

# Programmable Systems

## The H41q and H51q System Families

Catalog



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Industrial Automation

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## **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.

## **Important Notes**

All HIMA products mentioned in this manual are protected with the HIMA trade-mark. As not differently noted down this is possibly also valid for other mentioned manufacturers and their products.

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

All technical statements and data in this manual have been worked out very carefully, and effective checks and inspections have been applied. This manual may however contain flaws or typesetting errors. Therefore HIMA does not offer any warranties nor assume legal responsibility nor any liability for the possible consequences of any errors in this manual. HIMA would appreciate being informed on possible errors.

The technology is subject to changes without notice.

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Eventual complaints can be recognized only when we are being notified within 14 days after receipt of the merchandize.

The prices shown in a special list are valid ex works, packing charges excluded. The prices are subject to change.

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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 manual contains general notes to the PES and the description of the system families. 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 data sheets of the system and the modules are available on HIMA website at [www.hima.com](http://www.hima.com).**

Each type of PES has a corresponding assembly kit.

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 <sup>1)</sup>	mono <sup>1)</sup>	redundant
I/O bus	mono	mono	redundant

**Table 1: Safety and Availability**

<sup>1)</sup> 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.

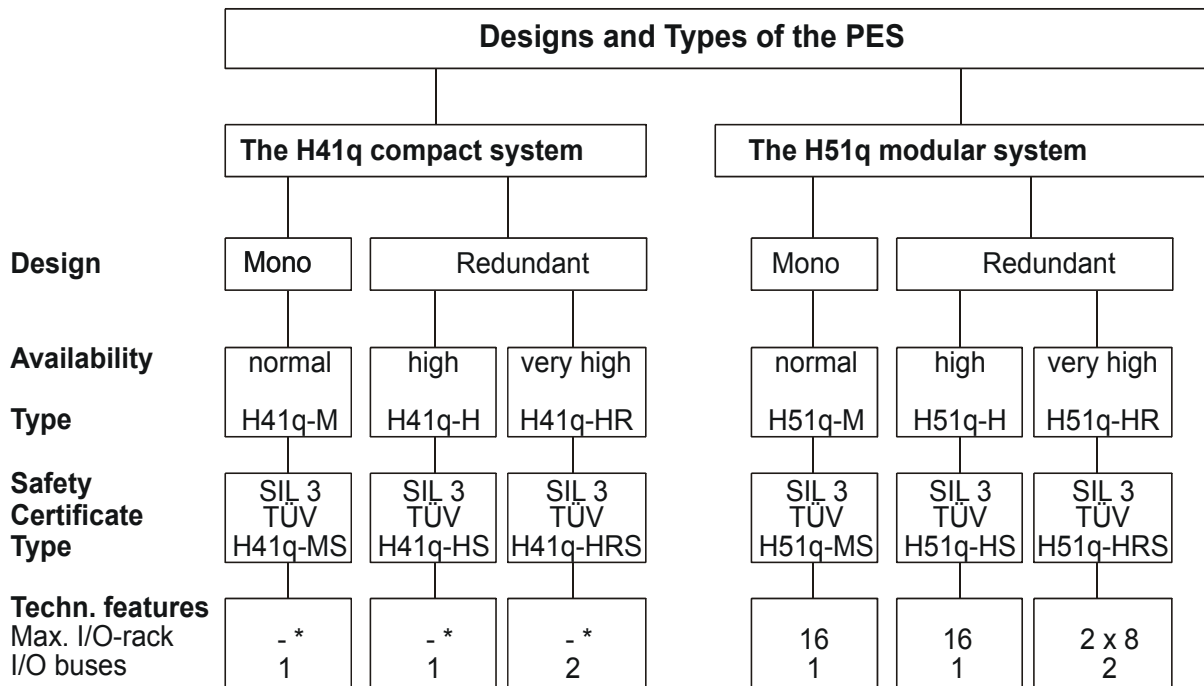
Mono = single channel system structure

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

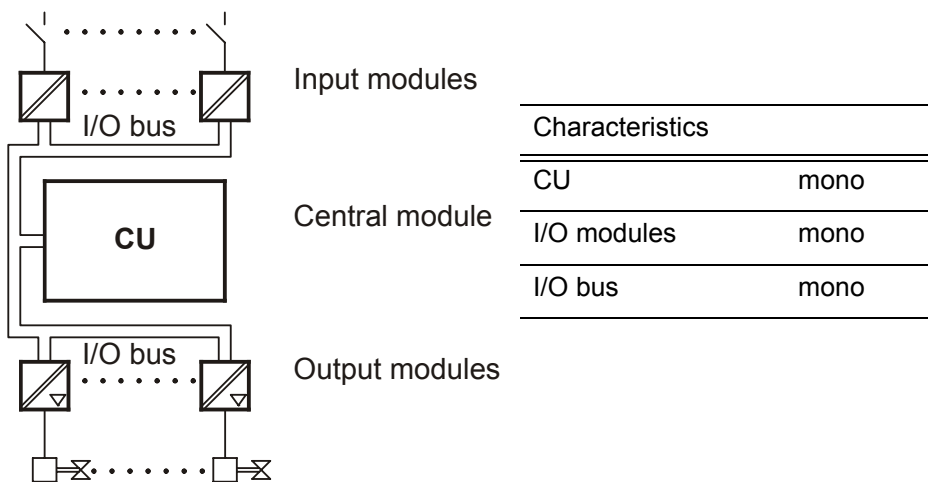


Figure 2: Concept of H41q-M, MS / H51q-M, MS

# Concept of the HIMA PES

## 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

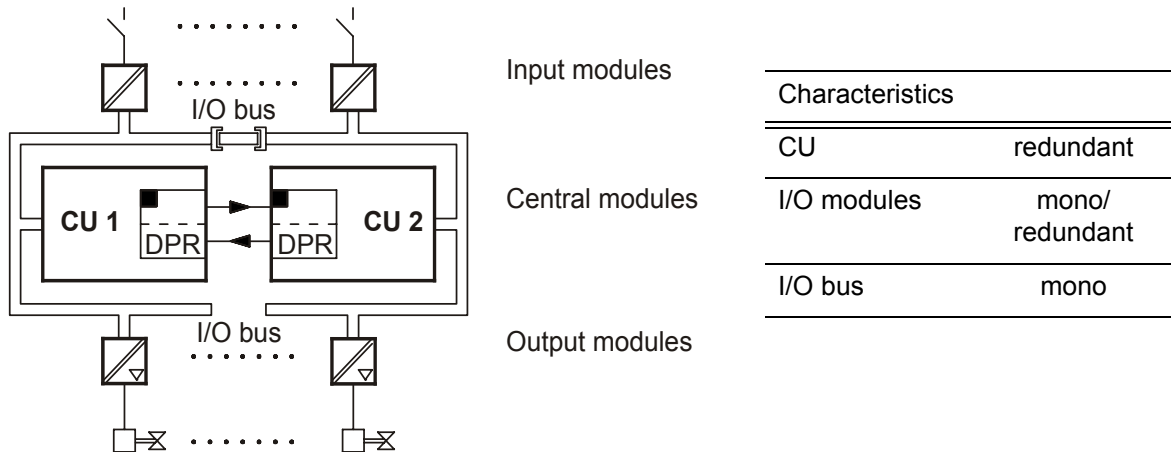


Figure 3: Concept of H41q-H, HS / H51q-H, HS

## 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

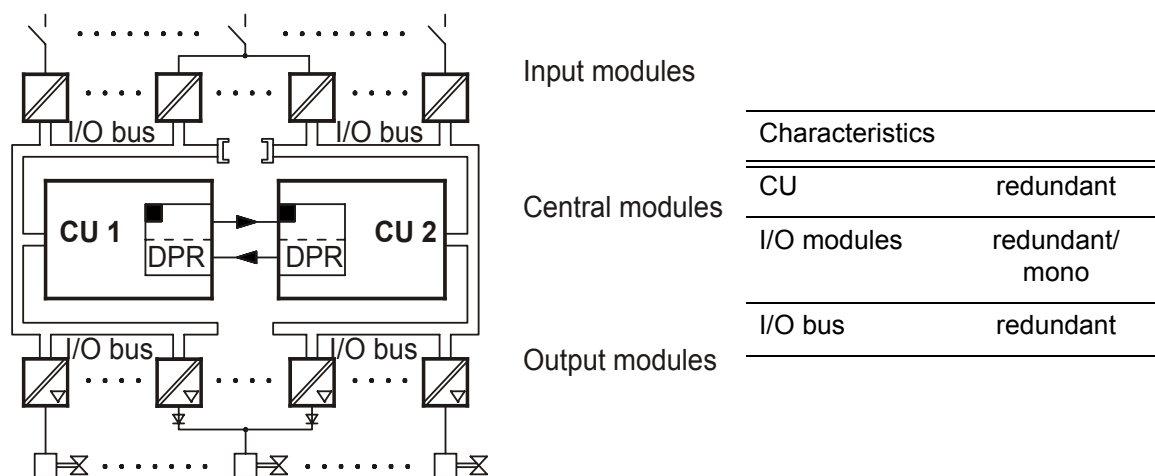


Figure 4: Concept of H41q-HR, HRS / H51q-HR, HRS

## Concept of the HIMA PES

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### 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/EWG 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).

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<b>Note</b>	Due to the high inrush current of lamps the correct dimensioning of the power supply units for lamp loads must be regarded.
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## 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 fusing, 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.

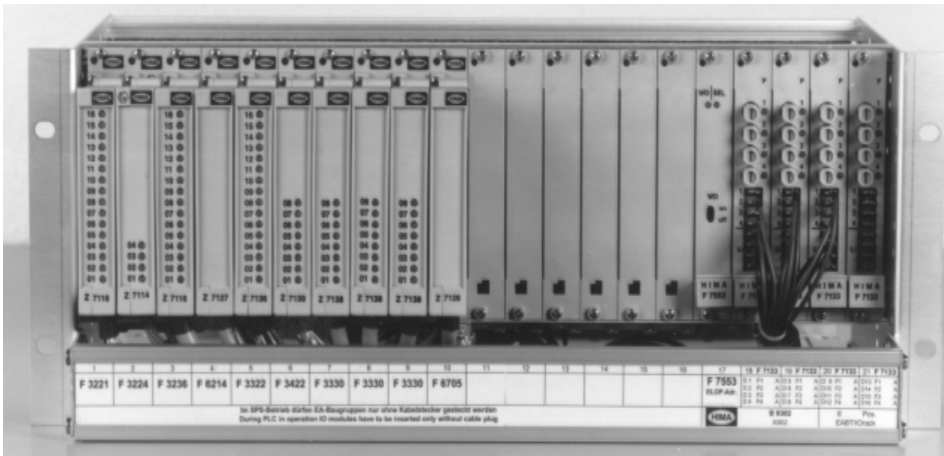


Figure 5: View of the I/O subrack 4 units high

#### 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

## The H51q System Family

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.

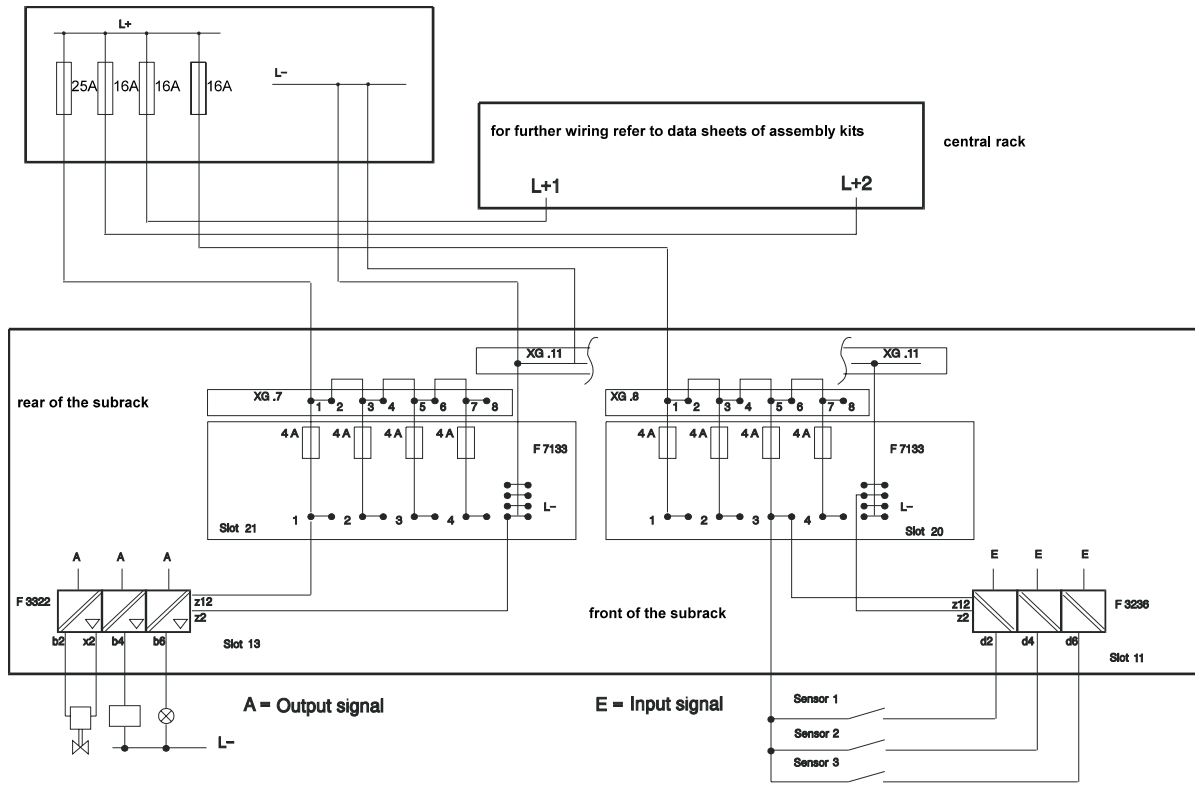


Figure 6: Feeding and distribution 24 VDC

### 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).

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<b>Note</b>	Due to the high inrush current of lamps the correct dimensioning of the power supply units for lamp loads must be regarded.
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## 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 (with redundant CUs up to 4 interfaces)
Interface extensions	
Quantity H51q	max. 5 interfaces on 5 communication modules (with redundant CUs up to 10 interfaces)
Interface extensions	
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 (with redundant CUs up to 4 interfaces)
Interface extensions	
Quantity H51q	max. 5 interfaces on 5 communication modules (with redundant CUs up to 10 interfaces)
Interface extensions	
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:

<b>IEC/EN 61131-2 Chapter 6.3.7</b>	<b>Verification of DC Power Supply Characteristics</b>
	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  $\geq 3.0$  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.

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### 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.

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- 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.

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### 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.

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<b>Note</b>	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.
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**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.

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<b>Note</b>	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.
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### 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/EEC 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

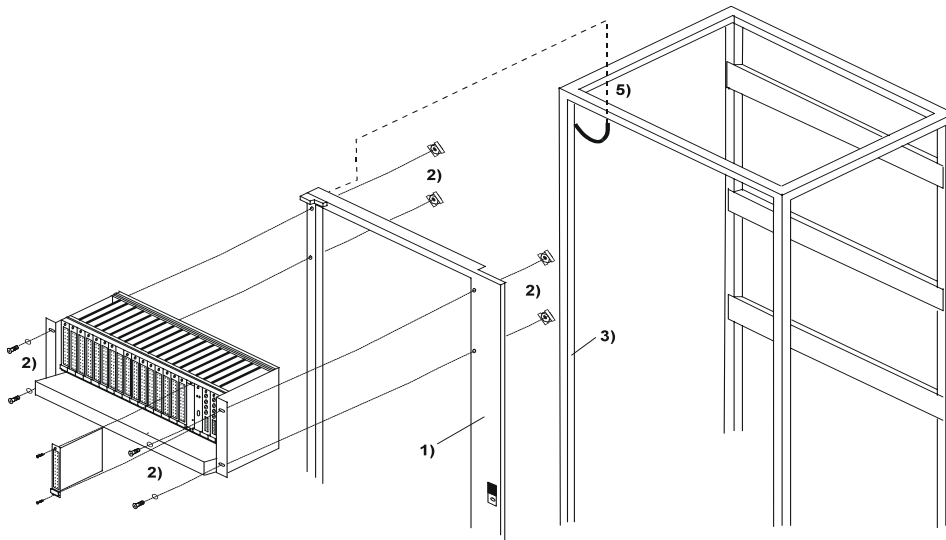
Reliable earthing and thus the fulfillment of the valid EMC regulations in HIMA systems is achieved by the measures described below.

#### 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).

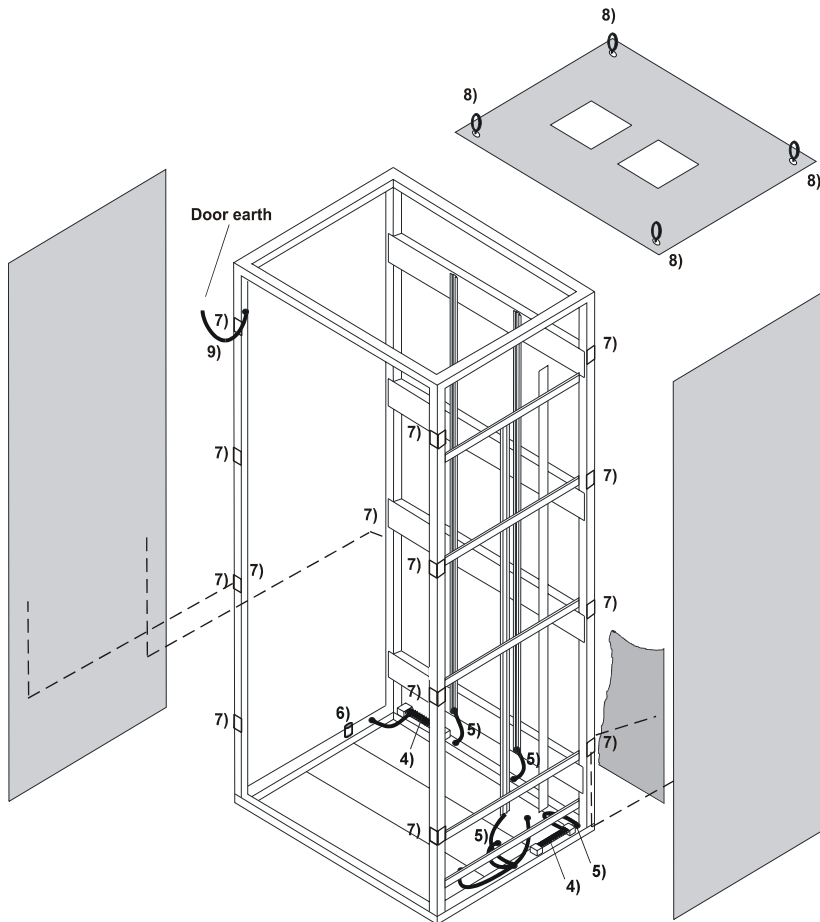
The parts of the cabinet framework (3) are welded together and therefore they make up an electrically conductive constructional element. Swing frame, door, mounting rails and mounting plates (if existing) are conductively connected to the cabinet framework via short earthing straps with a cross section of 16 mm<sup>2</sup> or 25 mm<sup>2</sup>. 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 mm<sup>2</sup> 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 <sup>2</sup>	300 mm
Door	9)	16 mm <sup>2</sup>	300 mm
Swing frame		25 mm <sup>2</sup>	300 mm
M 2500 bus bar (single-sided with connector sleeve)	4)	25 mm <sup>2</sup>	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

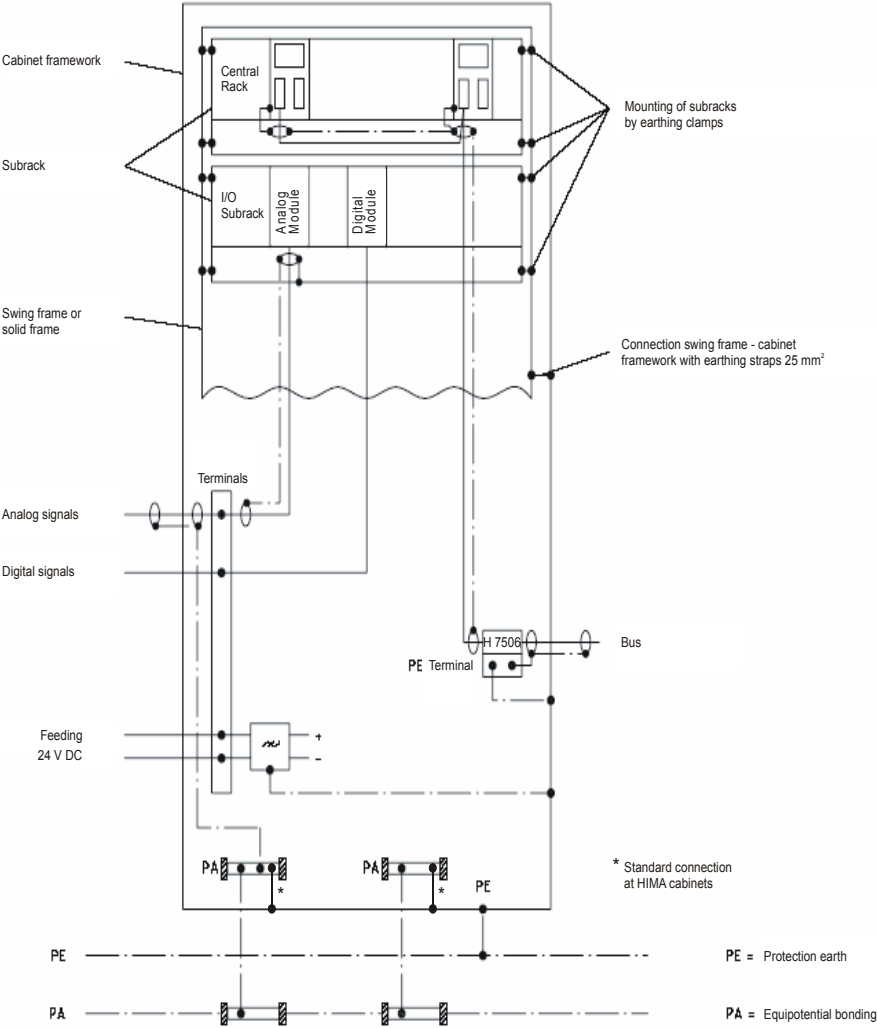


Figure 9: Earthing and shielding concept of the system cabinet

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.

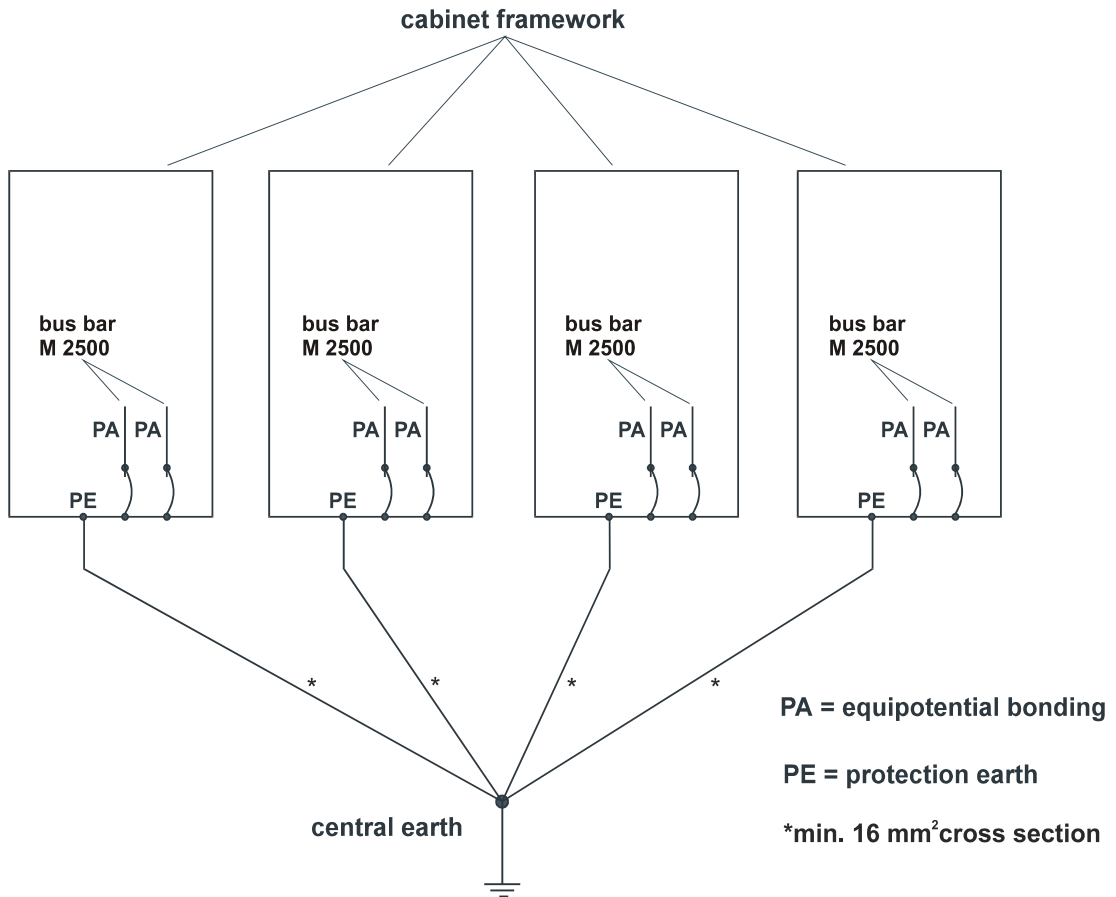


Figure 10: Connection of earth terminals

### 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 <sup>1)</sup> 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 <sup>2)</sup> 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 <sup>5)</sup> connection. According to HIMA earthing principles the top hat rail itself is connected to the cabinet earth or optionally, to an instrument earth <sup>6)</sup>.

The connection <sup>4)</sup> 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.



## Installation and Connections

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

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

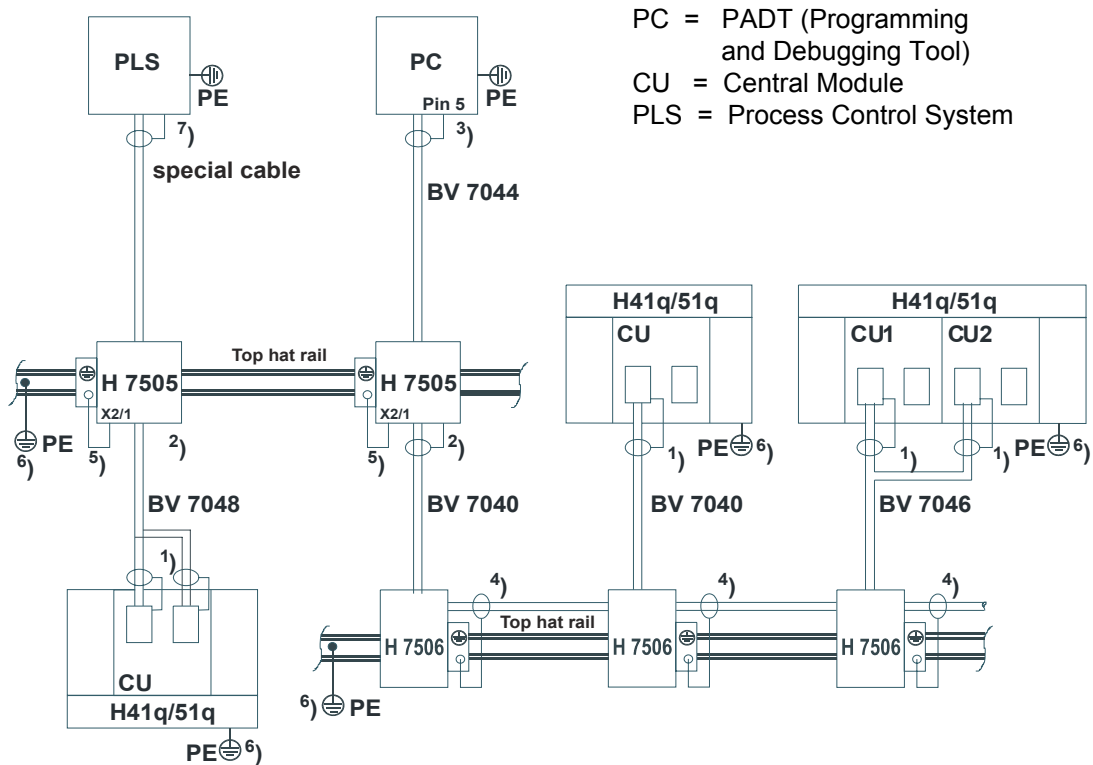


Figure 11: Connection of the cable shields

### 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:

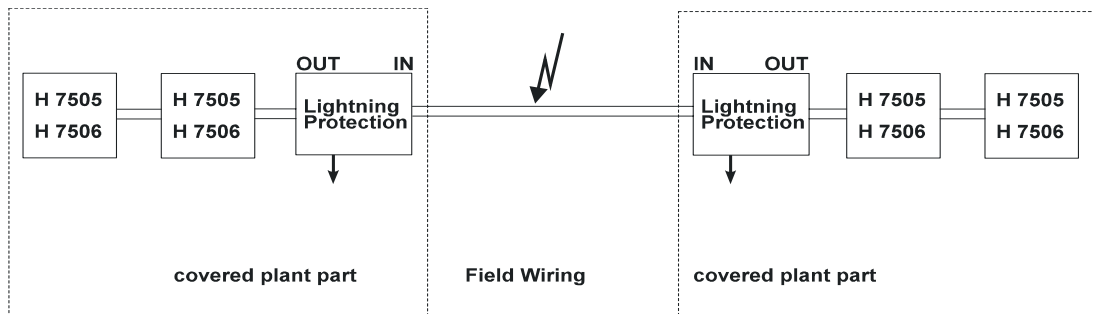


Figure 12: Connection of lightning protection tools

#### 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 mm<sup>2</sup> 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 mm<sup>2</sup> cross section.

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<b>Note</b>	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.
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### 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.

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<b>Note</b>	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.
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### 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 corresponding 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

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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!

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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  $T_A = 25\text{ °C}$ ,

200 days at  $T_A = 60\text{ °C}$

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!

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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](http://www.hima.com).

## 10 Data Sheets

The latest data sheets can be downloaded from HIMA website at [www.hima.com](http://www.hima.com).  
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
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### 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

Contact	Prox. switch	safety-related SIL 3	Line Control	(Ex)i	Counter	Space requirement	Type	Channels	Slot detection
•						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 requirement	Type	Channels	Slot detection
•	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



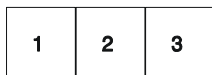
Digital/Analog converter



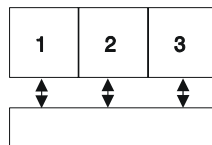
Automatic testing for operation



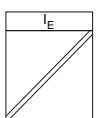
Signal contraction



Channel numbers according to "Modify Cabinet" in ELOP II

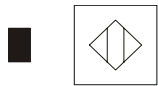


Module with automatic test functions



Threshold input for line break and line short-circuit monitoring

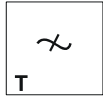




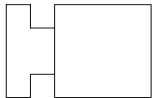
Proximity switch without attenuation, high current to the amplifier



Proximity switch with attenuation, low current to the amplifier



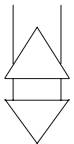
Input filter, testable



Control block for registers



Multiplexer



I/O bus



02



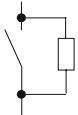
Indicator light (LED), off  
no. of the channel  
Indicator light (LED), on (in function tables)



or



Current source



Sensor with resistor as near as possible at the contact



Diode



Light-emitting diode (LED)



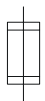
Relay with reverse current diode



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

<u>Z7nnn/nnnn/nnn/A/B</u>	
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





**HIMA**  
**...the safe decision.**



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