ECKELMANN
Industrieautomation

E•FBM

Digital Output Modules DOM08, DOM16

Technical Manual

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Chapter	Date	Person in charge	Modification	Release Date / Initials
All	10/15/01	E. Baun	First edition	
All	10/26/04	W. Niebling	Complete editorial revision	
4.7	08/05	WN	New: Example of connection DOM16	
4.5	08/05	WN	error corrected at terminal marking DOM16	
1.4, 9	12/05	WN	New chapter standards, CE declaration deleted	
2.1.2, 6.1	02 / 07	JP	Additional module variant with int. CAN-Address switch	
	10/2011	WN	V2.4: all chapters concerning cross communication deleted, humidity changed	

Table of contents

1 Introduction

Together with the technical data, this documentation includes general information and instructions regarding the intended use of the digital output modules DOM08 and DOM16 of series E•FBM.

1.1 System manual E•FBM

The system manual includes general information about the field bus modules of series E•FBM.

Moreover, this manual includes the respective instructions regarding the intended use of the field bus modules.

1.2 Intended use

The components are supplied ex works with a fixed hardware and software configuration setting suited to meet the respective field of application. Modifications shall be permitted only within the framework of the options documented in the manuals. All other modifications to the hardware and software as well as the not intended use of the components shall exclude any liability of the ECKELMANN AG.

1.3 Use of the product and documentation

The use of the product described in this manual is intended to be made exclusively by technically qualified and especially trained staff with a training in PLC programming, by skilled persons or by persons trained by skilled persons who are in addition familiar with the valid standards.

Knowledge, correct interpretation and technically perfect implementation of the included provisions and instructions are the prerequisite for a safe installation, commissioning and operation of the described components. Reference to additional documentation is made, if necessary. This documentation is to be used within the same meaning.

ECKELMANN AG shall assume no liability for misaction and damage to Eckelmann products or products of third supplies caused by the non-observance of the information included in this manual.

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1.4 Standards and approvals

The product complies with the following directives

89/336/EEC	Electromagnetic compatibility	EMC directive
73/23/EEC	Electrical Equipment designed for use within certain voltage limits	Low voltage directive LVD

The CE-conformation declaration is available from ECKELMANN AG.

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2 Characteristic features of the module

The modules are output modules for 8 or 16 digital 24V outputs.

2.1 Module variants, options

This manual is valid for the following module variants.

2.1.1 Variants of the DOM08

	Order number	**8 digital outputs Autobaud recognition at the CAN bus**
DOM08	FBMDOM0801	With screw-type terminal connection
	FBMDOM0805	With COMBICON connection plug

2.1.2 Variants of the DOM16

	Order number	**16 digital outputs Autobaud recognition at the CAN bus**
DOM16	FBMDOM1601	With screw-type terminal connection
	FBMDOM1602	With screw-type terminal connection and int. CAN-Addess switch
	FBMDOM1606	With COMBICON connection plug and int. CAN-Addess switch

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2.1.3 Accessories

Order number	Accessories for	
FBMSTS404	FBMDOM0805	Set of matching plugs for COMBICON connection, 4 plugs screw-type terminal (Phoenix Contact MSTB 2.5/ 4-ST KMGY, no. 1946312)
FBMSTF404	FBMDOM0805	Set of matching plugs for COMBICON connection, 4 plugs spring-force terminal (Phoenix Contact FKCT 2.5/ 4-ST KMGY, no. 1921900)
FBMSTS408	FBMDOM1605	Set of matching plugs for COMBICON connection, 8 plugs screw-type terminal (Phoenix Contact MSTB 2.5/ 4-ST KMGY, no. 1946312)
FBMSTF408	FBMDOM1605	Set of matching plugs for COMBICON connection, 8 plugs spring-force terminal (Phoenix Contact FKCT 2.5/ 4-ST KMGY, no. 1921900)
KLZCP0001	FBMDOM0805 FBMDOM1605	Coding section (Phoenix Contact CP-MSTB, no. 1734634) for COMBICON terminal (packing unit=100) Coding element (Phoenix Contact CR-MSTB, no. 1734401) for COMBICON housing (packing unit=100)

2.2 Characteristic features of the DOM08

- Digital output module for 8 optoisolated 24V signals
- Pulse generator with pulse width modulation parameterizable by the software
- Inverting of the output logics per output
- External supply 24 V DC for the outputs
- High-active switching, per channel 500 mA short-circuit proof
- Indicator LED per output for the signaling of the output states
- Indicator LED for life check
- Module address settable on the front by means of rotary switch
- 16 modules per node that can be addressed at the CAN bus
- Autobaud recognition at the CAN bus
- Screw-type terminal connection, variant with plugable terminals available
- Width of module housing 22.5mm

The electrical characteristics of the module with COMBICON connection are the same as those of the module with screw-type terminal connection.

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2.3 Characteristic features of the DOM16

- Digital output module for 16 optoisolated 24V signals
- Pulse generator with pulse width modulation parameterizable by the software
- Inverting of the output logics per output
- External supply 24 V DC for the outputs
- High-active switching, per channel 500 mA short-circuit proof
- Indicator LED per output for the signaling of the output states
- Indicator LED for life check
- Module address settable on the front by means of rotary switch
- 16 modules per node that can be addressed at the CAN bus
- Autobaud recognition at the CAN bus
- Screw-type terminal connection, variant with plugable terminals available
- Width of module housing 45 mm

The electrical characteristics of the module with COMBICON connection are the same as those of the module with screw-type terminal connection.

2.4 Additional functions

Inverting of the outputs

The module includes an inverting of the outputs parameterizable by the software.

Behavior of the outputs in case of malfunction

The behavior of the outputs in case of malfunction can be parameterized.

Pulse generator with pulse width modulation

The pulse generator makes an autonomous generation of the pulse width signals at 4 outputs of the modules possible.

The advantage is the time-synchronous output of the voltage curve, an unloading of the superordinate controller and a reduction of the data transfer on the CAN bus. This function supports the output of a pulse-width modulated voltage, e.g. during the control of valves or special motors in the field of robotics where the resulting load curve of a gripper is controlled as a function of the pulse width ratio.

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2.5 Supply voltage field level

The load voltage for the consumer of 24 V (18 V-32 V) is supplied externally to the upper part of the housing via the terminals. The 24V terminals of the load voltage are connected.

It is important that both the external field voltage / load voltage and the supply voltage of the control electronics have the same mass, since otherwise, the integrated input logics of the semi-conductor switches have no reference potential.

2.6 LED per output

A red LED is provided for each output as indicator. The current of this LED comes directly from the output of the respective switch and, therefore, makes an optic checking of the switching state possible. The respective LED is on if voltage is available at the respective output.

2.7 Life LED indicating the operating state of the module

The life LED (“life light”) is positioned in the upper part of the module and indicates the operating state of the module. Both the single operating states of the module and the life LED are described in the chapter Start-up. The function of the life LED can be parameterized via the CAN bus by means of object 2000H.

2.8 Loading capacity of the outputs

The module outputs are controlled by semi-conductor switches that have an internal protection against overcurrent, overheating and short-circuit. A wire breaking of the connected load is not recognized.

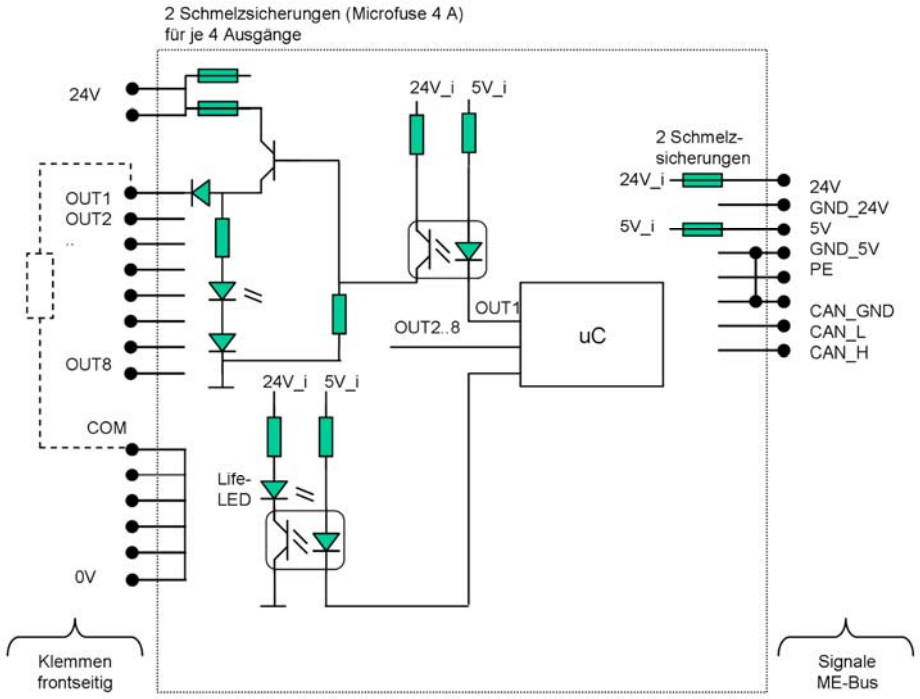
The modules are designed for a continuous loading of all outputs with the respective maximum current. Several outputs can be connected in order to obtain higher currents.

Fuses (microfuses 4A) are an additional protection against overcurrent and fire for 4 output channels each 1..4, 5..8 (or 1..4, 5..8, 9..12, 13..16). The fuses can only be activated if a longer short-circuit occurs permanently and simultaneously on all 4 output channels.

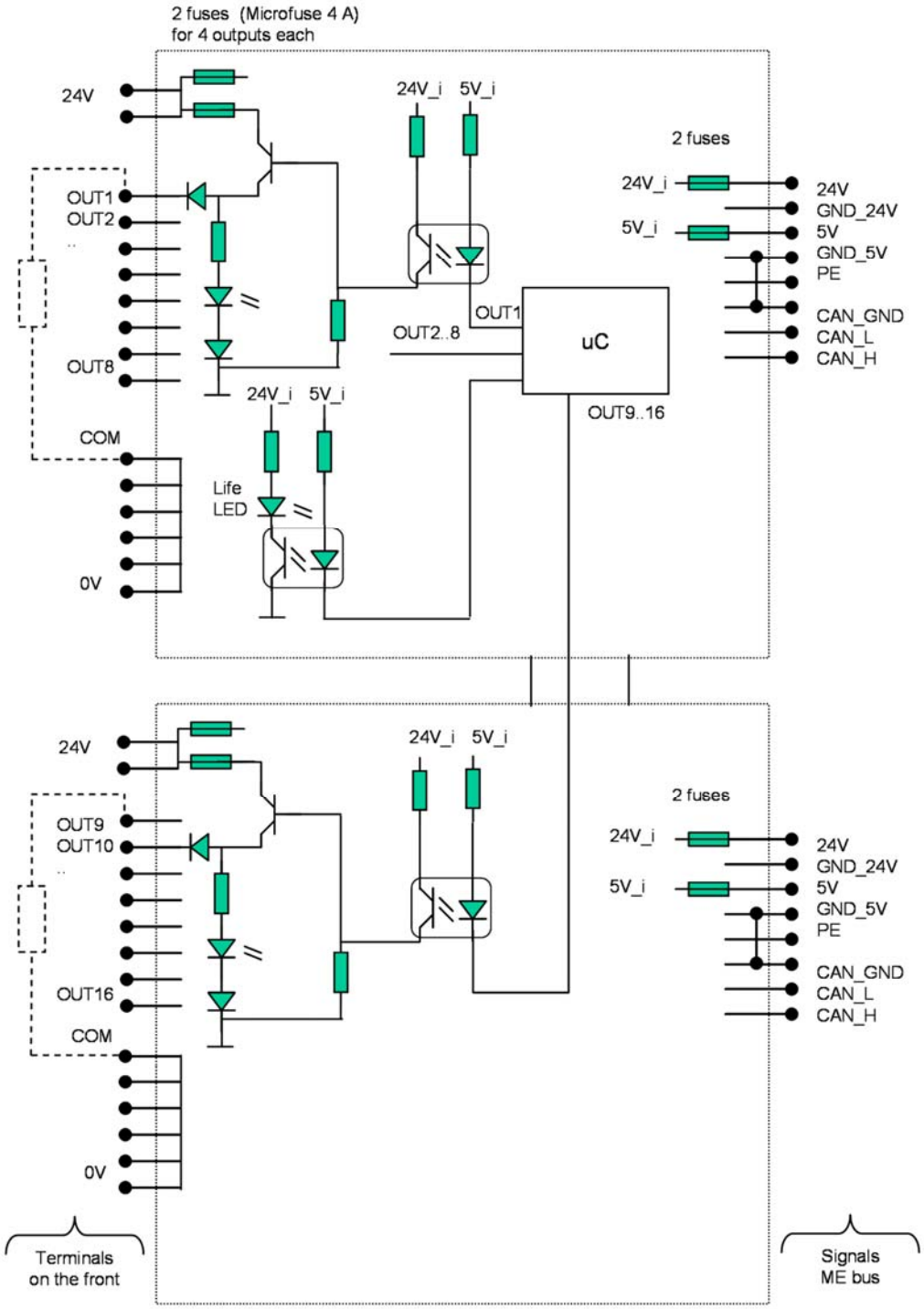
2.9 Electrical isolation

All outputs are electrically isolated from the microcontroller. The electrical isolation of the outputs is made between the microcontroller and the semi-conductor switches. It is important that both the external 24V field voltage and the 24V supply voltage of the control electronics have the same mass, since otherwise, the integrated input logics of the semi-conductor switch have no reference potential.

2.10 Schematic diagram DOM08



2.11 Schematic diagram DOM16



3 Technical data

General data	
Use: DOM08 DOM16	 8-channel output module 24 V DC 16-channel output module 24 V DC Semi-conductor switching versus 24V (high side switches)
Indication	LED indicating operating state, parameterizable via CANopen object 2000H 1 LED per output, connection parallelly to the switch output
Module addressing	4 bit, freely selectable in the range 10h to 1Fh
Connection system	Direct screw-type terminals optionally COMBICON connector system with screw-type terminals or spring-force plugs
Weight: DOM08 DOM16	 145 g 215 g
Installation height	min. 180mm
Dimensions (H x W x D) DOM08 DOM16	 99 mm x 22.5 mm x 114.5 mm 99 mm x 45.0 mm x 114.5 mm The dimensions are valid for the screw-type terminals and the COMBICON connection plugs without matching plugs

Supply	
Supply voltages:: Switching voltage of outputs Switching voltage of control Logic voltage	 typ. 24V DC (18...32V DC) external supply typ. 24V DC (18...32V DC) via ME bus typ. 5.0V DC (4.75...5.24V DC) via ME bus
Current input of the logic part via the internal bus 5V (and 24V external supply): DOM08, 4 outputs activated DOM08, 8 outputs activated DOM16, 8 outputs activated DOM16, 16 outputs activated Current input of the switch control at 24V (32V) field or system voltage: DOM08, 4 outputs activated DOM08, 8 outputs activated DOM16, 8 outputs activated DOM16, 16 outputs activated	 typ. 95 mA max. 180 mA typ. 130 mA max. 240 mA typ. 15 mA (at 24V), typ. 20 mA (at 32V) max. 25 mA (at 24V), max. 30 mA (at 32V) typ. 25 mA (at 24V), typ. 30 mA (at 32V) max. 50 mA (at 24V), max. 60 mA (at 32V)
Power loss: DOM08, 4 outputs activated DOM08, 8 outputs activated DOM16, 8 outputs activated DOM16, 16 outputs activated	 typ. 1.0 W typ. 1.8 W typ. 1.5 W typ. 3.0 W

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Outputs	
Outputs	
Switching voltage of the outputs	Typ. 24V DC (18...32V DC) external supply
Load characteristics	Ohmic, inductive, capacitive
Short-term current per channel per 1s	500 mA
Voltage drop of a switch	700 mA
Voltage drop of a switch	max. 400 mV at00 mA
Min. voltage at the output terminals at full load (0.5 A)	Supply voltage – 1.0 V
Parallel connection of several outputs	Possible
Max. switching frequency of switches	Approx. 250 Hz at ohmic load
Autonomous restart after the short-circuit	Yes (at available control)
Short-circuit peak current per channel:	Short-term 4.0 A (limited in the switch)
Autonomous restart current at permanent short-circuit at the output	3.0 A pulsed (at available control) switched off
Output indication	A LED is positioned per channel in the respective input signal line
Protection against polarity reversal for supply	Available
Output state at missing control by the logic part	Switched off
Intermediate storage of the control signal	No
Electrical isolation	Connection of the output mass lines

Fusing	
Fusing: Switch Switch control Logic part	 Microfuse 4A slow for 4 outputs each optionally plugable SMD fuse 500 mA slow SMD fuse 500 mA slow
Recovery	Up to max. ±32V are possible at an output terminal
Electrical isolation between logic part and output terminals	500 V DC
Protection	Outputs are protected against overheating, short-circuit and polarity reversal up to ±32 V DC. Additional fire protection by means of fuses 4A. Suppressor diode (36V) parallelly to each switch output. Longitudinal diode between switch output and output terminal. Release of a RESET in case of dropping logic voltage.

Environment	Transportation and storage	Operation
Ambient temperature	-20°C to +70°C	0°C to +50°C In case of max. load, vertical mounting and sufficient convection
Temperature change Relative humidity (not condensing) Shock (10 ms) Vibration (10 to 100 Hz) Air pressure	max. 20 K/h 5% to 95% max. 15 G max. 2 G 660 hPa to 1060 hPa	max. 10 K/h 5% to 95% max. 5 G max. 0.5 G 860 hPa to 1060 hPa
Type of protection	IP20	

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4 Mounting and installation

4.1 Module housing

All modules of series E•FBM have modular ME BUS housings. As a general rule, the housing is composed of a lower part and an upper part with the electronic system. For further details regarding the housing design please check the system manual.

4.2 Mounting

All modules of series E•FBM can be directly snapped on a mounting rail TS35 with a height dimension of 7.5 or 15mm as per European Standard EN 50022.

The mounting is easy and space-saving. The single modules are safely connected and positioned thanks to the 10-pole cross connection integrated in the housing bottom. Both the energy supply of the control electronics and the transmission of the bus signals are made via this cross connection.

The installation position must be vertical in order to ensure sufficient ventilation. On the top and on the bottom, a clearance of at least 80 mm should be kept for the module.

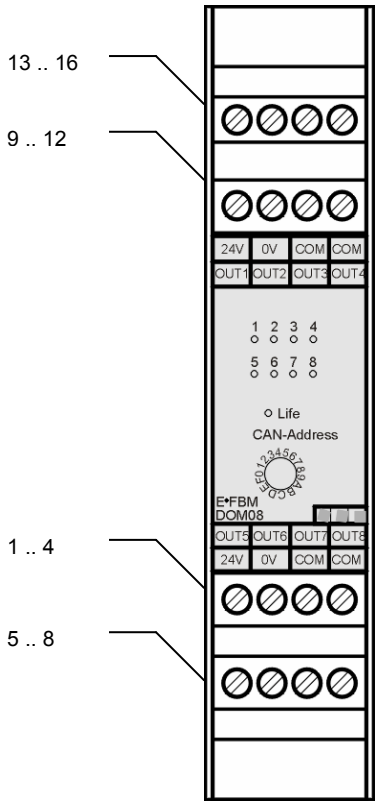
4.3 ESD protection

When handling the module, always take suited ESD protective measures, such as bracelets, conductive supports and suited packing material.

Make the following checks:

- Checking of the entire system for correct wiring
- Checking of the set CAN address
- Checking of the correct ME bus contacting
- Checking of the correct grounding

4.4 Terminal marking DOM08



Terminal	Marking	Signal	Comment
9, 10, 11, 12, 1, 2, 3, 4	OUT1..OUT8	8 digital outputs 24V	
13, 5	24V	Sensor supply 24V outputs	Terminals internally bridged
14, 6	0V	Reference potential sensor supply	Terminals internally bridged
15, 16, 7, 8	COM	Reference potential load	Terminals internally bridged, bridged with 0V

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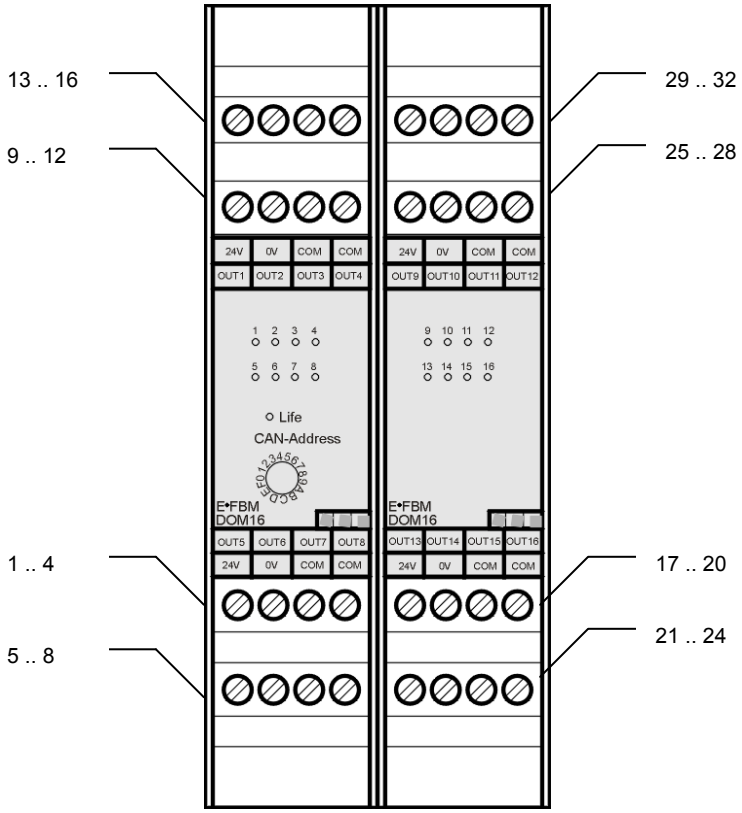
4.5 Terminal markings DOM16

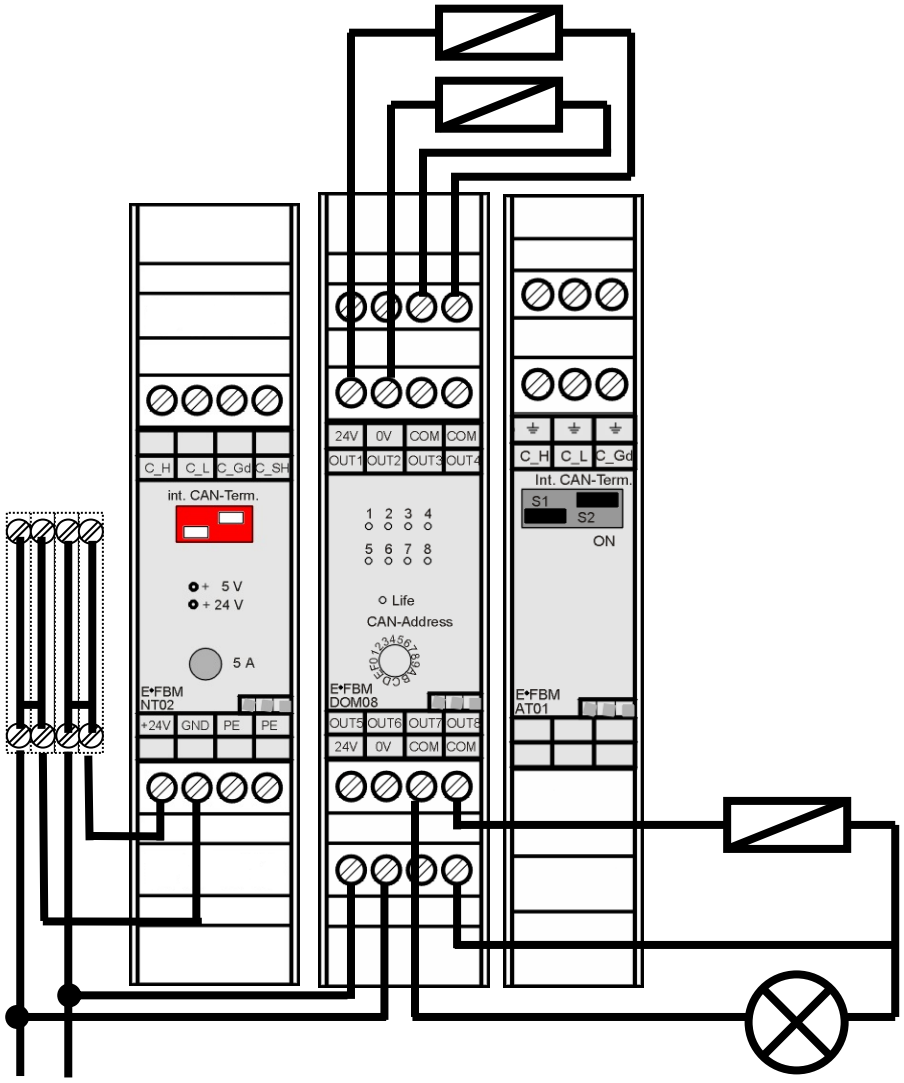


Terminal	Marking	Signal	Comment
9, 10, 11, 12, 1, 2, 3, 4, 25, 26, 27, 28, 17, 18, 19, 20	OUT1..OUT16	16 digital outputs 24V	
13, 5	24V	Sensor supply 24V outputs (OUT1..OUT8)	Terminals internally bridged
14, 6	0V	Reference potential sensor supply (OUT1..OUT8)	Terminals internally bridged
15, 16, 7, 8	COM	Reference potential load (OUT1..OUT8)	Terminals internally bridged, bridged with 0V
29, 21	24V	Sensor supply 24V outputs (OUT9..OUT16)	Terminals internally bridged
30, 22	0V	Reference potential sensor supply (OUT9..OUT16)	Terminals internally bridged
31, 32, 23, 24	COM	Reference potential load (OUT9..OUT16)	Terminals internally bridged, bridged with 0V

4.6 Example of connection DOM08

The following example shows the connection possibilities of the outputs of a module DOM08 via a power supply module and an external 24V supply as smallest configuration.

The termination of the internal CAN bus line is made via the power supply module NT02 and the termination module AT01 (switch S1= ON).



In this example, the 24V supply required for the outputs is externally connected.

The reference potential 0V of the external supply voltage of the outputs and the reference potential 0V of the power supply module must be connected.

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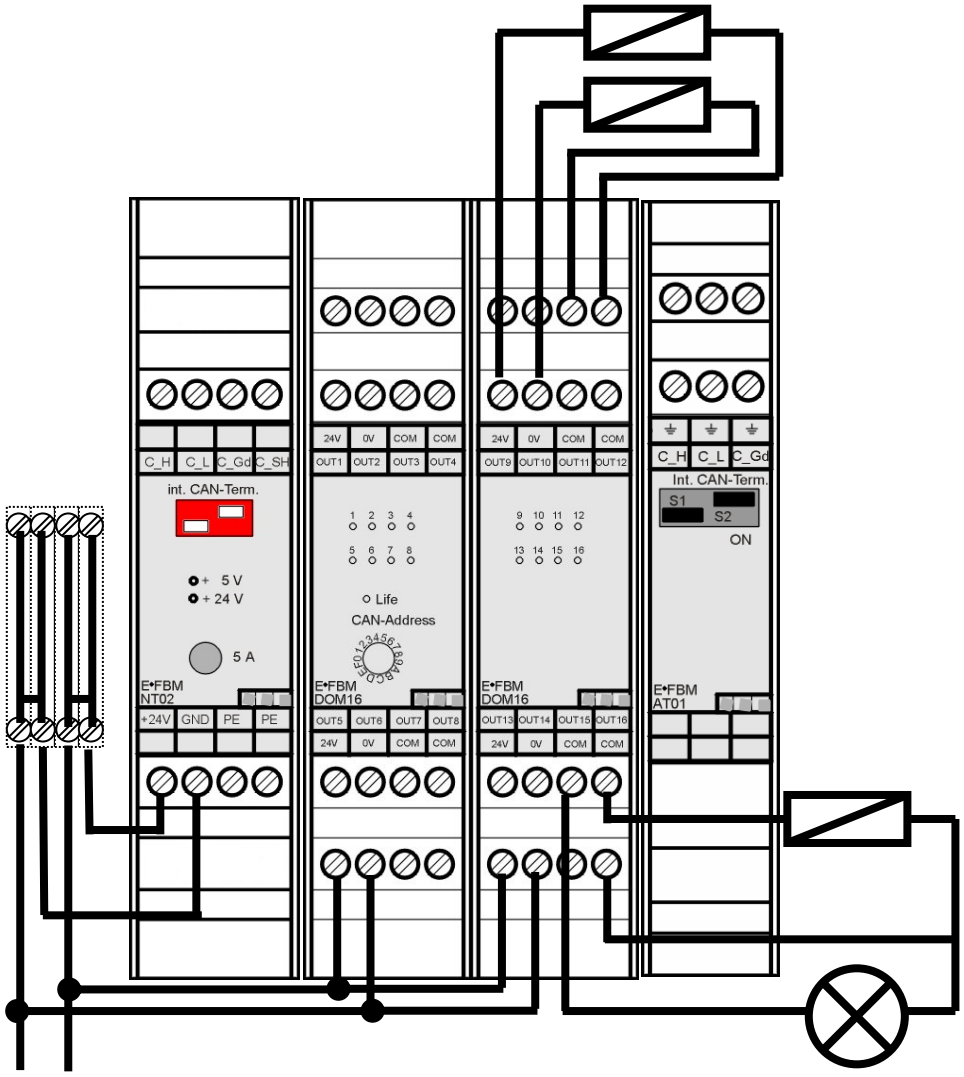
4.7 Example of connection DOM16

The following example shows the connection possibilities of the outputs of a module DOM16 via a power supply module and an external 24V supply as smallest configuration.

The termination of the internal CAN bus line is made via the power supply module NT02 and the termination module AT01 (switch S1= ON).



In this example, the 24V supply required for the outputs is externally connected.

The reference potential 0V of the external supply voltage of the outputs and the reference potential 0V of the power supply module must be connected.

5 Start-up

The start-up of the module can be made after the mechanical and the electrical installation of the field bus modules.

Supply voltage on: As soon as the supply voltage has been switched on, the module is in the state of automatic baud rate recognition. The life LED in the upper part of the module is flashing at 8 Hz. Upon recognition of the baud rate, an internal initialization of the module is made. Subsequently, the module is in the internal state „*Pre-operational*“. The module is now ready for operation and attends control signals via the CAN bus. The life LED is flashing at 0.25 Hz.

Initialization of the module: Upon successful initialization of the module via the CAN bus (e.g. by a controller) with the signal „Start-remote-node“, the module is in state „*Operational*“. The life LED is on (permanently).

All outputs are to be controlled and the specified voltage and current values are to be checked.

Module stopped: If the signal „Stop-remote-node“ is sent via the CAN bus, the module passes to the state „*Stopped*“. The module attends the respective signal to leave this state. In this state, the life LED is permanently off.

The life LED mode can be modified via the CAN bus (see chapter Parameterizing). Therefore, the statements made for the life LED are only valid for the default setting.

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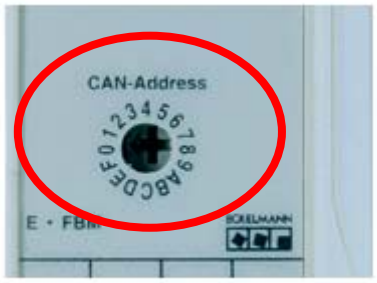
6 Programming and parameterizing

6.1 Setting of the node address

Each E•FBM module of a line is to be set with an unambiguous node address at the CAN bus.

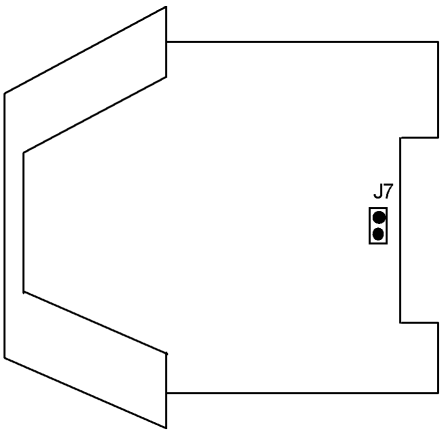


The setting of the node address is made via a hexagonal switch on the front (4 low-value address bits) and via hard-wired bridges inside the housing (3 higher-value address bits). Therefore, max. 16 modules are possible within one module type.

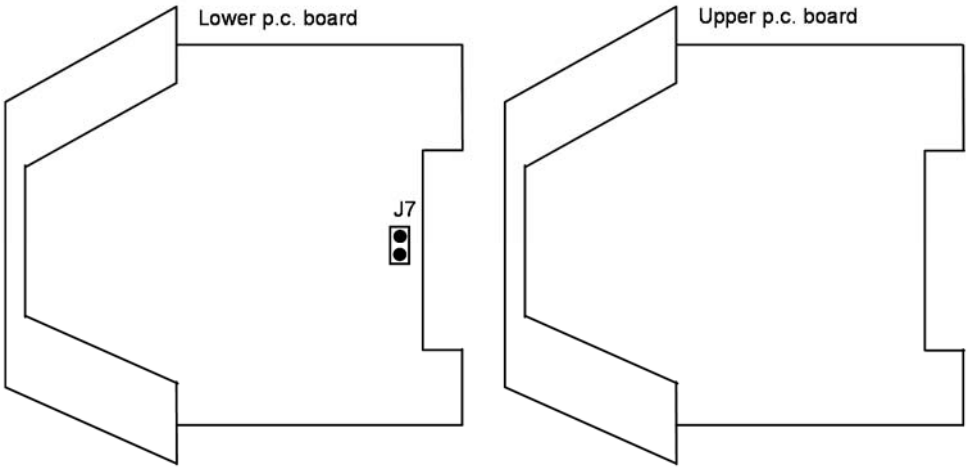
Module type	Higher-value address bits hard-wired	Low-value address bits, settable on the front via the hexagon switch	Set node address (hex)	Set node address (decimal)
DOMxx, DIO88	10H	0…FH	10H…1FH	16 .. 31

When setting the node address, make sure that no double assigning of modules to the same node address at the CAN bus occurs, i.e. several modules of the above table at the same CAN bus need to have differently set hexagon switches.

6.2 DOM08 bridges



6.3 DOM16 bridges



In the module, the lower and the upper p.c. board are connected electrically and mechanically by means of a dual in-line connector. The two p.c. boards can be separated from each other by drawing them carefully. After a checking or setting of the bridges, the two p.c. boards are reconnected via the dual in-line connector.

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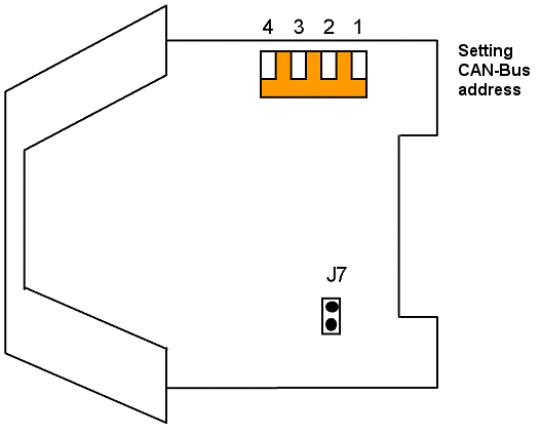
For module variant FBMDIM1602 and FBMDOM1606 only:



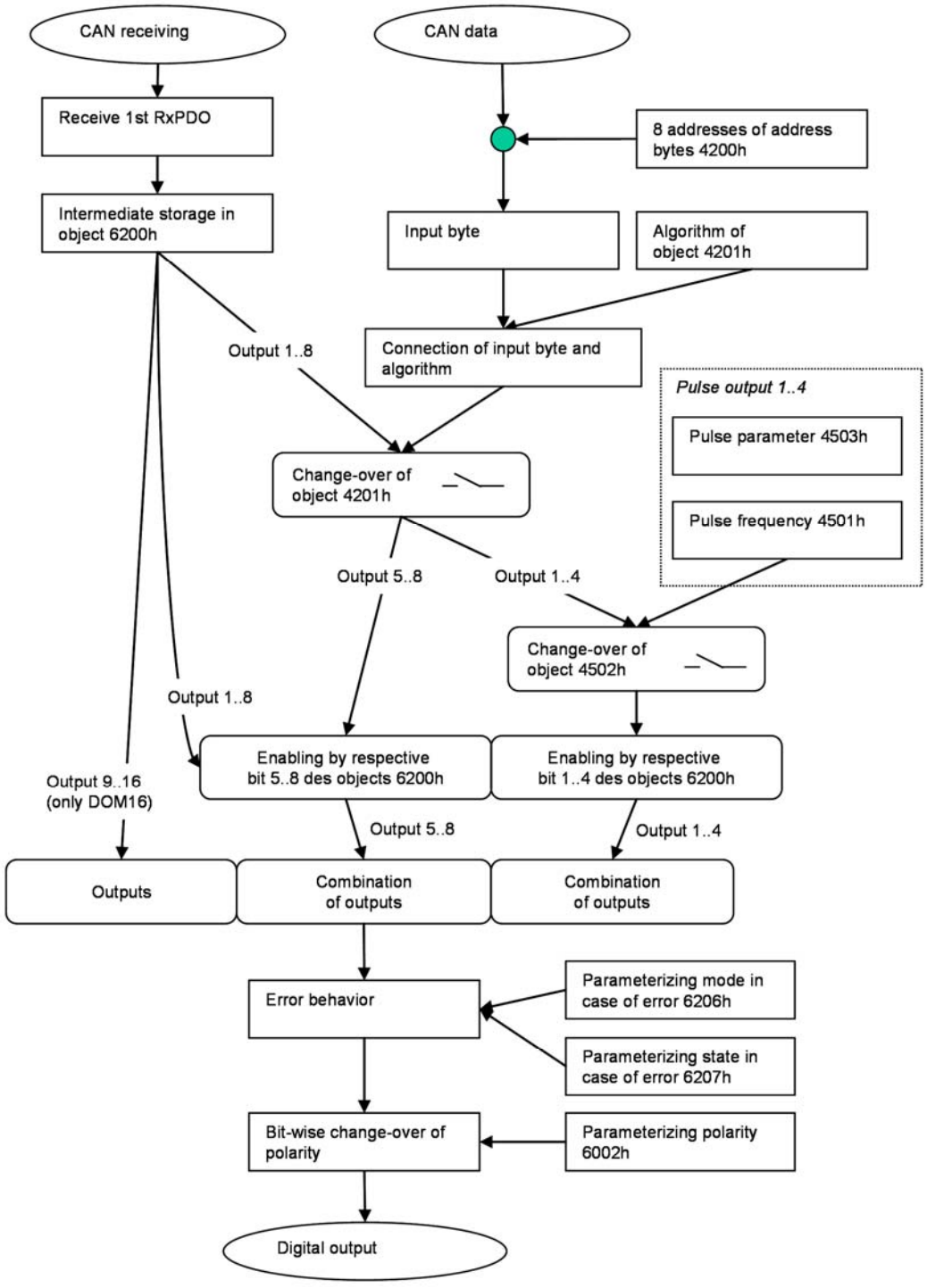
The basis address (higher-value address bits) of the CAN bus can be modified by means of the 4-pole DIL switch. Normally, the preset address should not be modified.

Note: The setting of the basis address is made by means of the DIL switches 1 .. 3. The setting of the DIL switches 4 (ON or OFF) has no influence on the resulting basis address.

DIL switch 1	DIL switch 2	DIL switch 3	DIL switch 4	Resulting basis address
OFF	OFF	OFF	OFF	00H
ON	OFF	OFF	OFF	10H
OFF	ON	OFF	OFF	20H
ON	ON	OFF	OFF	30H
OFF	OFF	ON	OFF	40H
ON	OFF	ON	OFF	50H
OFF	ON	ON	OFF	60H
ON	ON	ON	OFF	70H

Bridge J7 is provided for an optional termination of the CAN bus. With closed bridge, a resistance of 120 Ohm is added on the ME bus between the lines CAN_L and CAN_H. In normal operation, the bridge must not be closed.

6.4 Signal and data flow



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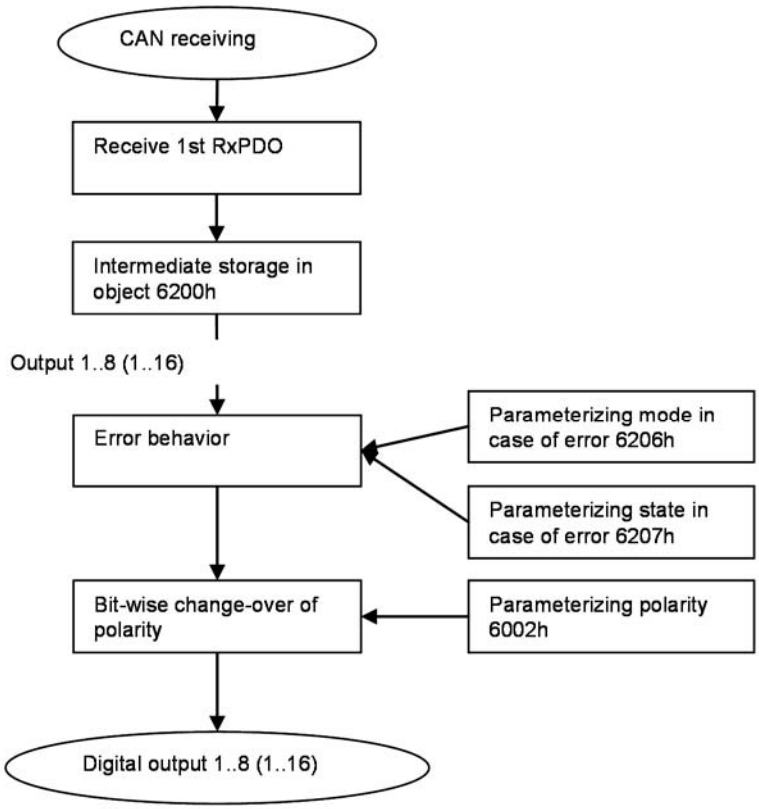
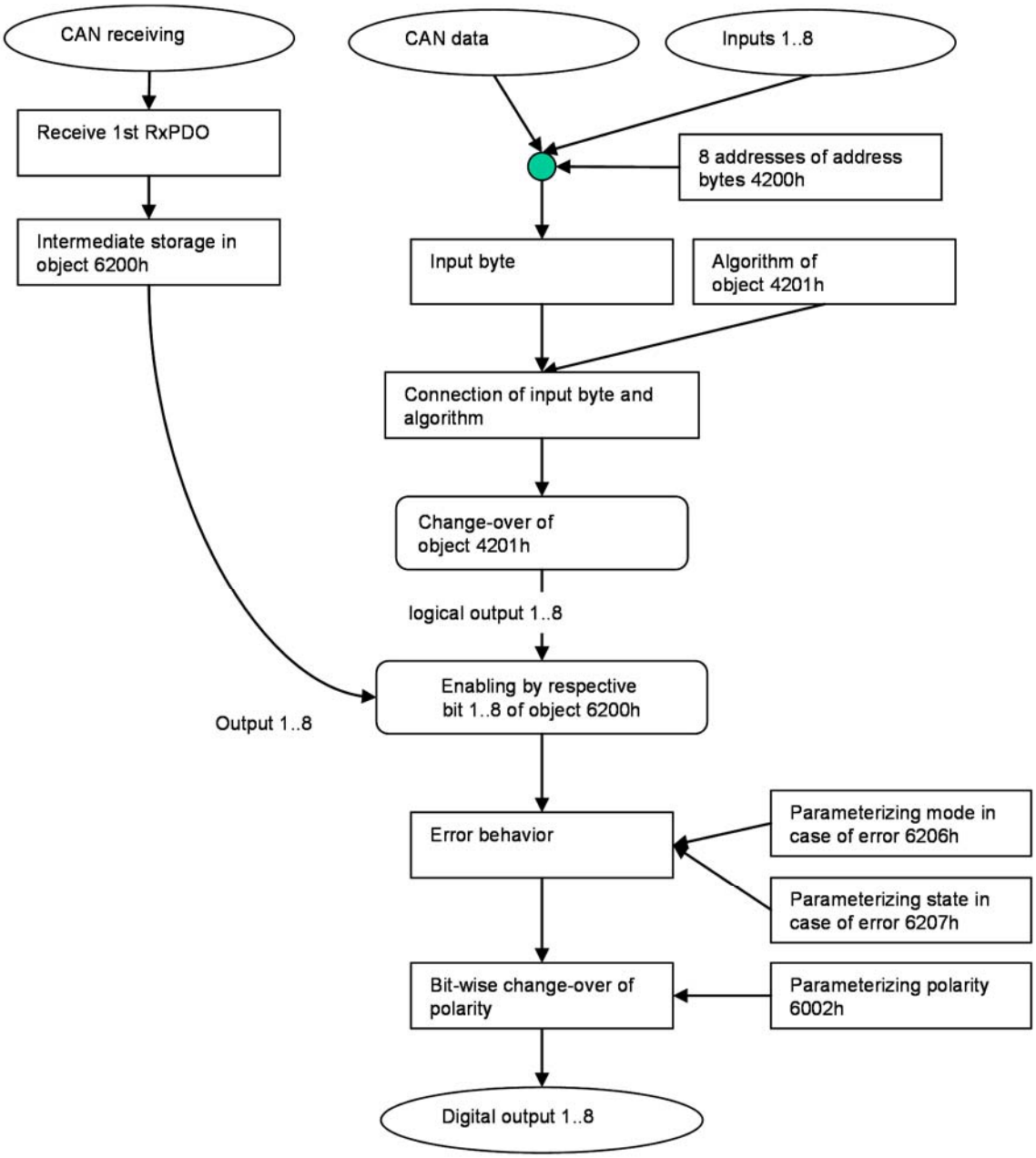
6.4.1 Signal and data flow (section of normal output)



6.4.2 Signal and data flow (section of logic output)



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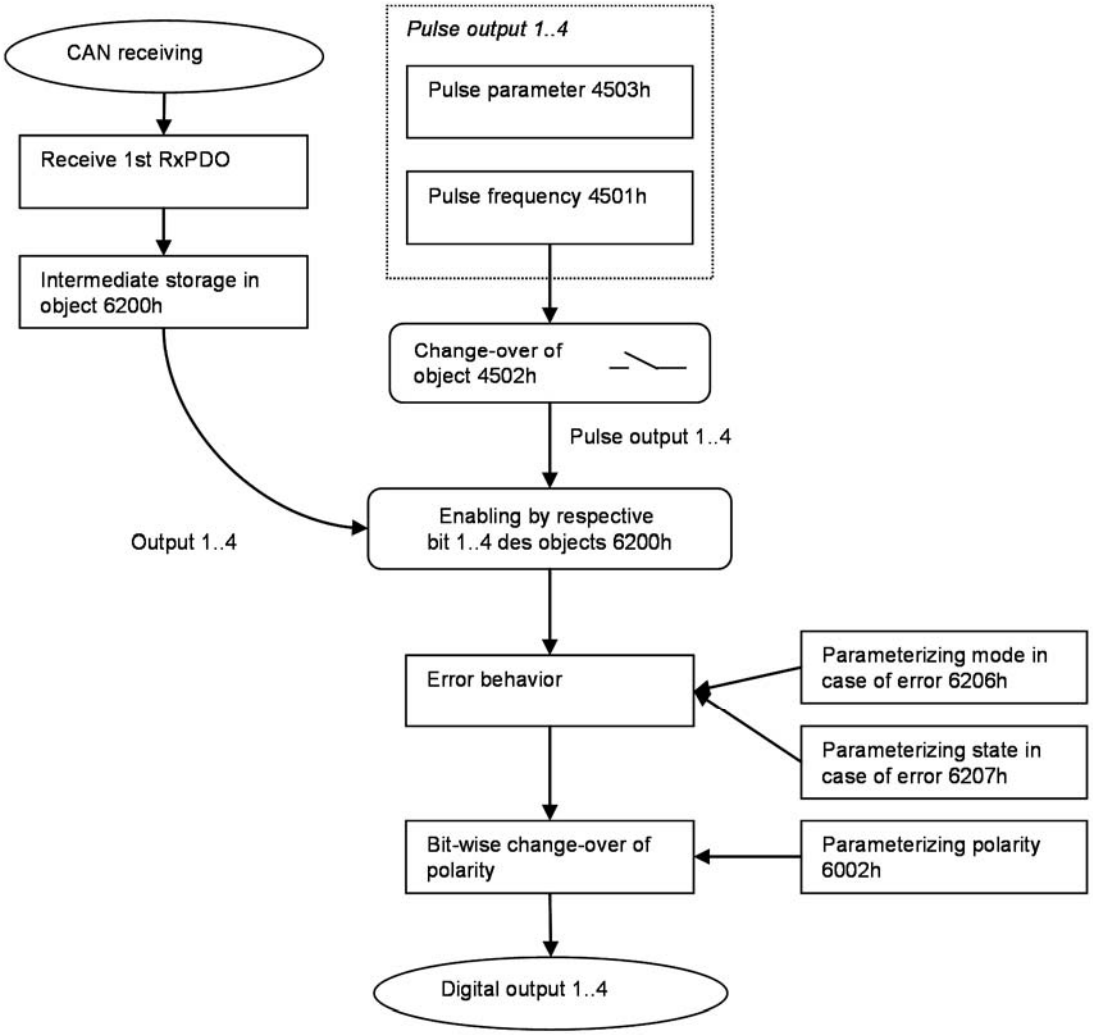
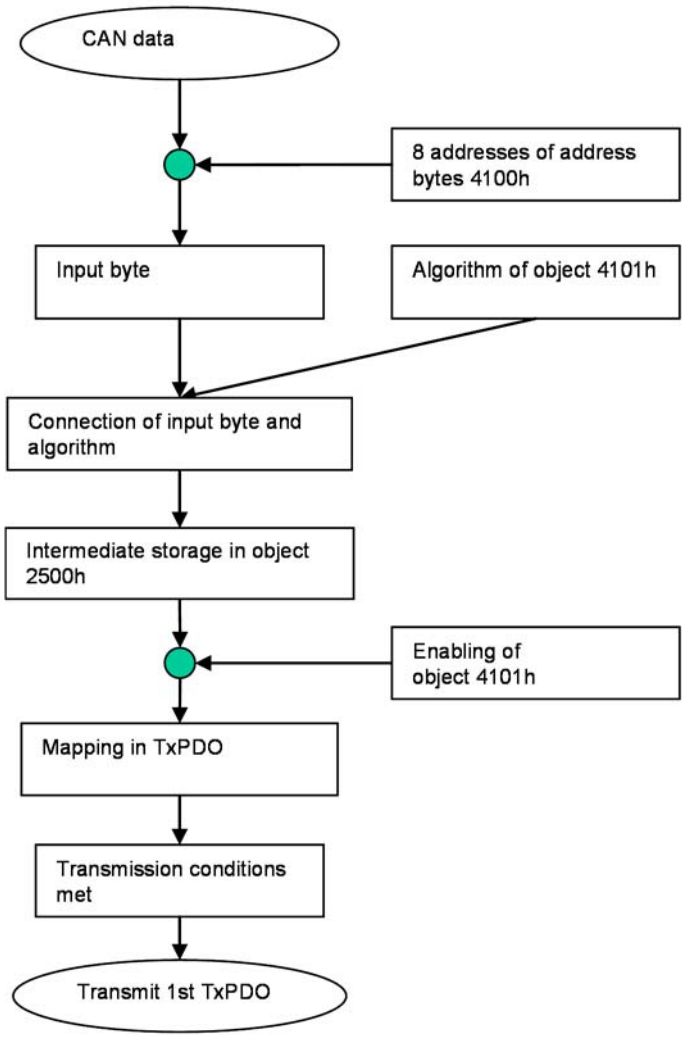
6.4.3 Signal and data flow (section of pulse generator)



6.4.4 Signal and data flow (logic input)



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6.5 Parameterizing

After power-on and the subsequent internal initialization it is possible to parameterize the following objects by means of SDO transfer:

Communication profile area:

Parameter	Object (hex)	Sub-index	Type	Admissible input	Preset value
Guard time (ms)	100C	0	unsigned 16	0 .. 65535	0
Life time factor	100D	0	unsigned 8	0 .. 255	0
Heartbeat time (ms)	1017	0	unsigned 16	0 .. 65535	0
Inhibit time for 1. TxPDO (0.1 ms)	1800	3	unsigned 16	0 .. 2550	0

Standardized device profile area:

Parameter	Object (hex)	Sub-index	Type	Admissible input	Preset value
Inverting of polarity of the outputs	6202	1, 2	See the following chapter		
Behavior of the outputs in case of malfunction	6206, 6207	1, 2	See the following chapter		
NMT behavior of the module in case of severe communication errors	67FE	1	unsigned 8	unsigned 8	0

Manufacturer-specific profile area:

Parameter	Object (hex)	Sub-index	Type	Admissible input	Preset value
Mode of life LED	2000	1	See the following chapter		

Manufacturer-specific profile area (additional functions):

Parameter	Object (hex)	Sub-index	Type	Admissible input	Preset value
Pulse generator frequency	4501	1	See the following chapter		
Pulse generator enabling and pulse width ratio	4502..4503	1..4			

6.5.1 Inverting of the polarity of the outputs

The polarity of the outputs (object 6002h) can be inverted with this function in compliance with the requirements of use.

The function requires the following parameters:

Parameter	Object (hex)	Sub-index	Type	Admissible input	Preset value
Inverting of the polarity of the outputs 1..8	6202	1	unsigned 8	Bit mask 0 -> Input n not modified 1 -> Input n inverted	0
Inverting of the polarity of the outputs 9..16 (only DOM16)	6202	2	unsigned 8	Bit mask 0 -> Input n not modified 1 -> Input n inverted	0

The bit pattern is shown in binary representation.

Example input	Not modified	Inverted
1	(Index 6202h, sub-index1) = xxxxxxx0	(Index 6202h, sub-index1) = xxxxxxx1
5	(Index 6202h, sub-index1) = xxx0xxxx	(Index 6202h, sub-index1) = xxx1xxxx
8	(Index 6202h, sub-index1) = 0xxxxxxx	(Index 6202h, sub-index1) = 1xxxxxxx
9	(Index 6202h, sub-index2) = xxxxxxx0	(Index 6202h, sub-index2) = xxxxxxx1
13	(Index 6202h, sub-index2) = xxx0xxxx	(Index 6202h, sub-index2) = xxx1xxxx
16	(Index 6202h, sub-index2) = 0xxxxxxx	(Index 6202h, sub-index2) = 1xxxxxxx

6.5.2 Behavior of the outputs in case of malfunction

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With the parameter „Fault mode“ (object 6206h) it is defined whether in case of a communication error with change of state (see System Manual), an output is to assume a value predefined in parameter „Fault State“ (object 6207h) or the last valid value.

The function requires the following parameters:

Parameter	Object (hex)	Sub-index	Type	Admissible input	Preset value
Fault mode output 1..8	6206	1	unsigned 8	Bit mask 1 -> predefined fault state n 0 -> not modified n	FFh
Fault mode output 9..16 (only DOM16)	6206	2	unsigned 8	Bit mask 1 -> predefined fault state n 0 -> not modified n	FFh
Fault state output 1..8	6207	1	unsigned 8	Bit mask 1 -> output n on 0 -> output n off	0
Fault state output 9..16 (only DOM16)	6207	2	unsigned 8	Bit mask 1 -> output n on 0 -> output n off	0

The bit pattern is shown in binary representation.

Example of output	Last valid value	Predefined value as per object 6207h
1	(Index 6206h, sub-index1) = xxxxxxx0	(Index 6206h, sub-index1) = xxxxxxx1
5	(Index 6206h, sub-index1) = xxx0xxxx	(Index 6206h, sub-index1) = xxx1xxxx
8	(Index 6206h, sub-index1) = 0xxxxxxx	(Index 6206h, sub-index1) = 1xxxxxxx
9	(Index 6206h, sub-index2) = xxxxxxx0	(Index 6206h, sub-index2) = xxxxxxx1
13	(Index 6206h, sub-index2) = xxx0xxxx	(Index 6206h, sub-index2) = xxx1xxxx
16	(Index 6206h, sub-index2) = 0xxxxxxx	(Index 6206h, sub-index2) = 1xxxxxxx

With the parameter „Fault State“ (object 6207h), the output state is defined in the case of a communication error with change of state (see System Manual) at correspondingly set Fault Mode.

Example of output	Fault State output off	Fault State output on
1	(Index 6207h, sub-index1) = xxxxxxx0	(Index 6207h, sub-index1) = xxxxxxx1
5	(Index 6207h, sub-index1) = xxx0xxxx	(Index 6207h, sub-index1) = xxx1xxxx
8	(Index 6207h, sub-index1) = 0xxxxxxx	(Index 6207h, sub-index1) = 1xxxxxxx
9	(Index 6207h, sub-index2) = xxxxxxx0	(Index 6207h, sub-index2) = xxxxxxx1
13	(Index 6207h, sub-index2) = xxx0xxxx	(Index 6207h, sub-index2) = xxx1xxxx
16	(Index 6207h, sub-index2) = 0xxxxxxx	(Index 6207h, sub-index2) = 1xxxxxxx

Result of the setting of the bit mask on the basis of the example for output 5:

	(Index 6206h, sub-index1) = xxx0xxxx	(Index 6206h, sub-index1) = xxx1xxxx
(Index 6207h, sub-index1) = xxx0xxxx	In case of error, output 5 maintains the last valid value	Output 5 is switched off in case of error
(Index 6207h, sub-index1) = xxx1xxxx	In case of error, output 5 maintains the last valid value	Output 5 is switched off in case of error

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6.5.3 Mode of the life LED

The operating states of the FBM are visually indicated by means of the life LED. The function of the life LED can be parameterized via the CAN bus by means of object 2000h.

Meaning	Object (hex)	Sub-index	Type	Admissible input	Preset value
Mode of life LED	2000	1	unsigned 8	0, 1	0

Two possible indication patterns of operating states can be parameterized by means of object 2000h for FBM states.

	(Index 2000h, sub-index1) = 0	(Index 2000h , sub-index1) = 1
FBM state after voltage on (automatic baud rate recognition)	Flashing at 8 Hz, 1:1	
FBM state „Pre-operational“	Flashing at 0.25 Hz, 1:1	Flashing at 0.25 Hz, 1:1
FBM state „Operational“	„permanently on“	Flashing at 1 Hz, 1:1
FBM state „Stopped“	„permanently off“	Flashing at 0.25 Hz, 7:1 („long-time on“ and „short-time off“)

6.5.4 Pulse generator with pulse width modulation

The function requires the following parameters:

Meaning	Object (hex)	Sub-index	Type	Admissible input	Preset value
Frequency (Hz)	4501	1	unsigned 16	25..512 *See Note1*	25
Enabling of the pulse width output	4502	1..4	Unsigned 8	>0: enabled 0: disabled *See Note2*	0
Pulse width ratio	4503	1..4	unsigned 16	0..1023 *See Note3*	0

Note1: The frequency is transmitted in object 4501h, sub-index 1 as a word within the range of 25 to 512 Hz.

Note2: The change-over between pulse generator and normal output is made in object 4502h, sub-index 1..4.

≠ 00: Pulse generator enabled, normal output is disabled

00: Pulse generator disabled, normal output is enabled

Note3: The pulse width ratio is transmitted in object 4503h, sub-index 1..4 as a word in the range of 0 to 1023 for active time. This results in a square curve with settable active time of 0...1023 when referred to the length of the period of 1023. The maximum value (1023) means the maximum active time of the output.

The smallest pulse width is 200µs because of the delay times of the hardware.

Since the signal output is an autonomous activity of the output modules, the outputs change without presetting by the controller, provided a respective configuration had been made. Therefore, the preset output value indicated in the controller will be different from the actual outputs in case of the enabled signal output.

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6.6 PDO mapping

The term PDO mapping stands for „Mapping of application objects in PDOs“. In objects RxPDO (1600h) and TxPDO (1A00h) this mapping of the objects is established for the receiver PDO RxPDO 1 and the transmission PDO TxPDO 1. This mapping is defined in the module and cannot be modified.

6.6.1 Mapped objects DOM08

1st RxPDO: In the DOM08 the outputs (objects: 6200h, sub-ID 1) are expected in the first byte of the 1st receiver PDO.

1st TxPDO: In case of enabled logic functions (by object 4101h), object 2500h (logic inputs) is mapped in the 1st PDO as 1st byte.

Object	Byte	Mapped object	Parameter
1. RxPDO	0	6200h, sub-ID 1	Output 1..8 (in case of disabled logic outputs via object (4201h) or Enabling of logic output 1..8 (in case of enabled logic outputs via object 4201h)
1. TxPDO	0	2500h	Logic input 1..8 (in case of enabling by 4101h)

6.6.2 Mapped object DOM16

1st RxPDO: In the DOM16 the outputs (objects: 6200h, sub-ID 1) are expected in the first and the second byte of the 1st receiver PDO.

1st TxPDO: In case of enabled logic functions (by object 4101h), object 2500h (logic inputs) is mapped in the 1st PDO as 1st byte

Object	Byte	Mapped object	Parameter
1. RxPDO	0	6200h, sub-ID 1	Output 1..8 (in case of disabled logic outputs via object (4201h) or Enabling of logic output 1..8 (in case of enabled logic outputs via object 4201h)
	1	6200h, sub-ID 2	Output 9..16
1. TxPDO	0	2500h	Logic input 1..8 (in case of enabling by 4101h)

7 Maintenance and repair

General maintenance instructions are given in the system manual.

7.1 Replacement of the module

In case of a defect, the module electronics are replaced completely. Remove all connected lines and switch off the voltage.

Prior to be removed, the respective module is to be separated from modules probably plugged on the left and on the right, since the single modules are connected with the internal ME bus via a connector.

Subsequently remove the respective module from the rail by means of a suited tool, after using a lever at the bracket on bottom side of the module.

For further information please check the system manual.

7.2 Maintenance in case of an error

Problem	Possible cause	Action
Module does not operate	Contacting of the ME bus is not correct	Check the module
	24V current supply at the power supply module is missing	Check the 24V supply
	Internal module error	Replace the module
Life LED is off	Short-circuit 24 V internal, PTC has switched	Replace the module
	Life LED is programmed differently	Check the parameterizing
Life LED is on, no input LED in spite of signal	Signal is not available	Check signal at the module
24V voltage is available, output is 0, output LED is off, but signal is available	Input parameterized with inverted logics via the CAN bus	Check the parameterizing

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8 Technical annex: parameterizing via the CAN bus

8.1 CANopen

The description of the implemented structures and functions of the CANopen, such as the mapping of the process data objects (PDO), the service data objects (SDO), the network management (NMT) as well as of the emergency messages is made in a separate document.

8.2 Emergency messages

Internal errors are written in a predefined error field and can be read in the object dictionary (index 1003H). The error field includes the single errors stated in a device, described in the form of error codes, as well as a device-specific additional information in the timely order of their occurring.

The presence of a device error and its type is displayed in a register that can be read by means of the object dictionary 1001H.

The transmission of the device-internal emergency objects is made by means of standardized high-priority messages.

An emergency message is sent once, at the occurring and after the elimination of the error.

Please check the system manual for further information about the error messages.

8.3 Configuration

The function and the configuration parameters are indicated as far as possible in the CANopen object dictionary of the device. The object dictionary is composed of 3 areas:

- Communication profile area as per CiA DS 301
- Standardized device profile area as per CiA DS 401
- Manufacturer-specific profile area

8.4 DOM08

8.4.1 Communication profile (parameters corresponding to CiA DS 301)

The following table includes all general parameters that belong to the communication profile area of the CANopen object dictionary (CiA DS 301). The most important parameters/objects are display in bold characters and are explained in detail in the following.

Index (hex)	Sub-index	Name	Type	Attr.	Meaning	Contents (hex)	Default (hex)
1000	0	Device type	Unsigned 32	R	Device type	00020191	
1001	0	Error register	Unsigned 8	R	Error register, bit-coded		00
1003		Error field					
	0	Number	Unsigned 8	RW	Number of errors occurred 0...16	0..10	00
	1	1. error field	Unsigned 32	R	Error code + Manuf.specific error field		
	2	2. error field	Unsigned 32	R	Error code + Manuf.specific error field		
	16	16. error field	Unsigned 32	R	Error code + Manuf.specific error field		
1004		Number of PDO			Number of PDO		
	0	Number	Unsigned 8	R	Total	00010000	
	1	Synchronous PDO	Unsigned 32	R	Synchronous PDO	00000000	
	2	Asynchronous PDO	Unsigned 32	R	Asynchronous PDO	00010000	
1008	0	Device name	Vis-String	R	Device name	"EST FBM-DOM08 "	
1009	0	Hardware version	Vis-String	R	Version HW	"Vxxh idxx "	
100A	0	Software version	Vis-String	R	Version SW	"V1.05 "	
100B	0	Node-Id	Unsigned 32	R	CAN address	000000010	
100C	0	Guard time	Unsigned 16	RW	NMT guard time (ms) 0..65535	0000..FFFF	0000
100D	0	Life time factor	Unsigned 8	RW	NMT life time 0..255	00..FF	00
100E	0	Node-guarding Id	Unsigned 32	R	CobId node guard	00000700 + Node-Id	
1012	0	Time stamp Id	Unsigned 32	R	CobId Timestamp	80000100	
1014	0	Emergency Id	Unsigned 32	R	CobId Emergency	40000080 + Node-Id	
1017	0	Heartbeat time	Unsigned 16	RW	Heartbeat cycle time (ms) 0..65535	0000..FFFF	0000
1200		SDO parameter			SDO Parameter		
	0	Number	Unsigned 8	R	Number of elements	02	
	1	Client->server Id	Unsigned 32	R	CobId ReciveSDO	00000600+Node-Id	
	2	Server->client Id	Unsigned 32	R	CobId TransmitSDO	00000580+Node-Id	
1400		1.RxPDO			Communication parameters 1. RxPDO		

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Index (hex)	Sub-index	Name	Type	Attr.	Meaning	Contents (hex)	Default (hex)
	0	Number	Unsigned 8	R	Number of elements	04	
	1	ID used by PDO	Unsigned 32	R	CobId 1.RxPDO	00000200+Node-Id	
	2	Transmission type	Unsigned 8	R		FF	
	3	Inhibit time	Unsigned 16	R	(ms)	0000	
	4	CMS priority group	Unsigned 8	R		03	
1600		1.RxPDO mapping			Mapping parameter 1.RxPDO		
	0	Number	Unsigned 8	R	Number of elements	01	
	1	1. object	Unsigned 32	R		62000108	
1800		1.TxPDO			Communication parameters 1.TxPDO		
	0	Number	Unsigned 8	R	Number of elements	04	
	1	ID used by PDO	Unsigned 32	R	CobId 1.TxPD	00000180+Node-Id	
	2	Transmission type	Unsigned 8	R		FF	
	3	Inhibit time	Unsigned 16	RW	Time in 0.1 ms (0..2550)	0000…09F6	0000
	4	CMS priority group	Unsigned 8	R		03	
1A00		TxPDO mapping			Mapping parameters 1.TxPDO		
	0	Number	Unsigned 8	R	Number of elements	00 bzw. 01	
	1	1. mapped object	Unsigned 32	R	Logic inputs (at enabling by 4101h)	25000108	

8.4.2 Standardized device profile area (parameters corresponding to CiA DS 401)

The parameters of the DOM08 are summarized in the following table that are part of the standardized device profile area of the CANopen object dictionary (CiA DS 401) and that describe the device function of the module. The data formats, the admissible value areas as well as the default values of the objects are explained in detail in the following.

Index (hex)	Sub-index	Name	Type	Attr.	Meaning	Contents (hex)	Default (hex)
6200		Digital outputs			Digital outputs		
	0	Number	Unsigned 8	R	Number of elements	01	
	1	Outputs 1...8	Unsigned 8	RW	Outputs 1...8		00
6202		Polarity			Polarity of inputs		
	0	Number	Unsigned 8	R	Number of elements	01	
	1	Outputs 1...8	Unsigned 8	RW	Bit mask 0 -> Input n not modified 1 -> Input n inverted		00
6206		Fault mode			Fault mode		
	0	Number	Unsigned 8	R	Number of elements	01	
	1	Fault mode 1...8	Unsigned 8	RW	Bit mask 1 -> predefined fault state n 0 -> not modified n		FF
6207		Fault state			Predefined fault state		
	0	Number	Unsigned 8	R	Number of elements	01	
	1	Fault state 1...8	Unsigned 8	RW	Bit mask 1 -> output n on 0 -> output n off		00
67FE		Error behavior			NMT error behavior in case of communication errors		
	0	Number	Unsigned 8	R	Number of elements	01	
	1	NMT state in case of communication errors	Unsigned 8	RW		00: Pre-operational 01: Not modified 02: Stopped	00

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8.4.3 Manufacturer-specific profile area

The additional parameters of the DOM08 are summarized in the following table that describe the manufacturer-specific device functions and that are not mentioned in the standardized device profile area of the CANopen object dictionary. The data formats, admissible value areas as well as default values of the objects are explained in detail in the following.

Index (hex)	Sub-index	Name	Type	Attr.	Meaning	Contents (hex)	Default (hex)
2000		Life LED			Mode of life LED		
	0	Number	Unsigned 8	R	Number of elements	01	
	1	Life LED	Unsigned 8	RW	00 or 01		00
2600		Digital outputs					
	0	Number	Unsigned 8	R	Number of elements	01	
	1	Outputs 1...8	Unsigned 8	RW	Outputs 1...8		00

8.5 DOM16

8.5.1 Communication profile (parameters corresponding to CiA DS 301)

The following table includes all general parameters that belong to the communication profile area of the CANopen object dictionary (CiA DS 301). The most important parameters/objects are display in bold characters and are explained in detail in the following.

Index (hex)	Sub-index	Name	Type	Attr.	Meaning	Contents (hex)	Default (hex)
1000	0	Device type	Unsigned 32	R	Device type	00020191	
1001	0	Error register	Unsigned 8	R	Error register, bit-coded		00
1003		Error field					
	0	Number	Unsigned 8	RW	Number of errors occurred 0...16	0..10	00
	1	1. error field	Unsigned 32	R	Error code + Manuf.specific error field		
	2	2. error field	Unsigned 32	R	Error code + Manuf.specific error field		
	16	16. error field	Unsigned 32		Error code + Manuf.specific error field		
1004		Number of PDO			Number of PDO		
	0	Number	Unsigned 32	R	Total	00010000	
	1	Synchronous PDO	Unsigned 32	R	Synchronous PDO	00000000	
	2	Asynchronous PDO	Unsigned 32	R	Asynchronous PDO	00010000	
1008	0	Device name	Vis-String	R	Device name	"EST FBM-DOM16 "	
1009	0	Hardware version	Vis-String	R	Version HW	"Vxxh idxx "	
100A	0	Software version	Vis-String	R	Version SW	"V1.05 "	
100B	0	Node-Id	Unsigned 32	R	CAN address	00000010	
100C	0	Guard time	Unsigned 16	RW	NMT guard time (ms) 0..65535	0000..FFFF	0000
100D	0	Life time factor	Unsigned 8	RW	NMT life time 0..255	00..FF	00
100E	0	Node-guarding Id	Unsigned 32	R	CobId node guard	00000700 + Node-Id	
1012	0	Time stamp Id	Unsigned 32	R	CobId Timestamp	80000100	
1014	0	Emergency Id	Unsigned 32	R	CobId Emergency	40000080 + Node-Id	
1017	0	Heartbeat time	Unsigned 16	RW	Heartbeat cycle time (ms) 0..65535	0000..FFFF	0000
1200		SDO parameter			SDO parameter		
	0	Number	Unsigned 8	R	Number of elements	02	
	1	Client->server Id	Unsigned 32	R	CobId ReciveSDO	0000000600+Node-Id	
	2	Server->client Id	Unsigned 32	R	CobId TransmitSDO	0000000580+Node-Id	
1400		1.RxPDO			Communication parameters 1. RxPDO		

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Index (hex)	Sub-index	Name	Type	Attr.	Meaning	Contents (hex)	Default (hex)
	0	Number	Unsigned 8	R	Number of elements	04	
	1	ID used by PDO	Unsigned 32	R	CobId 1.RxPDO	00000200+Node-Id	
	2	Transmission type	Unsigned 8	R		FF	
	3	Inhibit time	Unsigned 16	R		0000	
	4	CMS priority group	Unsigned 8	R		03	
1600		1.RxPDO mapping			Mapping parameter 1.RxPDO		
	0	Number	Unsigned 8	R	Number of elements	02	
	1	1. object	Unsigned 32	R	Output 1..8	62000108	
	2	2. object	Unsigned 32	R	Output 9..16	62000208	
1800		1.TxPDO			Communication parameters 1.TxPDO		
	0	Number	Unsigned 8	R	Number of elements	04	
	1	ID used by PDO	Unsigned 32	R	CobId 1.TxPD	00000180+Node-Id	
	2	Transmission type	Unsigned 8	R		FF	
	3	Inhibit time	Unsigned 16	RW	Time in 0.1 ms (0..2550)	0000…09F6	0000
	4	CMS priority group	Unsigned 8	R		03	
1A00		TxPDO mapping			Mapping parameters 1.TxPDO		
	0	Number	Unsigned 8	R	Number of elements	00 or 01	
	1	1. mapped object	Unsigned 32	R	Logic inputs (at enabling by 4101h)	25000108	

8.5.2 Standardized device profile area (parameters corresponding to CiA DS 401)

The parameters of the DOM16 are summarized in the following table that are part of the standardized device profile area of the CANopen object dictionary (CiA DS 401) and that describe the device function of the module. The data formats, the admissible value areas as well as the default values of the objects are explained in detail in the following.

Index (hex)	Sub-index	Name	Type	Attr.	Meaning	Contents (hex)	Default (hex)
6200		Digital outputs			Digital outputs		
	0	Number	Unsigned 8	R	Number of elements,	02	
	1	Outputs 1...8	Unsigned 8	RW	Outputs 1...8		00
	2	Outputs 9...16	Unsigned 8	RW	Outputs 9...16		00
6202		Polarity			Polarity of outputs		
	0	Number	Unsigned 8	R	Number of elements	02	
	1	Outputs 1...8	Unsigned 8	RW	Bit mask 0 -> Output n not modified 1 -> Output n inverted		00

	2	Outputs 9...16	Unsigned 8	RW	Bit mask 0 -> Output n not modified 1 -> Output n inverted		00
6206		Fault Mode			Fault mode		
	0	Number	Unsigned 8	R	Number of elements	02	
	1	Fault mode 1...8	Unsigned 8	RW	Bit mask 1 -> predefined fault state n 0 -> not modified n		FF
	2	Fault mode 9...16	Unsigned 8	RW	Bit mask 1 -> predefined fault state n 0 -> not modified n		FF
6207		Fault state			Predefined fault state		
	0	Number	Unsigned 8	R	Number of elements	02	
	1	Fault state 1...8	Unsigned 8	RW	Bit mask 1 -> output n on 0 -> output n off		00
	2	Fault state 9...16	Unsigned 8	RW	Bit mask 1 -> output n on 0 -> output n off		00
67FE		Error behavior			NMT error behavior in case of communication errors		
	0	Number	Unsigned 8	R	Number of elements	01	
	1	NMT state in case of communication errors	Unsigned 8	RW		00: Pre-operational 01: Not modified 02: Stopped	00

8.5.3 Manufacturer-specific profile area

The additional parameters of the DOM16 are summarized in the following table that describe the manufacturer-specific device functions and that are not mentioned in the standardized device profile area of the CANopen object dictionary. The data formats, admissible value areas as well as default values of the objects are explained in detail in the following.

Index (hex)	Sub-index	Name	Type	Attr.	Meaning	Contents (hex)	Default (hex)
2000		Life LED			Mode of life LED		
	0	Number	Unsigned 8	R	Number of elements	01	
	1	Life LED	Unsigned 8	RW	00 or 01		00
2600		Digital outputs					
	0	Number	Unsigned 8	R	Number of elements	02	
	1	Outputs 1...8	Unsigned 8	RW	Outputs 1...8		00
	2	Outputs 9...16	Unsigned 8	RW	Outputs 9...16		00

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8.6 Additional functions

8.6.1 Additional function pulse generator

Index (hex)	Sub-index	Name	Type	Attr.	Meaning	Contents (hex)	Default (hex)
4501		Frequency			Pulse generator		
	0	Number	Unsigned 8	R		01	
	1	Frequency	Unsigned 16	RW	25..512 Hz	*See chapter Parameterizing*	19
4502		Enabling			Switch-over pulse generator		
	0	Number	Unsigned 8	R		04	
	1	1. output	Unsigned 8	RW	Switch-over pulse generator / normal output	0X: enabled 00: disabled	00
	..	..					
	4	4. output	Unsigned 8	RW	as 1. output		
4503		Parameter			Pulse generator		
	0	Number	Unsigned 8	R		04	
	1	1. output	Unsigned 16	RW	0..1023	*See chapter Parameterizing*	00
	..	..					
	4	4. output	Unsigned 16	RW	as 1. output		