

Device handbook

SIRAX BT5500

Operating Instructions SIRAX BT5500



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1. Legal information

1.1 Safety and warning notices

In this document safety and warning notices are used, which you have to observe to ensure personal safety and to prevent damage to property.



If the warning notice is not followed death or severe personal injury **will** result.



If the warning notice is not followed damage to property or severe personal injury **may** result.



If the warning notice is not followed the device **may** be damaged or **may** not fulfill the expected functionality.



The installation and commissioning should only be carried out by trained personnel. Check the following points before commissioning:

- that the maximum values for all the connections are not exceeded, see „Technical data“ section,
- that the connection wires are not damaged, and that they are not live during wiring,
- that the power flow direction and the phase rotation are correct.

The instrument must be taken out of service if safe operation is no longer possible (e.g. visible damage). In this case, all the connections must be switched off. The instrument must be returned to the factory or to an authorized service dealer.

It is forbidden to open the housing and to make modifications to the instrument. The instrument is not equipped with an integrated circuit breaker. During installation check that a labeled switch is installed and that it can easily be reached by the operators.

Unauthorized repair or alteration of the unit invalidates the warranty.



Please observe that the data on the type plate must be adhered to!

The national provisions have to be observed in the installation and material selection of electric lines!

1.2 Qualified personnel

The product described in this document may be handled by personnel only, which is qualified for the respective task. Qualified personnel have the training and experience to identify risks and potential hazards when working with the product. Qualified personnel are also able to understand and follow the given safety and warning notices.

1.3 Intended use

The product described in this document may be used only for the application specified. The maximum electrical supply data and ambient conditions specified in the technical data section must be adhered. For the perfect and safe operation of the device proper transport and storage as well as professional assembly, installation, handling and maintenance are required.

1.4 Disclaimer of liability

The content of this document has been reviewed to ensure correctness. Nevertheless it may contain errors or inconsistencies and we cannot guarantee completeness and correctness. This is especially true for different language versions of this document. This document is regularly reviewed and updated. Necessary corrections will be included in subsequent version and are available via our webpage www.camillebauer.com.

1.5 Feedback

If you detect errors in this document or if there is necessary information missing, please inform us via e-mail to: customer-support@camillebauer.com

1.6 Repair work and modifications

Repair work and modifications shall exclusively be carried out by the manufacturer. Do not open the housing of the device. In case of any tampering with the device, the warranty claim shall lapse. We reserve the right of changing the product to improve it.

1.7 Calibration and new adjustment

Each device is adjusted and checked before delivery. The condition as supplied to the customer is measured and stored in electronic form. The uncertainty of measurement devices may be altered during normal operation if, for example, the specified ambient conditions are not met.

1.8 Cleaning

The display and the control buttons should be cleaned at regular intervals. Use a dry or slightly damp cloth.



Damage caused by cleaning agents

Detergents can not only affect the clarity of the display, but also cause damage to the device. Therefore, do not use detergents.

1.9 Disposal



Device may only be disposed in a professional manner!

The disposal of devices and components may only be realised in accordance with good professional practice observing the country-specific regulations. Incorrect disposal can cause environmental risks.

1.10 Return

All devices delivered to Camille Bauer Metrawatt AG shall be free of any hazardous contaminants (acids, lyes, solutions, etc.). Use original packaging or suitable transport packaging to return the device.



Damage by returning

Damages caused by improper returning, no warranties or guarantees can be given.

2. Introduction

2.1 Purpose of this document

This document describes the programmable multi-function transducer SIRAX BT5500. It is intended to be used by Installers and commissioners, Service and maintenance personnel, Planner.

Scope

This handbook is valid for all versions of the programmable multi-function transducer SIRAX BT5500. Some of the functions described in this document are available only, if the necessary optional components are included in the device.

Required knowledge

A general knowledge in the field of electrical engineering is required. For assembly and installation of the device knowledge of applicable national safety regulations and installation standard is required.

2.2 Scope of supply

- Programmable multi-function transducer SIRAX BT5500 with mounting kit
- Safety instructions (multiple languages)

2.3 Further documents

The following documents are provided electronically via www.camillebauer.com:

- Datasheet (ge, en)
- Safety instructions (multiple languages)
- Operating manual (ge, en)

3. Functional description

The SIRAX BT5500 is a programmable multifunctional transducer for measuring parameters in a three-phase 3- or 4-wire AC network. It ensures the conversion of measured values into analog standard signals. The output signals are galvanically isolated from the input signals and the power supply.

It can be parameterized via the RS485 interface with Modbus RTU or via the USB interface with the configuration software. The relay outputs signal the overflow of the selected measured variables and the pulse output can be used to monitor the consumption of active energy.

3.1 Quantities measured and calculated

• 3-phase mean voltage	U	• Reactive/active ratio of power factors	$\text{tg}\varphi 1, \text{tg}\varphi 2, \text{tg}\varphi 3$
• Phase voltages	U1, U2, U3	• Active mean power (e.g. 150 min)	Pav
• Phase-to-phase voltages	U12, U23, U31	• Voltage values THD	U1, U2, U3
• Phase-to-phase mean voltage	UPP	• Current values THD	I1, I2, I3
• 3-phase mean current	I	• Phase values φ	$\varphi 1, \varphi 2, \varphi 3$
• Phase currents	I1, I2, I3	• 3-phase values $\cos\varphi$	$\cos\varphi$
• 3-phase active, reactive and apparent powers	P, Q, S	• phase values $\cos\varphi$	$\cos\varphi 1, \cos\varphi 2, \cos\varphi 3$
• Phase active powers	P1, P2, P3	• Calculated current in the neutral conductor wire	In
• Phase reactive powers	Q1, Q2, Q3	• 3-phase active and reactive energy	Ept, Eqt
• Phase apparent powers	S1, S2, S3	• Frequency	f
• 3-phase mean power factors	Pf, tg φ	• Energy consumption - power guard	Pord

4. Mechanical mounting and Installation

The SIRAX BT5500 can be mounted either on DIN Rail or directly on to a wall by mounting plate.



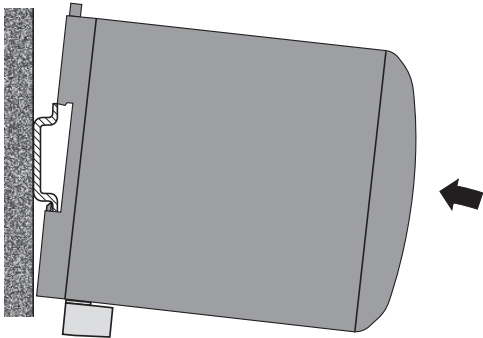
Please ensure that the operating temperature limits are not exceeded when determining the place of mounting (place of measurement): **-10 ... +55° C**



By installing, the device becomes part of an electrical power installation that must be designed, operated and maintained in accordance with country-specific regulations so that the installation is safe and provides prevention against fire and explosion as far as possible. It is the task of this installation to ensure that dangerous connections of the device can not be touched during operation and that the spread of flames, heat and smoke from the interior is prevented. This may be done by providing an enclosure (e.g. case, cabinet) or using a room accessible to qualified personal only and compliant with local fire safety standards.

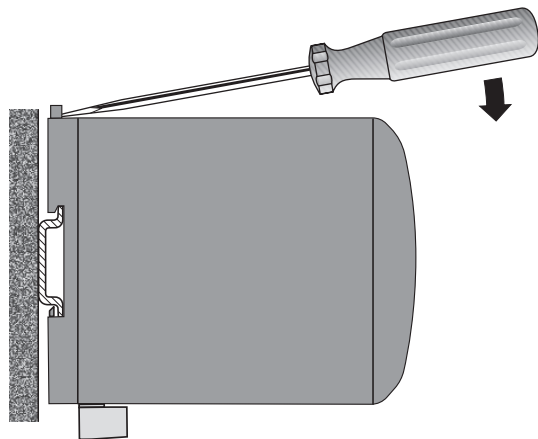
4.1 Mounting

Any mounting position is possible. Device may be clipped onto a top-hat rail according EN50022 or directly on to a wall by mounting plate.



4.2 Demounting of the device

Disassembly of the device requires that all connected wires be without current. First, remove all push terminals and the wires of the current and voltage inputs. Ensure that possible current transformers are short-circuited before the current connections on the device are opened. Release the transducer from a top-hat rail.



5. Terminal and Electrical connections details



Ensure under all circumstances that the leads are free of potential when connecting them!

5.1 General safety notes



Please observe that the data on the type plate must be adhered to!

The national provisions have to be observed in the installation and material selection of electric lines!

Symbol	Meaning
	Device may only be disposed of in a professional manner!
	Double insulation, device of protection class 2
CATIII	Measurement category CAT III for current / voltage inputs, power supply and relay outputs
	CE conformity mark. The device fulfills the requirements of the applicable EC directives. See declaration of conformity.
	Caution! General hazard point. Read the operating instructions.
	Attention: Danger to life!
	Please note

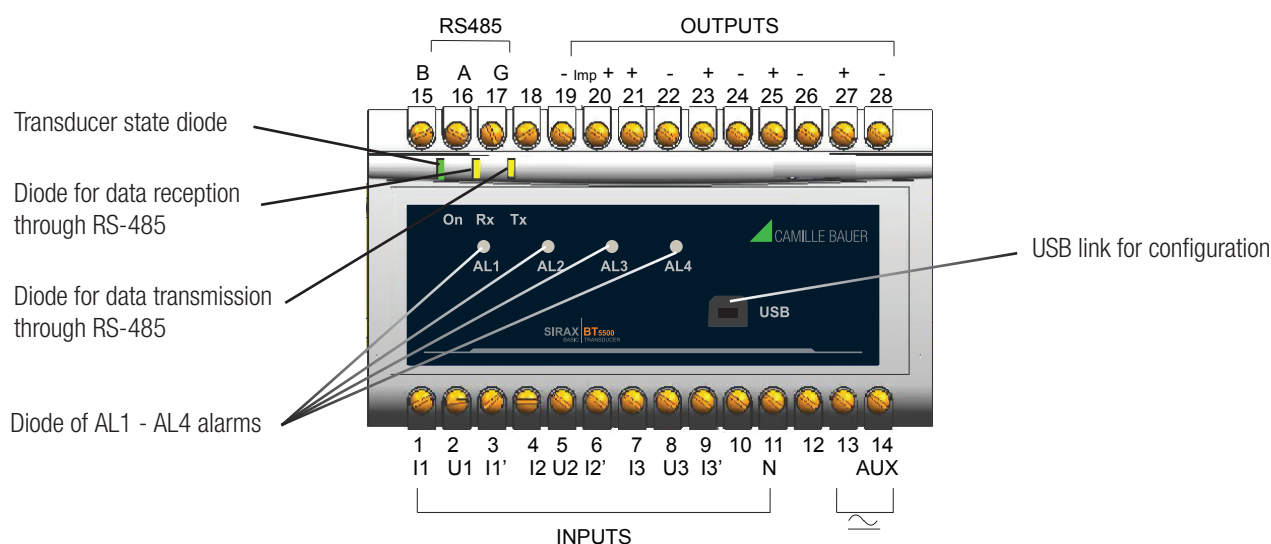
5.2 Possible cross sections and tightening torques

Inputs U1(2), U2(5), U3(8), N(11), I1(1/3), I2(4/6), I3(7/9), power supply (13/14), RS485 connector (15(B)/16(A)/17(G)), Outputs (19-28)

- Single wire: $\leq 4,0\text{mm}^2$ or multiwire with end splices: $2 \times 2,5\text{mm}^2$

- Torque: 0,5 ... 0,6Nm or 4,42 ... 5,31 lbf in

5.3 LED, Terminal and Connection details



LED indication

LED	State	Indication
ON	Green continuous	Aux Supply healthy condition and calibration ok
Rx	Pulsing	Data reception through RS-485
Tx	Pulsing	Data transmission through RS-485
AL1 ... AL4	Continuous ON	Alarm ON

Inputs



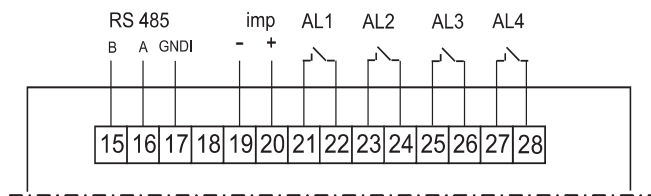
All voltage measurement inputs must originate at circuit breakers or fuses rated by 1 Amps. This does not apply to the neutral connector. You have to provide a method for manually removing power from the device, such as a clearly labeled circuit breaker or a fused disconnect switch.

When using **voltage transformers** you have to ensure that their secondary connections never will be short-circuited.

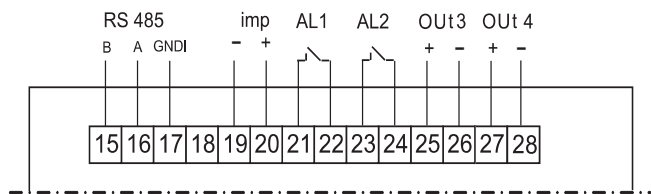
No fuse may be connected upstream of the **current measurement inputs!**

When using **current transformers** their secondary connectors must be short-circuited during installation and before removing the device. Never open the secondary circuit under load.

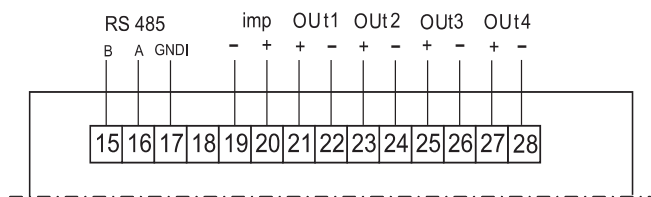
Version without analog outputs 4 relays



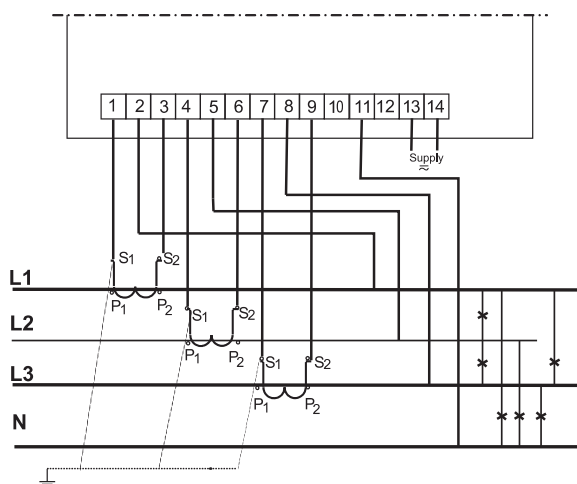
Version with 2 analog outputs 2 relays



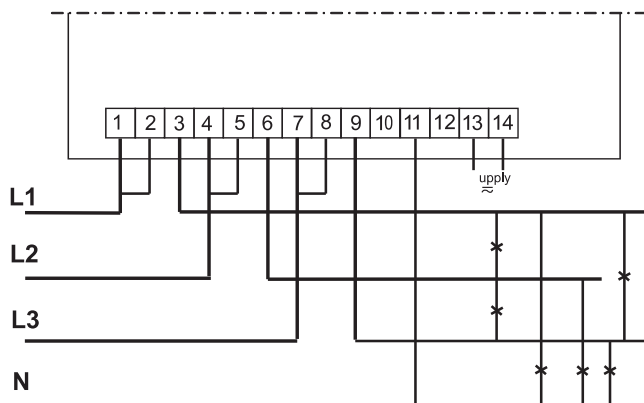
Version with 4 analog outputs without relays



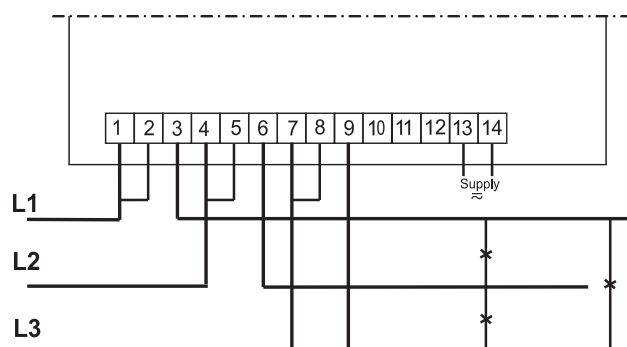
Measurement with the use of current transformer in a four-wire network



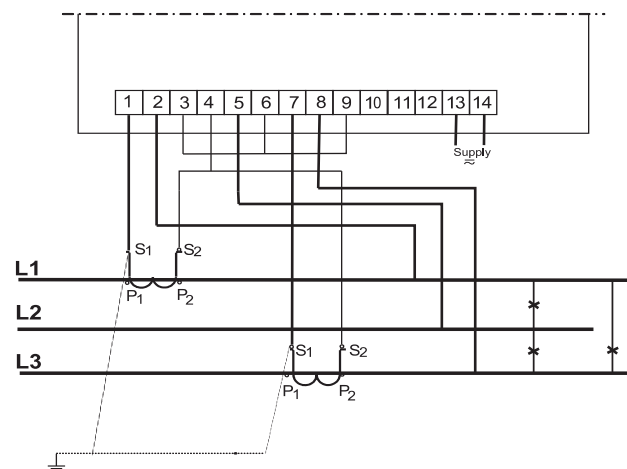
Direct measurement in a four-wire network



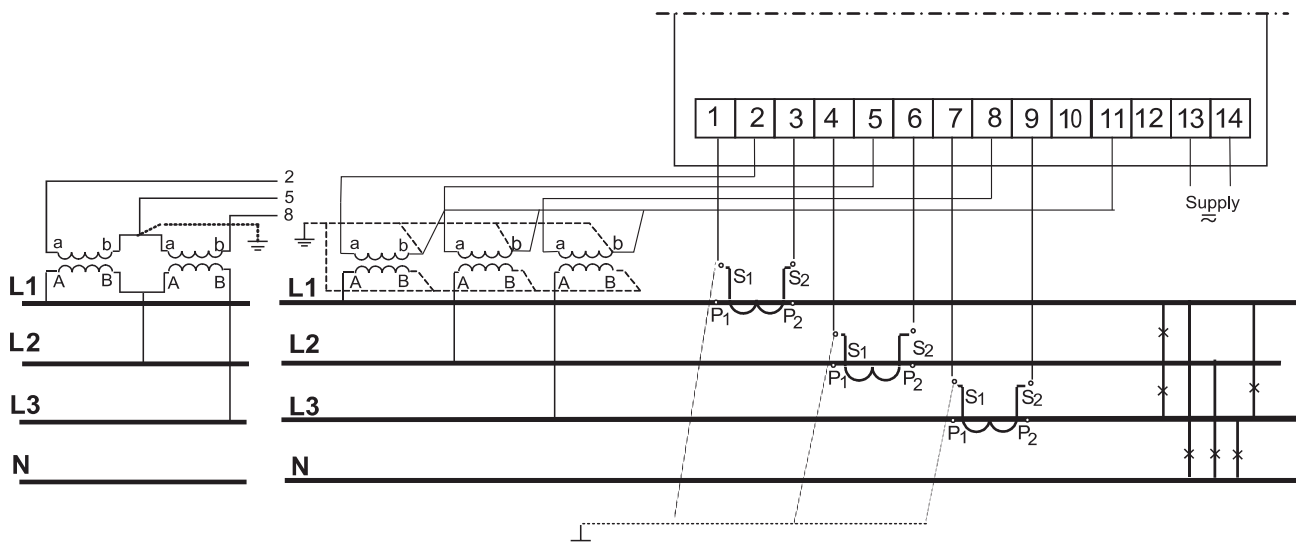
Direct measurement in a three-wire network

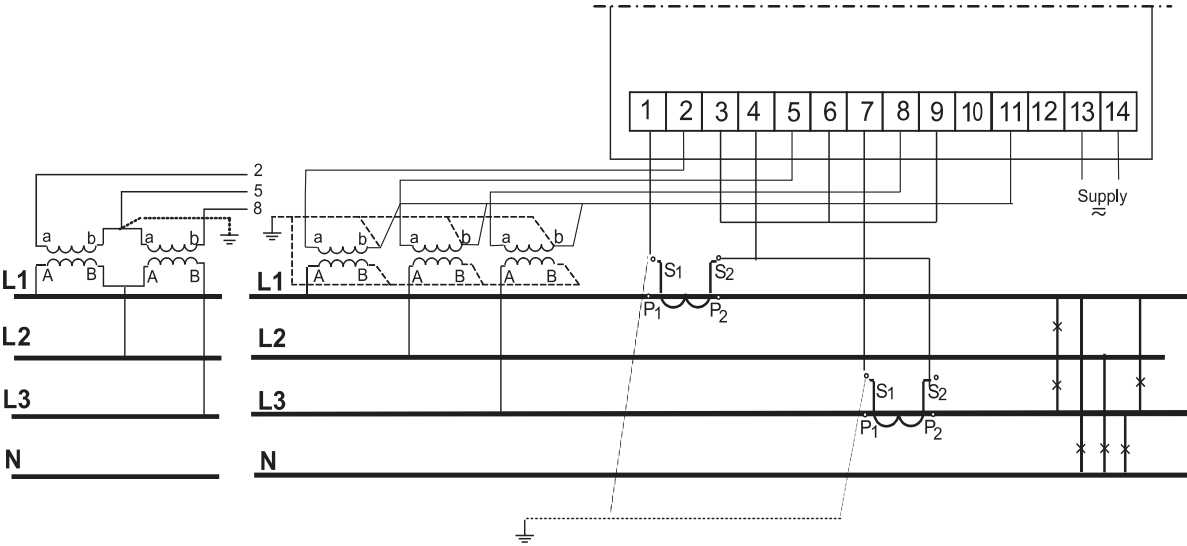


Semidirect measurement in a three-wire network



Indirect measurement with the use of 3 current transformers and 2 or 3 voltage transformers in a four-wire network





5.4 Power supply



A marked and easily accessible current limiting switch has to be arranged in the vicinity of the device for turning off the power supply. Fusing should be 10 Amps or less and must be rated for the available voltage and fault current.

After switching the power supply on, the state diode should light up for a moment in red, and next should light up in green. The recording confirmation in registers is signaled by a short extinction of the state diode.
The incorrect work is signaled by the state diode in the way described in the chapter 5.3 and 7.1.10. The data reception through the RS-485 interface is signaled by a pulsing of the Rx diode and the data transmission is signaled by a pulsing of the Tx diode.
The switching of the relay 1 - 4 on causes the lighting of the AL1 - AL4 diode.

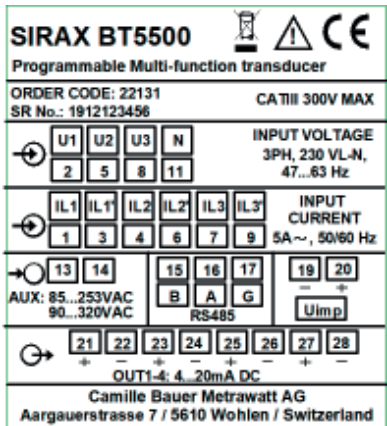
5.5 Modbus interface RS485

Via the optional Modbus interface measurement data may be provided for a superior system. When using the USB port interface, the configuration must be as follows: Device Address: 001; Baud rate: 57600; Parity: None; Stop bit: 1
The signal wires (A, B) have to be twisted. GND (G) can be connected via a wire or via the cable screen. In disturbed environments shielded cables must be used. Supply resistors (Rs) have to be present in bus master (PC) interface. Stubs should be avoided when connecting the devices. A pure daisy chain network is ideal.
You may connect up to 32 Modbus devices to the bus. A proper operation requires that all devices connected to the bus have equal communication settings (baud rate, transmission format) and unique Modbus addresses.
The bus system is operated half duplex and may be extended to a maximum length of 1200 m without repeater.

6. Commissioning



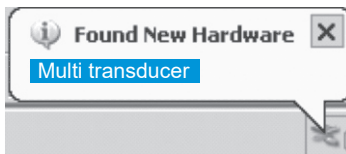
Before commissioning you have to check if the connection data of the device match the data of the plant.
If so, you can start to put the device into operation by switching on the power supply and the measurement inputs.



Label version with 4 analog output 4...20mA

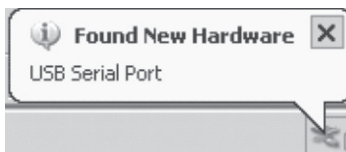
7. Programming

Before configuring the transducer, the driver should be installed. The transducer makes use of the software, which creates in the system, a device of Universal Serial Bus – Multi-transducer and connected to it, the virtual COM port named Multi-transducer. The controller installation in the Windows system causes the addition of a successive serial COM port to the list of ports serviced by the operating system. After connecting the transducer to the USB port, the operating system informs about the appearance of a new device by means of the message.

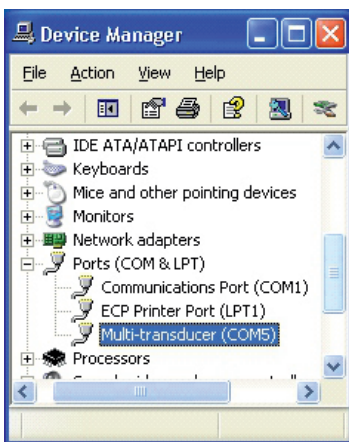


The creator to find a new hardware of the Universal Serial Bus will be started automatically. One must act in compliance with the creator suggestions, choosing the installation from the indicated location and giving the path to controllers being on www.camillebauer.com. Controllers are compatible with following systems: Windows 10, 2000, XP, Server 2003, Vista, server 2008, Windows 10 (x86 and X64). When installing controllers, information about the lack of the controller digital signature can occur. One must ignore this information and carry on the installation.

After closing the creator, the system detect immediately the successive device – USB Serial Port. The creator for detection a new hardware will start again.

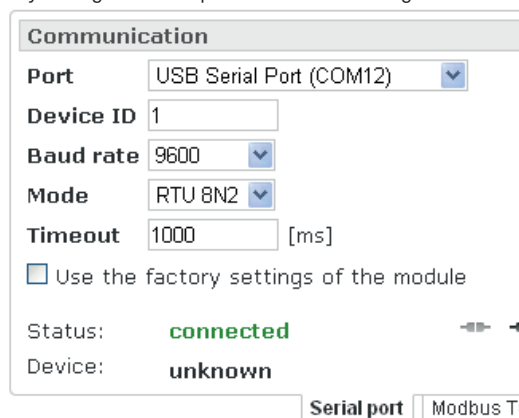
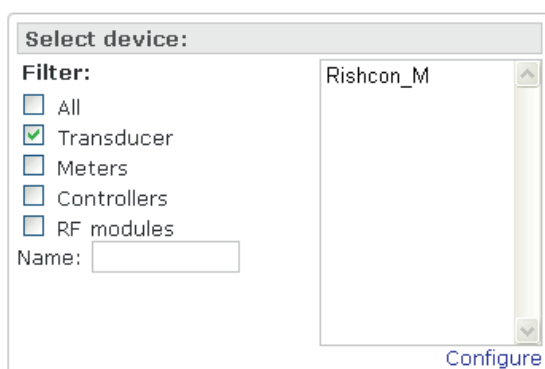


After the successful ending of the installation, the system will inform about the installation of a new device. Two new devices appear in the device manager – Multi-transducer and Port COM named: Multi-transducer.



7.1 Configuration of the transducer

The SIRAX BT5500 can be configured via software. The transducer has to be connected to the computer through the RS-485 converter, if the communication will be performed using RS-485/Modbus Interface or directly through the USB port and after selecting Multi-transducer the configuration for the connection can be done.



7.1.1 Setting of Transmission Parameters

After choosing the group – transmission parameters, it is possible to configure following elements:

- address – address for the communication with the Multi-transducer through the RS-485 interface from the range 1...247. The value 1 is normally set up by the manufacturer.
- baud rate – the communication rate through the RS-485 interface from the range (4800, 9600, 19200, 38400 bit/sec.). The value 9600 is set up by the manufacturer.
- transmission mode – The transmission mode through the RS485 interface from the range (RTU 8N2, RTU 8E1, RTU 8O1, RTU 8N1). The transmission mode is normally set up on RTU 8N2 by the manufacturer.

Multi-transducer - configuration



Transmission parameters

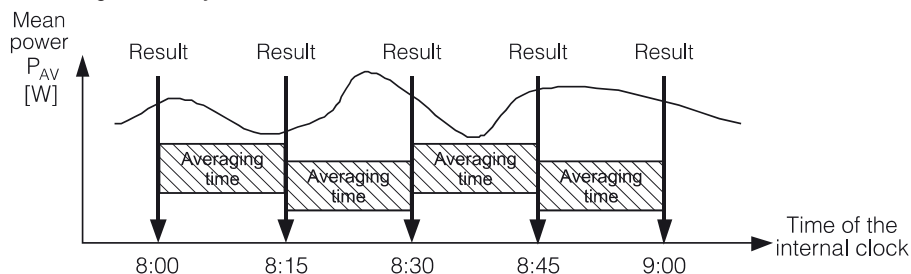
Device ID	1	[1 - 247]
Baud rate	9600	▼
Mode	RTU 8N2	▼
Save		

7.1.2 Setting of Measurement Parameters

After choosing the group: Meter parameters following elements can be configured:

- Current transformer ratio. The multiplier is used to recalculate the current in the transformer primary side. It is set up on 1 by the manufacturer.
- Voltage transformer ratio. The multiplier is used to recalculate the voltage in the transformer primary side. It is set up on 1 by the manufacturer.
- Way to synchronize the mean power:
 - 15 minutes' walking window – mean power P_{AV} will be recalculated for the last 15 minutes, actualized every 15 seconds, i.e. walking window,
 - Measurement synchronized with the clock every 15, 30 or 60 minutes - mean power PAV will be actualized every 15, 30 or 60 minutes synchronized with the external real clock.

It is set up on the walking window by the manufacturer.



Measurement of the 15 minutes' active mean power synchronized with the clock

- ordered power. Ordered power in percentage of rated power (see chapter 10, example 2).
- pulse ratio for the pulse output (for active energy).
- Storing min. and max. values. Choosing of minimal and maximal values storage method: only from measuring range or also overflow error occurrence.
- Reactive energy calculation method: inductive and capacitive or plus and minus.
- 3 phase measurement mode- 3 and 4 wire measurement.

7.1.3 Erasing of Watt-hour Meters and Extremal Values

After choosing the group: Service parameters following commands are possible to carry out:

- erasing of watt-hour meters. All watt-hour meters of active and reactive energy are erased.
- erasing of active mean power.
- erasing of averaging power archive.
- erasing of min. and max. values. The currently measured value is copied out to the minimal and maximal value.
- clock: it is possible to set time and date synchronize the clock with the time on the PC (computer).

Service parameters

Manufacturer parameters		Restore
Erase energy meters	None	▼
Erase mean active power	☐	
Erase averaged power archive	☐	
Erase min. and max. values	☐	
Date	[yyyy-mm-dd]	Synchronize
Time	[hh:mm]	
Save		

7.1.4 Setting of alarm parameters

After choosing the group: alarm 1-4 configuration, it is possible to configure following alarm parameters:

- assignment of the alarm output parameter – kind of signal, on which the alarm acc. to the table 1 has to react.
- kind of the alarm output operation – choose one from 6 modes n-on, n-off, on, off, h-on and h-off,
- lower value of alarm switching – percentage value of the state change of the chosen signal,
- upper value of alarm switching – percentage value of the state change of the chosen signal,
- switching delay of the alarm. Delay time in seconds when switching the alarm state,
- switching off delay of the alarm. Delay time in seconds when switching off the alarm state,
- deadlock of alarm re-switching. Time, after which the alarm can be switched on again.

Table 1

Value in registers 4015, 4023, 4031, 4039, 4047, 4055, 4063, 4072	Kind of quantity	Value for percentage calculation of alarms and output values
00	Lack of quantity /alarm or analog output switched off/	Lack
01	Voltage of phase L1	$U_n [V]^*$
02	Current in the wire of phase L1	$I_n [A]^*$
03	Active power of phase L1	$U_n \times I_n \times \cos(0^\circ) [W]^*$
04	Reactive power of phase L1	$U_n \times I_n \times \sin(90^\circ) [var]^*$
05	Apparent power of phase L1	$U_n \times I_n [VA]^*$
06	Coefficient of active power of phase L1	1
07	Coefficient $\tan \varphi$ of phase L1	1
08	Voltage of phase L2	$U_n [V]^*$
09	Current in the wire of phase L2	$I_n [A]^*$
10	Active power of phase L2	$U_n \times I_n \times \cos(0^\circ) [W]^*$
11	Reactive power of phase L2	$U_n \times I_n \times \sin(90^\circ) [var]^*$
12	Apparent power of phase L2	$U_n \times I_n [VA]^*$
13	Coefficient of active power of phase L2	1
14	Coefficient $\tan \varphi$ of phase L2	1
15	Voltage of phase 3	$U_n [V]^*$
16	Current in the wire of phase L3	$I_n [A]^*$
17	Active power of phase L3	$U_n \times I_n \times \cos(0^\circ) [W]^*$
18	Reactive power of phase L3	$U_n \times I_n \times \sin(90^\circ) [var]^*$
19	Apparent power of phase L3	$U_n \times I_n [VA]^*$
20	Coefficient of active power of phase L3	1
21	Coefficient $\tan \varphi$ of phase L3	1
22	3-phase mean voltage	$U_n [V]^*$
23	3-phase mean current	$I_n [A]^*$
24	3-phase active power	$3 \times U_n \times I_n \times \cos(0^\circ) [W]^*$
25	3-phase reactive power	$3 \times U_n \times I_n \times \sin(90^\circ) [var]^*$
26	3-phase reactive power	$3 \times U_n \times I_n [VA]^*$
27	Power factor of 3-phase active power	1
28	3-phase coefficient $\tan \varphi$	1
29	Frequency	100 [Hz]
30	Phase-to-phase voltage L1-L2	$\sqrt{3} U_n [V]^*$
31	Phase-to-phase voltage L2-L3	$\sqrt{3} U_n [V]^*$
32	Phase-to-phase voltage L3-L1	$\sqrt{3} U_n [V]^*$
33	Phase-to-phase mean voltage	$\sqrt{3} U_n [V]^*$
34	Mean active power	$3 \times U_n \times I_n \times \cos(0^\circ) [W]^*$
35	Used active ordered power (used energy)	100 [%]

* U_n , I_n – Rated values of transducer voltage and current

▼ Alarm 1

Alarm source	Off
Alarm type	n-on
Lower alarm switching value [ALof]	[-144.0 - 144.0 %]
Upper alarm switching value [ALon]	[-144.0 - 144.0 %]
Delay of the alarm switching	[0 - 900 s]
Alarm off delay	[0 - 900 s]
Delay of the alarm reswitching	[0 - 900 s]
Save	

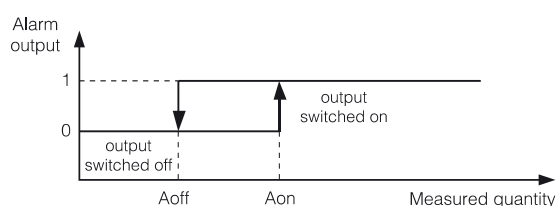
The set of the input quantity for alarms and analog outputs is included in the table 1. The calculation way is shown in examples in the chapter 10.

Caution! The setup of the value Aoff Aon causes the alarm switching off.

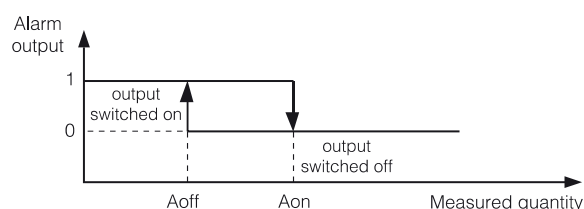
Caution! In version with analog outputs, alarms with numbers, which equal the analog outputs, control only the alarm diode on the transducer.

Exemplary configuration of alarms 1-4

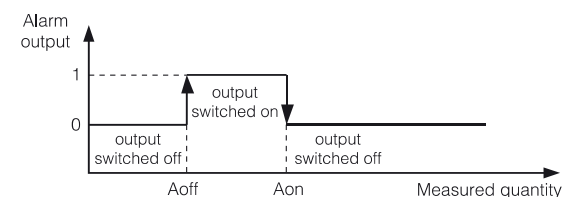
a) n-on



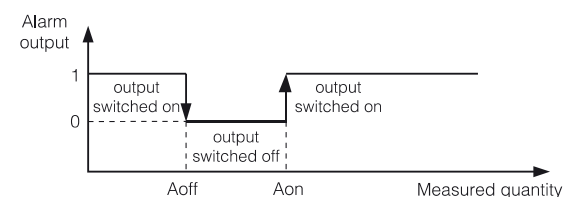
b) n-off



c) on



d) off



Other alarm types: h-on – always switched on; h-off – always switched off.

7.1.5 Setup of analog output parameters

After choosing the group: output 1-4, it is possible to configure following output parameters:

- assignment of the parameter to the analog output. Kind of signal, on which the output has to react acc. to the table 1,
- lower value of the input range. Percentage value of the chosen signal,
- upper value of the input range. Percentage value of the chosen signal,
- lower value of the output range. Output signal value in mA,
- upper value of the output range. Output signal value in mA,
- working mode of the analog output. Following modes are accessible: normal work lower value, upper value. Both alarms are set up in the normal mode by the manufacturer.
- value on the output by false input parameter value (1e20) in mA.

An exemplary configuration of the analog output

▼ Analog output 1

✓ Saved successfully.

Analog output source	U L1
Output type	0..20 mA
Lower value of the input range	0 [-144.0 - 144.0 %]
Upper value of the input range	100 [-144.0 - 144.0 %]
Lower value of the output range	4 [-20.00 - 20.00 mA]
Upper value of the output range	20 [0.01 - 20.00 mA]
Analog output mode	normal
Output value in case of error	24 [-24 - 24 mA]
Save	

Admissible overflow on the analog output: 20% of the lower and upper range value.

Minimal value on the analog output: $-20 \cdot 1.2 = -24$ mA.

Maximal value on the analog output: $20 \cdot 1.2 = 24$ mA.

7.1.6 Restoration of Manufacturer Parameters

After choosing the group: restoration of manufacturer parameters it is possible to restore following manufacturers parameters set in the table 2:

Table 2

Parameter description	Range/value	Manufacturer value
Ratio of the current transformer	1...10000	1
Ratio of the voltage transformer	1...4000	1.0
Synchronization of the active mean power:	15 minutes' walking window (recording in the archive every 15 minutes); measurement synchronized with the clock every 15, 30 or 60 minutes	walking window
The way of min. and max. value storage	0.1	0 - without errors -1e20, 1e20
The way of passive energy calculation	0.1	0 - inductive and capacitive energy
Ordered power	0...144,0 %	100,0 %
Quantity on the alarm output No 1, 2, 3, 4	0...35 (acc. to the table 1)	24
Output type of the alarm 1, 2, 3, 4	n-on; n-off; on; off; h-on; h-off	n-on
Lower value of the alarm 1, 2, 3, 4 switching	-144.0...144.0 %	99.0 %
Upper value of the alarm 1, 2, 3, 4 switching	-144.0...144.0 %	101.0 %
Switching delay of the alarm 1, 2, 3, 4	0...900 seconds	0
Switching-off delay of the alarm 1, 2, 3, 4	0...900 seconds	0
Deadlock of alarm 1,2,3,4 re-switching	0...900 seconds	0
Quantity on the continuous output No 1, 2, 3, 4	0...35 (acc. to the table 1)	24
Lower value of the input range in % of the rated range of the input No 1, 2, 3, 4	-144.0...144.0 %	0.0%
Upper value of the input range in % of the rated range of the input No 1, 2, 3, 4	-144.0...144.0 %	100.0%
Lower value of the output range of the output No 1, 2, 3, 4	-20.00...20.00 mA	0.00 mA
Upper value of the output range of the output No 1	0.01...20.00 mA	20.00 mA
Manual switching of the analog output 1, 2, 3, 4 on:	normal work, the lower value of the output range is set up, the upper value of the output range is set up.	normal work
Pulse quantity for pulse output	5000 - 20000	5000
Address in the MODBUS network	1... 247	1
Transmission mode	8n2, 8e1, 8o1, 8n1	8n2
Baud rate	4800, 9600, 19200, 38400	9600

7.1.7 Measured Values

After choosing the group: - measured values, all parameters measured by the transducer are displayed in the form of a list.

Parameter	Value	Parameter	Value
U L1	---	f	---
I L1	0 A	U L1-2	0 V
P L1	---	U L2-3	0 V
Q L1	---	U L3-1	0 V
S L1	---	Uavg (phase-to-phase)	0 V
PF L1	---	Pavg	0 W
tgφ L1	---	THD U1	---
U L2	---	THD U2	---
I L2	0 A	THD U3	---
P L2	---	THD I1	---
Q L2	---	THD I2	---
S L2	---	THD I3	---
PF L2	---	Cosine of angle between U1 and I1	---
tgφ L2	---	Cosine of angle between U2 and I2	---
U L3	---	Cosine of angle between U3 and I3	---
I L3	0 A	3-phase mean cosinus	---
P L3	---	Angle between U1 and I1	---
Q L3	---	Angle between U2 and I2	---
S L3	---	Angle between U3 and I3	---
PF L3	---	Current in neutral wire	---

7.1.8 Minimal and Maximal Values

After choosing the group: - minimal and maximal values, minimal and maximal values of individual parameters measured by the transducer in the form of a list are displayed.

Minimum and maximum values					
Refresh			float precision: 2		
Parameter	Min. value	Max. value	Parameter	Min. value	Max. value
U L1	---	---	Uavg (3-phase)	---	---
U L2	---	---	Iavg (3-phase)	0 A	0 A
U L3	---	---	ΣP (3-phase)	0 W	0 W
I L1	0 A	0 A	ΣQ (3-phase)	0 var	0 var
I L2	0 A	0 A	ΣS (3-phase)	0 VA	0 VA
I L3	0 A	0 A	PF (3-phase)	---	---
P L1	---	---	tg ϕ (3-phase)	---	---
P L2	---	---	f	---	---
P L3	---	---	Uavg (phase-to-phase)	0 V	0 V
Q L1	---	---	Mean active power	0 W	0 W
Q L2	---	---	THD U1	---	---
Q L3	---	---	THD U2	---	---
S L1	---	---	THD U3	---	---
S L2	---	---	THD I1	---	---
S L3	---	---	THD I2	---	---
PF L1	---	---	THD I3	---	---
PF L2	---	---	Cosine of angle between U1 and I1	---	---
PF L3	---	---	Cosine of angle between U2 and I2	---	---
tg ϕ L1	---	---	Cosine of angle between U3 and I3	---	---

7.1.9 Archive of power profile

After choosing the group: - archive of power profile, following information is available -record in archived : from which sample to display and number of records to be read.

Archive of Mean Active Power		
Records in archive:	560	
Read from number:	1	
Number of records to be read:	15	
Download		
Record No.	Time	Pavg
1	2011-02-02 21:15	0 W
2	2011-02-03 04:15	345.415 W
3	2011-02-03 04:30	290.468 W
4	2011-02-03 04:45	114.407 W
5	2011-02-03 05:00	232.687 W
6	2011-02-03 05:15	664.469 W
7	2011-02-04 03:00	0 W
8	2011-02-04 03:15	0 W
9	2011-02-04 03:30	0 W
10	2011-02-04 04:00	0 W
11	2011-02-04 07:15	0 W
12	2011-02-04 07:45	0 W
13	2011-02-14 03:30	0 W
14	2011-02-14 03:45	0 W

The transducer is equipped with an archive allowing to store up to 1000 measurements of averaged active power. The averaged active power PAV can be archived with time intervals 15, 30, 60 minutes (synchronized with the internal time clock) according to synchronization type in register 4005. In case of work in the walking window mode, the archiving follows in full quarters of an hour, despite the fact, that the step of the walking window lasts 15 seconds and the walking window function can be activated any moment. Direct access to the archive is for 15 records including date, time and value located in the range of addresses 1000 - 1077. In register 1000 is placed the position of the first (the oldest one) archived sample, and in register 1001 is the position of the last archived sample (the latest one). In register 1002 is placed the first record of the fifteen available records located in registers 1003 - 1077. After writing the first read record (1 - 9000), the data of 15 records for read-out are updated. Values 1e20 are in registers, in which samples are not written yet. The archive is organized in a shape of a circular buffer. After writing the nine thousandth value, the next value overwrites the oldest value with the number 0, and successively the next with the number 1, etc. If the value of the register 1000 is higher than 1001, it means, that the buffer at least once was overflowed. For example value 15 in the register 1000 and 14 in register 1001 means, that there was more than nine thousand of samples and the oldest samples are from the record 15 to 9000, next from the record 1 to the latest record with the number 14. Erasing of average power or change of the average time do not erase the archive. Automatic erasing of the archive and average power is made after current or voltage transformer ratio is changed.

7.1.10 Error Codes

After connecting the transducer to the network, messages about errors can appear. Causes of errors are presented below:

- the state diode pulsates in red – lack of calibration or the non-volatile memory is damaged. One must return the transducer to the manufacturer,
- the state diode lights in red – inappropriate work parameters; one must configure the transducer again.
- the state diode pulsate alternately in red and green - error of phase connection sequence; one must interchange the connection of phase L2 with the phase L3.

8. Technical specifications

Input

AC voltage

Nominal input (Un)	100 ... 400 VL-L (3-phase, 3-wire) 57.5 ... 230 VL-N (3-phase, 4-wire)
Measuring range	0 ... 0.05 ... 1.2 of rated value (Un)
Accuracy voltage L-L	±0.5%
Accuracy voltage L-N	±0.2%
Burden	≤ 0.05 VA
Admissible peak factor	2
Maximum overload	1.2 x Un continuously (480 V max.) 2 x Un (max. 1000 V) for 5 s

AC current

Nominal input (In)	1 / 5 A
Measuring range	0 ... 0.002 ... 1.2 of rated value (In)
Accuracy	±0.2%
Burden	≤ 0.1 VA
Admissible peak factor	2
Maximum overload	1.2 x In continuously (6 A max.) 10 x In for 5 s

Frequency

Range	47 ... 63 Hz
Accuracy	±0.2%

Auxiliary Supply

Nominal voltage range	85 ... 253 VAC (40 ... 400 Hz) or 90 ... 320 VDC 20 ... 40 VAC (40 ... 400 Hz) or 20 ... 60 VDC
Burden	≤ 10 VA

Power

Active Power range	-1.65 kW ... 1.4 W ... 1.65 kW
Accuracy	±0.5%
Reactive Power range	-1.65 kvar ... 1.4 var ... 1.65 kvar
Accuracy	±0.5%
Apparent Power range	1.4 VA ... 1.65 kVA
Accuracy	±0.5%
Power factor	-1 ... 0 ... 1 (0 Lag ... 1 ... Lead 0) (0 ... 0.1 ... 1.2 In and 0 ... 0.1 ... 1.2 Un) sinusoidal (THD ≤ 8%)
Accuracy	±0.5%
Tangens φ	-1.2 ... 0 ... 1.2 (0 ... 0.1 ... 1.2 In and 0 ... 0.1 ... 1.2 Un) sinusoidal (THD ≤ 8%)
Accuracy	±1%
Cosinus φ	-1 ... 1
Accuracy	±1%
Angle between U and I	-180° ... 180°
Accuracy	±0.5%

Energy

Input active energy	0 ... 99999999.9 kWh
Accuracy	±0.5%
Developed active energy	0 ... 99999999.9 kvarh
Accuracy	±0.5%

Reactive inductive energy	0 ... 99999999.9 kWh
Accuracy	±0.5%
Reactive capacitive energy	0 ... 99999999.9 kvarh
Accuracy	±0.5%
Total harmonic distortion (THD)	0 ... 100% (in the range 10 ... 120% U _I)
Accuracy	±5%

Additional errors	in percentage of the basic error
from frequency of input signals	< 50%
from ambient temperature changes	< 50% / 10°C
for THD > 8%	< 100%

Output

Analog Outputs

Number of analog outputs	0, 2 or 4 programmable outputs
Range for current	-20 ... 0 ... +20 mA
Maximum load resistance	0 ... 750 Ω (for admissible overflow of 20% on analog output R _{load} = 0 ... 600 Ω)
Accuracy	0.2%
Response time	3 s

Relay Outputs

Number of relays	0, 2 or 4 relays, voltageless NO contacts
Load capacity	250 V~ / 0.5 A~

Pulse Output

Energy pulse output	output of OC type, passive acc. to EN62053-31
Pulse constant of OC type output	5000 ... 20000 imp./kWh, independently on setting ratios K _u , K _i
Ratio of the voltage transformer K _u	0.1 ... 4000.0
Ratio of the current transformer K _i	1 ... 10000

Communication interface

RS-485, Modbus/RTU

Physics	Via screw terminal, RS-485, max. 1200m
Protocol	Modbus/RTU
Identifier	0xC4 (198)
Response time	500 ms
Address	1 ... 247
Mode	8N2, 8E1, 8O1, 8N1
Baud rate	4800, 9600, 19200, 38400 kbits/s
Number of participants	< 32
Maximal number registers retrieved in a single query	56 registers - 4 bytes each 105 registers - 2 bytes each
Implemented functions	03 readout of registers 16 write of registers 17 device identifying

USB

Physics	USB 1.1 / 2.0
Protocol	Modbus/RTU
Identifier	0xC6 (198)
Response time	500 ms
Address	1
Mode	8N2
Baud rate	9600 kbit/s

Maximal number of bytes during the readout/write	56 registers - 4 bytes each 105 registers - 2 bytes each
Implemented functions	03 readout of registers 16 write of registers 17 device identifying

Environmental conditions

Operating temperature	-10 ... +55 °C
Storage temperature	-30 ... +70 °C
Relative humidity	25 ... 95% (inadmissible condensation)
Preheating time	5 min.
Altitude	< 2000 m

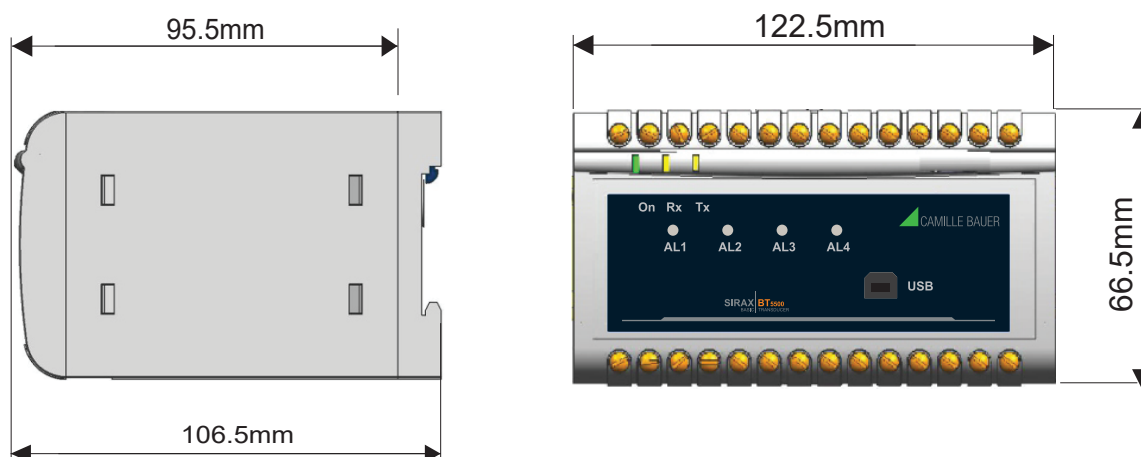
Safety

EMC immunity	acc. to IEC 61000-4-2
EMC emission	acc. to IEC 61000-6-4
External magnetic field	0 ... 40 ... 400 A/m
Protection class	II (Protection Isolated acc. to EN 61010-1)
Pollution degree	2
Installation category	CATIII
Maximal phase-to-earth voltage	300V (for supply and measurement circuit) 50V (for other circuit)
Isolation between circuits	basic (DC) 50Hz, 1min. (EN 61010-1) 3110 VDC, All terminals versus outer surface 3110 VDC, Input versus all other circuit 3110 VDC, Auxiliary supply versus outer surface and all other circuit
Housing protection class	IP40, housing acc. to EN50529 IP20, terminal acc. to EN50529

Mechanical properties

Mounting	DIN Rail mounting / wall mounting
Work position	Any
Connectors	Conventional Screw type terminal ≤ 4.0 mm single wire or 2 x 2.5 mm Fine wire
Flammability class	UL94 V-0, self-extinguishing, non-dripping, free of halogen
Dimensions	122.5 x 66.0 x 106.5 mm (w x h x d)
Weight	0.45 kg

Dimensions



9. Interface Definition Modbus (RS485)

The programmable multi-function transducer SIRAX BT5500 supports the MODBUS (RS485) RTU protocol (2-wire).

Connection should be made using twisted pair shielded cable. All "A" and "B" connections are daisy chained to-gether. The screens should also be connected to the "Gnd" terminal. To avoid the possibility of loop currents, an Earth connection should be made at one point on the network. Loop (ring) topology does not require any termination load. Line topology may or may not require terminating loads depending on the type and length of cable used. The impedance of the termination load should match the impedance of the cable and be at both ends of the line. The cable should be terminated at each end with a 120 ohm (1/4 Watt min.) resistor.

RS 485 network supports maximum length of 1.2km. Including the Master, a maximum of 32 instruments can be connected in RS485 network. The permissible address range for The Meter is between 1 and 247 for 32 instruments. Broadcast Mode (address 0) is not allowed.

The maximum latency time of an Meter is 500ms i.e. this is the amount of time that can pass before the first response character is output.

After sending any query through software (of the Master), it must allow 500ms of time to elapse before assuming that the Meter is not going to respond. If slave does not respond within 500 ms, Master can ignore the previous query and can issue fresh query to the slave.

In the transducer, data are located in 16-bit and 32-bit registers. Process variables and transducer parameters are located in the register address space in the way depending on the type of the variable value type. Bits in 16-bit register are numbered in the way depending on the variable value type. Bits in 16-bit registers are numbered from the younger to the older (b0-b15). 32-bit registers contain numbers of float type in the IEEE-745 standard. Register ranges are set in the table 3. 16-bit registers are presented in the table 4. 32-bit registers are set in tables 5 and 6. Register addresses in tables 3,4,5,6 are physical addresses.

Table 3

Range of addresses	Type of value	Description
1000 - 1077	Integer (16 bits) Record	Archive of average power profile. Table 9 contains description of registers
4000 - 4105	Integer (16 bits)	Value located in one 16-bit register. The table 3 contains the register description. Registers for write and readout.
6000 - 6335	Float (2x16 bits)	Value located in two successive 16-bit registers. Registers contain the same data as 32-bit registers from the area 7500. Registers for readout. Sequence of byte(0-1-2-3)
7000 - 7335	Float (2x16 bits)	Value located in two successive 16-bit registers. Registers contain the same data as 32-bit registers from the area 7500. Sequence of byte(3-2-1-0)
7500 - 7667	Float (32 bits)	Value located in one 32-bit register. The table 4 contains the description of registers. Registers for readout.

Table 4

Range of address 16 bits	Operation	Description
1000	R	Position of the oldest archived mean power
1001	R	Position of the youngest archived mean power
1002	R/W	First available record - NrBL (range 1...9000)
1003	R	Year of archived mean power with the number NrBL + 0
1004	R	Month* 100 + archived day of mean power with the number NrBL + 0
1005	R	Hour* 100 + archived minute of mean power with the number NrBL + 0
1006	R	Archived value of mean power with the number NrBL + 0 of float type - 4 bytes in order 3-2-1-0
1007	R	
1008	R	Archived year of mean power with the number NrBL + 1
1009	R	Archived month, day of mean power with the number NrBL + 1
1010	R	Archived hour, minute of mean power with the number NrBL + 1
1011	R	Archived value of mean power with the number NrBL + 0 of float type - 4 bytes in order 3-2-1-0
1012	R	
1073	R	Archived year of mean power with the number NrBL + 14
1074	R	Archived month, day of mean power with the number NrBL + 14
1075	R	Archived hour, minute of mean power with the number NrBL + 14
1076	R	Archived value of mean power with the number NrBL + 0 of float type - 4 bytes in order 3-2-1-0
1077	R	

Table 5

Register address	Operations	Range	Description	By default
4000	RW	0	Reserved	0
4001	RW	0	Reserved	0
4002	RW	0	Reserved	0
4003	RW	1 ... 10000	Current transformer ratio	1
4004	RW	1 ... 40000	Voltage transformer ratio x 10	10
4005	RW	0 ... 3	Synchronization of mean active power: 0 – 15 minutes walking window (recording synchronized every 15 min with the clock.) 1 – measurement synchronized every 15 min with the clock. 2 – measurement synchronized every 30 min with the clock. 3 – measurement synchronized every 60 min with the clock.	0
4006	RW	0	Reserved	0
4007	RW	0.1	The way of minimal and maximal value recording: 0 - without errors, 1 - with errors	0
4008	RW	0.1	Reserved	0
4009	RW	0 ... 2359	The way of reactive energy calculation: 0 - without errors, 1 - with errors	0
4010	RW	0 ... 1440	Ordered power	1000
4011	RW	0 ... 3	Erasing of energy counter: 0 - without changes, 1 - erase active energy, 2 - erase passive energy, 3 - erase all energy	0
4012	RW	0.1	Erasing of mean active power P_{AV}	0
4013	RW	0.1	Erasing of mean active power P_{AV} archive	0
4014	RW	0.1	Erasing of min. and max.	0
4015	RW	0.1 ... 35	Alarm output 1 - quantity on the output (code acc. to table 6)	0
4016	RW	0 ... 5	Alarm output 1 - type: 0 – n-on, 1 – n-off, 2 – on, 3 - off, 4 – h-on, 5 – h-off	0
4017	RW	-1440 ... 0 ... 1440 [‰]	Alarm output1 - lower alarm switching value of the rated input range	990
4018	RW	-1440 ... 0 ... 1440 [‰]	Alarm output 1 - upper alarm switching value of the rated input range	1010
4019	RW	0 ... 900 s	Alarm output 1 - switching delay	0
4020	RW	0 ... 900 s	Alarm output 1 - alarm switching-off delay (for ordered power quantity [register 4015 = 35] this parameter is excluded)	0
4021	RW	0 ... 900 s	Alarm output 1 - deadlock of re-switching	0
4022	RW	0.1	Reserved	0
4023	RW	0.1 ... 35	Alarm output 2 - quantity on the output (code acc. to the table 6)	24
4024	RW	0 ... 5	Alarm output 2 - type: 0 – n-on, 1 – n-off, 2 – on, 3 - off, 4 – h-on, 5 – h-off	3
4025	RW	-1440 ... 0 ... 1440 [‰]	Alarm output 2 - lower alarm switching value of the rated input range	990
4026	RW	-1440 ... 0 ... 1440 [‰]	Alarm output 2 - upper alarm switching value of the rated input range	1010
4027	RW	0 ... 900 s	Alarm output 2 - alarm switching delay	0
4028	RW	0 ... 900 s	Alarm output 2 - alarm switching-off delay (for ordered power quantity [register 4023 = 35] this parameter is excluded)	0
4029	RW	0 ... 900 s	Alarm output 2 - deadlock of re-switching	0
4030	RW	0.1	Reserved	0
4031	RW	0.1 ... 35	Alarm output 3 - quantity on the output (code acc. to the table 6)	24
4032	RW	0 ... 5	Alarm output 3 - type: 0 – n-on, 1 – n-off, 2 – on, 3 - off, 4 – h-on, 5 – h-off	0
4033	RW	-1440 ... 0 ... 1440 [‰]	Alarm output 3 - lower alarm switching value of the rated input range	990
4034	RW	-1440 ... 0 ... 1440 [‰]	Alarm output 3 - upper alarm switching value of the rated input range	1010
4035	RW	0 ... 900 s	Alarm output 3 - alarm switching delay	0

4036	RW	0 ... 900 s	Alarm output 3 - alarm switching-off delay (for ordered power quantity [register 4031 = 35] this parameter is excluded)	0
4037	RW	0 ... 900 s	Alarm output 3 - deadlock of re-switching	0
4038	RW	0.1	Reserved	0
4039	RW	0.1 ... 35	Alarm output 4 - quantity on the output (code acc.to the table 6)	24
4040	RW	0 ... 5	Alarm output 4 - type: 0 – n-on, 1– n-off, 2 – on, 3 - oFF, 4 – h-on, 5 – h-oFF	0
4041	RW	-1440 ... 0 ... 1440 [%]	Alarm output 4 - lower alarm switching value of the rated input range	990
4042	RW	-1440 ... 0 ... 1440 [%]	Alarm output 4 - upper alarm switching value of the rated input range	1010
4043	RW	0 ... 900 s	Alarm output 4 - alarm switching delay	0
4044	RW	0 ... 900 s	Alarm output 4 - alarm switching-off delay (for ordered power quantity [register 4039 = 35] this parameter is excluded)	0
4045	RW	0 ... 900 s	Alarm output 4 - deadlock of re-switching	0
4046	RW	0.1	Reserved	0
4047	RW	0 ... 15258	Continuous output 1 - quantity on the output (code acc. to table 6)	24
4048	RW	0 ... 65535	Continuous output 1 - type: 0 - (0 ...20) mA; 1 - (4...20) mA; 2 - (-20...20) mA	2
4049	RW	-1440 ... 0 ... 1440 [%]	Continuous output 1 - lower value of the input range in [%] of the rated input range	0
4050	RW	-1440 ... 0 ... 1440 [%]	Continuous output 1 - upper value of the input range in [%] of the rated input range	1000
4051	RW	-2400 ... 0 ... 2400 [10 µA]	Continuous output 1 - lower value of the current output range [10 µA]	0
4052	RW	1 ... 2400 [10 µA]	Continuous output 1 - upper value of the current output range [10 µA]	2000
4053	RW	0 ... 2	Continuous output 1 - manual switching on: 0 - normal work, 1- value set from the register 4051, 2 - value made from the register 4052	0
4054	RW	-24 ... 24 [mA]	Continuous output 1 - value on the output by error	24
4055	RW	0.1 ... 35	Continuous output 2 - quantity on the output (code acc. to the table 6)	24
4056	RW	0 ... 2	Continuous output 2 - type: 0 - (0 ...20) mA; 1 - (4...20) mA; 2 - (-20...20) mA	2
4057	RW	-1440 ... 0 ... 1440 [%]	Continuous output 2 - lower value of the input range in [%] of the rated input range	0
4058	RW	-1440 ... 0 ... 1440 [%]	Continuous output 2 - upper value of the input range in [%] of the rated input range	1000
4059	RW	-2400 ... 0 ... 2400 [10 µA]	Continuous output 2 - lower value of the current output range [10 µA]	0
4060	RW	1 ... 2400 [10 µA]	Continuous output 2 - upper value of the current output range [10 µA]	2000
4061	RW	0 ... 2	Continuous output 2 - manual switching on: 0 - normal work, 1- value set from the register 4059, 2 - value made from the register 4060	0
4062	RW	-24 ... 24 [mA]	Continuous output 2 - value on the output by error	24
4063	RW	0.1 ... 35	Continuous output 3 - quantity on the output (code acc. to the table 6)	24
4064	RW	0 ... 2	Continuous output 3 - type: 0 - (0 ...20) mA; 1 - (4...20) mA; 2 - (-20...20) mA	2
4065	RW	-1440 ... 0 ... 1440 [%]	Continuous output 3 - lower value of the input range in [%] of the rated input range	0
4066	RW	-1440 ... 0 ... 1440 [%]	Continuous output 3 - upper value of the input range in [%] of the rated input range	1000
4067	RW	-2400 ... 0 ... 2400 [10 µA]	Continuous output 3 - lower value of the current output range [10 µA]	0
4068	RW	1 ... 2400 [10 µA]	Continuous output 3 - upper value of the current output range [10 µA]	2000

4069	RW	0 ... 2	Continuous output 3 - manual switching on: 0 - normal work, 1 - value set from the register 4067, 2 - value made from the register 4068	0
4070	RW	-24 ... 24 [mA]	Continuous output 3 - value on the output by error	24
4071	RW	0.1 ... 35	Continuous output 4 - quantity on the output (code acc. to the table 6)	24
4072	RW	0 ... 2	Continuous output 4 - type: 0 - (0 ... 20) mA; 1 - (4...20) mA; 2 - (-20...20) mA	2
4073	RW	-1440 ... 0 ... 1440 [‰]	Continuous output 4 - lower value of the input range in [‰] of the rated input range	0
4074	RW	-1440 ... 0 ... 1440 [‰]	Continuous output 4 - upper value of the input range in [‰] of the rated input range	1000
4075	RW	-2400 ... 0 ... 2400 [10 µA]	Continuous output 4 - lower value of the current output range [10 µA]	0
4076	RW	1 ... 2400 [10 µA]	Continuous output 4 - upper value of the current output range [10 µA]	2000
4077	RW	0 ... 2	Continuous output 4 - manual switching on: 0 - normal work, 1 - value set from the register 4075, 2 - value made from the register 4076	0
4078	RW	-24 ... 24 [mA]	Continuous output 7 - value on the output by error	24
4079	RW	5000 ... 20000	Pulse quantity for pulse output	5000
4080	RW	1 ... 247	Address in the MODBUS network	1
4081	RW	0 ... 3	Transmission mode: 0 -> 8n2, 1 -> 8e1, 2 -> 8o1, 3 -> 8n1	0
4082	RW	0 ... 3	Baud rate: 0 -> 4800, 1 -> 9600, 2 -> 19200, 3 -> 38400	1
4083	RW	0.1	Update the change of transmission parameters	0
4084	RW	0 ... 59	Seconds	0
4085	RW	0 ... 2359	Hour*100 + minutes	0
4086	RW	101 ... 1231	Month*100 + minutes	1201
4087	RW	2009 ... 2100	Year	2010
4088	RW	0.1	Record of standard parameters (with zero adjustment of energy, min, max and mean power)	0
4089	R	0 ... 15258	Active input energy, two most significant bytes	0
4090	R	0 ... 65535	Active input energy, two least significant bytes	0
4091	R	0 ... 15258	Active output energy, two most significant bytes	0
4092	R	0 ... 65535	Active output energy, two least significant bytes	0
4093	R	0 ... 15258	Reactive inductive energy, two most significant bytes	0
4094	R	0 ... 65535	Reactive inductive energy, two least significant bytes	0
4095	R	0 ... 15258	Reactive capacitive energy, two most significant bytes	0
4096	R	0 ... 65535	Reactive capacitive energy, two least significant bytes	0
4097	R	0	Reserved	0
4098	R	0	Reserved	0
4099	R	0	Reserved	0
4100	R	0	Reserved	0
4101	R	0 ... 65535	Status register 1 - description below	-
4102	R	0 ... 65535	Status register 2 - description below	-
4103	R	0 ... 65535	Serial number, two older bytes	-
4104	R	0 ... 65535	Serial number, two younger bytes	-
4105	R	0 ... 65535	Program version (x 100)	100
4106	R	0 ... 65535	Reserved	-
4107	R	0 ... 65535	Reserved	-
4108	RW	0.1	Measurement Mode: 0 - 3Ph4W, 1 - 3Ph3W	0

In parenthesis []: resolution or unit is suitably placed.

Energies are render accessible in hundreds of Watt-hours (Var-hours) in two 16-bit registers and for this reason when recalculating values of each energy from registers, one must divide them by 10, i.e:

Active input energy = (value of register.4089 * 65536 + value of register 4090) / 10 [kWh]

Active output energy = (value of register.4091 * 65536 + value of register 4092) / 10 [kWh]

Reactive inductive energy = (value of register 4093 * 65536 + value of register 4094) / 10 [kVarh]

Reactive capacitive energy = (value of register 4095 * 65536 + value of register 4096) / 10 [kVarh]

Status register 1:

Bit 15 – „1” – damage of non-volatile memory

Bit 14 – „1” – lack of calibration or invalid calibration

Bit 13 – „1” – error of parameter values

Bit 12 – „1” – error of energy values

Bit 11 – „1” – error of phase sequence

Bit 10 – current range 0 – 1 A; 1 – 5 A

Bit 9 – reserved

Bit 8 – Voltage range: 0 - 57.8 V, 1 - 230 V

Bit 7 – „1” – the interval of power averaging has not elapsed

Bit 6 – „1” – bad frequency for THD measurement

Bit 5 – „1” – too low voltage to measure the frequency

Bit 4 – „1” – spent battery

Bit 3 – „1” – capacitive character Q

Bit 2 – „1” – capacitive character Q3

Bit 1 – „1” – capacitive character Q2

Bit 0 – „1” – capacitive character Q1

Status register 2:

Bit 15 – „1” – presence of continuous output 4

Bit 14 – „1” – presence of continuous output 3

Bit 13 – „1” – presence of continuous output 2

Bit 12 – „1” – presence of continuous output 1

Bit 11 – „1” – presence of alarm output 4

Bit 10 – „1” – presence of alarm output 3

Bit 9 – „1” – presence of alarm output 2

Bit 8 – „1” – presence of alarm output 1

Bit 7 – reserved

Bit 6 – reserved

Bit 5 – reserved

Bit 4 – reserved

Bit 3 – „1” – alarm output 4 switched on

Bit 2 – „1” – alarm output 3 switched on

Bit 1 – „1” – alarm output 2 switched on

Bit 0 – „1” – alarm output 1 switched on

Table 6

Address of 16 bit registers	Address of 32 bit registers	Operations	Description	Unit	3Ph4W	3Ph3W
7000/6000	7500	R	Voltage of phase L1	V	√	X
7002/6002	7501	R	Current of phase L1	A	√	√
7004/6004	7502	R	Active power of phase L1	W	√	X
7006/6006	7503	R	Reactive power of phase L1	Var	√	X
7008/6008	7504	R	Apparent power of phase L1	VA	√	X
7010/6010	7505	R	Active power factor of phase L1	-	√	X
7012/6012	7506	R	Reactive power to active power ratio of phase L1	-	√	X
7014/6014	7507	R	Voltage of phase L2	V	√	X
7016/6016	7508	R	Current of phase L2	A	√	√
7018/6018	7509	R	Active power of phase L2	W	√	X
7020/6020	7510	R	Reactive power of phase L2	Var	√	X

7022/6022	7511	R	Apparent power of phase L2	VA	√	X
7024/6024	7512	R	Active power factor of phase L2	-	√	X
7026/6026	7513	R	Reactive power to active power ratio of phase L2	-	√	X
7028/6028	7514	R	Voltage of phase L3	V	√	X
7030/6030	7515	R	Current of phase L3	A	√	√
7032/6032	7516	R	Active power of phase L3	W	√	X
7034/6034	7517	R	Reactive power of phase L3	Var	√	X
7036/6036	7518	R	Apparent power of phase L3	VA	√	X
7038/6038	7519	R	Active power factor of phase L3	-	√	X
7040/6040	7520	R	Reactive power to active power ratio of phase L3	-	√	X
7042/6042	7521	R	Mean 3-phase voltage	V	√	X
7044/6044	7522	R	Mean 3-phase current	A	√	√
7046/6046	7523	R	3-phase active power	W	√	√
7048/6048	7524	R	3-phase reactive power	Var	√	√
7050/6050	7525	R	3-phase apparent power	VA	√	√
7052/6052	7526	R	Mean active power factor	-	√	√
7054/6054	7527	R	Mean ratio of reactive power to active power	-	√	√
7056/6056	7528	R	Frequency	Hz	√	√
7058/6058	7529	R	Phase-to-phase voltage L1-L2	V	√	√
7060/6060	7530	R	Phase-to-phase voltage L2-L3	V	√	√
7062/6062	7531	R	Phase-to-phase voltage L3-L1	V	√	√
7064/6064	7532	R	Mean phase-to-phase voltage	V	√	√
7066/6066	7533	R	15, 30, 60 minutes' 3-phase act. power (P1+P2+P3)	W	√	√
7068/6068	7534	R	THD U1	%	√	X
7070/6070	7535	R	THD U2	%	√	X
7072/6072	7536	R	THD U3	%	√	X
7074/6074	7537	R	THD I1	%	√	X
7076/6076	7538	R	THD I2	%	√	X
7078/6078	7539	R	THD I3	%	√	X
7080/6080	7540	R	Cosinus angle between U1 and I1	-	√	X
7082/6082	7541	R	Cosinus angle between U2 and I2	-	√	X
7084/6084	7542	R	Cosinus angle between U3 and I3	-	√	X
7086/6086	7543	R	Mean 3-phase cosinus	-	√	√
7088/6088	7544	R	Angle between U1 and I1	°	√	X
7090/6090	7545	R	Angle between U2 and I2	°	√	X
7092/6092	7546	R	Angle between U3 and I3	°	√	X
7094/6094	7547	R	Current in neutral lead (evaluated from vectors)	A	√	X
7096/6096	7548	R	3-phase active input energy (number of register 7549 overfills, setting to zero after exceeding 99999999.9 kWh)	100 MWh	√	√
7098/6098	7549	R	3-phase active input energy (watt-hour meter counting to 99999.9 kWh)	kWh	√	√
7100/6100	7550	R	3-phase active output energy (number of register 7551 overfills, setting to zero after exceeding 99999999.9 kWh)	100 MWh	√	√
7102/6102	7551	R	3-phase active output energy (watt-hour meter counting to 99999.9 kWh)	kWh	√	√
7104/6104	7552	R	3-phase reactive inductive energy (number of register 7553 overfills, setting to zero after exceeding 99999999.9 kVarh)	100 MVarh	√	√
7106/6106	7553	R	3-phase reactive inductive energy (watthour meter counting to 99999.9 kWh)	kVarh	√	√
7108/6108	7554	R	3-phase active output energy (number of register 7555 overfills, setting to zero after exceeding 99999999.9 kVarh)	100 MVarh	√	√

7110/6110	7555	R	3-phase reactive capacitive energy (watthour meter counting to 99999.9 kWh)	kVarh	√	√
7112/6112	7556	R	Reserved		√	√
7114/6114	7557	R	Reserved		√	√
7116/6116	7558	R	Reserved		√	√
7118/6118	7559	R	Reserved		√	√
7120/6120	7560	R	Time - seconds	sec	√	√
7122/6122	7561	R	Time - hours, minutes	-	√	√
7124/6124	7562	R	Date - month, day	-	√	√
7126/6126	7563	R	Date - year	-	√	√
7128/6128	7564	R	Sterling up the analog output 1	mA	√	√
7130/6130	7565	R	Sterling up the analog output 2	mA	√	√
7132/6132	7566	R	Sterling up the analog output 3	mA	√	√
7134/6134	7567	R	Sterling up the analog output 4	mA	√	√
7136/6136	7568	R	Energy consumption in percentages in "power guard" modus	%	√	√
7138/6138	7569	R	Reserved	-	√	√
7140/6140	7570	R	Status 1	-	√	√
7142/6142	7571	R	Status 2	-	√	√
7144/6144	7572	R	Voltage L1 min	V	√	X
7146/6146	7573	R	Voltage L1 max	V	√	X
7148/6148	7574	R	Voltage L2 min	V	√	X
7150/6150	7575	R	Voltage L2 max	V	√	X
7152/6152	7576	R	Voltage L3 min	V	√	X
7154/6154	7577	R	Voltage L3 max	V	√	X
7156/6156	7578	R	Current L1 min	A	√	√
7158/6158	7579	R	Current L1 max	A	√	√
7160/6160	7580	R	Current L2 min	A	√	√
7162/6162	7581	R	Current L2 max	A	√	√
7164/6164	7582	R	Current L3 min	A	√	√
7166/6166	7583	R	Current L3 max	A	√	√
7168/6168	7584	R	Active power L1 min	W	√	X
7170/6170	7585	R	Active power L1 max	W	√	X
7172/6172	7586	R	Active power L2 min	W	√	X
7174/6174	7587	R	Active power L2 max	W	√	X
7176/6176	7588	R	Active power L3 min	W	√	X
7178/6178	7589	R	Active power L3 max	W	√	X
7180/6180	7590	R	Reactive power L1 min	Var	√	X
7182/6182	7591	R	Reactive power L1 max	Var	√	X
7184/6184	7592	R	Reactive power L2 min	Var	√	X
7186/6186	7593	R	Reactive power L2 max	Var	√	X
7188/6188	7594	R	Reactive power L3 min	Var	√	X
7190/6190	7595	R	Reactive power L3 max	Var	√	X
7192/6192	7596	R	Apparent power L1 min	VA	√	X
7194/6194	7597	R	Apparent power L1 max	VA	√	X
7196/6196	7598	R	Apparent power L2 min	VA	√	X
7198/6198	7599	R	Apparent power L2 max	VA	√	X
7200/6200	7600	R	Apparent power L3 min	VA	√	X
7202/6202	7601	R	Apparent power L3 max	VA	√	X
7204/6204	7602	R	Power factor (PF) L1 min	-	√	X
7206/6206	7603	R	Power factor (PF) L1 max	-	√	X

7208/6208	7604	R	Power factor (PF) L2 min	-	√	X
7210/6210	7605	R	Power factor (PF) L2 max	-	√	X
7212/6212	7606	R	Power factor (PF) L3 min	-	√	X
7214/6214	7607	R	Power factor (PF) L3 max	-	√	X
7216/6216	7608	R	Reactive and active power ratio L1 min	-	√	X
7218/6218	7609	R	Reactive and active power ratio L1 max	-	√	X
7220/6220	7610	R	Reactive and active power ratio L2 min	-	√	X
7222/6222	7611	R	Reactive and active power ratio L2 max	-	√	X
7224/6224	7612	R	Reactive and active power ratio L3 min	-	√	X
7226/6226	7613	R	Reactive and active power ratio L3 max	-	√	X
7228/6228	7614	R	Phase to phase voltage L_{1-2} min	V	√	√
7230/6230	7615	R	Phase to phase voltage L_{1-2} max	V	√	√
7232/6232	7616	R	Phase to phase voltage L_{2-3} min	V	√	√
7234/6234	7617	R	Phase to phase voltage L_{2-3} max	V	√	√
7236/6236	7618	R	Phase to phase voltage L_{3-1} min	V	√	√
7238/6238	7619	R	Phase to phase voltage L_{3-1} max	V	√	√
7240/6240	7620	R	3-phase mean voltage min	V	√	√
7242/6242	7621	R	3-phase mean voltage max	V	√	√
7244/6244	7622	R	3-phase mean current min	A	√	√
7246/6246	7623	R	3-phase mean current max	A	√	√
7248/6248	7624	R	3-phase active power min	W	√	√
7250/6250	7625	R	3-phase active power max	W	√	√
7252/6252	7626	R	3-phase reactive power min	Var	√	√
7254/6254	7627	R	3-phase reactive power max	Var	√	√
7256/6256	7628	R	3-phase apparent power min	VA	√	√
7258/6258	7629	R	3-phase apparent power max	VA	√	√
7260/6260	7630	R	Power factor (PF) min	-	√	√
7262/6262	7631	R	Power factor (PF) max	-	√	√
7264/6264	7632	R	Min 3-phase mean reactive and active power ratio	-	√	√
7266/6266	7633	R	Max 3-phase mean reactive and active power ratio	-	√	√
7268/6268	7634	R	Frequency min	Hz	√	√
7270/6270	7635	R	Frequency max	Hz	√	√
7272/6272	7636	R	Phase to phase mean voltage min	V	√	√
7274/6274	7637	R	Phase to phase mean voltage max	V	√	√
7276/6276	7638	R	15,30,60 minutes 3-phase active power min	W	√	√
7278/6278	7639	R	15,30,60 minutes 3-phase active power max	W	√	√
7280/6280	7640	R	THD U1 min	%	√	X
7282/6282	7641	R	THD U1 max	%	√	X
7284/6284	7642	R	THD U2 min	%	√	X
7286/6286	7643	R	THD U2 max	%	√	X
7288/6288	7644	R	THD U3 min	%	√	X
7290/6290	7645	R	THD U3 max	%	√	X
7292/6292	7646	R	THD I1 min	%	√	X
7294/6294	7647	R	THD I1 max	%	√	X
7296/6296	7648	R	THD I2 min	%	√	X
7298/6298	7649	R	THD I2 max	%	√	X
7300/6300	7650	R	THD I3 min	%	√	X
7302/6302	7651	R	THD I3 max	%	√	X
7304/6304	7652	R	Cosine angle between U1 and I1 min	-	√	X

7306/6306	7653	R	Cosine angle between U1 and I1 max	-	√	X
7308/6308	7654	R	Cosine angle between U2 and I2 min	-	√	X
7310/6310	7655	R	Cosine angle between U2 and I2 max	-	√	X
7312/6312	7656	R	Cosine angle between U3 and I3 min	-	√	X
7314/6314	7657	R	Cosine angle between U3 and I3 max	-	√	X
7316/6316	7658	R	Mean 3-phase cosine min	-	√	X
7318/6318	7659	R	Mean 3-phase cosine max	-	√	X
7320/6320	7660	R	Angle between U1 and I1 min	°	√	X
7322/6322	7661	R	Angle between U1 and I1 max	°	√	X
7324/6324	7662	R	Angle between U2 and I2 min	°	√	X
7326/6326	7663	R	Angle between U2 and I2 max	°	√	X
7328/6328	7664	R	Angle between U3 and I3 min	°	√	X
7330/6330	7665	R	Angle between U3 and I3 max	°	√	X
7332/6332	7666	R	Current in neutral lead min	A	√	X
7334/6334	7667	R	Current in neutral lead max	A	√	X

In case of a lower overflow, the value -1e20 is written in, however in case of an upper overflow or if an error occurs, the value 1e20 is written in.

10. Examples of transducer programming

10.1 Example 1 - Programming an Alarm 1 with Hysteresis

Program the operation of the alarm 1 in such a way, that at the value 250 V of the phase 1 voltage, the alarm will be switched on, however switched off at the value 210 V.

For the rated $U_n = 230$ V execution, one must set up values from the table 7:

Table 7

Register	Value	Meaning
4015	1	1 – voltage of phase 1 (U1)
4016	0	0 – n-on mode
4017	913	913 – 91.3% (percentage value with one place after the decimal point multiplied by 10) of the rated voltage of phase 1 – alarm switched off, $(210 \text{ V}/230 \text{ V}) \times 1000 = 913$
4018	1087	1087 – 108.7 % (percentage value with one place after the decimal point multiplied by 10) of the rated voltage of phase 1 – alarm switched on, $(250 \text{ V}/230 \text{ V}) \times 1000 = 1087$
4019	0	0 – 0 second delay in the alarm switching
4020	0	0 – 0 second delay in the alarm switching off
4021	0	0 – 0 second deadlock for the alarm re-switching

10.2 Example 2 - Configuring alarm of ordered power exceeding

Set the alarm of the earlier warning of ordered power exceeding possibility on 90% level by 15-minutes (900 sec.) calculation. Current transformer 2500 : 5 A, voltage $U_n=230$ V. Temporary maximal power consumption 1.5 MW.

Calculate:

3-phase rated active power of the transducer :

$$P = 3 \times 230 \text{ V} \times 2500 \text{ A} (500 \times 5\text{A}) = 1.725 \text{ MW} (500 \times 3450 \text{ W}) \text{ i.e. } 100\%$$

Ordered power and rated power ratio = 1 MW / 1.725 57.97% of the transducers rated value (register 4010).

Hysteresis of alarm work:

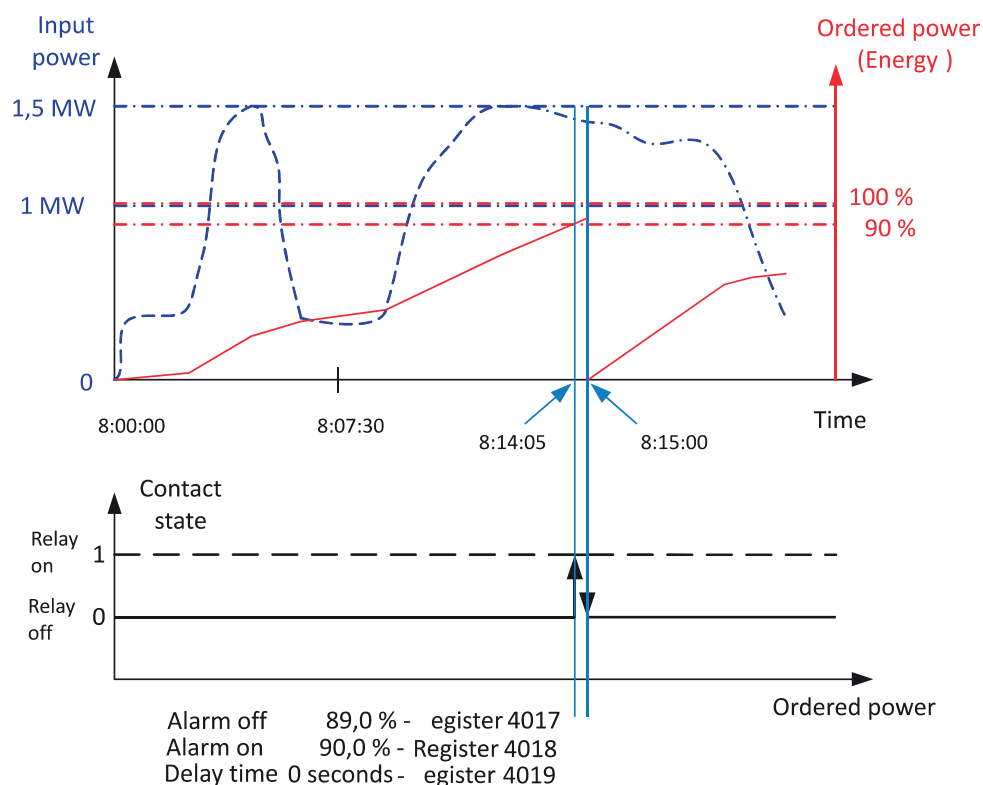
alarm switching for 90% of ordered power (register 4018), switching off for example: by 1% lower - 89% (register 4017)

Work optimization of power limit function (alarm switch on delay):

$$\text{delay time of the alarm } o = t \ 10\% \times [1 \text{ MW} \times 900 \text{ s} / 1.5 \text{ MW}] = 60 \text{ s (register 4019).}$$

The following figure presents how to take advantage of the parameter showing used ordered power to activate alarm. The alarm delay is switched off (set to 0 sec.) - register 4019.

In the example for the remaining 10% of ordered power under maximal power consumption the devices could work yet 60 seconds without exposing the consumer to penalties. If the delay was set to 60 seconds the alarm would not be activated (register 4019).



Measurement of used ordered power, 15-minutes averaging time, synchronization with the clock, alarm set to 90%.

Table 8

Register	Value	Meaning
4010	579	579 – 57.9 % (percentage value with one place after the decimal point multiplied by 10) percentage value of ordered power in relation to the rated power
4015	35	35 – alarm set to the percentage of used active power
4016	0	0 – n-on mode
4017	890	890 – 89.0% (percentage value with one place after the decimal point multiplied by 10) alarm switch off; for the alarm to work the value in the register 4017 should be lower than in the register 4018 (hysteresis), for example: by 1%
4018	900	900 – 90.0% mA (percentage value with one place after the decimal point multiplied by 10) percentage of ordered power - alarm switch on
4019	0 or 60	0 – 0 seconds of alarm switch on delay (without optimization), 60 with optimization
4020	0	0 – 0 seconds of alarm switch off delay
4021	0	0 – 0 seconds of blockade for alarm re-switching

10.3 Example 3 - Programming a Unidirectional Continuous Output 1

Configure the continuous out put 1 to have the value 20 mA, when 3-phase average current is 4 A, and to have the value 4 mA when the current is 0 A. For the rated current $I_n = 5$ A, one must set values according to the table 9:

Table 9

Register	Value	Meaning
4048	23	23 – mean 3-phase current (I)
4049	0	0 – 0.0% (percentage value with one place after the decimal point multiplied by 10) the lower value of the rated mean 3-phase current, $(0 \text{ A}/5 \text{ A}) \times 1000 = 0$
4050	800	800 – 80.0 % (percentage value with one place after the decimal point multiplied by 10) the upper value of the rated mean 3-phase current, $(4 \text{ A}/5 \text{ A}) \times 1000 = 800$
4051	400	400 – 4.00 mA (value in mA with two places after the decimal point multiplied by 100) lower value of the output current
4052	2000	2000 – 20.00 mA (value in mA with two places after the decimal point multiplied by 100) upper value of the output current. $(20.00 \text{ mA} \times 100) = 2000$
4053	0	0 – normal mode of the continuous output 1
4054	24	24 – 24 mA on continuous output 1 if the error $(-1e20 \text{ or } 1e20)$

10.4 Example 4 - Programming a Bidirectional Continuous Output 1

Configure the continuous output 1 to have the value -20 mA, when the three-phase power value $3 \times 4 \text{ A} \times 230 \text{ V} \times \cos(180^\circ) = -2760 \text{ W}$, and to have the value 20 mA when the three-phase power value is $3 \times 4 \text{ A} \times 230 \text{ V} \times \cos(0^\circ) = 2760 \text{ W}$.

For the rated execution $3 \times 5 \text{ A} / 230 \text{ V}$, one must set values according to the table 10:

Table 10

Register	Value	Meaning
4048	24	24 – mean 3-phase current (I)
4049	-800	-1000 – -100.0% (percentage value with one place after the decimal point multiplied by 10) the lower value of the rated mean 3-phase current, $3 \times 4 \text{ A} \times 230 \text{ V} \times \cos(180^\circ) / 3 \times 5 \text{ A} \times 230 \text{ V} \times 1000 = -800$
4050	800	1000 – 100.0 % (percentage value with one place after the decimal point multiplied by 10) the upper value of the rated mean 3-phase current, $3 \times 4 \text{ A} \times 230 \text{ V} \times \cos(0^\circ) / 3 \times 5 \text{ A} \times 230 \text{ V} \times 1000 = 800$
4051	-2000	4-2000 – -20.00 mA (value in mA with two places after the decimal point multiplied by 100) lower value of the output current (-20.00 mA x 100) = -2000
4052	2000	2000 – 20.00 mA (value in mA with two places after the decimal point multiplied by 100) upper value of the output current (20.00 mA x 100) = 2000
4053	0	0 – normal mode of the continuous output 1
4054	24	24 – 24 mA on continuous output 1 if the error (-1e20 or 1e20)