MFW – Product family

I/O – Expansion modules

Increase in the number of inputs and outputs of the MFW basic modules

Table of content

1 Applicability

This description is valid for the following MFW modules:

Article number	Type	as of software version
97AXXGAX0BA0	EM-G8DEX-0-BA-0	01404001.021.002
97AXXGAX0BB0	EM-G8DEX-0-BB-0	01404001.021.002
97AXXGAX0BE0	EM-G8DEX-0-BE-0	01404001.021.002
97AXXGAX0BF0	EM-G8DEX-0-BF-0	01404001.021.002
97AXXGAX0BJ0	EM-G8DEX-0-BJ-0	01404001.021.002
97AXXGAX0BB2	EM-G8DEX-0-BB-2	04308000.020.001
97AXXGAX0BBE	EM-G8DEX-0-BB-E	07b19001.022.000
97AXXGBX0BB0	EM-G8DAL-0-BB-0	00b08003.021.001
97AXXGCX0BX0	EM-G8DAR-0-BX-0	00b08003.021.001
97AXXGLX0BX0	EM-G2DAH-0-BX-0	00b08003.021.000
97AXXGEX0BX0	EM-G4AE0-0-BX-0	00b08002.021.002
97AXXGIX0BX0	EM-G4AA0-0-BX-0	00b08004.021.002

2 General notes

2.1 Symbols used

The following symbols have been used in this documentation:

Safety note
This symbol is used to indicate warnings, prohibitions and commands that indicate hazards and must be observed and followed without fail.

Additional note
This symbol indicates additional information and recommendations from the manufacturer.

Important passage
Particularly important information is marked with this symbol.

Cross-reference
This symbol refers to illustrations and other places in this documentation or to further literature.

2.2 Used terminology

MFW
The MFW modular telecontrol network consists of a central station and up to 31 substations. At least one basic module is required in each station, to which up to 15 extension modules can be connected.

Basic module
The basic modules represent the minimum configuration of a telecontrol station (central station or substation). They contain at least the following function groups:

- Internal modem
- Optionally 8 digital inputs or outputs with status LEDs or an additional serial interface for protocol coupling
- SDP interface for parameterization, diagnosis and protocol coupling
- One or two CAN bus interfaces for connection of the expansion modules
- Operating status display and fault contact

The basic modules are available in two variants - master and substation module.

Master module
A basic module in the master module variant is used e.g. in the control room. The master module coordinates the data exchange between the individual stations and has an image of all inputs and outputs of the system. Currently, master modules with the following type designations are available:
MF-...- Standard telecontrol master
MD-...- Telecontrol master with data logger function

Substation module
The substation modules are used in the substations. Currently, substation modules with the following type designations are available:
UF-... - Telecontrol substations
UD-...- Telecontrol substation with data logger function in standard version
UL-... - Telecontrol substation with data logger function in low-power version

Expansion module
To extend the I/O range, each basic module can be upgraded with a maximum of 15 extension modules can be added. These are connected via the CAN bus interface.

I/O module
Most basic modules have 8 inputs or outputs. These are referred to as I/O modules. The expansion modules also contain an I/O module consisting of 8 digital inputs, 8 transistor outputs, 8 output relays, 4 analog inputs or 4 analog outputs.

Station address
To identify the stations in the MFW system, each substation module is assigned a station address (1 - 31) is assigned to each substation module. For the master module, the address 0 is fixed. Station addresses must not be assigned twice.

Module number
Each I/O module is assigned a module number. The data is exchanged between modules with the same module number. Here the local arrangement of the module within the system (station address) is completely unimportant. For example, the input module with the number 5 transmits its data to all output modules with the number 5.

2.3 Safety instructions

These operating instructions must be read carefully and followed!

Danger of interference with electronic devices!
When operating the telecontrol system in the vicinity of equipment subject to interference, the special regulations for these areas must be observed!

Risk of ignition due to electromagnetic fields!
The MFW modules must not be operated in the vicinity of flammable gases or liquids. (tank farms, gas stations, chemical plants, gas containers, etc.)!

Risk of damage!
The MFW modules must not be opened or improperly modified!

2.4 Intended use

The telecontrol system is intended exclusively for the applications described in these operating instructions.

Any other use may lead to hazards and is prohibited. The manufacturer is not liable for the consequences of improper use of the MFW modules or any application that does not comply with the instructions in this operating manual.

3 Device description

3.1 Functional description

The expansion modules are designed to increase the number of analog or digital inputs and outputs of the basic modules of the MFW product family. The connection is made via the supplied bus cable to a CAN bus socket of the basic module. The second socket of the extension module can be used to connect another module, an additional power supply or for test purposes.

By default, the expansion modules are supplied with power from the basic modules via the CAN bus. Parallel to this, an additional supply via a further power supply unit e.g. WSN (→data sheets of the EES power supplies) is possible.

The configuration of the expansion modules is done via DIP switches.

After connection to the basic module, the expansion modules register themselves in the system, are entered in the module list and are thus immediately available. If an extension module fails, this is recognized by the basic module and treated as an error.
(See operating manual of the basic modules used). If an extension module is deliberately removed, the basic module must be disconnected from the power supply for a short time. This deletes the module list of the basic modules and the extension modules that are still connected log on again when the system is restarted. This ensures that the extension module just removed is deleted from the table of connected modules. If this does not happen, the module is recognized as faulty and reported.

3.2 In- and outputs

3.2.1 Digital inputs

Digital inputs are realized by expansion modules EM-G8DEX-... . Depending on the module type, the 8 inputs can be configured to one of the following input types via DIP switch:

Static binary input

Except for logged values, the current state of the inputs is recorded and transmitted with every data transmission. To reliably transmit a change of state, the state must be present at least until it has been transmitted. For dial-up line systems, this means that a state may not change again until it has been transmitted.

Pulse input

For the transmission of short pulses, depending on the module type, 4 or 8 inputs can be configured for secured pulse transmission. Pulses are treated as counter values within the MFW system. They are summed up in the input module until the next interrogation of the station and transmitted as a counter reading. The output is either via output modules as a pulse with configurable pulse width or as a counter value via a protocol interface. The current state of a pulse input (High or Low) cannot be displayed in the MFW system.

To monitor the counter values and to protect against incorrect counter pulse outputs, e.g. when a communication partner restarts, the counter readings between the MFW master and the substations are synchronized. For this reason, the difference of successively transmitted counter values must not be > 255.

Inverted inputs

Individual inputs can be inverted on the EM-G8DEX-0-B.-E module. The signals at these inputs are inverted before being displayed by the red status LEDs and transmitted. The associated red LEDs light up when no voltage is applied and go out when the input voltage exceeds the threshold for the high state. Low signals are output as high signals at the receiver and vice versa. Pulses are generated at inverted inputs at the High-Low transition and at standard inputs at the Low-High transition.

Operating hours counter

The DE1 and DE2 inputs of the standard "EM-G8DEX-0-B.-0" digital expansion modules can be used as operating hours counters. For this purpose, the inputs must be configured as pulse input (DIP switch B1 / B2) and as operating hours counter (DIP switch B5 / B6). The operating hours determined by evaluating a high signal at the input are stored as a counter value. Here the resolution is 5 ms. In the module, 5 ms sections with an active input are summed until the configured value (0.1 h or 1 h) is reached and then a pulse is generated. At the same time, the current state of the input (High or Low) is also registered and transmitted in the MFW system. The output of an input set up as an operating hours counter can then be a counter value (operating hours) and/or a binary value (operating status). If the output is via an output module, the output type can be set via the configuration (DIP switch B1 / B2). If the output is via a protocol interface, both display types (count value and binary value) can be used simultaneously. The value of the operating hours counter can be configured (→section "Digital input module standard").

3.2.2 Relay outputs

Expansion modules can have 2 or 8 output relays. These can be used as static binary outputs or pulse outputs. By means of DIP switches, the outputs O1 ... O4 can be switched between the operating modes "static binary output" or "pulse output". The output frequency (pulse width/pause) can also be adapted to the input of the further processing system by means of a DIP switch.
(→section "Relay module")

It must be ensured that the counting frequency at the input module is not permanently greater than the output frequency of the output module.

If the pulse frequency is high, it makes sense to use expansion modules with transistor outputs for life time reasons.

3.2.3 Transistor outputs

The transistor output modules have 8 plus-switching PNP transistors. These can be used as static binary outputs or pulse outputs. By DIP switch the outputs O1 ... O4 can be switched between the operating modes "static binary output" or "pulse output". The output frequency (pulse width/pause) can also be adapted to the input of the further processing system via DIP switch. (→ section "Transistor output module")

It must be ensured that the counting frequency at the input module must not be permanently higher than the output frequency of the output module.

3.2.4 Analog inputs and outputs

The expansion modules EM-G4AE0-0-BX-0 and EM-G4AA0-0-BX-0 can be used for the transmission of 4 analog values (0 ... 10 V or 0 ... 20 mA).

The connection of 4 ... 20 mA sensors is also possible, since the analog values are transmitted unchanged and thus the error states are also displayed.

3.3 Connections and control lights

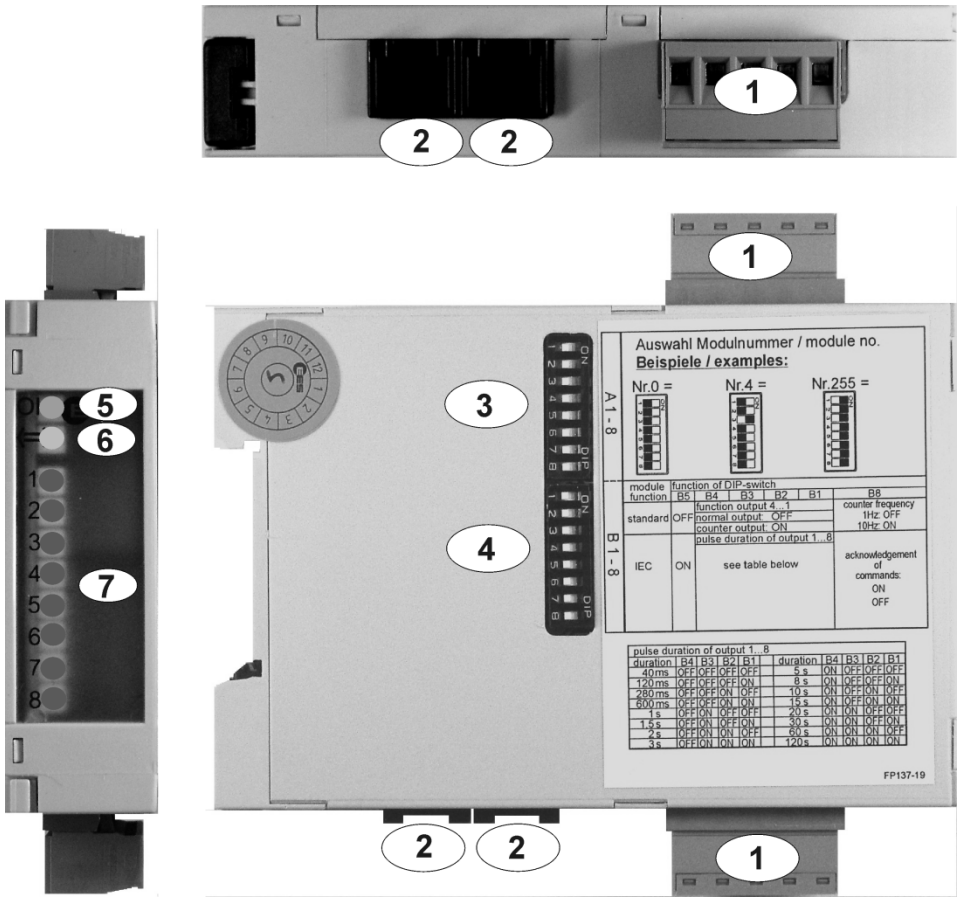


Fig. 1: Connections and control lamps of an expansion module

Caption:

[1] Plug-in terminals for the inputs or outputs
[2] CAN bus socket (internally bridged)
[3] DIP switch A
[4] DIP switch B
[5] Control lamp (green) "Operating status" - lights up when operating voltage is present.
[6] Control lamp (yellow) "CAN bus" - flashes when the module is communicating with the basic module.
[7] Control lamps (red) "I/O status display" - light up when a static binary signal is present or during a pulse. In the case of inverted inputs, the display is inverted (LED lights up when no voltage is applied). LEDs light up as long as a pulse is present. These LEDs are not present on analog modules.

4 Assembly and commissioning

1. Unpack all modules of the transmission system and check them for transport damage. Report any transport damage immediately to the responsible transportation company. Please check the completeness of the delivery by means of the delivery bill.

   The delivery can consist of master module, substation modules and extension modules. The scope of delivery of the extension modules also includes the system bus cables for connection to the basic modules.

2. Select mounting locations for the individual stations.

3. Configure the modules (→ section "Configuration via DIP switches").

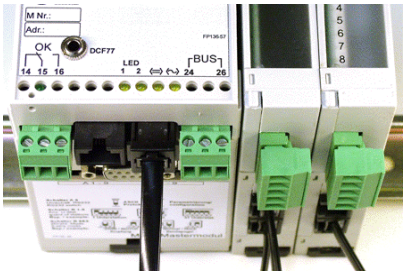
4. Snap the basic module and any necessary expansion modules onto the mounting rail.

5. Connect the input and output lines in accordance with the terminal assignment.

   The length of the input and output lines may have an influence on the noise immunity of the devices and should not exceed 3 m.

6. Connect the expansion modules to the basic module using the supplied system bus cable via the RJ45 sockets in the bottom of the modules. While using several extension modules, loop the bus connection.

7. Connect the power supply to the basic module. The expansion modules are supplied with power via the system bus cable.



   The length of the supply lines should not exceed 10 m.

8. Switch on the power supply. If the green LED on the expansion module lights up continuously and the yellow LED flashes, the expansion module is ready for operation. If the green "Operating status" LED on the basic module flashes (→ "Error code" section of the basic module operating instructions).

5. Configuration via DIP switch

5.1 General principles

Data exchange within the telecontrol system is based on module numbers. Each basic or expansion module with an I/O module is assigned a module number. Data is exchanged between modules with the same module number. Here, the local arrangement of the module within the system (station address) is completely unimportant. For example, the input module with the number 5 transmits its data to all output modules with the module number 5. There may be several output modules with one module number. However, an input module number may only be used once in the system.

All important settings can be made via DIP switches. These are e.g. module number (0 ... 254), switching between static binary value and pulse for digital I/O as well as current and voltage for analog signals, etc. The DIP switches A and B [3, 4] are located in the side panel of the expansion modules.

The module numbers 251 ... 254 are reserved for the output of station errors.

The setting of the module number (DIP switches A1 - A8) is binary coded at all module types. The following table shows some examples.

Meaning	A1	A2	A3	A4	A5	A6	A7	A8
	$2^0 = 1$	$2^1 = 2$	$2^2 = 4$	$2^3 = 8$	$2^4 = 16$	$2^5 = 32$	$2^6 = 64$	$2^7 = 128$
Module number 2	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Module number 7	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
Module number 250	OFF	ON	OFF	ON	ON	ON	ON	ON

Table 1: Examples for setting the binary coded module numbers

5.2 Digital modules

The digital expansion modules are available in 5 basic variants:

- Digital input module 8 DE (standard input module)
- (8 static inputs, 4 of them switchable as pulse inputs)
- Pulse input module (8 pulse inputs, also usable as 8 static inputs, inversion of inputs possible)
- Transistor output module
- Relay output module
- High load relay output module

5.2.1 Digital input module 8 DE (EM-G8DEX-0-B.-0)

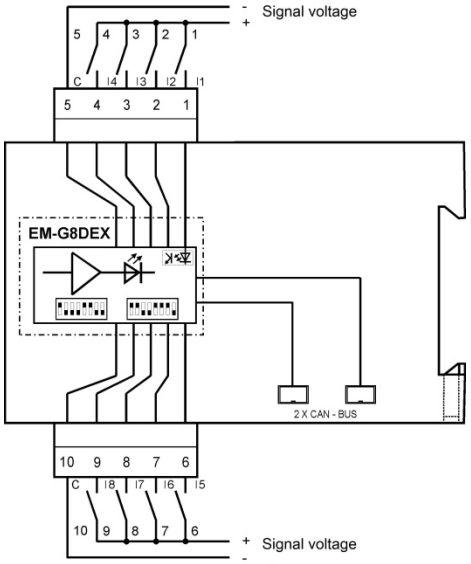


Fig. 2: Terminal assignment of the digital input module

In the digital input module 8 DE, 2 input groups with 4 inputs each and a common root are implemented. The two input groups are electrically isolated from each other.

The first 4 inputs can optionally be configured as static binary input or pulse input. Furthermore, inputs I1 and I2 can be used as operating hours counter. For this purpose, these inputs must be configured to pulse input (DIP switch B1 / B2) and operating hours counter (DIP switch B5 / B6). The unit of the operating hours counter can be switched between 0.1 h / pulse and 1 h / pulse. Switching to the smaller unit 0.1 h / pulse enables the detection of runtime fluctuations in plant sections used for a short time.
The response delay of the inputs can also be defined via DIP switch and represents the period of time in which a signal must be present at the input at least without interruption in order to be registered.

Meaning	Values	DIP switch
Module number	0 … 250 (binarily coded)	A1 – A8
Input type I1 - I4	OFF - static binary input ON - Pulse input	B1 – B4
Counter 1 (DI1)	OFF - Pulse counter ON - Operating hours counter	B5
Counter 2 (DI2)	OFF - Pulse counter ON - Operating hours counter	B6
Unit operating hours meter	OFF - 0,1 h / Pulse ON - 1 h / Pulse	B7
Response delay of the inputs	OFF - 100 ms ON - 5 ms	B8

Table 2: DIP switch of the digital input module EM-G8DEX-0-B.-0

The response delay of the inputs simultaneously determines the maximum frequency of counting pulses (100 ms → 5 Hz or 5 ms → 80 Hz) that can be processed by the inputs.

If this expansion module is used in a speed-optimized MFW system, it is essential to set switch B8 to "ON" (5 ms).

5.2.2 Pulse input module (EM-G8DEX-0-B.-E)

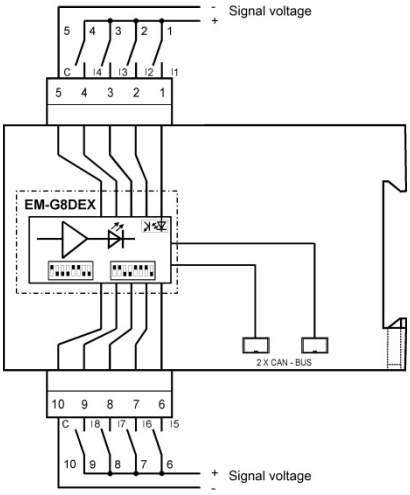


Fig. 3: Terminal assignment of the digital input module EM-G8DEX-0-BB-E

In the pulse input module 2 input groups with 4 inputs each and a common root are realized. The two input groups are electrically isolated from each other.

The inputs can optionally be configured as static binary inputs or pulse inputs. Depending on the configured operating mode, the signals applied to the inputs are inverted or not. The configuration of the operating mode of the individual inputs is done according to the table below with the DIP switches B1 ... B4.

The response delay of the inputs can also be defined by DIP switches and represents the time period in which a signal must be continuously present at the input in order to be registered.

To output the signals of a pulse input module, a substation module UF-ZDM12-G8DAR-DIA-0-BX-0 or an expansion module with binary outputs and enabled IEC functionality can be used. Output via an interface is not possible. The module is designed for communication between the central station and a substation. The transmission of signals from substation to substation is not possible.

Meaning	Values	DIP switch
Module number	0 … 250 (binarily coded)	A1 – A8
Operating mode of the inputs normal / inverted	See following table	B1 – B4
Not used	OFF	B5 – B6
Input type (applies to all 8 inputs)	OFF - static binary inputs ON - Counter/ Pulse inputs	B7
Input response delay	OFF - 100 ms ON - 5 ms	B8

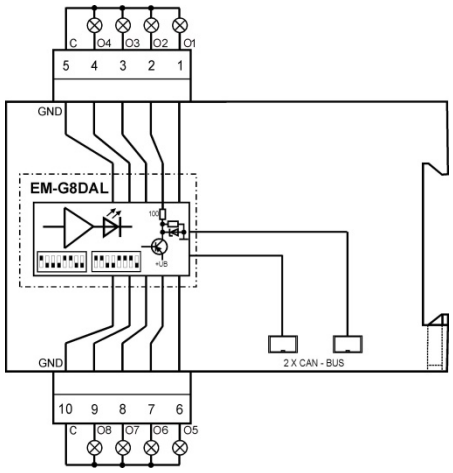
Table 3: DIP switch of the digital input module EM-G8DEX-0-BB-0

DIP switch setting				Input operating mode	
B1	B2	B3	B4	normal (not inverted)	inverted
OFF	OFF	OFF	OFF	I1 ... I8	No input
ON	OFF	OFF	OFF	I2 ... I8	I1
OFF	ON	OFF	OFF	I3 ... I8	I1, I2
ON	ON	OFF	OFF	I4 ... I8	I1 ... I3
OFF	OFF	ON	OFF	I5 ... I8	I1 ... I4
ON	OFF	ON	OFF	I6 ... I8	I1 ... I5
OFF	ON	ON	OFF	I7, I8	I1 ... I6
ON	ON	ON	OFF	I8	I1 ... I7
OFF	OFF	OFF	ON	No input	I1 ... I8

Table 4: Setting the operating mode of the inputs

The response delay of the inputs simultaneously defines the minimum pulse width / pause and the maximum frequency of counting pulses (100 ms → 5 Hz or 5 ms → 80 Hz) that can be processed by the inputs.

5.2.3 Transistor output module (EM-G8DAL-0-BB-0)



All 8 transistor outputs switch against the common GND (connection "C"). The first 4 outputs can be configured either as binary or pulse outputs. By DIP switch the pulse width / pause of the outputs of these pulse outputs can be defined.

With the DIP switch B5 additional IEC functionalities can be enabled. In this case, the meaning of some DIP switches changes.

Warning:
plus switching PNP transistors

Fig. 4: Terminal assignment of the transistor output module

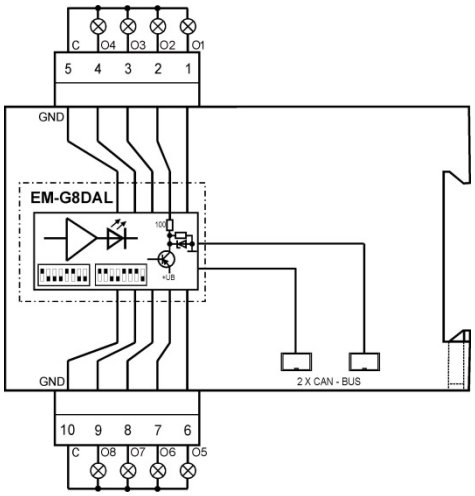
Meaning	Values	DIP switch
Module number	0 … 254 (binarily coded)	A1 – A8
Output type O1 ... O4 (B5 = OFF)	OFF - static binary output ON - Pulse output	B1 – B4 (Depending on the position of switch B5)
IEC pulse command length (B5 = ON)	(→Section "Digital output modules in systems with IEC interface“)	
Enabling IEC functionalities (→Section "Digital output modules in systems with IEC interface")	OFF - Standard ON - IEC	B5
Not used	OFF	B6 – B7
Pulse width / pause (B5 = OFF)	OFF - 500 ms ON - 50 ms	B8 (Depending on the position of switch B5)
Acknowledgement of IEC commands (B5 = ON)	OFF - Acknowledgement immediately upon acceptance by the MFW ON - Acknowledgement at output by the extension module	

Table 5: DIP switch of the transistor output module

Other output frequencies can be set at the factory on request.

In the IEC operating mode (B5 = ON), the module is suitable as an output module for the EM-G8DEX-0-B.-E pulse input module.

5.2.4 Relay Output module (EM-G8DAR-0-BX-0)



In this module 2 groups with 4 relays each and a common root "C" are realized. The two relay groups are electrically isolated from each other. The first 4 outputs of the module can optionally be configured as binary or pulse output. By DIP switch the pulse width / pause of the outputs of these pulse outputs can be defined.

With the DIP switch B5 additional IEC functionalities can be enabled. In this case, the meaning of some DIP switches changes.

„C“ – Connection point for common potential (optionally + or -).

Fig. 5: Terminal assignment of the relay output module

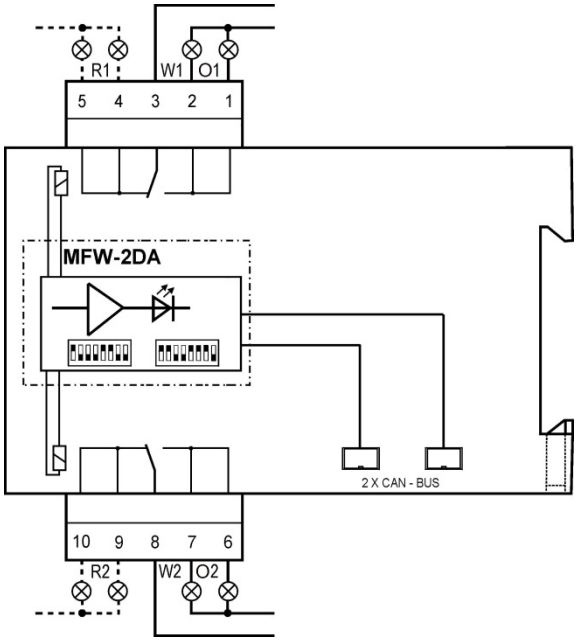
Meaning	Values	DIP switch
Module number	0 … 254 (binarily coded)	A1 – A8
Output type O1 ... O4 (B5 = OFF)	OFF - static binary output ON - Pulse output	B1 – B4 (Depending on the position of switch B5)
IEC pulse command length (B5 = ON)	(→Section "Digital output modules in systems with IEC interface“)	
Activation of IEC functionalities (→Section "Digital output modules in systems with IEC interface“)	OFF - Standard ON - IEC	B5
Not used	OFF	B6 – B7
Pulse width / pause (B5 = OFF)	OFF - 500 ms ON - 50 ms	B8 (Depending on the position of switch B5)
Acknowledgement of IEC commands (B5 = ON)	OFF - Acknowledgement immediately upon acceptance by the MFW ON - Acknowledgement at output by the extension module	

Table 6: DIP switch of the relay output module

Other output frequencies (pulse width / pause) can be set at the factory on request. For applications with frequent switching processes (counters), it is advisable to use transistor modules, as the service life of relays is electrically and mechanically limited.

In the IEC operating mode (B5 = ON), the module is suitable as an output module for the EM-G8DEX-0-B.-E pulse input module.

5.2.5 High load relay output module (EM-G2DAH-0-BX-0)



There are 2 relays with double changeover contacts, each with a root "W" and two normally closed contacts "R" as well as the normally open contacts "O", which are electrically isolated from each other. The outputs of the module can be configured either as binary or pulse outputs. The pulse width / pause of the outputs of these pulse outputs can be defined via DIP switch.

Fig. 6: Terminal assignment of the high load relay output module

Meaning	Values	DIP switch
Module number	0 … 250 (binarily coded)	A1 – A8
Output type O1 ... O2 (B5 = OFF)	OFF - static binary output ON - Pulse output	B1 – B2 (Depending on the position of switch B5)
IEC pulse command length (B5 = ON)	(→ Section „Digital output modules in systems with IEC interface“)	
Not used	OFF	B3 – B4
Activation of IEC functionalities (→ Section „Digital output modules in systems with IEC interface“)	OFF - Standard ON - IEC	B5
Not used	OFF	B6 – B7
Pulse width / -pause (B5 = OFF)	OFF - 500 ms ON - 50 ms	B8 (Depending on the position of switch B5)
Acknowledgement of IEC commands (B5 = ON)	OFF - Acknowledgement immediately upon acceptance by the MFW ON - Acknowledgement at output by the extension module	

Table 7: DIP switch of the high load relay output module

Other output frequencies (pulse width / pause) can be set at the factory on request.

5.2.6 Digital output modules in systems with IEC interface

In MFW systems whose masters are equipped with IEC 60870-5-101/104 interface, additional IEC functionalities can be enabled for digital output modules with **DIP switch B5**. By switching B5 to "ON" the DIP switches B1 - B4 and B8 get a different meaning.

B5 = OFF - Standard
B5 = ON - IEC

Pulse duration (B1 – B4)

If the switch B5 is set to "On", it is possible to output both continuous and pulse commands on all outputs. In this case the output of counter values on this module is no longer possible. With the switches B1 - B4 a pulse duration valid for all outputs in the range of 40 ms to 120 s can be set.

B1	B2	B3	B4	Pulse duration
Off	Off	Off	Off	40 ms
On	Off	Off	Off	120 ms
Off	On	Off	Off	280 ms
On	On	Off	Off	600 ms
Off	Off	On	Off	1 s
On	Off	On	Off	1,5 s
Off	On	On	Off	2 s
On	On	On	Off	3 s
Off	Off	Off	On	5 s
On	Off	Off	On	8 s
Off	On	Off	On	10 s
On	On	Off	On	15 s
Off	Off	On	On	20 s
On	Off	On	On	30 s
Off	On	On	On	60 s
On	On	On	On	120 s

Table 8: Coding of pulse duration

Acknowledgement of command execution (B8)

In the IEC protocol it is possible to evaluate the acknowledgement of the command execution. By default, this acknowledgement is formed immediately when the command is accepted via the IEC interface in the MFW. If the DIP switch B8 is switched to "ON", the acknowledgement is only formed when the command is at issue at the outputs of the expansion module. This function is of particular interest for master substation structures where there are appreciable signal propagation times between the master (with IEC interface) and the substations (with the output modules).

If the DIP switches B5 and B8 are set to "ON", the expansion module is not entered in the module list of the basic modules with the designation "DA" but with "DR"
(→ Section “Terminal commands" in the operating instructions of the basic modules used).

5.3 Analog Modules

The analog modules are available as input or output modules. They have 4 analog inputs or outputs. Current values (0 ... 20 mA) or voltage values (0 ... 10 V) can be processed optionally.

5.3.1 Analog Input module (EM-G4AE0-0-BX-0)

The input module implements 4 analog inputs that have a common GND. The inputs are isolated from the supply voltage. Via DIP switch each input can be switched between current and voltage (0 ... 20 mA or 0 ... 10 V).

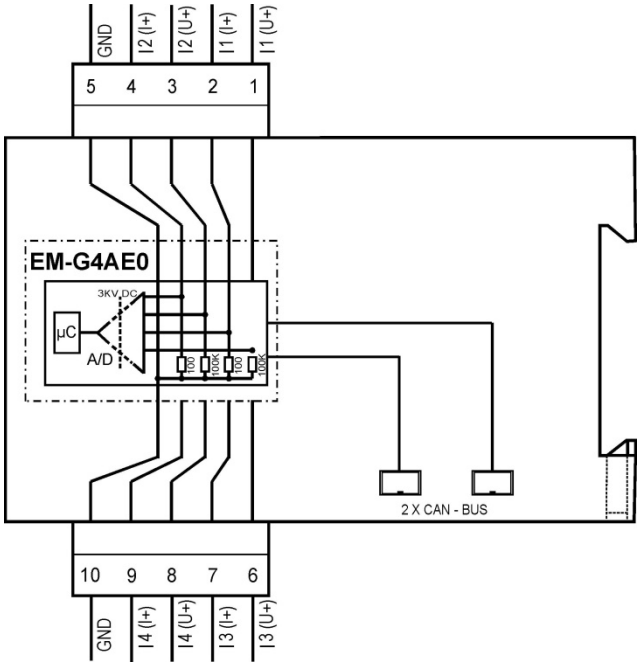


Fig. 7: Terminal assignment of the analog input module

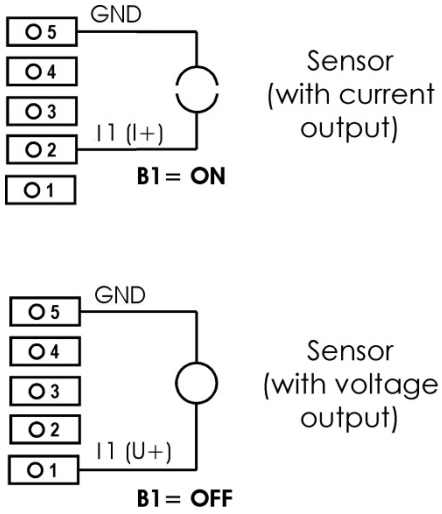


Bild 8: Example of the wiring of input I1 when used as current or voltage input. In addition, the DIP switch B1 must be configured accordingly.

Please note the polarity of the input circuit otherwise there is a risk of destruction of the inputs. All 4 inputs have a common GND.

Meaning	Values	DIP switch
Module number	0 … 250 (binarily coded)	A1 – A8
Signal type at the inputs I1 - I4	OFF - Voltage signal ON - Current signal	B1 – B4
Normalization of the values	OFF - MFW standard 0 … 10 000 ON - IEC standard 0 … 32767	B5
Not used	OFF	B6 – B8

Table 9: DIP switch of the analog input module

The analog inputs can process both voltage values (0...10 V) and current values (0...20 mA). The internal representation and the transfer to an interface (e.g. IEC 60870-5-101) is done by default in a 16 bit word as normalized value (0 ... 10 000). One digit thus corresponds to 1 mV or 2 µA. If the DIP switch B5 is set to "ON", the values are set to 0 ... 32767. One digit then corresponds to 0.305 mV or 0.610 µA.

Please note that with the setting "IEC Standard" (normalization to 0 ... 32767), any assigned analog output modules must also be set to "IEC Standard", since the MFW output modules otherwise expect values in the range 0 ... 10 000 and this would lead to scaling errors.

5.3.2 Analog output module (EM-G4AA0-0-BX-0)

The output modules implement 4 short-circuit-proof analog current and voltage outputs (0 ... 20 mA or 0 ... 10 V), for which no external auxiliary voltage is required.

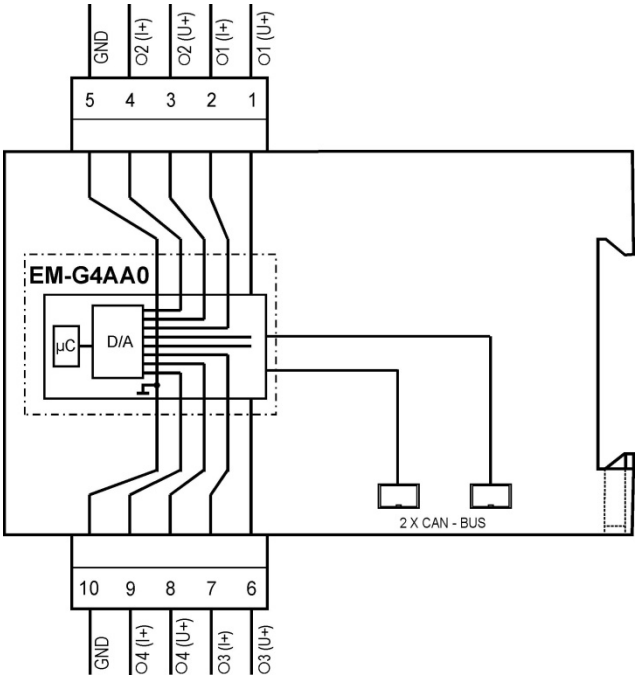


Fig. 9: Terminal assignment of the analog output module

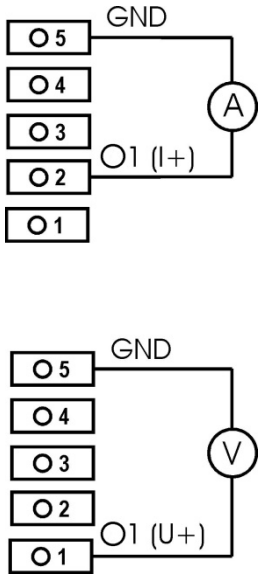


Fig. 10: Example of the wiring of output O1 when used as current or voltage output.

The common GND is potential equal with the supply voltage.

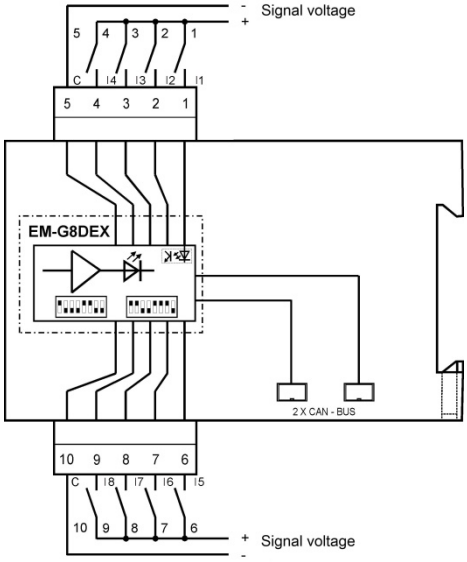
Meaning	Values	DIP switch
Module number	0 … 250 (binarily coded)	A1 – A8
Not used	OFF	B1 – B4
Normalization of the values	OFF - MFW standard 0 … 10 000 ON - IEC standard 0 … 32767	B5
Not used	OFF	B6 – B8

Table 10: DIP switch of the analog output module

Both voltage values (0...10 V) and current values (0...20 mA) are available at the outputs. The internal representation and the exchange at an interface (e.g. IEC 60870-5-101) takes place as standard in a 16-bit word as normalized value (0 ... 10 000). One digit thus corresponds to 1 mV or 2 µA. If the DIP switch B5 is set to "ON", the values are normalized to 0 ... 32767. One digit thus corresponds to 0.305 mV or 0.610 µA.

Please note that with the setting "IEC Standard" (normalization to 0 ... 32767), any assigned analog input modules must also be set to "IEC Standard", as the MFW input modules would otherwise provide values in the range 0 ... 10 000 and this would lead to scaling errors.

5.4 Object protection module (EM-G8DEX-0-BB-2)



The object protection module is based on the hardware of a digital input module. The mechanical and electrical data are identical. The inputs I1 ... I5 are treated as normal binary or pulse inputs. Only the inputs I6 ... I8 are needed to realize the function described below.

The inputs I7 and I8 are not represented in the MFW system as a real image of the input signals, but as generated messages. In case of a message, the signals are set to "High". Also the associated LEDs do not show the state of the inputs, but the state of the internally generated message. I7 forms the undelayed message "Enter plant" and I8 the delayed message "Alarm / Intrusion".

Fig. 11: Terminal assignment of the object protection module

Input	Input circuitry	Meaning within the MFW system
I1 ... I4	optionally as static binary input or pulse input (adjustable via DIP switch)	Binary value or pulse
I5	static binary input	Static binary value
I6	Acknowledgement / walk-through	Acknowledgement / walk-through
I7	Alarm input 1	internally generated alarm "Plant entered"
I8	Alarm input 2	internally generated alarm "Alarm / Intrusion

Table 11: Assignment and display of the inputs of the object protection module within the MFW system

Meaning	Values	DIP switch
Module number	0 … 250 (binarily coded)	A1 – A8
Input type I1 - I4	OFF - static binary input ON - pulse input	B1 – B4
Alarm delay time Arming delay time = Alarm delay time+ 30 s	B5 / B6 / B7 / [s] OFF / OFF / OFF / 0 ON / OFF / OFF / 30 OFF / ON / OFF / 60 ON / ON / OFF / 90 OFF / OFF / ON / 120 ON / OFF / ON / 150 OFF / ON / ON / 180 ON / ON / ON / 240	B5 – B7
Operating mode alarm input 2 (E8)	OFF - Normally open input ON - Normally closed input	B8

Table 12: DIP switches of the object protection module

The two inputs I7 and I8 serve as alarm inputs (e.g. door contact or motion detector), whereby the alarm input 2 (I8) can be switched between operation as normally open or normally closed input with the DIP switch "B8".

Authorized entry into the object can be signaled by means of a key switch connected to the input I6 Entry/Alarm Acknowledgement).

Activation of one of the two alarm inputs triggers the "PLANT ENTRY" state and generates the "Plant entered" message (I7). The alarm delay starts. Within the alarm delay time, the "ENTERED" state can be assumed by pressing the acknowledgement. If the acknowledgement is not made, the system switches to the "ALARM" state after the alarm delay time has elapsed. The "Alarm / Intrusion" message (I8) is generated.

When the plant is left, the state "PLANT IS ABANDONED" is assumed due to the deactivation of the acknowledgement. If the alarm input is deactivated within the arming delay time, the plant enters the "PLANT UNMANNED" state. The "Plant entered" message is cleared. If the alarm input is not deactivated within the arming delay time, the system switches to the "ALARM" state. The "Alarm / Intrusion" message (I8) is generated.

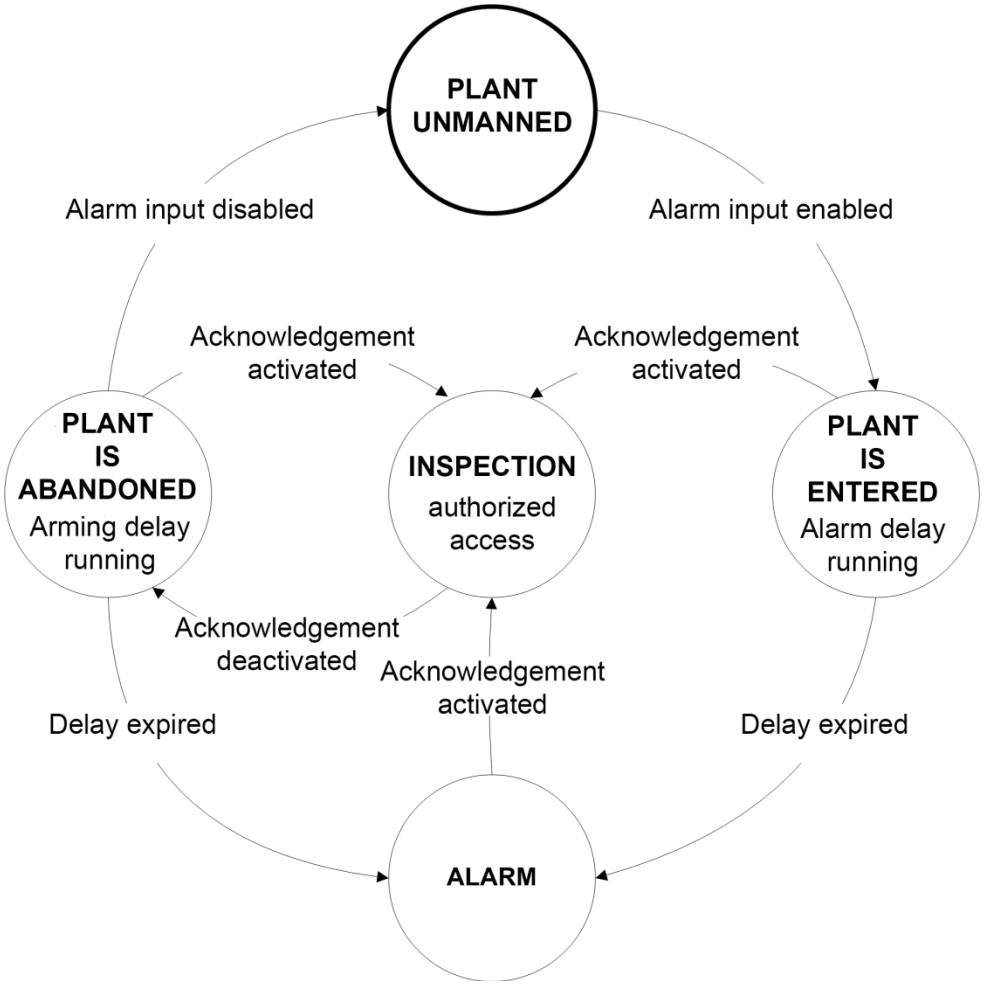


Fig. 12: State diagram of the object protection function

6 Technical data

Operating and ambient temperature	-20 °C ... +60 °C
Humidity	max. 95 %, non-condensing
Connection terminals	pluggable
Conductor cross section rigid or flexible	
without wire end sleaves	0,2 ... 2,5 mm^2
with wire end sleaves	0,25 ... 2,5 mm^2
Montage	on C DIN-rail TS35 acc. to EN60715:2001-09
Housing / Protection class	Plastic / IP 40

Digital input module

Power consumption	max. 1 W
Input type	8 digital inputs
Signal voltage U_S	see table
Input resistance	see table
Maximum counting frequency	5 Hz or 80 Hz switchable *[1]
Minimum pulse width / pause	100 ms or 5 ms *[1]
Galvanic isolation between signaling and supply voltage	4 kV_{eff}

Transistor output module

Power consumption	max. 2 W logic + load current
Type of transistor outputs	positive switching PNP transistors
Load capacity for transistor outputs	max. 50 mA per output
Counting frequency	1 Hz or 10 Hz switchable *[1]
Pulse width / pause	500 ms or 50 ms *[1]

Relay output module (8 relays)

Power consumption	max. 3 W
Contact type of relay outputs	8 x normally open
Contact rating of the relay outputs *[2]	
minimal	1,2 V / 1 mA (suitable for controlling LEDs)
maximal	250 V AC / 400 mA 250 V AC / 2 A (pure resistive load) 30 V DC / 2 A 110 V DC / 0,2 A 220 V DC / 0,1 A
Total current 230 V AC	max. 8 A (pure resistive load)
Counting frequency	1 Hz or 10 Hz switchable *[1]
Pulse width / pause	500 ms or 50 ms *[1]
Galvanic isolation between relay contacts and supply voltage	4 kV_{eff}

Relay output module (2 high load relays)

Power consumption	max. 2,5 W
Contact type of relay outputs	2 x double change-over contact
Contact rating of the relay outputs *[2]	250 V AC / 2 A (pure resistive load) 30 V DC / 8 A 110 V DC / 0,6 A 220 V DC / 0,3 A
Counting frequency	1 Hz or 10 Hz switchable *[1]
Pulse width / pause	500 ms or 50 ms *[1]
Galvanic isolation between relay contacts and supply voltage	2,5 kV_{eff}

Analog input module

Power consumption	max. 2 W
Input type	4 analog inputs (0 ... 10 V or 0 ... 20 mA)
Resolution	12 Bit
Accuracy	Error < 0,25 % from final value / 1 year *3
Load current input	100 Ω
Input resistance voltage input	100 kΩ

Analog output module

Power consumption	max. 3,5 W
Input type	4 analog outputs (0 ... 10 V or 0 ... 20 mA)
Resolution	12 Bit
Accuracy	Error < 0,5 % from final value / 1 year *3
Maximum load current output	500 Ω
Minimum load resistance of the voltage output	1 kΩ

Object protection module

Power consumption	max. 1 W
Signal voltage U_S	see table
Input resistance	see table
Maximum counting frequency	5 Hz *1
Minimum pulse width / pause	100 ms *1
Alarm delay time	0 s ... 4 min (adjustable via DIP switch)
Arming delay time	Alarm delay time + 30 s
Galvanic isolation between signaling and supply voltage	4 kV_{eff}

Digital input modules can be supplied for different signal voltages US. The corresponding voltage is defined by the 13th digit of the type designation (e.g. EM-G8DEX-0-B**A**-0).

Signal voltage U_S	**Voltage key**				
	A	**B**	**E**	**F**	**J**
Rated voltage	12 V AC/DC	24 V AC/DC	60 V AC/DC	110 V AC/DC	220 V AC/DC
Maximum input voltage	24 V	48 V	75 V	130 V	255 V
Input voltage DC					
maximum low state	5,0 V DC	9,5 V DC	12,5 V DC	22,0 V DC	58,0 V DC
minimum high state	7,5 V DC	14,5 V DC	19,5 V DC	35,0 V DC	92,0 V DC
Input voltage AC					
maximum low state	3,5 V AC	6,5 V AC	9,0 V AC	15,0 V AC	40,0 V AC
minimum high state	10,0 V AC	19,0 V AC	25,0 V AC	45,0 V AC	120,0 V AC
Input resistance	approx. 5 kΩ	10 kΩ	22 kΩ	68 kΩ	180 kΩ

Table 12: Available signal voltages of digital input modules

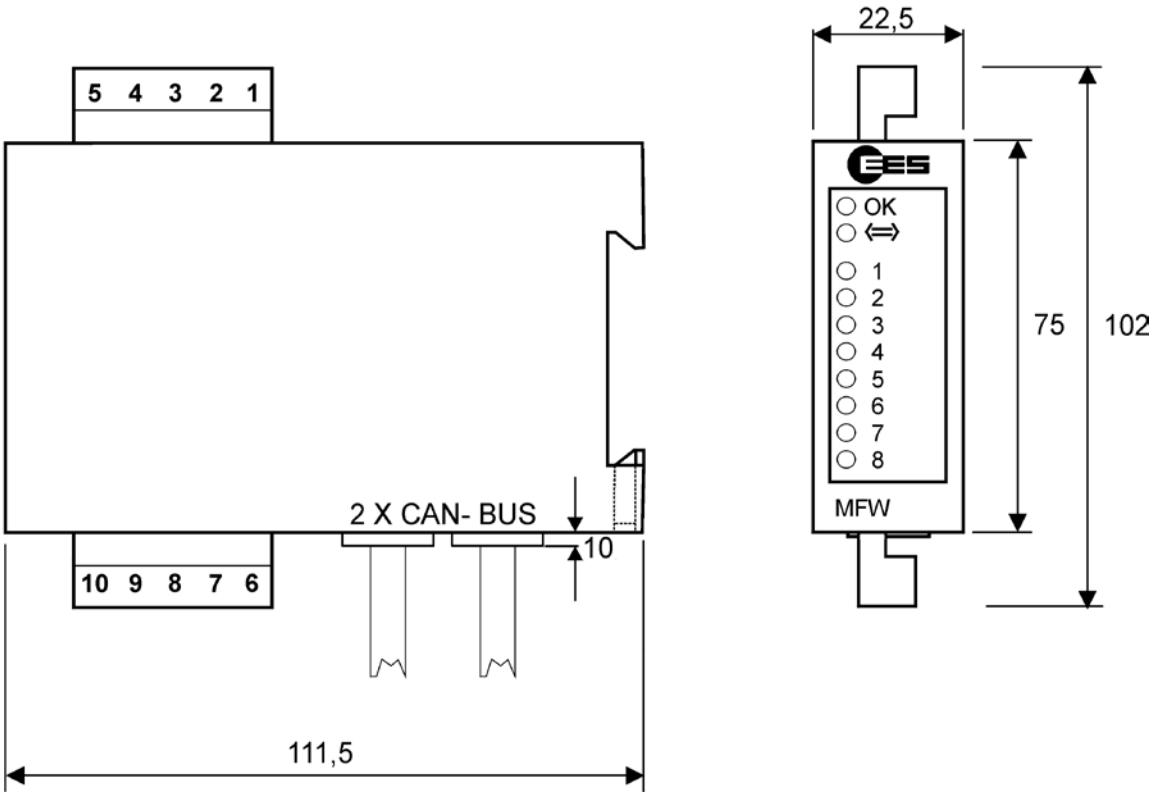
We recommend not to operate pulse inputs with AC voltage, but only with DC voltage.

Unless otherwise specified, the specifications for AC voltage refer to a sinusoidal AC voltage with a frequency of 50/60 Hz and all specifications refer to an ambient temperature of 25 °C.

*1 Other values on request
*2 More detailed specifications are available upon request.
*3 For highest accuracy requirements, an annual calibration service at EES is at your disposal.

Subject to technical changes

7 Dimensional drawing



Units in mm

Fig. 13: Dimensional drawing of the expansion modules

Subject to technical changes

8 Accessories

Only accessories approved by the manufacturer may be connected to the MFW modules.

Contact

Elektra Elektronik GmbH & Co Störcontroller KG | Hummelbühl 7-7/1 | 71522 Backnang | Germany
Tel.: +49 (0) 7191/182-0 | Fax: +49 (0) 7191/182-200 | info@ees-online.de | www.ees-online.de