

Modular telecontrol system for GPRS and network structures



→ Telecontrolling over public or private networks

- › Use of Ethernet/IP-structures: LAN (CAT-cables, fibre), WLAN, WAN (DSL, GPRS)
- › Integrated modems, symmetrical transmission behaviour
- › GPRS substations can economically be operated either by dynamic or fixed IP addresses or also in a VPN
- › Optimized data packets and integrated transmission volume counter
- › No IT-Server needed
- › Extremely low energy consumption of GPRS substations in low power technology
- › Data logger function with preprocessing of the measurements (e.g. average, minimal -and maximum values as well as counter differences)
- › Coupling possibilities to process control and visualization systems over standardised protocols (IEC 60870-5-101/104, Modbus RTU /-TCP)
- › Remote parameter setting and remote diagnosis over dial-up line and respectively LAN or WAN connection

→ Datasheet

*) EES was honoured for this MFW-product by the Innovation Award 2007 from the „Initiative of medium-sized companies“

MFW-NW-DB-UK-005

➔ **General system description of the MFW telecontrol family**

In the last couple of years IP based network techniques have established themselves also in the industrial area. There is often a request to use the existing network infrastructure also for transmission of plant conditions, measurements and counter values. For this formulation the approved MFW system was extended with the new network variant. With this variant also private and public networks can be used, in which the transmission media with the usual network technique (router, modems, media converter etc.) can be changed arbitrary and therefore flexibly adapted to heterogeneous networks. The following transmission medias are useable:

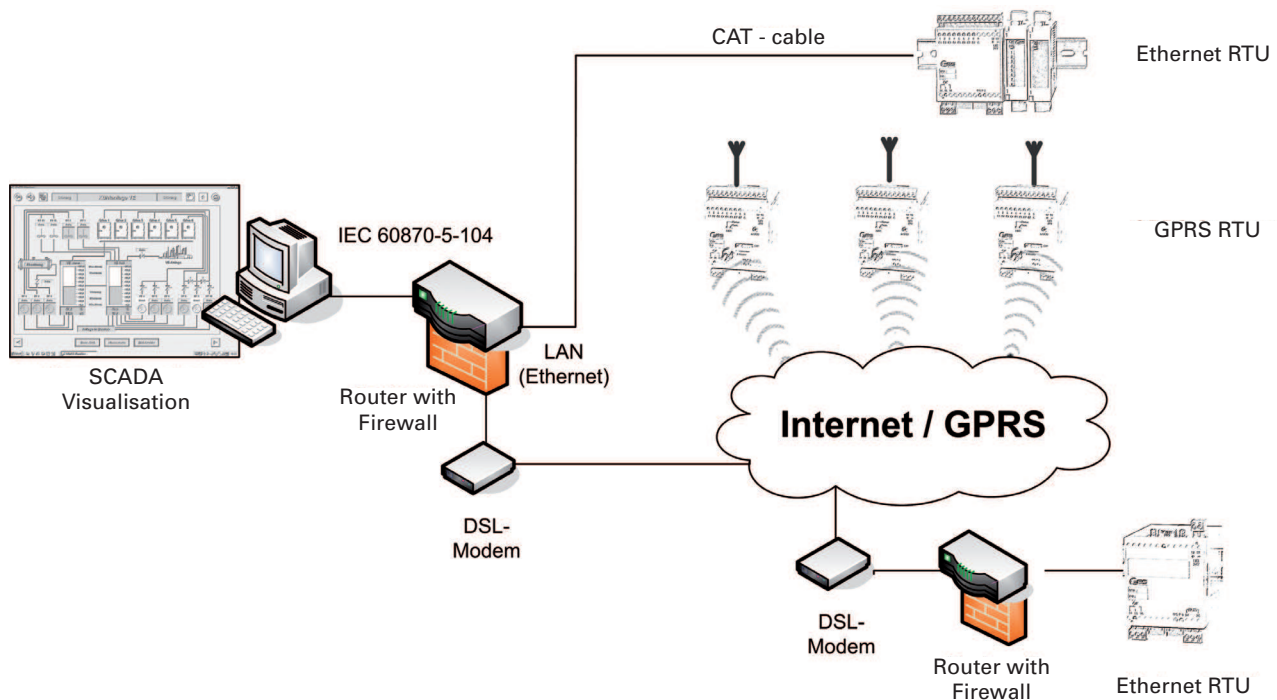
- LAN (CAT-cable, fibre)
- Wireless LAN
- DSL
- GPRS

➔ **Structure of a MFW-System for networks**

The network stations of the MFW can be operated in one of the two following variants:

- Stand-alone (decentralised peripheral station of a superior system)
or
- System integrated (bind in a master – substations- structure of a MFW system)

a) Use of a MFW-station as a stand-alone substation of a superior system

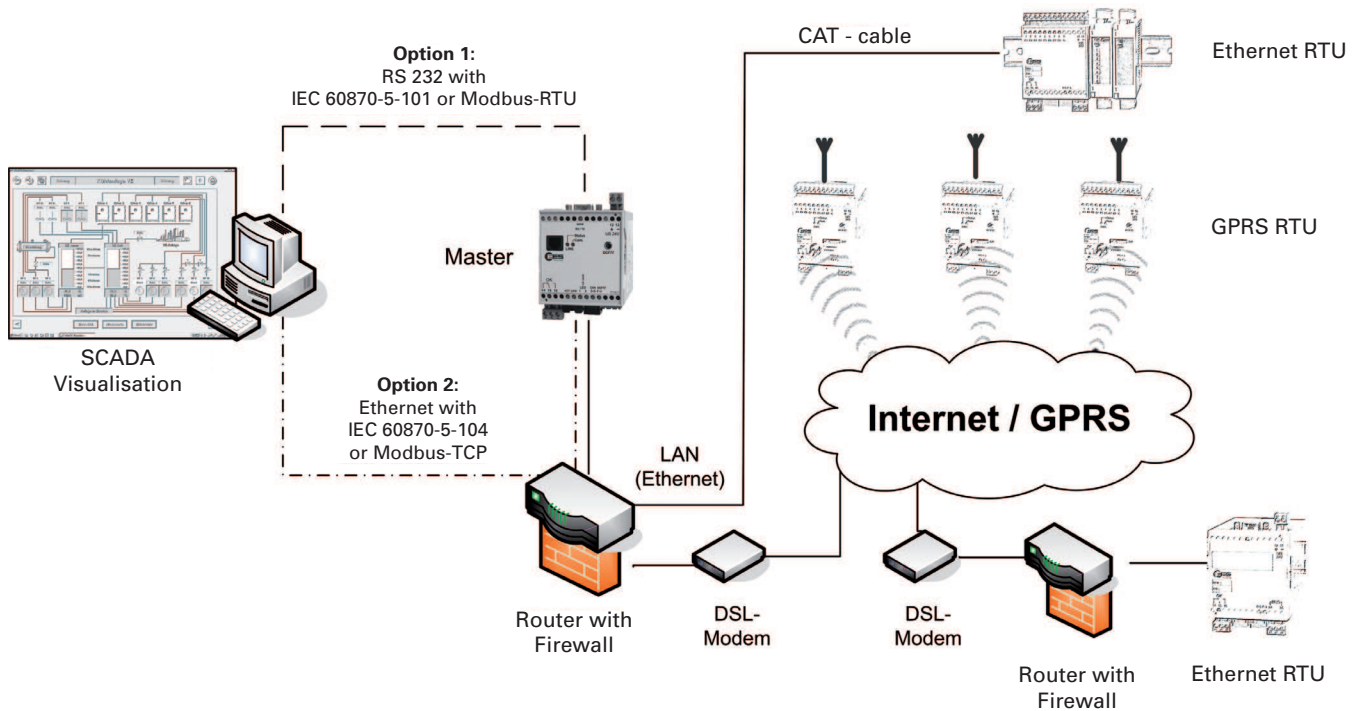


If the MFW-station is being operated as a stand-alone substation of a superior system, the data transmission to the SCADA system or PC is done by IEC 60870-5-104 directly over the communication media.

- The data exchange is done over the communication media directly between superior system and the MFW substation without use of a MFW master unit.
- The administration of the connection links including the failure diagnosis and –treatment must be taken over by the superior system
- The connection of arbitrary numerous RTUs to a host is possible



a) Integration of MFW substations in a MFW system structure



By this operation mode the communication on the transmission media occurs between master and substations within the MFW-system. The substations do not have a direct contact to the superior system, but communicate only with the MFW-master. The handover of values within the master (e.g. from the MFW-master to a SCADA system) is realised by a serial interface, an Ethernet interface, or by I/O modules attached to the master. In this operation mode the following elementary features are given:

- The MFW master does the administration of the communication links (e.g. address management und supervision of the transmission links)
- For the communication between master and superior system the protocol interfaces IEC 60870-5-101 / -104, Modbus-RTU or Modbus-TCP are useable.
- By use of the serial interface the master ensures a disjunction between substations and SCADA system
- The communication between master and substations is done by a volume optimised proprietary protocol. The used data volume is an important characteristic for GPRS transmission.
- At a master module with Ethernet interface (see drawing) a maximum of 31 substations can be connected. Master stations with GPRS-modem (direct GPRS – GPRS connection) can administrate 8 GPRS substations. If more substations are needed additional master stations can be used.



In the drawing above the transmission principle between the MFW-master module with network connection over Ethernet is shown. Master modules with internal GPRS modem do not need a router and no DSL modem for the communication of up to 8 GPRS substations.

→ Data transmission in heterogenous networks

In the following example on the next page different useable transmission medias are shown.

LAN (Ethernet)

In the simplest case the master and a substation are connected over a Crosslink cable. The MFW basic modules can just, however, be connected with a switch or router and therefore integrated into the available network over CAT cables. A firm IP-address is assigned to all MFW stations in the local network. The master module manages the address data of the substations in the integrated „Link Allocator“.

LAN (optical fibre)

The Ethernet connection can be converted under use of customary media converters on an optical fibre connection in rough disturbing contaminated surroundings, e.g. transformer stations, or to bridge larger distances.

Wireless LAN

By means of a router with wireless functionability wireless transmission lines can also be included.

WAN (DSL)

The transition of the local network to the Internet is carried out via a DSL modem attached at the router. Therefore a fixed IP of the DSL access, available from outside is needed. The router converts the accessible IP-address from outside to the internal local IP-address with the help of port numbers. To protect the local network the router should be equipped with a firewall like in all Internet transitions.

WAN (GPRS)

GPRS is the packet oriented transmission service of the GSM mobile radio. The combination between DSL, Internet and GPRS is realized by the respective providers. IP-addresses are generally allocated dynamically in the GPRS net. The construction of a VPN (Virtual private Network) initiated by the GPRS provider or the use of fixed IP-addresses is also possible with a MFW substation. The MFW system is conceived for the symmetrical communication. This means that the GPRS substations not only cyclical or event-driven establish connection to the master, itself is also able to set-up an active connection, e.g. for carrying out orders or set values. If the symmetrical connection is used, we recommend to use a master with callback function. These have an additional modem and ensure the reliable and cost-saving rebuilding of the connection by a special method after short-time disturbances of the GPRS net or the loss of the IP-address of the substation. Since the master also manages the IP-addresses of the GPRS substations, the additional IT server required in different systems is obsolete.



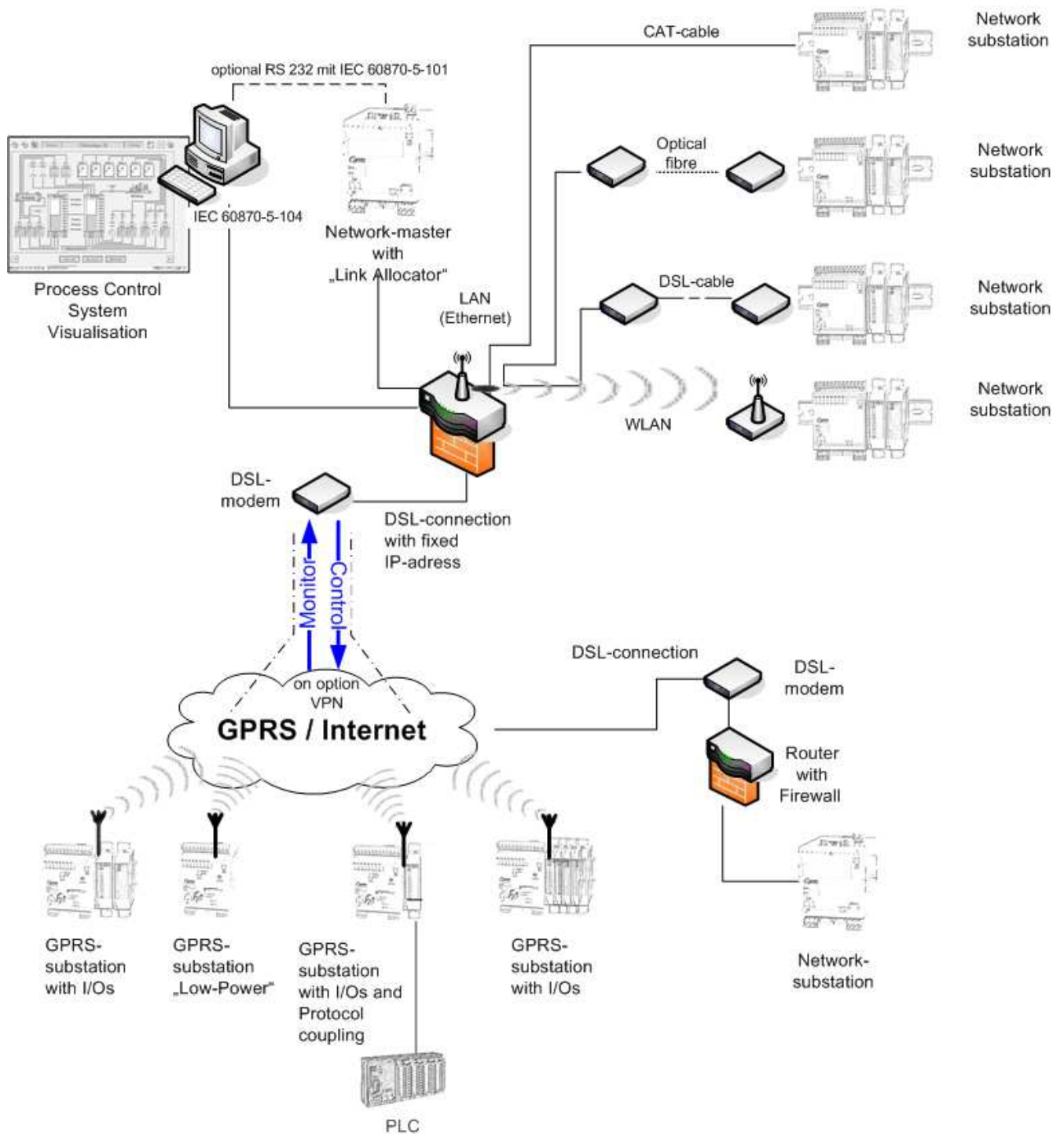
The visibility of IP addresses in heterogenous networks is an important criteria for the choice of SIM-cards. Detailed information can be taken from our operation manual.



Despite these advantages the GPRS data transmission isn't more economical as a modem connection in every case. The application possibilities and the cost performance ratio are determined by many factors, such as data volume, package sizes, rate structure and not last the GPRS coverage of the respective network provider. On alternative we are able to offer you the MFW-dial-up system for analog land lines or GSM nets. Furthermore information can be found in the separate datasheet " MFW dial-up telecontrol system".



→ Principle diagram



→ Archive function

MFW network stations can provide additionally to the process image 2 optional data memories, whose values also can be transmitted over the telecontrol links:

Measured values archive –	time cycled storage of the preprocessed message, counter- and measured values with time stamp
Event archive –	event triggered storage of messages, counter or measured values with time stamp

→ Soft-PLC

Optionally basic modules can provide an integrated PLC functionality.

The Soft-PLC of the MFW is programmed acc. to the international standard IEC 61131-3. By implementing the popular CoDeSys run time system (Controller Development System) extensive libraries for measuring and controlling processes are available for the user.

The realised concept enables the Soft-PLC the access to in- and outputs, archives, diagnosis information and system functions of the MFW. The PLC-Programm can be done in one or more selectable of the IEC 61131-3-standard designated languages:

- Instruction list
- Structured text
- Sequential function chart
- Function block diagram
- Continuous function chart
- Ladder diagram

As amendment to the IEC language standard defined modules and extensive libraries the MFW provides additional functions for solutions of typical telecontrol requirements, e.g. media dependent diagnosis (e.g. field reception strength) or the dispatch and reception of SMS in modules with GSM/GPRS-modem.

Furthermore information about the PLC functionality of the MFW can be taken from the separate MFW functional description of the "Programmable logic controller".

→ Energy saving function in GPRS substations

The GPRS substations in low power design have an energy management in common to reduce the energy demand at parameterisable times by switching the operation mode between communication and energy-saving. This function enables through the extremely reduced power consumption the supply over solar power or battery packs with maintenance intervals of several years.

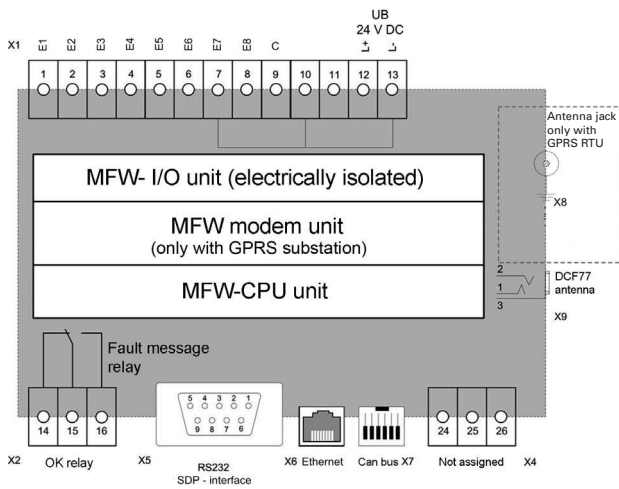


Elaborate information about these functions can be found in the functional description in the data logging devices.

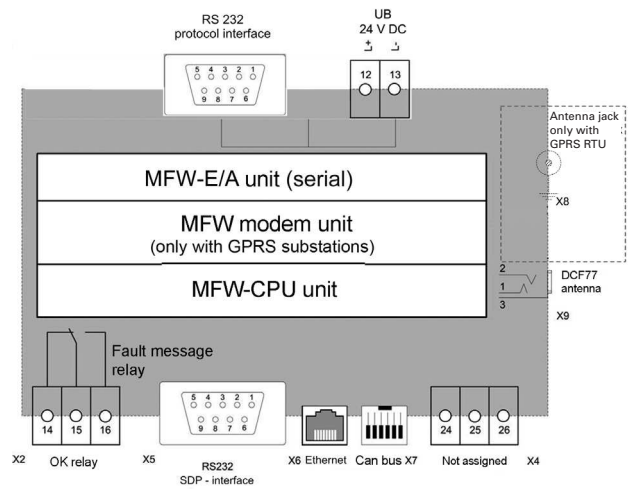


Terminal assignments

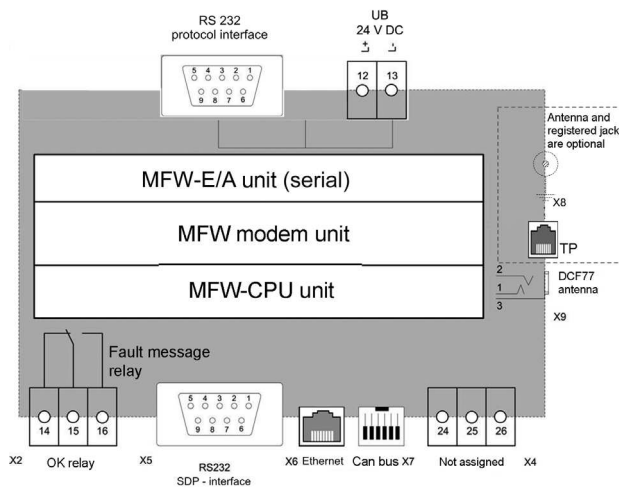
Substation with 8 DI



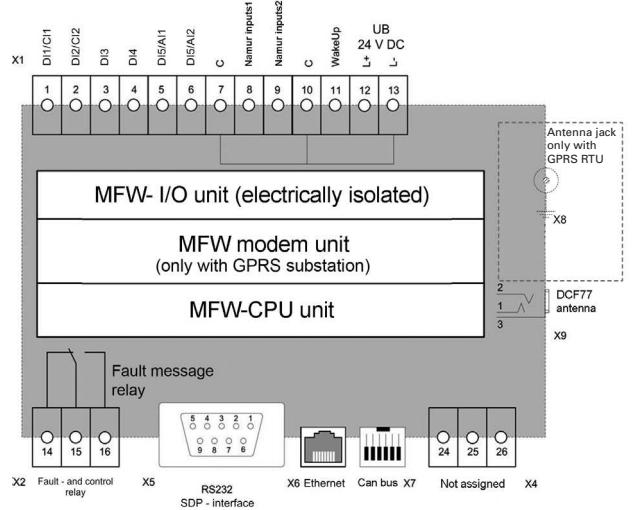
Substation with serial interface



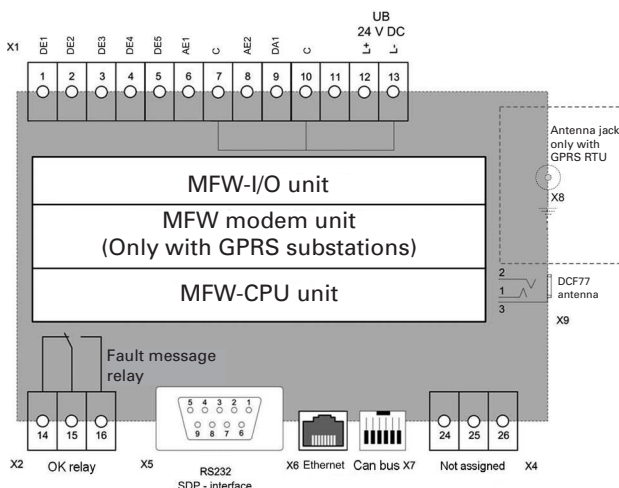
Master and stand-alone Ethernet substation



Substation low-power



Substation with 5 DI, 2 AE and 1 DA



EES On option the two Namur inputs of the low power substation can be replaced by 2 digital inputs.

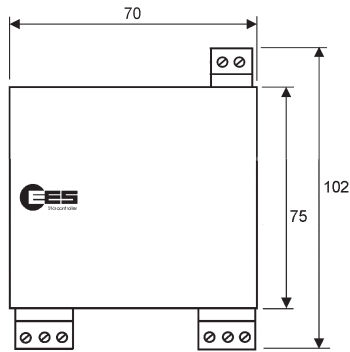
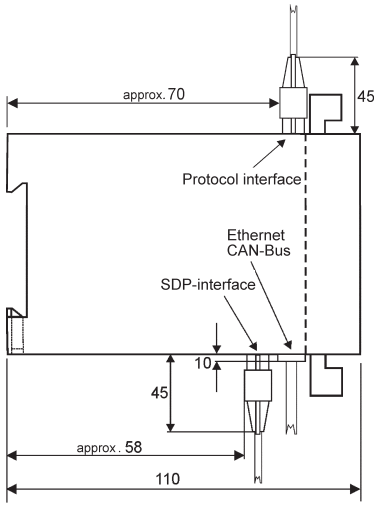


The common GND of the inputs „C“ is equipotential with „L-“ of the supply voltage.

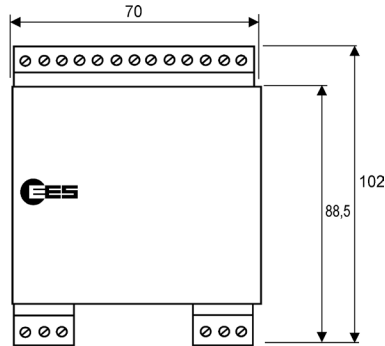
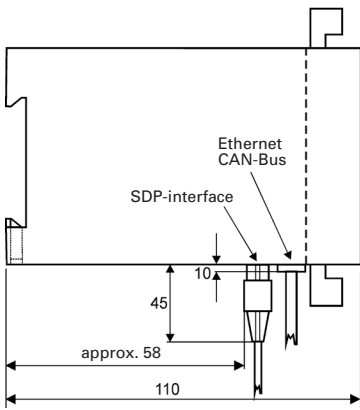


D01 is a plus switching PNP transistor

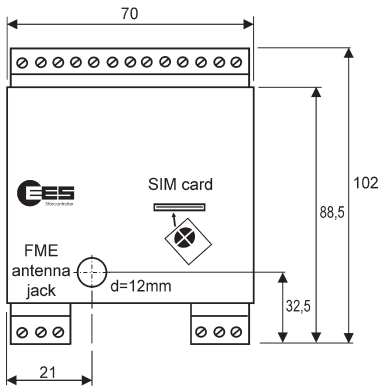
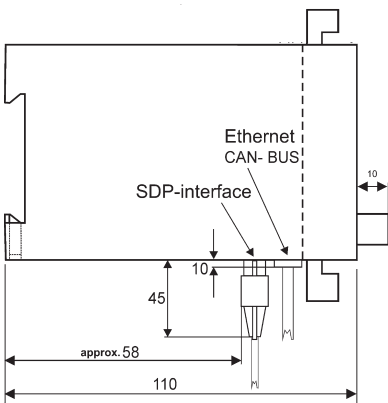
➔ Dimensional drawings



Basic module with Ethernet-interface and optional protocol interface



Basic module with Ethernet-interface and 8 DI



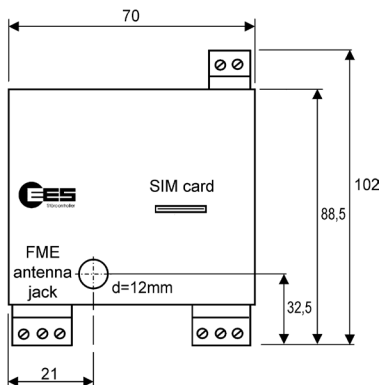
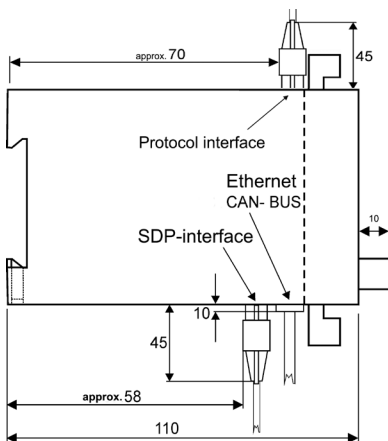
Basic module with GSM/GPRS-modem and protocol interface



Please take into account to provide enough space for the aerials.

Aerial set A: - overall depth 165 mm

Aerial set B: - overall depth 180 mm



Basic module with GSM/GPRS-modem and protocol interface



→ **System requirements**

Master module with Ethernet-connection	Network router 10/100 Mbit
Change-over to fibre	Ethernet / Fibre converter
Change-over to WLAN	WLAN Access Point
Change-over to DSL	DSL-connection with fixed IP and DSL modem
Ethernet substation	Network 10/100 Mbit
GPRS substation	GPRS-capable SIM-card*
Master module with GPRS-modem	GPRS-capable SIM-card with fixed IP-adress*
GPRS substation	GPRS-capable SIM-card with fixed IP-adress*

* available GPRS-net and sufficient GSM-field reception

→ **Technical data**

General data	
Mounting	DIN-rail acc. to 60715:2001-09
Housing / protection class	Plastic / IP 40
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
Operation and ambient temperature	-20°C ... +60°C except
Master module with analog callback modem	0°C ... +60°C
Operating voltage	
Nominal operating voltage U _b	24V DC
Operating voltage range	
Basic module	10 ... 32 V DC
with expansion modules	20 ... 32 V DC
Master module	
Power consumption	approx. 2,5 W
Ethernet-connection	10 Base-T
with landline „call-back“ Modem	
galvanic isolation between dial-up and supply voltage	0,5 kV _{eff}
Ethernet substation (standard variant)	
Power consumption	approx. 2,5 W
Ethernet connection	10-Base T
Range with twisted-pair cable	100m
GPRS-substation (standard variant)	
Power consumption	approx. 2,5 W

→ Technical data

Relay contacts

Load on relay contacts*1

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	max. 8 A (pure ohmic load)

Digital inputs at modules in standard variant

Input voltage U_s	
Rated voltage	24 V AC/DC
Maximum voltage	48 V
Voltage for high-state (DC)	> 15 V bzw. < -15 V
Voltage for high-state (AC)	> 19 V _{eff}
Voltage for low-state (DC)	< 9 V bzw. > -9 V
Voltage for low-state (AC)	< 6 V _{eff}
Input resistance	10 KΩ
Max. count rate	10 Hz
Min. pulse width / pause	50 ms
Galvanic isolation between signal and supply voltage	4 kV _{eff}

GPRS-substations in low power variant

Power consumption in communication mode (basic module only)	approx. 2,5 W
Current consumption in energy-saving mode	< 2 mA
Operating voltage limits *3	
Range 1 > 9,6 V	„normal“ operation mode
Range 2 < 9,6 V	no communication mode longer available, however still archiving (Return to “normal” operation mode, when operating voltage > 10,8 V)
Range 3 < 4,5 V	no archiving , real-time clock runs, no data loss
Range 4 < 2,5 V	Loss of archives, break-down of real time clock
Potential separation	Equipotential between inputs and supply voltage
Ramp-up time	parameterisable 0 ... 255 s
Tracking time	parameterisable 0 ... 65.535 s
Buffer time of the internal battery pack	at least 12 h
Charging time of the internal battery pack	maximum 72 h

Digital inputs at low power modules

Input voltage	
Rated voltage	24 V DC
Maximum voltage	48 V
Minimum voltage for high-state	7,0 V
Maximum voltage for low-state	2,2 V
Input resistance	
E1 ... E4	approx. 100 kΩ
E5 ... E6	approx. 33 kΩ
Max. count rate	10 Hz
Min. pulse width / pause	50 ms



→ **Technical data**

Namur inputs

According to the standards	EN50227 (DIN 19234) or IEC60947-5-6
Switching threshold	
Low	< 1,2 mA
High	> 2,1 mA
No-load voltage	8,2 V DC
Internal resistance	1 kΩ
Error status (Error bit set)	Current < 0.3 mA – open circuit > 6 mA – short circuit
Max. count rate	25 Hz
Min. pulse width / pause	20 ms

Analog inputs

Measuring range	0 ... 10 V
Resolution	10 Bit
Deviation	< 0.5% from end value of measuring range
Input resistance	70 kΩ

Wake-up input

Input voltage	
Rated voltage	24 V DC
Maximum voltage	48 V DC
Minimum voltage for high-state	7.0 V DC
Maximum voltage for low-state	2.2 V DC
Input resistance approx.	100 kΩ
Minimum pulse width	1 s

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

*2 We recommend not to run pulse inputs with alternating voltage, but only with direct voltage.

*3 The internal battery buffers range 3

If not otherwise noted, the given information for alternating voltage are referring to a sinusoidal alternating voltage with a frequency of 50/60 Hz.

For specification of the expansion modules see separate data sheet.

The right to make technical changes is reserved

→ **Order identification of systemintegrated stations**

Master module for data over Ethernet connection

Article-No	Type	Callback-Modem / Process coupling / Options
97BXNGCPABX0	MF-XNGPR-G8DAR-AKP-A-BX-0	without / AKP-Protocol + 8 Relay outputs
97GXNGCPABX0	MP-XNGPR-G8DAR-AKP-A-BX-0	without / AKP-Protocol + 8 Relay outputs / Archiving + PLC
97EXN1HPABX0	MD-XNGPR-1P10X-AKP-A-BX-0	without / IEC 60870-5-101/104 / Archiving
97EAN1HPABX0	MD-ANGPR-1P10X-AKP-A-BX-0	Analog / IEC 60870-5-101/104 / Archiving
97EIN1HPABX0	MD-INGPR-1P10X-AKP-A-BX-0	ISDN / IEC 60870-5-101/104 / Archiving
97EGN1HPABX0	MD-GNGPR-1P10X-AKP-A-BX-0	GSM / IEC 60870-5-101/104 Archiving

Master module for data exchange over GPRS-Modem

Article-No	Type	Process coupling / Options
97EGG1HPABX0	MD-GGGPR-1P10X-AKP-A-BX-0	IEC 60870-5-101/104 / Archiving
97EGG1JPABX0	MD-GGGPR-1PMIP-AKP-A-BX-0	Modbus-RTU/TCP / Archiving
97GGG1HPABX0	MP-GGGPR-1P10X-AKP-A-BX-0	IEC 60870-5-101/104 / Archiving + PLC

Substation module for data exchange over Ethernet-connection

Article-No	Type	Process coupling / Options
97HXNGANABBO	UF-XNGPR-G8DIX-DIA-A-BB-0	8 DI, 24 V
97KXNGANABBO	UD-XNGPR-G8DIX-DIA-A-BB-0	8 DI, 24 V / Archiving
97MXNGANABBO	UP-XNGPR-G8DIX-DIA-A-BB-0	8 DI, 24 V / Archiving + PLC
97KXN1JNABX0	UD-XNGPR-1PMIP-DIA-A-BX-0	Modbus-RTU/TCP / Archiving

Substation module for data exchange over GPRS-Modem

Article-No	Type	Process coupling / Options
97KGGGANABBO	UD-GGGPR-G8DIX-DIA-A-BB-0	8 DI, 24 V / Archiving
97MGGGANABBO	UP-GGGPR-G8DIX-DIA-A-BB-0	8 DI, 24 V / Archiving + PLC
97KGGGNABBO	UD-GGGPR-G6D2A-DIA-A-BB-0	5 DI, 24 V; 1 DA, 24 V; 2 AE (0 ... 20 mA) / Archiving
97MGGGNABBO	UP-GGGPR-G6D2A-DIA-A-BB-0	5 DI, 24 V; 1 DA, 24 V; 2 AE (0 ... 20 mA) / Archiving + PLC
97KGG1BNABX0	UD-GGGPR-1P512-DIA-A-BX-0	3964R/RK512 / Archiving
97KGG1JNABX0	UD-GGGPR-1PMIP-DIA-A-BX-0	Modbus-RTU/TCP / Archiving

Low-Power-Substation module mit GPRS-Modem

Article-No	Type	Process coupling / Options
97LGGGLNABBO	UL-GGGPR-G2N6D-DIA-A-BB-0	6 DI (2 useable as AI), 2 Namur / Archiving + energy saving function

→ Order identification of stand-alone stations

Data exchange over Ethernet or RS232

Article-No	Type	Protocol / Process coupling / Options
97EXN1XHABX0	MD-XNGPR-1P10X-AKP-A-BX-0	IEC 60870-5-101/104 / over I/O-Module / Archiving

Data exchange over internal GPRS-Modem

Article-No	Type	Protocol / Process coupling / Options
97KGGGANABBO	UD-GG104-G8DIX-DIA-A-BB-0	IEC 60870-5-104 and 8 DI, 24 V / Archiving

→ Expansion modules

More informationen can be taken from the separate datasheet.

→ Accessories

Expansion modules, power supplies, buffer chargers, solar power supplies, batteries and battery packs, antennas, parameterising cable.

KONTAKTA OSS GÄRNA FÖR MER INFORMATION

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