Modular optical fiber telecontrol system
Point to multipoint

Data transmission via optical fiber cable point to multipoint

- Modular expansion with one master and up to 31 substations
- Stations with 4 DI and 4 DO each
- Transmission times of 10 ms from the master to the substations
- Optical fiber singlemode (9/125 µm) optional multimode (50/125 µm)
- Simple parameterization of the modules via DIP switches

Functional description

The multipoint variant of the modular telecontrol system MFW based on optical fiber was developed for the speed-optimized transmission of signals for the rapid shutdown of power generation systems.

This variant of the MFW can be used both as a point-to-point transmission between master and substation and as a point-to-multipoint connection between a control center (master) and up to 31 substations. With the point-to-point transmission, a direct fiber optic connection is established between the two devices. For multipoint transmission, an additional fiber optic splitter is required on the master for the incoming and outgoing transmission direction.

The 4 inputs of the central unit are transmitted and output in parallel to the outputs of all substations within a time of less than 10 ms. This value applies when using output relays. If the transistor outputs option is used, this time can be reduced to 5 ms. The 4 inputs of the connected substations are transmitted to the central unit as feedback and output as an “AND” or “OR” logic operation. This means that the inputs E1 of all substations are linked to output A1 on the central unit. E2 to E4 are each linked to the outputs A2 to A4. The runtime of the feedback from the substations to the central unit depends on the expansion of the system. Each substation requires 10 ms. In the full configuration of 31 substations, this means a maximum runtime of 310 ms for the feedback signals of all substations.

In the event of an alarm, the system recognizes the faulty communication and reports this via LED and relay contact both in the control center as well as in the affected substations. Once the cause of the fault has been rectified, normal operation is automatically resumed.

The system is easily configured using the DIP switches on the underside of the devices.
If necessary, extended system diagnostics can be carried out using a laptop or PC via the USB interface.

Transmission medium optical fiber

The use of fiber optic cables as a transmission medium ensures robust, interference-free transmission over long distances. A separate fiber optic cable is used for each transmission direction. Two versions are available for coupling the different types of fiber optic cable:

1. Single-mode optical fibers with 9/125 µm core/cladding diameter. Wavelength 1310 nm
2. Multimode fibers with 50/125 µm core/cladding diameter Wavelength 1300 nm

LC-duplex connectors are used in all versions for the fiber optic coupling to the base modules.

The bridgeable distance is determined by the transmission power, the sensitivity of the receiver and the losses of the entire transmission path. Particular attention must be paid here to the attenuation of the fiber optic splitters used. The difference between transmission power and receiver sensitivity is referred to as the budget. The budget corresponds to the maximum permissible losses on the transmission path with which data transmission is still possible - without reserves.

The possible range is calculated as follows:

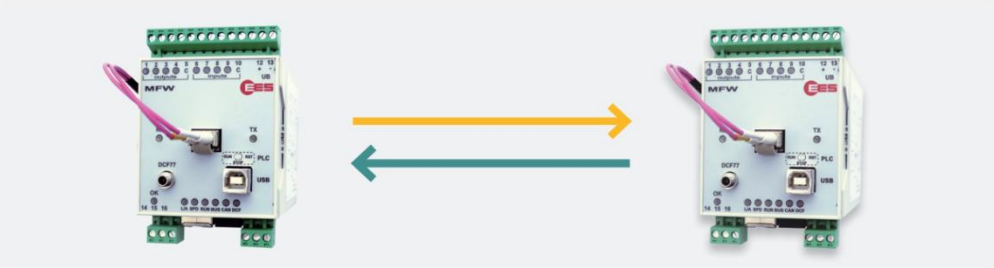
Range [km] = (budget [dB] - reserve [dB]) / fiber optic attenuation [dB/km]

The budget can never be fully utilized for the design of a transmission line; reserves must be kept for additional splices required for repairs, for example. The following table provides guide values for the range based on typical values. The actual range must be determined on the basis of the attenuation values of the components used (splitter, fiber optic cable, connector, number of splices, etc.)!

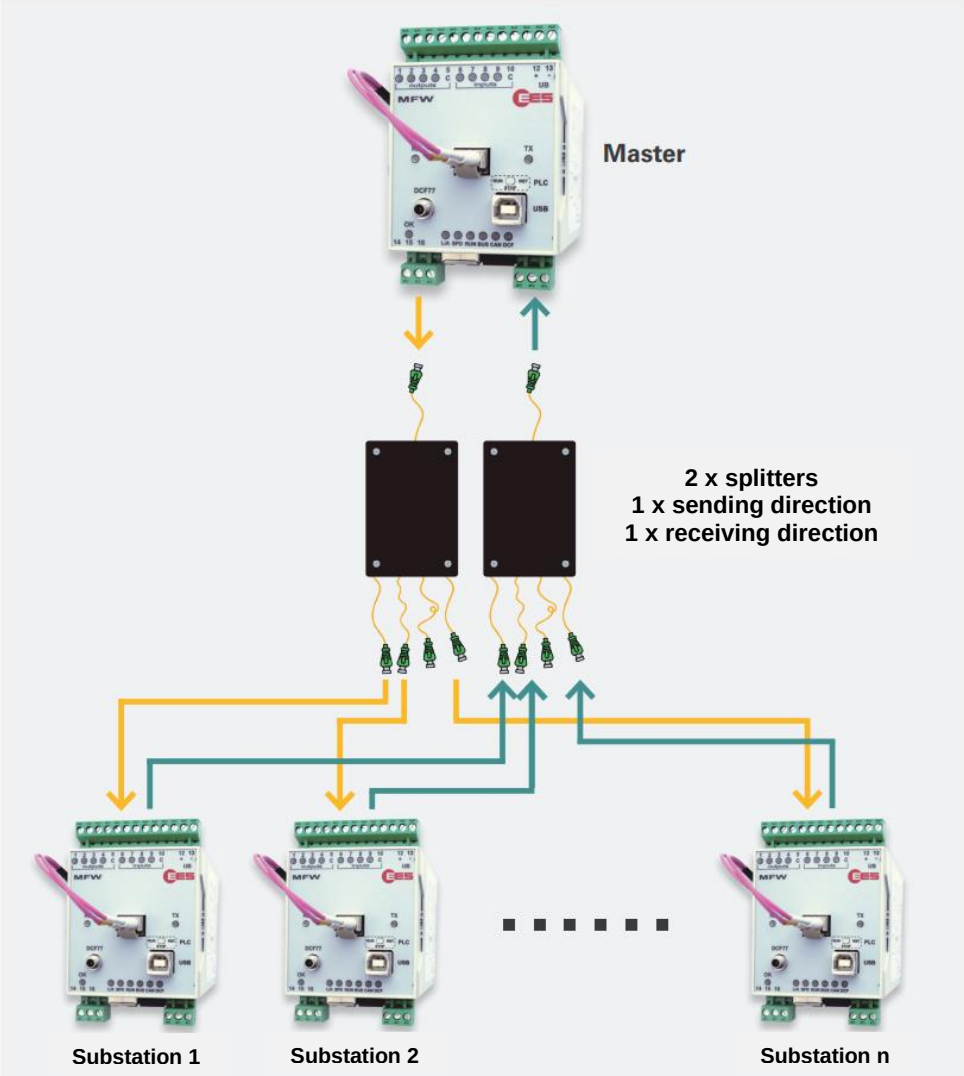
Optical fiber type Core/cladding diameter	Wave length	Budget min. / typ.	Typical optical fiber attenuation	Connector/ splice reserve	Range
Singlemode 9/125 µm	1310 nm	30 dB / 35 dB	0,4 dB / km	6 dB	60 km
Multimode 50/125 µm	1310 nm	10 dB / 18 dB	0,5 dB / km	4 dB	2 km

Types of transmission

Transmission can both take place as point-to-point transmission between the master and substation and as a point-to multipoint connection between a central unit (master) and up to 31 substations.



Principle of the bidirectional point-to-point transmission as a direct optical fiber connection.

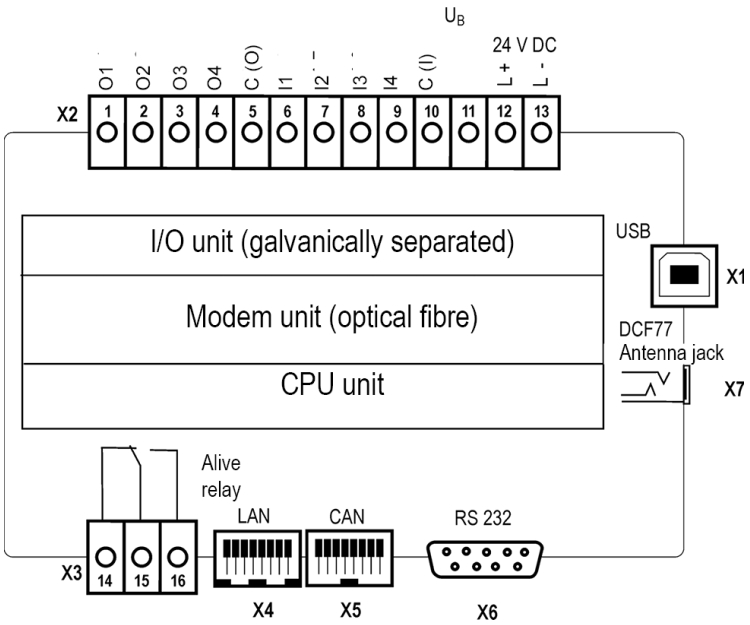


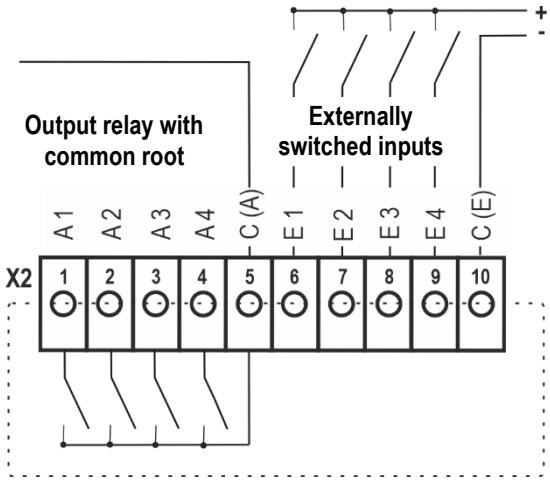
Principle of the bidirectional point to multipoint transmission under usage of 2 optical fiber splitters

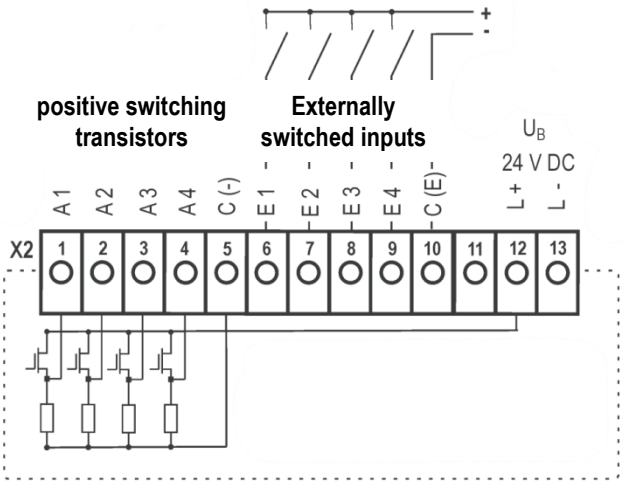
The diagram above shows the principle of fiber optic transmission between a master and up to 31 substations. The following criteria must be taken into account when selecting splitters:

1. Optical fiber type
2. Total attenuation of the splitter, the connecting elements and the fiber optic cable for the selected fiber optic type
3. Plug type
4. The number of connected substations

Terminal assignments

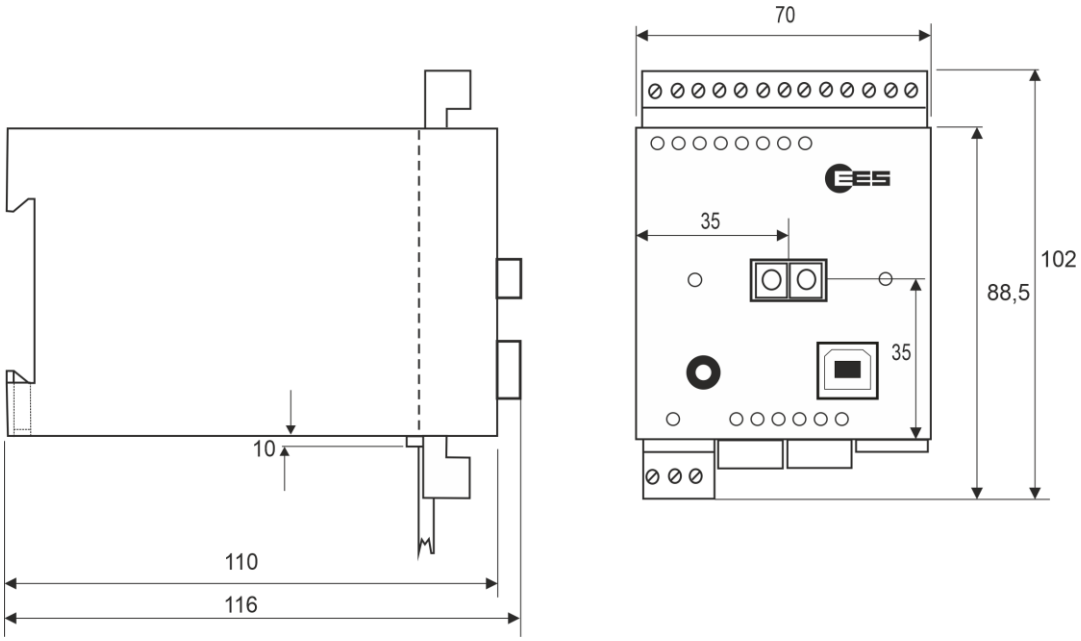






Wiring example of the inputs and outputs with output relay and output transistors

Dimensional drawings



Measurements in mm

Technical data

General data	
Mounting	on C-rail TS35 acc. to EN60715:2001-09
Housing / protection class	ABS / IP 40
Weight	approx. 320 g
Connection terminals	pluggable
Conductor cross-section rigid or flexible	
without ferrules	0,2 ... 2,5 mm^2
with ferrules	0,25 ... 2,5 mm^2
Operating and ambient temperature	-20 °C ... + 60 °C
Humidity	maximum 95 % non-condensing
Operating voltage	
Nominal operating voltage U_B	24 V DC
Operating voltage range	20 ... 32 V DC
Power consumption	approx. 3,5 W
Optical fiber	
Optical fiber connectors	2 type LC-duplex sockets acc. to norm IEC 61754-20
Signal delay master ➔ substation	
with relay outputs	< 10 ms
with transistor outputs	< 5 ms
Signal delay substation ➔ master	< n x 10 ms (n = number of substation on master)

Version for Singlemode-LWL @1310 nm

Budget minimum/typical with 9/125 µm-LWL	30 dB / 35 dB

Version for Multimode-LWL @1310nm

Budget minimal/typical with 50/125 µm-LWL	10 dB / 18 dB

Relay outputs

Contact load capacity of the relay outputs*[1]	
Minimum	1,2 V / 1 mA (suitable for controlling LEDs)
Maximum	250 V AC / 400 mA 250 V AC / 2 A (purely resistive load) 30 V DC / 2 A 110 V DC / 0,2 A 220 V DC / 0,1 A
Total current 230 V AC	8 A maximum (purely resistive load)
Galvanic isolation between	
Output and supply voltage	4 kV_{eff}

Transistor outputs

Type of transistor outputs	positive switching PNP transistors
Load capacity of the transistor outputs	100 mA maximum per output
Galvanic separation between output and supply voltage	none

Inputs

The inputs can be designed for different signal voltages US. The corresponding voltage is by the 23rd digit of the type designation (e.g. MF-L1S0L-G4E4R-DIA-B-BE-4).

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

Galvanic separation between Signal and supply voltage	4 kV_{eff}

EMC compatibility according to
EN 61000-6-2
EN 61000-6-4 + A1
EN 61000-4-2
EN 61000-4-3 + A1 + A2
EN 61000-4-4
EN 61000-4-5 + A1
EN 61000-4-6
EN 61000-4-29

*1 We will be happy to provide you with more detailed specifications on request.

Unless otherwise stated, 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.

The devices are developed and manufactured for use in the industrial sector in accordance with the EMC standard.

Subject to technical changes

Order descriptions

Singlemode 9/125 µm-LWL @1310 nm, connector LC-duplex according to IEC 61754-20

Master modules / Substation modules

Article number	Type	Module type / process coupling
97BLGGDNBBB4	MF-L1S0L-G4E4R-DIA-B-BB-4	Master 4 DI 24 V, 4 relay outputs
97BLGGDNBBE4	MF-L1S0L-G4E4R-DIA-B-BE-4	Master 4 DI 60 V, 4 relay outputs
97BLGGDNBBF4	MF-L1S0L-G4E4R-DIA-B-BF-4	Master 4 DI 110 V, 4 relay outputs
97BLGGDNBBJ4	MF-L1S0L-G4E4R-DIA-B-BJ-4	Master 4 DI 220 V, 4 relay outputs
97HLGGDNBBB4	UF- L1S0L-G4E4R-DIA-B-BB-4	US / 4 DI 24 V, 4 relay outputs
97HLGGDNBBE4	UF- L1S0L-G4E4R-DIA-B-BE-4	US / 4 DI 60 V, 4 relay outputs
97HLGGDNBBF4	UF- L1S0L-G4E4R-DIA-B-BF-4	US / 4 DI 110 V, 4 relay outputs
97HLGGDNBBJ4	UF- L1S0L-G4E4R-DIA-B-BJ-4	US / 4 DI 220 V, 4 relay outputs

Modules for multimode fibers or with transistor outputs on request.

Contact

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