Intelligence for
distribution systems
Automation concepts

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Sophisticated functionality, a high level of performance and a long service life are features of all SAE's telecontrol and substation automation solutions. To meet different requirements for monitoring, control and automation of supply infrastructures and industrial systems, we developed the series5: a product family with a common technical basis and specifically practice-orientated core services.

Intelligence for distribution systems
Automation concepts

Effects of the energy revolution on the distribution system

The distributed feed-in of renewable energies has changed conditions in the supply networks. The widespread feeding in of power from photovoltaic, wind and biogas plants is making it more and more complicated to ensure stable power systems with reliable voltage and frequency bands. In the high and medium voltage (HV/MV) transmission networks, bottleneck management and transformer tap control, for example, provide necessary mechanisms for adjustment. But the effects of distributed suppliers are considerable precisely in the distribution networks, because the meshed, usually heterogeneous structures typically lack regulation algorithms and control variables such as adjustable transformers. The cables, overhead lines and their switchgear have not been planned or designed for these new energy flows. So the network equipment can come under great loads, which reduce its service life. Without additional sensor systems and data collection, these states remain largely unknown. The resulting costs caused by premature replacement of equipment and reduced remuneration for power system use owing to longer downtimes can be considerable. In addition to the obligation for voltage stability, power system remuneration is coupled to the power system quality provided using the Qfactor under the German Ordinance on Incentive Regulation. An improvement in availability and shortening of outage times would be in the economic interests of the supply companies for this reason alone.

Distributed intelligence is the solution

Rapid expansion of the power systems is hardly possible and furthermore extremely cost-intensive. Intelligent networks are a suitable solution, as the expansion can be carried out selectively and at an appropriate time. About 500,000 transformer stations are currently in use in Germany in the form of connection, client or local network stations.

Experts estimate that approximately 10-15% of these stations would have to be incorporated into an intelligent network to achieve significant controllability. Due to the large quantities, this requires considerable effort and expenditure and must be well planned since the additional information from the networks often reaches control systems which are already at their capacity limits with the integration of the distributed suppliers. A suitable technological and economical telecontrol solution must therefore:

- Be able to accurately pre-select and process information from the different measurement unit systems for the control centre;
- take into account the space conditions depending on the type of station (compact station or accessible station) and in case of doubt, the dimensions must be suitably compact;
- be quick and easy to integrate into the existing structures in order to reduce the total expenditure.

The stations should be categorised into different classes as regards their varying significance in safeguarding network stability:

1. Stations with telemonitoring without remote control
2. Stations with telemonitoring & remote control
3. Stations with telemonitoring, remote control & protection

These problems posed must also be solved for existing as well as new systems.

1 Stations with telemonitoring without remote control

The simplest form of monitoring for transformer stations is the incorporation of earth fault and short circuit indicators. The units help to localise faults in the network reliably. In the case of distributed generation and the resulting bidirectional power flow, the use of units with additional direction display is recommended.
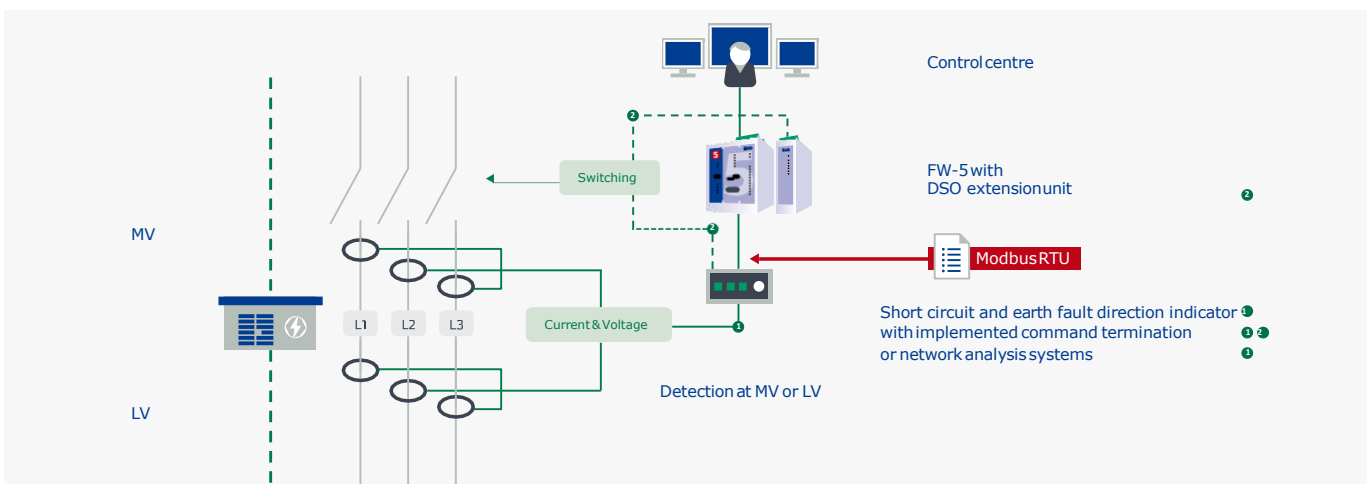
Measurement with short circuit and earth fault direction indicators or network analysis systems; different switching options.
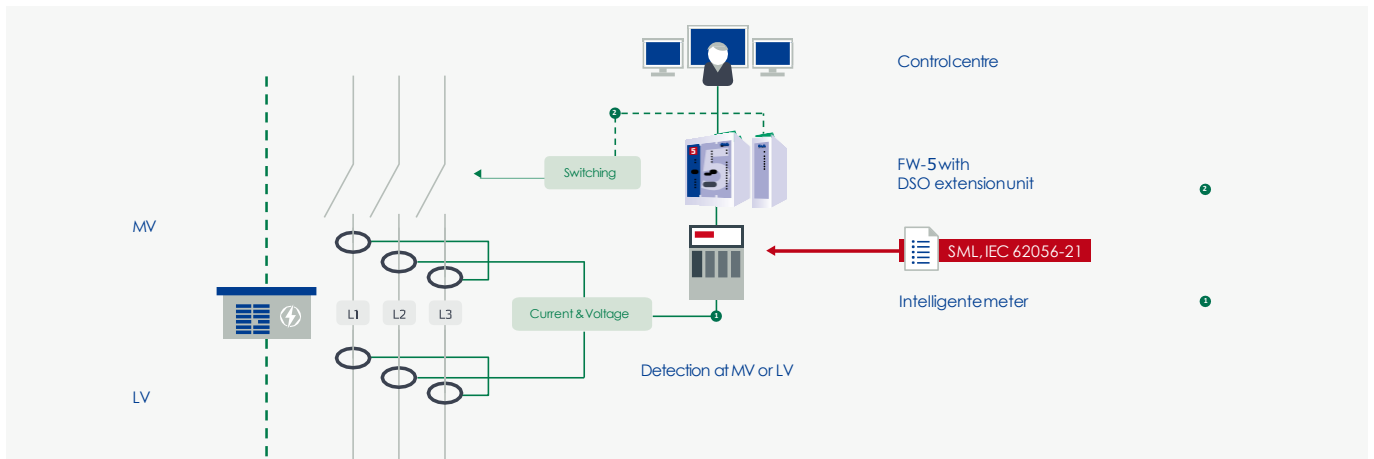
Connection to intelligent meters. Optional switching via DSO expansion module.

Network monitoring

Different systems are available for widespread network monitoring, which also provide network figures in addition to simply fault detection, such as for example:

Load current monitor
- Detection of phase currents L_1, L_2, L_3
- Average values of the last 15 minutes
- Non-return pointer function
- Detection of unbalance current I_E

Voltage monitor
- Detection of phase voltages U_{LL}
- Displacement voltage U_{NE}

Monitoring of other power system characteristic values:
- P, Q, S, cos φ, f

Detection of power flow direction:
- Forwards/backwards, A/B

Technical realisation

There are different approaches:
- Pick-off of currents and voltages on the MV side
- Pick-off of currents and voltages on the LV side

In new network stations, an intelligent short circuit and earth fault direction indicator is usually already installed ex-factory. Readings can be taken and values derived by the voltage information and split-core current transformers or sensors. The retrofitting of taps on the medium voltage side is complex on existing network stations. Measurements can be taken far more easily on the low voltage side. Based on the values measured, the telecontrol system can then calculate the medium voltage value. This task can be solved very easily and conveniently using the calculation value function which is integrated in the configuration tool setIT, since no PLC programming is required. Actuating variables such as primary and secondary transformer voltages can be entered into the station as variables from the web server, setIT or the control centre.

Four-quadrant meters are built into connection stations in particular in part. These also provide the meter reading and
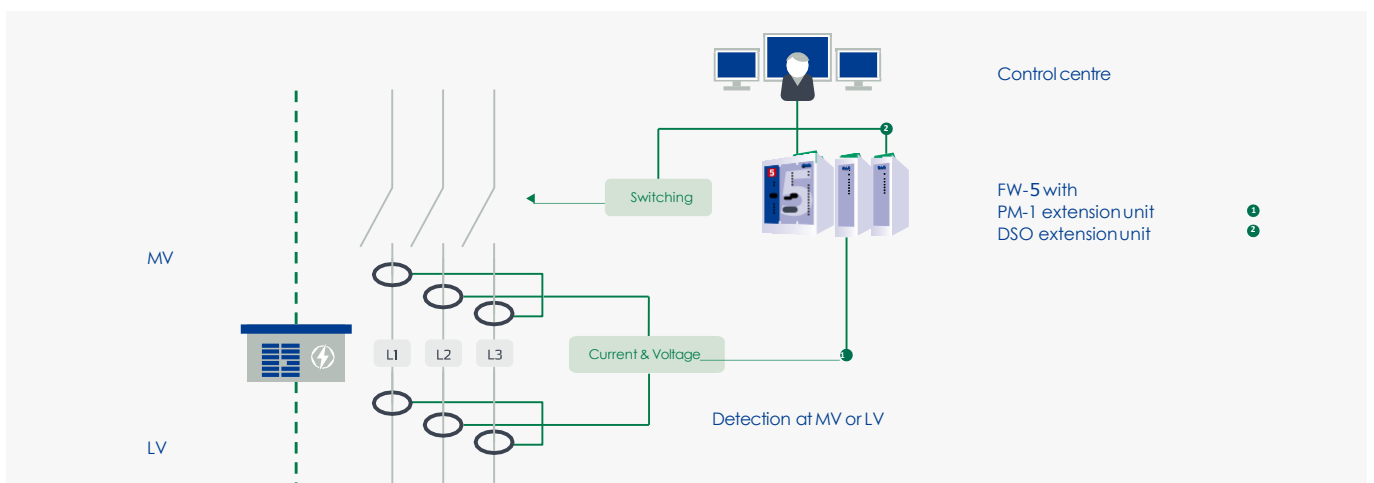
Everything from a single source PM-1 for measurements, DSO expansion module for secure switching.

all required parameters over a serial interface. The SML protocol of the Sym² meter or IEC 62056-21 (formerly IEC 1107) is provided as the protocol. The values are sent in the OBIS data model and are predefined in setIT.

In addition to the reading of values via external systems, an output measuring module is now available as an expansion module for the net-line FW-5 and FW-5-GATE. The PM-1 module has four current and three voltage inputs and calculates the derivable values. It is therefore a space-saving and low-cost alternative to external measurement devices and network analysis systems.

As it is not practical to transmit all the data provided by the measurement systems to the control centre as well, a selection and optimisation of the relevant data (e.g. by the hysteresis for measured values) can be carried out in the

Combined know-how
We were already able to establish links to numerous systems available on the market, e.g.:
- Horstmann ComPass B, B_n, B_s, B_p
- Kries IKI 50 Grid Inspector
- A.Eberle EOR 3D, NRG 96, ESM NA 400, ESM ENA 7000
- Janitza UMG 103, 104, 604, 96

Templates for automatic adaptation of relevant capacities are created in our setIT configuration software for the most popular systems. Modbus RTU is used for coupling between the measurement systems and the telecontrol system.

telecontrol station. Processes can also be logged here in freely selectable measurement periods. These can then be transmitted directly to the control centre or read out on site for evaluation at a later stage. For all types of station with telemonitoring, the compact net-line FW-5 compact system is recommended which comes in different basic forms and with expansion capabilities.
The telecontrol station and all interposed telecontrol interfaces manage the values of the connected components in the process image. All the information from the measurement points can be read out and displayed in diagnostics using the setIT configuration software or the web server and stored for more precise evaluations in the station archive.

2 Stations with monitoring and remote control

In local network stations with remote control, a DSO module (DSO = Distribution System Operator) is also required as an addition for the FW-5 system. The DSO-1 or DSO-2 modules allow secure command termination in networks by means of:
- 1/n monitoring
- Measuring circuit test and runtime monitoring
- Optional cascading for command groups

The command relays are 1.5- or 2-pole and managed by means of release relays. Activation can take place in single or double commands. This assures the secure control of servomotors, whereby faulty network segments can be quickly removed from the network and the availability of intact sections can be swiftly restored. Even some of the aforementioned short circuit and earth fault direction indicators and network analysis systems have already implemented the command termination options.

Excursus - Wide range control
In addition to the option to activate faulty network segments, some system operators use the collected measured values for an initial form of automated load optimisation. Since the local network transformers are not usually adjustable, the overall balance of a network segment is considered and the corresponding provisions are taken on the superimposed UW. Significant efficiency improvements can already be achieved in practice with this global control option.

Recommendation in regard to UPS

It is useful to equip stations at central positions in the network with uninterruptable power supplies which, in the event of a power cut, still allow interventions for a certain period of time, such as for example:
- Notification of network errors
- Targeted switching
- Defined "reboot"

Due to the high starting currents of the switching devices, the battery power must be sufficiently powerful in order to be able to perform the desired number of switching operations. Depending on the geographical location and design of the station (compact, accessible, etc.), the system may reach extremely high temperatures which can have a negative effect on the service life of the batteries. It may therefore be useful to equip the system with air-conditioning and/or switchgear cabinet heating to assure the safe operation of the battery.

3 Stations with monitoring, remote control and protection

The most comprehensive form of automation is found in the use of protective equipment in local network stations. In addition to the functionalities of the aforementioned systems, these also provide the autonomous protection of equipment. We can recommend our very own SG-50 combination protective equipment for protection. The SG-50 is available in different variants: With four current inputs for simple IOC protection, and with additional voltage inputs for more advanced functions. The protection functions of the system can (even subsequently) be configured from the well-structured software.
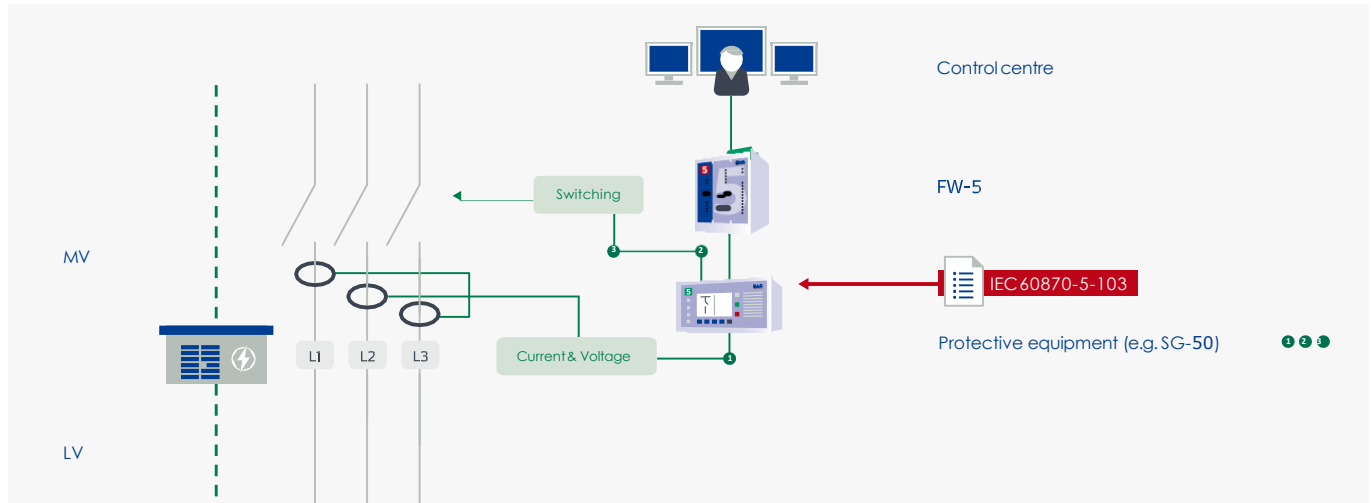
Measuring, switching, protecting – using the SG-50 combination protective equipment.

General information about the solutions

Housing

The aforementioned components are typically mounted in a wall enclosure. The telecontrol system, the transmission modem, the uninterruptible power supply and the transfer terminal are housed in the switchgear cabinet. To prevent heat building up in the summer, the dimensions of the housing should not be chosen too small. If no separate room is available in the local network station for the secondary technology, one clever solution is to use magnets to attach the switchgear cabinet.

Data transmission paths

If no separate transmission routes are available to the local network stations, the transmission is completed more and more frequently via DSL/GPRS/UMTS/LTE; as a rule via TCP/IP-based transmission routes with the IEC 870-5-104 protocol. The requirements made of protection against unauthorised access when these communication paths are used are justifiably very strict! Depending on the present infrastructure, it is advisable to use the following safety features with regard to BDEW-Whitepaper and ISMS:

- User administration
- Certificates (for https and ftps)
- Secure protocols
- End-to-End VPN encryption
  - IPsec
  - OpenVPN
- Firewalls

SAE's own M2G-1 is of interest for data transmission over GPRS. The modem is configured with setIT and the connection set-up phases can be analysed accurately with the diagnostics capabilities of the latest setIT generation.

Wide range control solution

In the Rittal plastic housing with Phoenix Contact power supply and FW-5-GATE in the 24-Volt variant. M2G-1 GPRS modem for secure data transmission with IPsec VPN encryption and hardware-based decoupling via the serial V24 interface.
The measurement is realised by a Janitza UMG-103. To ensure a straight-forward connection, terminal strips already labelled are provided in the bottom part of the box.

Special feature:
The SAE GPRS modem M2G-1 ensure the straightforward communication configuration in setIT. No additional configuration software is therefore required.
The Reset button can be used to locally switch the modem and station to volt-free, thereby forcing a restart; e.g. to re-establish the GPRS connection.
For a quick and straightforward installation, the box is attached to the side of the switching station using magnets.

Extended intervention option

In the Rittal metal switchgear cabinet with FW-5, the Dr. Neuhaus Tainy EMOD modem, the Phoenix Contact UPS and a 12-Ah battery (also by Phoenix Contact).

Special feature:
The combination of UPS and the powerful battery allows switching operations to be performed within a certain timeframe after or during a possible error.

Monitoring and switching

In the compact metal switchgear cabinet by Rittal with FW-5-GATE-230, output measuring module PM-1, DSO-1 for secure switching, Lucom modem for data transmission and transfer terminal strips in the bottom part of the box.

Special feature:
The 230-Volt variant of the FW-5-GATE provides the power supply of the modem and communication modules, so that no separate 230V-AC power supply is required.

Recommendations and options
For stations without remote control, an uninterruptible power supply can be implemented simply and cost-effectively with the 230V-AC variant of the FW-5 system. The battery is connected directly to the FW-5, and charging circuit and 24V-DC for modem and signal voltage are supplied by the FW-5.

The remote I/O (TBUS-T & TBUS-R) is used to connect separated expansion modules. This provides the option to control several faults via one box.

Even special requirements are possible

The net-line FWG-50 has been designed according to the requirements of one of our clients, specifically for the automation of 10 kV plants. The telecontrol unit is composed of standard components of the series5 or series5+ series of products. A special feature of this system is its accommodation in a metal housing as a rack drawer. Its 8.8 cm height and 60 cm depth has been adapted to restricted space conditions in 10 kV plants and allows the unit to be accommodated inside the plant.

In addition to the telecontrol unit, the housing also has space for a communication component such as a TETRA radio modem, DSL modem, VFT dedicated line modem or another type of interface. Local earth fault/short circuit direction indicators or protective equipment can be incorporated via an RS-485 interface.

All the supply and communication connections necessary for operation lead out of the front.

The required status information is displayed on the front panel using LEDs. Process integration takes place by means of a Harting connector attached to the side.

The telecontrol unit communicates with higher level devices by means of the standardised telecontrol protocols IEC 60870-5-101 or -104.

The FWG-50 also has the following functions:

- Detection of faults in the medium voltage station and UPS
- Teleswitching of 3 load interrupter switches by 1.5-pole double commands
- 1/n command termination with switch position check-back signal by means of double-point information
- Detection of short circuit indicators of the 3 outgoing circuits
- Resetting of short circuit indicators
- Two measured values e.g. for transformer temperature
- Standardised terminals for flexible replacement

Additional components

If the system voltage fails, an uninterruptible power supply (UPS) manufactured by Schneider supplies auxiliary power for a certain period. This capacitive 24V-DC UPS is used in the same housing shape in the rack to the left of the telecontrol unit. The load interrupter switches are teleswitched via DSO modules with 1/n monitoring (counterpart to DSO cards) by the servo-motors of the switching station.

net-line BCU-50
Robust substation automation

Robustness across the board

Bay station controllers in the electrical power supply must withstand special environmental requirements, especially when the station automation is used in high-voltage equipment, strongly vibrating or shock generating system components as well as environments with aseismic risk. BCU 50 sets the standards here. The modular bay station controller in the robust rack is designed for longlasting reliability, the greatest ease of use and fast integration with high IT security according to the BDEW whitepaper.

In different installation versions the system offers high flexibility through a wide selection of communication interfaces and highly resilient input/output modules. It is designed for use in locations such as power stations and medium voltage stations "G", high-voltage switchgears "H" as well as for signal and field connections "f" and high-voltage connections "h" according to IEC 61850-3.

Typical application areas

- Station and bay controller in medium and high-voltage switchgears
- Gateway and communication router between station buses, field bus and control systems
- Monitoring and control unit for the utilities, waste management and manufacturing industry

Brief profile net-line BCU-50

Extremely robust field device for modular assembly with interfaces and input/output cards in 14 slots. Direct linking of process signals, commands, metered values, measurands, set points, transformer taps, 1/n command termination and flexible data routing within the network. Cascadable up to 16 module frames. Up to 6 separate Ethernet network segments with VPN tunnel from the station, integrated switches each with 4x10/100BaseTx or fibre optic 100BaseTx with IEC 61850 station bus, IEC 60870-5-104 control centre coupling, DNP3, SYM² meter connection. Up to 4 serial interfaces with IEC 60870-5-10x protocol, DNP3, IEC 60870-5-103 protective device coupling, IEC 62056-21 meter connection or external field devices with field buses, Modbus and MPI.

19" and wall-mounting.

net-line BCU-50 hardware

The modular system can be expanded according to individual requirements and has impressive functionality while being simple to use:

- CPU series5+ with 400 MIPS, up to 512 MB memory
- High performance for integration complying with BDEW whitepaper
- Large selection of expansion modules
  - Communication modules
  - Signal/command modules
  - Measurement/set point modules
- Compatible with expansion modules of previous versions
- LAN integration of up to 6 separate network segments
- High noise immunity, high isolation class
- Up to 16 racks cascadable to a logical station

Communication channels

A particular strength of the series5 products lies in the large selection of communication possibilities and the redundant backup of routes, stations or process data. Links can be made via numerous protocols directly to the control system or in a contro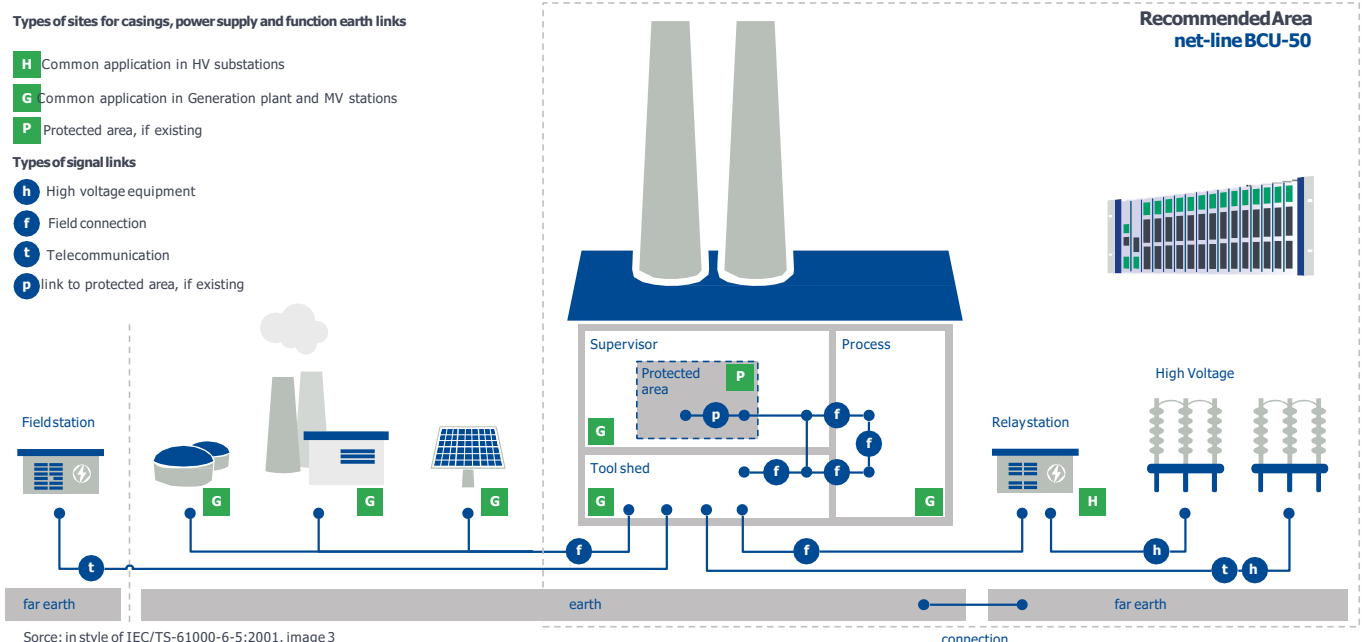lled manner with telecontrol interfaces. A connection of the BCU-50 to the IED (Intelligent Electronic Device) as protective devices in the IEC61850 network is of course possible. From setIT V5.004 the BCU-50 can be used itself as an IED, e.g. as a remote IO controller.

61850
approved

Voltage and shock-resistant

The BCU-50 has been consistently developed towards the product standard DIN EN 61850-3 (communication system for automation in the electric power supply) for the highest class of high voltage switchgears "H" and connections "h" which also cover the other areas. Therefore, the voltage resistance of 2.5 kV AC/3.5 kV DC and 5 kV surge also conforms to the VW3 class according to IEC 60870-2-1.

With a vibration resistance of 10 m/s^2 according to DIN EN 60068-2-6 and a shock resistance of 15 g (150 m/s^2) and a continuous shock load of 10 g with a stress immunity of 6000 shocks in accordance with IEC 60068-2-27, the system is able to withstand a good deal. In order to withstand the mechanical stresses in areas exposed to the risk of earthquake as well, the system can also tolerate seismic vibrations up to 3.5 mm in accordance with EN 60255-21-3 (measuring relays and protection equipment) in each axis.

Types of sites for casings, power supply and function earth links

- **H** Common application in HV substations
- **G** Common application in Generation plant and MV stations
- **P** Protected area, if existing

Types of signal links

- **h** High voltage equipment
- **f** Field connection
- **t** Telecommunication
- **p** link to protected area, if existing

Sorce: in style of IEC/TS-61000-6-5:2001, image 3

Intuitive parameterisation:

Convenient integration of complex features:

- Syntax checks to prevent input errors
- Fault analysis with link to error source
- Practical copy functions
- Context-sensitive online help functions
- Calculation values and logic functions
- Extensive diagnostic functions
- Integrated project documentation

net-line FW-50 software

Our innovative and well-established setIT parameterisation software allows exceptionally fast setup. The integrated codeIT soft PLC offers additional flexibility and allows many kinds of PLC programs to be implemented. A link to the OPC server can be realised by connectIT. The perfect solutions for station control systems, telecontrol technology or plant automation can be provided in this way.

set IT   code IT

Modules in IEC 61850-3 typetest

CPU modules

CPU-5C   RISC processor core, 400 MIP @ 400 MHz, MMU, 512 MB memory, encryption engine, 1.5 kV AC isolation für USB & LAN

Power supplies

SV-6-48   24 / 48 V DC ±15%, 1.5 kV AC isolation input/output overload, dyn. undervoltage control with switch interlock

SV-6-60   as SV-6-48 but 24 / 60 V DC ±15%

SV-6-110   80...132 V DC, 2.5 kV AC isolation input/output overload, undervoltage control with switch interlock below 93 V

SV-6-220   170...255 V DC, 2.5 kV AC isolation input/output overload, undervoltage control with switch interlock below 180 V

Information inputs

16OE-6   16 signal inputs for connections with circuit breakers wide range inputs 24...60 V DC / 110 V DC / 220 V DC

switching threshold ON at 80%, 5 kV surge voltage signal/ logic (S/L) according to IEC 61850-3 (h) & EN 60870-2-1 class VW3

EVU2-I   checkback indication card for command termination with EVU-2-O wide range inputs 18...72 V DC/60...110 V DC/220 V DC, common roots

EVU-X   Utility expansion card for cascading a utility command group over several module frames, release and locking via closed ring, ½ card format

Relay and command outputs

12RA-1   12 power relays 220 V DC, 1000 VA on, 5 A cont., 30 A 0.5 s 5 kV surge voltage signal/logic (S/L), protection class II

EVU2-O-1   1.5-pole command termination with 1-of-n monitoring, 16 single/8 double commands, command and release relays, individual coil resistance, tolerance, post command lag time, operating delay suppression, ext. measurement circuit: 100 - 20 kΩ

EVU2-O-2   2-pole command termination with 1-of-n monitoring, 8 single/4 double commands, command and release relays, individual coil resistance, tolerance, post command lag time, operating delay suppression, ext. measurement circuit: 100 - 20 kΩ

EVU2-O-3   as EVU-2-O-1 with external measurement circuit: 1 kΩ - 100 kΩ

EVU2-O-4   as EVU-2-O-2 with external measurement circuit: 1 kΩ - 100 kΩ

Measurand inputs

8AE16-3   8 analogue inputs, 16 bit, multi-range ±20/±10/±5±2.5 mA per channel overflow/underrun ± 110%, isolated, insul. 3 kV DC

Set point outputs

8AA16   8 analogue outputs 16 bit, isolation 3 kV DC, selection by channel 0(4)...20 mA or 0...10 V

Interfaces

SWI1-6   Switch FO 100BaseFx, mono-mode SC/ST mirroring and 10/100BaseTx, RJ-45, auto neg., auto-MDIX, isolation 1.5 kV AC

SWI1-7   as SWI1-6 FO single-mode SC/ST up to 32 km, port mirroring

RS-485-2   EIA-485 symmetrical, max. 115 kBit/s, 1.2 km

RS-485-3   EIA-485 symmetrical, max. 115 kBit/s, 0.8 km auto-keying

RS-422-2   EIA-422 symmetrical, max. 115 kBit/s, 1.2 km

General FW-50 system cards*

Power supplies

SV-6-24   24 V DC ±25%, no galv. isolation overload, dyn. undervoltage control with switch interlock

Optocoupler inputs

16OE-5   16 wide range inputs 18...72 V DC/60...130 V DC/150...240 V DC

16IE-5   16 fast wide range inputs from 250 µs 18...72 V DC/48...130 V DC

CNT1-3   8 counters 10 kHz, 8 messages 24 V DC

CNT1-5   8 counters 1 kHz, 8 messages 18...72 V DC/48...130 V DC

8OE-4-110   8 optocoupler inputs 110 V AC/DC

8OE-4-230   8 optocoupler inputs 230 V AC/220 V DC

Relay outputs

16RA-1   16 relays 230 V AC, 1 A, common root

16RA-3   16 relays 250 V AC, 1 A, isolated by channel

16OA-3-1   16 FET outputs 250 V, 130 mA, isolated by channel

16OA-3-2   16 FET outputs 100 V, 320 mA, isolated by channel

Combination and special cards

OERA-5   8 optocoupler inputs 18...72 V DC, acc. to root 8 relay outputs 230 V AC, 1 A, common root

Interfaces • Dedicated line

SWI1-5   4-port Ethernet switch with 10/100BaseTx, 4 * RJ-45, port mirroring auto negotiation, auto-MDIX, isolation 1.5 kV AC

SWI2-1   additional LAN segment over internal USB connection 4-fold RJ-45 Ethernet Switch as SWI-1-5

SWI2-2   additional LAN segment over internal USB connection glass fibre/FO and 1-way Ethernet Switch as SWI-1-6

SWI2-3   as SWI2-2 FO single-mode SC/ST up to 32 km, port mirroring

BBM-1   Baseband max. 19.2 kbit/s, 10 km, up to 8 subscriber

WT12   WT modem, R&TTE, FSK 1.2 kBit/s, max. 30 km, up to 17 subscriber

WT96   WT comp., 9.6 kBit/s, 2-/4-wire max. 20 km, up to 17 subscriber

V24-2   EIA/RS-232, max. 57.6 kBit/s, point-to-point

V24-3   RS-232 redundancy multipoint-point, max. 115 kBit/s

V24-4   RJ-45 acc. to ETSI EN 392-300-5, max. 115 kBit/s, point-to-point

Interfaces • Switched line

WM336-3   PSTN modem up to 33.6 kBit/s (V.34/V42.bis), isol. 1.5 kV AC

WM336-4   PSTN modem up to 33.6 kBit/s (V.34/V42.bis), isolation 3 kV

GSM-2   GSM/GPRS Quad-Band, 9600 Bit/s /115kBit/s (V.32/V.110)

Isolation resistance 2.5 kV AC signal/logic acc. to IEC 60870-2-1 VW3 except where indicated otherwise.

Isolation 5 kV surge voltage signal/ground via rack

*FW-50 system cards can be used, but may reduce strength

Technical data: net-line BCU-50

Design	Modular bay station controller for substation automation, cascadable V2a/aluminium rack with 14 slots
Configuration	Example: Max. input/output expansion 14 I/O slots (up to 224 dedicated I/O), 2 Ethernet 10/100BaseTx auto-MDIX Example: max. communication 6 switches integrated of 4 RJ-45 10/100 MBit/s or FO ST/SC 100 Mbit/s + RJ45 4 serial interfaces, 8 E/A slots (up to 128 dedicated I/O)
Input/output	Selection of 50 plug-in cards for: Single-/double-point, transformer step indications, measurands and integrated totals, single/double commands (1.5/2-pole), command termination, 1 of n monitoring, set-point values, integrated total outputs
Protocols	IEC 61850 ·IED and protective device coupling IEC 60870-5-101 ·telecontrol technology, station control technology IEC 60870-5-103 ·protective device coupling IEC 60870-5-104 ·TCP/IP coupling to control centre DNP3 server ·serial (IP from setIT V5.4) IEC 62056-21 ·meter connection (IEC 1107) SML ·SyM² meter connection via Ethernet DSfG ·Digital interface for gas measuring devices Modbus RTU/TCP ·master/slave, fieldbus MPI/3964R/RK512 SNMP ·network management, NTP/SNTP/DCF clock synchronisation VPN tunnel · IPsec [IKEv1/IKEv2] , OpenVPN from setIT V5.4
PLC programming	IEC 61131-3 compatible via codeIT, 128 kb program memory
CPU-5C series 5+	RISC processor core, 400 MIP @ 400 MHz, MMU, watchdog, real-time clock 512 MB memory (256 MB RAM, 256 MB flash) 4 Mb SDRAM, encryption engine
Memory expansion:	SDHC card up to 8 GB optional, 1 GB up to setIT V5.4
Real-time clock	max. error ±20 ppm over entire Temperature range with maintenance-free buffer, summer/winter time changeover, leap year correction
Status displays	CPU: 12 LEDs in front panel, green, red I/O cards: Card error, status LED of process data (binary) interfaces: Send and momentary contact signals depending on card type
Operational controls	PLC switch in front panel RUN/STOP USB pushbutton for config./backup/recovery function
Programming interface	Ethernet LAN 10/100BaseTx, auto-MDIX, USB device, USB 2.0 host 12 MBit/s (configuration/archive via memory stick)
Supply voltage	24-48 VDC / 24-60 VDC / 110 VDC / 220 VDC, max. 40 W Power-Fail management, failure bypass min. 50 ms, monitoring of supply voltage (lockout below 85%) and overload redundant supply with separate feed optional
Electrical Safety	Protection class I, clearance/creepage dist. acc. EN 60255-27, overvoltage cat. III 5 kV surge voltage 3.5 kV DC test voltage acc. to Class VW3 EN 60870-2-1
Standards	EMC immunity: IEC 61850-3 (H/h), EN 60255-26, EN 61000-4-2, /-3, /-4, /-5, /-6, /-8, /-9, /-16, /-17, /-18, /-29 EMC transient emissions: IEC 61850-3, EN 55022 /CISPR22 device class A Vibration: EN 60870-2-2, EN 60255-21-1, IEC 60068-2-6 1 g Shock: EN 60870-2-2, EN 60255-21-2, IEC 60068-2-27 15 g 11 ms /2-29 10g 6 ms Earthquake: EN 60870-2-2, EN 60255-21-3 3.5 mm 1 g Environment: IEC 61850-3, IEC 60068-2-1, /-2, /-30, /-78, EN 60721-3-3 class 3C1 3S1
Housing	BCU-50 rack, metal, IP30, dimensions 432 x 193 x 135 mm (WxHxD)
Mounting	19" rack, wall mount, 19" SC with local control in conjunction with
Terminals	MSTB screw-type terminal or Combicon spring-type terminal, 0.2...2.5 mm2
Environment	−20° ...+60°C, others on request, relative humidity < 95% without condensation

Product variants & accessories

BCU-50
14 slots
224 digital I/O*, 112 analogue I/O*
6 LAN segments*

BCU-50-W
as BCU-50 with wall-mounting
(T = 165 mm)

BCU-50-SC in preparation
BCU-50 with reverse mounting 19"
frame, terminals at the back, local
operator terminal via 10" monitor

Cable clamping tray BCU-50
Cable strain relief (H + 37 mm)

* Max. values only apply to limited extent, as some extensions use identical resources.

net-line FW-50
scalable telecontrol system

Outstanding performance on limited space

The net-line FW-50 modular telecontrol system provides powerful solutions for telecontrol, station control and automation applications. With its compact size and the performance of the series 5+ range of products, it is made for extremely simple use and fast integration, but ensures high IT-security complying with BDEW Whitepaper due to a comprehensive set-up.

The RTU offers a high degree of flexibility in three different module frames, thanks to the large selection of plug-in communication interfaces and input and output modules. In this way, the FW-50 can be used as a simple communication router or as a telecontrol station with small, medium or large I/O capacity. The system can be installed in any infrastructure thanks to the choice of DIN rail, wall or rear wall mounting and the 19" mounting bracket.

Typical fields of use

- Station and bay controller
  in MV and HV switching stations with bay or power system control technology
- Gateway and communication router
  between station buses, field bus and control systems
- Monitoring and control device
  for utilities, waste disposal and industrial sectors
- Data acquisition and communication system
  in transport and infrastructure applications

net-line FW-50 overview

Scalable field device for modular assembly with interfaces and input/output cards at 4, 7 or 14 I/O slots. Direct contact of process signals, commands, metered values, measurands, set points, transformer taps, 1-of-n command termination and flexible data routing/cross connection within the network. Cascadable up to 16 module frames. Up to 6 separate Ethernet network segments, integrated switches each with 4 x 10/100BaseTx or fibre optic+ 10/100BaseTx with IEC 61850 station bus, IEC 60870-5-104 control centre link, SYM² meter read out. Up to 4 serial interfaces with IEC 60870-5-10x protocol, IEC 60870-5-103 protective equipment, IEC 62056-21 meter link or external field devices with DSfG, field bus, Profibus DP, Modbus and MPI.
DIN rail, wall and rear wall mounting.

net-line FW-50 hardware

The modular system can be expanded according to individual requirements and has impressive functionality while being simple to use:

- CPU series 5+ with 400 MIPS, up to 512 MB memory
- High performance for integration complying with BDEW Whitepaper IT-security
- Large selection of expansion modules
  - Communication modules
  - Signal/command modules
  - Measurement/set point modules
- Compatible with expansion modules of previous versions
- LAN integration up to 6 separate network segments
- High noise immunity, high insulation class
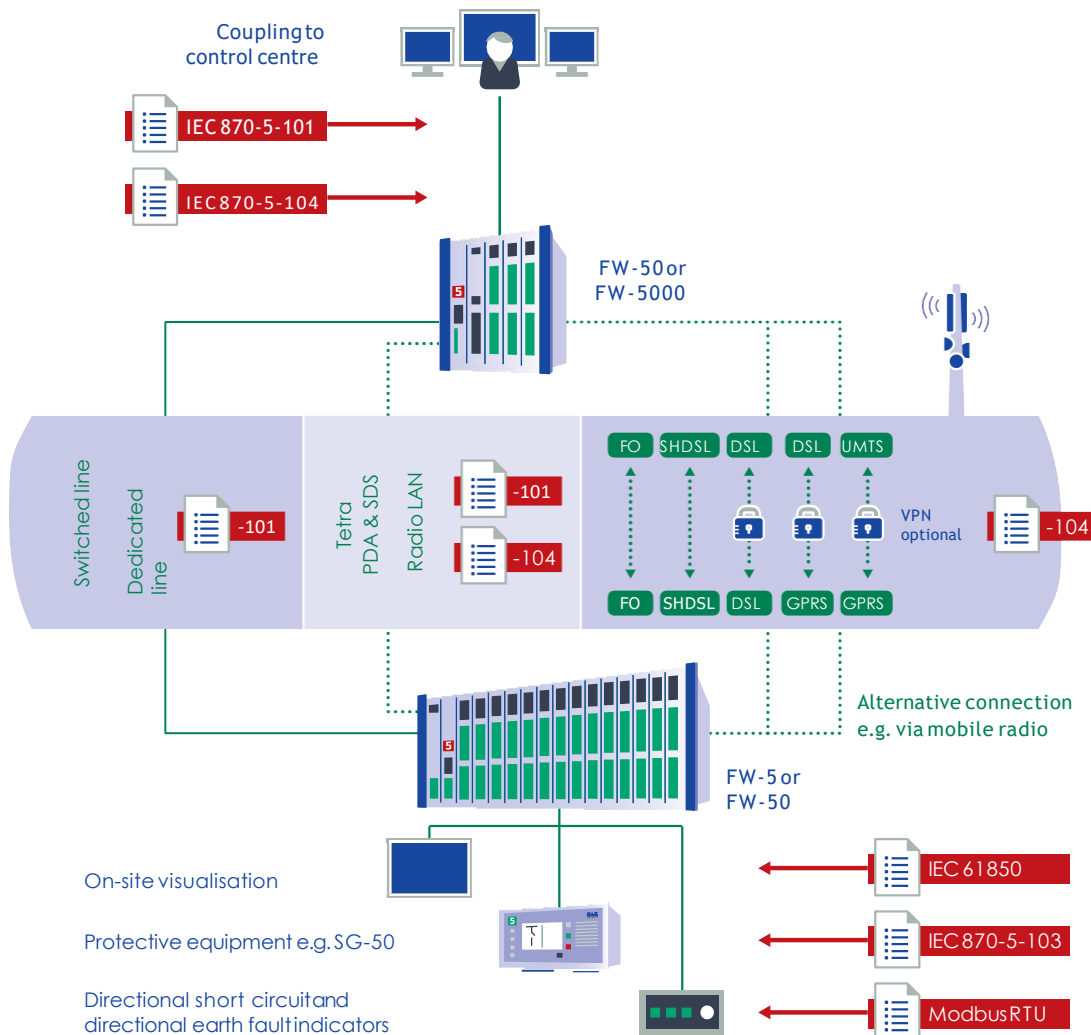- Cascadable up to 16 racks to form a logic station

Ideal handling

All components can be accessed and pulled out from the front. The operating state can be assessed quickly via the status LEDs.

- High speed download, secure even via the internet
- Memory stick for rapid setup or updates
- Backup of configuration, system and archives on SD card allows fast replacement of hardware
- Archive memory expansion up to 8 GB via SD card
- Diagnostics and download via browser
- Area roll-out due to optional address allocation in browser

Communication routes

A particular strength of the series 5 lies in the large selection of communication possibilities and the redundant backup of routes, stations or process points.

Links can be realised via numerous protocols directly to the control system or in a controlled manner with an interconnected telecontrol master station.

Coupling to control centre

IEC 870-5-101

IEC 870-5-104

FW-50 or FW-5000

Switched line — Dedicated line — -101

Tetra PDA & SDS Radio LAN — -101 / -104

FO SHDSL DSL DSL UMTS

VPN optional — -104

FO SHDSL DSL GPRS GPRS

Alternative connection e.g. via mobile radio

FW-5 or FW-50

On-site visualisation

Protective equipment e.g. SG-50

Directional short circuit and directional earth fault indicators

IEC 61850

IEC 870-5-103

Modbus RTU

net-line FW-50 software

Our innovative and well-established setIT parameterisation software allows exceptionally fast setup. The integrated codeIT soft PLC offers additional flexibility and allows many kinds of PLC programs to be implemented. A link to the OPC server can be realised by connectIT. The perfect solutions for station control systems, telecontrol technology or plant automation can be provided in this way.

Intuitive parameterisation:

Convenient integration of complex features:

- Syntax checks to prevent input errors
- Fault analysis by click and link to inaccurate entry
- Practical copy functions
- Context-sensitive online help
- Calculation values and logic functions
- Extensive diagnostic features
- Integrated project documentation

set IT   code IT   connect IT

Module communication

Dedicated line

SWI1-5	4-port Ethernet switch 10/100BaseTx, 4 * RJ-45, port mirroring auto negotiation, auto-MDIX, insulation 2.5 kV to VW2
SWI1-6	FO/optical fibre and 2-port Ethernet switch, port mirroring 100BaseFx duplex SC/ST, insulation 5 kV to VW3 IEC 870-2-1 10/100BaseTx, RJ-45, auto neg., auto-MDIX, insulation VW2
SWI1-7	same as SWI1-6 but FO Singlemode SC/ST up to 32 km
SWI2-1	additional LAN-segment via internal USB link 4-port Ethernet switch such as SWI1-5
SWI2-2	additional LAN-segment via internal USB link FO/optical fibre and 2-port Ethernet switch such as SWI1-6
SWI2-3	same as SWI2-2 but FO Singlemode SC/ST up to 32 km
F2G-1	GPRS/EDGE/GSM Quadband M2M, insulation 5 kV to VW3
TETRA-1	TETRA radio data transmission, PDA multislot/SDS, insulation 5 kV
RS-485-2	EIA-485 symmetrical, max. 115 kbit/s, 1.2 km, insulation 3 kV
RS-422-2	EIA-422 symmetrical, max. 115 kbit/s, 1.2 km, insulation 3 kV
BBM-1	Baseband max. 19.2 kbit/s, 10 km, up to 8 users, insulation 3 k V
WT12	VFT modem, R&TTE, FSK 1,2 kbit/s, max. 30 km, up to 17 users
WT96	VFT-comp., 9.6 kbit/s, 2-/4-wire max. 20 km, up to 17 users
V24-2	EIA/RS-232, max. 57.6 kbit/s, point-to-point, insulation 3 kV
V24-3	RS-232 redundancy multipoint-to-point, max. 115 kbit/s, 3 kV
V24-4	RJ-45 to ETSI EN 392-300-5, max. 115 kbit/s, P-P, insulation 3 kV
DPM-1	Profibus DP master, 1.2 km, 1 kbytes max. up to 31 users
DPS-1	Profibus DP slave, 1.2 km 386 bytes max.

Dial-up line

WM336-3	PSTN modem analogue max. 33.6 kbit/s (V.34/V42.bis), 1.5 kV
WM336-4	PSTN modem analogue max. 33.6 kbit/s (V.34/V42.bis), 3 kV
ISDN-1	ISDN terminal adapter B-channel 64 kbit/s (EDSS1, X.31b), 3 kV
GSM-2	GSM/GPRS Quad-Band, 9 600 bit/s /115 kbit/s (V.32/V.110), 5 kV

Measurand/set point value cards

Measurand inputs

8AE8-2	8 analogue inputs, 8 bit, 0(4) to 20 mA / 0 to 2.5 mA / 0 to 10 V common root, insulation 3 kV
8AE8-3-1	8 analogue inputs, 8 bit, 0(4) to 20 mA / 0 to 10 V, isolated separately
8AE16-3	8 analogue inputs, 16 bit, multi-range ±20/±10/±2,5 mA per channel overflow/underrun ± 110 %, isolated separately, insul. 3 kV

Set point outputs

8AA8-1	8 analogue inputs, 8 bit, 0(4) to 20 mA / 0 to 10 V, common root, insulation 1.5 kV
8AA16	8 analogue outputs, 16 bit, selection separately, 0(4) to 20 mA or 0 to 10 V, insulation 5 kV to EN 60870-2-1 class VW3

Signal/command cards

Optocoupler inputs

16OE-5	16 wide range inputs 18…72 V DC/60…130 V DC/150…240 V DC insulation 5 kV according to EN 60870-2-1 class VW3
16IE-5	16 fast wide range inputs detection 250 µs 18…72 V DC/48 …130 V DC, insulation 3 kV
CNT1-3	8 meter inputs 10 kHz, 24 V DC, insulation 3 kV
CNT1-5	8 meter inputs 1 kHz, 18…72 V DC/48…130 V DC, 3 kV
8OE-4-110	8 optocoupler inputs, 110 V AC/100 V DC, insulation 3 kV
8OE-4-230	8 optocoupler inputs, 230 V AC/200 V DC, insulation 3 kV

Relay outputs

16RA-1	16 relay outputs 230 V AC, 1 A, common root, insulation 2500 V
16RA-3	16 relay outputs, 250 V AC, 1 A, isolated separately, 3 kV
16OA-1	16 optocoupler outputs, 24 V DC, 100 mA, insulation 1.5 kV
16OA-3-1	16 FET outputs, 250 V, 130 mA, isolated separately, 3 kV
16OA-3-2	16 FET outputs, 100 V, 320 mA, isolated separately, insulation 3 kV

Combination and special cards

OERA-5	8 optocoupler inputs, 18...72 V DC, insulation 5 kV to VW3 8 relay outputs, 230 V AC, 1A, common root, insulation 2500 V
EVU2-I	Check-back card for command termination with EVU-2-O Wide range inputs 18…72 V DC/60…110 V DC/220 V DC, common root, insulation 3 kV
EVU2-O-1	1.5-pole command termination with 1-of-n monitoring, 16 single/8 double commands, command and release relays, channel-by-channel coil resistance, tolerance, post command lag time, operating delay suppression, insulation 3 kV external measurement circuit: 100 - 20 kΩ
EVU2-O-2	2-pole command termination with 1-of-n monitoring 8 single/4 double commands, command and release relays, channel-by-channel coil resistance, tolerance, post command lag time, operating delay suppression, insulation 3 kV external measurement circuit: 100 - 20 kΩ
EVU2-O-3	same as EVU-2-O-1 with external measurement circuit: 1 kΩ - 100 kΩ
EVU2-O-4	same as EVU-2-O-2 with external measurement circuit: 1 kΩ - 100 kΩ
EVU-X	Utility expansion card for cascading a utility command group over several module frames, release and locking via closed ring, ½ card format, insulation 3 kV

Technical data: net-line FW-50

Construction	Modular station control, telecontrol and automation system plastic/V2a/alloy module frame with 4/7/14 slots
Configuration	Example: Max. input/output expansion 14 I/O slots (up to 224 dedicated I/O) 2 Ethernet 10/100BaseTx auto-MDIX Example: max. communication 6 switches integrated with 4 RJ-45 10/100 Mbit/s or FO ST/SC 100 Mbit/s + RJ45 4 serial interfaces 1 communication component e.g. field bus
Input/output	Selection of 50 plug-in cards for: Single-point, double-point, transformer tap signals, measurands and metered values, single/double commands (1.5/2-pole), command termination, 1-of-n monitoring, transformer tap commands, set points, metered value outputs
Protocols	IEC 61850 ·IED and protective device coupling IEC 60870-5-101 ·telecontrol technology, station control technology IEC 60870-5-103 ·protective device coupling IEC 60870-5-104 ·TCP/IP coupling to control centre IEC 62056-21 ·meter connection (IEC 1107) SML ·SYM² meter connection via Ethernet DSfG ·Gas interface Profibus-DP ·master/slave Modbus RTU/TCP ·master/slave, MPI/3964R/RK512 ·field bus SNMP ·network management, NTP/SNTP/DCF clock synchronisation VPN-Tunnel · IPsec , OpenVPN
PLC programming	IEC 61131-3 compatible via codeIT, 128 kb program memory
CPU-5C series 5+	RISC processor core, 400 MIP @ 400 MHz, MMU, watchdog, real-time clock 384 MB memory (256 MB SDRAM, 256 MB Flash-EPROM), encryption engine
Memory expansion	optional SD card up to 8 GB, 1 GB up to setIT V5
Real-time clock	Errors max. ±20 ppm over entire temperature range, maintenance-free buffer, Daylight savin changeover, leap year correction
Status displays	CPU: 12 LEDs in front panel, green, red I/O cards: card error, status LED of process data (binary) Interfaces: Send and momentary contact signals depending on card type
Operational controls	PLC switch in front panel RUN/STOP USB pushbutton for configuration/backup/recovery
Programming interface	2 Ethernet LAN 10/100BaseTx, auto-MDIX, USB device, USB 2.0 host 12 Mbit/s (configuration/archive via memory stick), opt. CPU-5C-BT: Bluetooth® class 2
Power supply	+24 V DC, +20 %/-15 %, max. 50 W, rated current approx. 200 mA (CPU only), power fail management, failure buffering min. 120 ms, optional wide range power supply unit 48 to 60 V DC at I/O slot, 110 VDC/115 V AC/230 V AC, UPS and external redundant supply
Dielectric strength	5 kV surge supply & process I/O to PE, to DIN EN 60870-2-1 class VW3 2.5 kV surge, supply to measurands, EIA / RS-232, USB
Standards	EMC: EN61000-6-2 (03/2000), EN61000-6-4 (03/2000), EN55022, Insulation: DIN EN 60870-2-1, IEC 60255-5 R&TTE: ETSI EN 300328, EN 301489, NSRL: DIN EN 60950
Housing	FW-50 module frame, plastic V0 metal, IP20, width (mm) BGT-M: 228 /BGT-L: 432 /BGT-S: 152, height 173 mm, depth 135 mm
Installation	DIN rail, wall, rear wall, 19" installation rack
Terminals	MSTB screw-type terminal or Combicon spring terminal, 0.2 to 2.5 mm2
Ambience	−20° to +70°C, others on request, relative humidity < 80% without condensation

Product variants

FW-50-4
4 slots
64 digital I/O*
32 analogue I/O*

FW-50-7
7 slots
112 digital I/O*
56 analogue I/O*

FW-50-14
14 slots
224 digital I/O*
112 analogue I/O*

* Max. values only apply to limited extent, as some extensions use identical resources.

net-line FW-5
micro telecontrol station

Outstanding performance in limited space

The net-line FW-5 RTU provides cost-effective solutions for telecontrol, station control and automation applications without compromising on quality and functionality. The compact field device in a stable DIN-rail housing contains all the components a high-performance system must provide for monitoring, control, archiving and transmission.

The capacity of the net-line FW-5 can be adjusted optimally to the conditions of your application by means of inputs and outputs (I/O), expansion modules and interface modules. Tailor-made solutions are made possible for virtually any task.

Typical applications

- Bay unit in transformer substations with link to protective equipment
- Intelligent secondary unit substation including earth fault and short circuit indicators in the outgoing feeders
- Control box for direct marketing of power
- Feed-in management in renewable energy plants
- Intelligent measurement point for wide area control in distribution networks
- Monitoring of infrastructure systems and pipe-bound media

net-line FW-5 overview

Small maintenance-free field device in micro-housing for DIN-rail mounting with 8 signals, 4 command outputs, 2 measurands.

Ethernet LAN 10/100BaseTx, RS-485 and RS-232/V.24 interfaces for integration of communication drivers to IEC 61850, DNP3, IEC 60870-5-101/-104, -103, protective equipment, Modbus etc.
PLC programming via IEC 61131-3.
Configuration via LAN, USB-device, USB memory stick, SD card or Bluetooth®. Wide range power supply, 20 to 72 V DC, variant with mains supply (FW-5-230).

Expansion with external modem modules e.g. SWT-12/SWT-96, M2G-1/GPRS, TETRA or dial-up modem. Expansion with up to 12 I/O modules.

net-line FW-5 hardware

The basic system can be expanded according to individual requirements and has impressive electric strength.
It offers the following capacity and functions:

- 8 indication inputs
- 4 command outputs
- 2 measurand inputs, 16 bit, bipolar, multi-range
- Ethernet LAN TCP/IP
- RS-485 field interface
- RS-232/V.24 interface
- Integrated wide range power supply unit, 20 to 72 VDC 230 V AC mains supply in variants FW-5-230
- Configuration via LAN, USB, memory stick, SD card or Bluetooth® with FW-5-BT
- Removable screw or spring-type terminals

net-line FW-5 software

The net-line FW-5 supports impressively fast setup and high level of compatibility thanks to the innovative and well-established setIT parameterisation software.

- Intuitive operator guidance
- Almost complete prevention of input errors
- Fault analysis by click and link to inaccurate entry
- Practical copy functions
- Context-sensitive online help
- Calculation and logic functions
- Extensive diagnostic features
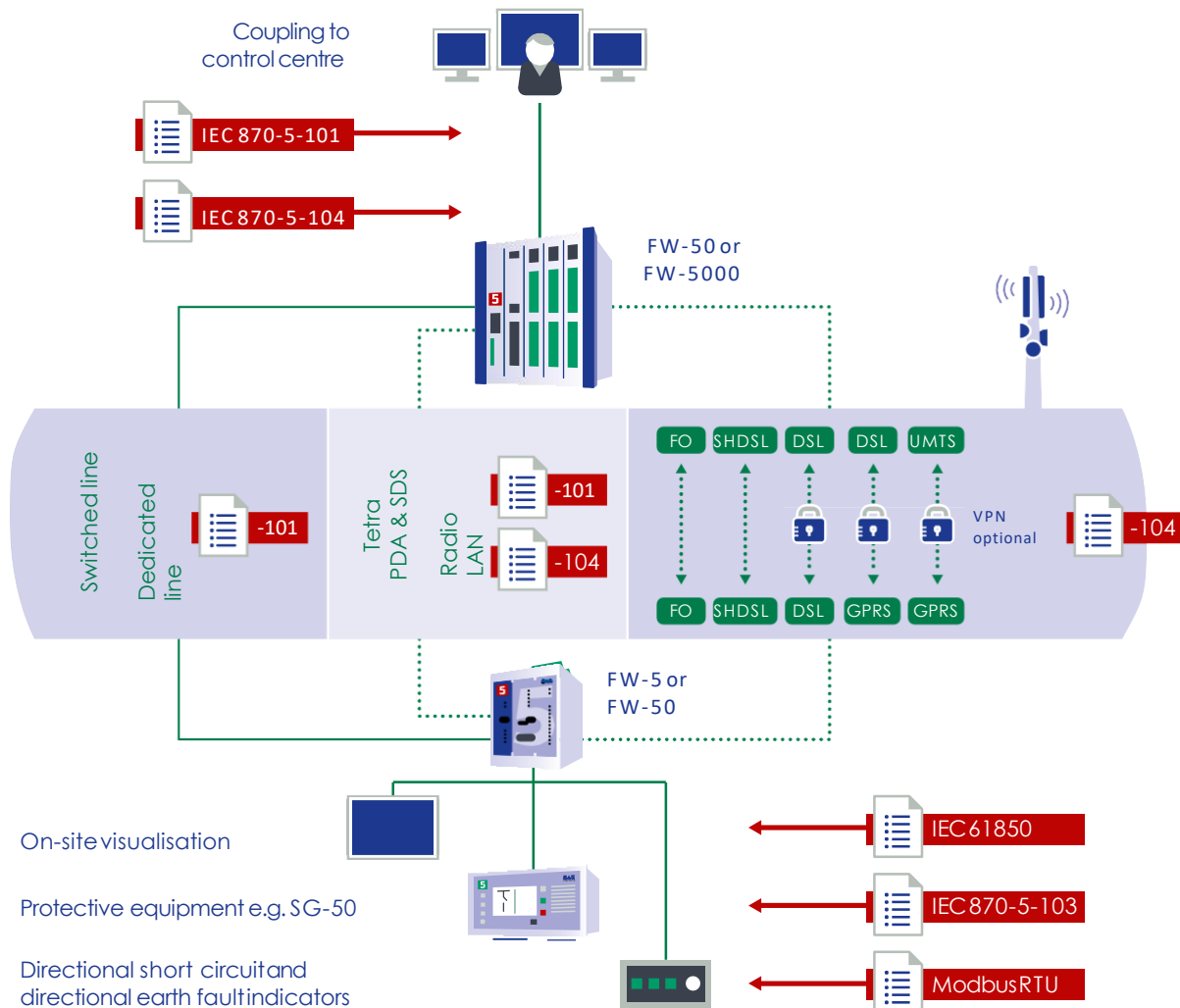- Integrated project documentation

The integrated soft PLC codeIT offers additional flexibility and allows many kinds of PLC programs to be implemented.

set IT   code IT

Communication routes

As with all the devices of the series 5 products, the link to the control centre can be realised by many communication routes and protocols directly or via master station, backed up with redundant systems if required.

Coupling to control centre

IEC 870-5-101

IEC 870-5-104

FW-50 or FW-5000

Switched line

Dedicated line

-101

Tetra PDA & SDS

Radio LAN

-101

-104

FO SHDSL DSL DSL UMTS

FO SHDSL DSL GPRS GPRS

VPN optional

-104

FW-5 or FW-50

On-site visualisation

Protective equipment e.g. SG-50

Directional short circuit and directional earth fault indicators

IEC 61850

IEC 870-5-103

Modbus RTU

Expansion modules

The net-line FW-5 can be extended with up to 12 expansion modules. Various modules with different capacities at inputs/outputs allow flexible process integration which meets your requirements. Via TBUS-extension, distributed extension boards may be integrated as remote I/O. A power booster PWR-1 adds more power to TBUS if restricted. Like the base unit, all the modules except PM-1 are equipped with removable terminals in screw or spring clamp technology.

* up to 12 boards supplied by TBUS-R or PWR-1

8DI: 8 signals

8 signals
digital wide-range inputs
24 to 60 V DC ±20% (18 to 72 V DC)
common root,
threshold 12 V DC, detection 1 ms
Supply: 85 mA per module, up to 10 modules

8DO: 8 commands

8 command outputs, relay outputs
up to 72 V DC, 150 V AC,
isolated by channel, 2-pole,
operating range: 1 A up to 48 V DC, 0.4 A at 60 V DC,
AC: 1 A up to 150 V AC
Supply: max. 200 mA per module, up to 5 modules*

4AI: 4 measurands

4 measurands, 16 bit
multi-range ±2,5 /±5 /±10 /±20 mA, overflow ±110%
ripple rejection 50 Hz, detection 100 ms
± 0.1% at 5°C to +55°C, max. error ±0.25%
isolated by channel, 2-pole
Supply: approx. 150 mA per module, up to 7 modules*

4AO: 4 set points

4 analogue outputs, 16 bit set points
uni-/bipolar ±20 mA, max. load impedance 500 Ω
±0.1% /10 K over entire range
isolated by channel, 2-pole
Supply: approx. 75 mA per module, up to 10 modules
additional external supply 24 to 60 V DC max. 3.7 W

8DI2AI: 8 signals, 2 measurands

8 signals, wide range, 24 to 60 V DC
common root
threshold 12 V DC, detection 1 ms
2 measurands, 16 bit multi-range ±2,5 /±5 /±10 /±20 mA
overflow ±110%, ripple 50 Hz
Supply: 120 mA per module, up to 8 modules*

RES-1:   4 S0 pulse inputs, 2 measurands, 4 commands

4 S0 pulse/meter inputs, active, 10 ms min.
2 measurands 16 bit, ±2,5 /±5 /±10 /±20 mA
overflow ±110%, detection 100 ms
4 command relays, 72 V DC, 1 A up to 48 V DC
isolated by channel, 2-pole
Supply: 400 mA per module, up to 2 modules*

DSO-1:   6 commands, 6 check-back signals

6 command relays, 1.5-pole, up to 72 V DC
1-of-n, external circuit testing, cascadable,
for 6 single/3 double commands. 2 release relays
6 check-back signals, 24 to 60 V DC ±20%
threshold 12 V DC, common root
Supply: max. 250 mA per module, up to 4 modules*

DSO-2:   4 commands, 2 check-back signals

4 command outputs, 2-pole, up to 72 V DC
1-of-n, external circuit testing, cascadable,
for 2 double commands , 2 internal release relays
2 check-back signals, 24 to 60 V DC ±20%
threshold 12 V DC, common root
Supply: max. 280 mA per module, up to 3 modules*

PM-1   Power measuring terminal

Measurement in MV-/NV-feeder via CT/VT
Voltage $U_1/U_2/U_3$, $U_{12}/U_{23}/U_{31}$, 100 V / 400 V AC
Current I_1, I_2, I_3, I_N, 1 / 5 A, active-/reactive-/apparent–
power, frenquencies, cos φ of phases
Supply: max. 150 mA per modul, up to 7 modules*

PDPS-1   Profibus-DP slave

Feldbus interface Profibus-DP V0
Direct integration in process data or RTU
max. 488 bytes, typ. 1,5 Mbit/s
Supply: max. 260 mA per module, up to 4 modules*

Technical data: net-line FW-5

Structure	Substation /bay control, telecontrol and automation system in plastic housing, integrated I/O, I/O expansion and communication modules, DIN rail mounting
Capacity base station	8 digital wide range inputs, 24 to 60 V DC ±20%, optocoupler, common root; 4 relay NO contacts, 2-pole, up to 72 V DC, 150 V AC, isolated by channel 2 measurands, 16 bit, uni-/bipolar, overflow/underrun, multi-range mA
Communication	1 Ethernet LAN TCP/IP, 10/100BaseTx, auto-MDIX, auto-negotiation 1 EIA/RS-485 interface, isolated; 1 EIA/RS-232/V.24 interface
Input/output	single-point, double-point, transformer tap position and alarm signals, measurands, metered values, single, double and transformer tap commands, set points, metered value pulse outputs, expandable up to 12 I/O modules
Protocols	IEC 61850 ·IED and protective equipment IEC 60870-5-101 ·telecontrol technology, station control technology IEC 60870-5-103 ·protective equipment IEC 60870-5-104 ·TCP/IP link to control centre IEC 62056-21 ·smart meter link (former IEC 1107) SYM²/SML ·smart meter link via Ethernet DNP3 ·server serial/IP DSfG ·natural gas interface Modbus RTU/TCP ·master/slave, Profibus-DP slave, MPI/3964R/RK512 ·fieldbus SNMP ·network management, NTP/SNTP/DCF clock synchronisation VPN-Tunnel ·IPsec IKEv1/IKEv2, OpenVPN
PLC programming	IEC 61131-3 programming via codeIT, 128 kb program memory
CPU series 5+	RISC processor core, 400 MIP@400 MHz, MMU, watchdog, real-time clock 384 MB memory (128 MB SDRAM, 256 MB Flash-EPROM)
Memory expansion	optional SD card up to 8 GB, 1 GB up to setIT V5
Real-time clock	Errors max. ±20 ppm over entire temperature range, maintenance-free buffer, daylight saving time changeover, leap year correction
Status displays	LED in front panel for system, communication and binary process values detailed diagnostics via integrated web server
Operational controls	PLC switch in front panel RUN/RUN-P/STOP USB pushbutton for configuration/backup/recovery functions
Programming interface	Bluetooth® 2.0 class 2, for wireless configuration at FW-5-BT, disengageable Ethernet LAN 10/100BaseTx, auto-MDIX, USB 2.0 device 12Mbit/s, USB 2.0 host 12Mbit/s (configuration/archive synchronisation via stick)
Fault signal output	to be configured to relay output
Power supply	+20 to 72 V DC max. 5 W, (24 V DC 0.2 A/60 V DC 0.1 A) without expansion; Power fail management with mains buffering, 220 V DC and 230 V AC via FW-5-230 or external module
Dielectric strength	5 kV surge supply & process I/O to PE, according to class VW3 2.5 kV surge, supply to measurands, EIA/RS-232, USB
Standards	EMC: EN61000-6-2 (03/2000), EN61000-6-4 (03/2000), EN55022, Insulation: DIN EN 60870-2-1, IEC 60255-5 R&TTE: ETSI EN 300328, EN 301489, NSRL: DIN EN 60950
Housing	FW-5 Micro, polyamide V0, IP20, weight FW-5: 360 g, FW-5-230: 440 g dimensions FW-5: 68×105×115 mm (W×H×D); expansion: 22.5×105×115 mm
Installation	DIN rail mounting, DIN-EN 60715 TH35
Terminals	MSTB removable screw-type terminal or spring terminal, 0.2 - 2.5 mm²
Ambience	−20° to +70°C , FW-5: supply > 48 V DC max +60° C Relative humidity < 80%, without condensation

Product variants

FW-5
FW-5 base unit

FW-5-BT
FW-5 base unit with Bluetooth®

FW-5-230
FW-5 base unit with mains power supply 140 - 230 V AC/DC, 24 V DC outputs for process, modem & battery charging circuit

FW-5-230-BT
FW-5 base unit with Bluetooth® power supply 140 - 230 V AC/DC, 24 V DC outputs for process, modem & battery charging circuit

FW-5-GATE
Variant without integrated I/O on the base unit with 2nd Ethernet interface and additional interface for smart meter read out

FW-5-GATE-230
FW-5-GATE base unit with mains power supply 140 - 230 V AC/DC, 24 V DC outputs for process, modem & battery charging circuit

net-line FW-5-GATE
micro telecontrol station

The compact communication specialist

The net-line FW-5-GATE RTU is designed especially for communication-intensive applications in telecontrol, substation control and automation technology. It is based on the enormously successful net-line FW-5. In order to offer more communication possibilities in an even smaller space, integrated inputs/outputs have been omitted. The FW-5-GATE can of course also be supplemented with expansion modules and interface modules.

It offers cost-effective solutions for intelligent secondary distribution networks and smart metering through further interfaces with SML/SyM² meter integration, among others. An integrated temperature sensor measures the station temperature, which can be used e.g. for overload checks on a transformer.

Typical applications

- Intelligent secondary unit substation with integration of power measurement terminal, earth fault/short circuit indicators and network analysis systems
- Smart meter integration in energy management systems and remote meter reading control centres
- Intelligent measurement for wide area tension control in distribution networks
- Bay unit in transformer substations with link to protective equipment
- Monitoring of infrastructure systems and pipe-bound media

net-line FW-5-GATE overview

Small maintenance-free field device in micro housing for DIN rail mounting with 2 independent Ethernet LAN 10/100BaseTx, 2 RS-485 field and meter interfaces and 1 RS-232/V.24. Integration with IEC 61850, DNP3, IEC 60870-5-101/-104, -103 protective equipment, Modbus. Meter link via IEC 62056-21, SML or S0 pulse. PLC programming via IEC 61131-3 Configuration via LAN, USB, memory stick or micro SD card. Wide range power supply 20 to 72 V DC, variant with mains supply (FW-5-GATE-230).

Expansion with external modem modules e.g. SWT-12/SWT-96, M2G-1/GPRS, TETRA or dial-up modem. Expansion with up to 12 I/O modules.

net-line FW-5-GATE hardware

The basic system can be expanded according to individual requirements and has impressive dielectric strength:

- 2 Ethernet LAN TCP/IP connections
- 2 RS-485 field interfaces
- CL/S0 meter interface in FW-5-GATE-cl
- RS-232/V.24 interface
- Temperature sensor, -20° to 100°C
- Integrated wide range power supply unit, 20 to 72 V DC or 230 V AC mains supply in variants FW-5-GATE-230

net-line FW-5-GATE software

The net-line series supports impressively fast setup and high level of compatibility thanks to the innovative and well-established setIT parameterisation software.

The optional soft PLC codeIT offers additional flexibility and allows many kinds of PLC programs to be implemented.

set IT   code IT

From the network to the Smart Grid

The FW-5-GATE is equipped with additional interfaces for coupling of external components to form intelligent networks. As with all the devices of the series 5 range of products, the connection to the control centre can be made by many communication routes and protocols directly or with a shell of a telecontrol master station, backed up with redundant systems if required.

Local meter integration is made via a second LAN link with SML protocol or via the additional serial interface with IEC 62056-21 protocol. In the CL variant, S0 meter pulse detection can also be used.

Example integration of intelligent meters

As well as 15-minute load profiles being provided for billing in the meter control centre, the data required for load control and forecast calculations can also be supplied to power system management e.g. in 1-minute measurement periods. Addressing using the OBIS data model and identification by means of the device-specific server ID allow a very quick mapping of extensive information of the four quadrant meters, including the voltages, currents and powers in setIT. Conversion factors and overflow thresholds can be stored here to display the values in a suitable manner. setIT also performs standard mathematical procedures e.g. to calculate an average MV level for LV wide area control.
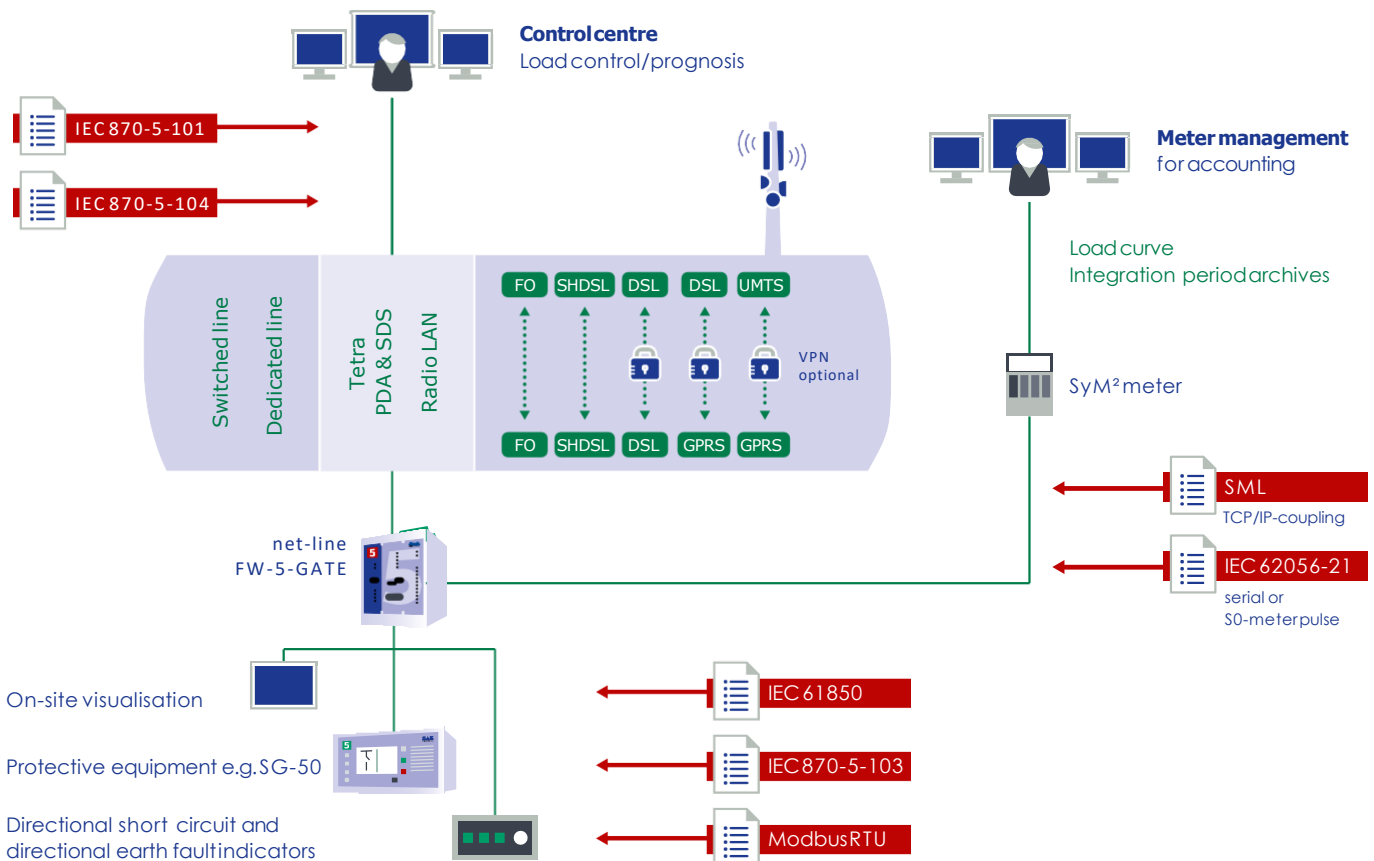
Expansion modules

The net-line FW-5-GATE can be extended with up to 12 expansion modules. Various modules with different capacities at inputs/outputs allow flexible process integration which meets your requirements. Via TBUS-extension, distributed extension boards may be integrated as remote I/O. A power booster PWR-1 adds more power to TBUS if restricted. Like the base unit, all the modules except PM-1 are equipped with removable terminals in screw or spring clamp technology.

* up to 12 boards supplied by TBUS-R or PWR-1

8DI: 8 signals

8 signals
digital wide-range inputs
24 to 60 V DC ±20% (18 to 72 V DC)
common root,
threshold 12 V DC, detection 1 ms
Supply: 85 mA per module, up to 10 modules

8DO: 8 commands

8 command outputs, relay outputs
up to 72 V DC, 150 V AC,
isolated by channel, 2-pole,
operating range: 1 A up to 48 V DC, 0.4 A at 60 V DC,
AC: 1 A up to 150 V AC
Supply: max. 200 mA per module, up to 5 modules*

4AI: 4 measurands

4 measurands, 16 bit
multi-range ±2,5 /±5 /±10 /±20 mA, overflow ±110%
ripple rejection 50 Hz, detection 100 ms
± 0.1% at 5°C to +55°C, max. error ±0.25%
isolated by channel, 2-pole
Supply: approx. 150 mA per module, up to 7 modules*

4AO: 4 set points

4 analogue outputs, 16 bit set points
uni-/bipolar ±20 mA, max. load impedance 500 Ω
±0.1% /10 K over entire range
isolated by channel, 2-pole
Supply: approx. 75 mA per module, up to 10 modules
additional external supply 24 to 60 V DC max. 3.7 W

8DI2AI: 8 signals, 2 measurands

8 signals, wide range, 24 to 60 V DC
common root
threshold 12 V DC, detection 1 ms
2 measurands, 16 bit multi-range ±2,5 /±5 /±10 /±20 mA
overflow ±110%, ripple 50 Hz
Supply: 120 mA per module, up to 8 modules*

RES-1: 4 S0 pulse inputs, 2 measurands, 4 commands

4 S0 pulse/meter inputs, active, 10 ms min.
2 measurands 16 bit, ±2,5 /±5 /±10 /±20 mA
overflow ±110%, detection 100 ms
4 command relays, 72 V DC, 1 A up to 48 V DC
isolated by channel, 2-pole
Supply: 400 mA per module, up to 2 modules*

DSO-1: 6 commands, 6 check-back signals

6 command relays, 1.5-pole, up to 72 V DC
1-of-n, external circuit testing, cascadable,
for 6 single/3 double commands. 2 release relays
6 check-back signals, 24 to 60 V DC ±20%
threshold 12 V DC, common root
Supply: max. 250 mA per module, up to 4 modules*

DSO-2: 4 commands, 2 check-back signals

4 command outputs, 2-pole, up to 72 V DC
1-of-n, external circuit testing, cascadable,
for 2 double commands , 2 internal release relays
2 check-back signals, 24 to 60 V DC ±20%
threshold 12 V DC, common root
Supply: max. 280 mA per module, up to 3 modules*

PM-1 Power measuring terminal

Measurement in MV-/NV-feeder via CT/VT
Voltage $U_1/U_2/U_3$, $U_{12}/U_{23}/U_{31}$, 100 V / 400 V AC
Current I_1, I_2, I_3, I_N, 1/5 A, active-/reactive-/apparent–
power, frenquencies, cos φ of phases
Supply: max. 150 mA per modul, up to 7 modules*

PDPS-1 Profibus-DP slave

Feldbus interface Profibus-DP V0
Direct integration in process data or RTU
max. 488 bytes, typ. 1,5 Mbit/s
Supply: max. 260 mA per module, up to 4 modules*

Technical data:	net-line FW-5-GATE
Construction	Substation/bay control, telecontrol and automation system in plastic housing, expandable with I/O and communication modules for DIN rail mounting
Communication	2 Ethernet LAN TCP/IP, 10/100BaseTx, auto-MDIX, auto-negotiation 1 EIA/RS-485 interface, galvanically isolated 1 EIA/RS-485 meter interface or CS/S0 interface, galvanically isolated 1 EIA/RS-232/V.24 interface
Inputs/outputs	Sensor for ambient/transformer temperature, -20° to 100° C±2° C, up to 12 expansion modules for operation of single-/double-point, transformer tap and alarm signals, measurands, metered values, single, double and transformer tap commands, set points, metered value pulse outputs
Protocols	IEC 61850 ·IED and protective equipment IEC 60870-5-101 ·telecontrol technology, station control technology IEC 60870-5-103 ·protective equipment IEC 60870-5-104 ·TCP/IP link to control centre IEC 62056-21 ·smart meter link (former IEC 1107) SML ·SyM² smart meter link via Ethernet DNP3 ·server serial/IP DSfG ·natural gas interface Modbus RTU/TCP ·master/slave Profibus-DP slave, MPI/3964R/RK512 ·field bus SNMP ·network management NTP/SNTP/DCF ·clock synchronisation VPN-Tunnel ·IPsec IKEv1/IKEv2, OpenVPN
PLC programming	IEC 61131-3 compatible via codeIT, 128 kb program memory
CPU series 5+	RISC processor core, 400 MIP@400 MHz, MMU, watchdog, real-time clock 384 MB memory (128 MB SDRAM, 256 MB Flash-EPROM)
Memory expansion	optional microSD card up to 8 GB, 1GB up to setIT V5
Real-time clock	Errors max. ±20 ppm over entire temperature range, maintenance-free buffer, daylight saving time changeover, leap year correction
Status displays	LED in front panel for system, communication and binary process values detailed diagnostics via integrated web server
Operational controls	PLC switch in front panel RUN/RUN-P/STOP USB pushbutton for configuration/backup/recovery functions
Programming interface	Ethernet LAN 10/100BaseTx, auto-MDIX, USB 2.0 device 12Mbit/s, USB 2.0 host 12Mbit/s (configuration/archive synchronisation via stick)
Fault signal output	to be configured to relay output
Power supply	+20 to 72 V DC max. 5 W, (24 V DC 0.2 A/60 V DC 0.1 A) without expansion Power failure management with power failure buffering 220 V DC and 230 V AC via FW-5-GATE-230 or external modules
Dielectric strength	5 kV surge supply & process I/O to PE, according to class VW3 2.5 kV surge, supply to measurands, EIA/RS-232, USB
Standards	EMC: IEC 60870-2-1, EN 61000-4-x, EN 55022, Insulation: IEC 60870-2-1, IEC 60255-5 NSRL: DIN EN 60950
Housing	Micro, polyamide V0, IP20, weight: 240 g, FW-5-GATE-230 300 g dimensions W×H×D: 45×105×115 mm; FW-5-GATE-230 68×105×115 mm expansion: 22.5×105×115 mm
Installation	DIN rail mounting, DIN-EN 60715 TH35
Terminals	MSTB removable screw-type or spring terminal, 0.2 bis 2.5 mm^2
Ambient temperature	−20° to +70°C, FW-5-GATE: supply > 48 V DC max +60° C Relative humidity < 80%, without condensation

Product variants

FW-5-GATE
2 Ethernet/LAN interfaces,
2 RS-485 field & meter link,
1 RS-232/V.24 interface

FW-5-GATE cl
2 Ethernet/LAN interfaces,
1 RS-485 field interface,
1 CL/S0 meter interface/pulse inp.
1 RS-232/V.24 interface

FW-5-GATE-230
FW-5-GATE with mains
power supply 140 - 230 V AC/DC,
24 V DC outputs for process,
modem & battery charging circuit

FW-5-GATE-230 cl
FW-5-GATE cl with mains
power supply 140 - 230 V AC/DC,
24 V DC outputs for process,
modem & battery charging circuit

net-line FW-5-GATE-4G
with built-in LTE modem

The safe connection

The comprehensive monitoring and control of supply networks and other large infrastructures is not economically viable without a mobile radio connection. The net-line FW-5-GATE-4G brings together powerful telecontrol technology based on the latest series5e generation of CPUs with an LTE modem for flexible mobile radio connection.

As with all FW-5 series remote terminal units, the FW-5-GATE-4G can be extended with I/O extension boards and interface modules in top-hat assembly. This makes it easy to implement compact telecontrol systems with the exact required capacity.

The FW-5-GATE-4G allows for a high degree of IT security in harmony with the requirements of the BDEW whitepaper and BSI recommendations.

Typical application areas

- Intelligent local network stations with integration of power measurement terminals, earth fault-/short circuit indicators, network analysis systems and protective equipment
- Feed-in management in renewable energy plants
- Control box for direct marketing and balancing energy
- Intelligent measurement point for wide range regulation in distribution networks
- Monitoring of media and infrastructure systems in pipelines
- Controls for street lighting
- Merging virtual power stations using VHPready

FW-5-GATE-4G overview

Compact bay station controller with LTE mobile radio module in a micro housing suitable for top-hat rail installation with the new series5e CPU technology.
LTE/4G with 3G/2G fallback for high availability, optional DUAL-SIM or 450 MHz radio. 2x independent Ethernet LAN 10/100 BaseTx, 2xRS-485 field and meter interfaces, RS-232/V.24.
Integration with IEC 61850, DNP3, IEC 60870-5-101/-104, -103 protection device link, Modbus, DSfG.
Meter connection IEC 62056-21, SML or S0 pulse.
Hardened system with end-to-end VPN Tunnel (IPsec/OpenVPN) from the station.
PLC programming to IEC 61131-3 optional. Configuration via LAN, USB, memory stick or micro SD card. 24 V DC supply.
Extension up for 12 I/O modules.

Hardware

The FW-5-GATE-4G is based on the new series 5e CPU genera-tion. Thanks to a procceor speed of 1200 MIPS it has enough power; also with respect to future challenges. The improved performance in particular has a positive impact on network communication via IEC 61850 and process point treatment ac-cording to IEC 60870-5-10x standards. The overall system was based on a modern Linux kernel which allows greater flexibility for continuous improvement, especially in terms of IT security.

The main system comprises:

- LTE wireless mobile modem 4G/3G/2G
- 2 Ethernet LAN TCP/IP connections
- 2 EIA/RS-485 field interfaces
- CL/S0 meter interface with
  - FW-5-GATE-4G cl
  - FW-5-GATE-4G-2D cl
  (reduces the number of RS-485 field interfaces)
- EIA/RS-232/V.24 interface
- Temperature sensor, -25° to +100° C

The PS-60 module allows floating power supply (20 to 72 V DC), galvanic isolation and redundant implementation.

Software

The parametrisation software setIT provides quick launch and high compatibility with telecontrol systems. Thanks to full configuration of all components of the FW-5-GATE-4G device in setIT, there is no need to integrate or adapt an external modem, which can be time-consuming. Up to 8 VPN tunnels with end-to-end-encryption can be set up from the station. In addition, all available information from the mobile radio module can be used in the setIT diagnostics functions.

The optional Soft-SPS codeIT offers additional flexibility and allows for the implementation of diverse PLC programs as per IEC 61131-3.
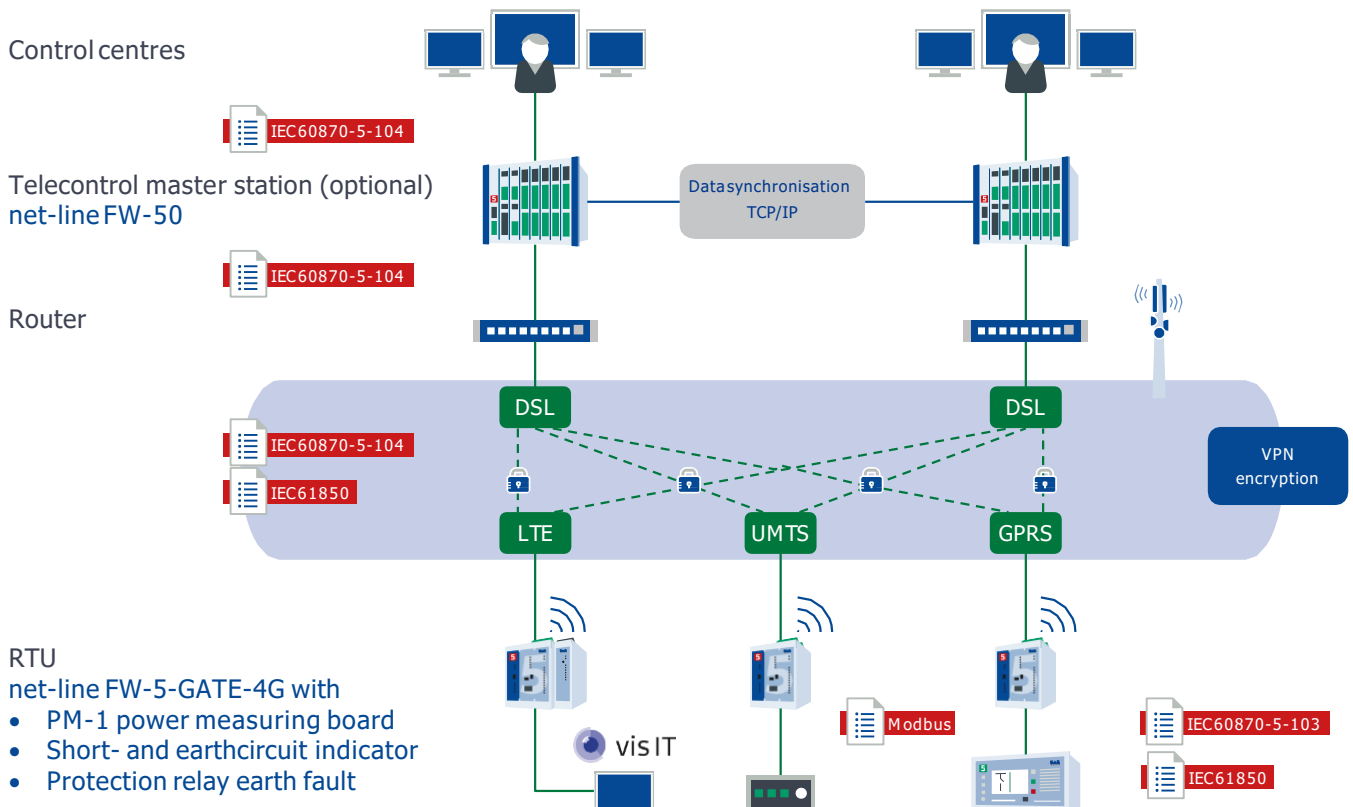
The visIT Web-based plant visualisation tool
- allows user interfaces to be created conveniently by import-ing process variables from setIT
- runs as a runtime in the remote terminal unit, has access to its process data/logged values and can display information relevant for service and operation.
- can be displayed safely on almost all HTML5-enabled terminals, smartphones or tablets.

set IT   code IT   vis IT

SAE - solutions in mind

If requested, we can assist you with complete project processing. From selecting the best fitting components to coordinating all project participants to practical integration of systems into existing infrastructures. In all these areas, you can take advantage of our extensive know-how.

Control centres

IEC60870-5-104

Telecontrol master station (optional)
net-line FW-50

Data synchronisation TCP/IP

IEC60870-5-104

Router

DSL   DSL

IEC60870-5-104

IEC61850

VPN encryption

LTE   UMTS   GPRS

RTU
net-line FW-5-GATE-4G with
- PM-1 power measuring board
- Short- and earth circuit indicator
- Protection relay earth fault

vis IT

Modbus   IEC60870-5-103

IEC61850

series5e IT security

series5e technology allows for comprehensive IT-Security measures as required in the current requirement profiles of the BDEW whitepaper and BSI recommendations. Security is verified using audits from renown consultants and offices backed up by periodical internal penetration tests.

- Hardened modern kernel
- Extended firewall rules with granular permissions controls
- Denial of Service identification DDOS
- Active ports are restricted to application choice
- https/ftps for protected web servers and remote access
- End-to-end encryption through
  - IPSec (IKEv1/IKEv2
  - OpenVPN
- SYSLOG service
- User administration with free role based assignment
- Signed firmware
- Signed database
- System commands for releasing diagnostics access
- Patch management

LTE mobile radio modules:

The LTE module radio module offers a flexible coupling to the conductor and energy management systems with high availability through its double antenna MIMO transmission (Multiple Input Multiple Output) and 3G/2G network fallback capability. The basis module allows 3GPP cat3 communication up to 100 Mbit/s. A module is offered as an option with 3GPP cat1 with 10 Mbit/s, DUAL-SIM and GPS time synchronisation.

FW-5-GATE-4G	Default mobile router
	LTE module 3GPP rel8, cat3; Europe EMEA
Transmission	LTE 100 Mbit/s down, 50 Mbit/s up
	HSPA+ 42 Mbit/s down, 5.76 Mbit/s up, WCDMA 384 kbit/s; EDGE 236.8 kbit/s, GPRS 85.6 kbit/s
Bands	4G: FDD B1/B2/B3/B5/B7/B8/B20
	3G: B1/B2/B5/B8 HSPA+/WCDMA
	2G: 850/900/1800/1900 MHz
Antenna	MIMO DL, LTE & HSPA, SMA-f
FW-5-GATE-4G-2D	mobile router LTE-IoT, DUAL-SIM & GPS
	LTE-IoT module 3GPP rel11, cat1, Europe, Asia
Transmission	LTE 10 Mbit/s down, 5 Mbit/s up
	HSPA+ 42 Mbit/s down, 5.76 Mbit/s up, WCDMA 384 kbit/s, DGE 236.8 kbit/s, GPRS 85.6 kbit/s
Bands	4G FDD LTE: B1/B3/B5/B7/B8/B20
	3G WCDMA: B1/B5/B8
	2G GSM: B3/B8 900/1800 MHz
Antenna	MIMO DL, SMA-f
other	DUAL-SIM DSSS, GNSS: GPS/Glonass/Galileo, clock synchronisation
FW-5-GATE-450	mobile router for 450 MHz CDMA networks
	CDMA450 CDMA 1xEV-DOrB (ISF-856-A) & 1xRTT, Europe
Transmission	2.4 Mbit/s download, 0.15 Mbit/s upload
Bands	CDMA 450 MHz B31
Antenna	diversity, SMA-f

Extension modules

The net-line FW-5-GATE-4G can be flexibly expanded with up to 12 extension modules (EM) and as required via an internal bus system. If the power supply to the basis station is not sufficient, the current booster PWR-1 can provide an additional 2.8 A. The TBUS expansion allows distributed EMs to be integrated as a remote I/O. Like the base unit, all the modules except for PM-1 are equipped with screw or spring terminals.

up to 12 modules with TBUS-R or current booster PWR-1

8DI	8 messages ±18 ... ±72 V DC, as per root
8DI-220	8 messages ±110/±220 V DC, as per root
8DO	8 relays no. 72 V DC, 2-pole, isolated
8DO-220	8 relays no. 220 V DC, 230 V AC, 2-pole, isolated
4AI	4 measured values 16 bit, ±2.5 /±5 /±10 /±20 mA, 2-pole
2AO	2 set point commands 16 bit ±20mA, 2-pole
4AO	4 set point commands 16 bit ±20mA, 2-pole
8DI2AI	8 messages ±18 ... ±72 V DC, as per root 2 measured values 16 bit, ±2.5 /±5 /±10 /±20 mA, 2-pole
8DI2AI-220	8 messages ±110/±220 V DC, as per root 2 measured values 16 bit, ±2.5 /±5 /±10 /±20 mA, 2-pole
4DI4DO-1	4 messages ±18 ... ±72 V DC, 2-pole, isolated 4 commands co monostable 75 V DC, 2 A up to 48 V DC
4DI4DO-2	4 messages ±18 ... ±72 V DC, 2-pole, isolated 4 commands co bistable, 75 V DC, 2 A up to 48 V DC
DSO-1	6 commands 72 V DC 1.5-pole 1/n, measuring circuit test 6 return information 18 ... 72 V DC
DSO-2	2 commands 72 V DC 2-pole 1/n, measuring circuit test 2 return information 18 ... 72 V DC
RES-1	4 S0 inputs message/counter vales 2 measured values 16 bit, ±2.5 /±5 /±10 /±20 mA, 2-pole 4 relays no 72 V DC, 2-pole, isolated
PM-1	power measurement terminal for LV- and MS networks Measurement via converter, Rogowski coil or sensors
PDPS-1	Profibus-DP Slave

Technical data: net-line FW-5-GATE-4G

Structure	Station control, telecontrol and automation system in plastic housing, can be expanded with I/O and communication modules for top-hat rail mounting
Communication	LTE modem 4G, fallback to 3G/2G, MIMO, opt. DUAL-SIM 2 Ethernet LAN TCP/IP, 10/100BaseTx, auto-MDIX, auto-negotiation 1 EIA/RS-485 interface, floating 1 EIA/RS-485 counter interface or CL/S0 interface, floating 1 EIA/RS-232/V.24 interface
Inputs/outputs	up to 12 expansion modules for detecting single-point, double-point, trans-former tap and fault signals, measured values, metered values, single, double and transformer tap commands, temperature sensor -25° to +100° C±2° C
Protocols	IEC 61850 ·IED and protection device coupling IEC 60870-5-101 ·telecontrol technology, station control technology IEC 60870-5-103 ·protection device coupling IEC 60870-5-104 ·TCP/IP coupling to control centre DNP3 server ·serial/IP IEC 62056-21 ·meter connection (IEC 1107) SML ·SyM² meter connection via Ethernet DSfG ·Digital interface for gas measuring devices Modbus RTU/TCP ·master/slave, Profibus-DP slave, MPI/3964R/RK512 ·field bus SNMPv3 ·Network management NTP-/SNTP-/DCF clock synchronisation VPN tunnel ·IPsec IKEv1/IKEv2
PLC programming	IEC 61131-3 compatible via codeIT, 128 kb program memory
CPU series 5e	RISC processor Cortex-A8, 1200 MIPS@800 MHz, FPU, Watchdog, RTC 1GB RAM (512 MB SDRAM, 512 MB SLC Flash), 8 MB NOR Flash
Memory extension	micro-SD card 1GB
Real time clock	Summer/winter time changeover, leap year correction, max. ±10 ppm over entire Temperature range, maintenance free buffer up to 60 days
Status displays	LED in front panel for system, communication and binary process values further diagnostics via integrated web server, optonal: visIT plant visualisation
Operational controls	PLC switch in front panel RUN/STOP USB pushbutton for configuration/backup/recovery function
Programming interface	Ethernet LAN 10/100BaseTx, auto-MDIX, USB 2.0 device 480 Mbit/s, USB 2.0 host 480 Mbit/s (configuration/archive synchronisation via stick)
Fault signal output	configurable to relay
Power supply	24 V DC max. 5 W, 0.2 A @24 V DC without extension, no isolation power failure management with power failure buffering opt. PS-60 wide-range 20 ... 72V DC, redundant power supply, isolation
Dielectric strength	5 kV surge, supply and process I/O for PE, as per Class VW3 2.5 kV surge, supply to EIA/RS-232, USB
Standards	EMC: IEC 61000-6-2, IEC 61000-6-3, ETSI EN 301489-24 Isolation: IEC 60870-2-1, IEC 60255-5 R&TTE: ETSI EN 301511, ETSI EN TS 125-101, ETSI EN TS 151 010-1, EN 62311 NSRL: DIN EN 60950
Housing	FW-5 Micro, polyamide V0, IP20, weight 310 g Dimensions: 68×105×115 mm; EMs: 22.5×105×115 mm (W×H×D)
Installation	DIN top-hat rail, DIN-EN 60715 TH35
Terminals:	withdrawable MSTB screw or spring terminal, 0.2 bis 2.5 mm²
Environment	−20° to +70°C , as of 5 EMs max +60° C, max. 3000m above sea level relative humidity <95%, without condensation

Product variants

FW-5-GATE-4G
RTU with 4G mobile radio modem
2 LAN interfaces, separated
2 RS-485 field- & meter connec-
tion 1 RS-232/V.24 interface

FW-5-GATE-4G CL
RTU with 4 mobile radio modems
2 LAN interfaces, 1 RS-485 field
interface, 1 CL/S0 meter pulse
interface, 1 RS-232/V.24 interface

FW-5-GATE-4G-2D
as with FW-5-GATE-4G,
4G module cat 1, LTE IoT, DU-
AL-SIM, GPS Position and clock
sync.

FW-5-GATE-4G-2D CL
as with FW-5-GATE-4G CL,
4G module cat 1, LTE IoT, DU-
AL-SIM, GPS position and clock
Sync.

FW-5-GATE-450
as with FW-5-GATE-4G,
450 MHz CDMA private radio
network.

FW-5-GATE-450 CL
as with FW-5-GATE-4G CL,
450 MHz CDMA private radio
network.

TBUS remote I/O
Flexible bus extension

TBUS remote I/O collects remote data

The TBUS extension offers a low-cost method for coupling detached fields and remote measuring points to a telecontrol system. Instead of installing a complete FW-5, or needing elaborate cabling of signal and measurement lines to a central RTU, expansion modules of the FW-5 family are installed in a decentralised manner and connected to the TBUS extension with a simple patch cable.

Remote I/O allows manufacturers of switching equipment to fully pre-wire switch panels, and fully install and test measurement points and switching elements to the extension boards; the commissioner only needs to fit the patch cables to a central FW-5 or FW-5-GATE.

Typical application areas
- Switching stations
- Substations
- Water towers and pump controllers
- Waste water plants
- Applications with decentralised measuring or metering points

TBUS extension brief characteristics

Extension of the TBUS for setting up Remote I/O using remote extension modules of the FW-5 and FW-5-GATE series. Integration of the indications, meters, measured values and switching elements in close proximity to the sensor/power unit; the pre-wiring of e.g. control panels by the system integrator is possible.

Remote I/O allows for a significantly more flexible integration of process data. Indications, measuring points and switching elements are wired in a decentralised way on extension boards of the FW-5 series. Remote I/O establishes the link between the extension modules to the station via a patch cable.

Simple Integration

The bus signal is read on an FW-5 or FW-5-GATE with sender TBUS-T as the last expansion module of the block, and routed to the TBUS-R receiver over a CAT6e cable. This unit again powers the local expansion modules and connects up the modules to the bus. Up to ten islands can be installed decentrally.

No more current limiting

With an additional 2.8 A means power, the TBUS-R's integrated power supply is also provided to a larger number of current-hungry expansion modules (such as the DSO-1, DSO-2 and RES-1).

The system works transparently and with all expansion module types in all setIT versions. A special configuration is not necessary.

Product variants

TBUS-T
Transmitter bus extension
Transmitter remote I/O

TBUS-R
Receiver bus extension
Receiver remote I/O
Integrated power supply
24 - 60 V DC ± 20%
Up to 10 expansion modules

TBUS set
Transmitter + receiver + patch cable
TBUS-T + TBUS-R + 10 m CAT6e cable

Technical data: TBUS extension TBUS-T / TBUS-R

Design	Integration of decentralised process data - Remote I/O - an FW-5 /FW-5-GATE Remote extension modules (EWB) of the FW-5 series are connected using the patch cable for the extension of the TBUS signal
FW-5 modules	All extension modules of the FW-5 series Removal of the current limitation through re-feeding with TBUS-R for each block
Link	Transparent transmission of the TBUS signals via CAT6e patch cable
Connections	RJ-45 for TBUS link 2 screw terminals MSTB 2-pin 0.2 to 2.5 mm² for interlocking signals of the command termination cmd and 1/n of the DSO-x TBUS-R has an additional MSTB 4-pin power supply 0.2 to 2.5 mm²
Status indicators	LEDs in the front panel for data, status, control lines and interlock
TBUS-T	Transmitter module remote I/O as the last expansion module in the block, transparent transmission of the TBUS signals
TBUS-R	Receiver module remote I/O Power supply 24 - 60 V DC ± 20 %, 20 VA, floating, isolation 1500 V AC Supply of the extension module with 2.8 A, load shedding when exceeded Enables powering up to 10 modules
Status indicators	additional indication: error, status, Uext
Controls	DIP switch for selecting behaviour during communication errors
Housing	Micro housing, Polyamide V0, IP 20 Dimensions 22.5×105×115 mm (W×H×D), Weight TBUS-T 90 g, TBUS-R 140 g
Installation	DIN top-hat rail, DIN-EN 60715 TH35
Ambient temperature	-20° …+70° C, with a supply > 48 V DC max. +55°C
Relative humidity	< 80%, without condensation

SAE IT-systems GmbH & Co. KG
Im Gewerbegebiet Pesch 14
50767 Köln (Cologne, Germany)
Phone: +49 (0) 221 / 59808-0
Fax: +49 (0) 221 / 59808-60
info@sae-it.de
www.sae-it.de