Programmable Systems
The H41q and H51q System Families

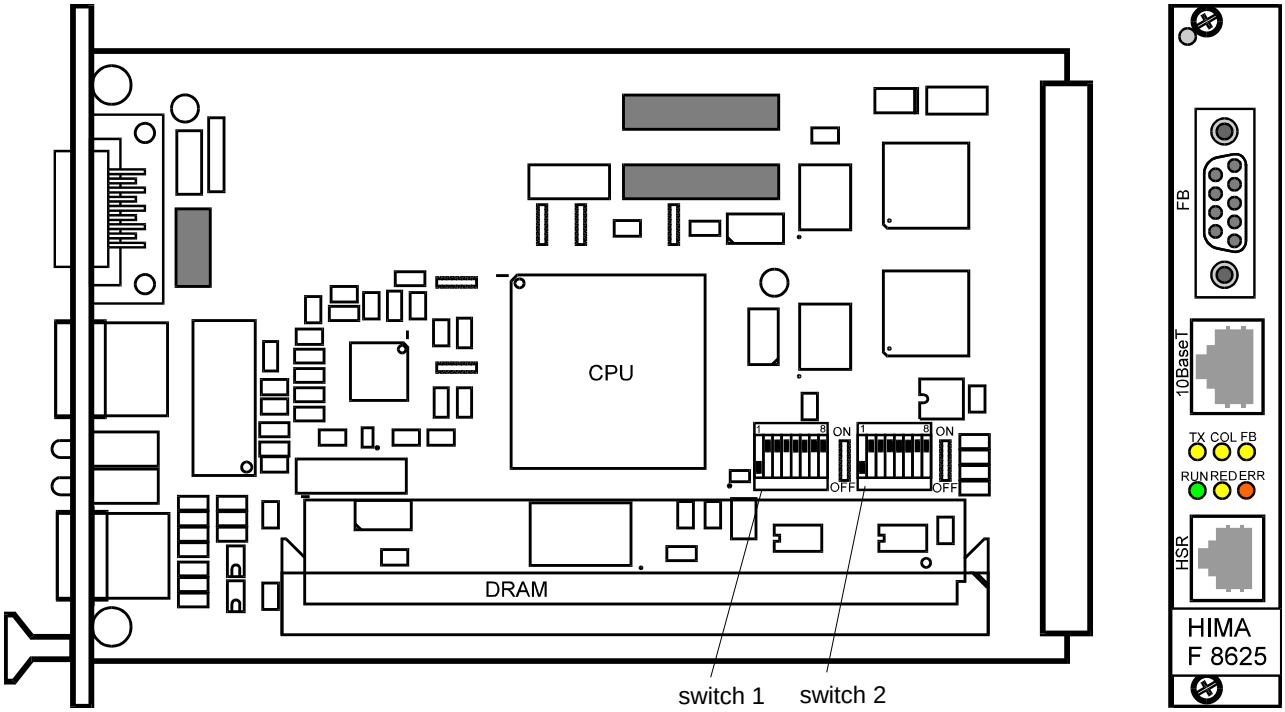
Data Sheet / Operating Instructions
for Module
F 8625

HIMA

F 8625

F 8625 Communication Module for Ethernet-Communication
Application in H51q PES (usable with BS41q/51q V7.0-7 (9835) and higher) with ELOP II.

General Description



With this communication module F 8625, up to 31 HIMA H51q PES can communicate with each other in a safety-related manner (Ethernet communication according to IEEE 802.3).

Interfaces

- Ethernet interface 10BaseT according to the IEEE 802.3 standard. Connection via an RJ-45 plug.
- High-speed serial communication interface to the redundant HSR (High Speed Redundancy) communication module. Connection via an RJ-12 plug with BV 7053.
- Serial interface FB not used.

Specifications

Processor	32 Bit Motorola CPU with integrated RISC communication controller
RAM	4...16 MB
Operating current	5 VDC / 1 A
Space required	3 HE (units high), 4 TE (units width)

Tabelle 1: Technical Data

Display Readings During Operation at the Module Front

Top row LEDs

TX	COL	FB	Operating status
ON	-	-	Send LED of Ethernet communication
-	ON	-	Collision on the Ethernet segment
-	-	OFF	No display (always OFF)

Table 2: Display readings during operation, top row

Bottom row LEDs

RUN	RED	ERR	Operating status
ON	-	OFF	Ethernet communication protocol active
Flashing	-	OFF	Ethernet communication protocol inactive
-	ON	OFF	Communication to redundant communication module active
Flashing	-	Flashing	Booting of the communication module
OFF	-	ON	Fatal error in communication module. Module must be replaced.
OFF	-	Flashing 3-times	Saving of error code in Flash-EPROM (required for repair purposes) **Do not unplug communication module!**

Table 3: Display readings during operation, bottom row

Properties of the F8625
The switches 1/1-7 and 2/3-8 are not used.

All communication partners must be configured in the same bus configuration.
A PES can have a maximum of 30 communication partners, since a bus configuration in ELOP II supports a maximum of 31 communication partners.

A PES can communicate with maximal 4 OPC servers. The number of communication partners is not reduced by the number of configured OPC servers.

Functions of Switch 1 (S1)

S1	ON	OFF	Description
8	Passive Mode disabled	Passive Mode enabled	The Passive Mode controls the communication to the OPC servers. Passive Mode enabled: (From operating system version 1.13. on) The Token Passing from the F 8625 to the OPC servers (and vice versal) is disabled. The OPC server exchange cyclic data with the F 8625, independent by the hold of the Token. Passive Mode disabled: The Token Passing from the F 8625 to the OPC servers (and vice versal) is enabled. The OPC server only exchange data with the F 8625, if the OPC server hold the Token.

Table 4: Functions of Switch 1 (S1)

Notes to the communication with OPC servers

- If the Passive Mode is enabled/disabled on the F 8625, then the Passive Mode must also be enabled/disabled on the OPC servers.
- On F 8625 modules with an operating system up to including V 1.16, the Passive Mode can only be switched on, if no safety-related communication for this F 8625 module is configured. The position of the switch Passive Mode does not have any meaning in this case. From operating system version 1.17, the Passive Mode can also be switched on, when safety-related communication for the F 8625 module is configured.
- For the F 8625 modules communicating safety-related with each other in a network, set the Passive Mode either for all to activated or for all to deactivated.

Advantages of Passive Mode

- If no safety-related communication should be operate via the F 8625, then no safety-related dummy variables must be defined by configuration between the PES.
- To prevent an overload of the PC on which the OPC server works, when the number of the communication partners which are available is too less. (Becaues of the frequently token holding, causes by the short token cycle).

Disadvantages of Passive Mode

- In networks in where hubs are used, there can arise to collisions on the network segment by the requests of the OPC server. Meanwhile the requests from the OPC servers are executed asynchronously to the token cycle.

Functions of Switch 2 (S2)

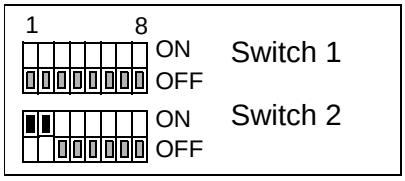
S2	ON	OFF	Description
1	1	2	Module number
2	Mono	Redundant	Wiring of the modules

Table 5: Functions of Switch 2 (S2)

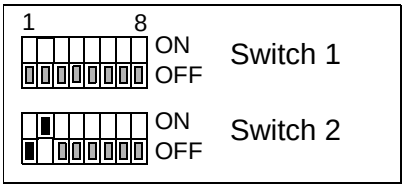
Operation mode variants of the communication module F 8625

Mono operation (only one F 8625 module required)

Mono operation, slot next to CU1

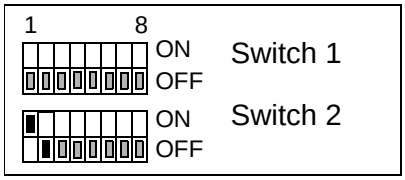


Mono operation, slot next to CU2

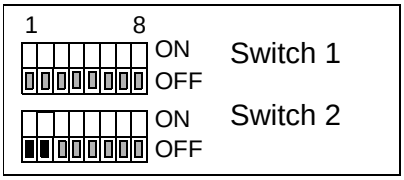


Redundant operation (two F 8625 modules are required)

Redundant operation,
slot next to CU1

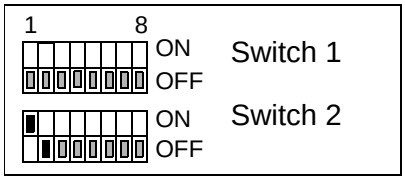


Redundant operation,
slot next to CU2

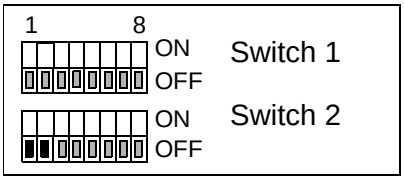


Redundant operation with one CU (two F 8625 modules are required)

Redundant operation,
first slot next to CU



Redundant operation,
second slot next to CU



Note for compatibility of the F 8625 to F 8627

"Passive mode" may only be selected on if this is also supported on the redundant F 8625/F 8627 devices.

Determining the IP Address for all OS Versions of the F 8625
The IP address is composed of the network address and the host address. The default network address is 192.168.0.
The last byte of the IP address 192.168.0.x is the Host address and is calculated as follows:

For module 1 (switch 2/1 = ON)
Host address = (the last two digits of the resource) ∗ 2 + 1

For module 2 (switch 2/1 = OFF)
Host address = (the last two digits of the resource) ∗ 2 + 2

Example:
Resource name MT200_33 and module 1 (switch 2/1 = ON)
Host address: 33 ∗ 2 + 1= 67; IP address = 192.168.0.**67**

Resource name MT200_33 and module 2 (switch 2/1 = OFF)
Host address: 33 ∗ 2 + 2 = 68; IP address = 192.168.0.**68**

Note:	The resource name **must** have eight characters and the last two characters **must** be numbers! Permitted ID's: 1 up to 64

Notes for parameterisation of HIPRO-S
The configuration of the Ethernet network in ELOP II for HIPRO-S takes place automatically. The communication modules must be configured however by the switches 2/1 and 2/2.

- The switch 2/1 sets the module number, which corresponds to the attached Ethernet segment.
- With the switch 2/2 mono or redundant interconnecting of the communication building group is stopped.

Calculation of the Monitoring Time for HIPRO-S Connections
For each HIPRO-S connection, the monitoring time must be set in ELOP II, in the dialog window *Properties -> HIPRO-S* of the target-resource.

The default value for monitoring time can be set to **13200 ms** in the target-resource for HIPRO-S connections.

We strongly recommend to calculate the monitoring time of the HIPRO-S, in order to optimize the detection and suppression of a communication failure.

- The smaller the monitoring time is, the faster a communication failure will be detected.
- The monitoring time should be large enough for the suppression of an unique communication failure, so the current data can be received in the next PES cycle.

Calculation of T_{max} for HIPRO-S

$T_{max} = (NP^2 + NP + 100)$ ms
If $T_{max} < 600$ ms than T_{max} must set to 600 ms.

NP: Number of PES communication partners + 4 OPC-Server, which are configured fix in HIPRO-S mode
T_{max}: Maximum Ethernet transmission time of the HIPRO-S Data

Depending on the used resource, the monitoring time MT or MTe is calculated using the following equations:

Monitoring time MTe for H41qe/H51qe

$WDe = CT * 1.5 + D * 5.5$
$MTe = 2 * WDe_{Source} + 2 * T_{max} + 2 * WDe_{Target}$

MTe: Monitoring time (HIPRO-S connection)
WDe: Watchdog time (ms) for H41qe/H51qe
CT: Maximum cycle time (ms) of the central module in status RUN (is shown in the control-panel of ELOP II).
D: Data size in kByte “Data Size (without SI Data)“ (is shown by the ELOP II Compiler).
T_{max}: See above “Calculation of T_{max} for HIPRO-S“

Monitoring time MT for H41q/H51q

$WD = CT * 1.7$
$MT = 2 * WD_{Source} + 2 * T_{max} + 2 * WD_{Target}$

MT: Monitoring time (HIPRO-S connection)
WD: Watchdog time (ms) for H41q/H51q
CT: Maximum cycle time (ms) of the central module in status RUN (is shown in the control-panel of ELOP II).
T_{max}: See above “Calculation of T_{max} for HIPRO-S“

The calculated monitoring time MT or MTe must set in the dialog window *Properties -> HIPRO-S* of the target-resource.

Note:	The monitoring time depends on the data import of the target-resource and must be set in the target-resource. The calculation of the monitoring time must also be done for the communication partner (source-resource), when the communication partner imports data. If a resource does not import HIPRO-S data, the monitoring time is not used and the dialog for setting the monitoring time is locked.

Example for the calculation of the monitoring time
Calculation of the monitoring time for a H41qe/H51qe with HIPRO-S and 20 communication partners.

Calculation of the watchdog time WDe_{Source} from the HIPRO-S source-resource.

- Note the maximum cycle time "**CT**" of the PES in RUN status, which is shown in the ELOP II control panel of the HIPRO-S source-resource (e.g. **100 ms**).

- Note the datasize "**D**" in kByte „Data Size (without SI Data)“ from the source-resource, which is shown by the ELOP II Compiler (e.g. **2 kByte**).

- Calculate the watchdog time WDe_{Source} for the source-resource
  $WDe_{Source} = CT * 1.5 + D * 5.5$
  $WDe_{Source} = 100 * 1.5 + 2 * 5.5$
  WDe_{Source} = 161 ms

Calculating of the watchdog time WDe_{Target} of the HIPRO-S target-resource

- Note the maximum cycle time "**CT**" of the PES in RUN status, which is shown in the ELOP II control panel of the HIPRO-S target-resource (e.g. **150 ms**).

- Note the datasize "**D**" in kByte „Data Size (without SI Data)“ from the target-resource, which is shown by the ELOP II Compiler (e.g. **1.5 kByte**).

- Calculate the watchdog time "**WDe_{Target}**" for the target-resource
  $WDe_{Target} = CT * 1.5 + D * 5.5$
  $WDe_{Target} = 150 * 1.5 + 1.5 * 5.5$
  WDe_{Target} = 233.25 ms -> 234 ms

Calculating the maximum transmission time "**T_{max}**"
20 communication partners + 4 OPC Server (configured fix)
-> **NP = 24**
$T_{max} = NP^2 + NP + 100$
$T_{max} = 576 + 24 + 100$
$T_{max} = 700$ ms
T_{max} = 700 ms

Calculation of Monitoring time "**MTe**".

- $MTe = 2 * WDe_{Source} + T_{max} + 2 * WDe_{Target}$
  $MTe = 2 * 161 + 2 * 700 + 2 * 234$
  MTe = 2190 ms -> 2200 ms

Set the calculated monitoring time "**MTe**" in the target-resource:

- Open the dialog window "Properties" via the context menue *Properties -> HIPRO-S* of the target-resource.
- Select the source-resource in the list of the HIPRO-S communication partners and click the button *EDIT*.
- Set in the dialog window "Edit resource" the monitoring time "**MTe**".

Calculating the monitoring time "**MTe**"

- for each of the 20 communication partners in this target-resource.
- for each of the 20 communication partners in its own resource.

Notes for creation of the user program
By the creation of the user program, the following points are to be considered:

- The resource name under ELOP II must have eight characters, of which the last two have to be numbers. Any numbers between 01 to 64 can be used. The numbers must be unique to prevent collisions in determining the IP address of the communication module.
- Safety-related communication with HIPRO-S is to be established in a way that enables the safety-related configuration of data exchange of **each PES with each other PES** (i.e. exchange of dummy data, if no user data are exchanged). The direction of the data exchange can be selected free. The reason for proceeding like this is the fact that for Ethernet the network of Ethernet nodes must be known in every PES which configures itself automatically, so that communication within the network is possible.
- To check the HIPRO-S configuration, the PES master programme should be compiled, but not loaded into the master, because mixed operation is not allowed. Errors that may occur can then be corrected.
- Via the system variables, the diagnosis of the safety-related communication can be analysed in the user program.
- For project configuration and monitoring of the F 8625 in ELOP II, the HK-COM-3 software function block is used.

Upgrade/Downgrade of the operation system versions of the F 8625
The following instructions describe the upgrade from the operation system version 1.17 and smaller to version 1.18 and higher and the downgrade from operating system version 1.18 and higher to version 1.17 and smaller for the module F 8625.

Caution:	The upgrade/downgrade may be proceeded only by HIMA service engineers. It is recommended to change the operating system in the time of a shutdown of the plant.

Upgrade to Version 1.18 and higher
For the upgrade from version 1.17 and smaller to version 1.18 and higher the file **f8625_bs_v1_x.bin** must be loaded.

Caution:	With the upgrade from version 1.17 and smaller it has to be made absolutely certain, that only the correct operating system file is loaded into the correct module. If the module F 8625 was loaded with any incorrect file, the functionality of the F 8625 is lost and can not be programmed any longer with the diagnostic dialog ComEth. In this case the module F 8625 must be reprogrammed by HIMA.

After the upgrade to Version 1.18 and higher a protection mechanism is activated, and only operating system files **8625_bs_v1_x.ldb** can be loaded.

Downgrade from Version 1.18 and higher
For the downgrade from version 1.18 and higher to version 1.17 and smaller the file **f8625_bs_v1_x.ldb** must be loaded.

Caution:	After the downgrade to version version 1.17 and smaller the protection mechanism to prevent loading any incorrect file is not more active!

Download of the operating system to the F 8625
The operating system download for the module F 8625 is done using the diagnosis dialog **ComEth**.

- Start the diagnosis dialog ComEth, and check in the error-state viewer that the
  - "main program version" is 0.8.0 or later
  - "diagnostic text version" is 0.2.0 or later.
- Select *Project -> New* in the menubar of the diagnosis dialog ComEth, to create a new Project.
- Select *New Configuration* in the context menu of the new project, to create a new configuration.
- Select *New Resource* in the context menu of the new configuration, to create a new resource.

- Select *New F 8625* in the context menu of the new resource, to create a new F 8625 in the new resource.
- Select *Properties* in the context menu of the new F 8625*,* to open the dialog window “Properties“.
  Configure the input fields as follows:
  - Enter an arbitrary unique name for the F 8625 (e.g. CU1CM1) in the input field.
  - Enter the IP address of the module F 8625 in the input field “IP address“, into which the operating system should be loaded. See page 6 to determine the IP address of the module F 8625.
  - In the view box "IP address PC“, all IP addresses of the available network cards of the PADT (PC) are displayed. Select the IP address of the network card via which the connection to the module F 8625 should be created.

Note: The IP address of the PADT (PC) must:

- be located in the same subnet as the module F 8625.
- own an IP address
  - from192.168.0.201 up to 192.168.0.214 or
  - from192.168.0.243 up to 192.168.0.254.

If several network cards are available on the PADT (PC), then an accordant routing entry has to be set for the network card, which is used for connection to the F 8625.

- Select *Control Panel* in the context menu of the new F 8625, to open the Control Panel.
- Select *PADT->Connect* in the control panel, to create a connection to the module F 8625.

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Caution: The next step leads to a communication loss, if no redundant module F 8625 exists or if the redundant module has no connection!

- Click the button *Stop Device* in the control panel of ComEth, to set the module F 8625 into the state STOP (green RUN LED flashes).
- Select *Extra->OS Update* in the control panel of ComEth*,* to open the standard dialog to open a file.
- Select and load the **proper** operating system for the upgrade/ downgrade into the selected module F 8625.
  (See page 10 “Upgrade to V 1.18 and higher“ and “Downgrade from V 1.18 and higher“).

Note: After successfully downloading the operating system for the F 8625, **the module F 8625 must be rebooted**. After the reboot the new operating system is started. Until then the F 8625 works with the old operating system.

- The reboot of the F 8625 can be done by
  - withdraw and plug of the module F 8625 or
  - the function *Extra->Reboot Device* in the Control Panel of the dialog ComEth.

- Check the upgrade/downgrade
  - Select *PADT->Connect* in the control panel to create a connection to the module F 8625 again.
  - Select the tab *Version* and check that the shown OS-Version is the same as the OS Version of the Upgrade/Downgrade.
- If a redundant module F 8625 exsists, the same procedure must be done for the redundant F 8625.

Note: The ARP entry on the PADT (PC) must be deleted if another F 8625 should be loaded with the **same IP address** as the F 8625 loaded before.
Otherwise no other F 8625 with the same IP address can be connected to the PADT (PC).

Example: Delete the ARP entry of a F 8625 with the IP address **192.168.0.67**.

- Start the "Dos Shell" on the PADT (PC)
- Enter the command **arp -d 192.168.0.67**.

Ethernet Communication

Application Guidelines/Notes

- The IEEE 802.3 standards must be complied with.
- The entire transmission link must ensure a transmission rate of 10 MBit/s.
- To ensure a deterministic data exchange for safety-related communication, a load-free Ethernet segment must be connected to the HIMA communication modules.
  If this is not possible, no defined time behavior on the Ethernet segment can be ensured. This may result in a safety shutdown because of exceeding the monitoring time.
- Redundant Ethernet segments must not be connected with each other.
- When replacing a communication module with attached HSR cable, first withdraw the module to ensure a defined cancelling of the Ethernet segment.
- Should the Ethernet segment not be available to the HIMA communication modules alone, the IP address range from 192.168.0.3 bis 192.168.0.130 must not be used otherwise.
- All single communication module connections must be connected to the same logical Ethernet segment.
- Communication modules belonging to one PES and having the same module number must be connected to different Ethernet segments.
- **The mixed operation of safety-related communication via a coprocessor module F 8621A and a communication module for Ethernet communication F 8625 in parallel is not allowed in a PES.**

Ethernet Topologies

All connected Ethernet components must adhere to the application guidelines!

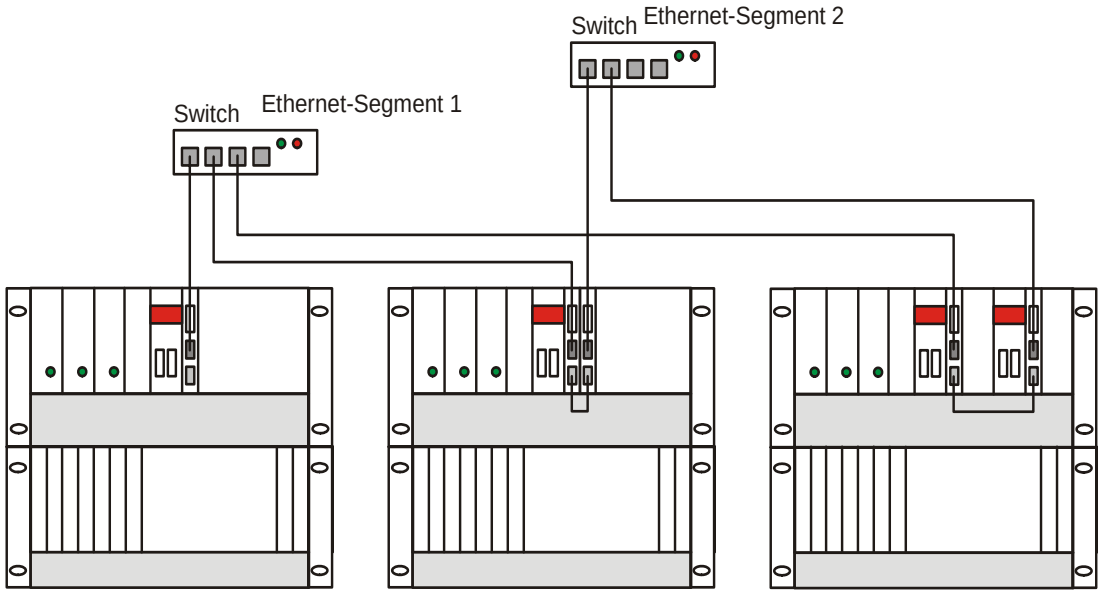

Figure 1: Ethernet topology: Possible PES connections

The redundant structure of the Ethernet segments is possible at any time. A bridge has to be plugged in between the redundant communication modules (using the HSR interface on modules F 8625) with HSR cable BV 7053.

Figure 1 shows all possibilities of interconnecting the PES.

- Left: Single PES on one Ethernet segment (each switch is an independent Ethernet segment).
- Centre: Single PES with two communication modules on both Ethernet segments.
- Right: Redundant PES with two communication modules on both Ethernet segments.

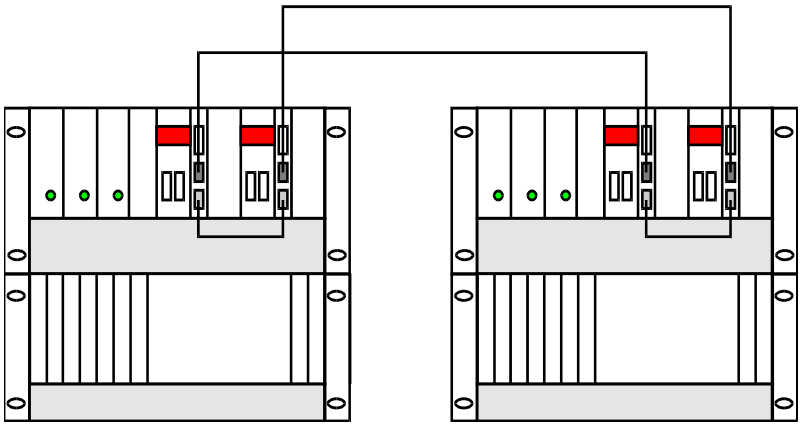

Figure 2: Ethernet Topology - Interconnection of two PES

When two PES are interconnected (Figure 2), the switch is not necessary. The two 10BaseT interfaces of the communication modules are connected directly by a special cross-over cable (with twisted wires).

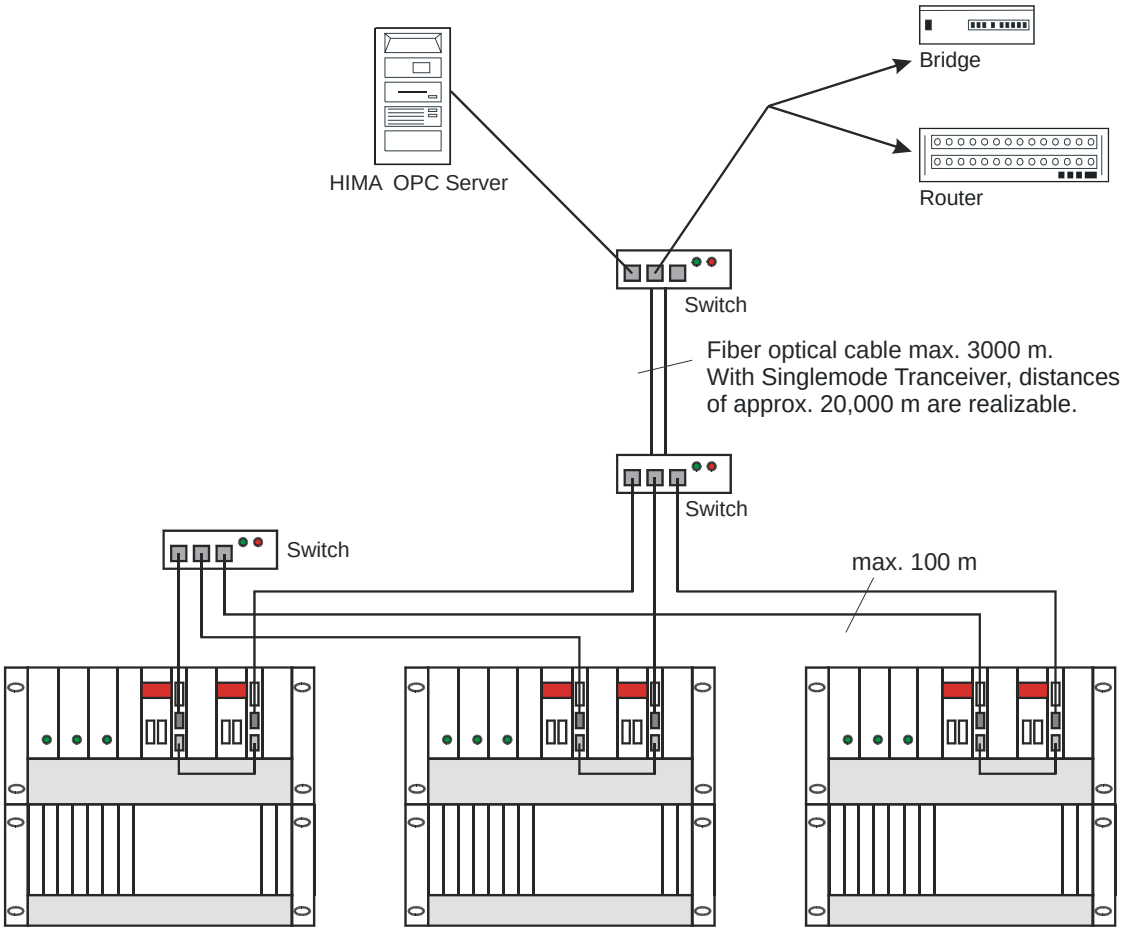

Figure 3: Ethernet Topology-Redundant interconnection with switches

In Figure 3, three PES are completely redundantly interconnected via two switches.
A third switch is connected to the redundantly interconnected PES via a redundant fibre optic connection (the fibre optic interface is integrated in the switch). An HIMA OPC Server and further Ethernet components are connected to the third switch.

Serial Communication

Name Definition Table

Table 6 provides an overview of and explains the terms used in the various standards.

	ELOP II (variables, data types)	Communication module	Data processing basis
Digital	BOOLEAN	BOOLEAN	1 Bit
Analog	WORD (SINT, USINT,INT,UINT)	WORD	2 Byte

Table 6: Name definitions

In ELOP II, WORD variables stand for all types of data which can be configured as 16-bit variables in the BUSCOM serial communication.

Data Mapping in the Communication Module

To transmit data in the Fieldbus format, the data of the central module of the PES are mapped into the communication module.

In ELOP II, the data to be transmitted are configured as BUSCOM variables in the context menu “HW Allocation”.
A distinction is made between export and import variables.

The internal memory of the communication module contains two data pools into which the BUSCOM variables are copied.
Data pool 1 of the communication module reflects the export variables and data pool 2 reflects the import variables.
Within one data pool the individual variable is described by its identity number.

Within one array of the central unit, the BOOLEAN data and the WORD data are stored separately, but they may be stored under the same BUSCOM address (Table 7).

Arrays	BOOLEAN (BUSCOM-addresses)	WORD (BUSCOM-addresses)
Import-array 0 (IB-0000)	0000 to 2047	0000 to 2047
Import-array 1 (IB-4096)	4096 to 8191	4096 to 8191
Export-array 0 (EB-0000)	0000 to 2047	0000 to 2047
Export-array 1 (EB-4096)	4096 to 8191	4096 to 8191

Table 7: BUSCOM variable arrays in the central unit

The **WORD** variables from BUSCOM address 0 on begin with the identity number 0 (Figure 4), then they proceed in ascending order up to the WORD variable with the highest address in array 0. The WORD variables from BUSCOM address 4096 (array 1) on begin with identity number of the highest WORD variable following (array 0) and then proceed in ascending order up to the WORD variable with the highest address.

The **BOOLEAN** variables having base address 0 begin with the identity number following the identity number of the highest WORD variable and then proceed in ascending order up to the BOOLEAN variable with the highest address in array 0 of the central unit (Figure 4). The BOOLEAN variables from BUSCOM address 4096 (array 1) on begin with the identity number of the highest BOOLEAN variable in array 0 following and then proceed in ascending order up to the BOOLEAN variable with the highest address.
If only BOOLEAN variables exist, they begin with identity number 0 corresponding to the WORD variables (Figure 5).

This scheme of conversion of BUSCOM variables to identity numbers is used for import and export variables in the same way.

The sequence of the BUSCOM variables is determined by ELOP II and can be programmed by the user by setting the base address and relative address.

The BUSCOM address of the central unit is calculated as follows:

Base address + relative address = BUSCOM address

The BUSCOM address must be in the same array as the corresponding base address.
Blanks in the BUSCOM addresses of a data type of one array remain with the data type also in the data pool of the communication module.

Examples of Address Imaging (Export Array - Data Pool 1)

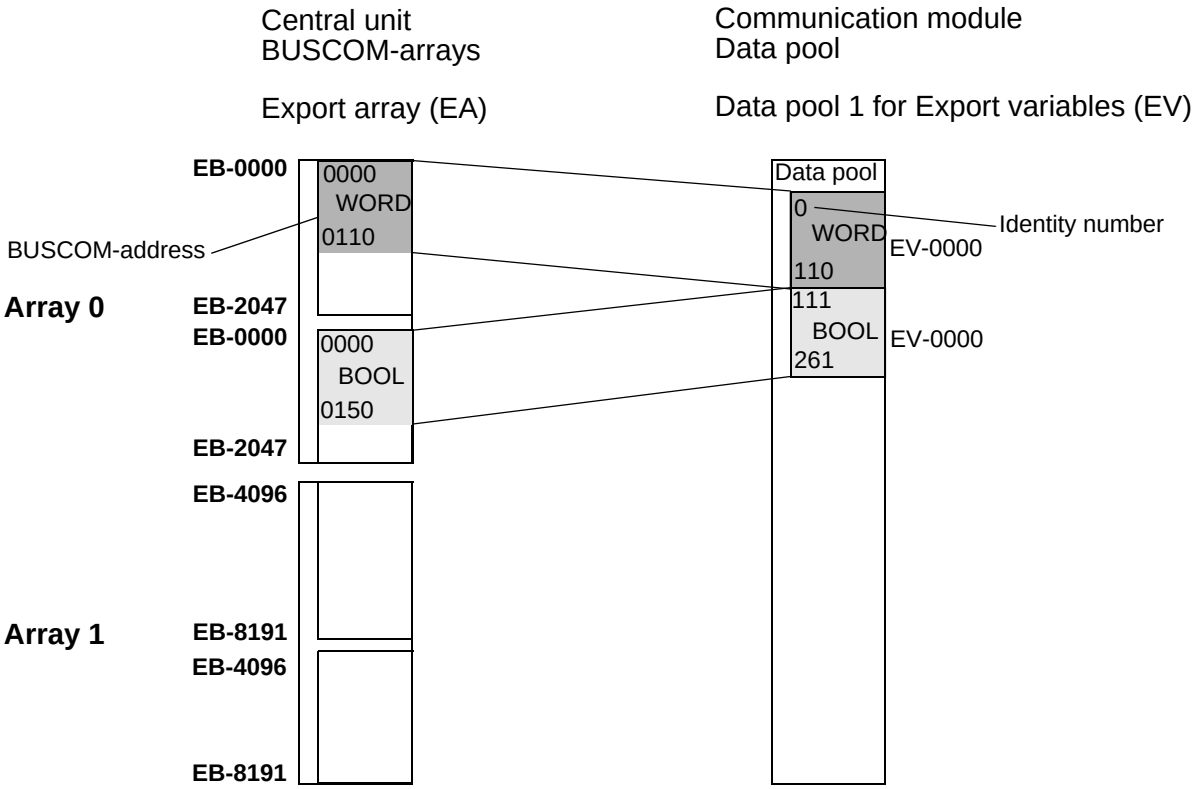

Figure 4: Example of address imaging for WORD and BOOLEAN export variables from array 0 (EB-0000)

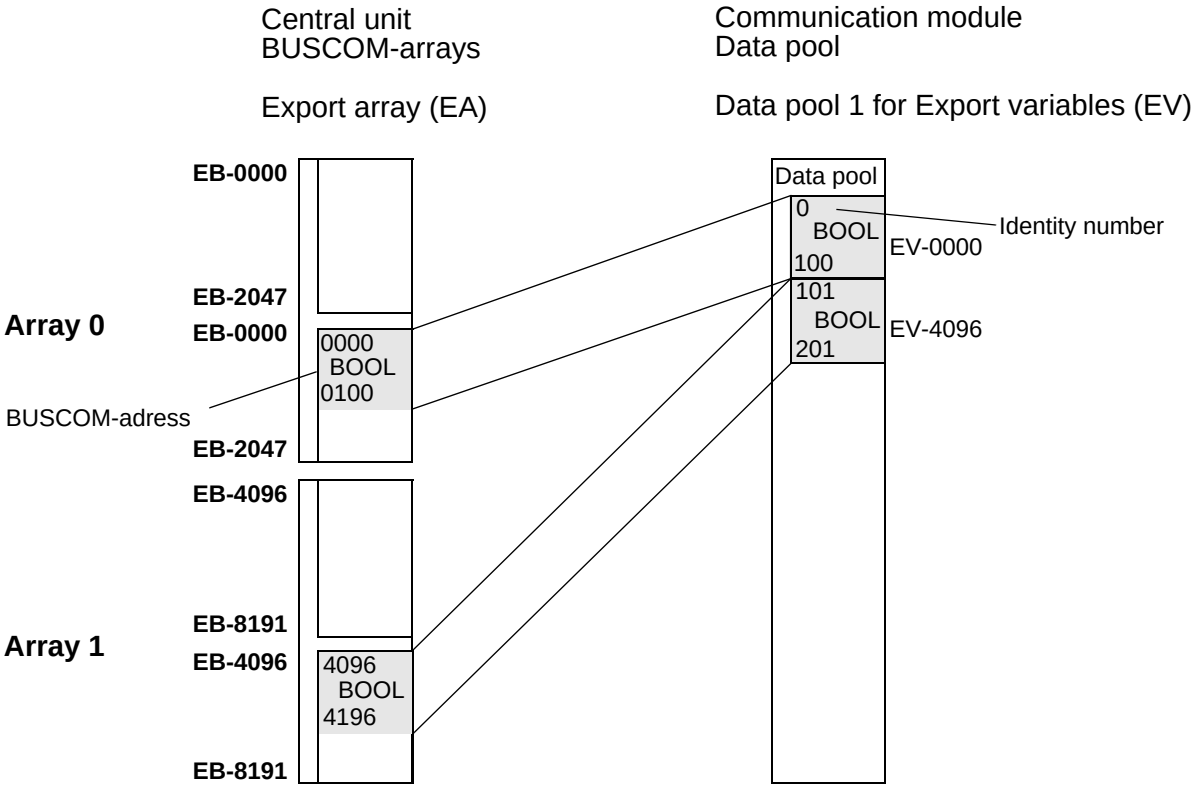

Figure 5: Example of address imaging for BOOLEAN export variables from both arrays (EB-0000 and EB-4096)

The BOOLEAN variables from BUSCOM address 0 on begin with the identity number 0 in the data pool. The BOOLEAN variables of array 1 of the central unit are stored in the data pool in ascending order after the last BOOLEAN variables of array 0.

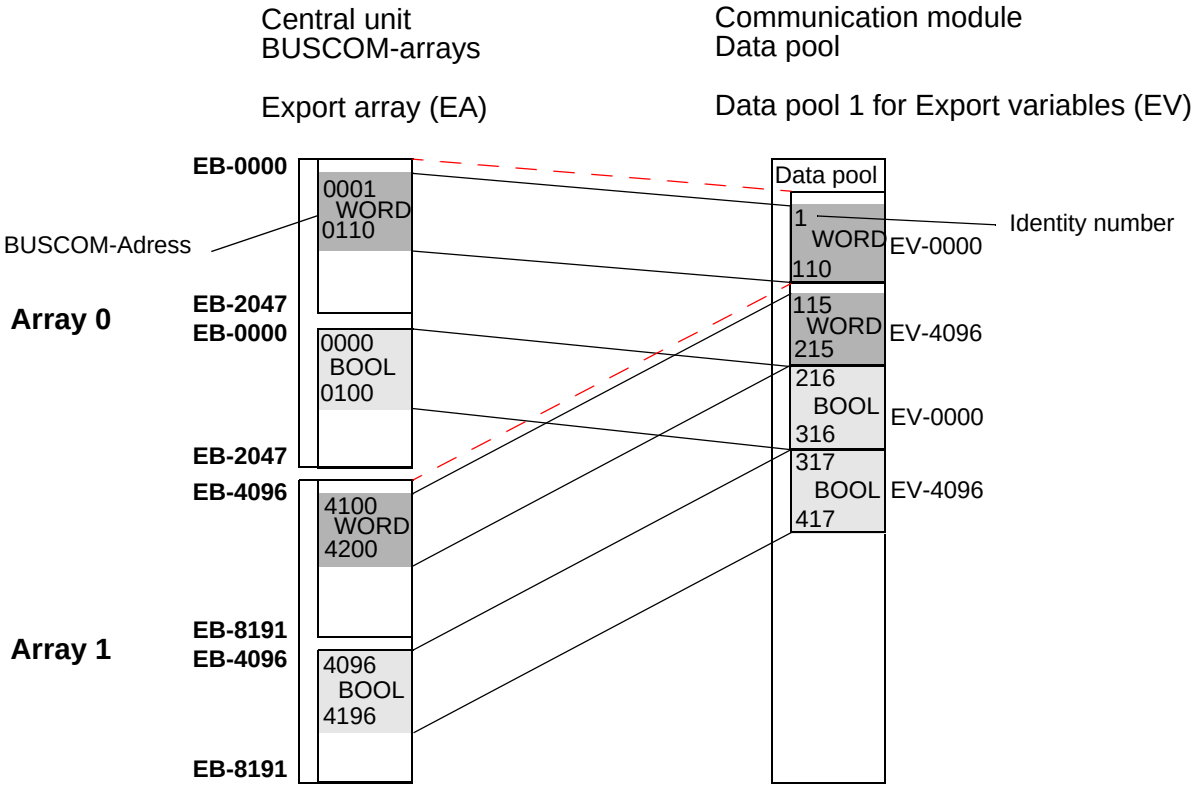

Figure 6: Example of address imaging for WORD and BOOLEAN export variables from both arrays

If variables do not begin at the top of an array, this part of the communication module will be completed with dummies in the data pool of the communication module

Address mapping of import variables in data pool 2 of the communication module has the same corresponding structure.

Definitions

10BaseT
Standardization in the IEEE 802.3 standard. Ethernet with twisted pair wiring with a transmission rate of 10 MBit/s. Supported cable types: STP (shielded twisted pair), UTP (unshielded twisted pair).

Bridge
A bridge connects the same type or different types of networks according to IEEE 802. It can expand the limits of a network with regard to the number of stations and the length. The bridge routes data or filters message/ data packets.

BUSCOM
Serial communication between HIMA PES and external systems (for configuration and programming see the ELOP II manuals).

CSMA/CD (Carrier Sense Multiple Access with Collision Detection)
Access procedure for the democratic access of a transmission medium. By tapping the medium, a station ready to transmit checks whether the network is free for a data packet. In the process, collisions may occur and the packet may be sent again.

ELOP II
Engineering tool for the planning and programming of HIMA PES according to IEC 61131-3.

HIPRO-S
Safety-related communication between HIMA PES (for configuration and programming see the ELOP II manuals).

Hub
For the interconnection of more than two Ethernet components having a 10BaseT connection, a central distributor (hub) is required. Ethernet components can be arranged in a star-shaped connection to the hub. The differences between the various types are the number of connectors and the construction of the hub.

IEEE 802.3 (Institute of Electrical and Electronics Engineers)
International standardization of the lower levels (physical and address level) of local networks. Part 3 specifies networks with bus topology, access procedures, CSMA/CD and transmission rates (10Base5, 10Base2, 10BaseT, 10BaseF).

IP Address
Internet Protocol address: unambiguous address of a network component for the transmission of data bursts across several networks.

OLE (Object Linking and Embedding)
Interface for applications where the objects concerned may be embedded or only linked with it.

HIMA OPC Server
The OPC (OLE for the process industry) Server provides an intelligent standardised interface for data exchange. The HIMA OPC Server is suitable for data exchange with HIMA modules 8625/ F8627.

For further information please refer to the HIMA ELOP II CD and to www.opcfoundation.org.

PES Master (according to IEC 61131-3)
Master in a HIMA PES managing the safety-related communication under HIPRO-S.

Resource
A HIMA PES under ELOP II.

RJ-12
Internationally standardised plug or socket for a maximum of 6 cores.

RJ-45
Internationally standardised 8 pin plug-in connector for the connection of STP/UTP lines according to 10BaseT.

Pin allocation of RJ-45 under 10BaseT:
1 Transmit Data + (TD+)
2 Transmit Data - (TD-)
3 Receive Data + (RD+)
6 Receive Data - (RD-)

Router
The router optimises the choice of routes within complex networks (using the IP address).

Switch
Like the bridge, the switch connects the same type or different types of networks with each other. One important feature is the short delay time during data routing. Unlike the bridge, which first checks the packet and then routes it, the switch can route the data to the corresponding interface very fast after the beginning of the frame (receiver's address in the data packet).

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