SIEMENS

Power Meter

SICAM P 7KG7750/55

Manual

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E50417-B1076-C340-A6

Note

Please observe the instructions and warnings for your safety in the foreword.

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Order No.: E50417-B1076-C340-A6

Foreword

Purpose of the manual

This manual describes the commissioning, operation and parameterization of the Power Meter SICAM P 7KG7750/55.

Target audience

This manual is directed to the user of the Power Meter SICAM P.

Validity of the manual

This manual is valid for the devices SICAM P 7KG7750/55.

Additional support

For any questions concerning your system, please contact your local Siemens representative.

Hotline

Our Customer Support Center provides around-the-clock service.

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E-mail: support.ic@siemens.com

Internet: http://www.powerquality.de/pq_da/index_e.htm

Further documents

SICAM P Power Meter 7KG775x Operating Instructions

Ordering no. E50417-B1074-C339

SICAM P PROFIBUS DP Manual

Ordering no. E50417-B1076-C238

Power Meter SICAM P Modbus Manual

Ordering no. E50417-B1076-C241

Power Meter SICAM P 7KG7750/55 Communication Protocol IEC 60870-5-103 Manual

Ordering no. E50417-B1076-C375

Training courses

Please ask our Training Center for information on the individual courses available:

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Information for your safety

This manual does not represent a complete listing of all the safety measures required to operate the equipment (module, device) since specific operating conditions may make further measures necessary. However, it contains information which you have to observe in order to ensure your personal safety and in order to avoid material damage. The information is highlighted by a warning triangle and, depending on the degree of danger, is shown as follows:

DANGER

DANGER means that death or severe injury **will** result if the measures specified are not taken.

- Comply with all instructions, in order to avoid death or severe injuries.

WARNING

WARNING means that death or severe injury **may** result if the measures specified are not taken.

- Comply with all instructions, in order to avoid death or severe injuries.

CAUTION

CAUTION means that minor or moderate injury **can** occur if the measures specified are not taken.

- Comply with all instructions, in order to avoid moderate or minor injuries.

NOTICE

NOTICE means that property damage **can** result if the measures specified are not taken.

- Comply with all instructions, in order to avoid material damage.

Note

Important information about the product, product handling or a certain section of the documentation, which must be given particular attention.

Qualified personnel

Commissioning and operation of the equipment (module, device) described in this manual must be performed by qualified personnel only. As used in the safety notes contained in this manual, qualified personnel are those persons who are authorized to commission, release, ground, and tag devices, systems and electrical circuits in accordance with the safety standards.

Use as prescribed

The equipment (device, module) must not be used for any other purposes than those described in the Catalogue and the Technical Description. If it is used together with third party devices and components, these must be recommended or approved by Siemens.

Correct and safe operation of the product requires adequate transportation, storage, installation, and mounting as well as appropriate use and maintenance.

During operation of electrical equipment, it is unavoidable that certain parts of this equipment will carry dangerous voltages. Severe injury or damage to property can occur if the appropriate measures are not taken:

- Before making any connections at all, ground the equipment at the PE terminal.
- Hazardous voltages can be present on all switching components connected to the power supply.
- Even after the supply voltage has been disconnected, hazardous voltages can still be present in the equipment (capacitor storage).
- Equipment with current transformer circuits must not be operated while open.
- The limit values indicated in the manual must not be exceeded; that also applies to testing and commissioning.

Statemant of Conformity

CE	This product complies with the directive of the Council of the European Communities on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Council Directive 2004/108/EC) and concerning electrical equipment for use within specified voltage limits (Low-voltage Directive 2006/95/EC). This conformity has been established by means of tests conducted by Siemens AG according to the Council Directive in agreement with the generic standards EN 61000-6-2 and EN 61000-6-4 for the EMC directives, and with the standard EN 61010-1 for the low-voltage directive. The device has been designed and produced for industrial use. The product conforms to the standards IEC 60688, EN 60688 or DIN EN 60688.

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Commissioning 1

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1.1 Application and Mode of Operation

Range of Application

The Power Meter SICAM P is capable of recording several different power system measurements. In addition, the SICAM P is designed to be utilized in a number of different industries.

The display of measured quantities can be easily configured to the specific requirements of the user.

Network linking is possible with the integral RS485 port equipped with the standard PROFIBUS DP-V1, Modbus RTU/ASCII or IEC 60870-5-103 protocol which provide for indication, evaluation and processing of several SICAM P measurements at a central master station.

Mode of Operation

Input voltages and currents are sampled for calculation of the corresponding RMS values. All measurements derived from sampled values are calculated by a processor. Measured quantities can be displayed on the screens and/or transmitted via the serial interface.

With the SICAM P, it is possible to program limit value groups for various measured quantities to activate limit violations when the value of a specific measured quantity exceeds a programmed threshold. In addition, it is possible use logical elements (AND, OR) to combine two or more measured quantities for the purpose of generating a limit violation. Limit violations are counted, indicated on the screen and/or utilized to operate the binary output contacts. The oscilloscope may be triggered via a limit violation as well.

All measured quantities can be displayed on the SICAM P screens as required by the user. Up to 20 screens can be selected with the front keys. The number, type, content and sequence of the screens are configurable. SICAM P is delivered with pre-programmed default settings.

A status line displayed in the measured value screens indicates status, interfacing and diagnostic messages for the SICAM P. The display is automatically refreshed every second.

1.2 Delivery

Delivery note

The power meter will be delivered in a cardboard box containing the SICAM P logo.

Contents of delivery

1 Device SICAM P

2 Panel mounting fittings (only 7KG7750)

1 Operating Instruction (Ordering no. E50417-B1074-C339)

1 Return Card

1 Device Test Report

1 Battery VARTA CR2032

WARNING

Warning: Danger of explosion of the battery.

Nonobservance of the safety instructions means that death, severe injuries or considerable material damages can occur.

- Servicing of the battery circuit and replacing of the battery must be performed by qualified personnel only. Battery may explode if mistreated.
- Do not reverse the polarity!
- Do not disassemble the battery!
- Do not completely discharge the battery!
- Do not throw the battery into a fire!

WARNING

Warning about battery disposal.

Nonobservance of the safety instructions means that death, severe injuries or considerable material damages can occur.

- When discharged, or when properly secured against short-circuit, lithium batteries can be disposed of through retailers or at depots run by competent organizations (e.g. in Germany GRS collection points).

Note

The lithium-batteries in the equipment are subject to special provision 188/A45 of the dangerous goods regulations of the different transport modes (as in edition 2003, lithium content and tests of UN Manual of Tests and Criteria).

This is only valid for the original battery or original spare batteries. For general transport security by shipment as freight: Electric equipment is only to be sent as freight if shut off.

1.3 Ordering Data

1.3.1 SICAM P 7KG7750

Description	Order No.															
Power Meter																
SICAM P 7KG7750	**7KG**	**7**	**7**	**5**	**0**	**-**	**0**		**A**	**0**		**-**	**0**	**A**	**A**	
Built in device for control panels 96 mm x 96 mm with graphic display																
I/O module (optional)																
Without (standard)								**A**								
2 binary outputs								**B**								
2 binary inputs								**C**								
2 analog outputs DC 0 mA to 20 mA/DC 4 mA to 20 mA								**D**								
2 analog inputs DC 0 mA to 20 mA								**E**								
3 relay outputs								**G**								
Front protection class																
IP 41											**1**					
IP 65											**3**					
Communication interface and protocols																
PROFIBUS DP and Modbus RTU/ASCII / RS485																**0**
IEC 60870-5-103 and Modbus RTU/ASCII / RS485																**1**

1.3.2 SICAM P 7KG7755

Description	Order No.															
Power Meter																
SICAM P 7KG7755	**7KG**	**7**	**7**	**5**	**5**	**-**	**0**		**A**	**0**	**0**	**-**	**0**	**A**	**A**	
Snap on mounting unit 96 mm x 96 mm, without grafic display, front protection class IP 20																
I/O Module (optional)																
Without (standard)								**A**								
2 binary outputs								**B**								
2 binary inputs								**C**								
2 analog outputs DC 0 mA to 20 mA/DC 4 mA to 20 mA								**D**								
2 analog inputs DC 0 mA to 20 mA								**E**								
3 relay outputs								**G**								
Communication interface and protocols																
PROFIBUS DP and Modbus RTU/ASCII / RS485																**0**
IEC 60870-5-103 and Modbus RTU/ASCII / RS485																**1**

1.3.3 Parameterization Package

Description	Order No.															
SICAM P Parameterization Package	**7KG**	**7**	**0**	**5**	**0**	**-**	**8**	**A**								
Software SICAM P PAR, RS232/RS485 adapter																
Type																
RS485 / 5 V-power supply unit / supply voltage AC 230 V/50 Hz									**A**							
RS485 / 5 V-power supply unit / supply voltage AC 120 V/60 Hz									**B**							

1.4 Dimensions

1.4.1 Device Variant SICAM P 7KG7750

Note: All dimensions in mm

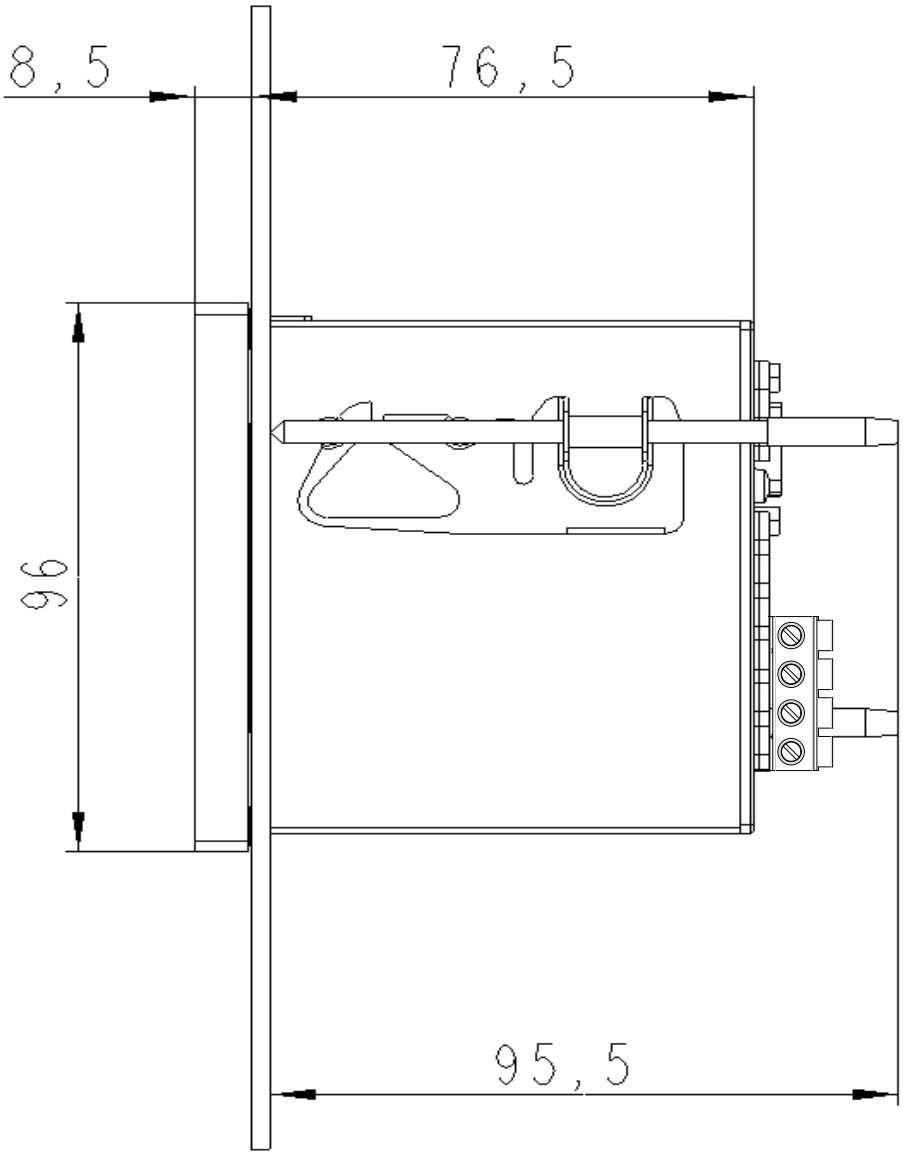


Fig. 1-1 SICAM P 7KG7750, variant IP 41

Note: All dimensions in mm

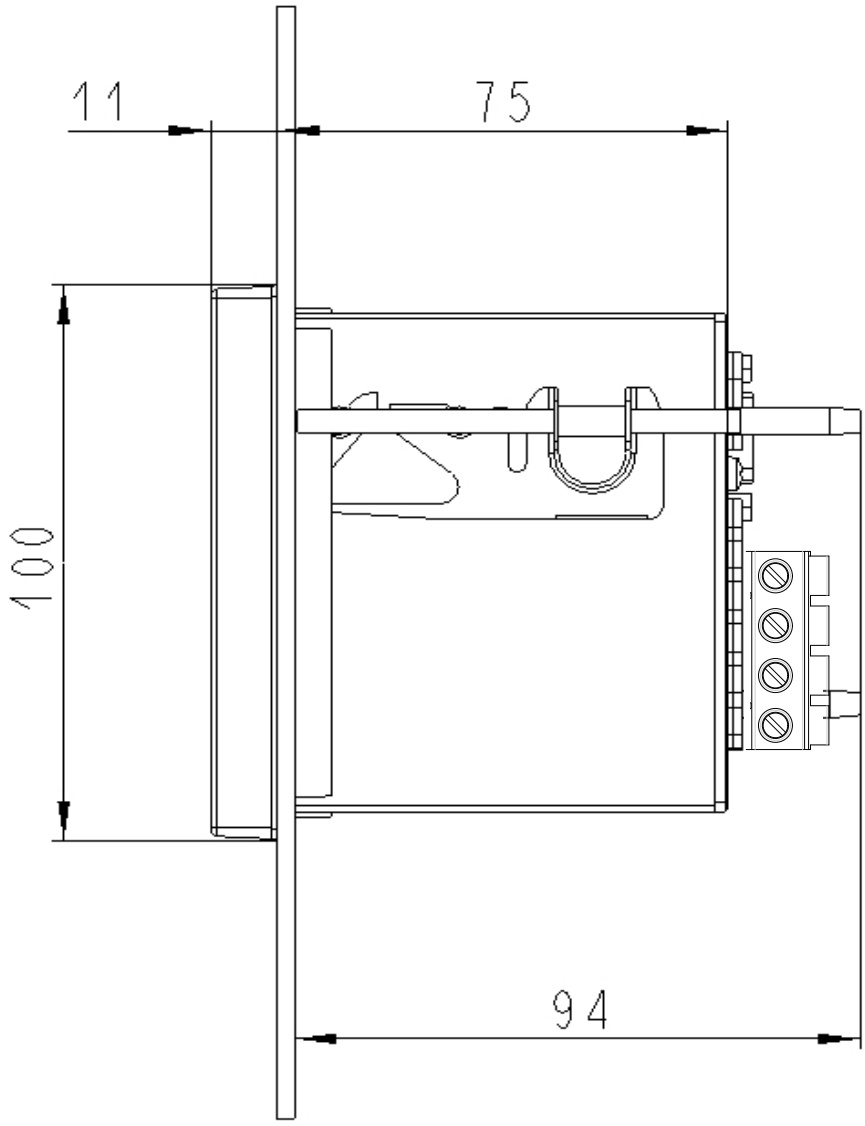
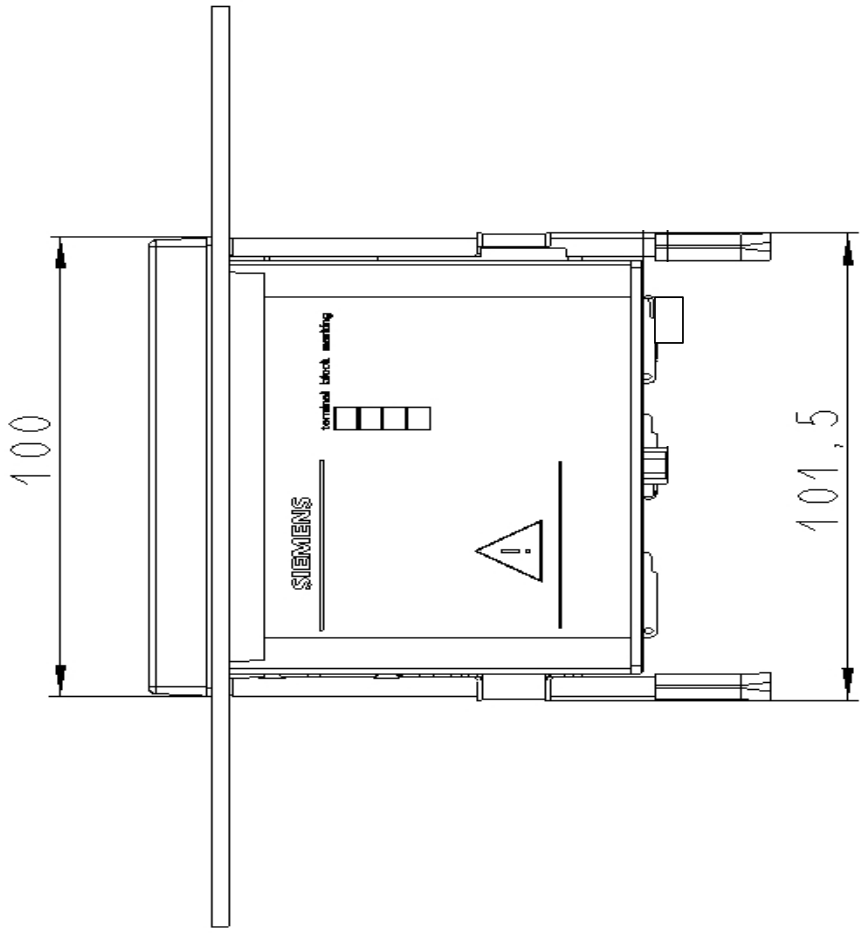


Fig. 1-2 SICAM P 7KG7750, variant IP 65



Note: All dimensions in mm

Fig. 1-3 SICAM P 7KG7750

Technical Data for Housing

Housing:	Flush mounting according to IEC 61554/DIN 43700
Panel section:	$92.0^{+0,8}$ mm x $92.0^{+0,8}$ mm
Protection class:	front IP 41 or IP 65
	terminals IP 20
	for personal security IP 1x

Terminals

Terminals for power supply, voltage inputs, current inputs, binary outputs, I/O modules (optional):

Conductor cross section, rigid max.:	2.5 mm^2
Conductor cross section with ferrule:	1.5 mm^2
Stripping length:	9 mm
Tightening torque:	0.4 Nm to 0.5 Nm
RS485 interface	9-pole D-Sub miniature female connector

1.4.2 Device Variant SICAM P 7KG7755

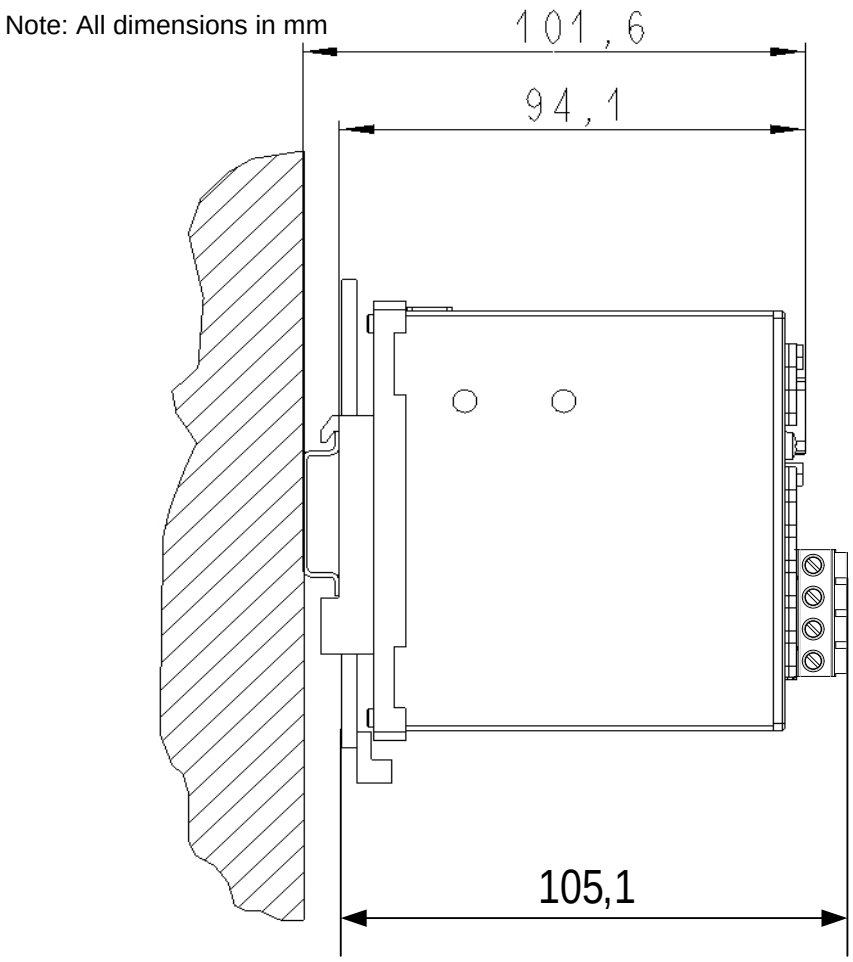


Fig. 1-4 SICAM P 7KG7755, snap on mounting unit

Technical Data for Housing

Housing	snap on mounting unit
Protection class	front / terminals IP 20
	for personal security IP 1x

Terminals

Terminals for power supply, voltage inputs, current inputs, binary outputs, I/O modules (optional):

Conductor cross section, rigid max.:	2.5 mm^2
Conductor cross section with ferrule:	1.5 mm^2
Stripping length:	9 mm
Tightening torque:	0.4 Nm to 0.5 Nm
RS485 interface	9-pole D-Sub miniature female connector

1.5 Block Diagram

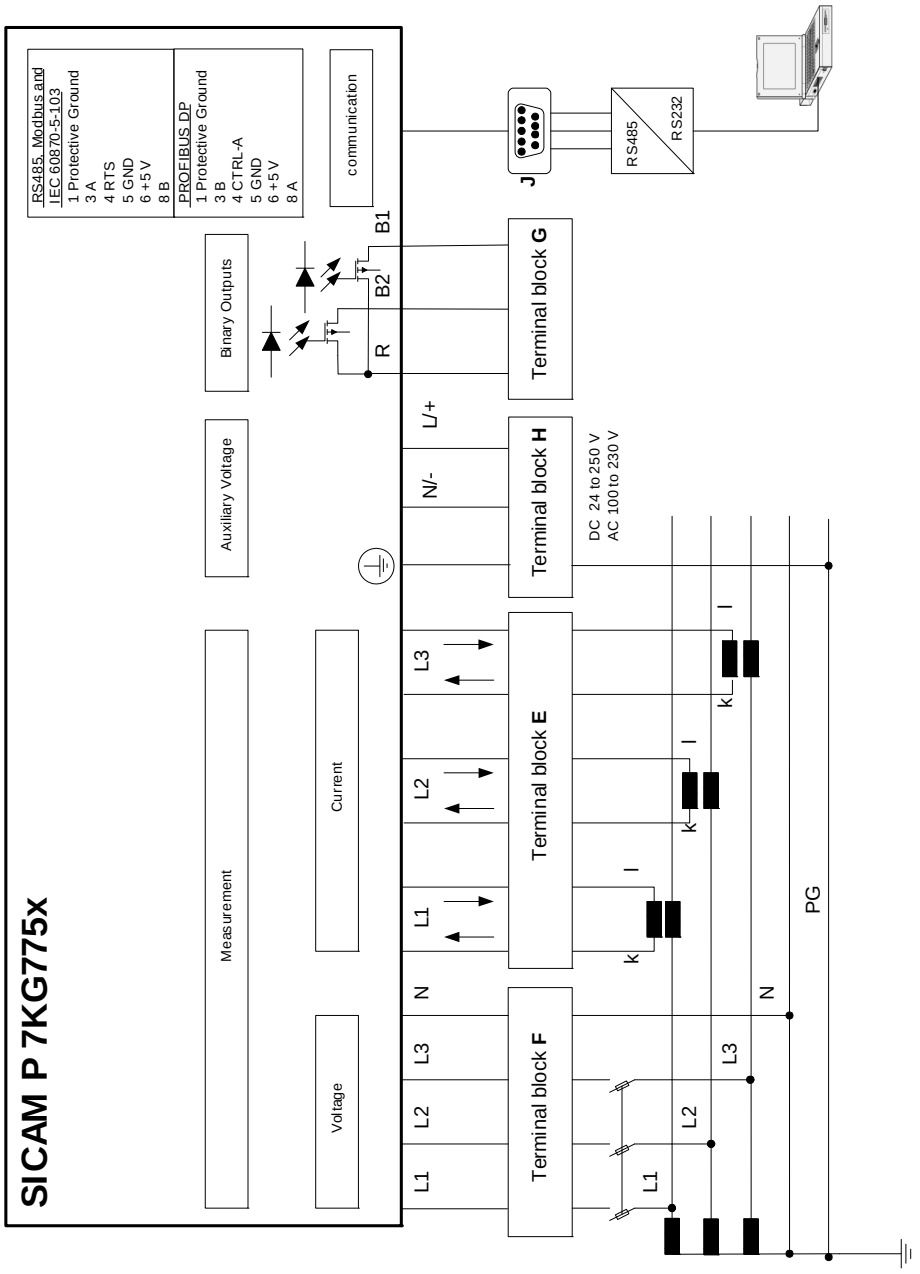


Fig. 1-5 Block diagram SICAM P 7KG7750/55

Note

The integrated battery serves to buffer the memory and the real-time clock.

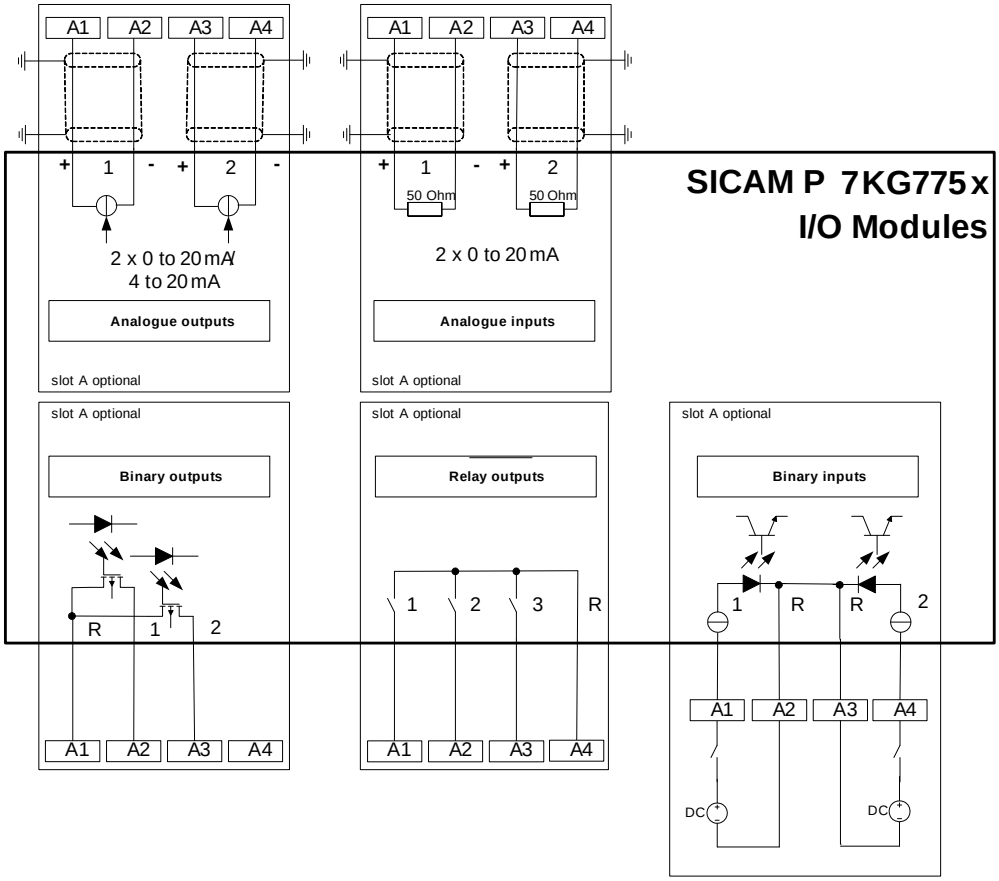


Fig. 1-6 I/O modules (option)

Additional input and output modules (see ordering data, chapter 1.3) are available for the device 7KG7750/55:

- Binary inputs (2 contacts with common contact)
- Binary outputs (2 contacts with common contact)
- Relay outputs (3 contacts with common contact)
- Analog inputs (2 channels)
- Analog outputs (2 channels)

1.6 Interface and Terminals

1.6.1 Terminal Assignment SICAM P 7KG7750/55

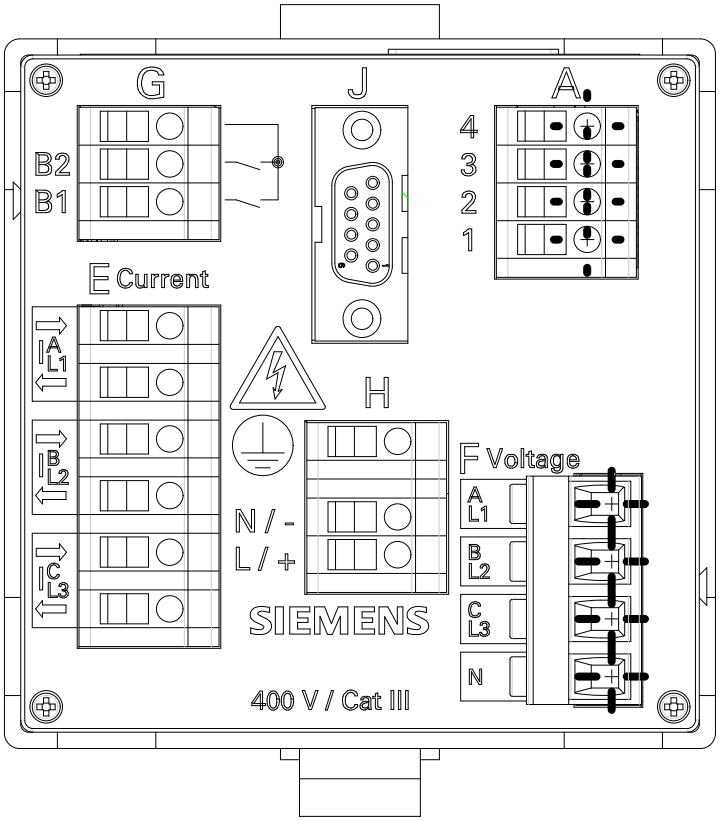


Fig. 1-7 Terminal assignment SICAM P 7KG7750/55

WARNING

Warning about missing protection.

Nonobservance of the safety instructions means that death, severe injuries or considerable material damages can occur.

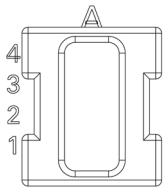
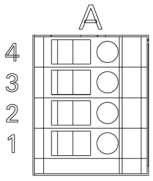
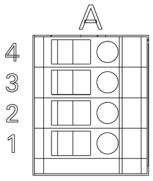
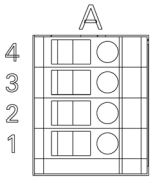
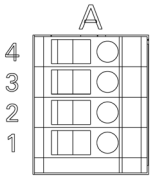
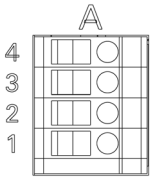
- Always connect the earth to the earthing terminal ⏚ of the SICAM P 7KG7750/55.

1.6.2 Terminal Assignment

Table 1-1 Terminal assignment

Terminal	Function		
E1	I_{L1}	I_A	Phase current 1, input
E2	I_{L1}	I_A	Phase current 1, output
E3	I_{L2}	I_B	Phase current 2, input
E4	I_{L2}	I_B	Phase current 2, output
E5	I_{L3}	I_C	Phase current 3, input
E6	I_{L3}	I_C	Phase current 3, output
F1	U_{L1}	U_A	Phase voltage 1
F2	U_{L2}	U_B	Phase voltage 2
F3	U_{L3}	U_C	Phase voltage 3
F4	U_N	U_N	Star point voltage measurement
G1	Common contact	Common contact	Common contact for the internal binary outputs 1 and 2
G2	B2	B2	Binary output 2
G3	B1	B1	Binary output 1
H1			Protective ground
H2	N/-	N/-	Supply voltage -
H3	L/+	L/+	Supply voltage +
A1 to A4	Optional, see Table 1-2, I/O modules		

Table 1-2 I/O modules (see Figure 1-6)

Modul Type	Terminal	Allocation	Ordering no. (see chapter 1.3)
not equipped			**A**
BO 2 binary outputs		n.c. BO2+ BO1+ BOR	**B**
BI 2 binary inputs		BI2+ BIR BIR BI1+	**C**
AO 2 analog outputs		AO2- AO2+ AO1- AO1+	**D**
AI 2 analog inputs		AI2- AI2+ AI1- AI1+	**E**
RO 3 relay outputs		ROR RO3 RO2 RO1	**G**

1.6.3 Assignment of the Interface

Table 1-3 Terminal assignment of RS485 interface

Pin No.	RS485 Interface	
	Modbus / IEC 60870-5-103	**Profibus DP**
1	Shield	Shield
2		
3	A	B(RxD/TxD-P)
4		
5	GND_{EXT}	GND_{EXT}
6	+5 V_{EXT}	+5 V_{EXT}
7	RTS	CTRL-A
8	B	A(RxD/TxD-N)
9		

The housing of the RS485 interface is connected to the protective ground. We recommend using standard connecting cables. The bus termination is accomplished via the connecting cable.

The isolated supply voltage of the interface is available at the D-Sub female connector, thus allowing the data signal terminating resistors to be connected to the connecting cable.

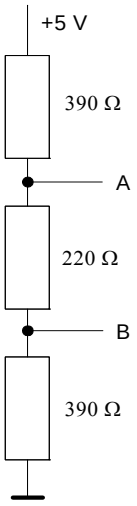


Fig. 1-8 Termination of the RS485 interface (external)

Note

All computing devices connected to the RS485 interface port shall be connected to a SELV (Separated Extra Low Voltage) circuit and must comply with the following standard: IEC/EN 60950.

1.6.4 Connection Examples

1.6.4.1 General

The following are examples of current and voltage input connections (according to DIN 43807). The device can be connected without current or voltage transformers as long as the maximum voltage and current ratings of the device are not exceeded.

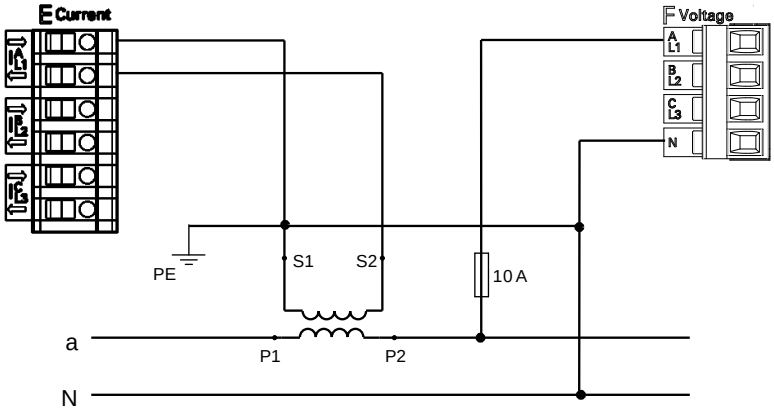
The voltage transformers can be connected in wye or open-delta configurations.

All input and/or output terminals not required for a particular input voltage and current configuration are not used.

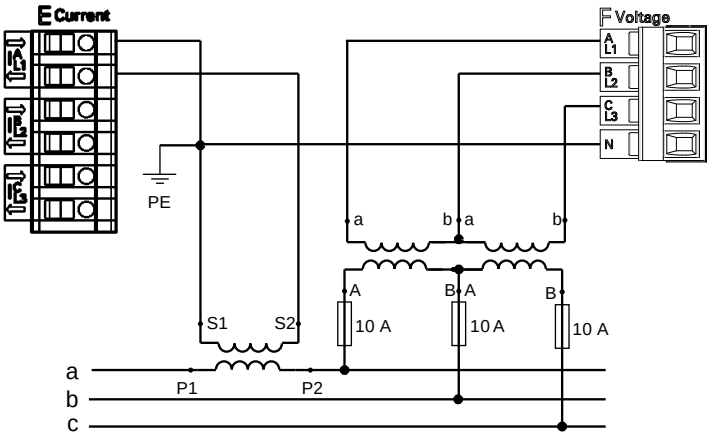
Note

The single ground connection of the instrument transformers is shown for illustration only. Actual grounds must be installed directly at each instrument transformer.

1.6.4.2 Single-phase



1.6.4.3 Three-phase, Three-wire, Balanced



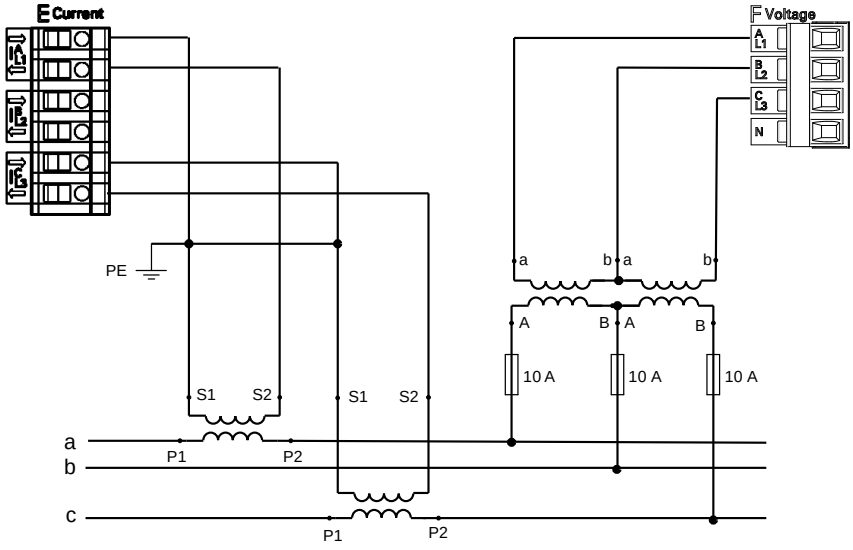
NOTICE

Do not exceed the maximum permissible voltage.

Nonobservance of the safety instructions means that property damage can result.

- The maximum secondary voltage is AC 480 V in this example. Do not exceed the maximum permissible voltage between phase and earth.

1.6.4.4 Three-phase, Three-wire, Unbalanced (2 I, Aron Circuit)



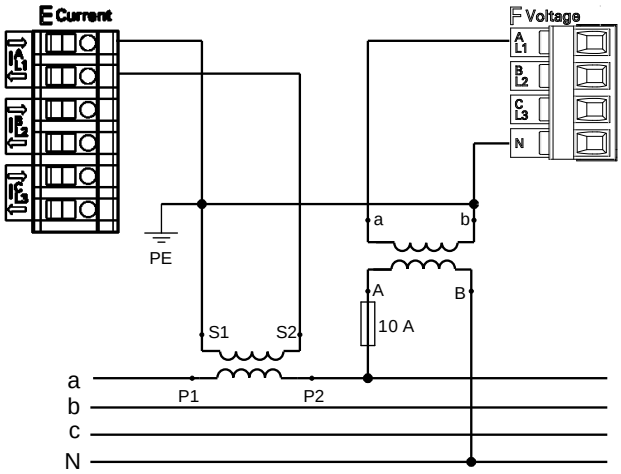
NOTICE

Do not exceed the maximum permissible voltage.

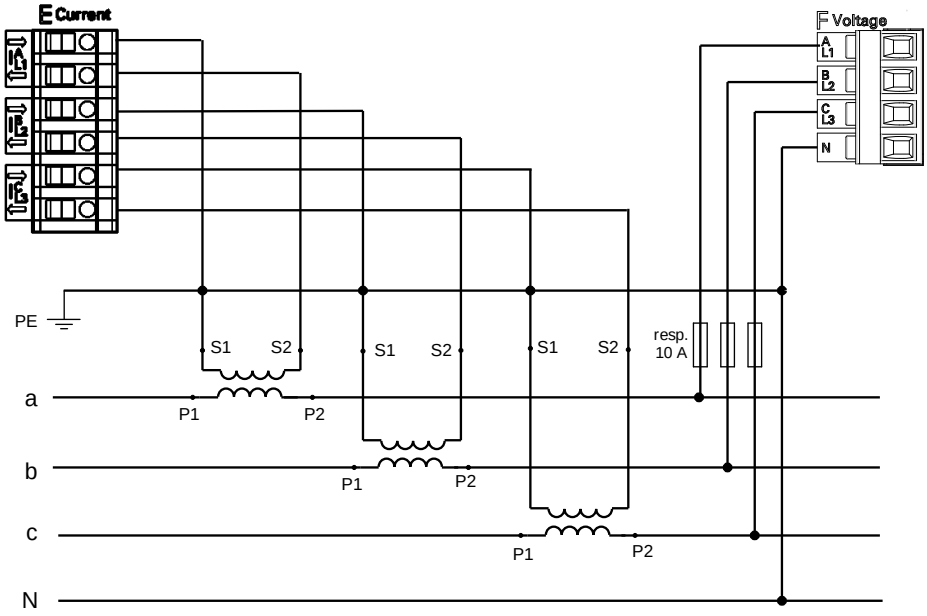
Nonobservance of the safety instructions means that property damage can result.

- The maximum secondary voltage is AC 480 V in this example. Do not exceed the maximum permissible voltage between phase and earth.

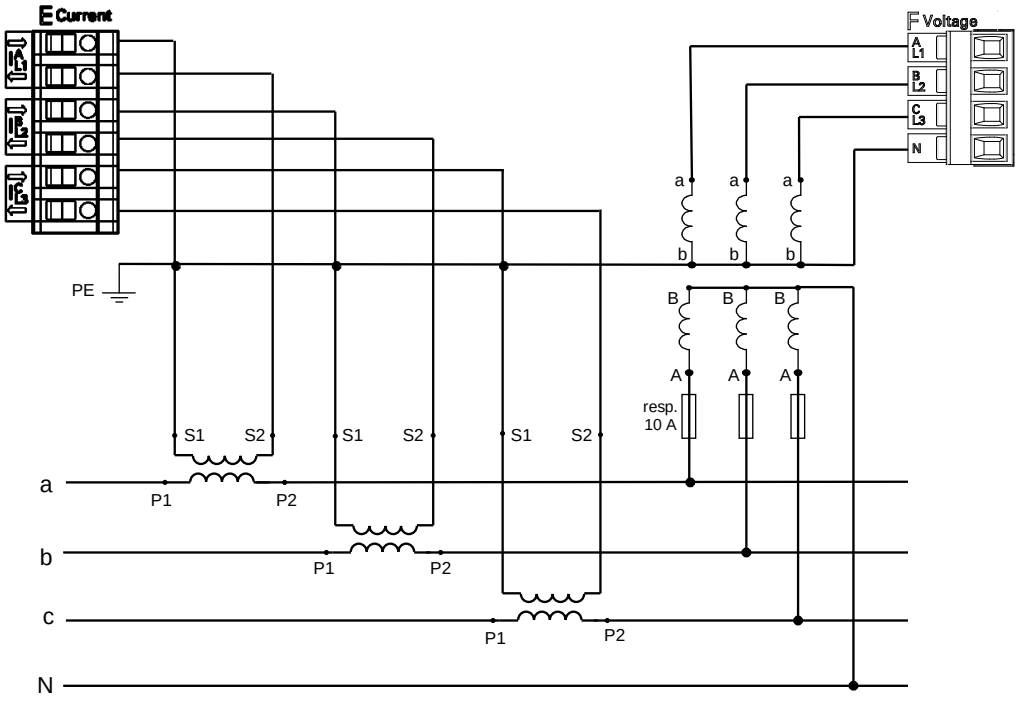
1.6.4.5 Three-phase, Four-wire, Balanced



1.6.4.6 Three-phase, Four-wire, Unbalanced (Low-voltage System)



1.6.4.7 Three-phase, Four-wire, Unbalanced (High-voltage System)



1.6.5 Mounting

WARNING

Warning about dangerous voltages when operating an electrical device.

Nonobservance of the safety instructions means that death, severe injuries or considerable material damages can occur.

- The SICAM P is a build-in device and must therefore be in-stalled on a switchboard or in a control cabinet. After installation, it is important that all terminals are properly covered to prevent accidental contact with energized parts.

To mount the device proceed as follows:

- Swing the mounting element (provided with the device) over the rear cone.
- Move the mounting element to the position. Use a screw driver (0.6 x 4.5) mm to fix the mounting elements until the slipping clutch takes effect.

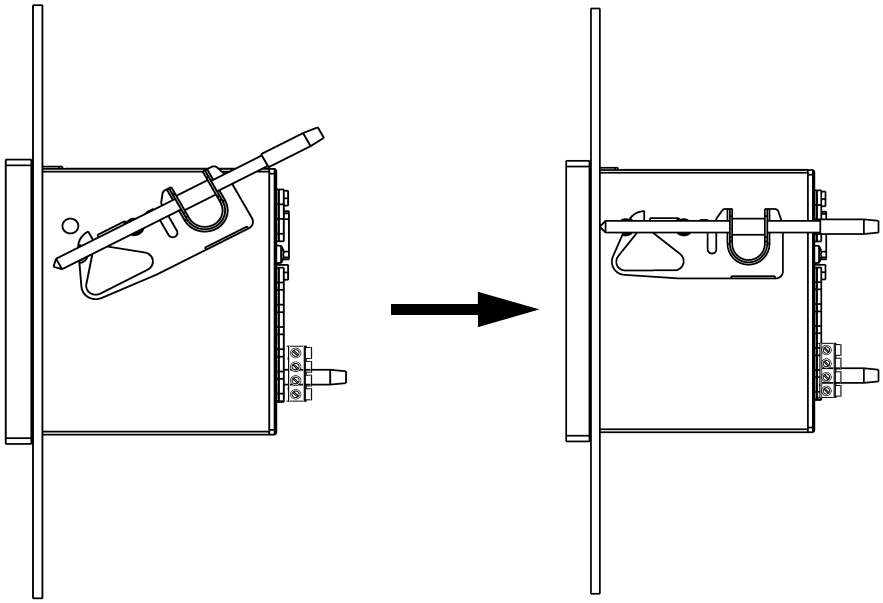


Fig. 1-9 Mounting

Notes

- The device location should be largely free from vibrations.
- The device must be operated within allowable ambient temperature limits. Operating the device outside of the operating temperature range can lead to measurement errors and device failure.
- Steps should be taken to minimize exposure of the device to direct sun light and large temperature variations.
- Minimum thickness of the mounting plate: 1 mm; steel.
- Steps must be taken to prevent condensation on or within the device during operation.
- To prevent accidental contact with energized parts the above described mounting must be taken care-fully and correctly.

1.6.6 Commissioning

The ratings and information on the nameplate should be checked prior to connecting the power supply voltage. In particular, power supply voltage ratings, as well as input voltage and current ratings should be verified. An operating period of 15 minutes is required before the device will perform within specified accuracy limits.

The battery serves to buffer the memory and the real-time clock of the SICAM P. The battery is included in the delivery scope. The battery is delivered in an isolated state. Remove the cover of the battery slot on the top of the device and remove the battery and the isolation. Insert the battery without isolation according to the polarity printed on the top of the device (marking shield) and replace the battery cover.

If the battery voltage is low the battery symbol occurs in status line of the display. Please change the battery in this case as described before. Use an isolated tool to remove the battery from the device to avoid a short circuit!

WARNING

Warning about battery change.

Nonobservance of the safety instructions means that death, severe injuries or considerable material damages can occur.

- All electrical connections must get separated from the device before the battery change.

1.6.7 Electrical Connection

WARNING

Warning about dangerous voltages when operating an electrical device.

Nonobservance of the safety instructions means that death, severe injuries or considerable material damages can occur.

- Only qualified people shall work on and around this device. They must be thoroughly familiar with all warnings and safety notices in this instruction manual as well as with the applicable safety steps, safety regulations, and precautionary measures.
- The following work is partly carried out at existence endangering voltages.

Note

- During electrical installation, all rules and regulations for power systems must be observed.
- For measurements in three-phase networks without neutral in V-connection and a nominal voltage of U_{LL} = 690 V, the voltage must be transformed to $U_{LL} \leq$ 400 V. The measuring range to be parameterized is then also U_{LL} = 690 V.
- Short-circuit the current transformer secondary circuits before current connections to the device are opened.
- The protective ground terminal of the device must be connected to the protective ground of the panel or cubicle.
- For connection of an auxiliary DC voltage, the correct polarity must be used.
- All of the terminals should be checked to verify proper connections.
- The polarities and phasing of all instrument transformers should be checked.
- Use screw-type terminals for 2.5 mm^2.
- In IT networks, the SICAM P cannot be connected directly because the voltage is measured against the PE conductor connection and the input impedance of the device causes a leakage current against earth. The leakage current can cause tripping of the leakage protective system in IT networks. Please make sure that the maximum permissible input voltage of the SICAM P against earth $U_{L\text{-}PE}$ = 480 V is not exceeded (e.g., due to an earth fault of one phase). Voltage transformers must be used in IT networks.
- Before initially energizing the device with supply voltage, it shall be situated in the operating area for at least two hours to ensure temperature equalization and to avoid humidity and condensation problems.

Operation 2

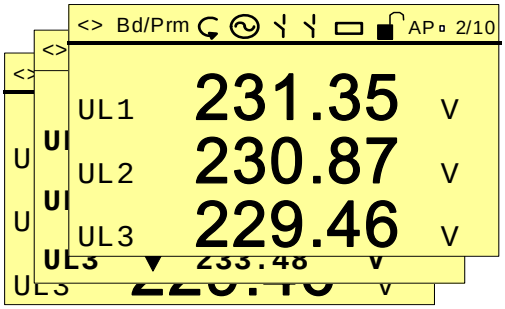
Contents

The following chapters describe the operation of the SICAM P 7KG7750. The operation of the SICAM P 7KG7755 is not described because this device has no display.

2.1	Screen Display	34
2.2	Screen Content	34

2.1 Screen Display

Once the SICAM P has been connected and configured for its measuring task, the measured quantities you have defined are displayed in screens.



- Specific screens can be selected via the two front arrow buttons ▼ ▲ .
- Press an arrow button once to display the next or previous screen.
- Hold an arrow button down to scroll through the screens automatically
- If desired, automatic scrolling can be programmed for normal display. When scrolling, the screens are arranged in a loop format (i.e., the first screen follows the last in one direction, whereas the last screen follows the first in the opposite direction, etc.).

2.2 Screen Content

The simple and individual screen design enables you to read the information relevant to your measuring tasks at a glance. The number of screens (max. 20), the screen types and their contents can be parameterized as required.

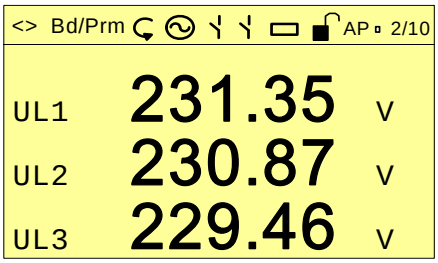
2.2.1 Screen Types

The following screen types are available:

- three measured values - digital
- six measured values - digital
- U, I, cos ϕ
- three min-max values

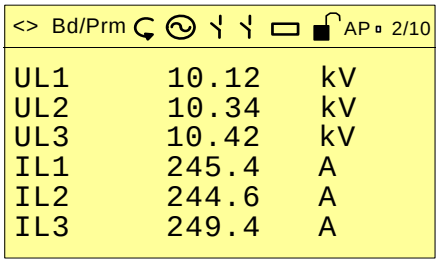
2.2.1.1 3 Measured Values - Digital

Display of any three measured quantities from the measured quantities Table 3-1.



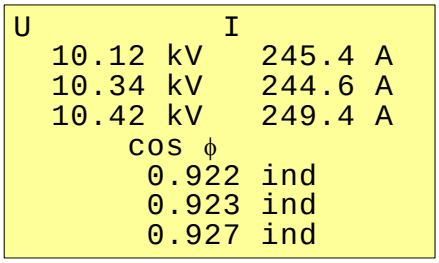
2.2.1.2 6 Measured Values - Digital

Display of any six measured quantities from the measured quantities Table 3-1.



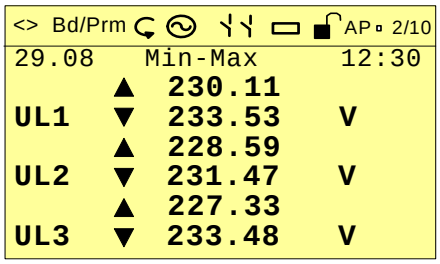
2.2.1.3 U, I and cos ϕ (Phasors)

- fast overview of the network conditions
- digital display of all connected phases
- measured quantities: U, I, cos ϕ



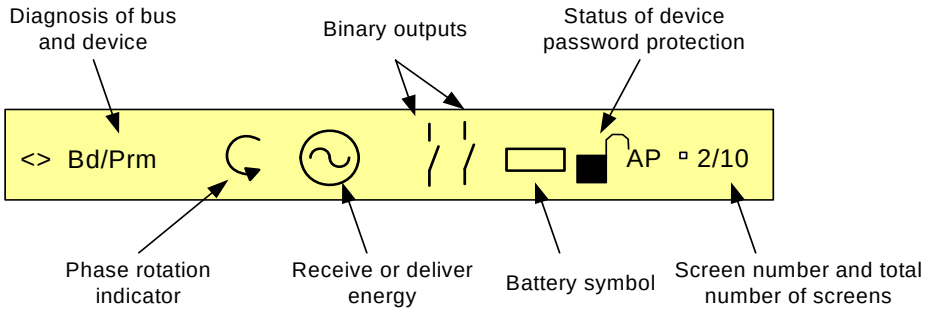
2.2.1.4 3 Min-Max Values

- Up to three measured quantities from the measured quantities tables (except energy and metered values) can be monitored here.
- The minimum, average and maximum values since recording was last initiated are displayed for a specific measured quantity. The values remain valid in case of a power failure.
- Recording is initiated (date and time):
  - when the device is switched on or
  - via "Reset" of the Min-Max values at the programming level.
- If no date/time is set, the duration of the recording is indicated in hours and minutes. If the time is set, the date and time of recording initiation are indicated.



2.2.2 Status Bar

The screens (except for U, I, cos ϕ) have a status line that displays the status of the device.



Meaning of the symbols

Symbol	Meaning
< >	Serial telegram sent / receive
Bd	Searching for the Profibus baud rate
Cfg	Waiting for the correct configuration of Profibus
Prm	Waiting for the correct parameters of Profibus
	Direction of rotation from U_{L1} to U_{L2} (U_A to U_B)
	Receive (this symbol) or delifer (resistor symbol) energy
	Status of binary outputs
	If the battery voltage falls below the defined threshold, then the symbol will be displayed in the status line. Please replace the battery in this case (see chapter 1.6.5).
	If the password protection is active a lock with a closed fastener will be displayed.
A	Recording of average values active
P	Recording of power values active

Measured Quantities

3

Contents

The following chapters describe the measured quantities.

3.1	Measured Quantities - Depend on the Connection Type	40
3.2	Formulas and Calculation of Derived Quantities	44
3.3	Connection Modes	49
3.4	View of Measured Quantities and Error Limits	51

3.1 Measured Quantities - Depend on the Connection Type

Table 3-1 Measured quantities that depend on the input connection type

No.	Measured Quantity	1-phase AC Current	Three-wire Three-phase Balanced	Three-wire Three-phase Unbalanced (3I)	Three-wire Three-phase Unbalanced (2I)	Four-wire Three-phase Balanced	Four-wire Three-phase Unbalanced	Designation
1	(Space line)*	X	X	X	X	X	X	
2	Voltage L1-N	X				X	X	U L1
3	Voltage L2-N						X	U L2
4	Voltage L3-N						X	U L3
5	Voltage L1-L2		X	X	X		X	U L12
6	Voltage L2-L3		X	X	X		X	U L23
7	Voltage L3-L1		X	X	X		X	U L31
8	Voltage E-N*		0	0	0	0	0	U E-N
9	Current L1	X	X	X	X	X	X	I L1
10	Current L2			X	X		X	I L2
11	Current L3			X	X		X	I L3
12	Average current*			X	X		ΣI / 3	I
13	Neutral current N			X			X	I0
14	Real power L1	X					X	P L1
15	Real power L2						X	P L2
16	Real power L3						X	P L3
17	Real power Σ		X	X	X	X	X	P
18	Reactive power L1	X					X	Q L1
19	Reactive power L2						X	Q L2
20	Reactive power L3						X	Q L3
21	Reactive power Σ		X	X	X	X	X	Q
22	Apparent power L1	X					X	S L1
23	Apparent power L2						X	S L2
24	Apparent power L3						X	S L3
25	Apparent power Σ		X	X	X	X	X	S
26	Active factor cos ϕ L1	X					X	COS PHI L1
27	Active factor cos ϕ L2						X	COS PHI L2
28	Active factor cos ϕ L3						X	COS PHI L3
29	Active factor cos ϕ Σ		X	X	X	X	X	COS PHI
30	Power factor L1	X					X	PF L1
31	Power factor L2						X	PF L2
32	Power factor L3						X	PF L3
33	Power factor Σ		X	X	X	X	X	PF

* see Table 3-2, Explanation

No.	Measured Quantity	1-phase AC Current	Three-wire Three-phase Balanced	Three-wire Three-phase Unbalanced (3I)	Three-wire Three-phase Unbalanced (2I)	Four-wire Three-phase Balanced	Four-wire Three-phase Unbalanced	Designation
34	Phase angle L1	X					X	PHI L1
35	Phase angle L2						X	PHI L2
36	Phase angle L3						X	PHI L3
37	Phase angle Σ		X	X	X	X	X	PHI
38	System frequency	X	X	X	X	X	X	f
39	Asymmetrical voltage						X	ASYM U
40	Asymmetrical current						X	ASYM I
41	THD voltage L1	X					X	THDU L1
42	THD voltage L2						X	THDU L2
43	THD voltage L3						X	THDU L3
44	THD current L1	X					X	THDI L1
45	THD current L2						X	THDI L2
46	THD current L3						X	THDI L3
47	Harmonic voltage L1*	X	X	X	X	X	X	HU L1 5, 7, 11, 13, 17, 19
48	Harmonic voltage L2*			X	X		X	HU L2 5, 7, 11, 13, 17, 19
49	Harmonic voltage L3*			X	X		X	HU L3 5, 7, 11, 13, 17, 19
50	Harmonic current L1*	X	X	X	X	X	X	HI L1 5, 7, 11, 13, 17, 19
51	Harmonic current L2*			X	X		X	HI L2 5, 7, 11, 13, 17, 19
52	Harmonic current L3*			X	X		X	HI L3 5, 7, 11, 13, 17, 19
53	Active energy L1 demand*	X					X	WpL1d
54	Active energy L2 demand*						X	WpL2d
55	Active energy L3 demand*						X	WpL3d
56	Active energy Σ demand*		X	X	X	X	X	WpΣd
57	Active energy L1 supply*	X					X	WpL1s
58	Active energy L2 supply*						X	WpL2s
59	Active energy L3 supply*						X	WpL3s
60	Active energy Σ supply*		X	X	X	X	X	WpΣs
61	Active energy L1 total*	X					X	WpL1t
62	Active energy L2 total*						X	WpL2t
63	Active energy L3 total*						X	WpL3t
64	Active energy Σ total*						X	WpΣt
65	Active energy (3L) demand net*	X	X	X	X	X		Wpnet

* see Table 3-2, Explanation

No.	Measured Quantity	1-phase AC Current	Three-wire Three-phase Balanced	Three-wire Three-phase Unbalanced (3I)	Three-wire Three-phase Unbalanced (2I)	Four-wire Three-phase Balanced	Four-wire Three-phase Unbalanced	Designation
66	Reactive energy L1 inductive	X					X	WqL1i
67	Reactive energy L2 inductive						X	WqL2i
68	Reactive energy L3 inductive						X	WqL3i
69	Reactive energy Σ inductive		X	X	X	X	X	WqΣi
70	Reactive energy L1 capacitve	X					X	WqL1c
71	Reactive energy L2 capacitve						X	WqL2c
72	Reactive energy L3 capacitve						X	WqL3c
73	Reactive energy Σ capacitve		X	X	X	X	X	WqΣc
74	Reactive energy total L1*	X					X	WqL1t
75	Reactive energy total L2*						X	WqL2t
76	Reactive energy total L3*						X	WqL3t
77	Reactive energy total Σ*		X	X	X	X	X	WqΣt
78	Apparent energy L1	X					X	WL1
79	Apparent energy L2						X	WL2
80	Apparent energy L3						X	WL3
81	Apparent energy Σ		X	X	X	X	X	WΣ
82	Counter 1 / 2 / 3 / 4*	X	X	X	X	X	X	Cntr. 1, 2, 3, 4
83	Binary inputs	X*	X*	X*	X*	X*	X*	
84	Analog inputs	X*	X*	X*	X*	X*	X*	

* see Table 3-2, Explanation

Explanations to the Table 3-1

Table 3-2 Explanation

No.	Name	Description
1	(Space line)	If a space line is selected as a measured quantity, the corresponding fields remain empty on the display screens.
8	Voltage E-N	The displayed value of the voltages (E-N) is always 0, but the value of residual voltage is shown, if it occurs.
12	Average current	The average value of the three phase currents is displayed here.
47 to 52	Harmonics U / I	For harmonics up to the 21st, the standards (IEC 61000-2-2 and EN 50160) specify compatibility levels only for harmonics of orders 5, 7, 11, 13, 17, and 19. Those of even order and those divisible by 3 are considered irrelevant. Therefore, on the "Harmonics" screen, selection is limited to all uneven orders up to the 21st. The selection of single harmonics on the measured values screens is limited to the 5th, 7th, 11th, 13th, 17th and 19th. For voltage harmonics, values are displayed as a percentage of the first harmonic. For current harmonics, the values are displayed directly in A.
53 to 60	Active energy demand	The default setting (industry mode) is "Load (standard)" indicated by a positive energy flow direction. You can configure the power supply company mode. In this mode, a positive value indicates "Generator".
61 to 64	Active energy total	The sum of the absolute values (without sign) of active energy demand and active energy supply.
65	Active energy (3L) net demand	*Net energy* is equal to *energy demand* minus *energy supply*. Because this measured value can be negative and can decrease as well as increase, it is not possible to use this measured value to generate pulses via the output contacts.
74 to 77	Reactive energy total	The sum of the absolute values (without sign) of inductive and capacitive kvarh.
82	Counter 1 / 2 / 3 / 4	Number of limit violations
83 84	Binary inputs, analog inputs	optional

3.2 Formulas and Calculation of Derived Quantities

3.2.1 Calculation of Derived Quantities

Line	Derived Quantity	Formula	Note
1	RMS value voltage, distorted waveform included	$V = \sqrt{\frac{1}{64}\sum_{\nu=1}^{64} u_\nu^2}$	
2	RMS value voltage, fundamental component U_1 only	$V_1 = \sqrt{\frac{a^2 + b^2}{2}}$	From the Fourier coefficients a and b of the fundamental component
3	RMS value current, distorted waveform included	$I = \sqrt{\frac{1}{64}\sum_{\nu=1}^{64} i_\nu^2}$	
4	RMS value voltage, fundamental component I_1 only	$I_1 = \sqrt{\frac{a^2 + b^2}{2}}$	From the Fourier coefficients a and b of the fundamental component
5	Active power P_{Std}	$P = \frac{1}{64}\sum_{\nu=1}^{64} v_\nu i_\nu$	From sample values
6	Active power P_{Four}	$P = Va_1 Ia_1 + Vb_1 Ib_1$	From the Fourier coefficients of the fundamental component
7	Active power P_{DIN}	$P = \sum_{n=1}^{21} (Va_n Ia_n + Vb_n Ib_n)$	From the Fourier coefficients of the fundamental component and from the harmonics.
8	Reactive power Q_{Std}	$Q = \frac{1}{64}\sum_{\nu=1}^{64} v_\nu i_\nu \cdot e^{-j\frac{1}{2}\pi}$	Standard up to now, additional fault for distortions[1]
9	Reactive power Q_{Four}	$Q = Va_1 Ib_1 + Vb_1 Ia_1$	
10	Reactive power Q_{DIN}	$Q_{tot} = \sum_{n=1}^{21} (Va_n Ib_n + Vb_n Ia_n)$	From the Fourier coefficients of the fundamental component
11	Apparent power S_{Std}	$S = V_{1N} \cdot I_1 + V_{2N} \cdot I_2 + V_{3N} \cdot I_3$	From the RMS values according to line 1 and 3
12	Apparent power S_{Four}	$S = \sqrt{V_{1N}^2 + V_{2N}^2 + V_{3N}^2} \cdot \sqrt{I_1^2 + I_2^2 + I_3^2}$	From the RMS values according to line 1 and 3
13	Apparent power S_{DIN}	$S = \sqrt{V_{1N}^2 + V_{2N}^2 + V_{3N}^2} \cdot \sqrt{I_1^2 + I_2^2 + I_3^2}$	From the RMS values according to line 2 and 4
14	Power factor	$\cos\varphi = \frac{\lvert P \rvert}{S}$ or $\frac{P_1}{S_{DIN}}$	No sign!
15	Power factor DIN	$\cos\varphi = \frac{\lvert P \rvert}{S_{DIN}}$	No sign!
16	Power factor cos φ	$\cos\varphi = \frac{P_1}{S_1}$	Four quadrants according to note 4
17	Phase Angle	$\varphi = \arctan\frac{Q_1}{P_1}$	From the fundamental component only!

[1] According to classic measuring devices (electrodynamic power meter)

Line	Derived Quantity	Formula	Note
18	System frequency	$f = \frac{N}{\overline{\frac{T}{P}}}$	Refer to note 1
19	Active energy demand	$W = \sum_{\nu=1} P_\nu \quad for\, P > 0$	The active energy demand will be calculated every second.
20	Active energy supply	$W = \sum_{\nu=1} P_\nu \quad for\ P < 0$	The active energy supply will be calculated every second.
21	Active energy without sign	$W = \sum_{\nu=1} P_\nu$	Calculation without sign
22	Active energy net demand	$W = \sum_{\nu=1} P_\nu$	Calculation with sign
23	Asymmetrical voltage U or current I	$V = \frac{G}{M}$	Refer to note 2 Range is 0 to ∞, avoid division by 0!
24	THD voltage, current	$THD = \sqrt{\frac{M_{tot}}{M_1} - 1}$	Refer to note 3
25	Harmonics		From Fourier transformation

3.2.2 Remarks to the Measuring Quantities

Note 1

N: Nominal value of the counting pulses per period at nominal value of the system frequency

T: Nominal value of the period length of the system frequency in µs

P: Counted pulses within one period

V: Asymmetry

G: Unbalanced system

M: Balanced system

M_n: Vector of the measured quantity, U_{LN} or I_L, from Fourier transformation

Note 2

No. of Equation	Equation
1	$G = \sqrt{A^2 + B^2}$
2	$A = M_1 + M_2 \cos\left(\varphi_{12} - \frac{2}{3}\pi\right) + M_3 \cos\left(\varphi_{13} + \frac{2}{3}\pi\right)$
3	$B = M_2 \sin\left(\varphi_{12} - \frac{2}{3}\pi\right) + M_3 \sin\left(\varphi_{13} + \frac{2}{3}\pi\right)$
4	$M = \sqrt{C^2 + D^2}$
5	$C = M_1 + M_2 \cos\left(\varphi_{12} + \frac{2}{3}\pi\right) + M_3 \cos\left(\varphi_{13} - \frac{2}{3}\pi\right)$
6	$D = M_2 \sin\left(\varphi_{122} + \frac{2}{3}\pi\right) + M_3 \sin\left(\varphi_{13} - \frac{2}{3}\pi\right)$

Note 3

Derivation of the formula:

Total distortion D according to IEC 61000-2-2:

Equation No. 7:

$$D = \sqrt{\sum_{n=2}^{N} u_n^2} = \frac{1}{M_1}\sqrt{\sum_{n=2}^{N} M_n^2}$$

u_n: U_n/U_1

n Order of the harmonic

U_n Voltage of the n-th harmonic

U_1 Voltage of the fundamental component

N 40, for SICAM P: 21

M_n Harmonic (n-th order) of voltage or current

M_1 Fundamental component of voltage or current

It is possible to derive the result from the harmonic M_1 and the RMS value M_{ges} of the distorted measured quantity. With the root „H“ from equation 8:

Equation No. 8:

$$H = \sqrt{M_{ges}^2 - M_1^2}$$

M_{ges}: RMS value of the distorted measured quantity U or I

M_1: RMS value of the fundamental component of the measured quantity

Inserting the values into the equation results in:
Equation 9:

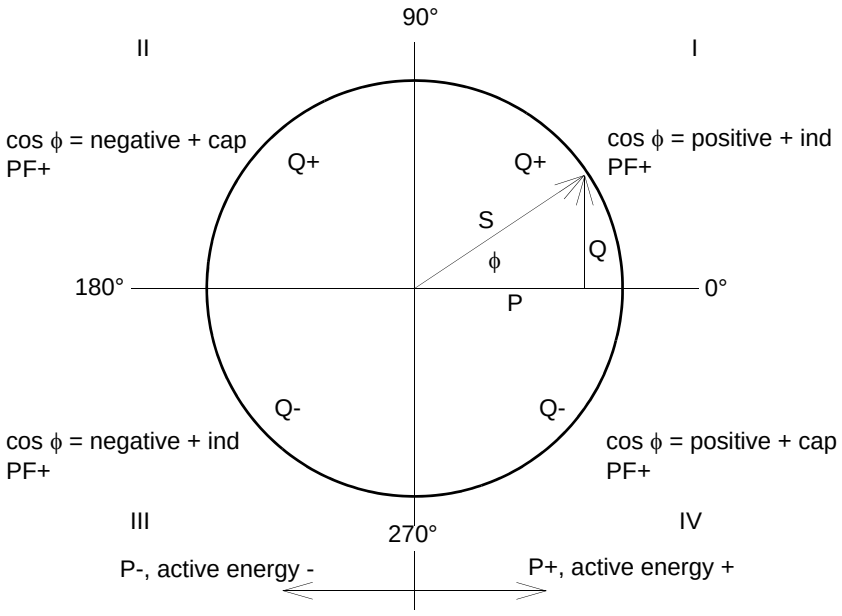
$$THD = \frac{1}{M_1} H = \frac{1}{M_1}\sqrt{M_{ges}^2 - M_1^2}$$

Inserting 1/M1 into the root results in:
Equation 10:

$$THD = \sqrt{\frac{M_{ges}^2 - M_1^2}{M_1^2}} = \sqrt{\frac{M_{ges}^2}{M_1^2} - 1}$$

Note 4

4 Quadrants



3.3 Connection Modes

3.3.1 Four-wire Three-phase Current with Any Load

Depending on the measuring method some quantities to be measured are not available. For the method according to DIN, for example the apparent power S or S_1 are available; only S_{DIN} can be calculated.

3.3.2 Single-phase AC

The measuring path for the voltage is A-N for the voltage and A for the other quantities. This applies also for the power values. The apparent power according to DIN, the reactive power Q_{tot} DIN and the asymmetry are not valid.

3.3.3 Four-wire Three-phase Current with Symmetrical Load

Current A and voltage A-N are available. You can display the same measured quantities as for Single-phase AC. For power Σ, the value calculated from U and I must be multiplied by 3. For power, power factor, cos ϕ, phase angle and energy only the sum is relevant. The measurement values Asymmetrical U or I are not available. THD and harmonics can be derived for A only.

3.3.4 Three-wire Three-phase Current with Symmetrical Load

For this connection mode, an artificial neutral point is formed via resistors. Since this internal neutral point is connected to the grounding conductor, it cannot be used here. The reactive power (Standard) can be derived from U_{32} and I_1:

Equation 11:

$$Q = \frac{\sqrt{3}}{64} \sum_{\nu=1}^{64} u_{32\nu} i_{1\nu}$$

You have to calculate u_{32} from u_{3E} - u_{2E}. To calculate the reactive power for the fundamental Q1, the adequate phasors are used. For the reactive power (Standard), sample points, which are shifted by 90°, are used for the voltage.

Equation 12:

$$P = \frac{\sqrt{3}}{64} \sum_{\nu=1}^{64} u_{32\nu} \cdot e^{-j\frac{\pi}{2}} i_{1\nu}$$

To calculate the active power of the fundamental P_1 the adequate phasors are used. The measurement values Asymmetrical U or I are not available. THD and harmonics cannot be calculated. The apparent power is the multiplication of the RMS values voltage and current, e.g.:

Equation 13:

$$S = \sqrt{3} \cdot U_{32} \cdot I_1$$

For S_1, the RMS values of the fundamental component are used; as symmetrical load is supposed $S_{DIN} = S$.

3.3.5 Three-wire Three-phase Current with Any Load

For this connection mode, the phase-to-ground voltages are not available. Active and reactive powers are calculated from the formulas of the two-wattmeter (Aron) circuit:

Equation 14:

$$P = \frac{1}{64}\sum_{\nu=1}^{64} u_{12\nu} i_{1\nu} + \frac{1}{64}\sum_{\nu=1}^{64} u_{23\nu} i_{3\nu}$$

This is also valid for the calculation via Fourier analysis. For the reactive power according to classic measuring devices (electro dynamic power meter), the following equation is valid:

Equation 15:

$$Q = \frac{1}{64}\sum_{\nu=1}^{64} u_{12\nu} i_{1\nu} e^{-j\frac{1}{2}\pi} + \frac{1}{64}\sum_{\nu=1}^{64} u_{23\nu} i_{3\nu} e^{-j\frac{1}{2}\pi}$$

Distortions will cause an additional fault. For the apparent power (classical method), the following equation is valid::

Equation 16:

$$S = \sqrt{3}\left(U_{12} I_1 + U_{23} I_3\right)$$

For the apparent power according to DIN calculated from the phase voltages, the following equation is valid:

Equation 17:

$$S = \sqrt{\frac{1}{3}\left(U_{12}^2 + U_{23}^2 + U_{31}^2\right)} \cdot \sqrt{I_1^2 + I_2^2 + I_3^2}$$

In both cases, current B must be calculated from the geometrical sum of the currents -A and -C. To do this, you can sum up the sample points or the Fourier coefficient.

The artificial neutral point does not allow measuring the voltage asymmetry exactly and is not realized. The measured values are only exact, if you use a four-wire net with neutral point. Often the three-wire net is used only to save the cable connection to current transformer 2. Only in this case, it would be useful to measure the asymmetry.

3.4 View of Measured Quantities and Error Limits

Table 3-3 Measured values and tolerances

Measured Values	Measuring Path [1]	Menu	Tolerances [2]
Voltage	L1-N, L2-N, L3-N	▼ ■ ●	±0.2 %
Voltage	L1-L2, L2-L3, L3-L1, Σ [3]	▼ ■ ●	±0.2 %
Current	L1, L2, L3, N, Σ [3]	▼ ■ ●	±0.2 %
Active power P + demand, - supply	L1, L2, L3, Σ	▼ ■ ●	±0.5 %
Reactive power Q + cap, - ind	L1, L2, L3, Σ	▼ ■ ●	±0.5 %
Apparent power S	L1, L2, L3, Σ	▼ ■ ●	±0.5 %
Power factor |cosφ| [4]	L1, L2, L3, Σ	▼ ■ ●	±0.5 %
Active power factor cosφ [4]	L1, L2, L3, Σ	▼ ■ ●	±0.5 %
Phase angle [4]	L1, L2, L3, Σ	▼ ■ ●	±2°
System frequency [5]	L1-N	▼ ■ ●	±10 mHz
Active energy demand	L1, L2, L3, Σ	▼ ■	±0.5 %
Active energy supply	L1, L2, L3, Σ	▼ ■	±0.5 %
Active energy total	L1, L2, L3, Σ	▼ ■	±0.5 %
Active energy net demand	Σ	▼ ■	±0.5 %
Reactive energy cap	L1, L2, L3, Σ	▼ ■	±0.5 %
Reactive energy ind	L1, L2, L3, Σ	▼ ■	±0.5 %
Reactive energy total	L1, L2, L3, Σ	▼ ■	±0.5 %
Apparent energy	L1, L2, L3, Σ	▼ ■	±0.5 %
Unbalance voltage	Four-wire system	▼ ■ ●	±0.5 %
Unbalance current	Four-wire system	▼ ■ ●	±0.5 %
THD voltage	L1, L2, L3	▼ ■ ●	±0.5 %
THD current	L1, L2, L3	▼ ■ ●	±0.5 %
Harmonic voltage 5., 7., 11., 13., 17. and 19. H.	L1, L2, L3	▼ ■ ●	±0.5 %
Harmonic current 5., 7., 11., 13., 17. and 19. H.	L1, L2, L3	▼ ■ ●	±0.5 %
Limit violation	Counter 1 to 4	▼ ■	
Analog input [6]	external	▼ ■	±0.5 %
Binary input [6]	external	▼ ■	

1) Phases are displayed based on the type of connection.

2) Tolerances at reference conditions (see chapter 7) are applicable from 0.1 to 1.2 x nominal range.

3) Average value of all phases.

4) Measuring beginning with 2 % of the internal apparent power in selected measurement range

5) Measuring beginning with 30 % of the input voltage L1-N

6) Optional

7) Limit values for the complete temperature range (see chapter 7) referring to: 0.1 to 1.2 x nominal range.

Symbol	Function
▼	Measured values can be displayed on measured value screens (only 7KG7750)
■	Measured values selectable over communication
●	Measured values selectable for list screens and oscilloscope (only 7KG7750)

Device Parameterization

4

Contents

The following chapters describe the device parameterization of the SICAM P 7KG7750 using a graphic display. The parameterization of the SICAM P 7KG7755 using PC software is explained in chapter 5.

4.1	Operating Notes	54
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4.1 Operating Notes

This chapter describes all of the setting options of the SICAM P that are made via the front buttons.

The Main Menu (programming level 2, see chapter 4.3) can be accessed :

- from the measured values screens, the min-max values screens or the screen U, I, cos ϕ via the ENTER button,
- from the data logger: use the arrow buttons to select the Date/Time screen and press the ENTER button.

4.1.1 Button Functions

The following functions are performed via the  buttons:

- Moving the cursor to the entry line,
- Scrolling through selection lists when entering settings,
- Selecting numbers when entering numerical values.

If the buttons are held down, the scrolling continues automatically. The buttons generally cycle between cursor, parameters or numbers.

The selected line, setting, or number is confirmed by pressing the ENTER button.

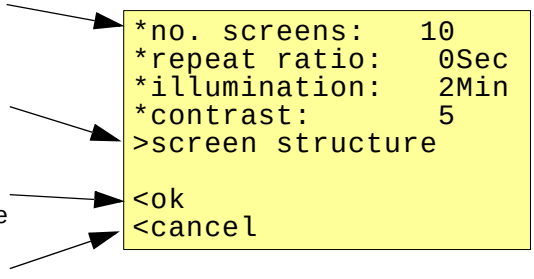
4.1.2 Windows Structure

Selecting ***** and pressing ENTER moves the cursor directly to the data entry field on the same line.

Selecting **> screen structure** and pressing ENTER opens a new window for additional data entry.

Selecting **< OK** and pressing ENTER confirms the settings and returns the user to the previous level.

Selecting **< Cancel** and pressing ENTER cancels the setting changes just made and returns the user to the previous level.

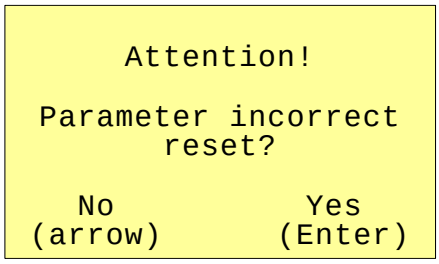


4.1.3 Notes on Parameterization

- The measured quantities offered for selection in the screens depend on the connection type selected.
- The numbers entered are checked for plausibility and the note: "ERR" is displayed if required. The input value is then set to the maximum value.
- If the power supply voltage is switched off during programming, the message illustrated below appears when the device is restarted. Therefore, the power supply voltage should only be switched off in level 1 (measuring screens).

Select **No** via the ▼ ▲ buttons to retain the settings as they existed prior to the loss of power supply voltage.

Choose **Yes** by pressing the ENTER button to restore the default settings.



Note

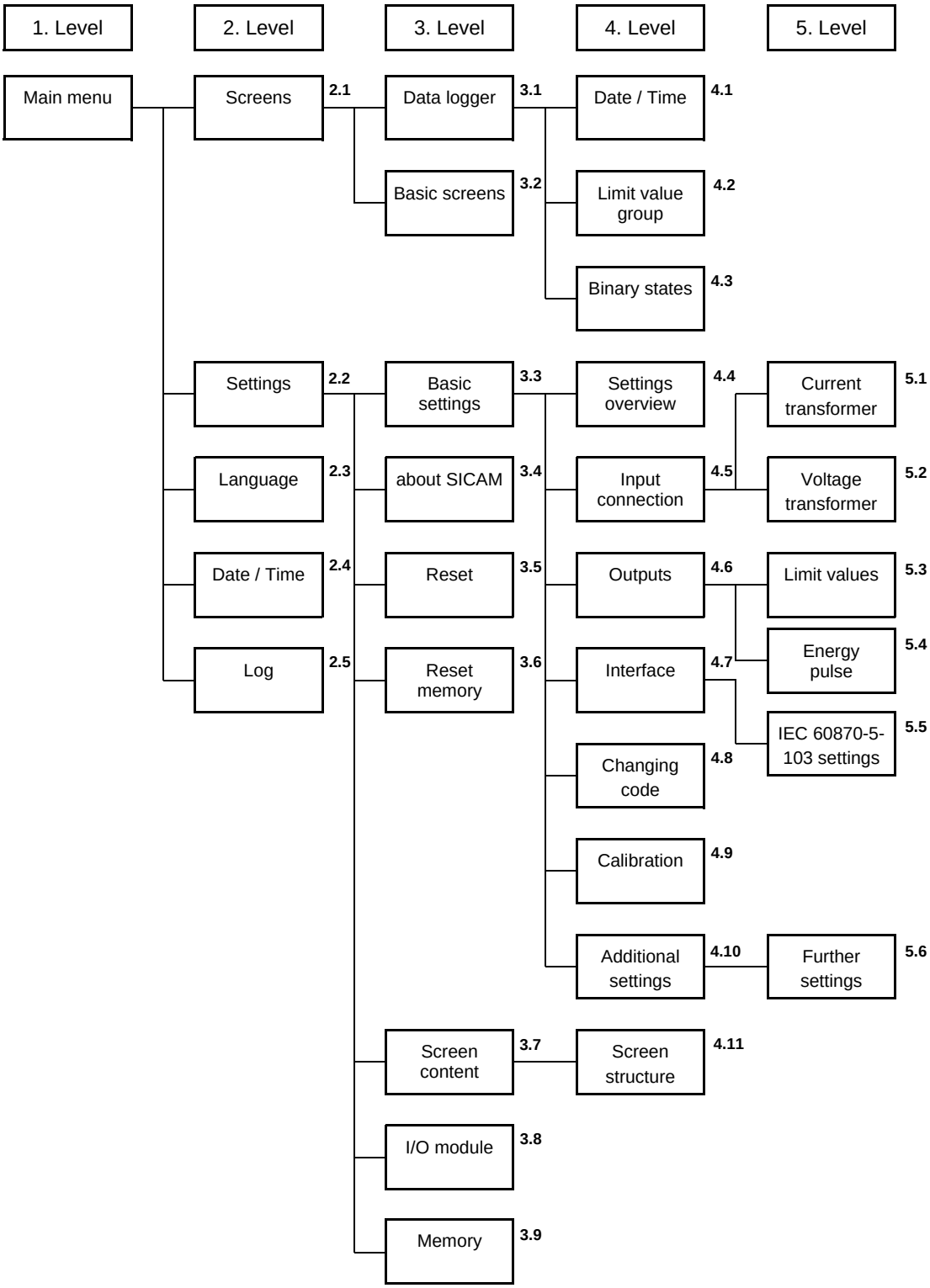
This means, that you should always leave the parameter screens completely (OK or Cancel) until the measurement screens are displayed again. This ensures that all parameters will be accepted by the device.

Note

Please check the parameters and the adjustment data afterwards, to ensure the correct function of the SICAM P.

If you have adjusted the device manually (refer to chapter 6), the adjustment data will not be overwritten by default settings.

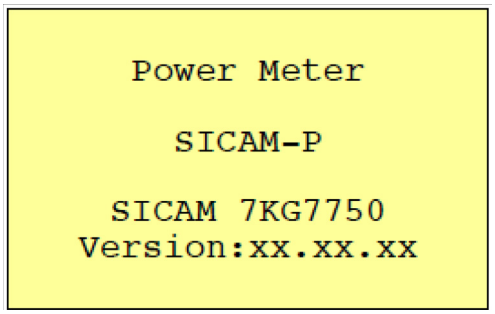
4.2 Overview of the Levels



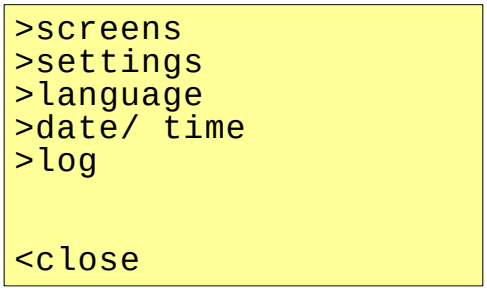
4.3 Main Menu

4.3.1 Startup-phase

After applying voltage to the power supply, the SICAM P will run in the startup-phase for 15 s.



The main menu is used to access various submenus.



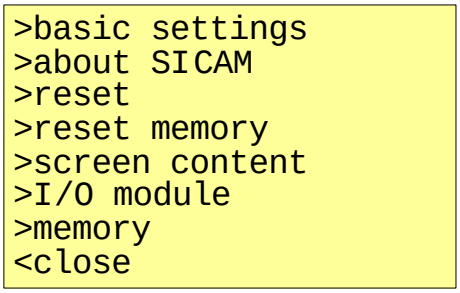
4.3.2 Screens

Use the ENTER key to switch between the displays

- Main menu
- Measured value screens
- Data logger

4.3.3 Settings

The setup masks for device parameterization can be selected from the Parameters menu.



4.3.4 Language

Language

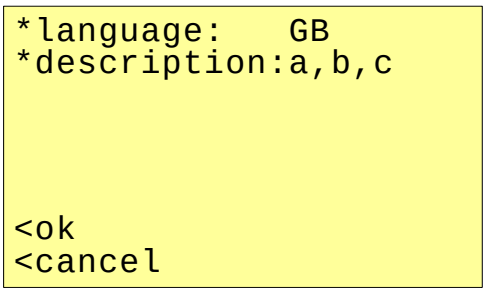
Here you can select the language of the SICAM P.

- D = German
- GB = English

Designation

Change of the conductor designations in the screens:

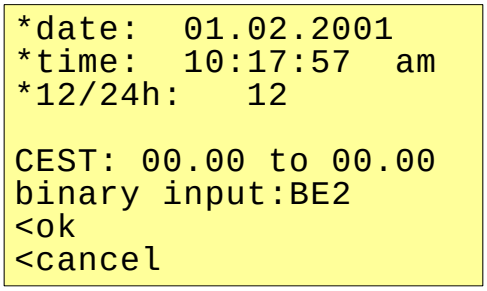
- a, b, c
- L1, L2, L3



4.3.5 Date / Time

SICAM P requires time information for the following functions:

- Oscilloscope
- Log entries
- Measured value memory

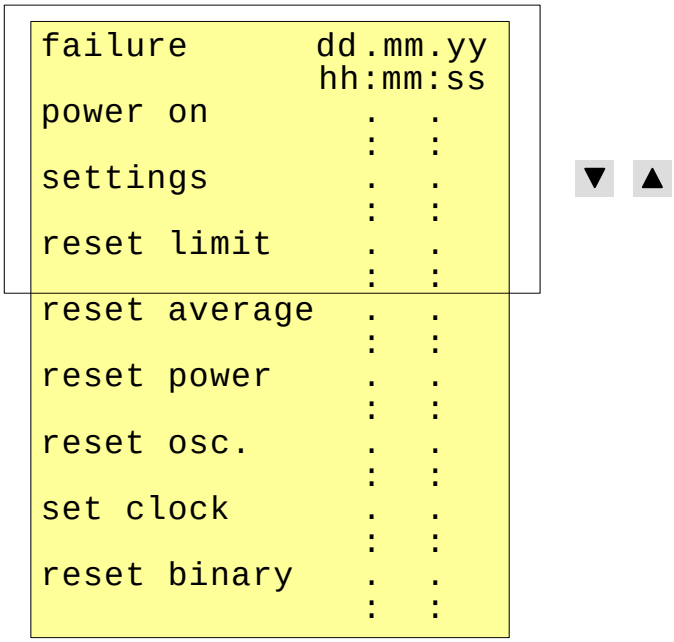


One binary input (optional) may be used for time synchronization via minute impulse.

The data for summer/winter time and the binary input can only be set via the PC software SICAM P parameterization (refer to chapter 5).

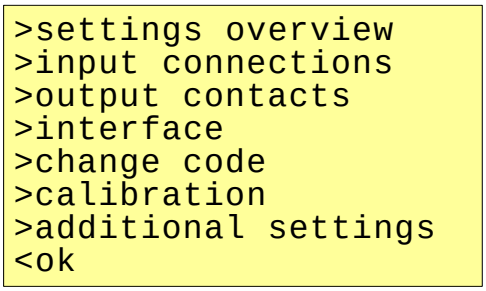
4.3.6 Log

The screen **Log** displays date and time of the most recent status changes.



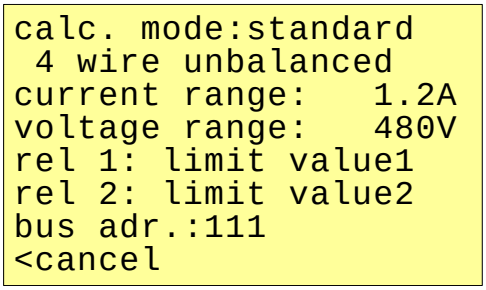
4.4 Basic Settings

Here you can make the most important settings directly on the device.



4.4.1 Settings Overview

Settings Overview is where the most important settings associated with the device are displayed.



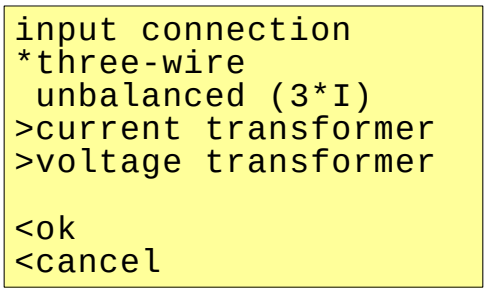
4.4.2 Connection / Transformer

Input connection

As shown in chapter 1.6.4, the connection mode can be selected here.

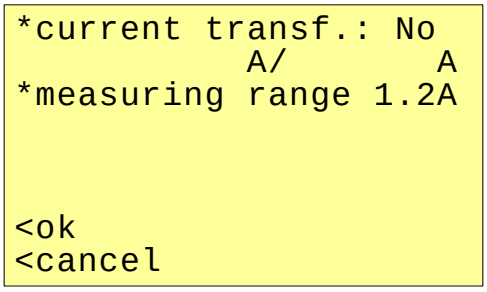
- Single-phase AC
- Three-phase, four-wire, balanced
- Three-phase, four-wire, unbalanced
- Three-phase, three-wire, balanced
- Three-phase, three-wire, unbalanced (2 x I)
- Three-phase, three-wire, unbalanced (3 x I)

Three-wire, unbalanced can be selected either with the connection of two current transformers (standard / Aron measuring circuit) or three current transformers.



4.4.2.1 Current Transformer

- **Yes**: Current transformers utilized (max. primary: AC 999999 A, secondary: AC 6 A)
- **No**: Current transformers not utilized



Measuring range

The secondary input current measuring range is selected for the SICAM P as follows:

- **1.2 A**: nominal input AC 1 A
- **6 A**: nominal input AC 5 A

Caution

- You must make these settings for a direct connection or for a connection with current transformers.
- The selected measuring range must be greater than the secondary rating of the current transformer!
- The accuracy of SICAM P (see table 3-3) is based on the selected measuring range.
- The determination of this range indicates the maximum current value that can be displayed on the device.

Note

When you change the current transformer settings, the power calculation in the device has to be reset.

Example

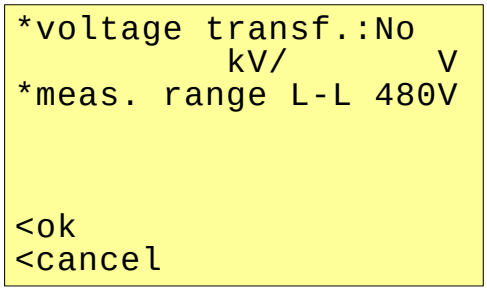
CT rating: 500 / 1 A

Measuring range 1.2 A: Maximum display range: AC 0 A to 600 A

Measuring range 6 A: Maximum display range: AC 0 A to 3000 A

4.4.2.2 Voltage Transformer

- Yes: Voltage transformers are utilized (max. primary: AC 1000 kV, secondary: AC 600 V)
- No: Voltage transformers are not utilized



Measuring range

- **132 V** nominal input AC 100/110 V
- **228 V** nominal input AC 190 V
- **480 V** nominal input AC 400 V
- **828 V** nominal input AC 690 V

Selectable measuring range L-L	Equivalent to measuring range L-N
AC 0 V to 132 V	AC 0 V to 76.2 V
AC 0 V to 228 V	AC 0 V to 132 V
AC 0 V to 480 V	AC 0 V to 276 V
AC 0 V to 828 V	AC 0 V to 480 V

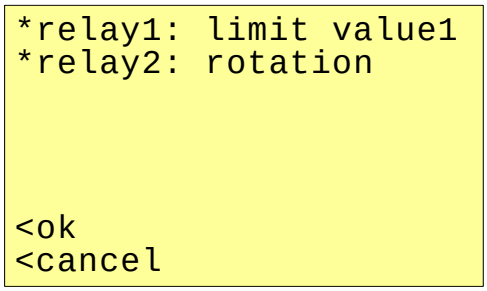
Up to U_{LN} = 480 V, the SICAM P can be connected directly without a transformer. In three- and four-phase networks, **except for three-phase networks without neutral** (see the respective notes), the SICAM P can also be connected directly without a transformer up to U_{LL} = 690 V.

Caution

- You must make these settings for a direct connection or for a connection with current transformers.
- The selected measuring range must be greater than the secondary rating of the voltage transformer!
- The accuracy of SICAM P is based on the selected measuring range.
- The determination of this range indicates the maximum voltage value that can be displayed on the device.
- "The frequency measurement of the SICAM P is initiated only when the measured voltage is > 30 % of the maximum voltage of the measuring range.
- Measurements in three-phase networks without neutral in V-connection (1:1 transformer) are possible **up to** a nominal voltage of U_{LL} = 400 V. With this nominal voltage, the measuring range U_{LL} = 690 V **must** be parameterized.
- For measurements in three-phase networks without neutral in V-connection and a nominal voltage of U_{LL} = 690 V, the voltage must be transformed to $U_{LL} \leq$ 400 V. The measuring range to be parameterized is then also U_{LL} = 690 V.
- In IT networks, the SICAM P cannot be connected directly because the voltage is measured against the PE conductor connection and the input impedance of the device causes a leakage current against earth. The leakage current can cause tripping of the leakage protective system in IT networks. Please make sure that the maximum permissible input voltage of the SICAM P against earth $U_{L\text{-}PE}$ = 480 V is not exceeded (e.g., due to an earth fault of one phase). Voltage transformers **must** be used in IT networks.

4.4.3 Outputs

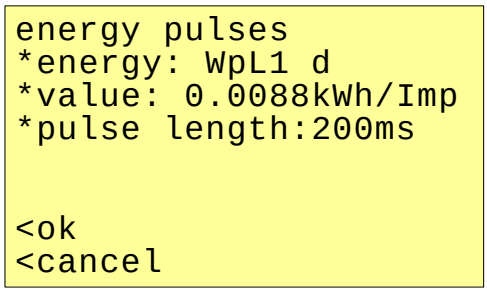
Here, the user can determine the function of the programmable output contacts (potential-free electronic relays). Further contacts can be assigned in devices with I/O modules of the binary output or relay output type (option).



Selection

- Off — Contact has no function
- SICAM P is on — Contact closed if power supply voltage is present.
- Energy pulses — If selected, a new window "Energy Pulses" appears.
- Limit value 1 — If selected, a new window "Limit Value 1" appears.
- Limit value 2 — If selected, a new window "Limit Value 2" appears.
- Limit value 3 — If selected, a new window "Limit Value 3" appears.
- Limit value 4 — If selected, a new window "Limit Value 4" appears.
- Limit value 5 — If selected, a new window "Limit Value 5" appears.
- Limit value 6 — If selected, a new window "Limit Value 6" appears.
- Limit value 7 — If selected, a new window "Limit Value 7" appears.
- Direction of rotation — This option allows you to output the rotation direction of the voltage.
  - 1: Contact activated; direction of rotation for clockwise display (phase sequence L1-L2-L3, clockwise rotation)
  - 0: Contact deactivated; direction of rotation for anti-clockwise display (2 phases interchanged, anti-clockwise rotation)

4.4.3.1 Screen for Energy Pulses



Energy

Selection of an energy or other metered quantity from the table 3-1 (depends on the type of the input connection).

Value

Selection of the amount of energy required to generate a pulse.

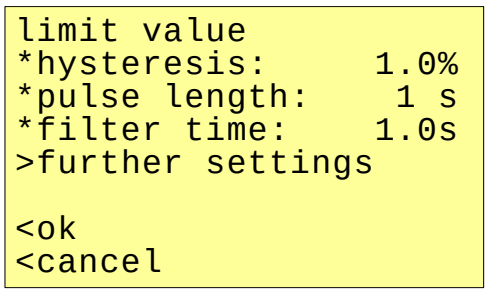
Puls length

Can be selected from 50 ms, 100 ms, 150 ms, 200 ms to 500 ms.

Note

An explanation on power metering can be found in chapter 5.7.2.

4.4.3.2 Screen for Limit Values



The values entered for hysteresis, pulse length and filter time are valid for all logically connected measured quantities.

Hysteresis

- Input of 0.1 % to 10 % of rated value
- Percentage refers to nominal values

Puls length

- 0.5 s, 1 s, 5 s, 10 s, 30 s, 60 s, 300 s
- ∞ (triggering for as long as a limit violation applies)

Filter time

Input of 0.0 s to 9.9 s max. (minimum time during which a limit violation must occur to launch a triggering)

Note

Limit violations are recorded reliably only from a duration of ≥ 1 s.

Limit values

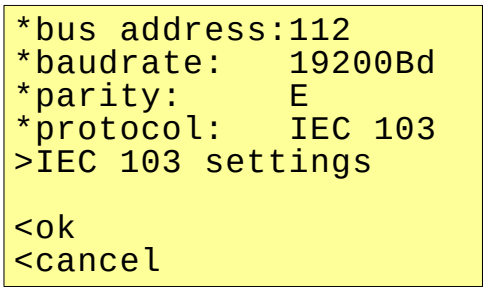
- Selection of any measured quantity from the table 3-1 (no energy or metered quantities)
- Selection as to whether triggering should be launched when the measured quantity exceeds or drops below the threshold value (< >).
- Selection of the threshold value that initiates triggering.
- Additional measured quantities can be connected logically via "AND" or „OR". A maximum of six measured quantities are possible.

Note

You can parameterize limit value groups also in „Additional Settings“ - „Counter“ (level 4, see chapter 4.2)!

4.4.4 Communication Interface

4.4.4.1 General Settings



Bus addres

Input address 1 to 254

Baud rate

- Selection only for connection to a PC or Modbus. The following baud rates are allowed: 300 bit/s, 600 bit/s, 1200 bit/s, 2400 bit/s, 4800 bit/s, 9600 bit/s, 19200 bit/s, 38400 bit/s, 57600 bit/s, 115200 bit/s.
- The baud rate of the Profibus is supported automatically up to 12 Mbit/s with the selection being performed via the master station.

Note

The Baud rate is selected during parameterization (using SICAM P Par or the display). It can be set in the range between 300 bit/s and 115200 bit/s, for the IEC 60870-5-103 protocol, however, only in the range between 9600 bit/s and 38400 bit/s.

Parity

- Only for Modbus (N = None, E = Even, O = Odd)

Protocol

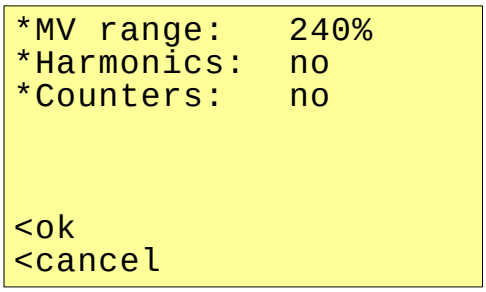
- SICAM P ASCII Protocol: PC RS485 (for connection to a PC via programming software)
- Profibus DP (with firmware version V3 only) or
  IEC 60870-5-103 (with firmware version V4 only)
- Modbus RTU
- Modbus ASCII

Note

At delivery, the following communication parameters are preset:

Address:	1
Protocol:	PC-RS485
Baud rate:	9600 bit/s
Parity:	No

4.4.4.2 IEC 60870-5-103 Settings



Measuring value range (MV range)

Parameterization of the measuring value range.

Settings:

- **120 %**
- **240 %**

Transmit Harmonic

Parameterization of the transmission of harmonic values for the harmonics as per IEC 60870-5-103 protocol.

Settings:

- **yes** Transmit
- **no** No transmit

Transmit counter values

Parameterization of the transmission of metered values (for power and pulse) as per IEC 60870-5-103 protocol.

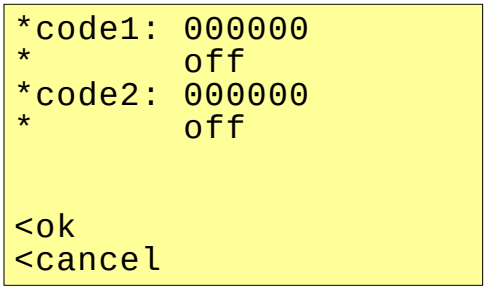
Settings:

- **yes** Transmit
- **no** No transmit

Note

The IEC 60870-5-103 parameters *MV range, Transmission of harmonic* and *Transmission of metered values* are also offered if Modbus has been selected as a protocol. The settings, however, are then ineffective.

4.4.5 Changing the Password



4.4.5.1 Password of Code 1

off: No function

on: Active if code 2 is active

Secured functions:

Parameterization the screens

Reset

Language / Designation

4.4.5.2 Password of Code 2

off: No function (code 1 is also deactivated)

on: Code activated

Secured functions:

Basic settings

Notes

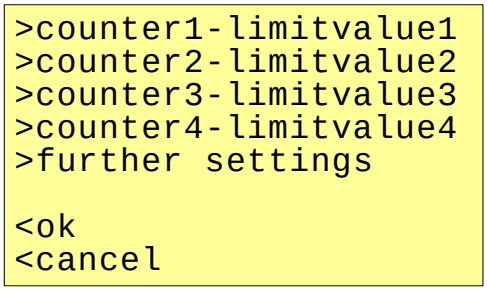
- A password always consists of a 6-digit number.
- If you have forgotten the password, the device can also be activated by using the master password. Please contact our hotline for the master password.
- Password 1 is only active if password 2 is also activated.
- If both password 1 and password 2 are activated, password 2 can be used to access all protected functions of password 1.
- If an identical password is chosen for password 1 and password 2, all functions of password 1 and password 2 can be activated by means of a single password.
- In Level 1, a lock displayed on the status bar indicates whether the status of the device is password protected (lock closed) or unprotected (lock open).
- After a password has been programmed, a time of 1 minute elapses before it is activated in level 1 (the activation can be detected when the lock closes on the status bar).

- If the protected functions are called in the menu, a window for entering the password appears.
- If a protected setting is activated by means of a password, all other settings associated with this password are activated as well. A reactivation is required after a time of 1 minute has elapsed in level 1.

4.4.6 Calibration

See chapter 6 "Calibration".

4.4.7 Additional Settings



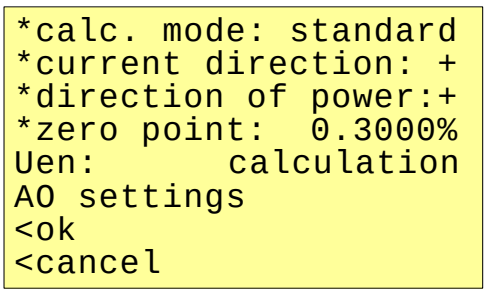
Counter 1 to 4

Counters 1 to 4 can be displayed in the screens. Limit value groups can be assigned to these counters. If a counter is selected, another window is opened for defining the limit value group (see outputs).

Note

Limit value groups can also be parameterized under **Outputs** - **Limit value group** (level 4, see chapter 4.2)!

4.4.8 Further Settings



Calculation mode

- **Standard**
- **DIN**
- **Fourier**

The calculation mode for some measured quantities can be changed here. For further information, see the chapter 3.1.

Current direction

- **+** Default setting for correct connection according to standard and back panel marking
- **-** Current direction is negated (change the current direction to avoid changing the connectors)

Direction of power

- **+** positive energy flow direction = energy demand

  negative energy flow direction = energy supply
- **-** positive energy flow direction = energy supply

  negative energy flow direction = energy demand

Zero point

The zero point suppression can be changed here.

Can be selected from 0.0 % to 10.0 % of the upper limit of the measurement range (default setting: 1 %)

Note

Due to its high precision, SICAM P can measure voltages and currents even without measuring values connected to the device. If you do not want this behaviour in your application, you can suppress measuring below a certain threshold.

Uen

- **Measurement** (default setting)
- **Calculation**

Uen will be calculated if terminal N is grounded (standard application).

Uen has to be measured if L2 or L3 is grounded (special application).

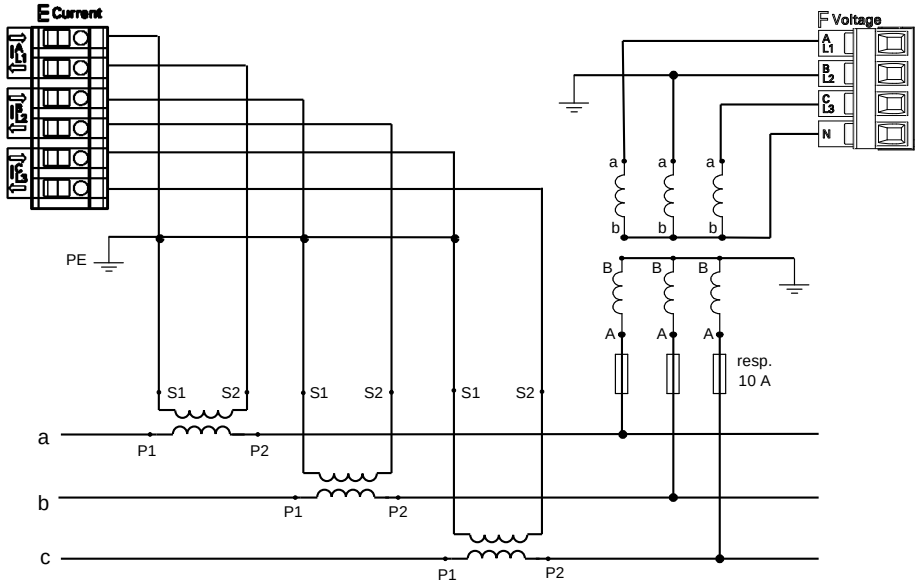


Figure 4-1 Network connection with grounded phase L2

Analog output setting (only visible in screen for devices with optional analog output module)

If the device is equipped with an optional analog output module (see table 1-2, order code D), analog outputs are configured in following screen:

```
Analog output setting
*start value:holding
*range from: -32767
*      to:    32767
*current range:0-20mA

<ok
<cancel
```

These settings allow writing the transduced measured values (range 0 mA to 20 mA) to analog outputs of analog output module via Modbus master or IE 60870-5-103 master.

Start value

- holding

  After power interruption the analog output is set to last in register saved value.

- default

  After power interruption the analog output is set to current value in register.

Range for Modbus protocol

- **from:** min. -32767
- **to:** max. 32767

Calculation:

$$\frac{AO_{fern} - from}{AO_{real} - AO_{min}} = \frac{to - from}{range_{(max - min)}}$$

Example:

from:	0
to:	1000
selected range:	4-20 mA
transmitted AO value:	500

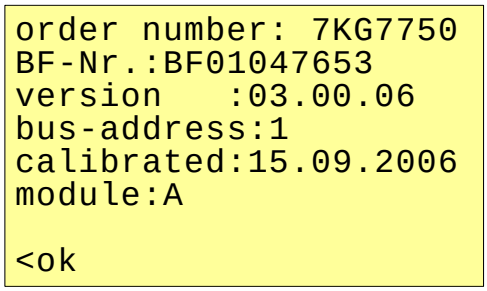
$$\frac{500 - 0}{AO_{real} - 4} = \frac{1000 - 0}{20 - 4} = 12mA$$

Current range

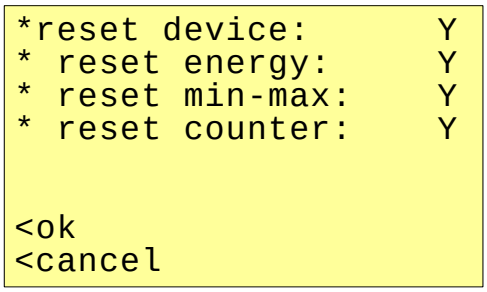
- 0-20 mA
- 4-20 mA

4.5 About SICAM

All of the device characteristics are displayed on this window.

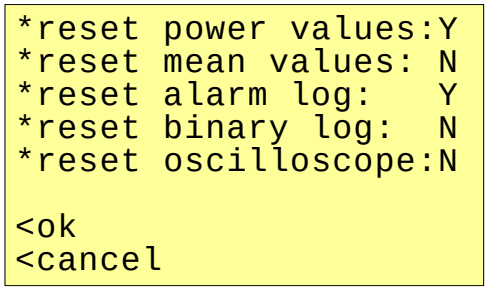


4.6 Reset



- Reset of SICAM P
- Energy values
- Min / Mean / Max values
- Alarm counter (counter for limit violations)

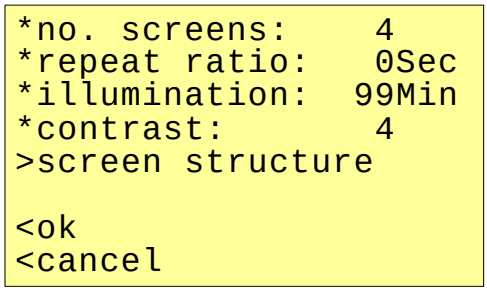
4.7 Reset Memory



The following records are deleted in the memory and restarted in the event of a reset:

- **Power values**
- **Mean values**
- **Alarm log**: states of the limit value groups
- **Binary log**: states of the binary states
- **Oscilloscope**

4.8 Parameterization Screens



The contents and display mode of the various screens are established in this window.

Number of Screens

1 to 20: The number of screens that can be selected in level 2 via the buttons ▼ ▲ .

Screen interval (repeat ratio)

0 s to 60 s

0 s: fixed screens (only selection via buttons possible)

1 s to 60 s: scrolls automatically to the next screen after 1 s to 60 s

Illumination

0 min to 99 min

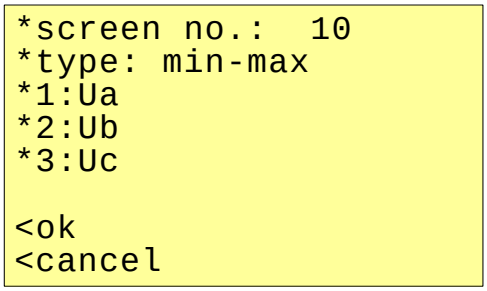
0 min = Illumination off

99 min = Illumination on permanently

Contrast

0 to 9 (default setting: 4)

Screen structure



The contents of specific measuring screens are programmed on the "Screen Structure" window.

Screen

Selection of a specific screen among the number previously established. The contents of the screen are automatically displayed when switching from one screen to the next.

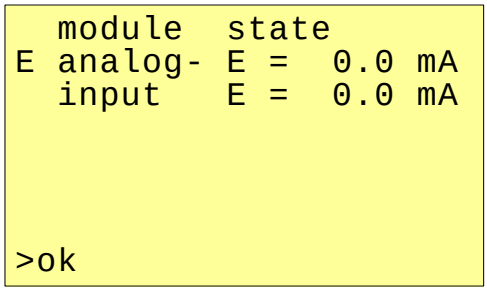
Contents

The contents of the selected screen can be established or modified here as follows:

- 3 measured values digital
- 6 measured values digital
- 3 Min - Max values
- Voltages, currents, cos ϕ, phases L1, L2, L3

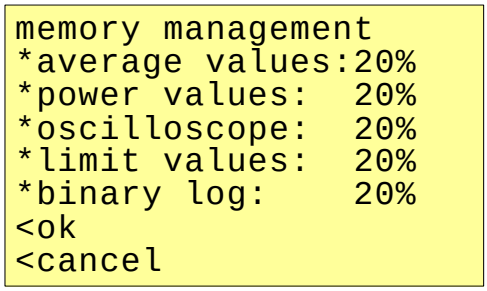
If specific screen content is selected, the input fields for the corresponding characteristics are automatically displayed.

4.9 I/O Modules



This screen displays the optional I/O modules together with their current state. For devices without I/O modules the table remains empty.

4.10 Memory Management



You can partition the main memory of 1 MByte as required for the recording of mean values, outputs, limit violations, binary state changes and oscilloscope records.

The total of the percentages entered must reach but not exceed 100%.

Notes

- For power recording, the recording time will be calculated from the number of channels to be recorded and the period time.
- For mean values and power recording settings, you have to use the PC software SICAM P Parameterization (ordering number see chapter 1.3).

4.11 Data Logger

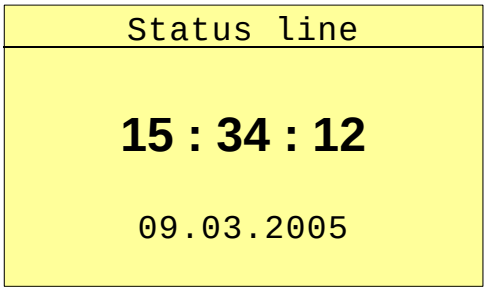
The group **Data logger** displays the following screens:

- Date and time
- Limit value group
- Binary states

To work with the group **Data logger** proceed as follows:

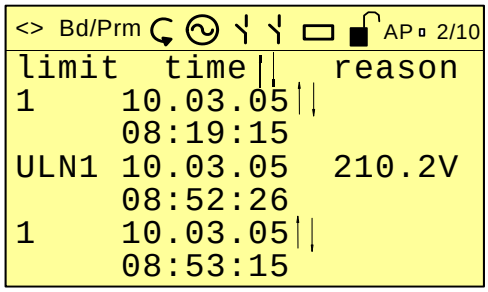
- In the **Main menu**, select **Screens** and press two times ENTER.
- Use the buttons ▼ ▲ to access the group **Data logger**.
- To leave the **Data logger**, go back to the screen **Date and Time** and press ENTER to return to the **Main menu**.

4.11.1 Data Logger Date and Time



This screen shows the current time of the SICAM P (to set the values refer chapter 4.3.5).

4.11.2 Data Logger Limit Violation Group



This screen displays all limit violations ordered by time. You have to read the lines from bottom to top.

Notes

- Press ENTER to activate the arrow buttons up/down to display all messages.
- Press ENTER again to deactivate this mode. This allows you to switch to the other screens via the arrow buttons up/down.
- Go back to the screen **Date and Time** and press ENTER to return to the **Main menu**.

4.11.3 Data Logger Binary States

```
      status line
binary time      state
In A-1 20.01.08  on
       10:20:10
Out1   20.01.08  on
       10:20:10
Out1   20.01.08  off
       10:21:10
```

This screen displays all changes of the binary states ordered by time. You have to read the lines from bottom to top.

Notes

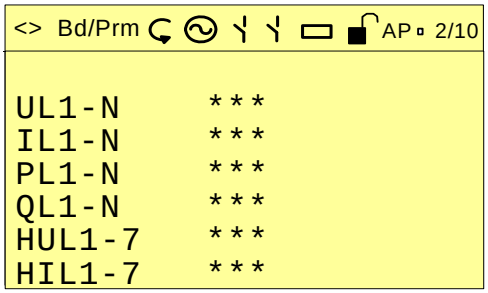
- Press ENTER to activate the arrow buttons up/down to display all messages.
- Press ENTER again to deactivate this mode. This allows you to switch to the other screens via the arrow buttons up/down.
- Go back to the screen **Date and Time** and press ENTER to return to the **Main menu**.

4.12 Overflow of Measured Values

If the measured values determined in a measurement circuit are higher than the possible values of the parameterized measuring range, a value overflow will be displayed. In addition, this value overflow is signaled via Modbus or IEC 60870-5-103 protocol.

The overflow is displayed or transmitted if the nominal AC voltage or AC current values are exceeded by 20 %.

Presentation of the measured value overflow in the display



An overflow of the measured values AC voltage and AC current, as well as the derived quantities such as active power, reactive power, harmonic, power, THD and cos ϕ is displayed by ***. The energy counting is only stopped, not reset.

Transmission of the measured value overflow using the Modbus protocol

A special Modbus register (register address 40200) has been reserved for the transmission of the measured value overflow. For detailed information, please see the *Powermeter SICAM P - Modbus* manual (order no. E50417-B1076-C241).

Transmission of the measured value overflow using the IEC 60870-5-103 protocol

The measured value overflow is transmitted using the IEC 60870-5-103 protocol. For detailed information, see the *Power Meter SICAM P 7KG7750/55 - Communication Protocol IEC 60870-5-103* manual (order no. E50417-B1000-C375).

Parameterization via PC Software

5

Content

The parameterization using a PC is described in the following chapters.

5.1	Basics	82
5.2	Overview of Parameterization	83
5.3	Date / Time Settings and Transmit	84
5.4	Dialog Window SICAM P	85
5.5	Basic Settings	86
5.6	Screens Setting on SICAM P 7KG7750	88
5.7	Input / Output Modules	91
5.8	Additionals	100
5.9	Memory Management	106
5.10	Updating the Firmware	118
5.11	Resetting Values in the Device	120
5.12	Reading the Device Memory	121
5.13	Changing the Communication Parameters	125

5.1 Basics

In order to program your SICAM P via the PC software SICAM P Parameterization you have to prepare for operation or parameterization:

Preconditions

- The device is ready to operate.
- The PC software SICAM P Parameterization (ordering number see chapter 1.3) is installed on your PC.
- The parameterization cable set (ordering number see chapter 1.3) or a RS485 converter is available.

Parameterization

1. Connect the device and the PC as described in the online help.
2. Set the connection parameters on the device:
   - Select the protocol "PC-RS485".
   - Select the baud rate for the connection.
3. Set the connection parameters in the PC software SICAM P Parameterization (**Connection** → **Setup connection**). Make sure to use the same baud rate.
4. Load the settings from the device (**Device** → **Connection configuration** → **Receive**).
5. Edit the settings in the PC software.
6. Send the new settings to the device again (**Device** → **Connection configuration** → **Send**).

Note

SICAM P Parameterization displays the parameters depending on the ordering number of the device.

Reading the ID from the device recognizes the device type and sets the functional scope.

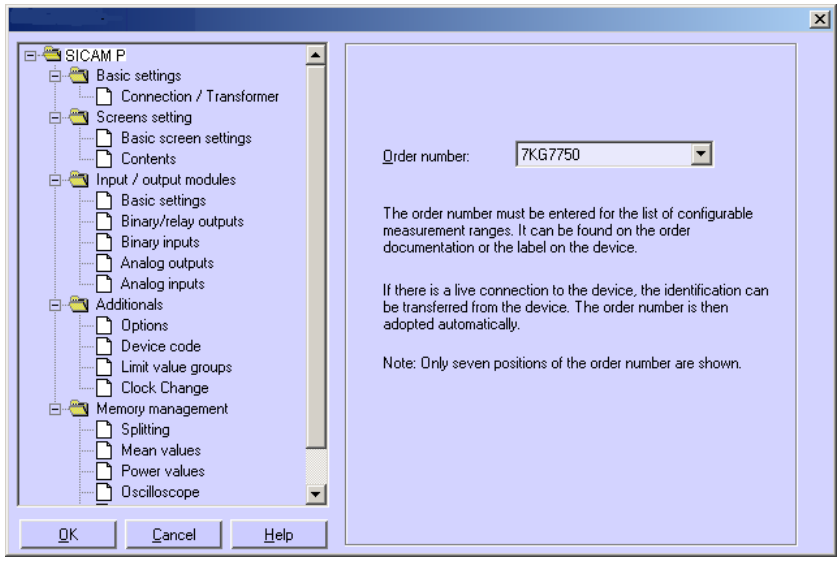
Note

All others functions of SICAM P Parameterization are described in the online help (key F1).

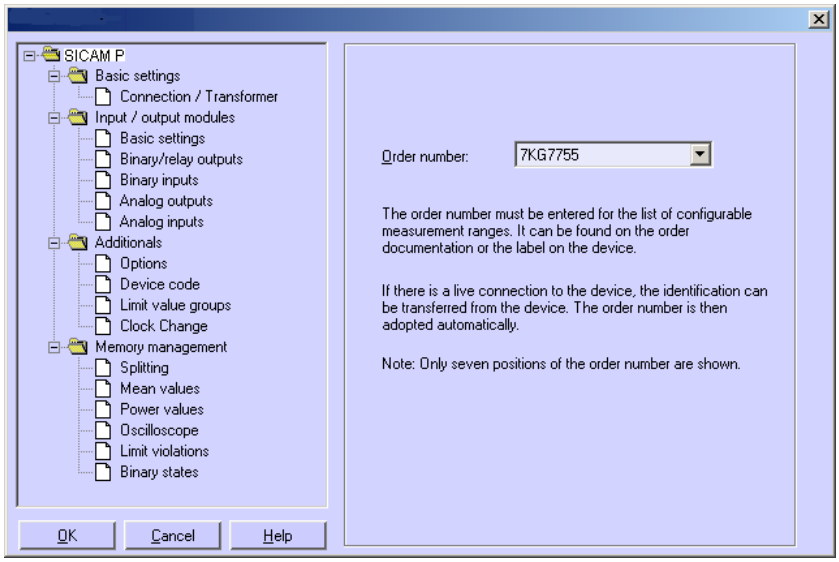
5.2 Overview of Parameterization

The following figures give an overview on all layers of the PC software SICAM P Parameterization depending on the device type.

5.2.1 Overview of Parameterization 7KG7750



5.2.2 Overview of Parameterization 7KG7755



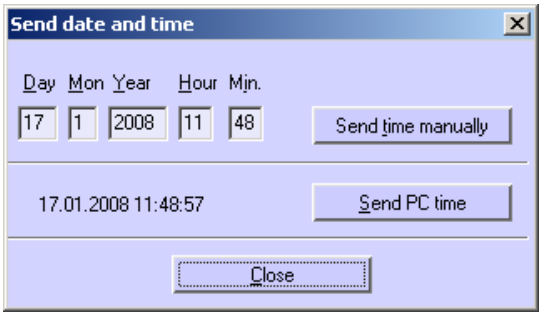
5.3 Date / Time Settings and Transmit

You can set the date and time of the internal clock of the SICAM P using the SICAM P Parameterization PC software. You can either accept the current PC time or define and transmit a freely selectable system time. To do this, proceed as follows:

To set the internal clock and transmit the time to a connected device, you have two options for calling up the *Send date and time* dialog window:

- Select the menu item **Device** → **Setup device clock**, or
- click the clock symbol in the toolbar.

The *Send date and time* dialog window is displayed.



Send PC time

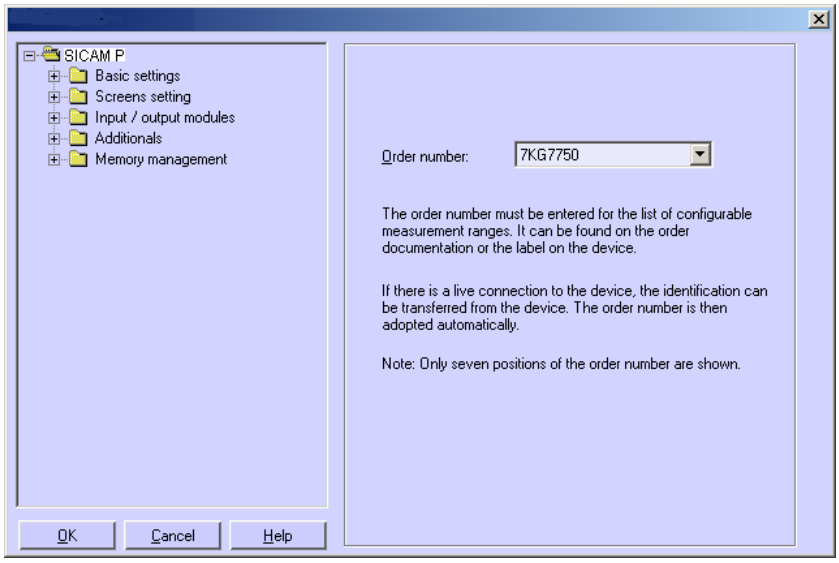
1. Click the **Send PC time** button to send the current PC time.
2. If the PC time has been transmitted correctly and accepted by the connected device, a confirmation will be displayed.
3. Click the **Close** button.

Send manual time setting

1. Change the entries in the fields **Day** to **Min** using your keyboard.
2. Then click **Send time manually**.
3. If the PC time has been transmitted correctly and accepted by the connected device, a confirmation will be displayed.
4. Click the **Close** button.

5.4 Dialog Window SICAM P

In this dialog window, you select the order number of the SICAM P device to be parameterized.

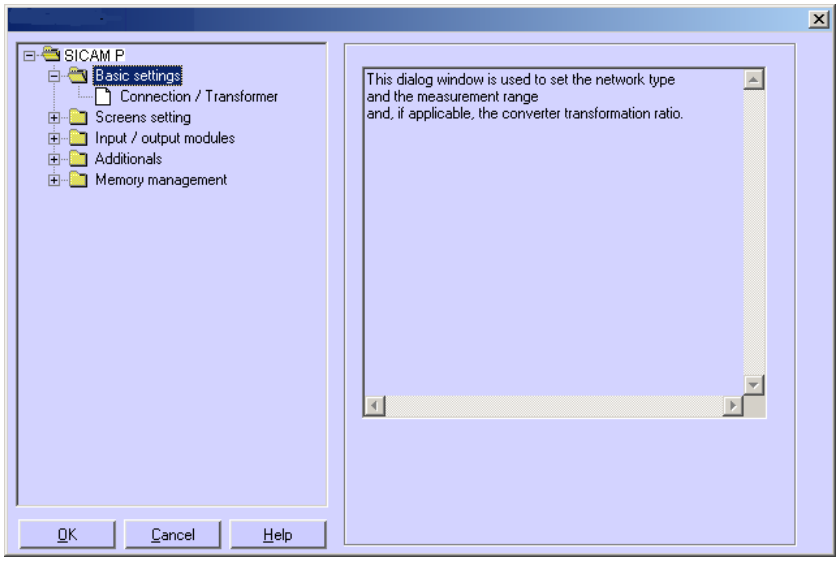


Note

SICAM P Parameterization displays the parameters depending on the order number of the device (see chapter 1.3). Thus, the display above may be different for your device. Reading the ID from the device recognizes the device type and sets the functional scope.

5.5 Basic Settings

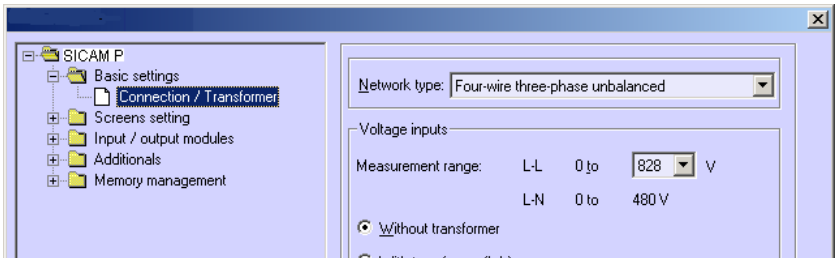
This dialog allows you to set the network type, the measuring range and the transformer ratio (optionally).



5.5.1 Connection / Transformer

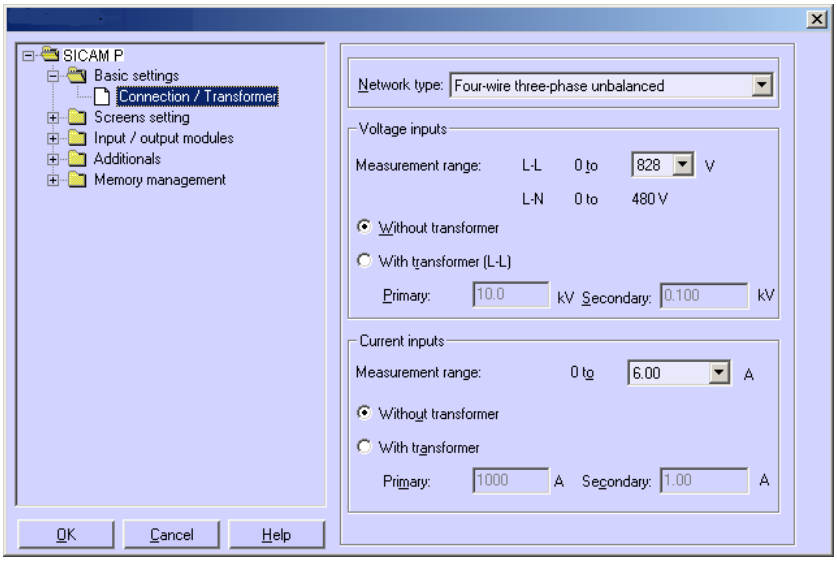
In order to adapt the SICAM P to the network to be measured, enter the network properties and the parameters for the current and voltage measurement inputs.

Network type



Select the relevant network type.

- Single-phase
- Three-wire three-phase balanced
- Three-wire three-phase unbalanced (2 current inputs ' Aron circuit)
- Three-wire three-phase unbalanced (3 current inputs)
- Three-phase four-wire balanced
- Three-phase four-wire, unbalanced



Voltage inputs

Measurement range

Select the maximum voltage measurement range up to which the device should display. For Single-phase or three-wire three-phase networks, both the core and the phase voltage are displayed here. The precision information for the device relates to the range selected here.

Without transformer

SICAM P can be operated without a voltage transformer up to a maximum of AC 690 V phase to phase.

With transformer (L-L)

If a voltage transformer is used, enter the primary and secondary data for the transformer here. The device measurement range is extrapolated internally by the factor of the transformation ratio.

Current inputs

Measurement range

Select the maximum current measurement range up to which the device should display. The precision information for the device relate to the range selected here.

Without transformer

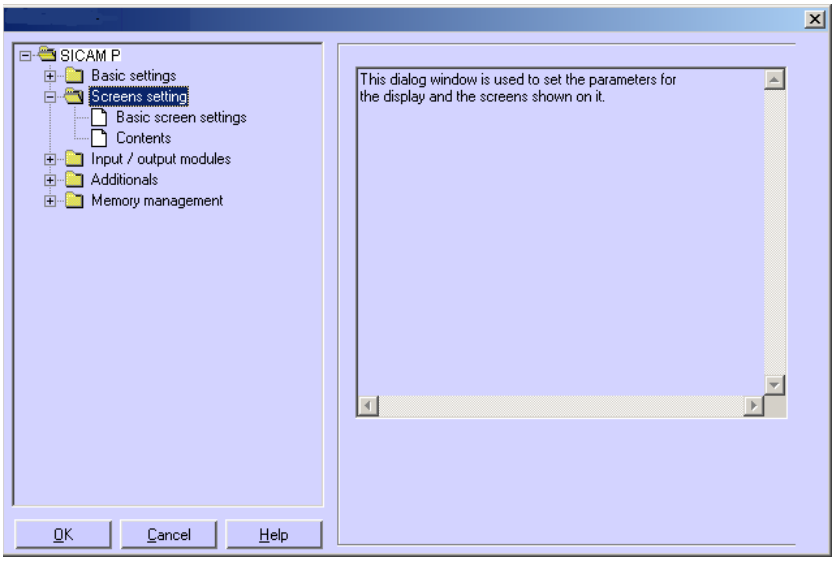
SICAM P can be operated without a current transformer up to a maximum of AC 6 A.

With transformer

If a current transformer is used, enter the **primary** and **secondary** data for the transformer here. The device measurement range is extrapolated internally by the factor of the transformation ratio.

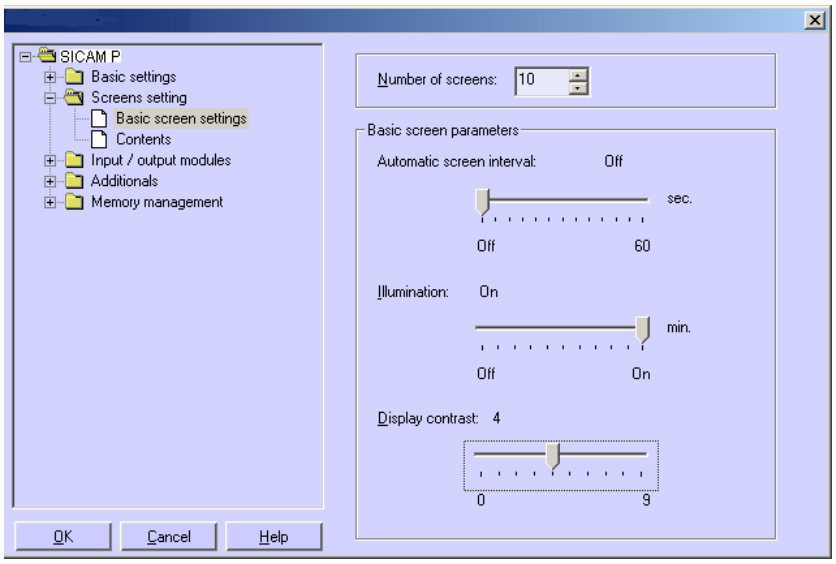
5.6 Screens Setting on SICAM P 7KG7750

The screens displayed in the SICAM P 7KG7750 (not possible with SICAM P 7KG7755 because no display) and their contents are defined in the following dialog windows.



5.6.1 Basic Screen Settings

Here you define fundamental properties of the display on the SICAM P 7KG7750.



Number of screens

Select the number of screens, which can be selected using the buttons on the front of SICAM P. You can enter between 1 and 20 screens.

Automatic screen interval

In SICAM P, you can switch between screens either manually using the buttons or automatically.

- 0 s (= **Off**): manual switching using keys
- 1 s to **60** s: automatic switching after the period set; the device then switches automatically from screen to screen on a loop.

Display illumination

You can enter the time the backlighting remains on in minutes here.

- 0 min (= **Off**): no backlighting
- 1 min to 98 min: after a button is pressed on the device, the back lighting remains on for the time set.
- 99 min (= **On**): permanent backlighting

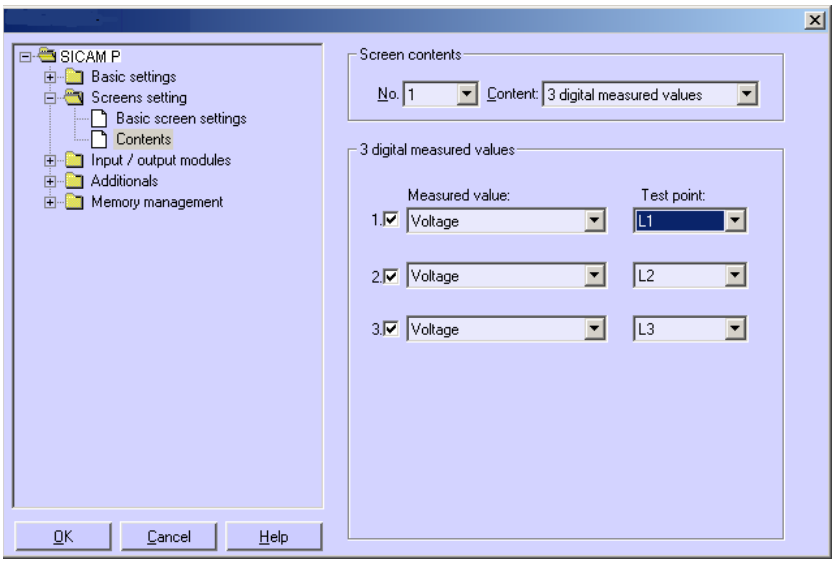
Display contrast

Here, you can adjust the contrast of the SICAM P display. The default value is 4.

- Input options: 0 to 9

5.6.2 Contents

Here you define the contents displayed in the individual screens.



To do this, select in field **Screen contents** the screen **No.** of the screen you wish to configure and assign it a screen type in the **Content** field. Screen types are predefined display formats for your measured values on the SICAM P display.

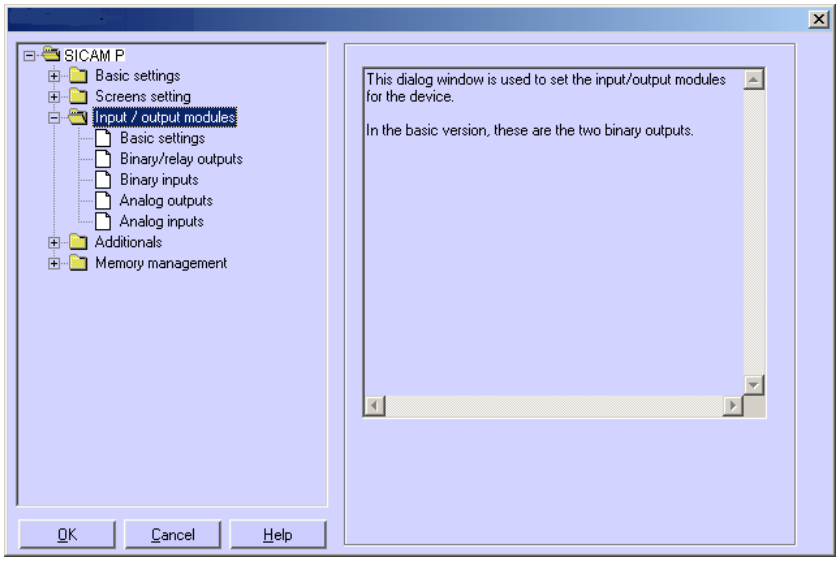
You can choose between the screen types:

- **3 Measured values digital**
- **6 Measured values digital**
- **Min-Max values**
- **U, I, cos** ϕ

For each screen type, further selection options are displayed.

- If you select **3 digital measured values**, **6 digital measured values** or **Min - Max - values**, the options are the measured values to be displayed and the measurement point.
- If you select **U, I, cos phi** no further settings are require in the basic version.

5.7 Input / Output Modules

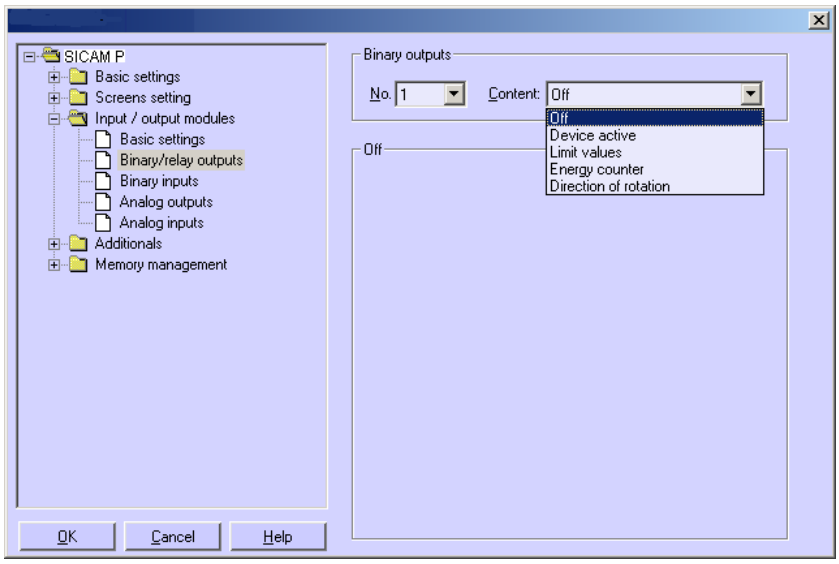


Two binary outputs are available in the device versions without I/O modules. As an option, the device has been equipped with an I/O module that is parameterized in the following dialog windows:

- *Basic settings* (see chapter 5.7.3)
- *Binary / relay outputs* (see chapter 5.7.1)
- *Binary inputs* (see chapter 5.7.6)
- *Analog outputs* (see chapter 5.7.4)
- *Analog inputs* (see chapter 5.7.5)

5.7.1 Binary / Relay Outputs

The SICAM P has two binary outputs. The devices are optionally equipped with a module with 3 additional relay outputs or a module with two binary outputs each.



In order to define the function of the two binary/relay outputs, select the binary output to be parameterized in field **Binary outputs** → **No.** In the **Contents** field, you can assign this binary output a function. You can select from the following options:

- **Off:** binary output with no function
- **Device active**: The SICAM P active function allows you to monitor whether the device is switched on (contact closed). If there is no contact, the device is switched off or broken.
- **Limit values**: Here, you can output the limit value group signals via the binary outputs. The pulse length indicates how long the binary contact is closed by means of a signal from a limit value group.
- **Energy counter**: If you assign this function to a binary output, the consumption or supply of the selected work is output as a pulse. Select a measured value and the related measurement point. Set a limit value (energy increase per pulse) for which a pulse should be triggered. The parameterizable range (minimum and maximum value) can be found by entering the max. consumer power in the field **Help**. The pulse duration can be selected in increments of 50 ms between 50 ms and 500 ms in the **Pulse** field .

  You will find a description of the energy pulse measurement in chapter 5.7.2.
- **Direction of rotation**: output the rotation direction of the voltage
  - 1: Contact activated: Direction of rotation for clockwise display (phase sequence A-B-C, clockwise rotation)
  - 0: Contact deactivated: Direction of rotation for anti-clockwise display (2 phases interchanged, anti-clockwise rotation)

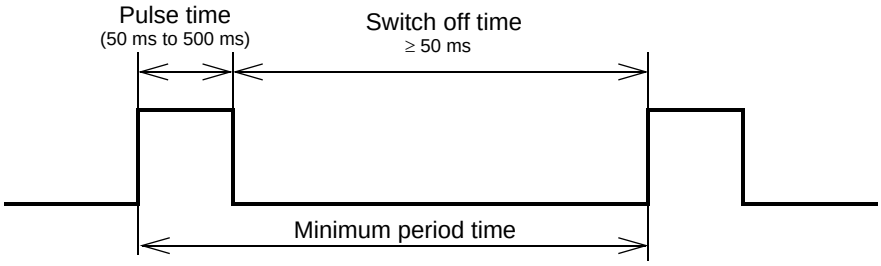
5.7.2 Information on Energy Pulse Measurement

The binary outputs of the SICAM P may be used to generate impulses for energy measurement: You can parameterize a specific amount of energy. When this threshold is reached, a defined pulse will be applied to the output. For energy pulse measurement, you have to adjust several settings at the device and in the parameterization software.

5.7.2.1 Parameterization via Device

Refer to chapter 4.4.3.

5.7.2.2 Pulse Time, Switch Off Time, Number of Pulses



- Pulse time (**Pulse**): Defines the "high" time of the signal at the binary output; possible values: 50 ms to 500 ms.
- Switch off time: Time during which the signal at the output of the binary contact is "low". The switch off time depends on the power measured.
- Minimum switch off time: The minimum switch off time must not be smaller than 50 ms to reach a defined switch off time.
- Number of pulses: The minimum pulse length and the minimum switch off time define the following maximum number of impulses per hour:

Pulse time (ms)	Minimum switch off time (ms)	Minimum period time (ms)	Max. number of pulses / h
50	≥ 50	100	36000
100	≥ 50	150	24000
150	≥ 50	200	18000
200	≥ 50	250	14400
250	≥ 50	300	12000
300	≥ 50	350	10286
350	≥ 50	400	9000
400	≥ 50	450	8000
450	≥ 50	500	7200
500	≥ 50	550	6545

5.7.2.3 Parameterization of Energy Pulses

If you want to use the binary outputs for energy measurement, you have to calculate the smallest possible input (kWh/pulse) first. Please use the following description:

1. Select the pulse length (e.g. 200 ms). Refer to the table in chapter 5.7.2.2 for the maximum number of pulses/h: 14400
2. Calculation of the maximum load to be connected:

   Single-phase circuit: Maximum load to be connected =

   (Voltage measuring range Ph-N x Transformation ratio of the voltage transformer) x (Current measuring range x Transformation ratio of the current transformer)

   e.g.: $U_{Ph\text{-}N,\ max}$ = 276 V, T_U = 1; I_{max} = 1.2 A, T_I = 1

   $P_{max} = U_{Ph\text{-}N,\ max} \times I_{max}$ = 331.2 W

   Three-phase or four-phase circuit: Maximum load to be connected = (Voltage measuring range Ph-N x Transformation ratio of the voltage transformer) x (Current measuring range x Transformation ratio of the current transformer) x 3

   e.g.: $U_{Ph\text{-}N,\ max}$ = 276 V, T_U = 1; I_{max} = 1.2 A, T_I = 1

   $P_{max} = (U_{Ph\text{-}N,\ max} \times I_{max}) \times 3$ = 993.6 W
3. Calculation of the minimum energy increase per pulse

   Depending on the pulse length and the maximum number of pulses/h the following calculation applies:

   Singl-phase circuit:

   $P_{max/W}$ / 14400 puls/h = 331.2 W / 14400 puls/h =

   0.023 Wh/puls = 0.000023 kWh/puls

   Three-phase or four-phase circuit:

   $P_{max/W}$ / 14400 puls/h = 993.6 W / 14400 puls/h =

   0.069 Wh/puls = 0.000069 kWh/puls

   For the example, the smallest energy increase is as follows:

   Singl-phase circuit: 0.000023 kWh/puls

   Three-phase or four-phase circuit: 0.000069 kWh/puls

   If you use a setting higher than these values the increase of energy will be registered correctly.

Note

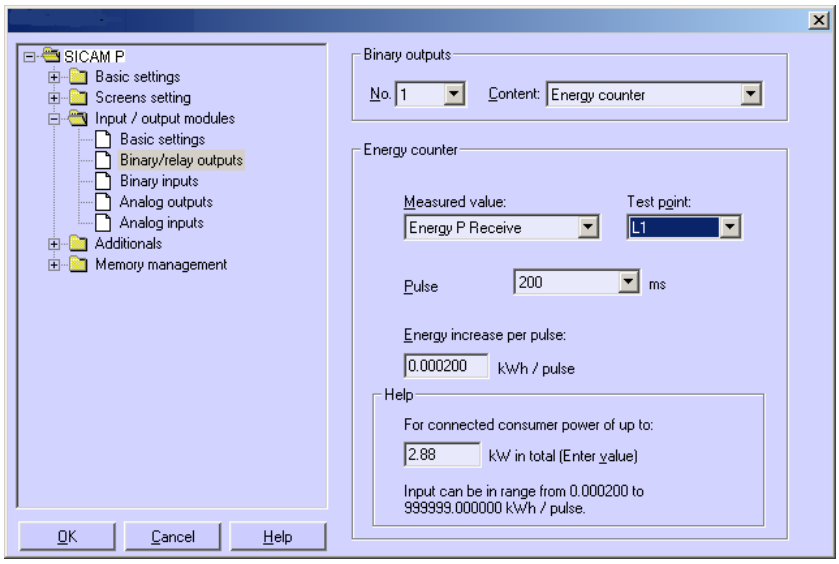
The smallest possible input values only apply if the connected load is close to the threshold of the measuring range of the device. If the connected load is smaller, the calculated values may also be smaller.

Note

A transformation ratio >1 has to be used in the calculation described above and in the parameterization of the device.

5.7.2.4 Parameterization of Energy Pulses via Parameterization Software

To parameterize energy impulses via parameterization software (refer also to chapter 5.7.1), proceed as follows:



1. Select the **Measured value** to be counted.
2. 2.Select the **Test point** for the energy measurement.
3. Select the **Pulse** length for the signal.

Note

Smallest pulse length = 50 ms.

4. Calculate the smallest energy increase per pulse. Use the description in chapter 5.7.2.3 to calculate the minimum value.

   You can use the **Help** field in the dialog window for the calculation. For this purpose, enter the connected consumer power in the **kW in total** field. Then switch over to another field of this dialog window to update the display. The smallest possible power increase per pulse for the connected consumer power you have entered is displayed in the **Help** field under **Input can be in range**.

Note

When you open the dialog for the first time, default values will be displayed. These values are derived from the connection type (single-phase, three-phase or four-phase circuit), the voltage and current range and the transformer ratios

The default values are only valid when you open the dialog for the first time!

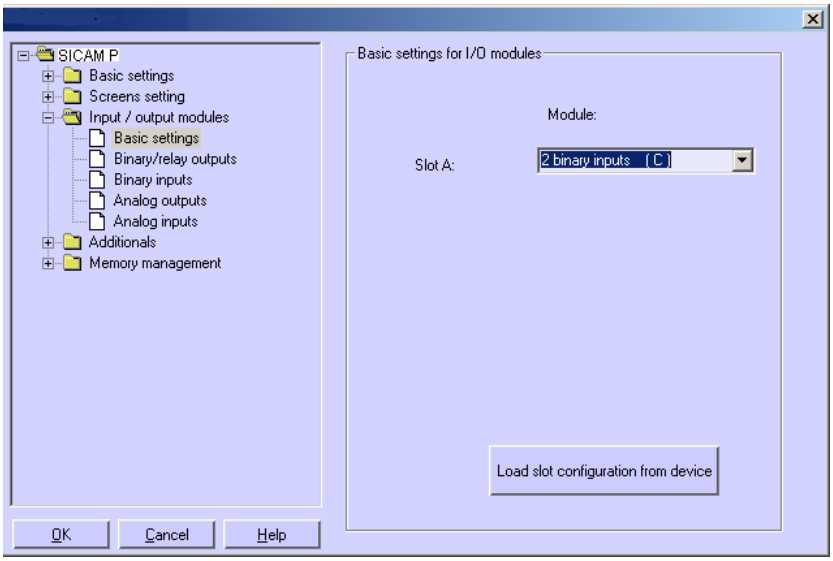
5. For the value entered in the field **Energy increase per pulse**, a pulse will be applied to the selected output each time when the given value will be reached

Note

To ensure proper energy registration, this value must not be lower than the value calculated in step 4.

5.7.3 Basic Settings

This dialog allows you to specify the I/O module (optionally) of your SICAM P.



There are two possibilities:

SICAM P is connected with PC (online)

1. Click the button **Load slot configuration** from device. The information will be loaded from the device and displayed on the screen.
2. Parameterize the I/O modules.
3. Send the new configuration to the device.

Note

This procedure ensures that the I/O modules displayed on the screen correspond to those in the device.

A parameter set is prepared for a later transmission to a SICAM P (offline).

1. Define slot A for the corresponding I/O module.

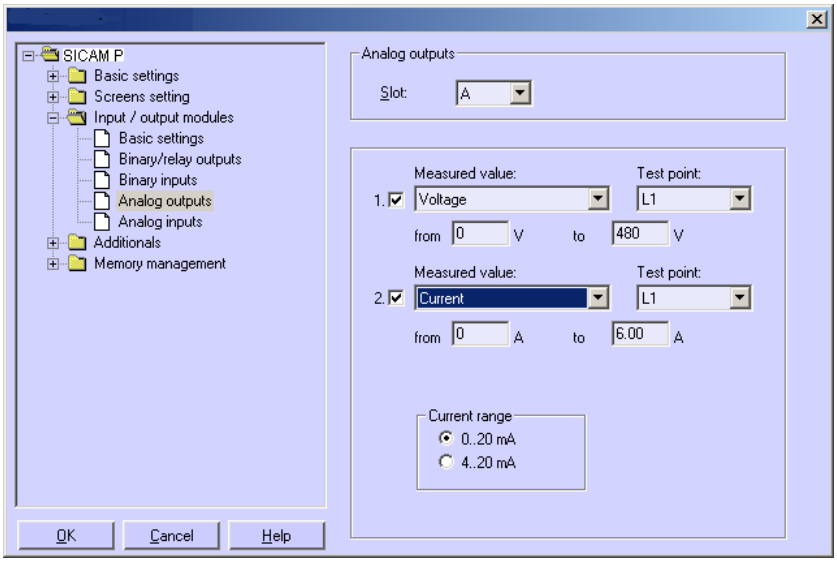
Note

These settings must correspond to the I/O modules in the device (refer to the ordering number, see chapter 1.3)!

2. Parameterize the I/O modules.
3. Send the new configuration to the device, as soon as the connection to the device has been established.

5.7.4 Analog Outputs (optional)

The analog outputs (optional) allow you to output internal measurement values as analog values in the range of 0 mA to 20 mA. This feature represents a measuring transducer.



Proceed as follows:

1. Please select **Slot A** to configure analog outputs.
2. Activate/Deactivate one or both analog outputs by ticking the corresponding check box under **1.** and/or **2.**
3. For each analog output used, choose the **Measured value** together with the **Test point** and set the signal range in the fields **from** and **to**.
4. Select the current range of the I/O module: **0..20 mA** or **4..20 mA**.

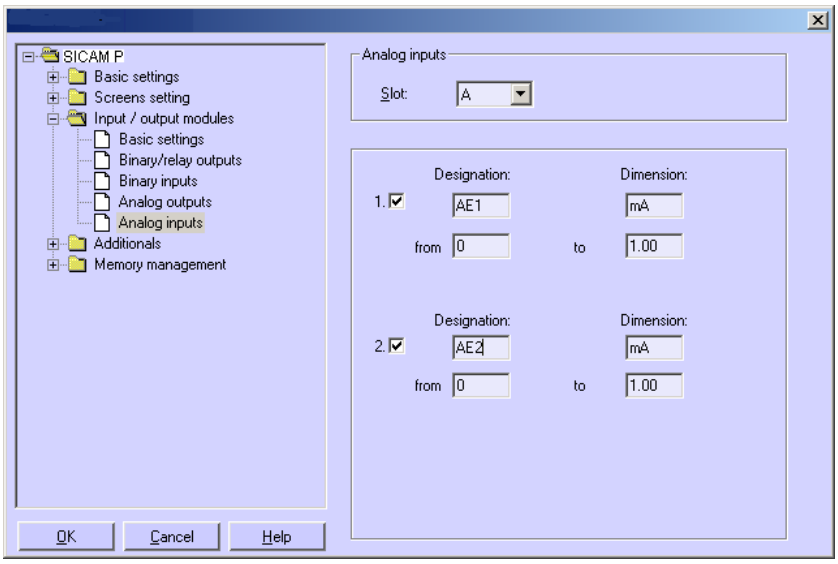
Note

The output of analog values can be controlled via Modbus, IEC 60870-5-103 or Profibus protocol. Select the output mode first in screen **further setting** (see chapter 4.4.8) in **AO settings** and choose **holding** or **default** mode in screen **Analog output settings**.

Deactivate the channel which will be controlled by communication protocol in dialog **Analog outputs**.

5.7.5 Analog Inputs (optional)

The analog inputs (optional) allow you to measure analog signals in the range of 0 mA to 20 mA.



Proceed as follows:

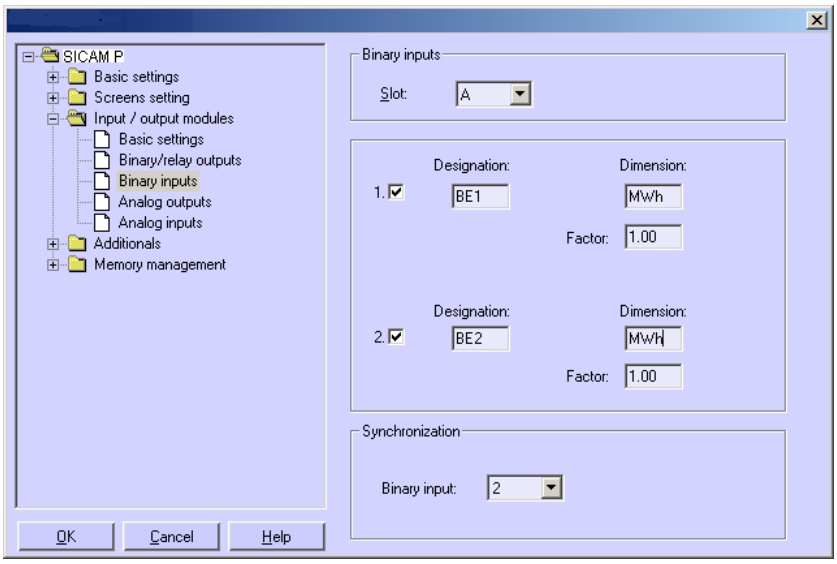
1. Activate/Deactivate one or both analog inputs by ticking the corresponding check box under **1.** and/or **2.**
2. For each input used, set the **Designation** together with the **Dimension** (max. 6 characters).
3. You define the range of values of the signal in the fields **from** and **to**.
4. The device display will be parameterized via screen contents, the supervision of limit values concerning the analog inputs via limit value groups.

Note

It is possible to save the values (together with the time information) recorded via analog inputs to the memory for mean values (see chapter 5.9.2).

5.7.6 Binary Inputs (optional)

The binary inputs (optional) can be used for static messages and impulse inputs.



Proceed as follows:

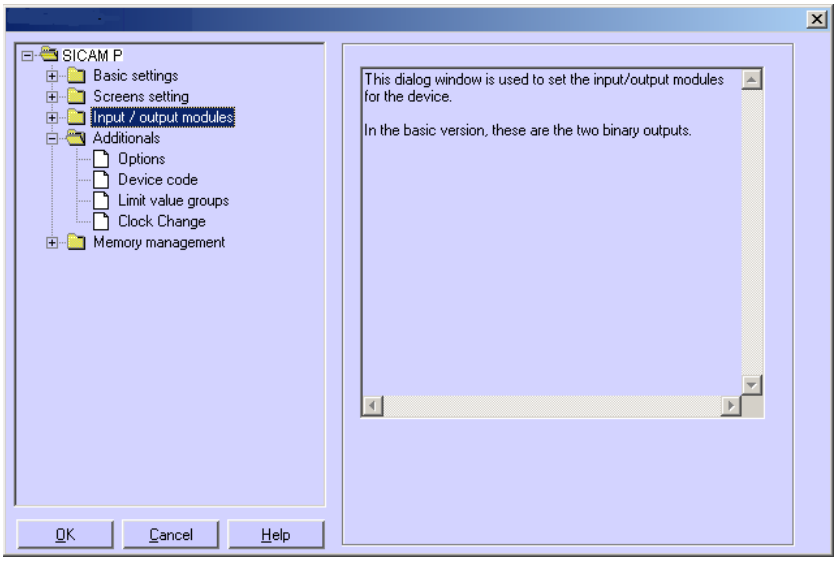
1. Activate/Deactivate one or both binary inputs by ticking the corresponding check box under **1.** and/or **2.**
2. For each input used, set the **Designation** together with the **Dimension**.
3. If you want to use the input as an external counter, you have to define the **Factor** e.g. as Energy increase per pulse (refer to chapter 5.7.2).
4. If you want to use the binary input to display binary information (0/1), 0 must be entered as a **factor**.
5. Choose the binary input to be used for time **Synchronization** via minute impulses. The device will display the designation, not the number of the **Binary input**.

Note

The designation of the binary input is displayed instead of the binary input number!

6. Analog to measured values, binary inputs may be displayed on measurement screens (see chapter 5.6.2).

5.8 Additionals



All other settings in SICAM P are made in the following windows.

Options

- **Regional settings**, such as device language and measured value descriptor
- Type of **power calculation**
- **Direction of current**
- **Power direction**
- **Counter assignment** of digital counter in screens
- **Zero point suppression**

Device code

Setting device codes to secure the device settings against unauthorized changes.

Limit value groups

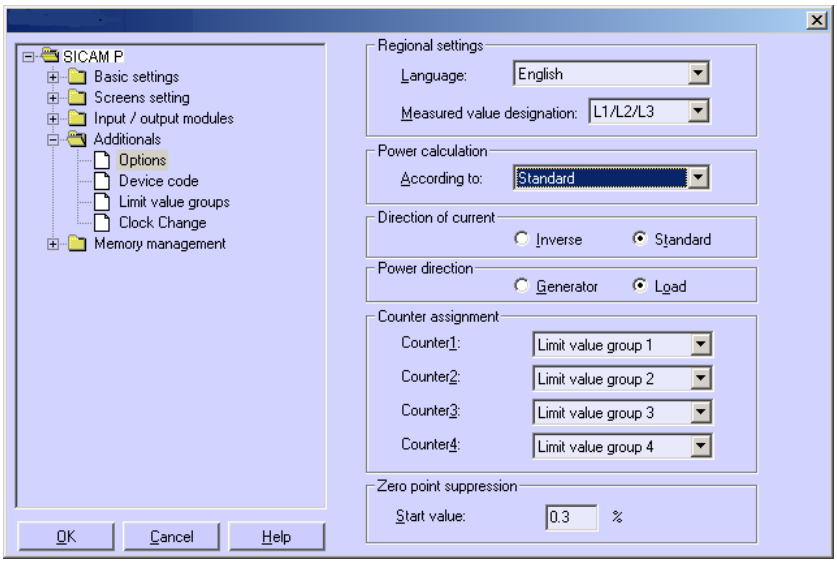
The 7 limit value groups for the device can be set here.

Clock Change

Here you can set the data for daylight saving time switchover.

5.8.1 Options

You can set more parameters for the SICAM P under Options.



Regional settings

- **Language**: Here, you can select what language the device display is in when you parameterize it using the device buttons.
- **Measured value designation:** The description of the conductor on device L1/L3/L3 or A/B/C can be selected here.

Power calculation

Here, you can select the type of power calculation and the calculation for current and voltage. The basic setting is standard. Settings options:

- **Standard:** All measured values are true RMS, taking all harmonics into consideration. Calculation of reactive power using methods used by traditional measuring devices. (electrodynamics power measurement)
- **DIN**: All measured values are true RMS, taking all harmonics into consideration. Customized from standard: reactive power calculation, apparent power calculation, cos ϕ and power factor, taking into consideration the new definition of apparent power in: DIN 40110-2.
- **Fourier**: All measured values calculated from the fundamental wave. Harmonics are not considered.

Direction of current

- **Standard:** Default setting for correct connection according to standard and back panel marking
- **Inverse**: Current direction is negated (change the current direction to avoid changing the connectors).

Power direction

This parameter allows you to set the operating mode of the SICAM P:

- **Load** (industry mode, standard)

  this means: Power positive = Energy demand

  Power negative = Energy supply

- **Generator** (Power generation mode)

  this means: Power negative = Energy demand

  Power positive = Energy supply

Counter assignment

Internal **counters 1 to 4** can be displayed in the digital measured value screens of the SICAM P. You can assign the four internal counters to the max. 6 **limit values groups** here.

Zero point suppression

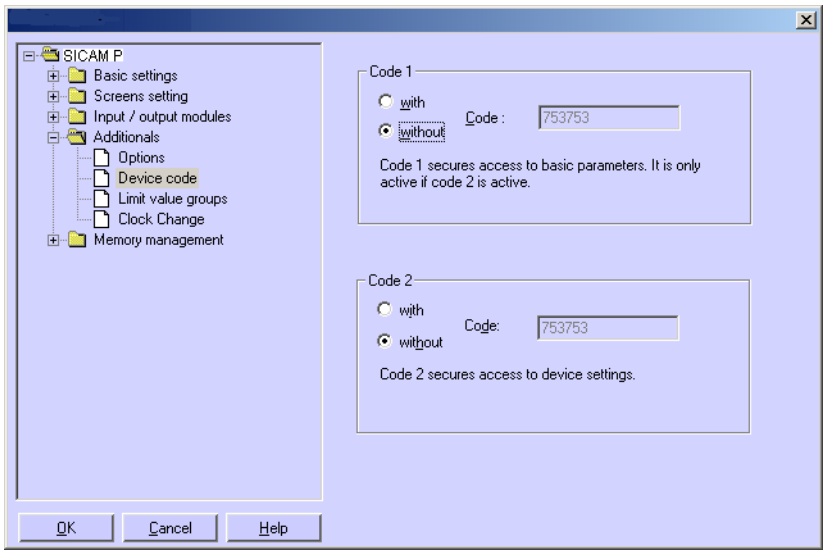
The zero suppression enables the definition of the **measuring range start** in % of the measuring range end. Can be selected from 0.0 % to 10.0 % of the upper limit of the measurement range (default setting: 1.000 %).

Note

Due to its high precision, SICAM P can measure voltages and currents even without measuring values connected to the device. If you do not want this behaviour in your application, you can suppress measuring below a certain threshold.

5.8.2 Device Code

Setting the device code secures the SICAM P against unauthorized changes.



When the code is activated, you are prompted to enter the password when you call up the

parameterization menu from the buttons on the device. The relevant menu is only enabled if you enter the correct password.

Note

The software does not require a password.

Code 1

- **without**: no security
- **with**: device code 1 is only active if code 2 is activated as well.

  Functions secured: screen parameterization, reset energy min / max values and changing device language.

Code 2

- **without**: no security (code 1 also deactivated)
- **with**: code is activated

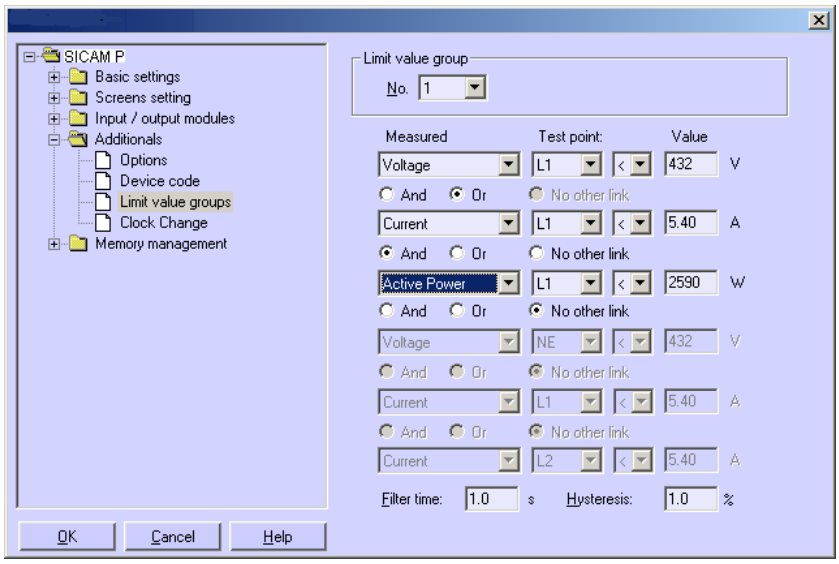
  Saved functions: basic parameters (connection / transformers, outputs, interface, change code, adjustment, other settings)

Notes:

- A password always consists of a 6-digit number.
- If you forget your password, you can activate the machine either using a master password (available from the hotline, see Foreword) or using the SICAM P parameterization software.
- Device code 1 is only active if code 2 is activated as well.
- If code 1 and 2 are activated, the code 2 password can also be used to unlock all the functions secured using code 1.
- If the secured parameter settings are called up in SICAM P, a window appears asking you to enter a password.
- If a secured parameter is unlocked by entering a password on the device, a new password prompt appears after a wait of 1 minute in level 1.

5.8.3 Limit Value Groups

In SICAM P, you can parameterize up to 7 limit value groups. For limit value group 7, only voltages are allowed.



Every **limit value group** provides the option to monitor whether the **measurements** exceed (**>**) or fall short of (**<**) a measured value that is entered. In each of the seven limit value groups, up to six measured quantities (no power quantities) can be **ANDed** or **ORed**.

The limit value groups set can be allocated either to binary outputs or to the internal counters. The oscilloscope can be triggered using a limit value group 1 to 6.

- Filter time: Time for which a threshold breach must remain in order to trigger an alarm. Input from 0.0 s to 9.9 s.

Note

To make sure that limit violations will be registered, enter a filter time ≥ 1 s.

- Hysteresis: Entry from 0.1 % to max. 10 %. The value relates to the nominal values for the individual measured values.

Note

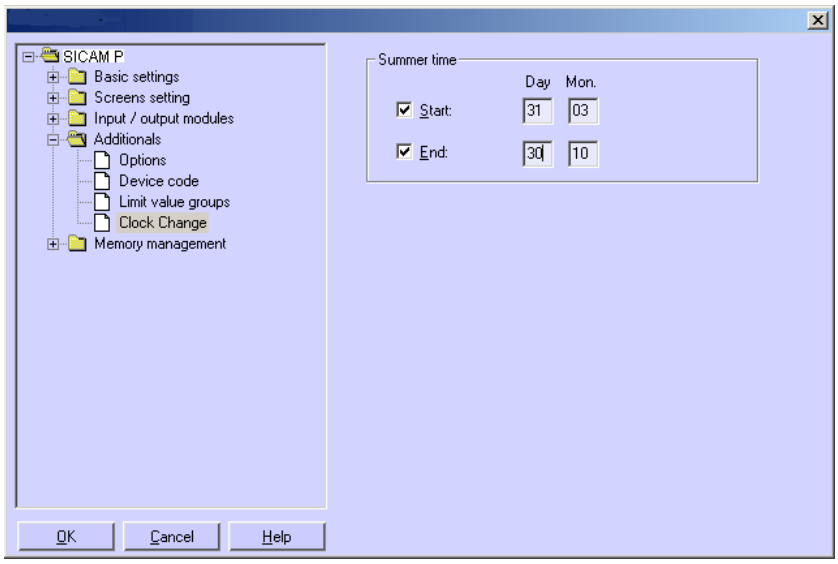
If the device provides additional analog inputs (optional), you can use external measurement signals for limit-value monitoring.

Note

Limit value group 7 allows you to monitor the measured voltages in real time and logs the measured value that caused a limit violation.

5.8.4 Clock Change

Select the date (day/month) when daylight saving time will start and end.

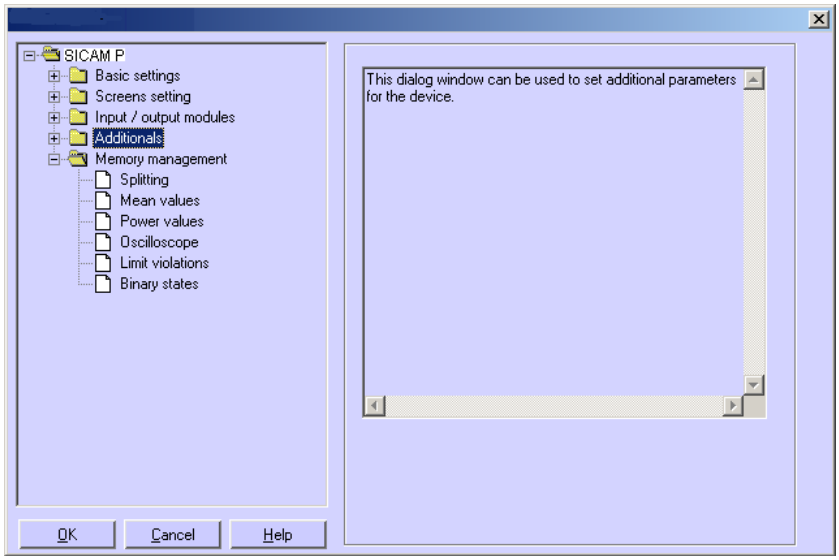


You do not have to indicate the hour since SICAM P considers the fact that the time change (**Day** / **Mon**.) will always take place at 2 a.m.

If you have not entered a date for start and end of the daylight saving time, the corresponding field remains grayed and SICAM P assumes that no time change will take place in the device. The time change will only be carried out if the corresponding date field is activated.

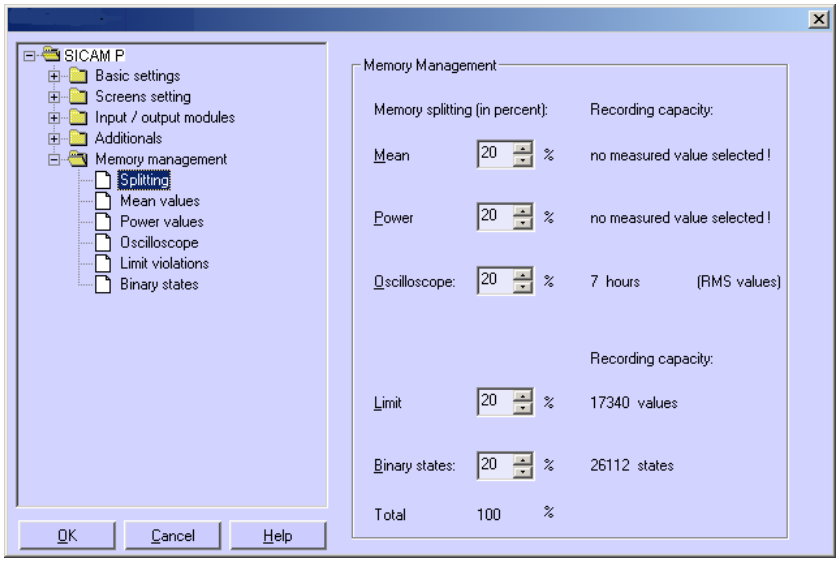
5.9 Memory Management

In the following dialog windows, you can customize the memory of SICAM P according to your requirements.



5.9.1 Splitting

In this dialog window you can determine how the available memory capacity will be allocated to the available functions.



Note

The indicated percentages must be in the range between 1 and 96 percent and total 100 %. Once you have entered a percent value, SICAM PAR displays to its right the recording time and the number of values that will be stored for this setting. The oldest values will be overwritten if you have selected Ring buffer = Yes for the recording or if overwriting is enabled by default. If you have selected Ring buffer = No, the recording will be terminated when the capacity of the associated memory area is exhausted. See the next chapters for details.

Note

The device has a memory capacity of 1 MByte (= 1048576 Bytes). The default setting ex works is 20 % of the total memory capacity for each of the five memory areas. With this memory partition, the theoretical memory capacity is 200 KBytes (exactly: 209715 Bytes) per memory area.

The recording capacities will be calculated according to the following formulas:

Note

For technical reasons (e.g., capacity for header data), the recording capacity for the individual measured values displayed in the dialog window is slightly smaller than the capacity in the examples.

Mean values

$$t_{MAX}[h] = \frac{AllocatedMemory[Byte] * Periodtime}{((n*12)+4)Byte*3600}$$

n: Number of channels (max. 8)

Period time: 5 s, 10 s, 15 s, 30 s, 60 s, 600 s, 900 s, 1800 s or 3600 s

Calculation example with 20 % memory size, n = 8 channels and period time = 10 s

$$t_{MAX}\,(h) = \frac{209715\ Byte * 10}{((8 * 12) + 4)\ Byte * 3600} = 5.8\ h$$

Power values

$$t_{MAX}[d] = \frac{AllocatedM\ emory[Byte] * Periodtime}{((n*4)+6)Byte*1440}$$

n: Number of channels (max. 8)

Period time: 15 min, 30 min or 60 min

Calculation example with 20 % memory size, n = 8 channels and period time = 15 min

$$t_{MAX}\,(d) = \frac{209715\ Byte * 15}{((8 * 4) + 6)\ Byte * 1440} = 60\ d$$

Oscilloscope: Instantaneous values

$$t_{MAX}[s] = \frac{AllocatedMemory[Byte]}{64*16Byte*50}$$

Calculation example with 20 % memory size

$$t_{MAX}\,(s) = \frac{209715\ Byte}{64 * 16\ Byte * 50} = 4{,}1\ s$$

Oscilloscop: RMS values

$$t_{MAX}[h] = \frac{AllocatedMemory[Byte]}{8Byte*3600}$$

Calculation example with 20 % memory size

$$t_{MAX}\,(h) = \frac{209715\ Byte}{8\ Byte * 3600} = 7\ h$$

Limit violations

$$Values = \frac{AllocatedMemory[Byte]}{12Byte}$$

Calculation example with 20 % memory size

$$Values = \frac{209715\ Byte}{12\ Byte} = 17476$$

Binary states

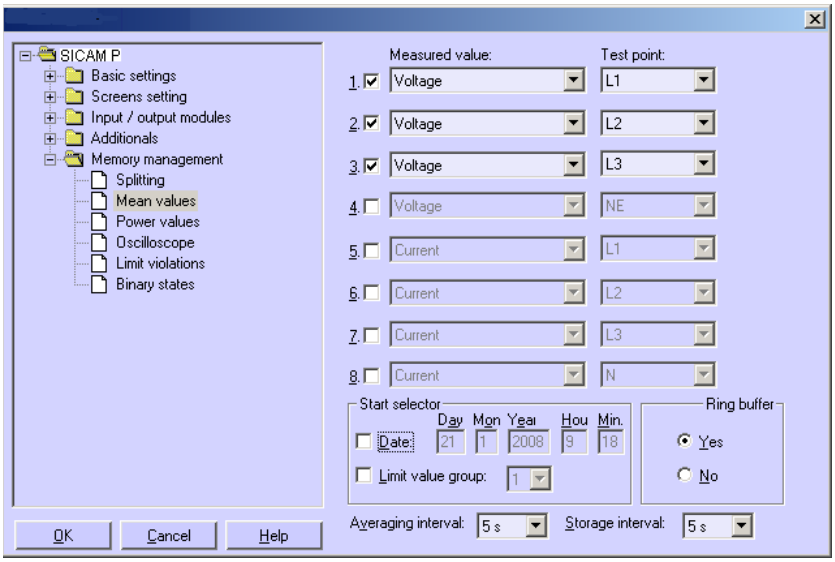
$$Values = \frac{AllocatedMemory[Byte]}{8Byte}$$

Calculation example with 20 % memory size

$$Values = \frac{209715\ Byte}{8\ Byte} = 26214$$

5.9.2 Mean Values

In this dialog window you can specify the settings for mean value recording.



Proceed as follows:

1. Select up to eight **Measured values** and **Test points**.
2. Select a **Date** or one of the six **Limit value group**s as **Start selector** for the average value recording. It is possible to combine Date and Limit value group as start selectors. The first of the two criteria fulfilled, will launch the recording.
3. When entering a date as **Start selector**, you must indicate a year between 2000 and 2060.
4. The **Ring buffer** mode allows you to select, if the oldest values will be overwritten (= **Yes**) or not (= **No**) when the capacity of the associated memory area is exhausted.

5. Also, you must indicate the **Averaging interval** (5 s, 10 s, 15 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min) and the **Storage interval** (5 s, 10 s, 15 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min). These parameters set the number of measured values to be used for mean value calculation and the interval for saving the values.

Note

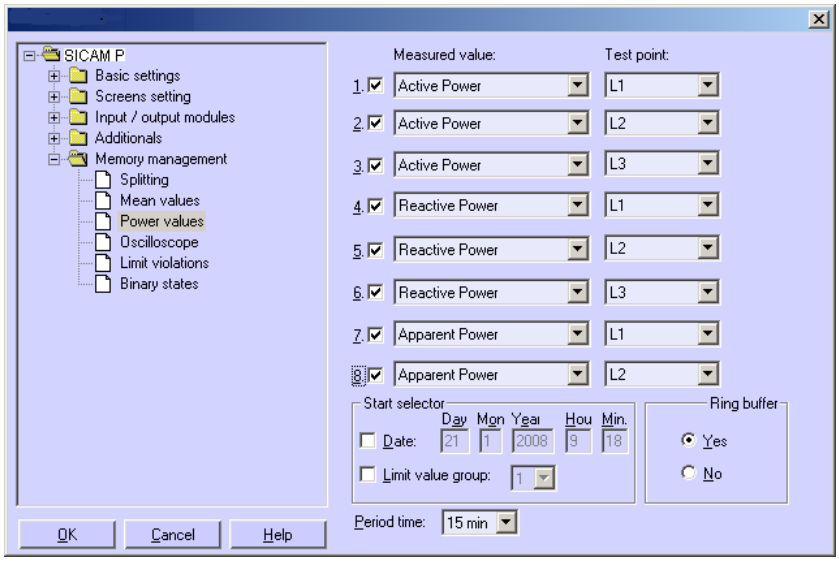
If you have entered a past start date, SICAM P will initiate mean value recording immediately after the setting. Manual start is not activated by configuration but can be initiated at any time.

Note

If the device provides additional analog inputs (optional), you can record external measurement signals.

5.9.3 Power Values

In this dialog window you can specify the settings for power recording.



Proceed as follows:

1. Select up to eight **Measured values** and **Test points**.
2. Select a **Date** or one of the six **Limit value groups** as **Start selector** for the power recording. It is possible to combine Date and Limit value group as start selectors. The first of the two criteria fulfilled, will launch the recording.
3. When entering a date as **Start selector**, you must indicate a year between 2000 and 2060.

Note

If you have entered a past start date, SICAM P will initiate mean value recording immediately after the setting. Manual start is not activated by configuration but can be initiated at any time.

4. The **Ring buffer** mode allows you to select, if the oldest values will be overwritten (= **Yes**) or not (= **No**) when the capacity of the associated memory area is exhausted.
5. Also, you must indicate the **Period time** (15 min, 30 min, 60 min).

5.9.4 Oscilloscope

- The **oscilloscope** is parameterized using SICAM P Par.
- Three measured quantities are always recorded.
- Normally, 30 % of the recording is allocated to pre-triggering history.
- Only one recording is possible. When initiating a new recording, the previous one is deleted.
- When triggering the oscilloscope via limit violation, the recording can also be executed in the background.
- Only the first of several limit violations that trigger a recording is recorded. Further violations are ignored.

Note

The memory range can be set by the user.

5.9.4.1 Characteristics of „Instantaneous Values“ Recording

Record length can be parameterized. The recording time to be saved in the allocated memory (see chapter 5.9.1) is calculated according to the following formula:

$$t_{MAX}[s] = \frac{AllocatedMemory[Byte]}{64*16Byte*50}$$

Sampling rate

The sampling rate is adjusted such that there are 64 samples per cycle. Therefore, the sampling rate is as follows for 50 Hz and 60 Hz respectively:

- at 50 Hz = 3.20 kHz
- at 60 Hz = 3.84 kHz

Trigger via Limit Violation

The RMS value of each half wave is calculated and tested for Max/Min violations. If a violation is detected, recording is triggered immediately. The bandwidth and filter time settings are irrelevant here.

Note

The recording type "Instantaneous value" allows to record the measurement values "current" and "voltage" only.

5.9.4.2 Characteristics of "RMS Value" Recording

- Any three measured quantities can be selected from the Table 3-1 with the exception of energy values and counters.

Recording time

Recording time can be parameterized. The recording time to be saved in the allocated memory (see chapter 5.9.1) is calculated according to the following formula:

$$t_{MAX}[h] = \frac{AllocatedMemory[Byte]}{8Byte * 3600}$$

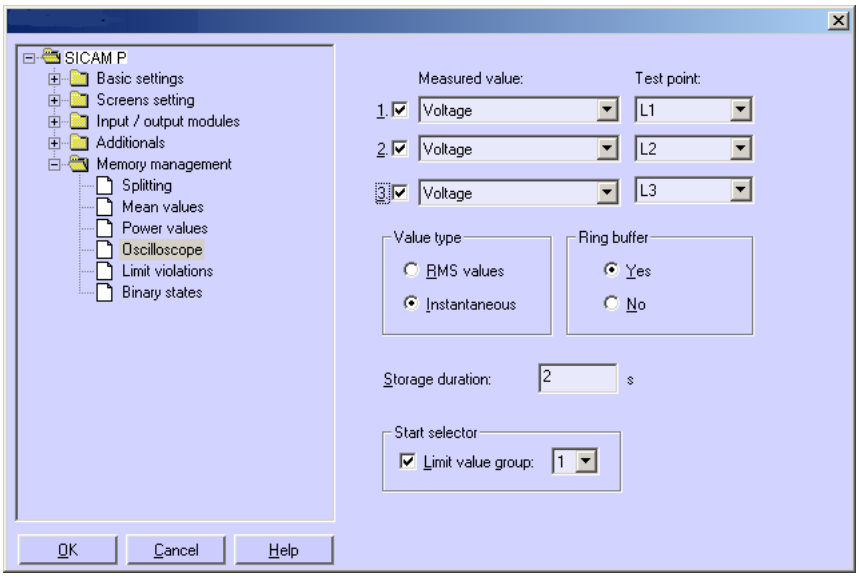
- One sample of a measured quantity is saved each second.
- Pre-trigger history is always 30 % of the selected recording time.

Note

- Since 30 % of the recording time is always allocated to pre-trigger history, the time for recording the pre-trigger history must expire before a new recording can be triggered.
- The recording type "RMS Value" does not allow to record analog inputs (optional).

5.9.5 Parameterization Oscilloscope

The oscilloscope can be set via this dialog window.



Proceed as follows:

1. Select up to three **measured quantities**: An oscilloscope recording is started via the selected **limit value group** (groups 1 to 6 are allowed).
2. Also, you must determine whether to record **Instantaneous** values or **RMS values**.

Note

When changing the value type (instantaneous or RMS), the present selection will be reset since the two types of measured values have different value ranges.

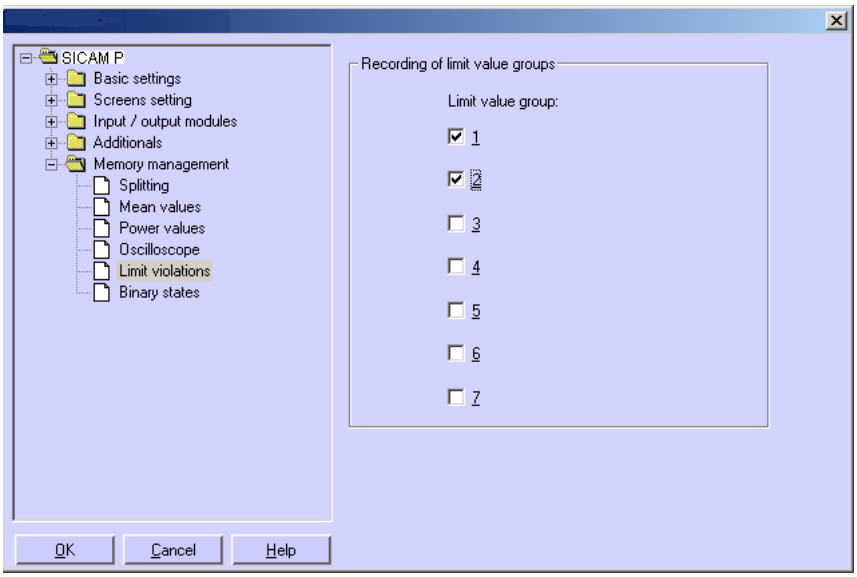
3. The **Ring buffer** mode allows you to select, if the oldest values will be overwritten (= **Yes**) or not (= **No**) when the capacity of the associated memory area is exhausted.
4. Indicate the **Storage duration** in seconds.

Note

In the submenu **Memory management** → **Splitting** you can see what storage time corresponds to the indicated percentage for oscilloscope.

5.9.6 Limit Violation

In this dialog window you can specify the limit value groups to be recorded.



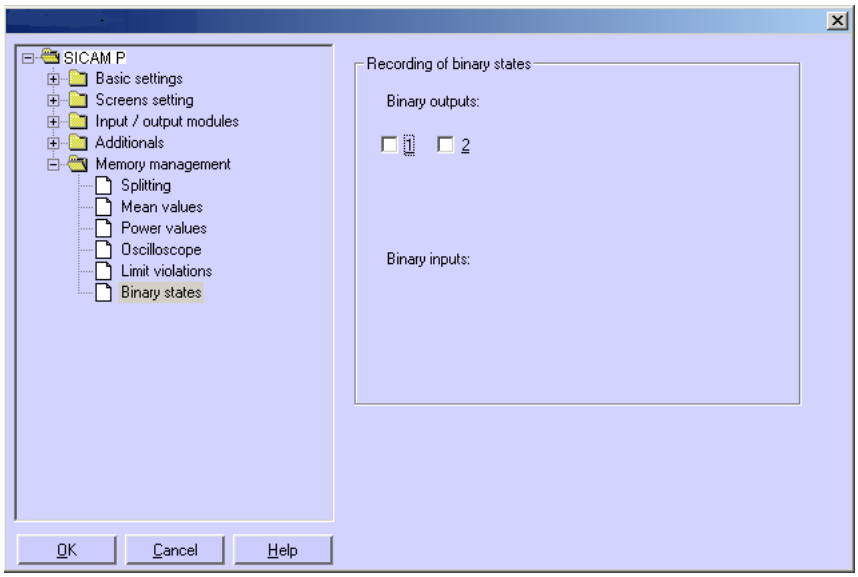
Select up to six **Limit value groups**. A violation of the specified limits will be recorded in the memory.

Note

If the memory capacity for the recording of limit violations is exhausted, data within this area will be overwritten.

5.9.7 Binary States

In this dialog window you can specify the settings for recording of binary states.

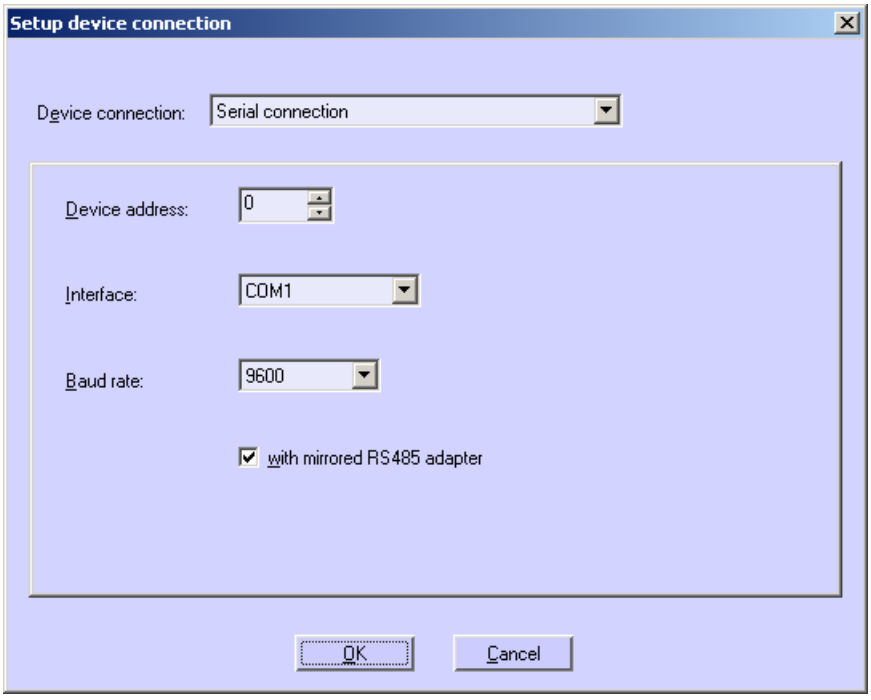


Select the **Binary outputs** to be recorded. The states of the binary outputs will then be recorded in the memory.

5.10 Updating the Firmware

Proceed as follows to update the firmware:

1. Establish a connection to the device. From the menu bar, select **Connection** → **Setup connection** and set the following parameters in the **Setup device connection** dialog:

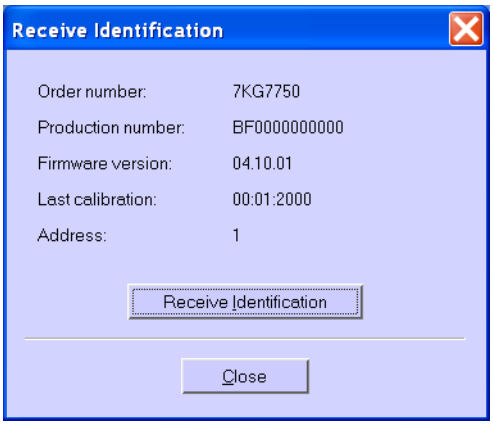


- **Device connection**: Serial connection
- **Device address**: address 0 is valid for all devices
- **Interface**: e.g. COM1
- **Baud rate**: 9600 Baud at delivery
- **depends on adapter type RS485**

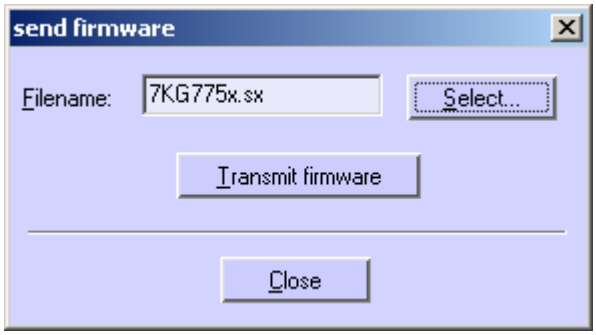
Note

Make sure to set the same parameter values in SICAM P Parameterization and in the device. In the device, the serial interface must be set to "PC-RS 485".

2. Confirm by clicking **OK**.
3. Query the device identification once to check the connection. To do this, click the **ID** symbol in the toolbar.



4. Click the **Receive Identification** button to retrieve data from the device. If the configuration is correct, all lines are filled with device data. **Close** the dialog window.
5. From the menu bar, select **Device** → **Send new firmware**.
6. In the *Send firmware* dialog, enter the path to the firmware (file 7KG*.SX)



7. Click the button **Transmit firmware**. The transfer may take some minutes. Check the ID again (symbol **ID**, see item 3). The new firmware version will be displayed.

Note

A check sum allows to relate each firmware version to device types and hardware versions. This ensures that no incompatible hardware and software version are updated. In this case, the transfer will be terminated with the message "Timeout while waiting for reply from device". The original firmware in the device remains unchanged.

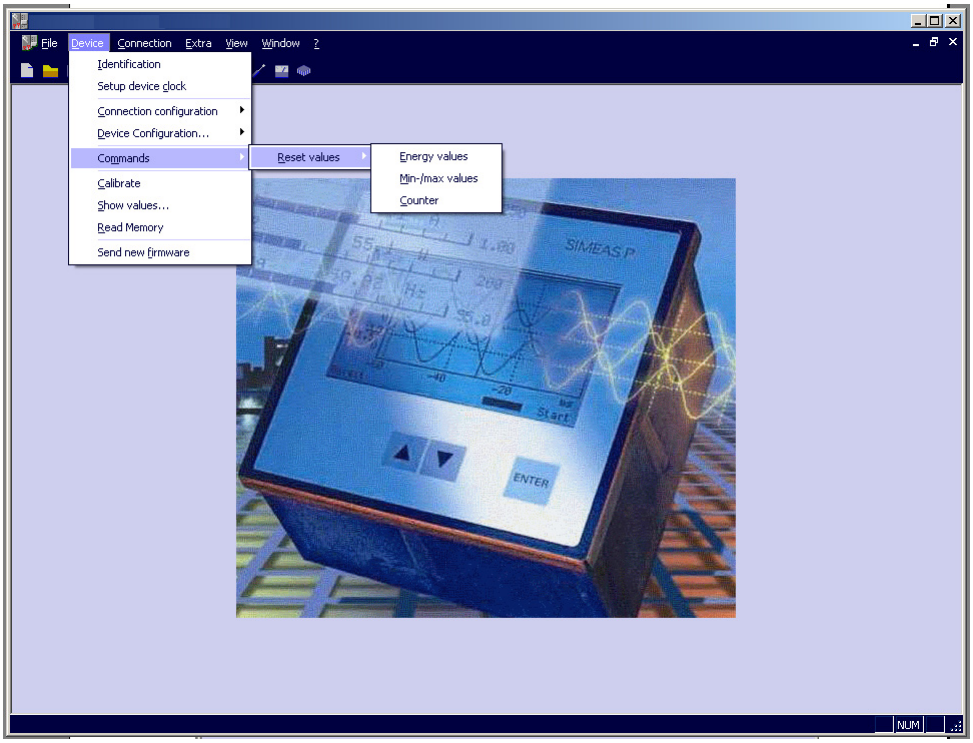
5.11 Resetting Values in the Device

SICAM P Parameterization allows you to reset the following values:

- Energy counter
- Counters for limit violations
- Min, aver and max values

Proceed as follows:

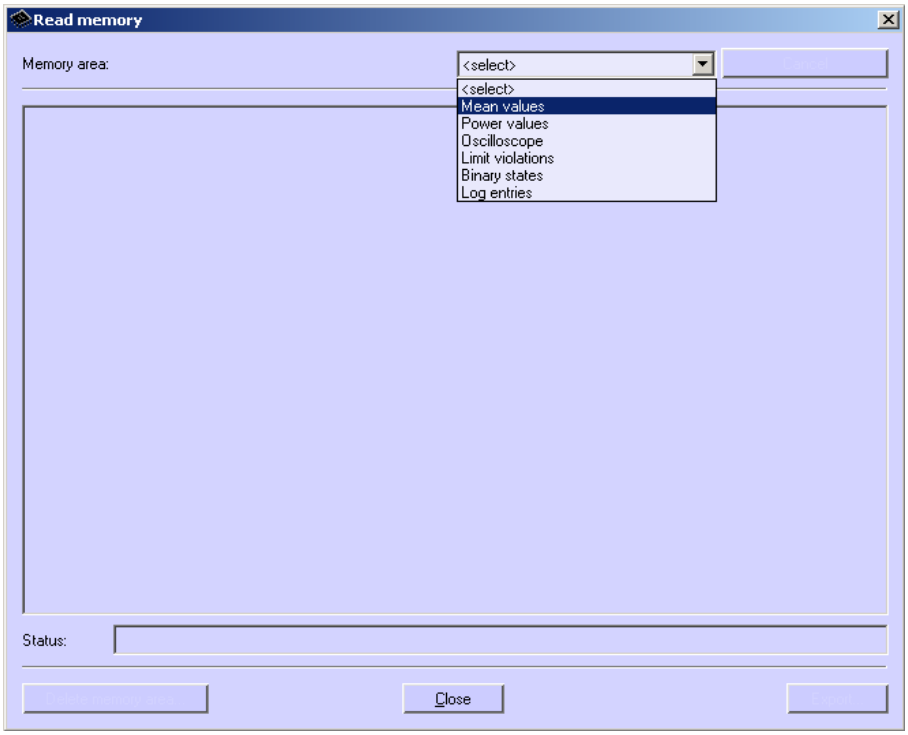
1. Establish a connection to the device. Make sure to set the same parameter values in SICAM P Parameterization and in the device. In the device, the serial interface must be set to "PC-RS 485".
2. From the menu bar, select **Device** → **Commands** → **Reset values** to reset the displayed items.



5.12 Reading the Device Memory

SICAM P Parameterization allows you read the memory content. The available memory capacity (1 MByte) can be allocated by the user to the available functions (see chapter 5.9.1).

1. From the menu bar, select **Device** → **Read Memory** to select the memory area in the *Read memory* dialog



2. Select a memory area.

5.12.1 Handling

Note

Depending on the function you have selected, different buttons are displayed. Inactive buttons are not shown.

Cancel

Click this button to interrupt the data download from the device. If a large amount of the memory is assigned to a record, the download of data may take a few minutes (at low baud rates perhaps some hours). The download progress is shown in the status line. If the download was successful or interrupted by the user, this button will be renamed to **Reload**.

Reload

Click this button to reload measured values or data from the device.

Close

Click this button to terminate the dialog window **Read memory**.

Export

Click this button to save measured values or information as CSV file (Comma separated values) or COMTRADE file (IEEE Standard Common Format for Transient Data Exchange). CSV files can be read and processed, e.g., with Excel. COMTRADE files are used for exchanging measured data as documented in the IEEE Std C37.111-1999. The standardization includes both the format for measuring files and the type of media used for the exchange of fault report, test or simulation data of power supply systems.

Delete memory area

Click this button to delete the selected memory area in the device. Optionally, you can restart the recording immediately or with the occurring of a parameterized trigger condition (mean values, power values, and limit violations only).

5.12.2 Charts / Diagrams

Diagrams and charts are coupled: By moving the measuring cursor in the diagram, the corresponding row in the chart is marked; by activating a row in the chart, the cursor in the diagram moves to the corresponding timestamp (mean values, power values, and binary states only).

5.12.3 Diagrams

In diagrams, zooming, measuring and other functions are available. Click the right mouse button in diagrams to activate the functions zoom, optimize, optimize x-axis, optimize y-axis, diagrams (fade in or blind out diagram for measured value), signals (fade in or blind out diagram for minimum, mean respectively maximum value) and copy diagrams in selectable size to the clipboard (mean values, power values, binary states, and oscilloscope data only).

5.12.4 Timestamps

All timestamps are shown in regional normal time. This avoids time gaps or overlap in data (for example, when summer time starts or ends).

5.12.5 Mean Value Record

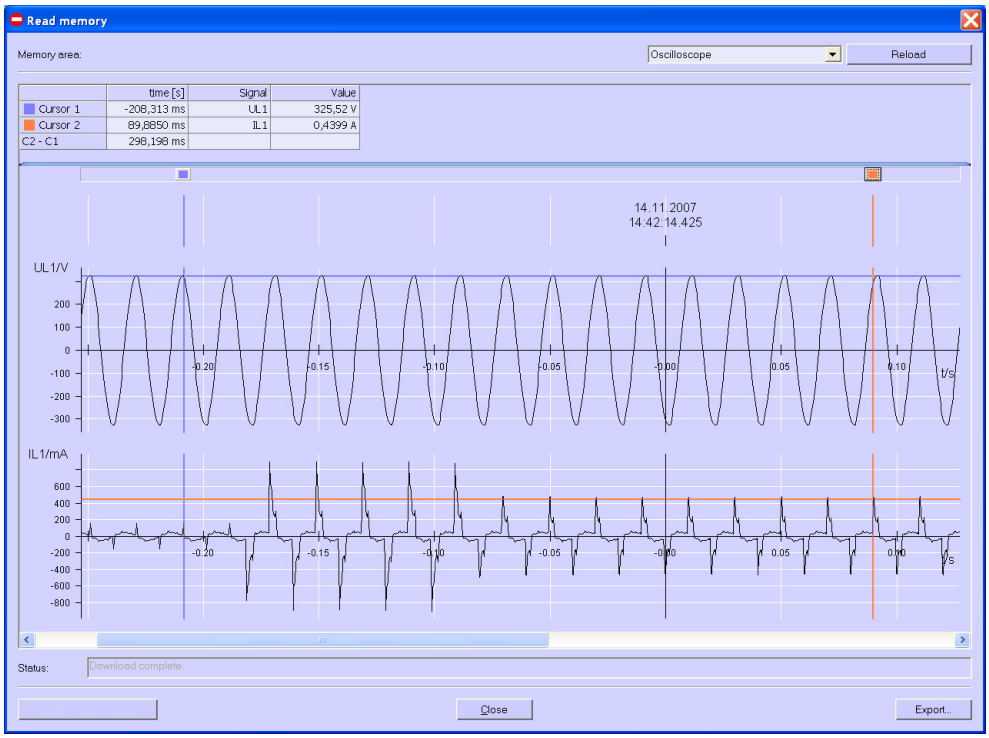
Mean values are represented in a chart and in diagrams. In the chart, you can select between minimum values, mean values and maximum values in headline. For each recorded mean value (max. 8), one column in the chart and one diagram is shown. In the diagram, the mean value and the tolerance area limited by minimum and maximum value are drawn.

5.12.6 Power Value Record

Power values are represented in a chart and in diagrams. For each recorded power value (max. 8), one column in the chart and one diagram is shown.

5.12.7 Oscilloscope

Records of oscilloscope are represented in one diagram for each value with trigger timestamp. With the two measuring cursors measurement on signals is possible. To do this, select signals in the table. Additional functions are available by pressing the right mouse button (see diagrams).



5.12.8 Limit Violation Record

Limit violations are represented in a chart. Limit violations of group 1 to 6 are shown when occurring (ON) and disappearing (OFF). For limit violation group 7, additional information is available: the signal on which the violation occurred and the measured value appeared.

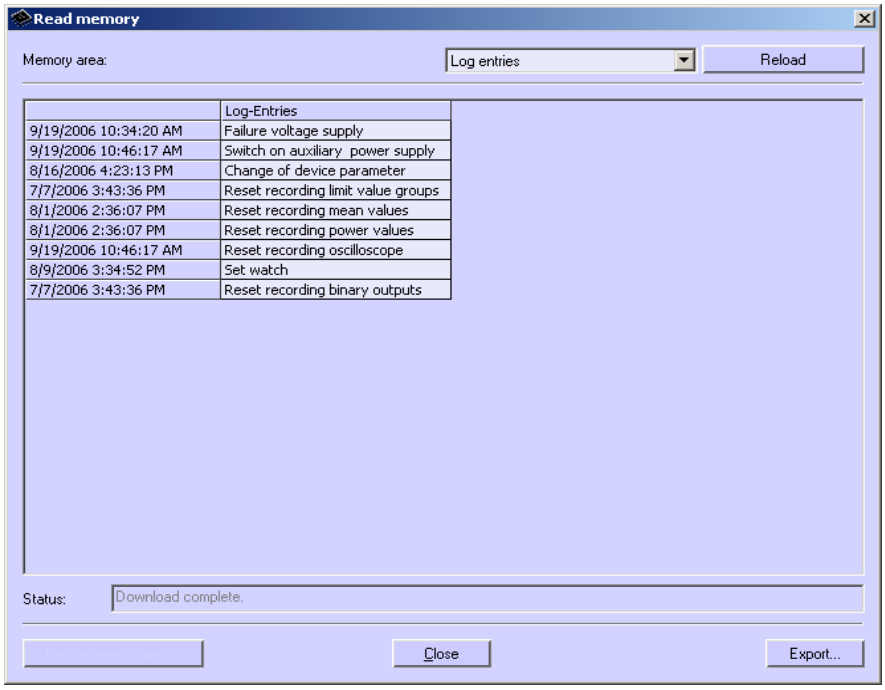
5.12.9 Binary States

Binary states are represented in a chart and in diagrams. For each recorded binary state, one column in the chart and one diagram is shown.

5.12.10 Log Entries

Log entries are represented in a chart. For each of the following entries, date and time are shown:

- Failure voltage supply
- Switch on auxiliary power supply
- Change of device parameter
- Reset recording limit value groups
- Reset recording mean values
- Reset recording power values
- Reset recording oscilloscope
- Set watch



Note

For further information on "Reading the Device Memory", refer to the online help of the PC programming software (press F1).

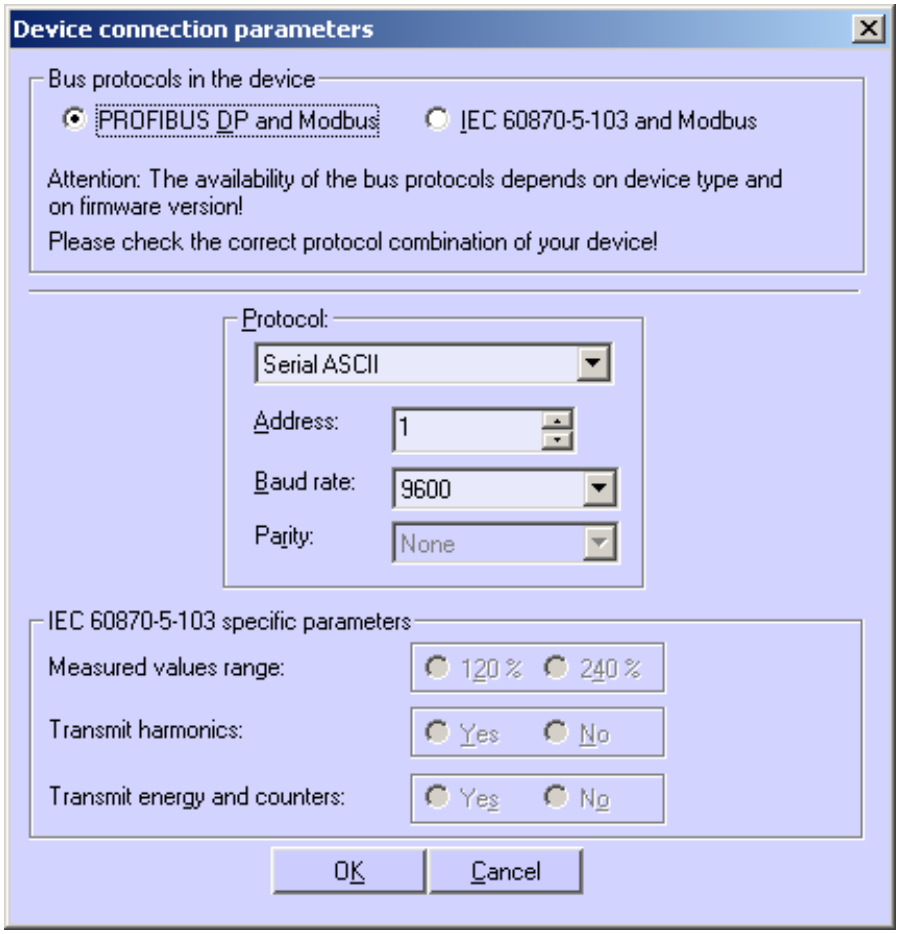
5.13 Changing the Communication Parameters

At delivery, the following communication parameters are preset:

- Address: 1
- Protocol: Serial ASCII
- Baud rate: 9600 bit/s
- Parity: No

In order to switch to another protocol, proceed as follows:

1. From the menu, select **Device** → **Connection configuration** → **Edit**. The dialog *Device connection parameters* will open.



2. Select the combination of bus protocols supported by your device in the **bus protocols in the device** field:
   - PROFIBUS DP and Modbus or
   - IEC 60870-5-103 and Modbus

Note

The bus protocols provided in your device depend on the device type and the firmware version.Therefore, check the correct bus protocol combination of your device.

3. Select the required protocol type depending on the bus protocol used:

PROFIBUS DP and Modbus	**IEC 60870-5-103 and Modbus**
- Serial ASCII	- Serial ASCII
- Profibus DP	- IEC 60870-5-103
- Modbus ASCII	- Modbus ASCII
- Modbus RTU	- Modbus RTU

4. Set the **Address** of the device and (if required) the **Baud rate** and the **Parity**.
5. If you have selected the IEC 60870-5-103 protocol, the following IEC 60870-5-103-specific parameters are activated, where you have to choose :
   - **Measured values range**: **120 %** or **240 %**
   - **Transmit harmonics**: **Yes** or **No**
   - **Transmit energy and counters**: **Yes** or **No**
6. Confirm your entries by clicking **OK**.
7. Select the menu item **Device**→ **Connection configuration** → **Send** to send the new setting to the device.

Note

The settings will not be activated in the device unless a hardware reset has been made.

After the device has been switched on, you have got 60 seconds to establish a connection to the parameterization tool. Once this time has elapsed, the communication protocol set will be activated automatically.

Calibration

6

Contents

The adjustment is explained in the following chapters.

6.1	Overview	128
6.2	Connection Diagrams for Adjustment	129
6.3	Procedure	130

6.1 Overview

SICAM P can be adjusted either directly from the device using the buttons on the front panel or by using the SICAM P programming software.

You can select the measurement range under **Basic Settings** → **Connection / Transformer**. Only the measurement ranges selected for current and voltage inputs can be adjusted in the Calibration menu.

Adjusting the SICAM P requires a single-phase adjusting device that can generate voltages and currents, e.g. Omicron CMC 256+EP. Adjustment frequency: 50 Hz or 60 Hz.

Note

To be able to make adjustments using the software, a connection must be established between the PC and the SICAM P device.

Before starting the adjustment, you should set the time in the SICAM P. This ensures that the last adjustment is displayed with a date in the SICAM P.

When connecting the adjusting outputs to the appropriate inputs, make sure that the SICAM P is correctly connected as per the Connection Diagrams for adjustment.

The following three elements should be adjusted during the adjustment process:

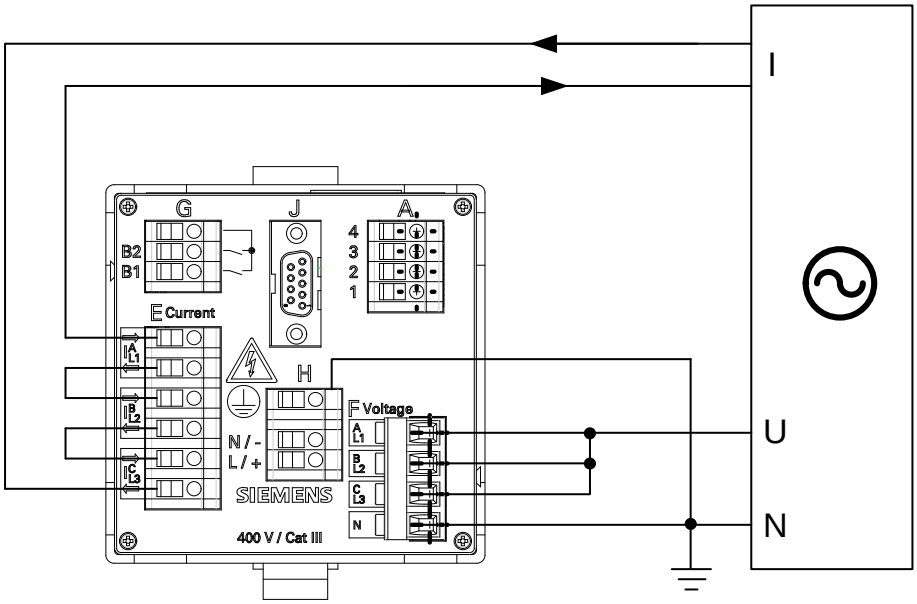
- Voltage inputs V
- Current inputs I

6.2 Connection Diagrams for Adjustment

Correct adjustment is crucial to the accuracy of the measurements made by the SICAM P.

The following applies to the adjustment of current and voltage inputs of the SICAM P:

- Single-phase current and voltage connection.
- Frequency 50 Hz or 60 Hz.
- There must be no phase shift between current and voltage.
- Connect the device terminals „Ground” (terminal block H) and „N” (terminal block F) with terminal "N" on the adjusting device.
- The SICAM P must be grounded.



6.3 Procedure

- First, connect the SICAM P as described in chapter 6.2.
- You can adjust the device manually or via programming software

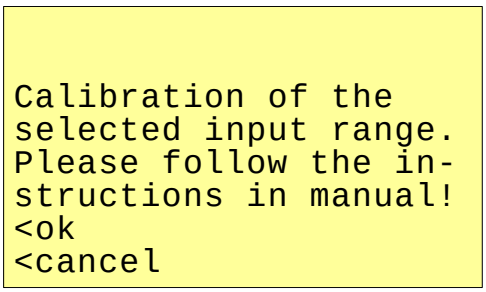
Procedure at the device

- Select **Basic settings** → **Connection / Transformer**.

  Select the range to be adjusted (e.g. AC 228 V).
- In the menu, select: Calibrate.

  A dialog window appears.
- Enter the setpoint value for adjustment voltage and adjustment current. Default setpoints are the nominal ranges of the measuring ranges set under **Connection / Transformer**. Optimal precision can be achieved by using these default setpoint values. If the default values are not available, make the appropriate changes.
- Switch the adjusting device on with the setpoints.
- Follow the instructions. SICAM P is readjusted.

Procedure for programming software



- Establish the communication between device and programming software.
- In the menu, select: Calibration

  A dialog window appears.
- Select the element you wish to adjust: U or I
- Enter the setpoints for adjustment of voltage and current. The setpoints given are the nominal values of the measurement ranges set under Connection / Transformer. These preset setpoints ensure optimum precision. If the preset values are not correct, change them accordingly.
- Switch the adjusting device on with the setpoints.
- Follow the instructions. SICAM P is readjusted.

Maintenance, Storage, Transport 7

Contents

7.1	Maintenance	132
7.2	Storage	132
7.3	Transport	132

7.1 Maintenance

Except for a battery replacement, the SICAM P 7KG7750/55 is maintenance-free. The Product Information enclosed with the device describes how to replace the battery.

Cleaning

Wipe the device using a clean, dry and soft cloth if necessary. Do not use solvents.

7.2 Storage

Store the device in a dry and clean location. Store the device within a temperature range from --25 °C to +70 °C (-13 °F to +158 °F).

The relative humidity must not lead to condensation or ice formation.

To avoid premature aging of the electrolytic capacitors, store the device within the recommended temperature range of +10 °C to +35 °C (+50 °F to +95 °F).
Siemens furthermore recommends connecting the device to supply voltage once a year for 1 to 2 days in order to form the inserted electrolytic capacitors. This procedure should also be carried out before operating the device.

7.3 Transport

If devices are to be shipped elsewhere, you can reuse the transport packaging. When using different packaging, you must ensure that the transport requirements according to ISO 2248 are adhered to. The storage packing of the individual devices is not adequate for transport purposes.

Technical Data

8

Contents

The following chapters include the technical data of both devices.

8.1	SICAM P 7KG7750	134
8.2	SICAM P 7KG7755	142

8.1 SICAM P 7KG7750

8.1.1 General Device Data

8.1.1.1 Power Supply

Direct Voltage

Rated input voltages	24 V to 250 V
Admissible input voltage tolerance	±20 %
Permitted ripple of the input voltage	15 %
Maximum inrush current	
At ≤ 110 V	< 15 A
At 220 V to 300 V	≤ 22 A; after 250 µs: < 5 A
Maximum power consumption	6 W

Alternating Voltage

Rated input voltages	110 V to 230 V
System frequency at AC	50 Hz/60 Hz
Admissible input voltage tolerance	±20 %
Permitted harmonics	2 kHz
Maximum inrush current	
At ≤ 115 V	< 15 A
At 230 V	≤ 22 A; after 250 µs: < 5 A
Maximum power consumption	9 VA

8.1.1.2 Inputs and Outputs

Inputs for Alternating Voltage Measurements (Connector Block F)

Rated input alternating voltages	
Phase-N/PE	100 V/110 V 190 V 400 V

Phase-phase	100 V/110 V 190 V 400 V 690 V
Overload	20 %
Maximum input alternating voltage	
Phase-N/PE	480 V
Phase-phase	831 V
Input impedances	
a, b, c to N	8.4 MΩ, 1 phase
	4.2 MΩ, 3 phases, symmetrical
a-b, b-c, c-a	8.4 MΩ
Further information about the voltage measuring inputs	
Power consumption per input for V_{rated} 400 V	38 mW
Permissible power frequency	45 Hz to 65 Hz min. > 30 % U_{IN}
Waveform	Sinusoidal or up to the 21st harmonic
Measuring error (with calibration) at 23 °C ± 1 °C 50 Hz or 60 Hz	typically ±0.1 % for reference conditions

Inputs for Alternating Current Measurements (Connector Block E)

Input alternating currents	
Rated input current range	1 A 5 A
Max. input current	2 x rated input alternating current
Power consumption per input	
at 1 A	83 μVA
at 5 A	2.1 mVA
Further information about the current measuring inputs	
Max. rated input voltage	150 V
Measuring error (with calibration) at 23 °C ± 1 °C 50 Hz or 60 Hz	Typically ±0.1 % at reference conditions
Thermal stability	10 A continuous 100 A for max. 1 s

Binary Outputs (Connector Block G)

Maximum contact voltage	
Alternating voltage	230 V
Direct voltage	250 V
Maximum currents	
Maximum continuous contact current	100 mA
Maximum pulse current for 0.1 s	300 mA
Further information about the binary outputs	
Internal impedance	35 Ω
Admissible switching frequency	10 Hz
Number of switching cycles	Unlimited

Binary Inputs (Connector Block A, optional)

Max. input voltage	DC 150 V
Current consumption for high level	DC 1,8 mA
Low level	≤ 10 V
High level	≥ 19 V
Signal delay	max. 3 ms

Analog inputs (Connector Block A, optional)

Measuring range	DC 0 mA to 20 mA
Input range	DC 0 mA to 24 mA
Input resistance	50 Ω ± 0.1 %
Accuracy	0.5 % of the measuring range limit

Analog outputs (Connector Block A, optional)

Output current	DC 0 mA to 20 mA
Output range	DC 0 mA to 24 mA
Max. load resistance	250 Ω
Accuracy	0.2 % (typical); max. 0.5 % of the nominal value

Relay outputs (Connector Block A, optional)

Max. switching voltage	AC 150 V; DC 150 V
Max. permanent current	AC 5 A; DC 5 A
Min. permanent current	1 mA at DC 5 V
Rating (resistive)	AC 5 A/150 V or DC 5 A/30 V
Max. response time	10 ms
Max. release time	7 ms

8.1.1.3 Communication Interface (Connector J)

Connection	Terminal side, 9-pin D-sub socket RS485
Protocol PROFIBUS DP-V1	
Baud rate	9600 bit/s to 12 Mbit/s
Protocol IEC 60870-5-103	
Baud rate	9600 bit/s, 19 200 bit/s, 38 400 bit/s
Protocol Modbus RTU/ASCII	
Baud rate	300 bit/s, 600 bit/s, 1200 bit/s, 2400 bit/s, 4800 bit/s, 9600 bit/s, 19 200 bit/s, 38 400 bit/s, 57 600 bit/s, 115 200 bit/s

Recommended termination of the RS485 Interface see chapter 1.6.3.

8.1.1.4 Environmental Conditions

Temperature data IEC/EN 60068	Operating temperature Devices with display: the legibility of the display is impaired at temperatures < 0 °C (+32 °F).	-25 °C to +55 °C -13 °F to +131 °F
	Temperature during transport	-25 °C to +70 °C -13 °F to +158 °F
	Temperature during storage	-25 °C to +70 °C -13 °F to +158 °F
	Maximum temperature gradient	20 K/h
Air humidity data	Mean relative humidity per year	≤ 75 %
	Maximum relative humidity	80 % for temperatures up to 31 °C (87.8 °F); decrease linearly to 50 % at 40 °C (104 °F)
	Condensation during operation	Not permitted
	Condensation during transport and storage	Permitted
Altitude	Max. altitude above sea level	2000 m
Pollution degree	2	

8.1.1.5 General Data

Battery	Type	PANASONIC CR2032 or VARTA 6032 101 501
	Voltage	3 V
	Capacity	230 mAh
	Typical life	For operation with permanently applied supply voltage: 10 years
		For operation with sporadically interrupted supply voltage: a total of 2 months over a 10-year period
Display		
Resolution	(128 x 64) pixel	The display is only restrictedly readable at low temperatures (≤ 0 °C; ≤ +32 °F).
Dimensions	40 mm x 60 mm	
Backround illumination	Yellow	
Protection		
Front	IP41 IP65	
Terminals	IP20	
Personal protection	IP1x	
Fuses		
Internal fuse	Type T1,6A/250V according IEC 60127	Not replaceable
Internal fuse, secondary	Type F2A/125V according UL 248-14	Not replaceable
Dimensions		
Dimensions (W x H x D)	Dimension figures: see chapter 1.4	
Mass	without I/O module	approx. 0.6 kg
	with 1 module	approx. 0.65

8.1.2 Test Data

Reference Conditions

Reference conditions	The stated error limits apply for reference conditions
Input current I_i	I_{iN} ± 1 %
Input voltage U_i	U_{iN} ± 1 %
Frequency f_i	45 Hz to 65 Hz
Waveform	Sinus, harmonic distortion ≤ 5 %
Ambient temperature T_A	23 °C ± 1 °C
Auxiliary voltage U_H	U_{HN} ± 1 %
Warm-up time	≥ 15 min
External fields	no

8.1.2.1 Electrical Tests

Standards

Standards:	IEC EN 61000-6-2 IEC EN 61000-6-4 IEC EN 61010-1 IEC EN 61010-2-030

Insulation Test according to IEC EN 61010-1 and IEC EN 61010-2-030

Inputs/Outputs	Insulation	Rated Voltage	ISO Test Voltage	Category
Current measurement inputs (E)	Reinforced	150 V	AC 2.21 kV	Cat. III
Voltage measurement inputs (F)	Reinforced	480 V	Surge voltage 9.76 kV	Cat. III
Supply voltage (H)	Reinforced	300 V	DC 3.125 kV	Cat. III
Binary outputs (G)	Reinforced	300 V	AC 3.51 kV	Cat. III
RS485 interface	SELV	< 50 V	DC 700 V	
Input-/Output module (A) - Binary input - Binary output - Relay output	Reinforced	150 V	AC 2210 V	Cat. III
Input-/Output module (A) - Analog input - Analog output	SELV	< 50 V	DC 700 V	

Isolation Test

Norm	IEC 60688
Isolation test acc. to IEC 60688	5 kV; 1.2 µs

8.1.2.2 Mechanical Stress Tests

Mechanical dynamic stress	
Standards	IEC/EN 60255-21 IEC/EN 60068
Vibration, sinusoidal for stationary application	IEC/EN 60255-21-1 (06.90) IEC/EN 60068-2-6 (03.95) Class 1
Vibration, sinusoidal transport	IEC/EN 60255-21-1 (06.90) IEC/EN 60068-2-6 (03.95) Class 1
Vibration on earthquake for stationary application	IEC/EN 60255-21-3 (06.90) IEC/EN 60068-2-57 (03.95) IEC/EN 60068-3-3 (03.95) Class 1
Shock, for stationary application	IEC/EN 60255-21-2 (06.90) IEC/EN 60068-2-27 (03.95) Class 1
Shock, semi-sinusoidal, transport	IEC/EN 60255-21-2 (06.90) IEC/EN 60068-2-27 (03.95) Class 1
Bump test (continuous shock), transport	IEC/EN 60255-21-2 (06.90) IEC/EN 60068-2-29 (03.95) Class 1

8.2 SICAM P 7KG7755

With the following exceptions, the technical data of the SICAM P 7KG7755 correspond to the data of the SICAM P 7KG7750:

The SICAM P 7KG7755 has no display.

Protection class according IEC/EN 60529 (VDE 0470 part 1)	
Device	IP20
Personnel protection	IP1x