



Supervision Relay

SR100

- Voltage and current auto range measurements up to 600V_{LN}, 12.5A
- Active, Reactive, Apparent Power calculation based on IEC 61400-21 Annex C
- Power accuracy class 0.5
- 4 configurable energy counters (import, export, active, reactive)
- 13 protection functions (over current – I/IE/Idiff, under/over voltage, under/over frequency, asymmetry – voltage/phase imbalance, directional power/power underrun, LoM – phase shift/ROCOF)
- Up to 8 configurable relay outputs (normal, normal inverse, latched, latched inversed, pulsed, pulsed inversed, always on, always off)
- Simple USB setting without auxiliary power supply
- Reliable communication option over CANopen protocol or MODBUS RS232/RS485
- Universal wide auxiliary power supply range 20 – 300 Vdc, 48 – 276 Vac
- User-friendly setting software, MiQen
- Certified ship version

PROPERTIES

- Measurements of instantaneous values of more than 50 quantities (V, A, kW, kVA, kvar, kWh, kvarh, PF, Hz, THD, etc)
- Measurements of all required values based only on fundamental wave according to IEC 61400-21 Annex C
- Power accuracy class 0.5
- 13 different protection functions in 6 different logical categories:
 - over current I/IE/Idiff,
 - under/over voltage,
 - under/over frequency,
 - asymmetry – voltage/phase imbalance,
 - Directional power/Power underrun,
 - LoM – phase shift (dPhi/dt) & ROCOF (df/dt)
- Input frequency: 50/60 Hz
- Serial communication (RS232 or RS485 up to 115.200 bit/s), CAN up to 1 Mbit/s and USB 2.0)
- MODBUS RTU and CANopen communication protocols
- Up to 8 configurable relay outputs (normal, normal inverse, latched, latched inversed, pulsed, pulsed inversed, always on, always off)
- Single wide auxiliary power supply range 20 – 300 Vdc, 48 – 276 Vac
- Automatic range of current and voltage (max. 12.5 A and 600 V_{L-N})
- Housing for DIN rail mounting
- Two-level password for temper-safe operation
- User-friendly setting software, MiQen

DESCRIPTION

Supervision relay SR100 is intended for measuring and monitoring single-phase or three-phase electrical power network. It measures RMS network values and all significant deviations from the nominal values by means of fast sampling of voltage and current signals. There is an option in MiQen Settings Studio software to select also the measurements based only on positive sequence fundamental wave, which does not include harmonics measurements. This option can be found under MiQen Settings menu. With this option included all corresponding values are replaced by IEC 61400-21 Annex C measurements. This makes supervision relay SR100 suitable for acquisition and validation of fast changes in the network. A built-in microcontroller calculates measured values (voltage, current, frequency, energy, power, power factor, THD phase angles, and deviations) and sends these data over a reliable CANopen communication interface to the CAN master devices.

COMPLIANCE WITH STANDARDS:

Standard	Description
EN 61010-1	Safety requirements for electrical equipment for measurement, control and laboratory use
EN 60688	Electrical measuring transducers for converting AC electrical variables into analog and digital signals
IEC 61400-21 Annex C	Measurements of active power, reactive power, active current, reactive current and voltage as positive sequence fundamentals
EN 61326-1	EMC requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements
EN 60529:1997/A1	Degrees of protection provided by enclosures (IP code)
EN 60068-2-1/ -2/ -6/ -27/-30	Environmental testing (-1 Cold, -2 Dry heat, -30 Damp heat, -6 Vibration, -27 Shock)
UL 94	Tests for flammability of plastic materials for parts in devices and appliances
EN 50325-4, CiA 301, CiA 401	CANopen communication compliance

APPLICATION

Supervision relay SR100 is used for measuring and monitoring of all single-phase or three-phase values and detecting predefined faults. With measuring 13 different network deviations supervision relay SR100 could be used as simple but efficient supervision relay. Supervision relay SR100 is delivered un-configured for customer configuration with user friendly setting software MiQEN. Supervision relay SR100 supports standard serial communication RS232/RS485 with speed up to 115200 baud and CANopen communication for speeds up to 1 Mbit/s which is perfect for integration into large systems.

Additional USB 2.0 interface can only be used for a fast set-up without the need for auxiliary power supply. This interface is provided with only BASIC insulation and can be used ONLY unconnected to power inputs.

Special "ship version" is available, certified by Bureau Veritas.

PROGRAMMING

Supervision relay SR100 is completely programmable. It can be programmed using standard RS232/RS485 communication (if available) or USB communication (always present). Some settings can also be defined over a CANopen interface via SDO messages. For more information about connection and programming see supervision relay SR100 *User's manual*.

Primary-secondary ratio (U, I), type of connection, fault (alarm) limits... are all programmed by setting software MiQEN via RS232 or RS485 or USB communication.

TECHNICAL DATA

MEASUREMENT INPUT

Nominal frequency (f_N) 50/60 Hz, 400 Hz

Current measurements:

Measuring range (auto) 0.01 ... 12.5 A
 Nominal current (I_N) 1 A, 5 A
 Max. measured value 20 I_N ($I_N = 1$ A),
 4 I_N ($I_N = 5$ A)
 sinusoidal
 Max. allowed value (thermal) 12.5 A; continuous
 20 A; 60 s
 100 A; 1 s
 Consumption $< I^2 \times 0.01 \Omega$ per phase

Voltage measurements:

Measuring range (auto) 10 ... 500 V_{LN}
 Nominal voltage (U_N) 50 ... 500 V_{LN}
 Max. measured value (cont.) 600 V_{LN} ; 1000 V_{LL}
 Max. allowed value 1.2 $\times U_N$; permanently
 2 $\times U_N$; 10 s
 Consumption $< U_2 / 3.3 M\Omega$ per phase
 Input impedance 3.3 $M\Omega$ per phase

Frequency measurement:

Frequency measuring range 16 ... 400 Hz

System:

Voltage inputs can be connected either directly to low-voltage network or via a high-voltage transformer to high-voltage network.

Current inputs can be connected either directly to low-voltage network or shall be connected to network via a corresponding current transformer (with standard 1 A or 5 A outputs).

For more information about different system connections see CONNECTION on page 6.

BASIC ACCURACY UNDER REFERENCE CONDITIONS

Accuracy is presented as percentage of nominal value except when it is stated as an absolute value.

Measured value	Accuracy (\pm % of range)
Current Rms	0.5
Voltage Rms P-N and P-P	0.5
Power (P, Q, S)	0.5
Power factor (PF)	0.5
Frequency (f)	10 mHz
P-N and P-P angle	0.5°
THD (U), THD (I) (0 ... 400 %)	0.5
Active energy	Class 1
Reactive energy	Class 2

COMMUNICATION

Supervision relay SR100 has one galvanically separated communication port, which can be equipped with RS232, RS485, CAN or left open (to be specified with order). Different configurations are possible (to be specified with order):

Configuration	COM
WO	USB *
RS232	RS232 + USB *
RS485	RS485 + USB *
CANopen	CANopen + USB *

* Read WARNING below

Serial communication:	RS232	RS485	CAN
Connection type	Direct	Network	Network
Connection terminals	screw terminals		
Function	Settings, measurements and FW upgrade		Measurements
Insulation	Protection class II, 3.3 kV_{ACRMS} 1 min		
Max. connection length	3 m	2000 m	
Transfer mode	Asynchronous	Synchronous	
Protocol	MODBUS RTU	CAN open	
Transfer rate	2.4 kBaud to 115.2 kBaud		10 to 1000 kBaud
Number of nodes	/	≤ 32	≤ 127

Additionally, supervision relay SR100 has a USB communication port, located on the bottom under small circular plastic cover. It is intended for settings ONLY and requires NO auxiliary power supply. When connected to this communication port, supervision relay SR100 is powered by USB.

WARNING:

USB communication port is provided with only BASIC insulation and can ONLY be used unconnected to aux. supply AND power inputs.

USB

Connection type	Direct
Connection terminal	USB-mini
Max. connection length	3 m
Function	Settings, firmware upgrade
Transfer mode	Asynchronous
Protocol	MODBUS RTU
Transfer rate	USB 2.0

The USB cover should not remain open. It should be closed immediately after the initial setting through USB port was done and should remain closed during all time of storing & operation. If unit operates without USB cover the warranty is void.

ELECTROMECHANICAL RELAY OUTPUT

Type	Electromechanical Relay switch
Rated voltage	48 V AC/DC (+40 % max)
Max. switching current	1000 mA
Contact resistance	≤ 100 mΩ (100 mA, 24 V)
Insulation voltage	
Between coil and contact	4000 VDC
Between contacts	1000 VDC
Response time	≤ 50 ms *

* Time from error detection to relay switching on/off is typically below 50ms

AUX POWER SUPPLY

Universal supply	
Nominal voltage AC range	48 ... 276 V
Nominal frequency range	45 ... 65 Hz
Nominal voltage DC range	20 ... 300 V
Consumption	< 8 VA
Power-on transient current	< 20 A; 3 ms
Consumption	< 5 VA

SAFETY:

Protection	protection class II
Pollution degree	2
Installation category	CAT III; 600 V _⊥ meas. inputs CAT III; 300 V _⊥ aux. uni.supply Acc. to EN 61010-1
Test voltages	UAUX↔I/O, COM: 3510 VACrms UAUX↔U, I inputs: 3510 VACrms U, I in↔I/O, COM: 3510 VACrms
Enclosure material	PC/ABS Acc. to UL 94 V-0

MECHANICAL

Dimensions	W100 × H75 × D105 mm
Max. conductor cross section for terminals	2.5 mm ² with pin terminal 4 mm ² solid wire
Vibration withstand	7 g, 3 ... 100 Hz, 1 oct/min 10 cycles in each of three axes
Shock withstand	300 g, 8 ms pulse 6 shocks in each of three axes
Mounting	Rail mounting 35 × 15 mm acc. to EN 50 022
Enclosure material	PC/ABS
Flammability	Acc. to UL 94 V-0
Weight	370 g
Enclosure protection	IP 20

ENVIRONMENTAL CONDITIONS:

Ambient temperature	usage group III - 10 ... 0 ... 45 ... 55 °C Acc. to IEC/EN 60 688
Operating temperature	- 30 to + 70 °C
Storage temperature	- 40 to +70 °C
Average annual humidity	≤ 93 % r.h.
Altitude	≤ 2000 m

PROTECTION FUNCTIONS

Supervision relay SR100 supports 13 different protection functions in 6 different logical categories:

- Current (over current, earth fault, differential current)
- Voltage (over/undervoltage)
- Frequency (over/underfrequency)
- Asymmetry (voltage unbalances and phase imbalances)
- Load (Directional power 1/2, Power underrun 1/2)
- LoM (phase shift, ROCOF df/dt)

Under every particular protection category an alarm triggering limit can be set for every function based on a particular **parameter limit** in %.

Compare time delay (0-60s) is then set to define the timespan within which the alarm trigger limit should be exceeded for a particular protection function to take effect. When switching off the protection function a **hysteresis (0-10%)** is set to prevent premature triggering.

For each of the protection functions an **assigned output** electromechanical relay can be dedicated.

Response time - time from error detection to relay switching on/off is typically below 50ms.

A more detailed description of all available protection functions is described below:

CURRENT PROTECTION FUNCTIONS:

Overcurrent (>I, >>I) ANSI# 50

Detect abnormally high network current. It is possible to define up to two overcurrent (>I, >>I) relay output limits with up to 2000% of nominal current.

Overcurrent (<E) ANSI# 50 N/G

Detects earth faults. It is possible to define up to two overcurrent (>IE) relay output limits with up to 550% of nominal current.

Overcurrent (>I') ANSI# 87

Compares the differential current. It is possible to define up to two overcurrent (>I') relay output limits with up to 200% of nominal current.

Please note

Each current protection function uses different electrical connection mode. When specific current protection function in correlation to its connection mode is used, it is not possible to activate other two current protection functions:

- If >I and >>I are chosen (4u electrical connection), monitoring of >IE and >I' is not allowed.
- If >IE is chosen (IE electrical connection), monitoring of >I, >>I and >I' is not allowed.
- If >I' is chosen (Idiff electrical connection), monitoring of >I, >>I and >IE is not allowed.

VOLTAGE PROTECTION FUNCTIONS:

Overvoltage (>U, >>U) ANSI# 59

It is possible to define up to two overvoltage alarm limits with up to 150% of nominal voltage.

Undervoltage (<U, <<U) ANSI# 27

It is possible to define up to two undervoltage alarm limits with down to 50% of nominal voltage.

FREQUENCY PROTECTION FUNCTIONS:

Overfrequency (>f, >>f) ANSI# 810

It is possible to define up to two overfrequency alarm limits with up to 150% of nominal frequency.

Underfrequency (<f, <<f) ANSI# 81U

It is possible to define up to two underfrequency alarm limits with down to 50% of nominal frequency.

ASYMMETRY PROTECTION FUNCTIONS:

Voltage Unbalances (>U_{Un})

Protection over phase unbalance resulting from phase inversion, unbalanced supply or distant fault, detected by the measurement of negative sequence voltage component of a three phase system. This parameter has a range of 0 to 100% of the rated nominal voltage.

Phase Imbalance (>I_{im}, >>I_{im}) ANSI# 46

Protection over phase imbalance resulting from phase inversion, unbalanced supply or distant fault, detected by the measurement of negative sequence voltage. This threshold is defined relative to the rated current and has a range between 0 and 100%.

LOAD PROTECTION FUNCTIONS:

Power Underrun 1/2 (<P, <<P) ANSI# 32R/U

Protection based on calculated active power. This user defined limit defines the permissible deviation of the load from defined thresholds. The alarm is triggered if the measured value falls below the rated active power limit and can be set between -300% and 300%.

Directional Power 1/2 (>P, >>P) ANSI# 32

Protection based on calculated active power. Active overpower monitoring is used to detect overloads and allow load shedding. It is possible to define up to two alarm limits within the range between -300% and 300% of the rated active power.

LoM (Loss of Mains) PROTECTION FUNCTIONS:

Phase Shift (> dPhi/dt)

Protection based on exceeding the phase angle deviation rate for any one of the three phases. This limit for single phase and 3-phase shifts can be set in the range between 0 and 90° respectively.

ROCOF protection (> df/dt)

Protection based on exceeding the Rate Of Change Of Frequency within the system. This parameter has a permissible limit range between 0 and 10 Hz/s.

MiQEN - setting and acquisition Software

MiQEN software is intended for setting up the supervision relay SR100 and many other instruments through a PC. Network and the transducer setting, display of measured

values are possible via the serial communication. The information and measurements can be exported in standard Windows formats. The software runs on Windows XP, Vista, Win7, Win8 and Win10 operating systems.

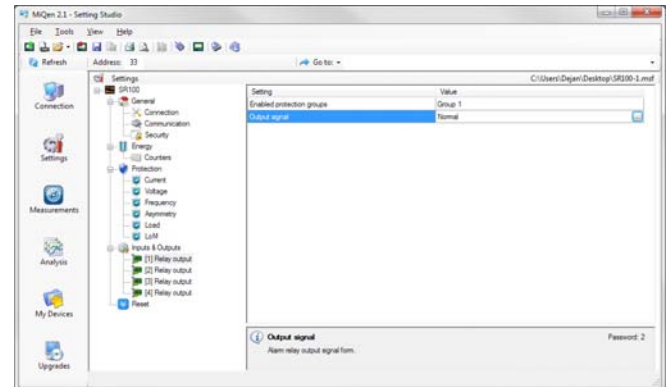


Figure 1: MiQEN Settings overview for supervision relay SR100 (example shows relay output module signal options)

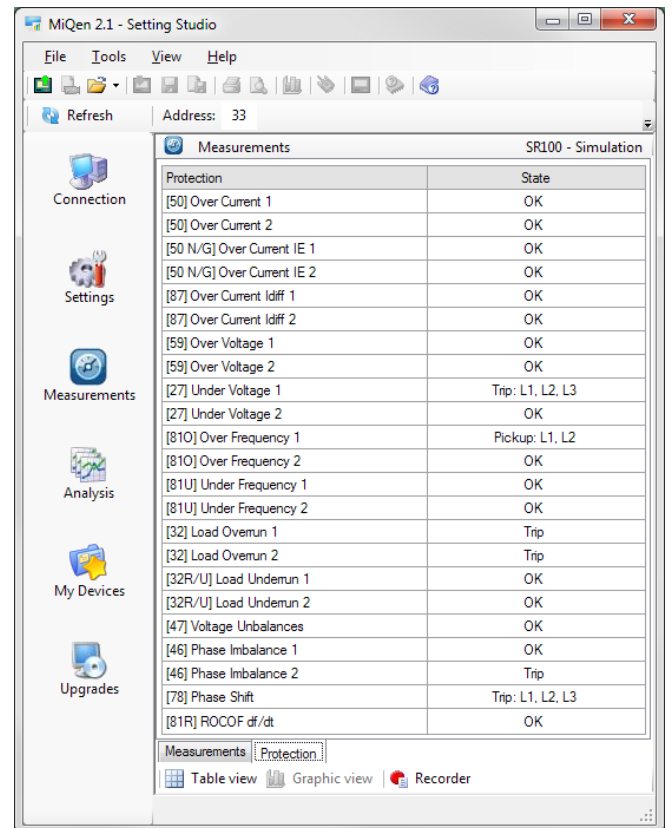


Figure 2: On-line data monitoring in supervision relay SR100 with MiQEN (example shows actual protection states)

The MiQEN Setting studio software comes together with the device and is intended for:

- Setting all of the instruments parameters (online and offline)
- Viewing current measured readings
- Setting and resetting energy counters
- Complete relay Output modules configuration
- Searching the network for devices
- Virtual interactive instrument
- Comprehensive help support

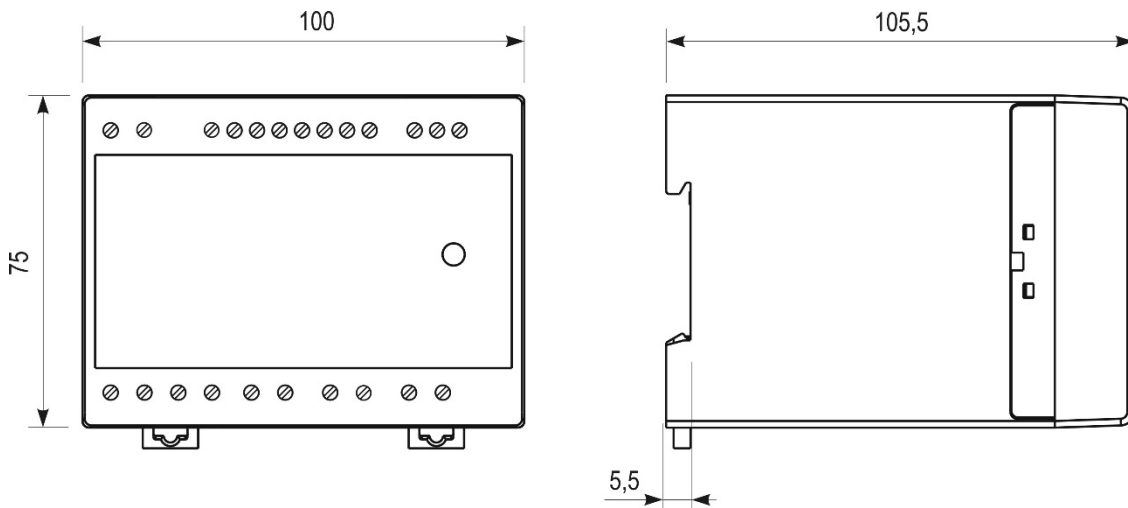
CONNECTION

System/connection	Terminal assignment
Connection 1b (1W) Single phase connection	
Connection 3b (1W3) Three phase, three wire connection with balanced load	
Connection 3u (2W3) Three phase, three wire connection with unbalanced load	

System/connection	Terminal assignment
Direct connection 3u (2W3) Three phase, three wire direct connection with unbalanced load	
Connection 4b (1W4) Three phase, four wire connection with balanced load	
Connection 4u (3W4) Three phase, four wire connection with unbalanced load	

System/connection	Terminal assignment
Connection Idiff Three phase, four wire connection with unbalanced load	
Connection IE Three phase, four wire connection with unbalanced load	

DIMENSIONAL DRAWING



Dimensions of supervision relay SR100.

CONNECTION TABLE

Function		Connection	
Measuring input	AC current	IL1	1/3
		IL2	4/6
		IL3	7/9
	AC voltage	UL1	2
		UL2	5
		UL3	8
N		11	
Inputs / outputs	I/O 1	+ / ~	15
		- / ~	16
	I/O 2	+ / ~	17
		- / ~	18
	I/O 3	+ / ~	19
		- / ~	20
	I/O 4	+ / ~	21
		- / ~	22
Auxiliary power supply		+ / ~ (L)	13
		- / ~ (N)	14
Communication	RS232 / RS485 / CANopen	Rx / A / CAN-H	23
		GND / NC / NC	24
		Tx / B / CAN-L	25

DATA FOR ORDERING

When ordering supervision relay SR100, all required specifications should be stated in compliance with the ordering code.

GENERAL ORDERING CODE

All specifications are obligatory, which should be stated in a form of description as stated below:

	Nominal Frequency	Communication	Output 1	Output 2	Output 3	Output 4	Finish	
SR100	x	x	x	x	x	x	x	
							A Standard *	
							H HVE (Tropical Seal)	
							S Ship version	
					N		Without	
					M		Electromechanical relay output	
				N			Without *	
				S			RS232	
				D			RS485	
				C			CANopen	
			S					50/60 Hz *
			A					400 Hz

EXAMPLE OF ORDERING:

Supervision relay SR100 connected to a 50 Hz network, with a CANopen communication, four electromechanical relay outputs and standard finish.

Example ordering code:

SR100 – S C M M M M A

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