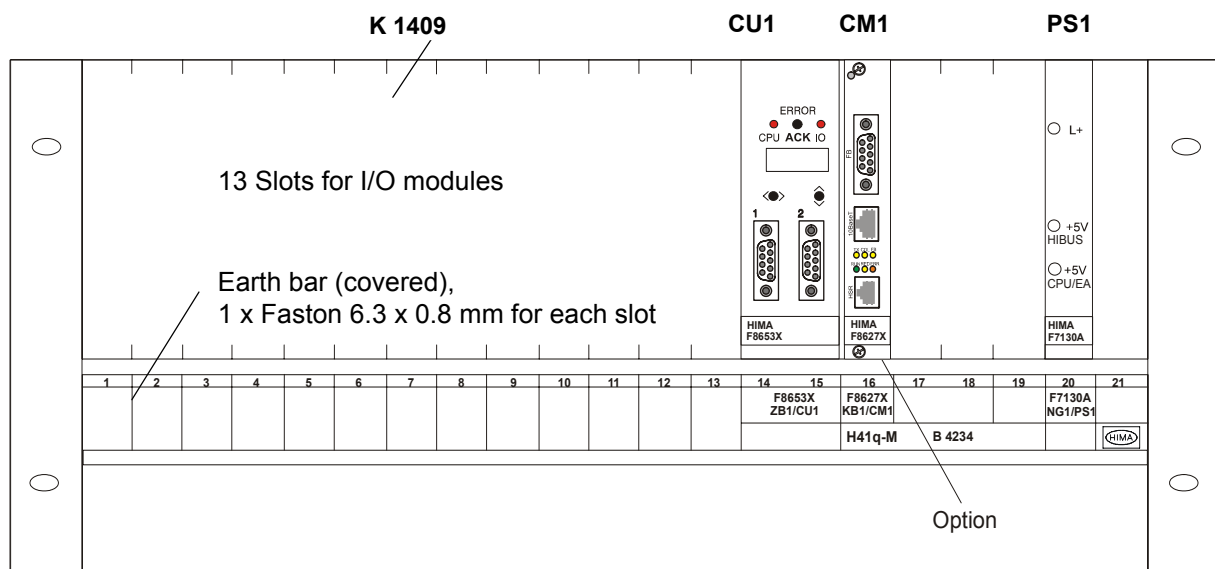


Figure 1: Front view

1 Parts of the B 4234 assembly kit / H41q-M system

- 1 x K 1409 system subrack, 5 HU, 19 inch, with cable tray with four fan modules K 9212, hinged receptacle for the label and backplane Z 1009. On the rear buffer batteries (G1, G2).
- additional modules on the rear
 - 2 x Z 6011 decoupling and fusing to feed the power supply modules
 - 1 x Z 6018 fan run monitoring and fuse monitoring
 - 2 x Z 6013 decoupling and fusing for the supply voltage of the WD signal
 - 1 x Z 6007 jumper plug (combination of the separated I/O buses, single channel system H41q-M)

include the modules:

- 1 x F 8653X central module (CU1)
- 1 x F 7130A power supply 24/5 VDC (PS1)

Modules for option (separate order):

- 1 x F 8621A coprocessor module (CU1)
- 1 x communication module (CM1),
e.g. F 8627X (Ethernet) or F 8628X (Profibus DP)
- max.13 I/O modules (slots1 to 13)
- 1 x F 7130A power supply 24/5 V on slot 21

Note**Operating system/resource type in ELOP II**

The assembly kit is usable since operating system BS41q/51q V7.0-8.
Resource type in ELOP II: H41qce-M.

2 Modules

2.1 Central module F 8653X

The central module of the PES H41q-M contains the essential functions demonstrated in the block diagram of the central module:

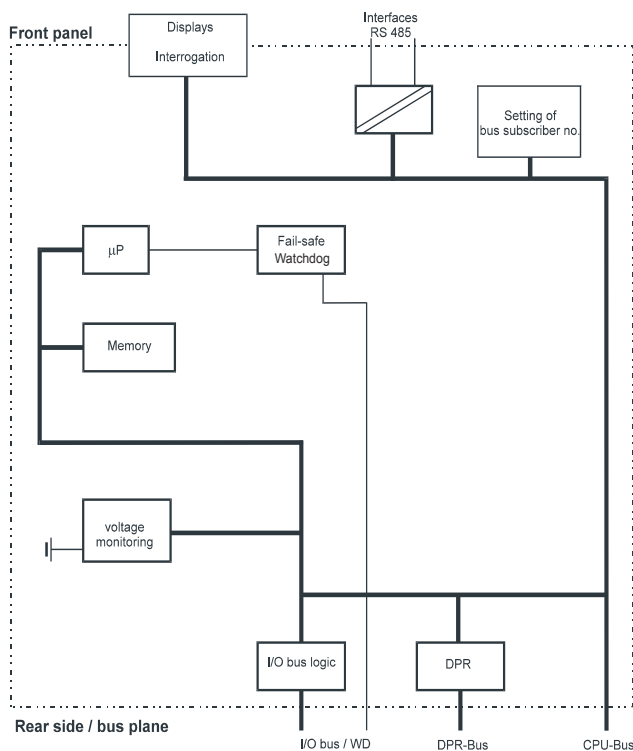


Figure 2: Block diagram of the central module F 8653X

- Microprocessor
- Flash-EPROMs of the program memory for the operating system and the user program usable for min. 100,000 writing cycles
- Data memory in sRAM
- 2 interfaces RS 485 with galvanic isolation. Transmission rate: max. 57600 bps
- 4digit diagnostic display and 2 LEDs for information out of the system, I/O level and user program
- Power supply monitoring
- I/O bus logic for the connection to the input/output modules
- Hardware clock, battery buffered
- Watchdog
- Battery backup of the sRAMs via battery with monitoring

2.2 Coprocessor module F 8621A

Right of the central module of the H41q-M PES one coprocessor module can be installed. The coprocessor module mainly contains:

- Microprocessor HD 64180 with a clock frequency of 10 MHz
- Operating system EPROM
- RAM for a PLC master project

Note

The RAM for the master project is buffered via the batteries on the backplane of the subrack.

- Two interfaces RS 485, via communication software function block setting of the baud rate up to 57600 bps
- Dual port RAM (DPR) for the communication with the central module via CPU bus

2.3 Communication modules F 8627/F 8628, F 8627X/F 8628X

Right of the central module of the H41q-M PES one communication module can be installed. The communication module mainly contains:

- 32-bit RISC microprocessor
- Operating system
- RAM for further protocols
- F 8627 Ethernet interface (safeethernet, OPC, ...)
- F 8628 Profibus-DP slave interface
- Dual port RAM (DPR) for the communication with the central module via CPU bus

Special applications with the communication module F 8627X:

- connection of the central module to a PADT (ELOP II TCP)
- connection to other communication partners within an Ethernet network (Modbus TCP)

Special application with the communication module F 8628X:

- ELOP II TCP connection (PADT) via the Ethernet interface of the F 8628X to the H41q/H51q controller

3 Startup and maintenance



Before startup the system switch on the rear buffer batteries G1 and G2 via DIP switches on the backplane!

A battery change of the buffer batteries without load (CPU in operation) is recommended every 6 years.

Buffer battery with soldering lug: HIMA part no. 44 0000016.

Buffer battery without soldering lug: HIMA part no. 44 0000019.

Further informations see also catalog H41q/H51q, chapter 9, "Startup and maintenance".

4 Wiring of the assembly kit

The assembly kit is already wired for operation. Wirings have still to be done by the user (optional modules, see "Assembly kit, wiring diagram").



With installation of the assembly kit a conductive connection to the frame or a separate earth connection has to be installed according to the EMC requirements.

Connection PE earth: Faston 6.3 x 0.8 mm.

Pay attention for the manufacturers information concerning detaching and replugging of the Faston connectors!

4.1 Current distribution within the assembly kit

4.1.1 HIMA devices for current distribution

It is recommended to use the HIMA supplies and current distributions:

- K 7212** redundant feeding up to 35 A total current, with 2 decoupling diodes and 2 network filters, with fusing of up to 12 single circuits with circuit breakers or
- K 7213** redundant feeding up to 35 A total current, with fusing of up to 12 single circuits with circuit breakers or
- K 7214** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers or
- K 7215** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers, graphical display.

4.1.2 Supply 24 VDC

See also catalog H41q/H51q, chapter 3.3, The Input/Output Level, 24 VDC Supply and Distribution.

Connection	Wire and connection	Fusing	Use
XG.24:2 (L+)	RD 2.5 mm ² , Faston 6.3 x 0.8	max. 16 A	PS1
XG.24:1(L-)	BK 2.5 mm ² , Faston 6.3 x 0.8		Reference pole L-
XG.14 (L-)	BK 2 x 2.5 mm ² , Faston 6.3 x 0.8 (see note)		Reference pole L-
XG.6 (L+)	RD 1 mm ² , Faston 2.8 x 0.8 13 single connections	max. 4 A slow blow	see wiring diagram
RD = Color code red BK = Color code black			

Table 1: Supply 24 VDC



Connection XG.14: To be wired to the central L- bus bar with at least 2 x 2.5 mm² BK. If output modules with 2-pole connection to the actors are used depending on the load up to 4 x 2.5 mm² BK wiring is necessary.

4.1.3 Supply 5 VDC

The 5 VDC power supply does not have to be wired separately as it is already installed as part of the subrack.

The 5 VDC power is used for the CPU, the control of the interfaces and the I/O modules. It is generated by 24 VDC / 5 VDC power supply module type F 7130A.

The 5 VDC output voltage of the power supply module (for the CPU, I/O and the interfaces) are monitored on the central module checking undervoltage, overvoltage or failure.

In case of a faulty power supply module the operating system of the CPU informs the user program via a system variable.

In case of a 5 VDC system power failure a lithium battery on the central module buffers the hardware clock and sRAM on the central module.

4.2 Connection of the monitoring loop (for fuses and fans)

Connection	Wire and connection	Fusing	Use
XG.21:4/5/6	GY 0.5 mm ² , Faston 2.8 x 0.8	max. 4 A slow blow	Floating NO/NC contact for signaling
GY = Color code gray			

Table 2: Connection of the monitoring loop

4.3 Internal fuses

Position	Size	Dimension	HIMA part no.
Z 6011	4 A slow blow	5 x 20 mm	57 0174409
Z 6013	1.6 A slow blow	5 x 20 mm	57 0174169

Table 3: Internal fuses

4.4 Backplane bus

Central module CU and I/O modules are connected via the backplane bus.

The jumper plug Z 6007 on connection XD .1 combines the separated I/O buses. For the single channel system this is mandatory. Redundant systems see also H41q-HR and H41q-HRS, slot 1 to 7 and 8 to 13.

4.5 Connections on the rear

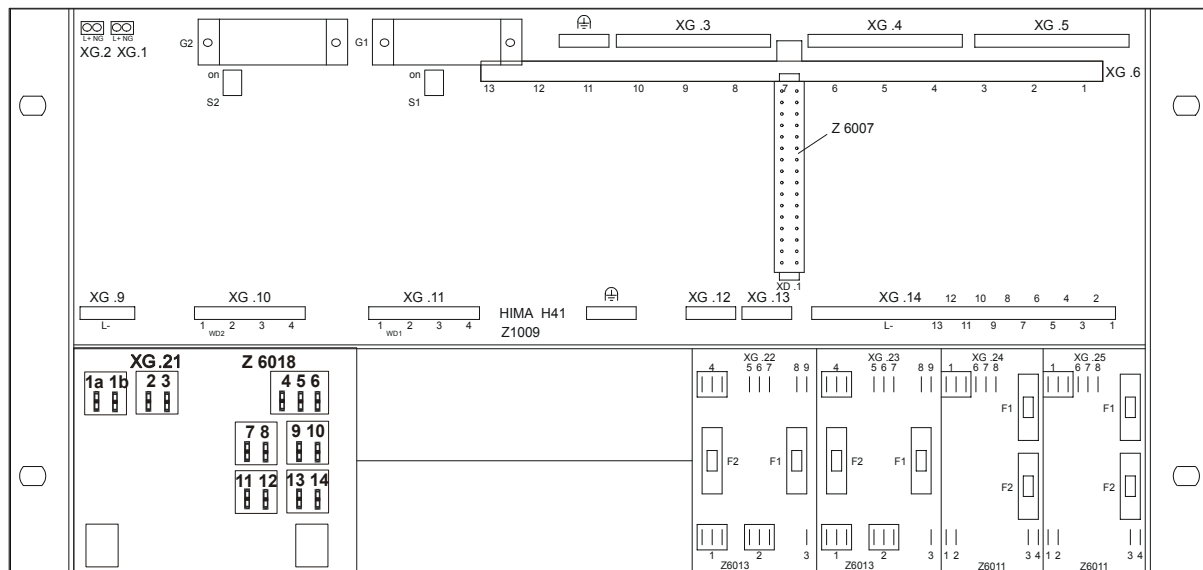


Figure 3: Connections on the rear of the system rack K 1409

4.5.1 Wiring ex works

XD .1	Jumper plug Z 6007 (combination of the separated I/O buses, single channel system H41q-M)
XG .1, XG .2	Supply L+ for the power supply module Reference pole: XG .9 (L-)
XG .3, XG .4, XG .5	Potential distributor, free disposal of
XG .9	L- for the power supply module
XG .10	Watchdog signal (not active at H41-M)
XG .11	Watchdog signal from CU1
XG .12	Watchdog signal for I/O modules (not active at H41-M)
XG .13	Watchdog signal for I/O modules



PE (earth)

Connections of the additional modules Z 6011, Z 6018, Z 6013:

XG. 21	refer to
XG. 22, XG .23	wiring of the assembly kit, wiring diagram
S1, S2	for switching off the buffer batteries G1, G2 Delivery state: Buffer batteries are switched off!

4.5.2 Wiring by customer

XG .6: 1 - 13	L+ for I/O modules (slots 1 to 13) 13 single connections, see also connection XG .14
XG .14: 1 - 13	Reference potential L- for I/O modules Slots 1 - 13, see also connection XG .6
XG .24, XG .25	Supply 24 VDC, see assembly kit, wiring diagram (L+, L-)

4.6 Assembly kit, wiring diagram

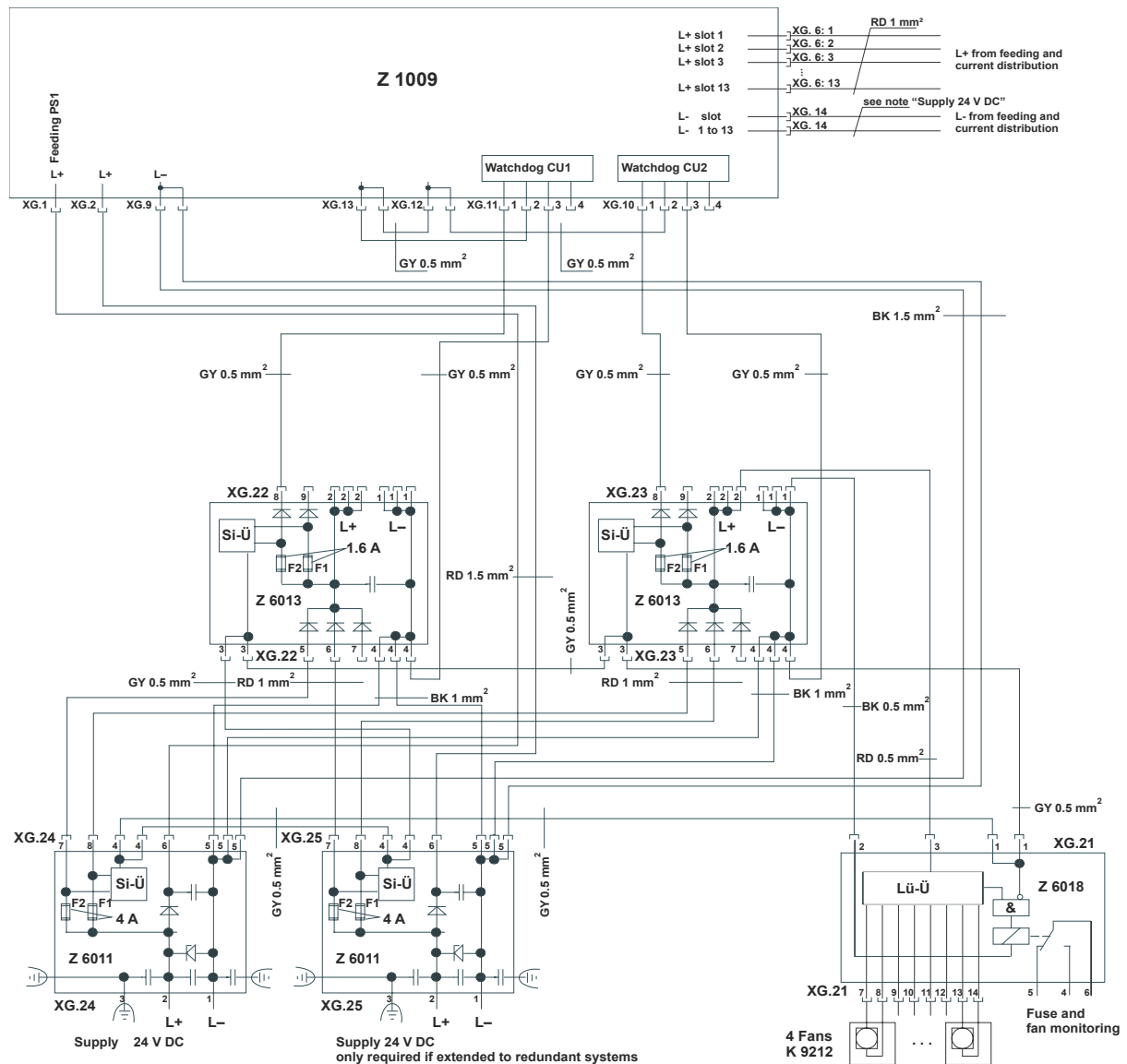


Figure 4: Assembly kit, wiring diagram

Lü-Ü = Fan monitoring
Si-Ü = Fuse monitoring

Note

The assembly kit is fully wired for a possible extension to redundant systems. For extension to redundant I/O buses remove jumper plug Z 6007 (see data sheet H41q-HR, H41q-HRS).

5 Side view B 4234 assembly kit / H41q-M system

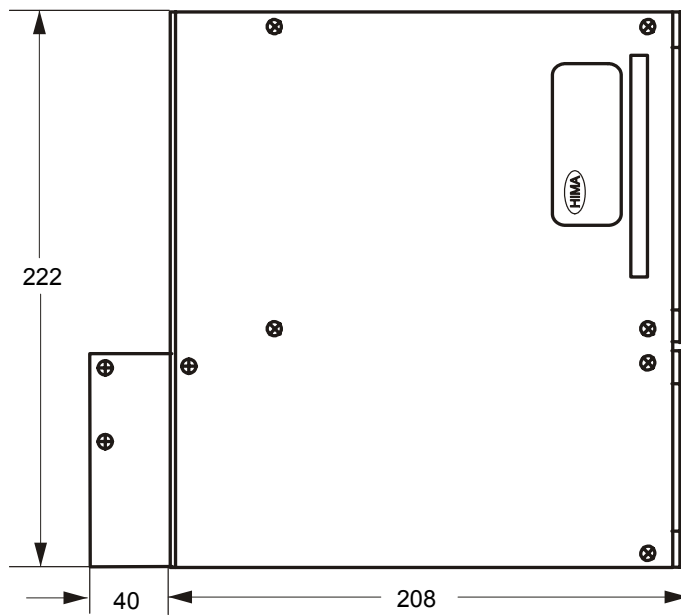


Figure 5: Side view



B 4235: Assembly Kit / H41q-MS: System

System H41q-MS in K 1409 system subrack, 5 HU, 19 inches with single channel central module, power supply 24/5 V, I/O level, communication module (optional), coprocessor module (optional) and four fans

TÜV certified, applicable up to SIL 3 according to IEC 61508

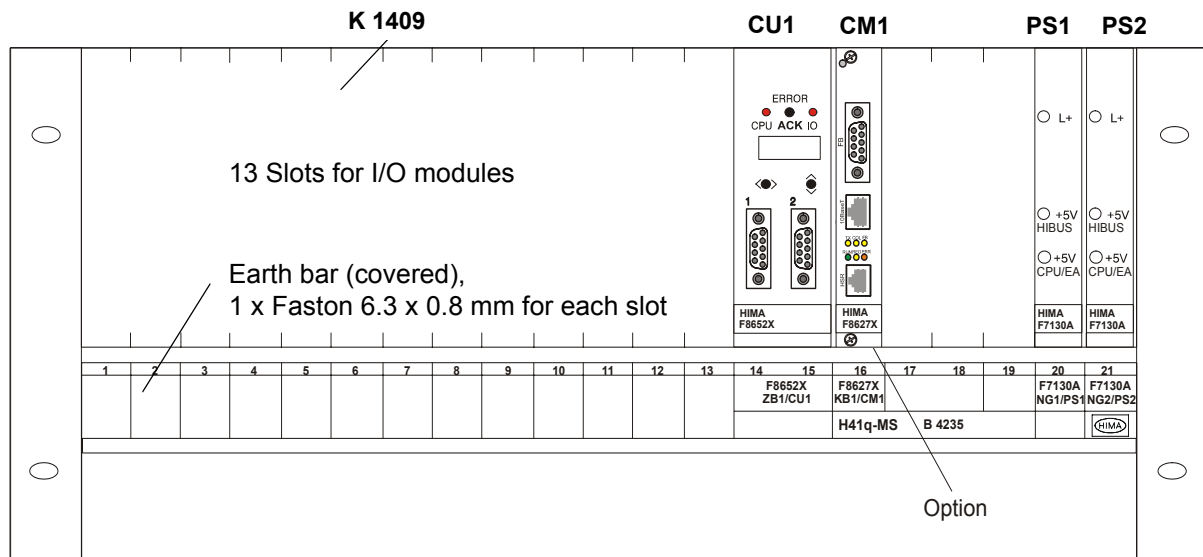


Figure 1: Front view

1 Parts of the B 4235 assembly kit / H41q-MS system

- 1 x K 1409 system subrack, 5 HU, 19 inch, with cable tray with four fan modules K 9212, hinged receptacle for the label and backplane Z 1009. On the rear buffer batteries (G1, G2)
- additional modules on the rear
 - 2 x Z 6011 decoupling and fusing to feed the power supply modules
 - 1 x Z 6018 fan run monitoring and fuse monitoring
 - 2 x Z 6013 decoupling and fusing for the supply voltage of the WD signal
 - 1 x Z 6007 jumper plug (combination of the separated I/O buses, single channel system H41q-MS)

include the modules:

- 1 x F 8652X central module (CU1)
- 2 x F 7130A power supply 24/5 VDC (PS1, PS2)
The 5 V outputs of both power supplies are switched in parallel.

Modules for option (separate order):

- 1 x F 8621A coprocessor module (CM1)
- 1 x communication module (CM1),
e.g. F 8627X (Ethernet) or F 8628X (Profibus DP)
- max. 13 I/O modules (slots 1 to 13)

Note**Operating system/resource type in ELOP II**

The assembly kit is usable since operating system BS41q/51q V7.0-8.
Resource type in ELOP II: H41qce-MS.

2 Modules

2.1 Central module F 8652X

The central module for safety related applications with TÜV certificate of the PES H41q-MS contains the essential functions demonstrated in the block diagram of the central module:

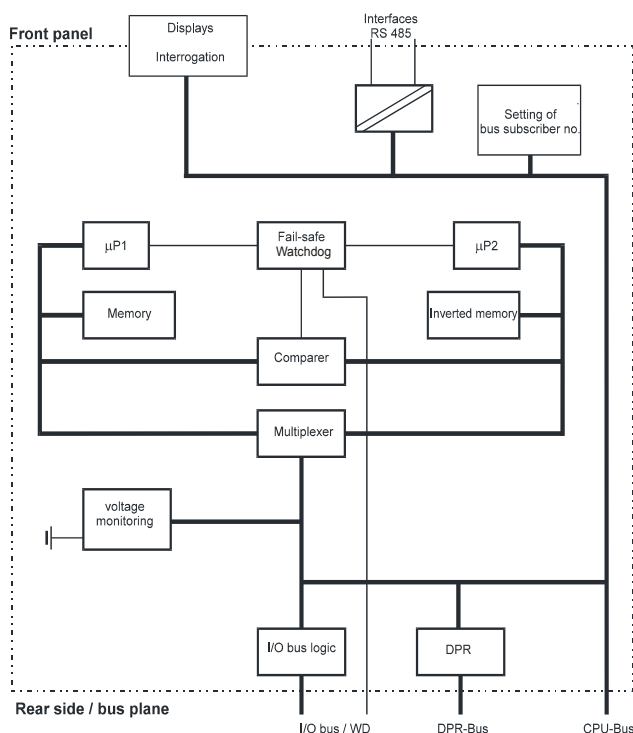


Figure 2: Block diagram of the central module F 8652X

- two clock-synchronized microprocessors
- each microprocessor with an own memory, one processor operates with real data and program and the other one with inverted data and program
- testable hardware comparer for all the external accesses of both microprocessors, in case of a fault the watchdog will be set to the safe status and the status of the processor is announced
- Flash-EPROMs of the program memory for the operating system and the user program usable for min. 100,000 writing cycles
- Data memory in sRAM
- Multiplexer to connect I/O bus, DPR and redundant CU (not used in the H41q-MS system)
- Battery backup of the sRAMs via batteries with monitoring
- 2 interfaces RS 485 with galvanic isolation. Transmission rate: max. 57600 bps
- 4digit diagnostic display and 2 LEDs for information out of the system, I/O level and user program
- Dual Port RAM for fast memory access to the second central module (not used in the H41q-MS system)

- Hardware clock, battery buffered
- I/O bus logic and connection to the input/output modules
- Watchdog
- Power supply monitoring, testable (5 V system voltage)
- Battery monitoring

2.2 Coprocessor module F 8621A

Right of the central module of the H41q-MS PES one coprocessor module can be installed. The coprocessor module mainly contains:

- Microprocessor HD 64180 with a clock frequency of 10 MHz
- Operating system EPROM
- RAM for a PLC master project

Note	The RAM for the master project is buffered via the batteries on the backplane of the subrack.

- Two interfaces RS 485, via communication software function block setting of the baud rate up to 57600 bps
- Dual port RAM (DPR) for the communication with the central module via CPU bus

2.3 Communication modules F 8627/F 8628, F 8627X/F 8628X

Right of the central module of the H41q-MS PES one communication module can be installed. The communication module mainly contains:

- 32-bit RISC microprocessor
- Operating system
- RAM for further protocols
- F 8627 Ethernet interface (safeethernet, OPC, ...)
- F 8628 Profibus-DP slave interface
- Dual port RAM (DPR) for the communication with the central module via CPU bus

Special applications with the communication module F 8627X:

- connection of the central module to a PADT (ELOP II TCP)
- connection to other communication partners within an Ethernet network (Modbus TCP)

Special application with the communication module F 8628X:

- ELOP II TCP connection (PADT) via the Ethernet interface of the F 8628X to the H41q/H51q controller

3 Startup and maintenance



Before startup the system switch on the rear buffer batteries G1 and G2 via DIP switches on the backplane!

A battery change of the buffer batteries without load (CPU in operation) is recommended every 6 years.

Buffer battery with soldering lug: HIMA part no. 44 0000016.

Buffer battery without soldering lug: HIMA part no. 44 0000019.

Further informations see also catalog H41q/H51q, chapter 9, "Startup and maintenance".

4 Wiring of the assembly kit

The assembly kit is already wired for operation. Wirings have still to be done by the user (optional modules, see "Assembly kit, wiring diagram").



With installation of the assembly kit a conductive connection to the frame or a separate earth connection has to be installed according to the EMC requirements.

Connection PE earth: Faston 6.3 x 0.8 mm.

Pay attention for the manufacturers information concerning detaching and replugging of the Faston connectors!

4.1 Current distribution within the assembly kit

4.1.1 HIMA devices for current distribution

It is recommended to use the HIMA supplies and current distributions:

- K 7212** redundant feeding up to 35 A total current, with 2 decoupling diodes and 2 network filters, with fusing of up to 12 single circuits with circuit breakers or
- K 7213** redundant feeding up to 35 A total current, with fusing of up to 12 single circuits with circuit breakers or
- K 7214** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers or
- K 7215** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers, graphical display.

4.1.2 Supply 24 VDC

See also catalog H41q/H51q, chapter 3.3, The Input/Output Level, 24 VDC Supply and Distribution.

Connection	Wire and connection	Fusing	Use
XG.24/25:2 (L+)	RD 2.5 mm ² , Faston 6.3 x 0.8	max. 16 A	PS1, PS2
XG.24/25:1(L-)	BK 2.5 mm ² , Faston 6.3 x 0.8		Reference pole L-
XG.14 (L-)	BK 2 x 2.5 mm ² , Faston 6.3 x 0.8 (see note)		Reference pole L-
XG.6 (L+)	RD 1 mm ² , Faston 2.8 x 0.8 13 single connections	max. 4 A slow blow	see wiring diagram
RD = Color code red BK = Color code black			

Table 1: Supply 24 VDC



Connection XG.14: To be wired to the central L- bus bar with at least 2 x 2.5 mm² BK. If output modules with 2-pole connection to the actors are used depending on the load up to 4 x 2.5 mm² BK wiring is necessary.

4.1.3 Supply 5 VDC

The 5 VDC power supply does not have to be wired separately as it is already installed as part of the subrack.

The 5 VDC power is used for the CPU, the control of the interfaces and the I/O modules. It is generated by 24 VDC / 5 VDC power supply module type F 7130A.

The 5 VDC output voltage of the power supply module (for the CPU, I/O and the interfaces) are monitored on the central module checking undervoltage, overvoltage or failure.

In case of a faulty power supply module the operating system of the CPU informs the user program via a system variable.

In case of a 5 VDC system power failure a lithium battery on the central module buffers the hardware clock and sRAM on the central module.

4.2 Connection of the monitoring loop (for fuses and fans)

Connection	Wire and connection	Fusing	Use
XG.21:4/5/6	GY 0.5 mm ² , Faston 2.8 x 0.8	max. 4 A slow blow	Floating NO/NC contact for signaling
GY = Color code gray			

Table 2: Connection of the monitoring loop

4.3 Internal fuses

Position	Size	Dimension	HIMA part no.
Z 6011	4 A slow blow	5 x 20 mm	57 0174409
Z 6013	1.6 A slow blow	5 x 20 mm	57 0174169

Table 3: Internal fuses

4.4 Backplane bus

Central module CU and I/O modules are connected via the backplane bus.

The jumper plug Z 6007 on connection XD .1 combines the separated I/O buses. For the single channel system this is mandatory. Redundant systems see also H41q-HR and H41q-HRS, slot 1 to 7 and 8 to 13.

4.5 Connections on the rear

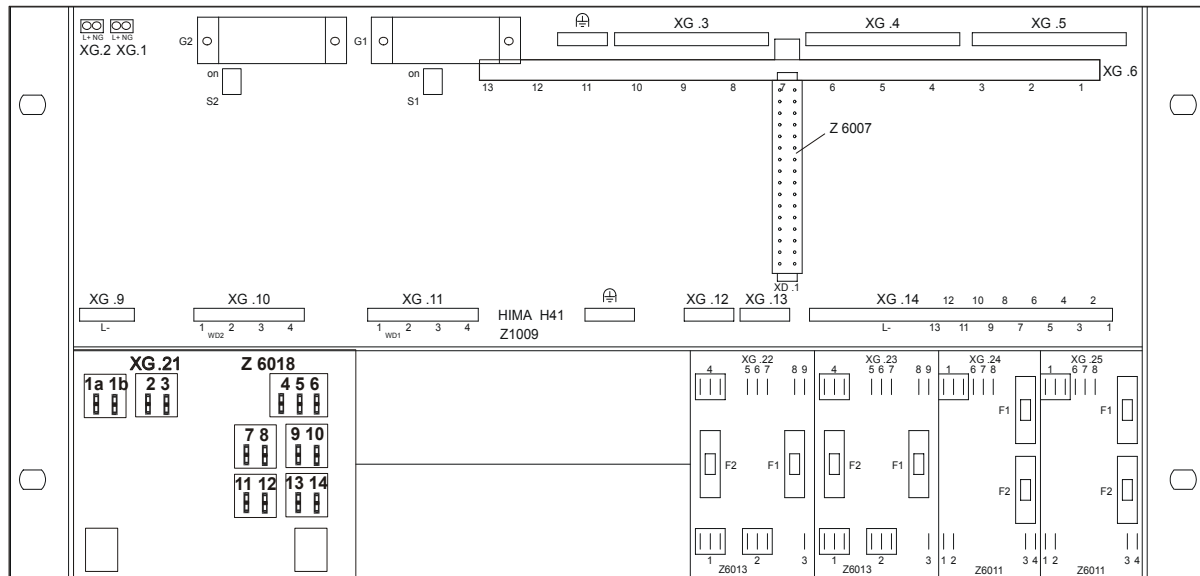


Figure 3: Connections on the rear of the system rack K 1409

4.5.1 Wiring ex works

XD .1	Jumper plug Z 6007 (Combination of the separated I/O buses, single channel system H41q-MS)
XG .1, XG .2	Supply L+ for the power supply module
	Reference pole: XG .9 (L-)
XG .3, XG .4, XG .5	Potential distributor, free disposal of
XG .9	L- for the power supply module
XG .10	Watchdog signal (not active at H41-MS)
XG .11	Watchdog signal from CU1
XG .12	Watchdog signal for I/O modules (not active at H41-MS)
XG .13	Watchdog signal for I/O modules



PE (earth)

Connections of the additional modules Z 6011, Z 6018, Z 6013:

XG .21	refer to
XG .22, XG .23	wiring of the assembly kit, wiring diagram
S1, S2	for switching off the buffer batteries G1, G2
	delivery state: buffer batteries are switched off!

4.5.2 Wiring by customer

XG .6: 1 - 13	L+ for I/O modules (slots 1 to 13) 13 single connections, see also connection XG .14
XG .14: 1 - 13	Reference potential L- for I/O modules Slots 1 - 13, see also connection XG .6
XG .24, XG .25	Supply 24 VDC, see assembly kit, wiring diagram (L+, L-)

4.6 Assembly kit, wiring diagram

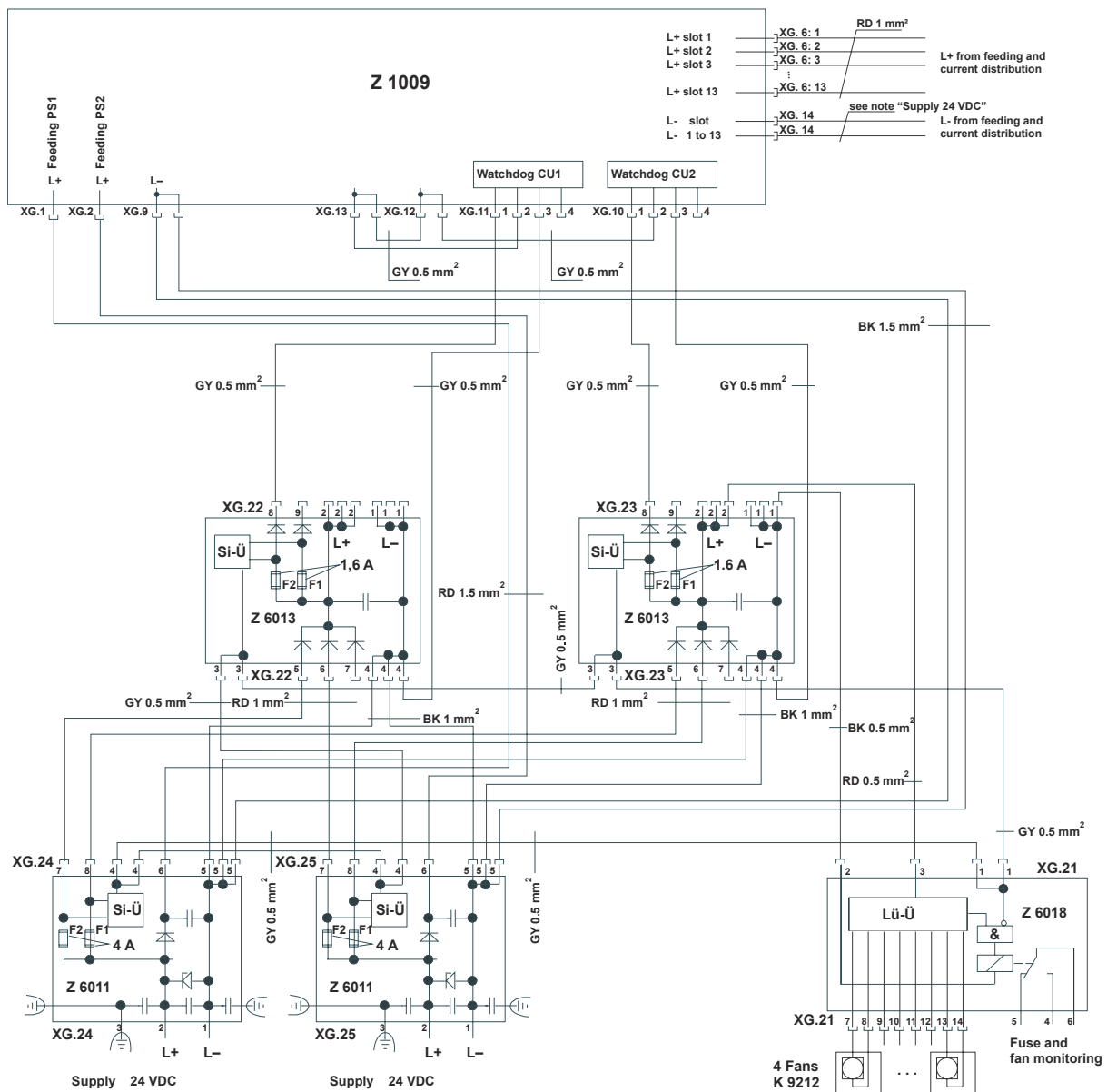


Figure 4: Assembly kit, wiring diagram

Lü-Ü = Fan monitoring
Si-Ü = Fuse monitoring

Note

The assembly kit is fully wired for a possible extension to redundant systems. For extension to redundant I/O buses remove jumper plug Z 6007 (see data sheet H41q-HR, H41q-HRS).

5 Side view B 4235 assembly kit / H41q-MS system

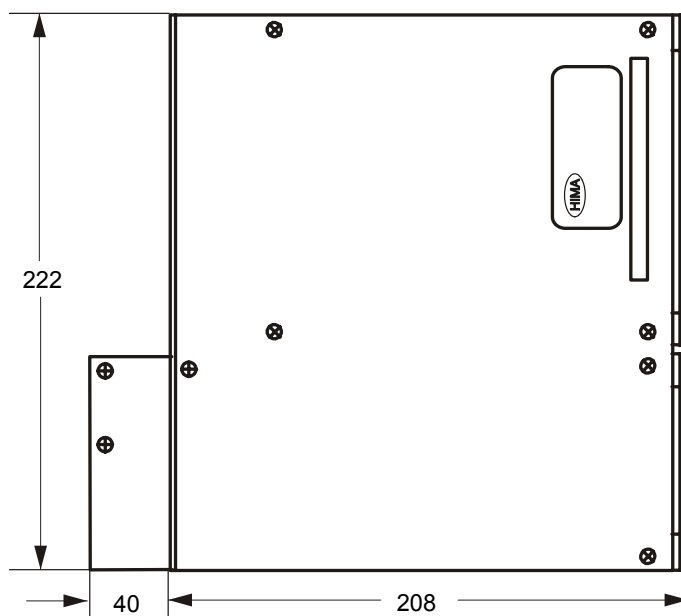


Figure 5: Side view



B 4236-1/-2: Assembly Kit / H41q-H/HR: System

System H41q-H/HR in K 1409 system subrack, 5 HU, 19 inches with redundant central modules, power supply 24/5 V, I/O level, communication module (optional), coprocessor modules (optional) and four fans

H41q-H / B 4236-1: single channel bus, redundant central modules

H41q-HR / B 4236-2: redundant bus, redundant central modules

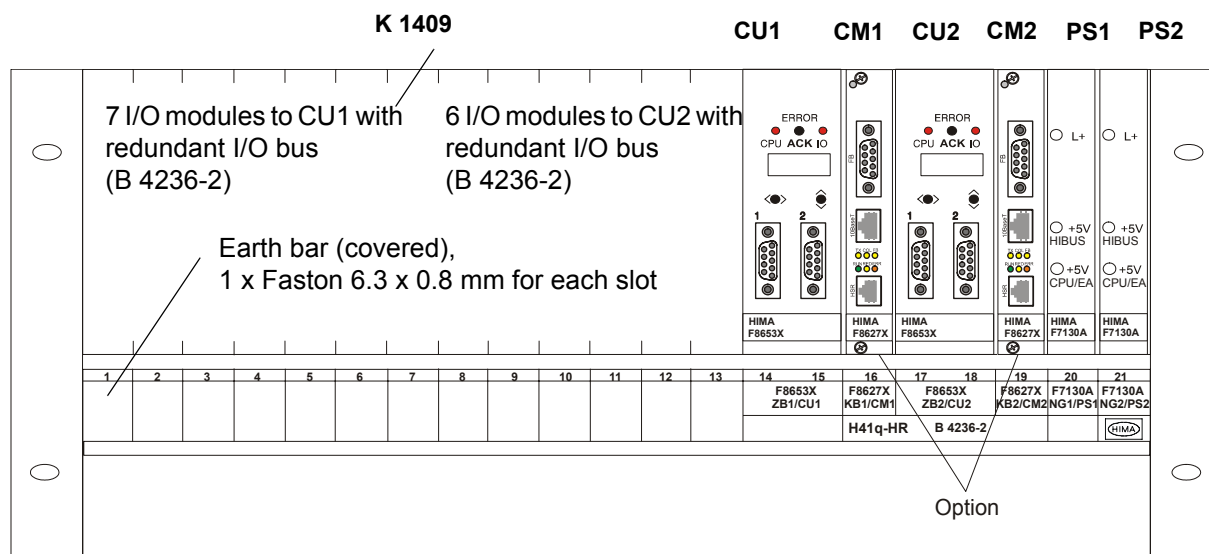


Figure 1: Front view

1 Parts of B 4236-1/2 assembly kit / H41q-H/HR system

- 1 x K 1409 system rack, 5 HU, 19 inches, with cable tray with four fan modules K 9212, hinged receptacle for the label and backplane Z 1009.
On the rear buffer batteries (G1, G2).
- additional modules on the rear
 - 2 x Z 6011 decoupling and fusing to feed the power supply modules
 - 1 x Z 6018 fan run monitoring and fuse monitoring
 - 2 x Z 6013 decoupling and fusing for the supply voltage of the WD signal
 - 1 x Z 6007 jumper plug (combination of the separated I/O buses, single channel system H41q-H / B 4236-1)

includes the modules:

- 2 x F 8653X central module (CU1, CU2)
- 2 x F 7130A power supply module 24 V / 5 VDC (PS1, PS2)
The 5 V outputs of both power supplies are switched in parallel.

Modules for option (separate order):

- 2 x F 8621A coprocessor modules (CM1, CM2)
- 2 x communication modules (CM1, CM2)
e.g. F 8627X (Ethernet) or F 8628X (Profibus DP)

- H41q-H / B 4236-1: max. 13 IO modules (slots 1 - 13)
- H41q-HR / B 4236-2:
7 IO modules (slots 1- 7) related to central module 1,
6 IO modules (slots 8 - 13) related to central module 2

Note**Operating system/resource type in ELOP II**

The assembly kit is usable since operating system BS41q/51q V7.0-8.
Resource type in ELOP II: H41qce-H/H41qce-HR.

2 Modules

2.1 Central module F 8653X

The central module for the PES H41q-H/HR contains the essential functions demonstrated in the block diagram of the central module:

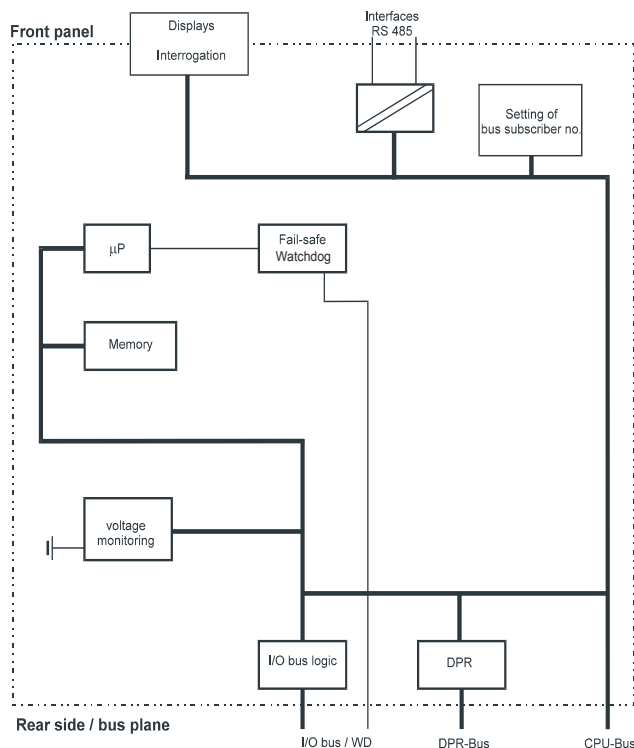


Figure 2: Block diagram of the central module F 8653X

- Microprocessor
- Flash-EPROMs of the program memory for the operating system and the user program usable for min. 100,000 writing cycles
- Data memory in sRAM
- 2 interfaces RS 485 with galvanic isolation. Transmission rate: max. 57600 bps
- 4digit diagnostic display and 2 LEDs for information out of the system, I/O level and user program
- Power supply monitoring
- I/O bus logic for the connection to the input/output modules
- Hardware clock, battery buffered
- Watchdog
- Battery backup of the sRAMs via battery with monitoring

2.2 Coprocessor module F 8621A

Right of the central module of the H41q-H/HR PES one coprocessor module can be installed. The coprocessor module mainly contains:

- Microprocessor HD 64180 with a clock frequency of 10 MHz
- Operating system EPROM
- RAM for a PLC master project

Note	The RAM for the master project is buffered via the batteries on the backplane of the subrack.

- Two interfaces RS 485, via communication software function block setting of the baud rate up to 57600 bps
- Dual port RAM (DPR) for the communication with the central module via CPU bus

2.3 Communication modules F 8627/F 8628, F 8627X/F 8628X

Right of the central module of the H41q-H/HR PES one communication module can be installed. The communication module mainly contains:

- 32-bit RISC microprocessor
- Operating system
- RAM for further protocols
- F 8627 Ethernet interface (safeethernet, OPC, ...)
- F 8628 Profibus-DP slave interface
- Dual port RAM (DPR) for the communication with the central module via CPU bus

Special applications with the communication module F 8627X:

- connection of the central module to a PADT (ELOP II TCP)
- connection to other communication partners within an Ethernet network (Modbus TCP)

Special application with the communication module F 8628X:

- ELOP II TCP connection (PADT) via the Ethernet interface of the F 8628X to the H41q/H51q controller

3 Startup and maintenance



Before startup the system switch on the rear buffer batteries G1 and G2 via DIP switches on the backplane!

A battery change of the buffer batteries without load (CPU in operation) is recommended every 6 years.

Buffer battery with soldering lug: HIMA part no. 44 0000016.

Buffer battery without soldering lug: HIMA part no. 44 0000019.

Further informations see also catalog H41q/H51q, chapter 9, "Startup and maintenance".

4 Wiring of the assembly kit

The assembly kit is already wired for operation. Wirings have still to be done by the user (optional modules, see "Assembly kit, wiring diagram").



With installation of the assembly kit a conductive connection to the frame or a separate earth connection has to be installed according to the EMC requirements.

Connection PE earth: Faston 6.3 x 0.8 mm.

Pay attention for the manufacturers information concerning detaching and replugging of the Faston connectors!

4.1 Current distribution within the assembly kit

4.1.1 HIMA devices for current distribution

It is recommended to use the HIMA supplies and current distributions:

- K 7212** redundant feeding up to 35 A total current, with 2 decoupling diodes and 2 network filters, with fusing of up to 12 single circuits with circuit breakers or
- K 7213** redundant feeding up to 35 A total current, with fusing of up to 12 single circuits with circuit breakers or
- K 7214** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers or
- K 7215** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers, graphical display.

4.1.2 Supply 24 VDC

The supply voltage 24 VDC may be fed two times to the H41q-H/HR system. See also catalog H41q/H51q, chapter 3.3, The Input/Output Level, 24 VDC Supply and Distribution

Connection	Wire and connection	Fusing	Use
XG.24/25:2 (L+)	RD 2.5 mm ² , Faston 6.3 x 0.8	max. 16 A	PS1, PS2
XG.24/25:1(L-)	BK 2.5 mm ² , Faston 6.3 x 0.8		Reference pole L-
XG.14 (L-)	BK 2 x 2.5 mm ² , Faston 6.3 x 0.8 (see note)		Reference pole L-
XG.6 (L+)	RD 1 mm ² , Faston 2.8 x 0.8 13 single connections	max. 4 A slow blow	see wiring diagram
RD = Color code red BK = Color code black			

Table 1: Supply 24 VDC



Connection XG.14: To be wired to the central L- bus bar with at least 2 x 2.5 mm² BK. If output modules with 2-pole connection to the actors are used depending on the load up to 4 x 2.5 mm² BK wiring is necessary.

4.1.3 Supply 5 VDC

The 5 VDC power supply does not have to be wired separately as it is already installed as part of the subrack.

The 5 VDC power is used for the CPU, the control of the interfaces and the I/O modules. It is generated by 24 VDC / 5 VDC power supply module type F 7130A. The subrack is equipped with two power supply modules. The power supply modules are switched in parallel. If one of them fails, the other supplies the PES.

The 5 VDC output voltage of the power supply module (for the CPU, I/O and the interfaces) are monitored on the central module checking undervoltage, overvoltage or failure.

In case of a faulty power supply module the operating system of the CPU informs the user program via a system variable.

In case of a 5 VDC system power failure a lithium battery on the central module buffers the hardware clock and sRAM on the central module.

4.2 Connection of the monitoring loop (for fuses and fans)

Connection	Wire and connection	Fusing	Use
XG.21:4/5/6	GY 0.5 mm ² , Faston 2.8 x 0.8	max. 4 A slow blow	Floating NO/NC contact for signaling
GY = Color code gray			

Table 2: Connection of the monitoring loop

4.3 Internal fuses

Position	Size	Dimension	HIMA part no.
Z 6011	4 A slow blow	5 x 20 mm	57 0174409
Z 6013	1.6 A slow blow	5 x 20 mm	57 0174169

Table 3: Internal fuses

4.4 Connections of the WD to H41q-HR / B 4236-2

Connection	Procedure
XG.12 and XG.13	Remove override between both connections

Table 4: Connections of the WD

4.5 Backplane bus

Central module CU and I/O modules are connected via the backplane bus.

The jumper plug Z 6007 on connection XD .1 combines the separated I/O buses. For the single channel system this is mandatory (H41q-H). With redundant I/O bus (H41q-HR) the jumper plug Z 6007 at the backplane of the subrack is not installed.

4.6 Connections on the rear

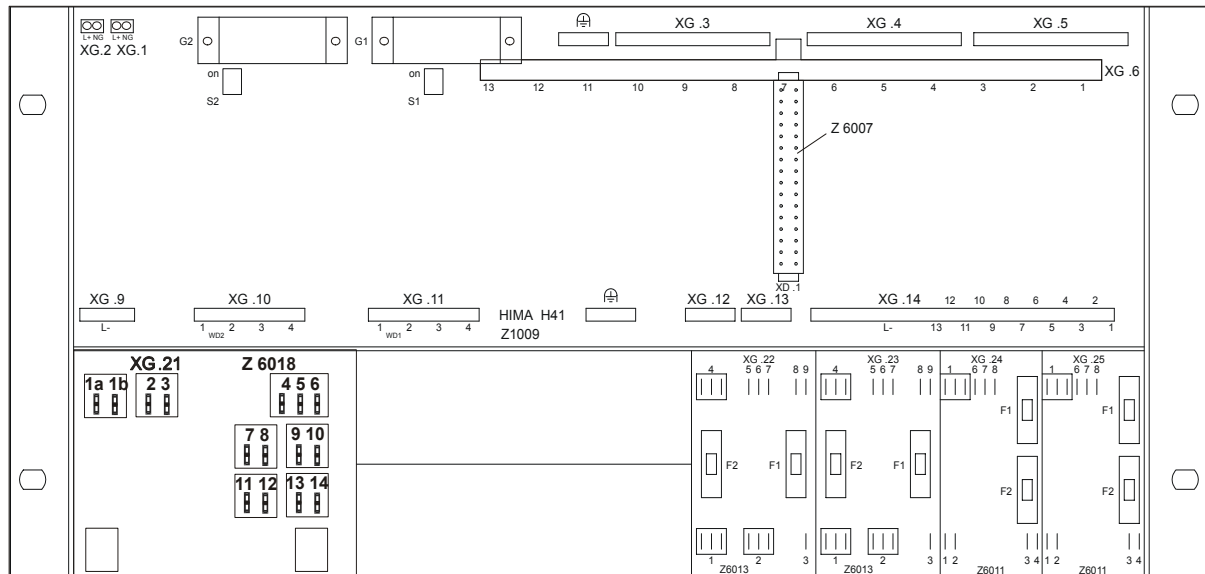


Figure 3: Connections on the rear of the system rack K 1409

4.6.1 Wiring ex works

XD .1	Jumper plug Z 6007 (Combination of the separated I/O buses, single channel system H41q-H), not at redundant system H41q-HR
XG .1, XG .2	Supply L+ for the power supply module Reference pole: XG .9 (L-)
XG .3, XG .4, XG .5	Potential distributor, free disposal of
XG .9	L- for the power supply module
XG .10	Watchdog signal from CU2
XG .11	Watchdog signal from CU1
XG .12	Watchdog signal for I/O modules 2. I/O bus
XG .13	Watchdog signal for I/O modules 1. I/O bus
	PE (earth)

Connections of the additional modules Z 6011, Z 6018, Z 6013:

XG. 21	refer to
XG. 22, XG .23	assembly kit, wiring diagram
S1, S2	for switching off the buffer batteries G1, G2 Delivery state: Buffer batteries are switched off!

4.6.2 Wiring by customer

XG .6: 1 - 13	L+ for I/O modules (slots 1 to 13) 13 single connections, see also connection XG .14
XG .14: 1 - 13	Reference potential L- for I/O modules Slots 1 - 13, see also connection XG .6
XG .24, XG .25	Supply 24 VDC, see assembly kit, wiring diagram (L+, L-)

4.7 Assembly kit, wiring diagram

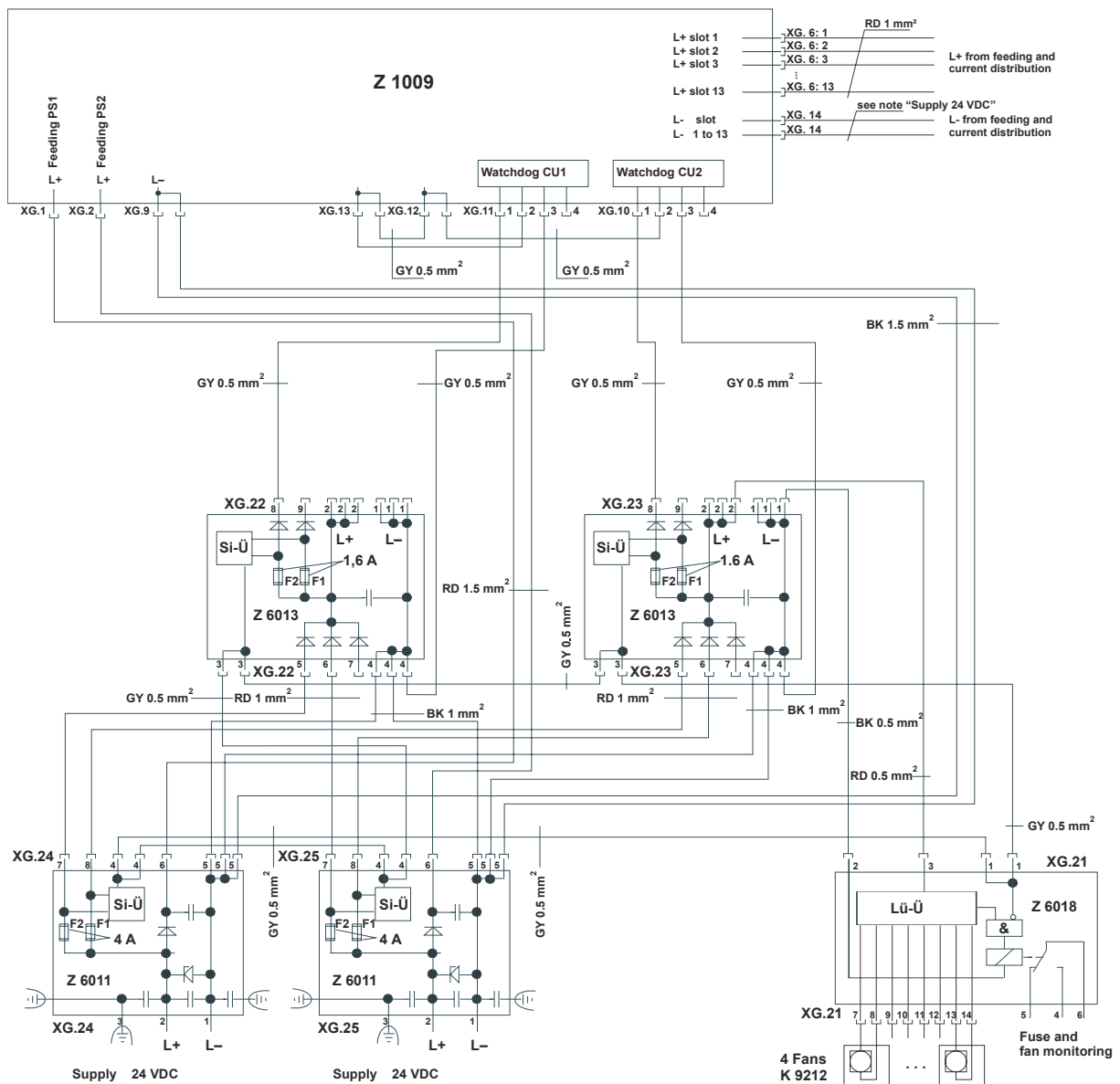


Figure 4: Assembly kit, wiring diagram

Lü-Ü = Fan monitoring
Si-Ü = Fuse monitoring

Note

The assembly kit is fully wired for a possible extension to redundant systems. For extension to redundant I/O buses remove jumper plug Z 6007 (H41q-HR).

5 Side view B 4236-1/-2 assembly kit / H41q-H/HR system

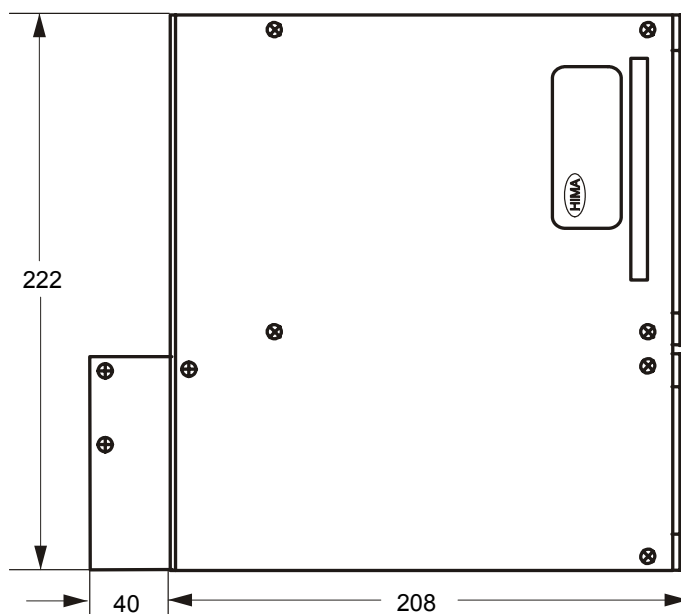


Figure 5: Side view



B 4237-1/-2: Assembly Kit / H41q-HS/HRS: System

System H41q-HS/HRS in K 1409 system subrack, 5 HU, 19 inches with redundant central modules, power supply 24/5 V, I/O level, communication module (optional), coprocessor modules (optional) and four fans

H41q-HS / B 4237-1: single channel bus, redundant central modules

H41q-HRS / B 4237-2: redundant bus, redundant central modules

TÜV certified, applicable up to SIL 3 according to IEC 61508

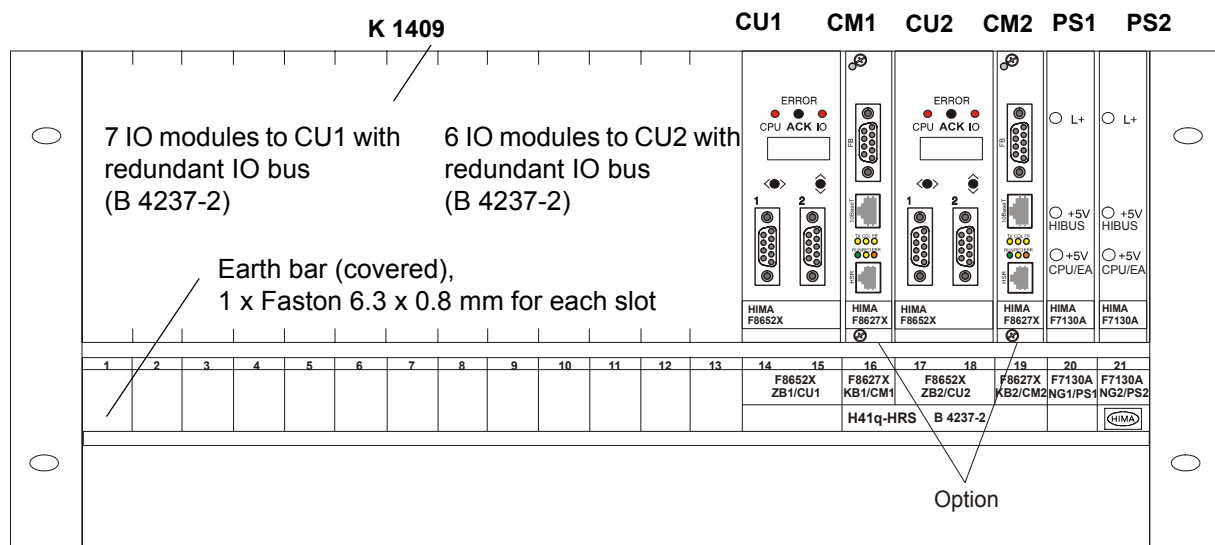


Figure 1: Front view

1 Parts of B 4237-1/2 assembly kit / H41q- HS/HRS system

- 1 x K 1409 system rack, 5 HU, 19 inches, with cable tray with four fan modules K 9212, hinged receptacle for the label and backplane Z 1009.
On the rear buffer batteries (G1, G2).
- additional modules on the rear
 - 2 x Z 6011 decoupling and fusing to feed the power supply modules
 - 1 x Z 6018 fan run monitoring and fuse monitoring
 - 2 x Z 6013 decoupling and fusing for the supply voltage of the WD signal
 - 1 x Z 6007 jumper plug (combination of the separated buses, single channel system H41q-HS / B 4237-1)

includes the modules:

- 2 x F 8652X central module (CU1, CU2)
- 2 x F 7130A power supply module 24 V / 5 VDC (PS1, PS2)
The 5 V outputs of both power supplies are switched in parallel.

Modules for option (separate order):

- 2 x F 8621A coprocessor module F 8621A (CM1, CM2)
- 2 x communication modules (CM1, CM2)

e.g. F 8627X (Ethernet) or F 8628X (Profibus DP)

- H41q-HS / B 4237-1: max. 13 IO modules (slots 1 - 13)
- H41q-HRS / B 4237-2:
7 IO modules (slots 1- 7) related to central module 1
6 IO modules (slots 8 - 13) related to central module 2

Note**Operating system/resource type in ELOP II**

The assembly kit is usable since operating system BS41q/51q V7.0-8.
Resource type in ELOP II: H41qce-HS/H41qce-HRS.

2 Modules

2.1 Central module F 8652X

The central module for safety related applications with TÜV certificate of the PES H41q-HS/HRS contains the essential functions demonstrated in the block diagram of the central module:

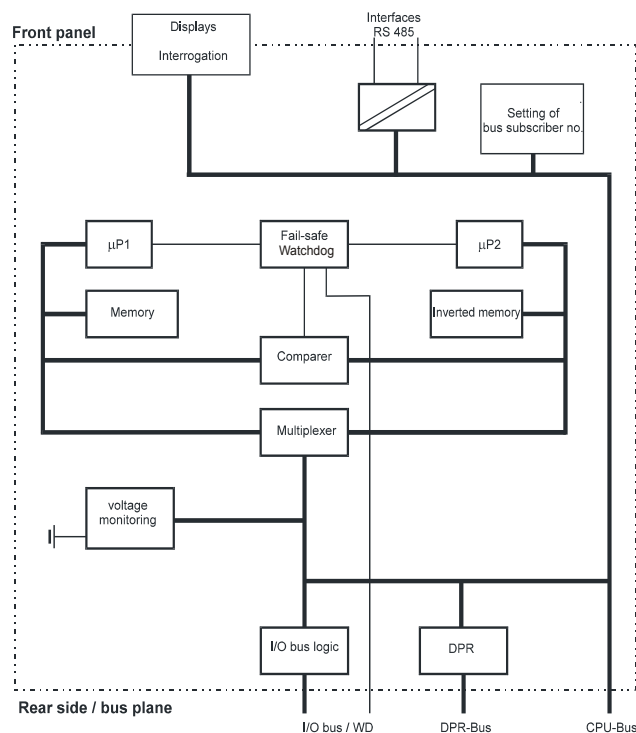


Figure 2: Block diagram of the central module F 8652X

- two clock-synchronized microprocessors
- each microprocessor with an own memory, one processor operates with real data and program and the other one with inverted data and program
- testable hardware comparer for all the external accesses of both microprocessors, in case of a fault the watchdog will be set to the safe status and the status of the processor is announced
- Flash-EPROMs of the program memory for the operating system and the user program usable for min. 100,000 writing cycles
- Data memory in sRAM
- Multiplexer to connect I/O bus, DPR and redundant CU
- Battery backup of the sRAMs via batteries with monitoring

- 2 interfaces RS 485 with galvanic isolation. Transmission rate: max. 57600 bps
- 4digit diagnostic display and 2 LEDs for information out of the system, I/O level and user program
- Dual Port RAM for fast memory access to the second central module
- Hardware clock, battery buffered
- I/O bus logic and connection to the input/output modules
- Watchdog
- Power supply monitoring, testable (5 V system voltage)
- Battery monitoring

2.2 Coprocessor module F 8621A

Right of the central module of the H41q-HS/HRS PES respectively one coprocessor module can be installed. The coprocessor module mainly contains:

- Microprocessor HD 64180 with a clock frequency of 10 MHz
- Operating system EPROM
- RAM for a PLC master project

Note	The RAM for the master project is buffered via the batteries on the backplane of the subrack.

- Two interfaces RS 485, via communication software function block setting of the baud rate up to 57600 bps
- Dual port RAM (DPR) for the communication with the central module via CPU bus

2.3 Communication modules F 8627/F 8628, F 8627X/F 8628X

Right of the central module of the H41q-HS/HRS PES respectively one communication module can be installed. The communication module mainly contains:

- 32-bit RISC microprocessor
- Operating system
- RAM for further protocols
- F 8627 Ethernet interface (safe**e**thernet, OPC, ...)
- F 8628 Profibus-DP slave interface
- Dual port RAM (DPR) for the communication with the central module via CPU bus

Special applications with the communication module F 8627X:

- connection of the central module to a PADT (ELOP II TCP)
- connection to other communication partners within an Ethernet network (Modbus TCP)

Special application with the communication module F 8628X:

- ELOP II TCP connection (PADT) via the Ethernet interface of the F 8628X to the H41q/H51q controller

3 Startup and maintenance



Before startup the system switch on the rear buffer batteries G1 and G2 via DIP switches on the backplane!

A battery change of the buffer batteries without load (CPU in operation) is recommended every 6 years.

Buffer battery with soldering lug: HIMA part no. 44 0000016.

Buffer battery without soldering lug: HIMA part no. 44 0000019.

Further informations see also catalog H41q/H51q, chapter 9, "Startup and maintenance".

4 Wiring of the assembly kit

The assembly kit is already wired for operation. Wirings have still to be done by the user (optional modules, see "Assembly kit, wiring diagram").



With installation of the assembly kit a conductive connection to the frame or a separate earth connection has to be installed according to the EMC requirements.

Connection PE earth: Faston 6.3 x 0.8 mm.

Pay attention for the manufacturers information concerning detaching and replugging of the Faston connectors!

4.1 Current distribution within the assembly kit

4.1.1 HIMA devices for current distribution

It is recommended to use the HIMA supplies and current distributions:

- K 7212** redundant feeding up to 35 A total current, with 2 decoupling diodes and 2 network filters, with fusing of up to 12 single circuits with circuit breakers or
- K 7213** redundant feeding up to 35 A total current, with fusing of up to 12 single circuits with circuit breakers or
- K 7214** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers or
- K 7215** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers, graphical display.

4.1.2 Supply 24 VDC

The supply voltage 24 VDC may be fed two times to the system H41q-HS/HRS. See also catalog H41q/H51q, chapter 3.3, The Input/Output Level, 24 VDC Supply and Distribution.

Connection	Wire and connection	Fusing	Use
XG.24/25:2 (L+)	RD 2.5 mm ² , Faston 6.3 x 0.8	max. 16 A	PS1, PS2
XG.24/25:1(L-)	BK 2.5 mm ² , Faston 6.3 x 0.8		Reference pole L-
XG.14 (L-)	BK 2 x 2.5 mm ² , Faston 6.3 x 0.8 (see note)		Reference pole L-
XG.6 (L+)	RD 1 mm ² , Faston 2.8 x 0.8 13 single connections	max. 4 A slow blow	see wiring diagram
RD = Color code red BK = Color code black			

Table 1: Supply 24 VDC



Connection XG.14: To be wired to the central L- bus bar with at least 2 x 2.5 mm² BK. If output modules with 2-pole connection to the actors are used depending on the load up to 4 x 2.5 mm² BK wiring is necessary.

4.1.3 Supply 5 VDC

The 5 VDC power supply does not have to be wired separately as it is already installed as part of the subrack.

The 5 VDC power is used for the CPU, the control of the interfaces and the I/O modules. It is generated by 24 VDC / 5 VDC power supply module type F 7130A. The subrack is equipped with two power supply modules. The power supply modules are switched in parallel. If one of them fails, the other supplies the PES.

The 5 VDC output voltage of the power supply module (for the CPU, I/O and the interfaces) are monitored on the central module checking undervoltage, overvoltage or failure.

In case of a faulty power supply module the operating system of the CPU informs the user program via a system variable.

In case of a 5 VDC system power failure a lithium battery on the central module buffers the hardware clock and sRAM on the central module.

4.2 Connection of the monitoring loop (for fuses and fans)

Connection	Wire and connection	Fusing	Use
XG.21:4/5/6	GY 0.5 mm ² , Faston 2.8 x 0.8	max. 4 A slow blow	Floating NO/NC contact for signaling
GY = Color code gray			

Table 2: Connection of the monitoring loop

4.3 Internal fuses

Position	Size	Dimension	HIMA part no.
Z 6011	4 A slow blow	5 x 20 mm	57 0174409
Z 6013	1.6 A slow blow	5 x 20 mm	57 0174169

Table 3: Internal fuses

4.4 Connections of the WD to H41q-HRS / B 4237-2

Connection	Procedure
XG.12 and XG.13	Remove override between both connections

Table 4: Connections of the WD

4.5 Backplane bus

Central module CU and I/O modules are connected via the backplane bus.

The jumper plug Z 6007 on connection XD .1 combines the separated I/O buses. For the single channel system this is mandatory (H41q-HS). With redundant I/O bus (H41q-HRS) the jumper plug Z 6007 at the backplane of the subrack is not installed.

4.6 Connections on the rear

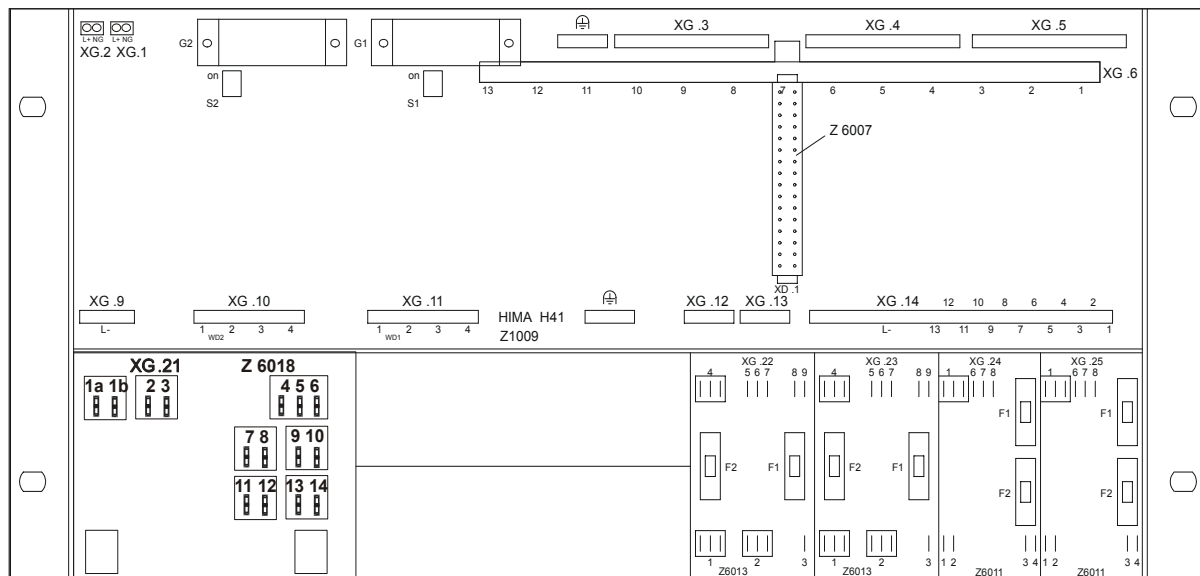


Figure 3: Connections on the rear of the system rack K 1409

4.6.1 Wiring ex works

XD .1	Jumper plug Z 6007 (Combination of the separated I/O buses, single channel system H41q-HS), not at redundant system H41q-HRS
XG .1, XG .2	Supply L+ for the power supply module Reference pole: XG .9 (L-)
XG .3, XG .4, XG .5	Potential distributor, free disposal of
XG .9	L- for the power supply module
XG .10	Watchdog signal from CU2
XG .11	Watchdog signal from CU1
XG .12	Watchdog signal for I/O modules 2. I/O bus
XG .13	Watchdog signal for I/O modules 1. I/O bus



PE (earth)

Connections of the additional modules Z 6011, Z 6018, Z 6013:

XG. 21, XG. 22, XG .23	refer to assembly kit, wiring diagram
S1, S2	for switching off the buffer batteries G1, G2 Delivery state: Buffer batteries are switched off!

4.6.2 Wiring by customer

XG .6: 1 - 13	L+ for I/O modules (slots 1 to 13) 13 single connections, see also connection XG .14
XG .14: 1 - 13	Reference potential L- for I/O modules Slots 1 - 13, see also connection XG .6
XG .24, XG .25	Supply 24 VDC, see assembly kit, wiring diagram (L+, L-)

4.7 Assembly kit, wiring diagram

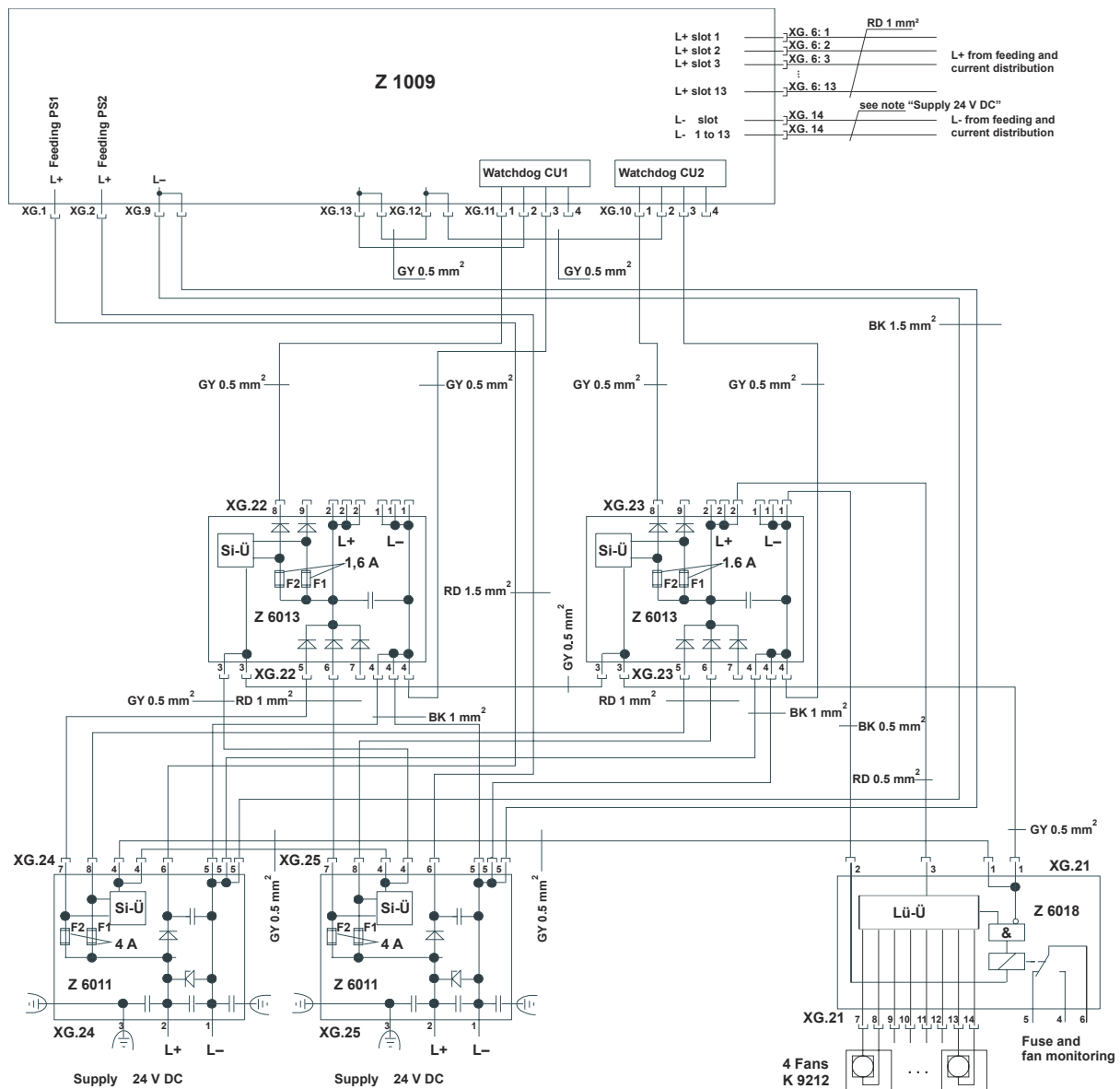


Figure 4: Assembly kit, wiring diagram

Lü-Ü = Fan monitoring
Si-Ü = Fuse monitoring

Note

The assembly kit is fully wired for a possible extension to redundant systems. For extension to redundant I/O buses remove jumper plug Z 6007 (H41q-HRS).

5 Side view B 4237-1/-2 assembly kit H41q-HS/HRS system

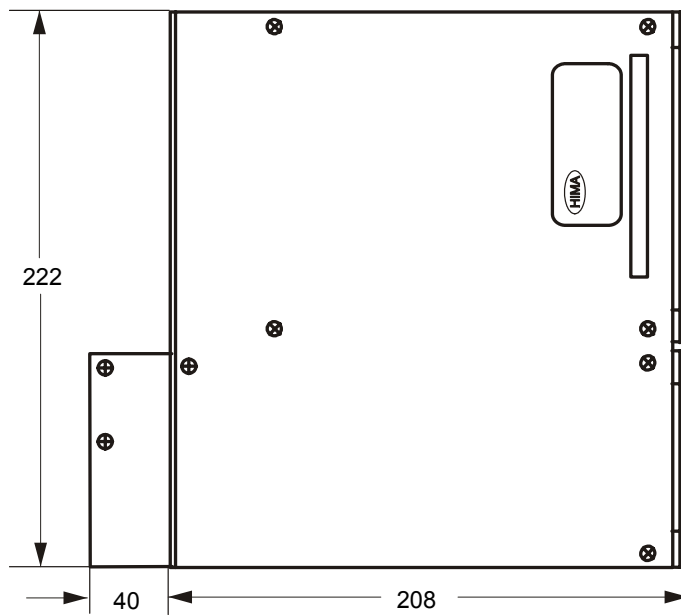


Figure 5: Side view



B 5230: Assembly Kit / H51q-M: System

System H51q-M in K 1412B system subrack, 5 HU, 19 inches with single channel central module, power supply 24/5 V, power supply monitoring module, I/O bus connection, communication modules (optional), coprocessor modules (optional) and three fans

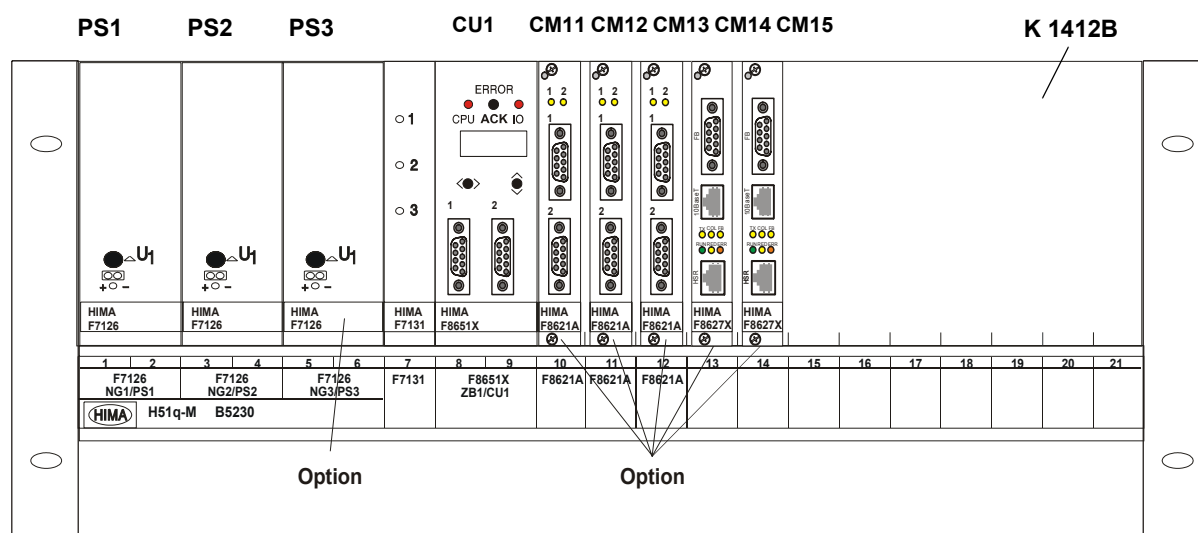


Figure 1: Front view

1 Parts of the B 5230 assembly kit / H51q-M system

- 1 x K 1412B central rack, 5 units high, 19 inches, with cable tray with three fan modules K 9212, hinged receptacle for the label and backplane Z 1001.
- additional modules on the rear
 - 3 x Z 6011 decoupling and fusing to feed the power supply modules
 - 1 x Z 6018 fan run monitoring and fuse monitoring
 - 2 x Z 6013 decoupling and fusing of the supply voltage for the WD signal
 - 2 x F 7546 bus termination modules

includes the modules:

- 2 x F 7126 power supply modules 24 V / 5 V, 10 A (PS1, PS2)
- 1 x F 7131 power supply monitoring
- 1 x F 8651X central module (CU1)

modules for option (separate order)

- 3 x F 8621A coprocessor module (CM11 - CM13)
- 5 x communication modules (CM11 - CM15)
- 1 x F 7126 power supply module 24 V / 5 V, 10 A (PS3)

Assembly kits to be used for the I/O level:

- B 9302 I/O subrack 4 units high, 19 inches
- B 9361 additional power supply, 5 VDC, 5 units high, 19 inches

The max. current must be 18 A (all I/O modules and the modules in the central rack), if 3 x F 7126 are used to keep the system in operation even one power supply module F 7126 has failed.

Values of the current requirement (+5 V DC) refer to the data sheets.

Note**Operating system/resource type in ELOP II**

The assembly kit is usable since operating system BS41q/51q V7.0-8.
Resource type in ELOP II: H51qe-M.

2 Modules

2.1 Central module F 8651X

The central module of the PES H51q-M contains the essential functions demonstrated in the block diagram of the central module:

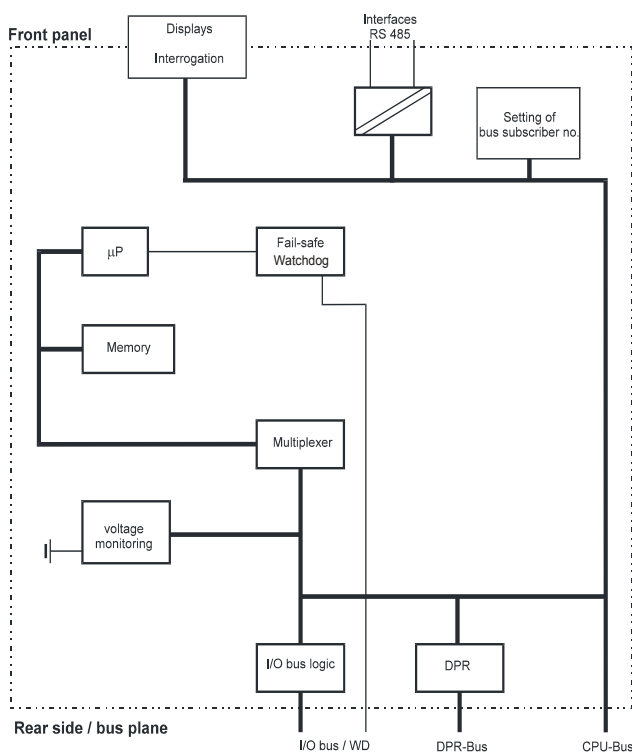


Figure 2: Block diagram of the central module F 8651X

- Microprocessor
- Flash-EPROMs of the program memory for the operating system and the user program usable for min. 100,000 writing cycles
- Data memory in sRAM
- Dual Port RAM for fast memory access to the second central module (not used in the H51q-M system)
- 2 interfaces RS 485 with galvanic isolation. Transmission rate: max. 57600 bps
- 4digit diagnostic display and 2 LEDs for information out of the system, I/O level and user program
- Power supply monitoring
- I/O bus logic for the connection to the input/output modules
- Hardware clock, battery buffered
- Watchdog
- Battery backup of the sRAMs via batteries on the central module with monitoring

2.2 Coprocessor module F 8621A

Right of each installed central module of the H51q-M PES up to three coprocessor modules can be installed. The coprocessor module mainly contains:

- Microprocessor HD 64180 with a clock frequency of 10 MHz
- Operating system EPROM
- RAM for a PLC master project

Note	The RAM for the master project is buffered via the batteries on the power supply monitoring module F 7131.

- Two interfaces RS 485, via communication software function block setting of the baud rate up to 57600 bps
- Dual port RAM (DPR) for the communication with the central module via CPU bus

2.3 Communication modules F 8627/F 8628, F 8627X/F 8628X

Right of the installed central module of the H51q-M PES up to five communication modules can be installed. The communication module mainly contains:

- 32-bit RISC microprocessor
- Operating system
- RAM for further protocols
- F 8627 Ethernet interface (safe**ethernet**, OPC, ...)
- F 8628 Profibus-DP slave interface
- Dual port RAM (DPR) for the communication with the central module via CPU bus

Special applications with the communication module F 8627X:

- connection of the central module to a PADT (ELOP II TCP)
- connection to other communication partners within an Ethernet network (Modbus TCP)

Special application with the communication module F 8628X:

- ELOP II TCP connection (PADT) via the Ethernet interface of the F 8628X to the H41q/H51q controller

3 Startup and maintenance

A battery change of the buffer batteries on the power supply monitoring module and the central module (CPU in operation) is recommended every 6 years.

Buffer battery with soldering lug: HIMA part no. 44 0000016.

Buffer battery without soldering lug: HIMA part no. 44 0000019.

Further informations see also catalog H41q/H51q, chapter 9, "Startup and maintenance".

4 Wiring of the assembly kit

The assembly kit is already wired for operation. Wirings have still to be done by the user (optional modules, see "Assembly kit, wiring diagram").



With installation of the assembly kit a conductive connection to the frame or a separate earth connection has to be installed according to the EMC requirements.

Connection PE earth: Faston 6.3 x 0.8 mm.

Pay attention for the manufacturers information concerning detaching and replugging of the Faston connectors!

4.1 Current distribution within the assembly kit

4.1.1 HIMA devices for current distribution

It is recommended to use the HIMA supplies and current distributions:

- K 7212** redundant feeding up to 35 A total current, with 2 decoupling diodes and 2 network filters, with fusing of up to 12 single circuits with circuit breakers or
- K 7213** redundant feeding up to 35 A total current, with fusing of up to 12 single circuits with circuit breakers or
- K 7214** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers or
- K 7215** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers, graphical display.

4.1.2 Supply 24 VDC

The 24 VDC power supply can be feeded three times to the system H51q-M (starlike wiring). See also catalog H41q/H51q, chapter 4.3, The Input/Output Level, 24 VDC Supply and Distribution.

Connection	Wire and connection	Fusing	Use
XG.21/22/23:2 (L+)	RD 2.5 mm ² , Faston 6.3 x 0.8	max. 16 A gL	PS1...PS3
XG.21/22/23:1 (L-)	BK 2.5 mm ² , Faston 6.3 x 0.8		Reference pole L-
RD = Color code red BK = Color code black			

Table 1: Supply 24 VDC

4.1.3 Output 24 VDC

Connection	Wire and connection	Use
XG.24:2 (L+)	RD 1.5 mm ² , Faston 6.3 x 0.8	Supply fuse monitoring and IO-CON in the I/O rack
RD = Color code red		

Table 2: Output 24 VDC

4.1.4 Supply 5 VDC

The 5 VDC power supply does not have to be wired extra as it is already part of the installation. To supply the I/O racks the 5 V power supply with corresponding GND is available at the rear side of the central rack.

The 5 VDC power and GND are connected starlike with each 2 wires to the potential distributor.

The 5 VDC power needed for the microprocessor system and as control current for the I/O modules is generated from the 24 VDC power of the system via (24 VDC / 5 VDC) power supply modules type F 7126. One central rack can be equipped with a maximum of 3 power supply modules. The power supply modules are switched in parallel. One or two power supply modules are usually able to supply the PES. A further power supply module is used to increase availability.

Note At planning the load of the power supply units have to be calculated.

The 5 VDC output voltage of the power supply module (for the CPU, I/O and the interfaces) are monitored by the power supply monitoring module F 7131 checking undervoltage, over-voltage or failure.

In case of a faulty power supply module the operating system of the CPU informs the user program via a system variable.

In case of a 5 VDC system power failure a lithium battery on the central module buffers the hardware clock and sRAM on the central module.

The sRAM memory of the coprocessor module is buffered via two lithium batteries on the power supply monitoring module F 7131.

4.1.5 Output 5 VDC

Connection	Wire and connection	Use
XG.2: +5 V	YE 2 x 2.5 mm ² , Faston 6.3 x 0.8	Supply I/O subrack (B 9302)
XG.3: GND	GN 2 x 2.5 mm ² , Faston 6.3 x 0.8	Supply I/O subrack (B 9302)
GN = Color code green YE = Color code yellow		

Table 3: Output 5 VDC

4.2 Output WD

Connection	Wire and connection	Use
XG.1:2 (4)	GY 0.5 mm ² , wire end ferrule	WD to I/O subrack
GY = Color code gray		

Table 4: Output WD

4.3 Connection of the monitoring loop (for fuses and fans)

Connection	Wire and connection	Fusing	Use
XG.26:4/5/6	GY 0.5 mm ² , Faston 2.8 x 0.8	max. 4 A slow blow	Floating NO/NC contact for signaling
GY = Color code gray			

Table 5: Connection of the monitoring loop

4.4 Internal fuses

Position	Size	Dimension	HIMA part no.
Z 6011	4 A slow blow	5 x 20 mm	57 0174409
Z 6013	1.6 A slow blow	5 x 20 mm	57 0174169

Table 6: Internal fuses

4.5 I/O bus

The data connection of the I/O level with the central module is established via the I/O bus.

Connection	Procedure
XD.4	Remove bus termination module F 7546 and plug it on XD.2 of the last I/O rack, then connect cable BV 7032 there and plug it on XD.1 of the 1st I/O rack.

Table 7: I/O bus connection

For the I/O rack the connection to the I/O bus is made via a coupling module F 7553 installed in slot 17. The connection of the bus between the individual subracks is established at the rear side via the BV 7032 data cable.

To terminate the I/O bus, an F 7546 module is plugged in at the beginning on central subrack and at the end (last I/O rack).

4.5.1 Construction principle of the I/O bus of the system H51q-M

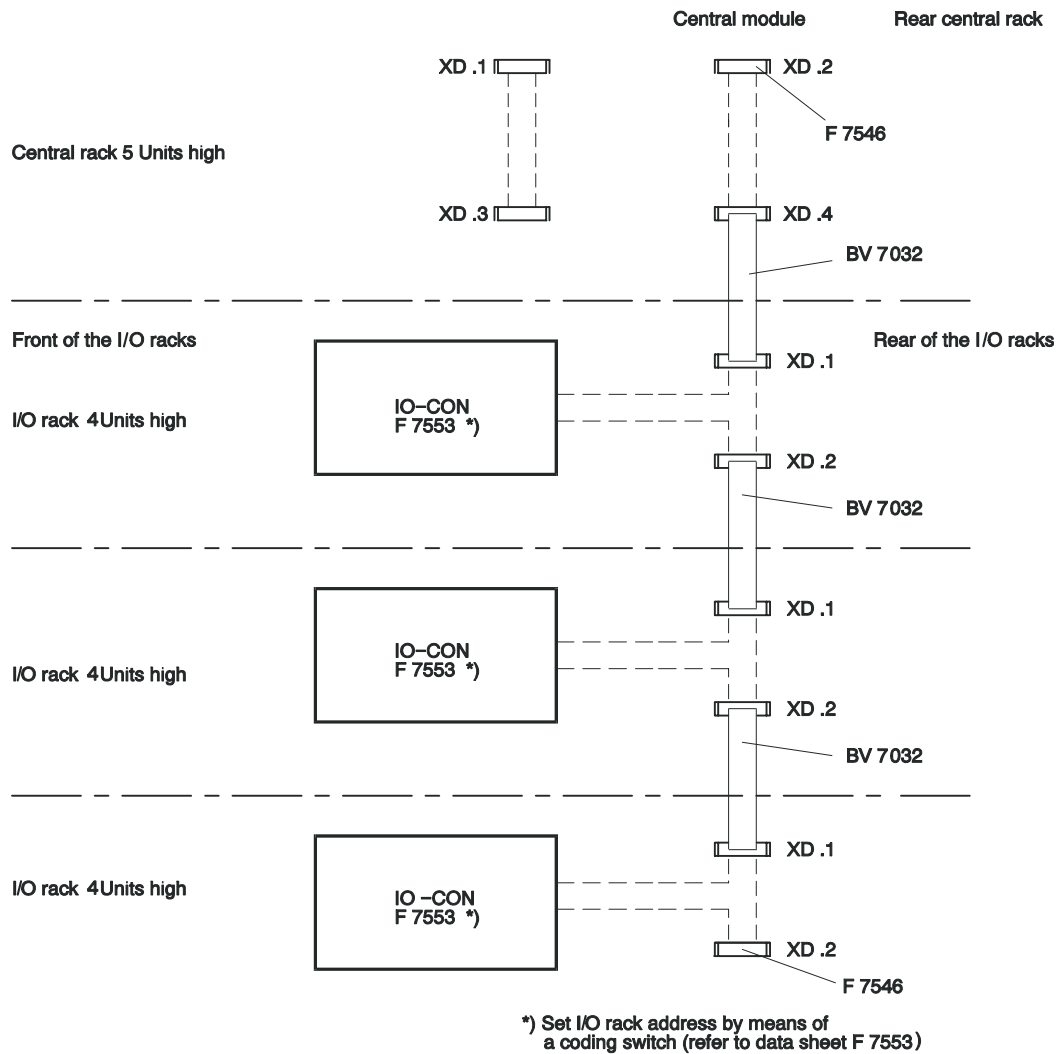


Figure 3: Construction principle of the I/O bus for system H51q-M

max. length I/O bus:	12 m
max. length cable BV 7032:	5 m
cable BV 7032 between subracks:	max. 0.5 m

4.6 Connections on the rear

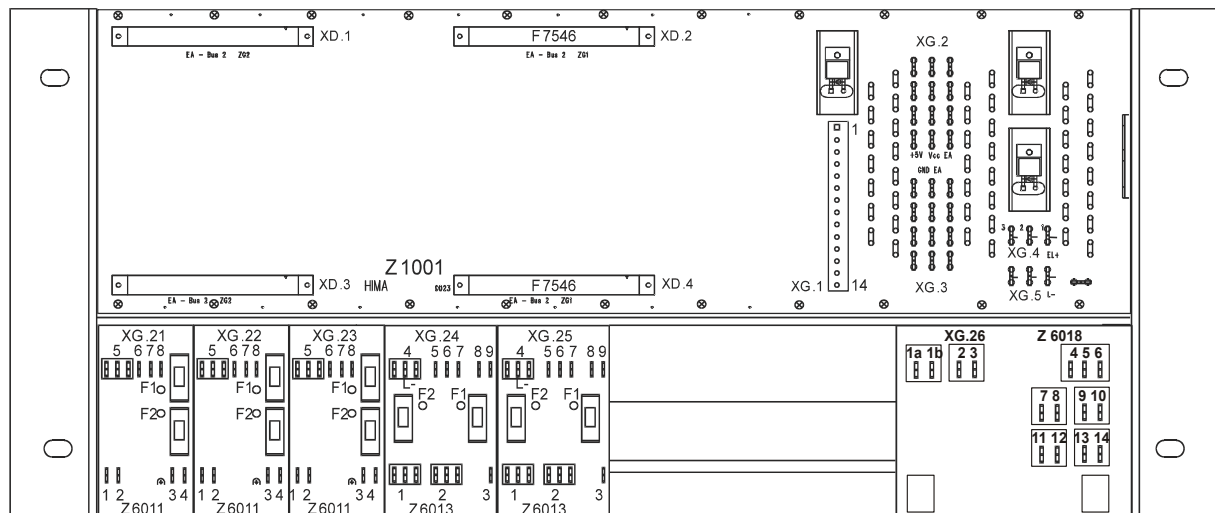


Figure 4: Connections on the rear of the system rack K 1412B

4.6.1 Wiring ex works

XD.1	Connection data cable BV 7032 (not used in single channel system H51q-M)
XD.2	Bus termination module F 7546 plugged / Connection data cable BV 7032
XD.3	Connection data cable BV 7032 (not used in single channel system H51q-M)
XD.4	Bus termination module F 7546 plugged / Connection data cable BV 7032
XG.1: 1, 3	Watchdog supply for module Z 6013
XG.1: 5, 7	Watchdog supply for module Z 6013
XG.1: 12 - 13	Connection external buffer battery on module F 7131
XG.1: 14	Ground (GND) for connection external buffer battery
XG.4	L+ for power supply 24V
XG.5	Reference potential: (L-)

Connections of the additional modules (see assembly kit, wiring diagram)

XG.24, XG.25	Z 6013
XG.26	Z 6018

4.6.2 Wiring by customer

XG.1: 2, 4	Watchdog signal for I/O modules
XG.1: 9 - 11	Monitoring power supply PS1 - PS3 by F 7131 for external examination
XG.2	Connection 5 VDC for I/O subrack
XG.3	Ground (GND) for supply 5 VDC
XG.21, XG.22, XG.23	Supply 24 V via module Z 6011 (see assembly kit, wiring diagram) L+, L-

4.7 Assembly kit, wiring diagram

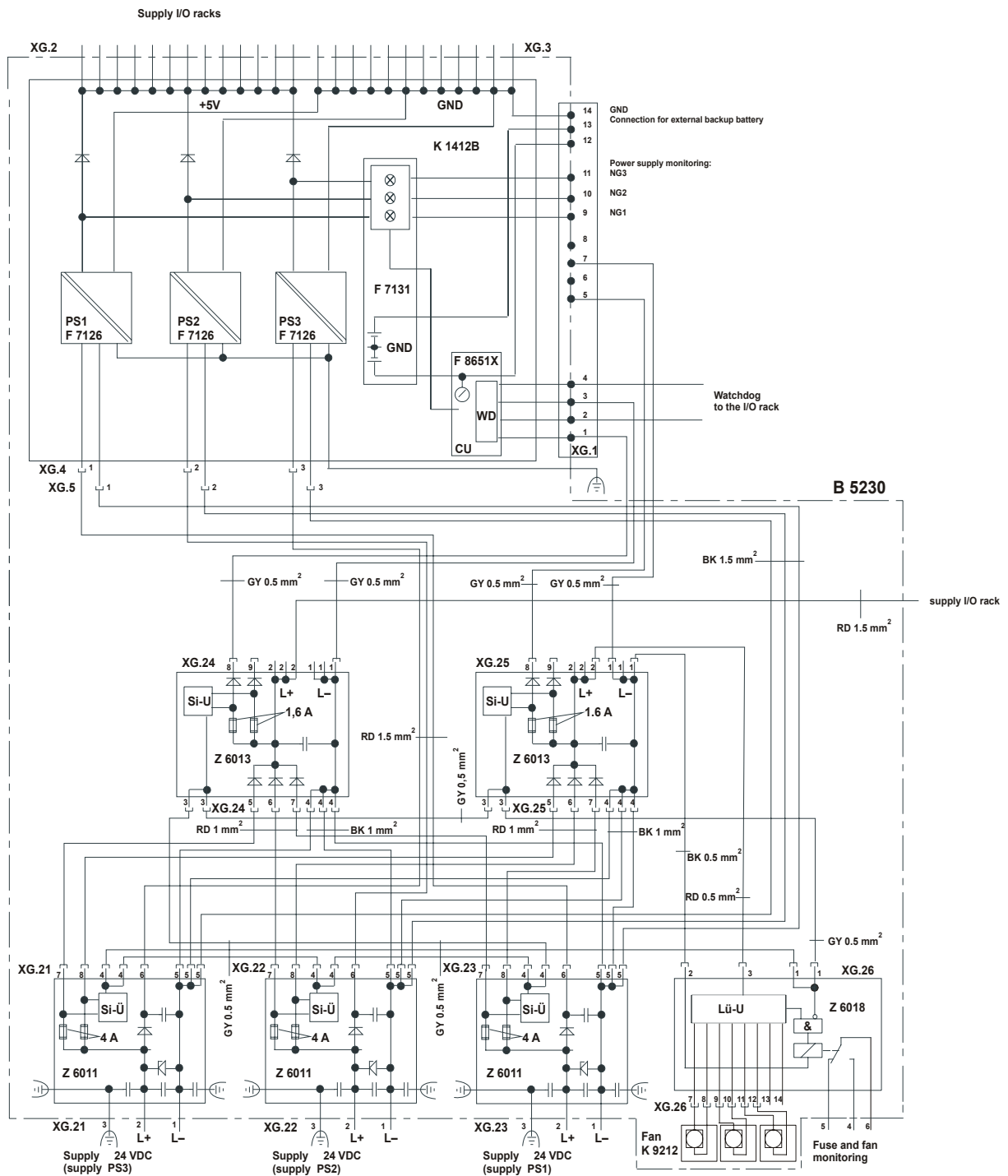


Figure 5: Assembly kit, wiring diagram

Lü-Ü = Fan monitoring
Si-Ü = Fuse monitoring

5 Side view B 5230 assembly kit / H51q-M system

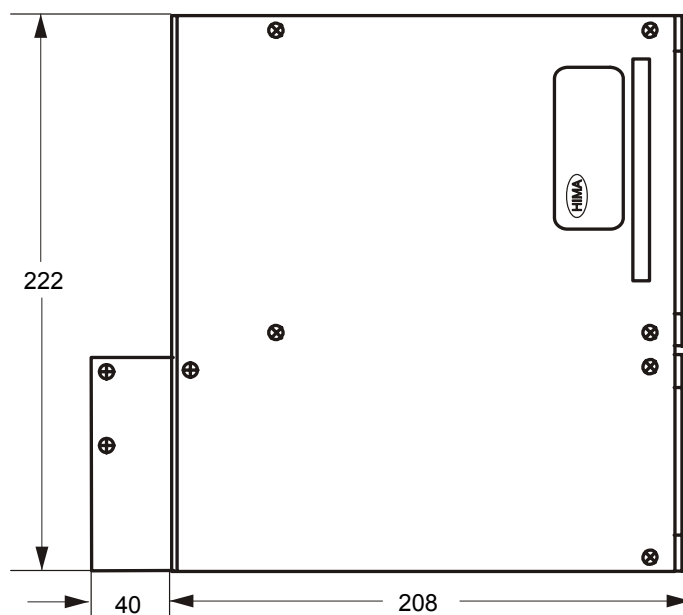


Figure 6: Side view



B 5231: Assembly Kit / H51q-MS: System

System H51q-M in K 1412B system subrack, 5 HU, 19 inches with single channel central module, power supply 24/5 V, power supply monitoring module, I/O bus connection, communication modules (optional), coprocessor modules (optional) and three fans

TÜV certified, applicable up to SIL 3 according to IEC 61508

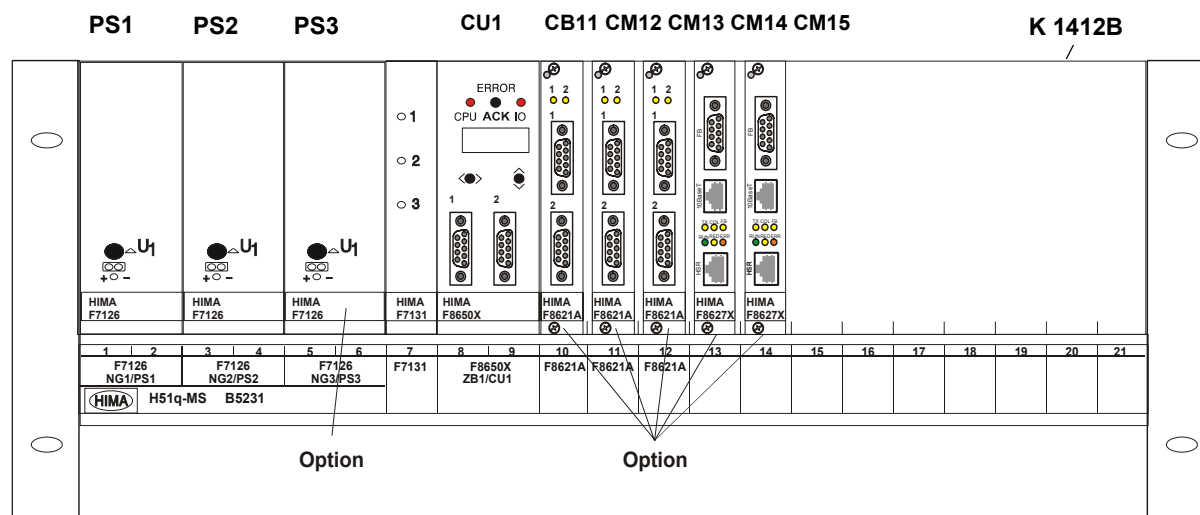


Figure 1: Front view

1 Parts of the B 5231 assembly kit / H51q-MS system

- 1 x K 1412B central rack, 5 units high, 19 inches, with cable tray with three fan modules K 9212, hinged receptacle for the label and backplane Z 1001.
- additional modules on the rear
 - 3 x Z 6011 decoupling and fusing to feed the power supply modules
 - 1 x Z 6018 an run monitoring and fuse monitoring
 - 2 x Z 6013 decoupling and fusing of the supply voltage for the WD signal
 - 2 x F 7546 bus termination module

includes the modules:

- 2 x F 7126 power supply modules 24 V / 5 V, 10 A (PS1, PS2)
- 1 x F 7131 power supply monitoring module
- 1 x F 8650X central module (CU1)

modules for option (separate order)

- 3 x F 8621A coprocessor modules (CM11 - CM13)
- 5 x communication modules (CM11 - CM15)
- 1 x F 7126 power supply module 24 V / 5 V, 10 A (PS3)

Assembly kits to be used for the I/O level:

- B 9302 I/O subrack 4 units high, 19 inches
- B 9361 additional power supply, 5 VDC, 5 units high, 19 inches

The max. current must be 18 A (all I/O modules and the modules in the central rack), if 3 x F 7126 are used to keep the system in operation even one power supply module F 7126 has failed.

Values of the current requirement (+5 VDC) refer to the data sheets.

Note**Operating system/resource type in ELOP II**

The assembly kit is usable since operating system BS41q/51q V7.0-8.
Resource type in ELOP II: H51qe-MS.

2 Modules

2.1 Central module F 8650X

The central module for safety related applications with TÜV certificate of the PES H51q-MS contains the essential functions demonstrated in the block diagram of the central module:

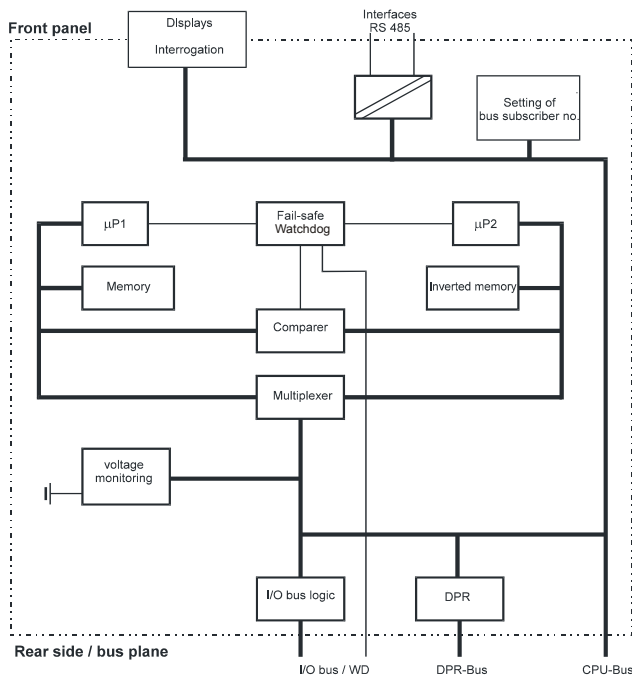


Figure 2: Block diagram of the central module F 8650X

- two clock-synchronized microprocessors
- each microprocessor with an own memory, one processor operates with real data and program and the other one with inverted data and program
- testable hardware comparer for all the external accesses of both microprocessors, in case of a fault the watchdog will be set to the safe status and the status of the processor is announced
- Flash-EPROMs of the program memory for the operating system and the user program usable for min. 100,000 writing cycles
- Data memory in sRAM
- Multiplexer to connect I/O bus, DPR and redundant CU (not used in the H51q-MS system)
- Battery backup of the sRAMs via batteries with monitoring
- 2 interfaces RS 485 with galvanic isolation. Transm. rate: max. 57600 bps
- 4digit diagnostic display and 2 LEDs for information out of the system, I/O level and user program

- Dual Port RAM for fast memory access to the second central module (not used in the H51q-MS system)
- Hardware clock, battery buffered
- I/O bus logic and connection to the input/output modules
- Watchdog
- Power supply monitoring, testable (5 V system voltage)
- Battery monitoring

2.2 Coprocessor module F 8621A

Right of the central module of the H51q-MS PES up to three coprocessor modules can be installed. The coprocessor module mainly contains:

- Microprocessor HD 64180 with a clock frequency of 10 MHz
- Operating system EPROM
- RAM for a PLC master project

Note	The RAM for the master project is buffered via the batteries on the power supply monitoring module F 7131.

- Two interfaces RS 485, via communication software function block setting of the baud rate up to 57600 bps
- Dual port RAM (DPR) for the communication with the central module via CPU bus

2.3 Communication modules F 8627/F 8628, F 8627X/F 8628X

Right of the central module of the H51q-MS PES up to five communication modules can be installed. The communication module mainly contains:

- 32-bit RISC microprocessor
- Operating system
- RAM for further protocols
- F 8627 Ethernet interface (safe**e**thernet, OPC, ...)
- F 8628 Profibus-DP slave interface
- Dual port RAM (DPR) for the communication with the central module via CPU bus

Special applications with the communication module F 8627X:

- connection of the central module to a PADT (ELOP II TCP)
- connection to other communication partners within an Ethernet network (Modbus TCP)

Special application with the communication module F 8628X:

- ELOP II TCP connection (PADT) via the Ethernet interface of the F 8628X to the H41q/H51q controller

3 Startup and maintenance

A battery change of the buffer batteries on the power supply monitoring module and the central module (CPU in operation) is recommended every 6 years.

Buffer battery with soldering lug: HIMA part no. 44 0000016.

Buffer battery without soldering lug: HIMA part no. 44 0000019.

Further informations see also catalog H41q/H51q, chapter 9, "Startup and maintenance".

4 Wiring of the assembly kit

The assembly kit is already wired for operation. Wirings have still to be done by the user (optional modules, see "Assembly kit, wiring diagram").



With installation of the assembly kit a conductive connection to the frame or a separate earth connection has to be installed according to the EMC requirements. Connection PE earth: Faston 6.3 x 0.8 mm. Pay attention for the manufacturers information concerning detaching and replugging of the Faston connectors!

4.1 Current distribution within the assembly kit

4.1.1 HIMA devices for current distribution

It is recommended to use the HIMA supplies and current distributions:

- K 7212** redundant feeding up to 35 A total current, with 2 decoupling diodes and 2 network filters, with fusing of up to 12 single circuits with circuit breakers or
- K 7213** redundant feeding up to 35 A total current, with fusing of up to 12 single circuits with circuit breakers or
- K 7214** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers or
- K 7215** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers, graphical display.

4.1.2 Supply 24 VDC

The 24 VDC power supply can be feeded three times to the system H51q-MS (starlike wiring). See also catalog H41q/H51q, chapter 4.3, The Input/Output Level, 24 VDC Supply and Distribution.

Connection	Wire and connection	Fusing	Use
XG.21/22/23:2 (L+)	RD 2.5 mm ² , Faston 6.3 x 0.8	max. 16 A gL	PS1...PS3
XG.21/22/23:1 (L-)	BK 2.5 mm ² , Faston 6.3 x 0.8		Reference pole L-
RD = Color code red BK = Color code black			

Table 1: Supply 24 VDC

4.1.3 Output 24 VDC

Connection	Wire and connection	Use
XG.24:2 (L+)	RD 1.5 mm ² , Faston 6.3 x 0.8	Supply fuse monitoring and IO-CON in the I/O rack
RD = Color code red		

Table 2: Output 24 VDC

4.1.4 Supply 5 VDC

The 5 VDC power supply does not have to be wired extra as it is already part of the installation. To supply the I/O racks the 5 V power supply with corresponding GND is available at the rear side of the central rack.

The 5 VDC power and GND are connected starlike with each 2 wires to the potential distributor.

The 5 VDC power needed for the microprocessor system and as control current for the I/O modules is generated from the 24 VDC power of the system via (24 VDC / 5 VDC) power supply modules type F 7126. One central rack can be equipped with a maximum of 3 power supply modules. The power supply modules are switched in parallel. One or two power supply modules are usually able to supply the PES. A further power supply module is used to increase availability.

Note	At planning the load of the power supply units have to be calculated.

The 5 VDC output voltage of the power supply module (for the CPU, I/O and the interfaces) are monitored by the power supply monitoring module F 7131 checking undervoltage, over-voltage or failure.

In case of a faulty power supply module the operating system of the CPU informs the user program via a system variable.

In case of a 5 VDC system power failure a lithium battery on the central module buffers the hardware clock and sRAM on the central module.

The sRAM memory of the coprocessor module is buffered via two lithium batteries on the power supply monitoring module F 7131.

4.1.5 Output 5 VDC

Connection	Wire and connection	Use
XG.2: +5 V	YE 2 x 2.5 mm ² , Faston 6.3 x 0.8	Supply I/O subrack (B 9302)
XG.3: GND	GN 2 x 2.5 mm ² , Faston 6.3 x 0.8	Supply I/O subrack (B 9302)
GN = Color code green YE = Color code yellow		

Table 3: Output 5 VDC**4.2 Output WD**

Connection	Wire and connection	Use
XG.1:2 (4)	GY 0.5 mm ² , wire end ferrule	WD to I/O subrack
GY = Color code gray		

Table 4: Output WD**4.3 Connection of the monitoring loop (for fuses and fans)**

Connection	Wire and connection	Fusing	Use
XG.26:4/5/6	GY 0.5 mm ² , Faston 2.8 x 0.8	max. 4 A slow blow	Floating NO/NC contact for signaling
GY = Color code gray			

Table 5: Connection of the monitoring loop

4.4 Internal fuses

Position	Size	Dimension	HIMA part no.
Z 6011	4 A slow blow	5 x 20 mm	57 0174409
Z 6013	1.6 A slow blow	5 x 20 mm	57 0174169

Table 6: Internal fuses

4.5 I/O bus

The data connection of the I/O level with the central module is established via the I/O bus.

Connection	Procedure
XD.4	Remove bus termination module F 7546 and plug it on XD.2 of the last I/O rack, then connect cable BV 7032 there and plug it on XD.1 of the 1st I/O rack.

Table 7: I/O bus connection

For the I/O rack the connection to the I/O bus is made via a coupling module F 7553 installed in slot 17. The connection of the bus between the individual subracks is established at the rear side via the BV 7032 data cable.

To terminate the I/O bus, an F 7546 module is plugged in at the beginning on central subrack and at the end (last I/O rack).

4.5.1 Construction principle of the I/O bus of the system H51q-MS

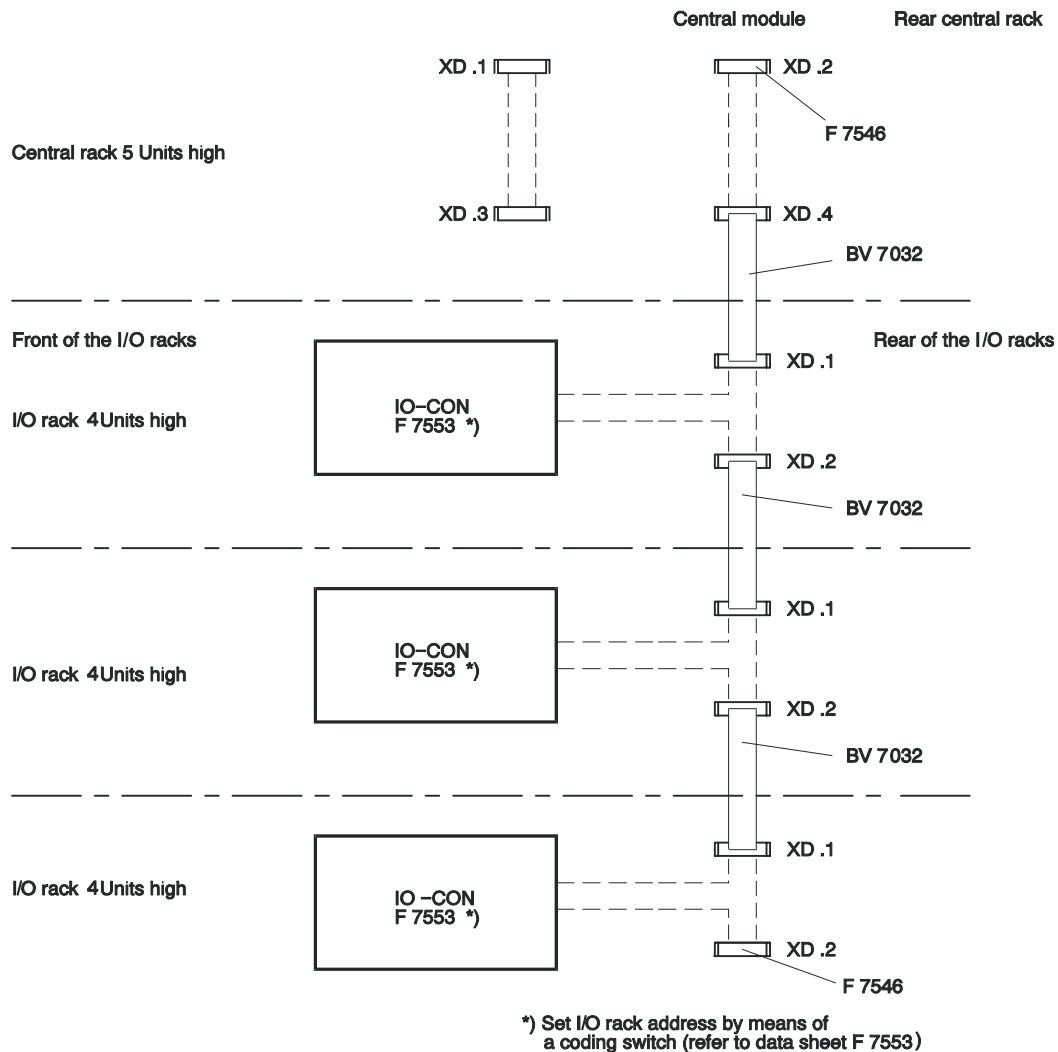


Figure 3: Construction principle of the I/O bus for system H51q-MS

max. length I/O bus:	12 m
max. length cable BV 7032:	5 m
cable BV 7032 between subracks:	max. 0.5 m

4.6 Connections on the rear

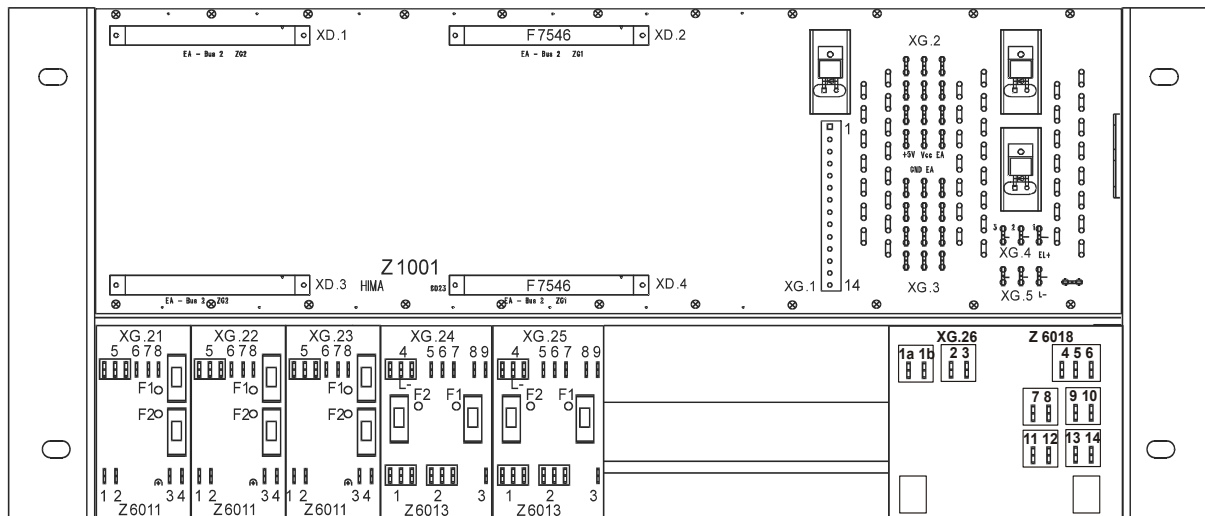


Figure 5: Connections on the rear of the system rack K 1412B

4.6.1 Wiring ex works

XD.1	Connection data cable BV 7032 (not used in single channel system H51q-MS)
XD.2	Bus termination module F 7546 plugged/ Connection data cable BV 7032
XD.3	Connection data cable BV 7032 (not used in single channel system H51q-MS)
XD.4	Bus termination module F 7546 plugged/ Connection data cable BV 7032
XG.1: 1, 3	Watchdog supply for module Z 6013
XG.1: 5, 7	Watchdog supply for module Z 6013
XG.1: 12 - 13	Connection external buffer battery on module F 7131
XG.1: 14	Ground (GND) for connection external buffer battery
XG.4	L+ for power supply 24V
XG.5	Reference potential: (L-)
Connections of the additional modules (see assembly kit, wiring diagram)	
XG.24, XG.25	Z 6013
XG.26	Z 6018

4.6.2 Wiring by customer

XG.1: 2, 4	Watchdog signal for I/O modules
XG.1: 9 - 11	Monitoring power supply PS1 - PS3 by F 7131 for external examination
XG.2	Connection 5 VDC for I/O subrack
XG.3	Ground (GND) for supply 5 VDC
XG.21, XG.22, XG.23	Supply 24 V via module Z 6011 (see assembly kit, wiring diagram) L+, L-

4.7 Assembly kit, wiring diagram

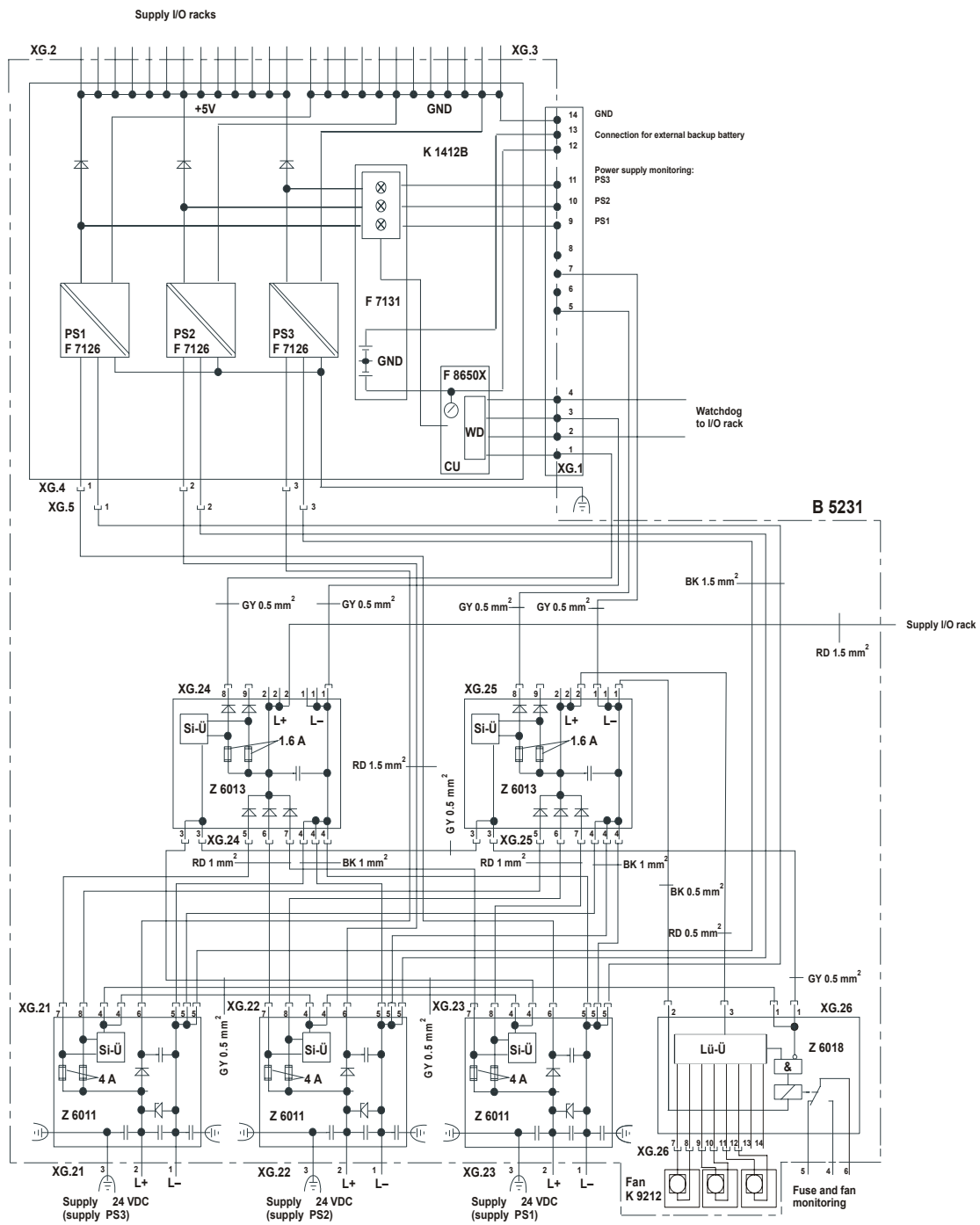


Figure 6: Assembly kit, wiring diagram

Lü-Ü = Fan monitoring
Si-Ü = Fuse monitoring

5 Side view B 5231 assembly kit / H51q-MS system

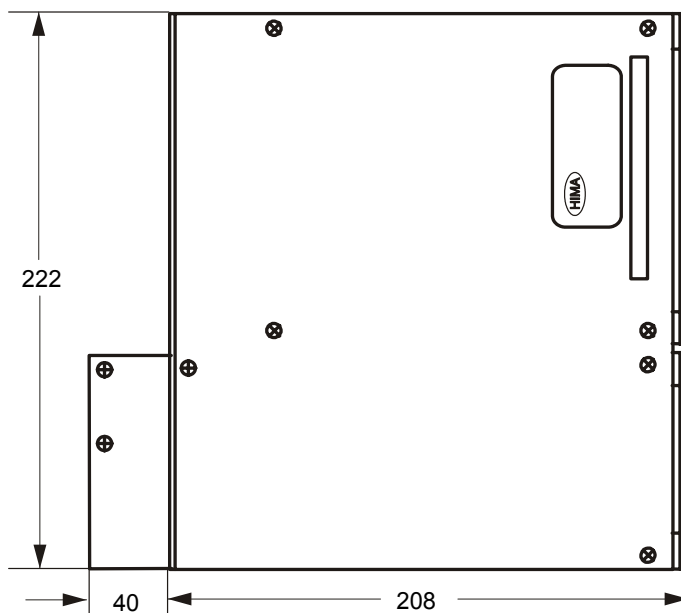


Figure 7: Side view



B 5232-1/-2: Assembly Kit / H51q-H/HR: System

System H51q-H/HR in K 1412B system subrack, 5 HU, 19 inches with redundant central module, power supply 24/5 V, power supply monitoring module, I/O bus connection, communication modules (optional), coprocessor modules (optional) and three fans

H51q-H / B 5232-1: single channel bus, redundant central modules

H51q-HR / B 5232-2: redundant bus, redundant central modules

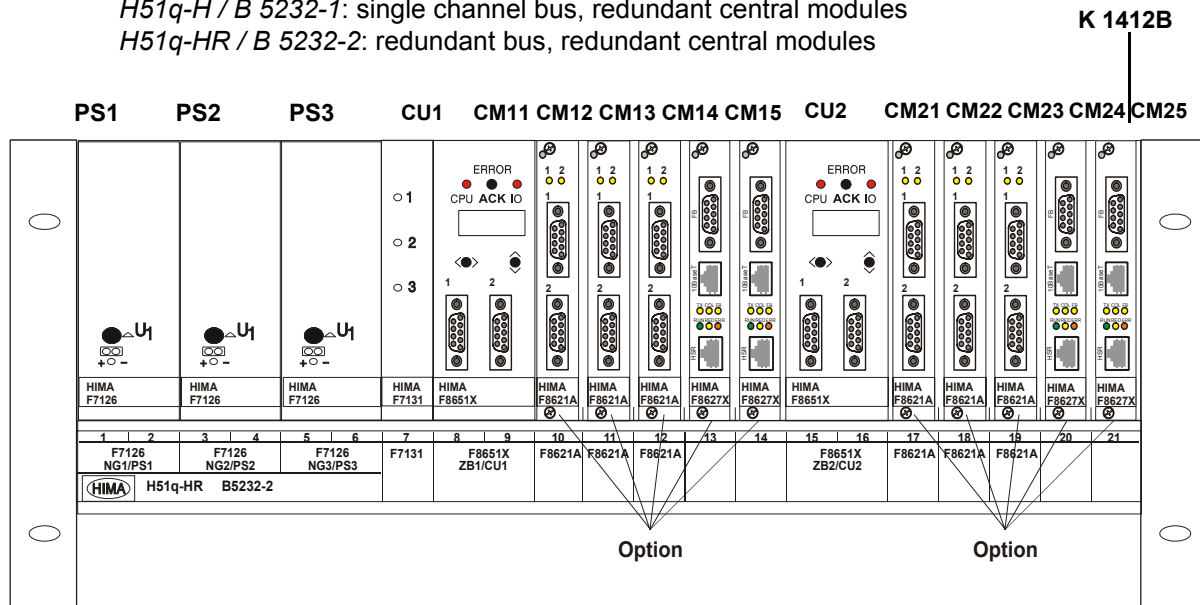


Figure 1: Front view

1 Parts of the B 5232-1/-2 assembly kit / H51q-H/H51q-HR system

- 1 x K 1412B central rack, 5 units high, 19 inches, with cable tray with three fan modules K 9212, hinged receptacle for the label and backplane Z 1001.
- additional modules on the rear
 - 3 x Z 6011 decoupling and fusing to feed the power supply modules
 - 1 x Z 6018 fan run monitoring and fuse monitoring
 - 2 x Z 6013 decoupling and fusing of the supply voltage for the WD signal
 - 2 x F 7546 bus termination module (B 5232-1)
 - 4 x F 7546 bus termination module (B 5232-2)
 - 1 x BV 7032 data cable (only B 5232-1)

includes the modules:

- 3 x F 7126 power supply modules 24 V / 5 V, 10 A (PS1, PS2, PS 3)
- 1 x F 7131 power supply monitoring
- 2 x F 8651X central module (CU1, CU2)

modules for option (separate order)

- 6 x F 8621A coprocessor modules (CM11 - CM13, CM21 - CM23)
- 10 x communication modules (CM11 - CM15, CM21 - CM25)

Assembly kits to be used for the I/O level:

- B 9302 I/O subrack 4 units high, 19 inches
- B 9361 additional power supply, 5 VDC, 5 units high, 19 inches

The max. current must be 18 A (all I/O modules and the modules in the central rack), if 3 x F 7126 are used to keep the system in operation even one power supply module F 7126 has failed.

Values of the current requirement (+5 VDC) refer to the data sheets.

Note**Operating system/resource type in ELOP II**

The assembly kit is usable since operating system BS41q/51q V7.0-8.
Resource type in ELOP II: H51qe-H/H51qe-HR.

2 Modules

2.1 Central module F 8651X

The central module of the PES H51q-H/HR contains the essential functions demonstrated in the block diagram of the central module:

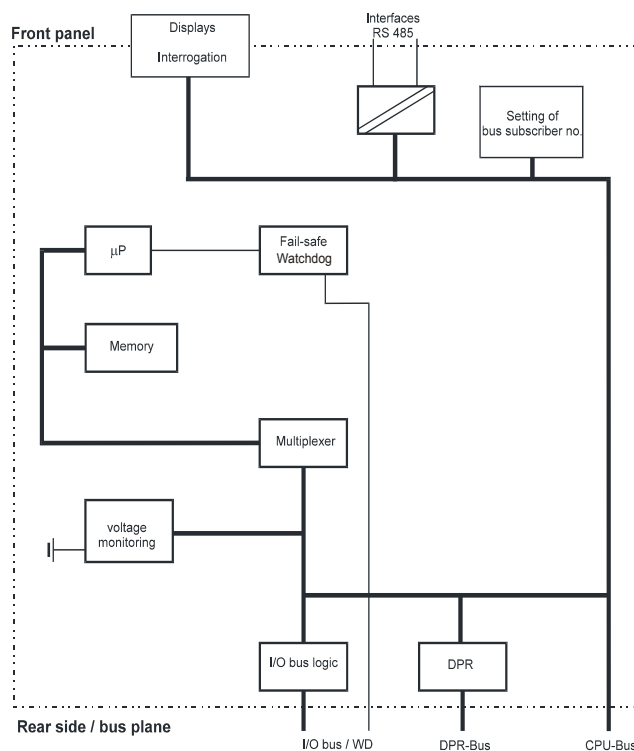


Figure 2: Block diagram of the central module F 8651X

- Microprocessor
- Flash-EPROMs of the program memory for the operating system and the user program usable for min. 100,000 writing cycles
- Data memory in sRAM
- Dual Port RAM for fast memory access to the second central module
- 2 interfaces RS 485 with galvanic isolation. Transmission rate: max. 57600 bps
- 4digit diagnostic display and 2 LEDs for information out of the system, I/O level and user program
- Power supply monitoring

- I/O bus logic for the connection to the input/output modules
- Hardware clock, battery buffered
- Watchdog
- Battery backup of the sRAMs via batteries on the central module with monitoring

2.2 Coprocessor module F 8621A

Right of each installed central module of the H51q-H/HR PES up to three coprocessor modules can be installed. The coprocessor module mainly contains:

- Microprocessor HD 64180 with a clock frequency of 10 MHz
- Operating system EPROM
- RAM for a PLC master project

Note	The RAM for the master project is buffered via the batteries on the power supply monitoring module F 7131.

- Two interfaces RS 485, via communication software function block setting of the baud rate up to 57600 bps
- Dual port RAM (DPR) for the communication with the central module via CPU bus

2.3 Communication modules F 8627/F 8628, F 8627X/F 8628X

Right of each installed central module of the H51q-H/HR PES up to five communication modules can be installed. The communication module mainly contains:

- 32-bit RISC microprocessor
- Operating system
- RAM for further protocols
- F 8627 Ethernet interface (safeethernet, OPC, ...)
- F 8628 Profibus-DP slave interface
- Dual port RAM (DPR) for the communication with the central module via CPU bus

Special applications with the communication module F 8627X:

- connection of the central module to a PADT (ELOP II TCP)
- connection to other communication partners within an Ethernet network (Modbus TCP)

Special application with the communication module F 8628X:

- ELOP II TCP connection (PADT) via the Ethernet interface of the F 8628X to the H41q/H51q controller

3 Startup and maintenance

A battery change of the buffer batteries on the power supply monitoring module and the central module (CPU in operation) is recommended every 6 years.

Buffer battery with soldering lug: HIMA part no. 44 0000016.

Buffer battery without soldering lug: HIMA part no. 44 0000019.

Further informations see also catalog H41q/H51q, chapter 9, "Startup and maintenance".

4 Wiring of the assembly kit

The assembly kit is already wired for operation. Wirings have still to be done by the user (optional modules, see "Assembly kit, wiring diagram").



With installation of the assembly kit a conductive connection to the frame or a separate earth connection has to be installed according to the EMC requirements.

Connection PE earth: Faston 6.3 x 0.8 mm.

Pay attention for the manufacturers information concerning detaching and replugging of the Faston connectors!

4.1 Current distribution within the assembly kit

4.1.1 HIMA devices for current distribution

It is recommended to use the HIMA supplies and current distributions:

- K 7212** redundant feeding up to 35 A total current, with 2 decoupling diodes and 2 network filters, with fusing of up to 12 single circuits with circuit breakers or
- K 7213** redundant feeding up to 35 A total current, with fusing of up to 12 single circuits with circuit breakers or
- K 7214** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers or
- K 7215** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers, graphical display.

4.1.2 Supply 24 VDC

The 24 VDC power supply can be feeded three times to the system H51q-H/HR (starlike wiring). See also catalog H41q/H51q, chapter 4.3, The Input/Output Level, 24 VDC Supply and Distribution.

Connection	Wire and connection	Fusing	Use
XG.21/22/23:2 (L+)	RD 2.5 mm ² , Faston 6.3 x 0.8	max. 16 A gL	PS1...PS3
XG.21/22/23:1 (L-)	BK 2.5 mm ² , Faston 6.3 x 0.8		Reference pole L-
RD = Color code red BK = Color code black			

Table 1: Supply 24 VDC

4.1.3 Output 24 VDC

Connection	Wire and connection	Use
XG.24:2 (L+)	RD 1.5 mm ² , Faston 6.3 x 0.8	Supply fuse monitoring and IO-CON in the I/O rack
XG.25:2 (L+)	RD 1.5 mm ² , Faston 6.3 x 0.8	Supply fuse monitoring and IO-CON in the I/O rack for 2nd I/O bus only B 5232-2)
RD = Color code red		

Table 2: Output 24 VDC

4.1.4 Supply 5 VDC

The 5 VDC power supply does not have to be wired extra as it is already part of the installation. To supply the I/O racks the 5 V power supply with corresponding GND is available at the rear side of the central rack.

The 5 VDC power and GND are connected starlike with each 2 wires to the potential distributor. The 5 VDC power needed for the microprocessor system and as control current for the I/O modules is generated from the 24 VDC power of the system via (24 VDC / 5 VDC) power supply modules type F 7126. One central rack can be equipped with a maximum of 3 power supply modules. The power supply modules are switched in parallel. One or two power supply modules are usually able to supply the PES. A further power supply module is used to increase availability.

Note	At planning the load of the power supply units have to be calculated.

The 5 VDC output voltage of the power supply module (for the CPU, I/O and the interfaces) are monitored by the power supply monitoring module F 7131 checking undervoltage, over-voltage or failure.

In case of a faulty power supply module the operating system of the CPU informs the user program via a system variable.

In case of a 5 VDC system power failure a lithium battery on the central module buffers the hardware clock and sRAM on the central module.

The sRAM memory of the coprocessor module is buffered via two lithium batteries on the power supply monitoring module F 7131.

4.1.5 Output 5 VDC

Connection	Wire and connection	Use
XG.2: +5 V	YE 2 x 2.5 mm ² , Faston 6.3 x 0.8	Supply I/O subrack (B 9302)
XG.3: GND	GN 2 x 2.5 mm ² , Faston 6.3 x 0.8	Supply I/O subrack (B 9302)
GN = Color code green YE = Color code yellow		

Table 3: Output 5 VDC

4.2 Output WD

Connection	Wire and connection	Use
XG.1:2 (4) and XG.1:6 (8)	GY 0.5 mm ² , wire end ferrule	WD to I/O subrack (only B 5232-1)
GY = Color code gray		

Table 4: Output WD

4.3 Connection of the monitoring loop (for fuses and fans)

Connection	Wire and connection	Fusing	Use
XG.26:4/5/6	GY 0.5 mm ² , Faston 2.8 x 0.8	max. 4 A slow blow	Floating NO/NC contact for signaling
GY = Color code gray			

Table 5: Connection of the monitoring loop

4.4 Internal fuses

Position	Size	Dimension	HIMA part no.
Z 6011	4 A slow blow	5 x 20 mm	57 0174409
Z 6013	1.6 A slow blow	5 x 20 mm	57 0174169

Table 6: Internal fuses

4.5 I/O bus

The data connection of the I/O level with the central module is established via the I/O bus.

4.5.1 System H51q-H

The data cable BV 7032 connects the I/O buses of central module 1 (XD.2) to central module 2 (XD.1).

I/O bus, H51q-H / B 5232-1

Connection	Procedure
XD.1 to XD.2	Connect with cable BV 7032
XD.4	Remove bus termination module F 7546 and plug it on XD.2 of the last I/O rack, then connect cable BV 7032 from XD.1 of the 1st I/O rack to empty terminal XD.4

Table 7: I/O bus, H51q-H / B 5232-1

4.5.2 System H51q-HR

The system H51q-HR has a redundant I/O bus. Each of the central modules has its own I/O bus and therefore only the correlated I/O subracks. The 1st I/O bus is assigned to central module 1 and the 2nd I/O bus is assigned to central module 2.

I/O bus, H51q-HR / B 5232-2

Connection	Procedure
XD.3 and XD.4	Remove bus termination module F 7546 and plug it on XD.2 of the last I/O rack of both I/O buses
XD.4	Plug in cable BV 7032 of the 1st I/O rack to the 1st I/O bus
XD.3	Plug in cable BV 7032 of the 2nd I/O rack to the 2nd I/O bus

Table 8: I/O bus, H51q-HR / B 5232-2

4.5.3 Systems H51q-H/HR

For the I/O rack the connection to the I/O bus is made via a coupling module F 7553 installed in slot 17. The connection of the bus between the individual subracks is established at the rear side via the BV 7032 data cable.

To terminate the I/O bus, an F 7546 module is plugged in at the beginning on central subrack and at the end (last I/O rack).

4.5.4 Construction principle of the I/O bus of the system H51q-H

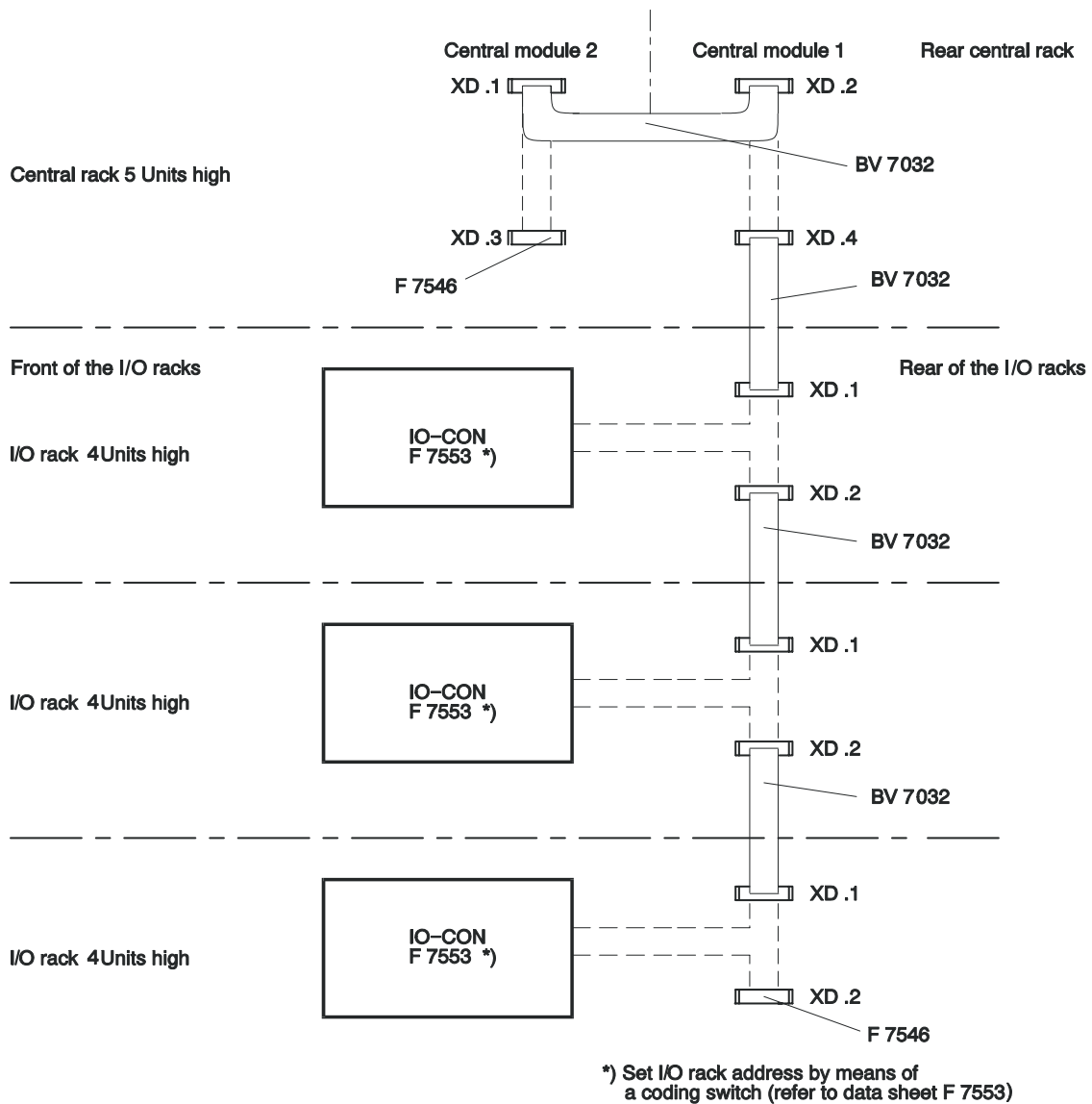


Figure 3: Construction principle of the I/O bus for system H51q-H

max. length I/O bus:	12 m
max. length cable BV 7032:	5 m
cable BV 7032 between subracks:	max. 0.5 m

4.5.5 Construction principle of the I/O bus of the system H51q-HR

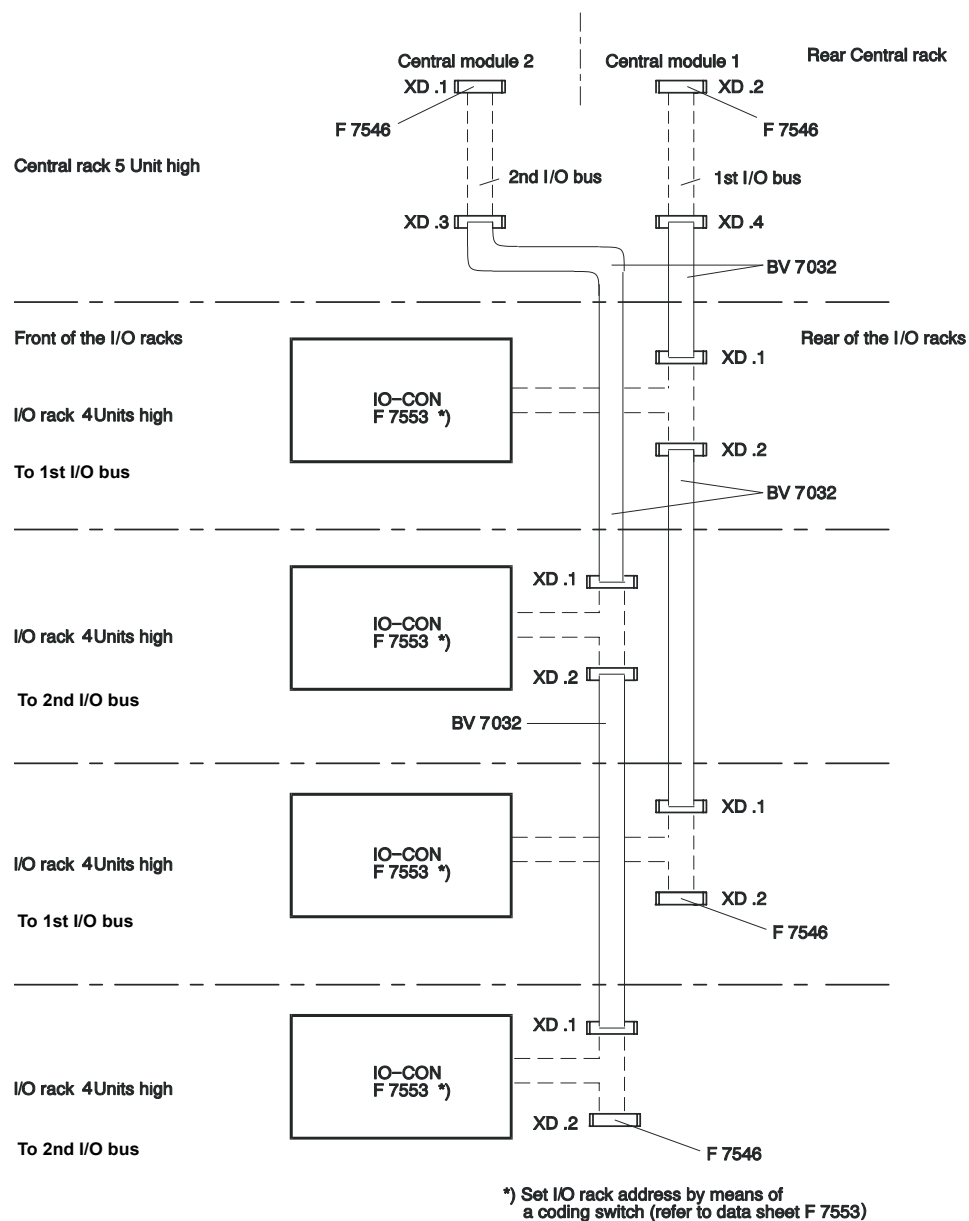


Figure 4: Construction principle of the I/O bus for system H51q-HR

max. length I/O bus:	12 m
max. length cable BV 7032:	5 m
cable BV 7032 between subracks:	max. 0.5 m

4.6 Connections on the rear

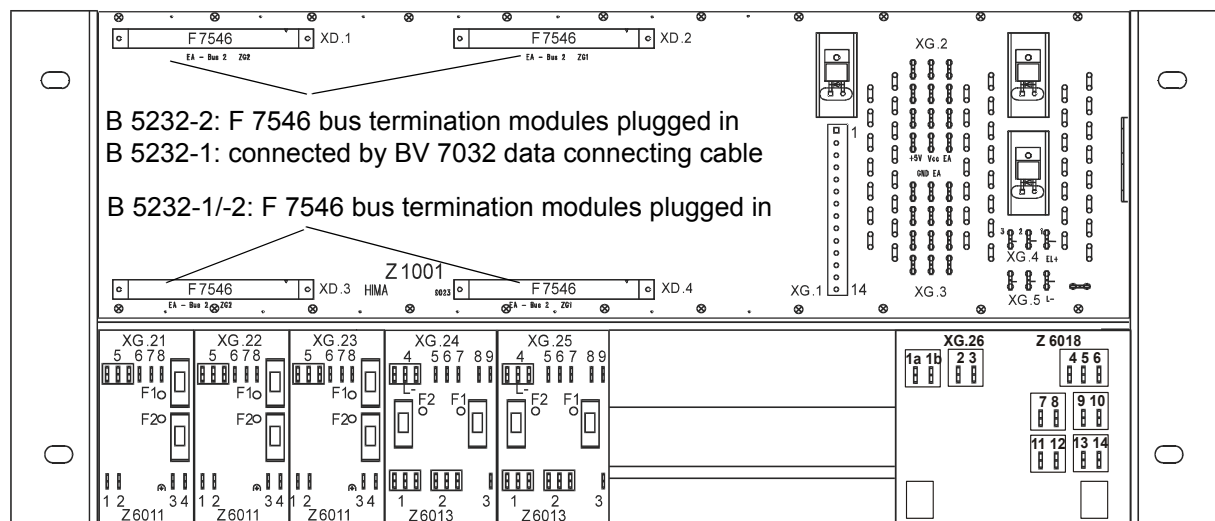


Figure 5: Connections on the rear of the system rack K 1412B

4.6.1 Wiring ex works

XD.1, XD.2	B 5232-2: Bus termination module F 7546 plugged
	B 5232-1: BV 7032 data connecting cable plugged
XD.3, XD.4	B 5232-1/-2: Bus termination module F 7546 plugged
XG.1: 1, 3	Watchdog supply for module Z 6013
XG.1: 5, 7	Watchdog supply for module Z 6013
XG.1: 12 - 13	Connection external buffer battery on module F 7131
XG.1: 14	Ground (GND) for connection external buffer battery
XG.4	L+ for power supply 24V
XG.5	Reference potential: (L-)

Connections of the additional modules (see assembly kit, wiring diagram)

XG.24, XG.25	Z 6013
XG.26	Z 6018

4.6.2 Wiring by customer

XG.1: 2, 4	Watchdog signal for I/O modules
XG.1: 9 - 11	Monitoring power supplies PS1 - PS3 by F7131 for external examination
XG.2	Connection 5 VDC for I/O subrack
XG.3	Ground (GND) for supply 5 VDC
XG.21, XG.22, XG.23	Supply 24 V via module Z 6011
	(see assembly kit, wiring diagram) L+, L-

4.7 Assembly kit, wiring diagram

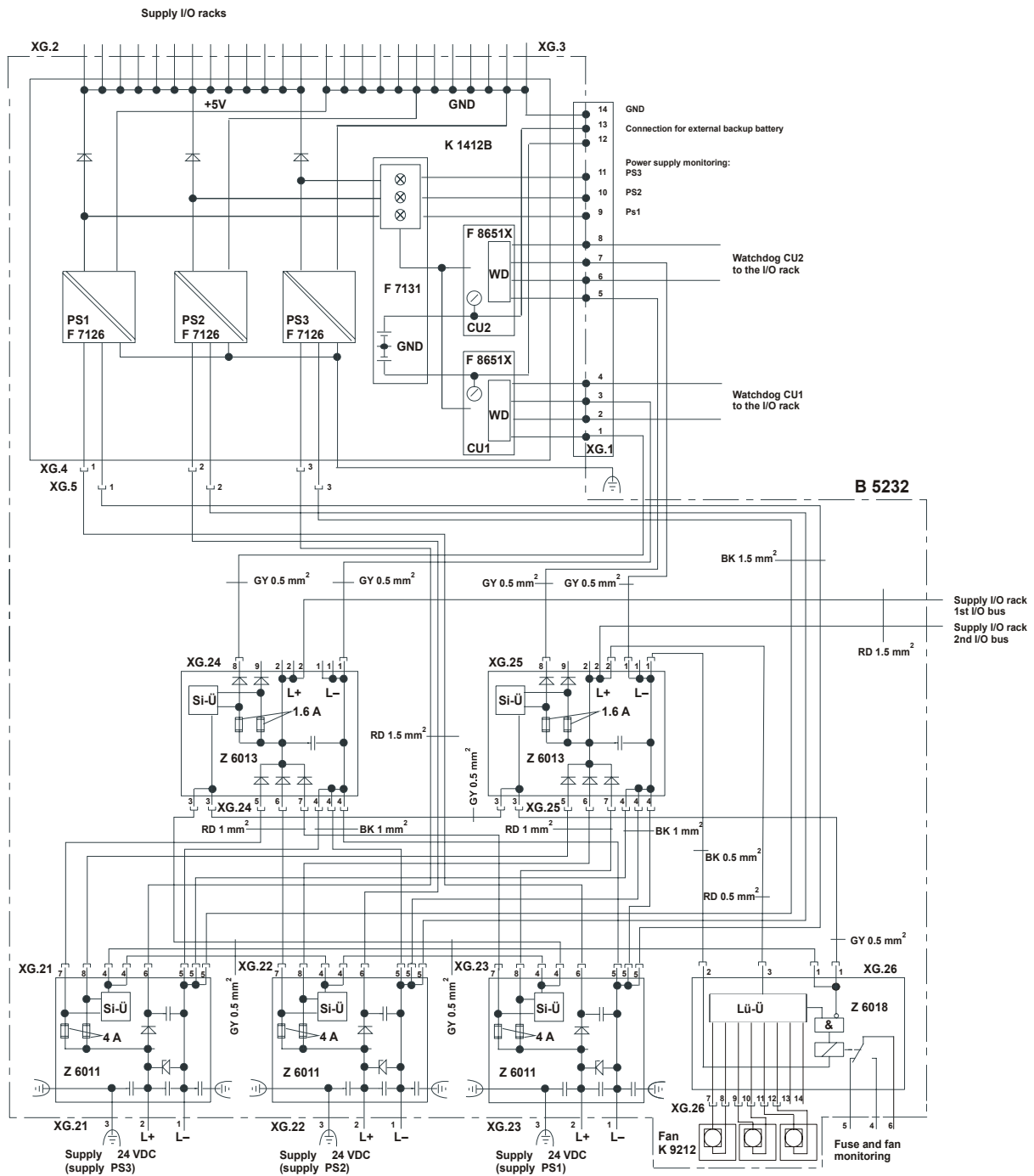


Figure 6: Assembly kit, wiring diagram

Lü-Ü = Fan monitoring
Si-Ü = Fuse monitoring

5 Side view B 5232-1/-2 assembly kit / H51q-H/HR system

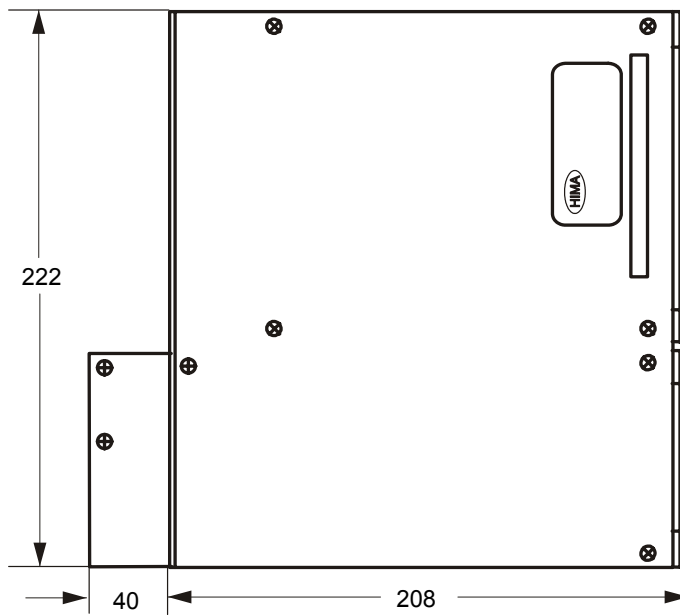


Figure 7: Side view



B 5233-1/-2: Assembly Kit / H51q-HS/HRS: System

System H51q-HS/HRS in K 1412B system subrack, 5 HU, 19 inches with redundant central module, power supply 24/5 V, power supply monitoring module, I/O bus connection, communication modules (optional), coprocessor modules (optional) and three fans

H51q-HS / B 5233-1: single channel bus, redundant central modules

H51q-HRS / B 5233-2: redundant bus, redundant central modules

TÜV certified, applicable up to SIL 3 according to IEC 61508

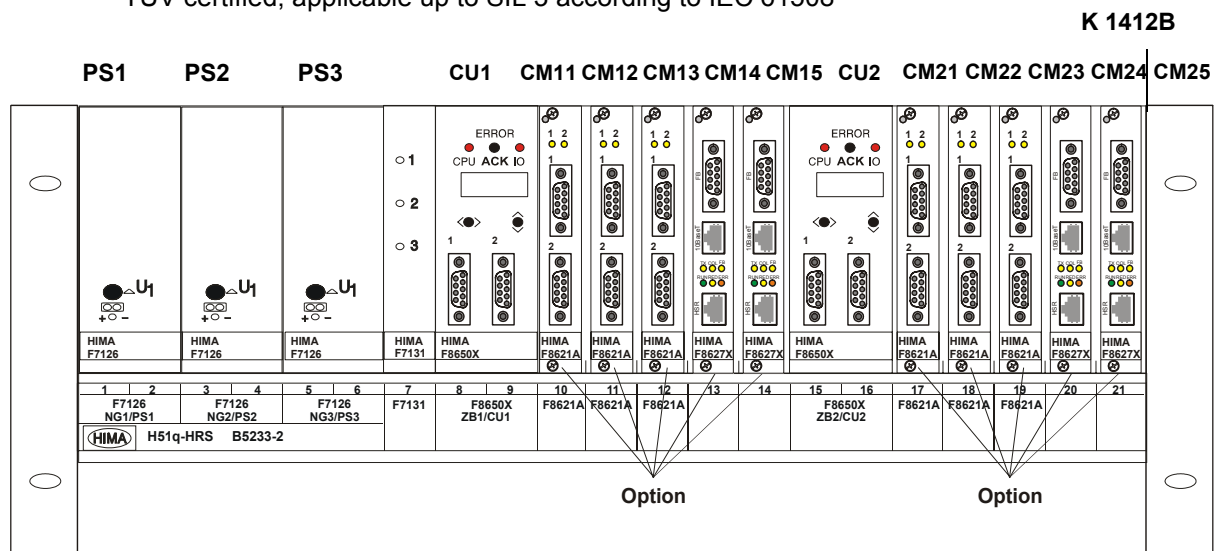


Figure 1: Front view

1 Parts of the B 5233-1/-2 assembly kit / H51q-HS/H51q-HRS system

- 1 x K 1412B central rack, 5 units high, 19 inches, with cable tray with three fan modules K 9212, hinged receptacle for the label and backplane Z 1001.
- additional modules on the rear
 - 3 x Z 6011 decoupling and fusing to feed the power supply modules
 - 1 x Z 6018 fan run monitoring and fuse monitoring
 - 2 x Z 6013 decoupling and fusing of the supply voltage for the WD signal
 - 2 x F 7546 bus termination module (B 5233-1)
 - 4 x F 7546 bus termination module (B 5233-2)
 - 1 x BV 7032 data cable (only B 5233-1)

includes the modules:

- 3 x F 7126 power supply modules 24 V / 5 V, 10 A (PS1, PS2, PS 3)
- 1 x F 7131 power supply monitoring
- 2 x F 8650X central modules (CU1, CU2)

modules for option (separate order)

- 6 x F 8621A coprocessor modules (CM11 - CM13, CM21 - CM23)
- 10 x communication modules (CM11 - CM15, CM21 - CM25)

Assembly kits to be used for the I/O level:

- B 9302 I/O subrack 4 units high, 19 inches
- B 9361 additional power supply, 5 VDC, 5 units high, 19 inches

The max. current must be 18 A (all I/O modules and the modules in the central rack), if 3 x F 7126 are used to keep the system in operation even one power supply module F 7126 has failed.

Values of the current requirement (+5 VDC) refer to the data sheets.

Note**Operating system/resource type in ELOP II**

The assembly kit is usable since operating system BS41q/51q V7.0-8.
Resource type in ELOP II: H51qe-HS/H51qe-HRS.

2 Modules

2.1 Central module F 8650X

The central module for safety related applications with TÜV certificate of the PES H51q-HS/HRS contains the essential functions demonstrated in the block diagram of the central module:

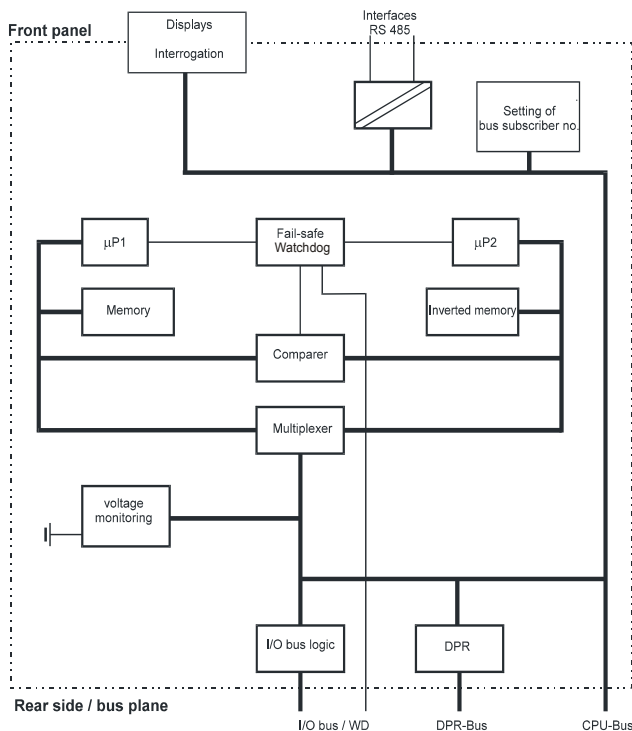


Figure 2: Block diagram of the central module F 8650X

- two clock-synchronized microprocessors
- each microprocessor with an own memory, one processor operates with real data and program and the other one with inverted data and program
- testable hardware comparer for all the external accesses of both microprocessors, in case of a fault the watchdog will be set to the safe status and the status of the processor is announced
- Flash-EPROMs of the program memory for the operating system and the user program usable for min. 100,000 writing cycles
- Data memory in sRAM

- Multiplexer to connect I/O bus, DPR and redundant CU
- Battery backup of the sRAMs via batteries with monitoring
- 2 interfaces RS 485 with galvanic isolation. Transm. rate: max. 57600 bps
- 4digit diagnostic display and 2 LEDs for information out of the system, I/O level and user program
- Dual Port RAM for fast memory access to the second central module
- Hardware clock, battery buffered
- I/O bus logic for the connection to the input/output modules
- Watchdog
- Power supply monitoring, testable (5 V system supply)
- Battery monitoring

2.2 Coprocessor module F 8621A

Right of each central module of the H51q-HS/HRS PES up to three coprocessor modules can be installed. The coprocessor module mainly contains:

- Microprocessor HD 64180 with a clock frequency of 10 MHz
- Operating system EPROM
- RAM for a PLC master project

Note	The RAM for the master project is buffered via the batteries on the power supply monitoring module F 7131.

- Two interfaces RS 485, via communication software function block setting of the baud rate up to 57600 bps
- Dual port RAM (DPR) for the communication with the central module via CPU bus

2.3 Communication modules F 8627/F 8628, F 8627X/F 8628X

Right of each central module of the H51q-HS/HRS PES up to five communication modules can be installed. The communication module mainly contains:

- 32-bit RISC microprocessor
- Operating system
- RAM for further protocols
- F 8627 Ethernet interface (safe**ethernet**, OPC, ...)
- F 8628 Profibus-DP slave interface
- Dual port RAM (DPR) for the communication with the central module via CPU bus

Special applications with the communication module F 8627X:

- connection of the central module to a PADT (ELOP II TCP)
- connection to other communication partners within an Ethernet network (Modbus TCP)

Special application with the communication module F 8628X:

- ELOP II TCP connection (PADT) via the Ethernet interface of the F 8628X to the H41q/H51q controller

3 Startup and maintenance

A battery change of the buffer batteries on the power supply monitoring module and the central module (CPU in operation) is recommended every 6 years.

Buffer battery with soldering lug: HIMA part no. 44 0000016.

Buffer battery without soldering lug: HIMA part no. 44 0000019.

Further informations see also catalog H41q/H51q, chapter 9, "Startup and maintenance".

4 Wiring of the assembly kit

The assembly kit is already wired for operation. Wirings have still to be done by the user (optional modules, see "Assembly kit, diagram wiring").



With installation of the assembly kit a conductive connection to the frame or a separate earth connection has to be installed according to the EMC requirements.

Connection PE earth: Faston 6.3 x 0.8 mm.

Pay attention for the manufacturers information concerning detaching and replugging of the Faston connectors!

4.1 Current distribution within the assembly kit

4.1.1 HIMA devices for current distribution

It is recommended to use the HIMA supplies and current distributions:

- K 7212** redundant feeding up to 35 A total current, with 2 decoupling diodes and 2 network filters, with fusing of up to 12 single circuits with circuit breakers or
- K 7213** redundant feeding up to 35 A total current, with fusing of up to 12 single circuits with circuit breakers or
- K 7214** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers or
- K 7215** redundant feeding up to 150 A total current, with fusing of up to 18 single circuits with circuit breakers, graphical display.

4.1.2 Supply 24 VDC

The 24 VDC power supply can be feeded three times to the system H51q-HS/HRS (starlike wiring). See also catalog H41q/H51q, chapter 4.3, The Input/Output Level, 24 VDC Supply and Distribution.

Connection	Wire and connection	Fusing	Use
XG.21/22/23:2 (L+)	RD 2.5 mm ² , Faston 6.3 x 0.8	max. 16 A gL	PS1...PS3
XG.21/22/23:1 (L-)	BK 2.5 mm ² , Faston 6.3 x 0.8		Reference pole L-
RD = Color code red BK = Color code black			

Table 1: Supply 24 VDC

4.1.3 Output 24 VDC

Connection	Wire and connection	Use
XG.24:2 (L+)	RD 1.5 mm ² , Faston 6.3 x 0.8	Supply fuse monitoring and IO-CON in the I/O rack
XG.25:2 (L+)	RD 1.5 mm ² , Faston 6.3 x 0.8	Supply fuse monitoring and IO-CON in the I/O rack for 2nd I/O bus (only B 5233-2)
RD = Color code red		

Table 2: Output 24 VDC

4.1.4 Supply 5 VDC

The 5 VDC power supply does not have to be wired extra as it is already part of the installation. To supply the I/O racks the 5 V power supply with corresponding GND is available at the rear side of the central rack.

The 5 VDC power and GND are connected starlike with each 2 wires to the potential distributor.

The 5 VDC power needed for the microprocessor system and as control current for the I/O modules is generated from the 24 VDC power of the system via (24 VDC / 5 VDC) power supply modules type F 7126. One central rack can be equipped with a maximum of 3 power supply modules. The power supply modules are switched in parallel. One or two power supply modules are usually able to supply the PES. A further power supply module is used to increase availability.

Note	At planning the load of the power supply units have to be calculated.

The 5 VDC output voltage of the power supply module (for the CPU, I/O and the interfaces) are monitored by the power supply monitoring module F 7131 checking undervoltage, overvoltage or failure.

In case of a faulty power supply module the operating system of the CPU informs the user program via a system variable.

In case of a 5 VDC system power failure a lithium battery on the central module buffers the hardware clock and sRAM on the central module.

The sRAM memory of the coprocessor module is buffered via two lithium batteries on the power supply monitoring module F 7131.

4.1.5 Output 5 VDC

Connection	Wire and connection	Use
XG.2: +5 V	YE 2 x 2.5 mm ² , Faston 6.3 x 0.8	Supply I/O subrack (B 9302)
XG.3: GND	GN 2 x 2.5 mm ² , Faston 6.3 x 0.8	Supply I/O subrack (B 9302)
GN = Color code green YE = Color code yellow		

Table 3: Output 5 VDC

4.2 Wiring Watchdog

4.2.1 Output WD

Connection	Wire and connection	Use
XG.1:2 (4) and XG.1:6 (8)	GY 0.5 mm ² , wire end ferrule	WD to I/O subrack (B 5233-1)
XG.1:2(4) XG.1:6(8)	GY 0.5 mm ² , wire end ferrule GY 0.5 mm ² , wire end ferrule	WD to 1st I/O bus (B 5233-2) WD to 2nd I/O bus (B 5233-2) (see "Wiring WD, assembly kit wiring")
GY = Color code gray		

Table 4: Output WD

4.2.2 Wiring watchdog signal (only H51q-HS / B 5233-1)

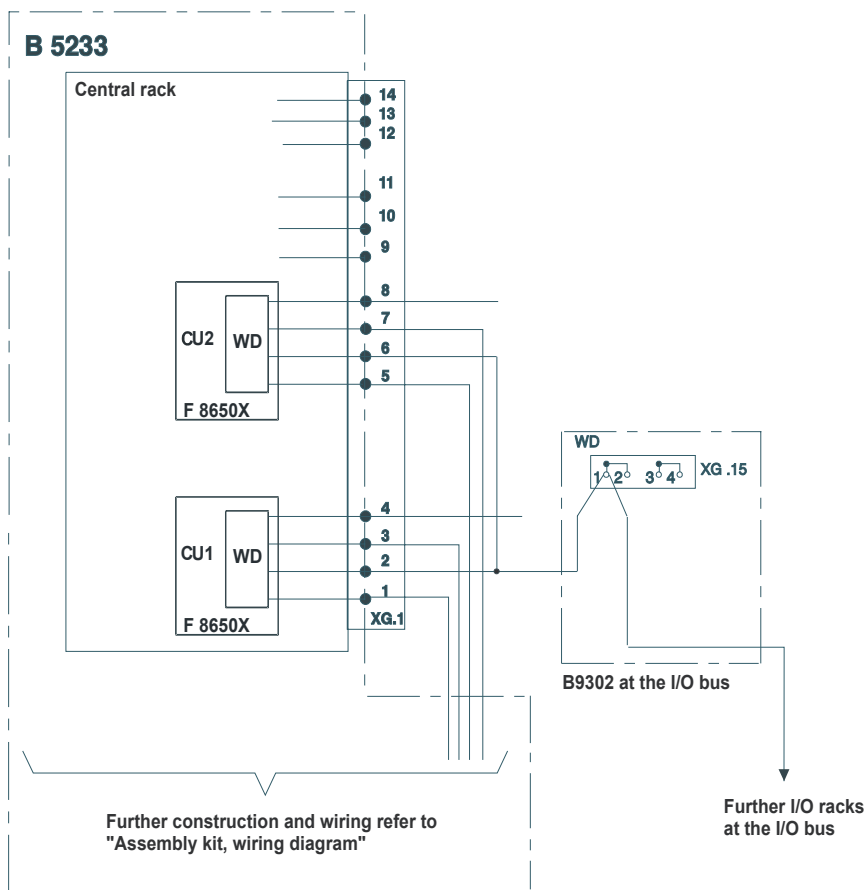


Figure 3: Wiring watchdog signal

4.3 Connection of the monitoring loop (for fuses and fans)

Connection	Wire and connection	Fusing	Use
XG.26:4/5/6	GY 0.5 mm ² , Faston 2.8 x 0.8	max. 4 A slow blow	Floating NO/NC contact for signaling
GY = Color code gray			

Table 5: Connection of the monitoring loop

4.4 Internal fuses

Position	Size	Dimension	HIMA part no.
Z 6011	4 A slow blow	5 x 20 mm	57 0174409
Z 6013	1.6 A slow blow	5 x 20 mm	57 0174169

Table 6: Internal fuses

4.5 I/O bus

The data connection of the I/O level with the central module is established via the I/O bus.

4.5.1 System H51q-HS

The data cable BV 7032 connects the I/O buses of central module 1 (XD.2) to central module 2 (XD.1).

I/O bus, H51q-HS / B 5233-1

Connection	Procedure
XD.1 to XD.2	Connect with cable BV 7032
XD.4	Remove bus termination module F 7546 and plug it on XD.2 of the last I/O rack, then connect cable BV 7032 from XD.1 of the 1st I/O rack to empty terminal XD.4

Table 7: I/O bus, H51q-HS / B 5233-1

4.5.2 System H51q-HRS

The system H 51q-HRS has a redundant I/O bus. Each of the central modules has its own I/O bus and therefore only the correlated I/O subracks. The 1st I/O bus is assigned to central module 1 and the 2nd I/O bus is assigned to central module 2.

I/O bus, H51q-HRS/ B 5233-2

Connection	Procedure
XD.3 and XD.4	Remove bus termination module F 7546 and plug it on XD.2 of the last I/O rack of both I/O buses
XD.4	Plug in cable BV 7032 of the 1st I/O rack to the 1st I/O bus
XD.3	Plug in cable BV 7032 of the 2nd I/O rack to the 2nd I/O bus

Table 8: I/O bus, H51q-HRS / B 5233-2

4.5.3 Systems H51q-HS/HRS

For the I/O rack the connection to the I/O bus is made via a coupling module F 7553 installed in slot 17. The connection of the bus between the individual subracks is established at the rear side via the BV 7032 data cable.

To terminate the I/O bus, an F 7546 module is plugged in at the beginning on central subrack and at the end (last I/O rack).

4.5.4 Construction principle of the I/O bus of the system H51q-HS

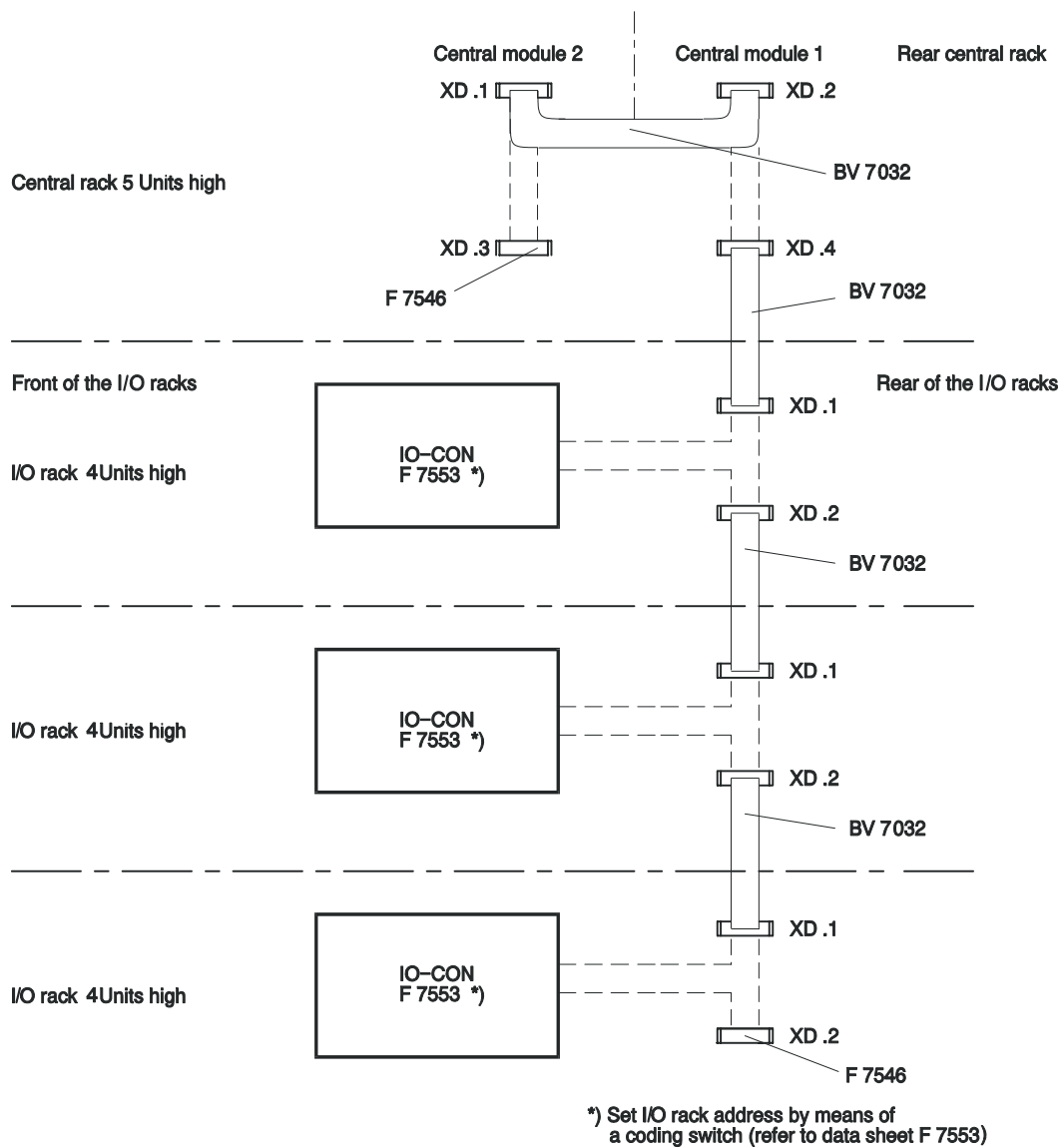


Figure 4: Construction principle of the I/O bus for system H51q-HS

max. length I/O bus:	12 m
max. length cable BV 7032:	5 m
cable BV 7032 between subracks:	max. 0.5 m

4.5.5 Construction principle of the I/O bus of the system H51q-HRS

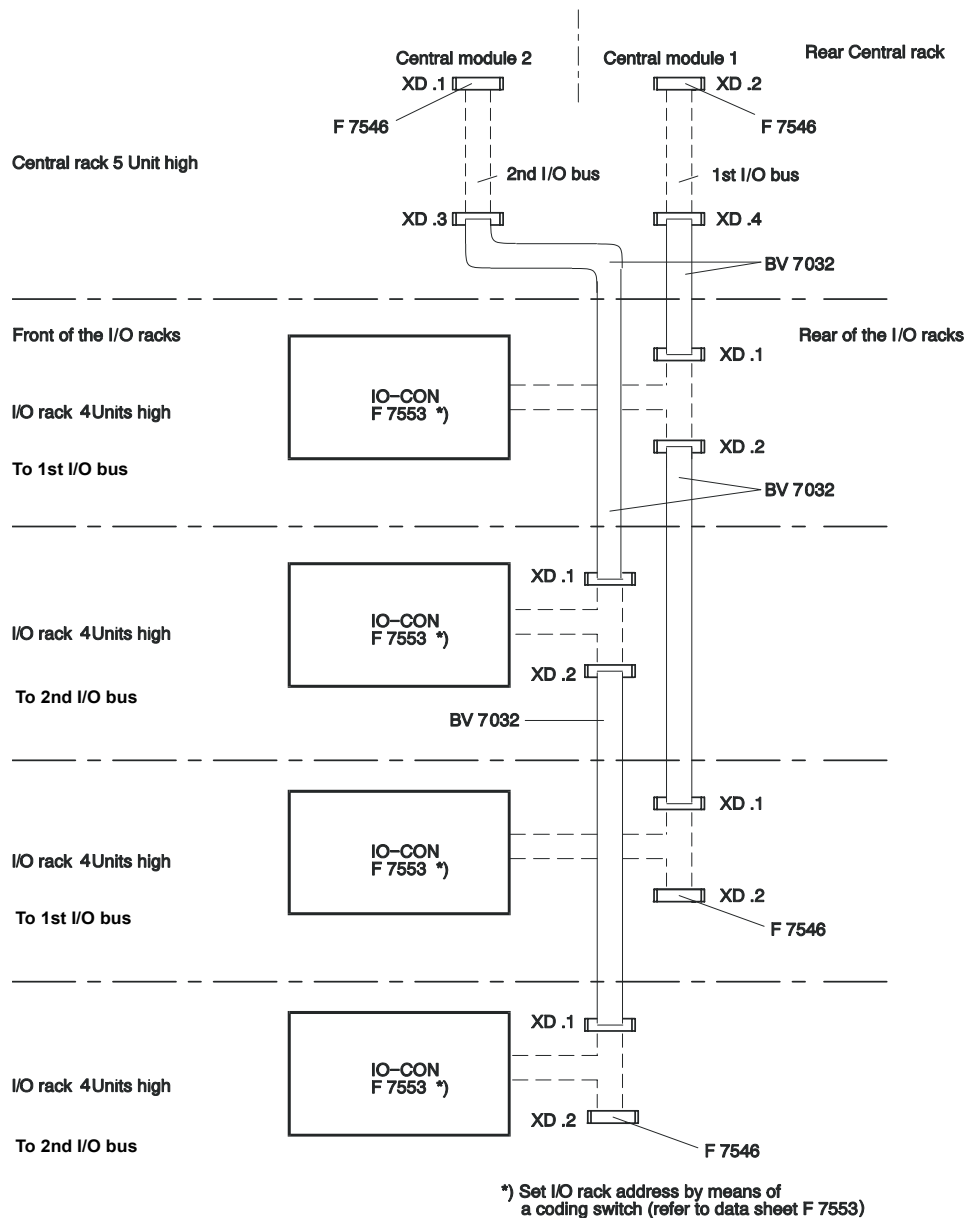


Figure 5: Construction principle of the I/O bus for system H51q-HRS

max. length I/O bus:	12 m
max. length cable BV 7032:	5 m
cable BV 7032 between subracks:	max. 0.5 m

4.6 Connections on the rear

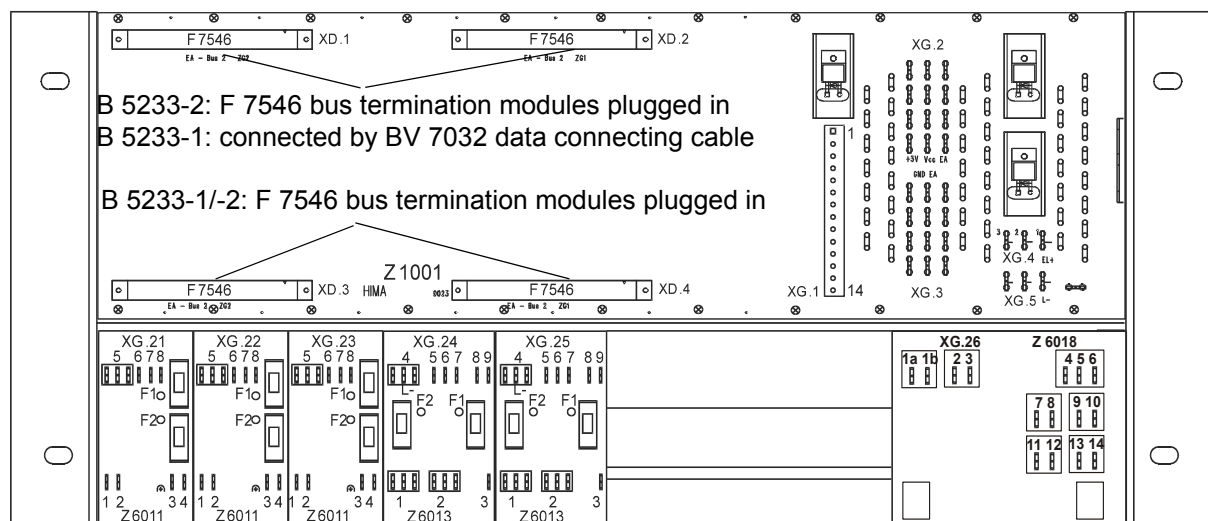


Figure 8: Connections on the rear of the system rack K 1412B

4.6.1 Wiring ex works

XD.1, XD.2	B 5233-2: Bus termination module F 7546 plugged B 5233-1: BV 7032 data connecting cable plugged
XD.3, XD.4	B 5233-1/-2: Bus termination module F 7546 plugged
XG.1: 1, 3	Watchdog supply for module Z 6013
XG.1: 5, 7	Watchdog supply for module Z 6013
XG.1: 12 - 13	Connection external buffer battery on module F 7131
XG.1: 14	Ground (GND) for connection external buffer battery
XG.4	L+ for power supply 24V
XG.5	Reference potential: (L-)

Connections of the additional modules (see assembly kit, wiring diagram)

XG.24, XG.25	Z 6013
XG.26	Z 6018

4.6.2 Wiring by customer

XG.1: 2, 4	Watchdog signal CU1 for I/O modules 1st I/O bus
XG.1: 6, 8	Watchdog signal CU2 for I/O modules 2nd I/O bus
XG.1: 9 - 11	Monitoring power supplies PS1 - PS3 by F 7131 for external examination
XG.2	Connection 5 VDC for I/O subrack
XG.3	Ground (GND) for supply 5 VDC
XG.21, XG.22, XG.23	Supply 24 V via module Z 6011 (see assembly kit, wiring diagram) L+, L-

5 Side view B 5233-1/-2 assembly kit / H51q-HS/HRS system

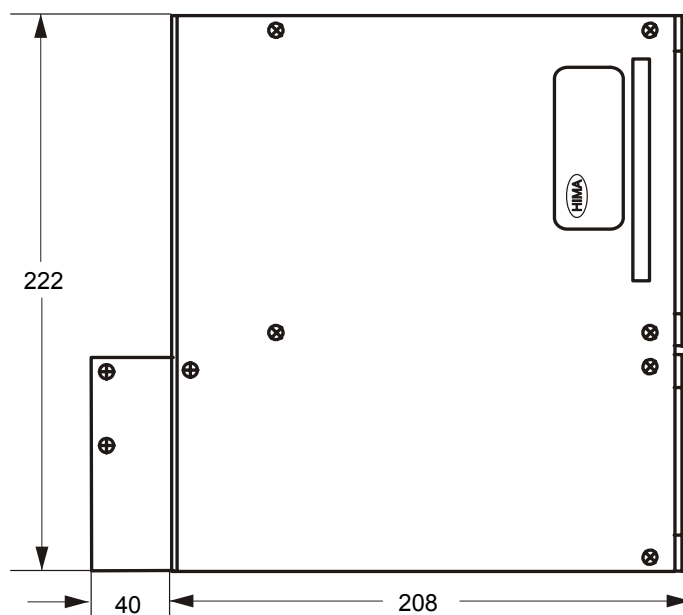


Figure 10: Side view



B 9302: Assembly kit

I/O subrack, 4 units high

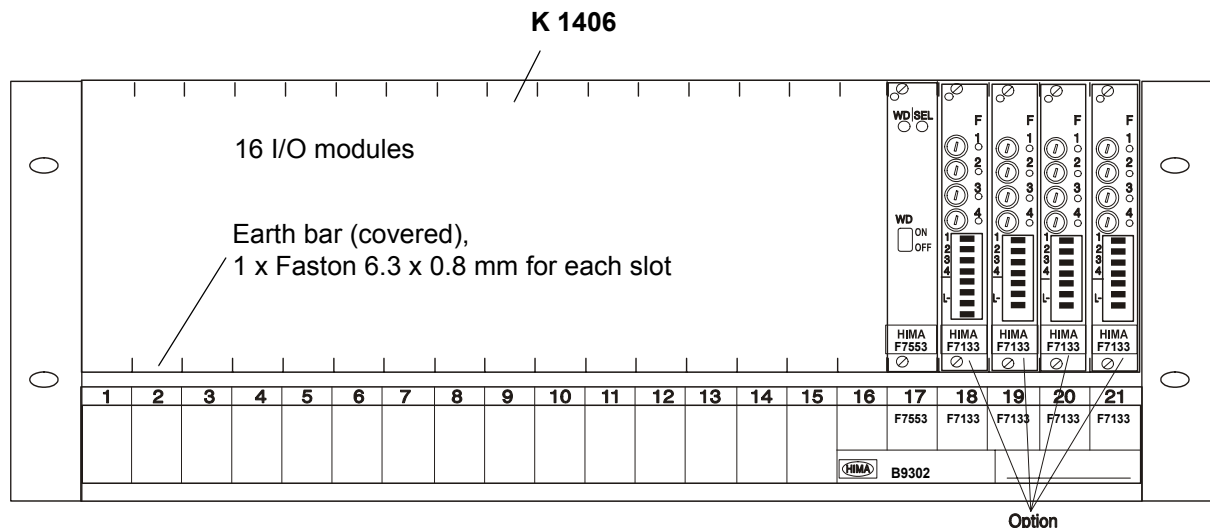


Figure 1: Side view

1 Parts of the B 9302 assembly kit

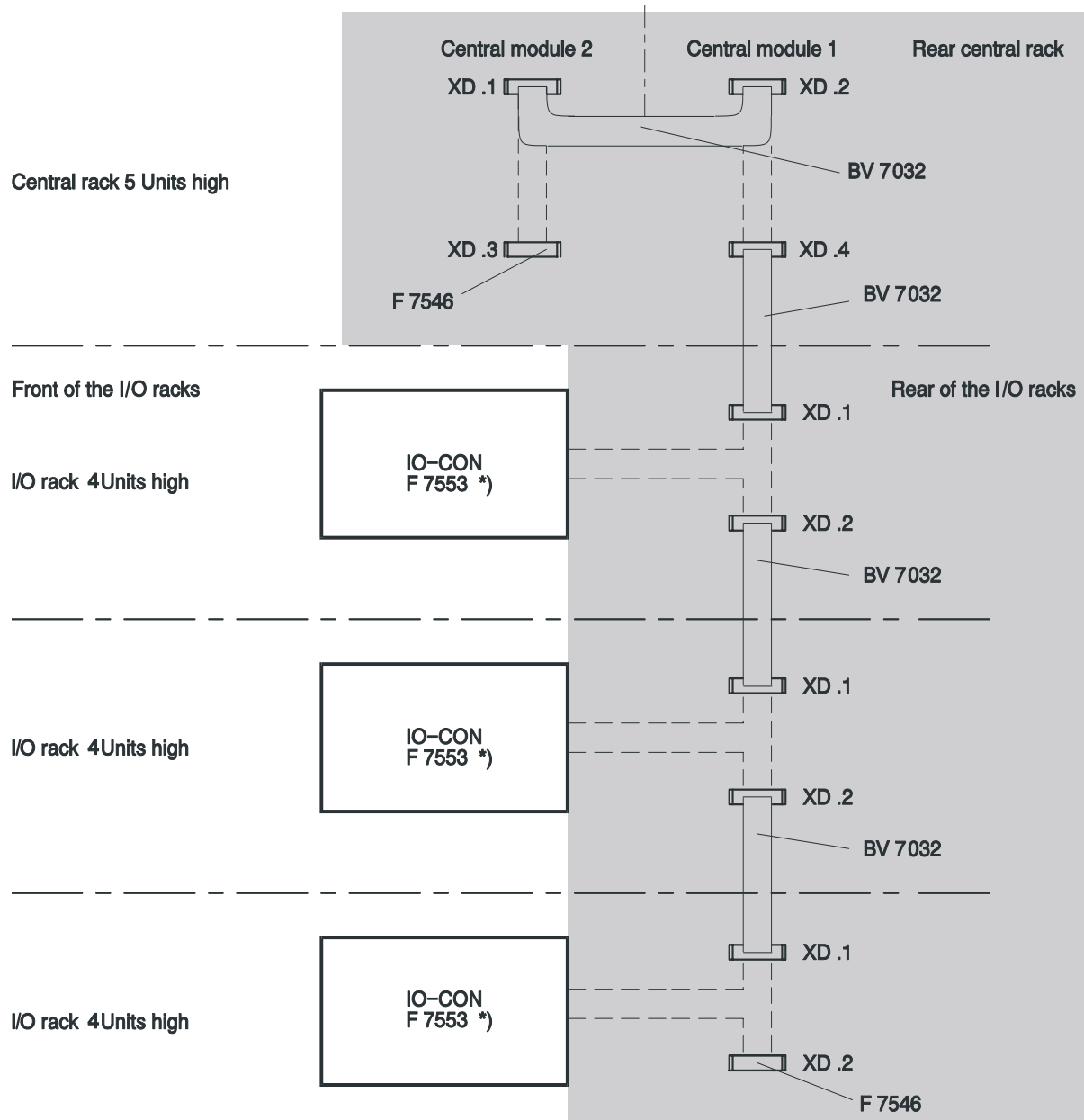
- 1 x K 1406 I/O subrack, 4 units high, 19 inch, with integrated cable tray, with a hinged receptacle for the label
- 1 x F 7553 coupling module (in slot 17)
- 1 x BV 7032 flat cable, length is depending on the order. The standards are B 9302 with 0.5 m cable. Assembly kit B 9302 with choosable cable length on demand. Total bus length is maximum 12 m.

The slots 1 through 16 of the rack K 1406 are reserved for I/O modules.

Modules for option (separate order):

- 1...4 x F 7133 4-channel power distribution with fuses (slots 18...21) to fuse and distribute L+ (EL+) and L-.

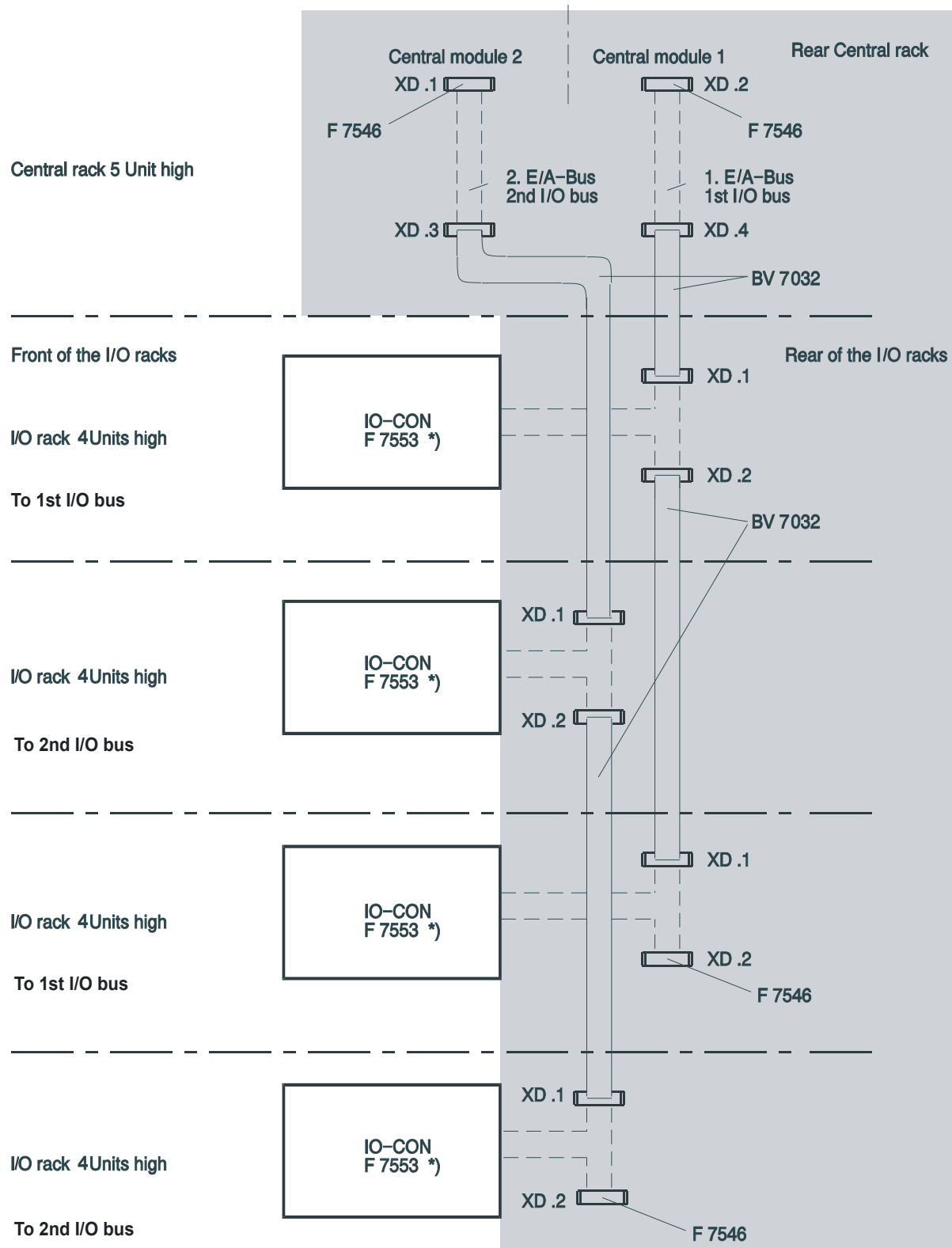
The fuse monitoring on the current distribution modules are internally switched in series. A corresponding fault signal is served via a neutral contact. The fault contact of a not installed current distribution module is bypassed by a jumper.



*) Set I/O rack address by means of a coding switch (refer to data sheet F 7553)

Figure 2: Wiring of the single channel I/O bus

max. length I/O bus:	12 m
max. length cable BV 7032:	5 m



*) Set I/O rack address by means of a coding switch (refer to data sheet F 7553)

Figure 3: Wiring of the redundant I/O bus

max. length of I/O bus:
max. length cable BV 7032:

12 m
5 m

2 Wiring of the assembly kit connections

Wirings to be done by the user:

2.1 Supply 24 VDC

Connection	Wire and connection	Fusing	Use
XG.7 (L+)	RD 2.5 mm ² , Faston 6.3 x 0.8	max. 16 A gL	F 7133, slot 21
XG.8 (L+)	RD 2.5 mm ² , Faston 6.3 x 0.8	max. 16 A gL	F 7133, slot 20
XG.9 (L+)	RD 2.5 mm ² , Faston 6.3 x 0.8	max. 16 A gL	F 7133, slot 19
XG.10 (L+)	RD 2.5 mm ² , Faston 6.3 x 0.8	max. 16 A gL	F 7133, slot 18
RD = Color code red			

Table 1: Supply 24 VDC

2.2 Output 24 VDC

Connection	Wire and connection	Use
XG.3 (L+)	RD 1.5 mm ² , Faston 6.3 x 0.8	from central rack and to further I/O racks
XG.11 (L-)	BK 2 x 2.5 mm ² , Faston 6.3 x 0.8 (see note)	Reference pole L-
RD = Color code red BK = Color code black		

Table 2: Output 24 VDC

Note

To be wired to the central L- bus bar with at least 2 x 2.5 mm² BK. If output modules with 2-pole connection to the actuators are used depending on the load up to 4 x 2.5 mm² BK wiring is necessary.

2.3 Output 5 VDC

Connection	Wire and connection	Use
XG.4: +5 V	YE 2 x 2.5 mm ² , Faston 6.3 x 0.8	from central rack
XG.12: GND	GN 2 x 2.5 mm ² , Faston 6.3 x 0.8	from central rack
GN = Color code green YE = Color code yellow		

Table 3: Output 5 VDC

2.4 Connection WD

Connection	Wire and connection	Use
XG.15:1	GY 0.5 mm ² , wire end ferrule	from central rack and to further I/O racks
GY = Color code gray		

Table 4: Connection WD

2.5 I/O Bus

Connection	Procedure
XD.1	Plug in BV 7032 and connect it with the I/O subrack before
XD.2	Plug in BV 7032 of the following I/O subrack on the according I/O bus or plug in bus termination module F 7546 (at the last I/O subrack)

Table 5: I/O Bus



With installation of the assembly kit a conductive connection to the frame or a separate earth connection has to be installed according to the EMC requirements.

Connection PE earth: Faston 6.3 x 0.8 mm.

Pay attention for the manufacturers information concerning detaching and replugging of the Faston connectors!

Refer also to: Supply, feeding and distribution of the 24 V system voltage, see assembly kit, wiring diagram.

2.6 Connections on the rear

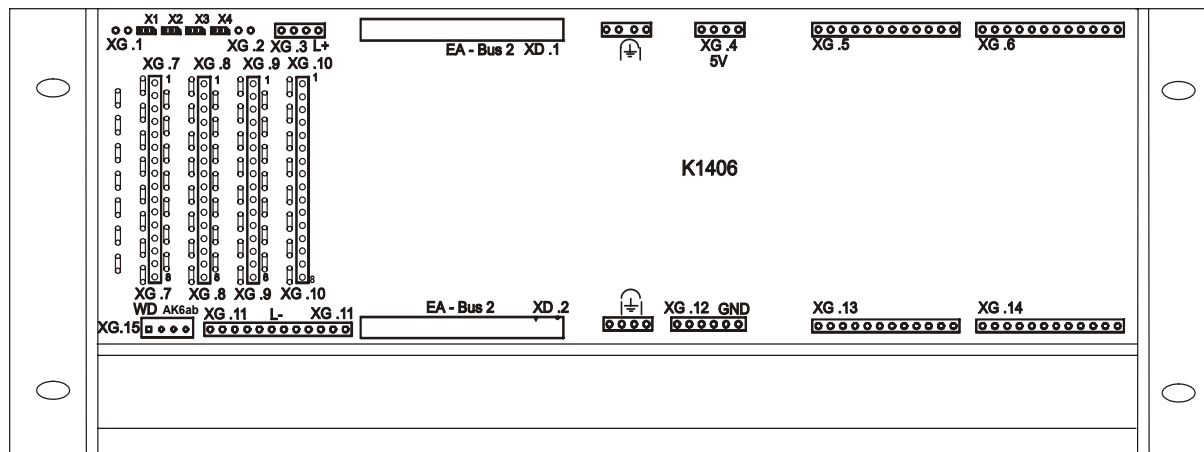


Figure 4: Connections on the rear of the I/O subrack K 1406

Connections on the rear of the I/O subrack K 1406 (refer also to: Supply, feeding and distribution of the 24 V system voltage, wiring diagram).

2.6.1 Wiring by customer

XG .1, XG .2	Fuse monitoring (neutral contacts on current distribution module F 7133, not equipped F 7133 slot can be overridden by the jumpers X1...X4)
XG .3	Supply EL+ for F 7133 and F 7553 Reference pole: XG .11 (L-)
XG .4	+ 5 V Reference pole: XG .12 (GND)
XG .5	Potential distributor, free disposal
XG .6	Potential distributor, free disposal
XG .13	Potential distributor, free disposal
XG .14	Potential distributor, free disposal
XG .7	L+ to F 7133, slot 21
XG .8	L+ to F 7133, slot 20
XG .9	L+ to F 7133, slot 19
XG .10	L+ to F 7133, slot 18
XG .11	Reference potential L-
XG.12	Reference pole GND
XG .15 (1+2)	WD (Watchdog signal)
XG .15 (3+4)	not used
XD .1, XD .2	I/O bus connection



PE (earth)



Figure 5: Assembly kit, wiring diagram

3 Side view B 9302 assembly kit

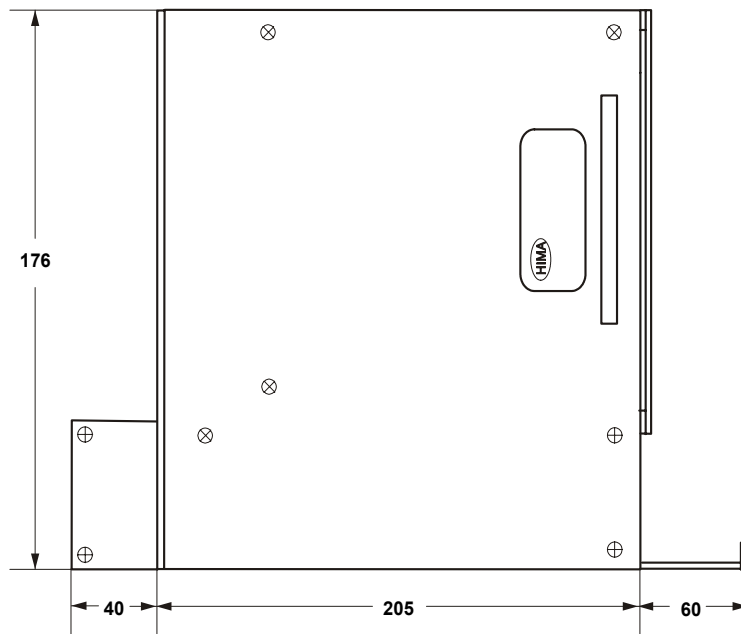


Figure 6: Side view



B 9361: Assembly kit

Additional power supply 5 V for Systems H51q

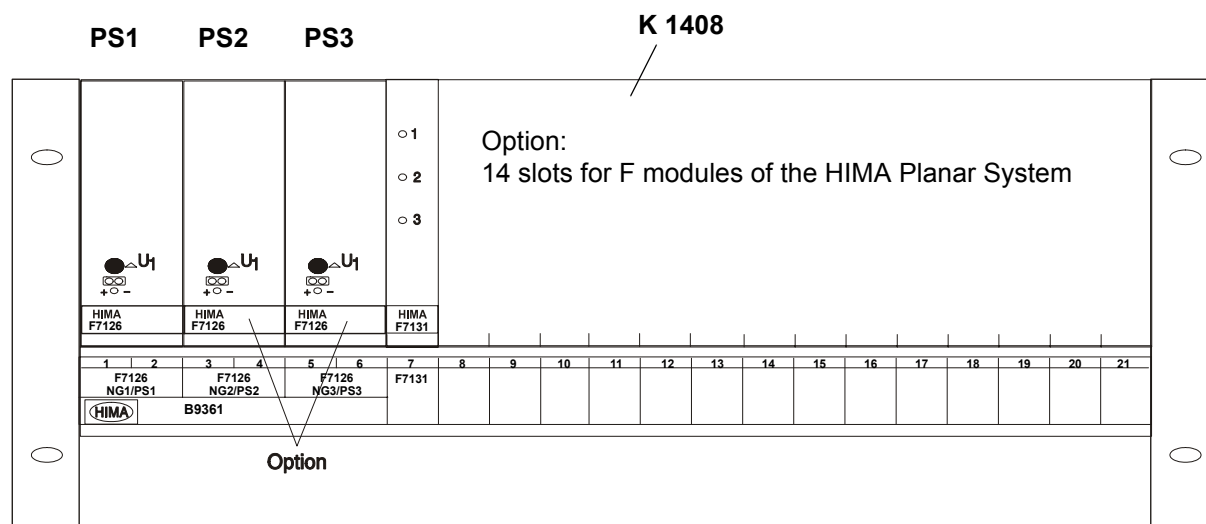


Figure 1: Front view

1 Parts of the B 9361 assembly kit

- 1 x K 1408 central rack, 5 units high, 19 inches, with integrated cable tray.
- additional modules on the rear
 - 3 x Z 6011 decoupling and fusing to feed the power supply modules
 - 1 x Z 6012 fan with fan run monitoring and fuse monitoring
 - 2 x Z 6013 decoupling and fusing of the supply voltage for Z 6012

include the modules:

- 1 x F 7126 power supply module 24 V / 5 V, 10 A (PS1)
- 1 x F 7131 power supply monitoring module
- 14 socket connectors to install standard (F type) modules of the HIMA Planar System

Modules for option (separate order):

- 2 x F 7126 power supply module 24 V/5 V (PS2, PS3)
The 5 V outputs of the power supply modules are switched in parallel.
- 1...14 x Standard (F type) modules of the HIMA Planar System

The additional power supply (loadable up to 18 A) will be used if the power supply modules built-in in the central rack are not sufficient to supply the 5 V circuits (i.e. $I > 18$ A for 3 power supply modules F 7126 in a redundant control). For the accurate current consumption for each module refer to the appertaining data sheets.

The 5 V circuits of the power supply modules in the central rack and in the additional power supply should not be switched in parallel but the GND of both power supplies has to be connected together. Availability is present because 2 of 3 power supply modules are able to guarantee the 5 V supply.

2 Wiring of the assembly kit

Wirings to be done by the user (refer to "Assembly kit, wiring diagram"):

2.1 Supply 24 VDC

Connection	Wire and connection	Fusing	Use
XG.21/22/23:2 (L+)	RD 2.5 mm ² , Faston 6.3 x 0.8	max. 16 A gL	PS1...PS3
XG.21/22/23:1 (L-)	BK 2.5 mm ² , Faston 6.3 x 0.8		Reference pole
RD = Color code red BK = Color code black			

Table 1: Supply 24 VDC

2.2 Output 5 VDC

Connection	Wire and connection	Use
XG.2: +5 V	YE 2 x 2.5 mm ² , Faston 6.3 x 0.8**	Supply I/O subrack (B 9302)
XG.3: GND	GN 2 x 2.5 mm ² , Faston 6.3 x 0.8**	Supply I/O subrack (B 9302), to be connected with the GND of the central rack
GN = Color code green YE = Color code yellow		

Table 2: Output 5 VDC

** for distances > 2 m: wire cross section 6 mm²

2.3 Output 24 VDC

Connection	Wire and connection	Use
XG.24:2 (L+)	RD 1.5 mm ² , Faston 6.3 x 0.8	Supply fuse monitoring and IO-CON in the I/O subrack
XG.25:2 (L+)	RD 1.5 mm ² , Faston 6.3 x 0.8	Supply fuse monitoring and IO-CON in I/O subrack for 2nd I/O bus (B 5222-2, B 5223-2, B 5232-2 and B 5233-2 only)
RD = Color code red		

Table 3: Output 24 VDC

2.4 Connection of the monitoring loop (for fuses and fans)

Connection	Wire and connection	Fusing	Use
XG.26:4/5/6	GY 0.5 mm ² , Faston 2.8 x 0.8	max. 4 A slow blow	Floating NO/NC contact for sig- naling
GY = Color code gray			

Table 4: Connection of the monitoring loop (for fuses and fans)

2.5 Internal fuses

Position	Size	Dimension	HIMA part no.
Z 6011	4 A slow blow	5 x 20 mm	57 0174409
Z 6013	1.6 A slow blow	5 x 20 mm	57 0174169

Table 5: Internal fuses

2.6 Earthing



With installation of the assembly kit a conductive connection to the frame or a separate earth connection has to be installed according to the EMC requirements.

Connection PE earth: Faston 6.3 x 0.8 mm.

Pay attention for the manufacturers information concerning detaching and replugging of the Faston connectors!

2.7 Connections on the rear

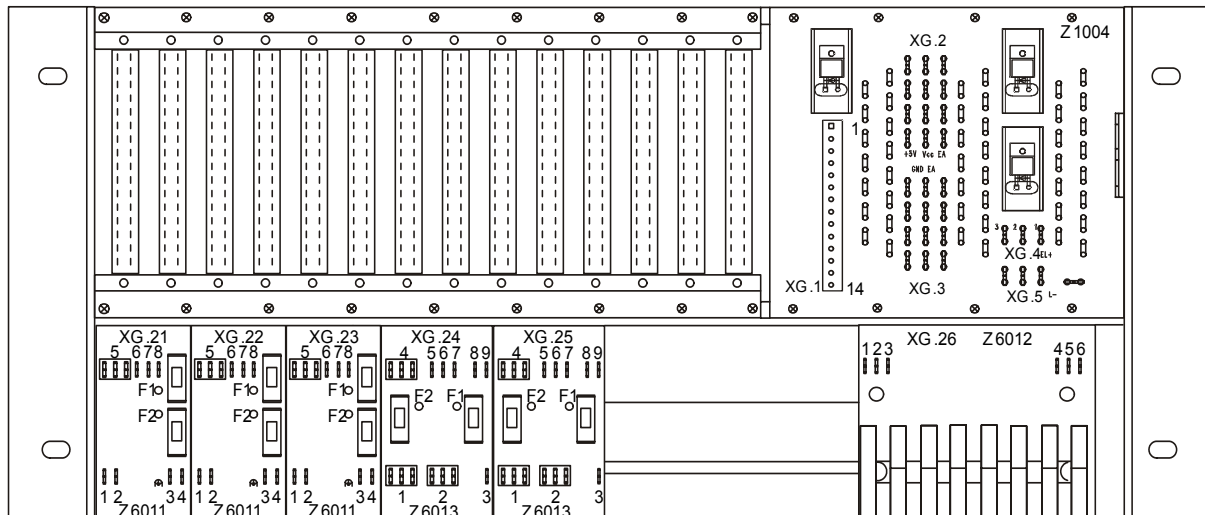


Figure 2: Connections on the rear of the additional power supply subrack K 1408

Connections on the rear of the additional power supply subrack K 1408 (see also assembly kit, wiring diagram):

2.7.1 Wiring ex works

XG .4	Feeding L+ (24 V) for power supply module F 7126
XG .5	Feeding L- (24 V) for power supply module F 7126
XG. 26	Connections for Z 6012: fan with fan run monitoring and fuse monitoring
XG .26: 2, 3	Power supply for fans
XG .26: 1	Wire for fuse monitoring
XG .26: 4, 5 ,6	Floating NO/NC contact for signaling of fuse and fan monitoring

2.7.2 Wiring by customer

XG .1:9-11	Connections for monitoring of the power supplies by power supply monitoring module F 7131
XG .2	Output + 5 V (supply of I/O subrack B 9302)
XG .3	Output GND (supply of I/O subrack B 9302, connection to GND of central subrack)
XG .21, XG .22, XG .23	Connections for Z 6011 (decoupling and fusing to feed the power supply modules)
XG .24, XG .25	Connections for Z 6013: decoupling and fusing of the supply voltage for Z 6012 and feeding of the coupling module F 7553 in I/O subrack
	XG .24: 1st I/O bus
	XG .25: 2nd I/O bus

2.8 Assembly kit, wiring diagram

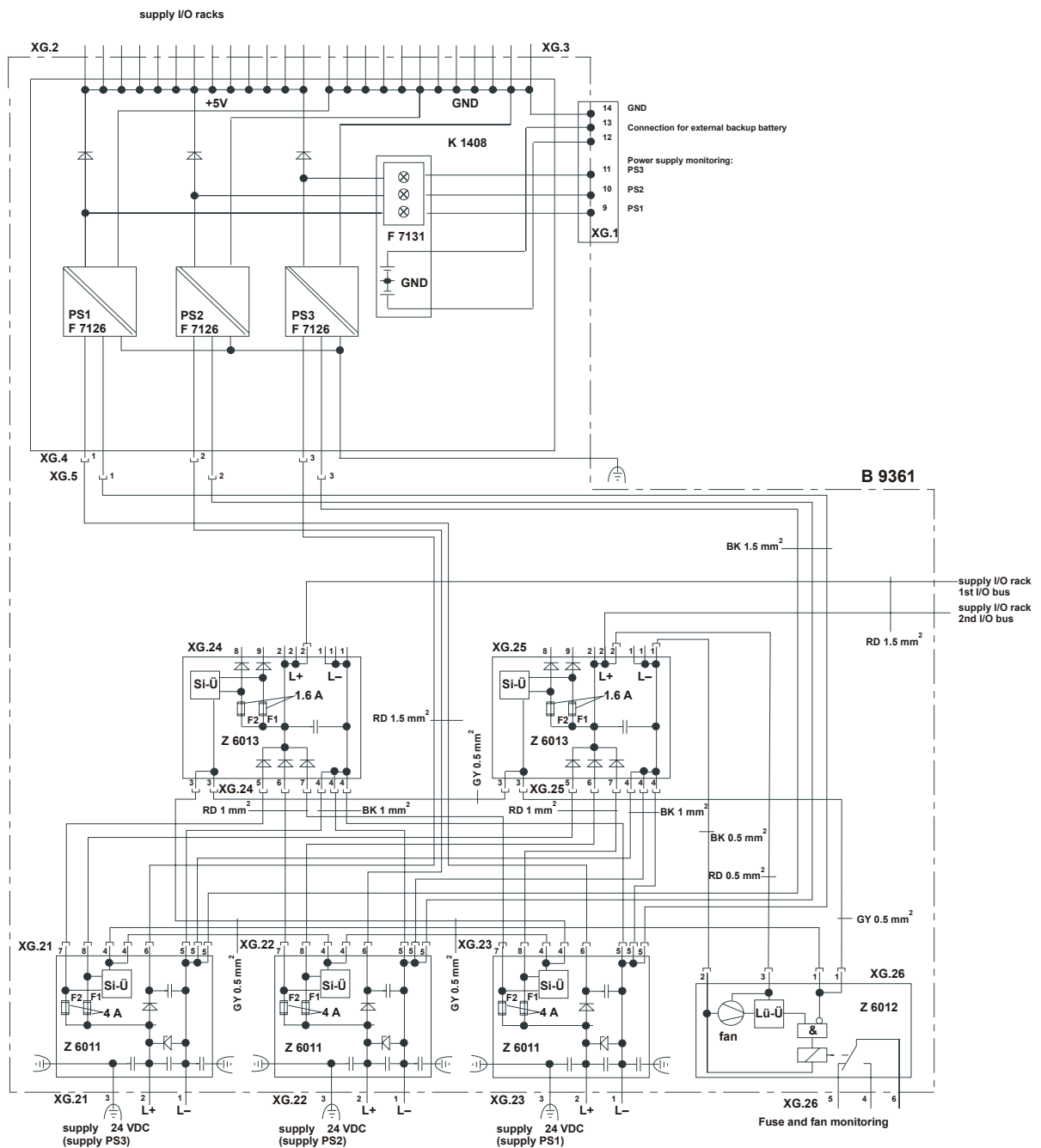


Figure 3: Assembly kit, wiring diagram

3 Side view B 9361 assembly kit

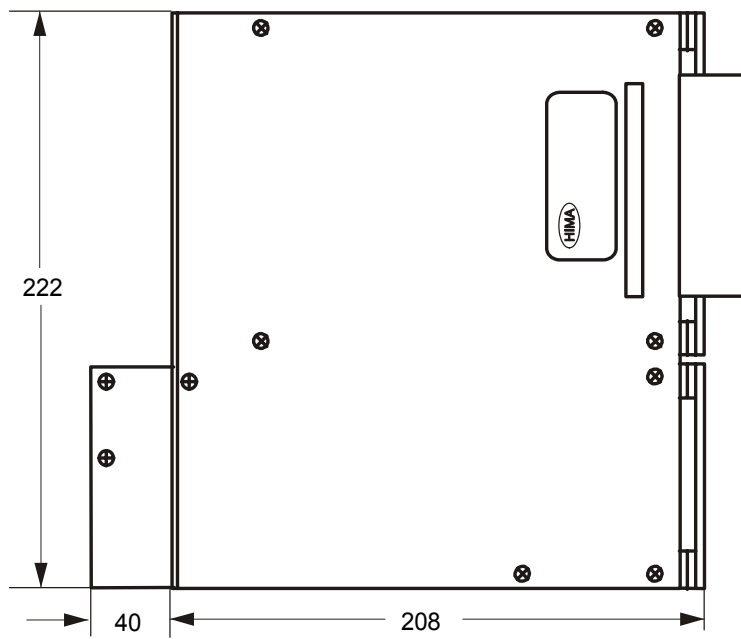


Figure 4: Side view



BV 7002: Data connecting cable

Connection of the bus terminal H 7505 to LCL printers

MT 2030 and MT 2033

Standard length: 5 m

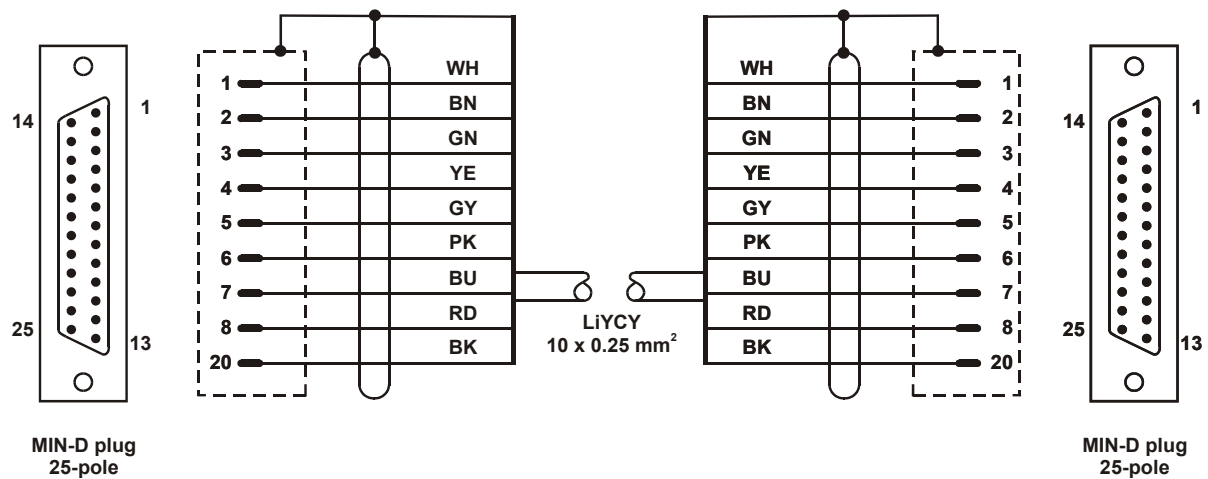


Figure 1: Wiring



BV 7032: Data connecting cable

Connection of the I/O bus between the I/O subracks,
to the central rack and to the PES coupling module

Standard length: 0.5 m

Special lengths up to 5 m or longer after testing

Total bus length: 12 m

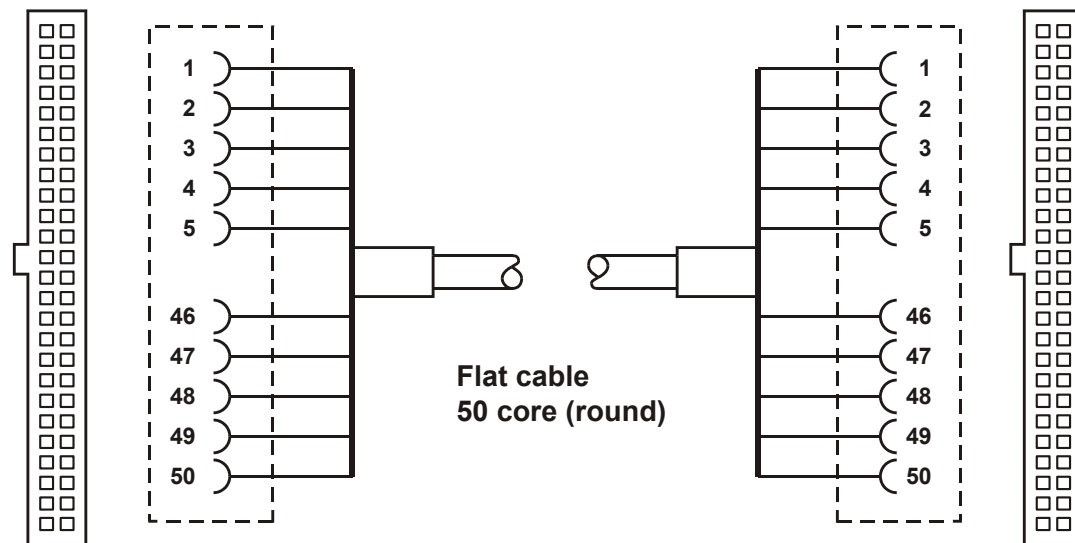


Figure 1: Wiring



BV 7040: Data connecting cable

Connection of the bus terminal H 7506 to the interface in the H41q/H51q system

Connection H 7505 --> H 7506

Standard lengths: 0.5 m, 2 m, 4 m

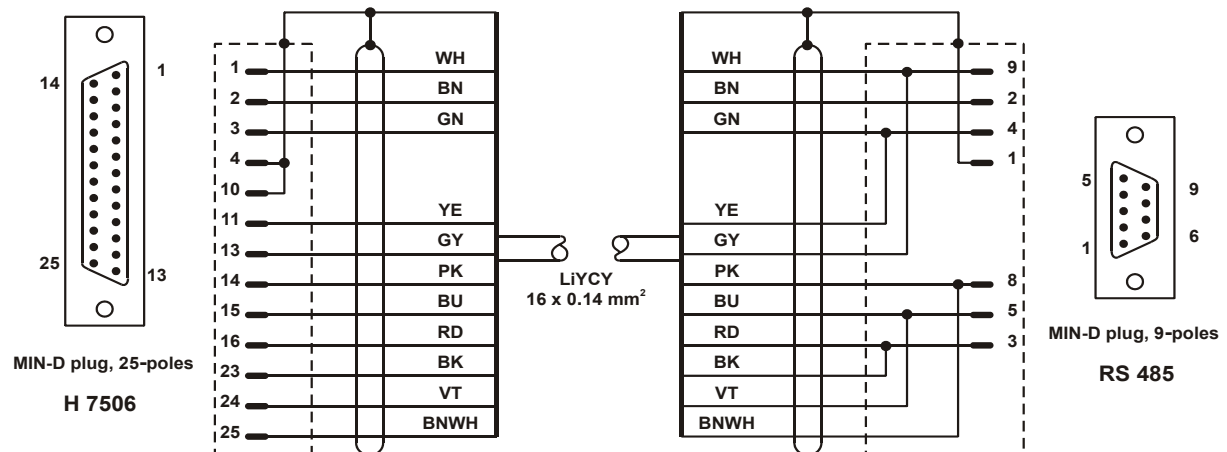


Figure 1: Wiring

Pin	RS 485	Signal	Meaning
1	-	-	not used
2	-	RP	5 V, decoupled by diodes
3	A/A'	RxD/TxD-A	Receive/Transmit Data A
4	-	CNTR-A	Control signal A
5	C/C'	DGND	Data Ground
6	-	VP	5 V, positive pole of power supply
7	-	-	not used
8	B/B'	RxD/TxD-B	Receive/Transmit Data B
9	-	CNTR-B	Control signal B

Table 1: Pin assignment of the interface RS 485, 9-pole



BV 7043: Data connecting cable

Direct connection of personal computer to the interface in
the H41q/H51q systems (also redundant)
without additional power supply
Standard lengths: 5 m, 15 m

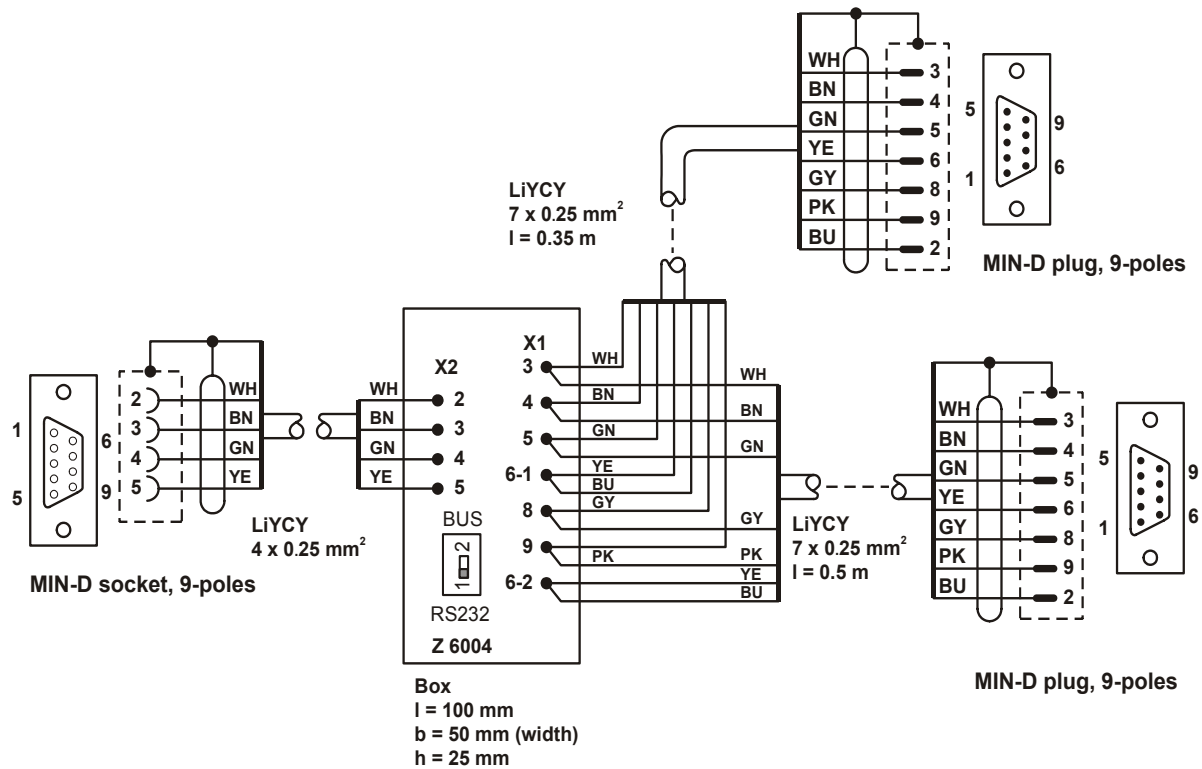


Figure 1: Wiring

Notes

- It is not possible to build up a serial connection of several cables BV 7043 for extension.
- Usable for service and set up, not for continuous operation (in this case use interface converter H 7505 and appertaining cables).
- Together with the MIN-D 9 pole adapter socket/socket (part no. 52 0009389) the BV 7043 is also usable as a branch to connect a PC with the system software HIMA communication analyzer HIKA.
- If the cable is used together with a system software which does not support the status line of an interface RS 232 C, the DIP switch on the board within the box Z 6004 has to be set from position 2 "Bus" to position 1 "RS 232":
Position 1: Operation with ELOP II or Wizcon
Position 2: Operation with ELOP or HIKA

Transmission rate	Maximum cable length
9 600 bps	15 m
57 600 bps	5 m

Table 1: Maximum cable length depending on transmission rate

Pin	RS 485	Signal	Meaning
1	-	-	not used
2	-	RP	5 V, decoupled by diodes
3	A/A'	RxD/TxD-A	Receive/Transmit Data A
4	-	CNTR-A	Control signal A
5	C/C'	DGND	Data Ground
6	-	VP	5 V, positive pole of power supply
7	-	-	not used
8	B/B'	RxD/TxD-B	Receive/Transmit Data B
9	-	CNTR-B	Control signal B

Table 2: Pin assignment of the interface RS 485, 9-pole

Pin	RS 232	Signal	Meaning
1	CF	DCD	Data could be received
2	BB	RxD	Receive data from interface to PC
3	BA	TxD	Send data from PC to interface
4	CD	DTR	PC ready to receive
5	AB	GND	Data Ground
6	CC	DSR	Interface ready to receive
7	A	RTS	PC indicates that PC would send
8	CF	CTS	Interface indicates that PC could send
9	CE	RI	Ring indicator

Table 3: Pin assignment of the interface RS 232, 9-pole



BV 7044: Data connecting cable

Connection from interface RS 232C / V.24 of a PC to the interface converter H 7505

Standard lengths: 5 m, 15 m, 30 m

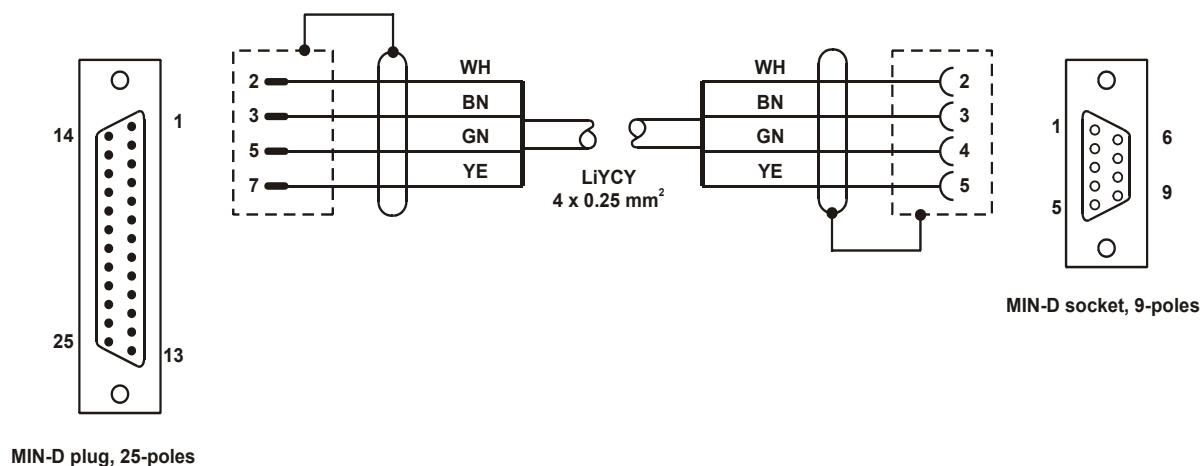


Figure 1: Wiring

Transmission rate	Maximum cable length
9 600 bps	30 m
19 200 bps	15 m
57 600 bps	5 m

Table 1: Maximum cable length at transmission rate

Pin	RS 232	Signal	Meaning
1	CF	DCD	Data could be received
2	BB	RxD	Receive data from interface to PC
3	BA	TxD	Send data from PC to interface
4	CD	DTR	PC ready to receive
5	AB	GND	Data Ground
6	CC	DSR	Interface ready to receive
7	A	RTS	PC indicates that PC would send
8	CF	CTS	Interface indicates that PC could send
9	CE	RI	Ring indicator

Table 2: Pin assignment of the interface RS 232, 9-pole



BV 7045: Data connecting cable

Connection of a personal computer to a branch of a
RS 232C / V.24 data connection (ELOP II, other systems)
for the communication analyzer HIKA
Standard length: 5 m

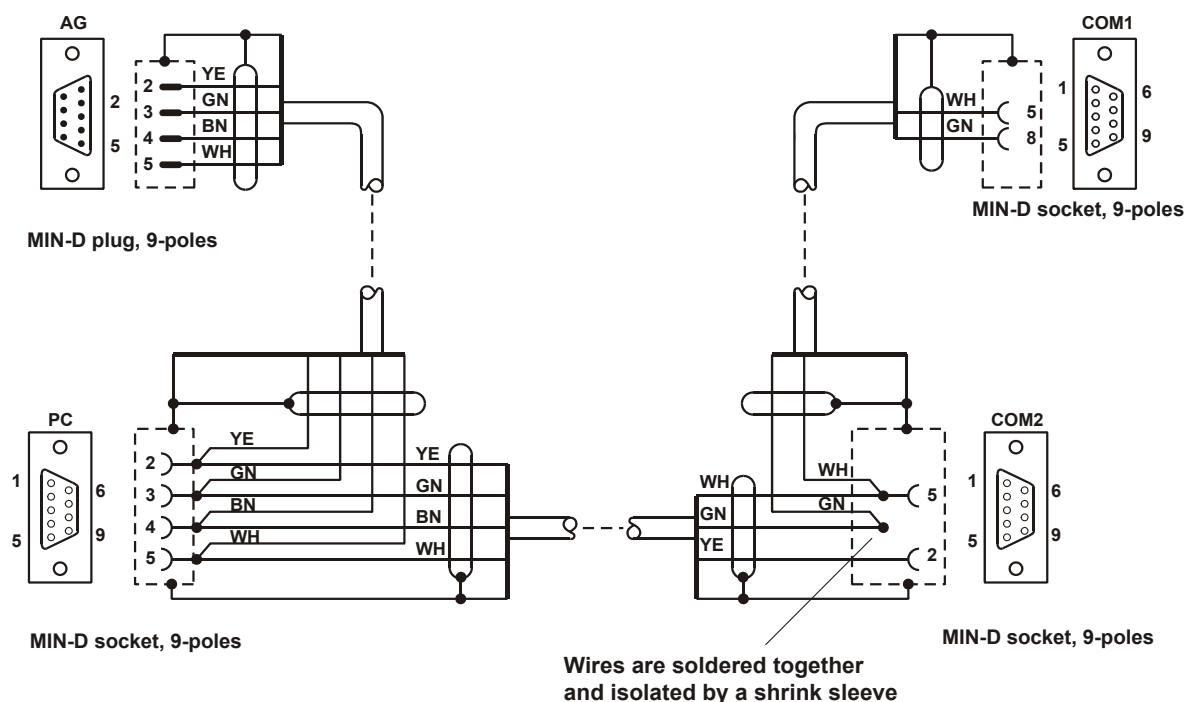


Figure 1: Wiring

Type of the used cable: LiYCY 4 x 0.25 mm²

Pin	RS 232	Signal	Meaning
1	CF	DCD	Data could be received
2	BB	RxD	Receive data from interface to PC
3	BA	TxD	Send data from PC to interface
4	CD	DTR	PC ready to receive
5	AB	GND	Data Ground
6	CC	DSR	Interface ready to receive
7	A	RTS	PC indicates that PC would send
8	CF	CTS	Interface indicates that PC could send
9	CE	RI	Ring indicator

Table 1: Pin assignment of the interface RS 232, 9-pole



BV 7046: Data connecting cable

Connection of the bus terminal H 7506 to the interface in the H41q/H51q systems (redundant systems)

Standard lengths: 2 m, 4 m

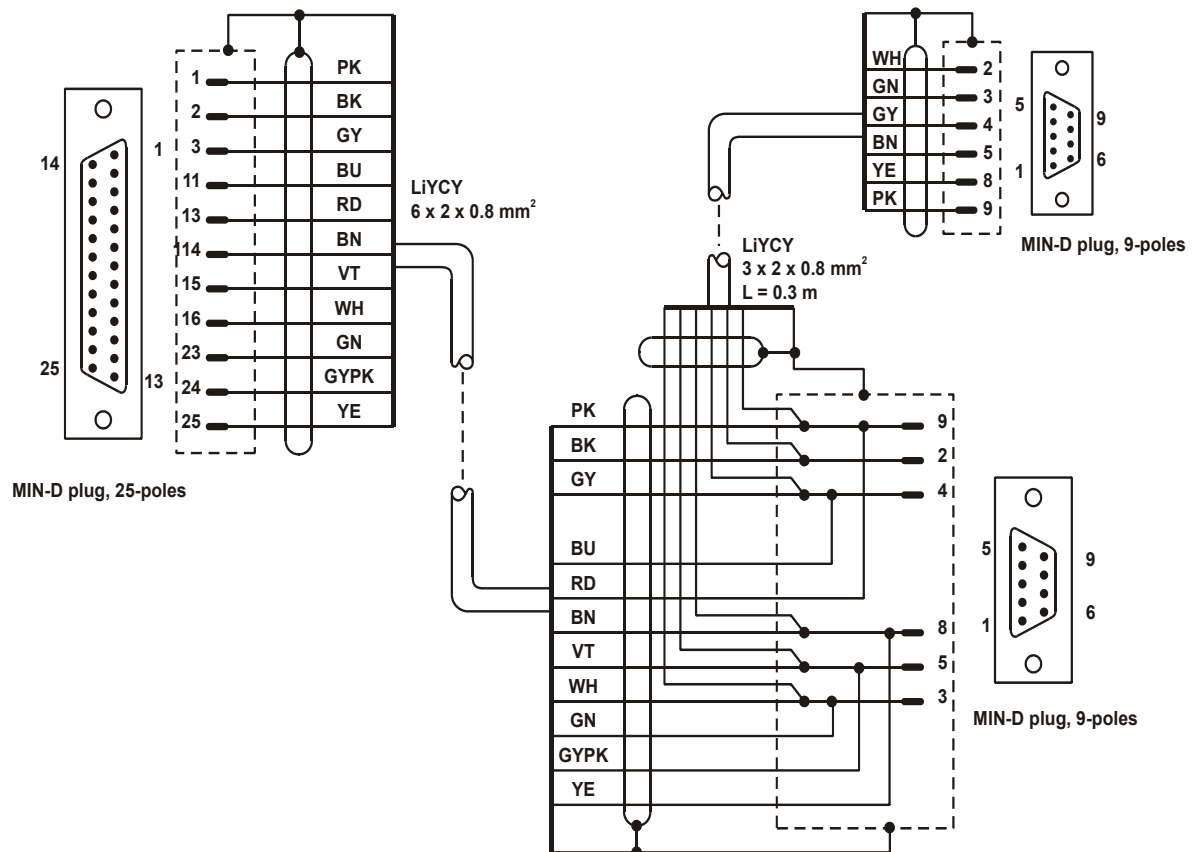


Figure 1: Wiring

Note

Depending on the used cross section the bus length calculated for the cable BV 7046 is four times the cable length.

Pin	RS 485	Signal	Meaning
1	-	-	not used
2	-	RP	5 V, decoupled by diodes
3	A/A'	RxD/TxD-A	Receive/Transmit Data A
4	-	CNTR-A	Control signal A
5	C/C'	DGND	Data Ground
6	-	VP	5 V, positive pole of power supply
7	-	-	not used
8	B/B'	RxD/TxD-B	Receive/Transmit Data B
9	-	CNTR-B	Control signal B

Table 1: Pin assignment of the interface RS 485, 9-pole



BV 7048: Data connecting cable

Connection of the interface converter H 7505 to the interface in the redundant H41q/H51q systems

Standard length: 4 m, bigger lengths on request

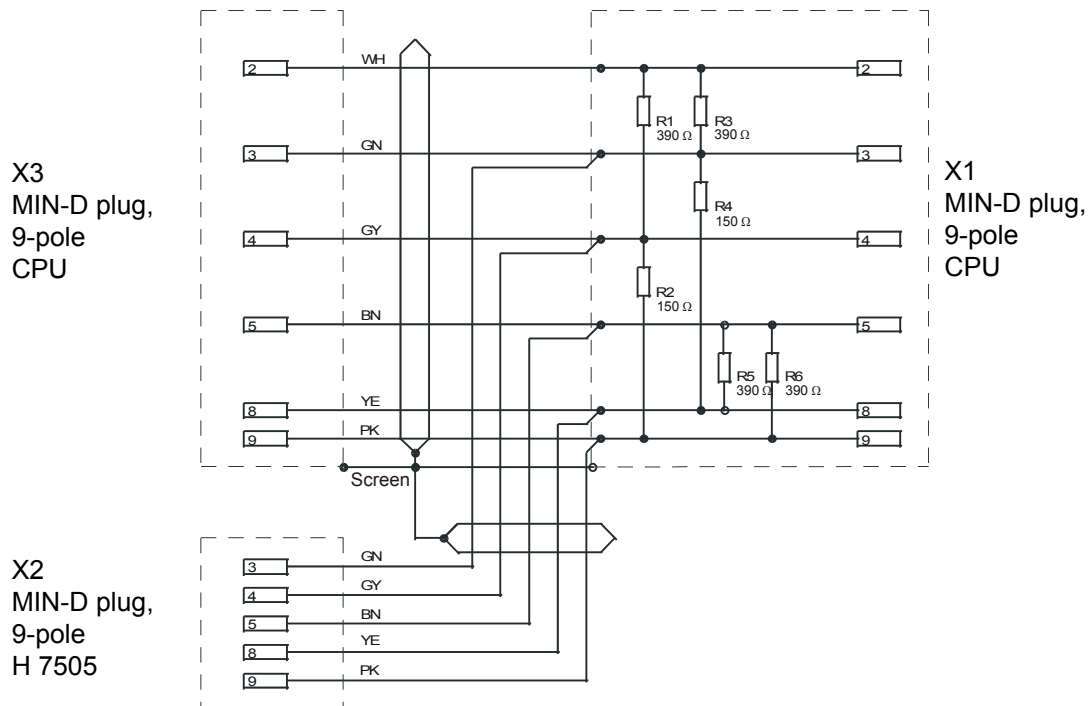
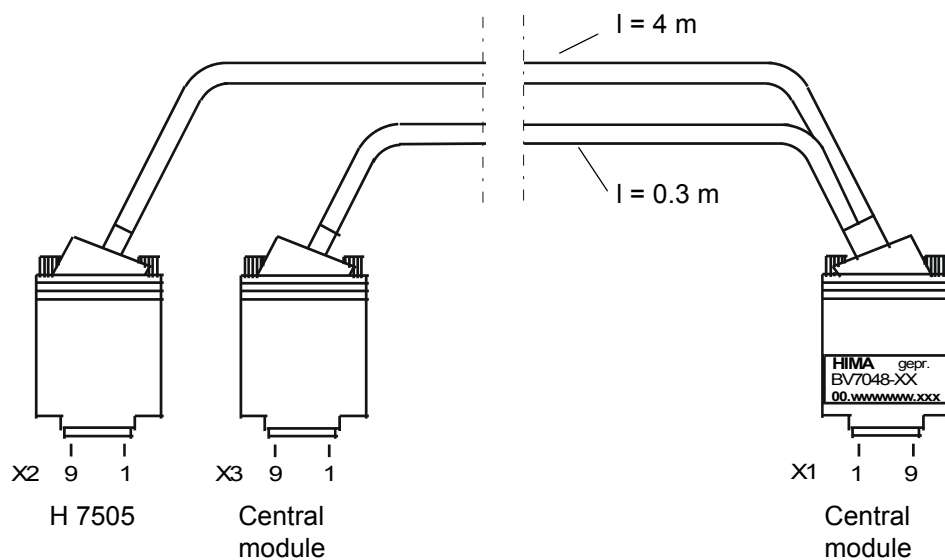


Figure 1: Wiring



Type of used cable: LifYCY 3 x 2 x 0.08 mm²

Pin	RS 485	Signal	Meaning
1	-	-	not used
2	-	RP	5 V, decoupled by diodes
3	A/A'	RxD/TxD-A	Receive/Transmit Data A
4	-	CNTR-A	Control signal A
5	C/C'	DGND	Data Ground
6	-	VP	5 V, positive pole of power supply
7	-	-	not used
8	B/B'	RxD/TxD-B	Receive/Transmit Data B
9	-	CNTR-B	Control signal B

Table 1: Pin assignment of the interface RS 485, 9-pole



BV 7049: Data connecting cable

Connection of interfaces in the redundant H41q/H51q systems
to PC 485 PCI interface card or optical fibre (FO)
Standard length: 4 m, bigger lengths on request

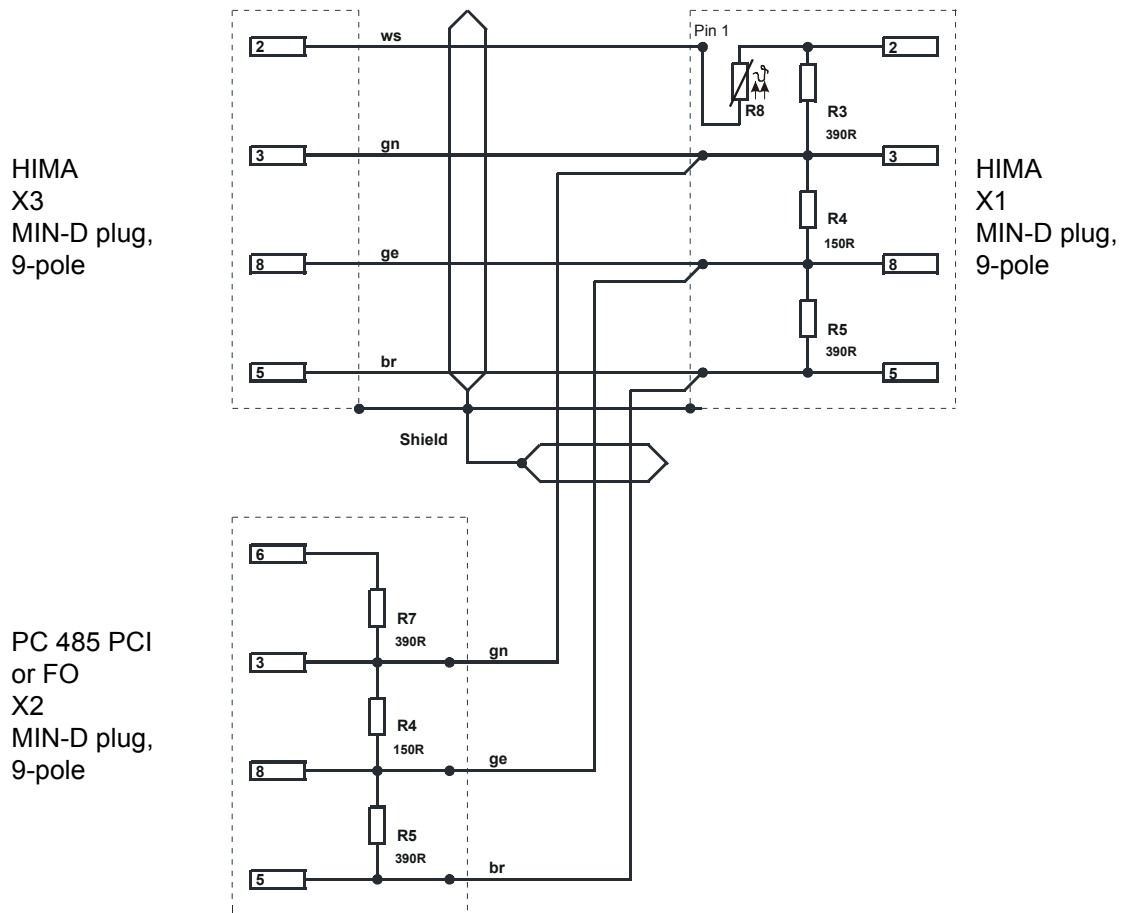
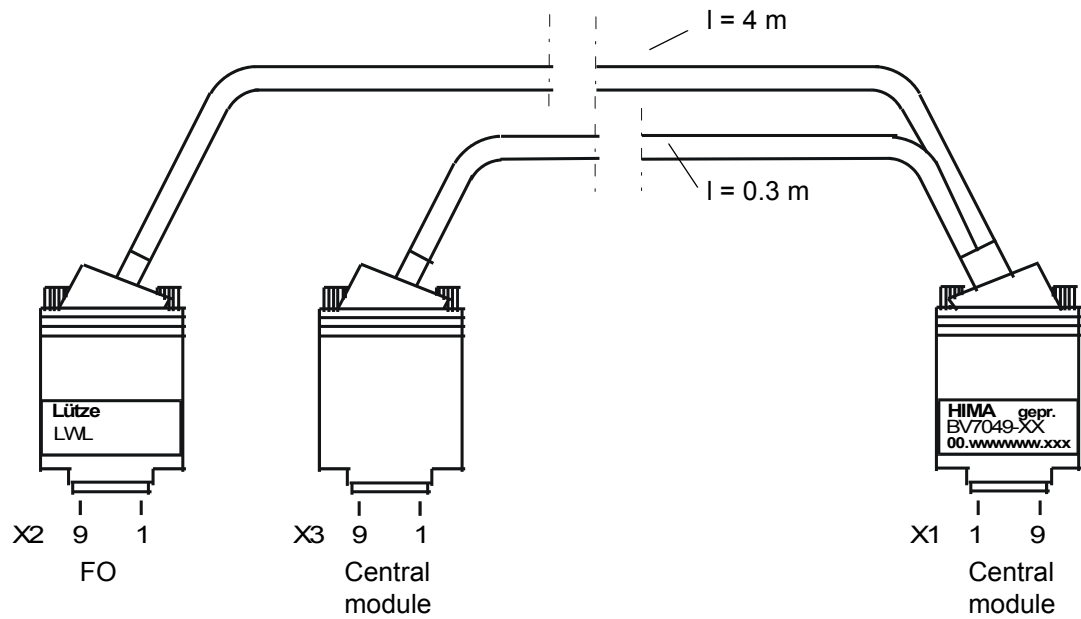


Figure 1: Wiring



Type of used cable: LifYCY 3 x 2 x 0.08 mm²

Pin	RS 485	Signal	Meaning
1	-	-	not used
2	-	RP	5 V, decoupled by diodes
3	A/A'	RxD/TxD-A	Receive/Transmit Data A
4	-	CNTR-A	Control signal A
5	C/C'	DGND	Data Ground
6	-	VP	5 V, positive pole of power supply
7	-	-	not used
8	B/B'	RxD/TxD-B	Receive/Transmit Data B
9	-	CNTR-B	Control signal B

Table 1: Pin assignment of the interface RS 485, 9-pole



BV 7050: Data connecting cable

Connection of interfaces in the single-channel HIMA PES

H 7505 inclusive to optical fibre (FO)

or HIMA PES to PC 485 PCI interface card

Standard length: 0.5 m, 4 m, bigger lengths on request

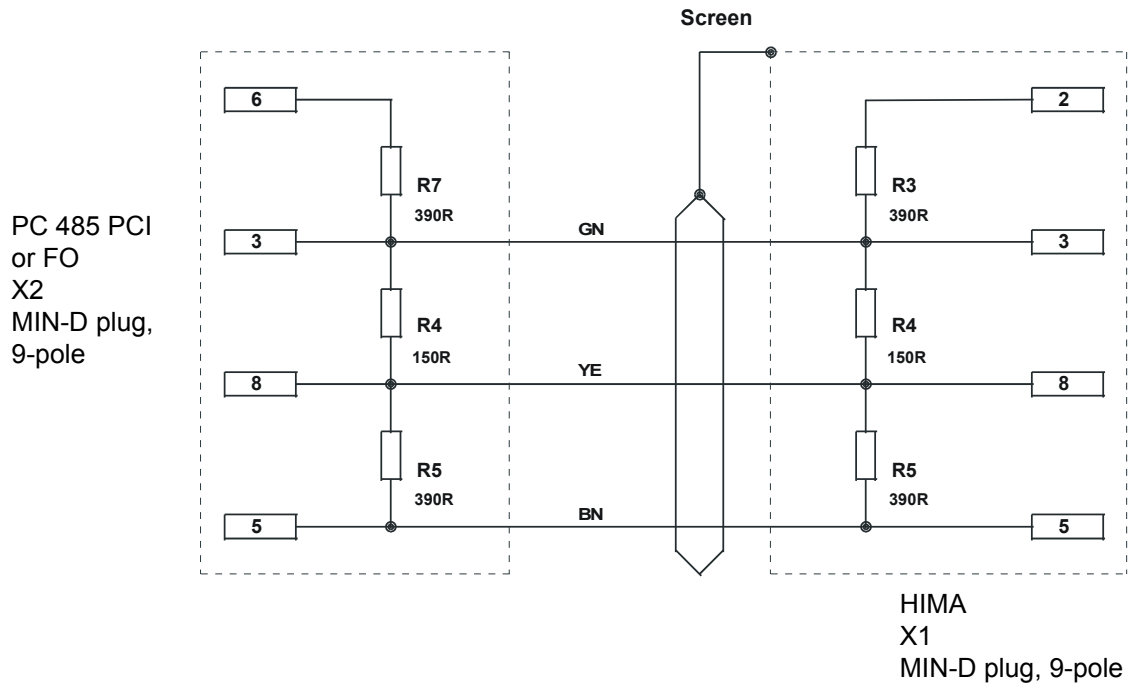
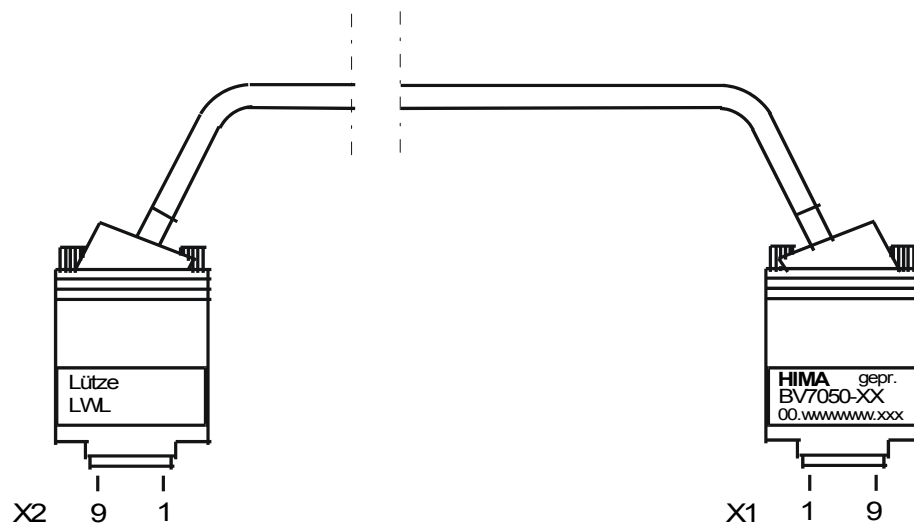


Figure 1: Wiring



Type of used cable: LifYCY 3 x 2 x 0.08 mm²

Pin	RS 485	Signal	Meaning
1	-	-	not used
2	-	RP	5 V, decoupled by diodes
3	A/A'	RxD/TxD-A	Receive/Transmit Data A
4	-	CNTR-A	Control signal A
5	C/C'	DGND	Data Ground
6	-	VP	5 V, positive pole of power supply
7	-	-	not used
8	B/B'	RxD/TxD-B	Receive/Transmit Data B
9	-	CNTR-B	Control signal B

Table 1: Pin assignment of the interface RS 485, 9-pole



BV 7051: Data connecting cable

Connection of the bus terminal H 7506 to optical fibre (FO)

Standard lengths: 0.5 m, 2 m, 4 m

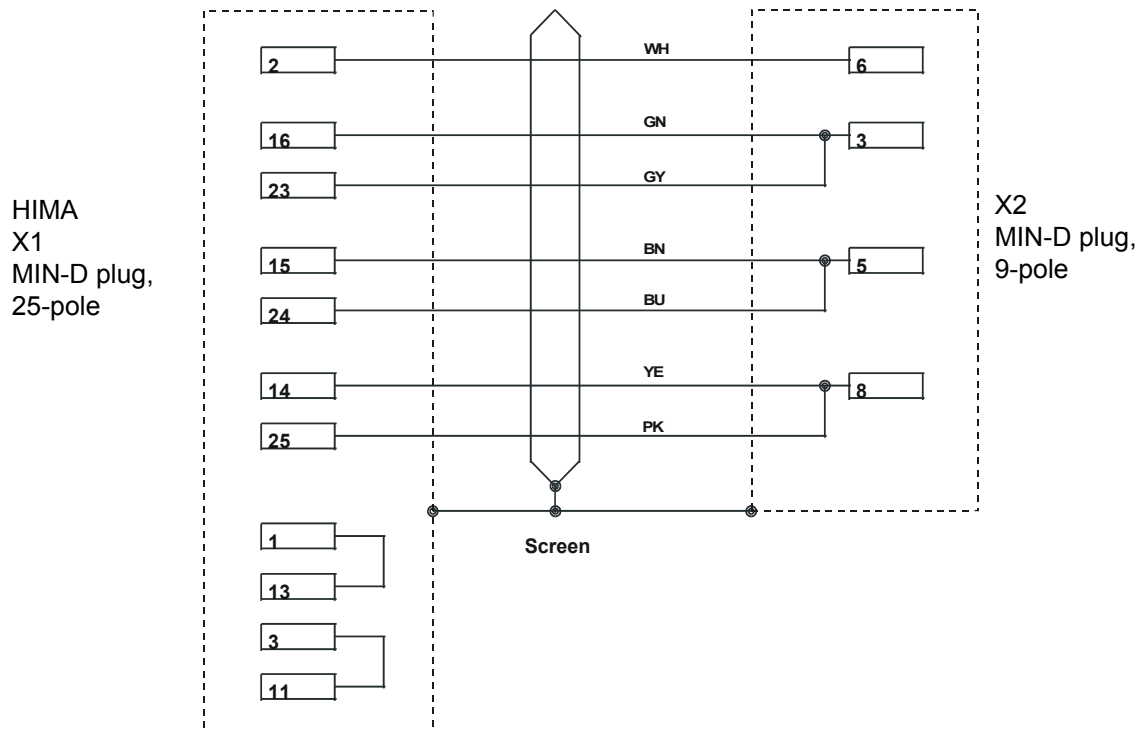
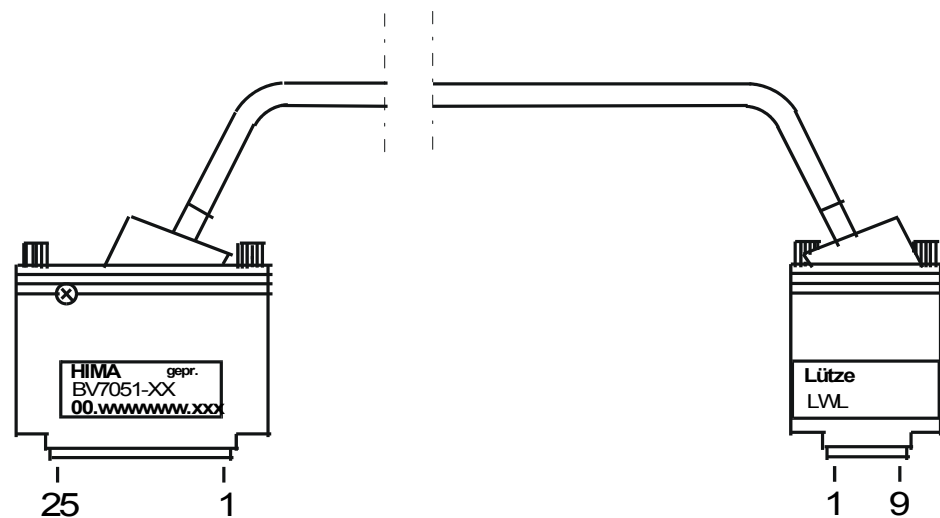


Figure 1: Wiring



Type of used cable: LifYCY 6 x 2 x 0.08 mm²

Pin	RS 485	Signal	Meaning
1	-	-	not used
2	-	RP	5 V, decoupled by diodes
3	A/A'	RxD/TxD-A	Receive/Transmit Data A
4	-	CNTR-A	Control signal A
5	C/C'	DGND	Data Ground
6	-	VP	5 V, positive pole of power supply
7	-	-	not used
8	B/B'	RxD/TxD-B	Receive/Transmit Data B
9	-	CNTR-B	Control signal B

Table 1: Pin assignment of the interface RS 485, 9-pole



BV 7052: Data connecting cable

Connection of the interface connector H 7505 to the interfaces in the single-channel HIMA PES
Standard lengths: 2 m, 4 m, bigger lengths on request

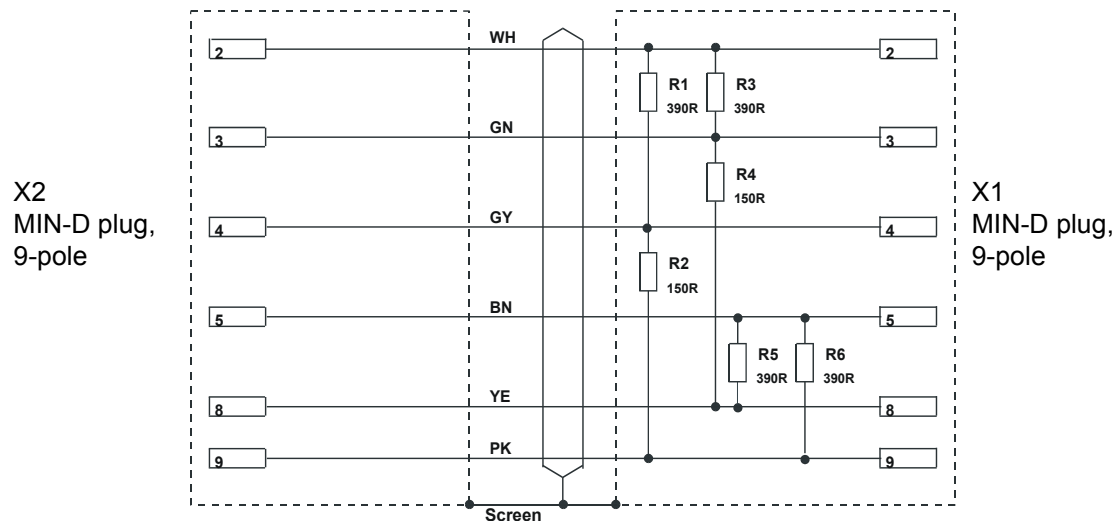
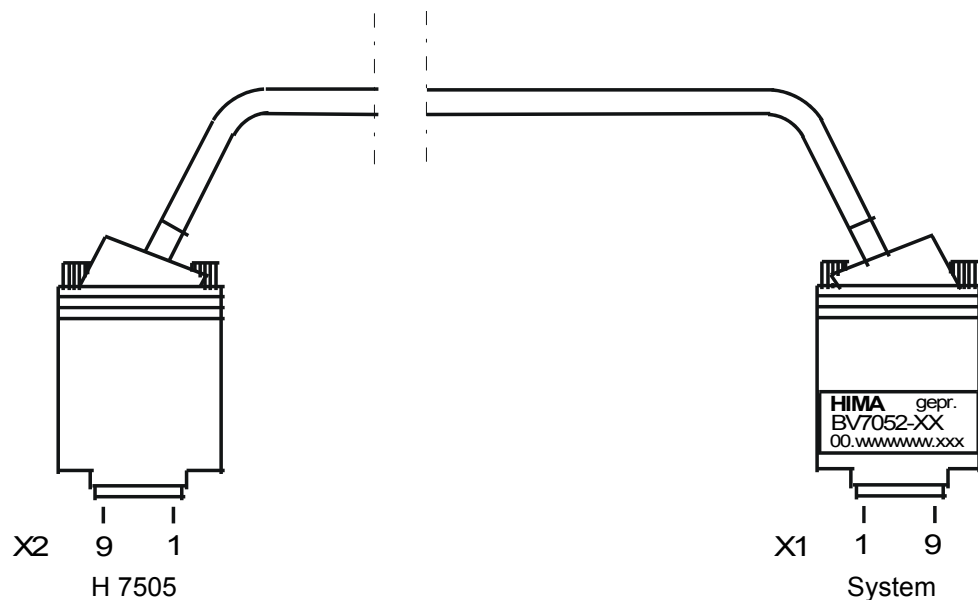


Figure 1: Wiring



Type of used cable: LifYCY 3 x 2 x 0.08 mm²

Pin	RS 485	Signal	Meaning
1	-	-	not used
2	-	RP	5 V, decoupled by diodes
3	A/A'	RxD/TxD-A	Receive/Transmit Data A
4	-	CNTR-A	Control signal A
5	C/C'	DGND	Data Ground
6	-	VP	5 V, positive pole of power supply
7	-	-	not used
8	B/B'	RxD/TxD-B	Receive/Transmit Data B
9	-	CNTR-B	Control signal B

Table 1: Pin assignment of the interface RS 485, 9-pole



BV 7053: HSR cable

HSR connection between redundant communication modules F 8627 / F 8627X
Standard length: 0.6 m

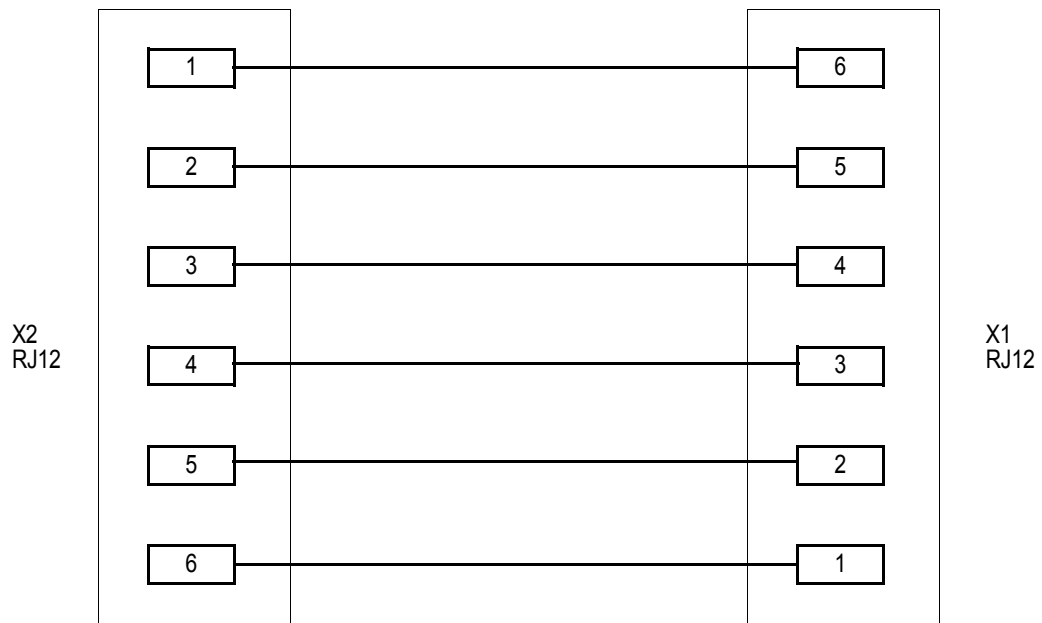


Figure 1: Wiring

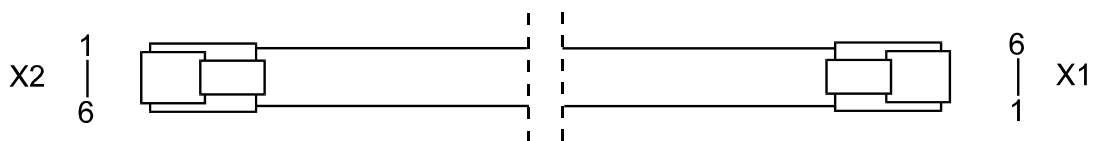


Figure 2: Construction



BV 7055: Data connecting cable

Connection of bus terminal H 7506 to converter Edgeport/2i (USB / RS 485)
in systems H41q/H51q
Standard lengths: 2 m, 4 m

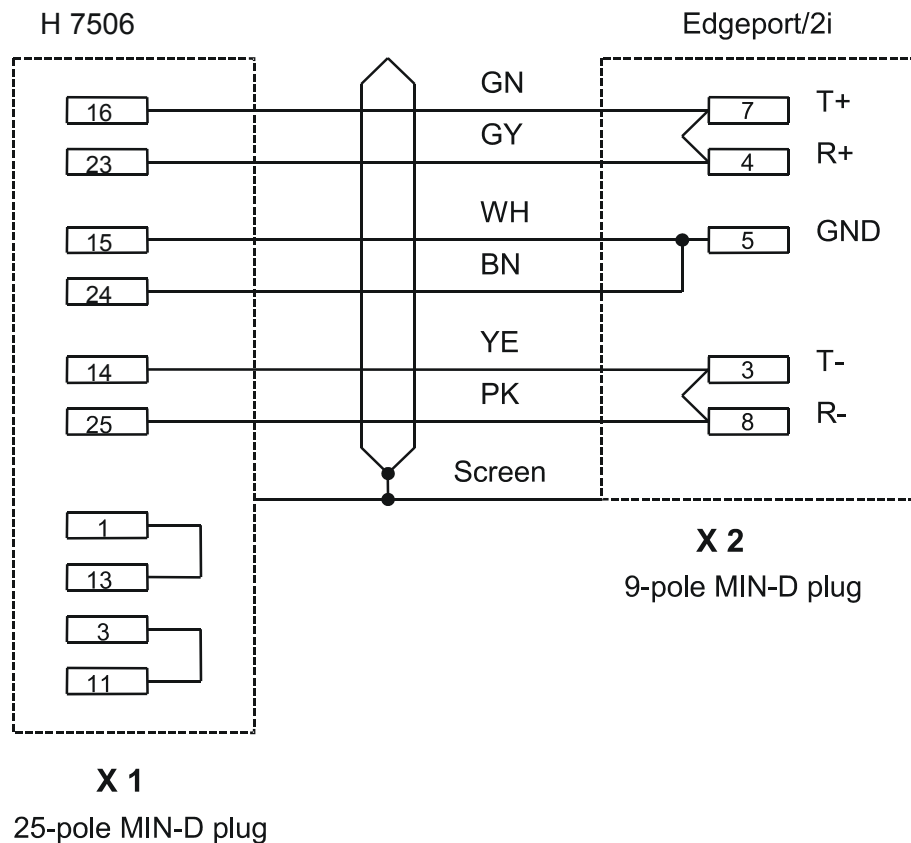
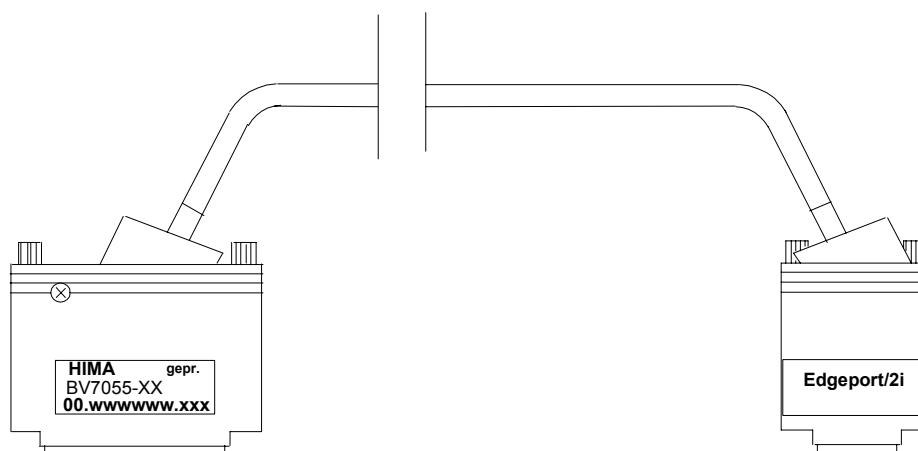


Figure 1: Wiring



Type of used cable: LiYCY 3 x 2 x 0.25 mm²

Pin	RS 485	Signal	Function
1		---	---
2		RP	5 V, decoupled with diodes
3	A/A'	RxD/TxD-A	Receive/Transmit data A
4		CNTR-A	Control signal A
5	C/C'	DGND	Data reference potential
6		VP	5 V, positive pole of supply voltage
7		---	---
8	B/B'	RxD/TxD-B	Receive/Transmit data B
9		CNTR-B	Control signal B

Table 1: Pin assignment of the interface RS 485, 9-pole

Applications

Connection to the centre of HIBUS

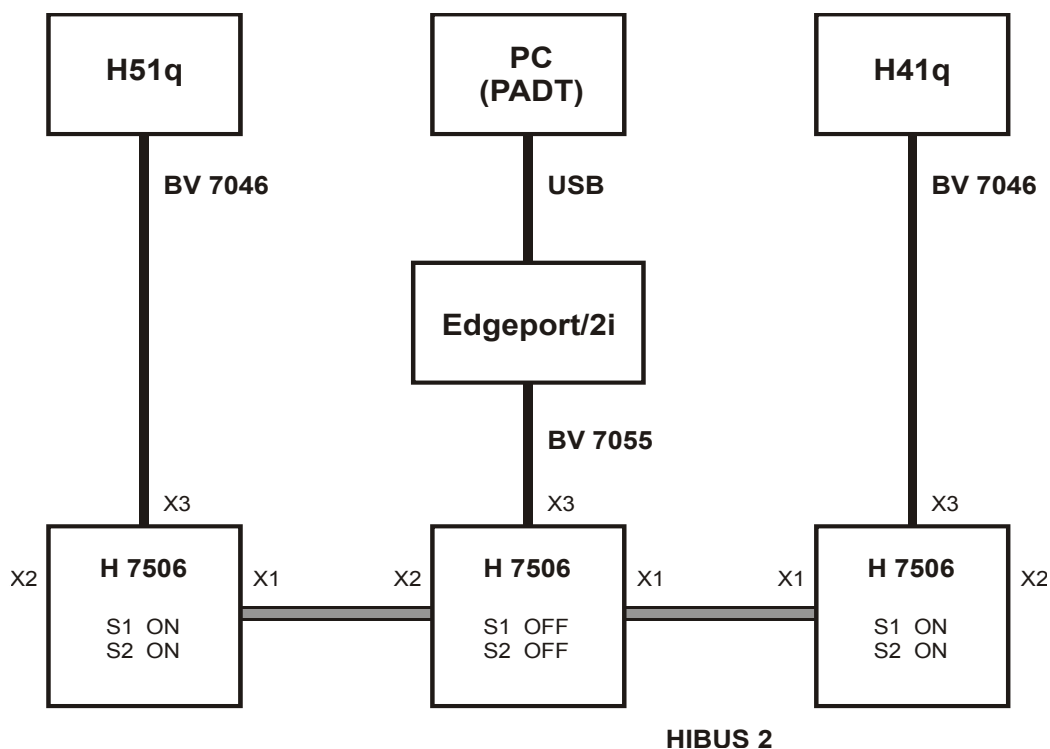


Figure 2: Connection to the centre of HIBUS

No.	Position	Explanation
1	ON	Echo disabled
2	ON	Half duplex
3	OFF	no bus termination
4	OFF	
5	ON	
6	ON	
7	OFF	not used
8	OFF	not used

Table 2: Switch positions (8-position DIP switch)



By removing the data cable BV 7055 the bus is disconnected.
The cable must remain plugged to H 7506 if the bus is not exclusively used for programming.

Connection to the end of HIBUS

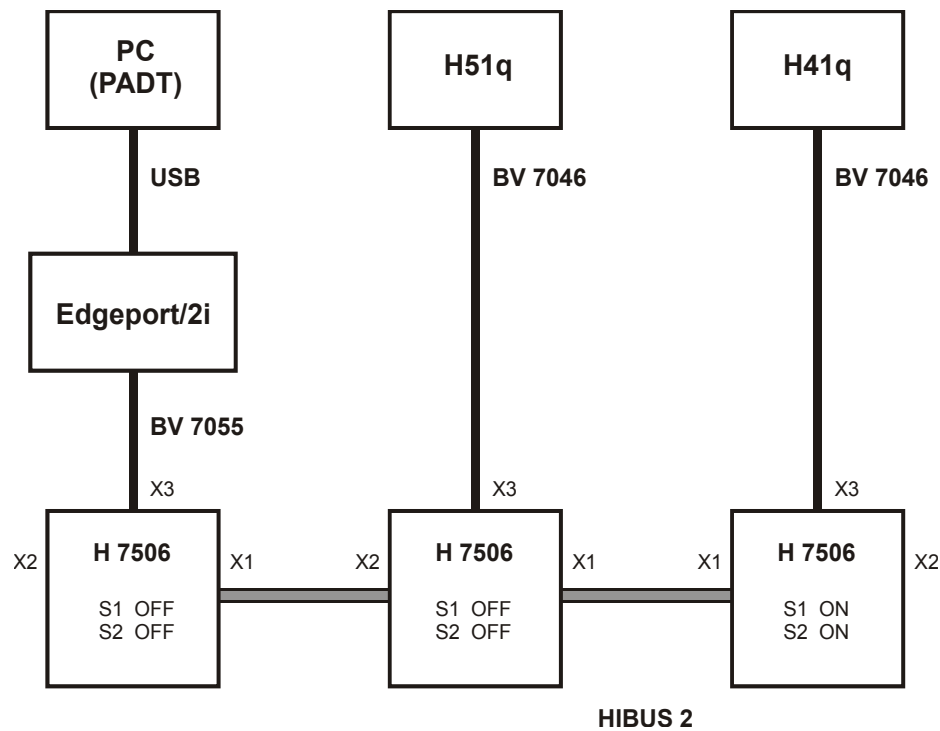


Figure 3: Connection to the end of HIBUS

No.	Position	Explanation
1	ON	Echo disabled
2	ON	Half duplex
3	ON	Bus termination activated
4	OFF	
5	ON	
6	ON	
7	OFF	not used
8	OFF	not used

Table 3: Switch positions (8-position DIP switch)

For the bus termination on H 7505 a 5 V supply is essential from the unit connected to X3. So the bus termination on the converter Edgeport/2i must be activated if it is connected to the end of the bus.



As the supply of the internal bus termination is made via the USB interface, there exists no termination if the PC is removed or switched off. So the connection of the converter to the end of a bus is only admissible if it is exclusively a programming bus.



BV 7201: Connection cable

for the connection (plug&play) between Terminal Module H 7015 and

- Terminal Module H 7016 from HIMA, or
- a compatible module from other manufacturers.

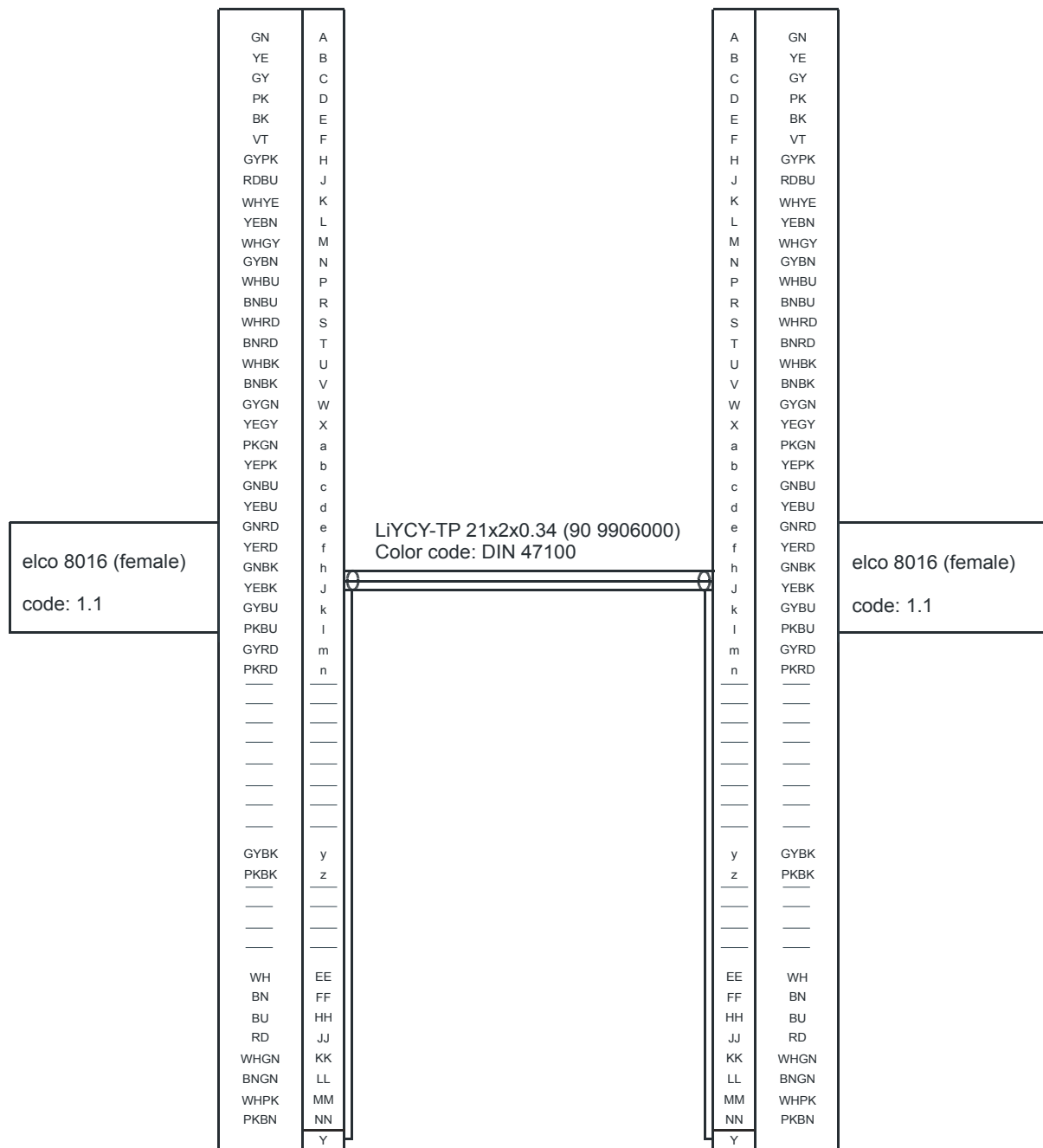


Figure 1: Connection cable BV 7201

In the data sheet H 7015A three applications are described where the connection cable BV 7201 is required.



F 3221: 16-channel input module

- for sensors or 1-signals with safety isolation
- non-interacting

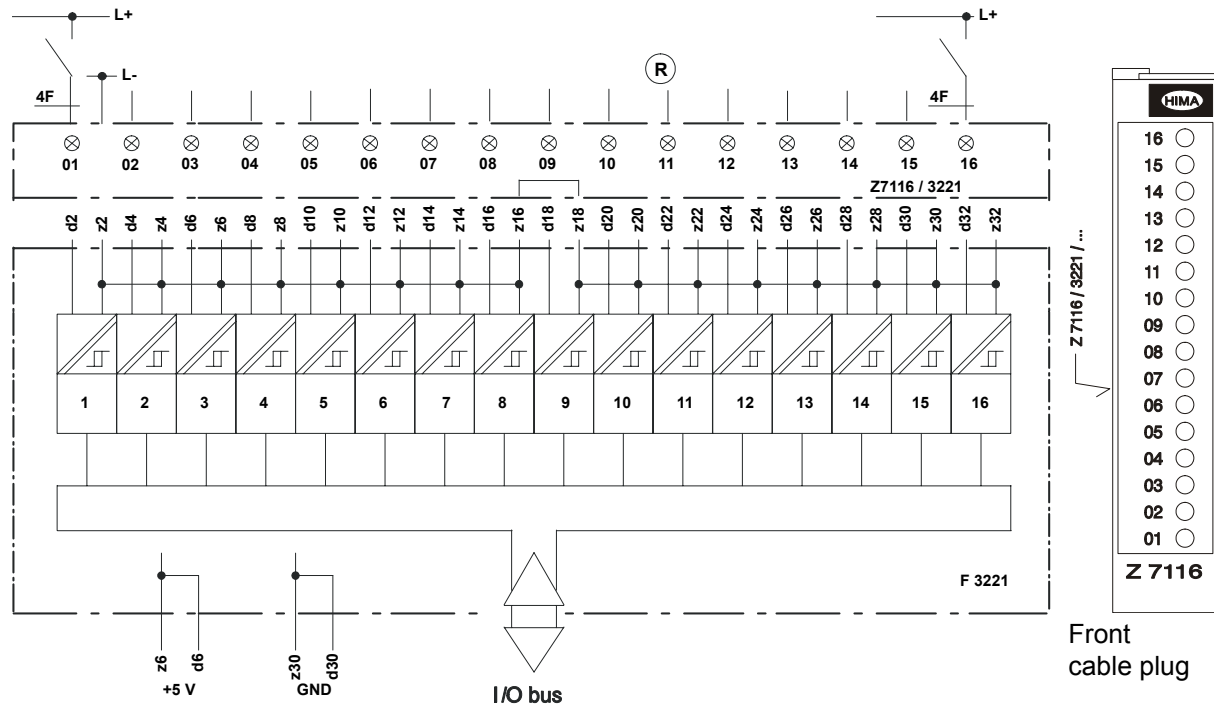


Figure 1: Block diagram and front cable plug

Inputs	1-signal, 8 mA (incl. cable plug) or mechanical contact 24 V (R) non-interacting
Switching time	typ. 10 ms
Space requirement	4 SU
Operating data	5 VDC / 70 mA 24 VDC / 130 mA

Channel	Connection	Color
1	d2	WH
2	d4	BN
3	d6	GN
4	d8	YE
5	d10	GY
6	d12	PK
7	d14	BU
8	d16	RD
9	d18	BK
10	d20	VT
11	d22	WHBN
12	d24	WHGN
13	d26	WHYE
14	d28	WHGY
15	d30	WHPK
16	d32	WHBU
L-	z2	BK

Cable
LiYY 16 x 0.25 mm²

Flat pin
plug
2.8 x 0.8 mm²
q = 1 mm²
l = 750 mm

Lead marking of the cable plug
Z 7116 / 3221/C..

Figure 2: Lead marking of the cable plug

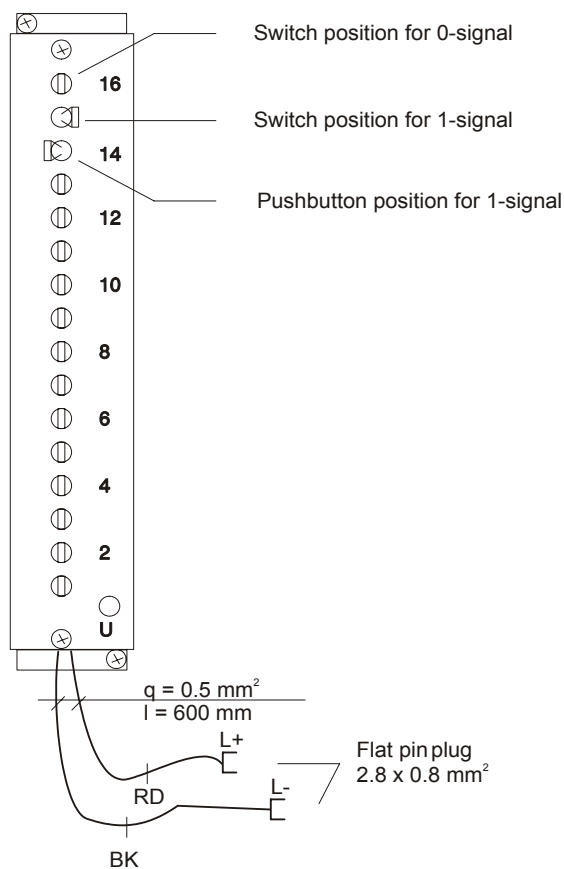


Figure 3: Test plug construction Z 7201 / 3221 + 25



F 3222: 8-channel input module

- for proximity switches according to EN 60947-5-6 (NAMUR)
- with safety isolation
- with feeding of the proximity switches

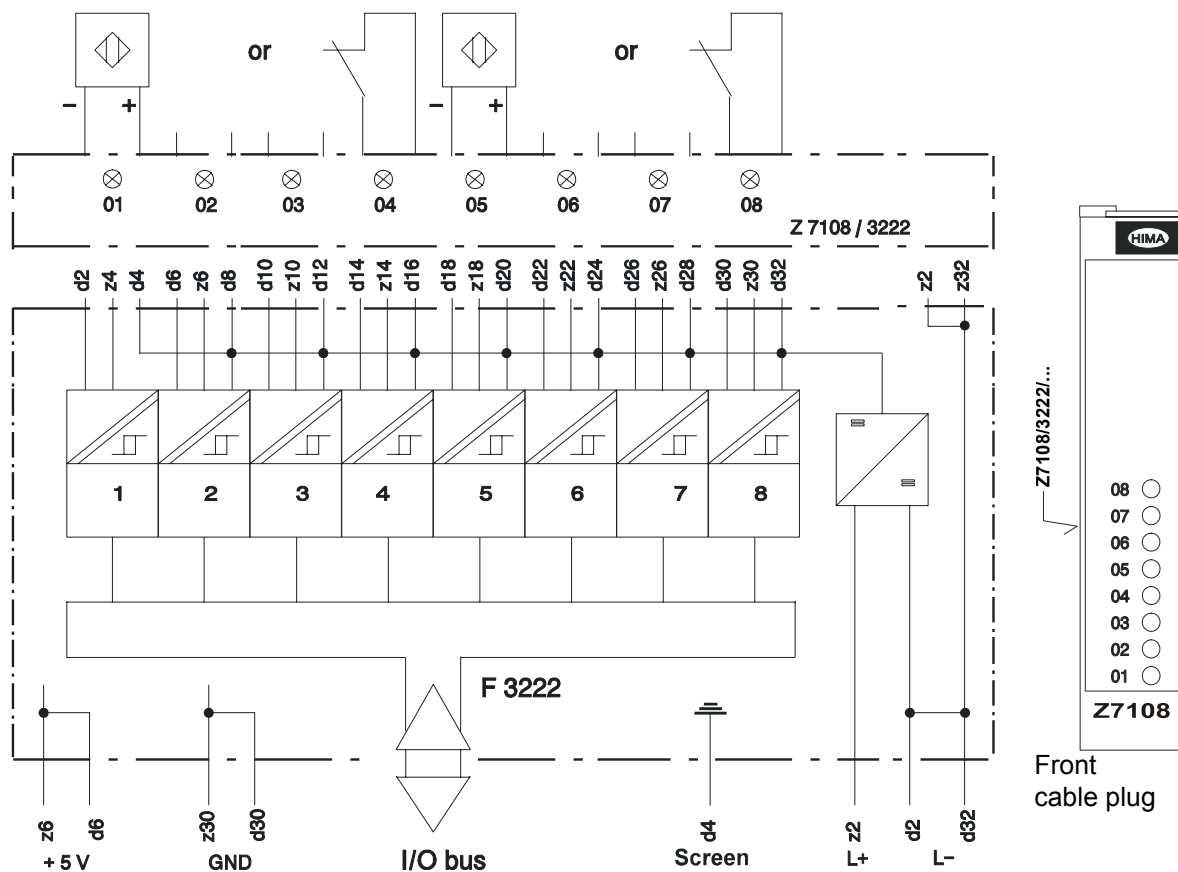


Figure 1: Block diagram and front cable plug

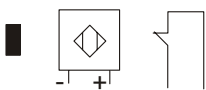
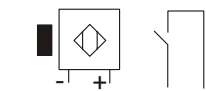
Switching point	1.65 mA ± 0.2 mA
Switching current difference	approx. 0.3 mA
Switching time	approx. 10 ms
Sensor supply	7.7...9 V
Space requirement	4 SU
Operating data	5 VDC / 40 mA
	24 VDC / 75 mA

Channel	Connection	Color		
1	d2	WH	Cable LiYY 16 x 0.5 mm ²	
	d4	BN		
2	d6	GN		
	d8	YE		
3	d10	GY		
	d12	PK		
4	d14	BU		
	d16	RD		
5	d18	BK		
	d20	VT		
6	d22	WHBN		
	d24	WHGN		
7	d26	WHYE		
	d28	WHGY		
8	d30	WHPK		
	d32	WHBU		

Lead marking cable plug
Z 7108 / 3222 / C..

Figure 2: Lead marking cable plug

Function table

Input d4 - d2 . . D32 - d30	Input current I_E in mA	LED z4 . . z30	Control channel 1 . . 8
	> 2.1		H signal
	< 1.2		L signal



F 3224A: 4-channel input module (Ex)i

- for intrinsically safe circuits (Ex)i, with safety isolation
- for proximity switches according to EN 60947-5-6 (NAMUR) and contacts
- with wire break monitoring

EC-Type-Examination Certificate: PTB 02 ATEX 2178

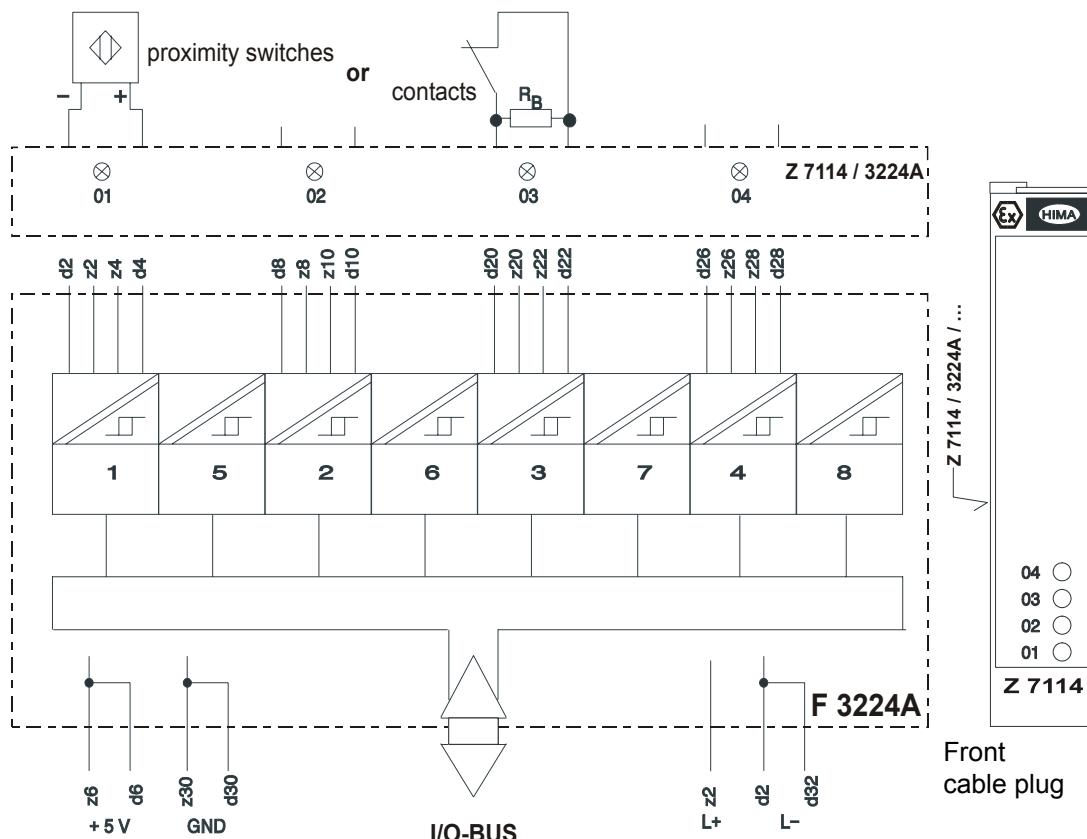


Figure 1: Block diagram and front cable plug

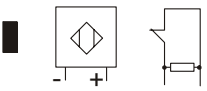
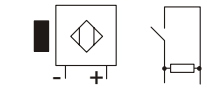
Switching point	1.65 mA $\pm$ 0.2 mA (at 8.2 V)
Switching current difference	approx. 0.2 mA
Switching time	approx. 10 ms
Proximity switch supply	7.7...9 V
Resistor R _B	8.2 k Ω up to 15 k Ω
Space requirement	4 SU
Operating data	5 VDC, 5 mA 24 VDC, 90 mA

Channel	Connection	Color		
1	d2	WH	Cable LiYY 8 x 0.5 mm ²	
	d4	BN		
2	d8	GN		
	d10	YE		
3	d20	GY		
	d22	PK		
4	d26	BU		
	d28	RD		

Lead marking for cable plug
 Z 7114 / 3224A / C.. gray or
 Z 7114 / 3224A / ExC.. blue

Figure 2: Lead marking for cable plug

Function table

Input d4 - d2 d10 - d8 d22 - d20 d28 - d26	Input current I_E in mA	LED z4 - z2 z10 - z8 z22 - z20 z28 - z26	Control channel 1 2 3 4	Line break monitoring 5 (for channel 1) 6 (for channel 2) 7 (for channel 3) 8 (for channel 4)
	> 2.1		H signal	H signal
	< 1.2		L signal	H signal
Sensitivity range	0.05 ... 0.35		L signal	L signal

1 Operating Instructions

1.1 Application

The module is used to evaluate proximity switches (according to NAMUR) or contacts in intrinsically safe circuits (Ex)i.

The proximity switches or contacts can be installed in hazardous areas from zone 0 on.

Note

The connection of a mechanical sensor requires a resistor (8,2 k Ω to 15 k Ω), connected in parallel directly at the sensor to avoid an input line break signal.



The module **may not** be mounted in hazardous areas.
The input channels **may not** be exposed to external voltage.
Modules, which were operated in general electrical systems, **may not** be used in Ex-plants thereafter.

1.2 Electrical specifications concerning intrinsic safety

For these specifications please refer to the EC-Type-Examination certificate (PTB 02 ATEX 2178) enclosed.

In case of the parallel connection of two outputs:

$$I_o = 2 \times 10 \text{ mA} = 20 \text{ mA}$$

$$P_o = 2 \times 23 \text{ mW} = 46 \text{ mW}$$

1.3 Assembly

The module is mounted in a 19" subrack. The mounting position must be vertically. The design of the subrack must allow heat dissipation.

The module is connected to the intrinsically safe field circuits via the cable plug Z 7114.

Further information for assembly and installation:
see HIMA Manual (catalog) "The H41q and H51q System Families".

1.4 Installation

- The electronic module including its connections has to be installed in a way that at least the system of protection IP 20 according to EN 60529: 1991 + A1: 2000 is achieved.
- Two intrinsically safe input circuits of two F 3224A modules can be wired in parallel. The reduced maximum values (C_0, L_0) due to this method of connection have to be considered.
- The separation between intrinsically safe and non-intrinsically safe terminals must be ≥ 50 mm (filament dimension), especially between adjacent modules.
- The separation between adjacent intrinsically safe terminals must be ≥ 6 mm (filament dimension).
- Intrinsically safe and not intrinsically safe lines must be installed separately, or the intrinsically safe lines must be provided with additional insulation.
- Intrinsically safe lines must be identifiable, e.g. by a light blue color (RAL 5015) of the insulation.
- The wiring has to be secured mechanically in a way which ensures that in the event of an accidental disconnection, the distance (EN 50020/ Part 7, Table 4) between the intrinsically safe and not intrinsically safe connections does not fall below the required minimum (e.g. by bundling).

The lines used must comply with the following insulation test voltages:

- Intrinsically safe lines ≥ 1000 VAC
- Not intrinsically safe lines ≥ 1500 VAC

For stranded wires, the line ends must be provided with wire end ferrules. The terminals must be suitable for clamping the wire cross section.

The applicable regulations and standards have to be complied with, especially:

- EN 50014: 1997 + Corrigendum: 1998 + A1: 1999 + A2: 1999
(VDE 0170/0171, Part 1: 2000, DIN EN 50014: 2000-02)
- EN 50020: 1994
(VDE 0170/0171, Part 7: 1996, DIN EN 50020: 1996-04)
- EN 60079-14: 1997
(VDE 0165 Part 1, DIN EN 60079-14: 1998-08)

1.5 System start-up

Prior to the first system start-up, an Ex-expert has to check the correct installation of the system, especially the supply voltage connections and the connections for the intrinsically safe circuits.

1.6 Maintenance

In case of a failure, the defective module must be replaced with the same, or with another approved type.



Any repair work must only be carried out by the manufacturer!

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin



(1) **EC-TYPE-EXAMINATION CERTIFICATE**
(Translation)

(2) Equipment and Protective Systems Intended for Use in
Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-type-examination Certificate Number:

PTB 02 ATEX 2178

(4) Equipment: Electronic assembly, type F3224A

(5) Manufacturer: HIMA Paul Hildebrandt GmbH + Co.KG

(6) Address: 68777 Brühl, Germany

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 03-22253.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014:1997 + A1 + A2

EN 50020:1994

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment shall include the following:

 **II (1) G D [EEEx Ia] IIC**

Zertifizierungsstelle Explosionschutz
By order:

Dr.-Ing. U. Johannsmeier
Regierungsdirektor



Braunschweig, February 03, 2003

sheet 1/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

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Braunschweig und Berlin



SCHEDULE

(13)

(14) **EC-TYPE-EXAMINATION CERTIFICATE PTB 02 ATEX 2178**

(15) Description of equipment

The electronic assembly, type F 3224A, is a quadruple isolation amplifier, which is used for transmitting control commands.

The permissible ambient temperature is -20 °C to 60 °C.

Electrical data

Supply circuit UB1 20 ... 30 V DC; approx. 2 W
(terminal z2(L+), d2, d32(L-)) $U_m = 40 \text{ V}$

Supply circuit UB2 4,5 ... 5,5 V DC; approx. 0.5 W
(terminal z6, d6(V_{DD}), z30, $U_m = 40 \text{ V}$
d30(GND))

Control circuits type of protection Intrinsic Safety EEx ia IIC/IIB
(terminals, or EEx ib IIC/IIB
circuit 1: d2, d4 with the following maximum values for each circuit:
circuit 2: d8, d10 $U_o = 9 \text{ V}$
circuit 3: d20, d22 $I_o = 10 \text{ mA}$
circuit 4: d26, d28 $P_o = 23 \text{ mW}$
Linear characteristic

The maximum permissible values for the external capacitance and inductance of one individual control circuit and two shunt-connected control circuits are shown in the table below:

EEx ia or ib	individual circuit		shunt connected	
	IIC	IIB	IIC	IIB
L_o	355 mH	1000 mH	88 mH	355 mH
C_o	4.9 μF	40 μF	4.9 μF	40 μF

In the event of concentrated capacitances and/or inductances in the intrinsically safe control circuits, the maximum permissible external capacitances and inductances of one individual control circuit and two shunt-connected control circuits are as follows:

sheet 2/3

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Braunschweig und Berlin



SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 02 ATEX 2178

EEx ia or ib	individual circuit		shunt connected	
	IIC	IIB	IIC	IIB
L_o	5 mH	5 mH	5 mH	5 mH
C_o	940 nF	4.9 μ F	900 nF	4.8 μ F

Two control circuits each of one electronic assembly or of two electronic assemblies of this type may be connected in parallel in the following manner:

one assembly : terminal d4 with terminal d10 and
terminal d2 with terminal d8 etc.

two assemblies, e.g. terminal d4 with terminal d4 and
terminal d2 with terminal d2 etc.

Output circuits $U = 5 \text{ V DC}$, $I \leq 24 \text{ mA}$
(terminals z22, d22, z24, d24 $U_m = 40 \text{ V}$
z26, d26, z28, d28)

The control circuits are safely electrically isolated from all other circuits up to a peak value of the nominal voltage of 375 V.

(16) Test report PTB Ex 03-22253

(17) Special conditions for safe use

None

(18) Essential health and safety requirements

met by compliance with the standards mentioned above

Zertifizierungsstelle Explosionschutz
By order:

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor



Braunschweig, February 03, 2003

sheet 3/3

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F 3236: 16-channel input module

safety-related, applicable up to SIL 3 according to IEC 61508

- for 1-signals or sensors
- with safety isolation

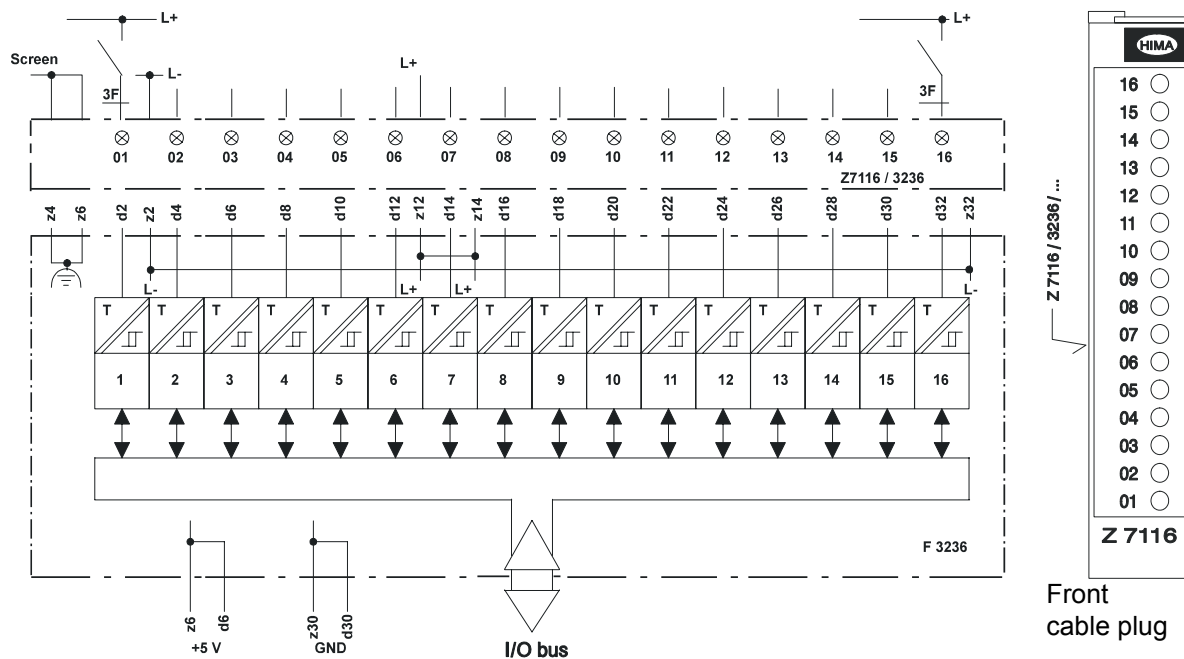


Figure 1: Block diagram and front cable plug

The module is automatically fully tested during operation for safety-related errors. The essential test procedures are:

- Cross-talking of the inputs by walking-zero
- Functions of the filter capacitors
- Function of the module

The LEDs of the cable plug are not tested.

Inputs

Input resistance
Switching time
Space requirement
Operating data

1-signal, 6 mA (incl. cable plug)
or mechanical contact 24 V
4 k Ω with cable plug / 12 k Ω without cable plug
typ. 8 ms
4 SU
5 VDC / 120 mA
24 VDC / 200 mA

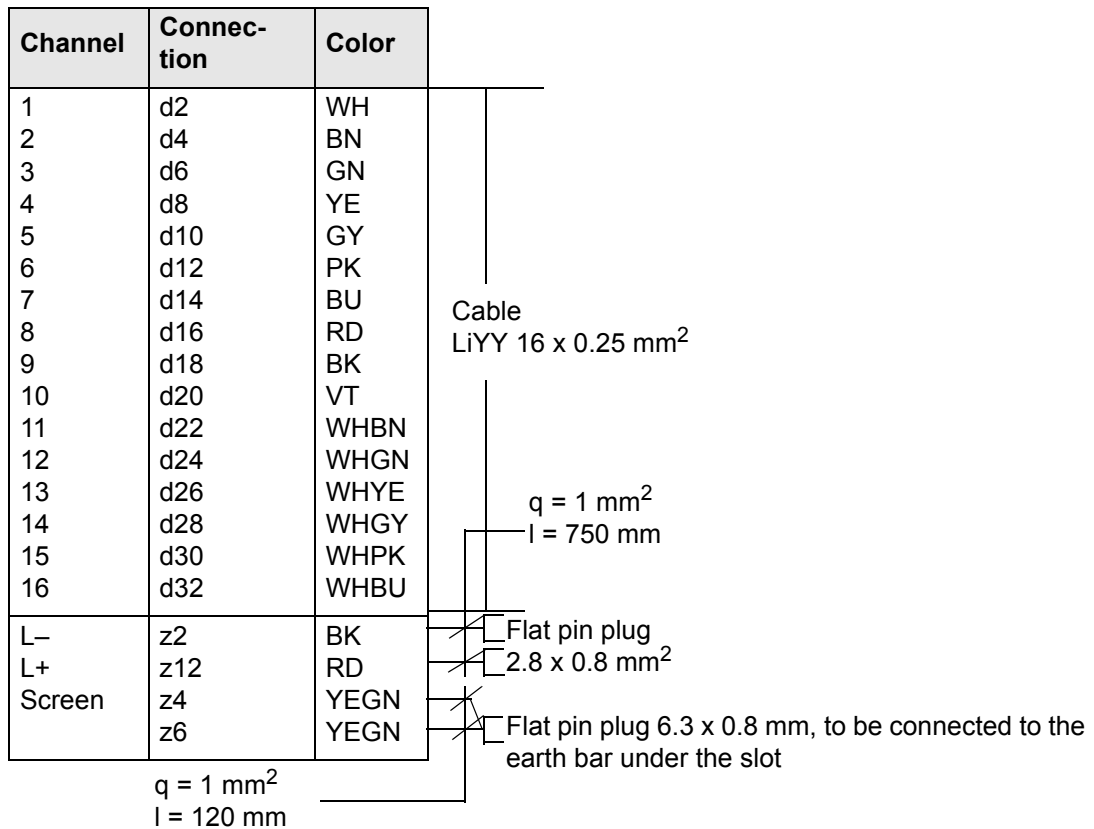


Figure 2: Lead marking of the cable plug Z 7116 / 3236 / C..

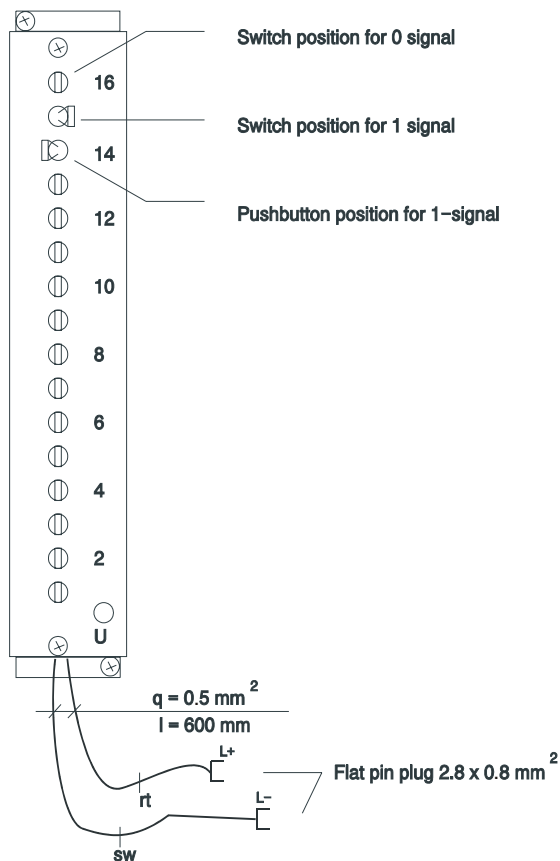


Figure 3: Test plug diagram Z 7201 / 3236



F 3237: 8-channel input module

safety-related, applicable up to SIL 3 according to IEC 61508,

- for the connection of safety-related proximity switches, proximity switches according to EN 60947-5-6 (NAMUR) and resistor-wired sensors
- monitoring of the lines for short-circuit and line break

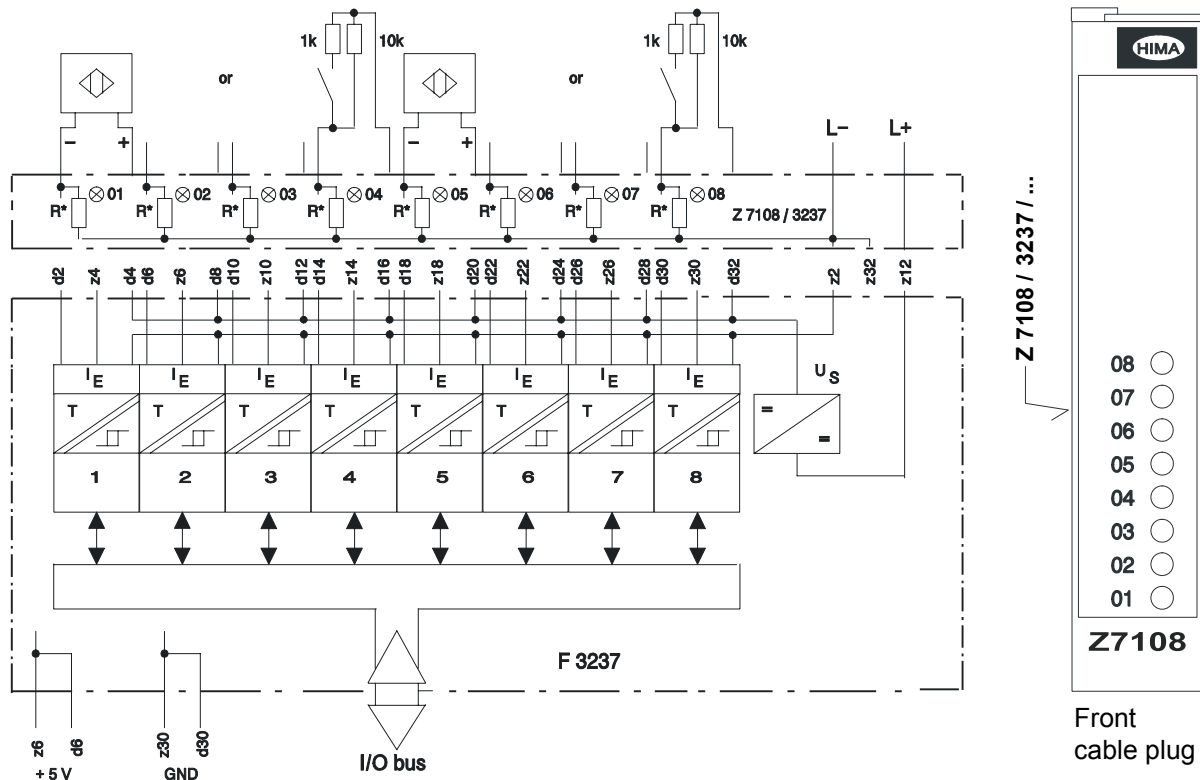


Figure 1: Block diagram and front cable plug

Appertaining function block: HB-RTE-3

The module is automatically tested completely during operation. The main test routines are:

- Switch on and switch-off capability
- Crosstalk of the input circuits by walking-zero
- Function of the input filters
- Correct function of the module

The function of LEDs are not tested.

Switching time	approx. 10 ms
Operating points I_E	
0-signal	$0.35 \leq I_E \leq 1.2 \text{ mA}$
1-signal	$2.1 \leq I_E \leq 6.0 \text{ mA}$
wire break	$\leq 0.28 \text{ mA}$
short circuit	$\geq 6.5 \text{ mA}$
Line impedance	$\leq 50 \Omega$ (acc. to EN 60947-5-6)
Line length	$\leq 1000 \text{ m}$ ($\varnothing = 0.5 \text{ mm}^2$)
Supply voltage U_S	8.2 V
Shunt R^*	681Ω ; 1 %; 0.25 W
(R17...R24)	part no. 00 0751681
Space requirement	4 SU
Operating data	5 VDC / 90 mA; 24 VDC / 170 mA

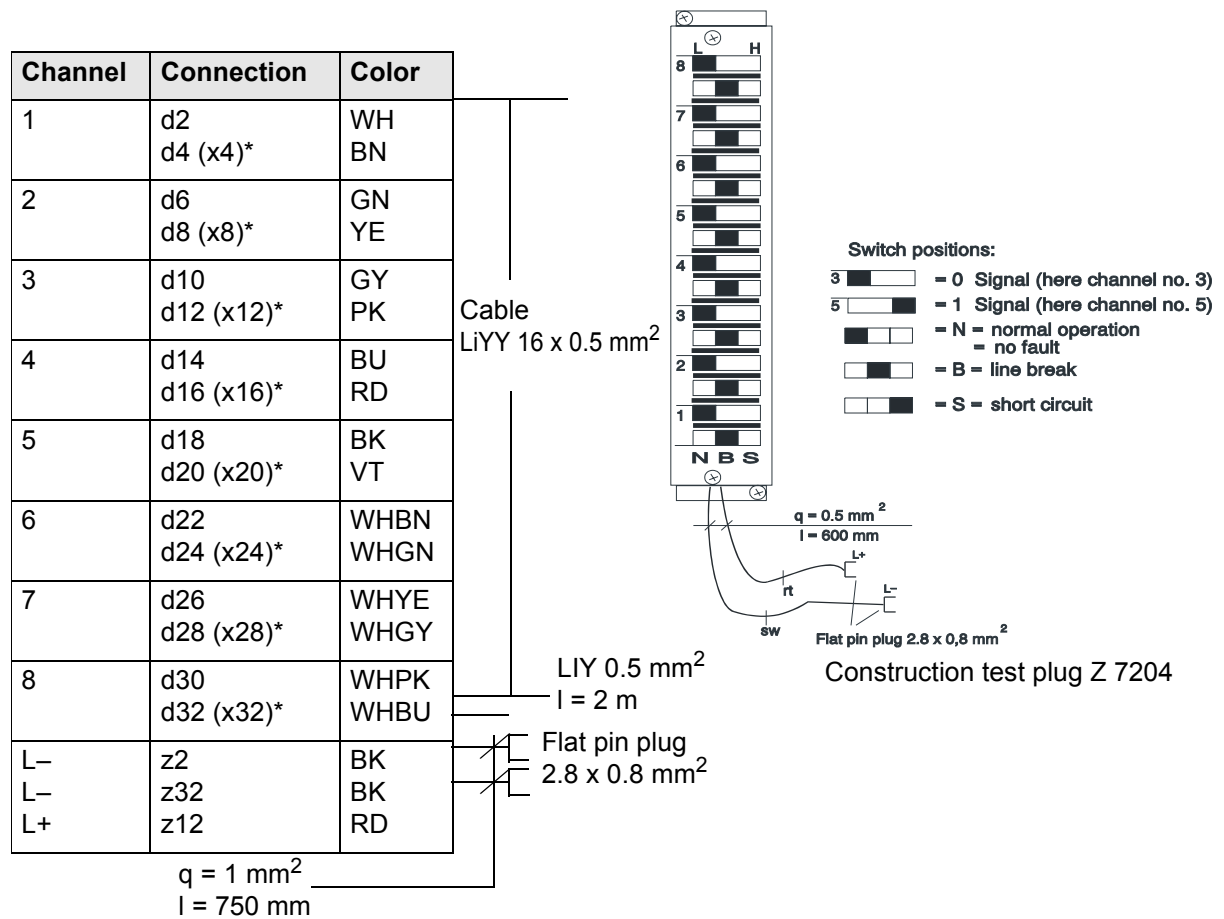


Figure 2: Lead marking cable plug Z 7108 / 3237 / .. and construction test plug Z 7204

* The connections (X4) to (X32) are only used at special cable connectors.

Redundant connection for a safety-related proximity switch

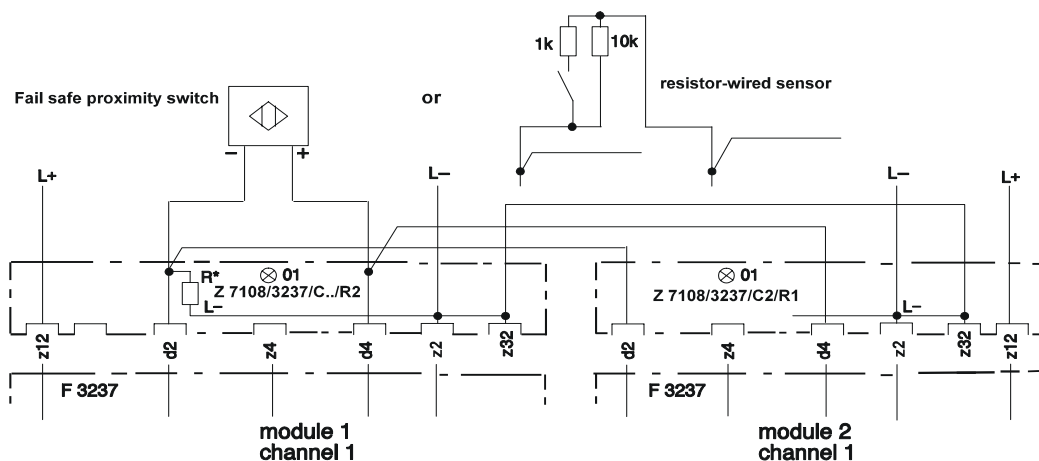
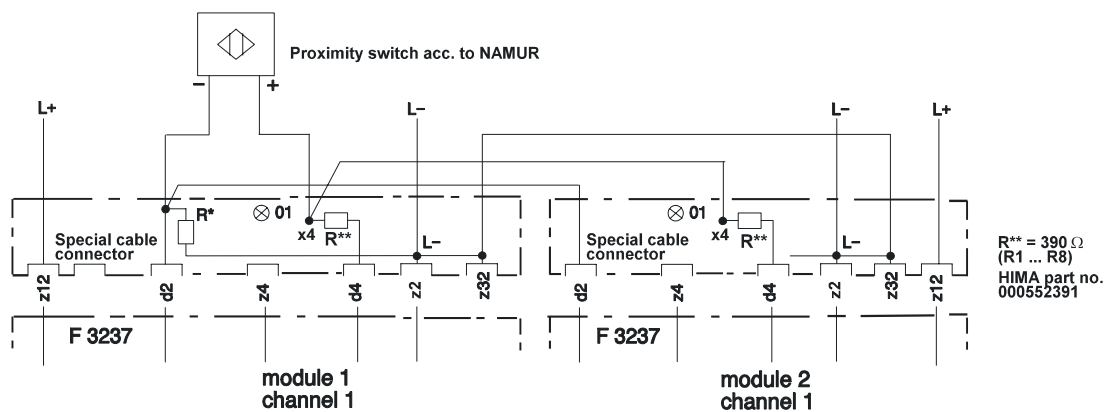


Figure 3: Redundant connection for a safety-related proximity switch

Cable plug: Z7108 / 3237 / C.. / R
HIMA order no.: 93 3237 300

Connection for proximity switches NAMUR (according to EN 60947-5-6: 2000)



R** is also necessary in mono applications!

Figure 4: Redundant connection for one proximity switch NAMUR
(according to EN 60947-5-6: 2000)

Special cable plug: Z7108 / 3237 / C.. / S102 (mono connection)
HIMA order no.: 93 3237102

At redundant connection of proximity switches NAMUR (according to EN 60947-5-6) the following redundant special cable plug must be used:

Z7108 / 3237 / W / R1 / S209 with resistors R1...R8=390 Ω for NAMUR proximity switches

Z7108 / 3237 / Cx / R2 / S209

HIMA order no.: 93 3237 209

Between the plug R2 and R1 (see Figure 4) the connections are configured as single cores.

Note	If using the special cable plug for Namur proximity switches in the safety loop (module - proximity switch) the SIL level may be reduced to that of the proximity switch.

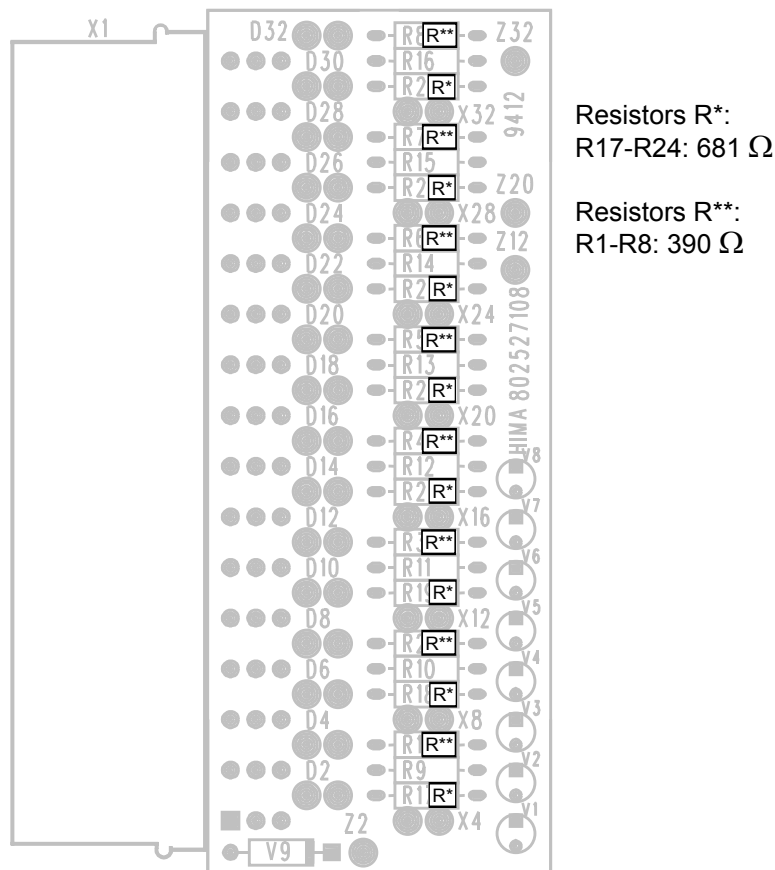
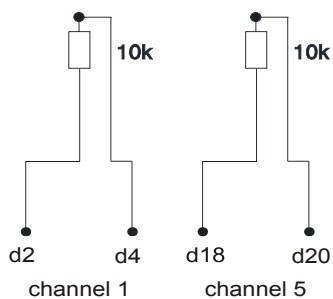


Figure 5: Cable connector Z 7108 (special design for NAMUR)

Termination of not used inputs

Note

Not used inputs, which are connected in the HIMA function block HB-RTE-3, must be terminated with a 10 k Ω resistor at the input of the module. Thereby line error messages of the not used input channels are eliminated (see following scheme).



Example:

Channel 1 and channel 5 are not used.

Termination of channel 1 (connections d2-d4) and channel 5 (connections d18-d20) each with 10 k Ω .

Figure 6: Resistor circuit for the inputs



F 3238: 8-channel input module (Ex)i

safety-related, TÜV certified according to IEC 61508 for applications up to SIL 3

- for the connection of safety-related proximity switches (P+F), proximity switches according to EN 60947-5-6 (NAMUR) and contacts with resistor network
- for intrinsically safe circuits (Ex)i, with sensor supply, with safe isolation
- monitoring of the lines for short circuit and line break

EC-Type Examination certificate: PTB 03 ATEX 2031

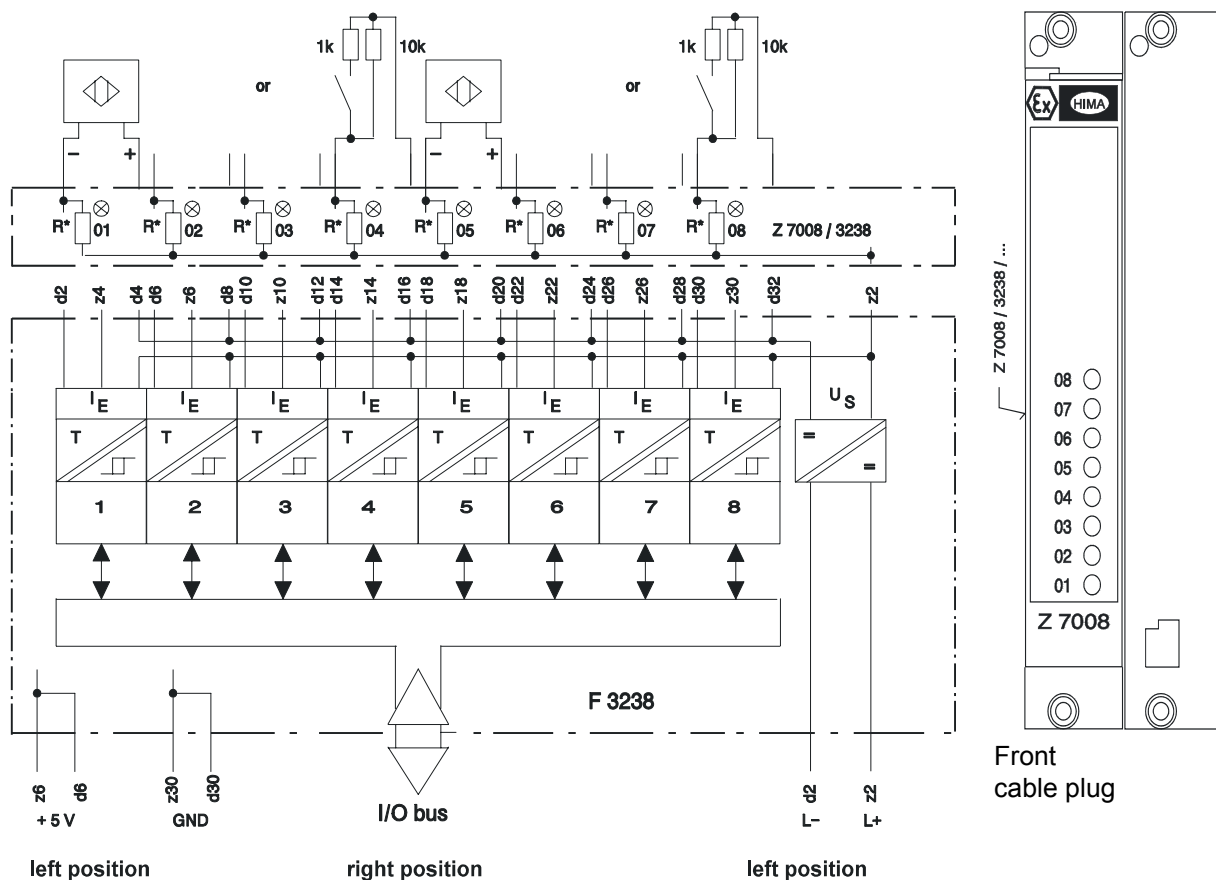


Figure 1: Block diagram and front cable plug

Appertaining function block: HB-RTE-3

Switching time	approx. 10 ms
Switching threshold I_E	0-signal: $0.35 \leq I_E \leq 1.2$ mA 1-signal: $2.1 \leq I_E \leq 6.0$ mA
Wire break	≤ 0.28 mA
Short circuit	≥ 6.5 mA
Line impedance	$\leq 50 \Omega$ (acc. EN 60947-5-6: 2000)
Line length	≤ 1000 m ($\varnothing = 0.5$ mm ²)
Supply voltage U_S	approx. 8.2 V
Shunt R^*	681 Ω
Space requirement	8 SU
Operating data	5 VDC, 150 mA 24 VDC, 100 mA

The module is tested completely during operation.
The main test routines are:

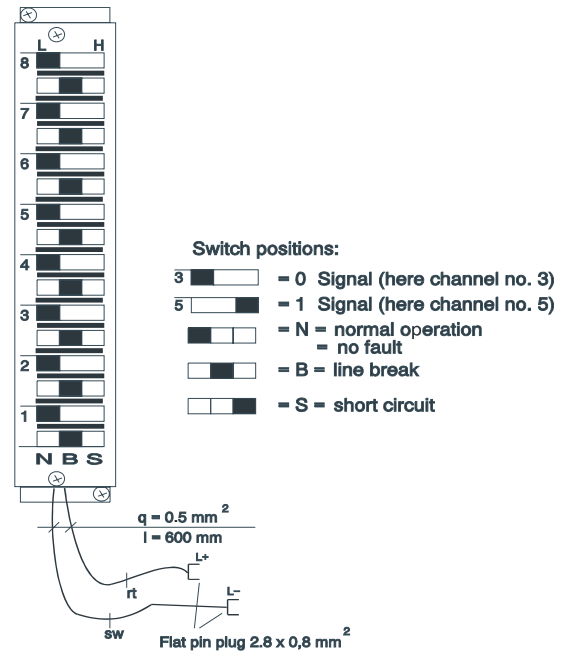
- Switch-on and switch-off capability
- Crosstalk on the input circuits by walking-zero
- Functions of the input filters
- Correct function of the module
- Short circuit and wire break of the sensor line

The LEDs are not tested.

Channel	Connection	Color
1	d2 d4 (x4)*	WH BN
2	d6 d8 (x8)*	GN YE
3	d10 d12 (x12)*	GY PK
4	d14 d16 (x16)*	BU RD
5	d18 d20 (x20)*	BK VT
6	d22 d24 (x24)*	WHBN WHGN
7	d26 d28 (x28)*	WHYE WHGY
8	d30 d32 (x32)*	WHPK WHBU

Cable
LiYY
16 x 0.5 mm²

Lead marking cable plug
Z 7008 / 3238 / C.. gray or
Z 7008 / 3238 / ExC.. blue



Assembly cable plug Z 7204

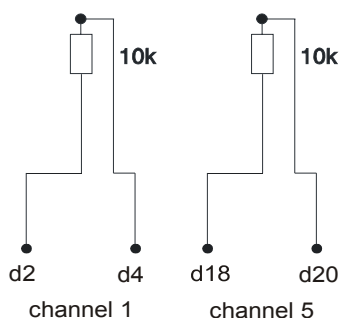
Figure 2: Connection wiring

* The connections (X4) to (X32) are only used at special cable connectors.

Termination of not used inputs

Note

Not used inputs, which are connected in the HIMA function block HB-RTE-3, must be terminated with a 10 kΩ resistor at the input of the module. Thereby line error messages of the not used input channels are eliminated (see following scheme).



Example:

Channel 1 and channel 5 are not used.

Termination of channel 1 (connections d2-d4) and channel 5 (connections d18-d20) each with 10 kΩ.

Figure 3: Resistor circuit for the inputs

1 Operating Instructions

1.1 Application

The module is used to evaluate proximity switches (according to NAMUR) or contacts with resistor network, in intrinsically safe circuits (Ex)i.

The proximity switches or contacts can be installed in hazardous areas from Zone 0 on, if certified.



The input channels must **not** be exposed to external voltage.

Modules, which were operated in general electrical systems, must **not** be used in (Ex)i-applications thereafter.

In addition, only the applications described in this data sheet are admissible.

1.2 Electrical specifications concerning intrinsic safety

For these specifications please refer to the EC-Type-Examination certificate enclosed.

1.3 Assembly

The module must not be mounted in hazardous areas.

The module is mounted in a 19" subrack. It must be plugged in vertically. The design of the subrack must allow heat dissipation.

The module is connected to the intrinsically safe field circuits via the cable plug Z 7008.

1.4 System start-up

Prior to the first system start-up, an Ex-expert has to check the correct installation of the system, especially the supply voltage connections and the connections for the intrinsically safe circuits.

1.5 Notes on project engineering

Appertaining software function block: HB-RTE-3 (for latest version refer to the description of the operating system).

Module in Surface Mounted Device (SMD) technology (AS03) usable with BS41q/51q V7.0-7 or newer.

Note for use in (Ex)i circuits: No restrictions about type of module adjacent to F 3238.

Redundant connection for a safety-related proximity switch

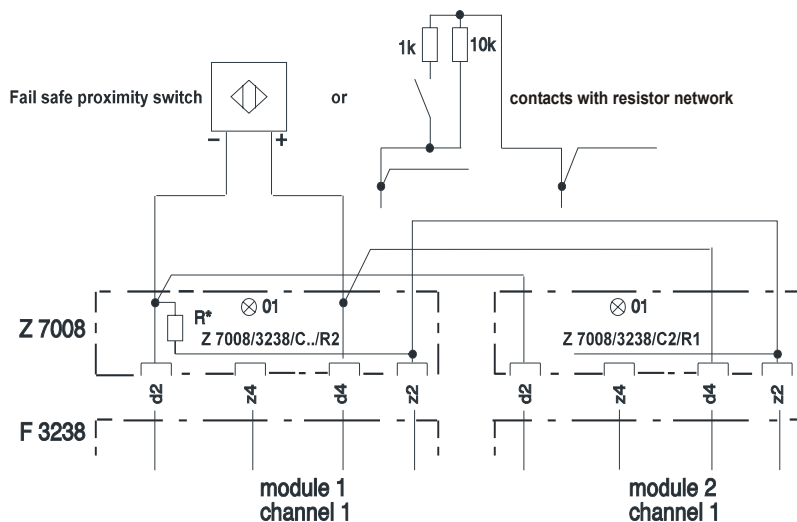
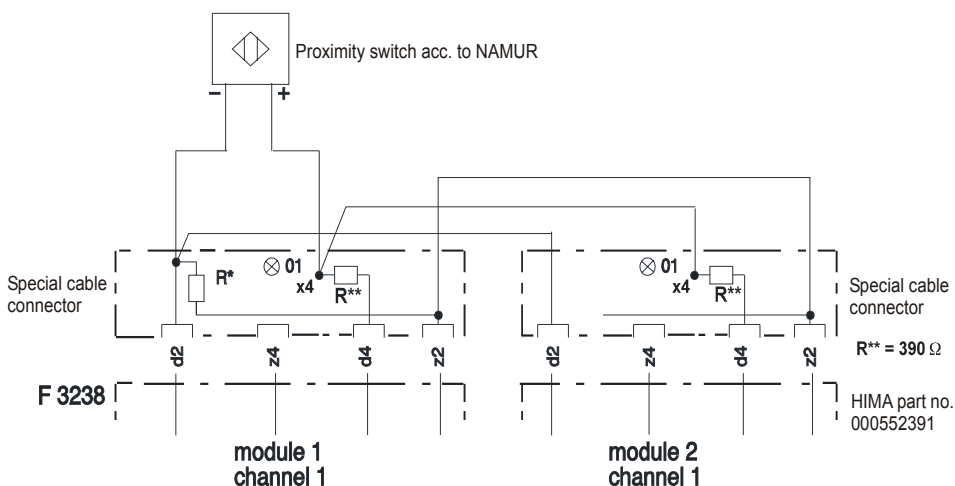


Figure 4: Redundant connection for a safety-related proximity switch

Cable plug: Z7008 / 3238 / Ex / C.. / R
HIMA order no.: 93 3238 300

Connection for proximity switches NAMUR (according to EN 60947-5-6: 2000)



R** is also necessary in mono applications!

Figure 5: Redundant connection for a proximity switch NAMUR
(according to EN 60947-5-6: 2000)

Special cable plug: Z7008 / 3238 / Ex / C../ S101 (mono connection)
HIMA order no.: 93 3238 101

At redundant connection of proximity switches NAMUR (according to EN 60947-5-6) the following redundant special cable plug must be used:

Z7008 / 3238 / Ex / W / R1 / S301 with resistors R1..R8=390 Ω for NAMUR proximity switches
Z7008 / 3238 / Ex / Cx / R2 / S301
HIMA order no.: 93 3238 301

Between the plug R2 and R1 (see Figure 4) the connections are configured as single cores.

Note

If using the special cable plug for Namur proximity switches in the safety loop (module - proximity switch) the SIL level may be reduced to that of the proximity switch.

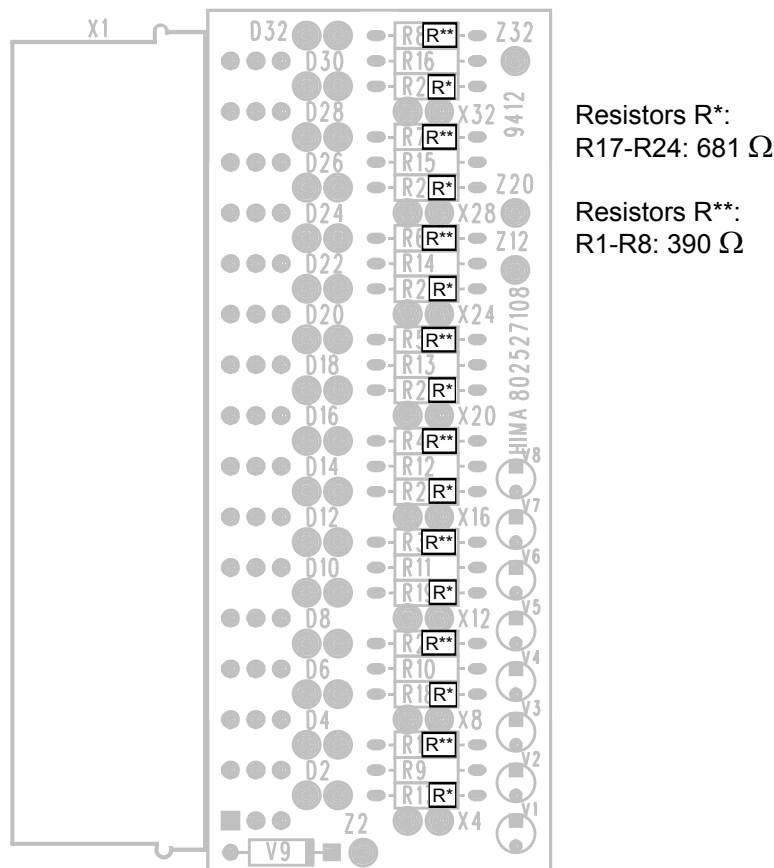


Figure 6: Cable connector Z 7008 (special design for NAMUR)

1.6 Installation

- The electronic module including its connections has to be installed in a way that at least the system of protection IP 20 according to EN 60529: 1991 + A1: 2000 is achieved.
- If two intrinsically safe input circuits of two F 3238 modules are wired in parallel, a special cable provided by HIMA, must be used.
- The separation between intrinsically safe and not intrinsically safe terminals must be ≥ 50 mm, especially between adjacent modules.
- The separation between adjacent intrinsically safe terminals must be ≥ 6 mm.
- Intrinsically safe and not intrinsically safe lines must be installed separately, or the intrinsically safe lines must be provided with additional insulation.
- Intrinsically safe lines must be identifiable, e.g. by a light blue color (RAL 5015) of the insulation.
- The wiring has to be secured mechanically in a way which ensures that in the event of an accidental disconnection, the distance (EN 50 020/ Part 7, Table 4) between the intrinsically safe and not intrinsically safe connections does not fall below the required minimum (e.g. by bundling).

The cables/ wires used must comply with the following dielectric withstand test:

- Intrinsically safe lines ≥ 1000 VAC
- Not intrinsically safe lines ≥ 1500 VAC

For stranded wires, suitable measures must be applied to prevent spreading at the end of wire. The terminals must be suitable for clamping the wire cross section.

The applicable regulations and standards have to be complied with, especially:

- EN 50014: 1997 + Corrigendum: 1998 + A1: 1999 + A2: 1999
(VDE 0170/0171, Part 1: 2000, DIN EN 50014: 2000-02)
- EN 50020: 1994
(VDE 0170/0171, Part 7: 1996, DIN EN 50020: 1996-04)
- EN 50039: 1980
(VDE 0170/0171, Part 10: 1982, DIN EN 50039: 1982-04)
- EN 60079-14: 1997
(VDE 0165 Part 1, DIN EN 60079-14: 1998-08)
- EN 60947-5-6: 2000
(VDE 0660 Part 212, DIN EN 60947-5-6: 2000-12)

Note

For further information on assembly and installation see the HIMA catalog "The H41q and H51q System Families".

1.7 Maintenance

In case of a failure, the defective module must be replaced with the same, or with another approved type.



Any repair work must only be carried out by the manufacturer.

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin



(1) EC-TYPE-EXAMINATION CERTIFICATE (Translation)

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-type-examination Certificate Number:

PTB 03 ATEX 2031



(4) Equipment: Electronic assembly, type F 3238

(5) Manufacturer: HIMA Paul Hildebrandt GmbH + Co KG

(6) Address: 68782 Brühl bei Mannheim, Germany

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 03-22333.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014:1997 + A1 + A2

EN 50020:1994

EN 50039:1982

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment shall include the following:

II (1) G D [EEx ia] IIC

Zertifizierungsstelle Explosionsschutz
By order:

Braunschweig, June 30, 2003

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor



sheet 1/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

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Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin



SCHEDULE

(13)

(14) **EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2031**

(15) Description of equipment

The electronic assembly, type F 3238 is used for the transmission of signals from up to 8 intrinsically safe input circuits to non-intrinsically safe output circuits. It includes a plug connector with built-in limiting facilities and it is intended for installation in combination with a rack-bound system. For redundant signal detection a combination of two interconnected plug connectors is used with a limitation of the output parameters as such, that two apparatus may be operated in parallel without change of the electrical data given below.

The maximum permissible range of the ambient temperature is $-20\text{ }^{\circ}\text{C}$ up to $+60\text{ }^{\circ}\text{C}$.

Electrical data

Supply circuit 1

$U_n \leq 30\text{ V DC}$, approx. 2.5 W
Maximum voltage $U_m = 40\text{ V}$

Supply circuit 2
and output circuits

$U_n \leq 6\text{ V DC}$, approx. 1 W
Maximum voltage $U_m = 7\text{ V}$

Control circuits

type of protection EEx ia IIB/IIC,
for connection to passive intrinsically safe circuits

Maximum values per circuit:

$U_o = 10\text{ V}$
 $I_o = 15\text{ mA}$
 $P_o = 38\text{ mW}$

linear characteristic

for the maximum permissible values of the external inductance L_o and capacitance C_o reference is made to the table below:

	IIB	IIC
$C_o\text{ }[\mu\text{F}]$	4.0	0.76
$L_o\text{ }[\text{mH}]$	5.0	5.0

sheet 2/3

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Physikalisch-Technische Bundesanstalt



Braunschweig und Berlin

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2031

The following values apply if capacitances or inductances or lines occur exclusively in the circuit:

	IIB	IIC
C_o [μ F]	20.2	3.0
L_o [mH]	560	155

The control circuits are interconnected through a common reference conductor and they are safely electrically isolated from all non-intrinsically safe circuits up to a peak value of the voltage of 375 V. The control circuits are safely electrically isolated from ground.

(16) Test report PTB Ex 03-22333

(17) Special conditions for safe use

not required

(18) Essential health and safety requirements

met by compliance with the standards mentioned above

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor



Braunschweig, June 30, 2003

sheet 3/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

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F 3240: 16-channel input module

safety-related, applicable up to SIL 3 according to IEC 61508

- for digital signals or sensors with input voltage 110 VDC, 127 VAC (one-phase)
- with safety isolation

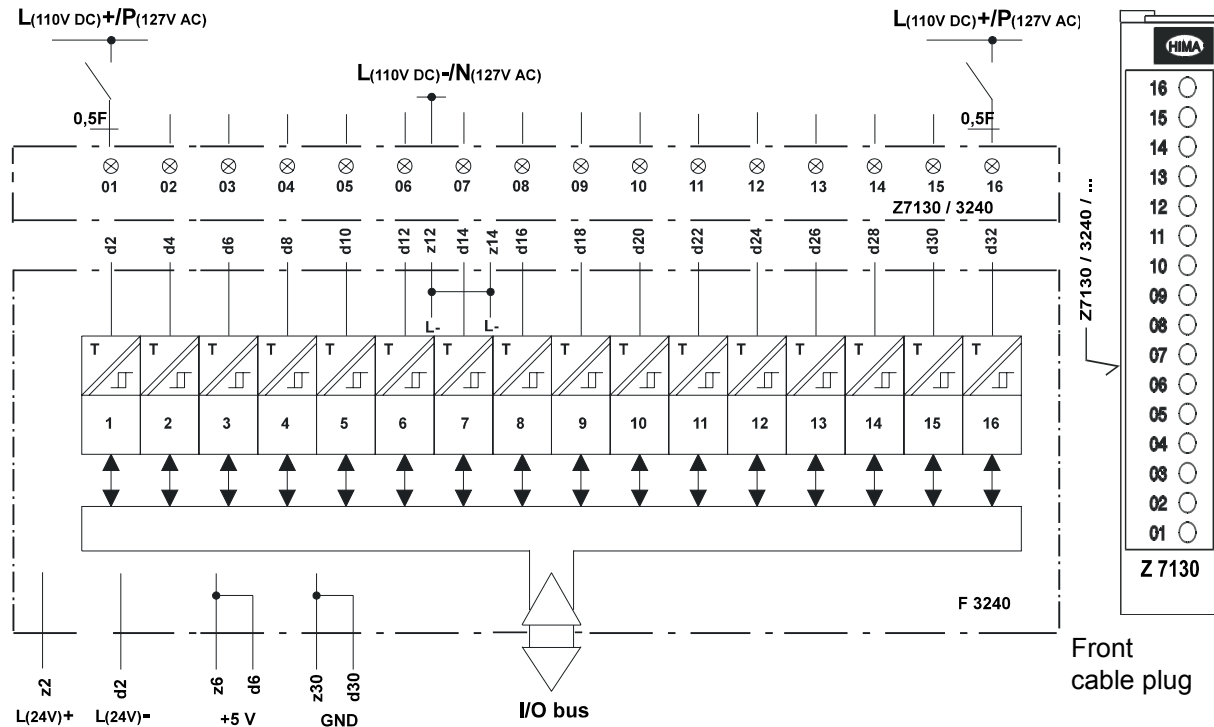


Figure 1: Block diagram and front cable plug

The module is automatically fully tested during operation for safety-related errors. The essential test procedures are:

- Cross-talking of the inputs by walking-zero
- Function of the filter capacitors
- Function of the module

The LEDs of the cable plug are not tested.

Inputs

Input current

Switching voltage

Switching time

Space requirement

Operating data

digital signals or mechanical contacts

input voltage 110 VDC, 127 VAC ($\pm 20\%$)

< 1 mA

approx. 45 V

approx. 50 ms

4 SU

5 VDC / 100 mA

24 VDC / 120 mA

Channel	Connection	Color		
1	d2	WH	Cable LiYY 20 x 0.25 mm ²	
2	d4	BN		
3	d6	GN		
4	d8	YE		
5	d10	GY		
6	d12	PK		
7	d14	BU		
8	d16	RD		
9	d18	BK		
10	d20	VT		
11	d22	WHBN		
12	d24	WHGN		
13	d26	WHYE		
14	d28	WHGY		
15	d30	WHPK		
16	d32	WHBU		
L- (110 V) N (127 V)	z12	WHRD		

Figure 2: Lead marking of the cable plug Z 7130 / 3240 / C..



F 3248: 16-channel input module

safety-related, applicable up to SIL 3 according to IEC 61508

- for digital signals or sensors with input voltage 48 VDC, 48 VAC
- with safety isolation

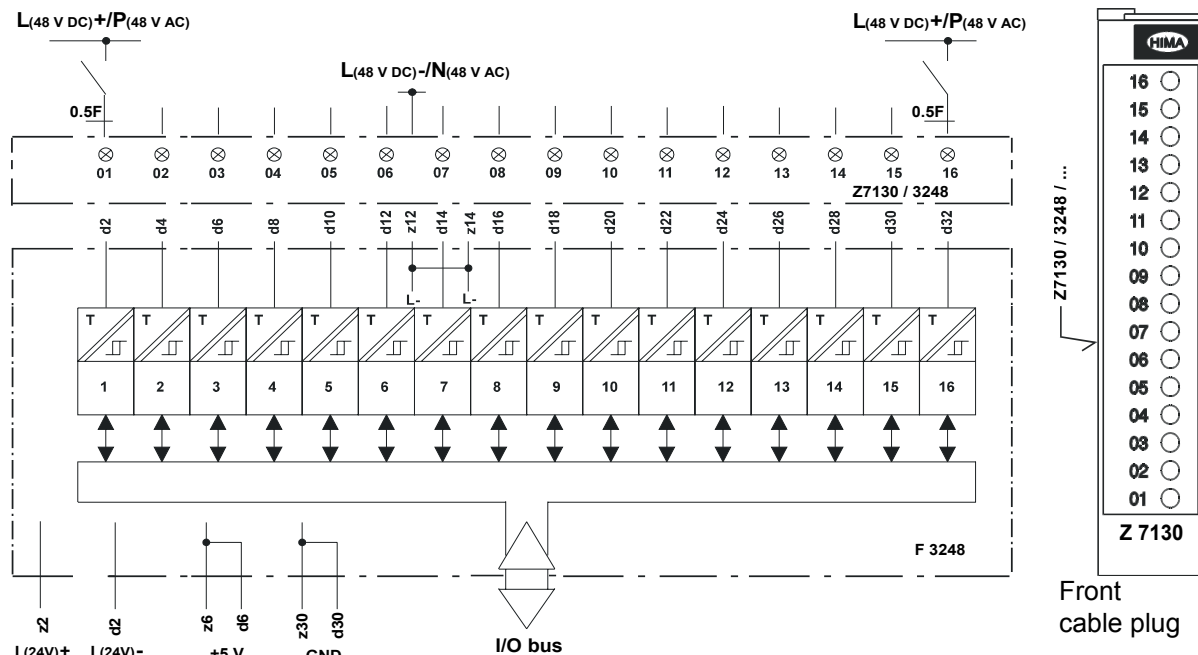


Figure 1: Block diagram and front cable plug

The module is automatically fully tested during operation for safety-related errors. The essential test procedures are:

- Cross-talking of the inputs by walking-zero
- Function of the filter capacitors
- Function of the module

The LEDs of the cable plug are not tested.

Inputs	digital signals or mechanical contacts
Input current	input voltage $\leq 48\text{ VDC}$, $\leq 48\text{ VAC}$ ($\pm 20\%$)
Operating point	$< 2\text{ mA}$
Switching time	typ. 19 VDC, 29 VAC
Space requirement	typ. 50 ms
Operating data	4 SU
	5 VDC / 100 mA
	24 VDC / 120 mA

Channel	Connection	Color	
1	d2	WH	Cable LiYY 20 x 0.25 mm ²
2	d4	BN	
3	d6	GN	
4	d8	YE	
5	d10	GY	
6	d12	PK	
7	d14	BU	
8	d16	RD	
9	d18	BK	
10	d20	VT	
11	d22	WHBN	
12	d24	WHGN	
13	d26	WHYE	
14	d28	WHGY	
15	d30	WHPK	
16	d32	WHBU	
L (48 VDC) N (48 VAC)	z12	WHRD	

Figure 2: Lead marking of the cable plug Z 7130 / 3248 / C..



F 3322: 16-channel output module

- resistive or inductive load up to 500 mA (12 W), lamp connection up to 12 W
- with safe isolation
- no output signal at break of the L- supply

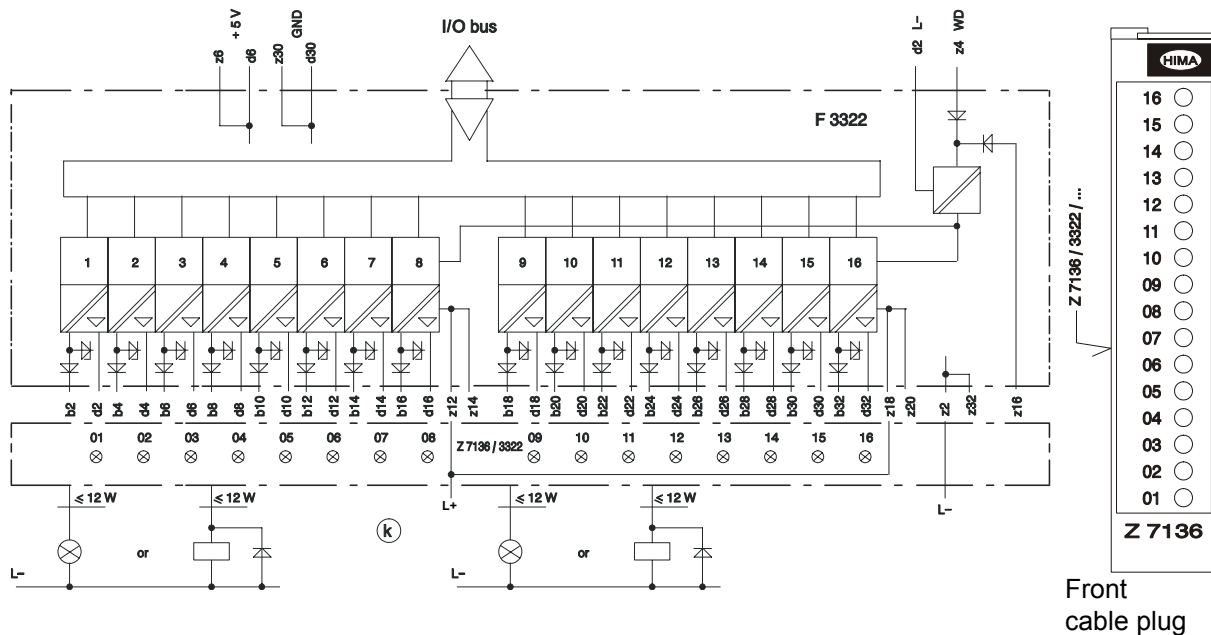


Figure 1: Block diagram and front cable plug

Planning note

Only max. 10 output modules with nominal load may be used in one I/O subrack, and not more than half of the possible output loads of $16 \times 0.5 \text{ A}$ ($= 8 \text{ A}$) may be switched on at the same time. The standard fusing of the modules in the I/O subrack is 4 A slow blow.

Outputs	500 mA, (k) short-circuit proof
Response value for current limiter	> 550 mA
Space requirements	4 SU
Operating data	5 VDC / 110 mA
	24 VDC / 150 mA plus load

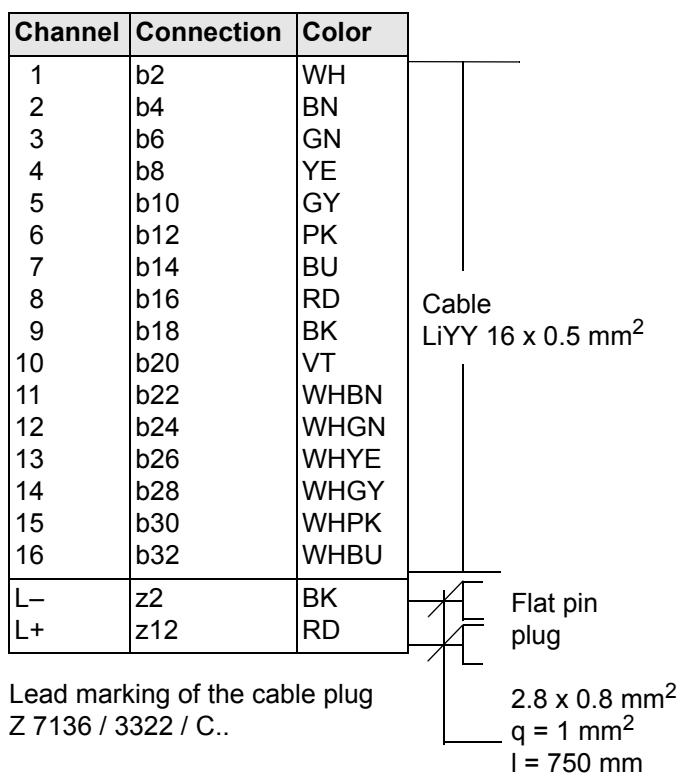


Figure 2: Lead marking of the cable plug Z 7136 / 3322 / C..

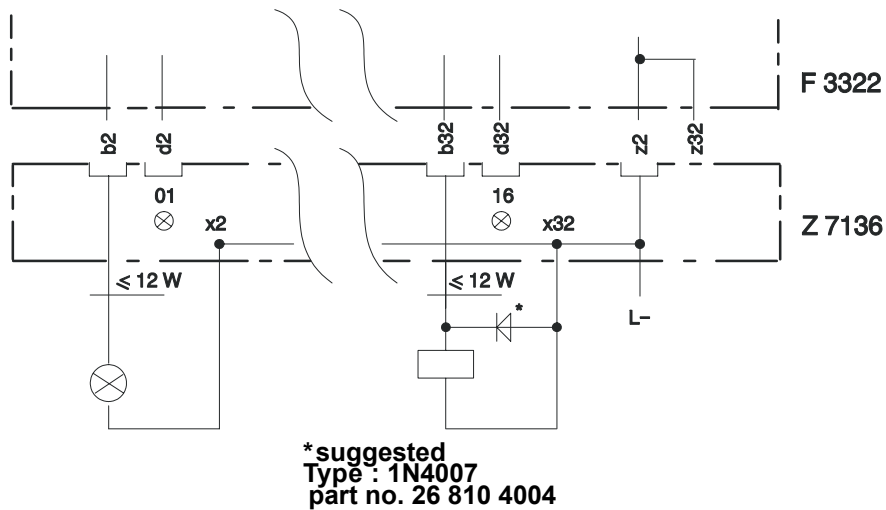


Figure 3: 2-pole connection

Channel	Connection	Color	
1	b2	WHRD	Cable LiYY 32 x 0.38 mm ²
	x2	WH	
2	b4	WHBK	
	x4	BN	
3	b6	BNGN	
	x6	GN	
4	b8	BNYE	
	x8	YE	
5	b10	BNGY	
	x10	GY	
6	b12	BNPK	
	x12	PK	
7	b14	BNBU	
	x14	BU	
8	b16	BNRD	
	x16	RD	
9	b18	BNBK	Flat pin plug 2.8 x 0.8 mm ²
	x18	BK	
10	b20	GNGY	
	x20	VT	
11	b22	GNPK	
	x22	WHBN	
12	b24	GNBU	
	x24	WHGN	
13	b26	GNRD	q = 1 mm ² l = 750 mm
	x26	WHYE	
14	b28	GNBK	
	x28	WHGY	
15	b30	YEGY	
	x30	WHPK	
16	b32	YEPK	
	x32	WHBU	
L-	z2	BK	Flat pin plug 2.8 x 0.8 mm ²
L+	z12	RD	

Lead marking of the cable plug
Z 7136 / 3322 / C.. / P2
2-pole connection

**Figure 4: Lead marking of the
cable plug Z 7136 / 3322 / C.. / P2 2-pole connection**



F 3325: 6-channel supply unit (Ex)i

- Supply unit, preferably used for the F 6221 module
 - Supply of transmitters 0/4...20 mA
- EC Type Examination Certificate (ATEX): EX5 02 04 19183 035

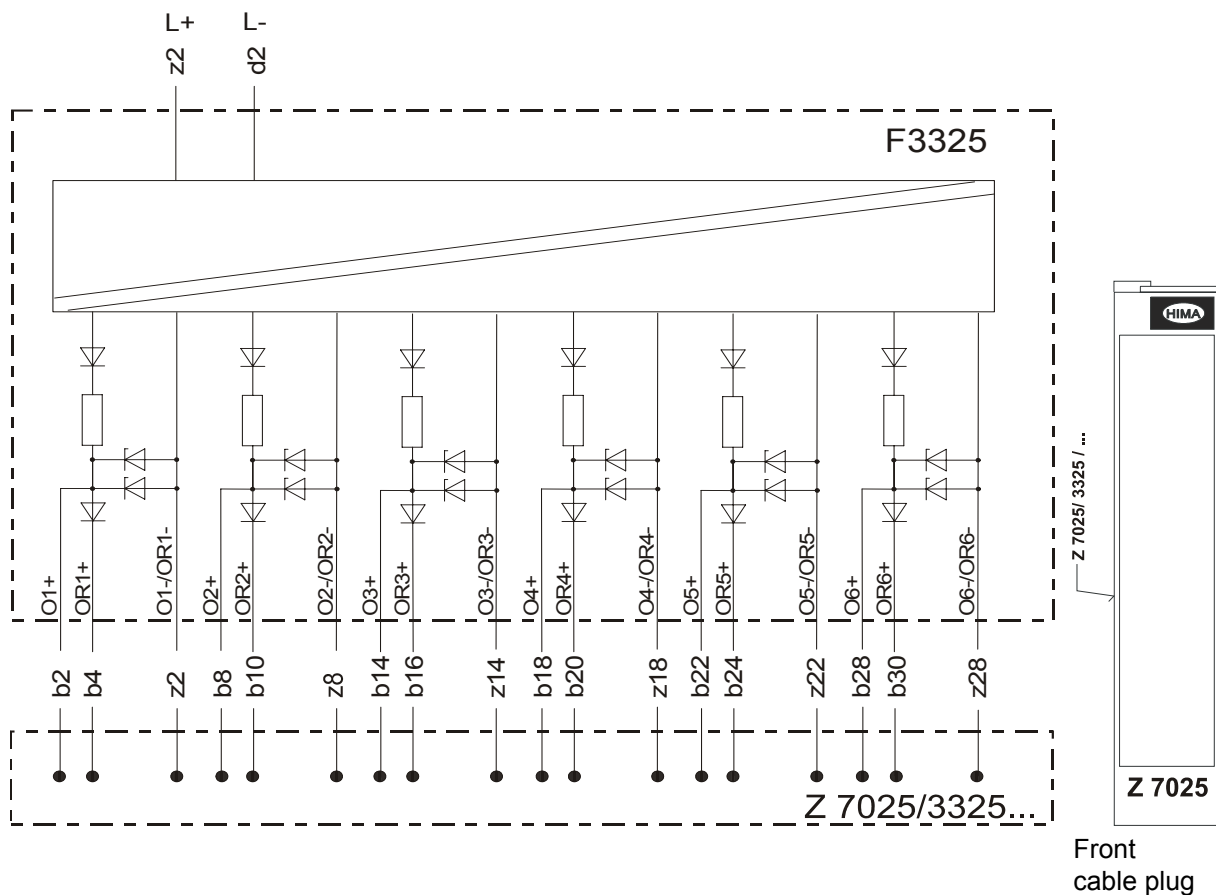


Figure 1: Block diagram and front cable plug

Nominal voltage	19 V at 20 mA load current
No-load voltage	22 V
Short-circuit current	60 mA
Maximum burden	250 Ω
Ex category	II (2) GD [Ex ib] IIC
Space requirements	4 SU
Operating data	24 V / 300 mA



The module must only be operated with forced ventilation (fan). The fan (K 9203) must be installed above the subrack where the F 3325 module is plugged in. If the F 3325 module is operated in an H 41q, the fan (K 9212) must be installed directly under the F 3325 module. The pins d6, d26, b6, b26 on the front plug of the F 3325 are omitted (coding pins on d6, d26, b6, b26).

Interconnection with the F 6221 module

The F 3325 module can be interconnected with the F 6221 module in several different ways (see data sheet of the module F 6221 for interconnection).

Single-channel interconnection of the supply module F 3325

6-channel supply module F 3325 with passive transmitter (e.g. for the channels 1 to 6 of the F 6221 module).

Cable type: Z 7025/3325/ExCn, part number 93 3325101

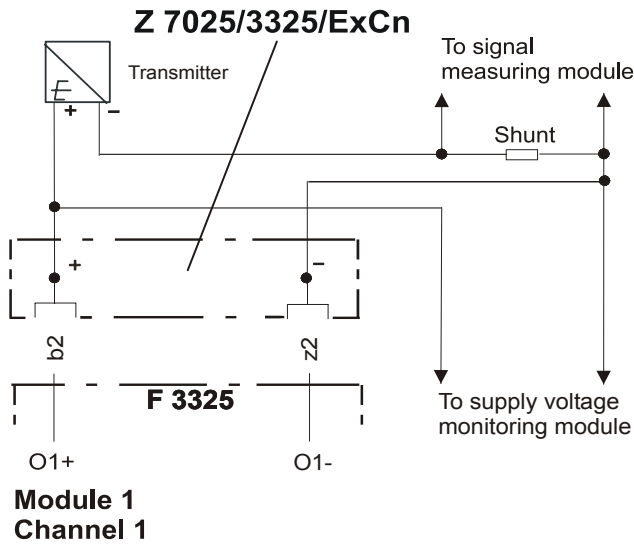


Figure 2: Single-channel interconnection of the supply module F 3325

Pin allocation

Cable type: Z 7025/3325/ExCn, part number 93 3325101

Channel	Pin	Color
O1-	z2	WH
O1+	b2	BN
O2-	z8	GN
O2+	b8	YE
O3-	z14	GY
O3+	b14	PK
O4-	z18	BU
O4+	b18	RD
O5-	z22	BK
O5+	b22	VT
O6-	z28	GY-PK
O6+	b28	RD-BU
Cable shield		YEGN

Cable
LiYCY
6x2 0.2 mm²
shielded

Figure 3: Pin allocation Z 7025/3325/ExCn, part number 93 3325101

Pin allocation

Cable type: Z 7025/3325/ExCn/R, part number 93 3325102

Channel	Pin	Color	Cable LifYCY 12x2 0.2 mm ² shielded
O1-	z2	WH	
O1+	b2	BN	
OR1-	z2	GN	
OR1+	b4	YE	
O2-	z8	GY	
O2+	b8	PK	
OR2-	z8	BU	
OR2+	b10	RD	
O3-	z14	BK	
O3+	b14	VT	
OR3-	z14	GY-PK	
OR3+	b16	RD-BU	
O4-	z18	WH-GN	
O4+	b18	BN-GN	
OR4-	z18	WH-YE	
OR4+	b20	YE-BN	
O5-	z22	WH-GY	
O5+	b22	GY-BN	
OR5-	z22	WH-PK	
OR5+	b24	PK-BN	
O6-	z28	WH-BU	
O6+	b28	BN-BU	
OR6-	z28	WH-RD	
OR6+	b30	BN-RD	
Cable shield		YEGN	

Figure 4: Pin allocation Z 7025/3325/ExCn/R, part number 93 3325102

Note

In Ex applications the cable shield has to be connected to the equipotential bonding. In non-Ex applications the cable shield is connected to the PE terminal / bus bar on the subrack.

1 Operating Instructions

1.1 Application

The module can be used to supply Ex measuring transmitters (0/4 to 20 mA). These transmitters can be installed in potentially explosive atmospheres from zone 1 on.

The cable shield for Ex applications has to be put to potential equalization. In non Ex applications the cable shield is connected to PE bar on the subrack.



No external voltage must be applied at the inputs.

Only these applications are permissible, which are described in the data sheets for F 3325 and F 6221.

1.2 Electrical specifications concerning intrinsic safety

For these specifications please refer to the EC Type Examination Certificate enclosed.

1.3 Assembly and installation

The module is mounted in a 19" subrack. It must be plugged in vertically. The design of the subrack must allow heat dissipation.

Further information for assembly and installation see HIMA main catalog "The H41q and H51q System Families".

Note

The module may not be mounted within a potentially explosive area.

The module is connected to the intrinsically safe field circuits via the cable plug Z 7025.

In addition, the following points should be considered:

- The electronic module including its connections has to be installed in a way that at least the degree of protection IP 20 according to EN 60529: 1991 + A1: 2000 is achieved.
- The separation between intrinsically safe and not intrinsically safe terminals must be ≥ 50 mm (filament dimension), especially between adjacent modules.
- The separation between adjacent intrinsically safe terminals must be ≥ 6 mm (filament dimension).
- Intrinsically safe and not intrinsically safe lines must be installed separately, or the intrinsically safe lines must be provided with additional insulation.
- Intrinsically safe lines must be identifiable, e.g. by the light blue color (RAL 5015) of the insulation.
- The wiring has to be secured mechanically in a way which ensures that in the event of an accidental disconnection, the distance (EN 50 020/ Part 7, Table 4) between the intrinsically safe and not intrinsically safe connections does not fall below the required minimum. (e.g. by bundling).
- The line shield has to be connected to equipotential bonding.
- Modules, which were operated in general electrical system, may not be used thereafter no more in Ex-plants.

The lines used must comply with the following insulation test voltages:

- Intrinsically safe lines ≥ 1000 VAC
- Not intrinsically safe lines ≥ 1500 VAC

Stranded wires must be provided with wire end ferrules. The terminals must be suitable for clamping the wire cross section.

The applicable regulations and standards have to be complied with, especially

- DIN EN 60079-14:1997 (VDE 0165, Part 1: 1998)
- EN 50 014: 1999 (VDE 0170/0171 Part 1 :2000)
- EN 50 020: 1994 (VDE 0170/0171 Part 7 :1996)

1.4 System start-up

Before the first system start-up, an Ex-expert has to check whether the system has been correctly installed, especially the supply voltage connections and the connections of the intrinsically safe circuits.

1.5 Maintenance

In case of a failure, the defective module must be replaced with the same or with another approved type.



Any repair work must only be carried out by the manufacturer!

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ CERTIFICADO ◆ CERTIFICAT

EC Type Examination Certificate

No.: EX5 02 04 19183 35



in accordance with Annex III of Council Directive No. 94/9/EC for equipment and protective systems intended for use in potentially explosive atmospheres (ATEX) for

HIMA Paul Hildebrandt GmbH + Co KG
Albert-Bassermann-Straße 28

68782 Brühl

Product: Electrical apparatus type of protection intrinsically safety i (EX-RL)

Model: Automation device
F 3325

Parameters: see appendix (four pages)

The above mentioned product meets the provisions of the Directive.

This certificate is issued on the basis of the product provided for testing and certification and on its technical documentation. The detailed results of the test and the provided technical documentation are listed in

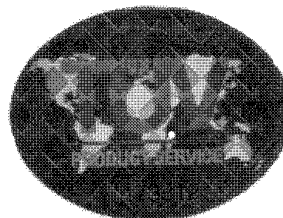
Test report no.: 70013102.2

This certificate pertains only to the sample product submitted to TÜV PRODUCT SERVICE for testing. Therefore this certificate has no specified period of validity.

Released with the above mentioned certificate number by the Certification Body of TÜV PRODUCT SERVICE.

f. Blum

Department: TA-ES/MUC-IQSE / jb
Date: 25.04.2002



TÜV PRODUCT SERVICE GMBH is a Notified Body in accordance with Council Directive 94/9/EC for equipment and protective systems intended for use in potentially explosive atmospheres with the identification number 0123.

TÜV PRODUCT SERVICE GMBH · Zertifizierstelle · Ridlerstrasse 65 · D-80339 München



1 Description

The module F 3325 is a associated electrical apparatus for installation only outside an atmosphere capable of explosion. This subassembly unit for installation in a subrack consist of one PCB-board. In order to supply (Ex-) transmitters six intrinsically safe power supply ports are connectable at the front. The output- and power supply ports are connectable at the rear of the module.

The environmental temperature averages $-20^{\circ}\text{C} \leq T_{\text{amb}} \leq 60^{\circ}\text{C}$.

From the manual of instruction you will see the general information for secure use.

2 Electrical data

2.1 Intrinsically output circuits, strip X200

Six voltages of 22V for the supply of the (Ex-) transmitters are provided. These are intrinsically safe and safety isolated up to a peak value of 375V against the power supply circuit.



Port	Output	Function
z2	O1-	Voltage output 1 -
b2	O1+	Voltage output 1 +
b4	OR1+	Redundant voltage output 1 +
z8	O2-	Voltage output 2 -
b8	O2+	Voltage output 2 +
b10	OR2+	Redundant voltage output 2 +
z14	O3-	Voltage output 3 -
b14	O3+	Voltage output 3 +
b16	OR3+	Redundant voltage output 3 +
z18	O4-	Voltage output 4 -
b18	O4+	Voltage output 4 +
b20	OR4+	Redundant voltage output 4 +
z22	O5-	Voltage output 5 -
b22	O5+	Voltage output 5 +
b24	OR5+	Redundant voltage output 5 +
z28	O6-	Voltage output 6 -
b28	O6+	Voltage output 6 +
b30	OR6+	Redundant voltage output 6 +



2.2 Output circuits

Voltage per output circuit, U_o	crest value DC 23,2 V
Amperage per output circuit, I_o	crest value DC 75,6 mA
Power per output circuit, P_o	crest value 657,7 mW
Characteristic curve	trapeze
Internal capacitance per output circuit, C_i	negligible
Internal inductance per output circuit, L_i	negligible

2.3 EEx ib IIC

Max. connectable inductance for one output circuit	$L_o = 6 \text{ mH}$
Max. connectable capacitance for one output circuit	$C_o = 138 \text{ nF}$
Max. connectable inductance for parallel connection of two output circuits	$L_o = 1,5 \text{ mH}$
Max. connectable capacitance for parallel connection of two output circuits	$C_o = 138 \text{ nF}$

2.4 EEx Ib IIB

Max. connectable inductance for one output circuit	$L_o = 25 \text{ mH}$
Max. connectable capacitance for one output circuit	$C_o = 1,01 \text{ }\mu\text{F}$
Max. connectable inductance for parallel connection of two output circuits	$L_o = 7 \text{ mH}$
Max. connectable inductance for parallel connection of two output circuits	$C_o = 1,01 \text{ }\mu\text{F}$



2.5 Power supply circuit, strip X1, port z2/d2 (non-intrinsically safe)

Nominal voltage	DC 24 V
Voltage	crest value DC 30 V
Power	6 W
Absolute maximum voltage without affecting the intrinsic safety U_m	crest value 40V

3 Identifying marking

The legible and durable marking must include the following option list:

- Name and address of the manufacturer
- Year of construction
- the identifier EEx Ib IIC

4 Production quality assurance

The manufacturer shall operate an approved quality system for production, final equipment inspection and testing according Annex IV directive 94/9/EC.

Munich, April 25th 2002

TÜV AUTOMOTIVE GmbH TA-ESMUC

Dipl.-Ing. J. Blum



F 3330: 8-channel output module

safety-related, applicable up to SIL 3 according to IEC 61508

- resistive or inductive load up to 500 mA (12 W)
- lamp load up to 4 W
- with integrated safety shutdown, with safe isolation
- no output signal with break of the L- supply

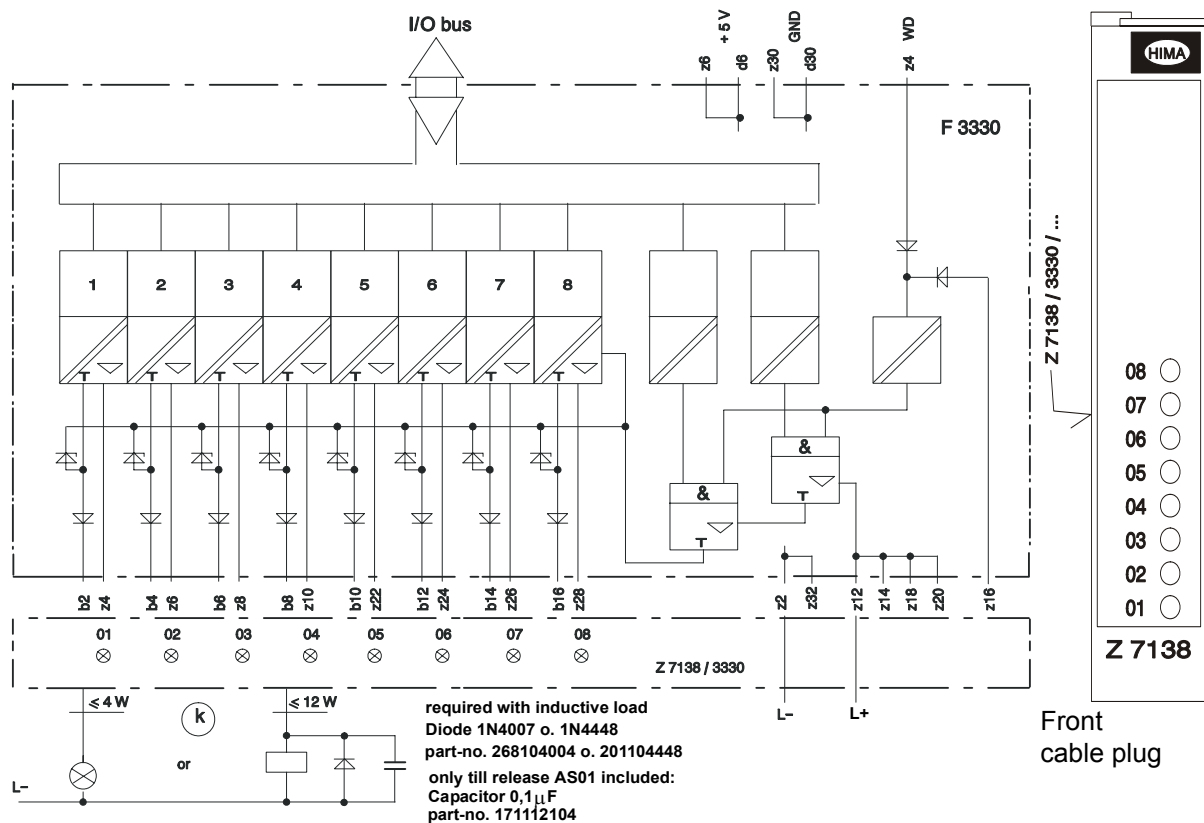


Figure 1: Block diagram and front cable plug

The module is automatically tested during operation. The main test routines are:

- Reading back of the output signals. The operating point of the 0-signal read back is ≤ 6.5 V. Up to this value the level of the 0-signal may arise in case of a fault and this will not be detected
- Switching capability of test signal and cross-talking (walking-bit test).

Outputs	500 mA, (k) short-circuit-proof
Internal voltage drop	max. 2 V at 500 mA load
Admissible line resistance (in + out)	max. 11 Ω
Undervoltage tripping	at ≤ 16 V
Operating point f. short-circuit current	0.75...1.5 A
Outp. leakage current	max. 350 μ A
Output voltage if output is reset	max. 1.5 V
Current input WD	max. 30 mA
Monitored switching time	max. 200 μ s
Space requirement	4 SU
Operating data	5 VDC / 110 mA
	24 VDC / 180 mA plus load

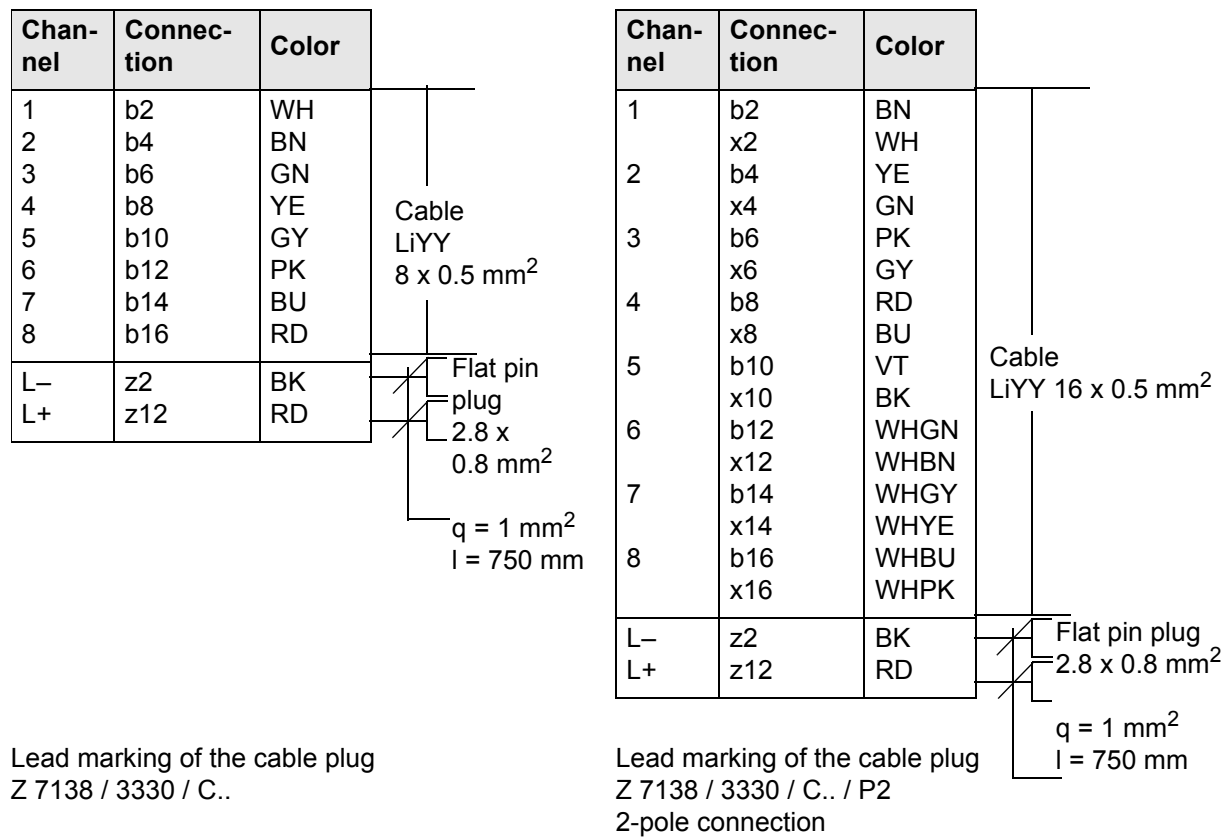


Figure 2: Lead markings of the cable plugs

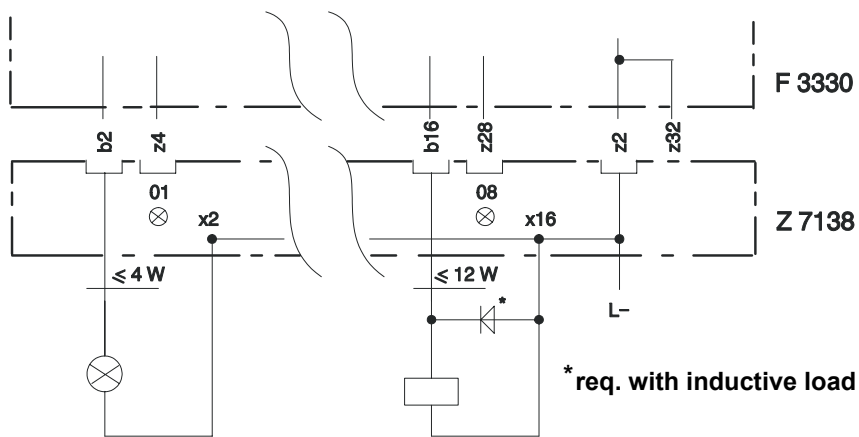
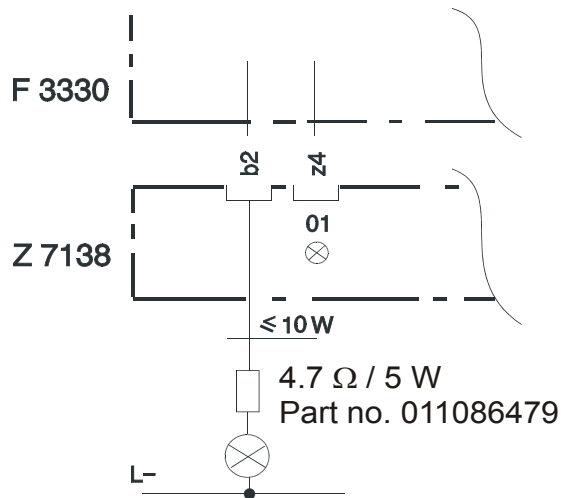


Figure 3: 2-pole connection

Note The safety-related outputs can be connected via the electronic fuses of the module **H 7014** (500 mA). Detailed information is available from the appertaining data sheet.

Planning notes

- max. 10 output modules with nominal load may be used in one I/O rack
- can be used in parallel without external diodes
- for lamp load 4 W to 10 W please refer to following sketch:

**Figure 4: Connection of a lamp load**

The connection of capacitive loads is not permitted. A length of the connection line up to 3 km is possible. The line capacity, however, is limited to a maximum of 1 μF.



F 3331: 8-channel output module

safety-related, applicable up to SIL 3 according to IEC 61508

- resistive or inductive load up to 500 mA (12 W)
- lamp connection up to 4 W
- with integrated safety shutdown, with safe isolation
- with line monitoring
- no output signal at break of the L- supply

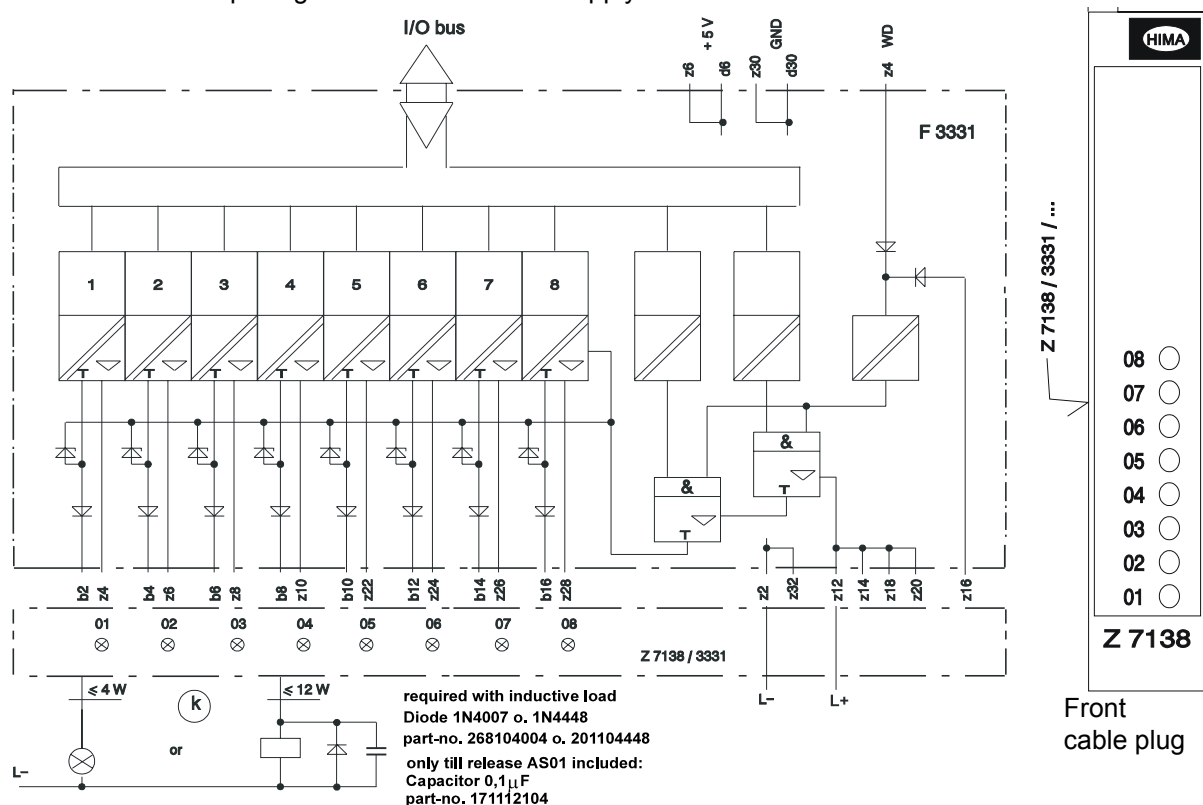


Figure 1: Block diagram and front cable plug

Appertaining function block: HB-BLD-3 or HB-BLD-4

The module is automatically tested during operation. The main test routines are:

- Reading back of the output signals. The operating point of the 0-signal read back is ≤ 6.5 V. Up to this value the level of the 0-signal may arise in case of a fault and this will not be detected
- Switching capability of the test signal and cross-talking (walking-bit test)

Outputs	500 mA, (k) short-circuit proof
Internal voltage drop	max. 2 V at 500 mA load
Admissible line resistance (in + out)	max. 11 Ω
Undervoltage tripping	at ≤ 16 V
Output leakage current	max. 350 μ A
Output voltage if output is reset	max. 1.5 V
Current input WD	max. 30 mA
Monitored switching time	max. 200 μ s
Space requirement	4 SU
Operating data	5 VDC / 130 mA
	24 VDC / 180 mA plus load

Chan-nel	Connec-tion	Color	
1	b2	WH	Cable LiYY 8 x 0.5 mm ²
2	b4	BN	
3	b6	GN	
4	b8	YE	
5	b10	GY	
6	b12	PK	
7	b14	BU	
8	b16	RD	
L-	z2	BK	Flat pin plug 2.8 x 0.8 mm ²
L+	z12	RD	

q = 1 mm²
l = 750 mm

Lead marking of the cable plug
Z 7138 / 3331 / C..

Chan-nel	Connec-tion	Color	
1	b2	BN	Cable LiYY 16 x 0.5 mm ²
2	x2	WH	
3	b4	YE	
4	x4	GN	
5	b6	PK	
6	x6	GY	
7	b8	RD	
8	x8	BU	
9	b10	VT	
10	x10	BK	
11	b12	WHGN	
12	x12	WHBN	
13	b14	WHGY	
14	x14	WHYE	
15	b16	WHBU	
16	x16	WHPK	
L-	z2	BK	Flat pin plug 2.8 x 0.8 mm ²
L+	z12	RD	

q = 1 mm²
l = 750 mm

Lead marking of the cable plug
Z 7138 / 3331 / C.. / P2
2-pole connection

Figure 2: Lead markings of the cable plugs

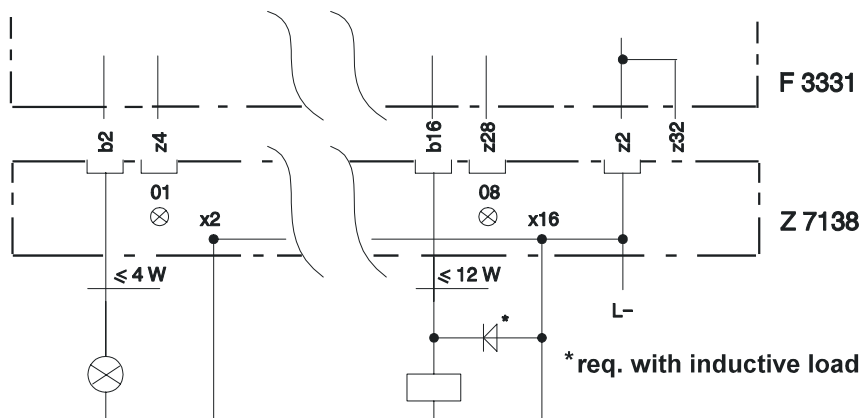


Figure 3: 2-pole connection

Operating points of the line monitoring
(value differences possible by component tolerances)

short-circuit current	0.75 ... 1.5 A
line break	0.5 ... 9.5 mA

Planning notes



The function block HB-BLD-3 (for single channel operation) or HB-BLD-4 (for redundant operation) must be used for all applications with the module.

- In case of line monitoring the appertaining function blocks HB-BLD-3 (for single channel operation) or HB-BLD-4 (for redundant operation) enable enhanced configuration possibilities for the module.
 - The extension of the time for the inrush current for lamp loads by the appertaining function block is valid for all channels. So inductive and lamp loads may not be operated on *one* module at the same time.
 - The line break monitoring requires a minimum load of 10 mA. Line short-circuit and line break can be evaluated in the user program as line faults by means of the function blocks HB-BLD-3 or HB-BLD-4. The evaluation of the signal "line break" is made up to SIL 1.
 - In one I/O subrack max. 10 output modules with nominal load may be used.
 - The outputs can be connected in parallel without external decoupling diodes.
-



The connection of capacitive loads is not permitted. A length of the connection line up to 3 km is possible. The line capacity, however, is limited to a maximum of 1 μ F.



F 3332: 4-channel output module

- resistive or inductive load up to 2 A (48 W)
- lamp connection up to 48 W
- with safe isolation
- no output signal at break of the L- supply

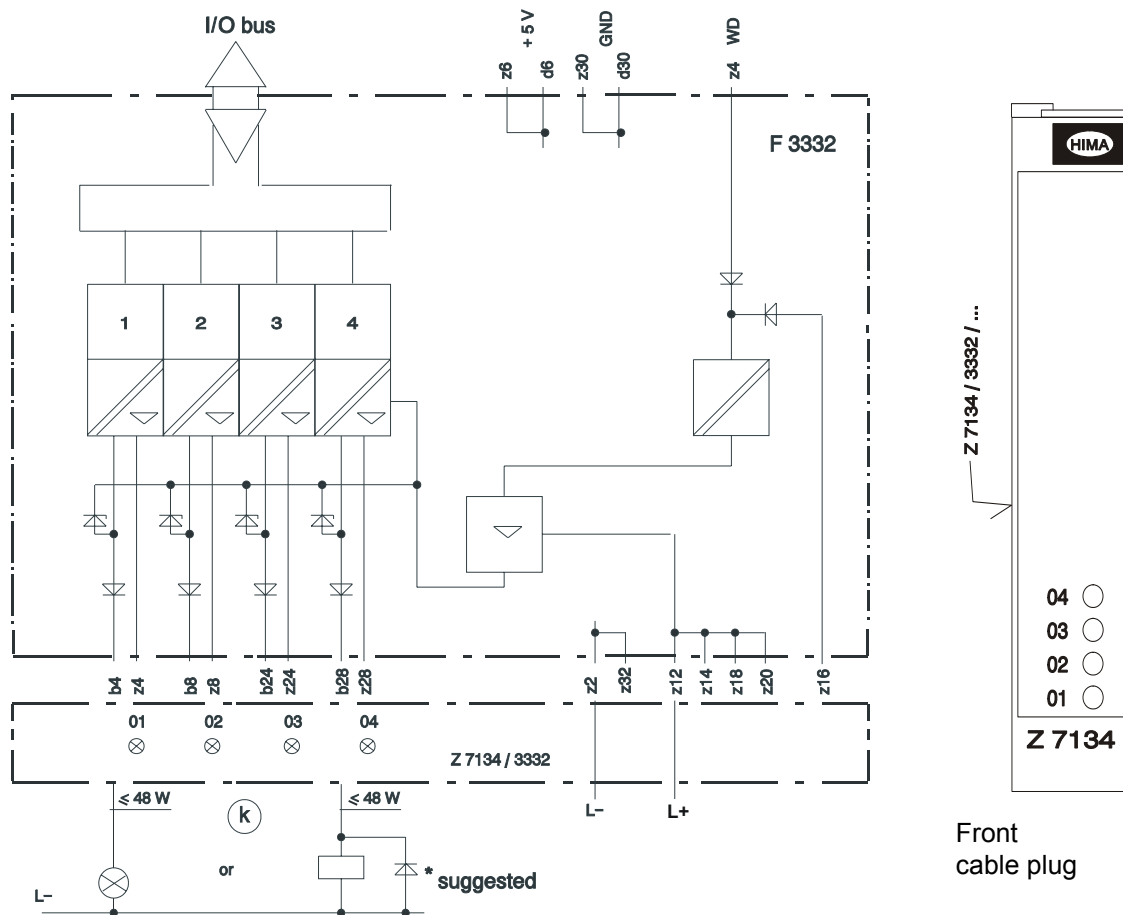


Figure 1: Block diagram and front cable plug

Outputs	2 A, (k) short-circuit proof
Internal voltage drop	max. 2 V at 2 A load
Admissible line resistance (in + out)	max. 3.6 Ω
Undervoltage tripping	at ≤ 16 V
Operating point	
for short-circuit current	2.6...5 A
Output leakage current	max. 550 μA
Output voltage if output is reset	max. 1.5 V
Space requirement	4 SU
Operating data	5 VDC / 70 mA
	24 VDC / 70 mA plus load

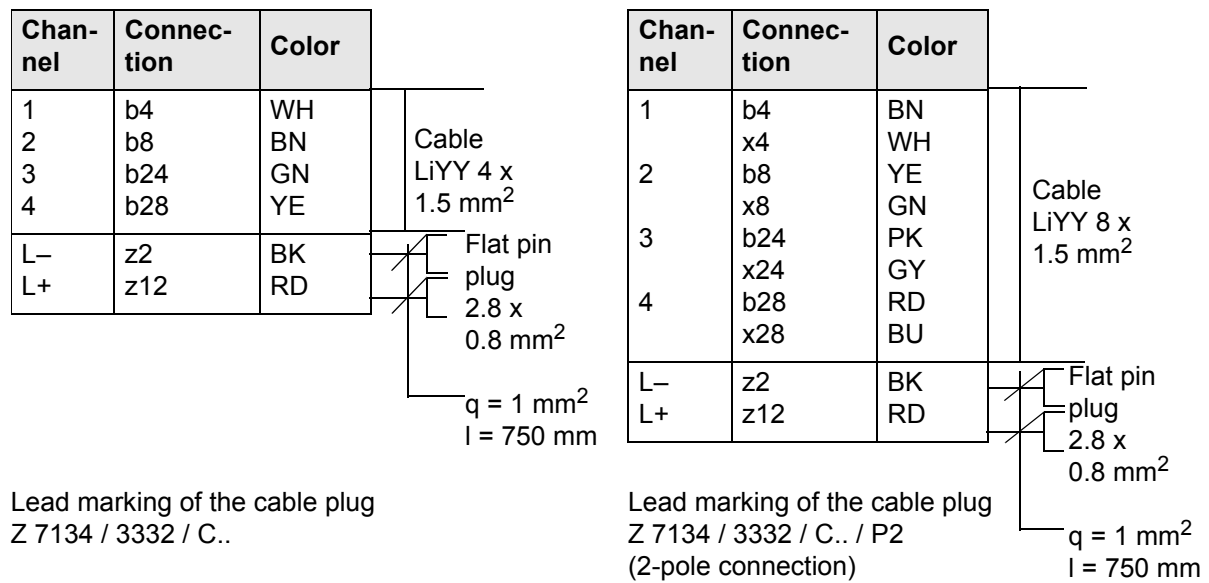


Figure 2: Lead markings of the cable plugs

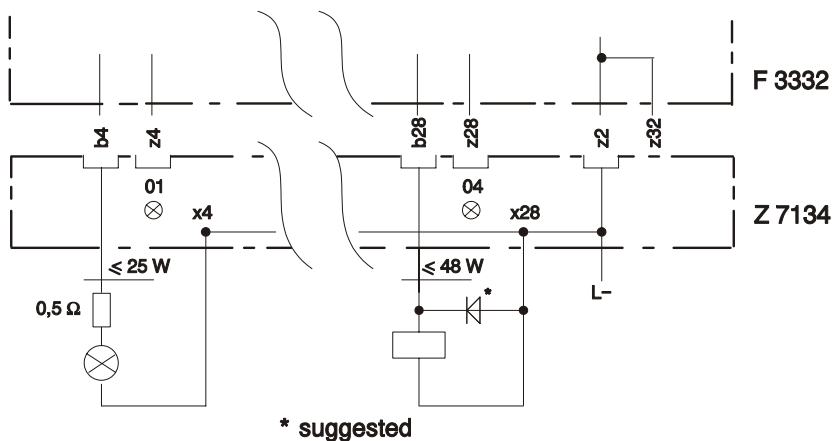


Figure 3: 2-pole connection

Planning notes

- at the same time only 2 channels may be operated with the max. load (2 A). If the load is up to max. 1 A, all channels may be operated at the same time.
- max. 10 output modules with nominal load may be used in one I/O subrack
- can be used in parallel without external diodes



F 3333: 4-channel output module

safety-related, applicable up to SIL 3 according to IEC 61508

- resistive load or inductive load up to 2 A (48 W)
- lamp connection up to 25 W
- with integrated safety shutdown, with safe isolation
- no output signal at break of the L- supply

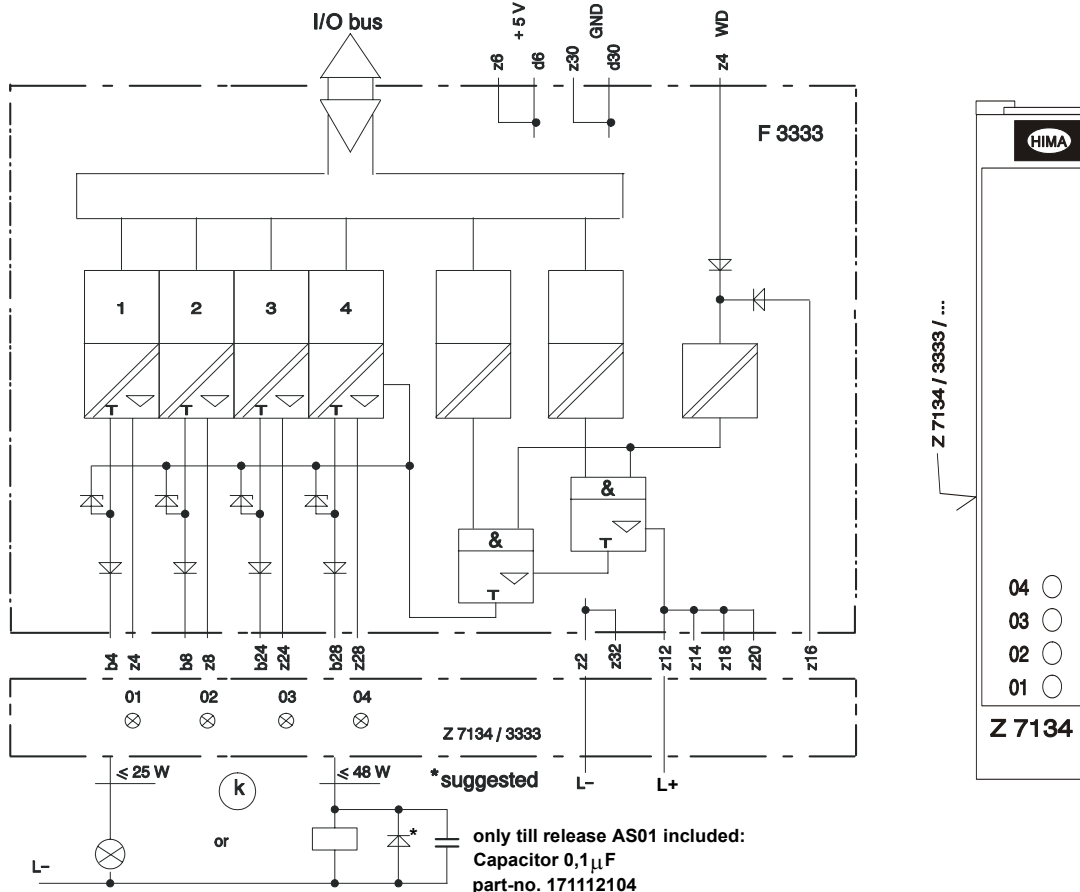
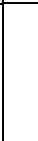


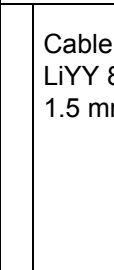
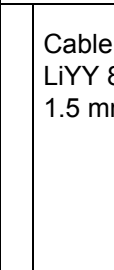
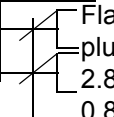
Figure 1: Block diagram and front cable plug

The module is automatically tested during operation. The main test routines are:

- Reading back of the output signals. The operating point of the 0-signal read back is ≤ 6.5 V. Up to this value the level of the 0-signal may arise in case of a fault and this will not be detected
- Switching capability of the test signal and cross-talking (walking-bit test)

Outputs	2 A, (k) short-circuit-proof
Internal voltage drop	max. 2 V at 2 A load
Admissible line resistance (in + out)	max. 3.6Ω
Undervoltage tripping	at ≤ 16 V
Operating point for short circuit current	2.6 ... 5 A
Output leakage current	max. $550 \mu\text{A}$
Output voltage if output is reset	max. 1.5 V
Monitored switching time	max. $200 \mu\text{s}$
Space requirement	4 SU
Operating data	5 VDC / 100 mA
	24 VDC / 120 mA plus load

Chan-nel	Conne-ction	Color		
1	b4	WH	 Cable LiYY 4 x 1.5 mm ²	
2	b8	BN		
3	b24	GN		
4	b28	YE		
L– L+	z2 z12	BK RD	 Flat pin plug 2.8 x 0.8 mm ²	

Channel	Connection	Color		
1	b4	BN		
2	x4	WH		
3	b8	YE		
4	x8	GN		
3	b24	PK		
4	x24	GY		
	b28	RD		
	x28	BK		
L-	z2	BK		
L+	z12	RD		

Lead marking of the cable plug
Z 7134 / 3333 / C.. / P2
2-pole connection

$q = 1 \text{ mm}^2$
 $l = 750 \text{ mm}$

Figure 2: Lead markings of the cable plugs

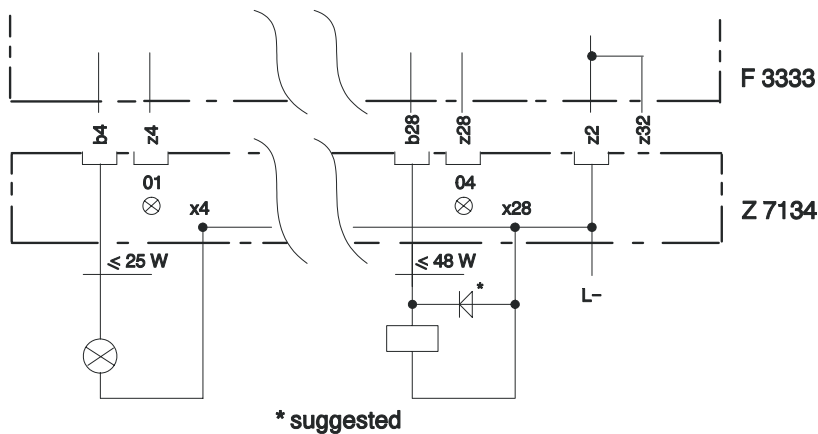


Figure 3: 2-pole connection

Planning notes

- at the same time only 2 channels may be operated with the max. load (2 A). If the load is up to max. 1 A, all channels may be operated at the same time
- max. 10 output modules with nominal load may be used in one I/O subrack
- can be used in parallel without external diodes



The connection of capacitive loads is not permitted. A length of the connection line up to 3 km is possible. The line capacity, however, is limited to a maximum of 1 µF.



F 3334: 4-channel output module

safety-related, applicable up to SIL 3 according to IEC 61508

- resistive or inductive load up to 2 A (48 W)
- lamp connection up to 25 W
- with integrated safety shutdown, with safe isolation, with line monitoring
- no output signal at break of the L- supply

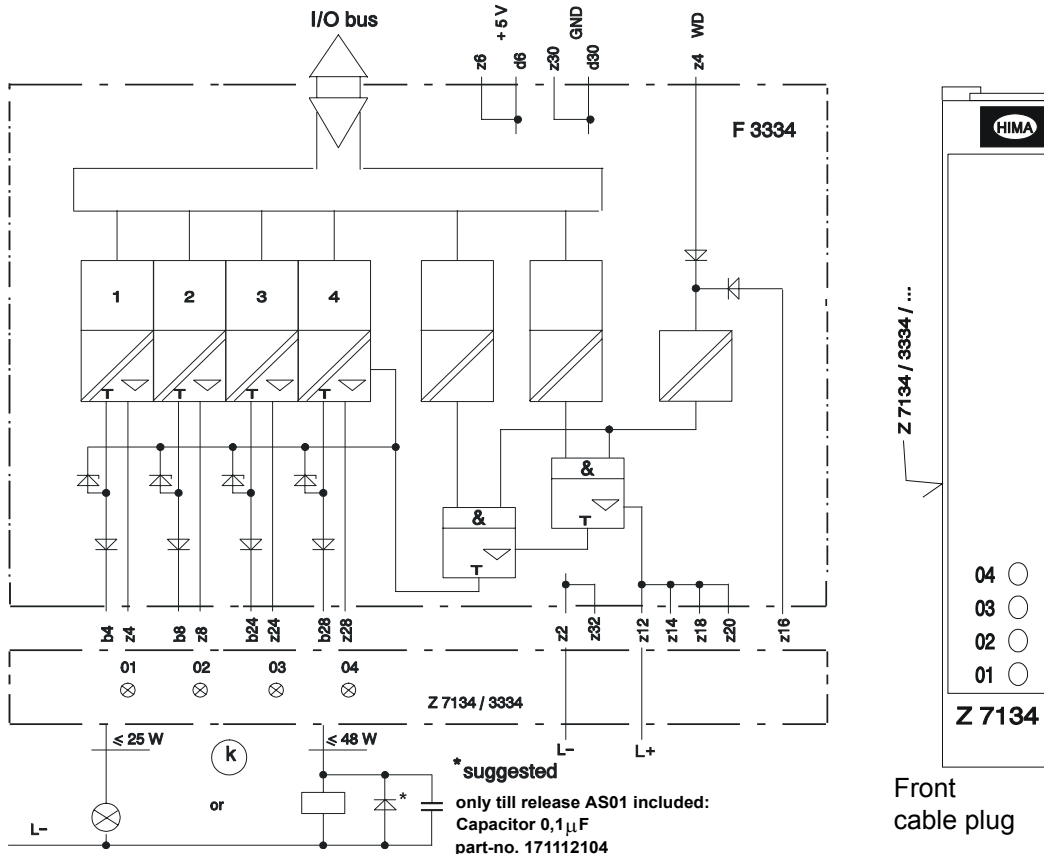


Figure 1: Block diagram and front cable plug

Appertaining function blocks: HB-BLD-3 or HB-BLD-4

The module is automatically tested during operation. The main test routines are:

- Reading back of the output signals. The operating point of the 0-signal read back is ≤ 6.5 V. Up to this value the level of the 0-signal may arise in case of a fault and this will not be detected
- Switching capability the test signal and cross-talking (walking-bit test)

Outputs	2 A, (k) short-circuit-proof
Internal voltage drop	max. 2 V at 2 A load
Admissible line resistance (in + out)	max. 3.6Ω
Undervoltage tripping	at ≤ 16 V
Output leakage current	max. $550 \mu\text{A}$
Output voltage if output is reset	max. 1.5 V
Current input WD	max. 30 mA
Monitored switching time	max. $250 \mu\text{s}$
Space requirement	4 SU
Operating data	5 VDC / 130 mA
	24 VDC / 130 mA plus load

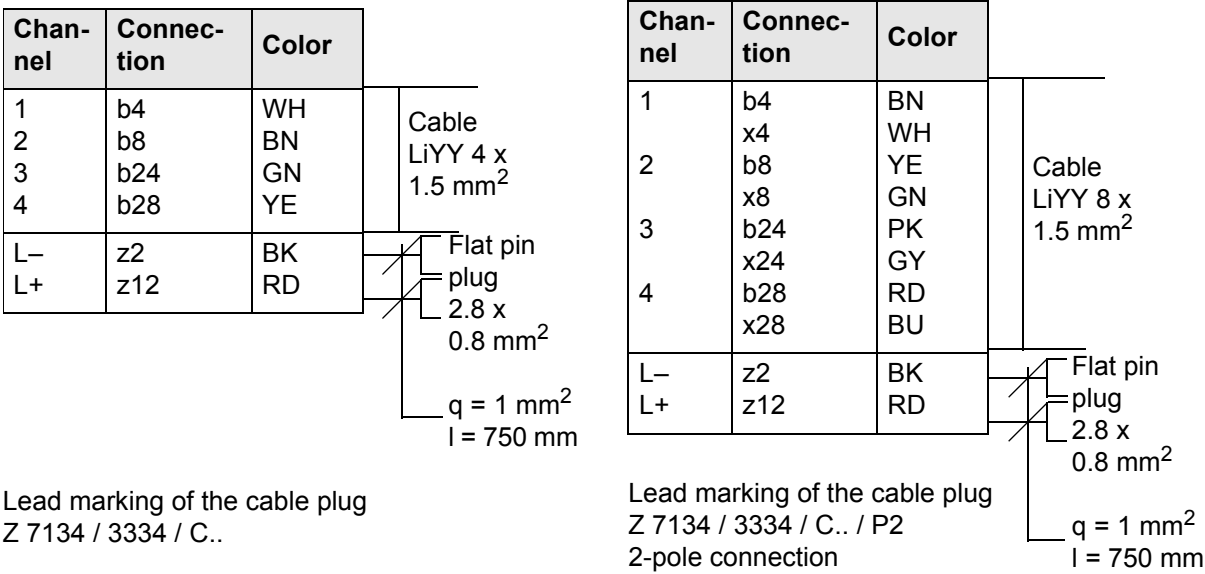


Figure 2: Lead markings of the cable plugs

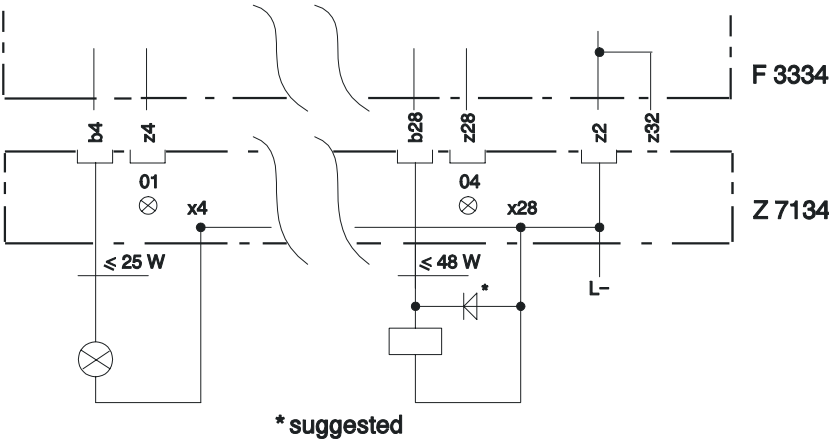


Figure 3: 2-pole connection

Operating points of line monitoring

short circuit current	2.6...5 A
line break	0.5...9.5 mA

Planning notes



The function block HB-BLD-3 (for single channel operation) or HB-BLD-4 (for redundant operation) must be used for all applications with the module.

- In case of line monitoring the appertaining function blocks HB-BLD-3 (for single channel operation) or HB-BLD-4 (for redundant operation) enable enhanced configuration possibilities for the module.
 - The extension of the time for the inrush current for lamp loads by the appertaining function block is valid for all channels. So inductive and lamp loads may not be operated on *one* module at the same time.
 - The line break monitoring requires a minimum load of 10 mA. Line short-circuit and line break can be evaluated in the user program as line faults by means of the function blocks HB-BLD-3 or HB-BLD-4. The evaluation of the signal "line break" is made up to SIL 1.
 - At the same time only 2 channels may be operated with the max. load (2 A). If the load is up to max. 1 A, all channels may be operated at the same time.
 - In one I/O subrack max. 10 output modules with nominal load may be used.
 - The outputs can be connected in parallel without external decoupling diodes.
-



The connection of capacitive loads is not permitted. A length of the connection line up to 3 km is possible. The line capacity, however, is limited to a maximum of 1 μ F.

In conjunction with certain 25 W lamp types problems may occur caused by too high inrush current.

To prevent this at building block HB-BLD-3 (HB-BLD-4) at input "INRUSH CURRENT IN ms" a time between 1 to 50 ms might be set to suppress the fault signal. The duration of the test then will be exceeded to the maximum of the entered time if this input is allocated.

Since edition (AS) 03 a resistor 1 Ω / 5 W must be connected in series to the lamp.



F 3335: 4-channel output module (Ex)i

safety-related, usable up to SIL 3 according to IEC 61508

- for the control of intrinsically safe valves and for the supply of intrinsically safe transmitters
- Four voltage outputs 24 V with current limiting

EC Type Examination certificate (ATEX): EX5 02 05 19183 037

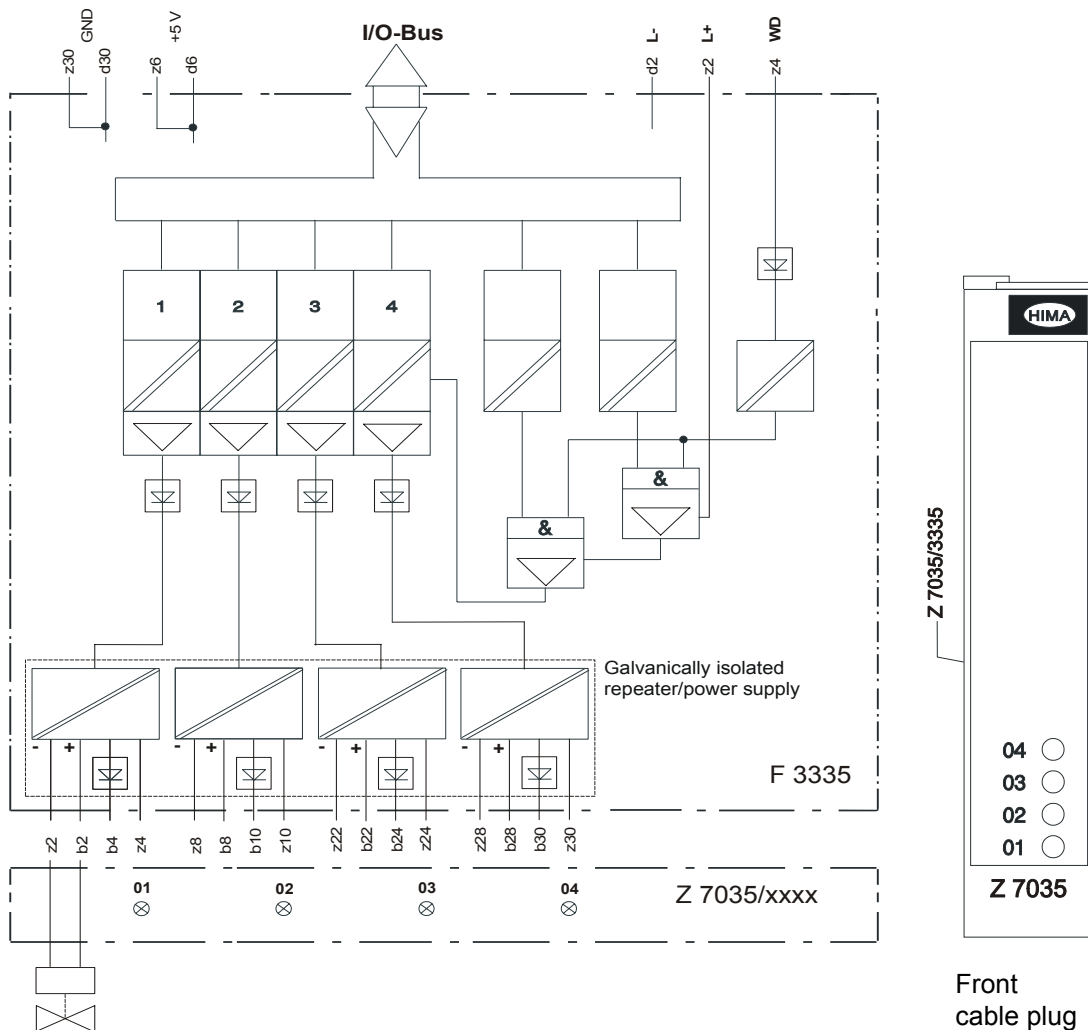


Figure 1: Block diagram and front cable plug

Nominal output voltage	19 V at 20 mA load current
No-load voltage	24 V
Short-circuit current	52 mA (short-circuit proof)
Vertex	24 V / 12 mA
Switching time	approx. 15 ms
Reset time	35 to 270 ms (depending on load)
Ex category	II (2) GD [Ex ib] IIC
Space requirements	4 SU
Operating data	24 V / 270 to 500 mA (depending on load) 5 V / 60 mA



The module must only be operated with forced ventilation (fan).
The fan (K 9203) must be installed above the subrack where the F 3335 module is plugged in.
If the F 3335 module is operated in an H 41q, the fan (K 9212) must be installed directly under the F 3335 module.

Output characteristic of the F 3335 module

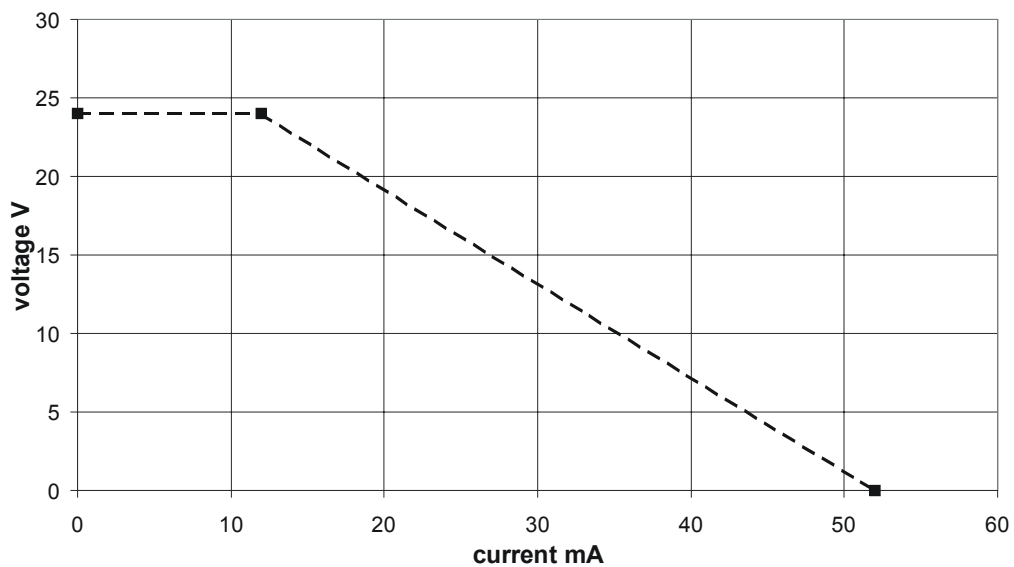


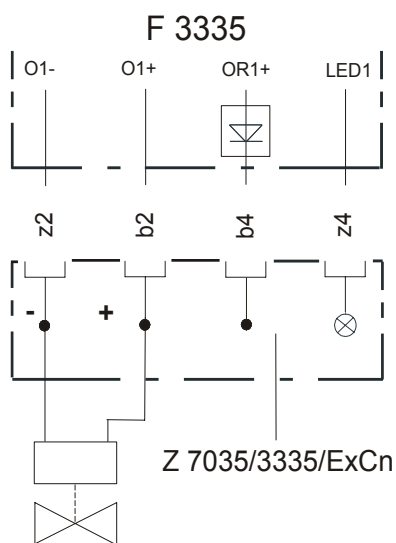
Figure 2: Output characteristic of the F 3335 module

The electrical characteristics of the solenoid valves must be always below the output characteristic of the F 3335 module.

Single channel operation (valve control)

for channels 1 to 4

Cable type: Z 7035/3335/ExCn, part number 93 3335100



Module 1, channel 1

Figure 3: Single channel operation (valve control)

Pin allocation for single channel operation

Channel	Pin	Color
O1-	z2	WH
O1+	b2	BN
O2-	z8	GN
O2+	b8	YE
O3-	z22	GY
O3+	b22	PK
O4-	z28	BU
O4+	b28	RD

Cable
LiYY
8 x 0.5 mm²
blue

Figure 4: Pin allocation for single channel operation

Redundant operation (valve control)

for channels 1 to 4

Cable type: Z 7035/3335/ExCn, part number 93 3335101

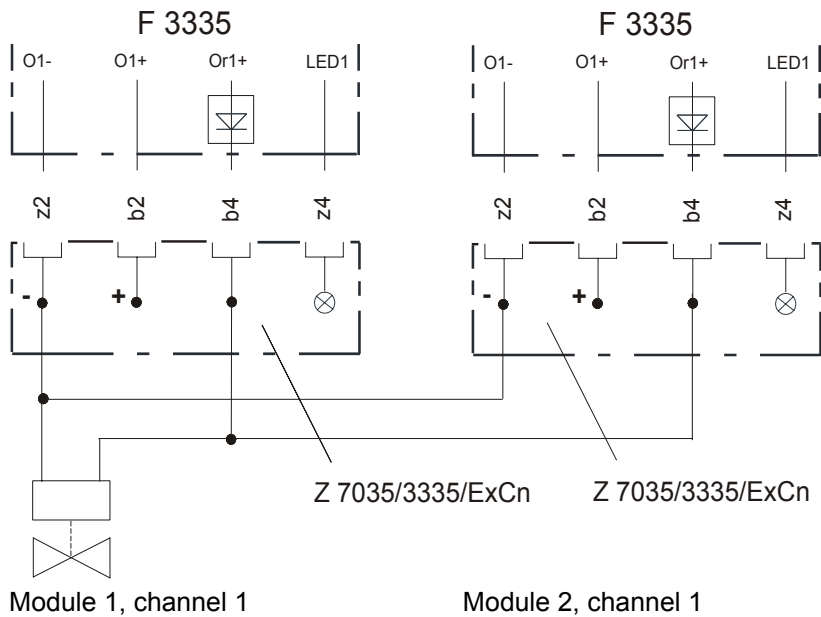


Figure 5: Redundant operation (valve control)

Pin allocation for redundant operation

Channel	Pin	Color
O1- OR1+	z2 b4	WH BN
O2- OR2+	z8 b10	GN YE
O3- OR3+	z22 b24	GY PK
O4- OR4+	z28 b30	BU RD

Cable
LiYY
8 x 0.5 mm²
blue

Figure 6: Pin allocation for redundant operation

1 List of suitable (Ex)i solenoid valves

This list is not intended to be complete. All data listed are without guarantee. The manufacturers' data sheets are authoritative.

1.1 Safety-related (Ex)i solenoid valves (up to SIL 4 according to IEC 61508)

Manufacturer	Type	Minimum pick-up values	
		U _{an}	I _{an}
Eugen Seitz (Pilot valves)	11 G 52		
	121.11.01	13 V	16 mA
	121.11.02	15 V	12 mA
	121.11.03	14 V	16 mA
	121.113.23	14 V	16 mA
	PV 12F73 Ci oH		
	133.288.00	14 V	2.2 mA
	PV 12F73 Xi oH		
	127.991.00	6.4 V	1.5 mA
	PV 12F73 Xi oH-2		
	128.319.00	7 V	4.4 mA
Norgren Herion (directly controlled valves)	2001, 2002	22 V	
		5 V ¹⁾	40 mA ¹⁾

¹⁾ Hold values

1.2 (Ex)i solenoid valves

Manufacturer	Type	Minimum pick-up values	
		U _{an}	I _{an}
ASCO Joucomatic (directly controlled valves)	IMXX (ISSC, WPIS)	21.6 V	
		11 V ¹⁾	28 mA ¹⁾
Bürkert (Pilot valves)	0590	10.4 V	29 mA
	5470		
	6516/6517		
	6518/6519		
	8640		
	6106	10.8 V	30 mA
Norgren Herion (Pilot valves)	2032	8.2 V	34 mA
	2033	9.0 V	30 mA
	2034	10.0 V	27 mA
	2035	11.5 V	25 mA
	2036	13.0 V	23 mA
	2037	14.4 V	21 mA
	2038	15.9 V	19 mA

Manufacturer	Type	Minimum pick-up values	
		U_{an}	I_{an}
Norgren Herion (Pilot valves)	LPV (E/P-converter) 2080, 2082 2081, 2083 2084	5 V 10 V 4 V	1 mA 2.7 mA 1.6 mA
Parker Lucifer (Pilot valves)	482160 482870	10.7 V	29 mA
Parker Lucifer (Directly controlled valves)	492965	13 V 10 V ¹⁾	20 mA ¹⁾
Samson (Pilot valves)	E/P-binary converter 3701, 3962, 3963, 3964, 3776, 3766 and 3767	9.4 V 18 V	1.43 mA
Telektron (Pilot valve)	V525011L00	12 V	8 mA

¹⁾ Hold values

2 Operating Instructions for F 3335

2.1 Application

The module can be used to control Ex valves and Ex measuring transmitters (0/4 to 20 mA). These valves or transmitters can be installed in potentially explosive atmospheres from Zone 1 on.



No external voltage may be applied at the outputs.
Only these applications are permissible, which are described in the data sheet for F 3335.

2.2 Electrical specifications concerning intrinsic safety

For these specifications please refer to the EC prototype test certificate enclosed.

2.3 Assembly and installation

The module is mounted in a 19" subrack. It must be plugged in vertically. The design of the subrack must allow heat dissipation.

Further information for assembly and installation see HIMA main catalog "The H41q and H51q System Families".

Note

The module may not be mounted within a potentially explosive atmosphere!

The module is connected to the intrinsically safe field circuits via the cable plug Z 7035.

In addition, the following points should be considered:

- The electronic module including its connections has to be installed in a way that at least the degree of protection IP 20 according to EN 60529: 1991 + A1: 2000 is achieved.
- Two output circuits of one or two modules of the F 3335 type can be wired in parallel. The reduced maximum values have to be complied with (see EC prototype test certificate).
- The separation between intrinsically safe and not intrinsically safe terminals must be ≥ 50 mm, especially between adjacent modules.
- The separation between adjacent intrinsically safe terminals must be ≥ 6 mm.
- Intrinsically safe and not intrinsically safe lines must be installed separately, or the intrinsically safe lines must be provided with additional insulation.
- Intrinsically safe lines must be identifiable, e. g. by the light blue color (RAL 5015) of the insulation.
- Modules, which were operated in general electrical system, may not be used thereafter no more in Ex-plants.

The lines used must comply with the following insulation test voltages:

- Intrinsically safe lines ≥ 1000 VAC
- Not intrinsically safe lines ≥ 1500 VAC

Stranded wires must be provided with wire end ferrules. The terminals must be suitable for clamping the wire cross section.

The applicable regulations and standards have to be complied with, especially:

- DIN EN 60079-14 (VDE 0165, Part 1)
- EN 50 014 (VDE 0170/0171, Part 1)
- EN 50 020 (VDE 0170/0171, Part 7)

2.4 System start-up

Before the first system start-up, an Ex-expert has to check whether the system has been correctly installed, especially the supply voltage connections and the connections of the intrinsically safe circuits.

2.5 Maintenance

In case of a failure, the defective module must be replaced with the same type or with another approved type.



Any repair work must only be carried out by the manufacturer!

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ CERTIFICADO ◆ CERTIFICAT

EC Type Examination Certificate

No.: EX5 02 05 19183 037



in accordance with Annex III of Council Directive No. 94/9/EC for equipment and protective systems intended for use in potentially explosive atmospheres (ATEX) for

HIMA Paul Hildebrandt GmbH + Co KG
Albert-Bassermann-Straße 28

68782 Brühl

Product: Electrical apparatus type of protection intrinsically safety i (EX-RL)

Model: Automation device, safety-related
 F 3335

Parameters: see appendix (four pages)

The above mentioned product meets the provisions of the Directive.

This certificate is issued on the basis of the product provided for testing and certification and on its technical documentation. The detailed results of the test and the provided technical documentation are listed in

Test report no.: 70013102.3

This certificate pertains only to the sample product submitted to TÜV PRODUCT SERVICE for testing. Therefore this certificate has no specified period of validity.

Released with the above mentioned certificate number by the Certification Body of TÜV PRODUCT SERVICE.

P. Blum



Department: TA-ES/MUC-IQSE / jb
 Date: 15.05.2002

TÜV PRODUCT SERVICE GMBH is a Notified Body in accordance with Council Directive 94/9/EC for equipment and protective systems intended for use in potentially explosive atmospheres with the identification number 0123.

TÜV PRODUCT SERVICE GMBH · Zertifizierstelle · Ridlerstrasse 65 · D-80339 München

Port	Output	Function
z2	O1-	Voltage output 1 -
b2	O1+	Voltage output 1 +
z4	LED1	Visual display voltage output 1
b4	OR1+	Redundant voltage output 1 +
z8	O2-	Voltage output 2 -
b8	O2+	Voltage output 2 +
z10	LED2	Visual display voltage output 2
b10	OR2+	Redundant voltage output 2+
z22	O3-	Voltage output 3 -
b22	O3+	Voltage output 3 +
z24	LED3	Visual display voltage output 3
b24	OR3+	Redundant voltage output 3+
z28	O4-	Voltage output 4 -
b28	O+	Voltage output 4 +
z30	LED4	Visual display voltage output 4
b30	OR4+	Redundant voltage output 4+

1 Description

The module F 3335 is a associated electrical apparatus for installation only outside an atmosphere capable of explosion. This subassembly unit for installation in a subrack consist of one PCB-board. In order to supply (Ex-) transmitters or to switch (Ex-) valves four intrinsically safe Voltage output ports are connectable at the front. The output- and Voltage output ports and the ports for controlling the EA-control bus are connectable at the rear of the module.

The environmental temperature averages $-20^{\circ}\text{C}\leq T_{\text{min}}\leq 60^{\circ}\text{C}$.

From the manual of instruction you will see the general information for secure use.

2 Electrical data

2.1 Intrinsically output circuits, strip X1

Four voltages of 25V for the supply of the (Ex-) transmitters or switching the (Ex-) valves are provided. These are intrinsically safe and safety isolated up to a peak value of 375V against the Voltage output circuit.



2.2 Output circuits

Voltage per output circuit, U_o	crest value DC 25,0 V
Amperage per output circuit, I_o	crest value DC 70,0 mA
Power per output circuit, P_o	crest value 581 mW
Characteristic curve	trapeze
internal capacitor per output circuit, C_i	negligible
internal inductance per output circuit, L_i	negligible

2.3 EEx Ib IIC

Max. connectable inductance for one output circuit	$L_o = 7$ mH
Max. connectable capacitance for one output circuit	$C_o = 110$ nF
Max. connectable inductance for parallel connection of two output circuits	$L_o = 1,6$ mH
Max. connectable capacitance for parallel connection of two output circuits	$C_o = 110$ nF

2.4 EEx Ib IIB

Max. connectable inductance for one output circuit	$L_o = 25$ mH
Max. connectable capacitance per output circuit	$C_o = 840$ nF
Max. connectable inductance for parallel connection of two output circuits	$L_o = 7$ mH
Max. connectable capacitance for parallel connection of two output circuits	$C_o = 840$ nF



2.5 Power supply circuits, strip X2, (non-intrinsically safe)

Power supply circuit 1	Port z2 and d2
Nominal voltage UB1	24 V DC
Voltage UB1 _{max}	crest value DC 30 V
Power	about 12 W
Power supply circuit 2	Port z2/d6 and z30/d30
Nominal voltage UB2	5V DC
Voltage UB2 _{max}	crest value DC 6 V
Power	about 1 W

Absolute maximum voltage without affecting the intrinsic safety U_m , crest value 40V

3 Identifying marking

The legible and durable marking must include the following option list:

- Name and address of the manufacturer
- Year of construction
- the identifier  II (2)GD [EEx Ib] IIC

3.1 Production quality assurance

The manufacturer shall operate an approved quality system for production, final equipment inspection and testing according Annex IV directive 94/9/EC.

Munich, May 15th 2002

TÜV AUTOMOTIVE GmbH TA-ESMUC


Dipl.-Ing. J. Blum



F 3348: 8-channel output module

safety-related, applicable up to SIL 3 according to IEC 61508

- Output voltage 48 VDC
- resistive load or inductive load up to 500 mA
- lamp connection up to 4 W
- with integrated safety shutdown, with safe isolation

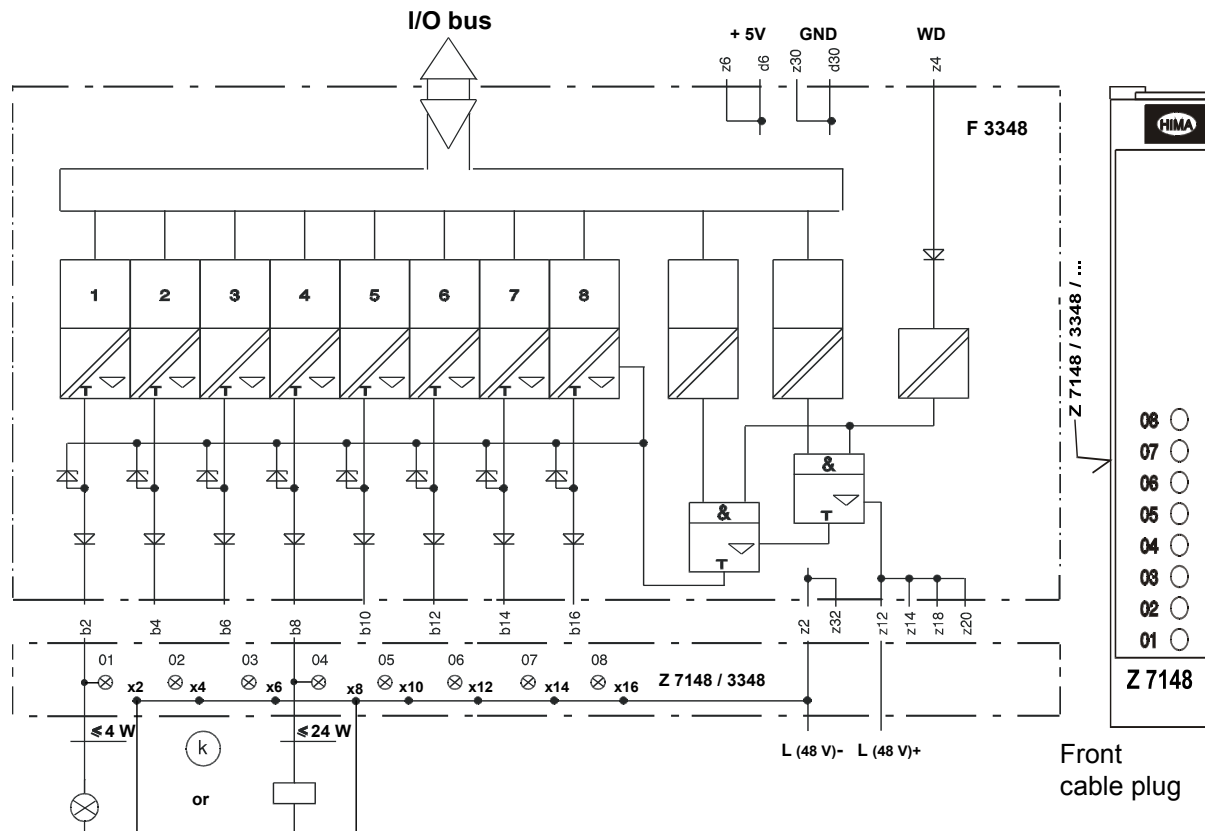


Figure 1: Block diagram and front cable plug

The module is automatically tested during operation. The main test routines are:

- Reading back of the output signals. The operating point of the 0-signal read back is ≤ 6.5 V. Up to this value the level of the 0-signal may arise in case of a fault and this will not be detected
- Switching capability of test signal and cross-talking (walking-bit test).

Outputs	500 mA, (k) short-circuit proof
Internal voltage drop	max. 2 V at 500 mA load
Admissible line resistance (in + out)	max. 11 Ω
Operating point for short-circuit current	0.6...1.0 A
Output leakage current	max. 200 μ A
Output voltage if output is reset	max. 1.5 V
Monitored switching time	max. 200 μ s
Space requirement	4 SU
Operating data	5 VDC / 100 mA
	48 VDC / 100 mA plus load
	(supply via cable plug)

Channel	Connection	Color		
1	b2	BN		
	x2	WH		
2	b4	YE		
	x4	GN		
3	b6	PK		
	x6	GY		
4	b8	RD		
	x8	BU		
5	b10	VT		
	x10	BK		
6	b12	WHGN		
	x12	WHBN		
7	b14	WHGY		
	x14	WHYE		
8	b16	WHBU		
	x16	WHPK		
L _(48V) -	z2	BN		
L _(48V) +	z12	WH		

Cable
LiYY 16 x 0.5 mm²

Cable
LiYY 2 x 1.0 mm²

Lead marking of the cable plug
Z 7148 / 3348 / C.. / P2
2-pole connection

Figure 2: Lead marking of the cable plug



The connection of capacitive loads is not permitted. A length of the connection line up to 3 km is possible. The line capacity, however, is limited to a maximum of 1 µF.



F 3349: 8-channel output module

safety-related, applicable up to SIL 3 according to IEC 61508

- resistive or inductive load up to 500 mA (at L+ 24 V or 48 V)
- lamp load up to 10 W
- with integrated safety shutdown
- with safe isolation, with line monitoring

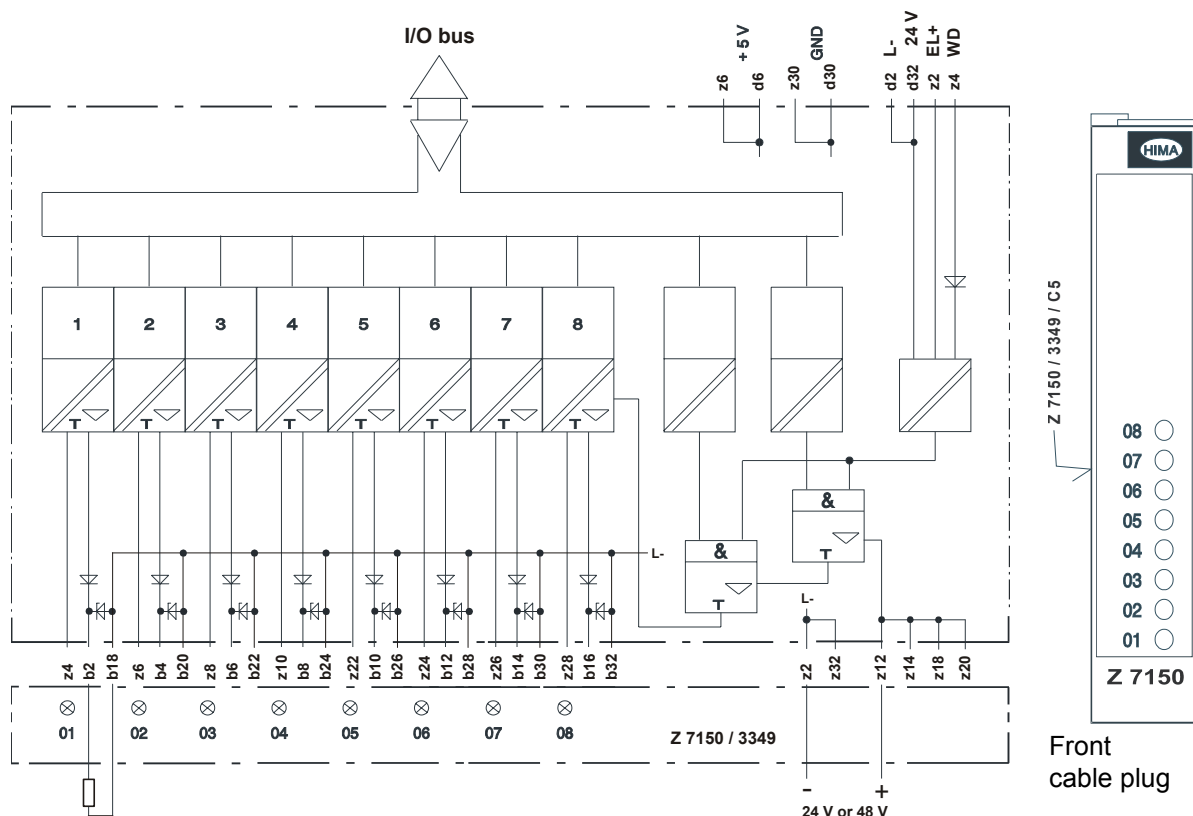


Figure 1: Block diagram and front cable plug

Appertaining function block: HB-BLD-3 or HB-BLD-4

The module is automatically tested during operation. The main test routines are:

- Reading back of the output signals. The operating point of the 0-signal read back is ≤ 6.5 V,
- Switching capability of the safety shutdown, cross-talking (walking-bit test),
- Line monitoring.

Nominal output voltage	24 V or 48 V, acc. to supply of L+ via cable plug, 500 mA, short-circuit-proof
Space requirement	4 SU
Operating data	5 VDC / 0.15 A, 24 VDC / 200 mA (via rear bus system) 24/48 VDC / 50 mA plus load (via cable plug)

Cable plug for outputs 24 VDC

Channel	Connection	Color
1	b2	BN
	b18	WH
2	b4	YE
	b20	GN
3	b6	PK
	b22	GY
4	b8	RD
	b24	BU
5	b10	VT
	b26	BK
6	b12	WHGN
	b28	WHBN
7	b14	WHGY
	b30	WHYE
8	b16	WHBU
	b32	WHPK
L- 24 V	z2	BK
L+ 24 V	z12	RD

Cable
LiYY 16 x 0.5 mm²

Flat pin plug 6.3 x 0.8 mm
Wire: q = 1 mm², l = 750 mm

Lead marking of the cable plug Z 7150 / 3349 / C5 / 24P2
2-pole connection of the load

Figure 2: Lead marking of the cable plug for outputs 24 VDC

Cable plug for outputs 48 VDC

Channel	Connection	Color
1	b2	BN
	b18	WH
2	b4	YE
	b20	GN
3	b6	PK
	b22	GY
4	b8	RD
	b24	BU
5	b10	VT
	b26	BK
6	b12	WHGN
	b28	WHBN
7	b14	WHGY
	b30	WHYE
8	b16	WHBU
	b32	WHPK
-48 V	z2	BN
+48 V	z12	WH

Cable
LiYY 16 x 0.5 mm²

Cable
LiYY 2 x 1 mm²

Lead marking of the cable plug Z 7150 / 3349 / C5 / 48P2
2-pole connection of the load

Figure 3: Lead marking of the cable plug for outputs 48 VDC

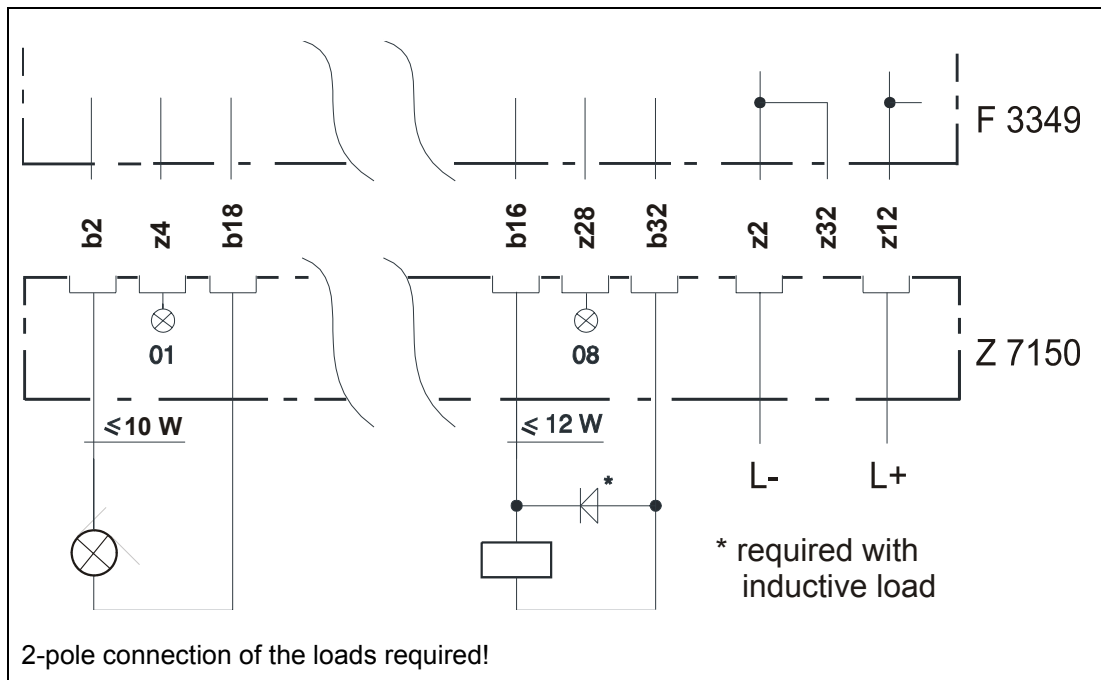


Figure 4: 2-pole connection

Additional technical data

Current input WD	1 mA
Monitored switching time	max. 200 μ s (without extension by the function block)
Internal voltage drop	max. 2 V at 500 mA load
Admissible line resistance	max. 11 Ω
max. lamp load	10 W
max. inductivity	1 H
max. capacity	100 μ F
Output leakage current	max. 500 μ A
Operating points of the line monitoring	
Line short-circuit	0.7...0.8 A
Line break	2...8 mA

Reaction of the module to errors

- Module error:
All outputs are switched off.
- Line error:
If an external line break or a short-circuit is detected, the module only makes an annunciation to the corresponding central module.
At a short-circuit and an overcurrent (> 2 A per channel) the overcurrent tripping is activated after 50 ms at the latest. For smaller overloads (> 0.7 A per channel) the reaction time can last up to several seconds.
At line errors the channel of the module is reconnected again after approx. 4.5 seconds.
- The error codes for the module are shown in the display of the corresponding central module. For further information see operating system manual.

Planning notes

The function block HB-BLD-3 (for single channel operation) or HB-BLD-4 (for redundant operation) must be used for all applications with the module.

- In case of line monitoring the appertaining function blocks HB-BLD-3 (for single channel operation) or HB-BLD-4 (for redundant operation) enable enhanced configuration possibilities for the module.
- The extension of the time for the inrush current for lamp loads by the appertaining function block is valid for all channels. So inductive and lamp loads may not be operated on *one* module at the same time.
- The line break monitoring requires an output load of at least 10 mA.
- The short-circuit and line break can be evaluated in the user program as line faults by means of the function blocks HB-BLD-3 or HB-BLD-4. The evaluation of the signal "line break" is made up to SIL 1.
- The outputs of the module and their supply voltage must be connected with *two poles*. The use of common lines can produce coupling loops with interferences, leading to a module fault or a failure of the safety shutdown of the outputs.
- The outputs can be connected in parallel without additional external decoupling diodes.
- An external short-circuit of a channel does not trigger the integrated safety shutdown, i.e. the remaining channels continue their function.
- If the line is longer than 10 m or if a power supply unit not manufactured by HIMA is used, for a faultless operation with 48 V the supply voltage must be filtered with an additional module Z 6019.
- Lines for outputs not used may not be extended to the plant without any terminal loads.
- In one I/O subrack max. 10 output modules with nominal load may be used at the same time.
- At maximum power dissipation a forced cooling with a fan module is required.

Note for the redundant use of modules

- In case of a line short-circuit the double current can flow, until this line short-circuit is diagnosed.
- In case of a line break the required minimum current is twice the value (20 mA) to prevent an indication of a line break.

Note

The connection of capacitive loads is not permitted. A length of the connection line up to 3 km is possible. The line capacity, however, is limited to a maximum of 1 μ F.
With an interruption of the supply line L- the safe shutdown of the outputs is no longer ensured.



F 3422: 8-channel relay module

- Switching voltage 60 VDC/AC
- with safety isolation
- solid state output (open collector) for LED display in the cable plug

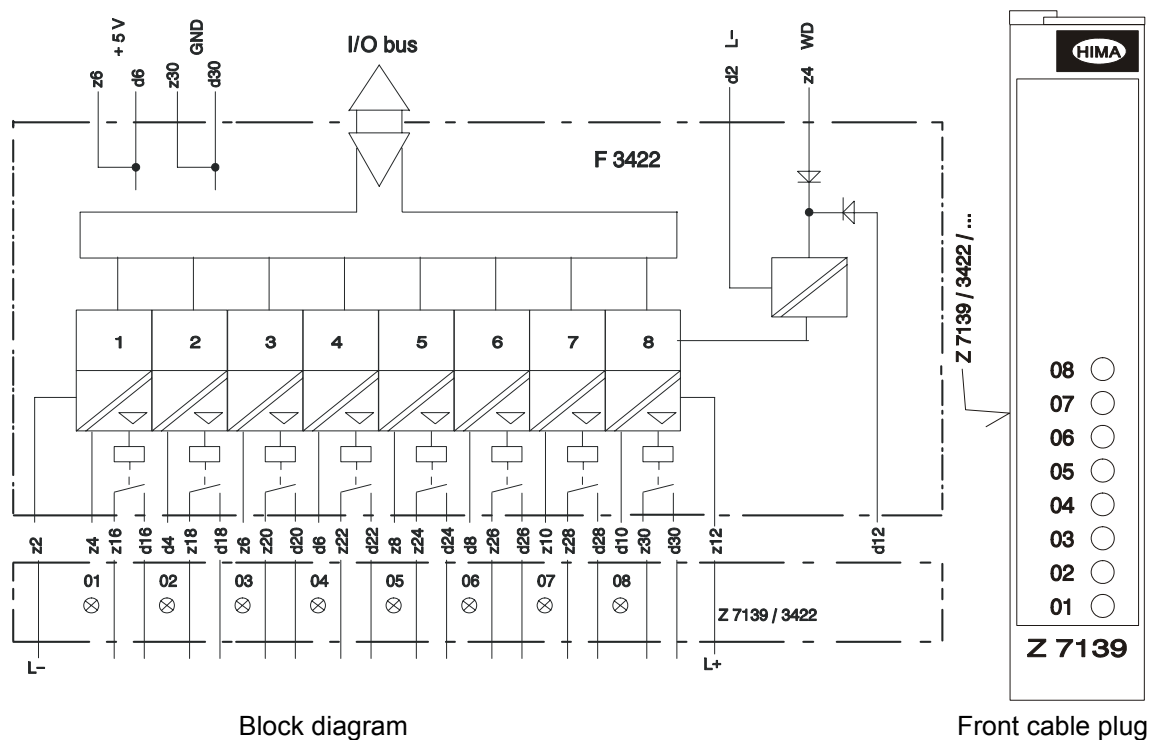


Figure 1: Block diagram and front cable plug

Relay outputs	NO contact, dust-tight
Contact material	AgNi 0.15, hard gold-plated
Switching time	approx. 10 ms
Bounce time	approx. 1.5 ms
Switching current	$1 \text{ mA} \leq I \leq 4 \text{ A}$
Inrush peak	$\leq 12 \text{ A}$ for 4 s (relative ON period $\leq 10 \%$)
Life, mechanical	2×10^7 cycles
Life, electrical	$> 10^5$ cycles with full resistive load and ≤ 0.1 cycles per second
Switching capacity	up to 60 VAC: max. 240 VA, $\cos \varphi \leq 0.5$
Switching capacity (non inductive)	up to 30 VDC: max. 120 W up to 60 VDC: max. 40 W
Switching frequency	max. 18 Hz
Space requirement	4 SU
Operating data	5 VDC / 60 mA 24 VDC / 150 mA
Isolation between contact circuits	up to 300 V to EN 50178 (VDE 0160), overvoltage class II

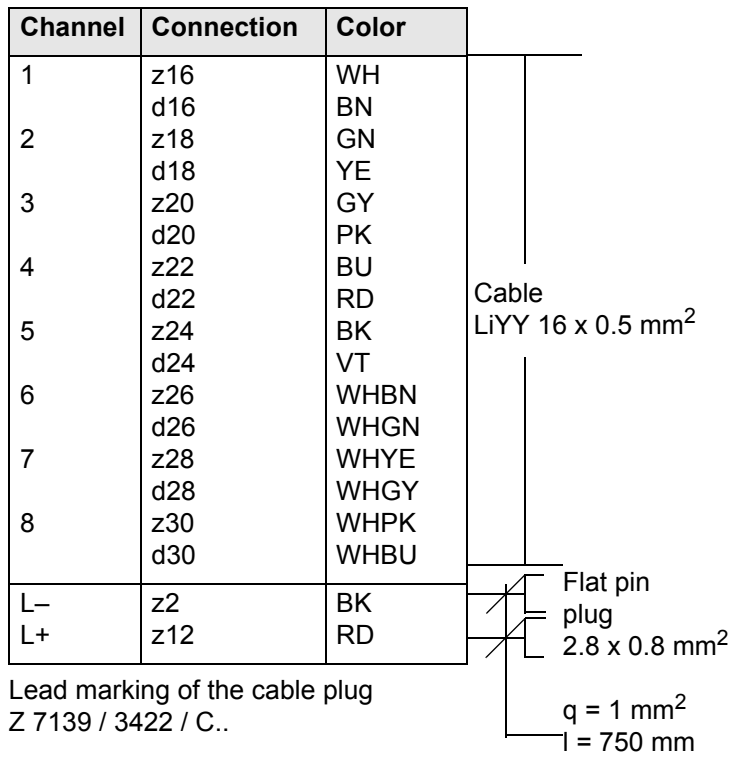


Figure 2: Lead marking of cable plug



F 3430: 4-channel relay module

safety-related, applicable up to SIL 3 according to IEC 61508

- Switching voltage $\geq 5\text{ V}$, $\leq 250\text{ VAC}$ / $\leq 110\text{ VDC}$
- with integrated safety shutdown
- with safety isolation, with 3 subsequent relays (in diversity)
- solid state output (open collector) for LED display in the cable plug

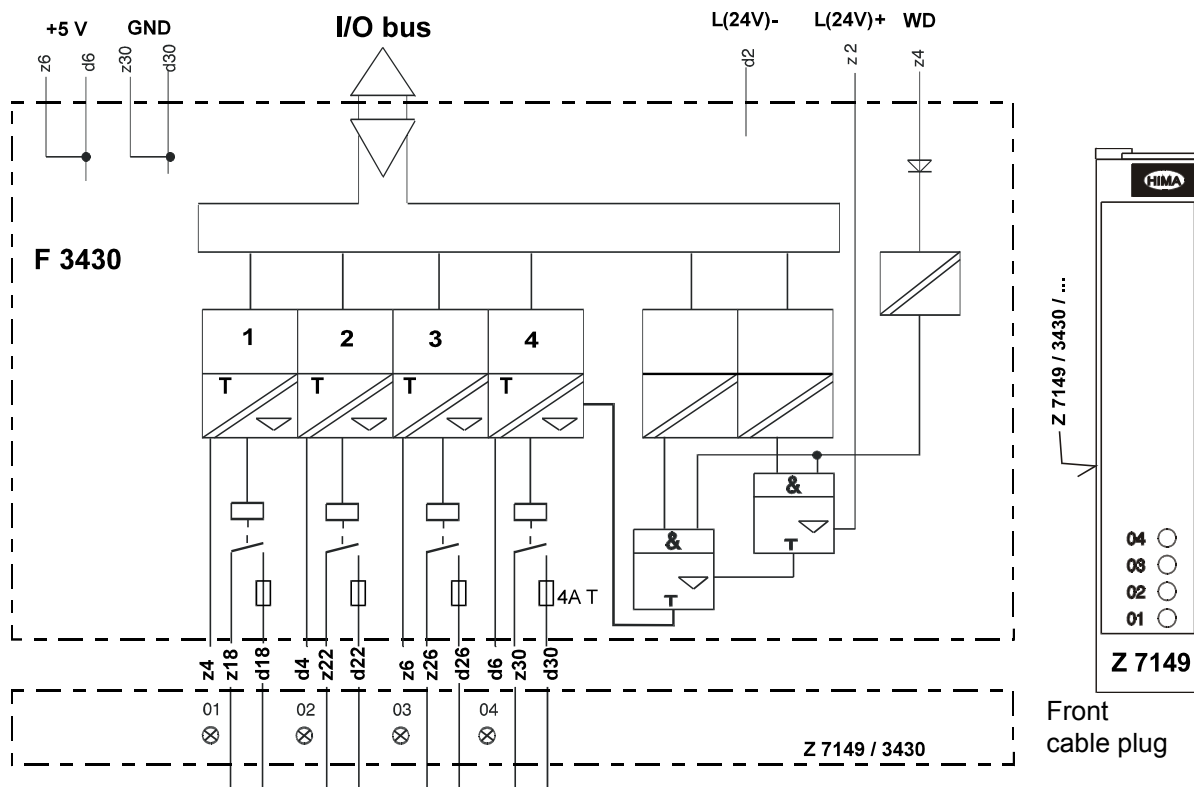


Figure 1: Block diagram and front cable plug

Relay output	NO contact, dust-tight
Contact material	Silver alloy, gold-flashed
Switching time	approx. 8 ms
Reset time	approx. 6 ms
Bounce time	approx. 1 ms
Switching current	$10\text{ mA} \leq I \leq 4\text{ A}$
Life, mech.	$\geq 30 \times 10^6$ cycles
Life, elec.	$\geq 2.5 \times 10^5$ cycles with full resistive load and ≤ 0.1 cycles per second
Switching capacity AC	up to 250 VAC max. 500 VA, $\cos \varphi > 0.5$
Switching capacity DC	up to 30 VDC max. 120 W
(non inductive)	up to 70 VDC max. 50 W
	up to 110 VDC max. 30 W
Space requirement	4 SU
Operating data	5 VDC / $< 100\text{ mA}$ 24 VDC / $< 120\text{ mA}$

Channel	Connection	Color		
1	z18	WH	Cable LiYY 8 x 1.5 mm ²	
	d18	BN		
2	z22	GN		
	d22	YE		
3	z26	GY		
	d26	PK		
4	z30	BU		
	d30	RD		

Lead marking of the cable plug
Z 7149 / 3430 / C../P2

Figure 2: Lead marking of the cable plug

The module has a safe isolation between the input and the output contact, according EN 50178 (VDE 0160). The clearance in air and the creepage distance are dimensioned for overvoltage class III up to 300 V.

The module is equipped with relays in diversity.

The relay amplifier is suitable for the switching of safety-related circuits. Thus the amplifier can be used for safety shutdowns, e. g. to cut off the entire fuel supply for combustion plants.

Restrictions

- For the application it must be ensured that the module is replaced after reaching the maximum quantity of switching cycles (e.g. 300.000 switching cycles at a rated operation 30 VDC / 4 A).
- For SIL 3 plants (according to IEC 61508) function checks have to be made by the manufacturer within a period of three years, for SIL 2 plants within a period of six years.
- The replacement of components must be made only by the manufacturer regarding the valid standards and TÜV restrictions.



F 5203: 14 bit ring counter

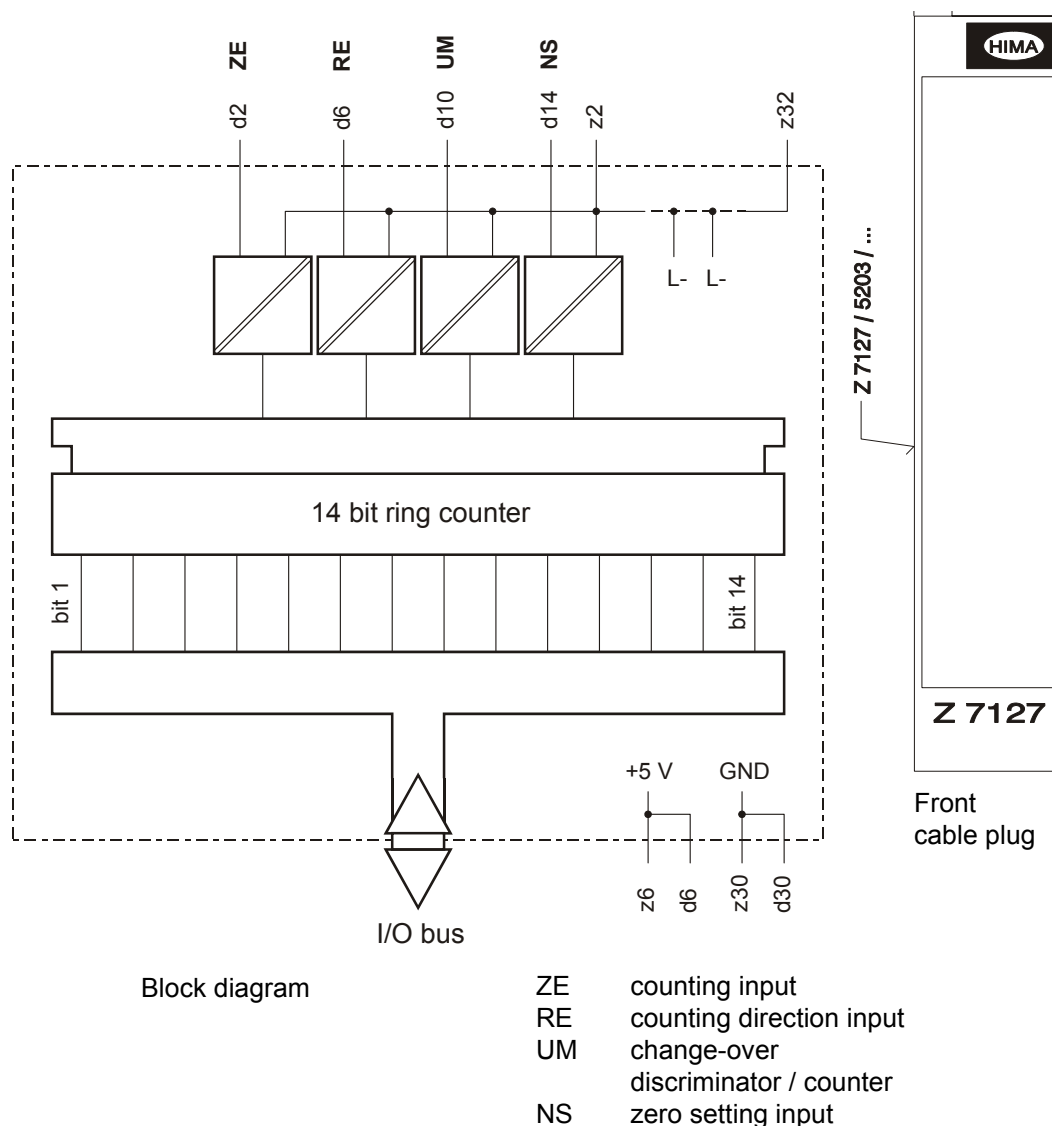


Figure 1: 14 bit ring counter

The module records fast counting pulses. It can be used as a counter or discriminator.

Inputs	1-signal, 4 mA, 24 VDC
Counting frequency	max. 5 kHz
Counting range	0...16383
Space requirement	4 SU
Operating data	5 VDC / 300 mA

The ring counter is controlled via the inputs ZE, RE, UM, NS. The value of the ring counter can be read over the defined digital input.

With 1-signal at the zero setting input (NS) the 14 bit ring counter is set on zero and the value 32,768 is transferred to the digital output. 0-signal transfers 0 to the digital output.

Counting mode

UM = 1-signal

ZE = counting pulses

The counting direction depends on a binary signal at the input RE:

0-signal = forward,

1-signal = backward.

Discriminator mode

UM = 0-signal

ZE = counting pulses

The counting direction depends on the signal sequence of the inputs RE and ZE.

If the signal on ZE changes before RE the counting direction is forward.

If the signal on ZE changes after RE the counting direction is backward.

Function	Connection	Color	
ZE	d2	WH	Cable LiYY 8 x 0.5 mm ²
RE	d6	BN	
UM	d10	GN	
NS	d14	YE	
none	d18	GY	
none	d22	PK	
none	d26	BU	
none	d30	RD	
L-	z2 (L-)	BK	Flat pin plug 2.8 x 0.8 mm ² q = 1 mm ² l = 750 mm

Lead marking of the cable
plug Z 7127 / 5203 / C..

Figure 2: Lead marking of the cable plug Z 7127 / 5203 / C..



F 5220: 2-channel counter module

safety-related, applicable up to SIL 3 according to IEC 61508

- for input signals 24 V and 5 V, safety-related proximity switches and proximity switches according to DIN EN 60947-5-6
 - Counting range 0 Hz to 1 MHz, for pulse counting, gate time monitoring via adjustable gate time, with recognition of rotation direction
 - Fast switching output independent from the PES cycle time
- The module records fast pulses for use in HIMA PES.

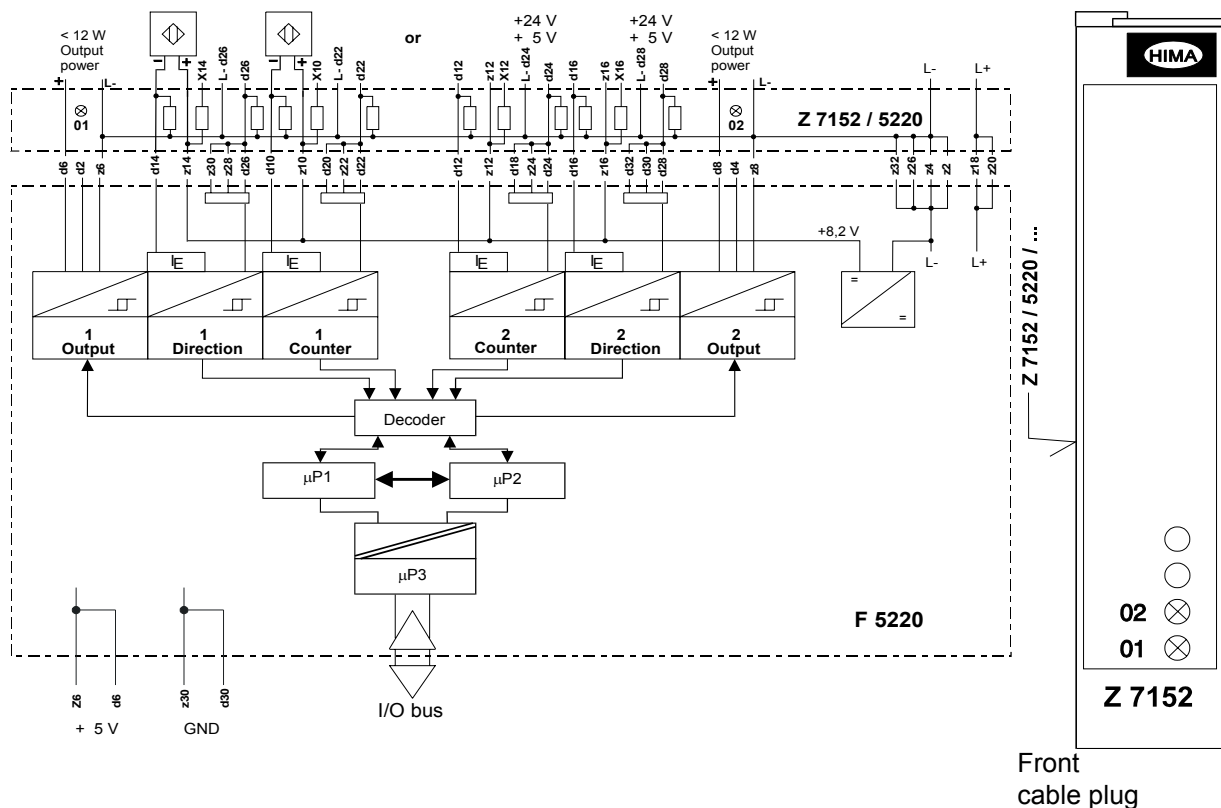


Figure 1: Block diagram and front cable plug

Appertaining function block: HF-CNT-3

Pulse input

- 1-signal 5 VDC (switching level high: 3 V), 6 mA
24 VDC, max. 8 mA
- Counting frequency max. 1 MHz (5 VDC)
- Edge steepness min. 1 V/μs

Proximity switch input

- Counting frequency max. 50 kHz

Resolution	24 Bit
Accuracy	gate time measuring: $\pm 0.5\%$ over the complete range pulse measuring: without loss of any pulse
Gate time	$n * 50 \text{ ms}$ ($n = 0 \dots 65,535$)
Min. pulse length	500 ns
Line length	500 m, screened, twisted pair (for 100 kHz)
Space requirement	4 SU
Operating data	5 VDC / 200 mA 24 VDC / 500 mA plus load
Outputs	2 with integrated safety shutdown, 1 output related to each input, switchable independent from the PES cycle; monitoring of the lines for short-circuit and line break SIL 1..SIL2 (evaluation only for used signals) Allowable line resistance 11 Ω max. (forward and return line)
• Output power	500 mA, 24 VDC
• short-circuit current	0.75...1.5 A
• line break	0.5...9.5 mA
• output leakage current	350 μA max.
• length of the test signal	200 μs max.
Reaction time	
• gate time measuring:	50 ms typical (depends on application: speed of the rotation variation)
• pulse measuring:	<100 μs verified during the safety time of the counter module

The error codes for the module are shown in the display of the corresponding central module. For further informations see operating system manual.

The parameterization of the module must also be performed according to the operating system manual for the currently used version of the operating system. Especially the chapter about the noise blanking has to be regarded.

Setting: Safety time $\geq 3 \times$ watchdog time.

Channel	Connection	Color	Color	Color
		Type A	Type B	Type C
Counter1 prox.sw.	z10 d10			WH BN
Counter1 24V/5VDC	d22 L- d22	WH BN	WH BN	
Direct. 1 prox.sw.	z14 d14			GN YE
Direct. 1 24V/5VDC	d26 L- d26	GN YE	GN YE	
Output 1	d6 z6	BK VT	BK VT	BK VT
Counter2 prox.sw.	z12 d12			GY PK
Counter2 24V/5VDC	d24 L- d24	GY PK	GY PK	
Direct. 2 prox.sw.	z16 d16			BU RD
Direct. 2 24V/5VDC	d28 L- d28	BU RD	BU RD	
Output 2	d8 z8	GYPK RDBU	GYPK RDBU	GYPK RDBU
L+ L-	z18 z2	RD BK	RD BK	RD BK
Cable shield		YEGN	YEGN	YEGN

Cable
LiYCY
6 x 2 x 0.5 mm²
screened

q = 1 mm²
l = 750 mm

Flat pin plug
2.8 x 0.8 mm²

l = 120 mm
q = 2.5 mm²

Figure 2: Lead marking cable plug

Flat pin plug 6.3 x 0.8 mm, to be connected to the earth bar under the slot

Lead marking cable plug

Type A cable plug Z 7152 / 5220 / C.. / PU5 / P2 (for 5 V)

Type B cable plug Z 7152 / 5220 / C.. / PU24 / P2 (for 24 V)

Type C cable plug Z 7152 / 5220 / C.. / PSW / P2 (for prox. switches)

The cable plug type A for 5 V and type B for 24 V are different in the resistance assembling. The cable plug for 5 V **may not** be used for 24 V signals.



The module must only be operated with forced ventilation (fan).

The fan (K 9203) must be installed above the subrack where the F 5220 module is plugged in.

If the F 5220 module is operated in an H 41q, the fan (K 9212) must be installed directly under the F 5220 module.

In order to ensure the forced ventilation, the air deflector panel M 7201 (1 HE) must be mounted over the fan (K 9203) or over the kit H 41q. The air deflector panel M 7201 deflects the warm air to the rear, in order to avoid a temperature rise of the subracks and modules which are mounted above.

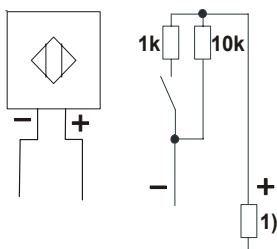
Function table

Proximity Switch Inputs	Signal	Status
$I_E = 0.35 \dots 2.1 \text{ mA}$ 	FALSE	OK
$I_E = 2.9 \dots 4.5 \text{ mA}$ 	TRUE	OK
$I_E > 5.1 \text{ mA}$	FALSE	short-circuit
$I_E < 0.2 \text{ mA}$	FALSE	line break

Notes

- The input configuration with safety-related proximity switches, e.g. P&F (... SN), contains a monitoring of the lines for short-circuit and line break.
- When safety-related proximity switches are used, please refer to the specifications and notes of the manufacturers.
- When non-safety-related proximity switches according to DIN EN 60947-5-6 are used, external 390Ω (0.25 W) resistors connected in series must be used.
- When operating in a redundant mode with proximity switches, in one of the two cable plugs the shunts must be removed.
- Direction inputs (proximity switches) which are not used must be terminated by a $6 \text{ k}\Omega$ resistor.

Alternatively to the proximity switch a resistor-wired sensor can be used:



1) use either connection X10 (X12, X14, X16) in the cable plug (resistor 390Ω existent) or separate 390Ω resistor connected in series

Figure 3: Resistor-wired sensor

Operating modes

- Pulse counting
- Gate time measuring
- Cycle independent output switching with comparison operation
- Recognition of rotation direction

Pulse counting

The module is counting up the incoming pulses. The resolution of the counter on the module is 24 bit. The value provided by the function block HF-CNT-3 for the user program is from type DINT. The counting range of the variable is $0 \dots 16,777,215$. The value of the variable can be reset via the function block. The counter starts again with 0 at overflow.

Gate time measuring

In the mode gate time measuring the module counts the incoming pulses over a parameterizable gate time ($n * 50 \text{ ms}$).

The gate time is a variable type UINT entered in steps of 50 ms. The gate time range is 0...65,535 (0...3276.75 s).

Cycle independent output switching with comparison operation

The output on the module is independent of the PES cycle time. It switches off when used for pulse counting if the parameterized value is reached (resolution from value 0...16,500,000) or when used for gate time measuring when the number of the parameterized pulses do not come in.

The switching off value is parameterizable at the function block HF-CNT-3 as type DINT.

Recognition of rotation direction

The rotation direction depends on the signal sequence of counter input and direction input. There has to be a phase shift between them:

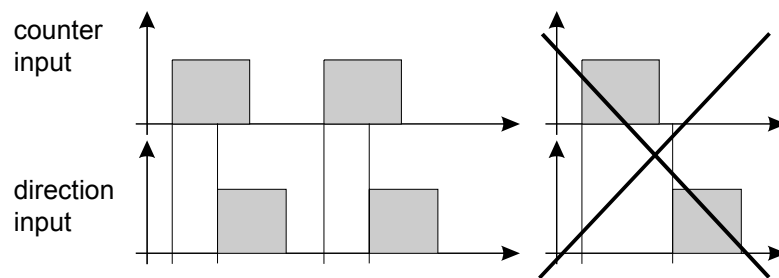


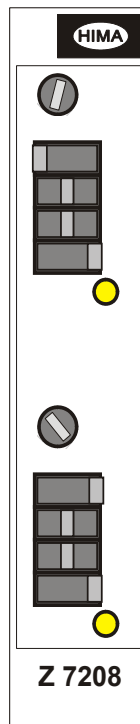
Figure 4: Application for clockwise rotation

If the direction of rotation pulse is leading, the function block shows a counter-clockwise rotation. If the pulse is lagging, there is a clockwise rotation. There is the possibility by parameterization to count only the pulses of one direction of rotation.

Test connector Z 7208

For testing the functions of the counter module F 5220 the test plug Z 7208 can be fixed on the module instead of the normal front cable plug. The plug generates signals to check the function.

The plug is connected with L+ and L- to the supply voltage for the concerning slot.



Operating elements of the test plug

Channel 2, Adjuster P2

Switch S7 *counter-clockwise* | clockwise
 Switch S5 LB | *normal* | LS
 Switch S8 LB | *normal* | LS
 Switch S6 LB | *normal*
 LED V2

Channel 1, Adjuster P1

Switch S2 counter-clockwise | *clockwise*
 Switch S1 LB | *normal* | LS
 Switch S3 LB | *normal* | LS
 Switch S4 LB | *normal*
 LED V1

Switch positions shown in *italic*

Functions

Adjuster P1 / P2	Adjustment of the supplied frequency (5 V)
Switch S2 / S7	Adjustment of the direction of rotation: counter-clockwise / clockwise
Switch S1 / S5	Line test of the counter input (proximity switch): LB = line break, normal, LS = line short circuit
Switch S3 / S8	Line test of the direction input (proximity switch): LB = line break, normal, LS = line short circuit
Switch S4 / S6	Line test of the output (pulse operation): LB = line break, normal
LED V1 / V2	Status display of the output

Using the counter module F 5220 with EMC filters and Ex isolated switch amplifiers

An EMC filter between the F 5220 and a proximity switch eliminates electromagnetic interferences of the proximity switch line. The effectivity of the filter depends on the installation and the conditions of the plant.

The Ex isolated switch amplifier HIMA H 4011 / H 4012 can be used for the galvanic isolation of proximity switches of the L+/L- potentials of the module. If the plants are electromagnetically exposed this is highly recommended. If using any Ex isolated switch amplifier HIMA power supply filters Z 6015 or H 7013 must be implemented. These dampen or eliminate the interferences in the supply lines of the switch amplifier, which can initiate count impulses in the counter module F 5220.

The following interferences between earth and L- or L+ are dampen by EMC filters and/or Ex isolated switch amplifiers:

- wide-banded, low energy switching interferences (burst)
according to IEC EN 61000-4-4 up to 2 kV, and
- wide-banded, high energy switching overvoltages (surge)
according to IEC EN 61000-4-5 up to 1 kV on a 24 VDC power supply circuit.

The interferences are discharged to earth.



F 6214: 4-channel analog input module

safety-related, applicable up to SIL 3 according to IEC 61508

- for transmitters in two-wire technology 4...20 mA
- voltage inputs 0...1/5/10 V
- current inputs 0...20 mA, with safe isolation
- resolution: 12 bits

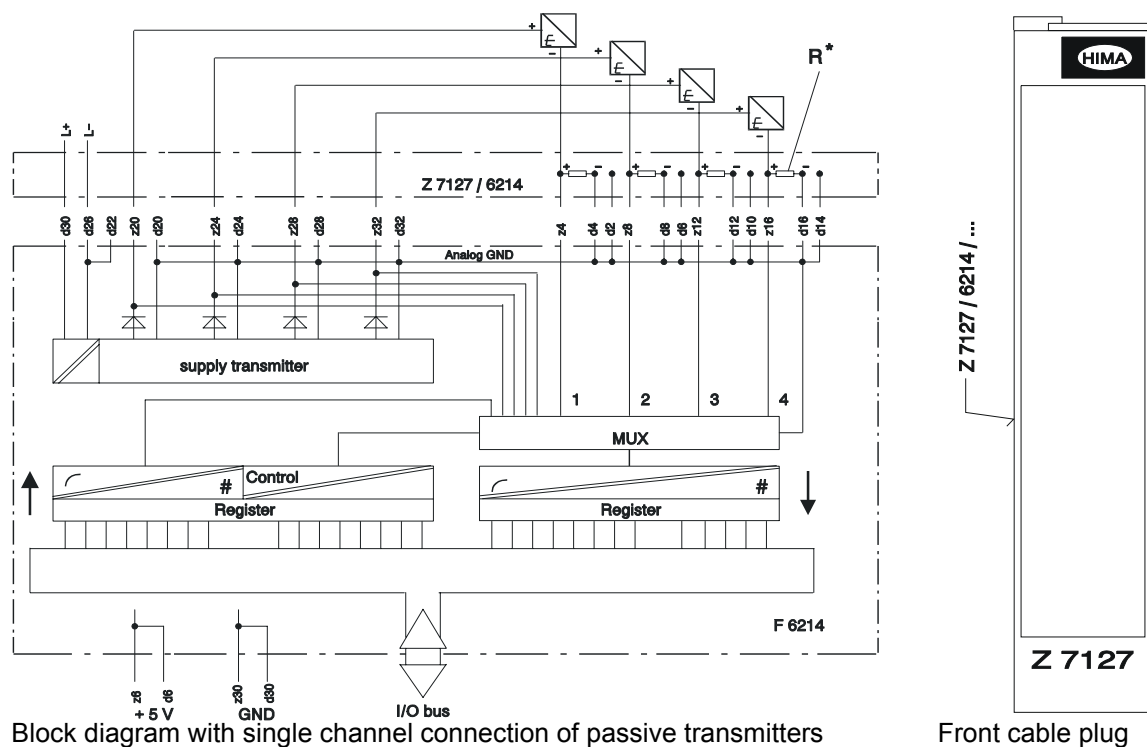


Figure 1: Block diagram and front cable plug

Appertaining function block: HA-RTE-3

Input voltage	0...1.06 V (appr. 6 % overflow)
Digital values	0 mV = 0
	1 V = 3840, 21.3 mA = 4095
Wait after test	100 ms
R*: Shunt for	50 Ω; 0.05 %; 0.125 W;
current input	T<10 ppm/K; part-no: 00 0710500
Input resistance	1 MΩ
Time const. input filter	approx. 10 ms
Transmitter supply	25 V...20 V, 0...22 mA
Short circuit current	25 mA
Load impedance	max. 900 Ω
Scan time	max. 100 ms for 4 channels
Basis error	0.2 % at 25 °C
Operating error	0.3 % at 0...+60 °C
Electric strength	250 V against GND
Space requirement	4 SU
Operating data	5 VDC / 150 mA
	24 VDC / 250 mA

Channel	Connection	Color	Channel	Connection	Color
1	z20 z4 x4 d4	WH BN GN	1	z20 z4 x4 d4	WH BN GN
2	z24 z8 x8 d8	YE GY PK	2	z24 z8 x8 d8	YE GY PK
3	z28 z12 x12 d12	BU RD BK	3	z28 z12 x12 d12	BU RD BK
4	z32 z16 x16 d16	VT WHBN WHGN	4	z32 z16 x16 d16	VT WHBN WHGN
L- L+	d26 d30	BK RD	L- L+	d26 d30	BK RD
Cable screen		YEGN	Cable screen		YEGN

Cable
LiYCY
12 x 0.25 mm²
screened

I = 750 mm
q = 1 mm²

Flat pin
plug
2.8 x 0.8 mm²

I = 120 mm
q = 2.5 mm²

Flat pin plug 6.3 x 0.8 mm, to be connected to the earth bar under the slot

Lead marking cable plug to connect active and passive transmitters
Z 7127 / 6214 / C.. / ITI (U1V)

Lead marking cable plug to connect voltage via potentiometer and smart transmitters
Z 7127 / 6214 / C.. / U5V (U10V)

Figure 2: Lead marking cable plug

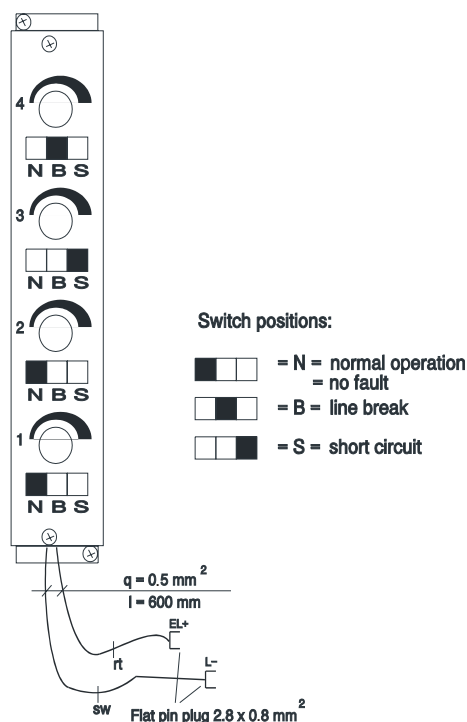


Figure 3: Design of test plug Z 7205

The module is automatically tested during operation. The main test routines are:

- Linearity of the A/D converter
- Cross-talk between the four input channels
- Function of the input filters
- Transmitter supply voltage

Current inputs:

Measuring range 0/4 - 20 mA

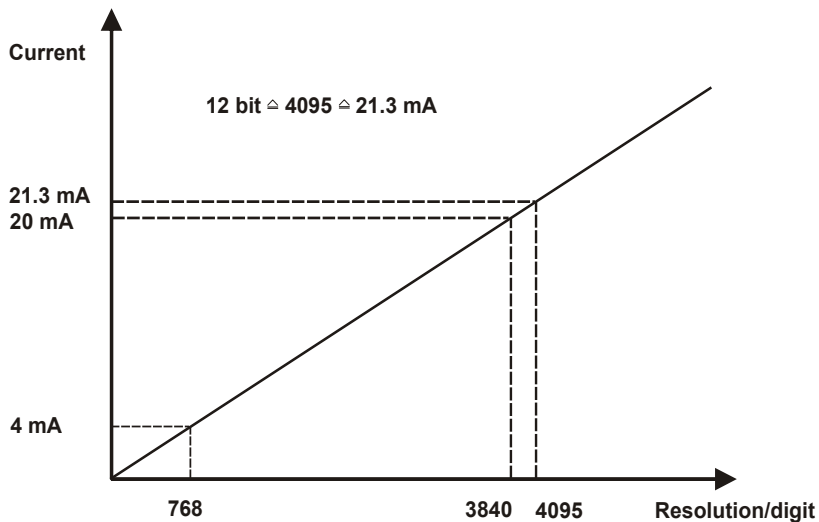


Figure 4: Current inputs

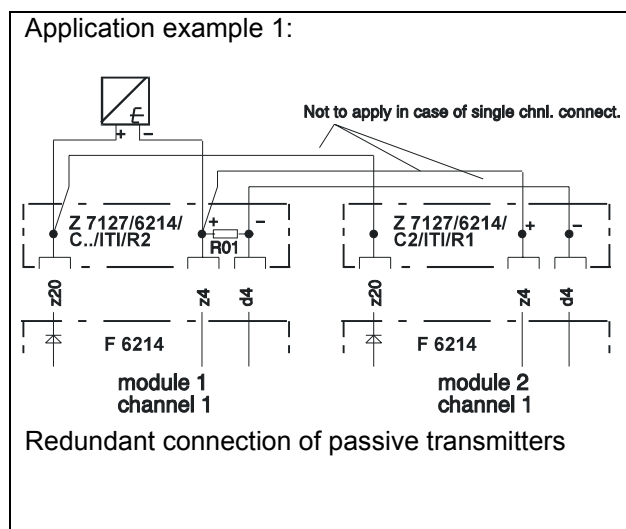


Figure 5: Application example 1

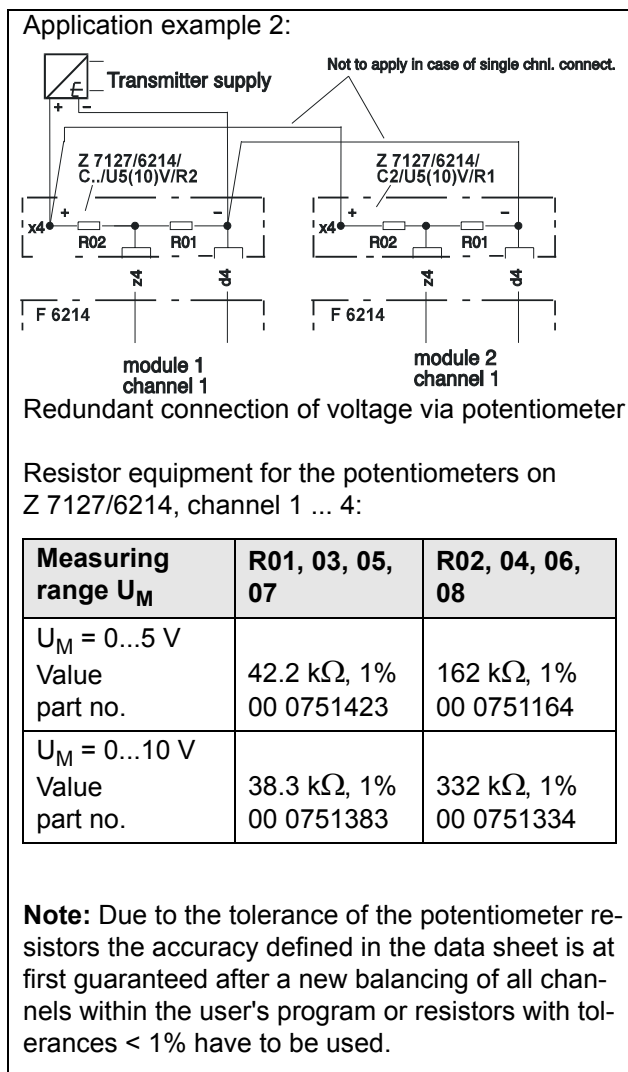


Figure 6: Application example 2

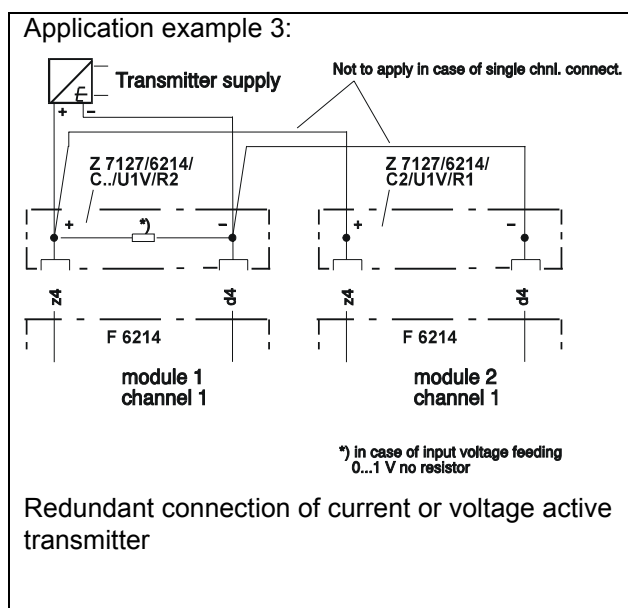


Figure 7: Application example 3

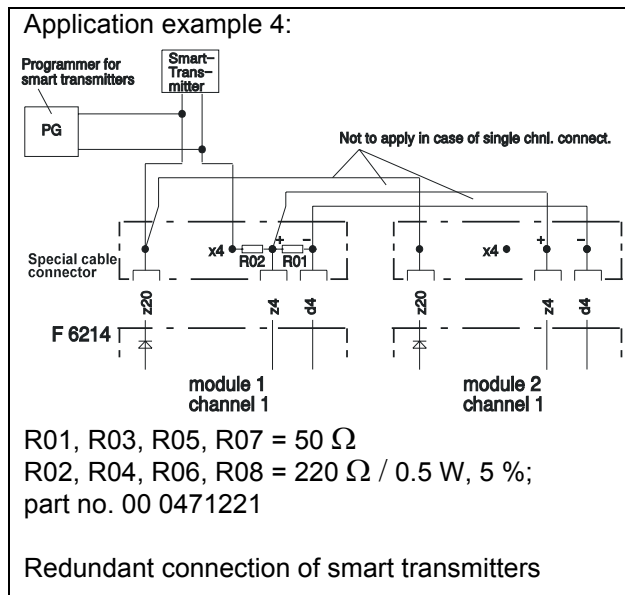


Figure 8: Application example 4

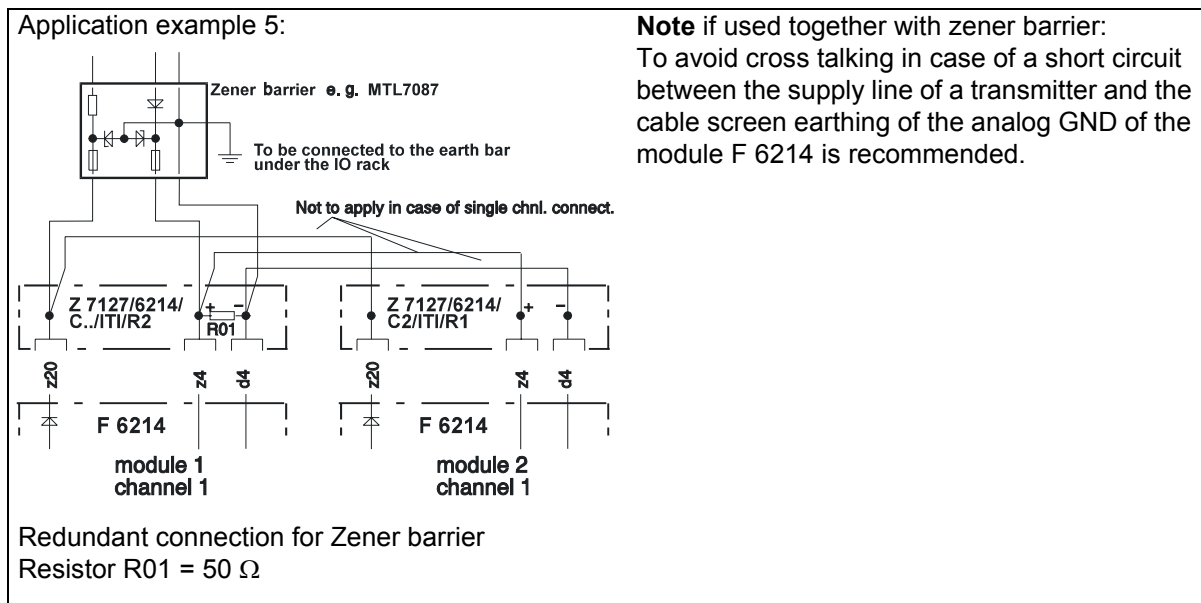


Figure 9: Application example 5

Occupation of not used inputs

To guarantee the correct operation of the internal test routines not used analog inputs have to be terminated with resistors.

Not used inputs, single channel connection

All examples are for channel 1

Installation of the resistors outside the cable connectors: On terminals.

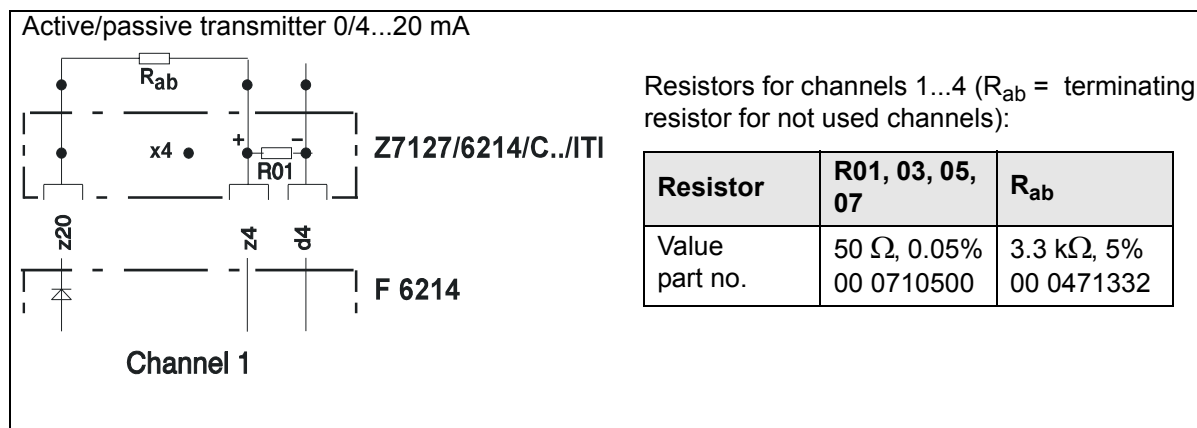


Figure 10: Active/passive transmitter 0/4 ... 20 mA

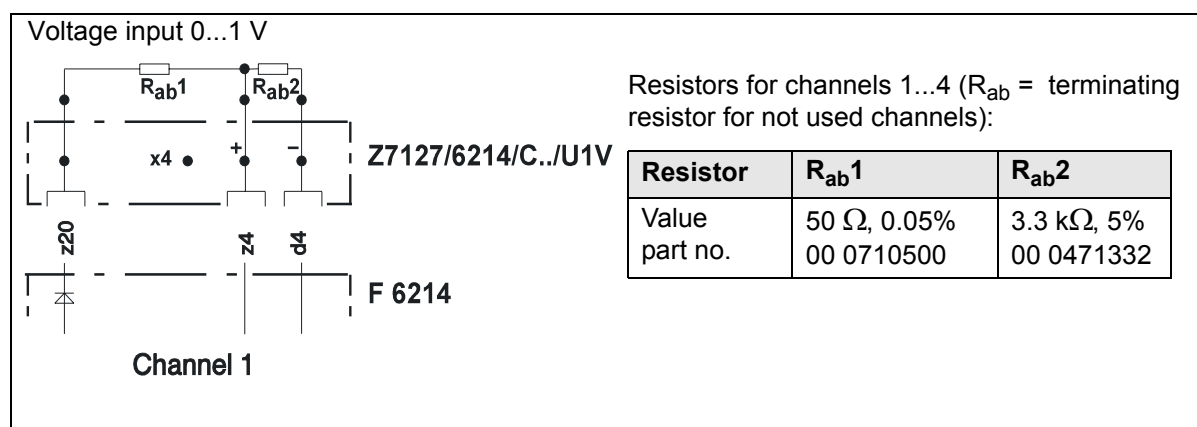


Figure 11: Voltage input 0...1 V

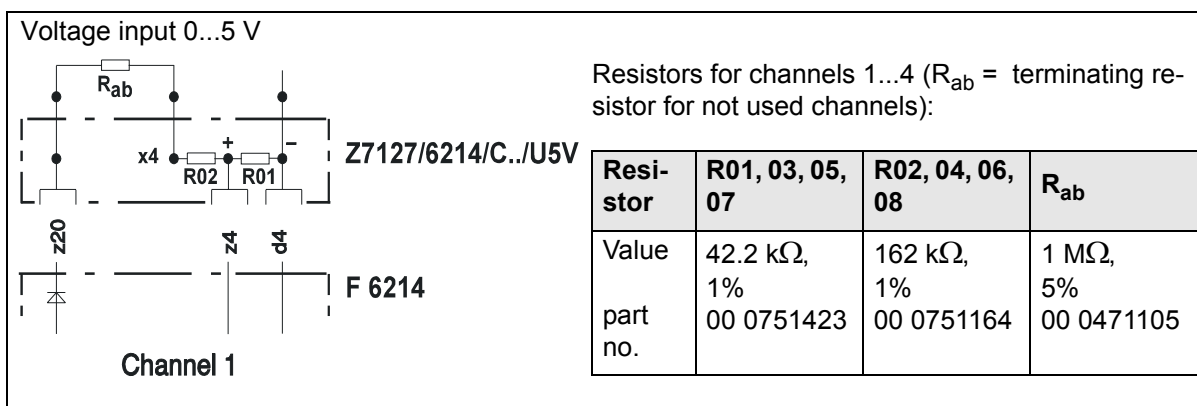


Figure 12: Voltage input 0...5 V

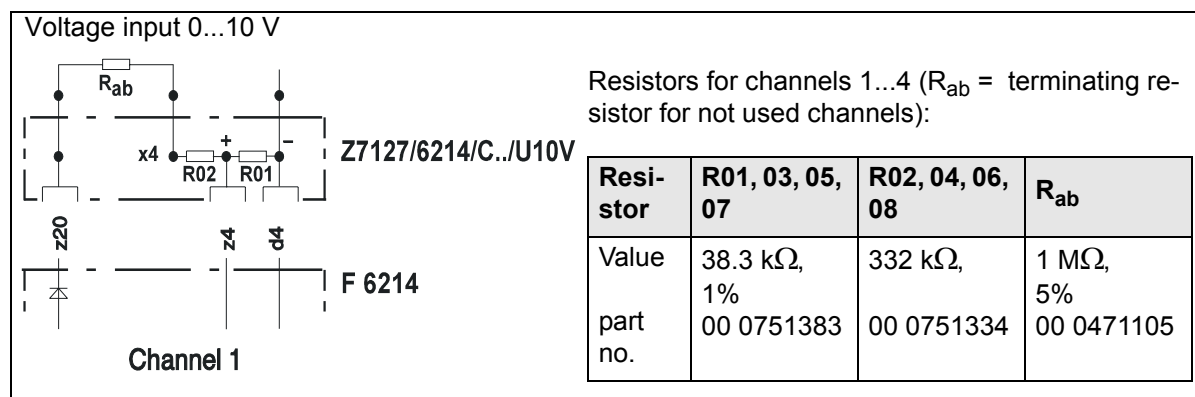


Figure 13: Voltage input 0...10 V

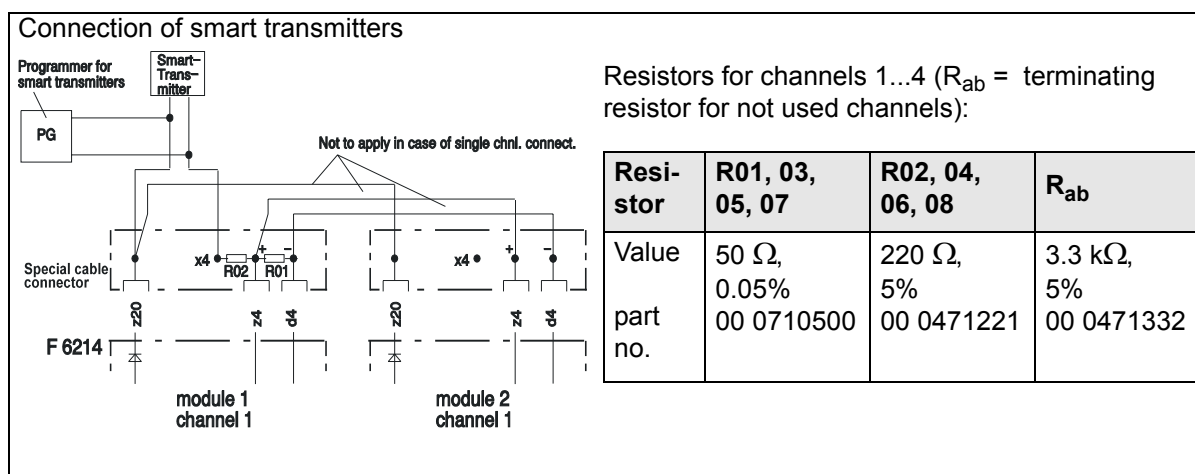


Figure 14: Connection of smart transmitters

Not used inputs, redundant connection

All examples are for channel 1

Install the resistors outside the cable connectors on terminals.

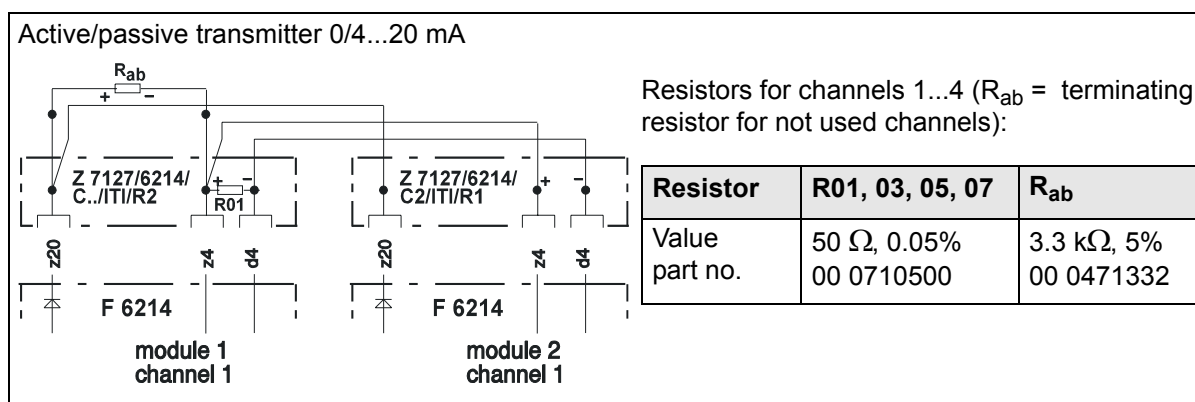


Figure 15: Active/passive transmitter 0/4...20 mA

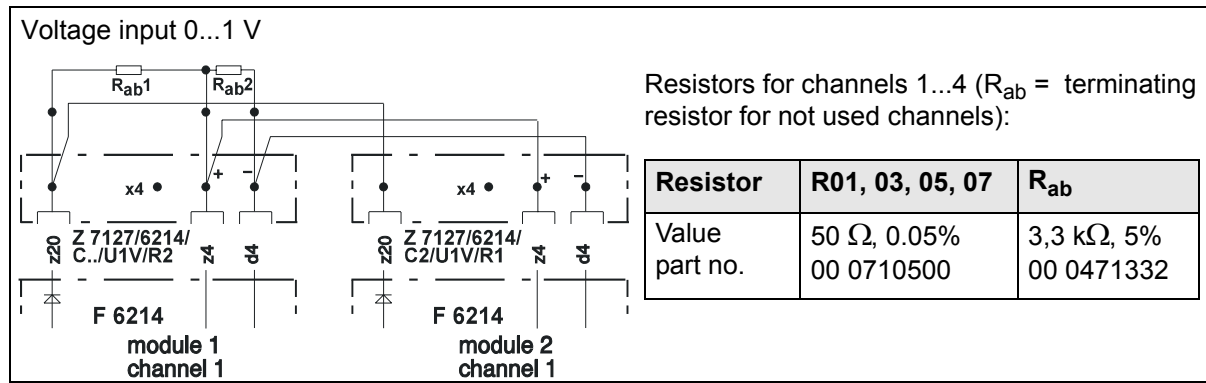


Figure 16: Voltage input 0...1 V

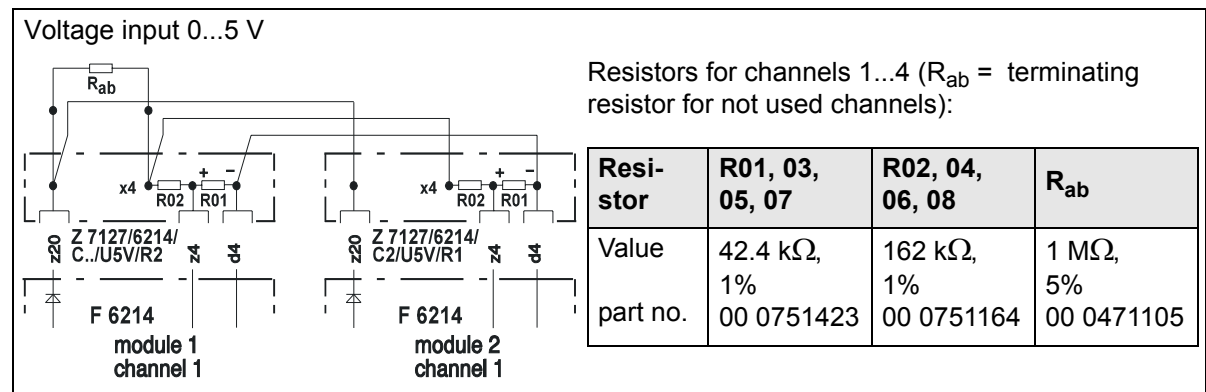


Figure 17: Voltage input 0...5 V

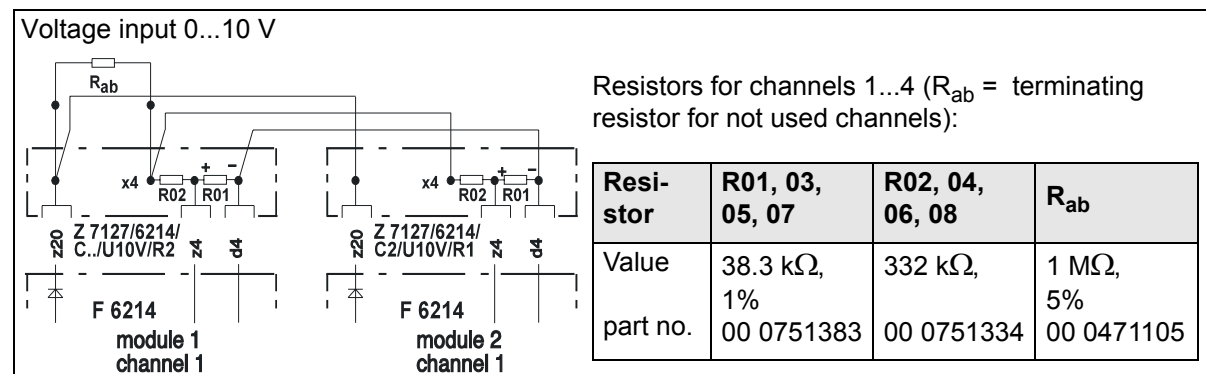


Figure 18: Voltage input 0...10 V

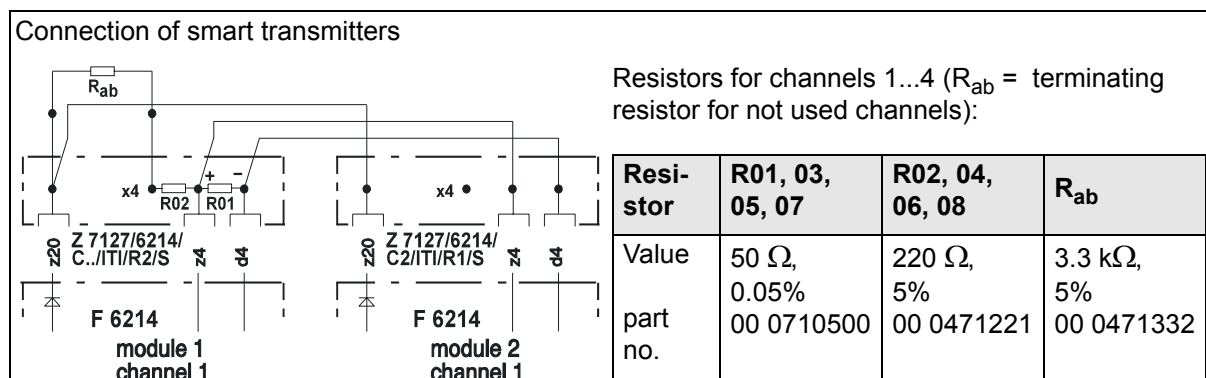
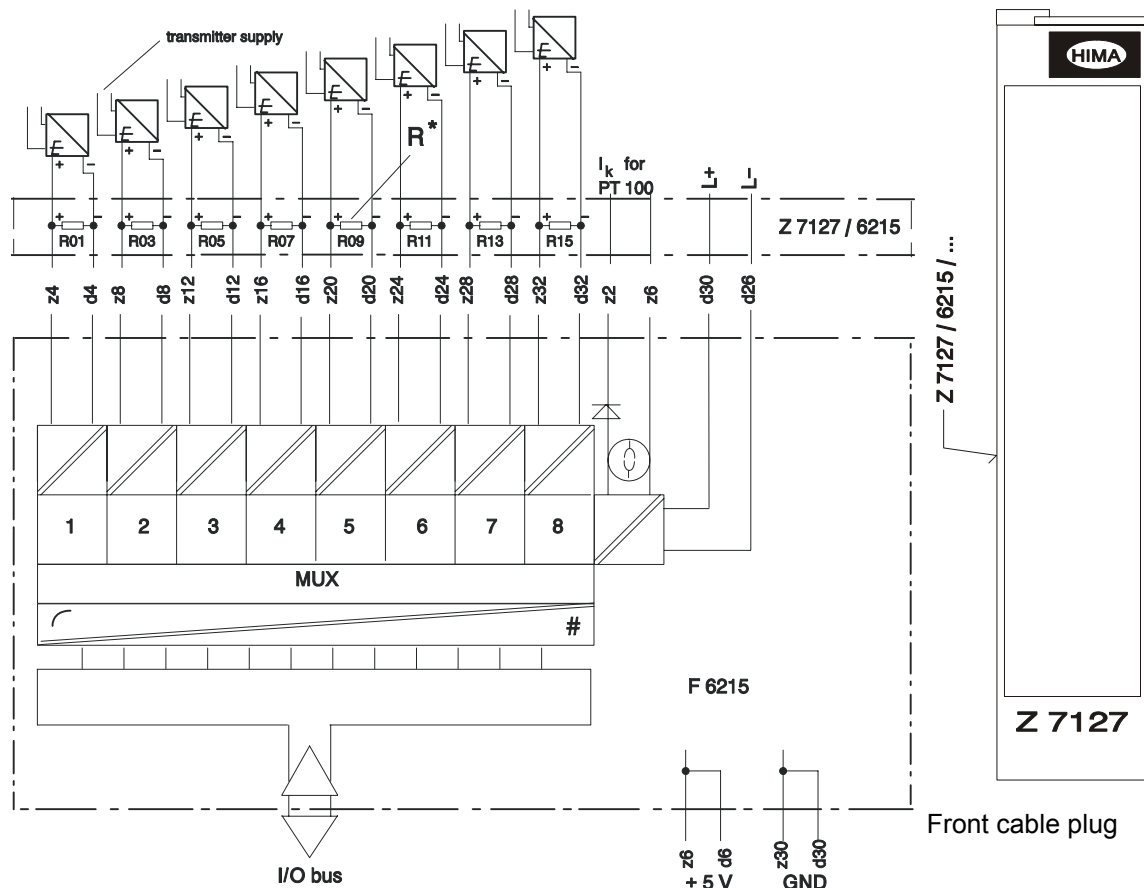


Figure 19: Connection of smart transmitters



F 6215: 8-channel analog input module

- for voltage inputs 0...1/5/10 V, Pt 100 inputs
- current inputs 0/4...20 mA
- with safe isolation to the plant and electric isolation between the inputs
- Resolution: 12 bits



Block diagram

Figure 1: Block diagram and front cable plug

Input voltage	0...1.06 V (appr. 6 % overflow)
Digital values	0 mV = 0, 1 V = 3840, 21.3 mA = 4095
R*: Shunt with current input	50 Ω ; 0.05 %; 0.125 W; T<10 ppm/K; part-no: 00 0710500
Input resistance	min. 1 M Ω
Time const. input filter	approx. 2.2 ms
Conversion time	max. 4 ms for 8 channels
Basis error	0.1 % at 25 °C
Operating error	0.3 % at 0...+60 °C
Electric strength	200 V against Analog GND
I _k for PT 100	2.5 mA
Space requirement	4 SU
Operating data	5 VDC / 100 mA, 24 VDC / 140 mA

Channel	Connection	Color	Channel	Connection	Color
IK for PT100	z2 z6	WHRD WHBK	IK for PT100	z2 z6	RDWH BKWH
1	z4 x4 d4	BN WH	1	z4 x4 d4	BN WH
2	z8 x8 d8	YE GN	2	z8 x8 d8	YE GN
3	z12 x12 d12	PK GY	3	z12 x12 d12	PK GY
4	z16 x16 d16	RD BU	4	z16 x16 d16	RD BU
5	z20 x20 d20	VT BK	5	z20 x20 d20	VT BK
6	z24 x24 d24	WHGN WHBN	6	z24 x24 d24	WHGN WHBN
7	z28 x28 d28	WHGY WHYE	7	z28 x28 d28	WHGY WHYE
8	z32 x32 d32	WHBU WHPK	8	z32 x32 d32	WHBU WHPK
L– L+	d26 d30	BK RD	L– L+	d26 d30	BK RD
Cable screen		YEGN	Cable screen		YEGN

Cable
LiYCY
20 x 0.25 mm²
screened

l = 750 mm
q = 1 mm²

Flat pin
plug
2.8 x 0.8 mm²

l = 120 mm
q = 2.5 mm²

Flat pin plug 6.3 x 0.8 mm, to be connected to the earth bar under the slot

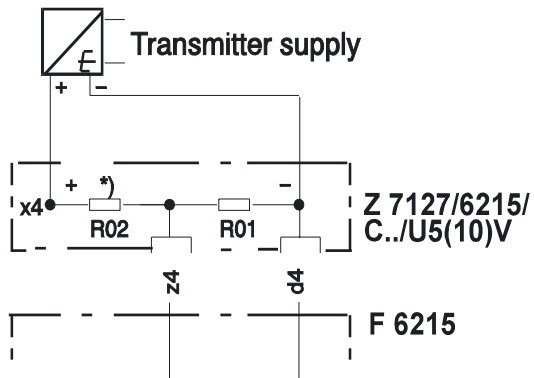
Lead marking cable plug to connect current/
voltage Z 7127 / 6215 / C.. / I (U1V)

Lead marking cable plug to connect voltage via
potentiometer
Z 7127 / 6215 / C.. / U5V (U10V)

Figure 2: Lead marking cable plug

Note to voltage inputs:

Note It is recommended to short-circuit unused voltage inputs in the cable plug or on the appertaining terminal row.



*) R02 = Potentiometer type resistor,
value depending on voltage range

Figure 3: Connection with potentiometer (for voltage areas $\neq 0 \dots 1$ V)

Note to the connection with potentiometer:

Note	Due to the tolerance of the potentiometer resistors the accuracy defined in the data sheet is at first guaranteed after a new balancing of all channels within the user program, or resistors with tolerances < 1 % have to be used.

Resistor equipment for the potentiometers on Z 7127 / 6215, channel 1...8:

Measuring range U_M	R01, 03, 05, 07, 09, 11, 13, 15	R02, 04, 06, 08 10, 12, 14, 16
$U_M = 0 \dots 5$ V		
Value	33.2 k Ω , 1%	133 k Ω , 1%
Part no.	00 0751333	00 0751134
$U_M = 0 \dots 10$ V		
Value	20 k Ω , 1%	178 k Ω , 1%
Part no.	00 0751203	00 0751174

Table 1: Resistor equipment

Current inputs:

Measuring range 0/4 - 20 mA

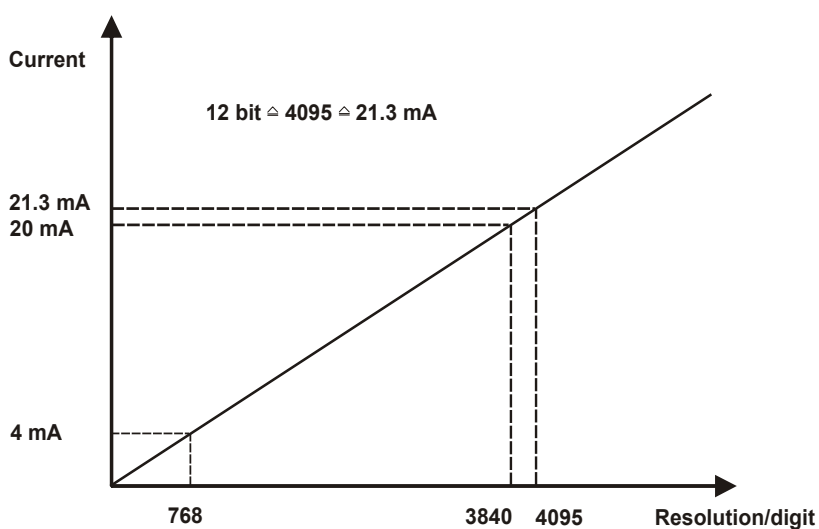


Figure 4: Current inputs

Two-wire technique with one Pt100 and line balancing (option):

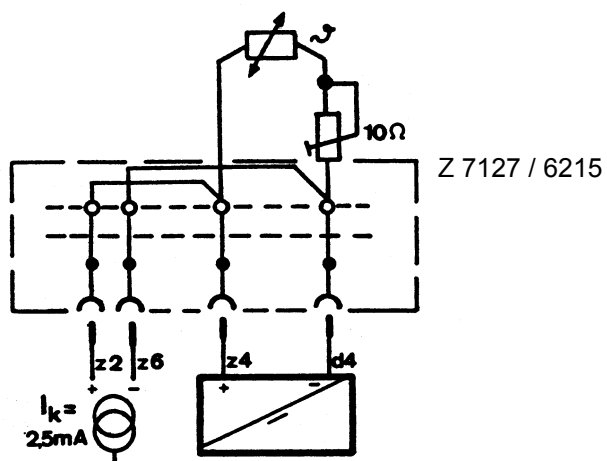


Figure 5: Two-wire technique with one Pt100 and line balancing (option)

Line compensation via correction calculation in the user program.

Using of more than one Pt100 in two-wire technique:

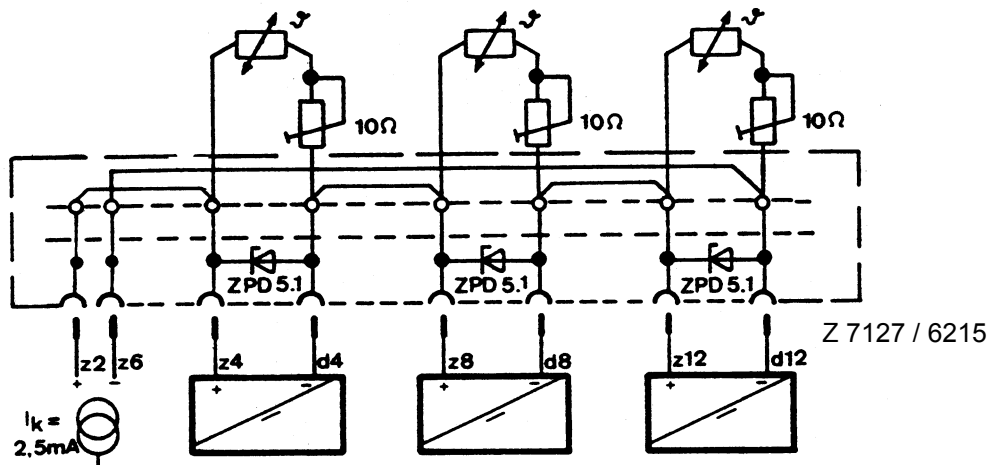


Figure 6: Using of more than one Pt100 in two-wire technique

Line compensation via correction calculation in the user program.

Connection of one Pt100 in three-wire technique:

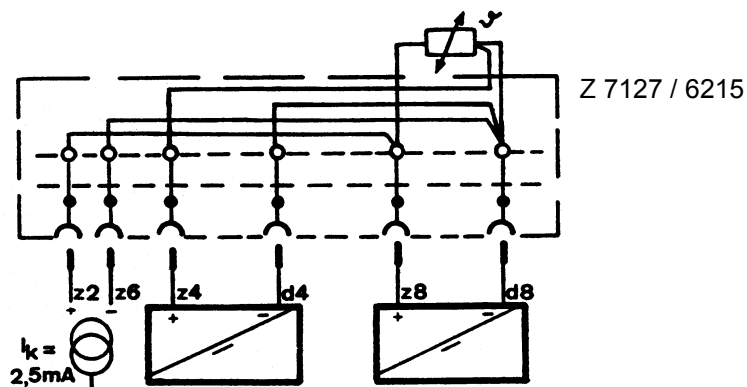


Figure 7: Connection of one Pt100 in three-wire technique

Connection of more than one Pt 100 in three-wire technique:

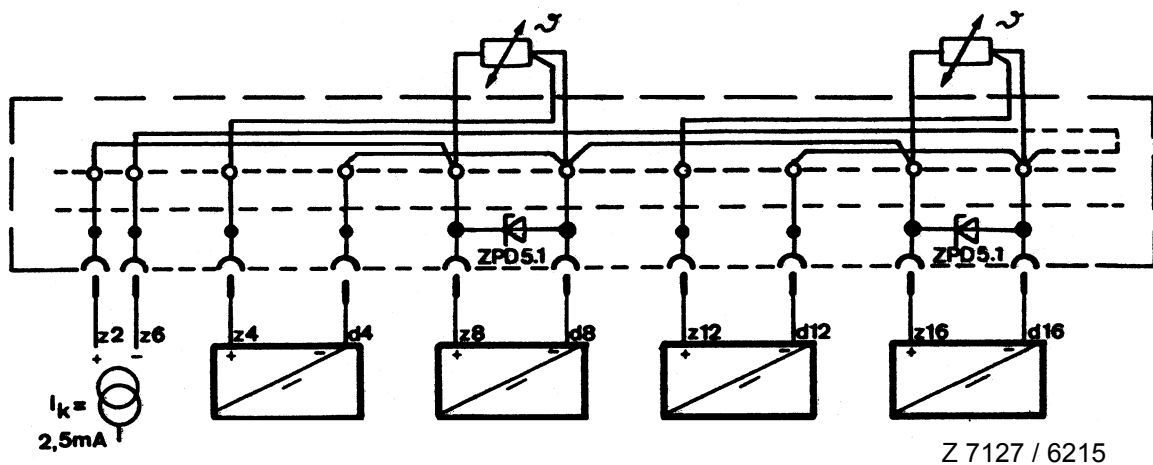


Figure 8: Connection of more than one Pt 100 in three-wire technique

Using of one Pt 100 in four-wire technique:

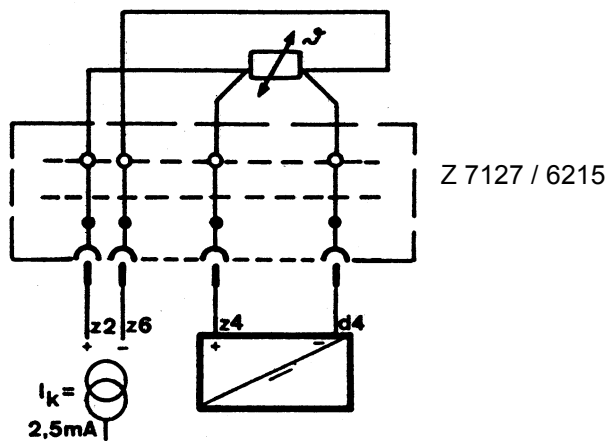


Figure 9: Using of one Pt 100 in four-wire technique

Using of more than one Pt 100 in four-wire technique:

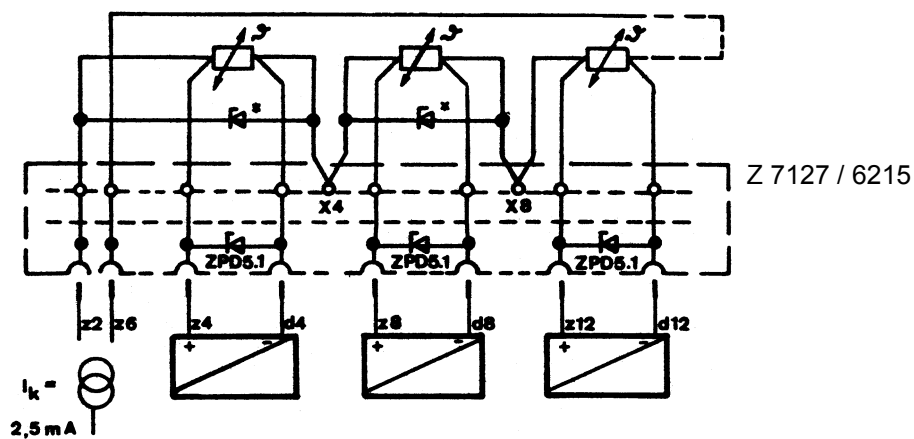


Figure 10: Using of more than one Pt 100 in four-wire technique

*) Installation of diode ZPD 5.1 on terminals in case of replacing a Pt 100 element.

Note

The resistance of the current loop must be less than 6 kΩ!

Reason: To ensure the security of the functions of all other Pt 100 measurements in case of **one** thermometer break.



F 6216A: 8-channel analog input module with transmitter supply

- for transmitters in two-wire technique 4...20 mA
- Pt 100 inputs, current inputs 0/4...20 mA
- with safety isolation to the plant and electrical isolation between the inputs
- resolution: 12 bits
- transmitter supply with safety isolation

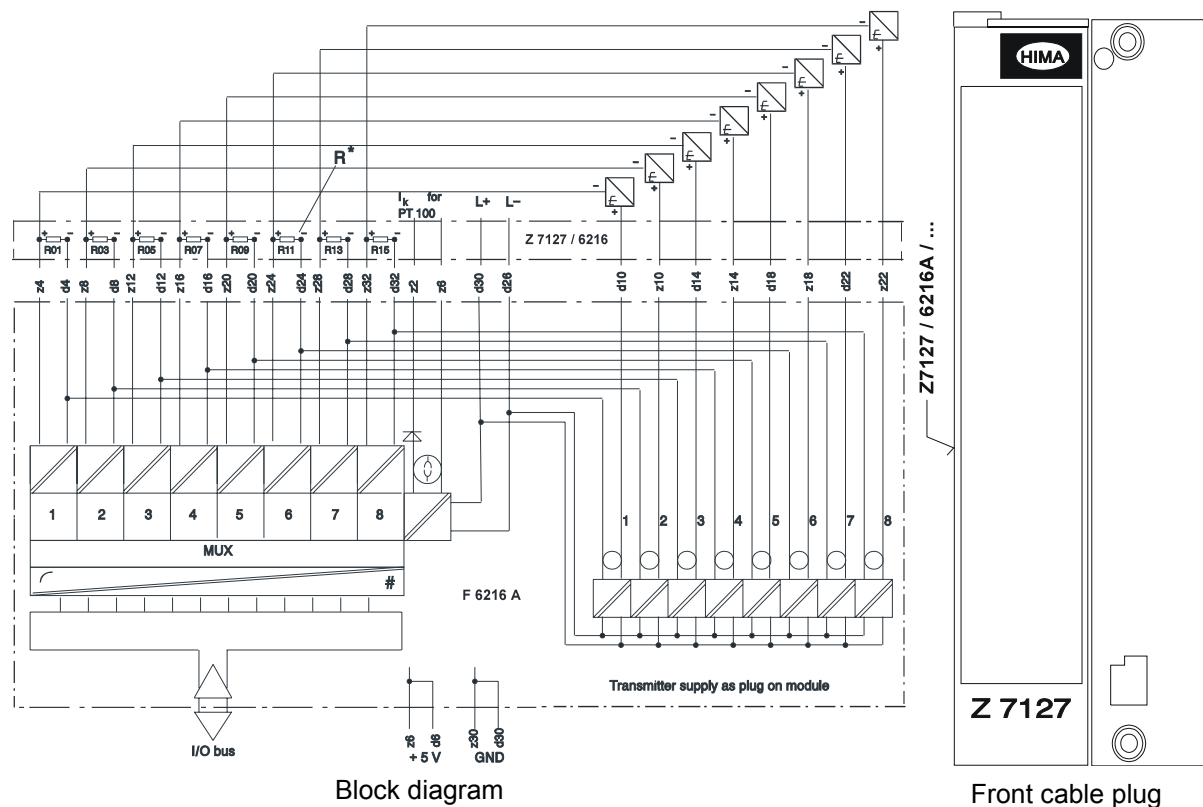


Figure 1: Block diagram and front cable plug

Analogue input module:

Input voltage	0...1.06 V (approx. 6 % overflow)
Digital values	0 mA = 0, 20 mA = 3840, 21.3 mA = 4095
R*: Shunt with	50 Ω; 0.05 %; 0.125 W;
current input	T<10 ppm/K; part-no: 00 0710500
Input resistance	min. 1 MΩ
Time const. input filter	approx. 2.2 ms
Conversion time	max. 4 ms for 8 channels
Basis error	0.2 % at 25 °C (of upper range value)
Operating error	0.4 % at 0...+60 °C (of upper range value)
Electric strength	200 V against Analog GND
I _k for PT 100	2.5 mA
Space requirement	8 SU
Operating data	5 VDC / 100 mA, 24 VDC / 590 mA

Transmitter supply:

Output	short-circuit-proof
Output voltage	26 V...21 V ($I > 1 \text{ mA}$)
Output current	0...25 mA
Load impedance	max. 900Ω
Short circuit current	30...40 mA

Channel	Connection	Color	Channel	Connection	Color
IK for PT100	z2 z6	WHRD WHBK	IK for PT100	z2 z6	WHRD WHBK
1	z4 x4 d10	BN WH	1	z4 x4 d10	BN WH
2	z8 x8 z10	YE GN	2	z8 x8 z10	YE GN
3	z12 x12 d14	PK GY	3	z12 x12 d14	PK GY
4	z16 x16 z14	RD BU	4	z16 x16 z14	RD BU
5	z20 x20 d18	VT BK	5	z20 x20 d18	VT BK
6	z24 x24 z18	WHGN WHBN	6	z24 x24 z18	WHGN WHBN
7	z28 x28 d22	WHGY WHYE	7	z28 x28 d22	WHGY WHYE
8	z32 x32 z22	WHBU WHPK	8	z32 x32 z22	WHBU WHPK
L–	d26	BK	L–	d26	BK
L+	d30	RD	L+	d30	RD
Cable screen		YEGN	Cable screen		YEGN

Cable
LiYCY
20 x 0.25 mm²
screened

$l = 750 \text{ mm}$
 $q = 1 \text{ mm}^2$

Flat pin
plug
2.8 x 0.8 mm²

$l = 120 \text{ mm}$
 $q = 2.5 \text{ mm}^2$

Flat pin plug 6.3 x 0.8 mm, to be connected to the earth bar under the slot

Lead marking cable plug
Z 7127 / 6216 / C.. / IT to connect current/voltage

Lead marking cable plug to connect smart transmitters
Z 7127 / 6216 / C.. / IT

Figure 2: Lead marking cable plug

Note to voltage inputs:

Note It is recommended to short-circuit unused voltage inputs in the cable plug or on the appertaining terminal row.

Current inputs:

Measuring range 0/4 - 20 mA

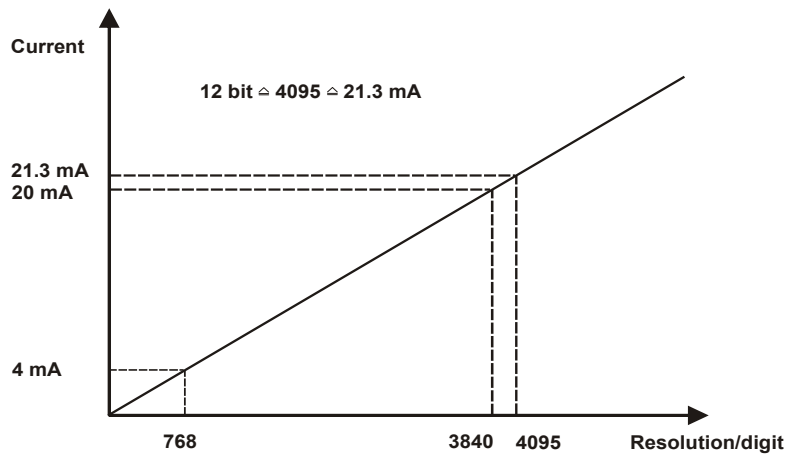
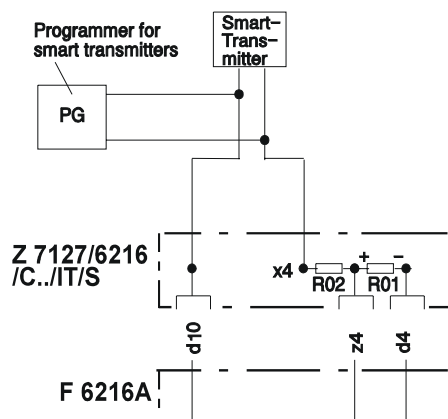


Figure 3: Current inputs

Smart transmitter



R01, R03, R05, R07,
R09, R11, R13, R15 =
50 Ω , 0.05 %
R02, R04, R06, R08,
R10, R12, R14, R16 =
220 Ω , 0.5 W, 5 %,
Part no.:
00 0471221

Connection of smart
transmitter

Figure 4: Connection of smart transmitter



F 6217: 8-channel analog input module

safety-related, applicable up to SIL 3 according to IEC 61508

- for current inputs 0/4...20 mA, voltage inputs 0...5/10 V
- with safe isolation
- resolution: 12 bits

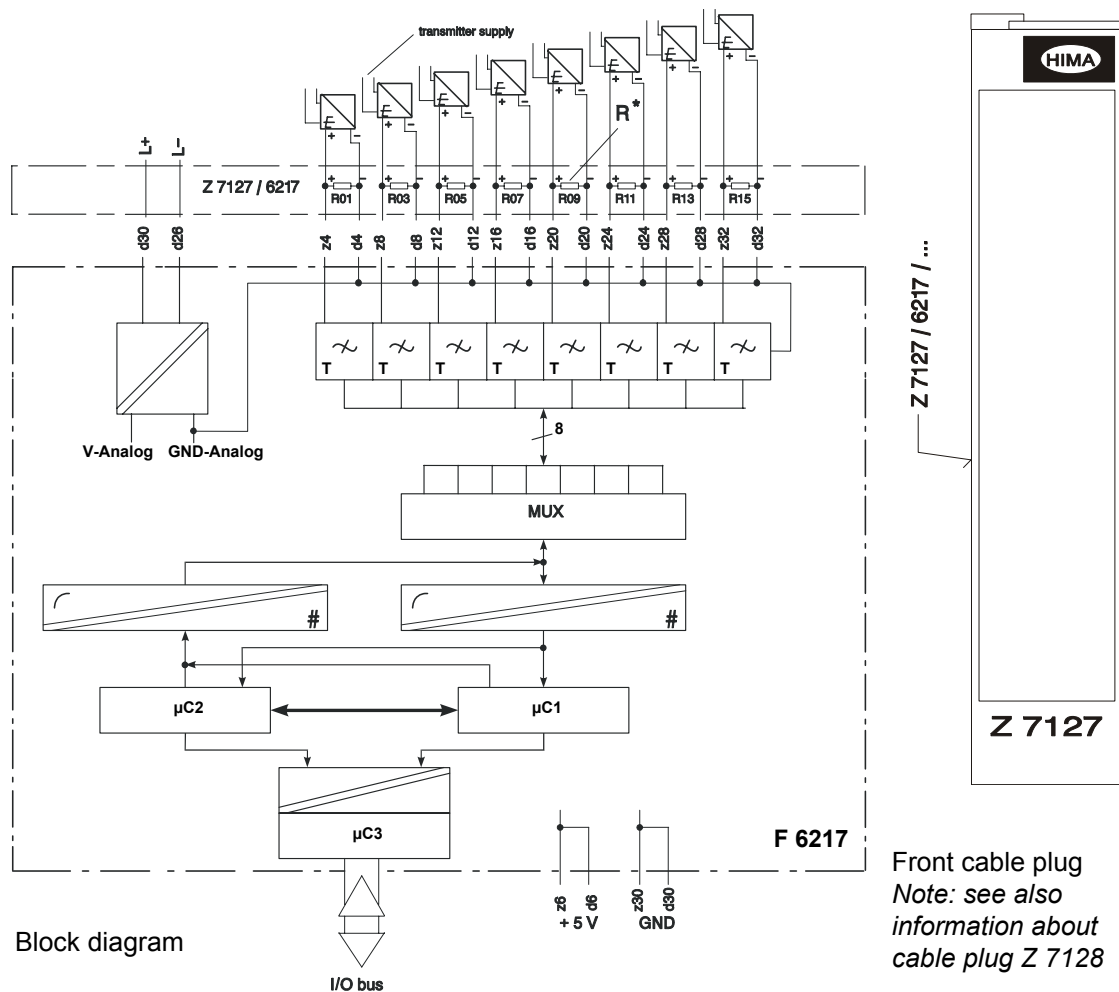


Figure 1: Block diagram and front cable plug

Interpretation of channel bit faults for each channel to project in ELOP II.

Input voltage	0...5.5 V
max. input voltage	7.5 V
Input current	0...22 mA (via shunt), 22 mA = 4095
max. input current	30 mA
R*: Shunt with	250 Ω; 0.05 %; 0.25 W;
current input	T<10 ppm/K; part-no: 00 0710251
Resolution	12 bit, 0 mV = 0, 5.5 V = 4095
Measurand update	50 ms
Safety time	< 450 ms
Input resistance	100 kΩ

Time const. input filter	approx. 10 ms
Basic error	0.1 % at 25 °C
Operating error	0.3 % at 0...+60 °C
Error limit related on safety	1 %
Electric strength	200 V against GND
Space requirement	4 SU
Operating data	5 VDC / 80 mA, 24 VDC / 50 mA

Channel	Connection	Color
1	z4 x4 d4	BN WH
2	z8 x8 d8	YE GN
3	z12 x12 d12	PK GY
4	z16 x16 d16	RD BU
5	z20 x20 d20	VT BK
6	z24 x24 d24	WHGN WHBN
7	z28 x28 d28	WHGY WHYE
8	z32 x32 d32	WHBU WHPK
L- L+	d26 d30	BK RD
Cable screen		YEGN

Channel	Connection	Color
1	z4 x4 d4	BN WH
2	z8 x8 d8	YE GN
3	z12 x12 d12	PK GY
4	z16 x16 d16	RD BU
5	z20 x20 d20	VT BK
6	z24 x24 d24	WHGN WHBN
7	z28 x28 d28	WHGY WHYE
8	z32 x32 d32	WHBU WHPK
L- L+	d26 d30	BK RD
Cable screen		YEGN

Cable
LiYCY
20 x 0.25 mm²
screened

l = 750 mm
q = 1 mm²

Flat pin
plug 2.8 x
0.8 mm²

l = 120 mm
q = 2.5 mm²

Flat pin plug 6.3 x 0.8 mm, to be connected to the earth bar under the slot

Lead marking cable plug to connect current/
voltage Z 7127 / 6217 / C.. / I (U5V)

Lead marking cable plug to connect voltage via
potentiometer and smart transmitters
Z 7127 / 6217 / C.. / U10V

Figure 2: Lead marking cable plug

The module contains a redundant, safety-related processor system. Because of this, all the tests are executed directly on the module. The main test routines are:

- Linearity of the A/D converters
- Overflow of the A/D converters
- Cross talking between the eight input channels
- Function of the input filters
- Function of the I/O bus communication

- Self tests of the microcontrollers
- Tests of the memories

The channel error bit is set for a recognized error; the evaluation must be made in the user program.

Current inputs

Measuring range 0/4 - 20 mA

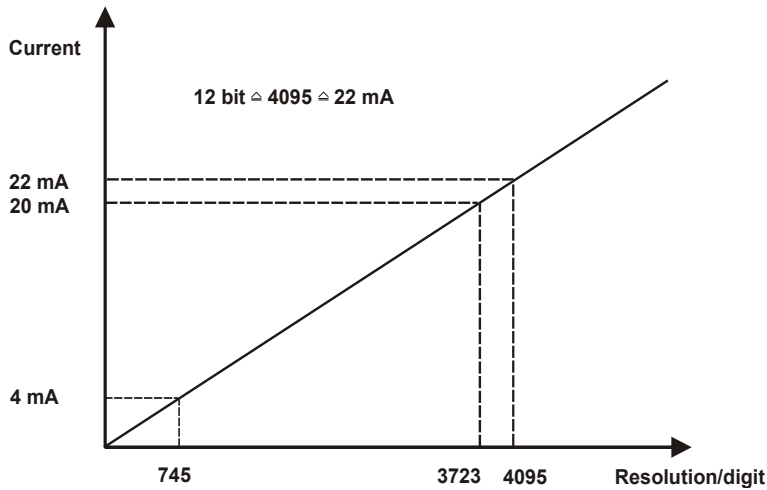


Figure 3: Current inputs

Redundant connection of current or voltage

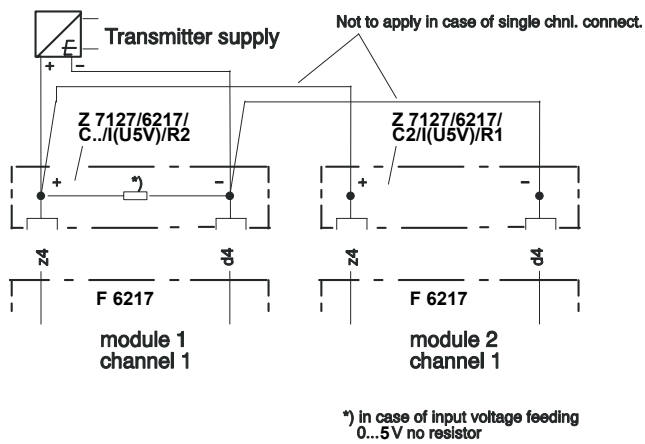


Figure 4: Redundant connection of current or voltage

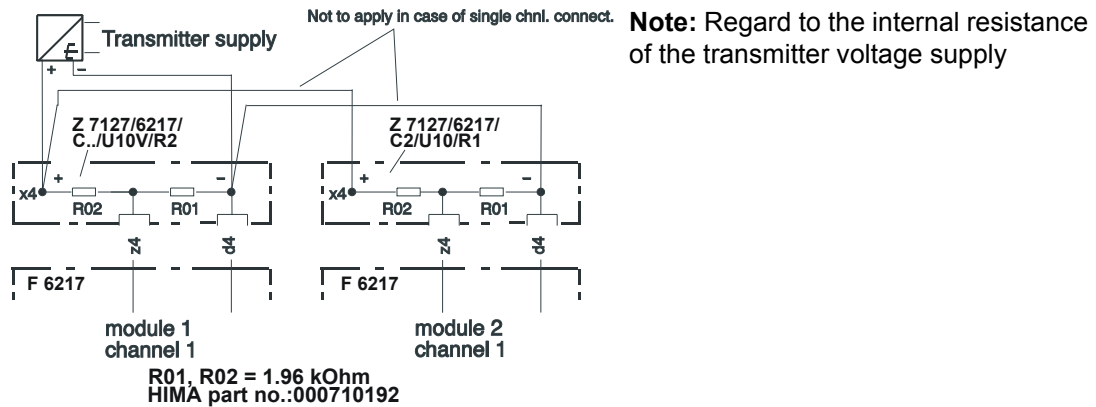


Figure 5: Redundant connection via voltage divider

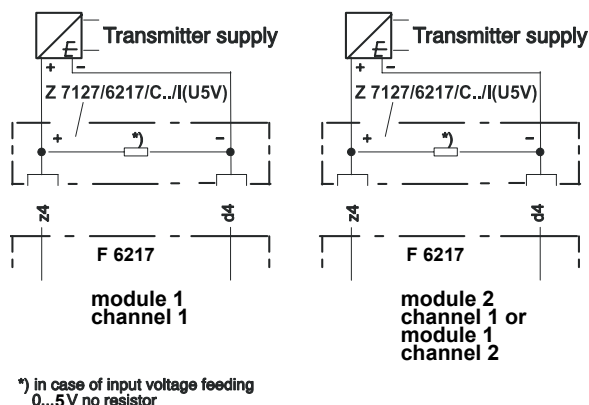


Figure 6: Current or voltage connection of redundant transmitters (evaluation in the user program)

Occupation of not used inputs

Not used voltage inputs 0 ... 5 V have to be terminated with jumpers. Not used current inputs are terminated with the shunt, not used voltage inputs 0...10 V with the voltage divider in the cable connector.

Not used inputs, redundant connection

Example is for channel 1.

Installation of jumpers outside of the cable connectors on the terminals:

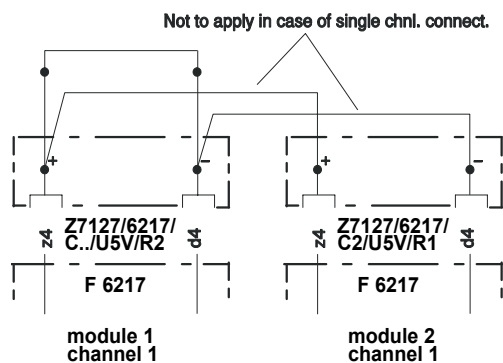


Figure 7: Voltage input 0...5 V

Notes to the safety-related operation and use

Screened cables have to be used for the field input circuits, twisted cables are recommended. If it is sure that the environment of the transmitter up to the module is free from interferences and the distance is relatively short (e.g. inside a cabinet) then the cabling can be performed without screened cables or twisted cables. However, the interference immunity of the analog inputs can only be achieved by using screened cables.

Planning notes for ELOP II

For each input channel of the module exists an analog input value and an appertaining channel fault bit. With activated channel fault bit a safety-related reaction has to be programmed in ELOP II related to the corresponding analog input.

Recommendations for the use of the module according to IEC 61508, SIL 3

- Cables for power supply shall be locally separated from the input circuits,
- Application of a suitable earthing must be regarded,
- Measures against rising of the temperature have to be taken outside of the module, e.g. fans in the cabinet,
- Recording events in a logbook for operation and maintenance.

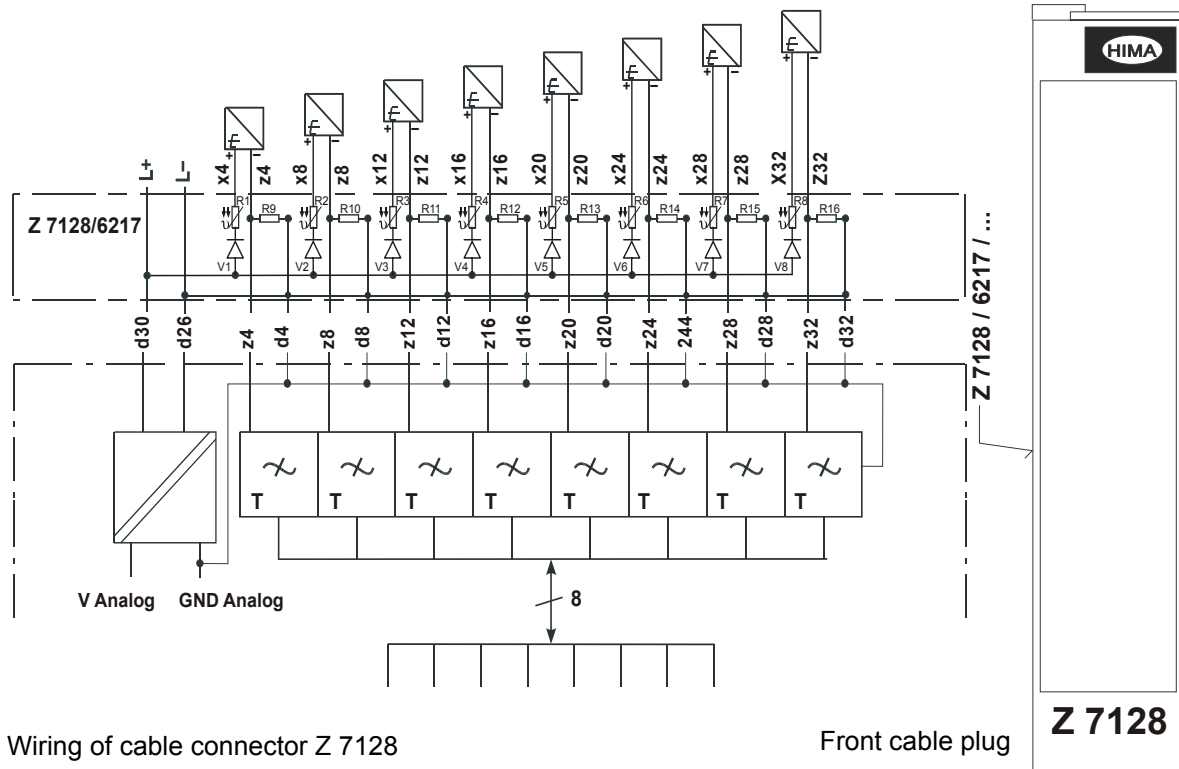
A maintenance of the module is not required. In case of fault there is a switch-off. The failed module must be replaced.

Z 7128 Cable plug with transmitter supply

For the supply of transmitters the Z 7128 cable plug with transmitter supply is available (suitable only for two-wire connections).



This cable plug **may not be used** together with zener barriers!

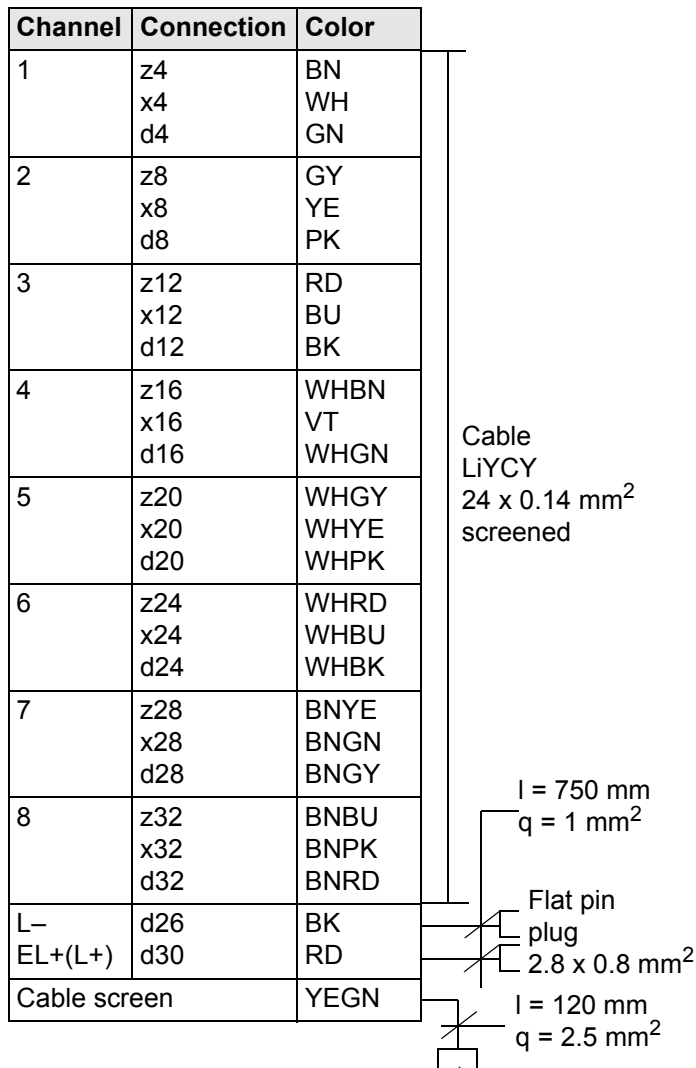


Wiring of cable connector Z 7128

Front cable plug

Z 7128

Figure 8: Wiring of cable connector Z 7128



Flat pin plug 6.3 x 0.8 mm, to be connected to the earth bar under the slot

Lead marking cable plug with transmitter supply Z 7128 / 6217 / C.. / ITI

Figure 9: Lead marking cable plug with transmitter supply

Cable plugs marked with R1 and R2 are for redundant systems, applications refer to previous figures.

If using the transmitter Saab/Rosemount 3300 GWR with internal zener diode a galvanic isolation in the signal connection must be provided to remove interferences (signal spikes, undefined signal levels) at the analog inputs of the F 6217.

Therefore e.g. the analog isolator with HART H 6200 of HIMA can be used.

Interferences of the module in low frequency range (10 Hz)

External disturbing pulses in the range of 10 Hz, e.g. at pressure measurements of nearby piston pumps, can lead to temporary channel bit faults at the analog inputs. Internal hardware tests carried out in the same rhythm are influenced by this pulses (fluctuations) in an adverse way. Input channels could be interpreted as faulty and de-energized.

Solution

- Pressure sensors:
By internal damping via adjustable digital filters in the sensor disturbing pulses can be minimized or eliminated.
- Use of low-pass filter H 7017:
The high time constant of the low-pass filter eliminates the low frequency disturbing pulses in the input current.



The low-pass filter may only be used in safety-related circuits with low-shut-down because in case of a failure in the filter (leakage current) the measured values are reduced. The time relay of the filter has to be regarded in calculating the safety time.

Note

Additional transmitter supplies, e.g. via front cable plug Z 7128, have no disturbing influences on the operation of the module F 6217.



F 6220: 8-channel thermocouple input module (Ex)i, safety-related

- with Pt 100 input for comparison measurement
- with safe isolation, applicable up to SIL 3 according to IEC 61508
- EC type examination certificate: ATEX EX5 00 02 19183 031

1 Overview

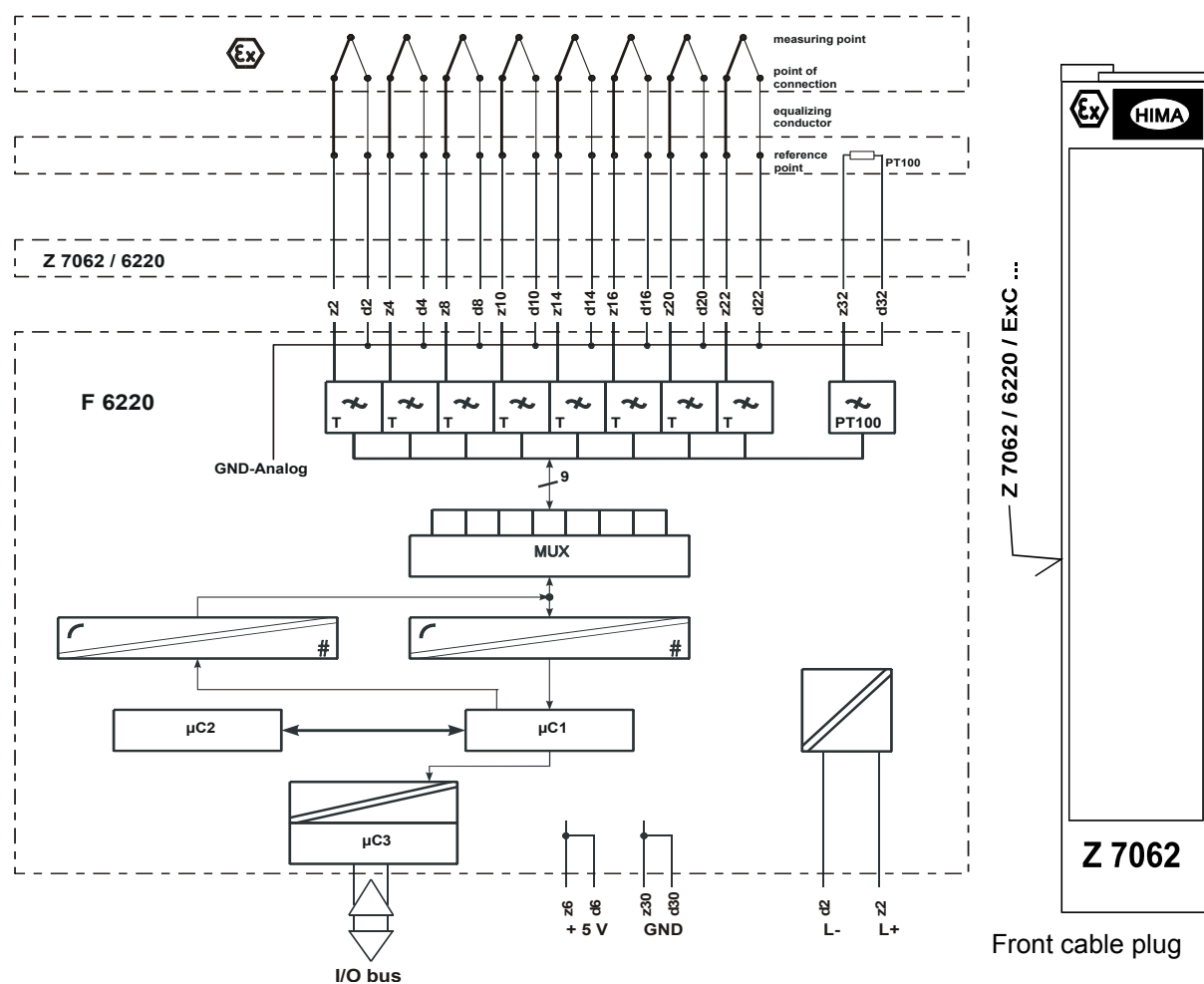


Figure 1: Block diagram and front cable plug

Software function block in user program: HF-TMP-3

Inputs thermocouples R, S, B, J, K, T, E, according to DIN EN 60584-1, temperature limits between -270 °C...+1820 °C, or low voltage input -100 mV...+100 mV, individual parameterizable by function block,

for intrinsically safe circuits [EEx ia] IIC

1 Pt 100 resistance thermometer,
according to DIN IEC 751
input only for reference temperature

Measurand update	80 ms
Space requirement	4 SU
Operating data	5 VDC / 125 mA, 24 VDC / 300 mA



The module must only be operated with forced ventilation (fan).
The fan (K 9203) must be installed above the subrack where the
F 6220 module is plugged in.
If the F 6220 module is operated in an H 41q, the fan (K 9212) must be
installed directly under the F 6220 module.
In order to ensure the forced ventilation, the air deflector panel M 7201
(1 HE) must be mounted over the fan (K 9203) or over the kit H 41q.
The air deflector panel M 7201 deflects the warm air to the rear, in
order to avoid a temperature rise of the subracks and modules which
are mounted above.

2 Useable thermocouples

Linearization in	
Nominal range	$< \pm 0.1 \%$
Resolution	$0.1 \text{ }^{\circ}\text{C}$
Type	R
Thermocouple	Pt13%Rh/Pt
Nominal range:	
Input voltage	-0.226 mV...21.003 mV
Temperature limits	-50 $^{\circ}\text{C}$...1760 $^{\circ}\text{C}$
Monitored	
Range of use:	
Input voltage	-0.226 mV...21.003 mV
Temperature limits	-50 $^{\circ}\text{C}$...1760 $^{\circ}\text{C}$
Value in ELOP II	-500...+17600 (variable type INT)
Type	S
Thermocouple	Pt10%Rh/Pt
Nominal range:	
Input voltage	-0.236 mV...18.609 mV
Temperature limits	-50 $^{\circ}\text{C}$...1760 $^{\circ}\text{C}$
Monitored	
Range of use:	
Input voltage	-0.236 mV...18.609 mV
Temperature limits	-50 $^{\circ}\text{C}$...1760 $^{\circ}\text{C}$
Value in ELOP II	-500...+17600 (variable type INT)

Type	B
Thermocouple	Pt30%Rh/Pt6%Rh
Nominal range:	
Input voltage	0.092 mV... 13.820 mV
Temperature limits	150 °C...1820 °C
Monitored	
Range of use:	
Input voltage	0.002 mV...13.820 mV
Temperature limits	50 °C... 820 °C
Value in ELOP II	+500...+18200 (variable type INT)
Type	J
Thermocouple	Fe/CuNi
Nominal range:	
Input voltage	-8.095 mV...69.553 mV
Temperature limits	-210 °C...1200 °C
Monitored	
Range of use:	
Input voltage	-8.095 mV... 69.553 mV
Temperature limits	-210 °C...1200 °C
Value in ELOP II	-2100...+12000 (variable type INT)
Type	K
Thermocouple	CrNi/NiAl
Nominal range:	
Input voltage	-6.035 mV...54.819 mV
Temperature limits	-210 °C...1370 °C
Monitored	
Range of use:	
Input voltage	-6.458 mV...54.819 mV
Temperature limits	-270 °C...1370 °C
Value in ELOP II	-2700...+13700 (variable type INT)
Type	T
Thermocouple	Cu/CuNi
Nominal range:	
Input voltage	-5.753 mV...21.003 mV
Temperature limits	-210 °C...400 °C
Monitored	
Range of use:	
Input voltage	-6.258 mV...21.003 mV
Temperature limits	-270 °C...400 °C
Value in ELOP II	-2700...+4000 (variable type INT)
Type	E
Thermocouple	CrNi/CuNi
Nominal range:	
Input voltage	-9.063 mV... 76.373 mV
Temperature limits	-210 °C...1000 °C
Monitored	
Range of use:	
Input voltage	-9.835 mV... 76.373 mV
Temperature limits	-270 °C...1000 °C
Value in ELOP II	-2700...+10000 (variable type INT)

3 Technical data

3.1 Low voltage input

Input voltage	-100 mV...+100 mV
Linearization	$< \pm 0.1 \%$
Resolution	0.01 mV (with scaling 0.1 %)
Value in ELOP II	-10000...+10000 (variable type INT)

3.2 Input for comparison measurement

Input for comparison	Pt100 with two-wire measurement
Measurement	(max. line length 6 m)
Reference temperature	
Limits	-40 °C...+80 °C
Resolution	0.1 °C
Value in ELOP II	-400...+800 (variable type INT)

The Pt 100 input of the module F 6220 can be used as reference temperature for all channels. As alternative it is possible to use for each channel of the module an own reference temperature.

3.3 Further data

Input resistance	$> 1 \text{ M}\Omega$
Line length	approx. 300 m, double screened cable, twisted pair, circuits load impedance max. 500 Ω
Noise voltage suppression	$\geq 60 \text{ dB}$ (common-mode 50 / 60 Hz)
Voltage endurance	$< 375 \text{ V}$ (Ex circuit -> non Ex circuit) $< 7 \text{ V}$ (Ex circuit -> non Ex circuit)

The value in ELOP II can be scaled (0...1000) by the software function block HF-TMP-. It is possible to select only a window of the range.

3.4 Errors

Basis fault (from nominal value)	$< 0.1 \%$ at 25 °C
Safety accuracy	$< 1 \%$
Metrological individual faults:	
Channel fault	$\pm 0.1 \%$
Temperatur fault zero point	$\pm 0.1 \%$ / 10 K
Temperature fault end point	$\pm 0.1 \%$ / 10 K
Linearity fault	$\pm 0.05 \%$

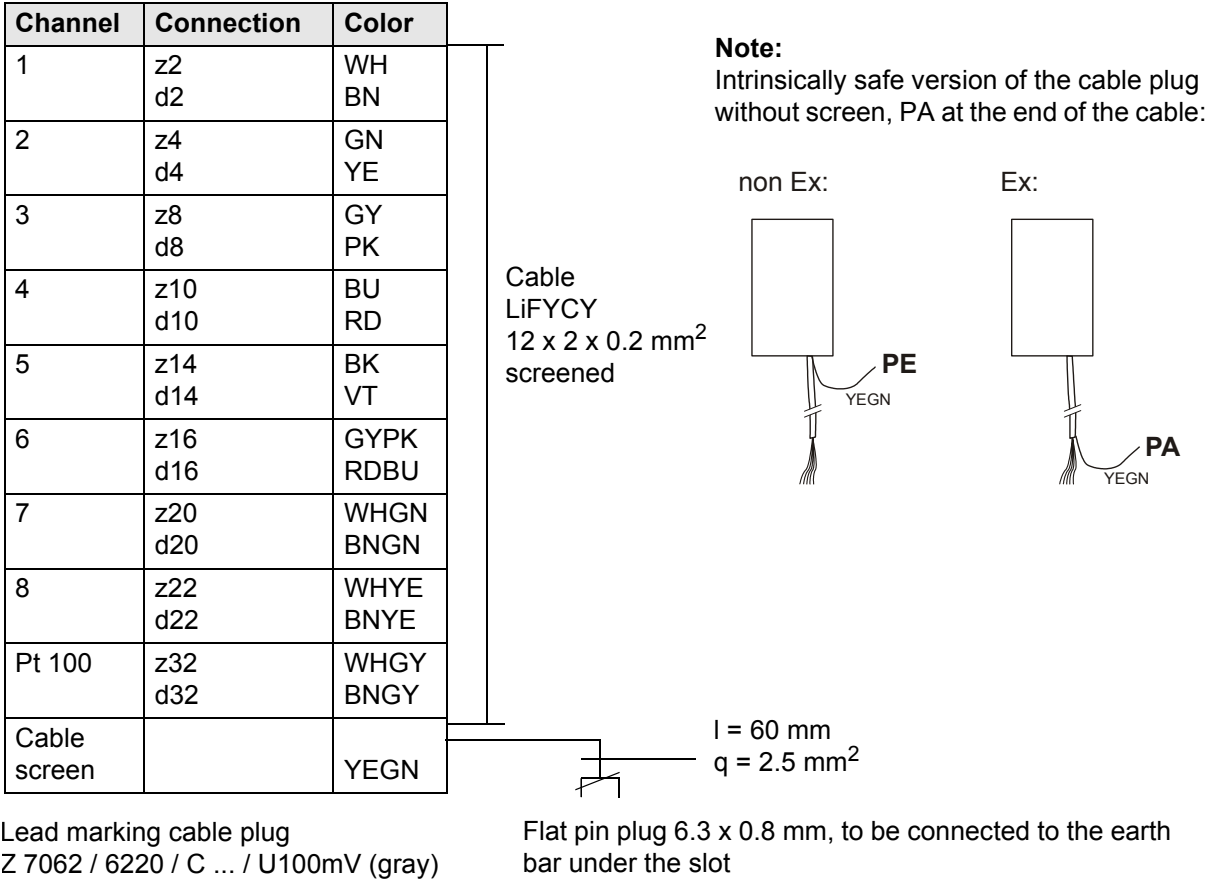


Figure 2: Lead marking cable plug

Cable plug Z 7062 / 6220 / Ex / C ... / U100mV (blue)
(intrinsically safe version, see note below)

Note	Intrinsically safe cables must be marked, e.g. with a blue (RAL 5015) color of the isolation.

4 Operating Instructions for F 6220

4.1 Usage

The module can be used to measure temperatures with low-resistance thermocouples. As reference junction temperature serves a PT 100. The thermocouples can be installed in hazardous areas up to zone 0.

Digitized process signals are available in the HIMA PES.



The inputs must not apply with external voltage. Beside all not described applications are not admissible.

4.2 Electrical data regarding intrinsic safety

The respective indications can be learnt from the enclosed EC type examination certificate.

4.3 Assembling

The module must be installed out of the hazardous area.

The modules shall be installed in 19 inches I/O subracks. The mounting position can be horizontal or vertical.

There are no installation instructions, any modules can be equipped together without free slots between.

4.4 Application hints for explosion protection

The relevant standards shall be observed, particularly:

- DIN EN 60079-14 (VDE 0165, part 1)
- EN 50014
- EN 50020

Besides that the following points shall be observed:

- The modules inclusive the connection facilities must be installed with a minimum degree of protection IP 20 according to EN 60529 (VDE 0470 part 1).
- The specified ambient temperature for the explosion protection is
 $T = -25\text{ °C to }+60\text{ °C}$.
- Two intrinsically safe input circuits from two thermocouple input modules Type F 6220 or some intrinsically safe input circuits from one thermocouple input module can be connected together. The calculation must use the reduced values for the max. inductivity.
- The separation between intrinsically safe and non-intrinsically safe terminals must have a distance of $\geq 50\text{ mm}$ (filament dimension).
- The separation between two intrinsically safe terminals must have a distance of $\geq 6\text{ mm}$ (filament dimension).
- Intrinsically safe and non-intrinsically safe lines and cables must be installed separately or the intrinsically safe lines must be additionally insulated.
- Intrinsically safe lines and cables must be marked, for example with light-blue colored

(RAL 5015) insulation.

- The wiring must be mechanically secured, that by an unintentional disconnection the minimum distance (EN 50020 / part 7, table 4) between an intrinsically safe connection and a non-intrinsically safe connection is not falling below the minimum.
- The cable shield must be wired on the equipotential bonding PA. For non-intrinsically safe applications the cable shield can be wired on the protective earth PE at the I/O subrack.

The used lines or cable must fulfill following insulation test voltages:

- Intrinsically safe lines ≥ 1000 VAC
- Non-intrinsically safe lines ≥ 1500 VAC
- The ends of stranded lines must be finished with wire end ferrules. The terminals must be able to connect the used conductor cross-sections.

4.5 General application notes

- Not used input channels must be short-circuited.
- In the case of a fault the output VALUE (INT) of the software function block HF-TMP-3 gets the value 0 without declaration of underflow or overflow. In this case the output of the software function block CHANNEL ERROR (BOOL) must be evaluated in the user program.
- For safety integrity level SIL 3 the reference temperature must be used out of the user program or out of the compare of two reference temperatures from two modules.
- The temperature of the thermocouple in applications with SIL 3 must be calculated out of two thermocouples.
- The parameterization of the module must be performed according to the operating system manual for the currently used version of the operating system. Especially the chapter about the noise blanking has to be regarded.
Setting: Safety time $\geq 3 \times$ watchdog time.

4.6 Start-up

Before commissioning the installation must be approved by an expert for intrinsically safe functions, particularly checking the power supply connections and the connections of intrinsically safe circuits.

4.7 Operation

The error codes for the module are shown in the display of the corresponding central module. For further informations see operating system manual.

4.8 Maintenance

When a module fails the defective module can be replaced against the same type or approved spare part. The repair of defective modules must only be made by the manufacturer.

EC Type Examination Certificate

No.: EX5 00 02 19183 031



in accordance with Annex III of Council Directive No. 94/9/EC for equipment and protective systems intended for use in potentially explosive atmospheres (ATEX) for

HIMA Paul Hildebrandt GmbH + Co KG
Albert-Bassermann-Straße 28

68782 Brühl

Product: **Automation devices, safety-related**
 type F

Model: **F 6220**

Parameters: **see appendix (four pages)**

The above mentioned product meets the provisions of the Directive.

This certificate is issued on the basis of the product provided for testing and certification and on its technical documentation. The detailed results of the test and the provided technical documentation are listed in

Test report no.: 990187410

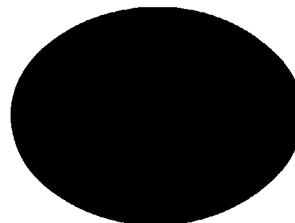
This certificate pertains only to the sample product submitted to TÜV PRODUCT SERVICE for testing. Therefore this certificate has no specified period of validity.

Released with the above mentioned certificate number by the Certification Body of TÜV PRODUCT SERVICE.

Department:
Date:

PS-IQSE / jb
17.03.2000

A handwritten signature in black ink, appearing to read 'J. Blum'.



TÜV PRODUCT SERVICE GMBH is a Notified Body in accordance with Council Directive 94/9/EC for equipment and protective systems intended for use in potentially explosive atmospheres with the identification number 0123.

TÜV PRODUCT SERVICE GMBH · Zertifizierstelle · Ridlerstrasse 65 · D-80339 München

Appendix to EC Type Examination Certificate

No.: EX5 00 02 19183 031



1 Description

The module F6220 is a associated apparatus for installation only outside an atmosphere capable of explosion. This subassembly unit for installation in a subrack consist of two PCB-boards. Nine galvanically coupled intrinsically safe input ports are connectable at the front and the output- and the power supply port are connectable at the rear of this module.

2 Electrical data

2.1 Intrinsically safe port, X2

The channel 1..8 for thermocouple and channel 9 for platinumsensor (PT 100) are intrinsically safe and safety isolated up to a peak value of 375V to the other terminals.

Input, Pin	Function	Common Reference, Pin
Z2	Thermocouple [1]	D2
Z4	Thermocouple [2]	D4
Z6	not connected	D6
Z8	Thermocouple [3]	D8
Z10	Thermocouple [4]	D10
Z12	not connected	D12
Z14	Thermocouple [5]	D14
Z16	Thermocouple [6]	D16
Z18	not connected	D18
Z20	Thermocouple [7]	D20
Z22	Thermocouple [8]	D22
Z24	not connected	D24
Z26	not connected	D26
Z28	not connected	D28
Z30	not connected	D30
Z32	Platinumsensor [PT 100]	D32

Appendix to EC Type Examination Certificate

No.: EX5 00 02 19183 031



2.1.1 Input port for thermocouple, channel 1...8

Voltage, U_0	crest value DC 19 V
Current, I_0	crest value DC 6 mA
Power, P_0	crest value 28.5 mW
internal capacitor, C_i	negligible
internal inductance, L_i	negligible

The permissible ratings for max. capacitor and inductance for one and two parallel input ports are listed in the following tables.

2.1.1.1 EEx Ia IIC

max. connectable inductance of <u>one</u> and <u>several</u> input port	$L_0 = 2 \text{ mH}$
max. connectable capacitor of <u>one</u> input port	$C_0 = 0.2 \mu\text{F}$
max. connectable capacitor of <u>two</u> parallel input port	$C_0 = 0.2 \mu\text{F}$

2.1.1.2 EEx Ia IIB

max. connectable inductance of <u>one</u> and <u>several</u> input port	$L_0 = 2 \text{ mH}$
max. connectable capacitor of <u>one</u> input port	$C_0 = 1.1 \mu\text{F}$
max. connectable capacitor of <u>two</u> parallel input port	$C_0 = 1.1 \mu\text{F}$

2.1.1.3 EEx Ib IIC

max. connectable capacitor of <u>one</u> and <u>several</u> input port	$C_0 (L_0 = 0) = 0.25 \mu\text{F}$
max. connectable inductance of <u>one</u> input port	$L_0 (C_0 = 0) = 0.6 \text{ H}$
max. connectable inductance of <u>two</u> parallel input port	$L_0 (C_0 = 0) = 0.58 \text{ H}$

2.1.1.4 EEx Ib IIB

max. connectable capacitor of <u>one</u> and <u>several</u> input port	$C_0 (L_0 = 0) = 1.5 \mu\text{F}$
max. connectable inductance of <u>one</u> input port	$L_0 (C_0 = 0) = 1 \text{ H}$
max. connectable inductance of <u>two</u> parallel input port	$L_0 (C_0 = 0) = 1 \text{ H}$

Appendix to EC Type Examination Certificate
No.: EX5 00 02 19183 031



2.1.2 Input port for platinumsensor (PT 100)

Voltage, U_0	crest value DC 19 V
Current, I_0	crest value DC 11 mA
Power, P_0	crest value 52.3 mW
internal capacitor, C_i	negligible
internal inductance, L_i	negligible

2.1.2.1 EEx Ia IIC

max. connectable inductance	$L_0 = 2 \text{ mH}$
max. connectable capacitor	$C_0 = 0.2 \text{ }\mu\text{F}$

2.1.2.2 EEx Ia IIB

max. connectable inductance	$L_0 = 2 \text{ mH}$
max. connectable capacitor	$C_0 = 1.1 \text{ }\mu\text{F}$

2.1.2.3 EEx Ib IIC

max. connectable capacitor	$C_0 (L_0 = 0) = 0.25 \text{ }\mu\text{F}$
max. connectable inductance	$L_0 (C_0 = 0) = 0.3 \text{ H}$

2.1.2.4 EEx Ib IIB

max. connectable capacitor	$C_0 (L_0 = 0) = 1.5 \text{ }\mu\text{F}$
max. connectable inductance	$L_0 (C_0 = 0) = 1 \text{ H}$

2.2 Output port, X1 pin Z8, Z22...Z28 / D8, D20...D28 (non-intrinsically safe)
Voltage crest value 5 V

2.3 Power supply port, X1 pin Z2 / D2 (non-intrinsically safe)
Nominal voltage DC 24 V
Voltage crest value DC 30 V
Power 6 W
Absolute maximum voltage to not affect the intrinsic safety U_m crest value 40V

Appendix to EC Type Examination Certificate
No.: EX5 00 02 19183 031



3 Identifying marking

The legible and durable marking must include the following option list:

- Name and address of the manufacturer,
- CE-marking (Annex X, point A directive 94/9/EC),
- designation of series or type / serial number,
- year of construction,
- the identifier  II (1)G [EEx ia] IIC
- essential information for safe use

4 Intended use in potentially explosive atmospheres

Pay attention to intended use in potentially explosive atmospheres by detailed instructions for safe use by the manufacturer according Annex II directive 94/9/EC.

5 Production quality assurance

The manufacturer shall operate an approved quality system for production, final equipment inspection and testing according Annex X directive 94/9/EC.

Munich, March 17th 2000

TÜV PRODUCT SERVICE GmbH PS-IQSE

Notified Body

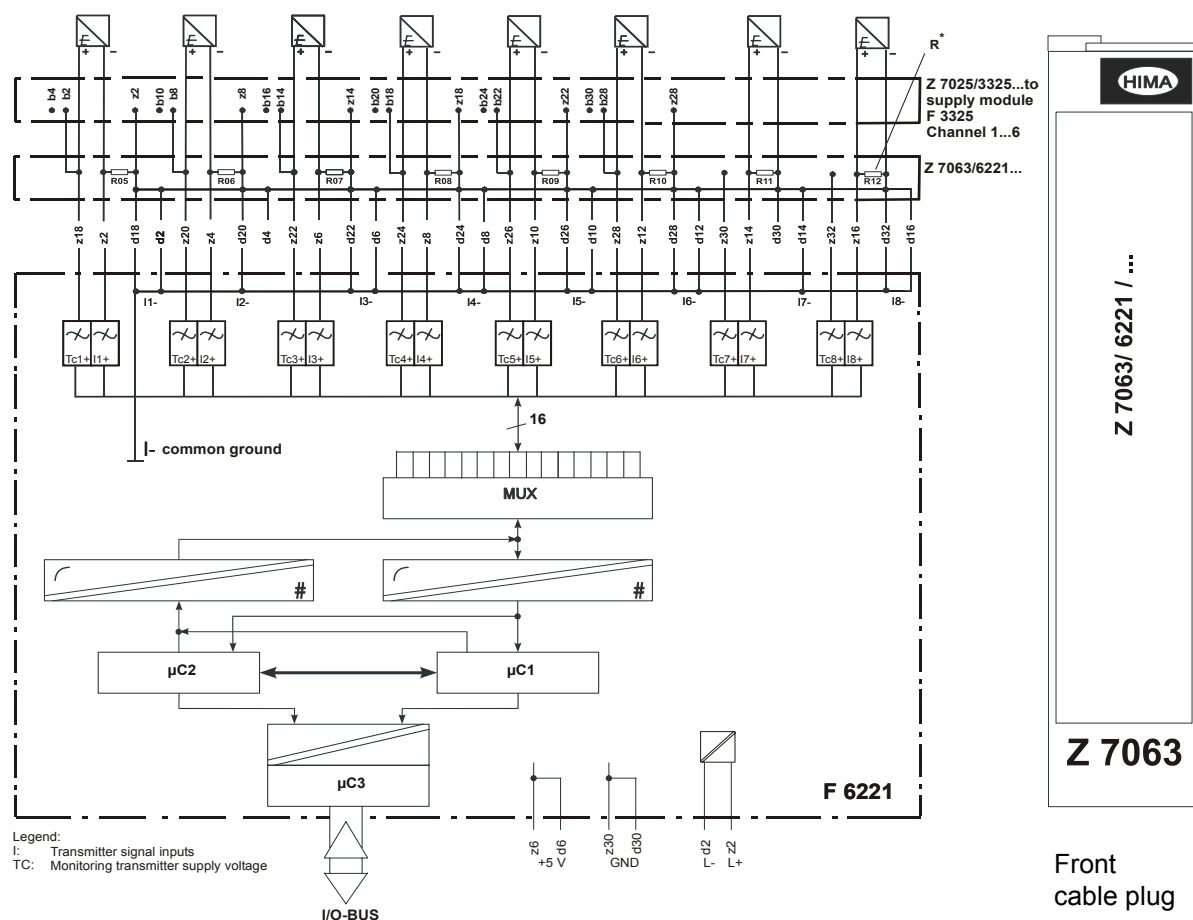
Dipl.-Ing. J. Blum



F 6221: 8-channel analog input module (Ex)i, safety-related

- 8 monitoring channels for checking the transmitter supply voltage 0...30 V
- Current inputs 0/4...20 mA, Voltage inputs 0...1 V
- EC Type Examination Certificate (ATEX): EX5 02 04 19183 036
- Safety-related, applicable up to SIL 3 according to IEC 61508

1 Overview



Block diagram

Figure 1: Block diagram and front cable plug

Appertaining function block: HF-AIX-3

Ex-category

II (1) GD [EEx ia] IIC

Electric strength

375 V Ex-circuit against non Ex-circuit

7 V Ex-circuit against Ex-circuit

Noise suppression

>60 dB (common mode 50/60 Hz)

Operating data	5 V, 125 mA 24 V, 300 mA
Space requirement	4 SU
Nominal input voltage	0 to 1.00 V
Nominal input current	0 to 20.0 mA (via shunt)
Range of use of voltage	-0.1 V to 1.1 V
Range of use of current	-2 mA to 22 mA
R*: Shunt for current measuring	50 Ω , T < 10 ppm/K tolerance 0.05 % part number: 00 0710490
Resolution	1 V = 10,000 parts 20 mA = 10,000 parts
Updating interval of measuring values	< 80 ms
Input resistance	min. 1 M Ω
Time constant of input filter	ca. 7 ms
Converting time	max. 1.8 ms for one channel
Maximum error	0.1 % at 25 °C
Max. variation factor due to temperature	0.1 % / 10 K
Max. temperature variation	0.2 % at -10 °C...+70 °C
Safety-related variation limit	1 %
Electric strength of inputs	5 V
Maximum current via shunt	80 mA

Transmitter supply voltage monitoring for channels 1 to 8

Input voltage	max. 30 V
Switch-off limit	< 16.0 V
Input resistance	min. 30 k Ω
Electric strength of inputs	30 V



The module must only be operated with forced ventilation (fan).
The fan (K 9203) must be installed above the subrack where the F 6221 module is plugged in.

If the F 6221 module is operated in an H 41q, the fan (K 9212) must be installed directly under the F 6221 module.

In order to ensure the forced ventilation, the air deflector panel M 7201 (1 HE) must to be mounted over the fan (K 9203) or over the kit H 41q. The air deflector panel M 7201 deflects the warm air to the rear, in order to avoid a temperature rise of the subracks and modules which are mounted above.

Note

The block diagram of F 6221 shows the wiring with the supply module F 3325. In this wiring variant, the first six channels of the F 3325 module are used for passive transmitters. The channels 7 and 8 are used for active transmitters (see Variant A1 and A2).
The pins d4 and d30 on the front socket of the F 6221 are omitted (coding of the front plug).

2 Application

The field of application of the F 6221 module is the operation with current transmitters (0/4 to 20 mA) which can be supplied via the intrinsically safe supply unit F 3325. For safety reasons, the supply voltage of the transmitters is monitored.

The F 6221 module contains the measuring device. It can be used to measure up to eight signal inputs (I1 to I8). For monitoring the transmitter supply voltages, another eight signal inputs (TC1 to TC8) are available. These signal inputs only monitor the switch-off limit and are not available to the user program as measuring values.

The signal inputs "I" and "TC" are related to each other (I1 to TC1, I2 to TC2 etc.).

There are some wiring variants for different applications available, for which HIMA supplies the corresponding cables.



Only the wiring variants described in the data sheets for F 3325 and F 6221 are permissible. All other ways of wiring are prohibited!
For the described wiring variants only the provided HIMA cables are admissible.

2.1 Wiring variants

2.1.1 Permissible wiring variants with two-wire passive transmitters

HIMA variants	Variants*)	Description
A1	1	Mono supply, mono current measuring, wiring via cable
B	1	Mono supply, mono current measuring, wiring via terminal
C1	3	Mono supply, redundant current measuring, wiring via cable
D	3	Mono supply, redundant current measuring, wiring via terminal

*) according to the technical report, No. 70013102.4 (/1./2)

Table 1: Permissible wiring variants with two-wire passive transmitters

Note	The other TÜV variants described in the technical report are only for theoretical considerations.

2.1.2 Permissible wiring variants with active transmitters / sources

HIMA variants	Description
A2	No supply, mono current measuring
C2	No supply, redundant current measuring, wiring via cable
E	Voltage measuring
F	Current measuring via shunt

Table 2: Permissible wiring variants with active transmitters / sources

These wiring variants must be carried out in compliance with the relevant Ex standards. For the interconnection of intrinsically safe operational equipment, the PTB-ThEx-10 and the operating instructions for the F 6221 have to be considered.

2.1.3 Variant A1: Mono supply, mono current measuring, wiring via cable

- Mono operation with transmitter supply for channels 1 to 6
- For channels 7 and 8 see note below
- Cable type: Z 7063/6221/ExCn/ITI + Z 7025/3325/ExCx
part number 93 6221 101

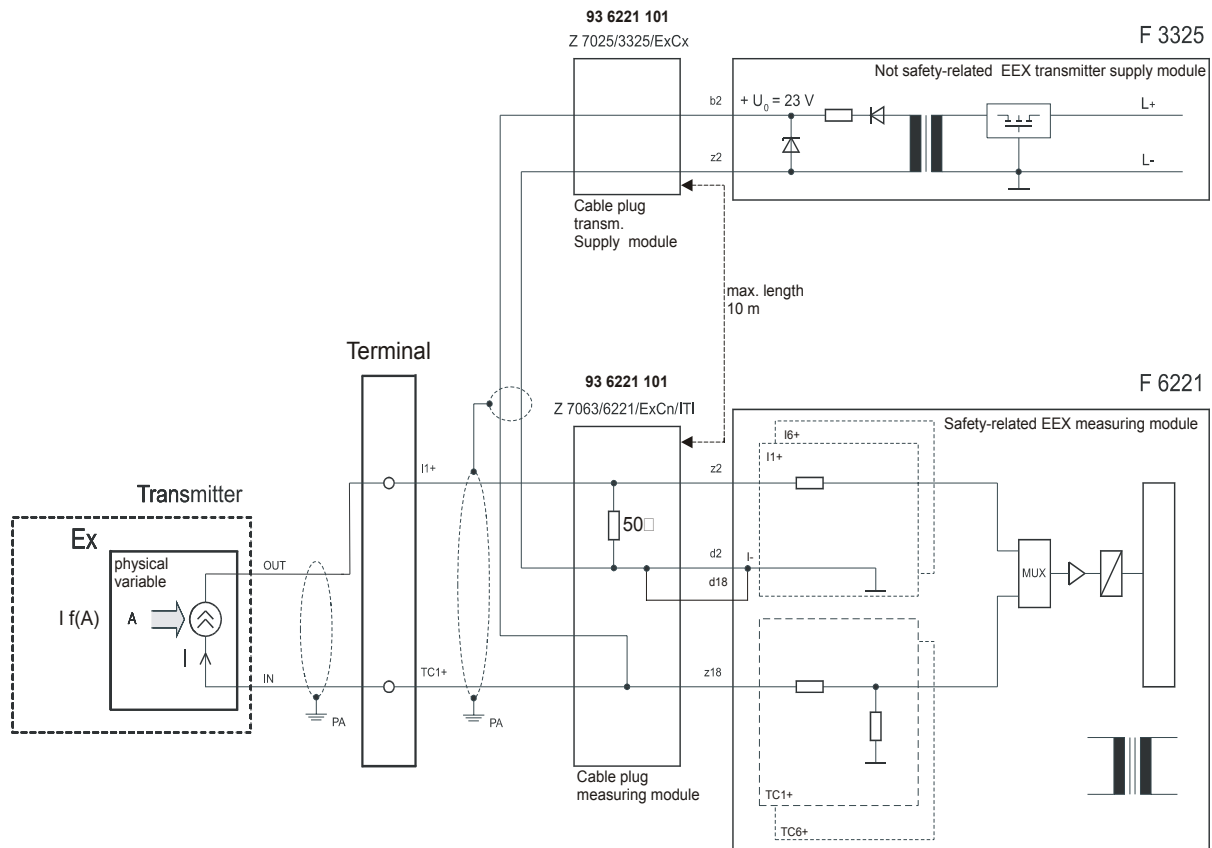


Figure 2: Mono supply, mono current measuring, wiring via cable

Note

In this wiring variant, the first six channels of the F 3325 module are always used for passive transmitters. Channels 7 and 8 are used for active transmitters (see Variant A2).

2.1.4 Variant A2: No supply, mono current measuring

- Mono operation without transmitter supply for channels 7 and 8
- Cable type: Z 7063/6221/ExCn/I part number 93 6221 105

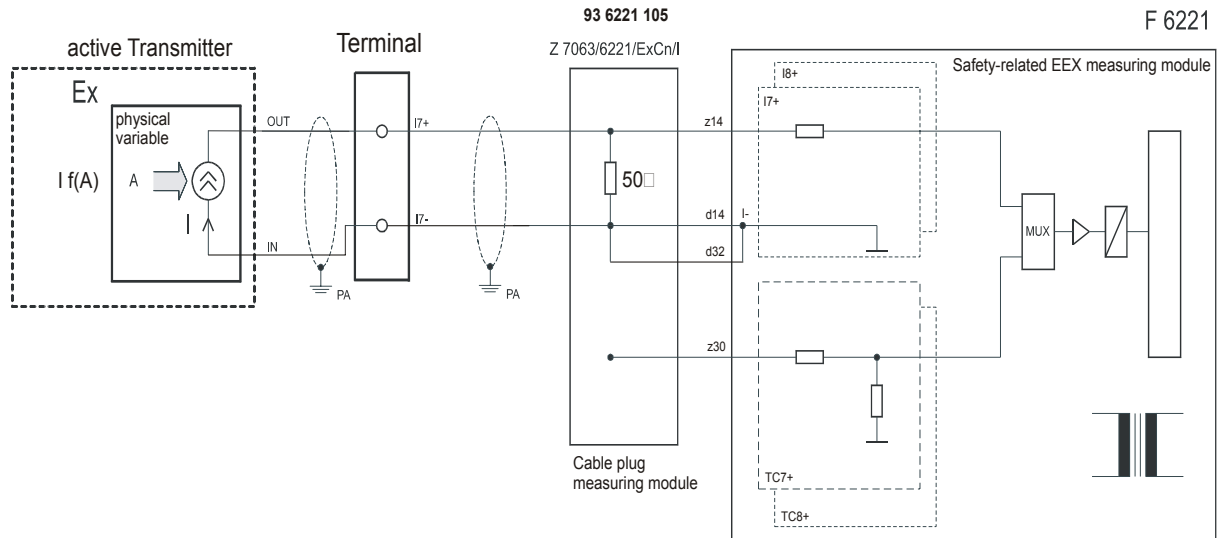


Figure 3: No supply, mono current measuring

2.1.5 Variant B: Mono supply, mono current measuring, wiring via terminal

- Mono operation with transmitter supply for channels 1 to 8
- Cable type:

Z 7063/6221/ExCn/I	part number	93 6221 105
Z 7025/3325/ExCn	part number	93 3325 101

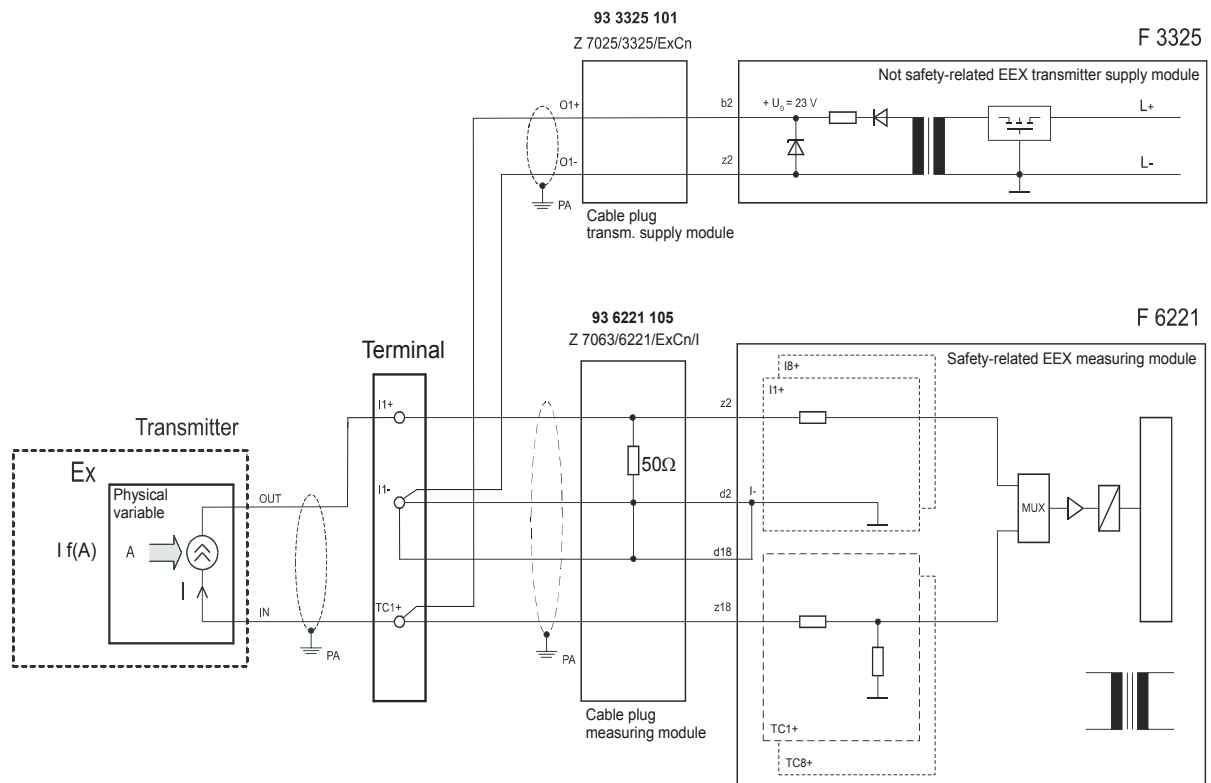


Figure 4: Mono supply, mono current measuring, wiring via terminal

Note

Instead of the F 3325 module, a galvanically isolated power supply can be used in this wiring variant. It has to be considered that a fault current runs through the monitoring inputs (TC1 to TC8, $R_e = 30 \text{ k}\Omega$) which affects the non-intrinsically safe side of the galvanically isolated power supply and must be compensated. The Hart protocol can also be transmitted if suitable transmitters are used.

2.1.6 Variant C1: Mono supply, redundant current measuring, wiring via cable

- Redundant operation with transmitter supply for channels 1 to 6
- For channels 7 and 8 see note below
- Cable type: Z 7063/6221/ExCn/ITI/R2 part number 93 6221 103

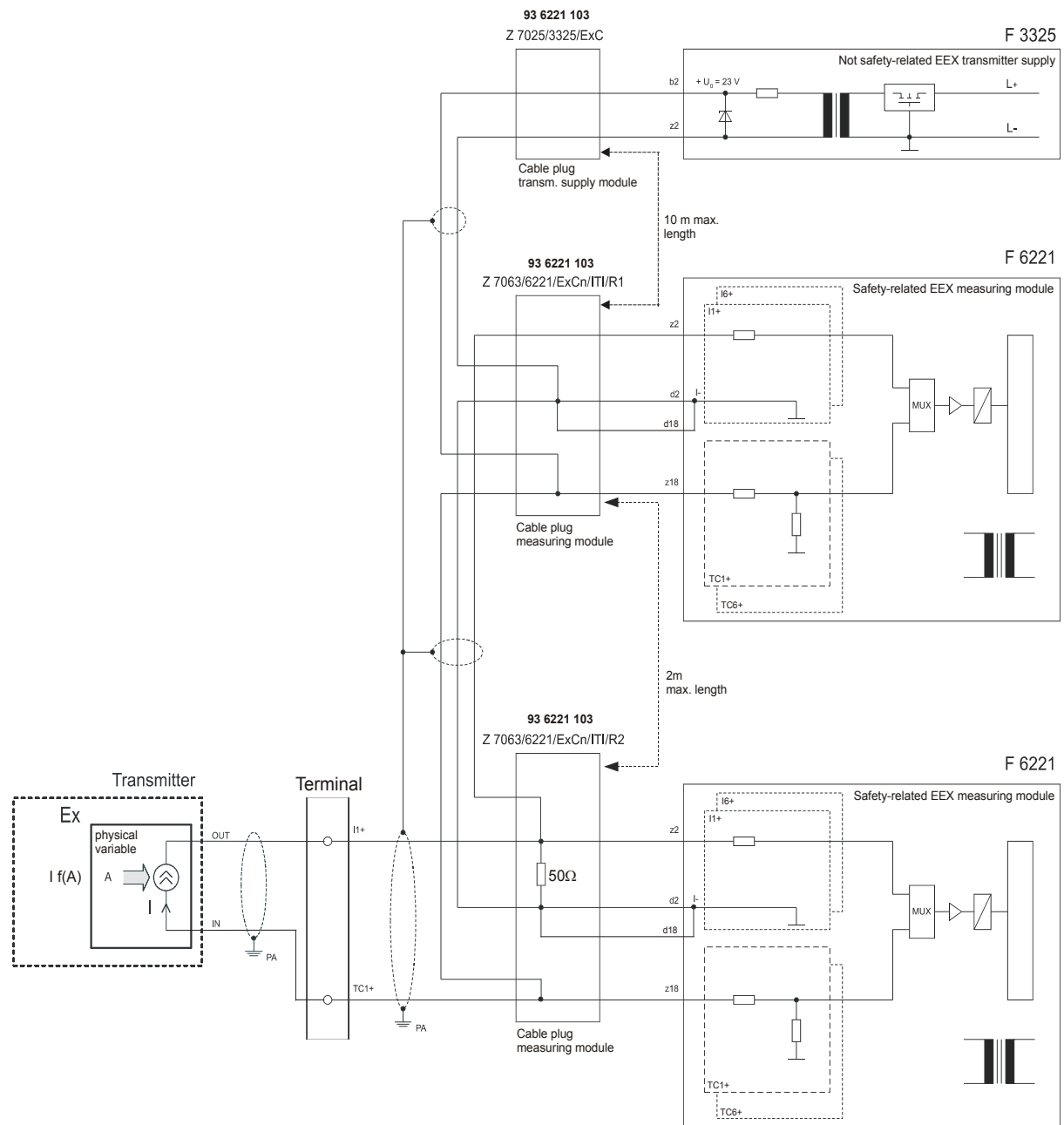


Figure 5: Mono supply, redundant current measuring, wiring via cable

Note

In this wiring variant, the first six channels of the F 3325 module are always used for passive transmitters. Channels 7 and 8 are used for active transmitters (see Variant C2).

2.1.7 Variant C2: No supply, redundant current measuring, wiring via cable

- Redundant operation without transmitter supply for channels 7 and 8
- Cable type: Z 7063/6221/ExCn/ITi/R2 part number 93 6221 103

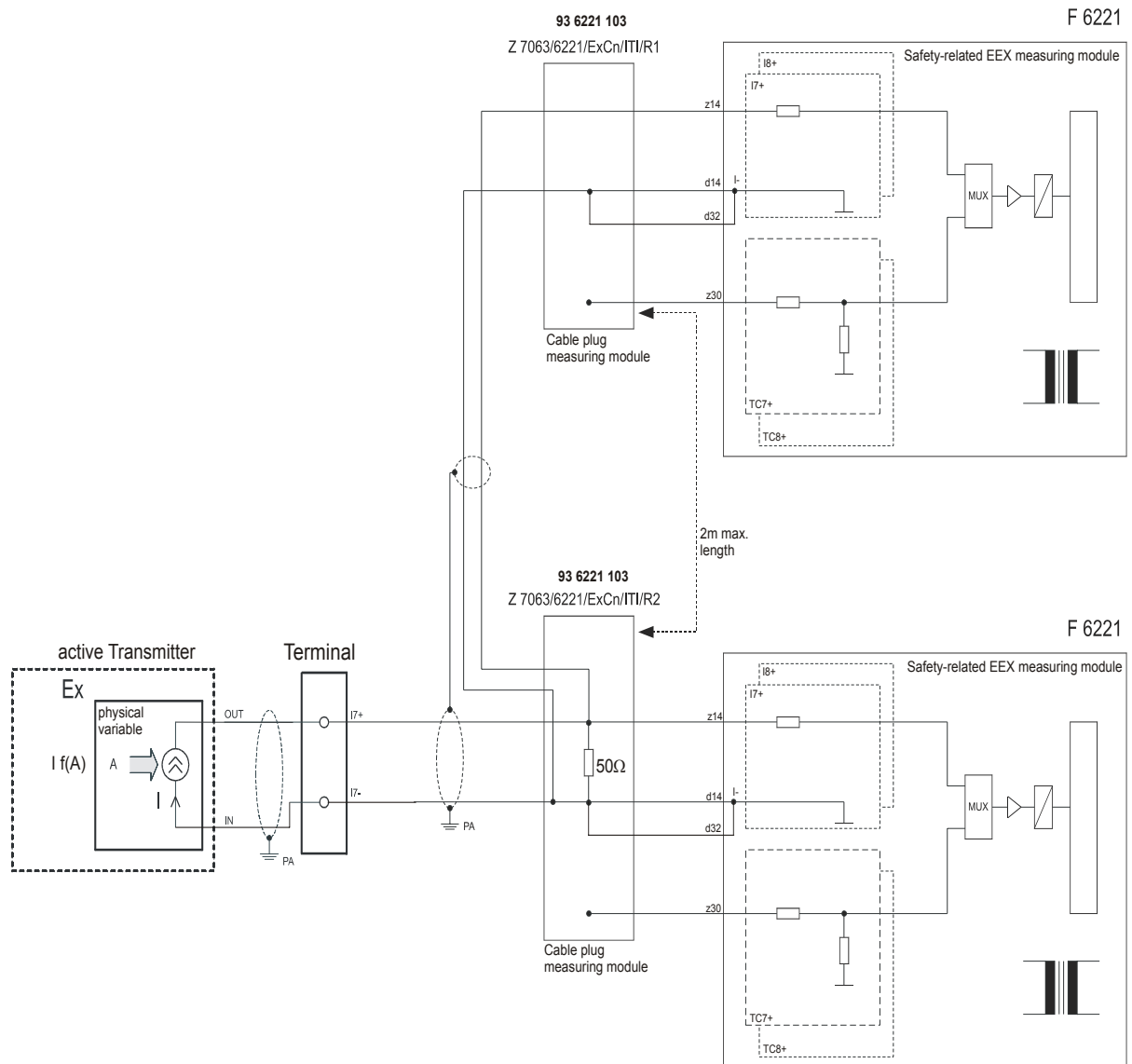


Figure 6: No supply, redundant current measuring, wiring via cable

2.1.8 Variant D: Mono supply, redundant current measuring, wiring via terminal

- Redundant operation with transmitter supply for channels 1 to 8
- Cable type:

2x Z 7063/6221/ExCn/U1V	part no. 93 6221 100
1x Z 7025/3325/ExCn	part no. 93 3325 101

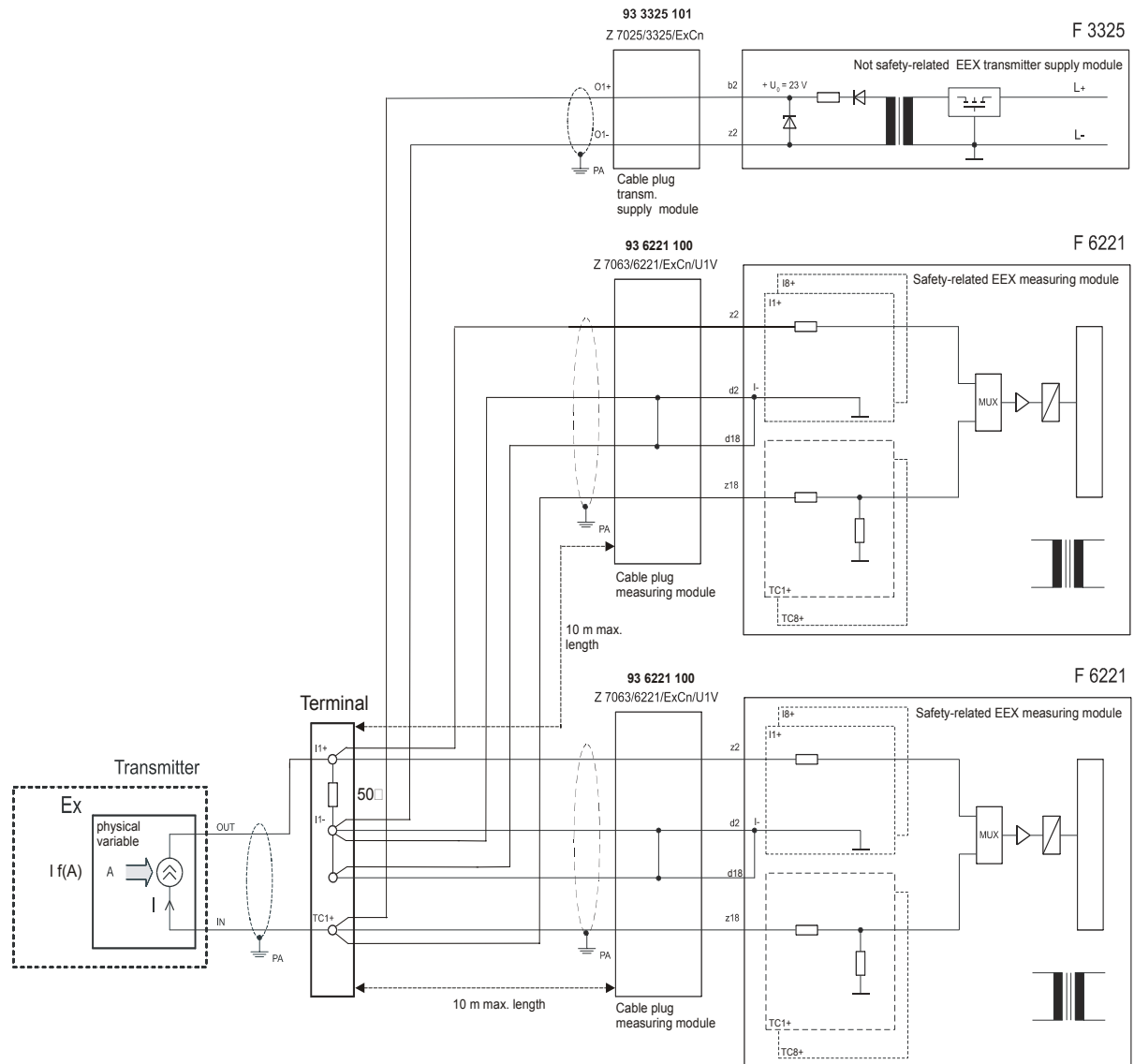


Figure 7: Mono supply, redundant current measuring, wiring via terminal

Note

Instead of the F3325 module, a galvanically isolated power supply can also be used in this wiring variant. It has to be considered that a fault current runs through the monitoring inputs (TC1 to TC8, $R_e = 15\text{ k}\Omega$) which affects the non-intrinsically safe side of the galvanically isolated power supply and must be compensated. The Hart protocol can also be transmitted if suitable transmitters are used.

2.1.9 Variant E: Voltage measuring

- Voltage measuring for signals (I1 to I8) and supply voltage monitoring (TC1 to TC8) for channels 1 to 8
- Cable type: Z 7063/6221/ExCn/U1V part number 93 6221 100

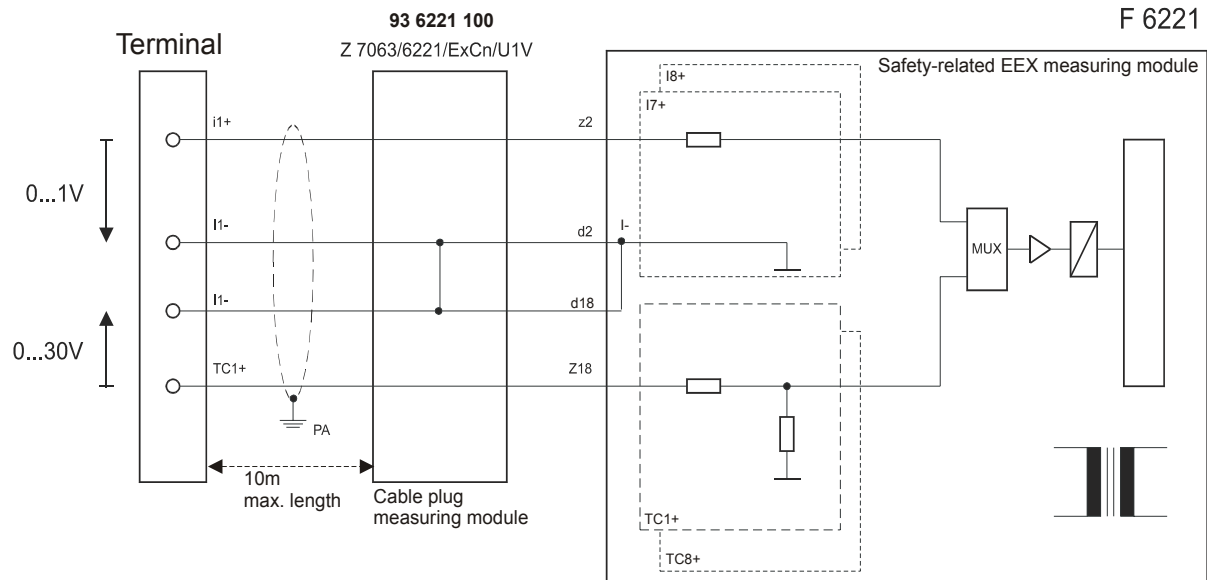


Figure 8: Voltage measuring

2.1.10 Variant F: Current measuring via shunt

- Current measuring for signals (I1 to I8) and supply voltage measuring (TC1 to TC8) for channels 1 to 8
- Cable type: Z 7063/6221/ExCn/I part number 93 6221 105

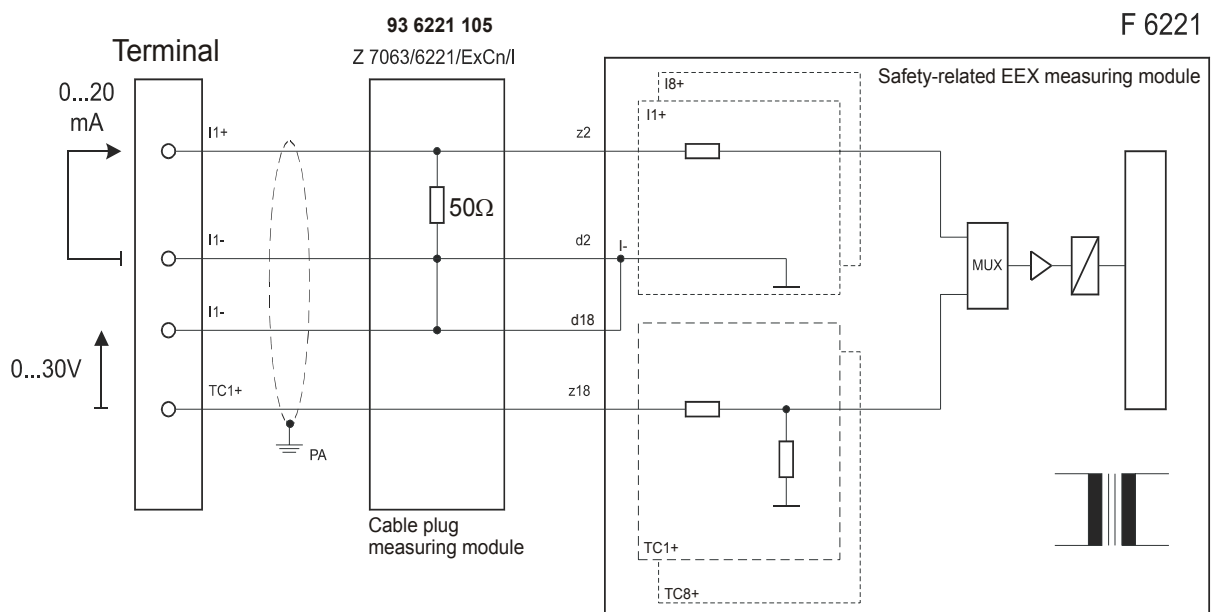


Figure 9: Current measuring via shunt

3 Pin allocation (in the field)

- Cable type: Z 7063/6221/ExCn/ITI + part no. 93 6221 101
Z 7025/3325/ExCx
Z 7063/6221/ExCn/ITI/R2 part no. 93 6221 103

Channel	Connection	Color	Cable LiYCY 8x2 x 0.2 mm ² screened
I1+	z2	WH	
TC1+	z18	BN	
I2+	z4	GN	
TC2+	z20	YE	
I3+	z6	GY	
TC3+	z22	PK	
I4+	z8	BU	
TC4+	z24	RD	
I5+	z10	BK	
TC5+	z26	VT	
I6+	z12	GY-PK	
TC6+	z28	RD-BU	
I7+	z14	WH-GN	
I7-	d14	BN-GN	
I8+	z16	WH-YE	
I8-	d16	YE-BN	
Cable screen		YEGN	

Channel 7 and 8 have no supply

Note

The grounds (I1- to I8-) on the module are taken together to one ground (I-). The signals (I1- to I8-) may only be interconnected on the module.

No external joints are allowed.

In Ex applications, the cable shield has to be connected to the equipotential bonding. In non Ex applications, the cable shield is connected to the PE terminal / bus bar on the subrack.

- Cable type: Z 7063/6221/ExCn/U1V part no. 93 6221 100
Z 7063/6221/ExCn/I part no. 93 6221 105

Channel	Connection	Color	Channel	Connection	Color
I1+	z2	WH	TC1+	z18	WH-GY
I1-	d2	BN	I1-	d2	GY-BN
I2+	z4	GN	TC2+	z20	WH-PK
I2-	d4	YE	I2-	d4	PK-BN
I3+	z6	GY	TC3+	z22	WH-BU
I3-	d6	PK	I3-	d6	BN-BU
I4+	z8	BU	TC4+	z24	WH-RD
I4-	d8	RD	I4-	d8	BN-RD
I5+	z10	BK	TC5+	z26	WH-BK
I5-	d10	VT	I5-	d10	BN-BK
I6+	z12	GY-PK	TC6+	z28	GY-GN
I6-	d12	RD-BU	I6-	d12	YE-GY
I7+	z14	WH-GN	TC7+	z30	PK-GN
I7-	d14	BN-GN	I7-	d14	YE-PK
I8+	z16	WH-YE	TC8+	z32	GN-BU
I8-	d16	YE-BN	I8-	d16	YE-BU
Cable screen		YEGN	Cable screen		YEGN

Cable
LiYCY
16x2 x 0.2 mm²
screened

Channels (I1+ to I8+) for
input signal measuring

Channels (TC1+ to TC8+) for
supply voltage monitoring

Note

The grounds (I1- to I8-) are joined to a common ground (I-). The signals (I1- to I8-) may only be interconnected on the module. No external joints are allowed.

The pins d4 and d30 on the front socket of the F 6221 are omitted (coding of the front plug). Pin allocations refer to the connections on the printed circuit board in the front plug.

In Ex applications, the cable shield has to be connected to the equipotential bonding. In non Ex applications, the cable shield is connected to the PE terminal / bus bar on the subrack.

4 Operating Instructions for F 6221

4.1 Application

The module is used to measure the current of 0/4 to 20 mA transmitters. These transmitters can be installed in potentially hazardous atmospheres from Zone 1 on.



No external voltage must be applied at the outputs.
Only these applications are permissible, which are described in the data sheets for F 3325 and F 6221.

The digitized process signals are made available at the outputs.

4.2 Electrical specifications concerning intrinsic safety

For these specifications please refer to the EC prototype test certificate enclosed.

4.3 Assembly and installation

The module is mounted in a 19" subrack. It must be plugged in vertically. The design of the subrack must allow heat dissipation.

Further information for assembly and installation see HIMA main catalog "The H41q and H51q System Families".

Note	The module must not be mounted within a potentially explosive area.

The module is connected to the intrinsically safe field circuits via the cable plug Z 7063.

In addition, the following points should be considered:

- The electronic module including its connections has to be installed in a way that at least the degree of protection IP 20 according to EN 60529: 1991 + A1: 2000 is achieved.
- Two intrinsically safe input circuits of two F 6221 modules or several intrinsically safe inputs of one F 6221 module as well as one Ex supply unit for the transmitter can be wired in parallel. The maximum values (U_0, I_0, C_0, L_0) reduced due to this method of connection have to be considered (interconnection according to PTB-ThEx-10). A technical report on the interconnection of the F 6221 and F 3325 modules with two-wire transmitters is available from HIMA on request.
- The separation between intrinsically safe and not intrinsically safe terminals must be ≥ 50 mm, especially between adjacent modules.
- The separation between adjacent intrinsically safe terminals must be ≥ 6 mm.
- Intrinsically safe and not intrinsically safe lines must be installed separately, or the intrinsically safe lines must be provided with additional insulation.
- Intrinsically safe lines must be identifiable, e.g. by the light blue color (RAL 5015) of the insulation.
- The wiring has to be secured mechanically in a way which ensures that in the event of an accidental disconnection, the distance (EN 50 020/ Part 7, Table 4) between the intrinsically safe and not intrinsically safe connections does not fall below the required minimum (e.g. by bundling).
- The line shield has to be connected to equipotential bonding.

- Modules, which were operated in general electrical systems, may not be used thereafter no more in Ex-plants.

The lines used must comply with the following insulation test voltages:

- Intrinsically safe lines ≥ 1000 VAC
- Not intrinsically safe lines ≥ 1500 VAC

Stranded wires, the line ends must be provided with wire end ferrules.

The terminals must be suitable for clamping the wire cross section.

The applicable regulations and standards have to be complied with, especially:

- DIN EN 60079-14: 1997 (VDE 0165, Part 1: 1998)
- EN 50 014: 1999 (VDE 0170/0171 Part 1: 2000)
- EN 50 020: 1994 (VDE 0170/0171 Part 7: 1996)

4.4 Connection of unused inputs

Any voltage inputs 0...1 V which are not used have to be short-circuited at the terminal strip.

Unused current inputs are terminated with the shunt in the cable plug.

Inputs, which are not terminated, are not reported as "faulty" (e.g. un-plugged cable).

4.5 Requirements for the supply

The internal resistance of supply must not exceed 500 Ω . Otherwise internal errors of the module can not be detected.

4.6 Redundant connection

When the inputs are connected redundantly, an error at one input may generate a measuring error at the redundant faultless input. The measuring error can be up to 2.5% when the input is terminated with a 50 Ω resistor.

Due to the voltage drop on the line connecting the redundant modules, the cable length is limited to 2 m.

4.7 External transmitter connection (variants D,E)

The line between the F 6221 module and the assigned measuring shunts (channels 1 to 8) can have a maximum length of 10 m.

4.8 Maximum cable length and load in the transmitter circuit

The maximum additional load R_b in the transmitter circuit is calculated as follows:

$$R_b = \left(\frac{U_{TC} - U_{Tmin}}{I_{max}} \right) - (50) \Omega = \frac{16V - 14V}{20mA} - 50 \Omega = 50 \Omega$$

R_b additional load

U_{TC} switch-off limit for the transmitter supply voltage monitoring

U_{Tmin} minimum supply voltage of the transmitter

I_{max} maximum current to be measured

The contact resistances of the clamps must be considered. When planning the Ex circuits the line inductance and the line capacitance for the respective line length have to be considered.

Max. transmitter supply voltage U_{Tmin}	Max. length of line at 0.2 mm ²	Max. length of line at 0.5 mm ²
14.5 V	135 m	312 m
14 V	271 m	625 m
13.5 V	407 m	937 m
13 V	543 m	1250 m
12.5 V	679 m	1562 m
12 V	815 m	1875 m
11.5 V	951 m	2187 m

Table 3: Max. cable length and load in the transmitter circuit

The cable to the transmitter must be shielded twisted-pair.

4.9 Start-up

Before the first system start-up, an Ex-expert has to check whether the system has been correctly installed, especially the supply voltage connections and the connections of the intrinsically safe circuits.

4.10 Maintenance

In case of a failure, the defective module must be replaced with the same type or with another approved type. Any repair work must only be carried out by the manufacturer.

4.11 Project planning in ELOP II

- Each input channel is configured via the HF-AIX-3 software function block. The transmitter supply voltage monitoring must be enabled in the software function block.
- The parameterization of the module must be performed according to the operating system manual for the currently used version of the operating system. Especially the chapter about the noise blanking has to be regarded.
Setting: Safety time $\geq 3 \times$ watchdog time.
- For each input channel, the corresponding error bit must be set. The channel error bit must be evaluated in the user programs in a way which leads to safety-related behavior of the corresponding input channel.
- For resetting a channel error, the recalibration input of the HF-AIX-3 software function block must be set to TRUE twice for at least one PLC cycle.

Spreading the measuring values (this can be configured in the HF-AIX-3 software function block) will result in an increase of the relative error by the spreading factor.

EC Type Examination Certificate**No.: EX5 02 04 19183 036**

in accordance with Annex III of Council Directive No. 94/9/EC for equipment and protective systems intended for use in potentially explosive atmospheres (ATEX) for

HIMA Paul Hildebrandt GmbH + Co KG
Albert-Bassermann-Straße 28

68782 Brühl

Product: Electrical apparatus type of protection intrinsically safety i (EX-RL)

Model: Automation device, safety-related
F 6221

Parameters: see appendix (six pages)

The above mentioned product meets the provisions of the Directive.

This certificate is issued on the basis of the product provided for testing and certification and on its technical documentation. The detailed results of the test and the provided technical documentation are listed in

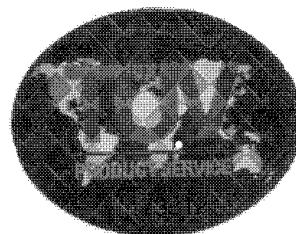
Test report no.: 70013102.1

This certificate pertains only to the sample product submitted to TÜV PRODUCT SERVICE for testing. Therefore this certificate has no specified period of validity.

Released with the above mentioned certificate number by the Certification Body of TÜV PRODUCT SERVICE.

Department: TA-ES/MUC-IQSE / jb
 Date: 25.04.2002

A handwritten signature in black ink, appearing to read 'J. Blum'.



TÜV PRODUCT SERVICE GMBH is a Notified Body in accordance with Council Directive 94/9/EC for equipment and protective systems intended for use in potentially explosive atmospheres with the identification number 0123.

TÜV PRODUCT SERVICE GMBH · Zertifizierstelle · Ridlerstrasse 65 · D-80339 München

1 Description

The module F 6221 is a associated electrical apparatus for installation only outside an atmosphere capable of explosion. This subassembly unit for installation in a subrack consist of two PCB-boards. 16 galvanically coupled intrinsically safe input ports are connectable at the front. The output- and power supply ports are connectable at the rear of the module.

The environmental temperature averages $-20^{\circ}\text{C} \leq T_{\text{amb}} \leq 60^{\circ}\text{C}$.

From the manual of instruction you will see the general information for secure use.

2 Electrical data

2.1 Intrinsically safe port, strip X20

Channel 1...8 for measuring electric circuits and channel 1...8 for backreading electric circuits are intrinsically safe and safety isolated up to a peak value of 375V against the output- and power supply ports.

Port, common ground	Port	Input	Function
d2	z2	I1+	Measuring circuit 1 +
	z4	I2+	Measuring circuit 2 +
d6	z6	I3+	Measuring circuit 3 +
d8	z8	I4+	Measuring circuit 4 +
d10	z10	I5+	Measuring circuit 5 +
d12	z12	I6+	Measuring circuit 6 +
d14	z14	I7+	Measuring circuit 7 +
d16	z16	I8+	Measuring circuit 8 +
d18	z18	TC1+	Backreading circuit 1 +
d20	z20	TC2+	Backreading circuit 2 +
d22	z22	TC3+	Backreading circuit 3 +
d24	z24	TC4+	Backreading circuit 4 +
d26	z26	TC5+	Backreading circuit 5 +
d28	z28	TC6+	Backreading circuit 6 +
	z30	TC7+	Backreading circuit 7 +
d32	z32	TC8+	Backreading circuit 8 +

2.2 Measuring circuits channel 1...8

Voltage, U ₀	crest value DC 5,7 V
Current, I ₀	crest value DC 2 mA
Power, P ₀	crest value 2,9 mW
Characteristic curve	linear
internal capacitor, C _i	negligible
internal inductance, L _i	negligible

2.3 Backreading circuits channel 1...8

Voltage, U ₀	crest value DC 5,7 V
Current, I ₀	crest value DC 0,5 mA
Power, P ₀	crest value 0,72 mW
Characteristic curve	linear
internal capacitor, C _i	negligible
internal inductance, L _i	negligible

2.4 Isolated view for measuring circuits

EEx ia IIC

Max. connectable inductance of one and parallel connection of two measuring circuits	L ₀ = 1 H
Max. connectable capacitance of one and parallel connection of two measuring circuits	C ₀ = 50 µF

EEx ia IIB

Max. connectable inductance of one and parallel connection of two measuring circuits	L ₀ = 1 H
Max. connectable capacitance of one and parallel connection of two measuring circuits	C ₀ = 1000 µF

2.5 Isolated view for backreading circuits

EEx ia IIC

Max. connectable inductance of one and parallel connection of two measuring circuits	L ₀ = 1 H
Max. connectable capacitance of one and parallel connection of two measuring circuits	C ₀ = 50 µF

EEx ia IIC

Max. connectable inductance of one and parallel connection of two measuring circuits	L ₀ = 1 H
Max. connectable capacitance of one and parallel connection of two measuring circuits	C ₀ = 1000 µF

2.6 Composite view for measuring circuits

EEx ia IIC

Max. connectable inductance of one and parallel connection of two measuring circuits	$L_0 = 5 \text{ mH}$
Max. connectable capacitance of one and parallel connection of two measuring circuits	$C_0 = 1,5 \mu\text{F}$

EEx ia IIB

Max. connectable inductance of one and parallel connection of two measuring circuits	$L_0 = 5 \text{ mH}$
Max. connectable capacitance of one and parallel connection of two measuring circuits	$C_0 = 7,5 \mu\text{F}$

2.7 Composite view for backreading circuits

EEx ia IIC

Max. connectable inductance of one and parallel connection of two measuring circuits	$L_0 = 5 \text{ mH}$
Max. connectable capacitance of one and parallel connection of two measuring circuits	$C_0 = 1,5 \mu\text{F}$

EEx ia IIB

Max. connectable inductance of one and parallel connection of two measuring circuits	$L_0 = 5 \text{ mH}$
Max. connectable capacitance of one and parallel connection of two measuring circuits	$C_0 = 7,5 \mu\text{F}$

2.8 Output port, strip X1 (non-intrinsically safe)

Voltage crest value 5 V

2.9 Power supply port, strip X1 pin z2 / d2 (non-intrinsically safe)

Nominal voltage DC 24 V

Voltage crest value DC 30 V

Power 6 W

Absolute maximum voltage without affecting the intrinsic safety U_m crest value 40V

3 Identifying marking

The legible and durable marking must include the following option list:

- Name and address of the manufacturer
- Year of construction
- the identifier  II (1)GD [EEx ia] IIC

4 Production quality assurance

The manufacturer shall operate an approved quality system for production, final equipment inspection and testing according Annex IV directive 94/9/EC.

Munich, April 25th 2002

TÜV AUTOMOTIVE GmbH TA-ES/MUC



Dipl.-Ing. J. Blum



Technical Report

Electrical interconnection of the modules
F 6221 and F3325

Manufacturer
HIMA Paul Hildebrandt GmbH + Co KG
Albert-Bassermann-Straße 28
68782 Brühl

Report-No.: 70013102.4 (I.1/2)
Revision 1.0 on June 28th 2002

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Order-No.: 70013102
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28.06.2002
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SÜDDEUTSCHLAND

1 Introduction

This report examines ten different variations of electrical interconnection of the power supply module F 3325 and the measurement module F 6221. The variations of electrical interconnection of these modules allow redundancy concerning measurement value logging and/or concerning power supply of the transmitters. Every variation of electrical interconnection possess an associated characteristic curve. This characteristic curve is composed of the characteristic curves of the particular components.

Chapter 2 of this report will show an interest in the electrical specification of the intrinsically safe electric circuits of the power supply- and the measurement modules. Chapter 3 describes as a matter of principle the electrical connection of the modules and the accrument of the accumulated characteristic curves. As a result of the electrical interconnection, in chapter 4 the accumulated voltages and electric currents will be investigated and personated. In chapter 5 the arising maximal inductances and capacitances will be presented and discussed.

2 Electrical data of the intrinsically safe circuits of the modules

This chapter describes the electrical data of the intrinsically safe circuits of the power supply module and the measurement module.

2.1 Module F 6221

2.1.1 Intrinsically safe port, strip X20

The module F 6221 is an associated electrical apparatus for installation only outside an atmosphere capable of explosion. This subassembly unit for installation in a subrack consist of two PCB-boards. 16 galvanically coupled intrinsically safe input ports are connectable at the front. The output- and power supply ports are connectable at the rear of the module.

The environmental temperature averages $-20^{\circ}\text{C} < T_{\text{amb}} \leq 60^{\circ}\text{C}$.

Channel one to eight for measuring electric circuits and channel one to eight for backreading electric circuits are intrinsically safe and safely isolated up to a peak value of 375 V against the output- and power supply ports. Tab. 2.1 shows the associated pin assignment. Tab. 2.2 shows the electrical data of the measurement circuits and Tab. 2.3 shows the electrical data of the backreading circuits.



SÜDDEUTSCHLAND

Port, common ground	Port	Input	Function
d2	z2	I1+	Measuring circuit 1 +
	z4	I2+	Measuring circuit 2 +
d6	z6	I3+	Measuring circuit 3 +
d8	z8	I4+	Measuring circuit 4 +
d10	z10	I5+	Measuring circuit 5 +
d12	z12	I6+	Measuring circuit 6 +
d14	z14	I7+	Measuring circuit 7 +
d16	z16	I8+	Measuring circuit 8 +
d18	z18	TC1+	Backreading circuit 1 +
d20	z20	TC2+	Backreading circuit 2 +
d22	z22	TC3+	Backreading circuit 3 +
d24	z24	TC4+	Backreading circuit 4 +
d26	z26	TC5+	Backreading circuit 5 +
d28	z28	TC6+	Backreading circuit 6 +
	z30	TC7+	Backreading circuit 7 +
d32	z32	TC8+	Backreading circuit 8 +

Tab. 2.1: Pin assignment of the intrinsically safe electric circuits of the module F 6221



2.1.2 Measurement circuits channel 1...8

Voltage, U ₀	crest value DC 5,7 V / -1 V
Current, I ₀	crest value DC 2 mA
Power, P ₀	crest value 2,9 mW
Characteristic curve	linear
internal capacitor, C _i	negligible
internal inductance, L _i	negligible

Tab. 2.2: Electric data of the measurement circuits of the module F 6221

2.1.3 Backreading circuits 1...8

Voltage, U ₀	crest value DC 5,7 V / -1 V
Current, I ₀	crest value DC 0,5 mA
Power, P ₀	crest value 0,72 mW
Characteristic curve	linear
internal capacitor, C _i	negligible
internal inductance, L _i	negligible

Tab. 2.3: Electric data of the backreading circuits of the module F 6221

2.2 Module F 3325

2.2.1 Intrinsically safe electric output circuits, strip X20

The module F 3325 is an associated electrical apparatus for installation only outside an atmosphere capable of explosion. This subassembly unit for installation in a subrack consist of one PCB-board. In order to supply (Ex-) transmitters six intrinsically safe power supply ports are connectable at the front. The output- and power supply ports are connectable at the rear of the module.

The environmental temperature averages $-20^{\circ}\text{C} \leq T_{\text{amb}} \leq 60^{\circ}\text{C}$.

Six voltages of 22 V for the supply of the (Ex-) transmitters are provided. These are intrinsically safe and safety isolated up to a peak value of 375 V against the power supply circuit. Tab. 2.4 shows the associated pin assignment. Tab. 2.5 shows the electric data of the output circuits.



Port	Output	Function
z2	O1-	Voltage output 1 -
b2	O1+	Voltage output 1 +
b4	OR1+	Redundant voltage output 1 +
z8	O2-	Voltage output 2 -
b8	O2+	Voltage output 2 +
b10	OR2+	Redundant voltage output 2 +
z14	O3-	Voltage output 3 -
b14	O3+	Voltage output 3 +
b16	OR3+	Redundant voltage output 3 +
z18	O4-	Voltage output 4 -
b18	O4+	Voltage output 4 +
b20	OR4+	Redundant voltage output 4 +
z22	O5-	Voltage output 5 -
b22	O5+	Voltage output 5 +
b24	OR5+	Redundant voltage output 5 +
z28	O6-	Voltage output 6 -
b28	O6+	Voltage output 6 +
b30	OR6+	Redundant voltage output 6 +

Tab. 2.4: Pin assignment of the intrinsically safe electric circuits of the module F 3325



Regarding the interconnection, the worst case is provided by the voltages U_{o1} , U_{o2} and U_{o3} and the electric circuits $Io1$, $Io2$ and $Io3$. The values of these voltages and electric circuits are personated in Tab. 3.1.

	Output channel F 3325	Measurement channel F 6221	Backreading channel F 6221
Io of the channel	Io1 = 75,6 mA	Io2 ≤ +/-2 mA	Io3 ≤ +/-0,5 mA
Uo of the channel	Uo1 = 23,2 V	Variant 1, 2, 3, 4, 9, 10 Uo2 = -1 V Variant 5, 6, 7, 8 Uo2 = 5,7 V	Variant 1, 2, 3, 4, 9, 10 Uo3 = -1 V Variant 5, 6, 7, 8 Uo3 = 5,7 V

Tab. 3.1: Most disadvantageous electric circuits and voltages regarding the interconnection of the modules

4 Cumulative electric circuits and cumulative voltages

Tab. 4.1 shows the accumulated electric circuits and voltages for the variants one to ten according to image 3.1. On the basis of this report, the interconnection of the modules is merely permitted under the following requirement: The precept of interconnection corresponds with image 3.1 and personates one of the variants of interconnection according to Tab. 4.1.



2.2.2 Electric output circuits

Voltage per output circuit, U_o	crest value DC 23,2 V
Amperage per output circuit, I_o	crest value DC 75,6 mA
Power per output circuit, P_o	crest value 657,7 mW
Characteristic curve	trapeze
Internal capacitance per output circuit, C_i	negligible
Internal inductance per output circuit, L_i	negligible

Tab. 2.5: Electric data of the module F 3325

3 Electric interconnection of the modules

This chapter shows an interest in the electrical interconnection of the modules F 6221 and F 3325.

According to the documentation of the electrical interconnection of the modules, a parallel connection of the output supply of the module F 3325 and the backreading channels of the module F 6221 in serial with the measurement channels of the module F 6221 according to image 3.1 takes place. The accumulated characteristic curve of the electric interconnection results from the graphic summation of the characteristic lines of the output power supply of the module F 3325 in terms of the electric circuit and the graphic summation of the characteristic curves of the measurement outputs of the module F 6221 in terms of the voltage.

The variation of the electrical interconnection corresponds with the precept according to image 3.1 and differs merely by the number of power supply channels, backreading channels and measurement channels.

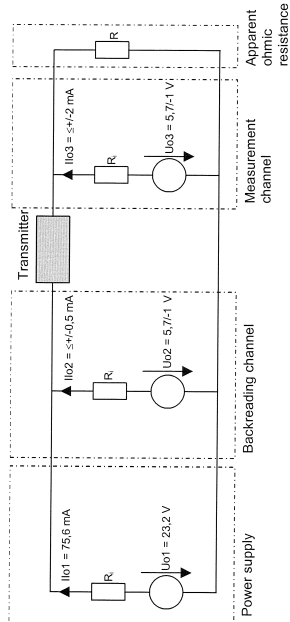


Image 3.1: Precept of electric interconnection of the modules

Variant	Kind of channel	Number of channels	Io of the channel in mA	Cumulative current in mA	Uo of the channel in V	Cumulative voltage in V
1	Output channel F 3325	1	75,6	75,6	23,2	23,2
	Measurement channel F 6221	1	$\leq \pm 1,2$	-	-1	-1
	Backreading channel F 6221	1	$\leq \pm 0,5$	$\leq \pm 0,5$	5,7/-1	-
			Cumulative current	$\leq 76,1$	Cumulative voltage	24,2
2	Output channel F 3325	1	75,6	75,6	23,2	23,2
	Measurement channel F 6221	2	$\leq \pm 1,2$	-	-1	-1
	Backreading channel F 6221	1	$\leq \pm 0,5$	$\leq \pm 0,5$	5,7/-1	-
			Cumulative current	$\leq 76,1$	Cumulative voltage	24,2
3	Output channel F 3325	1	75,6	75,6	23,2	23,2
	Measurement channel F 6221	2	$\leq \pm 1,2$	-	-1	-1
	Backreading channel F 6221	2	$\leq \pm 0,5$	$\leq \pm 1,1$	5,7/-1	-
			Cumulative current	$\leq 76,6$	Cumulative voltage	24,2
4	Output channel F 3325	1	75,6	75,6	23,2	23,2
	Measurement channel F 6221	4	$\leq \pm 1,2$	-	-1	-1
	Backreading channel F 6221	2	$\leq \pm 0,5$	$\leq \pm 1,1$	5,7/-1	-
			Cumulative current	$\leq 76,6$	Cumulative voltage	24,2
5	Output channel F 3325	0	75,6	-	-	-
	Measurement channel F 6221	1	$\leq \pm 1,2$	$\leq \pm 1,2$	5,7	5,7
	Backreading channel F 6221	0	$\leq \pm 0,5$	-	-	-
			Cumulative current	$\leq \pm 1,2$	Cumulative voltage	5,7

Variant	Kind of channel	Number of channels	Io of the channel in mA	Cumulative current in mA	Uo of the channel in V	Cumulative voltage in V
6	Output channel F 3325	0	75,6	-	-	-
	Measurement channel F 6221	2	$\leq \pm 1,2$	$\leq \pm 1,4$	5,7	5,7
	Backreading channel F 6221	0	$\leq \pm 0,5$	-	-	-
			Cumulative current	$\leq \pm 1,4$	Cumulative voltage	5,7
7	Output channel F 3325	0	75,6	-	-	-
	Measurement channel F 6221	2	$\leq \pm 1,2$	$\leq \pm 1,4$	5,7	5,7
	Backreading channel F 6221	0	$\leq \pm 0,5$	-	-	-
			Cumulative current	$\leq \pm 1,4$	Cumulative voltage	5,7
8	Output channel F 3325	0	75,6	-	-	-
	Measurement channel F 6221	4	$\leq \pm 1,2$	$\leq \pm 1,8$	5,7	5,7
	Backreading channel F 6221	0	$\leq \pm 0,5$	-	-	-
			Cumulative current	$\leq \pm 1,8$	Cumulative voltage	5,7
9	Output channel F 3325	2	75,6	151,2	23,2	23,2
	Measurement channel F 6221	2	$\leq \pm 1,2$	-	-1	-1
	Backreading channel F 6221	2	$\leq \pm 0,5$	$\leq \pm 1,1$	5,7/-1	-
			Cumulative current	$\leq 152,2$	Cumulative voltage	24,2
10	Output channel F 3325	2	75,6	151,2	23,2	23,2
	Measurement channel F 6221	2	$\leq \pm 1,2$	-	-1	-1
	Backreading channel F 6221	2	$\leq \pm 0,5$	$\leq \pm 1,1$	5,7/-1	-
			Cumulative current	$\leq 152,2$	Cumulative voltage	24,2

Tab 4.1: Cumulative currents and cumulative voltages for different variants of electrical interconnection



5 Maximum inductances and capacitances

5.1 Results of the isolated view

Tab. 5.1 shows the maximum connectable inductances and capacitances for the isolated view.

Variant	Uo in V	Io in mA	Po in mW	ib-IIC		ib-IIB		Annotation
				Lo in mH (Co = 0)	Co in µF (Lo = 0)	Lo in mH (Co = 0)	Co in µF (Lo = 0)	
1	24,2	≤76,1	657,7	5,5	0,11	22	0,84	with F 3325
2	24,2	≤76,1	657,7	5,5	0,11	22	0,84	with F 3325
3	24,2	≤76,6	657,7	5,5	0,11	22	0,84	with F 3325
4	24,2	≤76,6	657,7	5,5	0,11	22	0,84	with F 3325
5	5,7	≤2	2,9	1000	50	1000	1000	without F 3325
6	5,7	≤4	5,7	1000	50	1000	1000	without F 3325
7	5,7	≤4	5,7	1000	50	1000	1000	without F 3325
8	5,7	≤8	11,4	540	50	1000	1000	without F 3325
9	24,2	≤152,2	1315,4	1	0,11	6,2	0,84	with F 3325
10	24,2	≤152,2	1315,4	1	0,11	6,2	0,84	with F 3325

Tab. 5.1: Maximum connectable inductances and capacitances for the isolated view



5.2 Results of the composite view

Tab. 5.1 shows the maximum connectable inductances and capacitances for the composite view.

Variant	Uo in V	Io in mA	Po in mW	ib-IIC		ib-IIB		Annotation
				Lo in mH	Co in µF	Lo in mH	Co in µF	
1	24,2	≤76,1	657,7	1	0,06	5	0,3	with F 3325
2	24,2	≤76,1	657,7	1	0,06	5	0,3	with F 3325
3	24,2	≤76,6	657,7	1	0,06	5	0,3	with F 3325
4	24,2	≤76,6	657,7	1	0,06	5	0,3	with F 3325
5	5,7	≤2	2,9	5	1,5	5	7,5	without F 3325
6	5,7	≤4	5,7	5	1,5	5	7,5	without F 3325
7	5,7	≤4	5,7	5	1,5	5	7,5	without F 3325
8	5,7	≤8	11,4	5	1,5	5	7,5	without F 3325
9	24,2	≤152,2	1315,4	-	-	2	0,3	with F 3325
10	24,2	≤152,2	1315,4	-	-	2	0,3	with F 3325

Tab. 5.2: Maximum connectable inductances and capacitances for composite view

The composite view is not practicable for the interconnection according to variant 9 resp. 10, gas group IIC.

The power Po was estimated pessimistically.

TÜV AUTOMOTIVE GMBH
Group of companies TÜV Sueddeutschland
Automation, Software and Electronics - IQSE
Project manager

By order

Thomas Lammell



F 6705: 2-channel converter digital/analog

safety-related, applicable up to SIL 3 according to IEC 61508

- Outputs: 0/4...20 mA, individual electrical isolation
- with safe isolation
- with integrated safety shutdown
- for source or sink mode

1 Overview

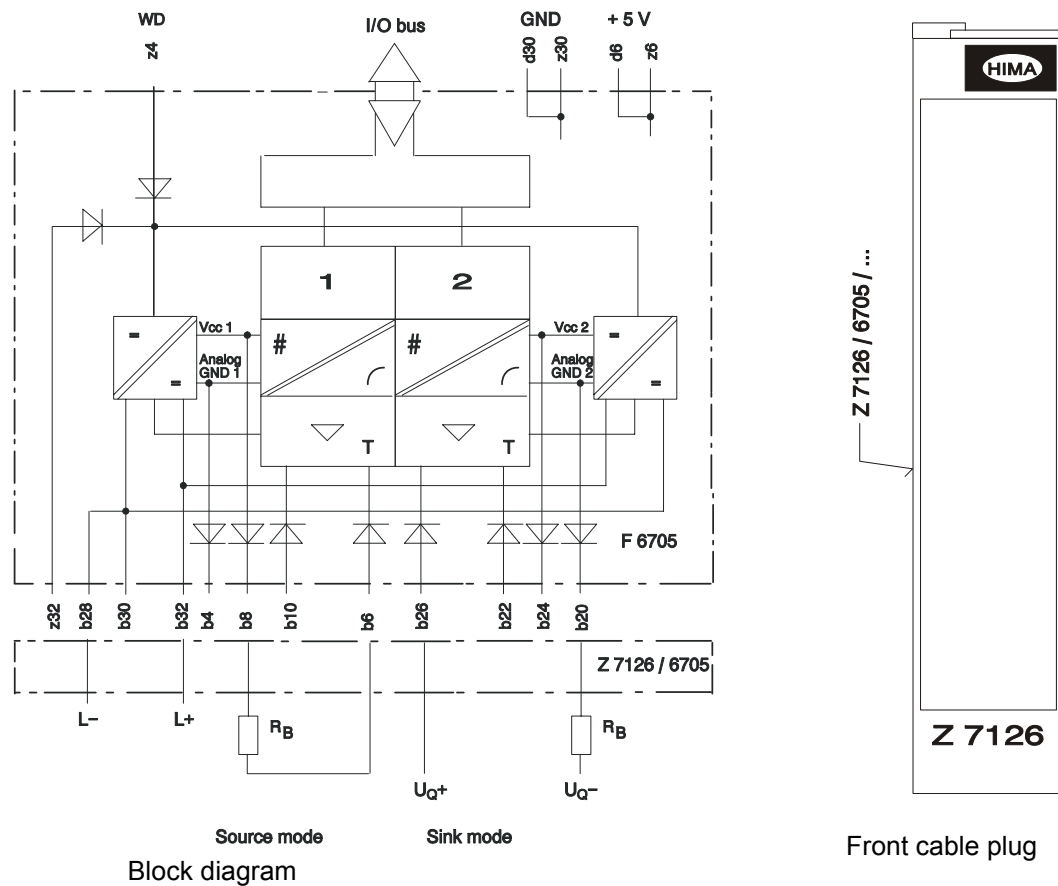


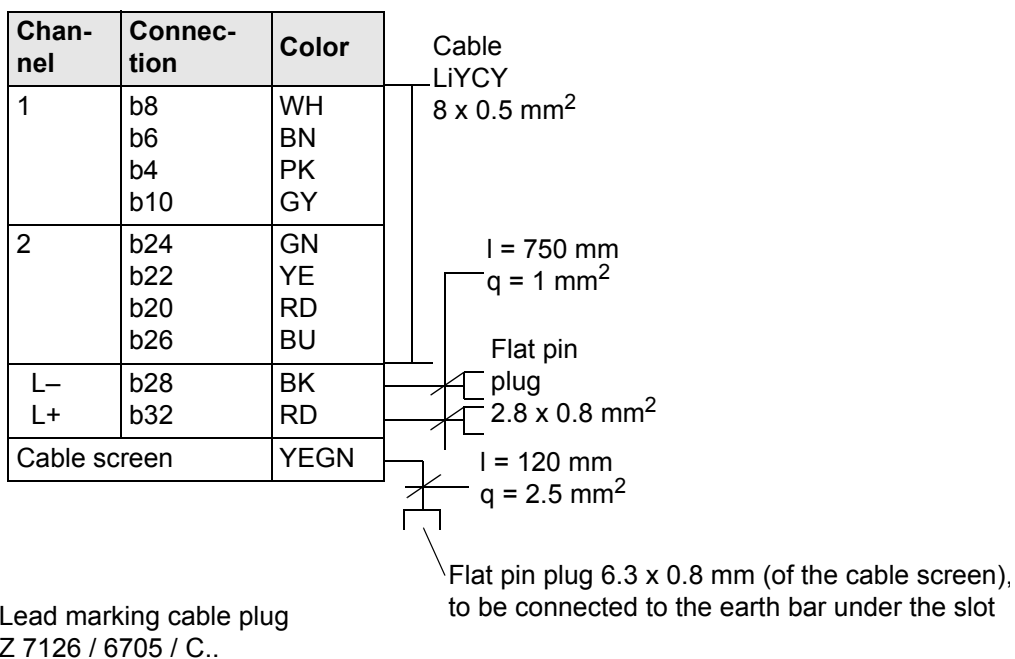
Figure 1: Block diagram and front cable plug

The module is automatically fully tested during operation by applying of test values with signal duration < 1ms. The main test routines are:

- Linearity of the D/A converter
- Cross-talk between the outputs
- Safety shutdown

Resolution 12 bits (4095 steps)
 0 = 0 mA, 3840 = 20 mA, 4095 = 21.3 mA

Burden R_B	$\leq 550 \, \Omega$ incl. line resistance to the burden
source mode	$\leq (U_Q - 10 \, \text{V}) / 21.3 \, \text{mA}$
sink mode	$U_Q = \text{source voltage}$
Basic error	$\leq 0.2 \, \%$ (40 μA) at 25 °C
Operating error	$\leq 0.4 \, \%$ at 0...+60 °C
Line length	max. 1000 m (observe burden)
Electric strength	250 V against Analog GND
Basic status with plug-in	$I \leq 40 \, \mu\text{A}$
Source voltage U_Q (sink mode)	10...30 V
Space requirement	4 SU
Operating data	5 VDC / 85 mA, 24 VDC / 130 mA



Note: To prevent module error messages, not used channels have to be terminated with a jumper

b6 - b8 for channel 1
or b22 - b24 for channel 2.

Figure 2: Lead marking cable plug

Note At use of the module with external devices (e.g. chart recorder) the compatibility with test values with signal duration < 1ms at the outputs has to be checked.

2 Current connections

2.1 Redundant current connection

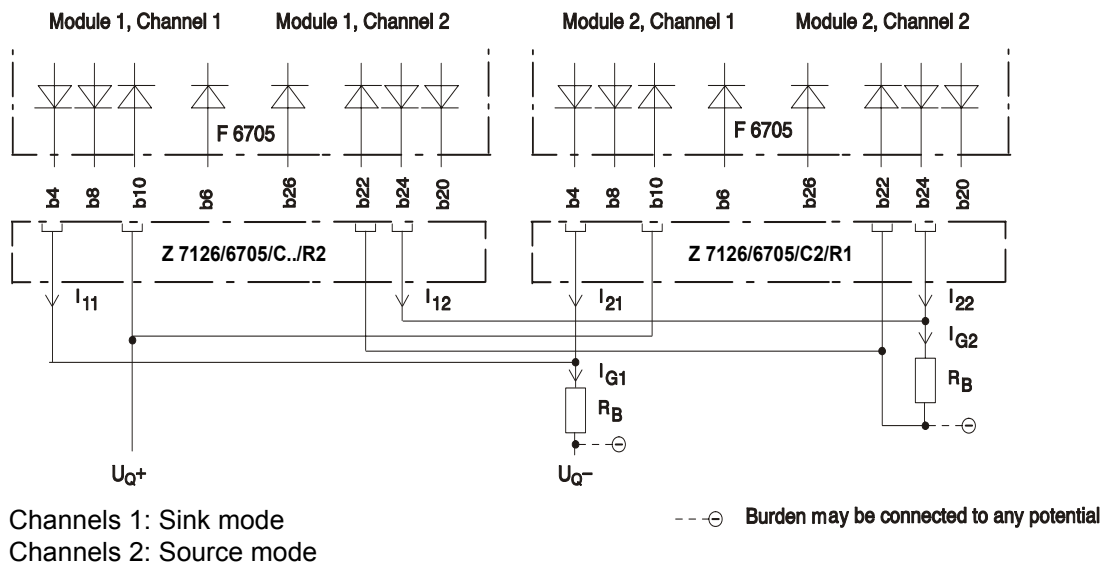


Figure 3: Redundant current connection

With redundant current connection, the following must be considered:

- The total current I_{G1} resp. I_{G2} to the burden R_B is the addition of the individual currents I_{11} and I_{21} resp. I_{12} and I_{22} .
- The admissible burden resistance is half the value.
- The paralleled channels have to be used in the same mode (source or sink mode).
- Because of the temperature error and of the wanted well-balanced load of the modules each output channel should generate the half of the current I_G to the burden.

Note

If one of the two redundant modules is switched off caused by an error, only half the current is delivered at the output (from *one* module), in the worst case for a maximum of two cycles.
With the connection of a replaced module twice the current may be delivered for a maximum of one cycle.

2.2 Bipolar current connection

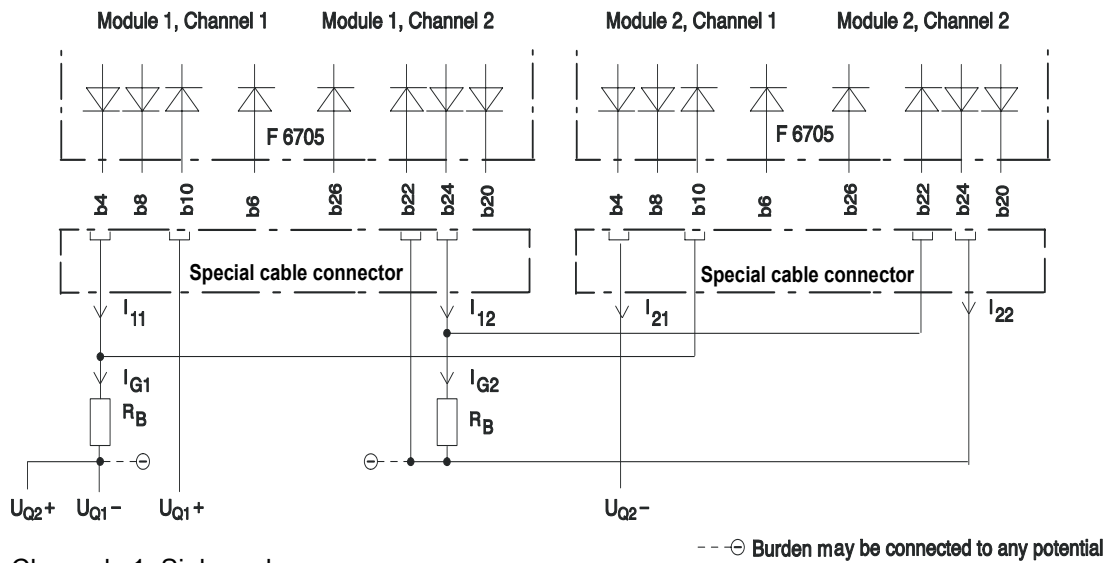


Figure 4: Bipolar current connection

The bipolar current connection serves the output of currents with sign between -20 mA to +20 mA. The following must be considered:

- The total current is the addition of the individual currents
 $I_{G1} = I_{11} - I_{21}$ or $I_{G2} = I_{12} - I_{22}$.
- The admissible burden resistance remains the same.
- Module 1 generates the positive part and module 2 the negative part of the total current.
- For reason of accuracy only one module may generate or consume current. This must be regarded in the user program.

2.3 Current outputs

Resolution in the range 0/4 - 20 mA

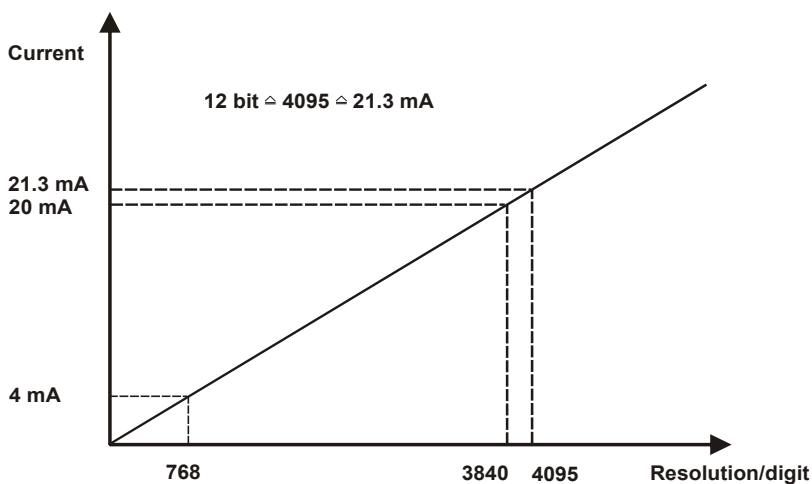


Figure 5: Current outputs



F 6706: 2-channel converter digital/analog

- Outputs: 0/4...20 mA, individual electrical isolation
- with safe isolation
- for source or sink mode

1 Overview

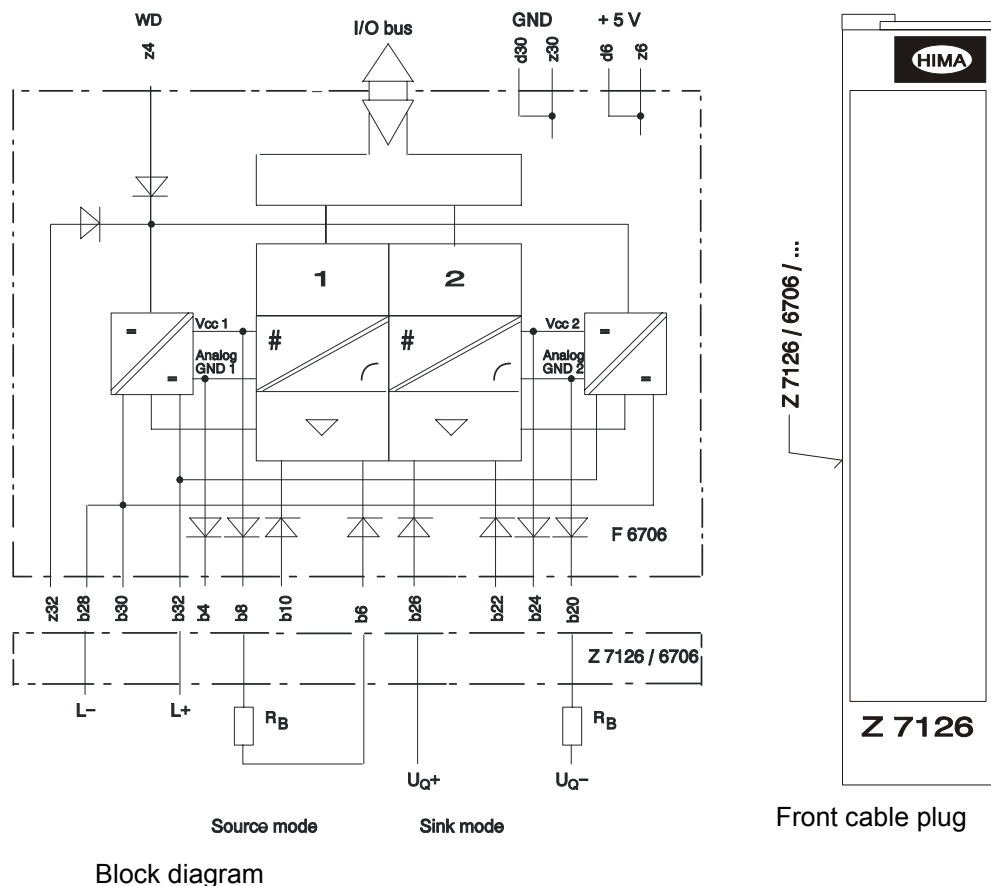


Figure 1: Block diagram and front cable plug

Resolution	12 bits (4095 steps) 0 = 0 mA, 3840 = 20 mA, 4095 = 21.3 mA
Burden R_B	
source mode	$\leq 750 \, \Omega$ incl. line resistance to the burden pins b8-b6 or b24-b26
sink mode	$\leq (U_Q - 5 \, \text{V}) / 21.3 \, \text{mA}$ U_Q = source voltage pins b4-b6 or b20-b26
Basis error	$\leq 0.1 \, \%$ (20 μA) at 25 °C
Operating error	$\leq 0.4 \, \%$ at 0...+60 °C

Line length	max. 1000 m (observe burden)
Electric strength	250 V against Analog GND
Basis status at plug-in	$I \leq 20 \mu\text{A}$
Source voltage U_Q (sink mode)	10...30 V
Space requirement	4 SU
Operating data	5 VDC / 40 mA, 24 VDC / 100 mA

Channel	Connection	Color	Cable LiYCY 8 x 0.5 mm ²
1	b8 b6 b4 b10	WH BN PK GY	
2	b24 b22 b20 b26	GN YE RD BU	I = 750 mm q = 1 mm ² Flat pin plug 2.8 x 0.8 mm ²
L- L+	b28 b32	BK RD	
Cable screen		YEGN	I = 120 mm q = 2.5 mm ²

Flat pin plug 6.3 x 0.8 mm (of the cable screen), to be connected to the earth bar under the slot

Lead marking cable plug Z 7126 / 6706 / C..

Note: To avoid failures of the module unused channels must be terminated by the bridge

b6 - b8 for channel 1 or
b22 - b24 for channel 2

Figure 2: Lead marking cable plug

2 Current connection

2.1 Bipolar current connection

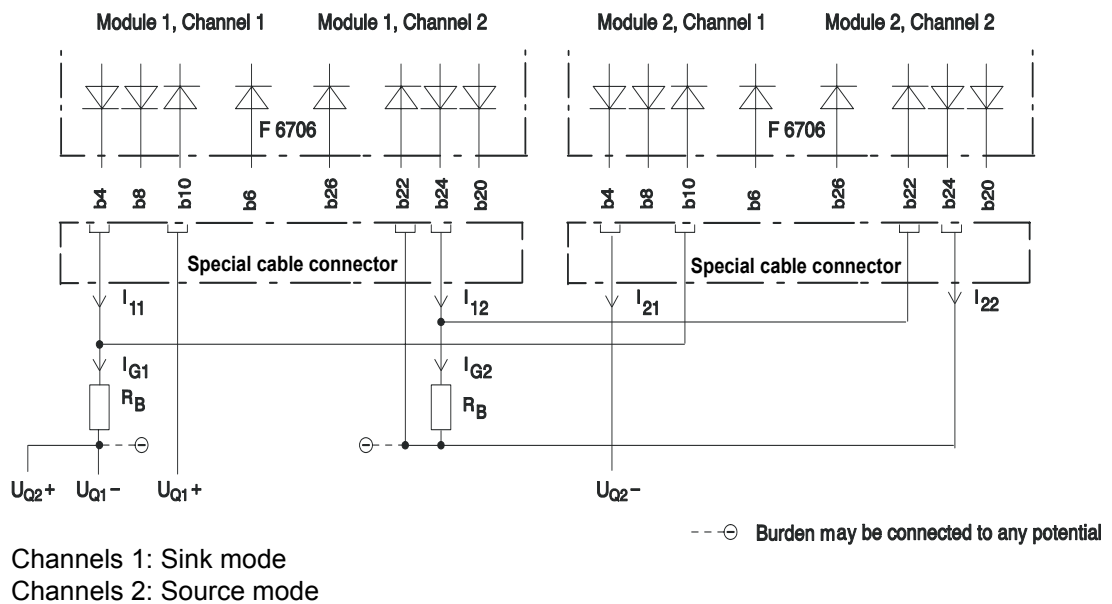


Figure 3: Bipolar current connection

The bipolar current connection serves the output of currents between -20 mA to +20 mA. The following must be considered:

- The total current is the addition of the individual currents
 $I_{G1} = I_{11} - I_{21}$ or $I_{G2} = I_{12} - I_{22}$.
- The admissible burden resistance remains the same.
- Module 1 generates the positive part and module 2 the negative part of the total current.
- In reasons of accuracy, only one module may generate or consume current. This must be regarded in the user program.

2.2 Current outputs

Resolution in the range 0/4 - 20 mA

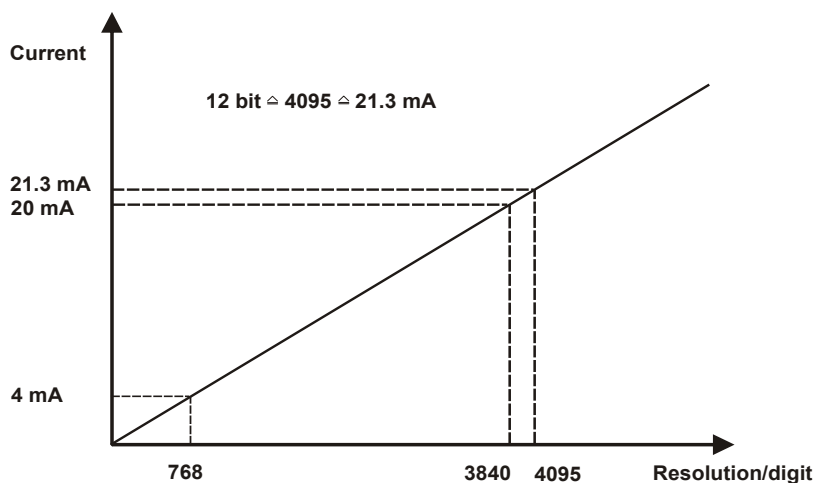


Figure 4: Current outputs



F 7126: Power supply module

Input voltage 24 VDC, output voltage 5 VDC
for PES H51q

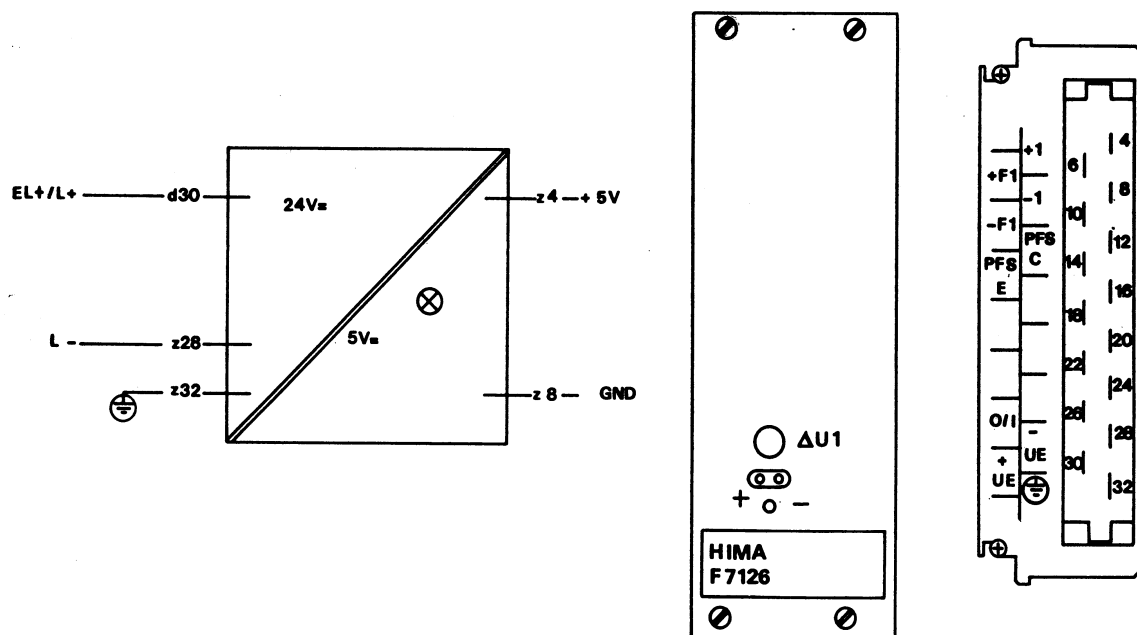


Figure 1: F 7126 power supply module

The module supplies automation systems with 5 VDC from a main supply of 24 VDC. It is a DC/DC converter with safe isolation between input and output voltage. The module is equipped with overvoltage protection and current limitation. The output is short-circuit-proof.

To avoid unbalanced load with redundant use of the power supply F 7126 the difference between their output voltages may not be more than 0.025 V.

On the front plate there are a test socket and a potentiometer for adjusting the output voltage. The adjustment is only admissible with a suitable measuring instrument of high accuracy.

Operating data	24 VDC, -15...+20 %, $r_{pp} < 15 \%$
Primary fuse	6.3 A slow blow
Output voltage	5 VDC ± 0.5 V steplessly adjustable factory adjustment: 5.4 VDC ± 0.025 V
Output current	10 A
Current limitation	approx. 13 A
Overvoltage protection	set to 6.5 V / ± 0.5 V
Efficiency rate	$\geq 77 \%$
Interference	according to EN 55011 / EN 55022
Space requirement	8 SU



F 7130A: Power supply module

Input voltage 24 VDC, output voltage 5 VDC
for PES H41q

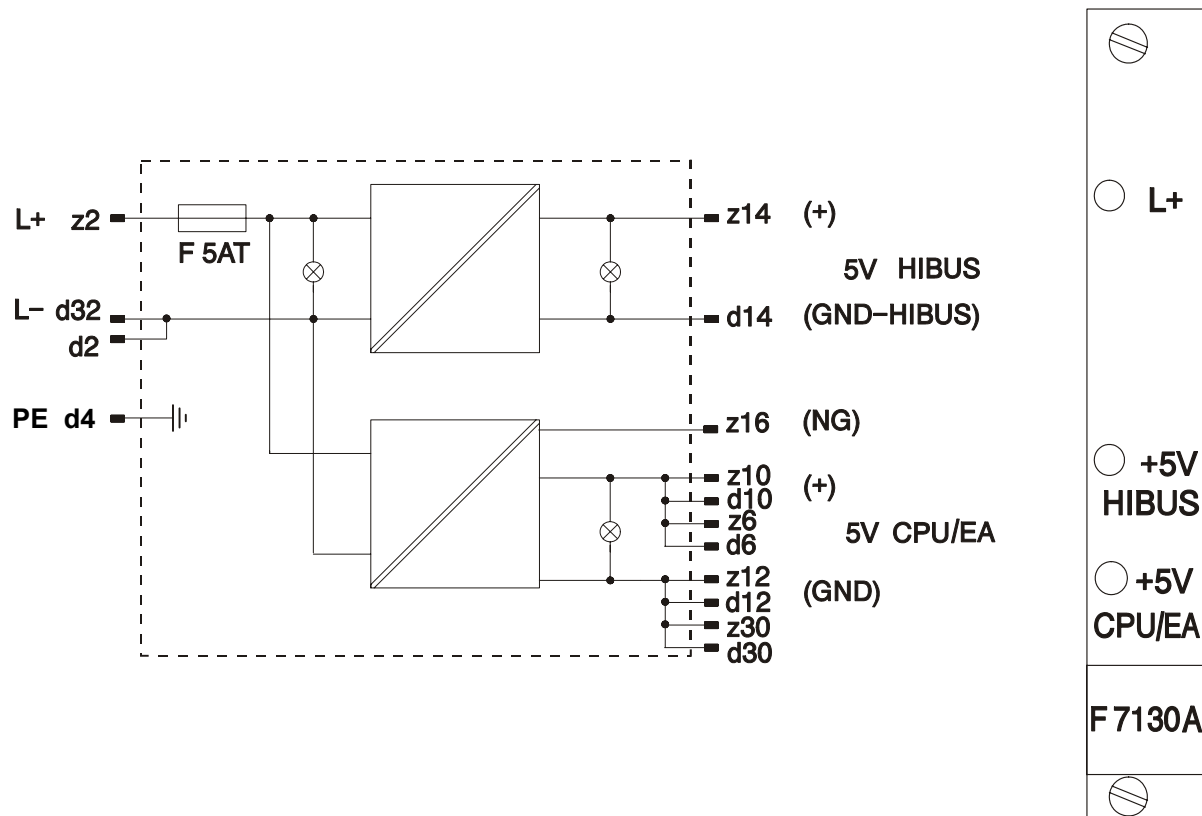


Figure 1: F 7130 A power supply module

The module supplies PES H41q with 5 VDC from a main supply of 24 VDC. It is a DC/DC converter with electrical isolation between input and output voltage. The module is equipped with overvoltage protection and current limitation. The outputs are short-circuit proof. The supply connections are separated for the central device/IO modules and HIBUS interface.

The present input voltage (L+) and the output voltages are indicated with LEDs on the front plate. A proper operation of the module is still assured if the LED 5 V CPU/EA illuminates only slightly.

The power supply for the monitoring of the central device is fed separately via pin z16 (NG).

Operating data	24 VDC, -15...+20 %, $r_{pp} < 15\%$
Primary fuse	5 A gL
Outputs for	
central device/IO-modules	5 VDC, $\pm 0.25\text{ V}$ / 10 A
HIBUS	5 VDC, $\pm 0.25\text{ V}$ / 1 A
Efficiency rate	$\geq 70\%$
Space requirement	4 SU



F 7131: Power supply monitoring with buffer batteries

for PES H51q

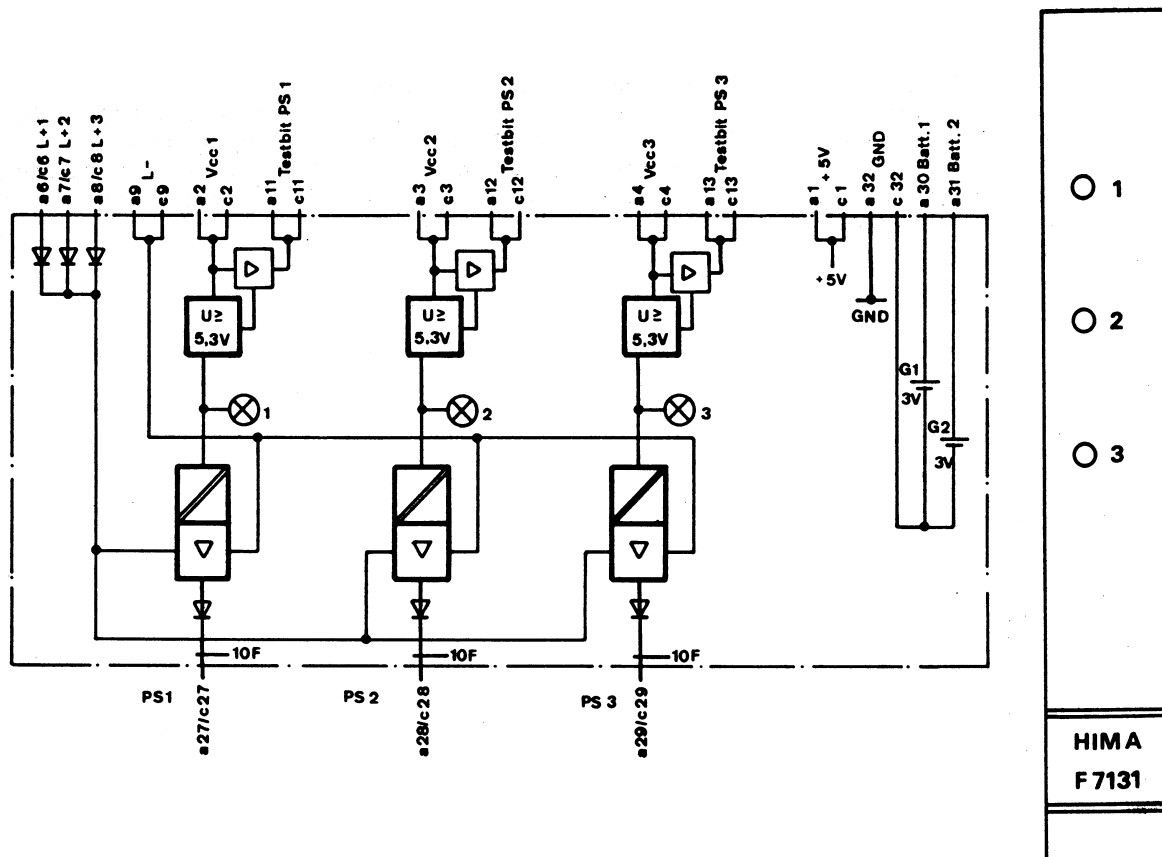


Figure 1: F 7131 Power supply monitoring with buffer batteries

The module F 7131 monitors the system voltage 5 V generated by the three power supplies (max.) as follows:

- 3 LED displays at the front of the module,
- 3 test bits for the central modules for the diagnostic display and for the operation within the user program,
- for the use within the additional power supply (assembly kit B 9361) the function of the power supply modules in it could be monitored via three outputs of 24 V (PS1 to PS 3).

Operating data	5 VDC / 25 mA
	24 VDC / 20 mA
Space requirement	4 SU

Note	Lifetime of the buffer battery (<i>without</i> external voltage feeding): 1000 days at $T_A = 25\text{ °C}$ 200 days at $T_A = 60\text{ °C}$ It is recommended to change the unloaded buffer battery (module in operation) at the latest after six years. Type of battery: CR-1/2 AA-CD, HIMA part no. 44 0000016 (with soldering lugs) HIMA part no. 44 0000019 (without soldering lugs, since AS 02)



F 7132: 4-channel power distribution

to distribute L+ (or EL+) and L-
for PES H41q/H51q

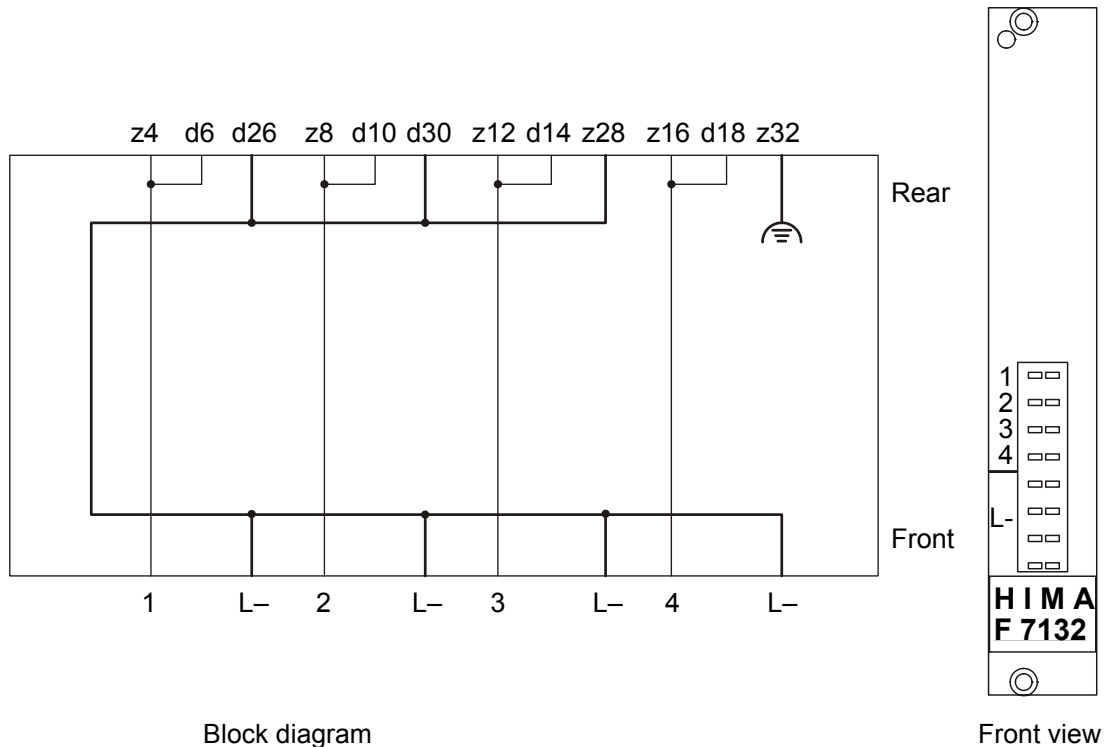


Figure 1: F 7132 4-channel power distribution

The contact pins 1, 2, 3, 4 and L- on the front side serve to connect L+ or EL+ and L- to the individual circuits.

The contacts d6, d10, d14, d18 serves as rear terminals for loads or current distributors.

Loadability of the contacts	max. 4 A
Space requirement	4 SU



F 7133: 4-channel power distribution

with fuse monitoring and L- distribution

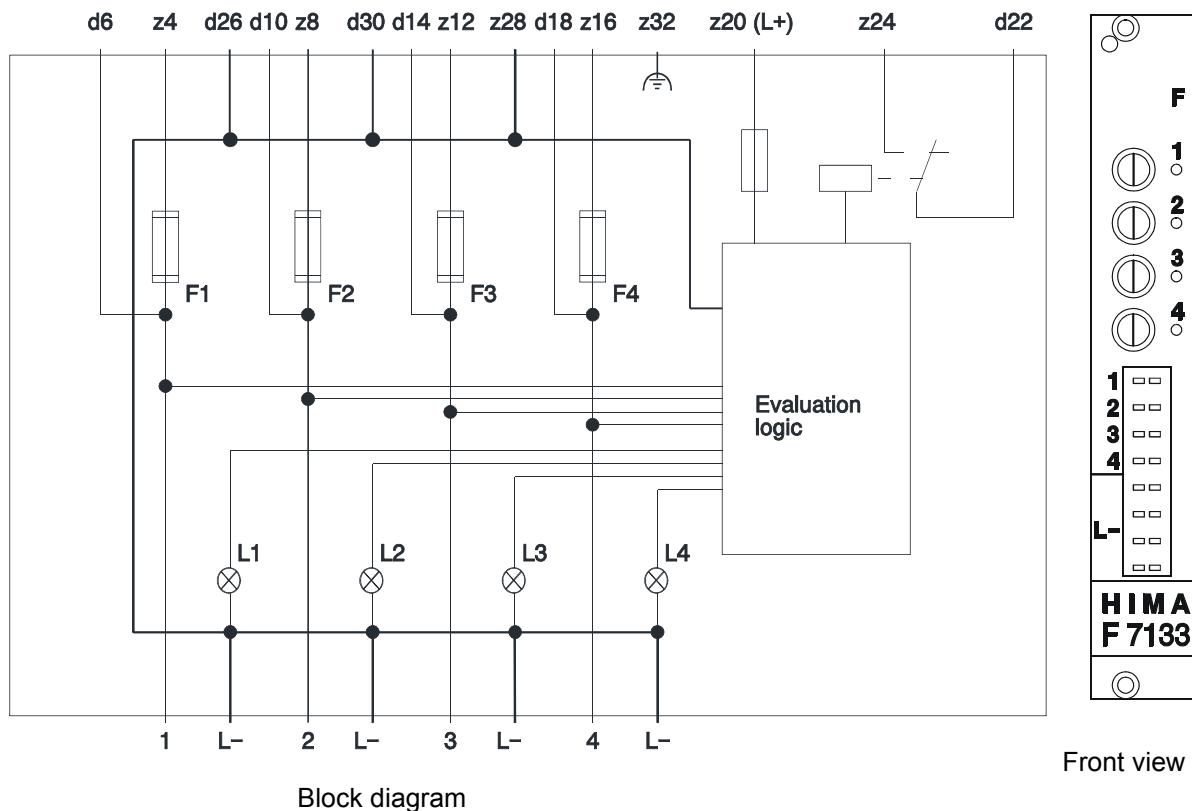


Figure 1: F 7133 4-channel power distribution

The module has four miniature fuses with assigned LEDs. The fuses are monitored via an evaluation logic, and the state of each circuit is signaled to the related LED.

The contact pins 1, 2, 3, 4 and L- on the front side serve to connect L+ or EL+ and L- to supply the I/O modules and the sensors.

The contacts d6, d10, d14, d18 serve as rear terminals for 24 V supply of one I/O slot each.

Fuses	max. 4 A slow blow
Switching time	approx. 100 ms (relay)
Loadability of the relay contacts	30 V / 4 A (continuous load)
Residual voltage in case of fuse tripped	0 V
Residual current in case of fuse tripped	0 mA
Residual voltage in case of missing supply	max. 3 V
Residual current in case of missing supply	< 1 mA
Space requirement	4 SU
Operating data	24 VDC / 60 mA

If all fuses are in order, the relay contact d22-z24 is closed. If a fuse is not equipped or faulty, the relay will be de-energized. Faults are announced via the LEDs as follows:

Supply voltage for path	Fuse	
	in order	faulty/missing
exists	LED on	LED flashing
fails	LED off	LED flashing

Table 1: LED displays

Note

If the module is not wired all LEDs are off.

If the input voltage is missing in case of current paths connected together, no statement about the different fuses can be made.



F 7553: Coupling module

in the assembly kit B 9302,
with switch-off of the watchdog signal,
for PES H51q

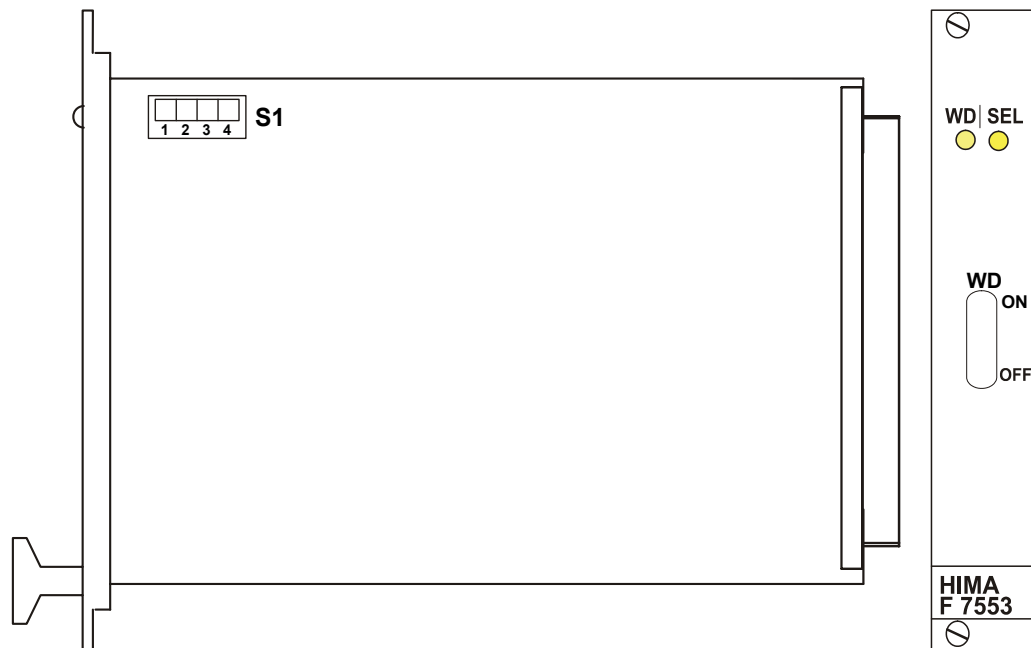


Figure 1: F 7553 Coupling module

The coupling module contains the monitoring of the 5 V supply of the I/O subrack and transmits a corresponding status signal to the central module. The module is automatically tested during operation.

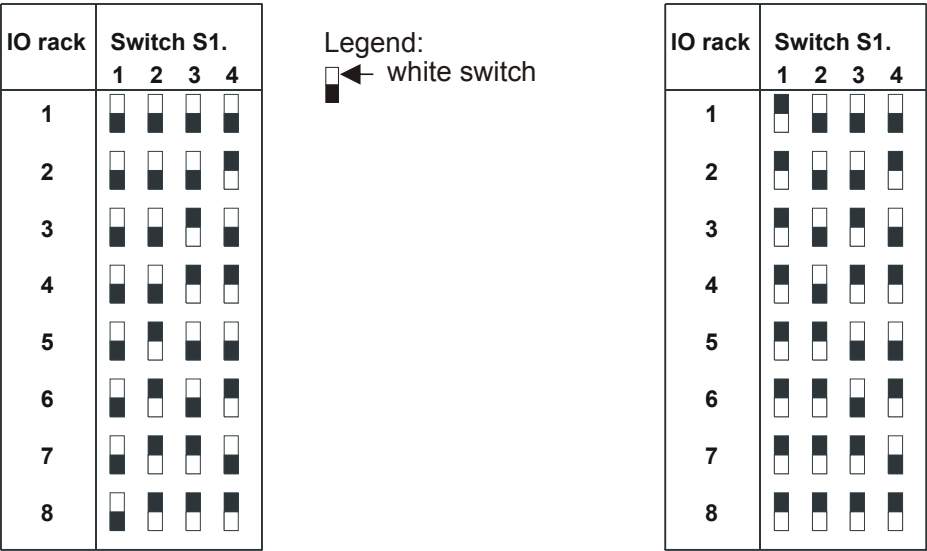
The LED WD on the front plate shows the existing safety-related watchdog signal. By the second LED SEL the access to the I/O modules of the appertaining I/O subrack is signaled.

Via the recessed WD switch the watchdog signal can be switched off for the appertaining I/O subrack to change the coupling module F 7553 without triggering an error stop for the -MS and -HS systems.

Note	If the WD switch is not operated before the coupling module is replaced, the entire system switches into error stop!

Space requirement	4 SU
Operating data	5 VDC / 600 mA, 24 VDC / 750 mA

The coding switches S1.1...S1.4 are used for setting the numbers for the cabinet or in HRS systems the I/O bus number and the I/O subrack number:



IO bus 1 / Cabinet 1

IO bus 2 / Cabinet 2

Figure 2: Coding switches



F 8621A: Coprocessor module

Use in PES H41q/H51q (from BS41q/51q V6.0-6 (9808) with ELOP II)

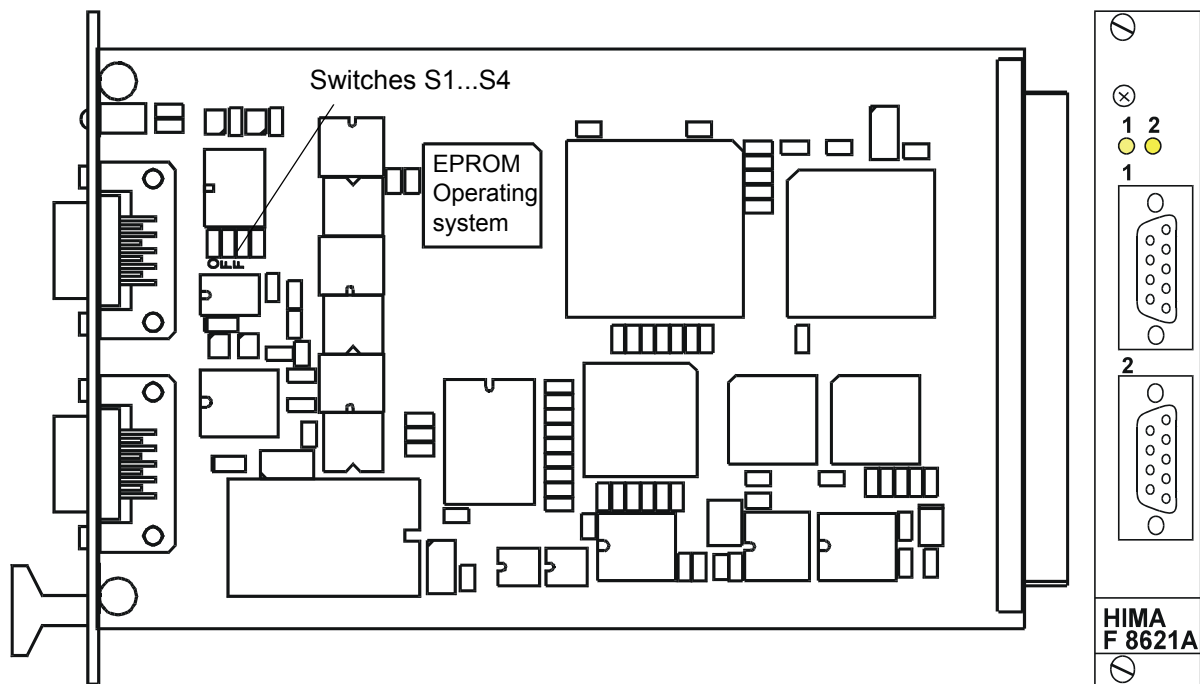


Figure 1: F 8621A Coprocessor module

The coprocessor module has its own microprocessor HD 64180 and operates with a clock frequency of 10 MHz. It contains mainly the following functions:

- 384 kbyte static memory, CMOS-RAM and EPROM on two ICs; battery buffering of the RAMs on power supply monitoring module F 7131 (H51q)
- at H41q subrack battery buffering via buffer batteries on rear PCB
- 2 interfaces RS 485 (half-duplex) with galvanic isolation and own communication processor. Transmission rates (set by software): 300, 600, 1200, 2400, 4800, 9600, 19200, 57600 bps, or takeover of the values which are set on the CU via DIP switches
- Dual Port RAM for fast alternating memory access to the central module

Note

In central subracks of H51q systems the coprocessor module can be used only in the slots CM1 to CM3.

Space requirement	4 SU
Operating data	5 VDC / 360 mA



The mixed operation for safety-related communication via a coprocessor module F 8621A and parallel via the communication module for Ethernet communication F 8627X is not admissible.

Note If a Profibus-DP communication module F 8628 / F8628X or an Ethernet communication module F 8627 / F 8627X is used in addition to the coprocessor module F 8621A the software function block HK-COM-3 (from ELOP II V 3.5 BS 41q/51q V 7.08 (0214)) with proper parameterization has to be set up.

Settings S1...S4 for RS 485

Interface 1:

	S1	S2
RS 485	ON	OFF

Table 1: Interface 1

Interface 2:

	S3	S4
RS 485	ON	OFF

Table 2: Interface 2



Other settings as given in the table are not admissible.

Note The redundant connection to a process control system is made via two redundant modules, each with a BV 7040.
The connection to an ELOP II bus is made via a cable BV 7046.

Pin assignment of the interface RS 485

Pin	RS 485	Signal	Explanation
1	-	-	not used
2	-	RP	5 V, decoupled by diodes
3	A/A'	RxD/TxD-A	Receive/Transmit Data A
4	-	CNTR-A	Control signal A
5	C/C'	DGND	Data Ground
6	-	VP	+5 V, power supply
7	-	-	not used
8	B/B'	RxD/TxD-B	Receive/Transmit Data B
9	-	CNTR-B	Control signal B

Table 3: Pin assignment of the interface RS 485



F 8627X:Ethernet module

F 8627X Communication Module for Ethernet-Communication

Application in H41q/H51q PES (beginning with OS 41q/51q V7.0-7 (9906)).

Appertaining ELOP II Function block: HK-COM-3

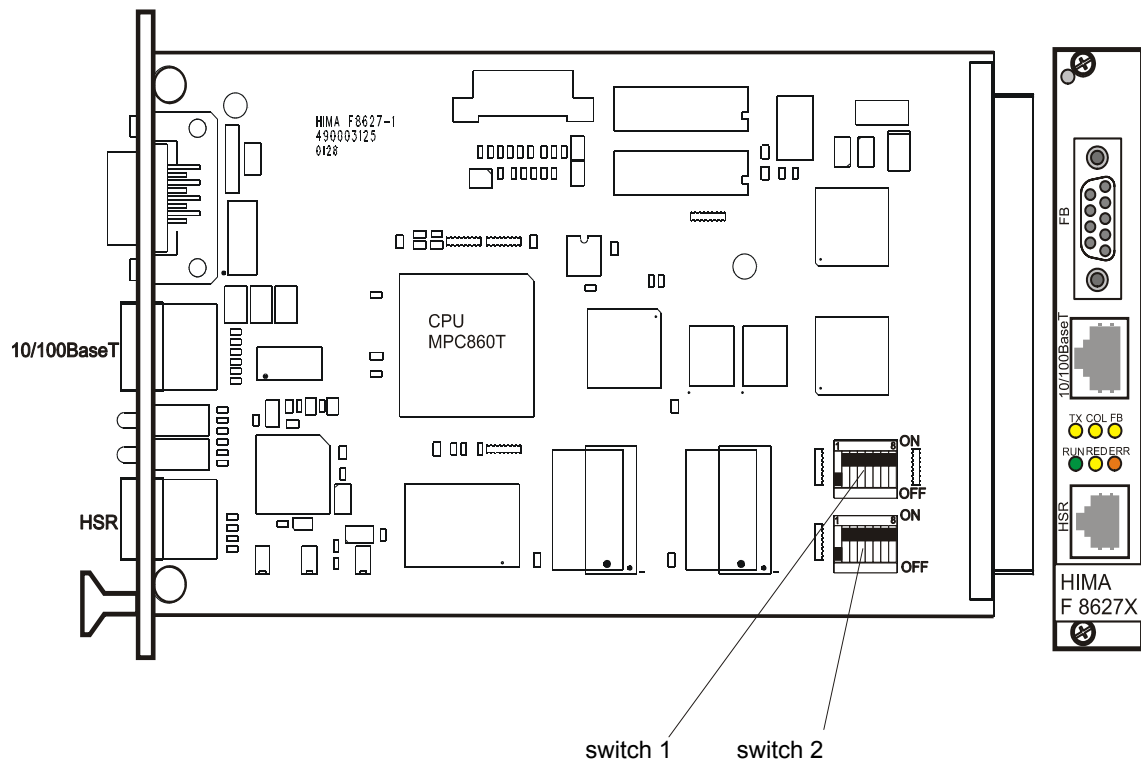


Figure 1: Communication module F 8627X

1 Technical data

Processor	32 bit Motorola CPU MPC860T with integrated RISC communication controller
Operating voltage	5 V
Current consumption	1 A
Space required	3 HU (units high), 4 SU (units wide)
Ethernet Interface	10BaseT or 100Base TX according to the IEEE 802.3 standard, connection via an RJ-45 plug.
HSR Interface	High-speed serial communication interface to the redundant HSR (High Speed Redundancy) communication module. Connection via an RJ-12 plug with BV 7053.
Serial Interface	The serial interface FB is not used.
Diagnostic Display	6 LEDs for display diagnostic during operation.
DIP switches	2 DIP switches for setting the module functions.

2 Functions of F 8627X

2.1 General

A H41q/H51q controller can simultaneously exchange via an F 8627X non safety-related data with a HIMA OPC server and safety-related data via **safeethernet**. In this case, the F865x central module ensures safety.

Beginning with operating system version 4.x, the F 8627X supports the functions "MODBUS TCP slave" and "ELOP II TCP". The ELOP II TCP connection provides a fast data exchange between a PADT (PC) and the F 865x central module.

Note	The F 8627X has the same functions as the F 8627 and is compatible with it. The new functions are only supported in an F 8627X with operating system V4.x or higher.

2.2 Operating system versions

Overview of the operating system versions which can be loaded into the F 8627X.
The F 8627X is delivered with operating system version 4.x

Operating system version	Properties/Mode
From OS version 2.x	- HIPRO-S Mode - A maximum of 31 HIMA PES can communicate with each other in a safety-related manner. - A PES can communicate with a maximum of 4 HIMA OPC servers (see also Table 8, "Overview of the communication with a HIMA OPC server via the F 8627X in combination with HIPRO-S," on page 372).
From OS version 3.x	- Compatible to OS version 2.x - HIPRO-S-DIRECT Mode - No more than 99 safeethernet members can be configured in the total network. An individual PES can have 63 safeethernet communication partners. - In HIPRO-S-DIRECT mode the number of OPC servers can be set via switch from 0 up to 14 (see also Table 8, "Overview of the communication with a HIMA OPC server via the F 8627X in combination with HIPRO-S," on page 372).
From OS version 4.x (only F 8627X)	- Compatible with OS versions 2.x and 3.x - A PES can communicate as a MODBUS TCP slave via Port 502 and Port 8896. - ELOP II TCP connection between a PADT (PC) and F 8627X. System environment required for F 8627X - Central module F 865x, OS version (05.34) or higher - ELOP II, version 4.1 Build (6118) or higher

Table 1: F 8627X operating system versions

2.3 Compatibility of the operating system versions

Communication modules having different operating system versions may operate within one rack, even if the communication modules are interconnected redundantly or communicate with one another via Ethernet.

Observe that the used functions of a communication module are supported by the respective operating system (see Table 1).

Note	Observe the application guidelines and settings of the F 8627X in Chapter 6.

2.3.1 Ethernet communication between F 8627X and F 8625

Check the following Ethernet communication settings between F 8627X and F 8625:

- If the F 8627X is directly connected with a F 8625 (using a "cross over" Ethernet cable without a switch), then "Autonegotiation" must be activated on the F 8627X (switch S2/3 to „ON“).
- The DIRECT Mode on the F 8627X must be switched off (set switch S1/7 to "OFF").
- "Passive mode" may only be used (set switch S1/8 to "OFF") if also activated on the communication partners.

2.3.2 Redundant interconnection in an H41q/H51q controller

The following table shows the operating systems for the redundant interconnection of the communication modules (CM) F 8627X and F 8627X/F 8625 and the settings that must be considered.

CM1	CM2	Properties/Settings
F 8625 OS V1.x	F 8627X from OS V2.x up to OS V4.x	The "DIRECT Mode" on the F 8627X module must be switched off (switch S1/7 to „OFF“).
F 8627X from OS V2.x up to OS V4.x	F 8627X from OS V2.x up to OS V4.x	The used functions must be supported by the used OS versions (see Table 1).

Table 2: Redundant interconnection of the communication modules

Note	The "passive mode" and the "DIRECT mode" may only be activated if activated on the redundant communication module.

Note	For redundant interconnection it is recommended to use communication modules of the same type with the same operating system.

2.4 Replacing an F 8627X



An F 8627X must never be removed from a redundant operation without a special procedure.

Before removing an F 8627X, its fixing screws must be completely loosened and freely movable. Remove the module from the bus board by pushing the ejection lever (front label) top down and quickly removing in an upward motion to ensure faulty signals are not triggered within the system.

To attach the module, place it on the terminal block and press it inwards as far as it will go. This action should be performed quickly to ensure that faulty signals are not triggered within the system.

2.4.1 Operation of the ejection lever

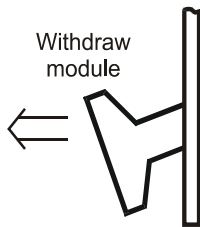
Push ejection lever
top down



Front plate

1

Withdraw
module



Front plate

2

Figure 2: Operation of the ejection lever

2.4.2 Procedure for exchanging a redundant F 8627X in a redundant H41q/H51q controller



Make sure that you connect the Ethernet cable to the Ethernet socket (10/100BASE-T) and the HSR cable to the HSR socket (HSR). The respective connectors must be pressed in until they snap into their sockets.

1. Unplug communication cable (Ethernet).
2. Corresponding central module (e.g. F 8650X) with operating system
 - Version below (05.34): remove the central module!
 - Version beginning with (05.34): erase application program manually to deactivate the central module (see operation system manual "Erasing the application program")
3. Unplug HSR cable BV 7053 (if used).
4. Remove communication module F 8627X.
5. Check the new F 8627X
 - Check the DIP-switch settings (see chapter 4 and compare to the exchanged F 8627X).
 - Check whether if the operating system (see sticker on the F 8627X) supports the used functions!
6. Plug the new communication module F 8627X.
7. Plug the HSR cable BV 7053 (if required).
8. Corresponding central module (e.g. F 8650X) with operating system
 - Version below (05.34): plug the central module!
 - Version beginning with (05.34): push the button "Ack" to activate the central module (see operation system manual "Self-Education")
9. Wait until the LED "RUN" on the F 8627X lights continuously.
10. Plug the communication cable (Ethernet).

Note

The ARP entry on the PADT (PC) must be deleted if the new F 8627X has the **same IP address** as the old F 8627X. If the new F 8627X has the same IP address it cannot be connected to the PADT (PC).

Example: Delete the ARP entry of an F 8627X with IP address **192.168.0.67**.

- Start the "Dos Shell" on the PADT (PC)
 - Enter the command **arp -d 192.168.0.67**.
-

3 Diagnostic LEDs on module front

3.1 Top row LEDs on module front

TX	COL	FB	Operating status
ON	-	-	Send LED of Ethernet communication
-	ON	-	Collision on the Ethernet segment
-	-	OFF	No display (always OFF)

Table 3: Top row LEDs on module front

3.2 Bottom row LEDs on module front

RUN	RED	ERR	Operating status
ON	-	OFF	Ethernet communication protocol active
Flashing	-	OFF	Ethernet communication protocol inactive
-	ON	OFF	Communication to redundant communication module active. Note The redundancy LED is OFF if DIRECT Mode (switch 1/7 ON) or Mono (switch S2/2 ON) is enabled. This applies also in case of a redundant connection via HSR cable.
Flashing	-	Flashing	Booting of the communication module
ON	-	Flashing	Beginning with OS version 4.6 User Error / Configuration Error - Res-ID and ID are not equal - Ethernet communication protocol inactive, even if the communication module is in RUN status.
OFF	-	ON	Fatal error in communication module. Module must be replaced.
OFF	-	Flashing 3-times	Saving the error code in Flash-EPROM (required for repair purposes) <i>Do not unplug communication module!</i>

Table 4: Bottom row LEDs on module front

4 Functions of the switches

4.1 Functions of switch 1 (S1)

S1	ON	OFF	Description
1	10 ms	0 ms	The "Timeout" is the timeframe within which the receiver must acknowledge receiving packets from the transmitter. It is set via the switches S1/1-5. Standard value: 10 ms (switch 1/1-5 "OFF"). Switches S1/1-5 can be combined by the user. 10 ms must be added for each combination of switches. HIPRO-S-DIRECT must be activated (switch 1/7 "ON").
2	20 ms	0 ms	
3	40 ms	0 ms	
4	400 ms	0 ms	
5	1000 ms	0 ms	
6	ID_IP ON	ID_IP OFF	For OS versions < 4.x no function (See also Chapter 5.2.3) ID_IP ON The bus station number (ID) which is set on the F 865x central module via switches (S1 1-7) is used as Res-ID if no Res-ID could be determined from the loaded user program. ID_IP OFF The bus station number (ID) which is set on the F 865x central module via switches (S1 1-7) is never used for the Res-ID.
7	DIRECT Mode enabled	DIRECT Mode disabled	HIPRO-S-DIRECT Mode must be activated if more than one bus configuration is required. HIPRO-S-DIRECT is supported beginning with the F 8627X OS version 3.x.
8	Passive Mode disabled	Passive Mode enabled	The Passive Mode controls the communication to the HIMA OPC server. Passive Mode enabled: The Token Passing between the F 8627X to the HIMA OPC servers is disabled. The HIMA OPC servers cyclically exchange data with the F 8627X, independent of the token owner. Passive Mode disabled: The Token Passing between the F 8627X and the HIMA OPC servers is enabled. The HIMA OPC servers only exchange data with the F 8627X if they have the Token.

Table 5: Functions of switch 1 (S1)

4.2 Functions of switch 2 (S2)

S2	ON	OFF	Description
1	Ethernet Channel 1	Ethernet Channel 2	F 8627X allocation to the Ethernet channel 1 or Ethernet channel 2.
2	Mono	Redundant	Wiring of the modules (Not used in HIPRO-S-DIRECT Mode)
3 ¹⁾	Auto-negotiation On	Auto-negotiation Off	Automatic adaptation of transmission rate (10/100 MBit/s) and duplex mode if Switch S2/3 is ON.
4	100 MBit/s	10 MBit/s	The switch position of switch is only relevant if switch S2/3 (auto-negotiation) is OFF.
5 ^{1) 2)}	Full duplex	Half duplex	The switch position of switch is only relevant if switch S2/3 (auto-negotiation) is OFF. Simultaneous sending and receiving if switch S2/5 is ON. Note on full-duplex operation: In network topologies where hubs are used, hubs must be replaced by full-duplex switches (hubs are not full-duplex capable).
6	2 OPC server	0	Beginning with the F 8627X OS version 3.x, the number of HIMA OPC servers (0 to 14) must be set via switches. Switches S2/6-8 can be combined by the user. If HIPRO-S-DIRECT is not active the number of HIMA OPC servers is four. For determining the Node Ids and IP addresses for the configuration of HIMA OPC server, see Chapter 6.8.1.4 and Chapter 6.9.1.5.
7	4 OPC server	0	
8	8 OPC server	0	

Table 6: Functions of switch 2 (S2)

- 1) Beginning with OS versions 3.x, only the transmission rate is automatically adapted when "Autonegotiation On" (S2/3 ON) is set. The duplex mode must be set using switch S2/5.
- 2) Beginning with OS versions 3.x, autonegotiation must be activated at the communication partner (e.g. switch) if full duplex (S2/5 ON) is set on the F 8627X. Not observing these settings can lead to communication problems.

Note

Beginning with OS version 4.x, an F 8627X with the settings "Autonegotiation Off" (S2/3 OFF) and "full duplex" (S2/5 ON) may not operate with a communication partner (e.g. switch) with Autonegotiation activated.

Since these settings are allowed for OS version V3.x and below, they must be checked and, if necessary, adapted when upgrading to OS version V4.x or higher. Not observing these settings can lead to communication problems.

5 Ethernet connection via the F 8627X

5.1 Determining the F 8627X IP address

For all OS versions the F 8627X IP address is determined from the resource name of the loaded user program.

The IP address is composed of the network address and the host address. The default network address is **192.168.0**.

The last byte of the IP address 192.168.0.x is the host address and is calculated as follows:

For ethernet module channel 1 (switch 2/1 = ON)

Host address = (the last two digits of the resource name) * 2 + 1

For ethernet module channel 2 (switch 2/1 = OFF)

Host address = (the last two digits of the resource name) * 2 + 2

Note

The resource name **must** have eight characters and the last two characters (Res-ID) **must** be numbers!
IDs allowed:

DIRECT Mode ON (switch 1/7 ON)

Res-ID: 1 up to 99

DIRECT Mode OFF (switch 1/7 OFF)

Res-ID: 1 up to 64

The ethernet module does not change to RUN status, if the Res-ID > 64 and the DIRECT Mode is deactivated.

Important for safeethernet:

If more than 30 communication partners are configured, several bus configurations must be created in ELOP II, since a bus configuration in ELOP II supports no more than 31 participants.

Example:

Resource name MT200_33, module channel 1 (switch 2/1 = ON)

Host address: $33 * 2 + 1 = 67$; IP address = 192.168.0.67

Resource name MT200_33, module channel 2 (switch 2/1 = OFF)

Host address: $33 * 2 + 2 = 68$; IP address = 192.168.0.68

F 8627X settings upon delivery

IP address 192.168.0.63 (switch 2/1 ON) or 192.168.0.64 (switch 2/1 OFF).

Switch ID_IP is deactivated (switch 1/6 OFF).

5.2 ELOP II TCP connection to the central module (CM)

Via the PADT (PC), the user can establish an ELOP II TCP connection to the F 865x central module via the F 8627X.

The ELOP II TCP connection provides a fast data exchange between a PADT and the F 865x central module.

Res-ID: The Res-ID is identical to the last two numbers of the resource name.

ID: The ID is set via DIP switches 1 to 7 on the F 865x central module.

5.2.1 Requirements for a ELOP II TCP connection

- F 865x central module OS version (05.34) or higher
- ELOP II, version 4.1 build (6118) or higher
- F 8627X Ethernet module OS version 4.x or higher
- HSR cable in redundant systems

5.2.2 Connection of ELOP II PADT (PC) to F 8627X

A PADT can only connect to a H41q/H51q via a single F 8627X on the H41q/H51q (even in cases of redundancy).

The selected F 8627X transfers the telegrams to the associated F 865x central module and via the HSR cable (BV 7053) to the redundant F 8627X and the associated F 865x central module. The HSR cable between the two redundant F 8627X enables the communication to both central modules as well as the "Reload" of a redundant H41q/51q.

Note	For ELOP II TCP connection, any free IP address for the PADT may be used. If the PADT IP addresses and the F 8627X are located in the same subnet, a routing entry for the subnet of the F 8627X is not required on the PADT (see also Chapter 5.2.6.1).

Note	Carefully check that no other participant (e.g. H41q/H51q , OPC server or PC) has the same IP address, as this could cause communication problems. Next time, when expanding communication, please consider the H41q/H51q and the OPC server IP-addresses.

5.2.3 Create ELOP II TCP connection to a H41q/H51q

Perform the following settings on the H41q/H51q:

- Activate the ID_IP (switch 1/6 ON) on the F 8627X .
- Set channel 1 or channel 2 on the Ethernet module F 8627X (see chapter 5.1).
- Set the redundant channel (if available) on the redundant Ethernet module F 8627X (see chapter 5.1).
- Make sure that a proper operating system OS Version (05.34) or higher is loaded in the F 865x central modules.
- Set the same number for the "ID" on the F 865x central module (DIP switches, see F 865x data sheet), which is used as Res-ID in the resource name (last two digits of the resource name).

If necessary, delete the User Program of the Central Module F 865x

If a user program with a wrong resource name (e.g. no or wrong Res ID) exists in the F 865x, no ELOP II TCP connection can be established.

Delete the user program with the wrong resource name, so that the F 8627X can determine the IP address from the F 865x ID settings (DIP switches 1-7).

Note Please refer to the manual "Functions of the operating system BS41q/H51q (HI 800 105)" for further information about "Erasing the user program".

Perform the following Settings in ELOP II

- Create a resource, having a name from which the required IP address can be determined (see chapter 5.1).
- In the dialog "cabinet layout" add the F 8627X module icons for the documentation of the cabinet allocation.

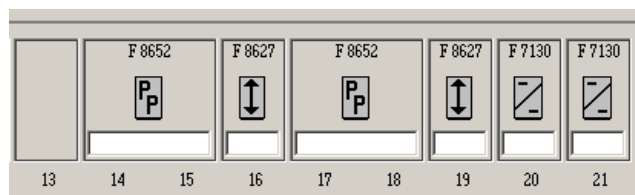


Figure 3: Cabinet Layout

- Open the context menu of the resource and select *Properties*.

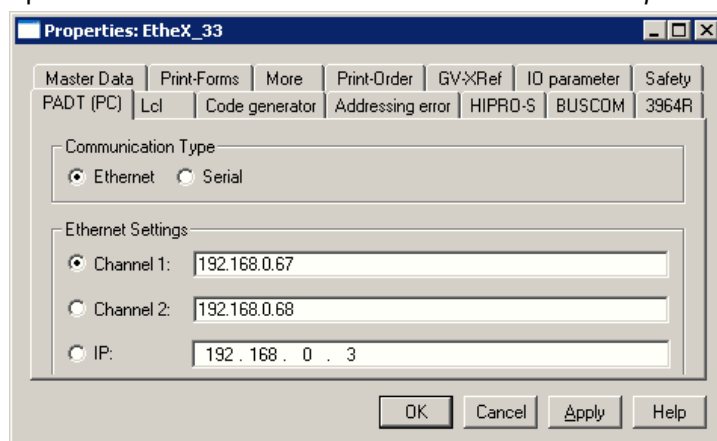


Figure 4: ELOP II dialog "Properties"

- Open the tab *PADT (PC)* and select the communication type *Ethernet*.
- Select one of the IP addresses *channel1* or *channel2* which are determined by ELOP II. By this the F 8627X connected to the PADT is selected.
- Click "OK" to close the "Properties" dialog with "OK".

Load the User Program into the H41q/H51q

- Connect the selected F 8627X with the PADT corresponding to a connection from chapter 5.2.5.

Note In case of a redundant H41q/H51q, make sure that the HSR cable (BV 7053) is plugged; otherwise there is no access available to the redundant central module F 865x.

- Open the context menu of the resource and select *Control Panel*.
If a connection has been established, "OK" appears in the field "Communication".

- Load the user program into the central module(s) F 865x using "Download/Reload".
- Start the H41q/H51q controller.

In case of problems with the ELOP II TCP communication see also chapter 5.2.6.

5.2.4 Upgrade of a H41q/H51q to ELOP II TCP without system stop

Preconditions

A H41q/H51q controller may change to ELOP II TCP without a system stop if the following conditions are fulfilled:

- The conditions for a ELOP II TCP connection are fulfilled (see chapter 5.2.1).
- A suitable operating system OS version (05.34) or higher must be loaded in the central module(s) F 865x.
- In the F 865x a user program must exist having a resource name , from which the F 8627X can determine an IP address.
- On all F 865x the same number for the ID must be set, which is used as Res ID in the resources name. For the reading of the ID, see manual "functions of the operating system BS41q/H51q" (HI 800 105).

Installation of the F 8627X module

For installation of the F 8627X Consider chapter 2.4.

- On all F 8627X activate the ID_IP (switch 1/6 ON).
- Set channel 1 or channel 2 on the Ethernet module F 8627X (see chapter 5.1).
- Set the redundant channel (if available) on the redundant Ethernet module F 8627X (see chapter 5.1).
- Replace the existing modules F 8627 by F 8627X, by which the ELOP II TCP connection is carried out. If no F 8627X modules were used previously, then plug the F 8627X into the specified module slot.

Perform the following Settings in ELOP II

- Open the resource context menu and select *Properties*.
- Open the tab *PADT (PC)* and select the communication type *Ethernet*.
- Select one of the IP addresses *channel1* or *channel2* that are determined by ELOP II. By this the F 8627X connected to the PADT is selected.
- Click "OK" to close the "Properties" dialog with "OK".

Load the User Program into the H41q/H51q

- Connect the selected F 8627X to the PADT corresponding to a wiring from chapter 5.2.5.

Note	In case of a redundant H41q/H51q, make sure that the HSR cable (BV 7053) is plugged; otherwise no access possible to the redundant central module F 865x.

- Open the context menu of the resource and select *control panel*.
If a connection has been established, "OK" appears in the field "Communication"

In case of problems with the ELOP II TCP communication see also chapter 5.2.6.

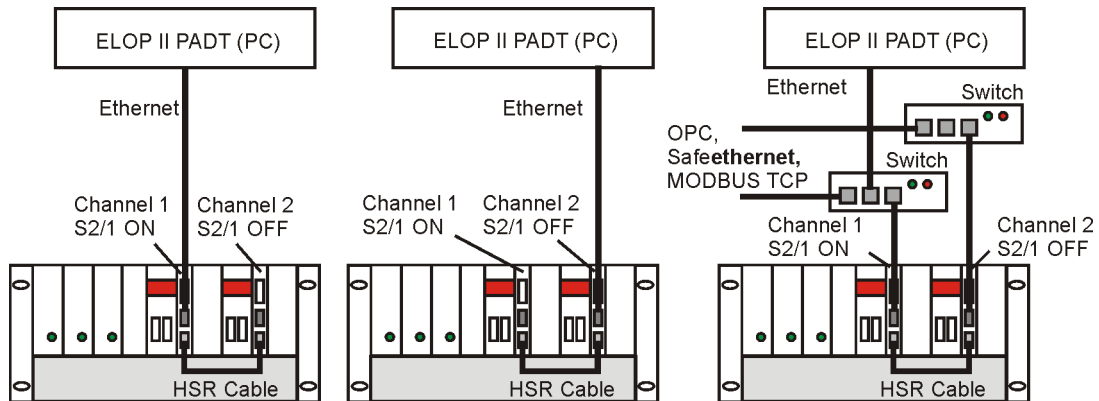
5.2.5 ELOP II TCP connections to H41q/H51q controllers

ELOP II, OPC and safeethernet can operate on the same network.

Certain restrictions apply to HIPRO-S and OPC (see Table 7 and Table 8 in Chapter 6).

If the PADT and the H41q/H51q controller are directly connected with one another, a "cross over" Ethernet cable is required.

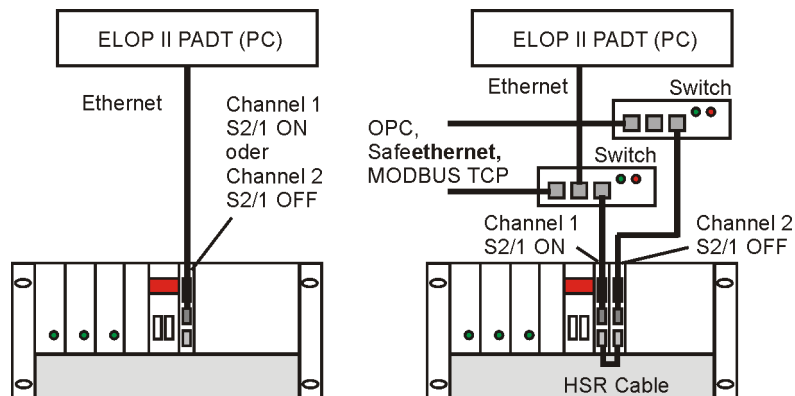
5.2.5.1 ELOP II TCP connections to redundant H41q/H51q controllers



The PADT can establish a connection to the H41q/H51q

- only via channel 1 (left figure).
- only via channel 2 (middle figure).
- only via channel 1 (right figure).

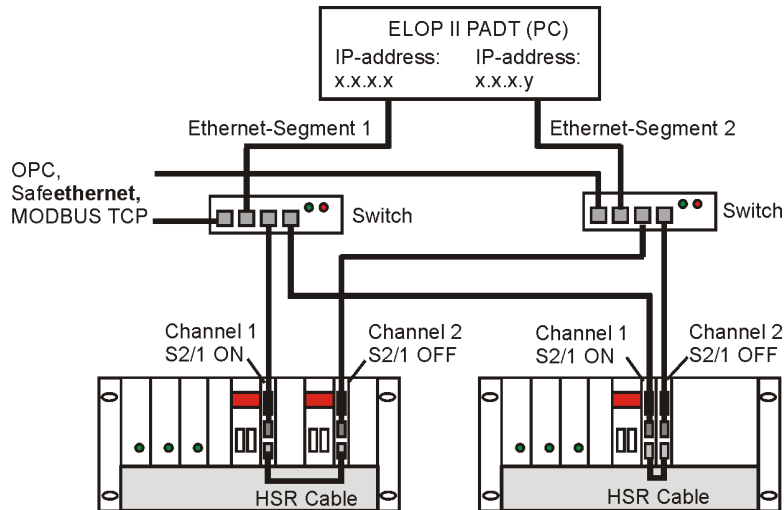
5.2.5.2 ELOP II TCP connections to mono H41q/H51q controller



The PADT can establish a connection to the H41q/H51q

- either via channel 1 or via channel 2 ,depending on F 8627X switch 2/1 (left figure).
- only via channel 1 (right figure).

5.2.5.3 ELOP II TCP connection to H41q/H51q controllers via a redundant network



The PADT can establish a connection to the H41q/H51q systems via ethernet segment 1 or ethernet segment 2.

A routing entry for each ethernet module of the PADT is required (see also chapter 5.2.6).



Others possibilities of the ELOP II TCP wiring shown above are not authorized and can cause problems!



Only communication modules of the same type may be connected to one another using the HSR cable (the connection between F 8627X and F 8628X is not permitted).

5.2.6 If ELOP II TCP communication can not be established

First check

- If ELOP II TCP wiring was correctly performed (see Chapter 5.2.5.1 to Chapter 5.2.5.3) and
- the F 865x ID (DIP switches 1-7) and the resources RES-ID are identical.

Note	A H41q/H51q PES can only communicate with a single PADT. If the user accesses the same PES using a second PADT, he can establish a connection to this PES by repeatedly pushing the button "Initialize communication". Then the connection to the first PADT is disconnected and the message "2. PADT (PC) connected to the PES" is displayed in the control panel's "Communication" field.

5.2.6.1 Is the PADT (PC) network card located in the same subnet?

1. Determining the IP address of the PADT(PC) network

- In MS-Windows, open the settings of the PADT network connections from the PADT.
- Select the network card used for connecting to the F 8627X.
- Select properties of the internet protocol.
 - If the network card is not located in the same F 8627X subnet "**192.168.0.x**", follow step 2 for creating a connection.
 - If the network card is located in the same subnet but no connection is available, check the connection using the function "Ping" specified in Chapter 5.2.6.3.

2. Establishing a network connection between a PC and an F 8627X, if they are located in different subnets.

- First method: Change the IP address of the PC network card in use
 - In the properties of the TCP/IP connection, enter a free IP address which is located in the same subnet as the F 8627X "**192.168.0.x**".
- Second method: Create a routing entry to the F 8627X on the PC
 - Start the "Dos Shell" on the PC.
 - Enter the following command:
route add [IP address F 8627X] mask 255.255.255.255 [IP address PC]

Note	To ensure the routing entry remains permanent (e.g. after the PC is restarted), use the -p parameter with the route command. Example: route -p add . Check if the routing entry for connecting the PC network card to the F 8627X is correct by using the command route print .

- Start the ELOP II control panel to establish a connection to the F 8627X.

5.2.6.2 Connection problem after exchanging an F 8627X

The ARP entry on the PC must be deleted if the new F 8627X has the **same IP address** as the old F 8627X.

Otherwise the new F 8627X with the same IP address cannot be connected to the PADT (PC).

Example: Delete the ARP entry of an F 8627X with the IP address **192.168.0.67**.

- Start the "Dos Shell" on the PADT (PC).
- Enter the command **arp -d 192.168.0.67**.

5.2.6.3 Check the connection to the F 8627X using "Ping"

- Start the "Dos Shell" on the PADT (PC).
- Enter the command **Ping 192.168.0.x**.
- Messages generated by "Ping":
 - Ethernet connection is OK : "Reply from 192.168.0.x: bytes = 32 time < 4ms...."
 - If ELOP II connection is available check the resource settings in ELOP II.
 - Ethernet connection is not OK: "Request timed out."
 - Check the wiring, routing entrie etc.

Note	If all steps described in this chapter have been followed and the F 8627X does not respond, check if other participants can be accessed using the PC's network card.

5.2.6.4 The F 8627X determines its IP address in accordance with the following priorities

1. The IP address is determined from the Resource ID (Res-ID) of the user program that is loaded in the F 865x.
The Res-ID of the user program always has a higher priority than the F 865x ID settings (DIP-switch 1-7).
2. The IP address is determined from the F 865x ID settings (DIP switches 1-7), if the Res-ID cannot be determined from the current user program's resource name and switch ID_IP is activated on the F 8627X (switch 1/6 ON).
3. IP address of the "Basic Configuration"
If no IP address can be determined using the Res-ID or ID (switch 1/6 OFF) as described in the first two cases, the last IP address determined on this F 8627X is used.

6 Communication via the F 8627X

This chapter describes the F 8627X communication types and the required settings. ELOP II TCP and MODBUS TCP can be operated in conjunction with any of the existing communication types (OPC, HIPRO-S and HIPRO-S-DIRECT).

Note If the HIPRO-S-DIRECT Mode is activated (see 6.4.4) the HSR-Communication for the MODBUS TCP slave via Port 8896 is deactivated (no redundancy).

6.1 Overview

The following tables provide a quick overview of the communication type properties that can be set for the F 8627X as well as the conditions that must be fulfilled to do so.

HIPRO-S	HIPRO-S-DIRECT
F 8625 / F 8627 / F 8627X all OS versions	F 8627, beginning with OS version 3.x F 8627X
DIRECT Mode Off Switch 1/7 (OFF)	DIRECT Mode On Switch 1/7 (ON)
Token passing	No token passing
No more than 64 safeethernet members can be configured in the entire network.	No more than 99 safeethernet members can be configured in the entire network.
One PES may have no more than 30 safeethernet communication partners.	A PES can have no more than 63 safeethernet communication partners.
Timeout fixed to 16 ms	Timeout adjustable 10 ms up to 1480 ms Switch S1/1-5
Communication between each PES and any other PES (HIPRO-S dummies might be required)	Not required
Ethernet network with low load: Only HIMA PES or HIMA OPC servers	An existing Ethernet network can be used if the requirements ¹⁾ are fulfilled.
Hub/Switch	Switch
HSR cable required for redundancy	HSR cable is required for ELOP II TCP and MODBUS TCP (Port 502)
Half/Full-Duplex	Full-Duplex

Table 7: Overview of the HIPRO-S (DIRECT) communication via the F 8627X

1) Requirements for using an existing Ethernet network for the HIMA PES with F 8627X

- Network may only contain switches
- Full-Duplex (no collisions)
- Sufficient bandwidth for transmission
- Calculating the timeout with the delay time induced by active network components (e.g. switches, gateways) taken into account.

OPC without Passive Mode	OPC with Passive Mode	OPC with Passive Mode + HIPRO-S-DIRECT
F 8625 from version 1.x F 8627 / F 8627X from version 2.x on	F 8625 from version 1.13 F 8627 / F 8627X from version 2.x on	F 8627 / F 8627X from version 3.x on
DIRECT Mode Off Switch 1/7 (OFF)	DIRECT Mode Off Switch 1/7 (OFF)	DIRECT Mode On Switch 1/7 (ON)
Passive Mode Off Token passing to a HIMA OPC server Switch 1/8 (ON)	Passive Mode On No token passing to an HIMA OPC server Switch 1/8 (OFF)	If "DIRECT Mode Off" switch 1/7 is activated (ON), the F 8627X's settings remain "Passive Mode On".
Deactivate the Passive Mode in the HIMA OPC server.	Activate the Passive Mode in the HIMA OPC server.	Activate the Passive Mode in the HIMA OPC server.
Number of HIMA OPC servers fixed to 4	Number of HIMA OPC servers fixed to 4	Up to 14 OPC servers can be used Switch S2/6-8
Monitoring Time for HIMA OPC server: fixed to 16 ms	Monitoring Time for HIMA OPC server: fixed to 16 ms	Monitoring Time for HIMA OPC server: fixed to 6 seconds
The F 8625 / F 8627(X) communicates with an OPC server via BUSCOM variables.	The F 8625 / F 8627(X) communicates with an OPC server via BUSCOM variables.	The F 8627(X) communicates with an OPC server via BUSCOM variables.
For communicating with a HIMA OPC server without Passive Mode, HIPRO-S variables must be sent from each PES to all other PES (one data direction is sufficient) to ensure token passing. HIPRO-S dummies may have to be configured.	HIPRO-S variables must not be defined when communicating with a HIMA OPC server in passive mode (otherwise OPC without passive mode). F 8625: from V. 1.13 F 8627(X): from V. 2.x No restrictions/specifications for HIPRO-S variables. F 8625: from V. 1.17 F 8627 / F 8627X: from version 3.x on	No restrictions/specifications for HIPRO-S variables.
Hub/Switch	Switch	Switch
HSR cable required for redundancy	HSR cable required for redundancy	HSR cable is required for ELOP II TCP and MODBUS TCP (Port 502)
Half/Full-Duplex	Full-Duplex	Full-Duplex

Table 8: Overview of the communication with a HIMA OPC server via the F 8627X in combination with HIPRO-S



The simultaneous use of both an F 8621A coprocessor module for safety-related communication and an F 8627X communication module for Ethernet communication is not allowed.

6.2 Application guidelines and notes

- The requirements of the IEEE 802.3 standards must be met.
- The cycle time of the communication partners' central module may differ up to factor 4.
- The entire transmission network must ensure a transmission rate of 10 MBit/s or 100 MBit/s.
- To ensure a deterministic data exchange for safety-related communication, a load-free Ethernet segment must be connected to the HIMA communication modules. If this is not possible, a specified time response can not be guaranteed on the Ethernet segment. This may result in a safety shutdown because of exceeded monitoring time.
- No connection between the redundant Ethernet segments is required.
- The HSR cable BV 7053 is required for redundancy in HIPRO-S, OPC and MODBUS TCP.
- The HSR cable between both redundant F 8627X functionally replace "Y-cable" BV 7049 when ELOP II TCP is connected to a PADT (PC).
- Replacing a communication module (see Chapter 2.4).
- Should the Ethernet segment not be available to HIMA communication modules, the following IP address cannot be used otherwise:
192.168.0.3 up to 192.168.0.130 (up to OS version 3.x)
192.168.0.3 up to 192.168.0.200 (from OS version 3.x on)
- All single communication module connections must be connected to the same logical Ethernet segment.
- Communication modules belonging to one PES and having the same module number must be connected to different Ethernet segments.



The F 8627X automatically accesses all HIPRO-S data, configured in the PES. This may cause problems, if a F 8621A simultaneously operates as PES master in the same PES.
In this case, the function block HK-COM-3 must deactivate the HIPRO-S communication via the F 8627X or the F 8621A configuration must change over to HIPRO-N.

6.3 Ethernet possible connections



All connected Ethernet components must meet the requirements specified in the application guidelines!

The Ethernet segments may always have a redundant structure. If a HIPRO-S is used, the HSR cable BV 7053 must be plugged in between the redundant communication modules F 8627X (via HSR interface).

The HSR cable BV 7053 is also required for the redundant MODBUS TCP and ELOP II TCP connection (see chapter 5.2).

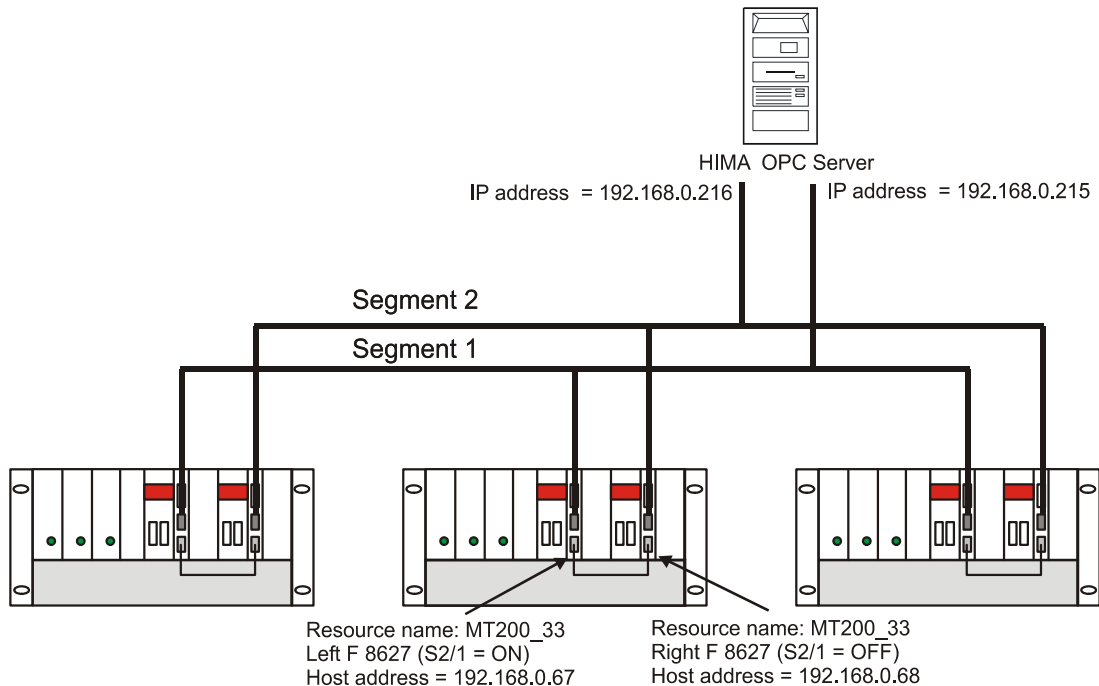


Figure 5: Redundant connection via 2 segments

For a "truly" redundant connection, an own network segment is required for each channel. All F 8625/27 (and PC network cards) with odd IP addresses (e.g. 192.168.0.67) must be attached to segment 1 and all F 8625/27 with even IP addresses to segment 2 (see Chapter 5.1).

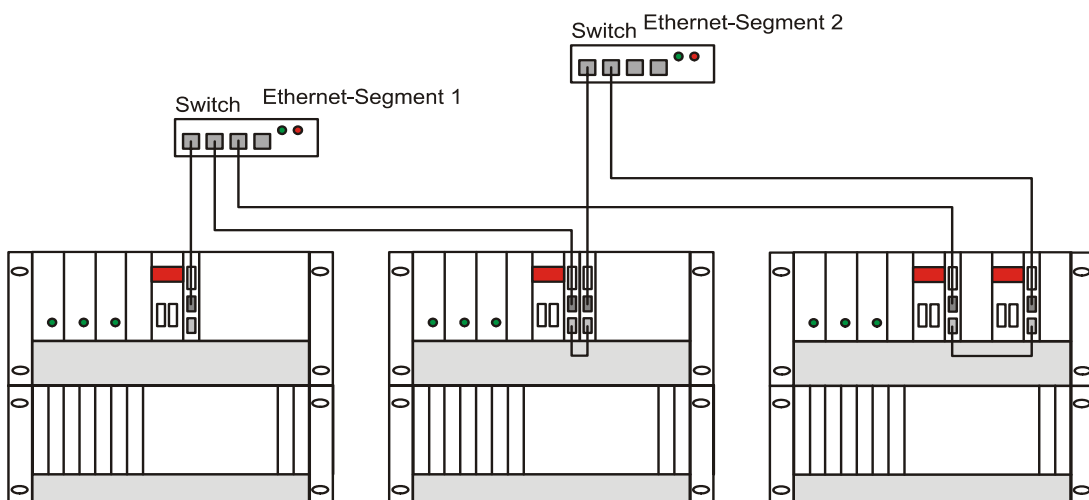


Figure 6: Possible PES connections

Figure 6: shows all possible PES connections.

- Left: Single PES on one Ethernet segment (each switch is an independent Ethernet segment).
- Centre: Single PES with two communication modules on both Ethernet segments.
- Right: PES with two communication modules on both Ethernet segments.

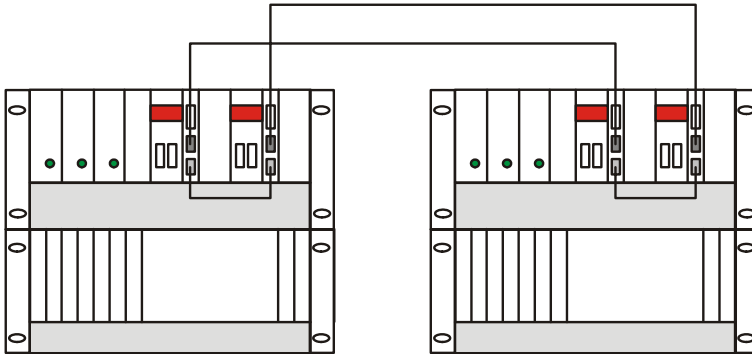


Figure 7: Interconnection of two PES

When two PES are interconnected together (Figure 7), no switch is required. Both 10BaseT or 100BaseTX interfaces of the communication modules are directly connected by a special cross-over cable (with twisted wires).

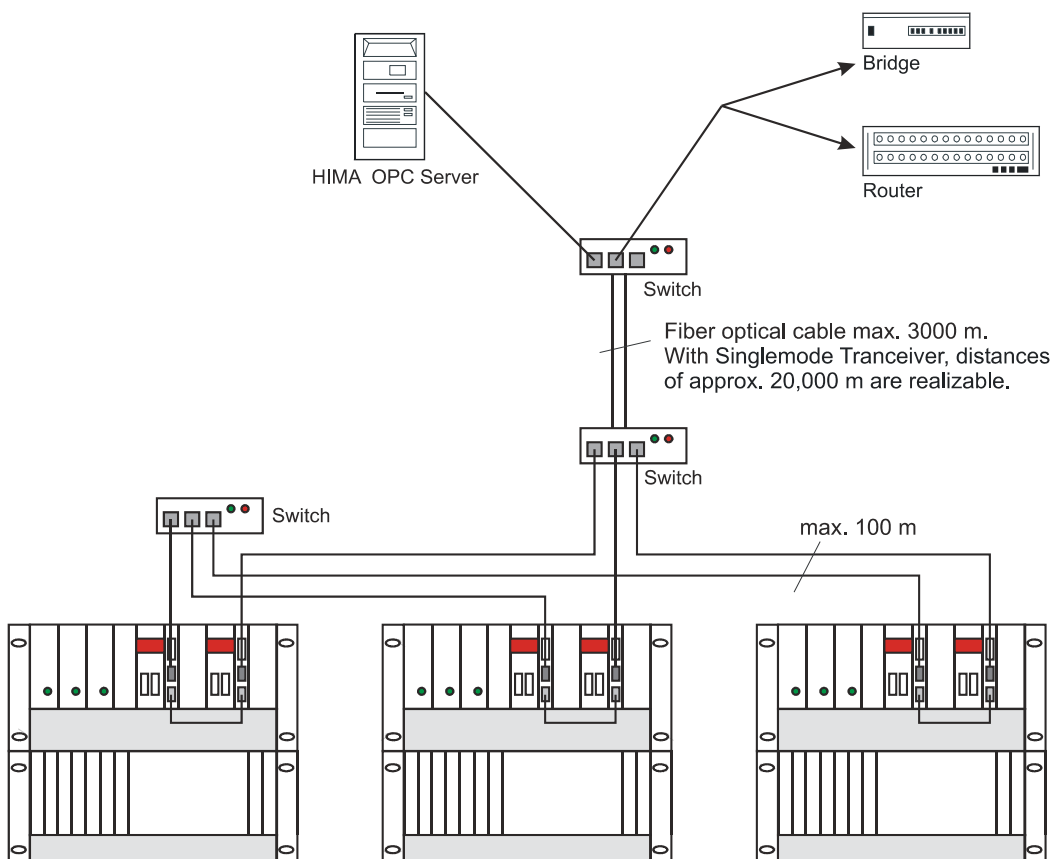


Figure 8: Redundant interconnection with switches

In Figure 8, three PES are completely redundantly interconnected via two switches. A third switch is connected to the redundantly interconnected PES via a redundant fibre optic connection (the fibre optic interface is integrated in the switch). An HIMA OPC server and further Ethernet components are connected to the third switch.

6.4 MODBUS TCP slave

Requirements for the MODBUS TCP slave

- F 865x central module, beginning with OS version (05.34)
- F 8627X Ethernet module, beginning with OS version 4.x

A MODBUS TCP slave is active if

- BUSCOM variables are existing
- the F 8627X is in RUN mode (RUN-LED on the F 8627X is lighting continuously)
- the associated F 865x central module is in RUN or MONO operating mode

The serial MODBUS slave is still supported (serial interface RS 485 on the F 865x central module).

The MODBUS TCP slave IP address is the F 8627X IP address (see chapter 5.1).

A MODBUS TCP master can access the MODBUS TCP slave in the H41q/H51q via the ports 502 and 8896.

- Via F 8627X port 502, the F 865x central module operates as a MODBUS TCP slave with the known functions (see manual "Functions of the operating system" HI 800 105).
- Via F 8627X port 8896, the F 8627X operates as a MODBUS TCP slave with further MODBUS function codes.

Both ports 502 and 8896 share the possible MODBUS TCP connections in according with the principle First Come, First Serve.

The following table shows three possible equipment configuration variants of H51q and how many MODBUS TCP master can access the F 865x central module.

Variants	F 865x	associated F 8627X	Max. number of MODBUS master
1	1 x CU1	1	4
	1 x CU2	1	4
2	1 x CU1	2	8
	1 x CU2	2	8
3	1 x CU1	5 (maximum equipment)	20
	1 x CU2	5 (maximum equipment)	20

Table 9: Variants for MODBUS master access the H51q

Note	Up to 40 MODBUS TCP masters can access the H51q controller. However, a maximum number of 16 MODBUS TCP master is recommended (see variant 2 in Table 9).

Partitioning of the BUSCOM address range in the MODBUS TCP slave (H41q/H51q)

All variables which should be sent via the MODBUS TCP slave must be created as BUSCOM variables using ELOP II.

While configuring the MODBUS communication, the user must ensure that separate address ranges are used for BUSCOM Import Variables for each MODBUS master; otherwise, the acceptance of the data sent by a MODBUS TCP master cannot be guaranteed.

The following figure shows an example, how the BUSCOM import address range of the H41q/H51q can be partitioning for the MODBUS TCP masters.

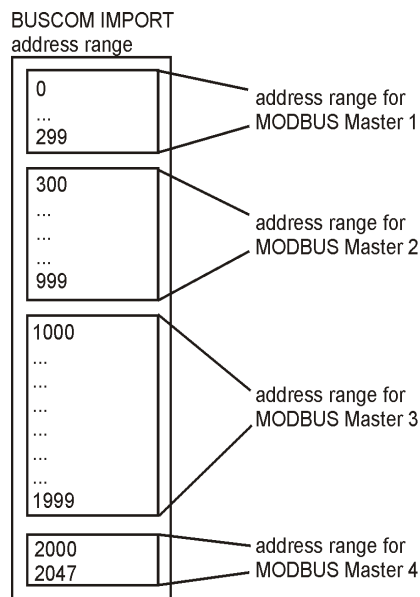


Figure 9: Partitioning of the BUSCOM Import address range for the MODBUS TCP Master

Note In case of port 8896, the BUSCOM variables are mapped into the process data image of the F 8627X. The MODBUS TCP master must therefore access the BUSCOM variables using the identity numbers (see chapter 7).
To avoid further dividing the BUSCOM variable address ranges into BOOL and WORD areas, we recommend creating BUSCOM variables of type WORD only. This helps maintain a more simple overview.

6.4.1 Polling intervall of the MODBUS TCP slave

The polling interval is the interval in which the MODBUS TCP slave is polled by the MODBUS master. The polling interval is registered within the MODBUS master.

Note The polling interval of the MODBUS TCP slaves should be selected depending on the cycle time of the F 865x central module.

$$t_{\text{Poll}} = \text{CT} + n * 15\text{ms}$$

CT: Maximum cycle time (ms) of the central module in status RUN (it is displayed on ELOP II control-panel).

n: Number of MODBUS masters polling the MODBUS slave

15ms: Process time per request in which the MODBUS masters should give to the F 865x central module.

Note Please read the cycle time under full communication load again and check whether the maximum cycle time "CT" has increased. An adaptation of t_{Poll} may be necessary.

6.4.2 Redundant MODBUS communication

To ensure a redundant MODBUS communication, the MODBUS master must be redundantly connected to the MODBUS slave (see Chapter 5.2.5.3).

To ensure the redundant MODBUS communication between a H41q/H51q PES and a MODBUS master, the following two methods are possible:

Cable redundancy

Under all circumstances, MODBUS communication only takes place via a single ethernet channel. If the MODBUS master no longer receives a responding telegram on the active channel, it can switch to the other channel and continue exchanging data. The MODBUS master can thus switch to the redundant channel if a network segment fails (e.g. broken ethernet cable or a faulty switch).

Redundancy with two "Peer to Peer" connections

In this case, the MODBUS master in use must possess the function to establish two independent MODBUS "Peer to Peer" connections to the MODBUS slave's two F 8627X.

The same data are then transmitted over both ethernet connections to the two F 8627X simultaneously.

The user must ensure that separate BUSCOM address ranges are used for each Ethernet channel transmitting the redundant BUSCOM variables (see figure below).

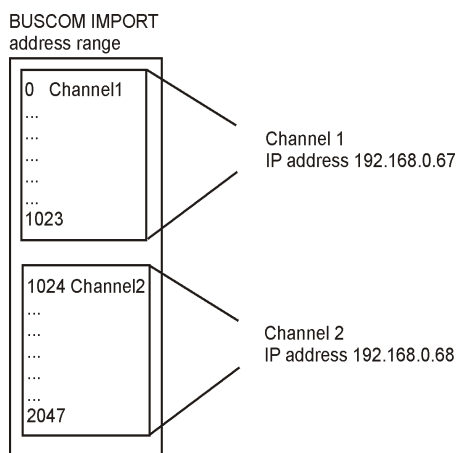


Figure 10: Partitioning of the BUSCOM Import address range for the redundant BUSCOM variables

Note In case of port 8896, the BUSCOM variables are mapped into the F 8627X process data image. The MODBUS TCP master must therefore access the BUSCOM variables using the identity numbers (see Chapter 7).

The logic of the user program must ensure, that the user program always processes the most current data record of the channel.

A monotonically increasing sequence number, incremented by the MODBUS TCP master, can serve e.g. as a criterion for determining how up-to-date the BUSCOM variables in the separate address ranges are.

Figure 10 shows an example, in which the sequence number is registered in the BUSCOM variables Channel1 and Channel2, respectively.

6.4.3 Connection via port 502

Via F 8627X port 502, the F 865x central module operates as a MODBUS TCP slave and can be directly reached.

The BUSCOM Variables can be accessed via the BUSCOM addresses configured in ELOP II. The MODBUS slave on the central module provides the MODBUS function codes, as described in the manual "Functions of the operating system" HI 800 105.

Note	The events query and the synchronization of the central module (CM) software clock is only possible via TCP server port 502. The HSR communication for a MODBUS TCP slave via port 502 is independent of the HIPRO-S-DIRECT mode.

The F 8627x and F 865x react to a MODBUS request via port 502 as follows:

- If the F 8627X is in mono operation mode (i.e. no HSR connection to a second F 8627X), then the F 8627X must have a connection to the F 865x, which in turn must be in RUN status to answer a MODBUS request with the corresponding MODBUS response.
- If two F 8627X are operating redundantly (i.e. HSR connection to a second F 8627X), then one of the two redundant F 8627X must have a connection to its associated F 865x, which in turn must be in RUN or MONO status to answer a MODBUS request with the corresponding MODBUS response.

If the MODBUS request cannot be passed on to an F 865x, the F 8627X sends the error code 0x0B back to the MODBUS master.

Note	Processing each MODBUS Request increases the cycle time for the F 865x central module. To avoid increasing the cycle time too much, the F 8627X limits the minimal polling interval per MODBUS master to 50 ms.

Using port 502, if the recommended polling interval " t_{Poll} " is ignored, the MODBUS communication may behave as follows:

- Should the same master send other MODBUS request within 50 ms, other MODBUS requests from the same master are received within 50 ms after a MODBUS request, the F 8627X transfers last MODBUS-Request from this master to the F 865x central module, if:
 - the central module is not processing a MODBUS request from this master and
 - 50 ms are expired.
- As long as the F 865x is processing a MODBUS request from a master, it will only accept another MODBUS request from this master after a minimum of 400 ms.
- In case of a new connection, the first request is passed on to the F 865x after ≥ 50 ms.

Note	If the MODBUS master is only connected to one F 8627X on the H41q/H51q, the MODBUS master <u>must</u> always be connected to the F 8627X plugged into the left F 865x via an Ethernet cable. This ensures that the data written most recently from the MODBUS master are also reflected in the data currently being processed by the user program.

6.4.4 Connection via port 8896

The MODBUS TCP master accesses the process data image from the F 8627X via port 8896. In this case, the F 8627X is an active MODBUS TCP slave and relieves the burden on the F 865x.

On port 8896, the BUSCOM variables are mapped into the F 8627X's process data image. For this reason, the MODBUS TCP master must access the identity numbers resulting from the process data mapping (see Chapter 7).



The WORD and BOOL variables are located in a common memory area on the F 8627X.

In case of port 8896, a MODBUS telegram for WORD can access the address range of the WORD and BOOL variables.

The user must pay attention to correctly interpret the variable types of reading and writing data.

Note

MODBUS function codes 2, 4, 23 and 43 are supported by port 8896. HK-COM 3 function block must allow the not safety-related data exchange via MODBUS TCP. The address mapping of the BUSCOM variables into the F 8627X is described in Chapter 7.

Note

If port 502 is not used in the H41q/H51q controller, the polling interval for port 8896 can be set to $t_{poll} \geq CT$.

F 8627X reacts to a MODBUS request via port 8896 as described below:

- If the F 8627X is in mono operation mode (i.e. no HSR connection to a second F 8627X), then the MODBUS TCP slave on the F 8627X must be active to answer a MODBUS request with the corresponding MODBUS response.
- If two F 8627X are operating redundantly (i.e. HSR connection to a second F 8627X), then the MODBUS TCP slaves must be active on one of the two redundant F 8627X to answer a MODBUS request with the corresponding MODBUS response.

If the MODBUS request cannot be passed to an active MODBUS TCP slave, the F 8627X sends the error code 0x0B back to the MODBUS master.

Note

HSR communication for a MODBUS TCP slave via port 8896 is only possible if both F 8627X are operating in redundant mode (DIP-switch 2/2 OFF) and the HPRO-S-DIRECT mode is deactivated (DIP-switch 1/7 OFF).

Via MODBUS TCP port 8896, the F 8627X supports the following function codes:

Function	Code	Type	Description
Read Coils	01	BOOL	Reads several variables (BOOL) from the slave's import or export area (same range as code 02).
Read discrete Inputs	02	BOOL	Reads several variables (BOOL) from the slave's export area.
Read Holding Registers	03	WORD	Reads several variables of any type from the slave's import or export area (same range as code 04).
Read Input Registers	04	WORD	Reads several variables of any type from the slave's export area.
Write Single Coil	05	BOOL	Writes one single variable (BOOL) in the slave's import area.
Write Single Register	06	WORD	Writes one single variable (WORD) in the slave's import area.
Write Multiple Coils	15	BOOL	Writes several variables (BOOL) in the slave's import area.
Write Multiple Registers	16	WORD	Writes several variables of any type in the slave's import area.
Read/Write Multiple Registers	23	WORD	Writes and reads several variables of any type in and from the slave's import area.
Read Device Identification	43	x ¹⁾	Transmits the slave's identification data to the master.

1) Note about the Modbus Function: Read Device Identification (43)

The HIMA Modbus slave supplies identification data to the master and supports the following Object-Ids:

Basic:

0x00 VendorName "HIMA Paul Hildebrandt GmbH + Co KG"

0x01 ProductCode "<Serial Number>"

0x02 MajorMinorRevision "<CU-OS Key 0x23ad CRC 0x----- / COM Vx.y CRC>"

Regular:

0x03 VendorUrl "http://www.hima.com"

0x04 ProductName "HIQuad"

0x05 ModelName "<RessourceTyp>" z.B. "F 8627X"

0x06 UserApplicationName "<Buchst00>" resource name from ELOP projekt

Extended:

0x80 CPU OS version/CRC "< CU-OS Key 0x23ad CRC 0x----->"

0x81 CPU OSL version/CRC deliver the error code 2 (Invalid Data)

0x82 CPU BL version/CRC deliver the error code 2 (Invalid Data)

0x83 COM OS version/CRC "<Vx.y / 0x23adcef>"

0x84 COM OSL version/CRC deliver the error code 2 (Invalid Data)

0x85 COM BL version/CRC deliver the error code 2 (Invalid Data)

0x86 Configuration-CRC "<Data-version 0x13ac / Area-version 0x13ac / Code-version 0x13ac / Run-version 0x13ac>"

The following ReadDevice ID Codes are supported:

- (1) Read Basic device identification (stream access)
- (2) Read regular device identification (stream access)
- (3) Read extended device identification (stream access)
- (4) Read one specific identification object (individual access)

For further information about MODBUS TCP, refer to "Modbus Application Protocol Specification" www.modbus.org.

Note	The function codes 03, 04 and 16 support data type Word (2 bytes) and any other data types. The interpretation of the two MODBUS master request parameters (start address, number) is done as follows: <u>Start address</u> describes the index of the first variable to be transmitted. <u>Number</u> determines the size of the area to be transmitted: 2*number bytes must be transmitted, provided the area ends directly at a variable boundary.

6.4.5 Error codes

Error code	Description
0x01 (Invalid Code)	If MODBUS TCP master sends a telegram with an unknown function code, MODBUS TCP slave responds with error code 0x01 (invalid code).
0x02 (Invalid Data)	If MODBUS TCP master's telegram does not match with the MODBUS TCP slave's configuration (e.g. the request telegram does not end "even" at a variable border), MODBUS TCP slave responds with error code 0x02 (invalid data).
0x03 (Invalid Value)	If MODBUS TCP master sends a telegram with faulty values (e.g. length field), MODBUS TCP slave responds with error code 0x03 (invalid value).
0x0B	No reply for a MODBUS Request is possible. In case of Port 502 No F 865x central module is reachable. In case of Port 8896 No active MODBUS TCP slave on the F 8627X is reachable. Note: The function code "0x0B" is based on a gateway function. Please refer to the Modbus specification at page modbus.org

6.5 HIPRO-S

HIPRO-S is a safe communication via the HIPRO-S variables configured in the PES. In the HIPRO-S Mode, the Ethernet bus access control is done by token passing. This mode provides operation with a hub and avoids collisions on the network.

No more than 31 **safeethernet** members can be configured in the entire network. One PES can have up to 30 **safeethernet** communication partners since a bus configuration in ELOP II supports a maximum of 31 communication partners. All communication partners must be configured in the same bus configuration. A PES can communicate with maximal 4 HIMA OPC servers. The number of communication partners is not reduced by the number of configured HIMA OPC servers.

The communication modules for HIPRO-S must be configured in ELOP II and via the DIP switches.

- Switch 2/1 sets the module numbers, which corresponds to the attached Ethernet segment (see Table 6 and Figure 5).
- Switch 2/2 set a mono or redundant interconnection of the communication module group (see Table 6 and Figure 5).

6.5.1 Notes for creating HIPRO-S user program

While creating the user program, the following points should be considered:

- In ELOP II, a resource name must have eight characters, the last two of which must be numbers (see Chapter 5.1.)
- With HIPRO-S, safety-related communication must be set up such that **each PES** has configured a safety-related data exchange **with all other PES** (i.e. exchange of dummy data if no other user data are exchanged). The direction of the data exchange can be freely selected.
- To check the HIPRO-S configuration, the PES master program should be compiled, but not loaded into the master. Potential errors can be corrected.
- Via the system variables, the diagnosis of the safety-related communication can be evaluated in the user program.
- ELOP II's function block HK-COM-3 can be used to project and monitor the F 8627X.
- The monitoring time "MT/MTe" for HIPRO-S connections must be calculated (Chapter 6.7).

6.6 HIPRO-S-DIRECT

Like HIPRO-S, HIPRO-S-DIRECT is a safety communication via the HIPRO-S variables configured in the PES. This mode can only be used with switches.

HIPRO-S-DIRECT mode allows a faster exchange of data than HIPRO-S mode.

No more than 99 safe**ethernet** members can be configured in the entire network.

One PES can have up to 63 safe**ethernet** communication partners.

If more than 30 communication partners are configured, several bus configurations must be created in ELOP II since a bus configuration in ELOP II supports a maximum of 31 bus participants.

The number of HIMA OPC servers can be set from 0 to 14. The number of HIPRO-S communication partners is not reduced by the number of configured HIMA OPC servers.

If HIPRO-S-DIRECT mode is active (switch 1/7 "ON"), switch S1/8 "passive mode" no longer influences communication. For this reason, "passive mode" must also be activated on the HIMA OPC servers.

The communication modules for HIPRO-S must be configured in ELOP II and via DIP-switches

- Switch 2/1 sets the module number which corresponds to the attached Ethernet segment (see Table 6 and Figure 5).
- Set switch 1/7 (Table 5 on page 361) to "ON" to activate the HIPRO-S-DIRECT mode.
- Switches 1/1 to 1/5 (Table 5 on page 361) set the "Timeout" for the answer of the communication partner.

Switch 1	Timeout
Off            	

- F 8627X redundancy mode is fixed to MONO in the HIPRO-S-DIRECT operating mode, independently of the position of switch 2/2. The HSR cable connection is not required for HIPRO-S-DIRECT communication.
- The number of HIMA OPC servers (0, 2, 4, 6, 8, 10, 12 or 14) can be set via switches 2/6 to 2/8 (see Table 6).

6.6.1 Notes for creating HIPRO-S-DIRECT's user program

While creating the user program, the following points must be considered:

- In ELOP II, the resource name must have eight characters, the last two of which must be numbers (see Chapter 5.1.)
- The exchange of dummy data is not required.
- If more than 31 communication members are required, they can be configured in several bus configurations. A communication partner must be configured in all bus configurations in which its communication partners are configured (see Chapter 6.8).
- To check the HIPRO-S configuration, the PES master program should be compiled, but not loaded into the master. Potential errors can be corrected.
- Via the system variables, the diagnosis of the safety-related communication can be evaluated in the user program.
- ELOP II's function block HK-COM-3 can be used to project and monitor the F 8627X.
In this case, a distinction differ between safe and non-safe communication can be made. (see ELOP II Online Help).
- The monitoring time "MT/MTe" for HIPRO-S connections must be calculated (Chapter 6.7).

6.7 Calculating the monitoring time for HIPRO-S/ HIPRO-S DIRECT connections

The monitoring time for HIPRO-S/ HIPRO-S-DIRECT connections is used for monitoring the update of HIPRO-S import variables at regular intervals.

The relevant factor is the safety time of the overall plant. If no imported safety-related variables are written within the defined period of time, they are set to 0 in the PES.

The monitoring time of the HIPRO-S/ HIPRO-S-DIRECT connections is set in the dialog window *Properties->HIPRO-S* of the corresponding target resource and must not be confused with the monitoring time of each PES.



Setting the monitoring time depends on the process and must be agreed upon with the appropriate authority. The monitoring time must not exceed the time period agreed upon.

If the monitoring time provided by the authority exceeds or is equal to **13200 ms**, the user can set the monitoring time of the HIPRO-S or HIPRO-S-DIRECT connections to **13200 ms** in the target resource. This value corresponds to the monitoring time, which is sufficient for the maximum size of a bus configuration (HIPRO-S with 31 or HIPRO-S-DIRECT with 64 members).

6.7.1 Calculation method and formulas

Step 1: Determining the maximum Ethernet transmission time ($T_{\max}$)

To calculate the monitoring time, the maximum Ethernet transmission time of the HIPRO-S data $T_{\max}$ must be determined.

$T_{\max}$ for HIPRO-S communication

$$T_{\max} = (NP^2 + NP + 100) \text{ ms}$$

If $T_{\max} < 600 \text{ ms}$ then $T_{\max}$ must be set to 600 ms.

NP: Number of PES communication partners + 4 OPC servers which are fixed configured in HIPRO-S mode.

$T_{\max}$: Maximum Ethernet transmission time of the HIPRO-S Data.

$T_{\max}$ for HIPRO-S-DIRECT communication

$$T_{\max} = T_{\text{DIP}}$$

T_{DIP} : Set value of the Timeout for HIPRO-S-DIRECT (Chapter 6.6) via switch 1/1-5.

$T_{\max}$: Maximum Ethernet transmission time of the HIPRO-S-DIRECT data.

Step 2: Calculating the Watchdog Time

- **$WD_{Source(Target)} = CT * 1.7$** for H41q/H51q (F 8650 up to F 8653)
- **$WDe_{Source(Target)} = CT * 1.5 + D * 5.5$** for H41qe/H51qe (F 8650E/X up to F 8653E/X)

$WD(e)_{Target}$: Watchdog time (ms) for the target resource

$WD(e)_{Source}$: Watchdog time (ms) for the source resource

CT: Maximum cycle time (ms) of the central module in RUN operation mode (is displayed in the ELOP II control panel).

D: Data size in kByte "Data Size (without SI Data)" (is displayed by the ELOP II Compiler).

Step 3: Calculating the monitoring time MT/MTe

Calculating the monitoring time MT for H41q/H51q

$$MT = 2 * WD_{Source} + 2 * T_{max} + 2 * WD_{Target}$$

MT: Monitoring time (HIPRO-S connection)

WD_{Target} : Watchdog time (ms) for the target resource

WD_{Source} : Watchdog time (ms) for the source resource

T_{max} : From "Step 1".

Calculating the monitoring time MTe for H41qe/H51qe

$$MTe = 2 * WDe_{Source} + 2 * T_{max} + 2 * WDe_{Target}$$

MTe: Monitoring time (HIPRO-S connection)

WDe_{Target} : Watchdog time (ms) for the target resource

WDe_{Source} : Watchdog time (ms) for the source resource

T_{max} : From "Step 1".

Step 4: Setting up the calculated monitoring time

The calculated monitoring time MT or MTe must set in the dialog window *Properties* -> *HIPRO-S* of the target resource.

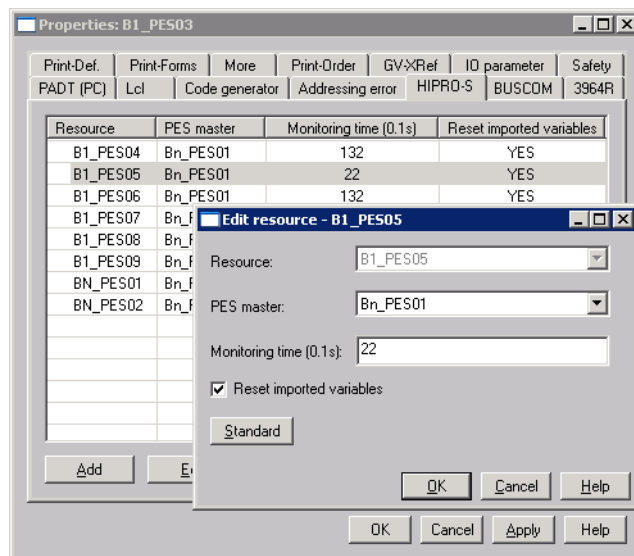


Figure 11: Configuration of the HIPRO-S connections



Setting the monitoring time depends on the process and must be agreed upon with the appropriate authority. The monitoring time must not exceed the time period agreed upon.

6.7.2 Example for calculating the monitoring time

Calculating of the monitoring time for a H41qe/H51qe with HIPRO-S and 20 communication partners.

Step 1: Calculating the maximum transmission time " $T_{\max}$ "

20 communication partners + 4 HIMA OPC server (fixed configuration)

-> **NP = 24**

$$T_{\max} = NP^2 + NP + 100$$

$$T_{\max} = 576 + 24 + 100$$

$$T_{\max} = 700 \text{ ms}$$

Note

In HIPRO-S-DIRECT mode, $T_{\max}$ is not calculated but it must be set up via DIP switches 1/1-5 (see Chapter 4.1).

Step 2: Calculating the HIPRO-S source/target resource**Calculating the Watchdog Time WDe_{Source} from the source resource**

- Note the maximum PES cycle time "**CT**" in RUN status, which is displayed on the ELOP II control panel of the HIPRO-S source-resource (e.g. **100 ms**).
- Note the datasize "**D**" in kByte "Data Size (without SI Data)" from the source-resource, which is displayed by the ELOP II Compiler (e.g. **2 kByte**).
- Calculate the Watchdog Time " **WDe_{Source}** " for the source-resource
$$WDe_{Source} = CT * 1.5 + D * 5.5$$
$$WDe_{Source} = 100 * 1.5 + 2 * 5.5$$
 $WDe_{Source} = 161 \text{ ms}$

Calculating the Watchdog Time WDe_{Target} from the target resource

- Note the maximum PES cycle time "**CT**" in RUN status, which is displayed on the ELOP II control panel of the HIPRO-S target-resource (e.g. **150 ms**).
- Note the datasize "**D**" in kByte "Data Size (without SI Data)" from the target-resource, which is displayed by the ELOP II Compiler (e.g. **1.5 kByte**).
- Calculate the Watchdog Time " **WDe_{Target}** " for the target-resource
$$WDe_{Target} = CT * 1.5 + D * 5.5$$
$$WDe_{Target} = 150 * 1.5 + 1.5 * 5.5$$
 $WDe_{Target} = 233.25 \text{ ms} \rightarrow 234 \text{ ms}$

Step 3: Calculating monitoring time " MTe "

- $MTe = 2 * WDe_{Source} + 2 * T_{max} + 2 * WDe_{Target}$
$$MTe = 2 * 161 + 2 * 700 + 2 * 234$$
 $MTe = 2190 \text{ ms} \rightarrow 2200 \text{ ms}$

Step 4: Set the calculated monitoring time " MTe " in the target-resource

- Open the dialog window "Properties" using the context menu *Properties* -> *HIPRO-S* of the target-resource.
- Select the source-resource in the list of HIPRO-S communication partners and click the button *EDIT*.
- Set the monitoring time " **MTe** " in the dialog window "Edit resource".

Calculating the monitoring time " MTe "

- for each of the 20 communication partners in this target-resource.
- for each of the 20 communication partners in its own resource.



Setting the monitoring time depends on the process and must be agreed upon with the appropriate authority. The monitoring time must not exceed the time period agreed upon.

6.8 Example of "Bus configuration with 64 resources"

In this example 64 resources are configured and partitioned into three bus configurations. Both resources "Bn_PES01" and "Bn_PES02" are configured for each bus and provide a gateway between the three bus configurations.

The bus configuration is identical for the communication versions "MONO" and "Double MONO". When "Double MONO" is used, a second F 8627X communication module with the corresponding DIP switch settings must be plugged into the redundant module slot for each communication partner.

Note	Respect the guidelines and application notes for configuring the Ethernet Segments (Chapter 6.2).

6.8.1 Function description of bus configuration

- The resources "Bn_PES01" and "Bn_PES02" are created in all three bus configurations. The resources "Bn_PES01" and "Bn_PES02" can thus exchange data with any other configured resource.
- In the bus configuration "BUS 1", the resources "B1_PES03" up to "B1_PES31" can communicate directly with each other.
- In the bus configuration "BUS 2", the resources "B2_PES32" up to "B2_PES60" can communicate directly with each other.
- In the bus configuration "BUS 3", the resources "B3_PES61" up to "B3_PES64" can communicate directly with each other.
- If data from different bus configurations must be exchanged between resources, the data must be sent via the gateway resources "Bn_PES01" and "Bn_PES02".

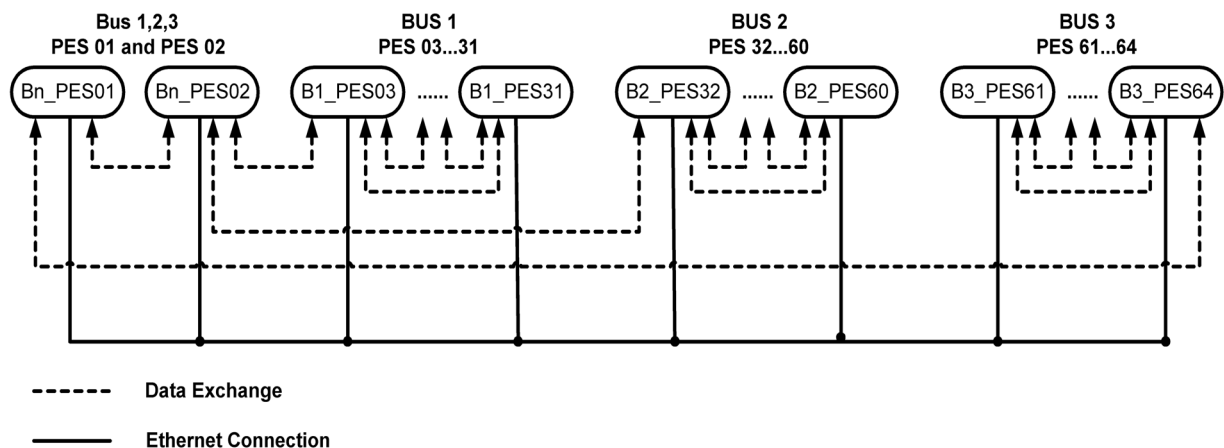


Figure 12: "MONO" bus configuration with HIPRO-S-DIRECT

Note	All communication partners must be connected via switches. Consider the delay time of the used switches. If the delay time is higher than 5 ms, "Time-out" for the answer of the communication partners must be configured via switches (S1/1-5) on each F 8627X.

6.8.2 Setting up the bus configuration in ELOP II

The user should be familiar with the programming tool **ELOP II** and HIMA H41q/H51q PES. Refer to the manual "First steps ELOP II" and the ELOP II Online Help for further information.

Note All resources must be created in the same configuration (here "Config"). Consider also the notes about parameterizing the HIPRO-S-DIRECT mode and generating the user program (Chapter 6.6).

Create the following resources in the configuration "Config":

- "Bn_PES01" and "Bn_PES02"
- "B1_PES03" to "B1_PES31"
- "B2_PES32" to "B2_PES60"
- "B3_PES61" to "B3_PES64"

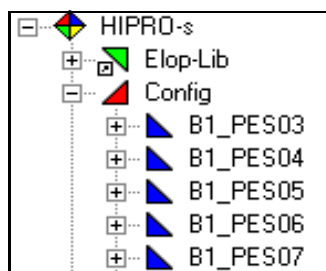


Figure 13: 64 resources in the configuration "Config"

In the application program of each resource, use the software function block HK-COM-3 for configuring and monitoring the F 8627X.

- The HK-COM3 must be assigned as described in the following table:

Input	Value
CU-Slot (1,2)	1
COM-Slot (1,2,3,4,5)	1
Enable Configuration	TRUE/FALSE
Function	0, 1 or 3

- In the user program, HK-COM3's outputs are used for monitoring.

Create and configure the three busses (see Table 11, Table 12, Table 13):

Name	Type	BSN	CU	CM	
BN_PES01	Slave	1			
Bn_PES01	PES master	1	1	1	
BN_PES02	Slave	2			
B1_PES03	Slave	3			
B1_PES04	Slave	4			
B1_PES05	Slave	5			
B1_PES06	Slave	6			
B1_PES07	Slave	7			
B1_PES08	Slave	8			
B1_PES09	Slave	9			

Figure 14: Configuration of BUS 1 in ELOP II

BUS 1 (Bus member)					
Name	Type	BSN	CU	CB	Number
Bn_PES01	PES master	1	1	1	1
Bn_PES01	slave	1			1
Bn_PES02	slave	2			1
B1_PES03	slave	3			29
"	"	"	"	"	
B1_PES31	slave	31			

Table 11: Configuration of BUS 1

BUS 2 (Bus member)					
Name	Type	BSN	CU	CB	Number
Bn_PES02	PES master	2	1	2	1
Bn_PES01	slave	1			1
Bn_PES02	slave	2			1
B2_PES32	slave	3			29
"	"	"	"	"	
B2_PES60	slave	31			

Table 12: Configuration of BUS 2

BUS 3 (Bus member)					
Name	Type	BSN	CU	CB	Number
B3_PES61	PES master	3	2	2	1
Bn_PES01	slave	1			1
Bn_PES02	slave	2			1
B3_PES61	slave	3			4
"	"	"	"	"	
B3_PES64	slave	6			

Table 13: Configuration of BUS 3

In each resource, define the communication partners (resources), with which HIPRO-S data are to be exchanged.

Determine and set the monitoring time for the communication partners (see Chapter 6.7).

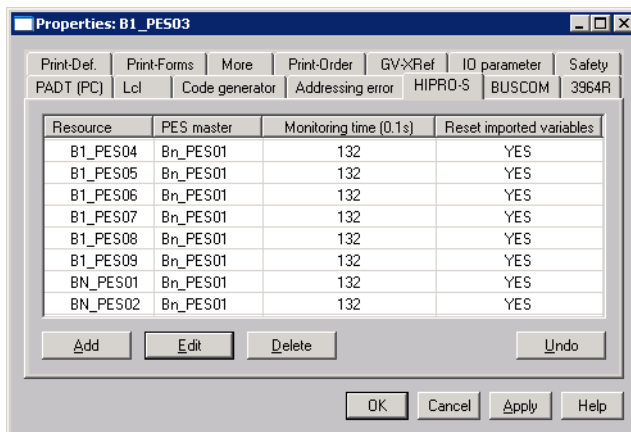


Figure 15: HIPRO-S communication partners of the resource



Setting the monitoring time depends on the process and must be agreed upon with the appropriate authority. The monitoring time must not exceed the time period agreed upon.

In ELOP II, define the HIPRO-S variable which should be used for the HIPRO-S communication:

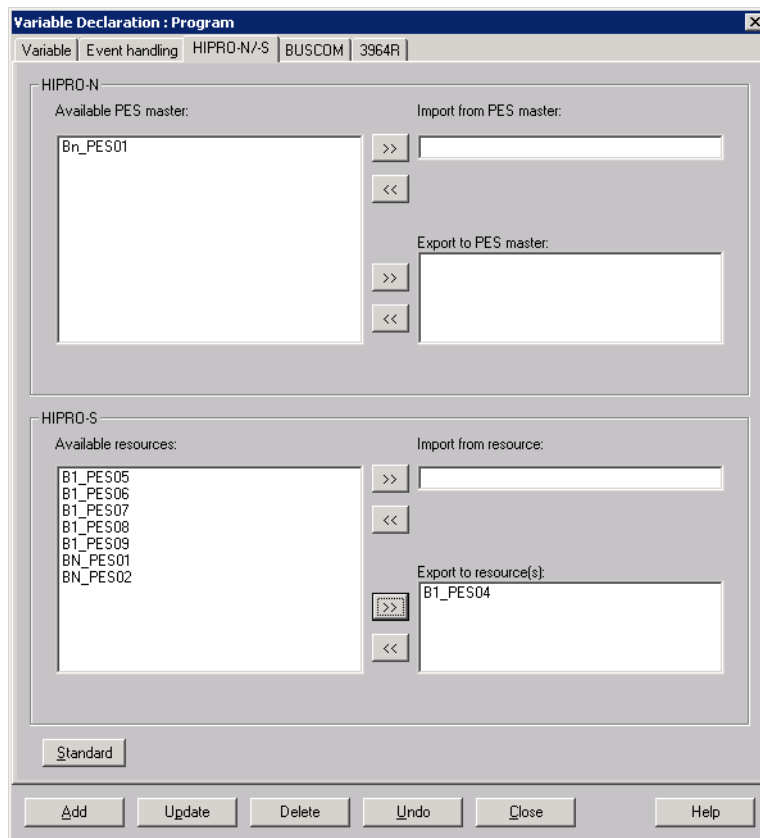


Figure 16: Configuration of a HIPRO-S variable in ELOP II

Note	To verify the HIPRO-S-DIRECT configuration, the PES master program should be compiled, but not be loaded into the master. Potential errors can thus be corrected.

6.9 Communication with HIMA OPC Server (BUSCOM)

The F 8627X communicates with an OPC server via the non safety related BUSCOM variables.

Note	The F 8627X OPC communication is only possible with a HIMA OPC server.

6.9.1 F 8627X configuration

The F 8627X is configured in ELOP II and via DIP switches.

In ELOP II, the resource name under ELOP II must have eight characters, the last two of which must be numbers. The numbers must be unique to avoid collisions while determining the communication module's IP address (see Chapter 5.1).

While configuring the communication with a HIMA OPC server, pay particular attention to the Passive mode (see Chapter 6.9.1.1 to Chapter 6.9.1.3).

6.9.1.1 Passive mode disabled (switch S1/8 "ON")

The token passing between the F 8627X and the HIMA OPC servers is active.

- If the Passive Mode is disabled on the F 8627X, it must also be disabled on the HIMA OPC servers.
- With HIPRO-S, safety-related communication must be set up such that **each PES** has configured a safety-related data exchange **with all other PES** (i.e. exchange of dummy data if no other user data are exchanged). The direction of the data exchange can be freely selected.
This procedure is used because all Ethernet nodes must be known in each PES within SafeEthernet to ensure communication within the network (token passing).

6.9.1.2 Passive mode enabled (switch S1/8 "OFF")

In this mode the F 8627X's behavior is passive and HIMA OPC server polls it in certain time intervals.

The token passing between the F 8627X and the HIMA OPC servers is disabled.

- The Passive mode may be only activated on a F 8627X, if HIMA OPC server also supports it (HIMA OPC server version 3.2.0 and higher).
- The Passive Mode can also be activated, if safety-related communication for the F 8627X module is configured.

Note	If HIPRO S DIRECT mode is active (switch 1/7 "ON"), switch S1/8 "passive mode" no longer influences communication. For this reason, "passive mode" must also be activated on the HIMA OPC servers.

6.9.1.3 Benefits of passive mode

- If safety-related communication will not be performed via the F 8627X, then safety-related dummy variables need not be defined between the PES during configuration.
- It is now possible to have simultaneously a safety-related communication (via AG master F 8621A or a second F 8625/27) and non safety-related communication to a HIMA OPC server in one PES since no more dummy variables are needed for communicating with the HIMA OPC server.
- An overload of the PC running the HIMA OPC server can be prevented in cases in which the number of available communication partners is too small (e.g. due to frequent token holding caused by the short token cycle).

Note Hubs may not be used in Passive mode. Switches are recommended.

6.9.1.4 Numbers of HIMA OPC server and determination of the node Id

- HIPRO-S mode (S1/7 "OFF"): Fixed to four HIMA OPC servers.
Node Ids of the HIMA OPC servers are 107 to 110.
- HIPRO-S-DIRECT mode (S1/7 "ON"):
Switches 2/6-8 set the number of HIMA OPC servers with which the F 8627X can exchange BUSCOM variables.
A range of node Id's is available for the number of HIMA OPC servers selected via switch 2 (see Table 14).
- The Node Id is required for configuring the HIMA OPC server (see manual "HIMA OPC server 3.0 Rev. 2").

Switch 2	Number of HIMA OPC server	Node Id
On Off                                                                		

6.9.1.5 Determining the IP address of the OPC Server network card

The IP address is composed of the network address and the host address. The default network address is 192.168.0.

The last byte of the IP address 192.168.0.x is the host address and it is calculated from the Node Id as specified below:

Host address = Node Id * 2 + 1 (For IP address Segment 1)

Host address = Node Id * 2 + 2 (For IP address Segment 2)

The following IP addresses are resulting from the calculation (see Table 15).

Node Id	IP Address Segment 1	IP Address Segment 2
107	192.168.0.215	192.168.0.216
108	192.168.0.217	192.168.0.218
109	192.168.0.219	192.168.0.220
110	192.168.0.221	192.168.0.222
111	192.168.0.223	192.168.0.224
112	192.168.0.225	192.168.0.226
113	192.168.0.227	192.168.0.228
114	192.168.0.229	192.168.0.230
115	192.168.0.231	192.168.0.232
116	192.168.0.233	192.168.0.234
117	192.168.0.235	192.168.0.236
118	192.168.0.237	192.168.0.238
119	192.168.0.239	192.168.0.240
120	192.168.0.241	192.168.0.242

Table 15: Mapping of IP addresses to node Id's

The IP address must be set in the properties of the network card of the PC running the HIMA OPC server.

6.9.2 Configuring of the BUSCOM variables in ELOP II

The F 8627X communicates with an OPC server via the BUSCOM variables, which must be created in ELOP II by the user.

The BUSCOM variables created in ELOP II can be exported into a text file, which in turn can be directly imported into the HIMA OPC server for configuration.

6.9.2.1 Address range of the BUSCOM variables

The address of the BUSCOM variables are calculated as follows

Base address + Relative address = BUSCOM address.

Note

The base address' settings are located in the resource's properties. In the "BUSCOM" tab, the user can set the base address separately for Import, Export and Import/Export; however, using the standard base address settings is recommended.

The following address ranges can be used for BUSCOM variables:

BUSCOM variables	Address range (Base address+ relative address)
BOOL	0 up to 2047 or 4096 up to 8191
UINT (WORD, INT, SINT, USINT)	0 up to 2047 or 4096 up to 8191

Table 16: Address range of the BUSCOM variables

Note	Select one of the two address ranges for the BUSCOM variables. If this is not possible, please contact the HIMA support.

Addresses for the BUSCOM variables can be allocated automatically or manually, but each address is allocated with reference to the base address.

6.9.2.2 Manually assigning the address for BUSCOM variables

By activating the function "set relative address" in the dialog located "Variable Declaration", set the address must be assigned manually. The base address is displayed above the input field. An overview of all used addresses can be found selecting in the *context menu of the resource->documentation->Res docu (generated)*.

Note	The user should assign the address for the BUSCOM variables, manually to avoid a reorganization of the addresses (address shift) after adding new BUSCOM variables.

6.9.2.3 Automatically assigning the address for BUSCOM variables

Deactivate the function "set relative address" located in the dialog "Variable Declaration". The automatic address assignment of the BUSCOM variables is arranged in alphabetical order on the basis of the variable name. An overview of all used addresses can be found selecting the *context menu of the resource->documentation->Res docu (generated)*.

Once new BUSCOM variables have been added, a *not reloadable code* must always be generated to allow the addressing to be reconfigured.

6.9.3 Example of a configuration in ELOP II for the communication with a HIMA OPC-Server

Define the BUSCOM variables used for the OPC communication:

- Select one of the following properties to determine the communication direction of the BUSCOM variables:

Export: read by HIMA OPC server

Import: written by HIMA OPC server

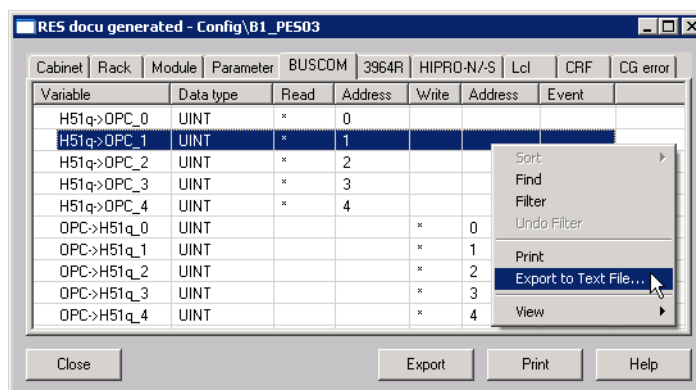
Import/Export: both written and read by HIMA OPC server

Create the BUSCOM resources' list for HIMA OPC server:

- Open the resource's context menu and select *Documentation*.
- Select the submenu function *RES-Docu (generated)* to open the dialog "Res-Docu (generated)".
- Select the tab "BUSCOM" located in the dialog "Res-Docu (generated)".
- Right click on the BUSCOM variable line, to open the export context menu.
- Select *Export to Text File*.

Note Consider that no filters are set during the export!

- Save the file with the extension **.txt* on a storage medium (server, floppy disk), which the HIMA OPC server can read.



Read: To be read by the HIMA OPC server

Write: To be written by the HIMA OPC server

Figure 17: Dialog "Res-Docu (generated)"

The generated BUSCOM list appears as seen in Figure 18 and can be used by the HIMA OPC server without any changes.

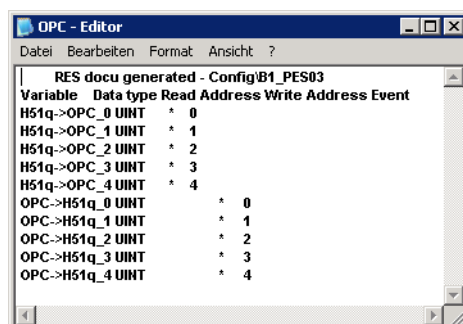


Figure 18: BUSCOM list for the HIMA OPC server

7 Address mapping of the BUSCOM variables

7.1 Data types of BUSCOM variables

Overview, how the BUSCOM variables are represented and stored.

ELOP II (variable data types)	Process data mapping on the F 8627X	Size of data types on the F 8627X and F 865x
BOOL	BOOL	1 Byte
WORD (WORD INT UINT)	WORD	2 Bytes

Table 17: Data type definitions

All 2 Byte data types configured in ELOP II as BUSCOM variables are transmitted as WORD. 1 Byte data types (e.g. Byte, SINT) must be packed into BUSCOM variables of data type WORD (e.g. with the function blocks "Pack" and "Unpack") such that they can be transmitted.

7.2 BUSCOM address of the F 865x central module

The user can set-up the BUSCOM Addresses of the BUSCOM variables by specifying the base and relative addresses in ELOP II.

The addresses of the BUSCOM variables are calculated on the central module F 865x as follows:

Base address + Relative address = BUSCOM address

The relative address must be set such that the BUSCOM address is located in the same range as the corresponding base address (see Table 18).

Note	The base address' settings are located in resource's properties. In the "BUSCOM" tab, the user can set the base address separately for Import, Export and Import/Export; however, using the standard base address settings is recommended.

The BOOL and WORD variables are stored within the import and export areas of the F 865x and further separated into 0 and 1 areas.

Ranges	BOOL (BUSCOM address)	WORD (BUSCOM address)
Import range 0 (Base address 0000)	0000 to 2047	0000 to 2047
Import range 1 (Base address 4096)	4096 to 8191	4096 to 8191
Export range 0 (Base address 0000)	0000 to 2047	0000 to 2047
Export range 1 (Base address 4096)	4096 to 8191	4096 to 8191

Table 18: BUSCOM variable ranges in the F 865x central module

7.3 Mapping of the BUSCOM variables on the F 8627X

To transmit the BUSCOM variables, they are mapped from the F 865x central module to the F 8627X communication module.

The BUSCOM variables from the F 865x are copied into two memory areas located in the F 8627X internal memory.

The memory areas EV and IV reflect the export and the import variables respectively. In the memory area, a BUSCOM variable is described by its identity number.

Note This scheme for converting BUSCOM variables (on the F 865x) into identity numbers (on the F 8627X) is used for WORD as well as for BOOL variables.



Consider at MODBUS Port 8896, that you neither reading nor writing with a Modbus telegram beyond the address range of a variable type (see also Chapter 6.4.4)

7.3.1 Example 1

In this example the **WORD** variables in the export area 0 (on the F865x) start with the BUSCOM address 0 and are mapped to the memory area EV (on the F 8627X) with the identity number 0.

The identity numbers of the WORD variables in memory area EV are in ascending order up to the last WORD variable (identity number 110) from export area 0.

In this example, the **BOOL** variables in export area 0 (on the F 865x) start with BUSCOM address 0 and are mapped to memory area EV (on the F 8627X) beginning with identity number 111, which follows the last identity number of the WORD variables (i.e. 110).

The identity numbers of the BOOL variables in memory area EV are in ascending order up to the last BOOL variable (identity number 150) from export area 0.

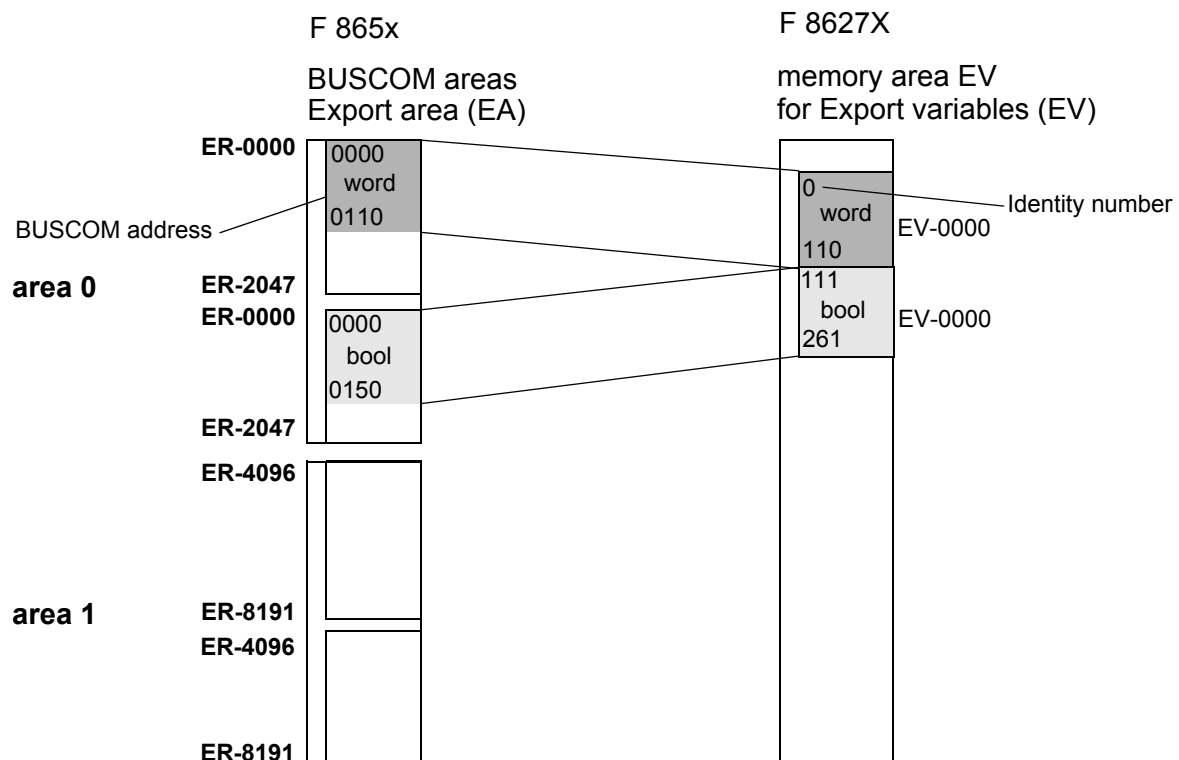


Figure 19: Mapping of WORD- and BOOL-variables from export area 0

7.3.2 Example 2

In this example the **BOOL** variables in the export area 0 (on the F865x) start with the BUSCOM address 0 and mapped to the memory area EV (on the F 8627X) with the identity number 0. The identity numbers of the BOOL variables in memory area EV are in ascending order up to the last BOOL variable (identity number 100) from export area 0.

In this example, the **BOOL** variables in export area 1 (on the F 865x) start with BUSCOM address 4096 and are mapped to memory area EV (on the F 8627X) beginning with identity number 101, which follows the last identity number of the BOOL variables (i.e. 100). The identity numbers of the BOOL variables in memory area EV are in ascending order up to the last BOOL variable 4196 from export area 1.

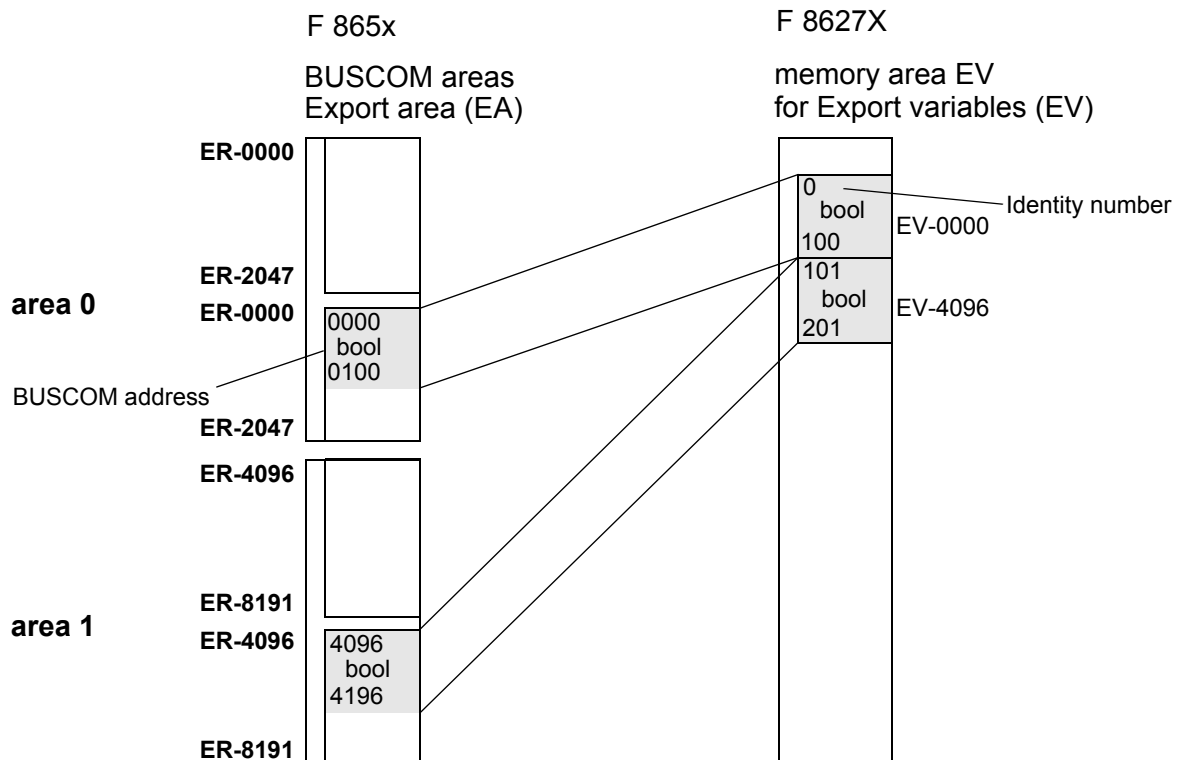


Figure 20: Mapping of BOOL-variables from export areas 0 and 1

7.3.3 Example 3

In this example, the **WORD** variables in export area 0 (on the F 865x) start with BUSCOM address 1 and are mapped to the memory area EV (on the F 8627X) beginning with identity number 1. The identity numbers of the WORD variables in memory area EV are in ascending order up to the last WORD variable (0110) from export area 0.

The unused BUSCOM address 0 is assigned a dummy variable and mapped to identity number 0 within memory area EV.

In this example, the **WORD** variables in export area 1 (on the F 865x) start with BUSCOM address 4100 and are mapped to the memory area EV (on the F 8627X) beginning with identity number 115. The identity numbers of the WORD variables in memory area EV are in ascending order up to the last

WORD variable (4200) from export area 1.

The unused BUSCOM addresses 4096 to 4099 are assigned dummy variables and mapped to identity numbers 111 to 114 within memory area EV.

In this example, the **BOOL** variables in export area 0 (on the F 865x) start with BUSCOM address 0 and are mapped to the memory area EV (on the F 8627X) beginning with identity number 216 which follows the identity number 215 of the last WORD variable from export area 0.

The identity numbers of the BOOL variables in memory area EV are in ascending order up to the last BOOL variable (0100) from export area 0.

In this example, the **BOOL** variables in export area 1 (on the F 865x) start with BUSCOM address 4096 and are mapped to the memory area EV (on the F 8627X) beginning with identity number 317 which follows the identity number 316 of the last BOOL variable from export area 0.

The identity numbers of the BOOL variables in the memory area EV are ascending up to the last BOOL variable 4196 from the export area 1.

Note If BUSCOM variables do not start at the beginning of an area, this area is padded with dummy variables on the central module and also mapped on the communication module.

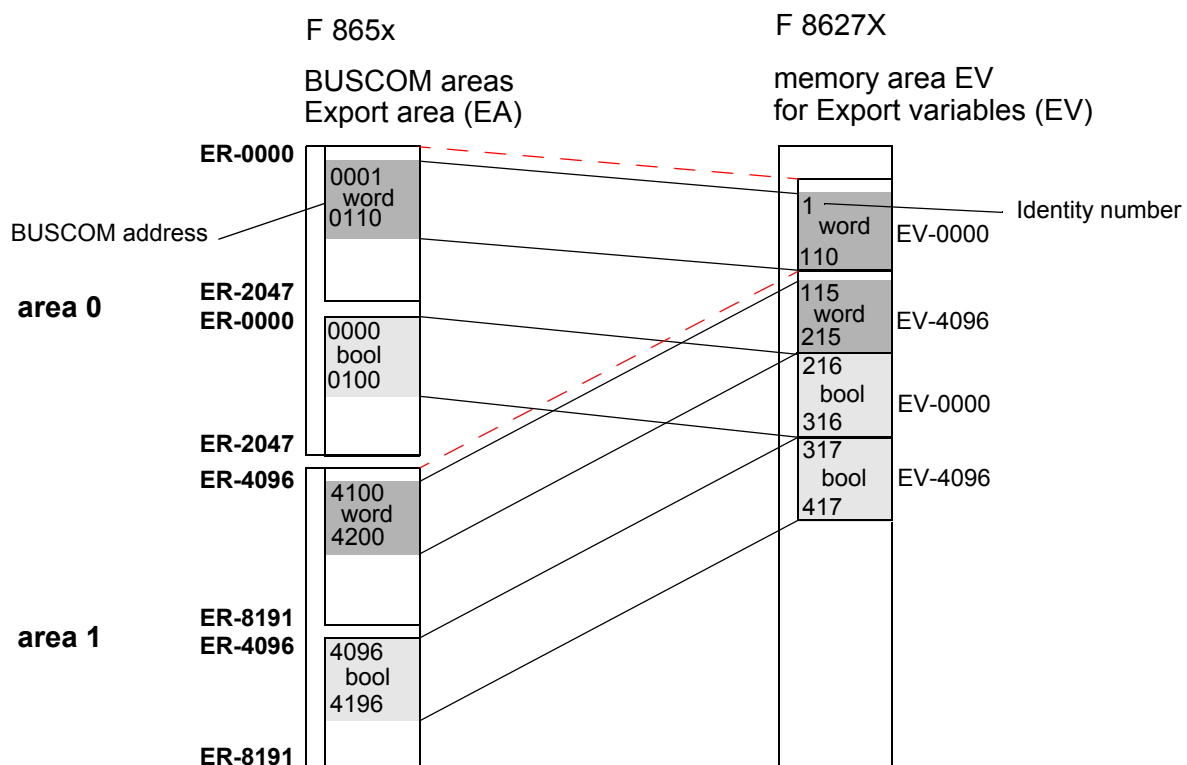


Figure 21: Mapping of WORD- and BOOL-variables from export areas 0 and 1

8 Replacing of the operating system

8.1 Upgrading/downgrading the operating system versions of the F 8627X

The following instructions describe the upgrade/downgrade the operation systems for the F 8627X module.



Upgrading/downgrading may only be performed by HIMA service engineers. It is recommended that the operating system is changed, e.g. in times of a shutdown of the plant.

8.1.1 Upgrading/downgrading from version 2.x

To upgrade/downgrade version 2.x, the operating system file with extension ***.flash** must be loaded.



When upgrading from version 2.x to another version, the user must ensure that only the correct operating system file is loaded into the corresponding module.

If the module F 8627X was loaded with any incorrect file, the functionality of the F 8627X is lost and can not be programmed any longer with the diagnostic dialog ComEth. In this case the module F 8627X must be programmed new by HIMA.

After upgrading to version 3.x and higher a protection mechanism is activated and only operating system files with extension ***.ldb** can be loaded.

8.1.2 Upgrading/downgrading from version 3.x and higher

To upgrade/downgrade version 3.x and higher, the operating system file with extension ***.ldb** must be loaded.



After downgrading to version 2.x, the protection mechanism preventing incorrect files from being loaded is no longer active!

8.2 Downloading the operating system into the F 8627X

The operating system for the F 8627X module is downloaded using the diagnosis dialog **ComEth**.



The connection between the **ComEth**'s control panel and the F 8627X Ethernet module should be closed, if **ComEth** is not used.
The connection to the **ComEth**'s diagnosis panel can remain.



Downgrading from version $\geq V4.x$ to version $\leq V3.x$!
If the F 8627X is set to "Autonegotiation Off" (S2/3 OFF) and full duplex (S2/5 ON), then autonegotiation must be activated for all communication partners (e.g. switch) once the downgrade has been completed (see also Chapter 4.2).



Upgrading from version $\leq V3.x$ to version $\geq V4.x$!
If the F 8627X is set to "Autonegotiation Off" (S2/3 OFF) and full duplex (S2/5 ON), then autonegotiation must be deactivated for all communication partners (e.g. switch) once the upgrade has been completed (see also Chapter 4.2).

- Start the ComEth diagnosis dialog and check in the error-state viewer that the
 - "main program version" is 0.8.0 or higher
 - "diagnostic text version" is 0.2.0 or higher.
- Select *Project->New* on the menubar of the ComEth diagnosis dialog, to create a new Project.
- Select *New Configuration* in the context menu of the new project, to create a new configuration.
- Select *New Resource* in the context menu of the new configuration, to create a new resource.
- Select *New F 8627X* in the context menu of the new resource, to create a new F 8627X in the new resource.
- Select *Properties* in the context menu of the new F 8627X, to open the dialog window "Properties".

Configure the input fields as follows:

- Enter any unique name for the F 8627X (e.g. CU1CM1) in the input field.
- In the input field "IP address", enter the IP address of the F 8627X module into which the operating system is to be loaded. For determining the IP address of the F 8627X module, (see Chapter 5.1).
- The view box "IP address PC" displays all IP addresses of the available PADT (PC) network cards. Select the IP address of the network card to be used for creating the connection to the F 8627X module.

Note

OS versions < V4.x

The PADT (PC) IP address must:

- be located in the same subnet as the F 8627 module.
- have an IP address in one of the following ranges:
 - from 192.168.0.201 to 192.168.0.214 or
 - from 192.168.0.243 to 192.168.0.254.

Exception: If the PADT (PC) is simultaneously used as an OPC server and already has own one of the OPC server IP addresses, it also can also use this IP address.

If several network cards are available on the PADT (PC), a corresponding routing entry must be set for the network card which is used for connection to the F 8627.

OS versions $\geq$ V4.x

Any free IP address for the PADT may be used. If the PADT IP addresses of the PADT and the F 8627X are located in different subnets, a routing entry for the subnet of the F 8627X is required on the PADT (PC).

-
- Select *Control Panel* in the context menu of the new F 8627X to open the Control Panel.
 - Select *PADT->Connect* in the control panel to create a connection to the F 8627X module.
-



The next step causes a communication loss, if no redundant F 8627X module exists or if the redundant module does not have any connection!

- Click the button *Stop Device* in the ComEth control panel, to set the F 8627X module into the STOP state (green RUN LED blinks).
 - Select *Extra->OS Update* in the ComEth control panel to open the standard dialog for opening a file.
 - Select and load the **proper** operating system for the upgrade/downgrade into the selected F 8627X module (see Chapter 8.1.1 and Chapter 8.1.2).
-



If the operating system download of the F 8627X was aborted, the F 8627X must **not** be removed!

Close the **ComEth** control panel and reopen it. Repeat the previous step to load the F 8627X operating system.

Note

After successfully downloading the F 8627X operating system, **the F 8627X module must be rebooted**. After rebooting the new operating system is started. Until then, the F 8627X operates using with the old operating system.

To reboot the F 8627X:

- Remove and replace the F 8627X module or
- select the function *Extra->Reboot Device* located in the ComEth Control Panel dialog.
- Check the upgrade/downgrade
- Select *PADT->Connect* in the control panel to create a new connection to the F 8627X module.
- Select the tab *version* and check that the OS version displayed is the same as the OS version of the Upgrade/Downgrade.
- If a redundant F 8627X module exists, follow the same procedure.

Note

The ARP entry must be deleted on the PADT (PC) if another F 8627X is to be loaded and has the **same IP address** as the F 8627X loaded immediately beforehand; otherwise, a connection cannot be opened to the newly loaded F 8627X with the same IP address.

Example: Delete the ARP entry of a F 8627X with the IP address **192.168.0.67**.

- Start the "Dos Shell" on the PADT (PC)
 - Enter the command **arp -d 192.168.0.67**.
-

9 Recommended literature

- [1] Safety Manual H41q/H51q
HIMA GmbH+Co KG Bruehl, 2005: HI 800 013

- [2] Functions of the Operating System H41q/H51q
HIMA GmbH+Co KG Bruehl, 2005: HI 800 105

- [3] Online Help in ELOP II
HIMA GmbH+Co KG Bruehl, 2005

- [4] First Steps ELOP II
HIMA GmbH+Co KG Bruehl, 2001: HI 800 000

- [5] HIMA OPC server 3.0 Rev. 2
HIMA GmbH+Co KG Bruehl, 2004



F 8628X: PROFIBUS-DP slave module

Communication Module for PROFIBUS-DP Communication

Application in H41q/H51q PES (beginning with OS41q/51q V7.0-7 (9906)).

Appertaining Function block: HK-COM-3

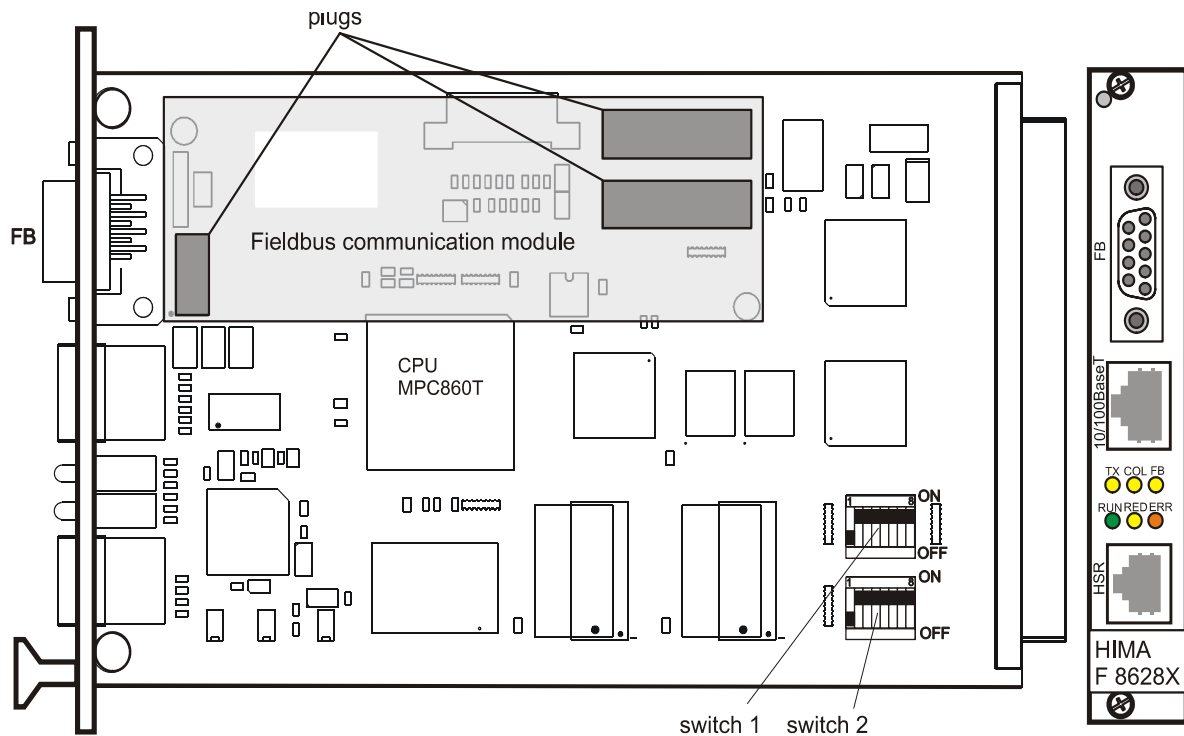


Figure 1: Communication module F 8628X

1 Technical data

Processor	32 Bit Motorola CPU MPC860T with integrated RISC communication controller
Operating voltage	5 VDC / 1 A
Space required	3 HU (units high), 4 SU (units width)
Serial interface FB	With PROFIBUS-DP slave module Connection via a 9-pole SUB-D plug
Ethernet interface	10Base-T or 100Base-TX according to the IEEE 802.3 standard, connection via an RJ-45 plug.
HSR interface	High-speed serial communication interface to the redundant HSR (High Speed Redundancy) communication module. Connection via an RJ-12 plug with BV 7053.
Diagnostic Display	6 LEDs for display diagnostic during operation
DIP switches	2 DIP switches for setting the module functions

2 Functions of the F 8628X



2.1 General

With the F 8628X communication module, a HIMA H41q/H51q controller can operate as a PROFIBUS-DP Slave.

Beginning with operating system version 4.x, the F 8628X supports the function "ELOP II TCP". The ELOP II TCP connection enables a fast data exchange between a PADT (PC) and the F 865x central module.

Note

The F 8628X has the same functions as the F 8628 and is compatible with it; however, the new function "ELOP II TCP" can only be used with an F 8628X with an operating system beginning with V4.x.



If an F 8628X module and a F 8621A coprocessor module operates in the same PES, the HK-COM-3 software function block with the proper parameterization must be used (see function block online help).

2.2 Replacing an F 8628X



An F 8628X must never be removed from a redundant operation without a special procedure.

Before removing an F 8628X, its fixing screws must be completely loosened and freely movable. Remove the module from the bus board by pushing the ejection lever (front label) top down and quickly removing in an upward motion to ensure faulty signals are not triggered within the system.

To attach the module, place it on the terminal block and press it inwards as far as it will go. This action should be performed quickly to ensure that faulty signals are not triggered within the system.

2.2.1 Operation of the ejection lever

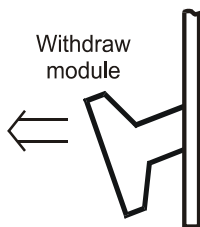
Push ejection lever
top down



Front plate

①

Withdraw
module



Front plate

②

Figure 2: Operation of the ejection lever

2.2.2 Procedure for exchanging a redundant F 8628X in a redundant H41q/H51q controller



Make sure that you connect the Ethernet cable to the Ethernet socket (10/100BASE-T) and the HSR cable to the HSR socket (HSR). The respective connectors must be pressed in until they snap into their sockets.

1. Unplug communication cable (PROFIBUS-DP).
 2. Unplug communication cable (Ethernet).
 3. Corresponding central module (e.g. F 8650X) with operating system
 - Version below (05.34): remove the central module!
 - Version beginning with (05.34): erase application program manually to deactivate the central module (see operation system manual "Erasing the application program")
 4. Unplug HSR cable BV 7053 (if used).
 5. Remove communication module F 8628X.
 6. Check the new F 8628X
 - Check the DIP-switch settings (see chapter Chapter 4 and compare to the exchanged F 8628X).
 - Check whether if the operating system (see sticker on the F 8628X) support the used function (e.g. "ELOP II TCP" from OS version 4.x on)!
 7. Plug the new communication module F 8628X.
 8. Plug the HSR cable BV 7053 (if required).
 9. Corresponding central module (e.g. F 8650X) with operating system
 - Version below (05.34): plug the central module!
 - Version beginning with (05.34): push the button "Ack" to activate the central module (see operation system manual "Self-Education")
 10. Wait until the LED "RUN" on the F 8628X lights continuously.
 11. Plug the communication cable (Ethernet).
 12. Plug the communication cable (PROFIBUS-DP).
-

Note

The ARP entry on the PADT (PC) must be deleted if the new F 8628X has the **same IP address** as the old F 8628X. If the new F 8628X has the same IP address it cannot be connected to the PADT (PC).

Example: Delete the ARP entry of an F 8628X with IP address **192.168.0.67**.

- Start the "Dos Shell" on the PADT (PC)
 - Enter the command **arp -d 192.168.0.67**.
-

2.3 Specifications for HIMA PROFIBUS-DP slaves

PROFIBUS is an international, open Fieldbus standard which was standardized in the EN 50170 Fieldbus standard.

Please contact your Regional PROFIBUS Association (RPA) or refer to the Internet page www.profibus.com for further information.

The functionality of the HIMA PROFIBUS-DP protocol meets the requirements of EN 50 170 (DP V0).

	Sizes	Comments
RPA ident number	0x00EA	Assigned by the RPA (PNO in germany)
GSD file	HIQ200EA.GSD	The GSD file for configuring a H41q/H51q PROFIBUS-DP slave in a PROFIBUS-DP master can be downloaded from the internet page www.hima.de
HIMA PROFIBUS-DP station address	To be set via switch 1	Permissible station address from 0 to 125
Baud rates	9.6 kBit/s 19.2 kBit/s 45.45 kBit/s 93.75 kBit/s 187.5 kBit/s 500 kBit/s 1.5 MBit/s 3 MBit/s 6 MBit/s 12 MBit/s	Baud rate that can be set via switch 2 45.45 kBit/s (OS version 2.18 and higher).
Transmission	RS 485	Most frequently used transmission mode for PROFIBUS, often referred to as H2
Input max.	192 Byte	Inputs + outputs maximum number 256
Output max.	240 Byte	Inputs + outputs maximum number 256
Min. slave Interval	3 ms	
Accuracy of PROFIBUS-DP watchdog monitoring	+/- 10 ms	
Modes of connecting the HIMA PROFIBUS-DP slave	In accordance with the international PROFIBUS standard EN 50170	Cable lengths, terminating resistors etc. have to be considered

Table 1: Specification of the HIMA PROFIBUS-DP slave

3 Diagnostic LEDs on module front

3.1 Top row LEDs on module front

TX	COL	FB	Operating status
ON	-	-	Send LED of Ethernet communication
-	ON	-	Collision on the Ethernet segment
-	-	OFF	No PROFIBUS-DP slave activities on the bus
-	-	Flashing	Slave waits for its configuration from PROFIBUS-DP master
-	-	ON	Data exchange between Slave and PROFIBUS-DP master

Table 2: Top row LEDs on module front

3.2 Bottom row LEDs on module front

RUN	RED	ERR	Operating status
ON	-	OFF	PROFIBUS-DP communication protocol active
Flashing	-	OFF	PROFIBUS-DP communication protocol inactive
-	ON	OFF	Communication to redundant communication module active. Is used for the ELOP II TCP communication.
Flashing	-	Flashing	Communication module booting
ON	-	Flashing	OS version 4.6 and higher User Error / Configuration Error - Res-ID and ID are not equal - Ethernet communication protocol inactive, even if the communication module is in RUN status.
OFF	-	ON	Fatal error in communication module. Module must be replaced.
OFF	-	Flashes 3-times	Saving error code in Flash-EPROM (required for repair purposes) <i>Do not unplug communication module!</i>

Table 3: Bottom row LEDs on module front

4 Functions of the switches

4.1 Functions of switch 1 (S1)

S1	ON	OFF	Description
1	1	0	The PROFIBUS-DP Slave address (0 to 125) for the F 8628X is set via switches 1/1-7 (See Table).
2	2	0	
3	4	0	
4	8	0	
5	16	0	
6	32	0	
7	64	0	
8	ID_IP ON	ID_IP OFF	For OS versions < 4.x no function ID_IP ON The bus station number (ID) which is set on the F 865x central module via switches (S1 1-7), is used as Res-ID, if no Res-ID could be determined from the loaded user program. ID_IP OFF The bus station number (ID) which is set on the F 865x central module via switches (S1 1-7), is never used for the Res-ID.

Table 4: Functions of switch 1 (S1)

4.1.1 Switches 1/1-7

The switches 1/1-7 are used to set PROFIBUS-DP Slave address (0 to 125) for the F 8628X communication module.

Switch 1	PROFIBUS-DP address
On  Off               	0
On  Off               	1
On  Off               	2
On  Off               	3
On  Off               	4
On  Off               	5
On  Off               	6
On  Off               	7
On  Off               	8
"	"
On  Off               	124
On  Off               	125

Legend:

Positions white switch:

On  Off  White switch in position OFF

On  Off  White switch in position ON

 Not used switch

Table 5: Settings of switch 1/1-7

4.2 Functions of switch 2 (S2)

S2	ON	OFF	Description
1	Ethernet Channel1	Ethernet Channel2	F 8628X allocation to the Ethernet channel 1 or Ethernet channel 2.
2	-	-	Not used
3	-	-	Not used
4	-	-	Not used
5	ON	OFF	The baud rate for the F 8628X module is set via switches 2/5-8 (See Table 6).
6	ON	OFF	
7	ON	OFF	
8	ON	OFF	

Table 6: Functions of switch 2 (S2)

4.2.1 Switch 2/5-8

The switches 2/5-8 are used to set the F 8628X module's baud rate for communicating as a PROFIBUS-DP slave.

Switch 2	Baud rate
On Off       	9.6 kBit/s
On Off       	19.2 kBit/s
On Off       	93.75 kBit/s
On Off       	187.5 kBit/s
On Off       	500 kBit/s
On Off       	1.5 MBit/s
On Off       	3 MBit/s
On Off       	6 MBit/s
On Off       	12 MBit/s
On Off       	45.45 kBit/s ¹⁾

Table 7: Settings of switch 2/5-8

Legend:

Positions white switch:

On  White switch in position OFF
 Off  White switch in position ON
 Not used switch

5 Ethernet connection via the F 8628X

5.1 Determining the F 8628X IP address

For all OS versions the F 8628X IP address is determined from the resource name of the loaded user program.

The IP address is composed of the network address and the host address. The default network address is **192.168.0**.

The last byte of the IP address 192.168.0.x is the host address and is calculated as follows:

For ethernet module channel 1 (switch 2/1 = ON)

Host address = (the last two digits of the resource name) * 2 + 1

For ethernet module channel 2 (switch 2/1 = OFF)

Host address = (the last two digits of the resource name) * 2 + 2

Note	The resource name must have eight characters and the last two characters (Res-ID) must be numbers!

Permitted ID's:

1 up to 99 (beginning with H41q/H51q OS version (05.34))

Example:

Resource name MT200_**33**, module channel 1 (switch 2/1 = ON)

Host address: $33 * 2 + 1 = 67$; IP address = 192.168.0.**67**

Resource name MT200_**33**, module channel 2 (switch 2/1 = OFF)

Host address: $33 * 2 + 2 = 68$; IP address = 192.168.0.**68**

F 8628X settings upon delivery

IP address 192.168.0.63 (switch 2/1 ON) or 192.168.0.64 (switch 2/1 OFF).

Switch ID_IP is deactivated (switch 1/6 OFF).

5.2 ELOP II TCP connection to the central module (CM)

Via the PADT (PC), the user can establish an ELOP II TCP connection to the F 865x central module via the F 8628X.

The ELOP II TCP connection provides a fast data exchange between a PADT and the F 865x central module.

Res-ID: The Res-ID is identical to the last two numbers of the resource name.

ID: The ID is set via DIP switches 1 to 7 on the F 865x central module.

5.2.1 Requirements for a ELOP II TCP connection

- F 865x central module OS version (05.34) or higher
- ELOP II, version 4.1 build (6118) or higher
- F 8628X Ethernet module OS version 4.x or higher
- HSR cable in redundant systems

5.2.2 Connection of ELOP II PADT (PC) to F 8628X

A PADT can only connect to a H41q/H51q via a single F 8628X on the H41q/H51q (even in cases of redundancy).

The selected F 8628X transfers the telegrams to the associated F 865x central module and via the HSR cable (BV 7053) to the redundant F 8628X and the associated F 865x central module. The HSR cable between the two redundant F 8628X enables the communication to both central modules as well as the "Reload" of a redundant H41q/51q.

Note	For ELOP II TCP connection, any free IP address for the PADT may be used. If the PADT IP addresses and the F 8628X are located in the same subnet, a routing entry for the subnet of the F 8628X is not required on the PADT (Chapter 5.2.6.1).

Note	Carefully check that no other participant (e.g. H41q/H51q , OPC server or PC) has the same IP address, as this could cause communication problems. Next time, when expanding communication, please consider the H41q/H51q and the OPC server IP-addresses.

5.2.3 Create ELOP II TCP connection to a H41q/H51q

Perform the following settings on the H41q/H51q:

- Activate the ID_IP (switch 1/8 ON) on the F 8628X .
- Set channel 1 or channel 2 on the module F 8628X (see chapter 5.1).
- Set the redundant channel (if available) on the redundant module F 8628X (see chapter 5.1).
- Make sure that a proper operating system OS Version (05.34) or higher is loaded in the F 865x central modules.
- Set the same number for the "ID" on the F 865x central module (DIP switches, see F 865x data sheet), which is used as Res-ID in the resource name (last two digits of the resource name).

If necessary, delete the User Program of the Central Module F 865x

If a user program with a wrong resource name (e.g. no or wrong Res ID) exists in the F 865x, no ELOP II TCP connection can be established.

Delete the user program with the wrong resource name, so that the F 8628X can determine the IP address from the F 865x ID settings (DIP switches 1-7).

Note Please refer to the manual "Functions of the operating system BS41q/H51q (HI 800 105)" for further information about "Erasing the user program".

Perform the following Settings in ELOP II

- Create a resource, having a name from which the required IP address can be determined (see chapter 5.1).
- In the dialog "cabinet layout" add the F 8628X module icons for the documentation of the cabinet allocation.

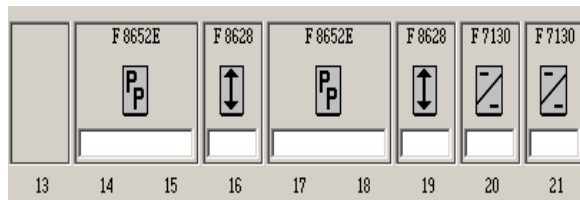


Figure 3: Cabinet Layout

- Open the context menu of the resource and select *Properties*.

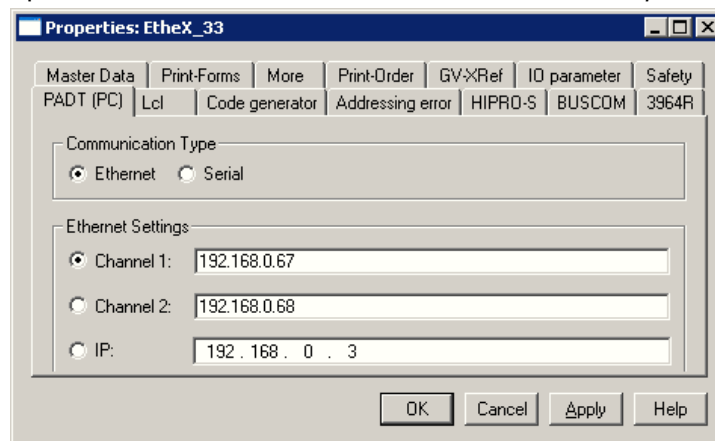


Figure 4: ELOP II dialog "Properties"

- Open the tab *PADT (PC)* and select the communication type *Ethernet*.
- Select one of the IP addresses *channel1* or *channel2* which are determined by ELOP II. By this the F 8628X connected to the PADT is selected.
- Click "OK" to close the "Properties" dialog with "OK".

Load the User Program into the H41q/H51q

- Connect the selected F 8628X with the PADT corresponding to a connection from chapter 5.2.5.

Note In case of a redundant H41q/H51q, make sure that the HSR cable (BV 7053) is plugged; otherwise there is no access available to the redundant central module F 865x.

- Open the context menu of the resource and select *Control Panel*.
If a connection has been established, "OK" appears in the field "Communication".

- Load the user program into the central module(s) F 865x using "Download/Reload".
- Start the H41q/H51q controller.

In case of problems with the ELOP II TCP communication see also chapter 5.2.6.

5.2.4 Upgrade of a H41q/H51q to ELOP II TCP without system stop

Preconditions

A H41q/H51q controller may change to ELOP II TCP without a system stop if the following conditions are fulfilled:

- The conditions for a ELOP II TCP connection are fulfilled (see chapter 5.2.1).
- A suitable operating system OS version (05.34) or higher must be loaded in the central module(s) F 865x.
- In the F 865x a user program must exist having a resource name , from which the F 8628X can determine an IP address.
- On all F 865x the same number for the ID must be set, which is used as Res ID in the resources name. For the reading of the ID, see manual "functions of the operating system BS41q/H51q" (HI 800 105).

Installation of the F 8628X module

For installation of the F 8628X Consider chapter 2.2.

- On all F 8628X activate the ID_IP (switch 1/8 ON).
- Set channel 1 or channel 2 on the module F 8628X (see chapter 5.1).
- Set the redundant channel (if available) on the redundant module F 8628X (see chapter 5.1).
- Replace the existing modules F 8628 by F 8628X, by which the ELOP II TCP connection is carried out. If no F 8628X modules were used previously, then plug the F 8628X into the specified module slot.

Perform the following Settings in ELOP II

- Open the resource context menu and select *Properties*.
- Open the tab *PADT (PC)* and select the communication type *Ethernet*.
- Select one of the IP addresses *channel1* or *channel2* that are determined by ELOP II. By this the F 8628X connected to the PADT is selected.
- Click "OK" to close the "Properties" dialog with "OK".

Load the User Program into the H41q/H51q

- Connect the selected F 8628X to the PADT corresponding to a wiring from chapter 5.2.5.

Note	In case of a redundant H41q/H51q, make sure that the HSR cable (BV 7053) is plugged; otherwise no access possible to the redundant central module F 865x.

- Open the context menu of the resource and select *control panel*.
If a connection has been established, "OK" appears in the field "Communication"

In case of problems with the ELOP II TCP communication see also chapter 5.2.6.

5.2.5 ELOP II TCP connections to H41q/H51q controllers

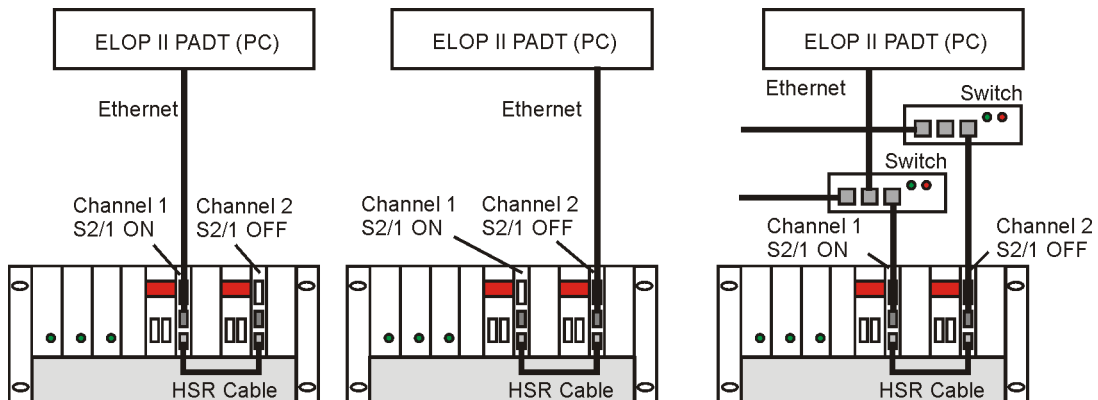
ELOP II TCP can operate on an existing Ethernet network.

Requirements for using an existing Ethernet network for the HIMA PES with F 8628X

- Network may only contain switches
- Full-Duplex (no collisions)
- Sufficient bandwidth for transmission
- Calculating the timeout with the delay time induced by active network components (e.g. switches, gateways) taken into account.

In case of direct connections (without switch) between the PADT and the H41q/H51q controller, a "cross over" Ethernet cable is required.

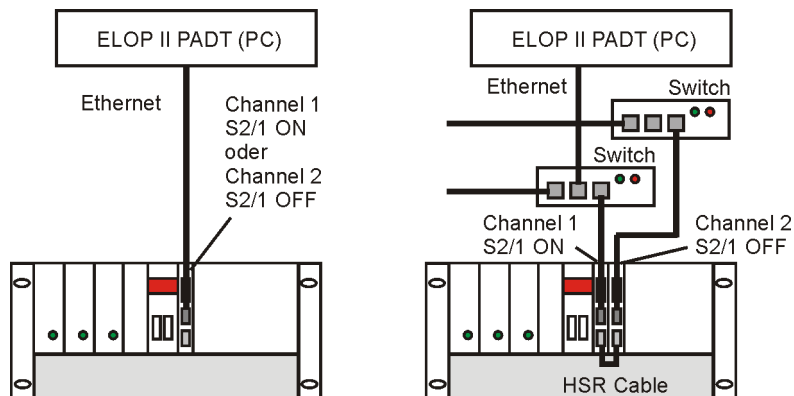
5.2.5.1 ELOP II TCP connections to redundant H41q/H51q controllers



The PADT can establish a connection to the H41q/H51q

- only via channel 1 (left figure).
- only via channel 2 (middle figure).
- only via channel 1 (right figure).

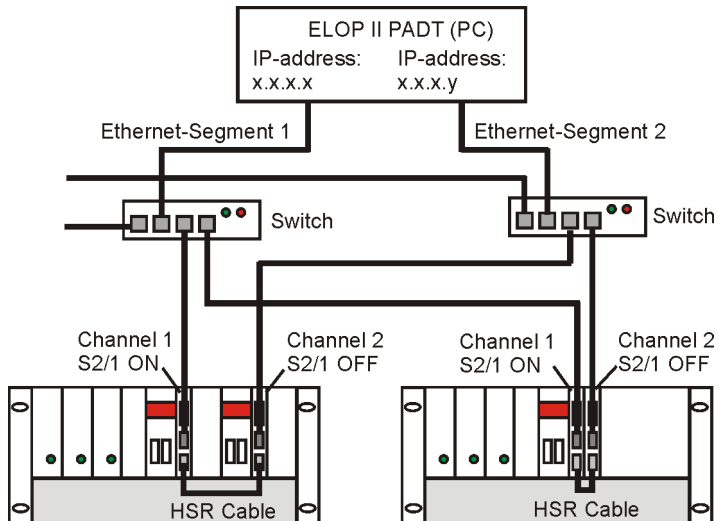
5.2.5.2 ELOP II TCP connections to mono H41q/H51q controller



The PADT can establish a connection to the H41q/H51q

- either via channel 1 or via channel 2 ,depending on F 8628X switch 2/1 (left figure).
- only via channel 1 (right figure).

5.2.5.3 ELOP II TCP connections to H41q/H51q controllers via a redundant network



The PADT can establish a connection to the H41q/H51q systems via ethernet segment 1 or ethernet segment 2.

A routing entry for each ethernet module of the PADT is required (see also chapter 5.2.6).



Others possibilities of the ELOP II TCP wiring shown above are not authorized and can cause problems!



Only communication modules of the same type may be connected to one another using the HSR cable (the connection between F 8627X and F 8628X is not permitted).

5.2.6 If ELOP II TCP communication can not be established

First check

- If ELOP II TCP wiring was correctly performed (see Chapter 5.2.5.1 to Chapter 5.2.5.3) and
- the F 865x ID (DIP switches 1-7) and the ressources RES-ID are identical.

Note	A H41q/H51q PES can only communicate with a single PADT. If the user accesses the same PES using a second PADT, he can establish a connection to this PES by repeatedly pushing the button "Initialize communication". Then the connection to the first PADT is disconnected and the message "2. PADT (PC) connected to the PES" is displayed in the control panel's "Communication" field.

5.2.6.1 Is the PADT (PC) network card located in the same subnet?**1. Determining the IP address of the PADT(PC) network**

- In MS-Windows, open the settings of the PADT network connections from the PADT.
- Select the network card used for connecting to the F 8628X.
- Select properties of the internet protocol.
 - If the network card is not located in the same F 8628X subnet "**192.168.0.x**", follow step 2 for creating a connection.
 - If the network card is located in the same subnet but no connection is available, check the connection using the function "Ping" specified in Chapter 5.2.6.3.

2. Establishing a network connection between a PC and an F 8628X, if they are located in different subnets.

- First method: Change the IP address of the PC network card in use
 - In the properties of the TCP/IP connection, enter a free IP address which is located in the same subnet as the F 8628X "**192.168.0.x**".
- Second method: Create a routing entry to the F 8628X on the PC
 - Start the "Dos Shell" on the PC
 - Enter the following command:
route add [IP address F 8628X] mask 255.255.255.255 [IP address PC]

Note	To ensure the routing entry remains permanent (e.g. after the PC is restarted), use the -p parameter with the route command. Example: route -p add . Check if the routing entry for connecting the PC network card to the F 8628X is correct by using the command route print .

- Start the ELOP II control panel to establish a connection to the F 8628X.

5.2.6.2 Connection problem after exchanging an F 8628X

The ARP entry on the PC must be deleted if the new F 8628X has the **same IP address** as the old F 8628X.

Otherwise the new F 8628X with the same IP address cannot be connected to the PADT (PC).

Example: Delete the ARP entry of an F 8628X with the IP address **192.168.0.67**.

- Start the "Dos Shell" on the PADT (PC).
- Enter the command **arp -d 192.168.0.67**.

5.2.6.3 Check the connection to the F 8628X using "Ping"

- Start the "Dos Shell" on the PADT (PC).
- Enter the command **Ping 192.168.0.x**.
- Messages generated by "Ping":
 - Ethernet connection is OK : "Reply from 192.168.0.x: bytes = 32 time < 4ms..."
If ELOP II connection is available check the resource settings in ELOP II.
 - Ethernet connection is not OK: "Request timed out."
Check the wiring, routing entry etc.

Note	If all steps described in this chapter have been followed and the F 8628X does not respond, check if other participants can be accessed using the PC's network card.

5.2.6.4 The F 8628X determines its IP address in accordance with the following priorities

1. The IP address is determined from the Resource ID (Res-ID) of the user program that is loaded in the F 865x.
The Res-ID of the user program always has a higher priority than the F 865x ID settings (DIP-switch 1-7).
2. The IP address is determined from the F 865x ID settings (DIP switches 1-7), if the Res-ID cannot be determined from the current user program's resource name and switch ID_IP is activated on the F 8628X (switch 1/6 ON).
3. IP address of the "Basic Configuration"
If no IP address can be determined using the Res-ID or ID (switch 1/6 OFF) as described in the first two cases, the last IP address determined on this F 8628X is used.

6 Parameter used in PROFIBUS-DP Master to reload a redundant H41q/H51q system

When reloading a redundant H41q/H51q system using a redundant PROFIBUS-DP connection, the PROFIBUS-DP communication is stopped for a short time after switching over to the central module that was loaded first.

To avoid failure reactions during the reload procedure, the downtime " t_{down} " must be considered when parameterizing the PROFIBUS-DP Master's redundancy management.

Estimating the downtime t_{down} for the PROFIBUS-DP Master

The following formula is used for estimating the downtime:

$$t_{\text{down}} < 200 \text{ ms} + \text{WDT} + t_{\text{master}}$$

t_{down} : Within this time, the F 8628X modules cannot communicate.

WDT: H41q/H51q system watchdog time.

t_{master} : The amount of time after loading central module 1 that the PROFIBUS-DP Master requires before the F 8628X communication module can exchange data.

The time " t_{master} " is at least 6 bus cycles (polling cycles). The user must determine the actual number of bus cycles (polling cycles) from the PROFIBUS-DP master settings or by using a bus analyzer.



The estimate (formula) is only suited for PROFIBUS-DP slave modules of type F 8628X. The PROFIBUS-DP slave modules must be set to a fixed baud rate (via switch 2/5-8). When reloading the redundant H41q/H51q systems, one must ensure that the central module 1 is loaded first.

7 Address mapping of the BUSCOM variables

7.1 Data types of BUSCOM variables

Overview, how the BUSCOM variables are represented and stored.

ELOP II (variable data types)	Process data mapping on the F 8628X	Size of data types on the F 8628X and F 865x
BOOL	BOOL	1 Byte
WORD (WORD INT UINT)	WORD	2 Bytes

Table 8: Data type definitions

All 2 Byte data types configured in ELOP II as BUSCOM variables are transmitted as WORD. 1 Byte data types (e.g. Byte, SINT) must be packed into BUSCOM variables of data type WORD (e.g. with the function blocks "Pack" and "Unpack") such that they can be transmitted.

7.2 BUSCOM address of the F 865x central module

The user can set-up the BUSCOM Addresses of the BUSCOM variables by specifying the base and relative addresses in ELOP II.

The addresses of the BUSCOM variables are calculated on the central module F 865x as follows:

Base address + Relative address = BUSCOM address

The relative address must be set such that the BUSCOM address is located in the same range as the corresponding base address (see Table 9).

Note	The base address' settings are located in resource's properties. In the "BUSCOM" tab, the user can set the base address separately for Import, Export and Import/Export; however, using the standard base address settings is recommended.

The BOOL and WORD variables are stored within the import and export areas of the F 865x and further separated into 0 and 1 areas.

Ranges	BOOL (BUSCOM address)	WORD (BUSCOM address)
Import range 0 (Base address 0000)	0000 to 2047	0000 to 2047
Import range 1 (Base address 4096)	4096 to 8191	4096 to 8191
Export range 0 (Base address 0000)	0000 to 2047	0000 to 2047
Export range 1 (Base address 4096)	4096 to 8191	4096 to 8191

Table 9: BUSCOM variable ranges in the F 865x central module

7.3 Mapping of the BUSCOM variables on the F 8628X

To transmit the BUSCOM variables, they are mapped from the F 865x central module to the F 8628X communication module.

The BUSCOM variables from the F 865x are copied into two memory areas located in the F 8628X internal memory.

The memory areas EV and IV reflect the export and the import variables respectively. In the memory area, a BUSCOM variable is described by its identity number.

Note	This scheme for converting BUSCOM variables (on the F 865x) into identity numbers (on the F 8628X) is used for WORD as well as for BOOL variables.

7.3.1 Example 1

In this example the **WORD** variables in the export area 0 (on the F 865x) start with the BUSCOM address 0 and are mapped to the memory area EV (on the F 8628X) with the identity number 0.

The identity numbers of the WORD variables in memory area EV are in ascending order up to the last WORD variable (identity number 110) from export area 0.

In this example, the **BOOL** variables in export area 0 (on the F 865x) start with BUSCOM address 0 and are mapped to memory area EV (on the F 8628X) beginning with identity number 111, which follows the last identity number of the WORD variables (i.e. 110).

The identity numbers of the BOOL variables in memory area EV are in ascending order up to the last BOOL variable (identity number 150) from export area 0.

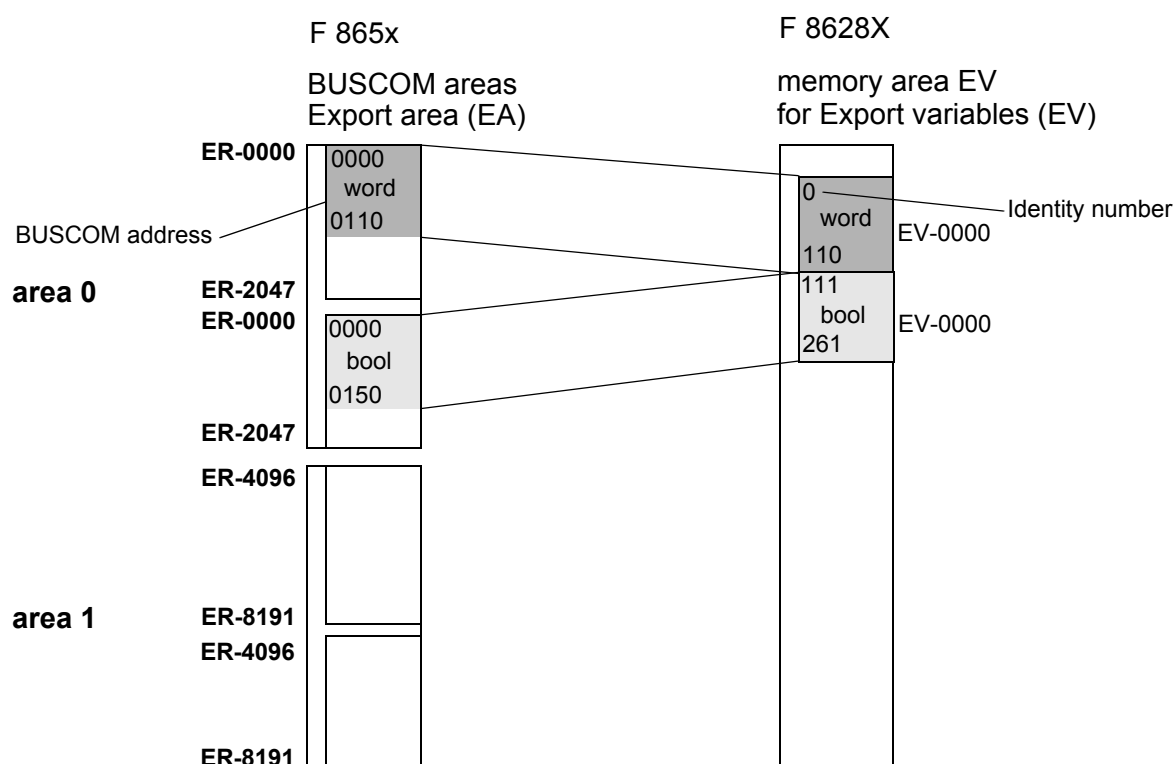


Figure 5: Mapping of the WORD- and BOOL-variables from the export area 0

7.3.2 Example 2

In this example the **BOOL** variables in the export area 0 (on the F865x) start with the BUSCOM address 0 and mapped to the memory area EV (on the F 8628X) with the identity number 0. The identity numbers of the BOOL variables in memory area EV are in ascending order up to the last BOOL variable (identity number 100) from export area 0.

In this example, the **BOOL** variables in export area 1 (on the F 865x) start with BUSCOM address 4096 and are mapped to memory area EV (on the F 8628X) beginning with identity number 101, which follows the last identity number of the BOOL variables (i.e. 100). The identity numbers of the BOOL variables in memory area EV are in ascending order up to the last BOOL variable 4196 from export area 1.

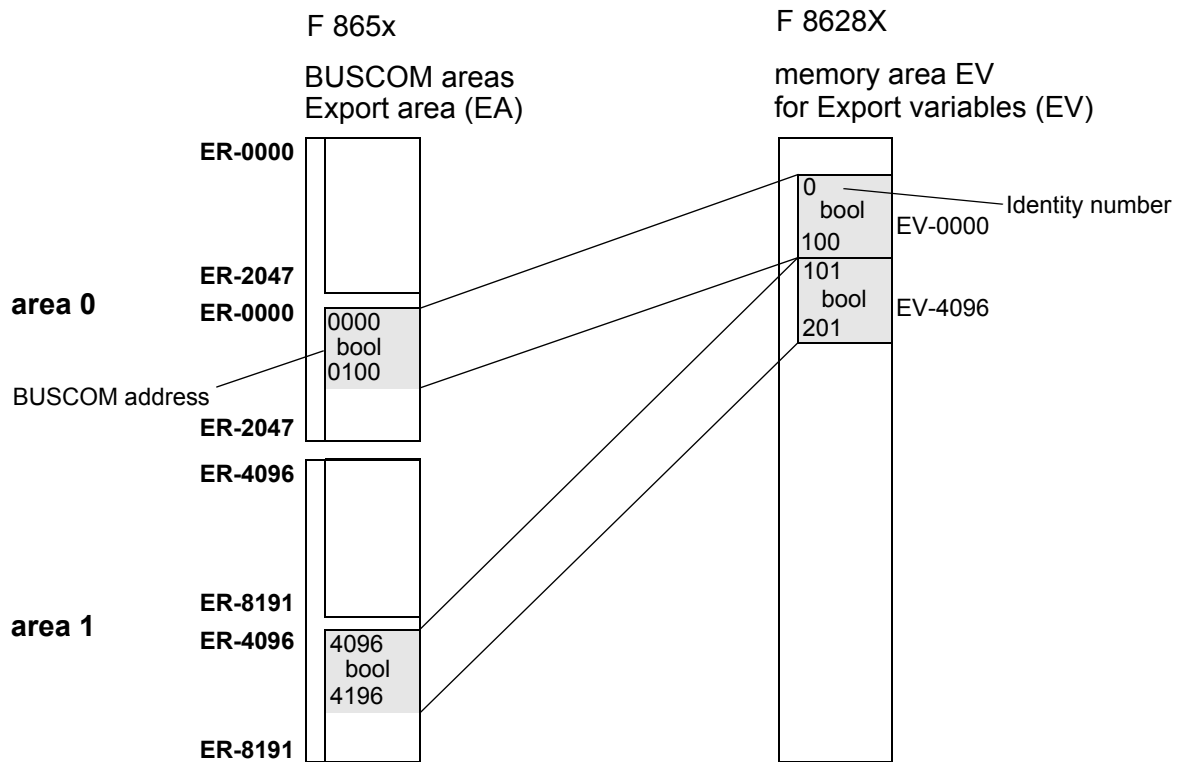


Figure 6: Mapping of the BOOL-variables from the export areas 0 and 1

7.3.3 Example 3

In this example, the **WORD** variables in export area 0 (on the F 865x) start with BUSCOM address 1 and are mapped to the memory area EV (on the F 8628X) beginning with identity number 1. The identity numbers of the WORD variables in memory area EV are in ascending order up to the last WORD variable (0110) from export area 0.

The unused BUSCOM address 0 is assigned a dummy variable and mapped to identity number 0 within memory area EV.

In this example, the **WORD** variables in export area 1 (on the F 865x) start with BUSCOM address 4100 and are mapped to the memory area EV (on the F 8628X) beginning with identity number 115. The identity numbers of the WORD variables in memory area EV are in ascending order up to the last WORD variable (4200) from export area 1.

The unused BUSCOM addresses 4096 to 4099 are assigned dummy variables and mapped to identity numbers 111 to 114 within memory area EV.

In this example, the **BOOL** variables in export area 0 (on the F 865x) start with BUSCOM address 0 and are mapped to the memory area EV (on the F 8628X) beginning with identity number 216 which follows the identity number 215 of the last WORD variable from export area 0. The identity numbers of the BOOL variables in memory area EV are in ascending order up to the last BOOL variable (0100) from export area 0.

In this example, the **BOOL** variables in export area 1 (on the F 865x) start with BUSCOM address 4096 and are mapped to the memory area EV (on the F 8628X) beginning with identity number 317 which follows the identity number 316 of the last BOOL variable from export area 0.

The identity numbers of the BOOL variables in the memory area EV are ascending up to the last BOOL variable 4196 from the export area 1.

Note If BUSCOM variables do not start at the beginning of an area, this area is padded with dummy variables on the central module and also mapped on the communication module.

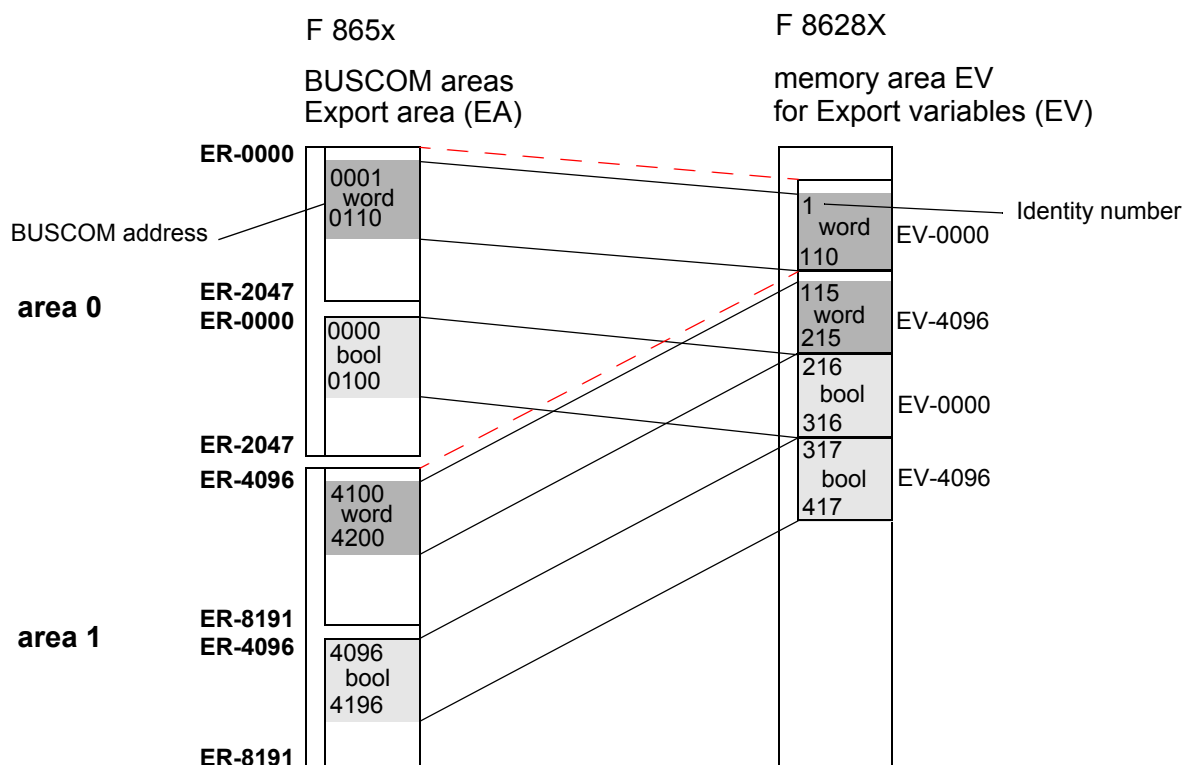


Figure 7: Mapping of the WORD- and BOOL-variables from the export area 0 and 1

8 Characteristics of the PROFIBUS DP transmission

On the PROFIBUS-DP's physical layer, the data are transferred in accordance with the RS-485 standard.

The following table presents the basic technical features of the RS 485 transmission used for PROFIBUS-DP.

Area	Sizes	Remark
Network topology	Linear bus, active bus termination on either end	Branch lines should be avoided.
Medium	Shielded, twisted cable	Shielding can be omitted depending on the environmental conditions.
Number of stations	32 stations in each segment without repeater	With repeaters, expandable up to 126 stations
Connectors	9-pole SUB-D connector	Available from HIMA

Table 10: Characteristics of the RS 485 transmission technology

8.1 Bus dependencies between cable length and baud rate

Baud rate	Range / Segment
9.6 kBit/s	1200 m
19.2 kBit/s	1200 m
45.45 kBit/s	1200 m
93.75 kBit/s	1200 m
187.5 kBit/s	1000 m
500 kBit/s	400 m
1.5 MBit/s	200 m
3 Mbit/s	100 m
6 Mbit/s	100 m
12 MBit/s	100 m

Table 11: Dependencies between cable length and baud rate

Cable lengths specified in Table 11 refer to cable type A with the following parameters:

- Surge impedance 135 Ω up to 165 Ω
- Capacitance per unit length < 30 pF/ m
- Loop resistance 110 W / km
- Core diameter 0.64 mm
- Core cross-section > 0.34 mm²

8.2 Bus connection and termination

The PROFIBUS-DP bus termination consists of a resistance combination ensuring a defined zero potential on the bus.

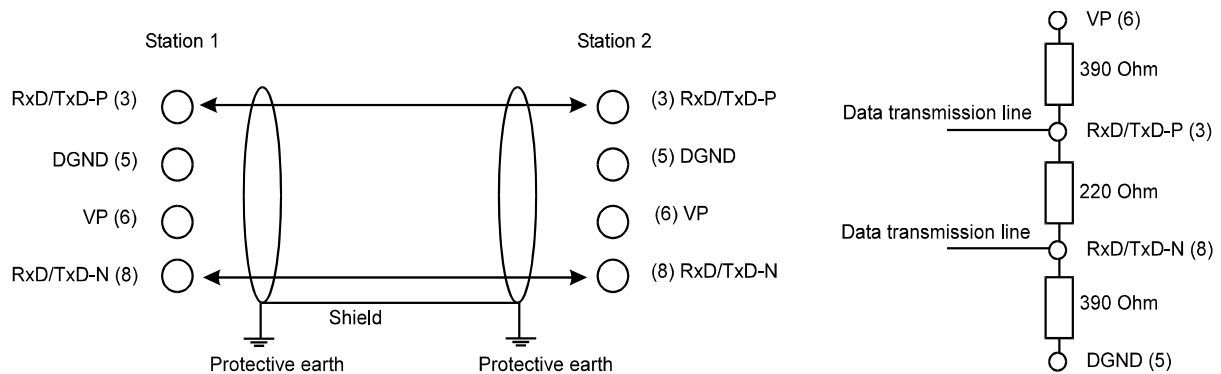


Figure 8: Bus connection and termination, pin assignment of the field bus interface

8.3 PROFIBUS-DP bus cable

In the IEC 61158, two bus cable types are specified. Cable type "A" may be used for all transfer rates up to 12 Mbps. Cable type "B" is outdated and should not be used any longer.

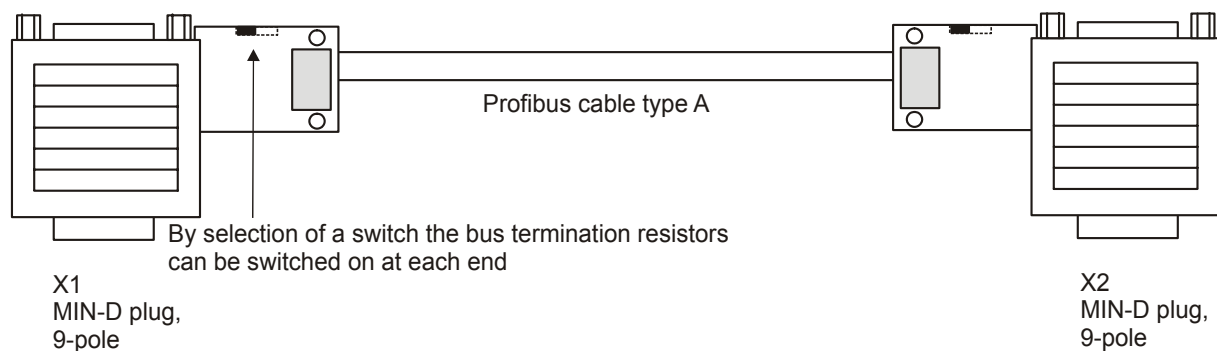


Figure 9: PROFIBUS-DP bus cable, Type A, with bus connector Plug

Note When using the F 8628X Ethernet interface (e.g. for ELOP II TCP), the straight PROFIBUS connector should be utilized. An angled connector might have to be removed to reach the F 8628X Ethernet interface.

The following table specifies the PROFIBUS connectors used within HIMA.

PROFIBUS Plug	PHOENIX CONTACT Description	HIMA Number
Axial	SUBCON-PLUS-PROFIB/AX/SC	52 000 9397
Angled plug, with additional PG connection	SUBCON-PLUS-PROFIB/PG/SC2	52 000 9394

Table 12: PROFIBUS connectors manufactured by PHOENIX CONTACT

9 Configuring the PROFIBUS-DP slave using a PROFIBUS-DP Master

Via the FB interface, the HIMA PROFIBUS-DP slaves enables the PES to be connected with a PROFIBUS-DP.

Using this function, a PROFIBUS-DP master can read and write BUSCOM variables.

To configure the HIMA PROFIBUS-DP slave, the HIMA PROFIBUS-DP master must have the PROFIBUS-DP configuration software. This software may appear as displayed in Figure 10.

The user can define variable windows. There are four reading and four writing windows. These windows must be configured in the parameter range (parameter data) within the master PROFIBUS-DP configuration software, see Figure 12.

The PROFIBUS-DP master can thus address data in accordance with standards. The user data length of the PROFIBUS-DP telegrams results from the window definition. The PROFIBUS-DP master must then parameterize and configure these telegrams for the HIMA PROFIBUS-DP slave as a modular slave in accordance with the standard (via HIMA GSD file).

The HIMA PROFIBUS-DP slave is a modular slave. Modules are therefore included in the communication module GSD file (HIQ200EA.GSD). They are used to set the number of input and output bytes so that they correspond to the total of the parameterized windows (Figure 13).

Slave Configuration

General

Device: F8628 Station address: 2

Description: HIMA Profibus-DP Slave

☒ Activate device in actual configuration

☒ Enable watchdog control GSD file: HIQ200EA.GSD

Max. length of in-/output data: 256 Byte Length of in-/output data: 0 Byte

Max. length of input data: 240 Byte Length of input data: 0 Byte

Max. length of output data: 240 Byte Length of output data: 0 Byte

Max. number of modules: 32 Number of modules: 0

Module	Inputs	Outputs	In/Out	Identifier
DP-Input/ELOP2-Export: 1 Word	1 Word			0x50
DP-Input/ELOP2-Export: 2 Word	2 Word			0x51
DP-Input/ELOP2-Export: 4 Word	4 Word			0x53
DP-Input/ELOP2-Export: 8 Word	8 Word			0x57
DP-Input/ELOP2-Export: 16 Word	16 Word			0x5F
DP-Output/ELOP2-Import: 1 Byte		1 Byte		0x20
DP-Output/ELOP2-Import: 2 Bytes		2 Byte		0x21
DP-Output/ELOP2-Import: 4 Bytes		4 Byte		0x23

Idx	Module	Type	I Addr.	Type	O Addr.

Assigned master
Station address 1
1 / Other DP device

Actual slave
Station address 2
HIMA Profibus-DP Slave
2 / F8628

Buttons: OK, Cancel, Parameter Data ..., Append Module, Remove Module, Insert Module

Figure 10: Slave configuration of the HIQ200EA.GSD file in a PROFIBUS-DP master with a selection of available modules

9.1 Data formats

The following description concerns the telegram user data only.

Please we refer to the EN 50 170 standard for further information about telegram data.

The BUSCOM data type **WORD** appears in a telegram as 2 consecutive bytes in big-endian format.

During the transmission, the BUSCOM data type **BOOL** is compressed such that up to 8 consecutive variables defined in the import/export range are packed in one byte. The TRUE value corresponds to 1, and the FALSE value corresponds to 0. The numbering of the Boolean BUSCOM variables in the bits of the byte begins at bit 0 and ends at bit 7. This corresponds to Boolean variable [a] to Boolean variable [a+7]. If integer multiples of 8 consecutive Boolean variables have not been defined in one range/data pool, the remaining bits of the last byte will remain undefined.

If Word variables follow a row of Boolean variables, the Word variables begin in the subsequent byte.

9.2 Addressing

The BUSCOM variables are addressed using their identity number, which is used to replace the BUSCOM address.

The window definition for PROFIBUS INPUT and OUTPUT appears as follows:

Range	Parameters	PROFIBUS INPUT	PROFIBUS OUTPUT
Export 1	[0,1] = Start identity number [2,3] = Number of variables	X	
Export 2	[4,5] = Start identity number [6,7] = Number of variables	X	
Export 3	[8,9] = Start identity number [10,11] = Number of variables	X	
Export 4	[12,13] = Start identity number [14,15] = Number of variables	X	
Import 1	[16,17] = Start identity number [18,19] = Number of variables		X
Import 2	[20,21] = Start identity number [22,23] = Number of variables		X
Import 3	[24,25] = Start identity number [26,27] = Number of variables		X
Import 4	[28,29] = Start identity number [30,31] = Number of variables		X

Table 13: Window definitions for PROFIBUS-DP input and output

The parameter range (parameter data in the master PROFIBUS-DP configuration software) consists of 32 byte initialized with 00 hex. In the PROFIBUS-DP master, they are set to their values (Figure 10).

The first 16 bytes (byte 0 to 15) describe the export variable windows; the last 16 bytes (byte 16 to 31) describe import variables of the communication module.

In ELOP II, export variables correspond to PROFIBUS input variables and import variables in ELOP II correspond to PROFIBUS output variables (modules in Figure 13).

The data in the parameter range (parameter data) each consist of 2 bytes forming a big-endian

coded 16 bit word.

The start identity number corresponds to an identity number in the corresponding data pool of the communication module. The number of variables determines the number of variables to be transmitted beginning with the start identification number.

The size of window always comprises integer bytes and is determined by the data types defined by the window and the number of data types (compressed or uncompressed).

The total of the sizes of the 4 export windows determines the user data length of the PROFIBUS INPUT telegram. The total of the sizes of the 4 import windows determines the length of the OUTPUT telegram.

The user data length of INPUT and OUTPUT together must not exceed 256 bytes. With this e.g. 2048 Boolean variables may be transmitted.

In accordance with the limit value specified in the PROFIBUS EN 50170 standard, a maximum of 240 bytes may be configured for INPUT or OUTPUT (i.e. up to 1920 Boolean variables in one direction).

The start identity number must have a value valid for the corresponding data pool of the communication module, i.e. a variable with this identity number must have been defined in this data pool. Also, beginning with this variable, a number of further variables must have been defined.

A window may have a sequence of variables of different types (i.e. both Bool and Word). Data are only compressed for the variables within one window.

If a window definition is not used, 0 must be entered for the start identification number and the number of variables.

9.3 Addressing example

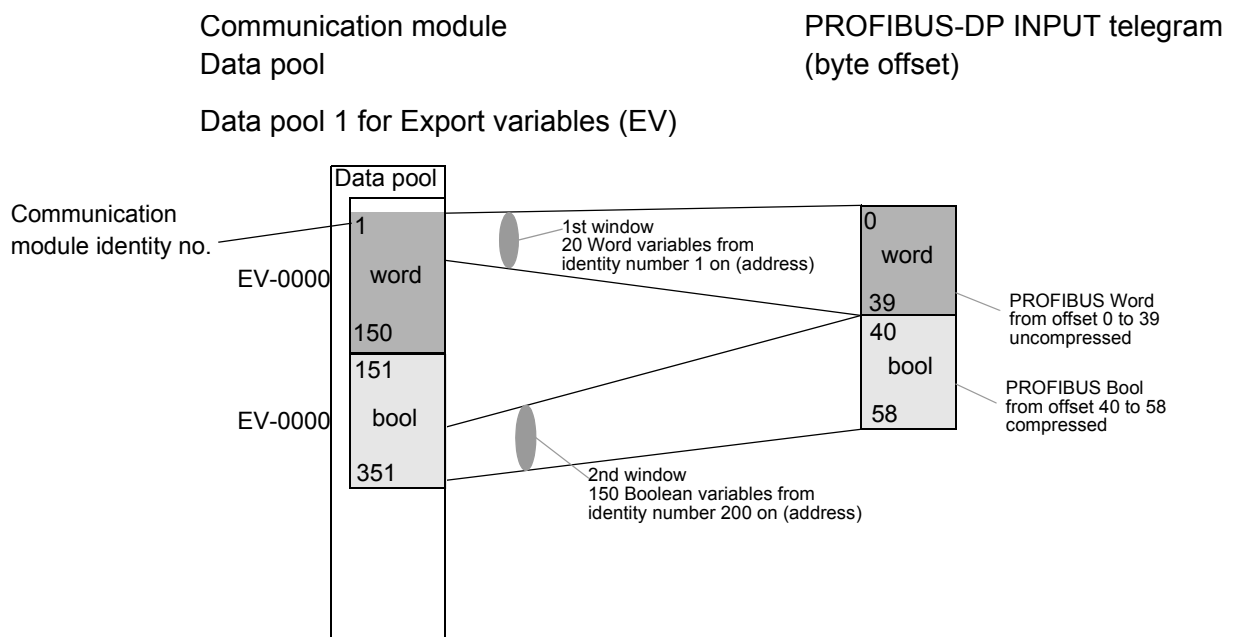


Figure 11: Example of address mapping for PROFIBUS-DP export variables (and for import variables accordingly)

The two export variable windows from data pool 1 are placed transparently onto the PROFIBUS-DP. The PROFIBUS-DP INPUT telegram has a user data length of 59 bytes (0 to 58). It has the following structure:

- 1st window: start of the variables beginning with identity no. 1. (1 dec = 0001 hex in big-endian format); number of variables: 20 (20 dec = 0014 hex). From identity no. 1 to 20, there are Word variables which cannot be compressed. Each word variable requires 2 bytes. A user data length of 40 bytes is generated (byte 0 to 39).

- 2nd window: start of the variables beginning with identity no. 200 (200 dec = 00C8 hex); number of variables: 150 (150 dec = 0096 hex).
From identity no. 200 to 349 there are Boolean variables which can be compressed into bytes (150 / 8 = 18.75). A user data length of 19 bytes is generated. (offset by 1st window, bytes 40 to 58)

Byte	Description	Value
0	1 parameter data byte 1. window	0x00 begin of the Word variables in
1	2 parameter data byte	0x01 hex data format 0x0001 = 1 dec
2	3 parameter data byte	0x00 number of Word variables 20
3	4 parameter data byte	0x14 0x0014 = 20 dec
4	5 parameter data byte 2. window	0x00 begin of the Boolean variables in
5	6 parameter data byte	0xC8 hex data format 0x00C8 = 200 dec
6	7 parameter data byte	0x00 number of Boolean variables 150
7	8 parameter data byte	0x96 0x0096 = 150 dec
8	9 parameter data byte	0x00
9	10 parameter data byte	0x00
10	11 parameter data byte	0x00
11	12 parameter data byte	0x00
12	13 parameter data byte	0x00

Figure 12: Example of address mapping for the export parameter data in the PROFIBUS-DP master

Module	Inputs	Outputs	In/Out	Identifier
DP-Input/ELOP2-Export: 1 Byte	1 Byte			0x10
DP-Input/ELOP2-Export: 2 Bytes	2 Byte			0x11
DP-Input/ELOP2-Export: 4 Bytes	4 Byte			0x13
DP-Input/ELOP2-Export: 8 Bytes	8 Byte			0x17
DP-Input/ELOP2-Export: 16 Bytes	16 Byte			0x1F
DP-Input/ELOP2-Export: 1 Word	1 Word			0x50
DP-Input/ELOP2-Export: 2	2 Word			0x51
DP-Input/ELOP2-Export: 4	4 Word			0x53

Idx	Module	Type	I Addr.	Type	O Addr.
1	DP-Input/ELOP2-Export: 16 Words	Iw	0		
1	DP-Input/ELOP2-Export: 8 Bytes	IB	0		
1	DP-Input/ELOP2-Export: 16 Bytes	IB	0		
1	DP-Input/ELOP2-Export: 2 Bytes	IB	0		
1	DP-Input/ELOP2-Export: 1 Byte	IB	0		

Figure 13: Example of address mapping for the PROFIBUS-DP input telegram, user data length of 59 bytes in 5 modules

10 Replace of the operating system

10.1 Upgrading/downgrading the operating system versions of the F 8628X

The following instructions describe the upgrade/downgrade the operation systems for the F 8628X module.



The upgrade/downgrade may be done only by HIMA service engineers. It is recommended to change the operating system only in the time of a shutdown of the plant.

10.1.1 Upgrading/downgrading from version 2.x

To upgrade/downgrade version 2.x, the operating system file with extension ***.flash** must be loaded.

Since the F 8628X has the same operating system as the F 8627X, the F 8628X must use the same operating system file.



When upgrading from version 2.x to another version, the user must ensure that only the correct operating system file is loaded into the corresponding module.

If the module F 8628X was loaded with any incorrect file, the functionality of the F 8628X is lost and can not be programmed any longer with the diagnostic dialog ComEth. In this case the module F 8628X must be programmed new by HIMA.

After an upgrade to version 3.x and higher a protection mechanism is activated and only operating system files with the extension ***.ldb** can be loaded.

10.1.2 Upgrading/downgrading from version 3.x and higher

To upgrade/downgrade version 3.x and higher, the operating system file with extension ***.ldb** must be loaded.

Since the F 8628X has the same operating system as the F 8627X, the F 8628X must use the same operating system file.



After downgrading to version 2.x, the protection mechanism preventing incorrect files from being loaded is no longer active!

10.2 Download of the operating system to the F 8628X

The operating system download for the module F 8628X is done using the diagnosis dialog **ComEth**.



The connection between the **ComEth**'s control panel and the F 8628X Ethernet module should be closed, if **ComEth** is not used.
The connection to the **ComEth**'s diagnosis panel can remain.

- Start the ComEth diagnosis dialog and check in the error-state viewer that the
 - "main program version" is 0.8.0 or higher
 - "diagnostic text version" is 0.2.0 or higher.
- Select *Project->New* on the menubar of the ComEth diagnosis dialog, to create a new Project.
- Select *New Configuration* in the context menu of the new project, to create a new configuration.
- Select *New Resource* in the context menu of the new configuration, to create a new resource.
- Select *New F 8628X* in the context menu of the new resource, to create a new F 8628X in the new resource.
- Select *Properties* in the context menu of the new F 8628X, to open the dialog window "Properties".

Configure the input fields as follows:

- Enter any unique name for the F 8628X (e.g. CU1CM1) in the input field.
- In the input field "IP address", enter the IP address of the F 8628X module into which the operating system is to be loaded. For determining the IP address of the F 8628X module, (see Chapter 5.1).
- The view box "IP address PC" displays all IP addresses of the available PADT (PC) network cards. Select the IP address of the network card to be used for creating the connection to the F 8628X module.

Note

OS versions < V4.x

The PADT (PC) IP address must:

- be located in the same subnet as the F 8628 module.
- have an IP address from 192.168.0.201 up to 192.168.0.254.

If several network cards are available on the PADT (PC), a corresponding routing entry must be set for the network card which is used for connection to the F 8628.

OS versions ≥ V4.x

Any free IP address for the PADT may be used. If the PADT IP addresses of the PADT and the F 8628X are located in different subnets, a routing entry for the subnet of the F 8628X is required on the PADT (PC).

- Select *Control Panel* in the context menu of the new F 8628X to open the Control Panel.
- Select *PADT->Connect* in the control panel to create a connection to the F 8628X module.



The next step causes a communication loss, if no redundant F 8628X module exists or if the redundant module does not have any connection!

- Click the button *Stop Device* in the ComEth control panel, to set the F 8628X module into the STOP state (green RUN LED blinks).
 - Select *Extra->OS Update* in the ComEth control panel to open the standard dialog for opening a file.
 - Select and load the **proper** operating system for the upgrade/downgrade into the selected F 8628X module (see Chapter 10.1.1 and Chapter 10.1.2).
-



If the operating system download of the F 8628X was aborted, then the F 8628X must **not** be withdraw!
Close the control panel of **ComEth** and open this again. Repeat the previous step to load the operating system of the F 8628X.

Note

After successfully downloading the operating system for the F 8628X, **the module F 8628X must be rebooted**. After the reboot the new operating system is started. Until then the F 8628X works with the old operating system.

To reboot the F 8628X:

- Remove and replace the F 8628X module or
 - select the function *Extra->Reboot Device* located in the ComEth Control Panel dialog.
 - Check the upgrade/downgrade
 - Select *PADT->Connect* in the control panel to create a new connection to the F 8628X module.
 - Select the tab *version* and check that the OS version displayed is the same as the OS version of the Upgrade/Downgrade.
 - If a redundant F 8628X module exists, follow the same procedure.
-

Note

The ARP entry must be deleted on the PADT (PC) if another F 8628X is to be loaded and has the **same IP address** as the F 8628X loaded immediately beforehand; otherwise, a connection cannot be opened to the newly loaded F 8628X with the same IP address.

Example: Delete the ARP entry of a F 8628X with the IP address **192.168.0.67**.

- Start the "Dos Shell" on the PADT (PC)
 - Enter the command **arp -d 192.168.0.67**.
-

11 Recommended literature

- [1] Safety Manual H41q/H51q
HIMA GmbH+Co KG Bruehl, 2005: HI 800 013

- [2] Functions of the Operating System H41q/H51q
HIMA GmbH+Co KG Bruehl, 2005: HI 800 105

- [3] Online Help in ELOP II
HIMA GmbH+Co KG Bruehl, 2005

- [4] First Steps ELOP II
HIMA GmbH+Co KG Bruehl, 2001: HI 800 000

- [5] HIMA OPC Server 3.0 Rev. 2
HIMA GmbH+Co KG Bruehl, 2004



F 8650X: Central module

Use in the PES H51q-MS, -HS, -HRS,

Safety-related, applicable up to SIL 3 according to IEC 61508

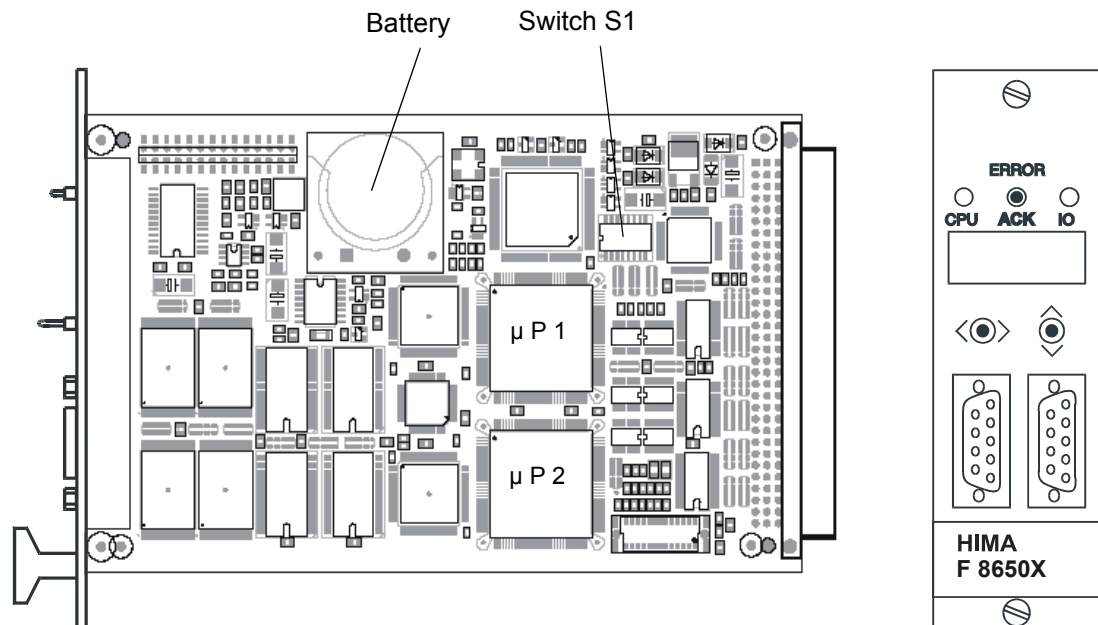


Figure 1: View

Central module with two clock-synchronized microprocessors

Microprocessors	INTEL 386EX, 32 bits
Clock frequency	25 MHz
Memory per microprocessor	
Operating System	Flash-EPROM 1 MB
User program	Flash-EPROM 1 MB *
Data	SRAM 1 MB *
	* Degree of utilization depending on operating system version
Interfaces	Two serial interfaces RS 485 with electric isolation
Diagnostic display	Four digit matrix display with selectable information
Shutdown on fault	Safety-related watchdog with output 24 V, loadable up to 500 mA, short-circuit proof
Construction	Two European standard PCBs, one PCB for the diagnostic display
Space requirement	8 SU
Operating data	5 V / 2 A

Setting of the bus station no. via switches S1-1/2/3/4/5/6/7:

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5
0 On ☐ Off ☐ not admissible	8 On ☐ Off ☐	16 On ☐ Off ☐	24 On ☐ Off ☐
1 On ☐ Off ☐	9 On ☐ Off ☐	17 On ☐ Off ☐	25 On ☐ Off ☐
2 On ☐ Off ☐	10 On ☐ Off ☐	18 On ☐ Off ☐	26 On ☐ Off ☐
3 On ☐ Off ☐	11 On ☐ Off ☐	19 On ☐ Off ☐	27 On ☐ Off ☐
4 On ☐ Off ☐	12 On ☐ Off ☐	20 On ☐ Off ☐	28 On ☐ Off ☐
5 On ☐ Off ☐	13 On ☐ Off ☐	21 On ☐ Off ☐	29 On ☐ Off ☐
6 On ☐ Off ☐	14 On ☐ Off ☐	22 On ☐ Off ☐	30 On ☐ Off ☐
7 On ☐ Off ☐	15 On ☐ Off ☐	23 On ☐ Off ☐	31 On ☐ Off ☐

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5
32 On ☐ Off ☐	40 On ☐ Off ☐	48 On ☐ Off ☐	56 On ☐ Off ☐
33 On ☐ Off ☐	41 On ☐ Off ☐	49 On ☐ Off ☐	57 On ☐ Off ☐
34 On ☐ Off ☐	42 On ☐ Off ☐	50 On ☐ Off ☐	58 On ☐ Off ☐
35 On ☐ Off ☐	43 On ☐ Off ☐	51 On ☐ Off ☐	59 On ☐ Off ☐
36 On ☐ Off ☐	44 On ☐ Off ☐	52 On ☐ Off ☐	60 On ☐ Off ☐
37 On ☐ Off ☐	45 On ☐ Off ☐	53 On ☐ Off ☐	61 On ☐ Off ☐
38 On ☐ Off ☐	46 On ☐ Off ☐	54 On ☐ Off ☐	62 On ☐ Off ☐
39 On ☐ Off ☐	47 On ☐ Off ☐	55 On ☐ Off ☐	63 On ☐ Off ☐

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5
64 On ☐ Off ☐	72 On ☐ Off ☐	80 On ☐ Off ☐	88 On ☐ Off ☐
65 On ☐ Off ☐	73 On ☐ Off ☐	81 On ☐ Off ☐	89 On ☐ Off ☐
66 On ☐ Off ☐	74 On ☐ Off ☐	82 On ☐ Off ☐	90 On ☐ Off ☐
67 On ☐ Off ☐	75 On ☐ Off ☐	83 On ☐ Off ☐	91 On ☐ Off ☐
68 On ☐ Off ☐	76 On ☐ Off ☐	84 On ☐ Off ☐	92 On ☐ Off ☐
69 On ☐ Off ☐	77 On ☐ Off ☐	85 On ☐ Off ☐	93 On ☐ Off ☐
70 On ☐ Off ☐	78 On ☐ Off ☐	86 On ☐ Off ☐	94 On ☐ Off ☐
71 On ☐ Off ☐	79 On ☐ Off ☐	87 On ☐ Off ☐	95 On ☐ Off ☐

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5		
96 On ☐ Off ☐			
97 On ☐ Off ☐			
98 On ☐ Off ☐			
99 On ☐ Off ☐			

Legend:

Positions white switch:

On ☐ Off ☐	Bit is set	On ☐ Off ☐	Bit is not set
White switch in position OFF		White switch in position ON	

Setting of the transmission rate with switch S1-8:

1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8
On ☐ Off ☐	S1-8 ON = 9600 bps	On ☐ Off ☐ S1-8 OFF = 57600 bps

Pin	RS 485	Signal	Meaning
1	-	-	not used
2	-	RP	5 V, decoupled by diodes
3	A/A'	RxD/TxD-A	Receive/Transmit Data A
4	-	CNTR-A	Control signal A
5	C/C'	DGND	Data Ground
6	-	VP	5 V, positive pole of power supply
7	-	-	not used
8	B/B'	RxD/TxD-B	Receive/Transmit Data B
9	-	CNTR-B	Control signal B

Table 1: Pin assignment of the interface RS 485, 9-pole

For the serial interface only the bus station no. 1-31 can be set.

Within an Ethernet network the bus station no. can be set from 1 to 99. Therefore the switches S1-6/7 must be set in addition to the switches S1-1/2/3/4/5.

The number of the communication partners within a network is still limited to 64.

This enhanced setting of the bus station no. is only possible from operating system BS41q/51q V7.0-8 (05.31) of the central module.

Applications with the communication module F 8627X:

- connection of the central module to a PADT (ELOP II TCP)
- connection to other communication partners within an Ethernet network (safeethernet, Modbus TCP)

The communication runs from the central module via the backplane bus to the communication module F 8627X and from the Ethernet ports of the F 8627X into the Ethernet network and vice versa.

Special features of the central module:

- Self-education: from operating system BS41q/51q V7.0-8 (05.31)
- ELOP II TCP: from operating system BS41q/51q V7.0-8 (05.31)

Further informations about the bus station no., ELOP II TCP, loading of operating systems and application programs (self-education) et al. corresponding to the central module you will find in the data sheet of the F8627X as well as the operating system manual of H41q/H51q and the safety manual of H41q/H51q.



Before removing a central module its fixing screws must be completely loosened and freely movable. Remove the module from the bus board by pushing the ejection lever (front label) top down and quickly removing in an upward motion to ensure that faulty signals are not triggered within the system!

To attach the module, place it on the terminal block and press it inwards as far as it will go. This action should be performed quickly to ensure that faulty signals are not triggered within the system!

Function of the ejection lever with front label

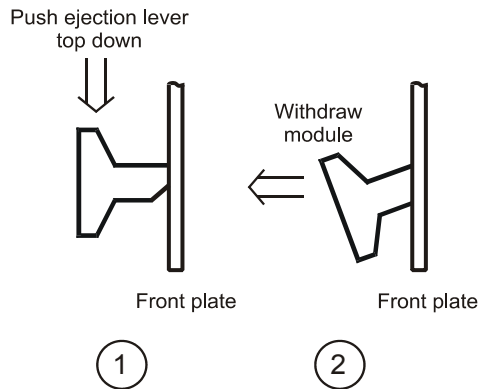


Figure 2: Function of the ejection lever

Diagnostic display of the central module

- Four digit alphanumerical display,
- two LEDs for the general display of errors (CPU for the central modules, IO for the testable input/output modules),
- two toggle switches to request detailed error information,
- push-button ACK resets the error indication;
in failure stop ACK behaves like restarting the system.

For further information on the diagnostic display and lists of error codes, refer to the documentation "Functions of the operational system BS 41q/51q" (also on ELOP II CD).

Notes for start-up and maintenance

- Lifetime of the buffer battery (*without* voltage feeding):
1000 days at $T_A = 25\text{ °C}$
200 days at $T_A = 60\text{ °C}$
- It is recommended to change the buffer battery (CPU in operation) at the latest after 6 years, or with display BATI within three months
(Lithium battery, e.g. type CR 2477N, HIMA part no. 44 0000018)
- Check the bus station no. and transmission rate at switch S1 for correct settings
- **Important:** When upgrading an F 8650 to an F 8650X module the fan concept has also to be changed!



F 8651X: Central module

Use in the PES H51q-M, -H, -HR,

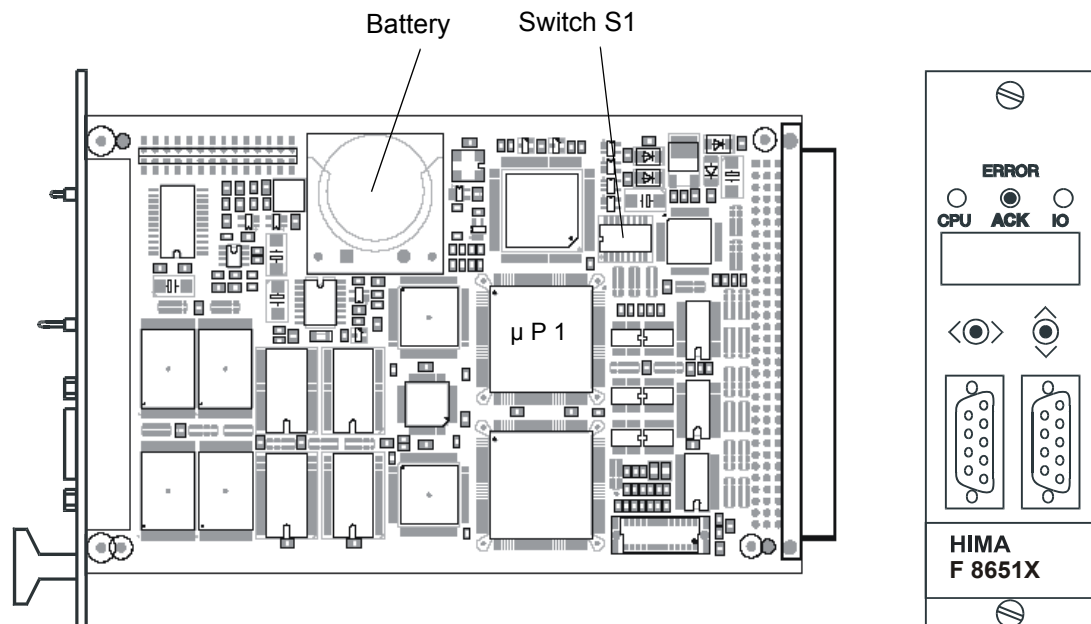


Figure 1: View

Microprocessor	INTEL 386EX, 32 bits
Clock frequency	25 MHz
Memory per microprocessor	
Operating System	Flash-EPROM 1 MB
User program	Flash-EPROM 1 MB *
Data	SRAM 1 MB *
	* Degree of utilization depending on operating system version
Interfaces	Two serial interfaces RS 485 with electric isolation
Diagnostic display	Four digit matrix display with selectable information
Shutdown on fault	Safety-related watchdog with output 24 V, loadable up to 500 mA, short-circuit proof
Construction	Two European standard PCBs, one PCB for the diagnostic display
Space requirement	8 SU
Operating data	5 V / 2 A

Setting of the bus station no. via switches S1-1/2/3/4/5/6/7:

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5
0 On ☐ Off ☐ not admissible	8 On ☐ Off ☐	16 On ☐ Off ☐	24 On ☐ Off ☐
1 On ☐ Off ☐	9 On ☐ Off ☐	17 On ☐ Off ☐	25 On ☐ Off ☐
2 On ☐ Off ☐	10 On ☐ Off ☐	18 On ☐ Off ☐	26 On ☐ Off ☐
3 On ☐ Off ☐	11 On ☐ Off ☐	19 On ☐ Off ☐	27 On ☐ Off ☐
4 On ☐ Off ☐	12 On ☐ Off ☐	20 On ☐ Off ☐	28 On ☐ Off ☐
5 On ☐ Off ☐	13 On ☐ Off ☐	21 On ☐ Off ☐	29 On ☐ Off ☐
6 On ☐ Off ☐	14 On ☐ Off ☐	22 On ☐ Off ☐	30 On ☐ Off ☐
7 On ☐ Off ☐	15 On ☐ Off ☐	23 On ☐ Off ☐	31 On ☐ Off ☐

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5
32 On ☐ Off ☐	40 On ☐ Off ☐	48 On ☐ Off ☐	56 On ☐ Off ☐
33 On ☐ Off ☐	41 On ☐ Off ☐	49 On ☐ Off ☐	57 On ☐ Off ☐
34 On ☐ Off ☐	42 On ☐ Off ☐	50 On ☐ Off ☐	58 On ☐ Off ☐
35 On ☐ Off ☐	43 On ☐ Off ☐	51 On ☐ Off ☐	59 On ☐ Off ☐
36 On ☐ Off ☐	44 On ☐ Off ☐	52 On ☐ Off ☐	60 On ☐ Off ☐
37 On ☐ Off ☐	45 On ☐ Off ☐	53 On ☐ Off ☐	61 On ☐ Off ☐
38 On ☐ Off ☐	46 On ☐ Off ☐	54 On ☐ Off ☐	62 On ☐ Off ☐
39 On ☐ Off ☐	47 On ☐ Off ☐	55 On ☐ Off ☐	63 On ☐ Off ☐

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5
64 On ☐ Off ☐	72 On ☐ Off ☐	80 On ☐ Off ☐	88 On ☐ Off ☐
65 On ☐ Off ☐	73 On ☐ Off ☐	81 On ☐ Off ☐	89 On ☐ Off ☐
66 On ☐ Off ☐	74 On ☐ Off ☐	82 On ☐ Off ☐	90 On ☐ Off ☐
67 On ☐ Off ☐	75 On ☐ Off ☐	83 On ☐ Off ☐	91 On ☐ Off ☐
68 On ☐ Off ☐	76 On ☐ Off ☐	84 On ☐ Off ☐	92 On ☐ Off ☐
69 On ☐ Off ☐	77 On ☐ Off ☐	85 On ☐ Off ☐	93 On ☐ Off ☐
70 On ☐ Off ☐	78 On ☐ Off ☐	86 On ☐ Off ☐	94 On ☐ Off ☐
71 On ☐ Off ☐	79 On ☐ Off ☐	87 On ☐ Off ☐	95 On ☐ Off ☐

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5
96 On ☐ Off ☐	97 On ☐ Off ☐	98 On ☐ Off ☐	99 On ☐ Off ☐

Legend:

Positions white switch:

On ☐ Off ☐	Bit is set	On ☐ Off ☐	Bit is not set
White switch in position OFF		White switch in position ON	

Setting of the transmission rate with switch S1-8:

1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8
On ☐ Off ☐	On ☐ Off ☐
S1-8 ON = 9600 bps	S1-8 OFF = 57600 bps

Pin	RS 485	Signal	Meaning
1	-	-	not used
2	-	RP	5 V, decoupled by diodes
3	A/A'	RxD/TxD-A	Receive/Transmit Data A
4	-	CNTR-A	Control signal A
5	C/C'	DGND	Data Ground
6	-	VP	5 V, positive pole of power supply
7	-	-	not used
8	B/B'	RxD/TxD-B	Receive/Transmit Data B
9	-	CNTR-B	Control signal B

Table 1: Pin assignment of the interface RS 485, 9-pole

For the serial interface only the bus station no. 1-31 can be set.

Within an Ethernet network the bus station no. can be set from 1 to 99. Therefore the switches S1-6/7 must be set in addition to the switches S1-1/2/3/4/5.

The number of the communication partners within a network is still limited to 64.

This enhanced setting of the bus station no. is only possible from operating system BS41q/51q V7.0-8 (05.31) of the central module.

Applications with the communication module F 8627X:

- connection of the central module to a PADT (ELOP II TCP)
- connection to other communication partners within an Ethernet network (safeethernet, Modbus TCP)

The communication runs from the central module via the backplane bus to the communication module F 8627X and from the Ethernet ports of the F 8627X into the Ethernet network and vice versa.

Special features of the central module:

- Self-education: from operating system BS41q/51q V7.0-8 (05.31)
- ELOP II TCP: from operating system BS41q/51q V7.0-8 (05.31)

Further informations about the bus station no., ELOP II TCP, loading of operating systems and application programs (self-education) et al. corresponding to the central module you will find in the data sheet of the F8627X as well as the operating system manual of H41q/H51q and the safety manual of H41q/H51q.



Before removing a central module its fixing screws must be completely loosened and freely movable. Remove the module from the bus board by pushing the ejection lever (front label) top down and quickly removing in an upward motion to ensure that faulty signals are not triggered within the system!

To attach the module, place it on the terminal block and press it inwards as far as it will go. This action should be performed quickly to ensure that faulty signals are not triggered within the system!

Function of the ejection lever with front label

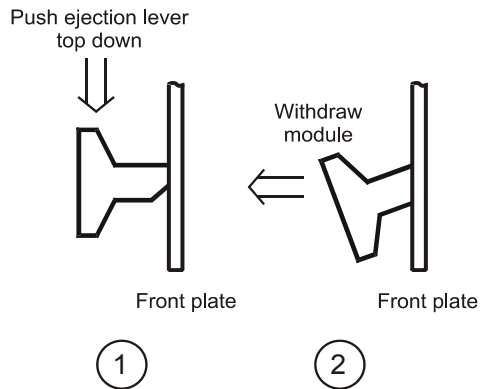


Figure 2: Function of the ejection lever

Diagnostic display of the central module

- Four digit alphanumerical display,
- two LEDs for the general display of errors (CPU for the central modules, IO for the testable input/output modules),
- two toggle switches to request detailed error information,
- push-button ACK resets the error indication;
in failure stop ACK behaves like restarting the system.

For further information on the diagnostic display and lists of error codes, refer to the documentation "Functions of the operational system BS 41q/51q" (also on ELOP II CD).

Notes for start-up and maintenance

- Lifetime of the buffer battery (*without* voltage feeding):
1000 days at $T_A = 25\text{ °C}$
200 days at $T_A = 60\text{ °C}$
- It is recommended to change the buffer battery (CPU in operation) at the latest after 6 years, or with display BATI within three months
(Lithium battery, e.g. type CR 2477N, HIMA part no. 44 0000018)
- Check the bus station no. and transmission rate at switch S1 for correct settings
- **Important:** When upgrading an F 8651 to an F 8651X module the fan concept has also to be changed!



F 8652X: Central module

Use in the PES H41q-MS, -HS, -HRS,

Safety-related, applicable up to SIL 3 according to IEC 61508

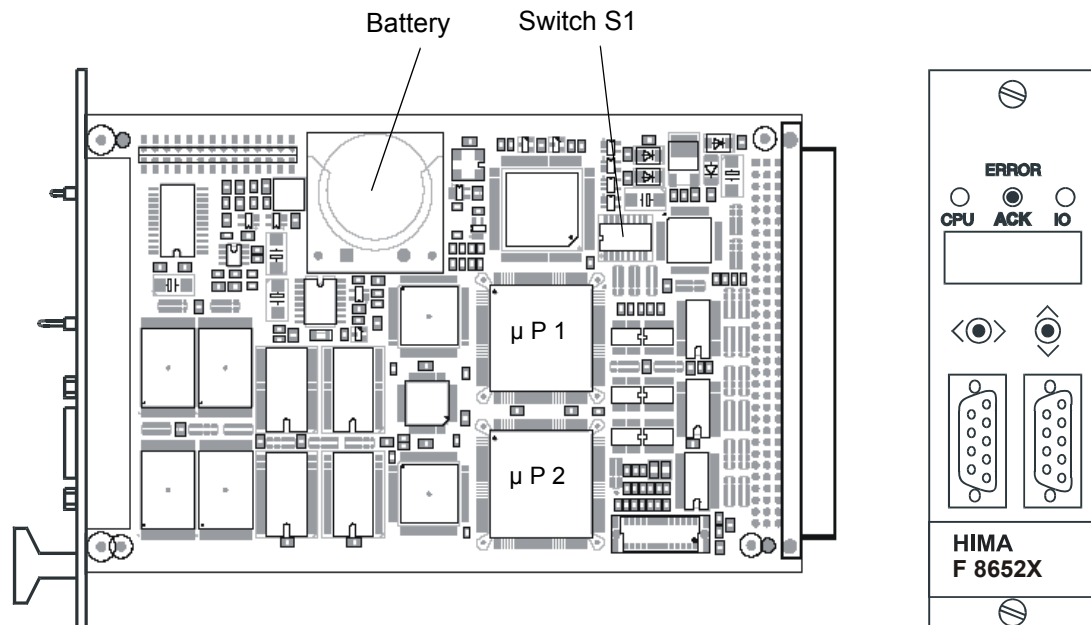


Figure 1: View

Central module with two clock-synchronized microprocessors

Microprocessors	INTEL 386EX, 32 bits
Clock frequency	25 MHz
Memory per microprocessor	
Operating System	Flash-EPROM 1 MB
User program	Flash-EPROM 1 MB *
Data	SRAM 1 MB *
	* Degree of utilization depending on operating system version
Interfaces	Two serial interfaces RS 485 with electric isolation
Diagnostic display	Four digit matrix display with selectable information
Shutdown on fault	Safety-related watchdog with output 24 V, loadable up to 500 mA, short-circuit proof
Construction	Two European standard PCBs, one PCB for the diagnostic display
Space requirement	8 SU
Operating data	5 V / 2 A

Setting of the bus station no. via switches S1-1/2/3/4/5/6/7:

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5
0 On ☐ Off ☐ not admissible	8 On ☐ Off ☐	16 On ☐ Off ☐	24 On ☐ Off ☐
1 On ☐ Off ☐	9 On ☐ Off ☐	17 On ☐ Off ☐	25 On ☐ Off ☐
2 On ☐ Off ☐	10 On ☐ Off ☐	18 On ☐ Off ☐	26 On ☐ Off ☐
3 On ☐ Off ☐	11 On ☐ Off ☐	19 On ☐ Off ☐	27 On ☐ Off ☐
4 On ☐ Off ☐	12 On ☐ Off ☐	20 On ☐ Off ☐	28 On ☐ Off ☐
5 On ☐ Off ☐	13 On ☐ Off ☐	21 On ☐ Off ☐	29 On ☐ Off ☐
6 On ☐ Off ☐	14 On ☐ Off ☐	22 On ☐ Off ☐	30 On ☐ Off ☐
7 On ☐ Off ☐	15 On ☐ Off ☐	23 On ☐ Off ☐	31 On ☐ Off ☐

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5
32 On ☐ Off ☐	40 On ☐ Off ☐	48 On ☐ Off ☐	56 On ☐ Off ☐
33 On ☐ Off ☐	41 On ☐ Off ☐	49 On ☐ Off ☐	57 On ☐ Off ☐
34 On ☐ Off ☐	42 On ☐ Off ☐	50 On ☐ Off ☐	58 On ☐ Off ☐
35 On ☐ Off ☐	43 On ☐ Off ☐	51 On ☐ Off ☐	59 On ☐ Off ☐
36 On ☐ Off ☐	44 On ☐ Off ☐	52 On ☐ Off ☐	60 On ☐ Off ☐
37 On ☐ Off ☐	45 On ☐ Off ☐	53 On ☐ Off ☐	61 On ☐ Off ☐
38 On ☐ Off ☐	46 On ☐ Off ☐	54 On ☐ Off ☐	62 On ☐ Off ☐
39 On ☐ Off ☐	47 On ☐ Off ☐	55 On ☐ Off ☐	63 On ☐ Off ☐

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5
64 On ☐ Off ☐	72 On ☐ Off ☐	80 On ☐ Off ☐	88 On ☐ Off ☐
65 On ☐ Off ☐	73 On ☐ Off ☐	81 On ☐ Off ☐	89 On ☐ Off ☐
66 On ☐ Off ☐	74 On ☐ Off ☐	82 On ☐ Off ☐	90 On ☐ Off ☐
67 On ☐ Off ☐	75 On ☐ Off ☐	83 On ☐ Off ☐	91 On ☐ Off ☐
68 On ☐ Off ☐	76 On ☐ Off ☐	84 On ☐ Off ☐	92 On ☐ Off ☐
69 On ☐ Off ☐	77 On ☐ Off ☐	85 On ☐ Off ☐	93 On ☐ Off ☐
70 On ☐ Off ☐	78 On ☐ Off ☐	86 On ☐ Off ☐	94 On ☐ Off ☐
71 On ☐ Off ☐	79 On ☐ Off ☐	87 On ☐ Off ☐	95 On ☐ Off ☐

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5
96 On ☐ Off ☐	97 On ☐ Off ☐	98 On ☐ Off ☐	99 On ☐ Off ☐

Legend:

Positions white switch:

On ☐ Off ☐	Bit is set	On ☐ Off ☐	Bit is not set
White switch in position OFF		White switch in position ON	

Setting of the transmission rate with switch S1-8:

1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8
On ☐ Off ☐	On ☐ Off ☐
S1-8 ON = 9600 bps	S1-8 OFF = 57600 bps

Pin	RS 485	Signal	Meaning
1	-	-	not used
2	-	RP	5 V, decoupled by diodes
3	A/A'	RxD/TxD-A	Receive/Transmit Data A
4	-	CNTR-A	Control signal A
5	C/C'	DGND	Data Ground
6	-	VP	5 V, positive pole of power supply
7	-	-	not used
8	B/B'	RxD/TxD-B	Receive/Transmit Data B
9	-	CNTR-B	Control signal B

Table 1: Pin assignment of the interface RS 485, 9-pole

For the serial interface only the bus station no. 1-31 can be set.

Within an Ethernet network the bus station no. can be set from 1 to 99. Therefore the switches S1-6/7 must be set in addition to the switches S1-1/2/3/4/5.

The number of the communication partners within a network is still limited to 64.

This enhanced setting of the bus station no. is only possible from operating system BS41q/51q V7.0-8 (05.31) of the central module.

Applications with the communication module F 8627X:

- connection of the central module to a PADT (ELOP II TCP)
- connection to other communication partners within an Ethernet network (safeethernet, Modbus TCP)

The communication runs from the central module via the backplane bus to the communication module F 8627X and from the Ethernet ports of the F 8627X into the Ethernet network and vice versa.

Special features of the central module:

- Self-education: from operating system BS41q/51q V7.0-8 (05.31)
- ELOP II TCP: from operating system BS41q/51q V7.0-8 (05.31)

Further informations about the bus station no., ELOP II TCP, loading of operating systems and application programs (self-education) et al. corresponding to the central module you will find in the data sheet of the F8627X as well as the operating system manual of H41q/H51q and the safety manual of H41q/H51q.



Before removing a central module its fixing screws must be completely loosened and freely movable. Remove the module from the bus board by pushing the ejection lever (front label) top down and quickly removing in an upward motion to ensure that faulty signals are not triggered within the system!

To attach the module, place it on the terminal block and press it inwards as far as it will go. This action should be performed quickly to ensure that faulty signals are not triggered within the system!

Function of the ejection lever with front label

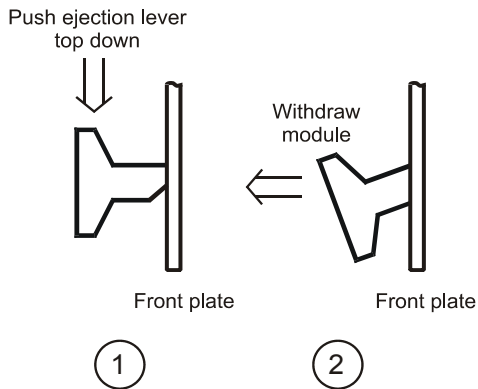


Figure 2: Function of the ejection lever

Diagnostic display of the central module

- Four digit alphanumerical display,
- two LEDs for the general display of errors (CPU for the central modules, IO for the testable input/output modules),
- two toggle switches to request detailed error information,
- push-button ACK resets the error indication;
in failure stop ACK behaves like restarting the system.

For further information on the diagnostic display and lists of error codes, refer to the documentation "Functions of the operational system BS 41q/51q" (also on ELOP II CD).

Notes for start-up and maintenance

- Lifetime of the buffer battery (*without* voltage feeding):
1000 days at $T_A = 25\text{ °C}$
200 days at $T_A = 60\text{ °C}$
- It is recommended to change the buffer battery (CPU in operation) at the latest after 6 years, or with display BATI within three months
(Lithium battery, e.g. type CR 2477N, HIMA part no. 44 0000018)
- Check the bus station no. and transmission rate at switch S1 for correct settings
- **Important:** When upgrading an F 8652 to an F 8652X module the fan concept has also to be changed!



F 8653X: Central module

Use in the PES H41q-M, -H, -HR,

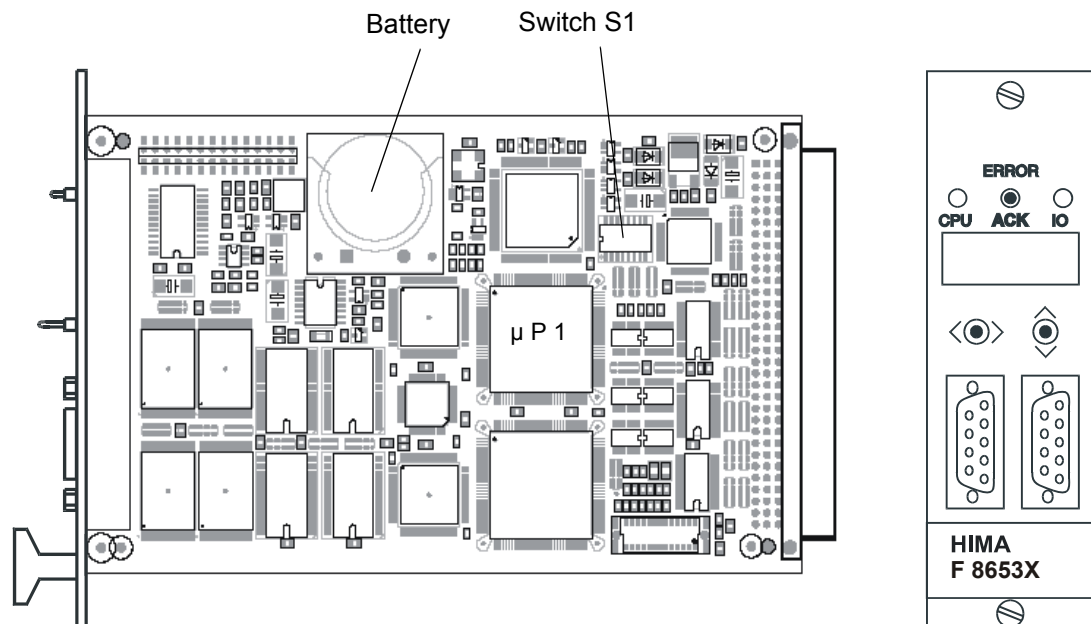


Figure 1: View

Microprocessor	INTEL 386EX, 32 bits
Clock frequency	25 MHz
Memory per microprocessor	
Operating System	Flash-EPROM 1 MB
User program	Flash-EPROM 1 MB *
Data	SRAM 1 MB *
	* Degree of utilization depending on operating system version
Interfaces	Two serial interfaces RS 485 with electric isolation
Diagnostic display	Four digit matrix display with selectable information
Shutdown on fault	Safety-related watchdog with output 24 V, loadable up to 500 mA, short-circuit proof
Construction	Two European standard PCBs, one PCB for the diagnostic display
Space requirement	8 SU
Operating data	5 V / 2 A

Setting of the bus station no. via switches S1-1/2/3/4/5/6/7:

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5
0 On ☐ Off ☐ not admissible	8 On ☐ Off ☐	16 On ☐ Off ☐	24 On ☐ Off ☐
1 On ☐ Off ☐	9 On ☐ Off ☐	17 On ☐ Off ☐	25 On ☐ Off ☐
2 On ☐ Off ☐	10 On ☐ Off ☐	18 On ☐ Off ☐	26 On ☐ Off ☐
3 On ☐ Off ☐	11 On ☐ Off ☐	19 On ☐ Off ☐	27 On ☐ Off ☐
4 On ☐ Off ☐	12 On ☐ Off ☐	20 On ☐ Off ☐	28 On ☐ Off ☐
5 On ☐ Off ☐	13 On ☐ Off ☐	21 On ☐ Off ☐	29 On ☐ Off ☐
6 On ☐ Off ☐	14 On ☐ Off ☐	22 On ☐ Off ☐	30 On ☐ Off ☐
7 On ☐ Off ☐	15 On ☐ Off ☐	23 On ☐ Off ☐	31 On ☐ Off ☐

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5
32 On ☐ Off ☐	40 On ☐ Off ☐	48 On ☐ Off ☐	56 On ☐ Off ☐
33 On ☐ Off ☐	41 On ☐ Off ☐	49 On ☐ Off ☐	57 On ☐ Off ☐
34 On ☐ Off ☐	42 On ☐ Off ☐	50 On ☐ Off ☐	58 On ☐ Off ☐
35 On ☐ Off ☐	43 On ☐ Off ☐	51 On ☐ Off ☐	59 On ☐ Off ☐
36 On ☐ Off ☐	44 On ☐ Off ☐	52 On ☐ Off ☐	60 On ☐ Off ☐
37 On ☐ Off ☐	45 On ☐ Off ☐	53 On ☐ Off ☐	61 On ☐ Off ☐
38 On ☐ Off ☐	46 On ☐ Off ☐	54 On ☐ Off ☐	62 On ☐ Off ☐
39 On ☐ Off ☐	47 On ☐ Off ☐	55 On ☐ Off ☐	63 On ☐ Off ☐

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5
64 On ☐ Off ☐	72 On ☐ Off ☐	80 On ☐ Off ☐	88 On ☐ Off ☐
65 On ☐ Off ☐	73 On ☐ Off ☐	81 On ☐ Off ☐	89 On ☐ Off ☐
66 On ☐ Off ☐	74 On ☐ Off ☐	82 On ☐ Off ☐	90 On ☐ Off ☐
67 On ☐ Off ☐	75 On ☐ Off ☐	83 On ☐ Off ☐	91 On ☐ Off ☐
68 On ☐ Off ☐	76 On ☐ Off ☐	84 On ☐ Off ☐	92 On ☐ Off ☐
69 On ☐ Off ☐	77 On ☐ Off ☐	85 On ☐ Off ☐	93 On ☐ Off ☐
70 On ☐ Off ☐	78 On ☐ Off ☐	86 On ☐ Off ☐	94 On ☐ Off ☐
71 On ☐ Off ☐	79 On ☐ Off ☐	87 On ☐ Off ☐	95 On ☐ Off ☐

Position switch no. 6 7		On ☐ Off ☐	
Switch no.		Switch no.	
Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5	Station no. 1 2 3 4 5
96 On ☐ Off ☐	97 On ☐ Off ☐	98 On ☐ Off ☐	99 On ☐ Off ☐

Legend:

Positions white switch:

On ☐ Off ☐	Bit is set	On ☐ Off ☐	Bit is not set
White switch in position OFF		White switch in position ON	

Setting of the transmission rate with switch S1-8:

1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8
On ☐ Off ☐	On ☐ Off ☐
S1-8 ON = 9600 bps	S1-8 OFF = 57600 bps

Pin	RS 485	Signal	Meaning
1	-	-	not used
2	-	RP	5 V, decoupled by diodes
3	A/A'	RxD/TxD-A	Receive/Transmit Data A
4	-	CNTR-A	Control signal A
5	C/C'	DGND	Data Ground
6	-	VP	5 V, positive pole of power supply
7	-	-	not used
8	B/B'	RxD/TxD-B	Receive/Transmit Data B
9	-	CNTR-B	Control signal B

Table 1: Pin assignment of the interface RS 485, 9-pole

For the serial interface only the bus station no. 1-31 can be set.

Within an Ethernet network the bus station no. can be set from 1 to 99. Therefore the switches S1-6/7 must be set in addition to the switches S1-1/2/3/4/5.

The number of the communication partners within a network is still limited to 64.

This enhanced setting of the bus station no. is only possible from operating system BS41q/51q V7.0-8 (05.31) of the central module.

Applications with the communication module F 8627X:

- connection of the central module to a PADT (ELOP II TCP)
- connection to other communication partners within an Ethernet network (safeethernet, Modbus TCP)

The communication runs from the central module via the backplane bus to the communication module F 8627X and from the Ethernet ports of the F 8627X into the Ethernet network and vice versa.

Special features of the central module:

- Self-education: from operating system BS41q/51q V7.0-8 (05.31)
- ELOP II TCP: from operating system BS41q/51q V7.0-8 (05.31)

Further informations about the bus station no., ELOP II TCP, loading of operating systems and application programs (self-education) et al. corresponding to the central module you will find in the data sheet of the F8627X as well as the operating system manual of H41q/H51q and the safety manual of H41q/H51q.



Before removing a central module its fixing screws must be completely loosened and freely movable. Remove the module from the bus board by pushing the ejection lever (front label) top down and quickly removing in an upward motion to ensure that faulty signals are not triggered within the system!

To attach the module, place it on the terminal block and press it inwards as far as it will go. This action should be performed quickly to ensure that faulty signals are not triggered within the system!

Function of the ejection lever with front label

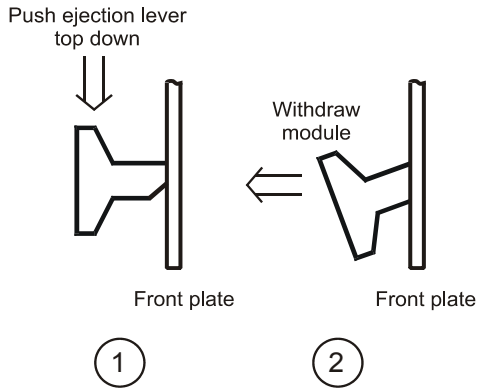


Figure 2: Function of the ejection lever

Diagnostic display of the central module

- Four digit alphanumerical display,
- two LEDs for the general display of errors (CPU for the central modules, IO for the testable input/output modules),
- two toggle switches to request detailed error information,
- push-button ACK resets the error indication;
in failure stop ACK behaves like restarting the system.

For further information on the diagnostic display and lists of error codes, refer to the documentation "Functions of the operational system BS 41q/51q" (also on ELOP II CD).

Notes for start-up and maintenance

- Lifetime of the buffer battery (*without* voltage feeding):
1000 days at $T_A = 25\text{ °C}$
200 days at $T_A = 60\text{ °C}$
- It is recommended to change the buffer battery (CPU in operation) at the latest after 6 years, or with display BATI within three months
(Lithium battery, e.g. type CR 2477N, HIMA part no. 44 0000018)
- Check the bus station no. and transmission rate at switch S1 for correct settings
- **Important:** When upgrading an F 8653 to an F 8653X module the fan concept has also to be changed!



H 4116: Relay in an electronic housing

safety-related, for circuits up to SIL 2 according to IEC 61508

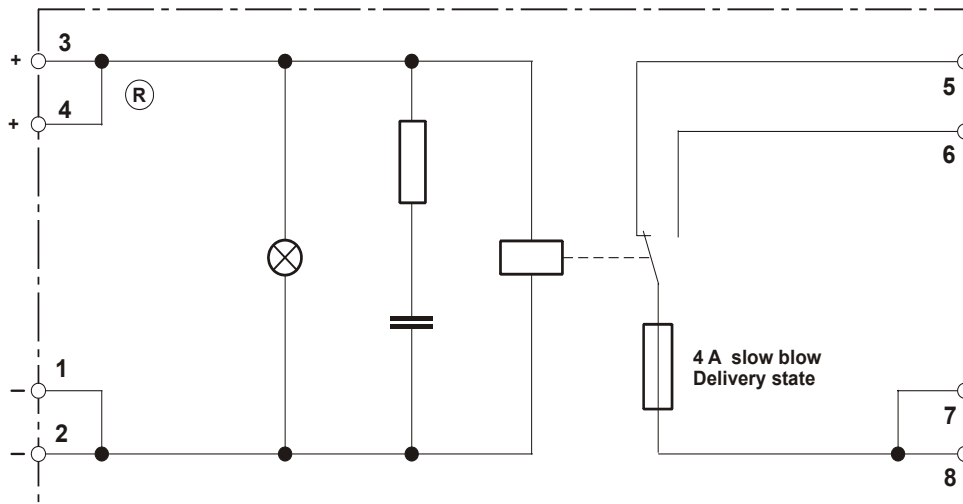


Figure 1: Block diagram

The module is tested according to

- IEC 61508 / SIL 2,
- EN 298,
- DIN VDE 0116, EN 50156,
- NFPA 8501, NFPA 8502,
- EN 60664, DIN EN 50178 (VDE 0160),
- EN 6100-6-2, EN 50082-2, EN 61000-6-4,
- (DIN V 19250 / RC 1...4, DIN VDE 0801 incl. A1)

Due to its low current consumption the relay can be controlled directly from the outputs of safety-related modules with an output load of at least 20 F. The output signal of the module then may not be loaded additionally. An LED indicates the relay coil energized.

Input voltage	24 VDC / -15...+20 %
Current consumption	15 mA
Switching time	approx. 7 ms
Reset time	approx. 5 ms
Output	1 floating changeover contact, sealed
	Relay data: cf. reverse
Ambient conditions	-25...+50 °C
Degree of protection	IP 20 according to IEC/EN 60529 (VDE 0470 part 1)

The relay has a **safe isolation** according to DIN EN 50178 between the output contact and the input. The clearance in air and the creepage distance are dimensioned for overvoltage class III up to 300 V.

Relay data

Contact material	AgNi, hard gold-plated
Switching voltage	≤ 250 VAC/DC, ≥ 1 mV
Switching current	≤ 4 A, ≥ 1 mA (also for safety-related use)
Inrush peak current	≤ 12 A for ≤ 0.5 s
Fusing	≤ 4 A slow blow (delivery state)
Switching capacity AC	≤ 1000 VA, $\cos \varphi > 0.5$
Switching capacity DC	non-inductive load, up to 30 V: ≤ 120 W 70 V: ≤ 40 W 125 V: ≤ 25 W 250 V: ≤ 40 W
Bounce time	approx. 1 ms
Switching frequency	≤ 10 cycles per second
Life	
mechanical	$> 10^7$ cycles
electrical	$> 2.5 \times 10^5$ cycles (at full resistive load and ≤ 0.1 cycles per second)

Restrictions

- For SIL 2 applications (according to IEC 61508) function checks have to be made within a period of three years (offline proof test).
- The replacement of components must be made only by the manufacturer regarding the valid standards and TÜV restrictions.

Mechanical construction and dimensions

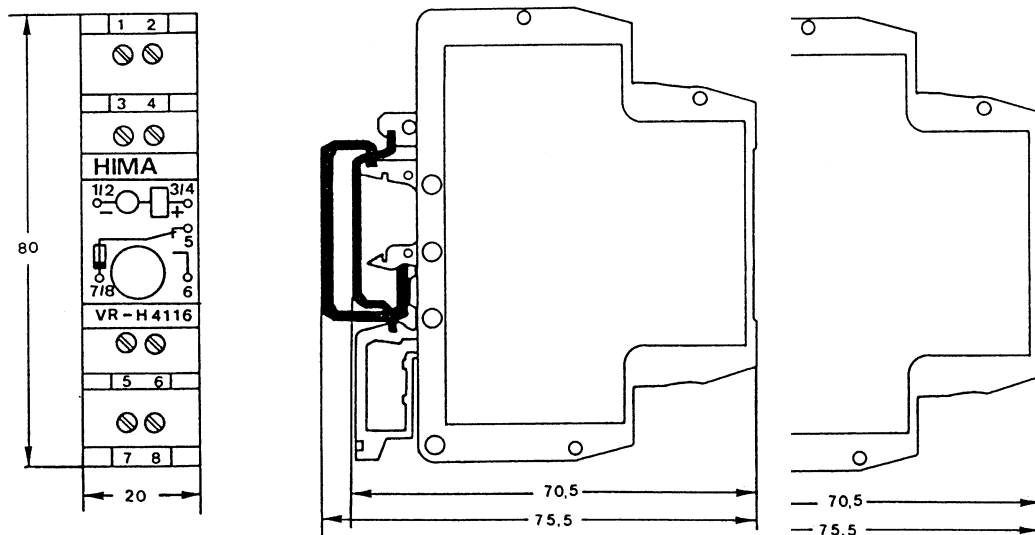


Figure 2: Mechanical construction and dimensions

Cross section of connecting wires	$\leq 2.5 \text{ mm}^2$ (AWG 14)
Mounting	on DIN rail 35 mm or on C profile
Mounting position	horizontal or vertical
Assembling distance	not required



TÜV Rheinland Group

TÜV Industrie Service GmbH
Automation, Software und Informationstechnologie

ZERTIFIKAT

CERTIFICATE

Nr./No. 968/EZ 165.00/04

Prüfgegenstand Product tested	Safety Related Electronic System	Hersteller Manufacturer	HIMA Paul Hildebrandt GmbH + Co. KG Albert-Bassermann-Straße 28 68782 Brühl bei Mannheim
Typbezeichnung Type designation	Modules for Planar F System H 4116 (SIL 2, AK 4) H 4135 (SIL 3, AK 5, 6) H 4136 (SIL 3, AK 5, 6)	Verwendungszweck Intended application	Safety Related Electronic Modules for use in process control, Burner Management (BMS), emergency shut down, where the safe state is the de-energized state.
Prüfgrundlagen Codes and standards forming the basis of testing	IEC 61508, Part 1 - 7:2000 VDE 0801:1990 and Amendment A1:1994 DIN V 19250:1994 DIN VDE 0116:1989, prEN 50156-1:CDV 2000 EN 60664-1:2003 EN 50178:1997 EN 298:1994 NFPA 8501:1997; NFPA 8502:1999 EN 61000-6-2:2000, EN 61000-6-4:2002		
Prüfungsergebnis Test results	The modules are suitable for safety related applications up to SIL 2 or SIL 3 (IEC 61508), RC 4, 5, 6 (DIN V 19250).		
Besondere Bedingungen Specific requirements	For the use of the Planar F-Modules, the Safety Manual, the User Manual and the actual revision of the official list of product documentation, hardware modules and software components released by HIMA and TÜV Rheinland have to be considered.		



Der Prüfbericht-Nr. 968/EZ 165.00/04 vom 2004-04-14 ist Bestandteil dieses Zertifikates.

Der Inhaber eines für den Prüfgegenstand gültigen Genehmigungs-Ausweises ist berechtigt, die mit dem Prüfgegenstand übereinstimmenden Erzeugnisse mit dem abgebildeten Prüfzeichen zu versehen.

The test report-no. 968/EZ 165.00/04 dated 2004-04-14 is an integral part of this certificate.

The holder of a valid licence certificate for the product tested is authorised to affix the test mark shown opposite to products which are identical with the product tested.

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2004-04-14

Datum/Date

Firmenstempel/Company seal

Unterschrift/Signature



H 4135: Relay in an electronic housing

safety-related, for circuits up to SIL 3 according to IEC 61508

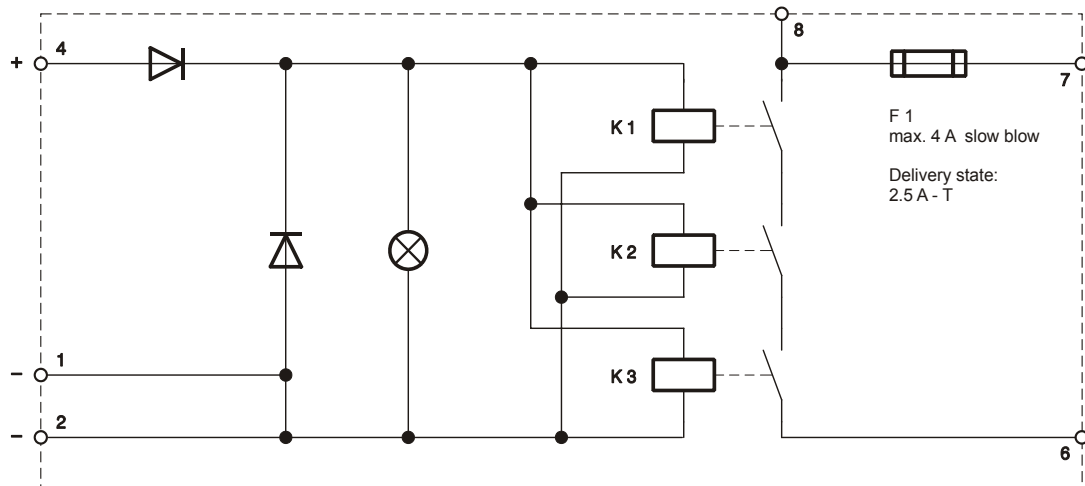


Figure 1: Block diagram

The module is tested according to

- IEC 61508 / SIL 3,
- EN 298,
- DIN VDE 0116, EN 50156,
- NFPA 8501, NFPA 8502,
- EN 60664, DIN EN 50178 (VDE 0160),
- EN 6100-6-2, EN 50082-2, EN 61000-6-4,
- (DIN V 19250 / RC 1...6, DIN VDE 0801 incl. A1)

The relay is suitable for the switching of safety-related circuits. Thus the relay can be used for safety shutdowns, e.g. to cut off the entire fuel supply for combustion plants.

The module is equipped with relays in diversity.

Note	The connection terminal 8 may be used only for monitoring the fuse F1, but not to supply a voltage for the contact!

Input	24 VDC / -15...+20 %, ≤ 40 mA
Output	floating NO contact
	Relay data: cf. reverse
Switching time	approx. 8 ms
Reset time	approx. 6 ms
Ambient conditions	-25...+60 °C
Degree of protection	IP 20 according to IEC/EN 60529 (VDE 0470 part 1)

The relay has a **safe isolation** according to DIN EN 50178 between the output contact and the input. The clearance in air and the creepage distance are dimensioned for overvoltage class III up to 300 V.

Relay data

Contact material	AgNi, hard gold-plated
Switching voltage	$\geq 5 \text{ V}$, $\leq 250 \text{ VAC} / \leq 127 \text{ VDC}$
Switching current	$\geq 10 \text{ mA}$, $\leq 4 \text{ A}$
Switching capacity AC	$\leq 500 \text{ VA}$, $\cos \varphi > 0.5$ $\leq 830 \text{ VA}$, $\cos \varphi > 0.9$
Switching capacity DC	up to 30 V : $\leq 120 \text{ W}$ up to 70 V : $\leq 50 \text{ W}$ up to 127 V : $\leq 25 \text{ W}$
Bounce time	approx. 1 ms
Life	
mechanical	$\geq 30 \times 10^6$ cycles
electrical	$\geq 2.5 \times 10^5$ cycles (with full resistive load and ≤ 0.1 cycles per second)

Restrictions

- For SIL 3 applications (according to IEC 61508) function checks have to be made within a period of three years (offline proof test).
- The replacement of components must be made only by the manufacturer regarding the valid standards and TÜV restrictions.

Mechanical design and dimensions

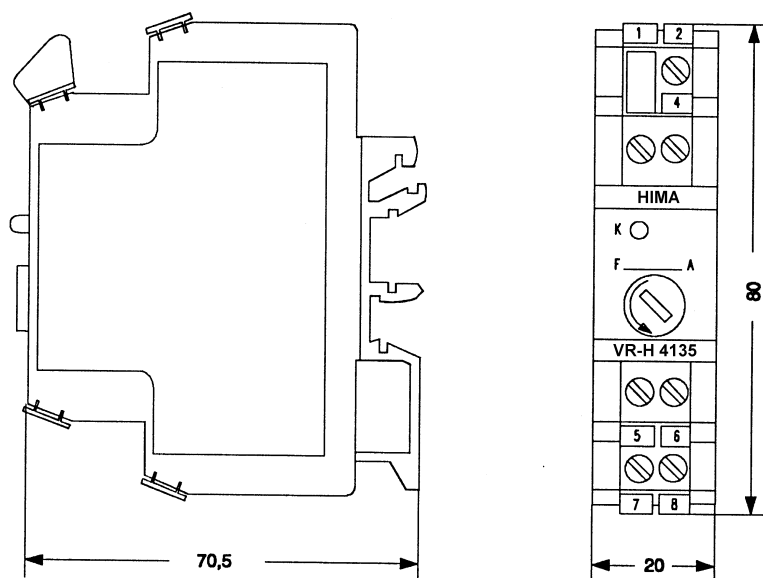


Figure 2: Mechanical design and dimensions

Cross section of connecting wires	$\leq 2.5 \text{ mm}^2$ (AWG 14)
Mounting	on DIN rail 35 mm or on C profile
Mounting position	horizontal or vertical
Assembling distance	not required



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Prüfgrundlagen Codes and standards forming the basis of testing	IEC 61508, Part 1 - 7:2000 VDE 0801:1990 and Amendment A1:1994 DIN V 19250:1994 DIN VDE 0116:1989, prEN 50156-1:CDV 2000 EN 60664-1:2003 EN 50178:1997 EN 298:1994 NFPA 8501:1997; NFPA 8502:1999 EN 61000-6-2:2000, EN 61000-6-4:2002		
Prüfungsergebnis Test results	The modules are suitable for safety related applications up to SIL 2 or SIL 3 (IEC 61508), RC 4, 5, 6 (DIN V 19250).		
Besondere Bedingungen Specific requirements	For the use of the Planar F-Modules, the Safety Manual, the User Manual and the actual revision of the official list of product documentation, hardware modules and software components released by HIMA and TÜV Rheinland have to be considered.		



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2004-04-14

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H 4136: Relay in an electronic housing

safety-related, for circuits up to SIL 3 according to IEC 61508

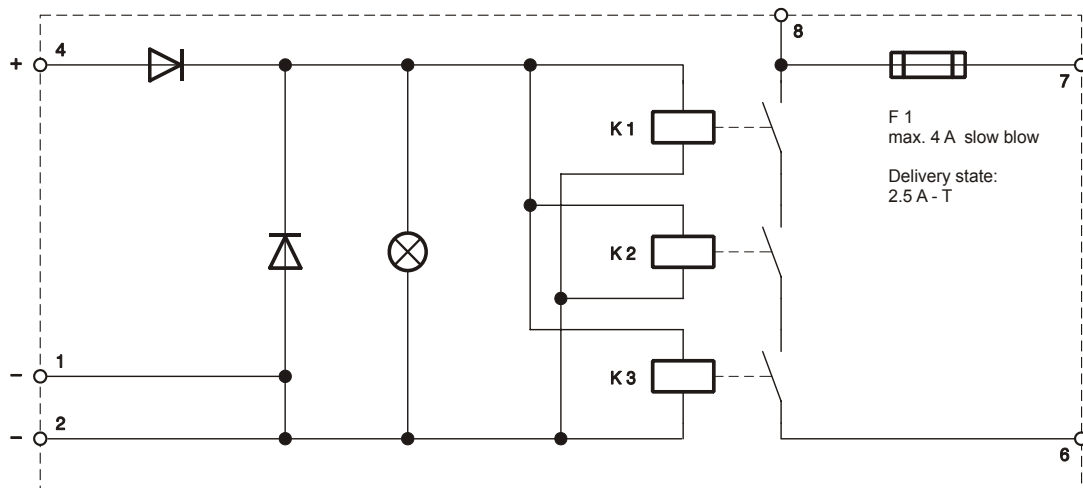


Figure 1: Block diagram

The module is tested according to

- IEC 61508 / SIL 3,
- EN 298,
- DIN VDE 0116, EN 50156,
- NFPA 8501, NFPA 8502,
- EN 60664, DIN EN 50178 (VDE 0160),
- EN 6100-6-2, EN 50082-2, EN 61000-6-4,
- (DIN V 19250 / RC 1...6, DIN VDE 0801 incl. A1)

The relay is suitable for the switching of safety-related circuits. Thus the relay can be used for safety shutdowns, e.g. to cut off the entire fuel supply for combustion plants.

The module is equipped with relays in diversity.

Note The connection terminal 8 may be used only for monitoring the fuse F1, but not to supply a voltage for the contact!

Input	48 VDC / -15...+20 %, ≤ 20 mA
Output	floating NO contact
	Relay data: cf. reverse
Switching time	approx. 8 ms
Reset time	approx. 6 ms
Ambient conditions	-25...+60 °C
Degree of protection	IP 20 according to IEC/EN 60529 (VDE 0470 part 1)

The relay has a **safe isolation** according to DIN EN 50178 between the output contact and the input. The clearance in air and the creepage distance are dimensioned for overvoltage class III up to 300 V.

Relay data

Contact material	AgNi, hard gold-plated
Switching voltage	$\geq 5 \text{ V}$, $\leq 250 \text{ VAC} / \leq 127 \text{ VDC}$
Switching current	$\geq 10 \text{ mA}$, $\leq 4 \text{ A}$
Switching capacity AC	$\leq 500 \text{ VA}$, $\cos \varphi > 0.5$ $\leq 830 \text{ VA}$, $\cos \varphi > 0.9$
Switching capacity DC	up to 30 V : $\leq 120 \text{ W}$ up to 70 V : $\leq 50 \text{ W}$ up to 127 V : $\leq 25 \text{ W}$
Bounce time	approx. 1 ms
Life	
mechanical	$\geq 30 \times 10^6$ cycles
electrical	$\geq 2.5 \times 10^5$ cycles (with full resistive load and ≤ 0.1 cycles per second)

Restrictions

- For SIL 3 applications (according to IEC 61508) function checks have to be made within a period of three years (offline proof test).
- The replacement of components must be made only by the manufacturer regarding the valid standards and TÜV restrictions.

Mechanical design and dimensions

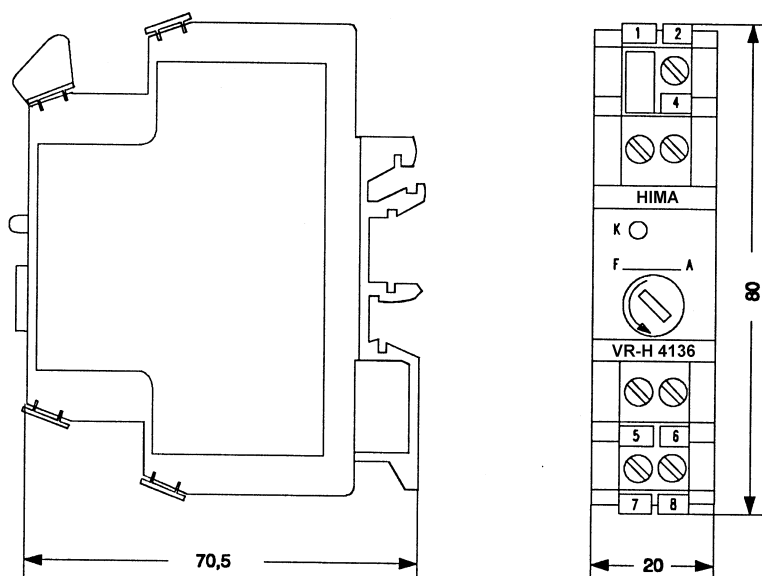


Figure 2: Mechanical design and dimensions

Cross section of connecting wires	$\leq 2.5 \text{ mm}^2$ (AWG 14)
Mounting	on DIN rail 35 mm or on C profile
Mounting position	horizontal or vertical
Assembling distance	not required



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Prüfgrundlagen Codes and standards forming the basis of testing	IEC 61508, Part 1 - 7:2000 VDE 0801:1990 and Amendment A1:1994 DIN V 19250:1994 DIN VDE 0116:1989, prEN 50156-1:CDV 2000 EN 60664-1:2003 EN 50178:1997 EN 298:1994 NFPA 8501:1997; NFPA 8502:1999 EN 61000-6-2:2000, EN 61000-6-4:2002		
Prüfungsergebnis Test results	The modules are suitable for safety related applications up to SIL 2 or SIL 3 (IEC 61508), RC 4, 5, 6 (DIN V 19250).		
Besondere Bedingungen Specific requirements	For the use of the Planar F-Modules, the Safety Manual, the User Manual and the actual revision of the official list of product documentation, hardware modules and software components released by HIMA and TÜV Rheinland have to be considered.		



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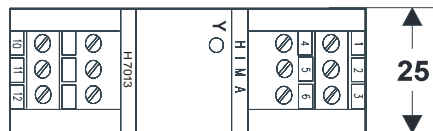
Firmenstempel/Company seal

Unterschrift/Signature

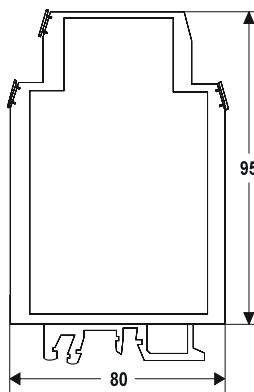


H 7013: Power supply filter

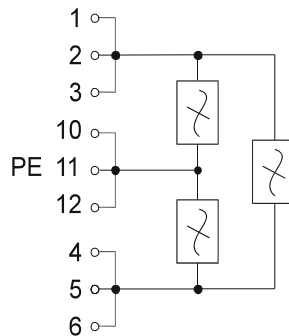
- for power supply systems 24 VDC



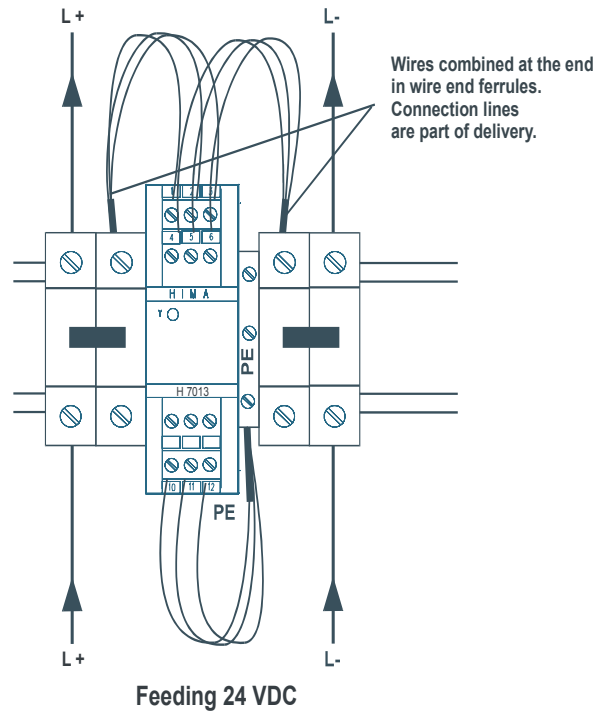
Top view



Side view



Circuit diagram



Feeding 24 VDC
Connecting example
with terminals on mounting rail

Figure 1: H 7013 power supply filter

The power supply filter H 7013 dampens wide-banded, low energy switching interferences (Burst) according to IEC EN 61000-4-4 up to 2 kV, and wide-banded, high energy overvoltages (Surge) according to IEC EN 61000-4-5 up to 1 kV on a 24 VDC power supply circuit. The interferences are discharged to earth.

Highest effectiveness can be achieved if the filter is installed directly at the 24 V power supply.

Connection

Height over mounting rail
Electric strength against earth
Max. permissible operation voltage
Power consumption
Ambient conditions

2.5 mm² directly on the device terminals,
combined wires on terminals of min. 10 mm²
approx. 100 mm
250 V
30 VAC / 42 VDC
5.5 mA at 24 VDC
-25...+70 °C

Mounting the H 7013 into Zone 2 (EG guideline 94/9/EG, ATEX)

The device is suitable for mounting into zone 2. The corresponding Declaration of Conformity is added on the following page.

For this mounting the following mentioned special conditions have to be regarded.

Special conditions X for safety-related application

1. The power supply filter **H 7013** must be mounted, for securing the category 3G, in an enclosure, which fulfills the requirements of the EN 60079-15 with the type of protection at least IP 54, according to EN 60529.
2. This enclosure must be labeled with

"Working permitted only in the de-energized state"

Exception:

If it is assured that there exists no explosive atmosphere working under voltage is also permitted.

3. The used enclosure must be able to dissipate safely the generated heat. The power dissipation of the power supply filter **H 7013** is **250 mW** max.
4. The following items of the standards

VDE 0170/0171 part 16, DIN EN 60079-15: 2004-5

VDE 0165 part 1, DIN EN 60079-14: 1998-08

must be regarded:

DIN EN 60079-15:

Chapter 5	Design
Chapter 6	Terminals and cabling
Chapter 7	Air and creeping distances
Chapter 14	Connectors

DIN EN 60079-14:

Chapter 5.2.3	Equipment for use in zone 2
Chapter 9.3	Cabling for zones 1 and 2
Chapter 12.2	Equipment for zones 1 and 2

The power supply filter additionally has the following label:

H I M A

**Paul Hildebrandt GmbH + Co KG
A.-Bassermann-Straße 28, D-68782 Brühl**



II 3 G EEx nA II T4 X

H 7013

**-25 °C ≤ Ta ≤ 70 °C
Special conditions X must be regarded!**

Konformitätserklärung
Declaration of Conformity



Wir / We

HIMA Paul Hildebrandt GmbH + Co KG
Albert Bassermann-Straße 28 - 68782 Brühl
Postfach 1261 - 68777 Brühl
Telefon 0 62 02 / 709-0

erklären in alleiniger Verantwortung, dass die Produkte
declare under our sole responsibility that the products

QF - H 7013	Netzfilter, 24 VDC
QF - H 7021	Netzfilter, 48 VDC

auf die sich diese Erklärung bezieht, mit den folgenden Normen übereinstimmt.
to which this declaration relates is in conformity with the following standards.

EN 61000-6-4 (08.02)
EN 61000-6-2 (08.02)

EN 61131-2 (2003)

EN 60079-15 (2003)

Elektrische Betriebsmittel für gasexplosionsgefährdete Breiche – Teil 15 : Zündschutzart "n"
Electrical apparatus for explosive gas atmospheres – Part 15 : Type of protection "n"

Gemäß den Bestimmungen der Richtlinien
Following the provisions of Directives

EMV-Richtlinie **89/336/EWG**

Ex-Richtlinie **94/9/EG**

Brühl, den 22. November 2005

ppa.

Prof. Dr. habil. Josef Börsök
Bereichsleiter Entwicklung
Vice-President Development

i.A.

Jürgen Hölzel
Leiter Vorentwicklung und Qualitätswesen
Lead Engineer Predevelopment and Quality Assurance



H 7014: Electronic fuses

- for the safety-related outputs of the F 3330 module
- resistive or inductive loads up to 500 mA (12 W)

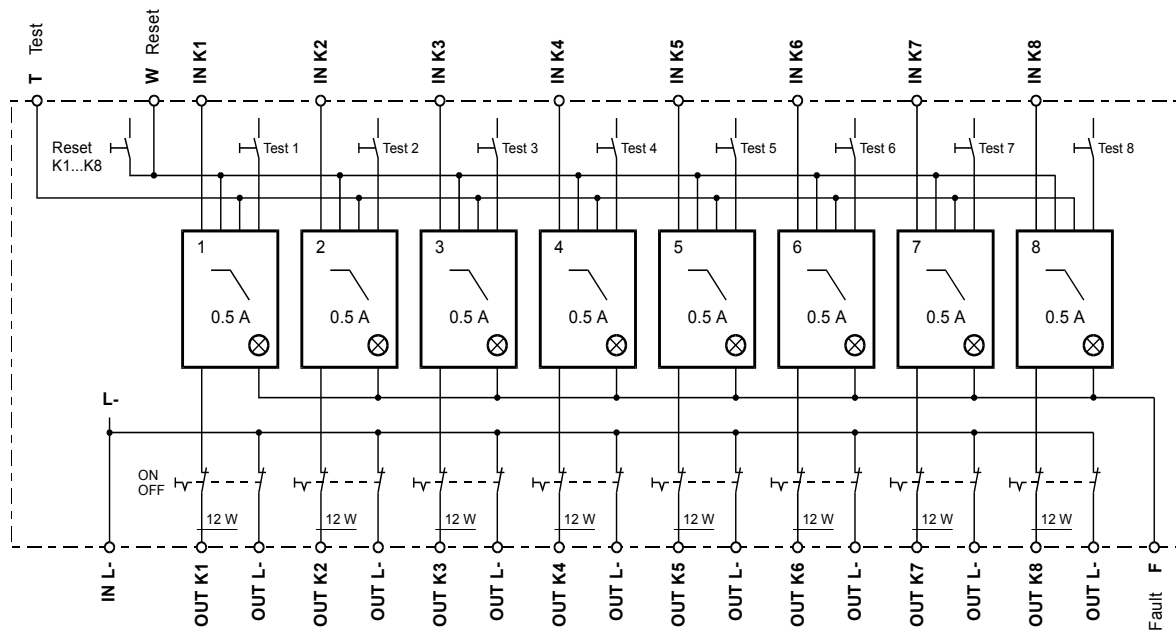


Figure 1: Block diagram

The module is tested according to IEC 61508-2 (SIL 3), IEC 61131-2, EN 298, DIN VDE 0116, EN 50156, EN 50178 (and DIN V 19250).

The electronic fuses are dimensioned to be connected to the outputs (also redundant outputs) of the F 3330 module.

All input signals for the H 7014 must be generated in SELV systems.
The output loads can be disconnected separately with slide switches.

Inputs	voltage range matched to the outputs of the F 3330 module
Current consumption	≤ 10 mA per channel
Load rating of the output F	1 input F 3221 or F 3236
Operating point	approx. 550 mA
Switching time	< 200 μs
Switching frequency	≤ 1 Hz
Ambient conditions	0...+60 °C
Degree of protection	IP 20 according to IEC/EN 60529 (VDE 0470 part 1)

The channels are individually checked for short-circuit or overload current and switched off if necessary. Resetting the fuses is made via a common reset input (W) for 24 VDC or via the internal reset pushbutton.

The fuses can be tripped together via an input (T) for a 24 VDC signal or individually with own test pushbuttons. The fuse trip is indicated with LEDs and signaled via a common output (F). If this output is not used, it must be terminated against L- with a resistor of 10 k Ω (0.25 W).

Connections and cross sections

T, F, W	1 female plug-in connection 1.5 mm ² , 3-pole
IN	1 female plug-in connection 1.5 mm ² , 9-pole
OUT	Screw terminals for loads 2.5 mm ² , 2 x 8-pole

Mechanical design and dimensions

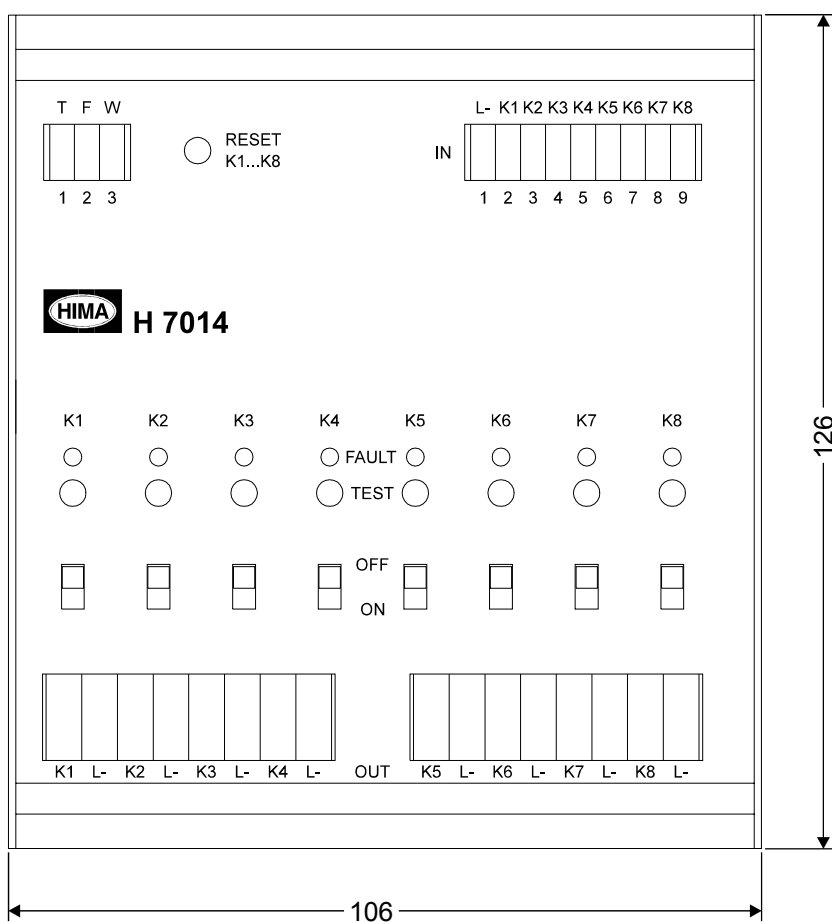


Figure 2: Mechanical design and dimensions

Depth	57 mm (with terminals)
Mounting	on DIN rail 35 mm
Mounting position	horizontal or vertical
Assembling distance	not required

Applications

Connecting the inputs of the H 7014 in parallel is not permitted:

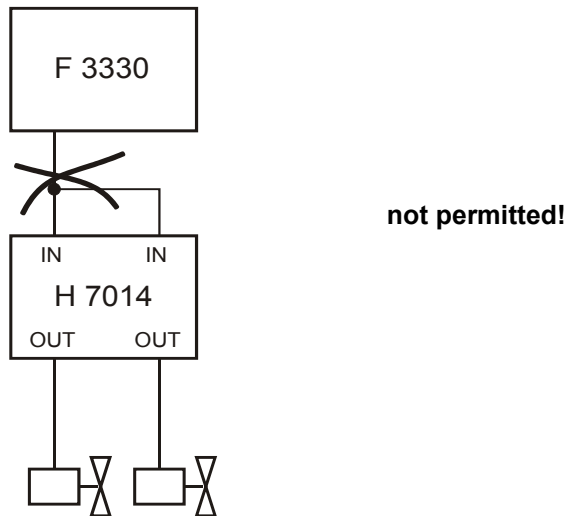


Figure 3: Connecting the inputs of the H 7014 in parallel

The outputs of the F 3330 and the H 7014 can be used in redundancy:

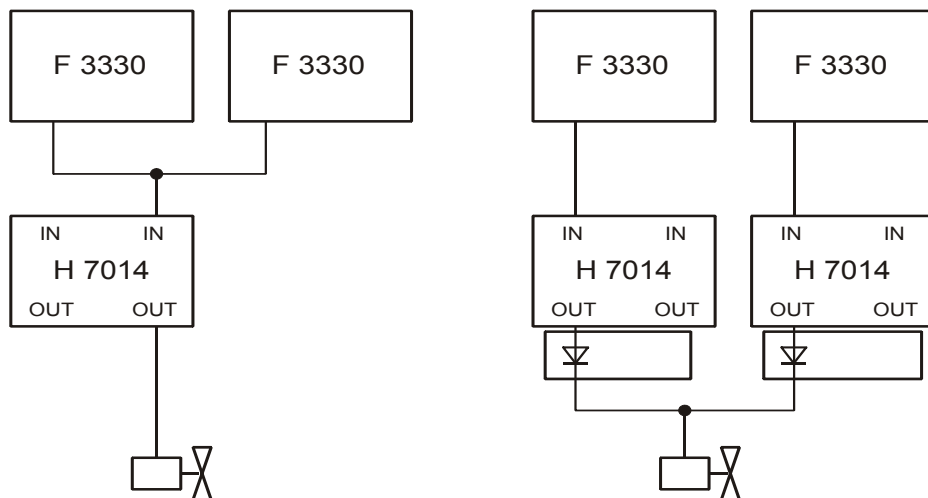


Figure 4: Connecting the outputs of the F 3330 and H 7014 in redundancy

For the use of *two* electronic fuses H 7014 their outputs must be decoupled by means of external diodes.



H 7015A: Terminal module

- plug and play with a 56-pins Vario-plug ELCO 8016 (Code 1-1)
- for fast and efficient wiring to the Terminal Module H 7018
- compatible with modules from other manufacturers (see applications)

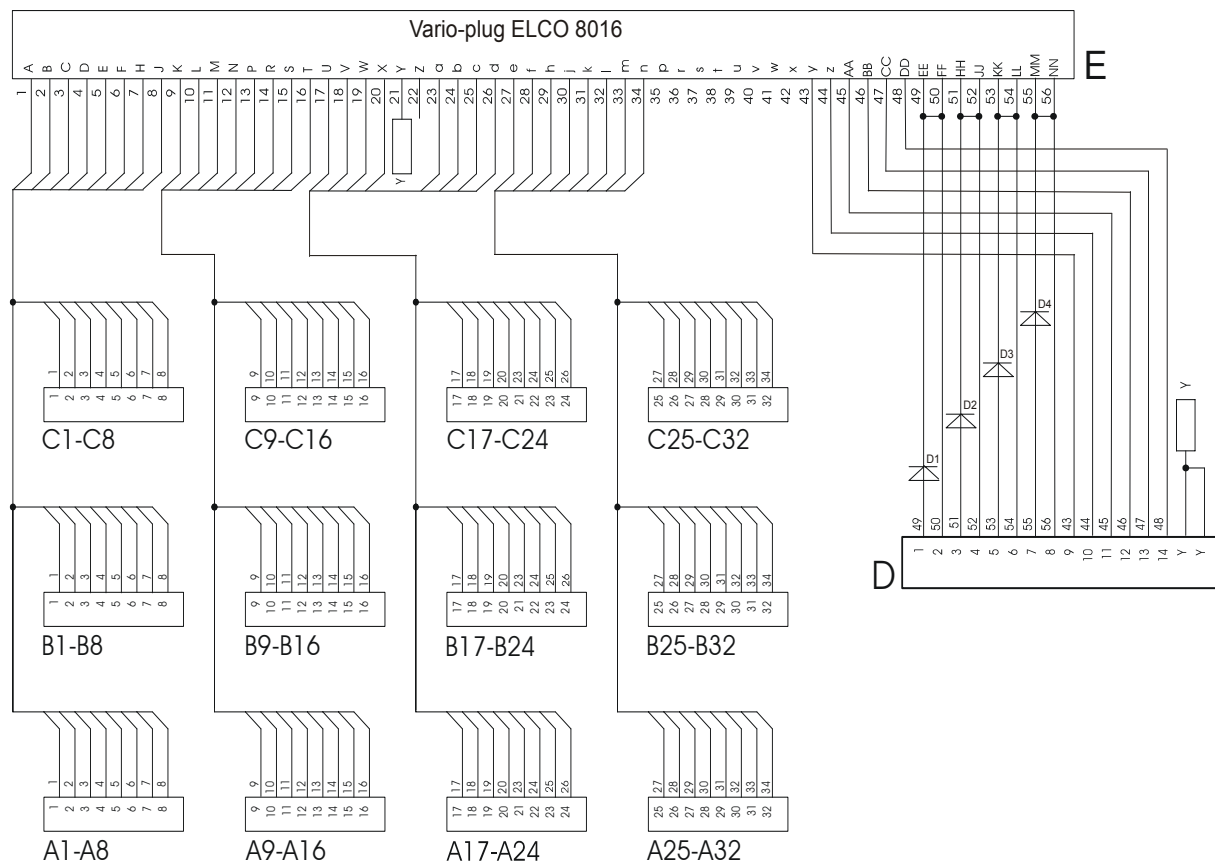


Figure 1: Block diagram

Electrical characteristics of supply contacts

Permissible voltage	up to 48 VDC, 30 VAC
Current per channel	2 A
Total current	max. 16 A
Cross section	A,B,C, D 0.2 ... 1.5 mm ² (Combicon Connector) 0.2 ... 2.5 mm ²
Diodes	2 A (2 A slow blow fuses are permitted)

Sockets and terminals on the Terminal Module H 7015A

Designator	Type	Contact	
E	Vario-plug ELCO 8016 (Code 1-1)	1x	56-pin
A1...C32	Phoenix Headers *)	12x	8-pin
D	Wago 739		1x 16-pin
	1, 3, 5, 7	Supply contacts, decoupled (red)	
	2, 4, 6, 8	Supply contacts, not decoupled (black)	
	9 up to 14	Floating contacts (gray)	
	15, 16	Shield Y (white)	

*) Accessories: Phoenix Combicon Connector FK-MCP 1,5/8-ST-3,81

Table 1: Sockets and terminals H 7015A

Mechanical design and dimensions of Terminal Module H 7015A

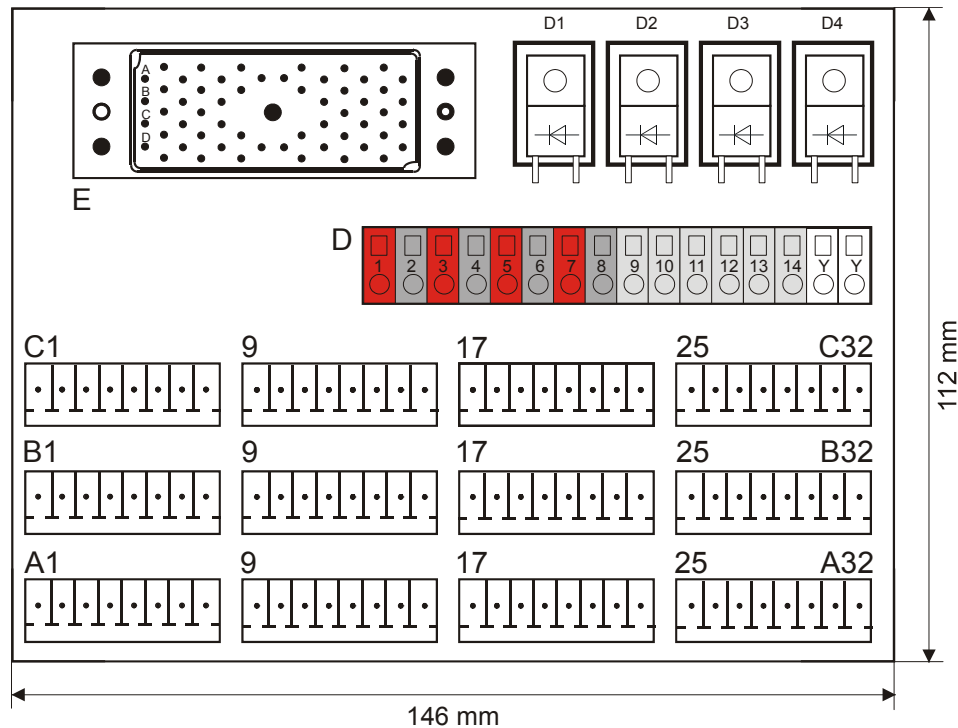


Figure 2: Mechanical design and dimensions of Terminal Module H 7015A

Depth	105 mm with Vario-plug ELCO 8016
Mounting	on 35 mm DIN-rail
Installation orientation	horizontally or vertically
Installation clearance	not necessary

Applications for Terminal Module H 7015A

Wiring of H 7015A with H 7018

For fast and efficient wiring (plug and play) between a PLC cabinet and a marshalling cabinet, the Terminal Modules H 7015A, H 7018 and the cable BV 7201 are required.

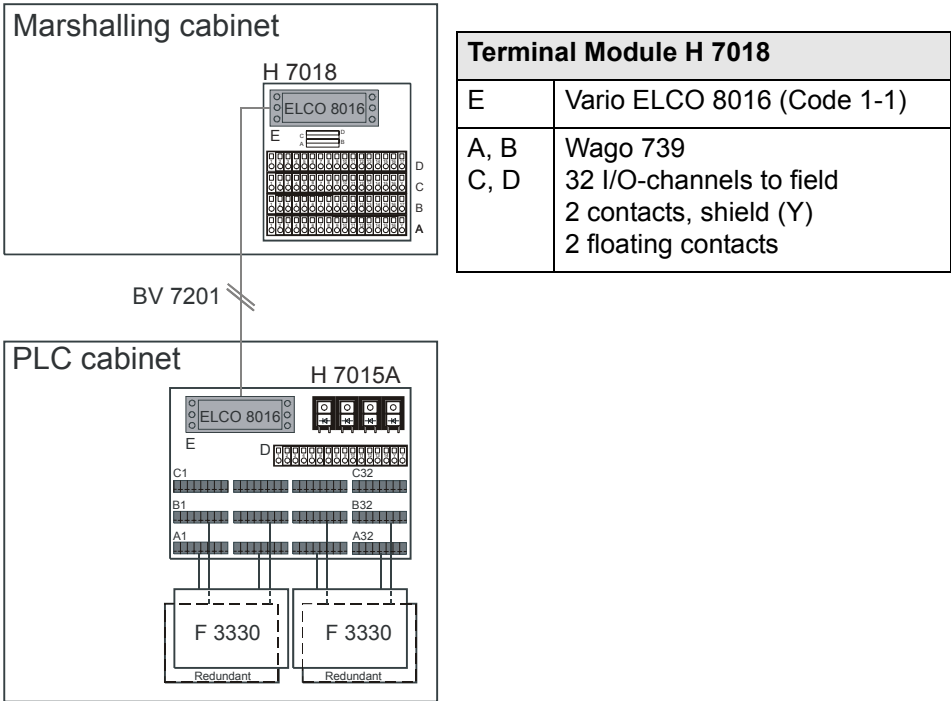


Figure 3: Wiring of H 7015A with H 7018

Wiring of H 7015A with PHOENIX UMK-EC56/56

One-to-one-connection of all signals and power supplies from Terminal Module H 7015A to Phoenix UMK-EC56/56.

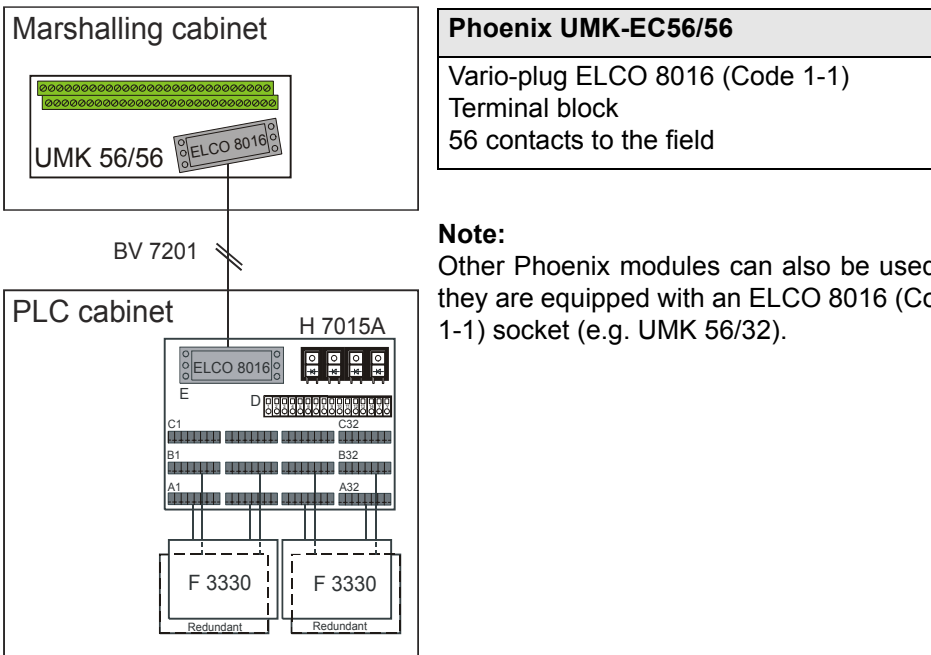


Figure 4: Wiring of H 7015A with UMK-EC56/56

Wiring H 7015A with Pepperl+Fuchs Motherboard

For 16 analog inputs	
Motherboard type	P+F Motherboard MB-AI-HIMA-118233
Motherboard equipped with max.	16x P+F Module KFD2-STC4-(Ex)1 or 16x P+F Module KFD2-STC4-(Ex)1.2 with additional output on X2

Table 2: Analog inputs

For 16 digital inputs	
Safety-related single channel	1x P+F Motherboard MB-DI-HIMA-119935, equipped with max. 16x P+F Modul KFD2-SH-(Ex)1.T.OP
Not safety-related dual channels	1x P+F Motherboard MB-DI-HIMA-119941, equipped with max. 16x P+F Modul KFD2-SR2-(Ex)2.2S

Table 3: Digital inputs

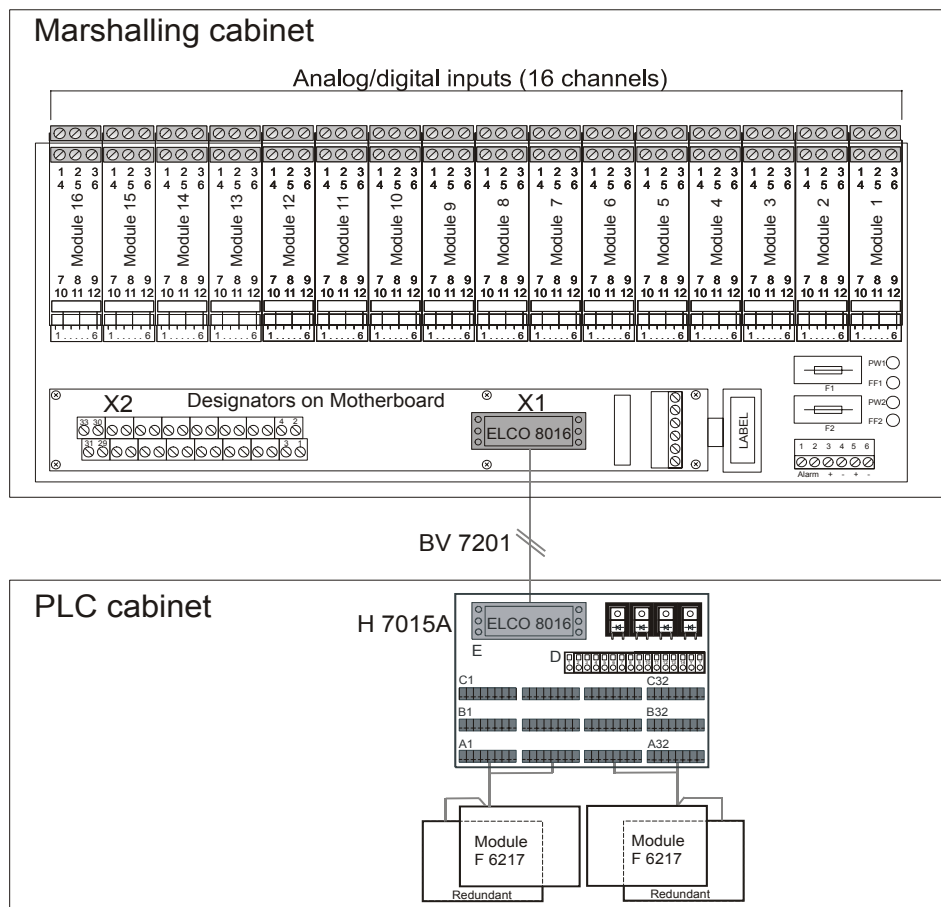


Figure 5: Wiring of H 7015A with P+F Motherboard

Allocation of the P+F Modules to the Terminal Module H 7015A

Motherboard	Motherboard (X1)	H 7015A (A,B,C)
Module 1	1 (A)	A1, B1, C1
	2 (B)	A2, B2, C2
Module 2	3 (C)	A3, B3, C3
	4 (D)	A4, B4, C4
Module 3	5 (E)	A5, B5, C5
	6 (F)	A6, B6, C6
Module 4	7 (H)	A7, B7, C7
	8 (J)	A8, B8, C8
Module 5	9 (K)	A9, B9, C9
	10 (L)	A10, B10, C10
Module 6	11 (M)	A11, B11, C11
	12 (N)	A12, B12, C12
Module 7	13 (P)	A13, B13, C13
	14 (R)	A14, B14, C14
Module 8	15 (S)	A15, B15, C15
	16 (T)	A16, B16, C16
Module 9	17 (U)	A17, B17, C17
	18 (V)	A18, B18, C18
Module 10	19 (W)	A19, B19, C19
	20 (X)	A20, B20, C20
Module 11	23 (a)	A21, B21, C21
	24 (b)	A22, B22, C22
Module 12	25 (c)	A23, B23, C23
	26 (d)	A24, B24, C24
Module 13	27 (e)	A25, B25, C25
	28 (f)	A26, B26, C26
Module 14	29 (h)	A27, B27, C27
	30 (j)	A28, B28, C28
Module 15	31 (k)	A29, B29, C29
	32 (l)	A30, B30, C30
Module 16	33 (m)	A31, B31, C31
	34 (n)	A32, B32, C32

Table 4: Allocation of the P+F Modules



H 7016: Terminal module

- plug and play with Vario-plug ELCO 8016 (56-pins)
- for fast and efficient wiring to the Terminal Module H 7015

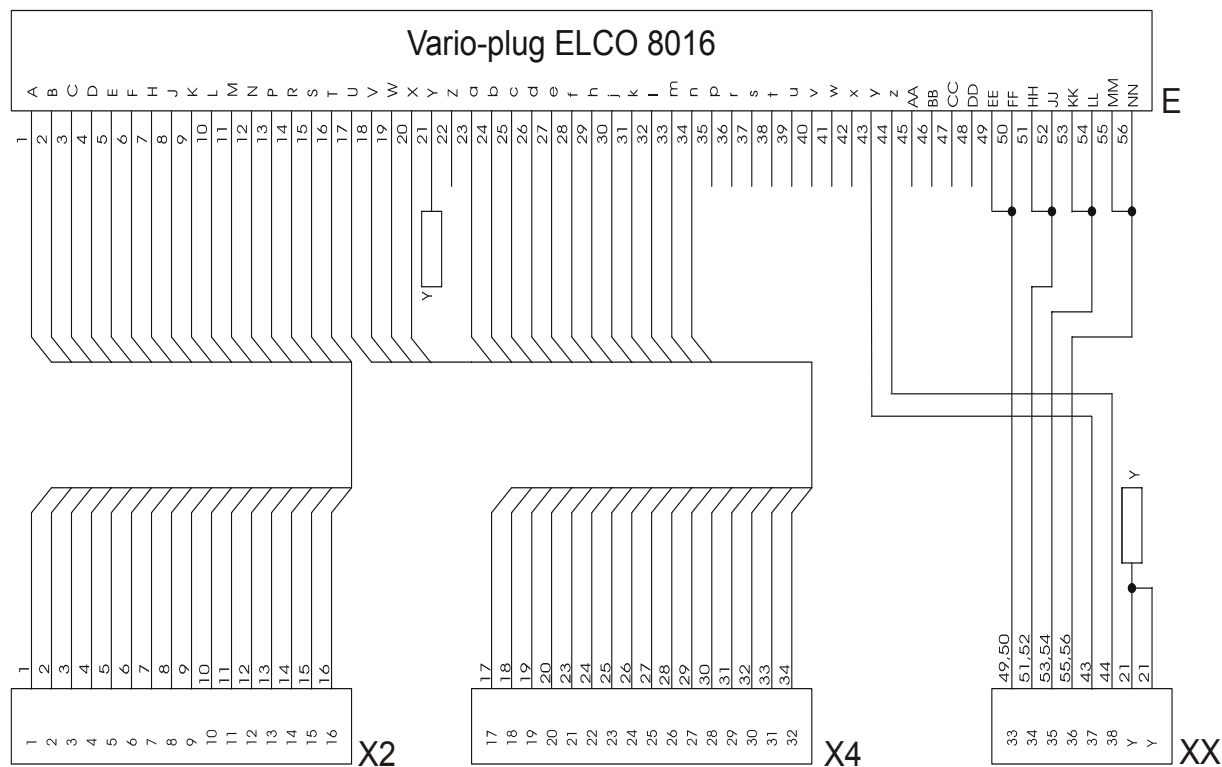


Figure 1: Block diagram

Electrical characteristics of supply contacts

Nominal voltage	30 VDC
Current per channel	2 A
Max. total current	16 A
Insulation	30 V 30 VAC/DC
Cross section	X2, X4, XX 0.2 ... 2.5 mm ²

Sockets and terminals on the Terminal Module H 7016

Designator	Type	Contact
E	Vario-ELCO 8016	1x 56-pins
X2, X4	Terminal block	2x 16-pins
XX	Terminal block 4x supply contacts 2x floating contacts 2x contacts Y, for shield	1x 8-pins

Table 1: Sockets and terminals H 7016

Mechanical design and dimensions of Terminal Module H 7016

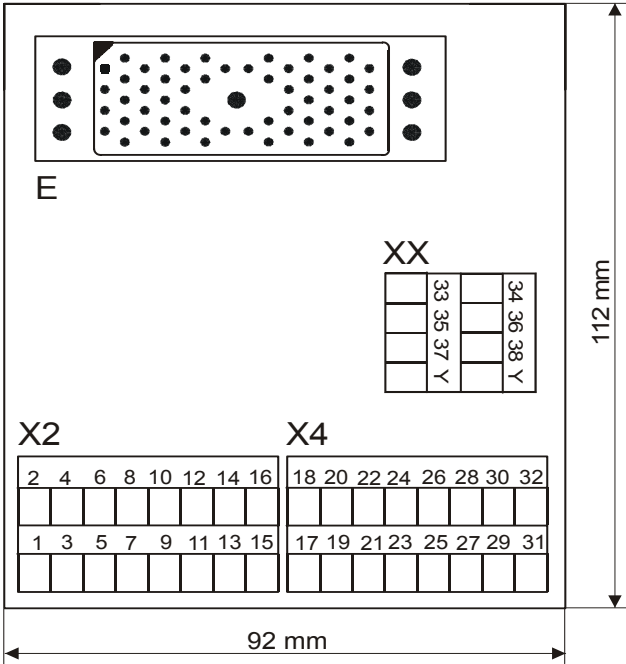


Figure 2: Mechanical design and dimensions of Terminal Module H 7016

Depth	105 mm with Vario-plug ELCO 8016
Mounting	on 35 mm DIN-rail
Installation orientation	horizontally or vertically
Installation clearance	min. 25 mm to next Terminal Module H 7016

Application: Wiring of H 7015 with H 7016

For fast and efficient wiring (plug and play) between a PLC cabinet and a marshalling cabinet, the Terminal Modules H 7015, H 7016 and the cable BV 7201 are required.

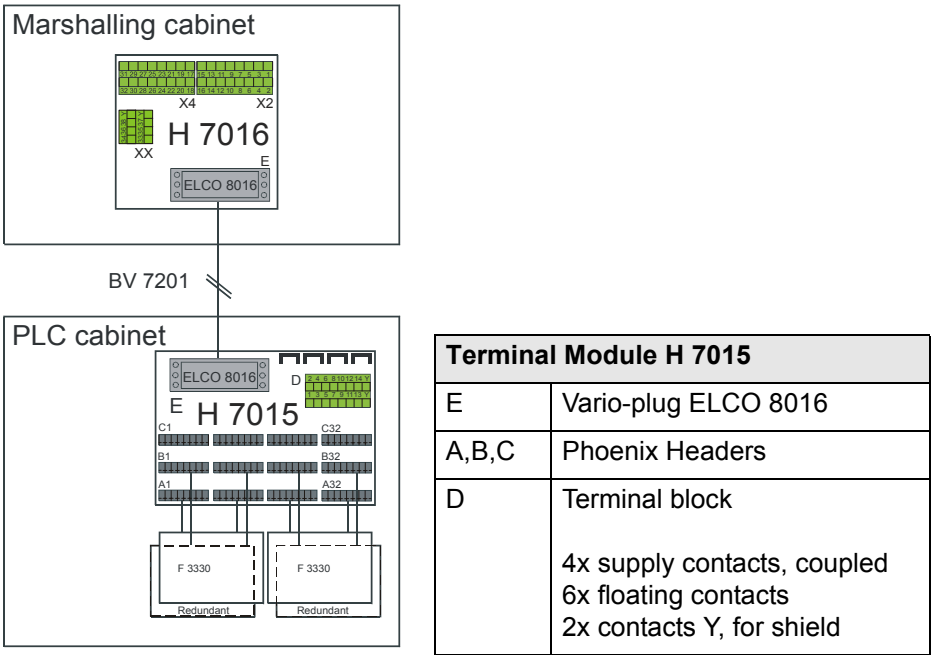


Figure 3: Wiring of H 7015 with H 7016



H 7017: Shunt with low-pass filter

- for current measurement with analog input modules
- as a module for mounting on a DIN rail

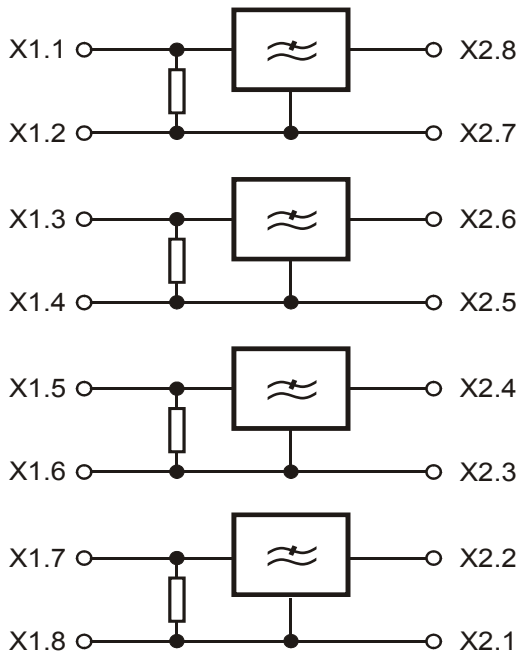


Figure 1: Block diagram

If analog input modules operate under extreme ambient conditions or not according to the HIMA recommendations there can be interferences or interspersions in the module channels. The module H 7017 is used in these cases as a module for a current measuring with the analog input modules.

The module H 7017 can operate with e.g. the following modules:

- F 6217 8-channel analog input module
Elimination of interferences at sensors with high dynamic signals
- F 6251 (Planar F) or 62100 (Planar4) 2-fold limit monitor
Increase of noise immunity (10 V) according to IEC 61000-4-6 at use with unshielded cables.



When using the module H 7017 the shunts in the analog input modules must be unsoldered (modified cable plug) otherwise the current measurement would be tampered. Further details you will find in the corresponding data sheets.

The module comprises four identical functions: for each a shunt with a subsequent low-pass filter.

The filter is equipped with a triple redundancy. So it is ensured that the input signal is continuously measured even if there is an interruption of a filter resistor. In case of an error, for the tantalum capacitors increased leakage currents have to be assumed.



With use of the module the process signal can be delayed up to 3 seconds.
In case of an error a reduction of the process signal must be considered.

Technical data

Shunt	250 Ω
Time constant of the filter	$\tau = 300$ ms
Operational limit	1.5 %
Ambient temperature	0...+60 °C
Degree of protection	IP 00

Connections and cross sections

X1	Inputs	Terminal row 8-pole, 2.5 mm ²
X2	Outputs	Terminal row 8-pole, 2.5 mm ²

Mechanical design and dimensions of Terminal Module H 7017

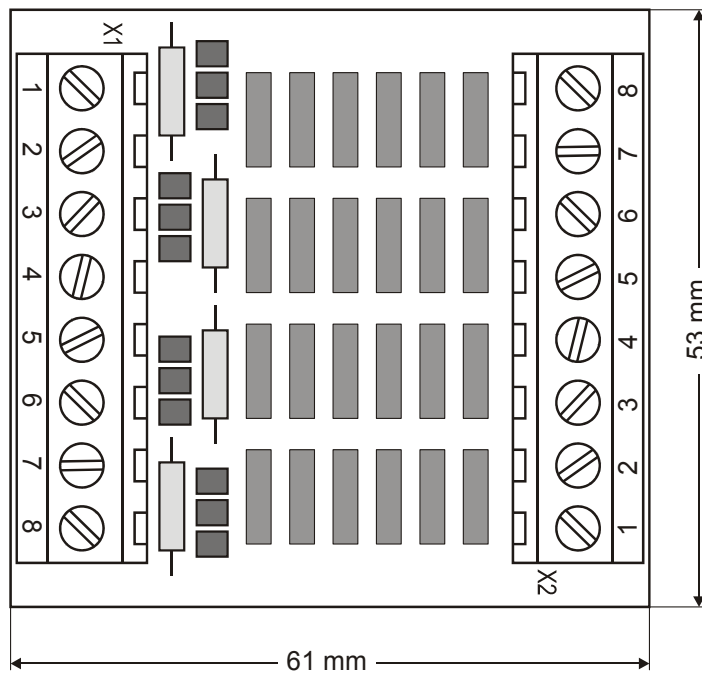


Figure 2: Mechanical design and dimensions of Terminal Module H 7017

Depth	40 mm (including terminals)
Mounting	on C rail or DIN rail 35 mm
Mounting position	horizontal or vertical
Assembling distance	not required

Application

Sensors with high dynamic signals can cause a channel fault in some cases. The module H 7017 (with integrated shunt) is designed for filtering these interferences. When using the module the cable plug Z 7127 / 6217 / C.. / I with unsoldered shunts (see Figure 3) or the cable plug Z 7128 / 6217 / C.. / ITI with unsoldered shunts (see Figure 4) has to be used for the F 6217.

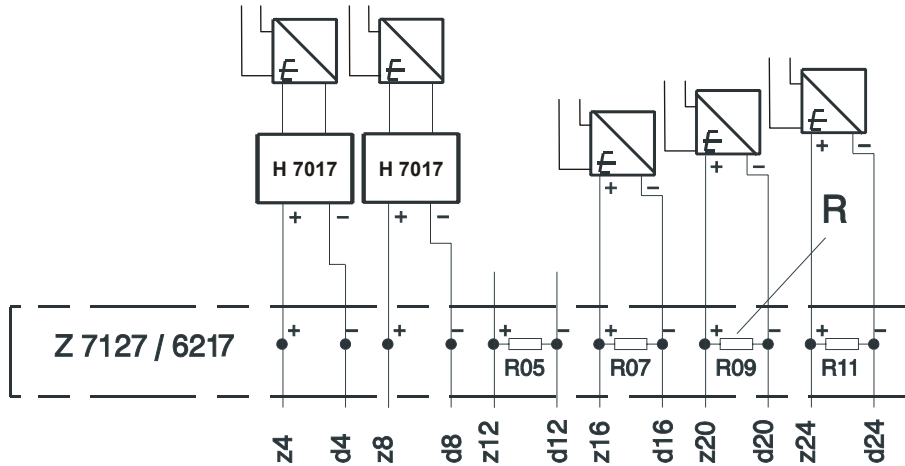


Figure 3: Application with cable plug Z 7127 / F 6217 with modules H 7017 instead of shunts

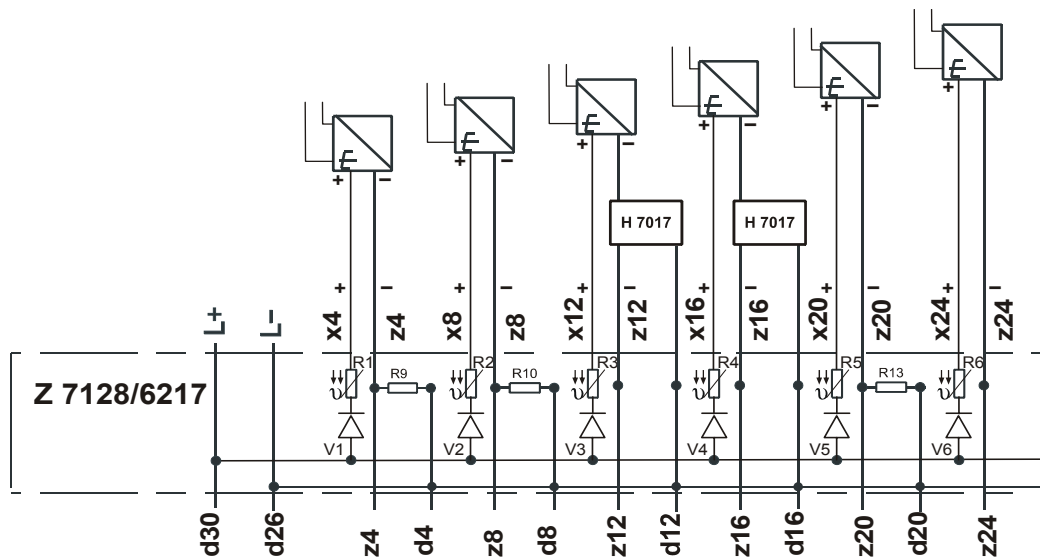


Figure 4: Application with cable plug Z 7128 / F 6217 with modules H 7017 instead of shunts



H 7018: Terminal module

- plug and play with 56-pins Vario-plug ELCO 8016 (Code 1-1)
- for fast and efficient wiring to the Terminal Module H 7015(A)

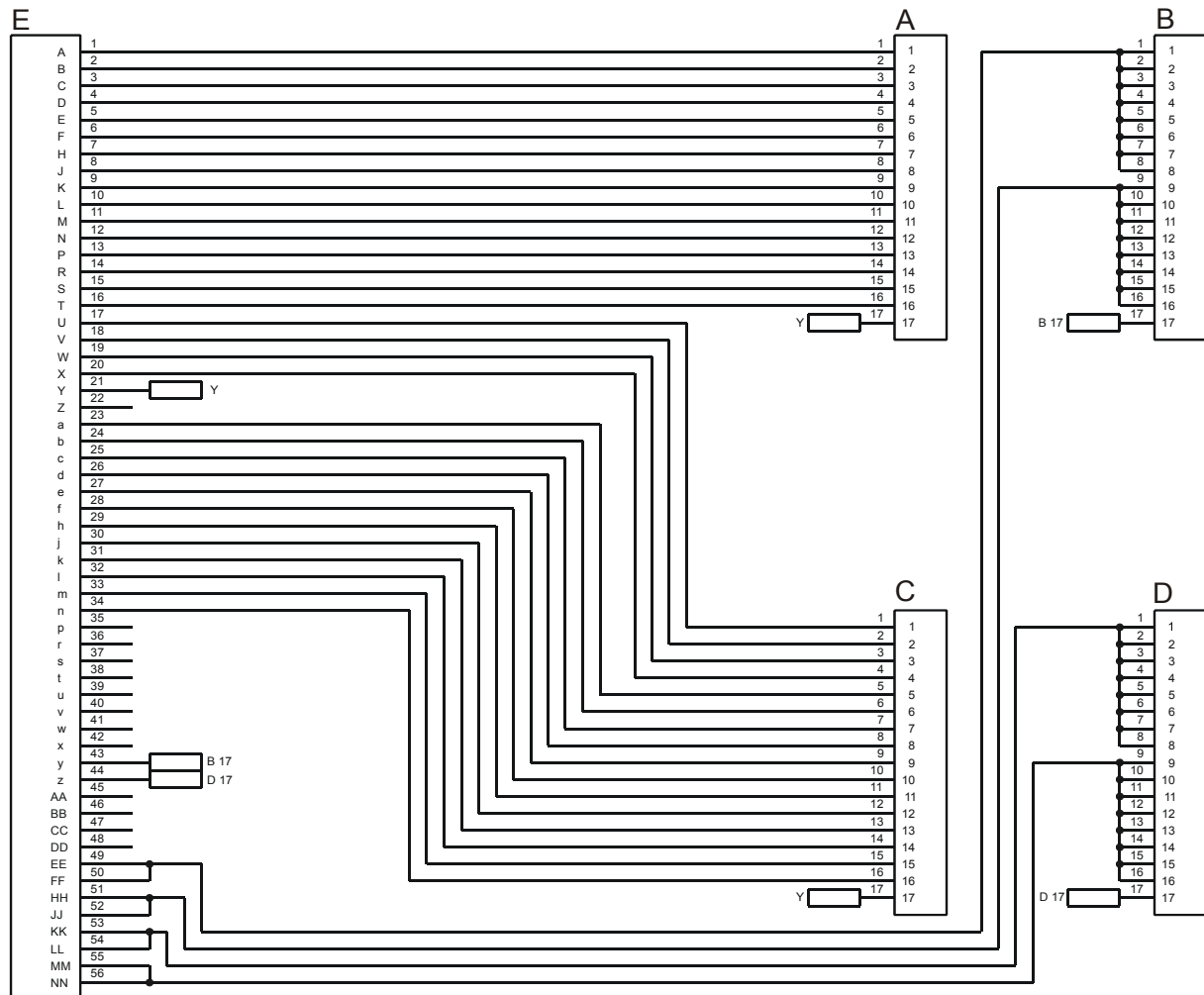


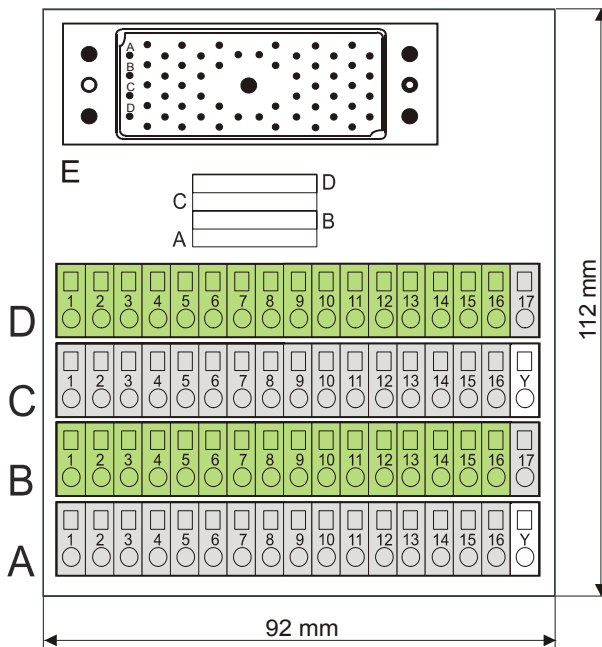
Figure 1: Block diagram

Electrical characteristics of the Terminal Module H 7018

Permissible voltage	up to 48 VDC, 30 VAC
Current per channel	2 A
Total current	max. 16 A
Cross section	A, B, C, D 0.2 ... 2.5 mm ²

Sockets and terminals on the Terminal Module H 7018

Designator	Type	Contact
E	Vario-ELCO 8016 (Code 1-1)	1x 56-pole
A, B, C, D	WAGO 739	4x 17-pole
	A1 up to A16	I/O channels to field (gray)
	B1 up to B16	Reference potential (green)
	C1 up to C16	I/O channels to field (gray)
	D1 up to D16	Reference potential (green)
	A 17, C 17	Shield Y (white)
	B 17, D 17	Floating contacts (gray)

Table 1: Sockets and terminals H 7018
Mechanical design and dimensions of Terminal Module H 7018

Figure 2: Mechanical design and dimensions of Terminal Module H 7018

Depth	105 mm with Vario-plug ELCO 8016
Mounting	on 35 mm DIN-rail
Installation orientation	horizontally or vertically
Installation clearance	dependent on cable routing from ELCO 8016

Application: Wiring of H 7015A with H 7018

For fast and efficient wiring (plug and play) between a PLC cabinet and a marshalling cabinet, the Terminal Modules H 7015A, H 7018 and the cable BV 7201 are required.

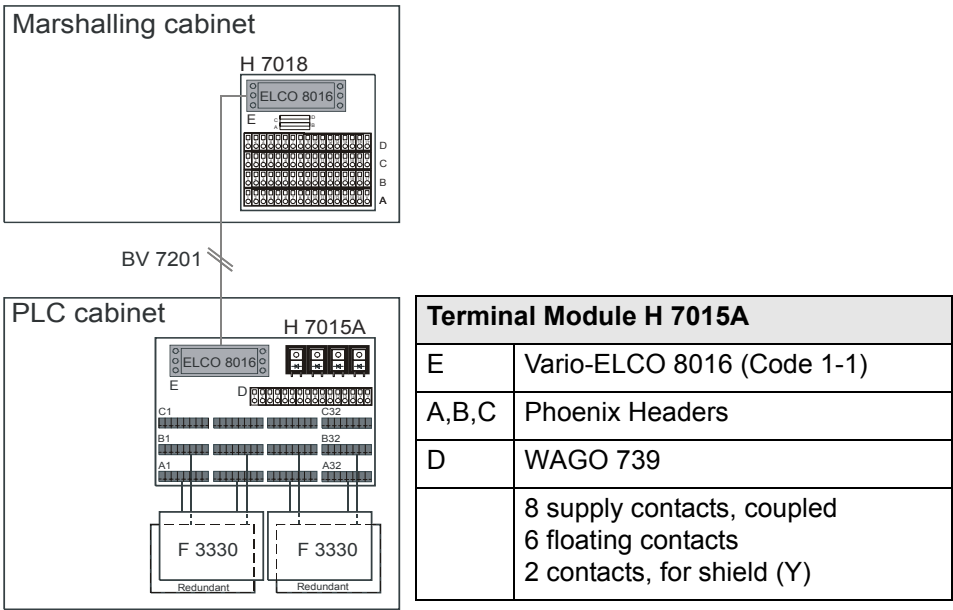


Figure 3: Wiring of H 7015A with H 7018



H 7020: Terminal Module

- For connection between the I/O modules and the field level
- For DIN-Rail mounting

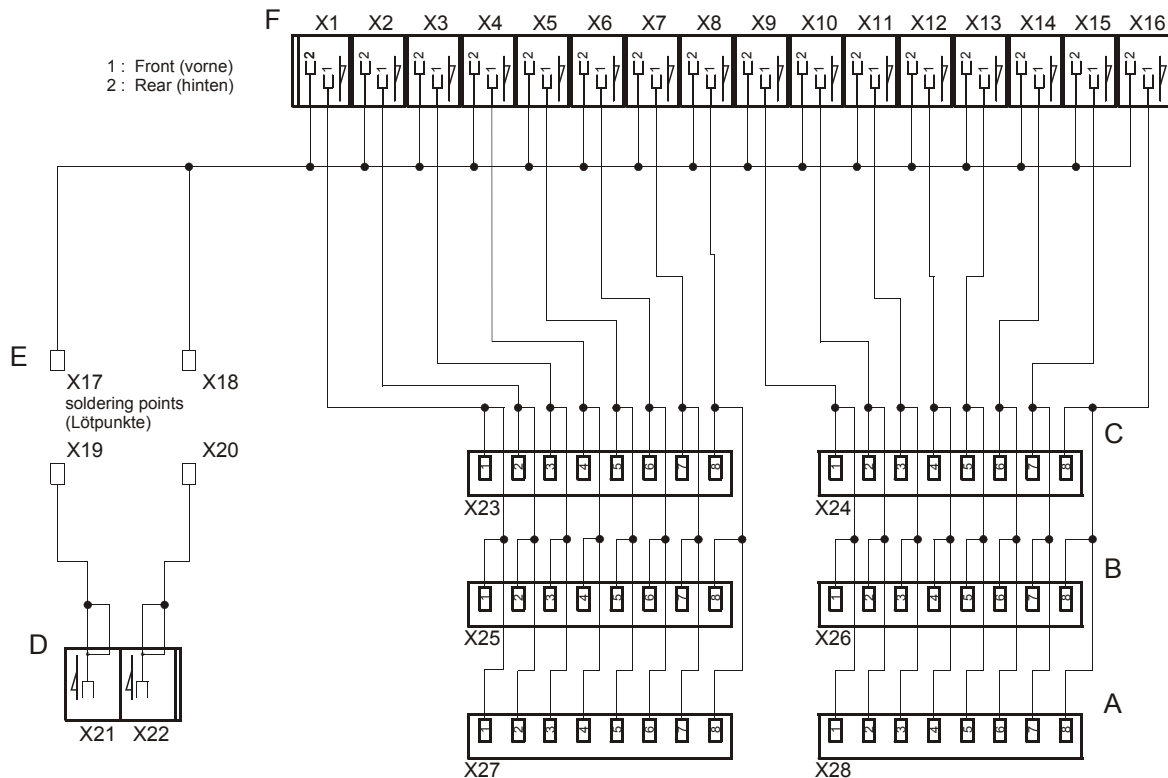


Figure 1: Block Diagram

Technical Data

Permissible voltage		max. 48 VDC, 30 VAC SELV or PELV
Current per channel	X1...X16	2 A
	X21...X22	4 A
Total current (X1-X16)		max. 16 A
Cross section	A, B, C	0.2...1.5 mm ² (Combicon Connector)
	D, F	0.2...1.5 mm ²
Ambient temperature range		-20°C to +50°C
Dimension (L x W x H)		90 mm x 91.5 mm x 60 mm
Mounting		on 35 mm DIN-Rail
Weight		ca. 130 g
Installation orientation		horizontally or vertically, installation clearance is not necessary

Wiring on the Terminal Module

Designator	Type		Contact	
F	X1 - X16	double-level terminal spring-cage connection	16x	1-pin
E	X17 - X20	soldering points (for soldering of jumpers or diodes)	4x	
D	X21 - X22	terminal spring-cage connection	2x	1-pin
A, B, C	X23 - X28	Phoenix Headers Accessories: Phoenix Combicon Connector FK-MCP 1,5/8-ST-3,81 HIMA Part-No. 52 0000 002	6x	8-pin

Table 1: Wiring on the Terminal Module

Diodes for inverse polarity protection

For wiring with input modules diodes are soldered between X17/X19, X18/X20.

Diode 1N5624 3A / 200 VDC
HIMA Part-No. 26 8200 015

Mechanical Design

The designators (L+,L-) on the labels D and F are project dependent.

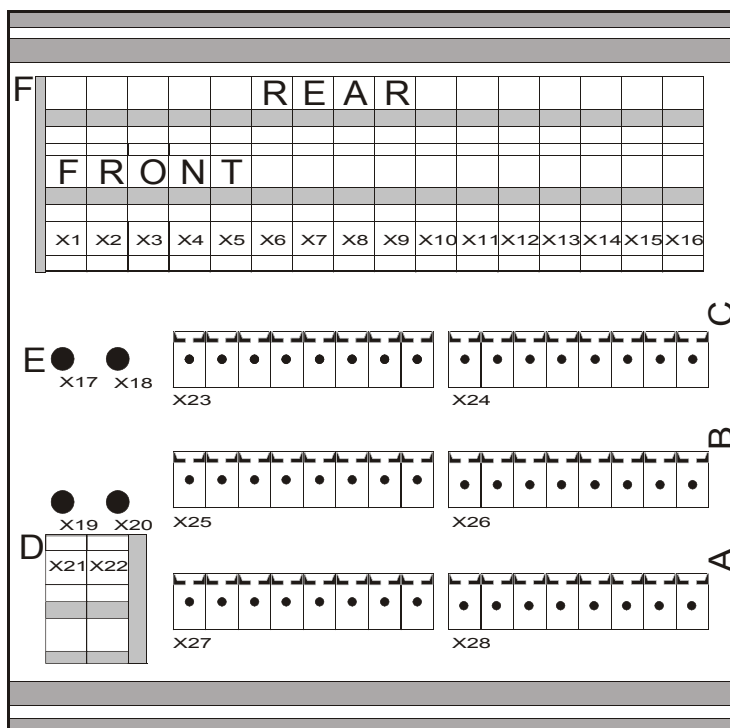


Figure 2: Mechanical Design H 7020

Applications for the Terminal Module H 7020

The terminal module is used to interconnect I/O modules single pole or double pole, redundant or mono and connect them with the field level. The terminal module can be mounted on DIN-Rails in control cabinets or in marshalling cabinets. Field cables can be attached directly from the field level to the clamps "F" of the terminal module. The advantage of the H 7020 terminal module is the complete connection of the I/O modules to the terminal module via confectioned Combicon connectors. The Combicon connector is used for a fast connection between the Terminal Module and other modules.

Wiring of H 7020 single pole redundant with F 3236 input modules

Both digital input modules F 3236 are each redundantly connected single pole to the terminal module via a 16-wire system cable. The following figures show redundant wiring of F 3236 input modules in a combined control and marshalling cabinet or in separate cabinets.

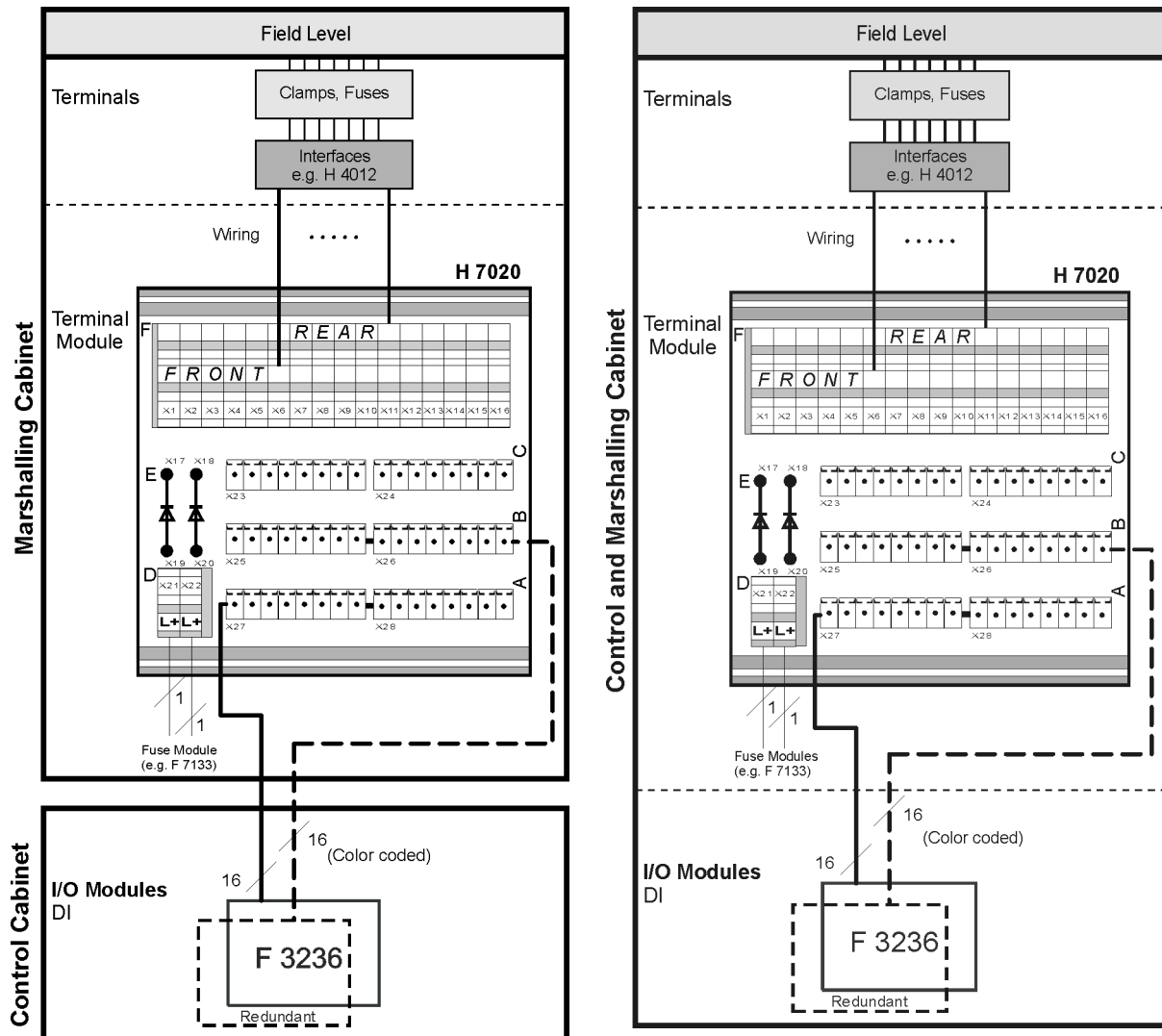


Figure 3: Single pole redundant wiring via H 7020

Note

The voltage supply L+ for the sensors and contact makers must be wired separately to the fuse module (e.g. F 7133). The fuse module is connected to clamp "D".

The wires of the two system cables are color coded and are clamped to Combicon connectors. For inverse polarity protection diodes are soldered between soldering points (X17/X19 and X18/X20) of the terminal module, if input modules are connected to the terminal module. The clamps "D" (headers X23 and X24) are used for test purposes.

Wiring of H 7020 single pole mono with output modules F 3330

Two digital output modules F 3330 are connected to the field level via terminal module H 7020. The two 8-wire system cables are connected single pole to the clamps "A" of the terminal module. The following figures show single pole wiring of two F 3330 output modules in a combined control and marshalling cabinet or in separate cabinets.

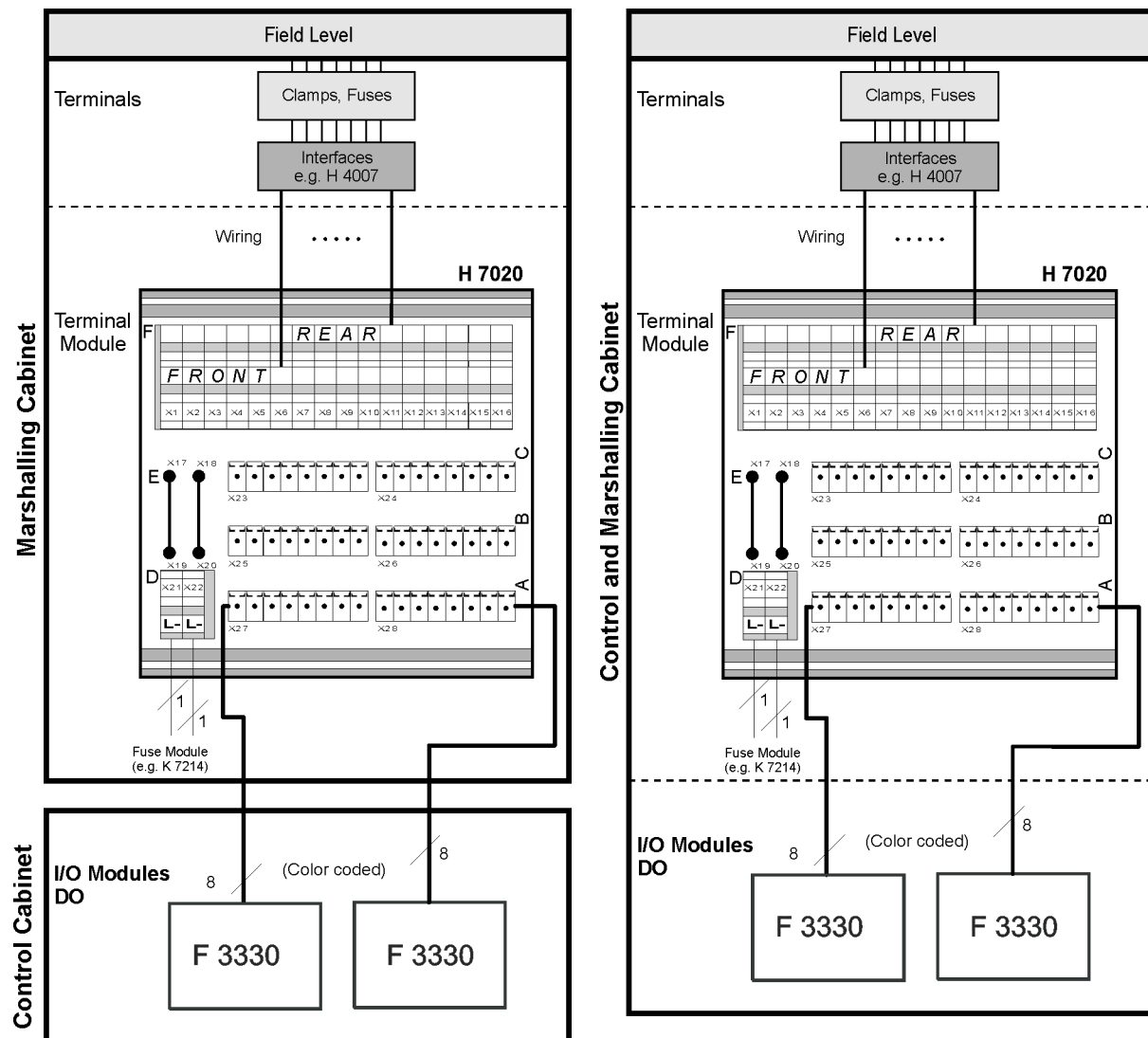


Figure 4: Single pole mono wiring via H 7020

Note

The reference potential L- should be wired separately to a central distribution (e.g. K 7214). The distribution is connected to clamp "D".

The wires of the two system cables are color coded and are clamped to Combicon connectors. For output modules the soldering points are only jumpered, different than for input modules.

Wiring of H 7020 redundant with analog output modules F 6217

Analog modules can be connected to the field level by the terminal module H 7020 the same way as digital modules. In the following example, the analog input modules F 6217 are connected redundantly to each other by the cable plug Z 7127 and the system cable. It is also possible to connect the I/O modules redundantly via voltage divider or transmitter. For information about redundant current and voltage connection of the analog output module F 6217 and the cable plugs, refer to the respective documentation.

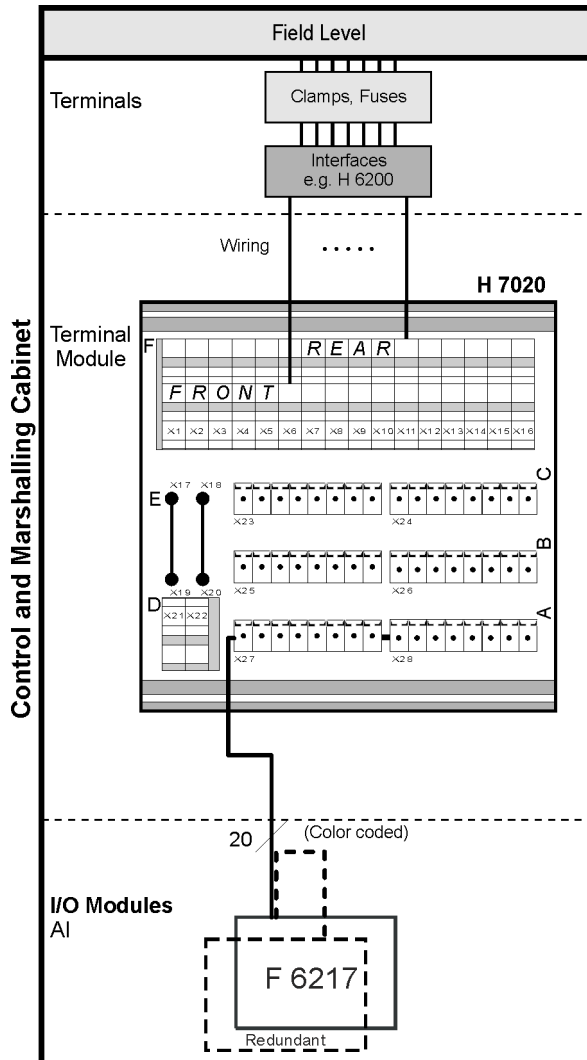


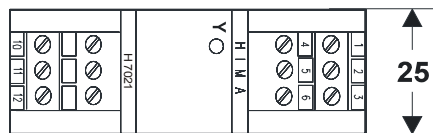
Figure 5: Redundant wiring of analog output modules F 6217

The soldering points are jumpered in case of connecting analog I/O modules.

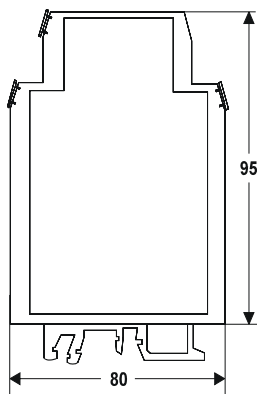


H 7021: Power supply filter

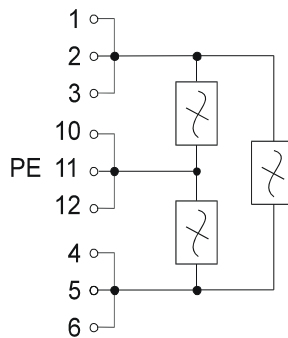
- for power supply systems 48 VDC



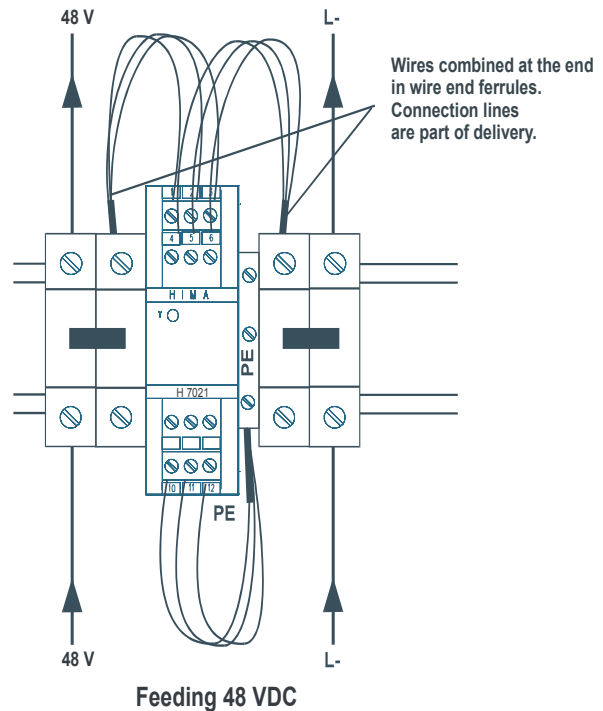
Top view



Side view



Circuit diagram



Feeding 48 VDC
with terminals on mounting rail

Figure 1: H 7021 power supply filter

The power supply filter H 7021 dampens wide-banded, low energy switching interferences (Burst) according to IEC EN 61000-4-4 up to 2 kV, and wide-banded, high energy overvoltages (Surge) according to IEC EN 61000-4-5 up to 1 kV on a 48 VDC power supply circuit. The interferences are discharged to earth.

Highest effectiveness can be achieved if the filter is installed directly at the 48 V power supply.

Connection

Height over mounting rail
Electric strength against earth
Max. permissible operation voltage
Power consumption
Ambient conditions

2.5 mm² directly on the device terminals,
combined wires on terminals of min. 10 mm²
approx. 100 mm
250 V
48 VAC / 60 VDC
3.0 mA at 48 VDC
-25...+70 °C

Mounting the H 7021 into Zone 2 (EG guideline 94/9/EG, ATEX)

The device is suitable for mounting into zone 2. The corresponding Declaration of Conformity is added on the following page.

For this mounting the following mentioned special conditions have to be regarded.

Special conditions X for safety-related application

1. The power supply filter **H 7021** must be mounted, for securing the category 3G, in an enclosure, which fulfills the requirements of the EN 60079-15 with the type of protection at least IP 54, according to EN 60529.
2. This enclosure must be labeled with

"Working permitted only in the de-energized state"

Exception:

If it is assured that there exists no explosive atmosphere working under voltage is also permitted.

3. The used enclosure must be able to dissipate safely the generated heat. The power dissipation of the power supply filter **H 7021** is **250 mW** max.
4. The following items of the standards

VDE 0170/0171 part 16, DIN EN 60079-15: 2004-5

VDE 0165 part 1, DIN EN 60079-14: 1998-08

must be regarded:

DIN EN 60079-15:

Chapter 5	Design
Chapter 6	Terminals and cabling
Chapter 7	Air and creeping distances
Chapter 14	Connectors

DIN EN 60079-14:

Chapter 5.2.3	Equipment for use in zone 2
Chapter 9.3	Cabling for zones 1 and 2
Chapter 12.2	Equipment for zones 1 and 2

The power supply filter additionally has the following label:

H I M A

**Paul Hildebrandt GmbH + Co KG
A.-Bassermann-Straße 28, D-68782 Brühl**



II 3 G EEx nA II T4 X

H 7021

**-25 °C ≤ Ta ≤ 70 °C
Special conditions X must be regarded!**

Konformitätserklärung Declaration of Conformity



Wir / We

HIMA Paul Hildebrandt GmbH + Co KG
Albert Bassermann-Straße 28 - 68782 Brühl
Postfach 1261 - 68777 Brühl
Telefon 0 62 02 / 709-0

erklären in alleiniger Verantwortung, dass die Produkte
declare under our sole responsibility that the products

QF - H 7013	Netzfilter, 24 VDC
QF - H 7021	Netzfilter, 48 VDC

auf die sich diese Erklärung bezieht, mit den folgenden Normen übereinstimmt.
to which this declaration relates is in conformity with the following standards.

EN 61000-6-4 (08.02)
EN 61000-6-2 (08.02)

EN 61131-2 (2003)

EN 60079-15 (2003)

Elektrische Betriebsmittel für gasexplosionsgefährdete Breiche – Teil 15 : Zündschutzart "n"
Electrical apparatus for explosive gas atmospheres – Part 15 : Type of protection "n"

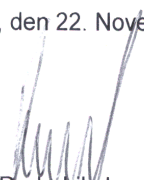
Gemäß den Bestimmungen der Richtlinien
Following the provisions of Directives

EMV-Richtlinie **89/336/EWG**

Ex-Richtlinie **94/9/EG**

Brühl, den 22. November 2005

ppa.


Prof. Dr. habil. Josef Börsök
Bereichsleiter Entwicklung
Vice-President Development

i.A.


Jürgen Hölzel
Leiter Vorentwicklung und Qualitätswesen
Lead Engineer Predevelopment and Quality Assurance



H 7505: Multifunctional interface converter

to built up the bus systems:

HIBUS-1 4-wire-bus, HIBUS-L, RS 422, full duplex,
active bus coupling

HIBUS-2 2-wire-bus, RS 485, half duplex,
passive bus coupling

HIBUS-2/HIBUS-2 Repeater

HIBUS-2/HIBUS-1 Repeater

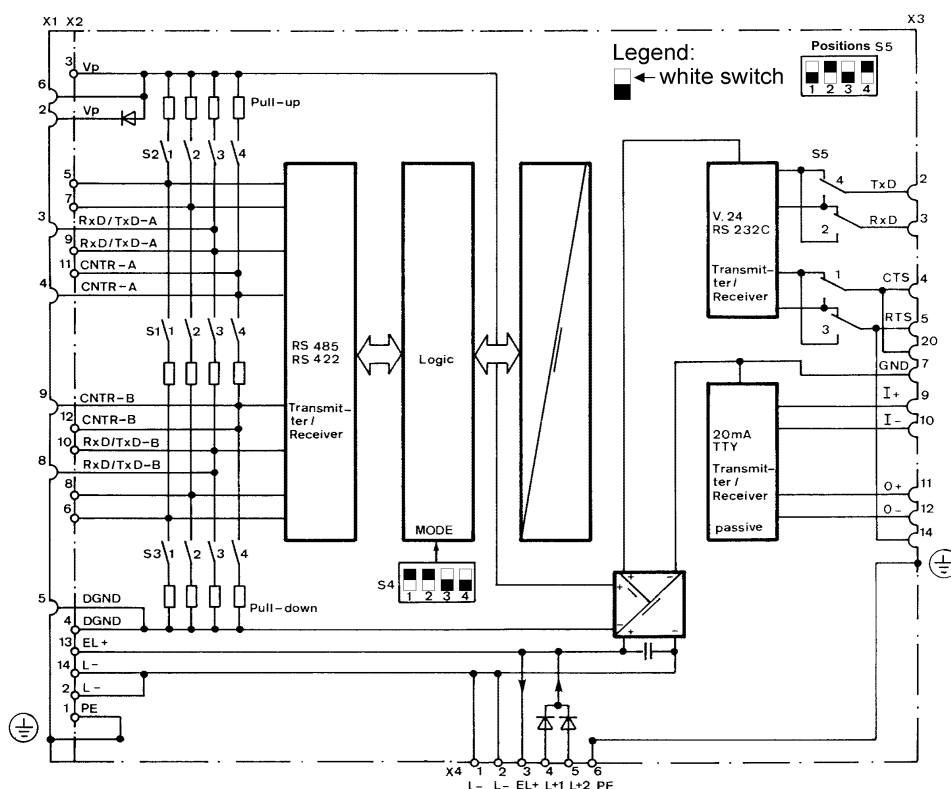


Figure 1: Block diagram

Note

The signal designations written at X2 are only valid for the HIBUS-2 connection, otherwise refer to table "operating modes".
Connectors and setting elements (refer also to the block diagram):
S1, S2, S3 Switches for the bus termination resistors
S4 Mode selection switch
S5 Switch for signal crossing (RS 232 C only)

Note

Adjust the switches S1...S5 only under the considering of all ESD protection measures. The direct touching is only allowed for electrostatic discharged persons.
X1 MIN-D socket 9-poles for HIBUS-2 connection
X2 Plug clamp 14-poles for HIBUS-1 connection and L+, L- supply
X3 MIN-D socket 25-pole for RS 232 C and TTY connection
X4 Plug clamp 6-poles for L+, L- supply

Note Choice of power supply connection on X2 or X4, depending on the mounting position.
Operating data 24 VDC / 120 mA

Note With exceeding the ambient temperature of 50 °C the transparent cover will be deformed.
This will not influence the function of the module.

Table of the operating modes

Mode	Applicati-on	Setting S4	5	6	7	8	9	10	11	12	active connect.
TTY — RS 232C	①	ON OFF 1 2 3 4	—	—	—	—	—	—	—	—	X3
Repeater HIBUS-2 — HIBUS-1	② 3)	ON OFF 1 2 3 4	S+	S-	E+	E-	RxD/ TxD-A	RxD/ TxD-B	CNTR -A	CNTR -B	X1/X2
RS 232C — HIBUS-2	④ 4)	ON OFF 1 2 3 4	—	—	—	—	—	—	—	—	X1/X3
RTS — CNTR	⑤	ON OFF 1 2 3 4	BE+	BE-	AE+	AE-	AS+	AS-	BS+	BS-	X2/X3
TTY — HIBUS-1	⑥ 1)	ON OFF 1 2 3 4	BE+	BE-	AE+	AE-	AS+	AS-	BS+	BS-	X2/X3
RS 232C — HIBUS-1	⑦	ON OFF 1 2 3 4	RxD/ TxD-A Bus 1	RxD/ TxD-B Bus 1	CNTR -A Bus 2	CNTR -B Bus 2	RxD/ TxD-A Bus 2	RxD/ TxD-B Bus 2	CNTR -A Bus 1	CNTR -B Bus 1	X2
HIBUS-2-Repeater	⑧	ON OFF 1 2 3 4	CTS+	CTS-	RxD+	RxD-	TxD+	TxD-	RTS+	RTS-	X2
HIMA-network	⑨ 2)	ON OFF 1 2 3 4	BE+	BE-	AE+	AE-	AS+	AS-	BS+	BS-	X2/X3
RS 232C — HIBUS-1	⑩ 5)	ON OFF 1 2 3 4	—	—	—	—	—	—	—	—	X1/X3

V.24 = RS 232 C (H50, PC, PLS)

20 mA = TTY (H30)

HIBUS-2 = PROFIBUS (Hardware compatible)

= RS 485 (H51)

HIBUS-1 = RS 422 (H7503)

1) constant status signal (= H7503 A)

2) active status signal (= H 7503)

3) only at the end of the HIBUS-1

4) since 1992 (ref. to planning list), PLESY-P V ≥ 1.5
The DTR signal controls the direction of the H 7505, basic direction RS 485 --> RS 232C

5) till 1992 (ref. to planning list), PLESY-P V ≤ 1.4
The CNTR signals of the RS 485 interface control the direction of the H 7505, basic direction RS 232C --> RS 485
Application ④ and ⑩: Setting in ELOP II, Wizcon (connection via Modem, fiber optic cable)

Legend:

◻ ← white switch
◼

Transmission rates

20 mA ≤ 19,200 bps

V.24 ≤ 57,600 bps

RS 485 and RS 422 ≤ 600,000 bps

Cable cross sections for power supply

max. cable length	250 m	400 m	530 m	800 m	1300 m	2500 m
Cross section (mm ²)	0.5	0.75	1.0	1.5	2.5	4.0

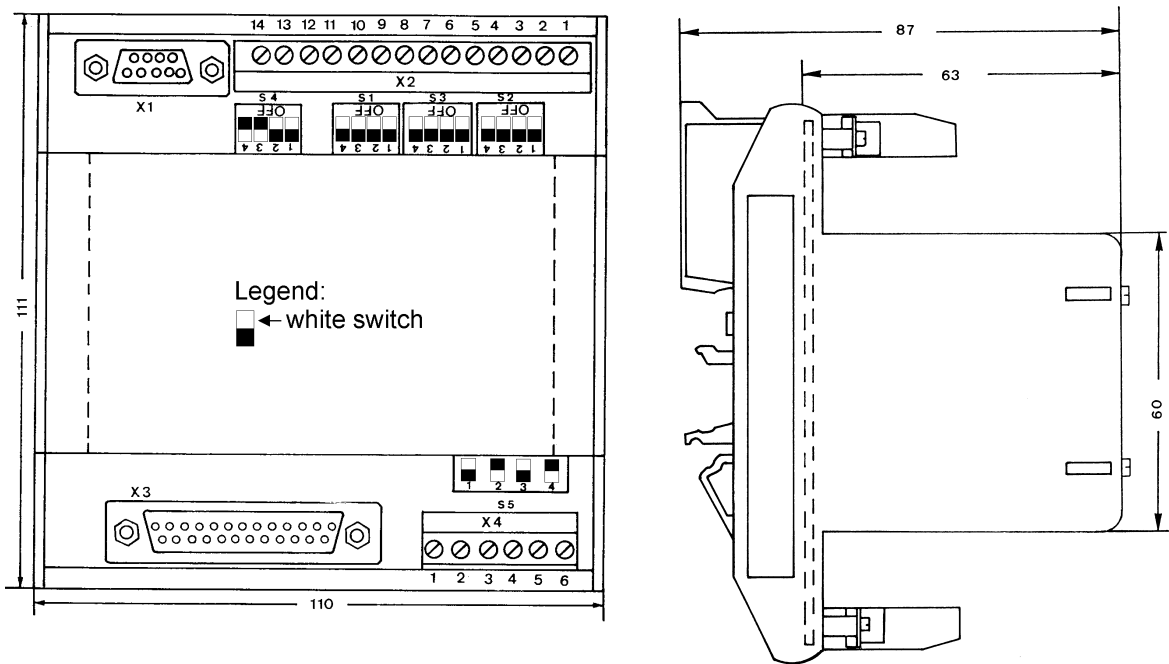


Figure 2: Dimensions of the housing

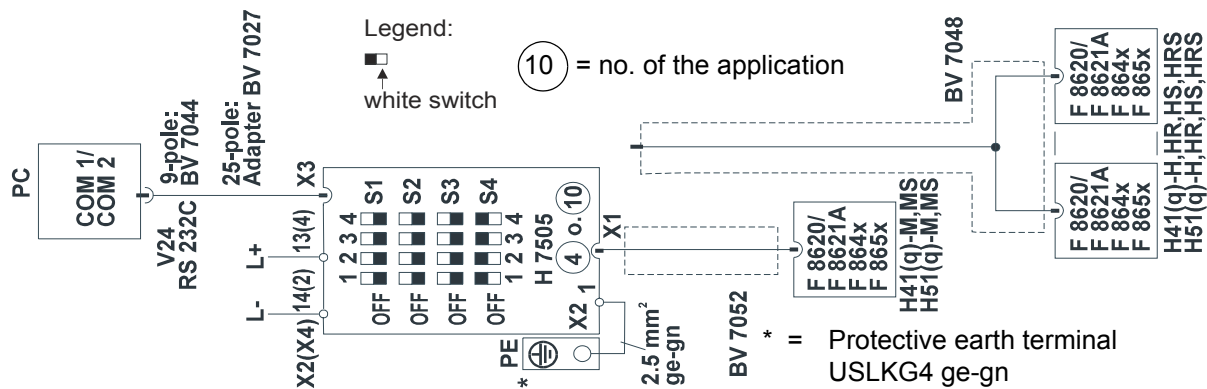


Figure 3: Direct connection PC to H41(q)/H51(q)

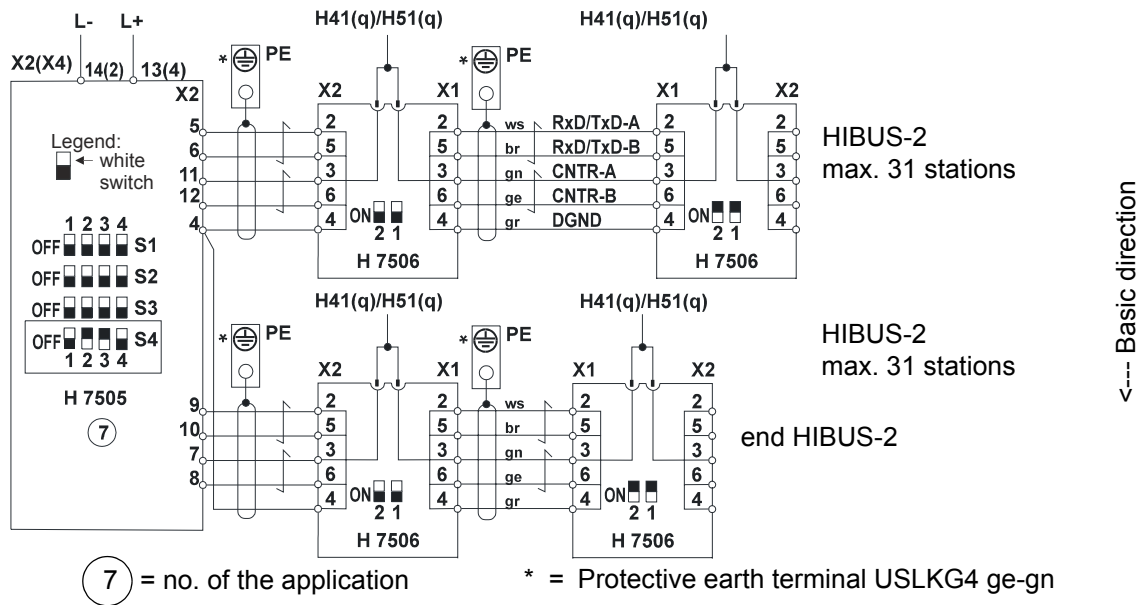


Figure 4: Use as a HIBUS-2 repeater in one basic direction

In this case the control lines to switch over the basic direction have to be used additionally.

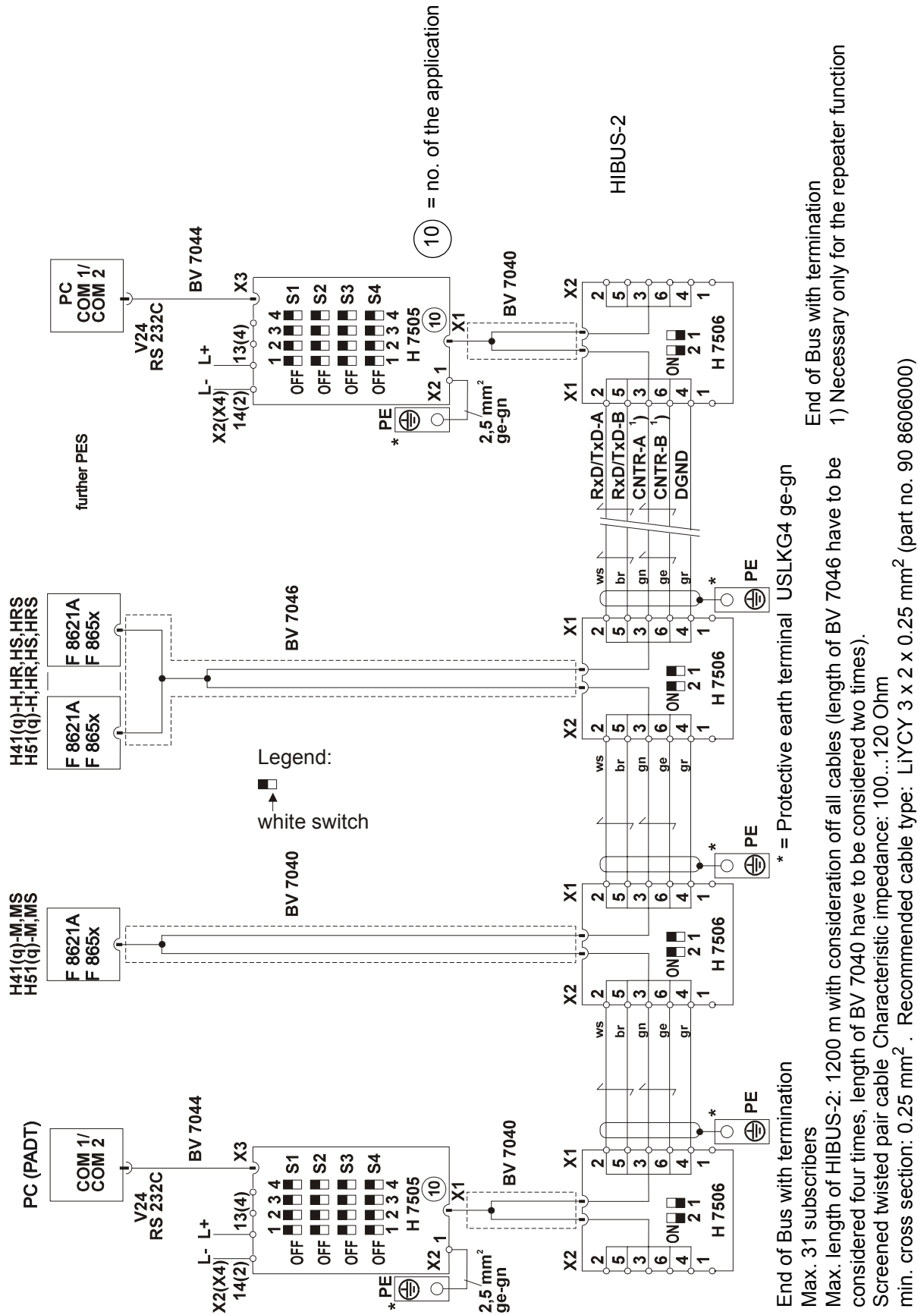
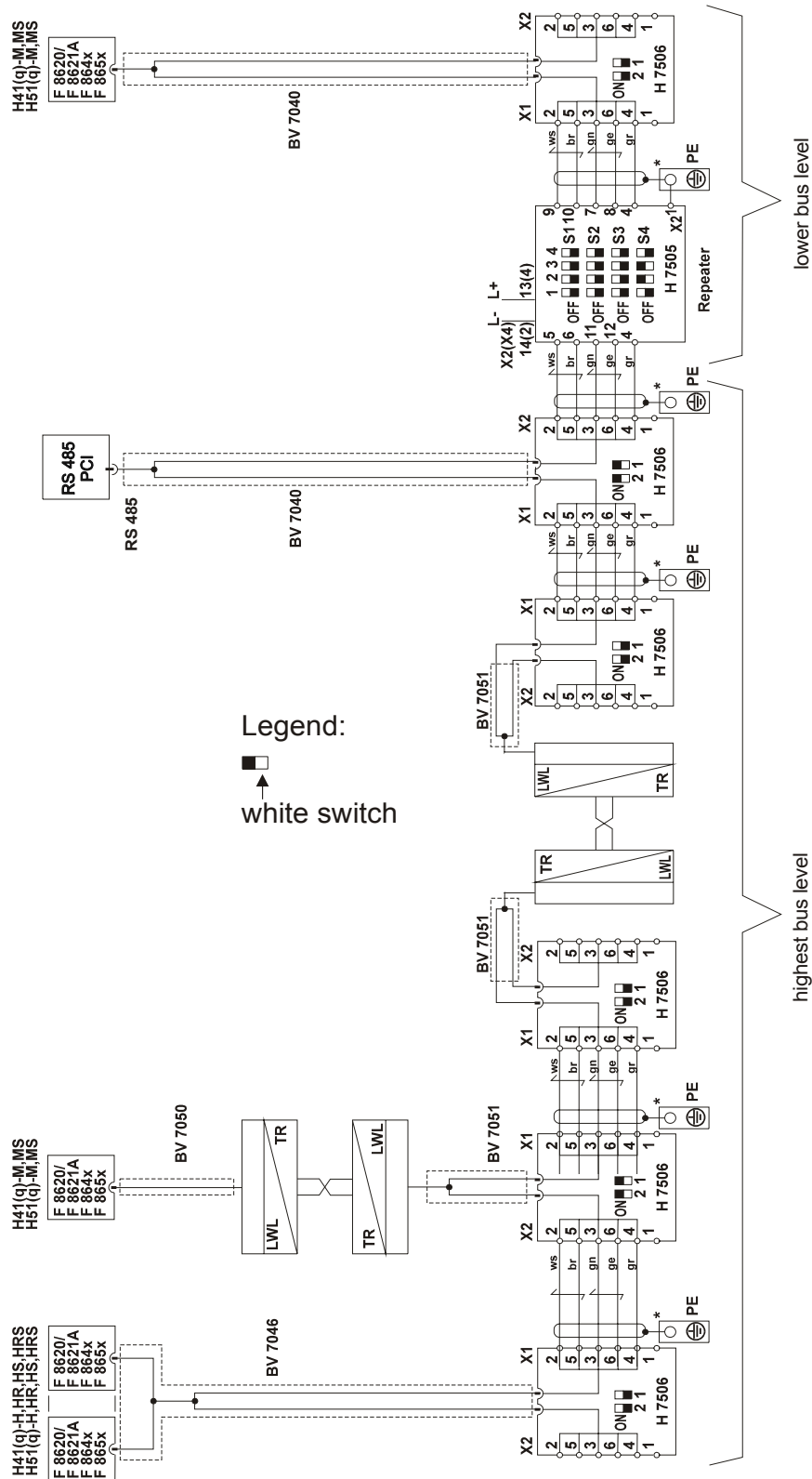


Figure 5: Communication by HIBUS-2

For HIMA system software with flying-master capabilities since 1992 (refer to planning list) and with interface converter since ID-no. 03.



* = Protective earth terminal USLKG4 ge-gn

Figure 6: Use of optical fibres

The 4-wire-connections can also be designed as optical fibres.

- Range: 2000 m max.
- With using in bus systems with several bus levels coupled with repeaters the optical conductors may only be used in the highest bus level (no transmission of the status signal)!

The coupling of a device with RS 232C interface is only possible with the correct operating of the status signal.



H 7506: Bus terminal

for the installation of HIBUS-2 (RS 485)

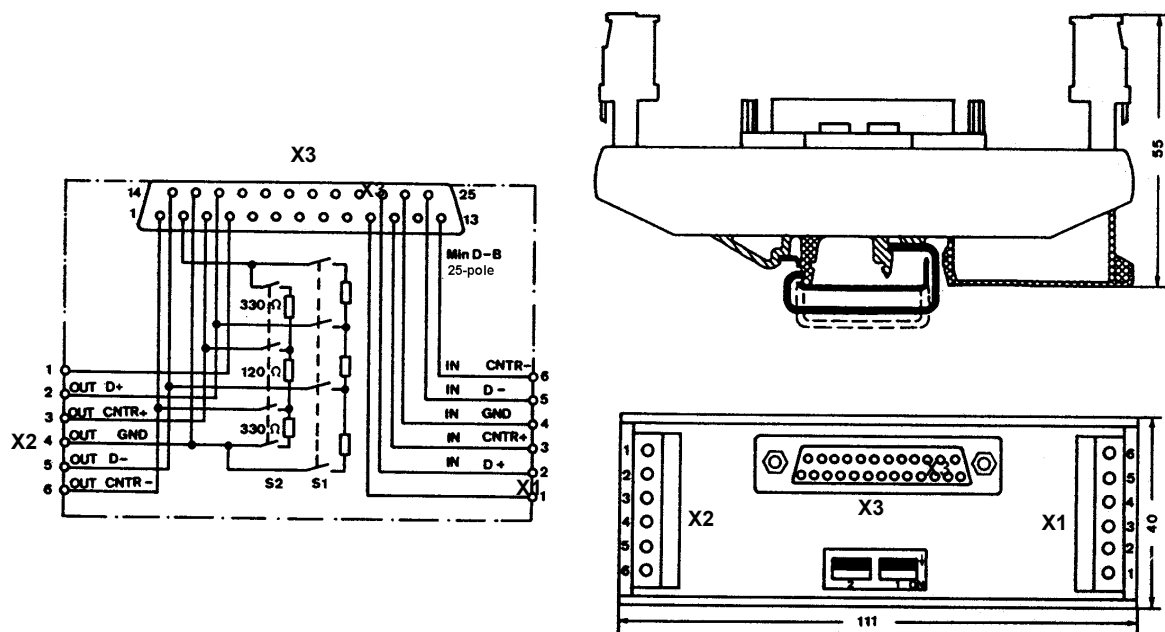


Figure 1: Wiring diagram, top view, front view

The bus terminal consists of a 25-pole Min-D socket to connect single channel PES and redundant PES H41q/H51q via the data cables BV 7040 or BV 7046.

The connections for the 2-wire bus are made by means of two 6-pole terminal blocks. By selection of two switches the bus terminating resistors can be switched on at each end of the 2-wire bus. If the bus terminal block H 7506 is used at the end of the 2-wire bus then the terminal block X2 cannot be connected.

Use of the bus terminal H 7506 see the following application and the applications in data sheet H 7505.

Mechanical design

Terminal box for top hat profile rail according to EN 50022
two 6-pole terminal blocks for cross-sections up to 2.5 mm²
one 25-pole Min-D socket, protective earth terminal

Note

Do not use PIN1 bus terminal X1.1 and X2.1 to prevent interferences on the bus.
Connect the wire shield to the protective earth terminal.

Application:

Programmer station (PADT) with RS 485 interface card RS 485 PCI

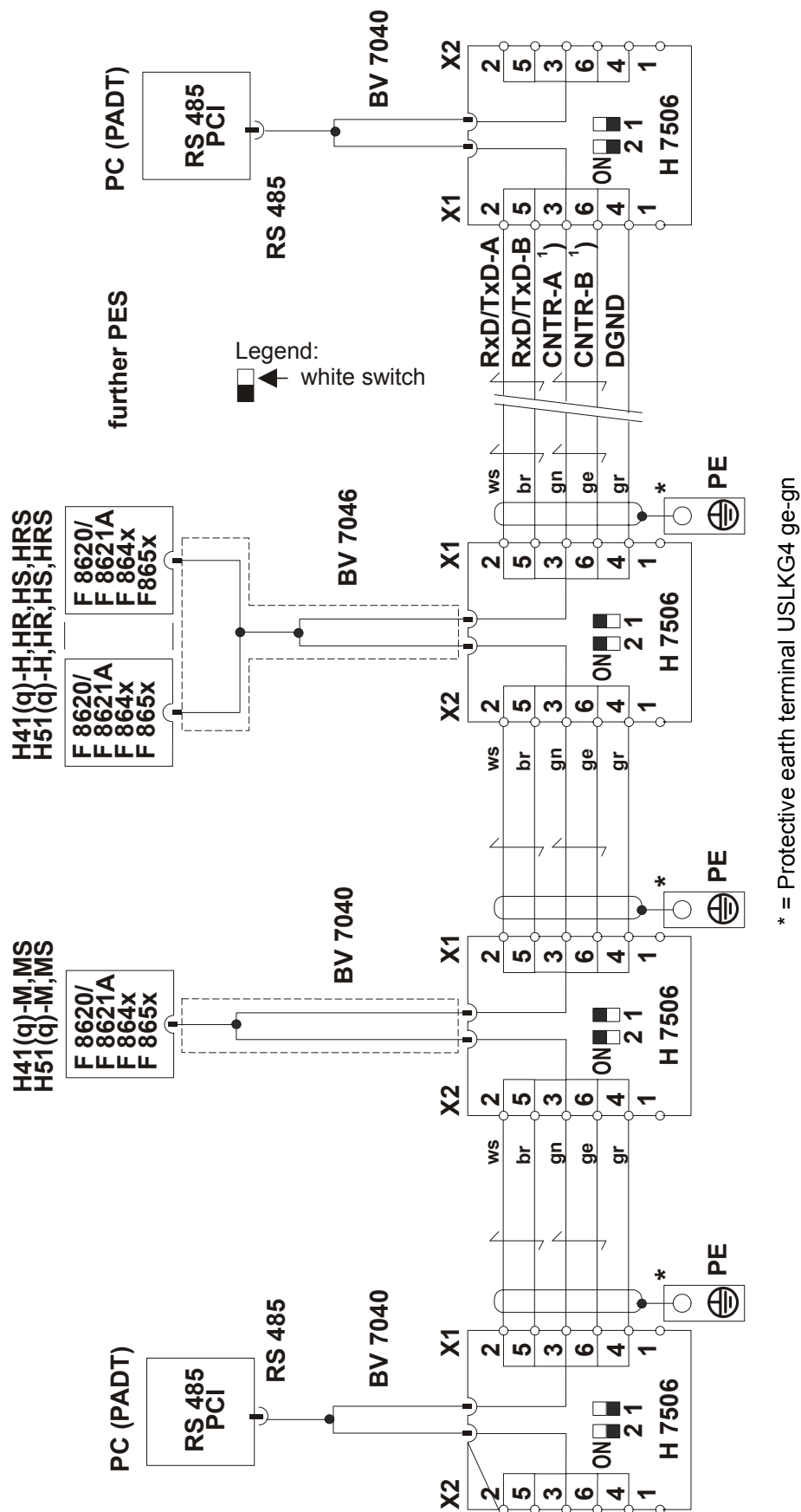


Figure 2: Programmer station (PADT) with RS 485 interface card RS 485 PCI



RS 485 PCI: Interface card

RS 485 Interface extension card for personal computers

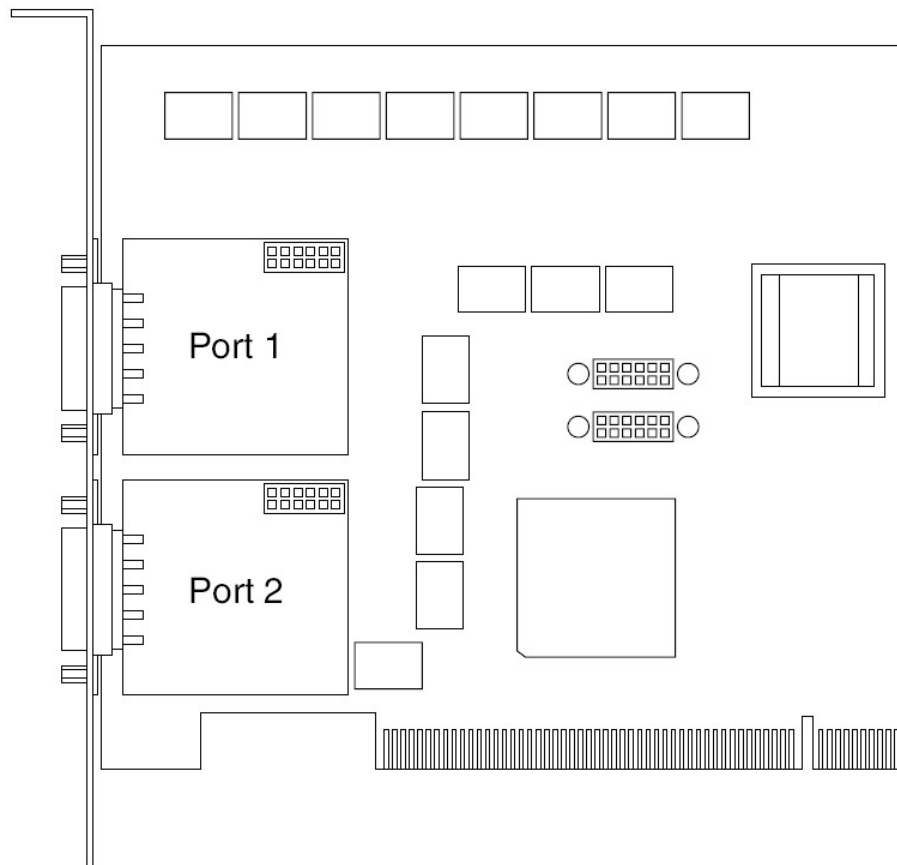


Figure 1: Side view

The card contains two independent RS 485 interfaces as an extension for a PC (PADT). The interfaces are electrically isolated (also among themselves) and suitable to connect HIBUS-2 directly to programmer units and visualization stations.

Baud rate	9.6 to 57.6 kBaud
Data format	any
Basis addresses	automatic configuration
Interrupts	automatic configuration
Isolation (electric isolation)	> 1 kV
Connections	2 Sub-D plugs 9-pole
Operating data	5 V / 0.2 A
Dimensions	120 x 106 mm
Weight	approx. 110 g



After installation of the following HIMA programs the FIFO for the corresponding interface must be deactivated in the device manager of the windows operating system (communication ports):

- ELOP II
- OPC A&E
- Axeda Supervisor (Wizcon)

Operation with *ELOP II*

If short-time disturbances or failures in communication should still occur despite of a deactivated FIFO, the following measures can solve the problems:

from ELOP II Version 4.1: reduce value for message length

Open in the context menu of the resource *Properties* and reduce the value for the message length in the register *PADT (PC)*.

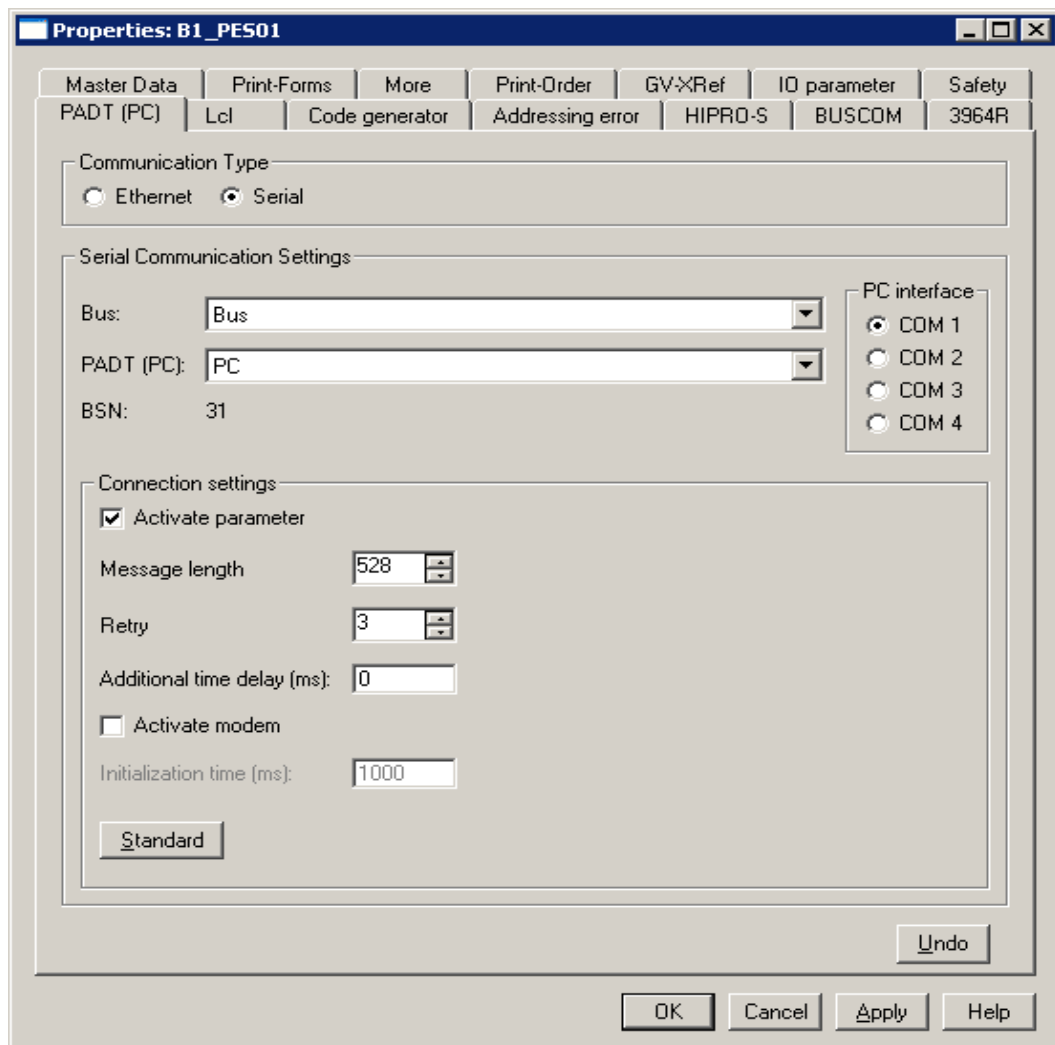


Figure 2: Reduce value of message length

The check box "Activate parameter" must be set that a change of the message length becomes active.

up to ELOP II Version 3.5: Setting the time delay

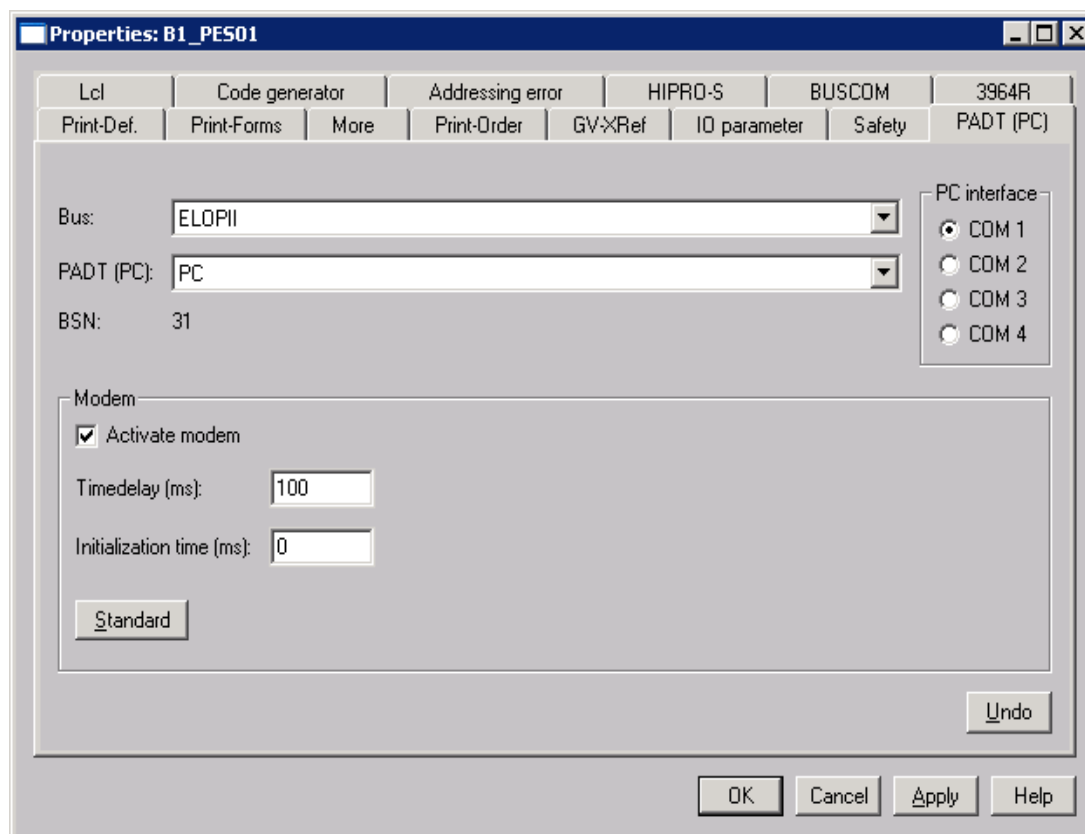


Figure 3: Setting the time delay at modem

The check box "Activate modem" must be set that a change of the time delay becomes active for the communication.

After initialization of the "Modem Connection" after each start from the control panel or at online tests an annunciation results about the initialization of the time.

Bus system with *ELOP II* and *HIPRO* data exchange (several masters)

If the bus system is used in common for *ELOP II* and *HIPRO*, several bus masters share the communication. If in this case the time delay was activated as described above, the time delays must be set for all masters to the same value. This time delay must be the same as the time delay of the modem otherwise the following error message will appear:

" If the PADT and the PES Master are used together on the same bus the same time delay setting must be used. Please check your time settings. "

Therefore in the configuration of the project

- select *Properties*,
- select the bus and mark it to open the dialog *Edit HIBUS*,
- select bus station *PES master* and process it in the dialog *HIBUS station*. There the time delay is set (example *ELOP II* up to version 4.1):

Figure 4: Setting the time delay at PES master

Note

With a loss of the communication connection an increased time delay triggers an increased bus cycle time. The concerning master waits during the defined time delay for an answer and so delays the data exchange.

This performance has to be considered.

Pin	RS 485	Signal	Meaning
1	-	-	not used
2	-	RP	5 V, decoupled by diodes
3	A/A'	RxD/TxD-A	Receive/Transmit Data A
4	-	CNTR-A	Control signal A
5	C/C'	DGND	Data Ground
6	-	VP	5 V, positive pole of power supply
7	-	-	not used
8	B/B'	RxD/TxD-B	Receive/Transmit Data B
9	-	CNTR-B	Control signal B

Table 1: Pin assignment of the interfaces RS 485, 9-pole

HIMA Paul Hildebrandt GmbH + Co KG
Industrie-Automatisierung
Documentation
P.O. Box 1261
68777 Brühl
Germany

From:
Company:

Name:
Dept.:
Address:

Phone:
Fax:

Date

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Please use therefore just this page or a photocopy of it and send it to us by post or by fax.
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Sub.: The H41q and H51q System Families

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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