SO-55

communication unit for substation automation systems

In power substation the SO-55 integrates IED devices for effective connection with remote supervision control centers or local HMI workstation. The integration covers operating of protocol transmission, all required protocol conversions and database creating of object variables.

It implements security mechanisms to protect communications, remote and local access and data.

The SO-55 can also enable indications, measurements and station automation functions thanks to the optional RTU block for acquisition of binary signals, controls and measurements. It can perform interlocking controls, control sequences, transformer tap changer adjustment, also based on variables received from other devices.

It is possible to configure the communication controller in specialized versions of the IP address converter or multi-channel protocol converter. SO-55 concentrates data and supervises the substation equipment in an uninterrupted manner. The device provides time synchronization according to various time sources, through transmission protocols, GPS/GLONASS clock and NTP/SNTP, PTP standards.

The device allows you to design hardware redundancy and network connections, including the PRP protocol.

The device can operate in a single or redundant configuration. Transmission can take place in a star, ring or mixed structure. The communication controller supports all basic transmission standards, such as PN-EN 60870-5-101, 102, 103, 104, DNP3.0, PN-EN 61850 and dedicated protocols. Transparent data retransmission is also possible.

The unit concentrates the data and performs all necessary protocol conversion to establish efficient communication between stations IED devices and local or remote supervising centers. It can also be equipped with an RTU block for acquisition of binary and analog signals and controls.

MIKRONIKA

Features

- concentration and grouping of data in an internal database or retransmission in any protocol
- co-operation with digital protections and bay controllers in 750/500/400/220/110/15kV switchgears
- solutions in the field of cyber security based on the recommendations of ENISA, NIST, BDW, BlueCrypt. Implementation in accordance with PN-EN 62351, IEEE P1686, PN-ISO/IEC 27001
- cyber security solutions include device access control, data protection, communication protection, logging/user activity monitoring
- possibility to operate two independent object's LAN for bay controllers, protection devices and other IED
- possibility to establish the transparent device connection for communication in dedicated protocol
- data recording mode in the case of transmission channel failure
- ability to perform station automation functions, bay interlocking, sequences, regulators
- ability to read the archived event log by means of maintenance channel
- supervising of operation correctness of all connected devices
- starcoupler function
- scalable, redundant construction depending on the needs
- self-diagnostic of equipment and transmission channels

Multichannel and multiprotocol transmission

- various protocols: DNP 3.0, PN-EN 60870-5-101/103/104, Modbus, SPA, in MASTER and SLAVE modes; PN-EN 61850, SNMP, PPM2
- protocols and IP addresses conversion
- support for PRP (Parallel Redundancy Protocol), support for dedicated protocols
- up to 96 asynchronous serial channels, speed range 50÷115kBd for each channel separately
- up to 200 logical channels, expandable up to 520 channels
- SMS messages and alarms by integrated GSM modem
- transparent transmission thanks to UDP protocol layer
- transmission carrier on request: PLC, modems, wires, fiber optic, wireless
- galvanically isolated interfaces: RS-232, RS-485, CANBUS/RS-485, Ethernet 100/1000 BaseTX/FX, GPRS

Communication with dispatch system and remote centers

- simultaneous co-operation with several dispatch centres
- ability to define a set of double receiving and transmitting channels, operated in main and reserve mode with automated switching and supervising of unused channel
- concurrent multiprotocol and multichannel transmission with the ability to define the scope of transmitted data and controls for each channel

Communication with station equipment

- co-operation with other devices for data acquisition by means of RS-232/485/422, 100/1000Base-TX/FX network, serial fiber optic connections
- ability to connect digital protections and bay controllers to SCADA /NMS/EMS systems
- operation in redundant ring or star LAN configuration
- mixed configurations ability, bay controllers are operated by redundant object ring and protection devices are connected by star net
- different information types from various devices can be linked into one chosen transmission protocol
- concentration of data in an internal database

Source of time synchronization / time synchronization uncertainty

- integrated or external GPS/GLONASS timer / 1μs
- PTP protocol / 1μs; IRIG-B / 10μs; NTP/SNTP / 1ms
- host system - synchronization function is based on protocol data / 1ms for transmission losses less than 1min

Time service for slave devices: NTP server, IEEE 1588 PTP precision time protocol, IEC 60870-5-xxx, IRIG-B protocols
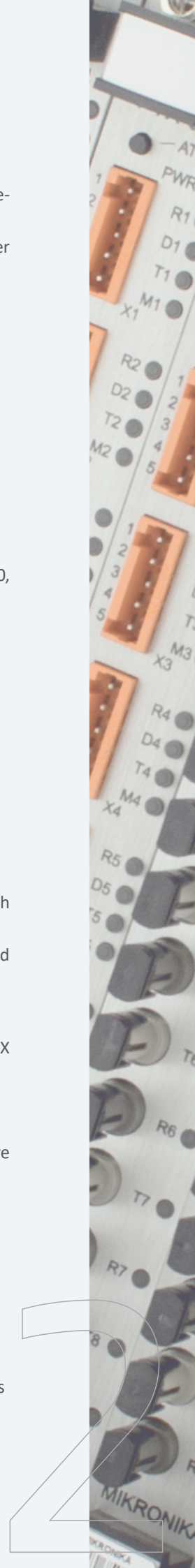
Construction

The communication controller has a modular structure, adapted to be used in power stations of all voltage types and other industrial facilities. It is produced in a 6U/19'' cassette or in a specialized housing containing processor modules, a set of modules with interfaces, a power supply and an optional RTU block consisting of binary, measuring and analog input and output modules. Their quantity, type and configuration are selected according to the application. The controller can be powered redundantly. Due to applied software and hardware solutions, SO-55 can be easily adapted to newly installed protection devices, recorders or other equipment.

Typical modules:

- **PJC-9xx-x**   CPU with database, up to 5x 100/1000 Base TX/FX, 1x RS-232/-485, 1x RS-485
- **PTX-008**   8x programmable transmission channels, RS-485 up to 1200m distance or RS-232 up to 12m distance
- **PTF-008**   8x multimode fiber channels 62,5/125µm, up to 2km distance
- **PTS-528**   8x multimode fiber channels 62,5/125µm, up to 2km distance
- **PTS-518**   8x multimode fiber channels POF 1mm, up to 40m distance
- **PTS-608**   8x isolated RS-232 channels, up to 12m distance
- **PTS-656**   6x isolated channels in full RS-232 standard, up to 12m distance
- **PTS-728**   8x isolated RS-485 channels, up to 1200m distance
- **PTS-758**   4x isolated RS-485 channels, up to 1200m distance and 4x isolated RS-232 channels, up to 12m distance
- **PTS-814**   4x single-mode fiber channels 9/125µm, up to 20km distance
- **PTS-918**   8x programmable trensmission channels, RS-485 up to 1200m distance or RS-232 up to 12m distance
- **MZA-410**   power supply

communication unit SO-55 in a 6U/6" housing
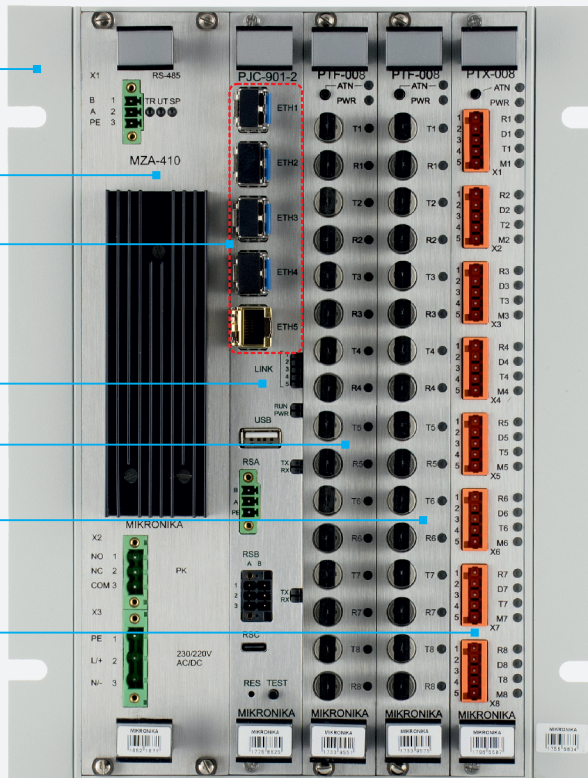
power supply

Ethernet 100/1000Base-TX/FX channels, SFP

processor module

fiber optic channel

fiber optic channel

RS-232/RS-485 transmission

Service

Dedicated pConfig software is used to parameterize the concentrator, support communication channels and configure the database. All service and diagnostic activities, including software updates, can be carried out remotely via a secure communication channel.

The built-in web server can be used for local supervision, control and settings control, as well as for the presentation of current states and database objects. The device can send SMS messages via a supported GSM/GPRS modem.

Internal structure

A set of modules selected according to the requirements of the facility and placed in a common housing creates a physical transmission layer. All received data are loaded into the internal data base of physical values. The virtual data base contain all results of internal calculations and objects variables. The protocol operating in, the protocol operating out, the processing module and others internal features are configured by means of p-Config software. The configurations files are stored in data base. Supervising and selftesting module controls hardware and software watchdog operation, main and reserve power supply supervision and hot reserve synchronization.
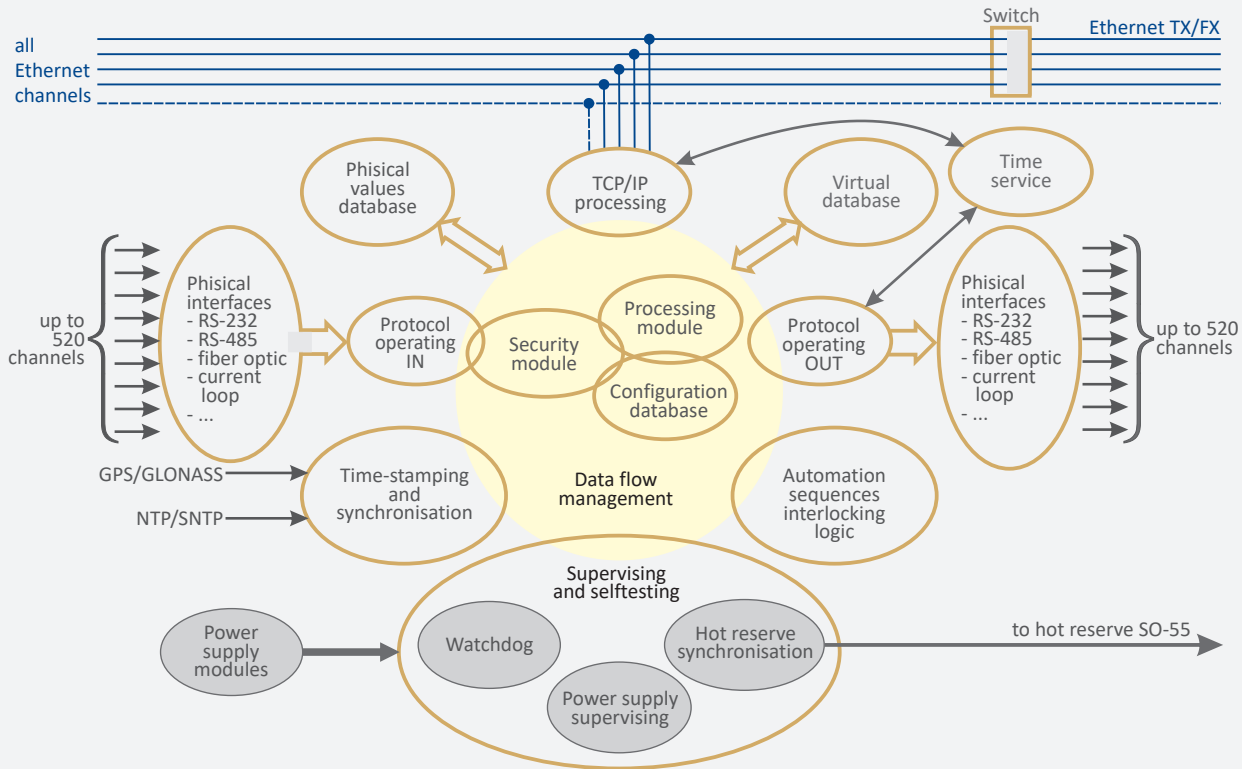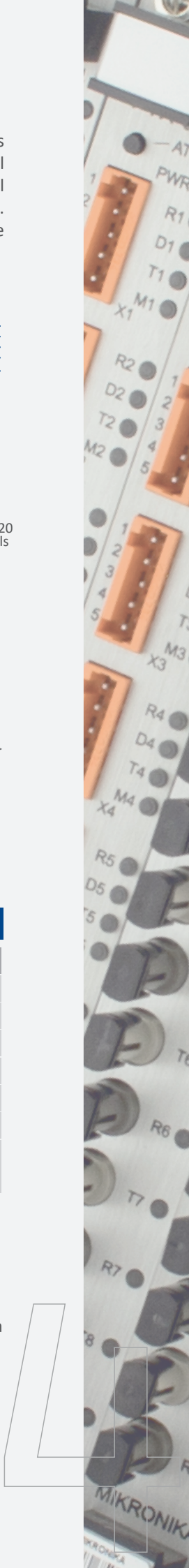

Modules

Central processor unit module PJC-86x-xx/PJC-9xx-x

FEATURES	PJC-863-xx	PJC-865-xx	PJC-901-1	PJC-901-2	PJC-911-1	PJC-911-2
Number of add ETH channels	3	5	3	5	3	5
Type of Ethernet channels	100TX/FX/MM	100FX/MM	SFP	SFP	SFP	SFP
USB 2.0	No	No	Yes	Yes	Yes	Yes
Procesor DSP	No	No	No	No	Yes	Yes
RS-485/RS-232 channels	2/2	2/2	1/univ.	1/univ.	1/univ.	1/univ.
Service RS-232 channel	1	1	1	1	1	1
Additional bus on connector Y	No	No	Yes	Yes	Yes	Yes

where: MM - multimode fiber, single-mode fiber SM available as an option;
   RS-univ. = RS-232/485/422 programmable;
   SFP - small form-factor pluggable transceiver

Functionality

The module realizes the function of a central processing unit (CPU). It performs all functions related to data collecting information processing and communication.

PTS-xxx serial fiber optic transmission module - for cooperation with PJC-86x-xx

FEATURES	PTS-514	PTS-518	PTS-524	PTS-528	PTS-812	PTS-814
fiber optic mode	multimode	multimode	multimode	multimode	single-mode	single-mode
fiber optic type	POF 1mm	POF 1mm	62.5/125μm*	62.5/125μm*	9/125μm*	9/125μm*
connectors type	VLF**	VLF**	ST	ST	ST	ST
channels no	4	8	4	8	2	4

where: * glass optic fibers
      ** VLF - Versatile Link Family firmy HP for plastic POF 1mm optical fiber

Functionality

- PTS-5xx - gives an opportunity to configure each of 8 fiber optic channels in positive or negative mode
- PTS-81x - features singlemode fiber optic channels. Every channel is equipped with three LEDs to signalize transmission status

PTS-xxx serial transmission module - for cooperation with PJC-86x-xx

FEATURES	PTS-604	PTS-608	PTS-656	PTS-724	PTS-728	PTS-758	PTS-918
transmision type	RS-232	RS-232	full RS-232	RS-485	RS-485	RS-232/485	RS-232/485
connectors type	press clamp*	press clamp*	D-SUB	press clamp*	press clamp*	D-SUB	press clamp*
number of channels	4	8	6	4	8	8(4/4)**	8***

where: * WAGO terminal connectors, type: socket 734-265, plug 734-205
      ** 4x RS-232 transmission channels and 4x RS-485 transmission channels
      *** programmable transmission mode RS-232 or RS-485

Functionality

- PTS-60x - serial RS-232 transmission; LEDs to signal the transmission status
- PTS-65x - serial full standard RS-232 transmission; LEDs to signal the transmission status
- PTS-72x - to handle RS-485 or RS-422 transmission; LEDs to signal the transmission status
- PTS-75x - supports 4x RS-232 and 4x RS-485/RS-422 transmission. The RS-485 mode is controlled software or automatically
- PTS-91x - software selectable RS-232 or RS-485 transmission

Remarks: all serial transmission are galvanically isolated

Serial transmission module PTX-0xx/PTF-0xx - for cooperation with PJC-9xx-x

FEATURES	PTX-004	PTX-008	PTF-004	PTF-008	PTF-014	PTF-018
transmission type	RS-232/485	RS-232/485	fiber optic	fiber optic	fiber optic	fiber optic
fiber optic mode	-	-	multimode	multimode	multimode	multimode
fiber optic type	-	-	62.5/125μm	62.5/125μm	POF 1mm	POF 1mm
connector type	press clamp*	press clamp*	ST	ST	VLF	VLF
channels no	4	8	4	8	4	8

where: * WAGO terminal connectors, type: socket 734-265, plug 734-205

Power supply module MZA-xxx

FEATURES	MZA-205	MZA-205-1	MZA-210	MZA-210-3	MZA-410	MZA-502	MZA-502-3
main supply voltage	220V DC	110V DC	230V AC/DC	24V DC	230V AC/DC	230V AC/DC	48V DC
reserve supply voltage	230V AC/DC	230V AC/DC	-	-	-	-	-
output current	5V/6A	5V/6A	5V/6A	5V/6A	5V/12A	5V/16A	5V/10A
parallel operation	No	No	Yes	Yes	Yes	Yes	Yes
available transmission type	RS-485	RS-485	RS-485	RS-485	RS-485	RS-485	RS-485
power on/off switch	No	No	No	No	No	No	Yes
control outputs	2	2	1	1	1	1	1

Functionality

Supply module of various features to power the bay controller. A possibility to connect redundant 230/220V AC/DC voltage with automatic switching function of main supply to reserve.

Technical data

Construction

housing	typically a 6U/19" rack	internal modem	GSM/GPRS (optionally)
specialized housing	basis on special arrangement with the producer	internal recorder	4GB
modules	pluggable	transmission channels	RS-485, RS-232, fiber optic
montage	19" cassette or housing	network connections	100/1000TX, 100/1000FX

Power supply and basic communication features

main supply Up voltage	220V DC or 110/48/24V DC	serial physical channels available	up to 96
reserve supply Ur voltage	230/220V AC/DC; 110/48/24V DC	serial logical channels available	up to 200
Ur/Up acceptable fluctuations	class AC3/DC3 (-20 do +15 %)	100/1000Base-TX/FX interfaces	up to 5
power consumption	typical 80VA*		

* power consumption depends on module type quantity

Electromagnetic compatibility (EMC)

PARAMETER	STANDARD	TEST LEVEL
electrostatic discharges (ESD)	PN-EN 61000-4-2 level 4	15kV - air, 8kV - contact, class A
resistance to electromagnetic field	PN-EN 61000-4-3 level 4	10V/m 80MHz, 80MHz..1GHz 80%, class A
surge resistance 1,2/50 - 8/20µs	PN-EN 61000-4-4 level 4	4,0 kVp
resistance to wire disturbances	PN-EN 61000-4-5 level 4	class A
resistance to fast transient states	PN-EN 61000-4-6 level 4	±4,0 kV, class A
resistance to magnetic field	PN-EN 61000-4-8	class A
voltage dips	PN-EN 61000-4-11	60% for t=1s, class A
interrupts in voltage	PN-EN 61000-4-11	100% for t=1s, class B
electromagnetic emission	PN-EN 61000-6-4	30MHz ≤ f ≤ 1GHz, class B

Dielectric strength

PARAMETER	STANDARD	TEST LEVEL
electrical strength	PN-EN 60870-2-1 class VW3	2,5kV; 1min/RMS (for power supply and HV* I/O)
	PN-EN 60870-2-1 class VW2	1kV; 1min/RMS (for LV** I/O)
surge resistance	PN-EN 60870-2-1 class VW3	5kV; 1,2/50µs (for power supply and HV* I/O)
	PN-EN 60870-2-1 class VW2	2kV, 1,2/50µs (for LV** I/O)

where: *HV I/O - high voltage inputs/outputs
        **LV I/O - low voltage inputs/outputs

Operation and storage

PARAMETER	STANDARD	TEST LEVEL
standard operation temperature: -10°C to 55°C	PN-EN 60255-1	-10°C to 55°C, 96-hour test
operation temperature: -25°C to 70°C*	---	-25°C to 70°C, 96-hour test
transport temperature: -40°C to 70°C	PN-EN 60870-2-2, class Ct2	---
storage temperature: -40°C to 55°C	PN-EN 60870-2-2, class C2	---
protection against water and dust permeating	PN-EN 60529:2006	IP51
humidity	PN-EN 60870-2-2 class Cm	10 ÷ 95 %
vibrations	PN-EN 60870-2-2 class Cm	half-sinusoid duration time 11 [ms] max. acceleration 300 [m/s^2]

* - for „B" type construction