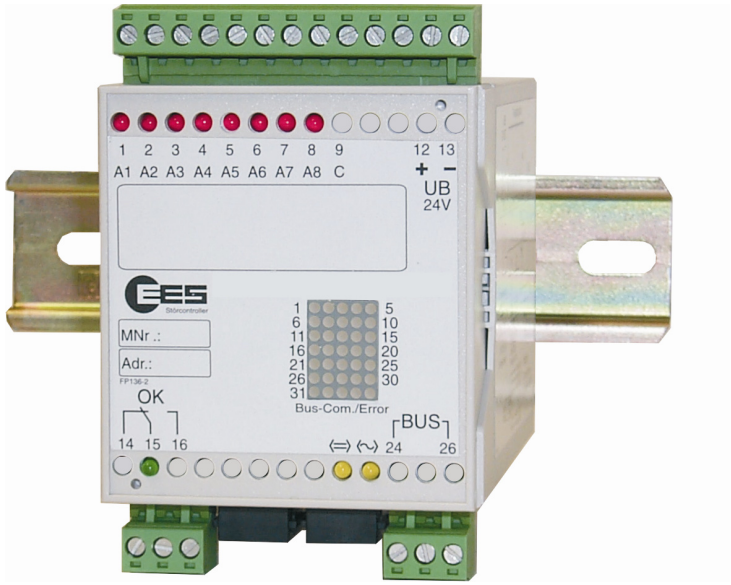
A system from the
MFW product family

OPERATING INSTRUCTIONS



Modular 2 wire telecontrol system

Telecontrol over electrically isolated cables

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MFW-ZD-BA-UK-006

OPERATING INSTRUCTIONS

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1 Applicability

The description applies to the following MFW modules:

Item number	Type	as from software version
97BZA1DN0BX0	MF-ZDM12-1PRTU-DIA-0-BX-0	01523004.003.001
97BZA1BN0BX0	MF-ZDM12-1P512-DIA-0-BX-0	01b04003.003
97BZA1ENABX0	MF-ZDM12-1P101-DIA-A-BX-0	05428000.009.000
97BZA3MN0BX0	MF-ZDM12-3PPDP-DIA-0-BX-0	01712000.003.000
97BZAGAN0BB0	MF-ZDM12-G8DEX-DIA-0-BB-0	00b22003.003
97BZAGCN0BX0	MF-ZDM12-G8DAR-DIA-0-BX-0	00b22000.004
97HZA1BN0BX0	UF-ZDM12-1P512-DIA-0-BX-0	01c18000.006
97HZAGAN0BB0	UF-ZDM12-G8DEX-DIA-0-BB-0	00b22002.004
97HZAGAN0BE0	UF-ZDM12-G8DEX-DIA-0-BE-0	00b22002.004
97HZAGAN0BF0	UF-ZDM12-G8DEX-DIA-0-BF-0	00b22002.004
97HZAGAN0BJ0	UF-ZDM12-G8DEX-DIA-0-BJ-0	00b22002.004
97HZAGAN0BB0	UF-ZDM12-G8DEX-DIA-0-BB-3	00b22002.004
97HZAGCN0BX0	UF-ZDM12-G8DAR-DIA-0-BX-0	00b22001.005.000

2 General notes

2.1 Symbols used

The following symbols are used in this documentation:

Safety instruction
This symbol marks warnings, prohibitions and directions relating to hazards. It is essential that they are observed and obeyed.

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

Important section
This symbol indicates particularly important information.

Cross-reference
This symbol refers to diagrams and to other locations within the document or to other literature.

2.2 Terminology used

MFW
The MFW modular telecontrol network consists of a central station and up to 31 substations. Each station requires at least one basic module. Up to 15 expansion modules can be connected to this.

Basic module
The basic modules represent the minimum core 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 LED, or an additional serial interface for protocol coupling
- SDP-interface for parameterisation, diagnostics and protocol coupling
- one or two CAN bus interfaces for connecting the expansion modules
- Operating status indicator and fault signalling contact

The basic modules are available in two versions – master module and substation module.

Master module
In each central station one basic module of the master module version is used. The master module coordinates the data exchange between the individual stations and has an image of all system inputs and outputs. At the moment master modules are available with the following type names:
MF-... - standard telecontrol master
MD-... - telecontrol master with data logger function *

Substation module
The substation modules are used in the substations. At present, substation modules with the following type names can be used:
UF-... - telecontrol substations
UD-... - standard version of the telecontrol substation with data logger function *
UL-... - low power version of the telecontrol substation with data logger function *

Expansion module
Each basic module can be fitted with up to a maximum of 15 expansion modules in order to increase the I/O range. These are connected via the CAN bus interface.

I/O module
The majority of basic modules have 8 inputs or outputs. These are referred to as I/O modules. In the same way, the expansion modules 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 given a station address (1 -31). The master module is fixed to address 0. Station addresses must be unique.

Module number
Each I/O module is given a module number. The data is exchanged between modules with the same module number. The physical arrangement of the modules within the system (the station address) is of no significance at all here. The input module with number 5, for instance, transmits its data to all the output modules whose number is 5.

** These modules are not available with 2 wire modem.*

2.3 Safety instructions

These operating instructions must be carefully read and followed!

Risk of interference with electronic devices!
When operating the telecontrol system close to devices that are subject to interference, the special regulations for these areas must be observed!

Risk of ignition from electromagnetic fields!
The MFW modules must not be operated in the neighbourhood of inflammable gases or liquids (fuel depots, petrol stations, chemical works, gas containers etc.)!

Risk of damage!
The MFW modules must not be opened or subjected to improper modification!

2.4 Correct and proper usage

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

Any other usage can be hazardous and is forbidden. The manufacturer cannot be held liable for the consequences of improper use of the MFW modules or for any application that does not accord with the contents of these operating instructions.

3 Functional description

3.1 The MFW telecontrol family

The MFW telecontrol family features a flexible modular concept which can use practically all the media available for data transmission purposes, such as GSM networks, landline dial-up lines, dedicated lines, two-wire control lines, various radio data transmission ranges, optical fibres or LAN and WLAN. A product of this extensive family is the two wire MFW telecontrol system. It is designed specially for the integration of widely spread outdoor installations. The MFW can be operated as a fully independent, cost-effective telecontrol system or as an extension to existing telecontrol interface modules.

In its minimum configuration, the telecontrol system consists of a central station and a substation. In each station at least one basic module is needed. This includes the following function groups, display and setting elements:

- internal 2 wire modem
- optionally 8 digital inputs or outputs with status LED, or an additional serial interface for protocol coupling
- SDP-interface for parameterisation, diagnostics and protocol coupling
- one or two CAN bus interfaces for connecting the expansion modules
- Operating status indicator and fault signalling contact

Each basic module can be fitted with up to a maximum of 15 expansion modules in order to increase the I/O scope. These are connected via the CAN bus interface. Further information about the expansion modules can be found in the respective instruction manual.

Each I/O module is given a **module number**. The data is exchanged between modules with the same module number. The physical arrangement of the modules within the system (the station address) is of no significance at all here. The input module with number 5, for instance, transmits its data to all the output modules whose number is 5.

The **data exchange** is controlled by the master. All substations are cyclically synchronised with the master in the query principle. This concerns not only the current input and output values but also the error information and configuration data. This means that the master is always informed about the current module occupancy of each substation and transmits the values of one input module's without additional parameterisation to all substations, that have an associated output module.

Measuring and set values, messages, commands and pulses are transmitted. With digital I/O modules, the inputs/outputs DE1- DE4 are switchable between static binary of pulse values. Analog signals can be transmitted both as 0-10V voltage values or as 0-20mA current values. The recording of the operating hours is possible with EM-G8DEX-0-B.-0 digital expansion modules.

In the event of **transmission faults**, the system detects the faulty communication and reports it via LED and relay contact both in the central station and in the respective substation. In addition, a binary contact can be used to signal availability of all connected stations at any point of the telecontrol system, if appropriate I/O modules are used. If a serial interface is used, this information can also be evaluated via this interface. In case of a transmission fault the input and output values of a defective station are frozen in the state of the last valid transmission. After the cause of the fault has been rectified, normal operation is resumed automatically.

3.2 2 wire line transmission medium

Any standard signal cable is suitable as transmission medium. The two wire system can be configured as a line, star or branch system. However the maximum loop resistance, that results from the sum of the resistance of both individual wires, may not be exceeded. The interference immunity of the 2 wire data transfer is very high. To avoid undesirable interference through induction of interference pulses from wires laid parallel to each other, the distance between wire pairs should be selected to as large as possible in multi-wire lines. The use of cables twisted in pairs is the best solution for this.

To match the MFW to each application (type and length of transmission cable and interference impact) the transmission level of the input damping of the 2 wire modem can be adjusted by means of a DIP switch (→ "Configuration via DIP switch" section).

The **system transmission rate** (cycle time) depends on the system configuration and the frequency of the almost simultaneously changing input states. The cycle time is approximately 1 second plus approximately 250 ms per substation.

The MFW always transmits the current inputs status at the time of query. The minimum pulse width/pause, that is required for the secure transmission of a status change, depends on the above mentioned cycle time. Inputs and outputs 1 - 4 of the digital modules can be used for safe transfer of short pulses. This ensures that the pulses are reliably transmitted even in the case of longer cycle times.

The MFW data transfer is made via the telegrams with test information. The basic modules reliably recognise faulty telegrams and reject them. Any faults delay transmission or interrupt the connection but don't lead to incorrect output values.

3.3 Inputs and outputs

3.3.1 Digital inputs

Digital inputs are made with the basic or expansion modules. Each module has 8 inputs which can be switched via DIP switch or parameterisation via PC to one of the following 4 input types:

Static binary input

The current input status is recorded for each transmission. The status must be present longer than the cycle time to be sure that the status change is transferred.

Binary input saved statically (only for substation basic modules)

Change to a digital input of the substation's basic module is recorded and saved in a substation until the master register's and confirms the change. Only after this confirmation is it possible to record a new status on the digital input. All status changes that appear in the meantime are not registered.

Pulse input

Inputs E1...E4 can be configured for safe transfer of short pulses. Pulses or counter values are summed up in the input module until the next station query and transferred as the counter states. Please make sure that the assigned outputs are also configured as pulse outputs.

The counter values are compared between the MFW master and the substations in order to monitor the values and to protect against incorrect pulse outputs, for instance when a communication partner restarts. For this reason, the difference between a pair of sequentially transmitted counter values must not be > 255.

Hour meter

The inputs E1 and E2 of the “EM-G8DEX-” digital expansion modules can be used as an hour meter. To do so the inputs have to be configured simultaneously as hour meter and counter value processing ones. Hour meters are treated the same as all other counter values in MFW. The significance of the hour meter can be configured (⟶ **Operating instructions of the expansion modules**).

The hour meters can only be configured on the “EM-G8DEX-...” expansion module starting from Software version 01404001.021.000 and not on the basic module.

3.3.2 Relay outputs

The “-ZDM12-G8DAR-DIA-0-BX-0” basic modules have 8 relay outputs. It is possible to change the outputs A1 ... A4 between “static binary output” or “pulse output” using the DIP switch. The outputs A5 ... A8 are used as static binary outputs.

Alternatively the “UF-ZDM12-G8DAR-DIA-0-BX-0” substation modules can be used as pulse output ones. In this case all 8 output relays are switched to pulse output via software parameterisation.

The output frequency (pulse width /pause) can be matched to the input of the subsequent processing system via parameterisation. (⟶“Parameterisation by PC” section)

Please make sure that the pulse frequency on the input module may not be permanently greater than the output frequency of the output module.

For higher pulses frequencies it makes sense from a durability point of view to use expansion modules with transistor outputs (EM-G8DAL-0-BB-0) for outputting.

3.3.3 Analog inputs and outputs

The expansion modules EM-G4AE0-0-BX-0 and EM-G4AA0-0-BX-0 can be used for transferring 0 ... 10 V or 0 ... 20 mA analog values by connecting them to the basic module using a CAN bus. Detailed information about the analog expansion modules can be found in the respective operating instructions.

3.4 Interfaces

There is a 9 pin sub-D socket integrated on the bottom of the basic modules for the SDP interface. For basic modules with protocol interfaces there is an 9-pin sub D socket integrated in the top of the module for protocol coupling.

3.4.1 SDP interface

The **SDP** interface on the bottom of the modules has three functions:

Service	- Parameterisation of the module with help of the terminal program e.g. Hyper terminal in Windows
Diagnostics	- Using a terminal program for simple diagnosis and error localisation of the telecontrol system
Protocol interface	- ASCII coupling protocol (AKP) (Can only be used for modules with IEC 60870-5-101/104 interface)

The ASCII coupling protocol is a simple, open EES protocol for exchanging data between the MFW and an automation system. We would be pleased to provide you with our separate interface description for more information on this protocol.

To use the SDP interface as a service or diagnostic one, the hyper terminal program used has to be set to the following values depending on the MFW module used:

Master module with IEC interface

- 115 200 Baud
- 8 bits
- 1 start bit
- 1 stop bit
- no parity
- no flow control

On all other basic modules

- 9600 Baud
- 8 bits
- 1 start bit
- 1 stop bit
- no parity
- no flow control

3.4.2 Protocol interface

One of the following standard protocols can be realised via the optional protocol interface in the top of the module depending on the type:

- IEC 60870-5-101
- Modbus RTU
- Profibus DP
- 3964R/RK512

The functional description and parameterisation of the interface can be found in the separate interface description.

3.5 Connections and indicator lamps

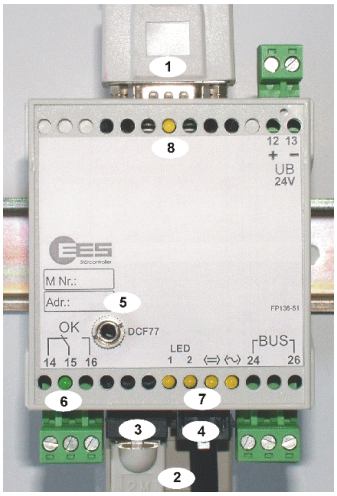


Figure 1: Master module with IEC interface

1 Protocol interface
(only for modules with serial protocol interface)

2 SDP interface

3 Socket for the prepared Ethernet interface
(only for master module with IEC interface)

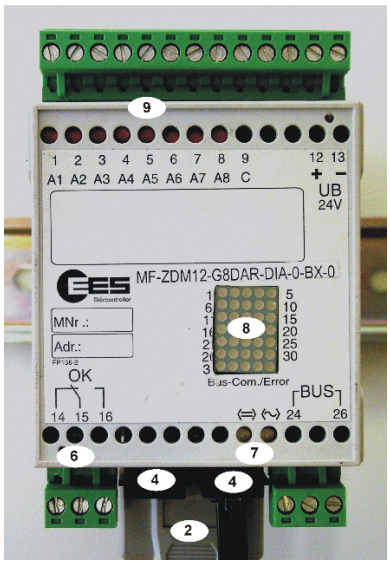
4 CAN bus interface
(for connecting the expansion modules)

5 Connecting socket for the DCF77 active antenna
(only for master module with IEC interface)

6 Indicator light “Operating condition”
Permanent light - No error
Off - no supply voltage or module defect
flashing - Error (→ “Diagnostic functions” section)

7 Status LEDs
LED1 TX for data traffic on the two wire (telegram transmission)
LED2 RX for data traffic on the two wire (telegram receiving)
<=> “External module” LED flashes if an expansion module is connected.
<~> LED “DCF77 module”
Flashing once per second - DCF77 reception
Irregular flashing - bad DCF77 reception
Off - no DCF77 reception or no DCF77 receiver connected

8 COM-LED for the serial interface flashes when data is sent to or received by the interface.



2 SDP interface

4 CAN bus interfaces (for connecting the expansion modules)

6 Indicator light “Operating condition”
Permanent light - No error
Off - no supply voltage or module defect
flashing - Error
(”Diagnostic functions” section)

Figure 2: Basic module with digital inputs or outputs

7 Status LEDs
<=> “External module” LED flashes if an expansion module is connected.
<~> LED “2 wire” – Signalling of transmitted and received telegrams on the 2 wires

8 LED matrix for status indicator of the substation (only on the master module)
LED off - Station is not configured on the master
(→ “Configuration via DIP switch” section)
Flashing light - optical signal indicating data exchange with the substation
Permanent light - Station malfunctioning or not accessible

9 Status indicator of “digital inputs or outputs”

Operating mode	Input status	acknowledged by the master	Led
Static binary input or output	1	no influence	Permanent light
	0		Off
Pulse input or output	Pulse		On (for the pulse duration)
	Pause		Off
Binary input saved statically	0	yes	Off
	1	no	Flashing (900 ms on and 100 ms off)
	1	yes	Permanent light
	0	no	Flashing (900 ms off and 100 ms on)

Table 1: Status indicator of the inputs and outputs of the basic module via red status LEDs

4 Assembly and commissioning

1. Unpack all the transmission system's modules, and check them for transport damage. Report any transport damage immediately to the responsible carrier. Please check that the delivery is complete as per the delivery note.

   The delivery may contain master module, substation and expansion modules. The system bus cable for connecting to the basic modules is supplied with the expansion modules.

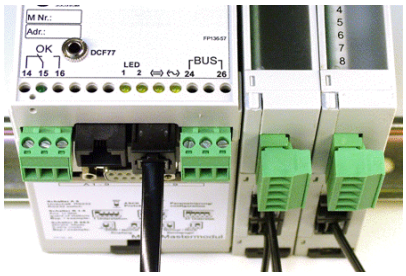
3. Configuring the modules → "Configuration via DIP switch" section.

4. Engage the basic module and any expansion modules that may be required on the mounting rail.

5. Connect the 2 wire line and the input and output leads as per the terminal assignment.

   The length of the input and output leads should not exceed a maximum of 3 m.

6. If expansion modules are used then connect them to the basic module with the system bus cable supplied via the RJ45 sockets in the bottom of the modules. Loop the bus connection for use with several expansion modules.

   Please use the right RJ45 socket for master modules with IEC interface (see illustration). The left socket is prepared for use as an Ethernet connection.

7. Connect the power supply to the basic module. The power supply of the expansion modules is made via the system bus cable.

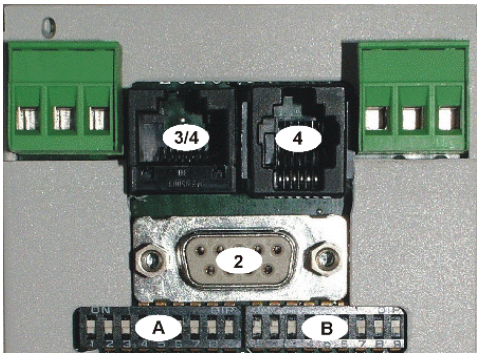
   The length of the power supply leads should not exceed 10 m.

8. Switch on the power supply. The station is ready for operation once the green LED on the basic module lights permanently. Please refer to the → "Error codes" section if this LED flashes.

5. Configuration via DIP switch

5.1 General principles

Data within the telecontrol system is exchanged on the basis of module numbers. A module number is assigned to every basic or expansion module that contains an I/O module. The data is exchanged between modules with the same module number. The physical arrangement of the modules within the system (the station address) is of no significance at all here. The no. 5 input module, for example, transfers its data to all output modules with module no. 5. Several output modules with the same module no. may be present. An input module number, however, can only be used once within one system.



The most important settings can be made with the aid of DIP switches. These can include station address of the substation (0 – 31), number of substations connected to the master, module number (0 ... 254), digital I/O operating mode and current and voltage with analog signals etc. The DIP switches A and B are located on the bottom of the basic modules.

Module numbers 251 ... 254 are reserved for the output of station errors in the factory setting.

Figure 3: Bottom of the basic modules

5.2 Master module

The station address is always 0. The following settings are required:

Meaning	Values	DIP switches
Module number of the I/O module	0 – 250	A1 –A8
Diagnostic interface switchover	ON - diagnostic interface OFF - protocol interface	A9
Number of substations	1 – 31	B1 – B5
Number of pulse inputs or outputs	0, 1, 2 or 4 (All other inputs and outputs are handled as static I/Os by MFW.)	B6 / B7 / Pulse input or output OFF / OFF / none ON / OFF / E/A1 OFF / ON / E/A1 and E/A2 ON / ON / E/A1 – E/A4
2 wire reception level	Standard /-20 dB	B8
2 wire transmission level	Standard / high	B9

Table 2: DIP switch of the master module

The DIP switch A9 only functions for modules with switchable interface.

The setting of the module numbers and the number of connected substations are binary coded.

For example:

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 254	OFF	ON	ON	ON	ON	ON	ON	ON

Meaning	B1	B2	B3	B4	B5
	$2^0 = 1$	$2^1 = 2$	$2^2 = 4$	$2^3 = 8$	$2^4 = 16$
2 stations	OFF	ON	OFF	OFF	OFF
7 stations	ON	ON	ON	OFF	OFF
31 stations	ON	ON	ON	ON	ON

5.3 Substation module

The following settings must be made

Meaning	Values	DIP switches
Module number of the I/O module	0 – 250	A1 –A8
not used		A9
Station address	1 – 31	B1 – B5
Number of pulse inputs or outputs	0, 1, 2 or 4 (All other inputs and outputs are handled as static I/Os by MFW.)	B6 / B7 / Pulse input or output OFF / OFF / none ON / OFF / E/A1 OFF / ON / E/A1 and E/A2 ON / ON / E/A1 – E/A4
2 wire reception level	Standard /-20 dB	B8
2 wire transmission level	Standard / high	B9

Table 3: DIP switch of the basic module

The setting of the module numbers and the station addresses are binary coded.

For example:

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 254	OFF	ON	ON	ON	ON	ON	ON	ON

Meaning	B1	B2	B3	B4	B5
	$2^0 = 1$	$2^1 = 2$	$2^2 = 4$	$2^3 = 8$	$2^4 = 16$
Station 2	OFF	ON	OFF	OFF	OFF
Station 7	ON	ON	ON	OFF	OFF
Station 31	ON	ON	ON	ON	ON

6 Parameterisation by PC

The following functions can be parameterised by hyper terminal. To do so the PC has to be fitted with a 1:1 connection cable (9 pin sub D socket/plug) connected to the SDP interface. The setting of the interface parameters of the hyper terminal program depends on the MFW module type and is explained in the "SDP interface" section.

The parameterisation commands are listed below. The commands have to be completed with <ENTER>. This is not mentioned in the following versions, it is assumed.

6.1 Pulse width

If outputs A1 ... A4 of a "ZDM12-G8DAR-DIA-0-BX-0" basic module are configured as pulse outputs via DIP switches B6 and B7, then the pulse width/pause can be matched to the speed of the subsequent processing system. Pulse width/pause can be set in 40 ms steps. The parameterised value is also valid for all outputs of the basic module, which are set to pulse output via DIP switch.

The pulse width can only be set with the parameter "z" when the module is not used as a pulse output module (Parameter „pipt" = 0).

Syntax

Read parameter: z
Write parameter: z<n>

n -1...256 pulse width = n x 40 ms

Example

Command	*z*	*;Query of the set value*
Response	*1*	*40 ms*
Command	*z4*	*;Pulse width = 4 x 40 ms*
Response	*4*	

Factory setting: n = 1 ; pulse width = 40 ms

Please note that during pulse width parameterisation it is not permitted to have permanently more pulses input than output. This would lead to loss of pulses and may occur if the input frequency is permanently higher than the output one.

6.2 Pulse output module

If all 8 output relays of a "UF-ZDM12-G8DAR-DIA-0-BX-0" basic module are used for pulse output (e.g. pulses, which are recorded with an EM-G8DEX-0-BB-E input module or pulse commands for control via a master with IEC 60870-5-101/104 interface), then these are set by software parameterisation. The output frequency (pulse width/pause) is defined simultaneously by the parameter. The parameterisation is always valid for all 8 output relays together.

If a module is used as pulse output one (Parameter „pipt" > 0) the position of DIP switches B6 and B7 is ignored and the parameter "z" is ineffective.

Syntax

Read parameter: pipt
Write parameter: pipt<n>

n - 0 Use of the outputs according to the setting of DIP switches B6 and B7
1...256 Pulse output module (all outputs as pulse ones)
Pulse width = n x 40 ms

Example

Command	*pipt*	*;Query of the set value*
Response	*1*	*40 ms*
Command	*pipt4*	*;Pulse width = 4 x 40 ms*
Response	*4*	

Factory setting: n = 0 ; A1 ... A4 according to the setting of DIP switches B6 and B7
A5 ... A8 static binary output

6.3 Static binary inputs / saved statically

Each digital input of a "UF-ZDM12-G8DEX-...", which is configured as a static binary input (→ "Substation configuration module" section), can be parameterised for the „Binary input saved statically" operating mode (→ "Digital inputs" section). In the factory setting all 8 digital inputs are parameterised as static binary inputs without saving.

Syntax

Read parameter: t26
Write parameter: r26,<Mask>[,<Refresh time>]

Mask - 8 digit 0/1 string
the 1st digit corresponds with input 8 and the 8th one with input 1
0 - static binary input
1 - binary input saved statically

Refresh time - (refresh time +1) x 10 = time in seconds, after which the saved status of the input is re-transmitted in case of a query by the master. This continues until the master acknowledges the receipt of the status change.
Value range 0…255

The refresh time is optional, and does not have to be entered. The previously set value remains if the entry is not made.

Example

Command r26,00011111,5 *; Inputs 1 -5 binary input saved statically*
Inputs 6 -8 static binary input
Refresh time = (5 +1) x 10 s = 60 s

Factory setting: 00000000,0 ; Use of the inputs according to the setting of DIP switches B6 and B7
Refresh time = 10 s

As soon as one of the 8 digital inputs is configured per DIP switch as a „binary input saved statically" an "EM-G8DEX-..." virtual module is automatically generated with the same module number. That is why it is only possible to connect a maximum of another 14 expansion modules to the basic module.

→ Parameterisation commands, which are only required for modules with a serial interface can be found in the relevant interface descriptions.

7 Diagnostic functions

A variety of diagnostic information is available to monitor and assess the system functions. These include, for instance, individual station fields indicated via the LED matrix or signalling via relay contacts, or more detailed information via the diagnostic interface.

7.1 "Operating condition" indicator light and signalling relay.

The "operating condition" indicator light provides information about the current error status:

- Permanent light = no error
- Flashing = fault
- Off = no power supply

The sequence of flashes is composed of:

No. of long flashes → 1st error code digit
No. of short flashes → 2nd error code digit
Pause

For example: long, short, short, short, pause = error code 13

When more than one error occurs at the same time, the one with the highest priority is always the one that is indicated.

In addition to the "operating condition" indicator light, a relay with change-over contact indicates the state of the station. (The status of the complete system is indicated on the master module).

Contact 14 / 15 closed - power failure or error (⟶ Table of error codes)
Contact 15 / 16 closed - no error

7.2 Error codes

No	Error	Comment
12	CAN bus error	Communication with an expansion module is disrupted or the expansion module is faulty.
13	Substation error	An error has occurred in a substation.
15	Substation/ master is not accessible	At least one substation does not respond to the master's queries. The error occurs on the substation if it is no longer queried by the master or when it doesn't recognise the telegrams.
61	Serial interface error	There are communication problems on the protocol interface. This errors only occurs for basic modules with a communication interface.

Table 4: Error codes

7.3 Station fault as a binary message

In certain applications it makes sense to assign each substation with its own binary output for indicating the operating condition. Module numbers 254 – 251 are reserved for this purpose. Errors are assigned to the outputs as shown in the following table. Outputs that are set signal a malfunctioning station. The output modules required for this can be inserted at any location within the telecontrol system. It is also possible to insert more than one of these modules.

Module number	Output	Error in station
254	A1	Master
	A2	Substation 1
	A3	Substation 2
	A4	Substation 3
	A5	Substation 4
	A6	Substation 5
	A7	Substation 6
	A8	Substation 7
253	A1	Substation 8
	A2	Substation 9
	A3	Substation 10
	A4	Substation 11
	A5	Substation 12
	A6	Substation 13
	A7	Substation 14
	A8	Substation 15

Module number	Output	Error in station
252	A1	Substation 16
	A2	Substation 17
	A3	Substation 18
	A4	Substation 19
	A5	Substation 20
	A6	Substation 21
	A7	Substation 22
	A8	Substation 23
251	A1	Substation 24
	A2	Substation 25
	A3	Substation 26
	A4	Substation 27
	A5	Substation 28
	A6	Substation 29
	A7	Substation 30
	A8	Substation 31

Table 5: Allocation of the station error messages to the outputs

7.4 Diagnostics via interface

The SDP interface can be used to obtain additional information about the condition of the system with the aid of a terminal. The setting of the interface parameters of the hyper terminal program depends on the MFW module type and is explained in the "SDP interface" section. The following sections list the commands that can be used to ask for information. Upper and lower-case are ignored in the letters composing the command. The commands have to be completed with <ENTER>.

7.4.1 Master module terminal commands

Command/syntax	Function
f<No.>	f - Output of the current error (error codes) f<No.> - Output of the error text belonging to the error number <No.> *For example:* *f<ENTER> → "Error: 12,13"* *f12<ENTER> → "Error: CAN bus error"* *f13<ENTER> → "Error: (1) substation error" ; Error in substation 1* The substation number is only displayed for MF-ZDM12-1P101-DIA-A-BX-0.
u<n>	If a substation error is present it can be queried. <n> is the number of the substation 1...31 The function returns the error code of the substation's current error. Only the most significant error is ever reported. *For example: u1→ Output of the error by substation 1* *12= CAN bus error*
v<n>	Display of the connection quality <n> is the number of the substation, 0...30 (address - 1) The ratio of responses to inquiry telegrams for this substation is returned, expressed as the figure per thousand (0...999). The command v cannot be used on MF-ZDM12-1P101-DIA-A-BX-0.
<mnr>	Output of the 5 data words of a module as a decimal value <mnr> - Module number 0 ... 254 *For example:* *0, 254, 5, 0, 0, 0 ;Module number 0, 1st value = 254, 2nd value =5, 3rd-5th value =0*
hl hl<n>	Output of the overall history or the <n> most current entries. This command can only be used on MF-ZDM12-1P101-DIA-A-BX-0. *For example:* *hl5 → Output of the last 5 history entries* *hl → Output of the overall history* *hl0 → Stops the history output*
s	Outputs the DIP switch settings of the basic module as a 0/1 sequence 1 = ON, 0 = OFF *For example:* *Switch= <10000000 >,<10000000 >* *< SA1 – SA8>< SA9,SB1 – SB7> Switch at the bottom of the module, the positions of switches SB8 and SB9 are not output.*
i	Output of the station address and basic module number *For example: Substations = 1 module number = 0*

m	Output of the list of station modules. A line is used for every possible module. *For example:* *M<L no.>,<status>,<serial number>,<MNR>,<MType>,<error>* *<No.> 0...15 (position of the module in the configuration list)* *<Status> 0 = free, 1 = occupied* *<Serial number> Hardware serial number of the basic module* *<MNR> Set module number* *<MTyp> The module type DE, DA, AE, AA* *<Error> "Error" or "OK"*
l	Output of the configuration list for the whole system For example: L<station address>,<module number>,<module type>,<serial number>
n	Output of the hardware serial number
t53	Output of the software version *For example: 01b16000.000.000*

Table 7: Master module terminal commands

Data word	Analog module	Digital module
1	1st analog value	Binary value as a decimal value
2	1nd analog value	1st counter value if present
3	3rd analog value	2nd counter value if present
4	4th analog value	3rd counter value if present
5	not used	4th counter value if present

Table 8: Internal illustration of the I/O status of the I/O modules in 5 data words.

Example 1:

On the digital input module with module number 0 the first input is set as a pulse one. The 5 data words are output as follows:

0, 7, 5, 0, 0, 0

Module number 0

1. *Binary value decimal = 7 → "0000110"* *E1 = 0 (counter input)*
   E2 = 1
   E3 = 1
   E4 ... E8 = 0
2. *Until now 5 counter values have been registered on input E1.*

Example 2:

The first input is set as a current one and the second, third and fourth outputs as voltage ones on the analog output module number 1. Analog values are saved as standardised ones in the range from 0 ... 10 000. The 5 data words are output as follows:

1, 1000, 5000, 1,10000, 0

Module number 1

1. *Analog value = 1000* → *2 mA*
2. *Analog value = 5000* → *5 V*
3. *Analog value = 1* → *1 mV*
4. *Analog value = 10 000* → *10 V*

7.4.2 Substation module terminal commands

Command/syntax	Function
f<No.>	f - Output of the current error (error codes) f<No.> - Output of the error text belonging to the error number <No.> *For example:* *f<ENTER> → "Error: 12,15"* *f12<ENTER> → "Error: CAN bus error"* *f15<ENTER> → "Error: Master is not accessible"*
i	Output of the station address and basic module number *For example: Address = 1 module number = 0*
m	Output of the list of station modules. A line is used for every possible module. *For example:* *M<L no.>,<status>,<serial number>,<MNR>,<MType>,<error>* *<No.> 0...15 (position of the module in the configuration list)* *<Status> 0 = free, 1 = occupied* *<Serial number> Hardware serial number of the basic module* *<MNR> Set module number* *<MTyp> The module type DE, DA, AE, AA* *<Error> "Error" or "OK"*
s	Outputs the DIP switch settings of the basic module as a 0/1 sequence 1 = ON, 0 = OFF *For example:* *Switch= <10000000 >,<10000000 >* *< SA1 – SA8>< SA9,SB1 – SB7> Switch at the bottom of the module, the positions of switches SB8 and SB9 are not output.*
n	Output of the hardware serial number
t53	Output of the software version *For example: 01b16000.000.000*

Table 9: Substation module terminal commands

8 Technical data

Rated operating voltage U_B	24 V DC
Operating voltage range	20 ... 32 V DC
Operating and ambient temperature	-20 °C ... + 60 °C
Air humidity	Maximum 95 %, non-condensing
Connection terminals	pluggable
Conductor cross-section – rigid or flexible	
without wire-end sleeves	0,2 ... 2.5 mm^2
with wire-end sleeves	0,25 ... 2.5 mm^2
Housing / protection class	Plastic / IP 40

2 wire modem

Two-wire cable attenuation	maximum 40 dB
Loop resistance	maximum 1 MΩ
Impedance	600 Ω
Transmit voltage	switchable 2 V_{PP} / 9.5 V_{PP} to 680 Ω
Isolation voltage between	
2 wire and supply voltage	4 kV_{RMS}
2 wire and I/O	4 kV_{RMS}

Digital input module

Power consumption	approx. 2.5 W
Signal voltage U_S	see table
Switching threshold for 24 V rated voltage *	
Maximum voltage	48 V
Voltage for high-state (DC)	> 10 V or < -10 V
Voltage for high-state (AC)	> 15 V_{RMS}
Voltage for low-state (DC)	< 9 V or > -9 V
Voltage for low-state (AC)	< 9 V_p
Input resistance	see table
Maximum count rate	10 Hz
Minimum pulse width	
Standard module (...-0)	Standard 50 ms
Module with rapid inputs (...-3)	10 ms
Electrical isolation between signal and supply voltage	4 kV_{RMS}

Digital output module

Power consumption	approx. 3.5 W
Contact loading of the relay outputs**	
minimum	1.2 V / 1 mA (suitable for control of LED)
maximum	250 V AC / 400 mA 250 V AC / 2 A (pure ohmic load) 30 V DC / 2 A 110 V DC / 0.2 A 220 V DC / 0.1 A
Total current 230 V AC	maximum 8 A (pure ohmic load)
Count rate	12 Hz ***
Pulse width / pause	40 ms ***
Electrical isolation between output and supply voltage	4 kV_{RMS}

* Switching thresholds of other signal voltages on request
** We would be happy to supply you with more precise specifications on request.
*** Other figures on request

Digital input modules can be supplied with varying signal voltages. The corresponding voltage is specified via the 23rd digit of the order identification.

Order identification	Rated voltage	Voltage range limit value	Input resistance
..-ZDM12-G8DEX-DIA-0-BA-.	12 V AC/DC	9 V - 24 V AC/DC	approx. 5 kΩ
..-ZDM12-G8DEX-DIA-0-BB-.	24 V AC/DC	16 V - 48 V AC/DC	10 kΩ
..-ZDM12-G8DEX-DIA-0-BE-.	60 V AC/DC	35 V - 75 V AC/DC	22 kΩ
..-ZDM12-G8DEX-DIA-0-BF-.	110 V AC/DC	75 V - 130 V AC/DC	68 kΩ
..-ZDM12-G8DEX-DIA-0-BJ-.	220 V AC/DC	180 V - 255 V AC/DC	180 kΩ

Table 10: Coding of the signal voltages on the inputs in the order identification

8.1 Terminal assignments

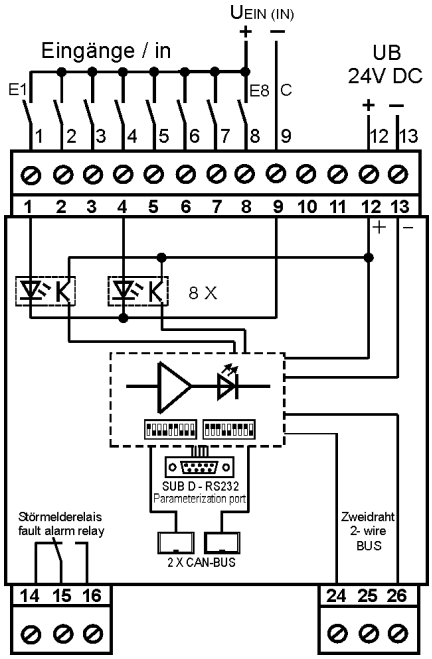


Figure 4: Basic module with 8 digital inputs

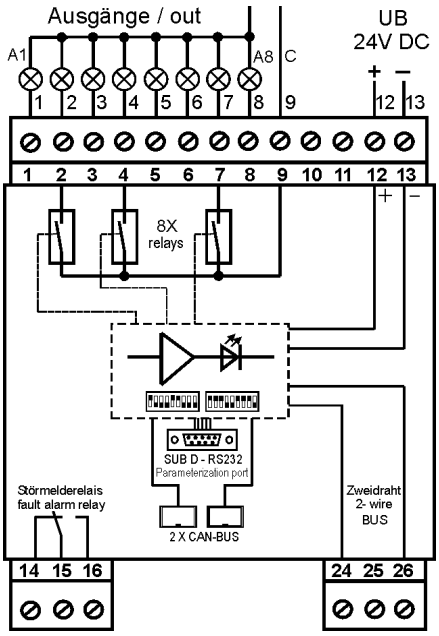


Figure 5: Basic module with 8 output relays

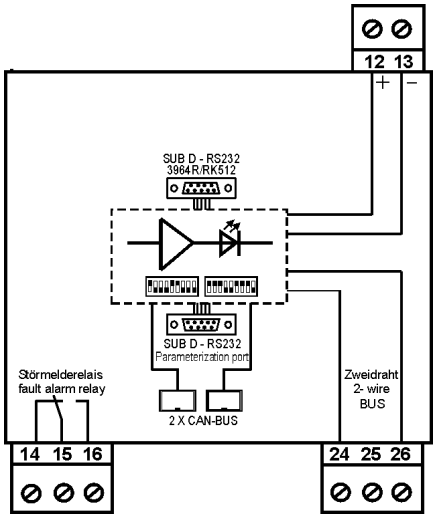


Figure 6: Basic module with protocol interface

8.2 Dimensional drawings

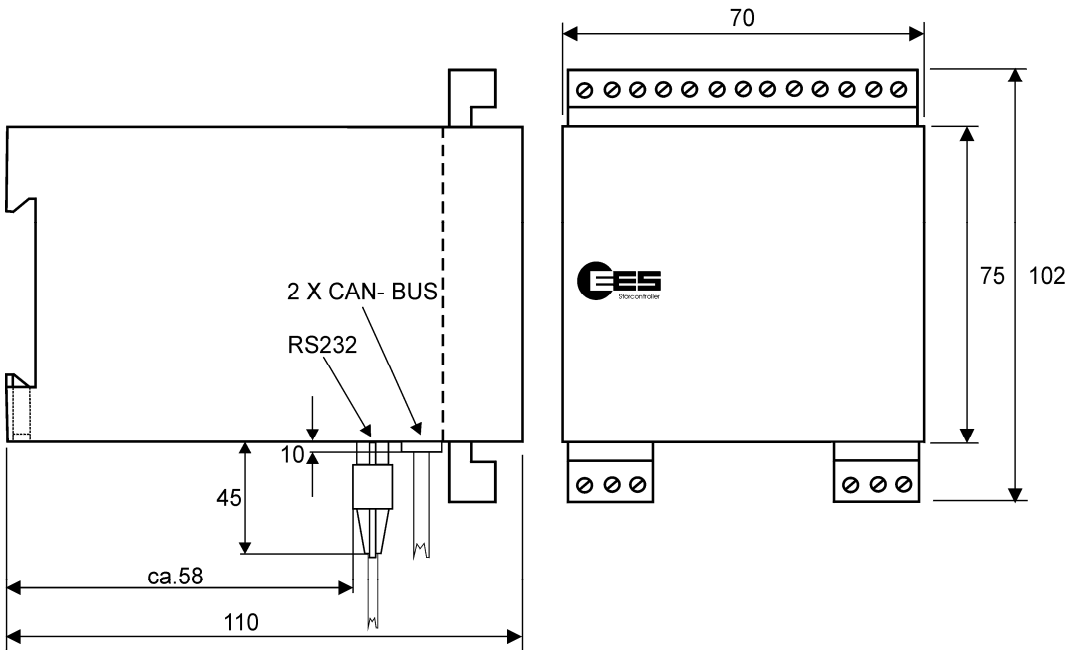


Figure 7: Basic module with 8 digital inputs or 8 relay outputs

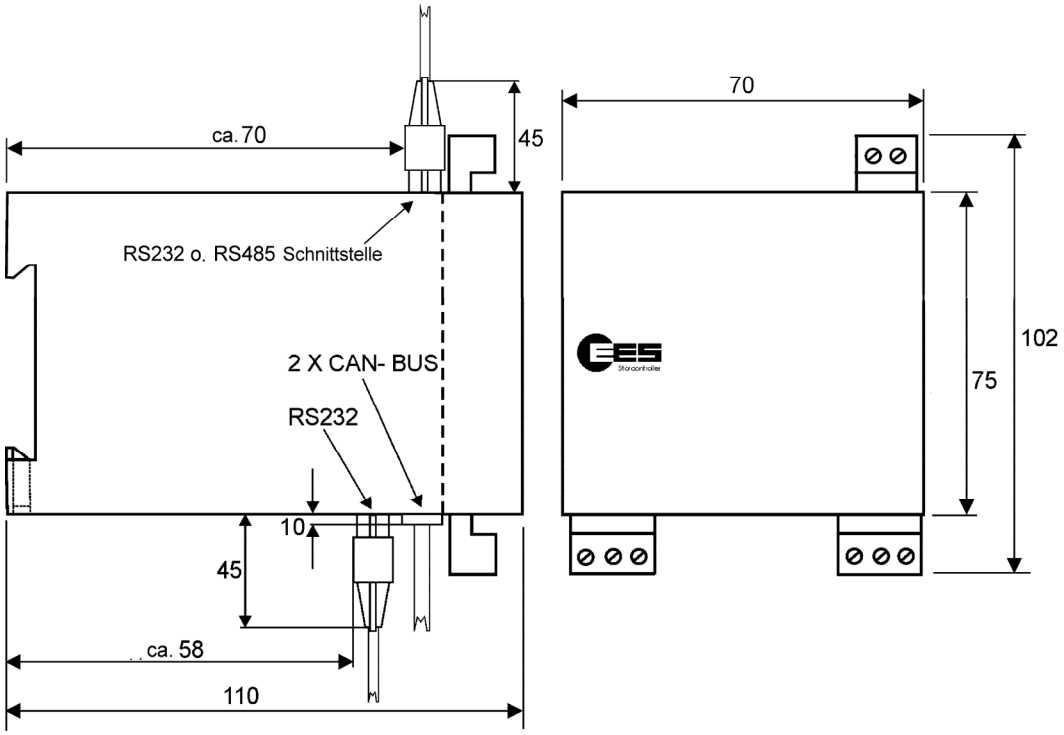


Figure 8: Basic module with protocol interface

Dimensions in mm

The right to make technical changes is reserved

9 Accessories

Only accessories approved by the manufacturer (expansion modules etc.) may be connected to the MFW modules.

Further accessories and more detailed information may be found in the appropriate product groups in the telecontrol catalogue.