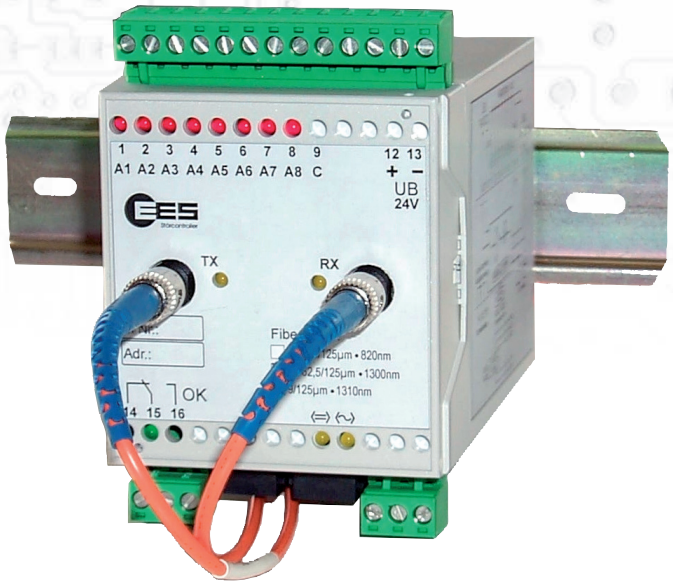
THE SOLUTION

OPERATING INSTRUCTIONS

Application-ready systems from the

MFW product family



Modular optical fibre telecontrol system

Optimised transmission speed variant

29.11.2006

MFW-GOLWL-BA-UK-000

INFO www.ees-online.de

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1 Applicability

The description applies to the following MFW modules:

Item number	Type
97BLAGAN1BB1	MF-L1S00-G8DEX-DIA-1-BB-1
97BLAGCN1BX1	MF-L1S00-G8DAR-DIA-1-BX-1
97BLBGAN1BB1	MF-L1M10-G8DEX-DIA-1-BB-1
97BLBGCN1BX1	MF-L1M10-G8DAR-DIA-1-BX-1
97BLCGAN1BB1	MF-L1M20-G8DEX-DIA-1-BB-1
97BLCGCN1BX1	MF-L1M20-G8DAR-DIA-1-BX-1

2 General notes

2.1 Symbols used

The following symbols are used in this document:

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.

Important section
This symbol indicates particularly important information.

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

2.2 Terminology

MFW
In general the MFW modular telecontrol network consists of one master and up to 31 substations. **The speed optimised point-to-point connection version of the MFW Modular Telecontrol Network is only available by a system consisting of a central unit and a substation. Each station requires at least one basic module and a maximum of 4 expansion modules.**

Basic module
The basic module represents the minimum core of a telecontrol station. It contains at least the following function groups:

- internal modem (in this case a fibre-optic modem)
- 8 binary inputs or outputs with status LED, or an additional serial interface for protocol coupling
- two CAN bus interfaces for connecting the expansion modules
- watchdog LED and fault signalling contact

Master module
Using speed optmised optical fibre telecontrol system in every station a basic module designed as master module is required. A maximum of 4 expansion modules can be connected to it.

Expansion module
In order to increase the I/O scope up to 4 expansion modules can be connected to a basic module These are connected via the CAN bus interface.

I/O module
The basic modules contain 8 inputs or outputs. These are referred as I/O modules. In the same way, the expansion modules contain an I/O module consisting of 8 binary inputs, 8 binary outputs, 4 analog inputs or 4 analog outputs.

Module number
Each I/O module is given a module number. The data is exchanged between modules with the same module number. The assignment of in- and output modules is done by the module number.

2.3 Safety instructions


These operating instructions must be carefully read, understood 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 comply with the contents of these operating instructions.

3 Device description

The modular telecontrol network (MFW) stands for a flexible, modular concept, which is able to use all available medias e.g. telephon cables, three-phase current wires, cableshields, potential free wires, optical fibre and different radio frequencies for data transmission.

In some applications (e.g. Intertripping of railway substations) the whole performance complexity is not necessary instead an optimised variant for the special request is needed. For such requirements the MFW-system was optimised for high transmission speeds between a point-to-point connection over optical fibre. The delay between applying a signal on the one side up to the appearance of the message on the other side is below 100 ms.
The parameterisation of the system is done by DIP-switches for easy handling.

In every station the telecontrol system consists of a basic module (designed as master station). This includes the following function groups, display and setting elements:

- Internal fibre optic modem
- RS232 diagnostics interface
- I/O Unit with 8 binary outputs with status LED
- Two CAN bus interfaces for connecting the expansion modules
- Watchdog LED and fault signalling contact
- DIP switch for setting of module number etc.

Each basic module can be fitted with up to a maximum of 4 expansion modules in order to increase the I/O scope. These are connected via the CAN bus interface. The assignment of input and output modules is done by module numbers, which are set by DIP-switches.

In the event of a fault, the system detects the faulty communication and reports it via LED and relay contact in both stations. If the serial diagnostic interface is used, this information can also be evaluated via this interface (e.g. error codes, transmission quality etc.).

The use of optical fibres as transmission media ensures a robust fault-free transmission over long distances. For each direction of transmission an individual optical fibre is used. There are three types available for the connection of the different fibre optic types:

1. Multimode fibre 50/125 µm or 62.5/125 µm core/cladding diameter.
   Wavelength 1300 nm
2. Monomode fibre 9/125 µm core/cladding diameter,
   Wavelength 1310 nm
3. Multimode fibre 50/125 µm or 62.5/125 µm core/cladding diameter.
   Wave length 820 nm

The distance which can be bridged depends on the glass fibre type used, on the plugs and on the splice losses and can amount up to 22 km. For the fibre optic connection to the basic module the ST type plug connection is used.

4 Assembly and installation

1. Unpack all the telecontrol 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. The delivery can include master modules, expansion modules and other accessories.

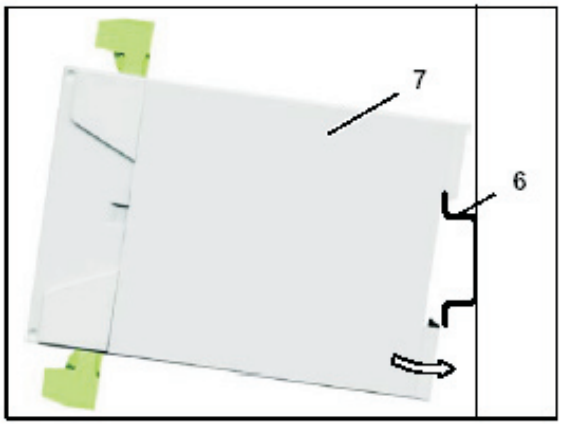
2. Select mounting locations for the individual stations.

3. Module configuration (→ see section „Configuring the telecontrol system")

The following DIP switch settings must be done when starting the system for the first time:

- Module function
- Module numbers for all modules with I/O
- Current or voltage input at analog input modules
- Counting or pulse I/O at digital modules

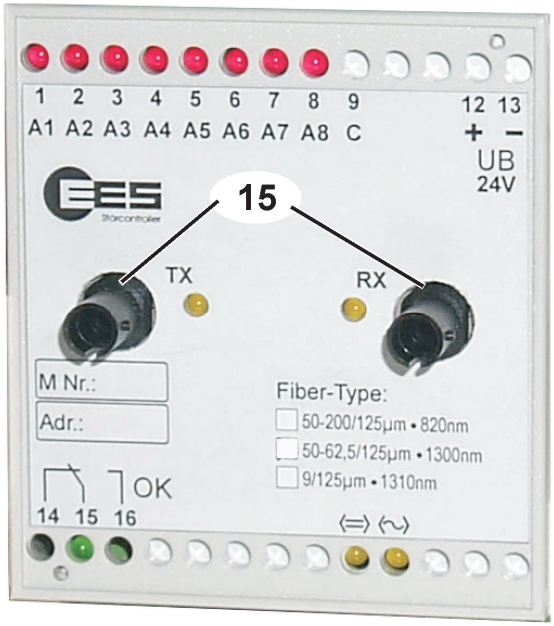
4. Engage the basic module and any expansion modules [7] that may be required on the mounting rail [6].



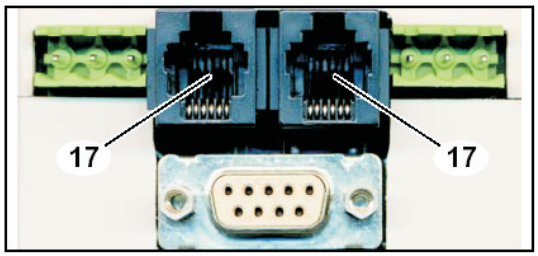
5. Connect the input and output leads.

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

6. Connect the transmitting and receiving optical fibres to the appropriate sockets [15].



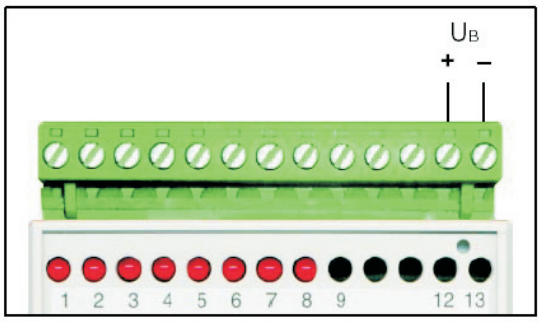
7. When required connect optional input/output modules using the supplied cable to the expansion sockets [17] (COM1, COM2).



Assembly and installation are carried out in accordance with the associated instructions.

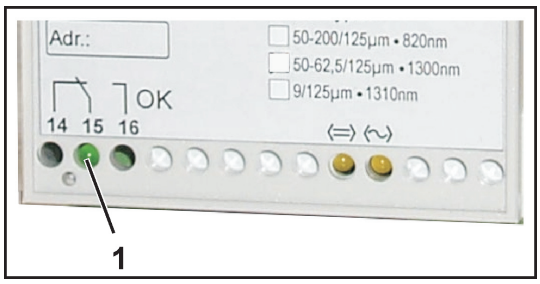
8. Connect the power supply to the basic module..

The length of the power supply lead should not exceed a maximum of 10 m.



9. Switch on the power supply.

✓ Watchdog LED [1] lights up.
The substation is ready for operation.
LED flashes → see section:
“Watchdog LED and error codes”



5. Configuring the telecontrol system

5.1 General principles

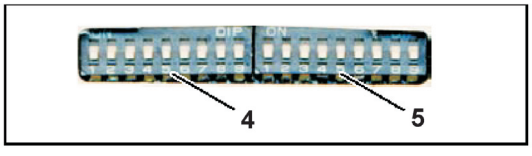
Data within the telecontrol system is exchanged on the basis of module numbers.
The assignment of input and output modules is done according to the following table.

Input modules		Output modules	
Module number	Module type	Module number	Module type
0	8 DI incl. 4 CV	128	8 DO incl. 4 CV
1	8 DI incl. 4 CV	129	8 DO incl. 4 CV
2	4 AI	130	4 AO
3	8 DI	131	8 DO

Table: Assignment of module numbers

Using digital input module with module number 3 counting values can not be transmitted.
Note: Refering output modules have always in this version numbers + 128 !

All the important settings can be made with the aid of DIP switches. These include, for instance, the module function, module number , selection between static and counter values in the case of digital I/O or between current and voltage in the case of analog signals and so forth. DIP switches A and B [4, 5] are located on the bottom side of the basic modules.

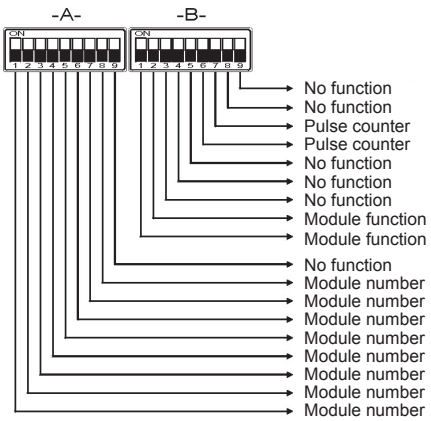


5.2 **Basic module**

The following settings can be done by DIP-switches:

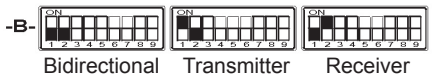
Meaning	Values	DIP switches
Module function	- bidirectional operation - unidirectional (transmitter) - unidirectional (receiver) - test mode	B1 – B2
Module number of the I/O module	see table „Assignment of module numbers“	A1 –A8
Number of pulse counters	0 – 4	B6 – B7

Programming switch for the master module:

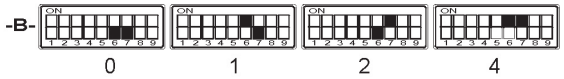


Addressing: (examples for module numbers)

Function in the system:



Number of pulse counters:



5.3 **Expansion modules**

Each basic module can be fitted with up to a maximum of 4 expansion modules in order to increase the I/O scope. The following modules are available for this purpose:

EM-G8DEX-0-BB-0	8 digital inputs
EM-G8DAR-0-BX-0	8 relay outputs
EM-G8DAL-0-BB-0	8 transistor outputs
EM-G4AE0-0-BX-0	4 analog inputs (0 ..10 V or 0 ..20 mA)
EM-G4AA0-0-BX-0	4 analog outputs (0 ..10 V or 0 ..20 mA)

A precise description of the way the modules operate can be found in the operating instructions for the MFW expansion modules. Only the necessary DIP switch settings will be listed below. The assignment of the DIP switches may be read from the label on the side of the module or found in the expansion module‘s operating instructions.

5.4.1 **Digital input**

Meaning	Values
Module number of the I/O module	0 – 250
Type of I/Os 1 - 4	static or pulse
Maximum count rate	1 Hz / 10 Hz

5.4.2 **Digital output**

Meaning	Values
Module number of the I/O module	0 – 254
Type of I/Os 1 -4	static or pulse
Maximum count rate	1 Hz / 12 Hz

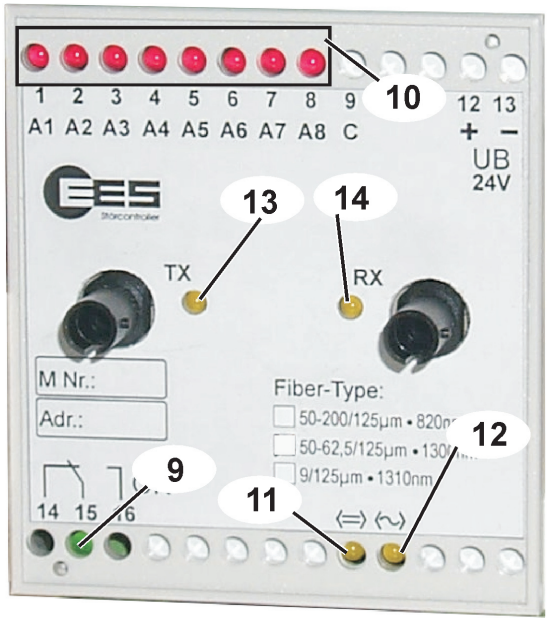
5.4.3 **Analog input**

Meaning	Values
Module number of the I/O module	0 – 250
Current or voltage input may be set for each channel	Current / voltage

5.4.4 **Analog output**

Meaning	Values
Module number of the I/O module	0 – 250

6 **Indicator lights**



9 Watchdog light *OK*

10 Indicator lights
Digital inputs or outputs light up if a signal is present.

11 The *External module* indicator light lights up if an external module is connected.

12 No function

13 TX transmitting data over optical fibre

14 RX receiving data over optical fibre

7 Diagnostic functions

A variety of diagnostic information is available to monitor and assess the data link. These include, for instance, station errors indicated via the LED matrix display or by a relay contact, or more detailed information via the diagnostic interface.

7.1 Watchdog-LED „OK“ and error codes

The *OK* Watchdog light [9] provides information about the current error status:

- Permanent light = no error
- Flashing = error
- 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: — — ---- (= error code 24)

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

No	Error	Comment
12	CAN bus error	The link between the basic module and the expansion module is faulty.
13	Error in partner station	The partner station is reporting an error.
16	Bad connection to partner station	(poor reception, or none at all, at the partner station)
17	Bad connection from the partner station	(poor reception, or none at all, at this station)
61	Serial interface error	The error only occurs on basic modules with a serial interface. It occurs if this communication is faulty.

After loading parameters, they are stored in the internal EEPROM. By this time the LED flashes in a very fast sequence. This procedure has not to be interrupted by switching off power supply, otherwise there will occur data losses.

7.2 „OK“-Relay

In addition to the Watchdog-LED “OK” a relay with a change-over contact monitors the condition of the station.

Contact 14 / 15 closed = error or supply failure
Contact 15 / 16 closed = no error

7.3 **Diagnostic interface**

The basic modules have an RS 232 interface that can be used as a diagnostic interface. The diagnostic interface can be used to obtain additional information about the condition of the system with the aid of a terminal. The terminal must be set as follows for this purpose:

-9600 baud
-8 bits
-1 start bit
-1 stop bit
-no parity
-no hardware or software handshake

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>.

Command/ syntax	Function
VQ<x>	Quality of connection The ratio of responses to inquiry telegrams for this substation is returned, expressed as the figure per thousand (0...999). No x or x=1 - Switch on output of the connection quality (continuous output) All other values of x - Switch off output The connection quality output has the following format: E = <V1>%, G = <V2>%<cr> V1 - connection quality (reception at this station) V2 - connection quality (reception at the partner station) For example: E = 100 %, G = 100 %
F<No.>	F without <No.> - 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: Error in partner station"
N	Output of the serial number
U1	Query of the current substation error The function returns the error code of the substation's current error. Only the most significant error is always reported.
T...	Reading parameters <52> Serial number of the module <53> Version number of the software
Z<n>	Specifies the pulse width of the output pulse for all outputs that are set to generate pulse outputs. n =1...256 pulse width = n x 40 ms Standard setting n =1

8. **Transmission ranges**

The range of the optical fibre system is determined by the transmission power, the receiver sensivity and the losses on the transmission path. The difference between transmission power and receiver sensivity is called budget. The budget correspond to the maximum allowed losses on the transmission path with which a data tranmission is still possible without having any reserve.

The possible range is calculated as follows:

Range (as km) = (Budget (db) - Reserve (db)) / Optical absorption (db per km)

For the design of a transmission path the entire budget can not be taken into account, due to the fact that reserves for e.g. additional repairs which cause splice losses should be considered.
The following table shows recommended values for the distances on basis of typical results. The actual distance has to be determined according to the transmission perfo-mance rating of the used components (Optical fibre, plugs, numbers of splices, ...) !

Optical fibre type Core/cladding diameter	Wavelength	Budget min. / typ.	Typical optical fibre attenuation	Connector/ splice reserve	Transmission range min. / typ.
Monomode 9/125µm	1310nm	12db / 18db	0,4db / km	6db	15km / 30km
Multimode 50/125µm	1300nm	11db / 15db	0,5db / km	4db	14km / 22km
Multimode 62.5/125µm	1300nm	15db / 18db	0,9db / km	4db	12km / 15km
Multimode 50/125µm	820nm	11db / 15db	2,4db / km	4db	3km / 5km
Multimode 62.5/125µm	820nm	16db / 20db	3,0db / km	4db	3km / 5km

9 Technical data

Rated operating voltage	24 V DC
Operating voltage range	20 ... 32 V DC
Air humidity	maximum 95 %, non-condensing
Operating and ambient temperature	-20°C ... +60°C
Connection terminals	Nominal cross section 2.5 mm^2
Housing / protection class	Plastic / IP 40
Version for monomode optic fibre @1310 nm	
Budget minimal/typical with 9/125 µm fibre optic	12 db/18 db
Optical fibre connection plugs	2 ST sockets
Version for monomode optic fibre @1300 nm	
Budget minimal/typical with 50/125 µm fibre optic	11 db/15 db
Budget minimal/typical with 62,5/125 µm fibre optic	15 db/18 db
Optical fibre connection plugs	2 ST sockets
Version for monomode optic fibre @820 nm	
Budget minimal/typical with 50/125 µm fibre optic	11 db/15 db
Budget minimal/typical with 62.5/125 µm fibre optic	16 db/20 db
Optical fibre connection plugs	2 ST sockets
Digital input module	
Power consumption	approx. 2.5 W
Signal voltage	see table
Input resistance	see table
max. count rate	10 Hz
min. pulse width / pause	50 ms
Electrical isolation between signal and supply voltage	4 kV_{eff}
Digital output module	
Power consumption	
With relay outputs	approx. 3.5 W
With transistor outputs	max. 2.5 W logic + load current
Contact loading of the relay outputs*	
minimum	1,2 V /1 mA
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 230V AC current (purely ohmic load)	maximum 8 A
Load capacity with transistor outputs	maximum 50 mA per output
min. pulse width / pause	40 ms**
Electrical isolation between output and supply voltage	4 kV_{eff} (not at transistor outputs!)

* We would be happy to supply you with more precise specifications on request.

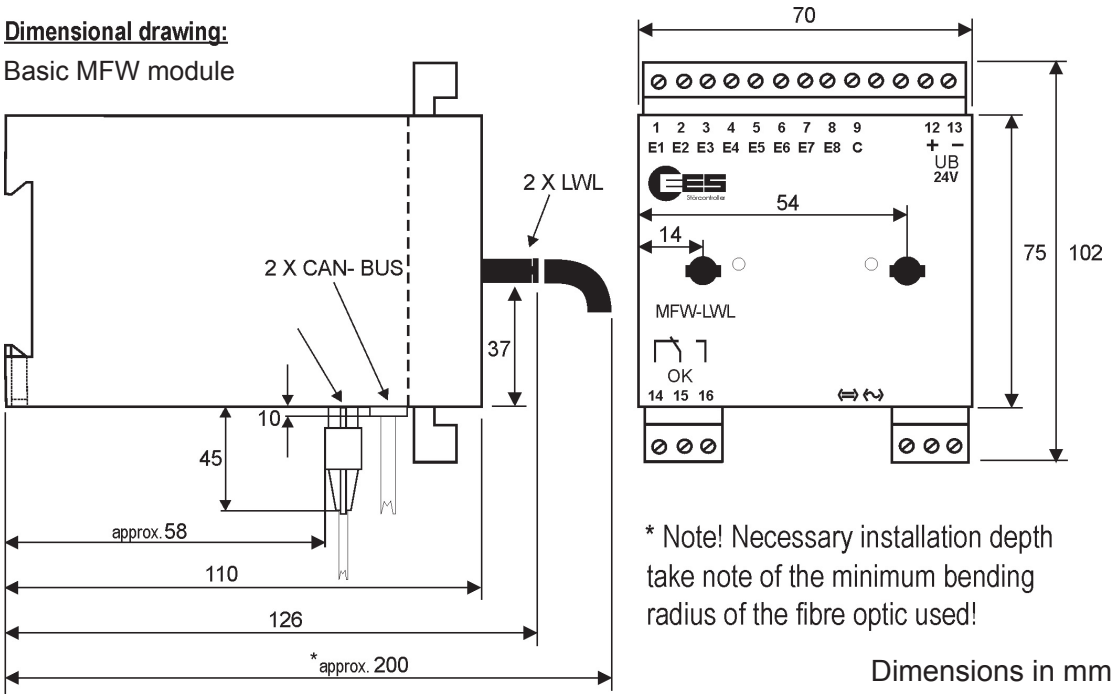
** Other figures on request

Type description	Nominal voltage	Voltage range limit	Input resistance
UF-L1S00-G8DEX-DIA-1-BB-1	24 V AC/DC	16 V - 48 V AC/DC	10 kΩ
UF-L1S00-G8DEX-DIA-1-BE-1	60 V AC/DC	35 V - 75 V AC/DC	22 kΩ
UF-L1S00-G8DEX-DIA-1-BF-1	110 V AC/DC	75 V - 130 V AC/DC	68 kΩ
UF-L1S00-G8DEX-DIA-1-BJ-1	220 V AC/DC	180 V - 255 V AC/DC	180 kΩ

Digital input modules are deliverable in different signalling voltages. The corresponding voltage is defined by the 23th character of the type description.

Dimensional drawing:

Basic MFW module

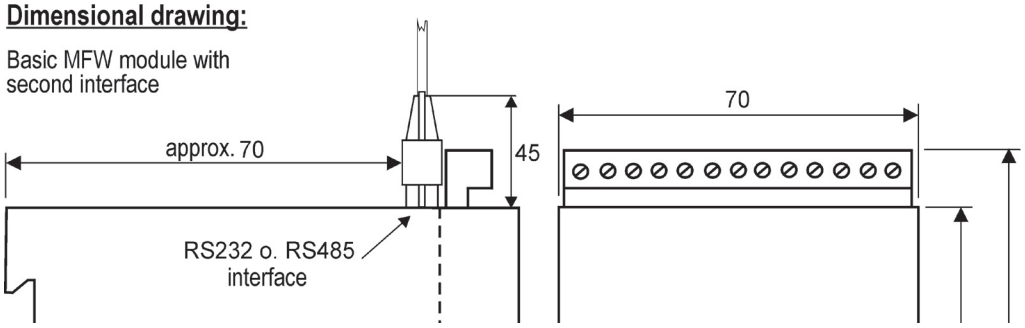


* Note! Necessary installation depth take note of the minimum bending radius of the fibre optic used!

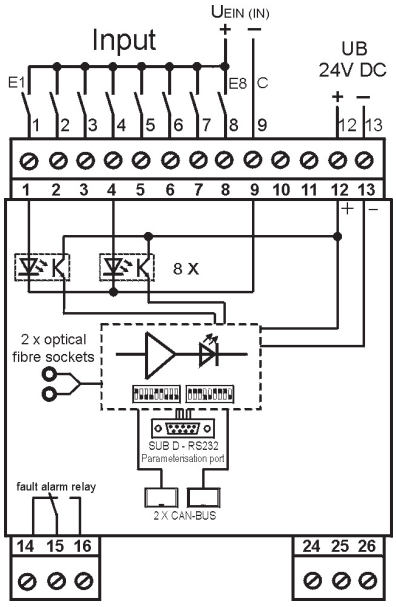
Dimensions in mm

Dimensional drawing:

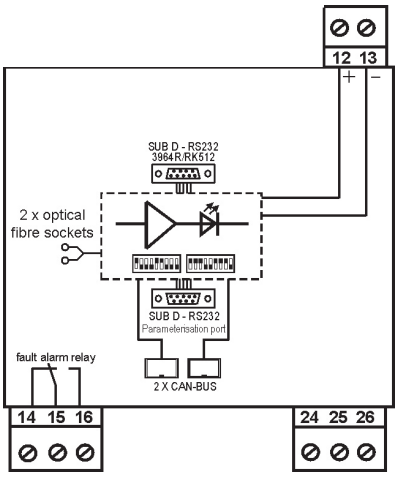
Basic MFW module with second interface



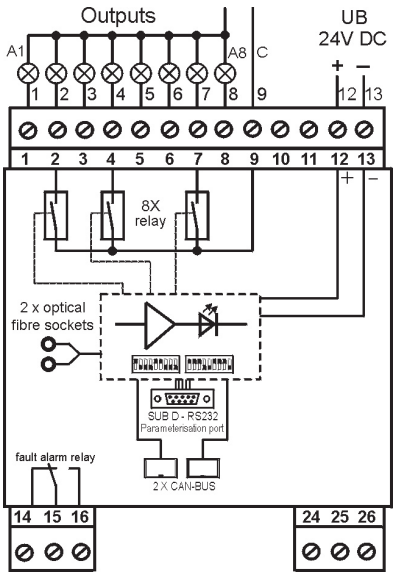
Terminal assignments



Basic module with 8 digital inputs



Basic module with additional serial interface



Basic module with 8 output relays

The right to make technical changes is reserved

10 Accessories

Only accessories approved by the manufacturer (input/output modules etc.) may be connected to the MFW module.

Additional modules for digital and analog input and output are available for the basic MFW modules.

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

HOTLINE
+49(0)7191-182 235/214

INTERNET
www.ees-online.de

Elektra Elektronik GmbH & Co Störcontroller KG
Hummelbühl 7-9 • D-71522 Backnang/Germany
P.O.Box 12 40 • D-71502 Backnang
Phone: +49(0)7191/182-0 • Fax: +49(0)7191/182-200
e-Mail: info@ees-online.de