SEW EURODRIVE

Manual

Com User Task for MOVISAFE® HM31

(version PFF-HM31A)

Edition 03/2014

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Contents

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1 General Information

This manual contains information on the designated use of the safety controller.

The following conditions are required for safe installation, startup and safety during operation and maintenance:

- Knowledge of regulations
- Proper technical implementation of the safety instructions in this manual through qualified personnel.

Under the following circumstances, disruption or impairment of safety functions can cause severe injury to persons, damage to property or damage to the environment, for which SEW-EURODRIVE cannot assume liability:

- Unskilled access to the units
- De-activating or bypassing safety functions
- Non-observance of instructions in this manual

SEW-EURODRIVE develops, manufactures and tests safety controllers in compliance with the pertinent safety standards. The units may only be used if the following requirements have been met:

- They are only used for the intended applications
- They are only operated under the specified environmental conditions
- They are only operated in conjunction with approved non-SEW units

1.1 About the documentation and its structure

The "Com User Task (CUT) for MOVISAFE® HM31" manual contains the following topics:

- General information
- Com user task (CUT)
- Creating a Com user task
- CUT interface in SILworX®
- Modbus/UDP
- Diagnostics

The manual describes the following variant:

Programming tool	Processor operating system	Communication operating system
SILworX®	CPU-BS V.8 and later	COM-BS V.13 and later

To read out the operating system version in SILworX®, connect online to the controller and double click the corresponding module (COM module or CPU module).

1.2 Target group

This document was written for planners, project planners, and programmers of automation systems as well as for persons authorized to start up, operate, and service the units and systems. Specific knowledge of safety-related automation systems is required.

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1.3 Text conventions

The following notation is used in this document to enhance readability and comprehensibility:

Notation	Meaning
Bold	To highlight important text.
[...]	Names of buttons and menu commands that you can click in the programming tool.
Italics	Parameters and system variables.
`Courier`	Actual user entries.
RUN	Names of operating states in capital letters.

1.4 Structure of the safety notes

1.4.1 Meaning of signal words

The following table shows the grading and meaning of the signal words for safety notes.

Signal word	Meaning	Consequences if disregarded
⚠ **DANGER**	Imminent hazard	Severe or fatal injuries
⚠ **WARNING**	Possible dangerous situation	Severe or fatal injuries
⚠ **CAUTION**	Possible dangerous situation	Minor injuries
NOTICE	Possible damage to property	Damage to the drive system or its environment
INFORMATION	Useful information or tip: Simplifies handling of the drive system.	

1.4.2 Structure of section-related safety notes

Section-related safety notes do not apply to a specific action but to several actions pertaining to one subject. The hazard symbols used either indicate a general hazard or a specific hazard.

This is the formal structure of a safety note for a specific section:

SIGNAL WORD

Type and source of hazard.

Possible consequence(s) if disregarded.

- Measure(s) to prevent hazard.

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Meaning of the hazard symbols

The hazard symbols in the safety notes have the following meaning:

Hazard symbol	Meaning
	General hazard
	Warning of dangerous electrical voltage
	Warning of hot surfaces
	Warning of risk of crushing
	Warning of suspended load
	Warning of automatic restart

1.4.3 Structure of embedded safety notes

Embedded safety notes are directly integrated into the instructions just before the description of the dangerous action.

This is the formal structure of an embedded safety note:

- ⚠ **SIGNAL WORD** Type and source of hazard.

  Possible consequence(s) if disregarded.

  – Measure(s) to prevent hazard.

1.5 Rights to claim under limited warranty

A requirement of fault-free operation and fulfillment of any rights to claim under limited warranty is that you adhere to the information in the documentation. Read the documentation before you start working with the unit.

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1.6 Exclusion of liability

You must comply with the information contained in this documentation to ensure safe operation and to achieve the specified product characteristics and performance features. SEW-EURODRIVE assumes no liability for injury to persons or damage to equipment or property resulting from non-observance of these operating instructions. In such cases, any liability for defects is excluded.

1.7 Other applicable documentation

Observe the following applicable documents:

- "Decentralized Safety Controller MOVISAFE® HM31" operating instructions
- "Decentralized Safety Controller MOVISAFE® HM31" safety manual
- "Decentralized Safety Controller MOVISAFE® HM31" system manual
- "MOVIVISION® Parameter and Diagnostics Tool Version 2.0" manual
- Drive Engineering – Practical Implementation, Electromagnetic Compatibility (EMC) in Drive Engineering

You require software that is **not** included in the delivery. You can order the software together with the documentation on a data storage medium (CD/DVD) from SEW-EURODRIVE using the following order information:

Designation	Part number
SILworX® for MOVISAFE® HM31 • Hardware: SILworX® license dongle • Software: SILworX® 4.64.0 or later	19500114
Motion Library MOVISAFE® HM31: Function block library for safety-related position detection	17106400

Also observe the applicable documentation for the connected drive technology.

The latest documentation versions are available for download from the SEW website (www.sew-eurodrive.com) under "Documentation".

1.8 Copyright

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1.9 Product names and trademarks

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2 Com user task (CUT)

In addition to the user program created with SILworX®, a C program can also be run on the controller. This non-safe C program runs as a Com user task and does not impact the safe processor module of the controller's communications module.

The Com user task has its own cycle which is independent of the CPU cycle.

2.1 CUT features

The following table describes the features of the CUT

Element	Description
Com user task	One Com user task can be configured for each safety controller.
Safety-related	No

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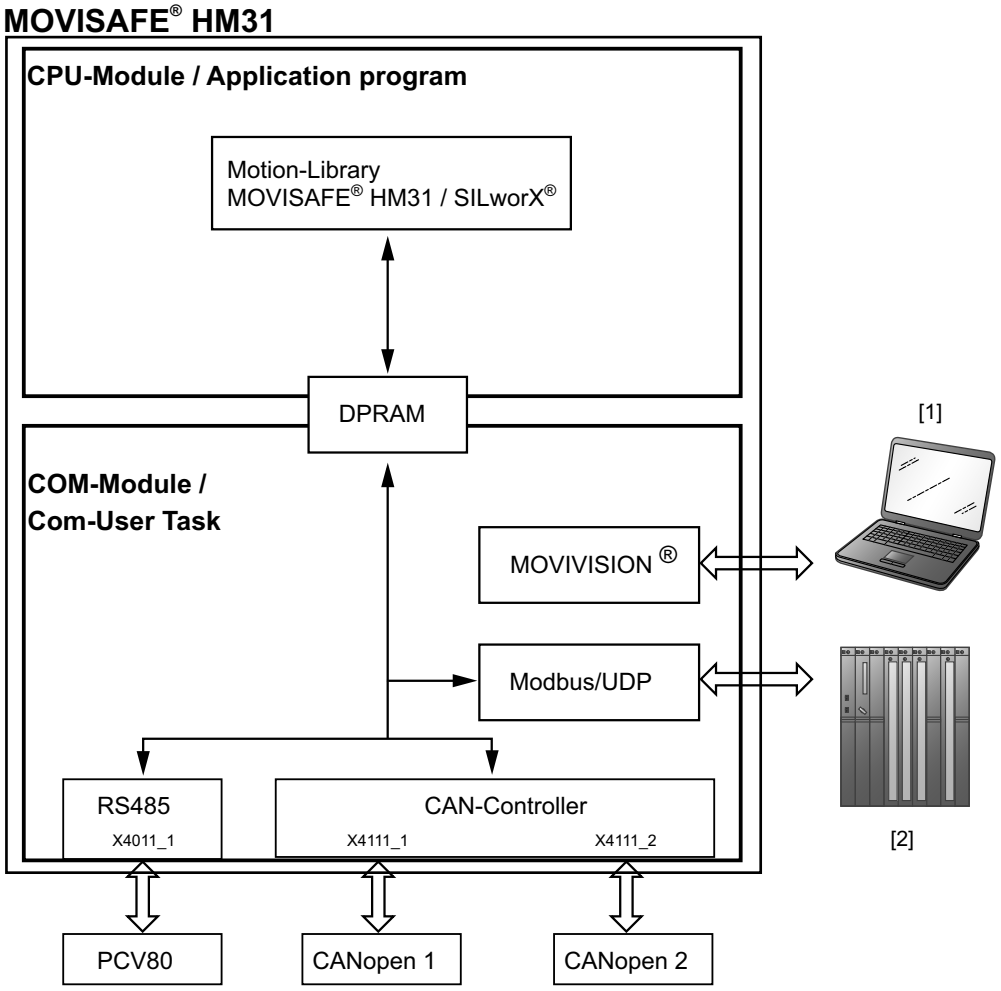
2.2 Architecture

The Com user task (CUT) allows for communication between lower-level sensor technology (such as encoders, position coding systems, positioning systems, etc.) and the user program. The data is exchanged via the DPRAM by means of function blocks from the "MOVISAFE® HM31 motion library".

You can also transmit data to a PLC [2] via Modbus interface, or to an engineering PC for diagnostics purposes [1]. In this case, the MOVIVISION® parameter and diagnostics tools from SEW-EURODRIVE are used as software.

The following figure illustrates this relation:



[1] Engineering PC with installed MOVIVISION® parameter and diagnostics tool

[2] PLC

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2.3 Configuration specifications

Observe the configuration specifications in the following table:

Inter-face	Max. number		Type
	DPRAM <-> user program	Modbus <-> PLC	
RS485	1	1	Position detection system from SEW-EURODRIVE and Pepperl & Fuchs: • PCV80 • PCV80A • PCV100 • PCV100A
CAN	4 per CAN interface	4 in total (distributed between CAN1 and CAN2)	CANopen (e.g. CMV58 or OLM100)

2.4 Requirement

You will need the following to set up a SILworX® program with a Com user task:

- Loadable file (ldb):

  28202430.11-Sewos_PFF_HM31.ldb / part number: 28202430.xx

- Software that is **not** included in the delivery:

  You can order this software together with the documentation on a data storage medium (CD/DVD) from SEW-EURODRIVE via the following order information:

Designation	Part number
SILworX®for MOVISAFE® HM31A • Hardware: SILworX® license dongle • Software: SILworX® 4.64.0 or later	19500114
Motion Library MOVISAFE® HM31 Function block library for safety related position detection	17106400

- You need the MOVIVISION® Parameter and Diagnostics Tool Version 2.0 software for diagnostics for Com user task applications (not included in the delivery).

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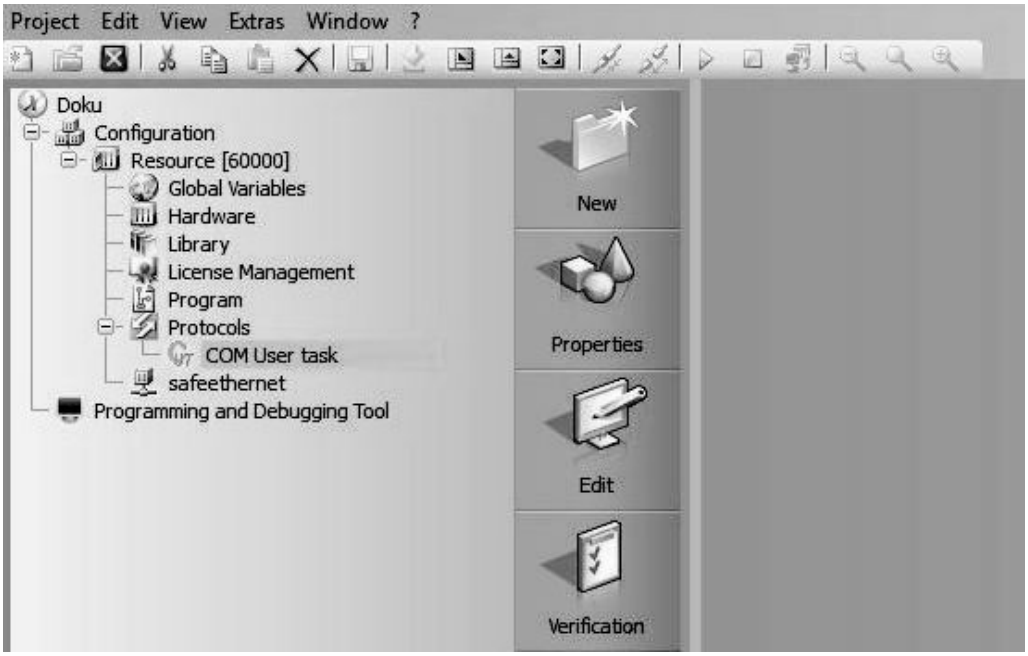
3 Creating a Com user task

Do the following to create a new Com user task in SILworX®:

1. Open [Configuration]/[Resource]/[Protocols] in the structure tree.
2. In the context menu of Protocols, select [New]/[COM User Task] to add a new Com user task.
3. Assign a name to the Com user task.

Now you have created a Com user task with standard settings.



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For information on how to change the standard settings, refer to chapter "Setting the properties of the Com user task".

INFORMATION

Only one Com user task can be created per resource.

3.1 Loading program code into the project

Do the following to load a new Com user task into the project:

1. Open [Configuration]/[Resource]/[Protocols] in the structure tree.
2. Choose [Load User Task] from the context menu of COM User Task. On the CD enclosed in the delivery, open the directory "../COM User Task".
3. Select the ldb file you want to have executed in the Com user task.

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INFORMATION

You can apply new versions of the ldb file by loading the executable code (ldb file) again. The content of the ldb file is not checked for correctness during loading. The ldb file is compiled in the project together with the resource configuration and can be loaded into the controller. If changes are made to the ldb file, you have to compile and load the project again.

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4 CUT interface in SILworX®

The process data communication of the Com user task is carried out between the COM and the CPU.

The CUT code goes to the CPU via the COM in a non-reactive manner. This means the safe CPU is protected from the CUT code. However, observe the following warning note:

⚠ WARNING

Errors in the CUT code can affect the entire COM function and can consequently influence the controller function.

Severe or fatal injuries.

- Take appropriate measures when programming the user program to detect errors in the COM module (for instance by performing a data plausibility check)

4.1 Schedule interval [ms]

The Com user task is called up in a parameterized schedule interval [ms] in the controller states RUN and STOP_VALID_CONFIG (COM module).

The schedule interval [ms] is set in SILworX in the Com user task properties.

Schedule interval [ms]	
Value range	10 – 255 ms
Default value	15 ms

INFORMATION

The COM processor time in the CUT depends on the other parameterized COM functions, such as safeethernet, Modbus-TCP, etc.

If the CUT is not completed within the schedule interval (≥ 3 × cycle time of the safety controller), then each new call-up of the CUT is rejected until the CUT has been processed.

4.2 Scheduling lead time

- **In RUN controller mode:**

  Prior to calling the CUT, the COM provides the process data from the safe CPU to the CUT in a memory section defined by the CUT.

- **In STOP controller mode:**

  There is no process data exchange from COM to safe CPU.

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4.3 Scheduling lag

- **In RUN controller mode:**

  After each CUT call, the COM provides the CUT process data to the safe CPU.
- **In STOP controller mode:**

  There is no process data exchange from COM to safe CPU.

4.4 Scheduling in the event of an error

If the COM is in STOP_INVALID_CONFIG state, then CUT is not executed.

If the COM switches to STOP_INVALID_CONFIG state and executes the CUT, then CUT is terminated.

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4.5 Setting the properties of the Com user task

Proceed as follows to set the properties of the Com user task:

1. In the structure tree, select the Com user task and choose [Properties] from the context menu.

   The following properties are displayed:

Feature	Description
Type	Com user task
Name	Random, unique name for a Com user task
Force process data consistency	**Activated:** The entire data of the protocol is transferred from the CPU to the COM within a cycle of the CPU. **Deactivated:** The entire data of the protocol is transferred from the CPU to the COM and distributed via several CPU cycles with 1100 bytes each per data direction. This might also reduce the cycle time of the controller. Default: Activated
Module	Selection of the COM module on which this protocol is processed. **Setting value: x.x.x (COM)**
Activation of max. µP budget	**Activated:** Adopt limitation of the µP budget from the field max. µP budget in [%]. **Deactivated:** Do not use a limitation of the µP budget for this protocol.
Max. µP budget in [%]	Maximum µP budget of the module that may be produced during execution of the program. Value range: 1 – 100% Default: 30%
Response if the CPU/COM connection is interrupted	If the connection from the processor module to the communication module is interrupted, the input variables are either initialized or forwarded to the process module depending on how this parameter is set. **Accept initial data:** Input variables are reset to their initial values. **Retain last value:** Input variables retain their last values.
Schedule interval [ms]	The Com user task is called in a parameterized schedule interval [ms] of the controller (COM module), see chapter "Schedule interval [ms]". Value range: 10 – 255 ms Default: 15 ms • Setting values: – 10 ms (if the cycle time of MOVISAFE® HM31 is shorter than 3 ms) – ≥ 3 × cycle time of MOVISAFE® HM31
User task	Path to loadable file if already loaded

2. Change the standard values for the following properties:

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- Module: x.x.x (COM)
- Schedule interval: 10 ms

The window shows the properties with the correct setting values:

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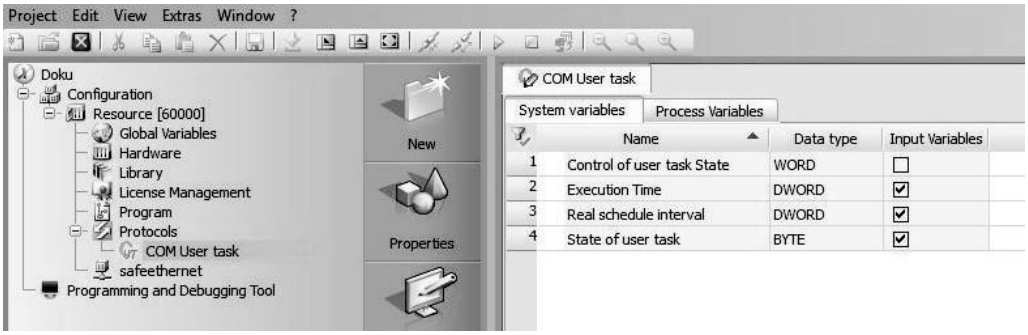
4.6 Setting system variables

Proceed as follows to set the system variables:

1. In the structure tree, select the Com user task and choose [Edit] from the context menu.

   The "System variables" tab comprises the following system variables for monitoring and controlling the CUT:



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System parameters	Function	
Execution time [DWORD]	Execution time of the Com user task in µs	
Real schedule interval [DWORD]	Delay between two Com user task cycles in ms	
Control of user task State [WORD]	The following table shows the options for the user to control the Com user task via the controller system parameter of the user task:	
	DISABLED 0x8000	The user program locks the CUT (that is the CUT is not started).
	AUTOSTART 0 (default)	Once the CUT is terminated, it starts automatically as soon as the malfunction or error has been removed.
State of user task [BYTE]	1 = RUNNING (CUT running) 0 = ERROR (CUT not running due to an error)	

INFORMATION

If the CUT is terminated and started again, the COM state of the flash `Stop/apply data from flash` is indicated briefly although the CUT is in RUN state.

4.7 Process variables

The MOVISAFE® HM31 motion library must be included in the project to being able to configure process variables.

⚠ WARNING

The Com user task is not safety-related.

Severe or fatal injuries.

- Do not use the unsafe variables of the Com user task for the safety functions of the CPU user program.

⚠ WARNING

Danger of incorrect evaluations in the user program

Severe or fatal injuries.

- Set up the data structure as shown in this manual. Another setup is not possible and will result in faulty evaluations.

INFORMATION

The names of the input and output signals can be freely assigned by the user.

- Note that the names (e.g. PCV80 In, Receive CAN-Controller 1, Send CAN-Controller 1, etc.) in the following screenshots are only used as an example.

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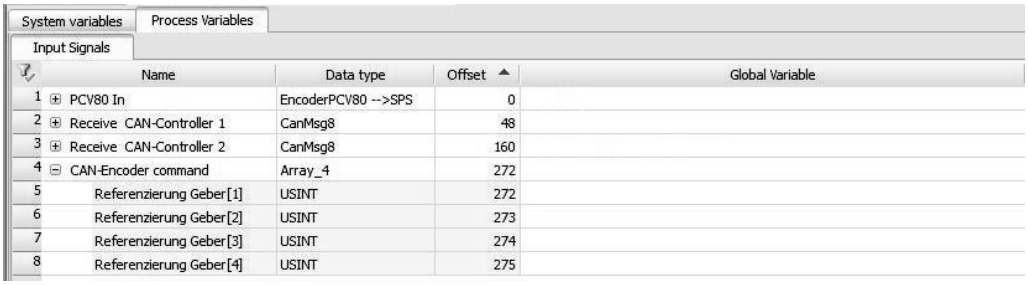
4.7.1 Configuring input data (COM → CPU)

Do the following to enter the variables to be sent from the COM module (CUT) to the input section of the CPU (manual configuration):

1. In the structure tree, select the Com user task and choose [Edit] from the context menu.
2. Go to the "Process variables" tab and edit the input signals.



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Input signal	Data type	Off-set	Meaning
PCV80 In	Encoder PCV80 → SPS	0	Data structure for the encoder evaluation blocks. For detailed information, refer to the documentation of the motion libraries.
Receive CAN controller 1	CanMsg8	48	
Receive CAN controller 2	CanMsg8	160	
CAN encoder command	Array_4	272	Encoder command: Setting this bit means that the referencing or the reset for encoders 1 to 4 has been requested externally via the Com user task. A reset is performed if the corresponding bit has been set via the output data or if the timeout has elapsed. 0x01: referencing 0x02: reset

INFORMATION

You can also read in the variable structure by using the csv import file included in the delivery. To do so, open the context menu in the "Input signals" group and choose [Import table content from csv].

Choose the following format: Separator = semicolon; coding = ANSI.

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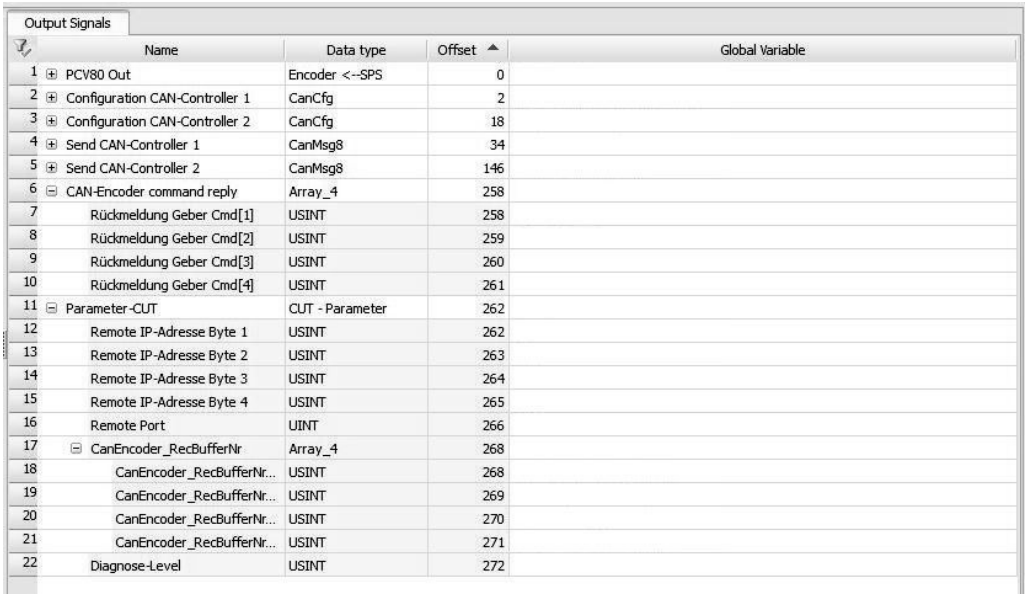
4.7.2 Configuring output data (CPU → COM)

Do the following to enter the variables to be sent from the output section of the CPU to the COM module (CUT) (manual configuration).

1. In the structure tree, select the Com user task and choose [Edit] from the context menu.
2. Go to the "Process variables" tab and edit the output signals.



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Output signal	Data type	Offset	Meaning
PCV80 Out	Encoder ← SPS	0	Data structure for the encoder evaluation blocks. For detailed information, refer to the documentation of the motion libraries.
Configuration CAN controller 1	CanCfg	2	
Configuration CAN controller 2	CanCfg	18	
Send CAN controller 1	CanMsg8	34	
Send CAN controller 2	CanMsg8	146	
CAN encoder command reply	Array_4	258	Signal to the Com user task indicating that the command has been executed. This also resets the corresponding bit in the command.
CUT parameter (SEW parameter)	(CUT parameter)	262 – 265	• Remote IP address (4 bytes):

	Byte1	**Byte 2**	**Byte 3**	**Byte 4**

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Output signal	Data type	Offset	Meaning				
			IP address of the Modbus slave, for example: 192.168.10.200	192	168	10	200
		266	• Remote Port: UDP port of the Modbus slave (e.g. 503) Important notes: – Make sure that the port is not already being used by other protocols (e.g. Modbus). – Observe the port assignment of the *Internet Corporation for Assigned Names and Numbers (ICANN)*.				
		268	• Encoder receive buffer: Number of the data buffer from receive CAN controller 1/2 that shall be copied to the Modbus as encoder 1 – 4:				
				Value	**Encoder**		
				0	Disabled		
				1 – 8	Receive CAN controller 1[1] – Receive CAN controller 1[8]		
				9 – 16	Receive CAN controller 2[1] – Receive CAN controller 2[8]		
		272	• Diagnostics level of the motion library functions				
				Value	**Diagnostics level**		
				0	Disabled		
				1 – 255	Diagnostics level, see motion library documentation		

INFORMATION

You can also read in the variable structure by using the csv import file included in the delivery. To do so, open the context menu in the "Output signals" group and choose [Import table content from csv].

Choose the following format: Separator = semicolon; coding = ANSI.

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5 Modbus/UDP

The Modbus/UDP interface defines user data that is sent via standard UDP/IP communication (for example based on Ethernet or WLAN). The Modbus user organization has published the protocol definition of Modbus/TCP. You can download the protocol definition from the website "www.modbus.org".

Unlike Modbus/TCP, Modbus/UDP is a connectionless communication. This communication uses the UDP/IP network protocol.

The data section and the telegram header of the Modbus/UDP protocol corresponds to the TCP specification. However, no connection is established and timeout is not monitored. Timeout monitoring, error detection, and error handling has to be performed in the application layer.

5.1 Output section (Master → Slave)

Under Modbus/UDP, the slave can receive a fixed data area. This data area must always be sent completely.

The following table shows the outputs from master to slave:

Module	Tab	Size	Description
Version = telegram version V1.002 (value 1002 = V1.002)	1	Word	Telegram version number
PCV80 – Run	2	Word	Receive telegram counter for timeout monitoring
PCV80 – Type and ID	3 – 4	4 bytes	"Name" and ID for identification and access to diagnostics. • Name = "PCV" → PCV data present in the telegram. • Name = " " → no data present in the telegram. PCV module deactivated in the CUT.
PCV80 – Request telegram 1	5	Byte	RS485 request telegram according to PCV80 data sheet.[1) 2)]
PCV80 – PDO 1 data length	6	Word	Max. length of response telegram = 10 bytes
PCV80 – Response telegram 1	7 – 11	10 bytes	RS485 response telegram according to PCV80 data sheet.[1)2)]
PCV80 – Request telegram 2	12	Byte	RS485 request telegram according to PCV80 data sheet.[1)2)]
PCV80 – PDO 2 data length	13	Word	Max. length of response telegram = 10 bytes
PCV80 – Response telegram 2	14 – 18	10 bytes	RS485 response telegram according to PCV80 data sheet.[1)2)]
CANopen encoder 1 - run	19	Word	Receive telegram counter for timeout monitoring.

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Module	Tab	Size	Description
CANopen encoder 1 – Type and ID	20 – 21	4 bytes	"Name" and ID for identification and access to diagnostics. • Name = "COE" → COE data present in the telegram. • Name = " " → no data present in the telegram. COE module or encoder 1 deactivated in the CUT, for example by means of the safety program.
CANopen encoder 1 – PDO data length	22	Word	PDO data length (written bytes in CANopen encoder 1 – PDO data).
CANopen encoder 1 – PDO ID	23 – 24	DWord	CANopen ID (for example hexadecimal 0x181)
CANopen encoder 1 – PDO data	25 – 28	8 bytes	CANopen data from CAN buffer.[1)]
CANopen encoder 2 – Run	29	Word	Receive telegram counter for timeout monitoring
CANopen encoder 2 – Type and ID	30 – 31	4 bytes	"Name" and ID for identification and access to diagnostics. • Name = "COE" → COE data present in the telegram. • Name = " " → no data present in the telegram. COE module or encoder 2 deactivated in the CUT, for example by means of the safety program.
CANopen encoder 2 – PDO data length	32	Word	PDO data length (written bytes in CANopen encoder 2 – PDO data)
CANopen encoder 2 – PDO ID	33 – 34	DWord	CANopen ID (for example hexadecimal 0x181)
CANopen encoder 2 – Data PDO	35 – 38	8 bytes	CANopen data from CAN buffer.[1)]
CANopen encoder 3 – Run	39	Word	Receive telegram counter for timeout monitoring.
CANopen encoder 3 – Type and ID	40 – 41	4 bytes	"Name" and ID for identification and access to diagnostics. • Name = "COE" → COE data present in the telegram. • Name = " " → no data present in the telegram. COE module or encoder 3 deactivated in the CUT, for example by means of the safety program.
CANopen encoder 3 – PDO data length	42	Word	PDO data length (written bytes in CANopen encoder 3 - data PDO)
CANopen encoder 3 – PDO ID	43 – 44	DWord	CANopen ID (for example hexadecimal 0x181)
CANopen encoder 3 – Data	45 – 48	8 bytes	CANopen data from CAN buffer.[1)]
CANopen encoder 4 – Run	49	Word	Receive telegram counter for timeout monitoring.

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Module	Tab	Size	Description
CANopen encoder 4 – Type and ID	50 – 51	4 bytes	"Name" and ID for identification and access to diagnostics. • Name = "COE" → COE data present in the telegram. • Name = " " → no data present in the telegram. COE module or encoder 4 deactivated in the CUT, for example by means of the safety program.
CANopen encoder 4 – PDO data length	52	Word	PDO data length (written bytes in CANopen encoder 4 - data PDO)
CANopen encoder 4 – PDO ID	53 – 54	DWord	CANopen ID (for example hexadecimal 0x181)
CANopen encoder 4 – PDO data	55 – 58	8 bytes	CANopen data from CAN buffer.[1)]

1) For information on the data structure, refer to the data sheet of the connected encoder.

2) PCV characteristics: The parity bit is not sent, event data is not supported.

The process data (PDO) of the encoders is sent via Modbus (1:1) without being evaluated. The evaluation (for example whether the telegram has been received correctly) must be performed by the slave.

The "RUN" module is available for timeout monitoring of the individual encoders. If this module does not change within a certain time, then this encoder has no longer updated the data. The time depends on the cycle time of the Com user task and the safety program.

Possible reasons:

- No connection to the encoder.
- The Com user task was stopped (for example via SILworX®, or if an error has occurred).
- The user program was stopped or no longer send requests to the encoder.
- The encoder is being parameterized.

5.2 Access functions

The I/O section is accessed via registers. A register comprises one word, that is two bytes. A register is also sent for modules with only one byte. However, the high byte is not used (value 0); the low byte contains the data.

For modules that consist of several bytes, the bytes are always sent in the low and high words (example: module with 8 bytes = 4 registers).

The following function code (hexadecimal) is supported:

Code	Name	Description
0x41	User FC: Write multiple registers with no telegram response	The function code 0x41 corresponds to the function code 0x10 (write multiple registers). However, the sender does not expect/evaluate a response telegram. The Modbus telegram of the sender (header/data section) corresponds to the function code 0x10.

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6 Diagnostics

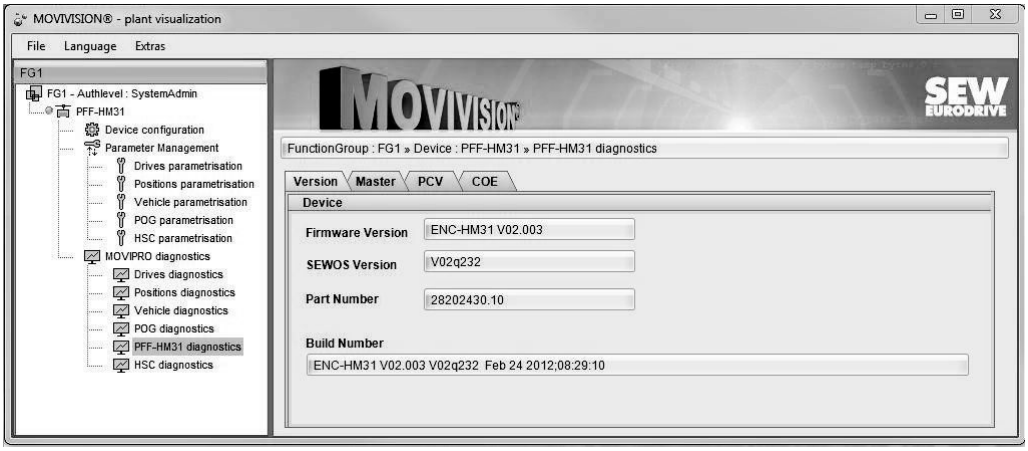
Diagnostics is performed with the MOVIVISION® parameter and diagnostics tool.

Do the following to perform diagnostics with MOVIVISION®:

1. Open MOVIVISION® from the Windows start menu via:

   [Start] / [Programs] / [SEW] / [MOVIVISION]

2. In the structure tree, open the category [MOVIPRO diagnostics] / [PFF-HM31 diagnostics].



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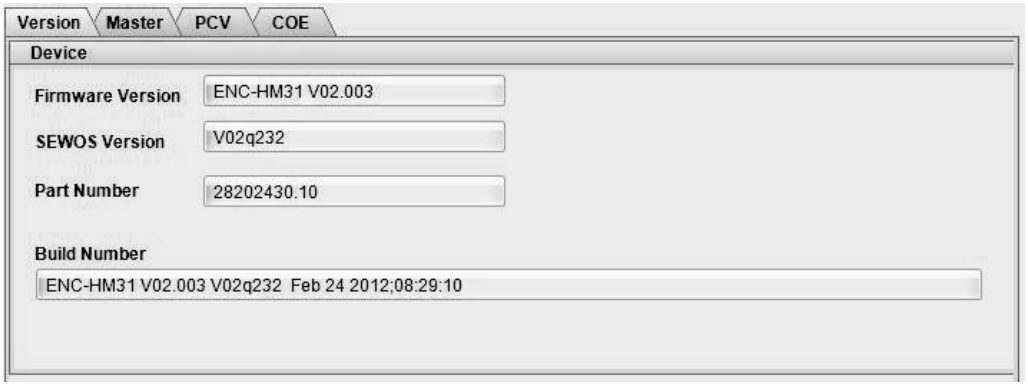
3. You will see tabs with the following diagnostics information:

6.1 Version

- Go to the "Version" tab for the following diagnostics parameters:



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Diagnostics parameters	Description
Firmware version	Firmware version: • MOVIVISION® device software • Com user task (CUT) for MOVISAFE® HM31
SEWOS version	Version of the MOVIVISION® device software
Part number	Part number of the Com user task
Generation number	Firmware generation number with date

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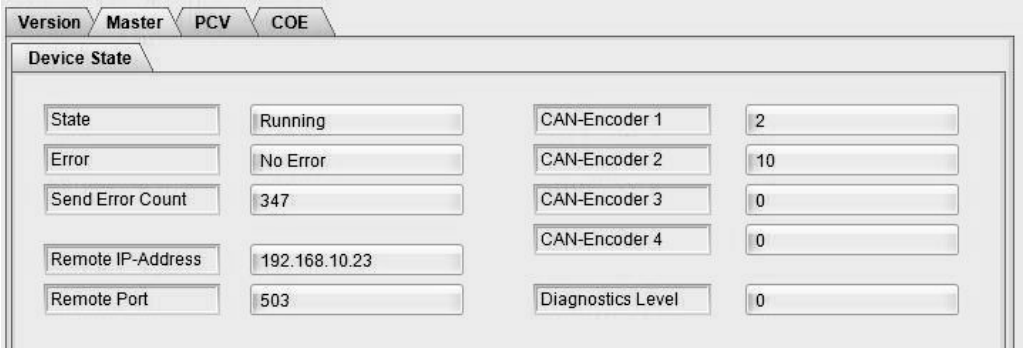
6.2 Process variables / parameters (CPU<->COM)

You can use the "Master" tab to read the diagnostics data from the Modbus/UDP module and the parameters sent by the user program.

- Go to the "Master" tab for the following diagnostics parameters:



5321027979

Diagnostics parameters	Description
State	Current state of the Modbus master module
Error	Current error of the Modbus master module
Send error count	Number of UDP send errors
Remote IP address/Remote port	IP address and port of the Modbus slave to which the Modbus telegrams are sent (passed by the user program)
CAN encoder	Number of the data buffer from receive CAN controller 1/2 to be copied to the Modbus as encoder 1 to 4 (passed by the user program)
Diagnostics level	Diagnostics level of the motion libraries

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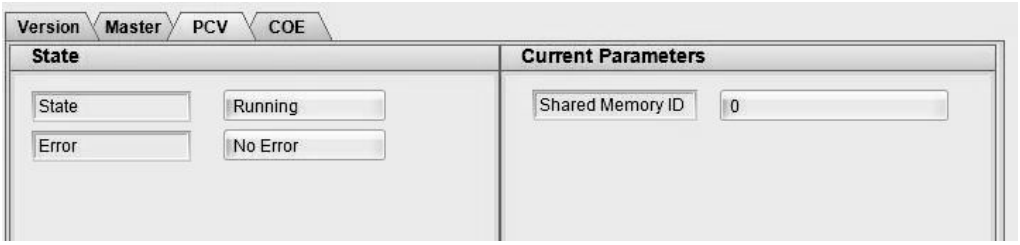
6.3 Pepperl & Fuchs PCV80

- Go to the "PCV" tab for the following diagnostics parameters:



5321033995

Diagnostics parameters	Description
State	Current state of the PCV80 (RS485) module
Error	Current error of the PCV80 (RS485) module
Shared memory ID	Internal ID via which the encoder data is passed to the Modbus module. • ID = 0: RS485 encoder in the Modbus protocol • ID > 0: Not permitted (system error)

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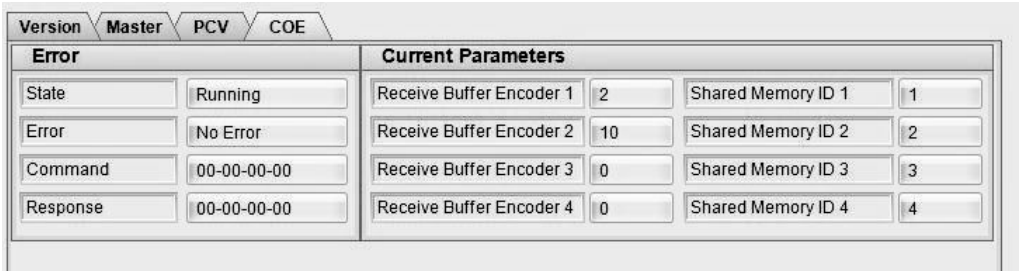
6.4 CANopen

- Switch to the "COE" tab for the following diagnostics parameters:



5323204107

Diagnostics parameters	Description
State	Current state of the CANopen module
Error	Current error of the CANopen module
Command	Command (referencing or reset) from a PLC to the motion libraries of the safety program.
Response	Response of the safety program to the command request (e.g. command executed).
Receive buffer encoder 1 – 4	Number of the data buffer from receive CAN controller 1/2 to be copied to the Modbus as encoder 1 – 4 (passed by the DPRAM)
Shared memory ID 1 – 4	Internal ID via which the encoder data is passed to the Modbus module. ID = 1: CANopen encoder 1 in Modbus protocol ID = 2: CANopen encoder 2 in Modbus protocol ID = 3: CANopen encoder 3 in Modbus protocol ID = 4: CANopen encoder 4 in Modbus protocol

The following table shows the assignment of the receive buffers to the shared memory sections:

Current encoder parameters	
Receive buffer	**Shared memory ID**
Receive buffer encoder 1	Shared memory ID 1 (Data receive CAN controller 1[2] -> CANopen encoder 1 Modbus)
Receive buffer encoder 2	Shared memory ID 2 (Data receive CAN controller 2[2] -> CANopen encoder 2 Modbus)
Receive buffer encoder 3	Shared memory ID 3
Receive buffer encoder 4	Shared memory ID 4

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7 Appendix

7.1 Glossary

Term	Description
DC 24 V	The safety controller has the following DC 24 V input voltage potential: 24V_CU: DC 24 V input – controller 24V_L: DC 24 V input – load 24V_S: DC 24 V input – sensor supply Reference potential 0V24
ARP	Address resolution protocol (network protocol for assigning network addresses to hardware addresses)
BS	Operating system
BL	Boot loader
BWS	Contactless protection device
COM	Communication module
COE	CANopen software module
CRC	Cyclic redundancy check (checksum)
CUT	Com user task
DCS	Distributed control system (process control system)
DI	Digital input (binary input)
DO	Digital output (binary output)
EMC	Electromagnetic compatibility
EN	European standard
ESD	Electrostatic discharge
FB	Fieldbus interface of the controller
FBD	Function block language
FIFO	First-in first-out (data memory)
FTA	Field termination assembly
FTT	Fault tolerance time
ICMP	Internet control message protocol (network protocol for status and error messages)
IEC	International Electrotechnical Commission
IF	InterFace
MAC address	Media access control address (hardware address of a network connection)

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Term	Description
PADT	Programming and debugging tool (in accordance with IEC 61131-3), PC with SILworX®
NVRAM	Non volatile random access memory
PE	Protective earth
PELV	Protective extra low voltage
PES	Programmable electronic system
POU	Program organizational units (in accordance with IEC 61131-1)
PFD	Probability of failure on demand
PFF-HM31A	Safety controller
PFH	Probability of failure per hour
R	Read (system variable provides a value, for example to the user program)
Non-reactive	Supposed two input circuits are connected to the same source (e.g. a transmitter). In this case, an input circuit is referred to as non-reactive if it does not distort the signals of the other input circuit
R/W	Read/Write (column title for system variable type)
SB	System bus (module)
SELV	Safety extra low voltage
SFF	Safe failure fraction
SIL	Safety integrity level (according to IEC 61508)
SILworX®	Programming tool for PFF-HM31A safety controller
SNTP	Simple network time protocol (RFC 1769)
S.R.S	System.Rack.Slot (addressing of a module)
SW	Software
S&R	Send and Receive; in connection with TCP protocols
TMO	Timeout
W	Write (system variable is provided with a value, for example from the user program)
Watchdog (WD)	Time monitoring for modules or programs. A fault stop will occur in the module or program if the watchdog time is exceeded.
WDT	Watchdog time

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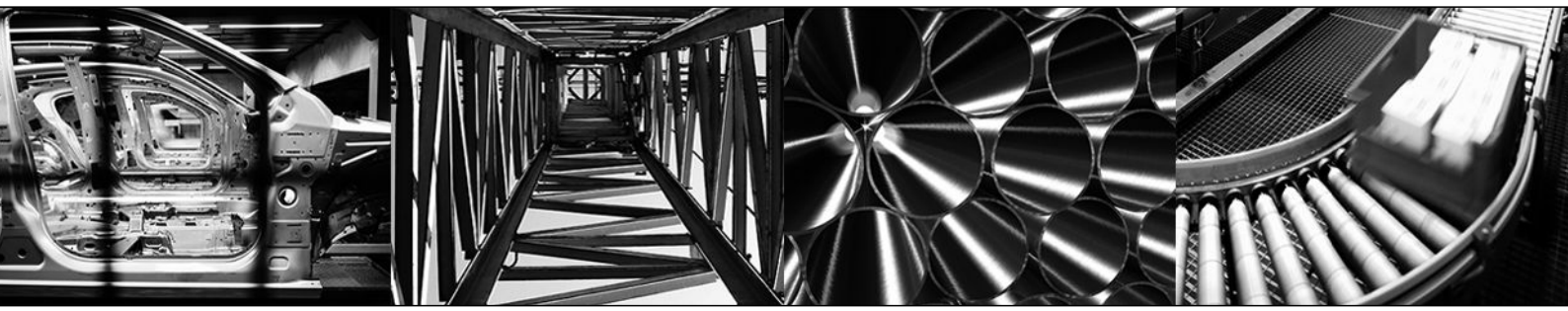

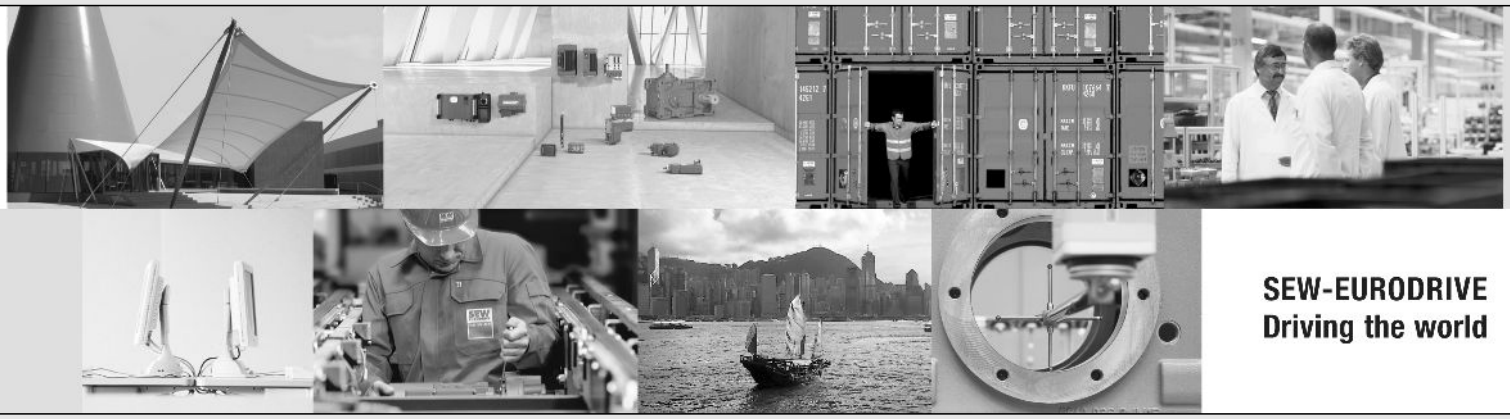

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