Operating Instructions

GOSSEN METRAWATT

A2000

Multifunctional Power Meter

3-348-981-03
21/2.08

Contents Page

Contents Page

1 Application

The A2000 measuring instrument is used for the analysis and monitoring of 3-phase current systems. It can be operated with internal transformers in 3-phase current systems of up to 5 A and 500 V nominal voltage, and can perform measurements in medium-voltage systems in combination with external current and voltage transformers.

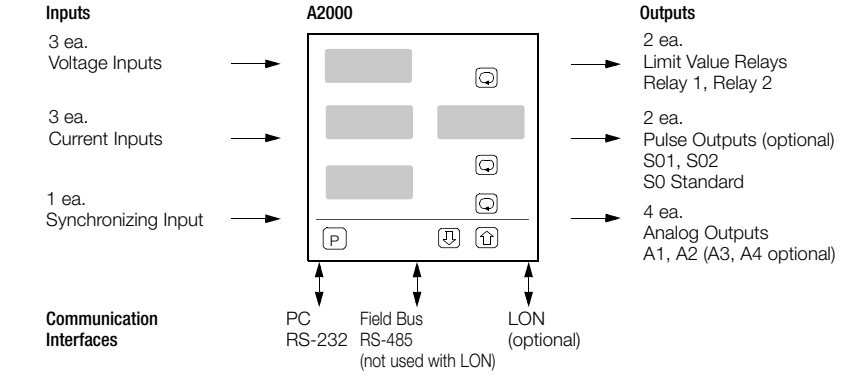
The A2000 acquires voltages, current, frequency and phase displacement in 3 and 4-wire systems. It calculates active, reactive and apparent power, active and reactive energy, as well as the power factor for the individual phases based upon these values.

An FFT (= Fast Fourier Transformation) is performed on the basis of the currents and phase voltages and the harmonic waves are determined up to the 15^{th} harmonic. For the phase voltages, the harmonic distortions of the individual harmonics are indicated as well as the total harmonic distortion, for the currents, the respective RMS values are indicated.

Transformation ratios can be entered to the instrument, which means that all primary measurement data can be displayed directly at the A2000. Maximum values are stored to memory for every measured or calculated quantity. If limit values are exceeded, corrective action can be triggered via relay outputs. Energy meters, recorders, data loggers and control loops can be connected to the digital and analog outputs. The instrument can be integrated into a field bus system or a LON network with the communications interfaces, or its parameters can be configured with a PC.

2 Instrument Description

2.1 Instrument Overview

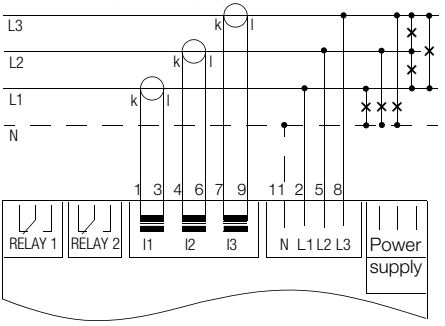


2.2 Inputs, Outputs and Interfaces

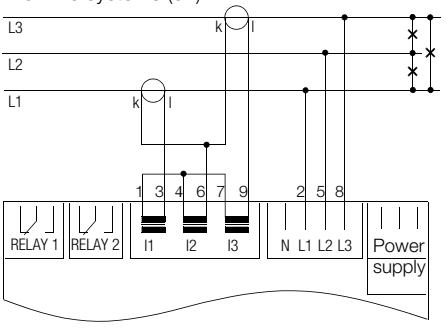
Current Inputs

All current inputs are isolated from one another. If measurements are performed with external transformers, their primary and secondary current values must be entered, in order to enable direct display of current values. Switching between the two meas. ranges (1 A and 5 A) is accomplished via software.

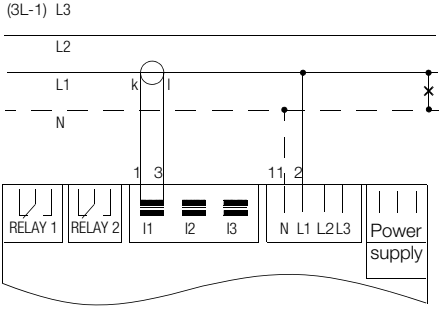
Connection with 3 current transformers in 3/4-wire systems (4L)



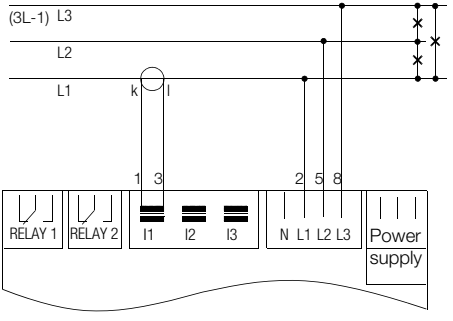
Connection with 2 current transformers in 3-wire systems (3L)



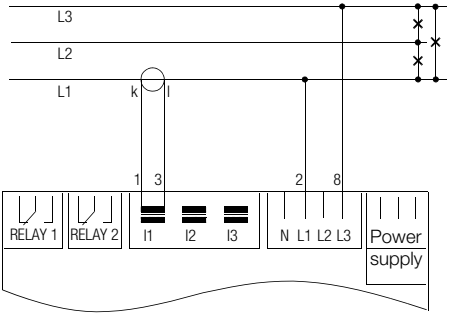
Connection with 1 current transformer in 4-wire systems (balanced load) (3L-1)



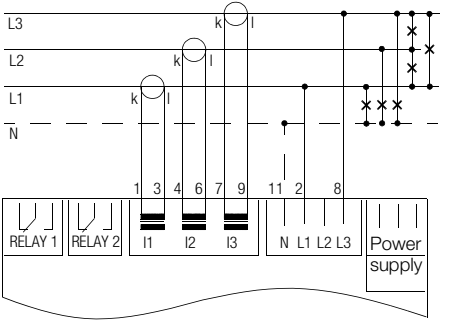
Connection with 1 current transformer in 3-wire systems (balanced load) (3L-1)



Connection with 1 current transformer
in 3-wire systems (balanced load) (3L13)



Connection with 3 current transformers
in 4-wire systems (Open Y) (4L13)



For this connection type the accuracy values for the measurement of power, energy and power factor are only observed in the case of low-distortion tension. The setting „Compensating reactive power“ is not possible.

Voltage Inputs

Each voltage measurement input is provided with a safety impedance (incl. the N conductor). Measurements within 3-phase systems of up to 500 V are possible without the use of external transformers.

Mains Supply Power

Mains supply power must correspond to the specified values indicated on the serial plate. Correct connection is absolutely essential!

Synchronizing Input

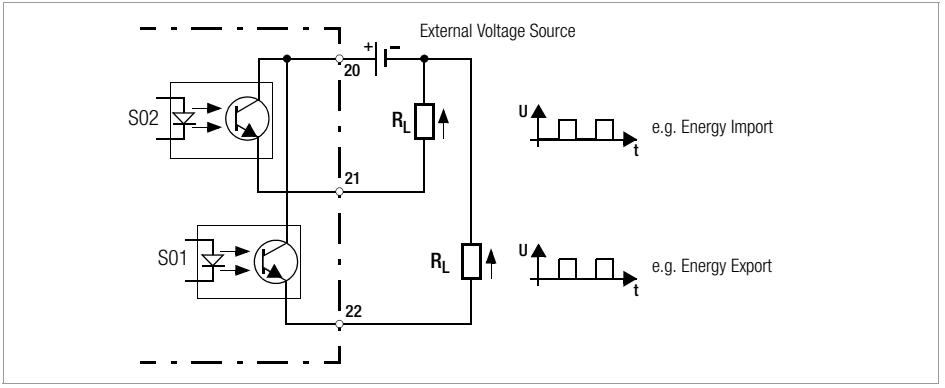
The synchronizing input is used to select the interval for calculation of the consumption value.
An external, potential-free contact must be used to drive this input. However, synchronization can also be internally controlled with the software. Alternatively, a switch-over between low tariff and high tariff is possible with the synchronizing input (see chapter 4.7 on page 33).

Relay Outputs

Limit values can be monitored for every measured or calculated quantity. These limit values can be assigned to the relay outputs.

Pulse Outputs

The values for measured reactive and active energy can be read out at the pulse outputs in the form of standard S0 pulses for the driving of electromechanical counting mechanisms.



Analog Outputs

Each measured or calculated quantity can be assigned to one of the analog outputs. Exception: FFT-values, which can only be read out via the RS-232 and RS-488 interfaces. This allows for the logging or driving of secondary control loops. The outputs can be configured as voltage or current outputs with the help of the DIP switches.

Communications Interfaces

The A2000 is provided with RS232 and RS485 interfaces as standard equipment. The RS485 interface is not included with the LON model due to space limitations.
The **RS232 interface** allows for the transmission of measurement values from the A2000 to a PC, as well as external instrument configuration. The chapter entitled “Interface Description” on page 41 provides detailed information regarding the generation of user specific programs. The **RS485** field bus interface allows for the interconnection of up to 32 instruments.

2.3 Available Measurement Data

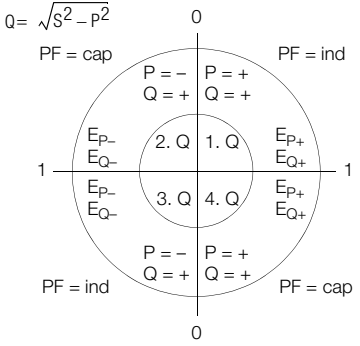
	Individual Phases				Collective Values			
Phase Voltages	U1 ... U3		$U1_{max}$ ... $U3_{max}$		U_{Σ} [4]		$U_{\Sigma max}$ [5]	
Delta Voltages	U12, U23, U31		$U12_{max}$ ... $U31_{max}$		$U_{\Delta avg}$ [4]		$U_{\Delta avg\ max}$ [5]	
Phase Current	I1 ... I3		$I1_{max}$ ... $I3_{max}$		I_{Σ} [4]		$I_{\Sigma max}$ [5]	
Averaged Phase Current	$I1_{avg}$ ... $I3_{avg}$		$I1_{avg\ max}$ ... $I3_{avg\ max}$		$I_{avg\ \Sigma}$ [4]		$I_{avg\ \Sigma max}$ [5]	
Neutral Conductor current	In		In_{max}		—		—	
Averaged Neutral Conductor Current	In_{avg}		In_{avgmax}		—		—	
Line Frequency	—		—		f		—	
Active Power	P1 ... P3		$P1_{max}$ ... $P3_{max}$		P_{Σ}		$P_{\Sigma max}$	
Reactive Power	Q1 ... Q3		$Q1_{max}$ ... $Q3_{max}$		Q_{Σ}		$Q_{\Sigma max}$	
Apparent Power	S1 ... S3		$S1_{max}$ ... $S3_{max}$		S_{Σ}		$S_{\Sigma max}$	
Power Factors	PF1 ... PF3		$PF1_{min}$ ... $PF3_{min}$		PF_{Σ}		$PF_{\Sigma min}$	
Energy Mode	L123 [1]	LTHT [2]	L123 [1]	LTHT [2]	L123 [1]	LTHT [2]	L123 [1]	LTHT [2]
Active Energy	E_{P1} ... E_{P3}	–	–	–	$E_{P\Sigma}$	$E_{P\Sigma L-}$, $E_{P\Sigma L+}$ [3] $E_{P\Sigma H-}$, $E_{P\Sigma H+}$	–	–
Reactive Energy	E_{Q1} ... E_{Q3}	–	–	–	$E_{Q\Sigma}$	$E_{Q\Sigma L-}$, $E_{Q\Sigma L+}$ [3] $E_{Q\Sigma H-}$, $E_{Q\Sigma H+}$	–	–
Intervalic Active Energy	–		–		$P_{int\ \Sigma}$		$P_{int\ \Sigma max}$	
Interv. Reactive Energy	–		–		$Q_{int\ \Sigma}$		$Q_{int\ \Sigma max}$	
Interv. Apparent Energy	–		–		$S_{int\ \Sigma}$		$S_{int\ \Sigma max}$	
THD, 1^{st}... 15^{th} harmon.	U1h ... U3h, I1h ... I3h		U1hmax ... U3hmax, I1hmax ... I3hmax		–		–	

1) L123 = individual phases L1, L2, L3
2) LTHT = low tariff (LT) high tariff (HT)
3) L = low tariff, H = high tariff, + = import, – = export
4) only via interface and as a source for relay and analog output
5) only via interface

- The determination of measured and calculated quantities is performed in accordance with DIN 40110 part 1,2 4.96 (non-sinusoidal quantities).
- PEN conductor current is not taken into consideration for the calculation of collective phase current and collective apparent power.
- The averaging of currents $I1_{avg}$ … $I3_{avg}$, In_{avg} is performed in the same manner as with a bimetallic indicator, with a setting time of approx. 10 min relative to 99% of the final value.

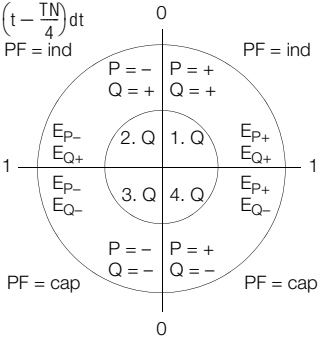
Display of Reactive Power

dIn = calculation of reactive power per DIN 40110 without + or – sign



SIGn = calculation of reactive power with + or–

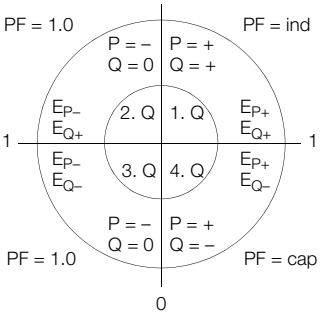
$$Q = \frac{1}{TN} \cdot \int_0^{TN} u(t) \cdot i\left(t - \frac{TN}{4}\right) dt$$



CoMP = compensating reactive power (reactive power is only produced if current and voltage have different + or - signs)

$$Q = -\frac{2}{TN} \cdot \int_0^{TN} u(t) \cdot i(t) dt$$

for $u(t) \cdot i(t) < 0$



Calculation of Collective Values

$U_{\Delta avg} = (U_{12} + U_{23} + U_{31})/3$

$U_\Sigma = \sqrt{U_1^2 + U_2^2 + U_3^2}$

$I_\Sigma = \sqrt{I_1^2 + I_2^2 + I_3^2}$ (without I_N)

$S_\Sigma = U_\Sigma \cdot I_\Sigma$

$P_\Sigma = P_1 + P_2 + P_3$

$Q_\Sigma = \sqrt{S_\Sigma^2 - P_\Sigma^2}$ (per DIN)

$Q_\Sigma = Q_1 + Q_2 + Q_3$ (others)

$PF_\Sigma = P_\Sigma / S_\Sigma$

2.4 Possible A2000 Parameter Settings

Inputs 4 or 3-Wire Connection	Primary Transformer Phase Conductor	Secondary Transformer Phase Conductor	Transformer Primary Current	Transformer Secondary Current	Synchronization Pulse
	100 V ... 750 kV	100 V ... 500 V	1 A ... 150 kA	1 A, 5 A	external or internal: 1 ... 60 minutes
Relay 1, 2 Max, Min	Source	Limit Value	Hysteresis	Delay	Alarm Memory
	1) 4)	2)	0 ... 9999 Digit	0 ... 30 min	off, on
Analog Outputs 1 ... 4	Source	Output	Start Source	End Source	
	1) 3)	0 ... 20 mA 4 ... 20 mA –20 ... +20 mA	2)	2)	
Pulse Outputs S01, S02	Source	Energy Type	Energy Direction	Pulse Rate	Tariff
	L1, L2, L3, Σ	Active, Reactive Energy	Import, Export	1... 5000 pulses/kWh (MWh) 1... 5000 pulses/kVArh (MVArh)	High, low tariff
Display	Brightness 0 ... 7	Filter 0 ... 30 s			
Interfaces RS-232, RS-485	Address	Baud Rate		Parity	Protocol
	0 ... 254	1200, 2400, 4800, 9600, 19200		Even, odd, space, no	E244, 870, Mod1, Mod2
Energy Meter	Mode			Swith-over high/low tariff	
	L123 / LTHT 5)			Clock / Synchr. input	
Reactive Power	per DIN / with +/- sign / for Compensation				

1) Possible sources (see below)
2) Limits are dependent upon the selected transformation ratio at the voltage or current transformer
3) Interval –1 applies to P_{int}, Q_{int} or S_{int} (for recording max. values)
4) Interval 0 applies to P_{int}, Q_{int} or S_{int} (current shutdown interval for shutdown options)
5) L123 = individual phases L1, L2, L3; LTHT = low tariff high tariff

Possible Parameter Setting, Data Logger

Trigger: relay 1, relay 2, both, off	Pretrigger: 0%, 25%, 50%, 75%	Disable Trigger: external (synchronizing input), off
Sampling Time: 0,3 s, 0,6 s, 1 s, 2 s, 5 s, 10 s, 15 s, 30 s, 1 min, 2 min, 5 min, 10 min, 15 min, 30 min	Storetime: 1 min, 2 min, 5 min, 10 min, 15 min, 30 min, 1 h, 2 h, 4 h, 8 h, 12 h, 1 day, 2 day, 4 day	Storemode: cyclic, once
Trace 1 ... 12: Source, off		

Possible Sources for Relays, Analog Outputs and Logger

	U Δ	U ⅄	I	I_{avg}	P	Q	S	PF	Frequency	P_{int}	Q_{int}	S_{int}	Ext
Source	U12	U1	I1	$I1_{avg}$	P1	Q1	S1	PF1	f	$P_{int\Sigma}$	$Q_{int\Sigma}$	$S_{int\Sigma}$	Actuation via interface (not for logger)
	U23	U2	I2	$I2_{avg}$	P2	Q2	S2	PF2					
	U31	U3	I3	$I3_{avg}$	P3	Q3	S3	PF3					
	$U_{\Delta mean}$	UΣ	IΣ	$I\Sigma_{avg}$	PΣ	QΣ	SΣ	PFΣ					
	—	—	In	In_{avg}	—	—	—	—					
	for all Phases (only for Relays)												

Additional Sources for Logger

	EP	EQ	I hd	U hd
Source	EP1 / $EP\Sigma_{L-}$	EQ1 / $EQ\Sigma_{L-}$	I thd I 1.hd . . . I 15.hd	U thd U 1.hd . . . U 15.hd
	EP2 / $EP\Sigma_{L+}$	EQ2 / $EQ\Sigma_{L+}$		
	EP3 / $EP\Sigma_{H-}$	EQ3 / $EQ\Sigma_{H-}$		
	EPΣ / $EP\Sigma_{H+}$	EQΣ / $EQ\Sigma_{H+}$		

2.5 Factory Default Instrument Parameters

Inputs	Primary Transformer Phase Conductor	Secondary Transformer Phase Conductor	Transformer Primary Current	Transformer Secondary Current	Synchronization Pulse
4-Wire	500 V	500 V	5 A	5 A	Internal, 15 minutes
	Source	Limit Value	Contact Type	Hysteresis, Delay	Alarm Memory
Relay 1	I1	5 A	Max	0	off
Relay 2	U1	240 V	Max	0	off
	Source	Output	Start Source	End Source	
Analog Output 1	PΣ	4 ... 20 mA	0 W	2000 W	
Analog Output 2	QΣ	4 ... 20 mA	0 VAr	1000 VAr	
Analog Output 3	I2	4 ... 20 mA	0 A	5 A	
Analog Output 4	U2	4 ... 20 mA	0 V	250 V	
	Source	Energy Type	Energy Direction	Pulse Rate	Tariff
S01	EPΣ	Active Energy	Import	10 pulses/kWh	High tariff
S02	EPΣ	Active Energy	Export	10 pulses/kWh	High tariff
Display	Brightness 5	Filter 0			
RS-232, RS-485	Baud Rate 9600	Address 250	Parity Even	Protocol E244	
Energy Meter	Mode LTHT				
Reactive Power	per DIN				

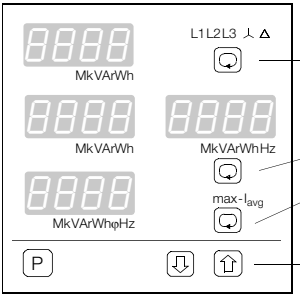
Factory Default Data Logger Parameters

Trigger: off	Pretrigger: 50%	disable Trigger: off
Sampling time: 0.3 s	Storetime: 1 min	Storemode: once
Trace 1 ... 12: all off		

This table applies to the setting: “Set – set default”.

3 Operating the A2000

3.1 Control Panel



T1: select phase L1, L2, L3

T2: selection of measured quantities: voltage, current, power, energy, ...

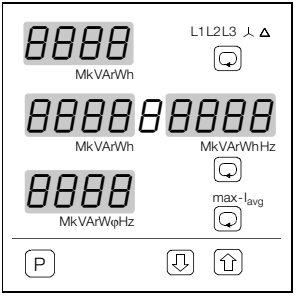
T3: max: Max. value display for desired quantities
I_{avg}: Display mean current value
max–I_{avg}: Display averaged mean current value
$T3_{long}$: Delete max. values

T⇩+T⇧: Delete limit value relay alarms

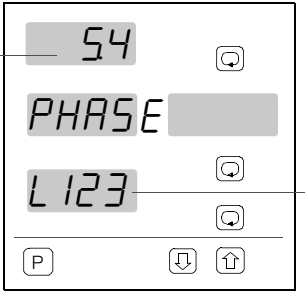
P_{long}: Enter parameters configuration (press & hold ≥ 2 seconds)

3.2 Response After Auxiliary Power is Switched On

Segment Test → Display of phase sequence and connected phases → Display Menu



Software Version (Example)



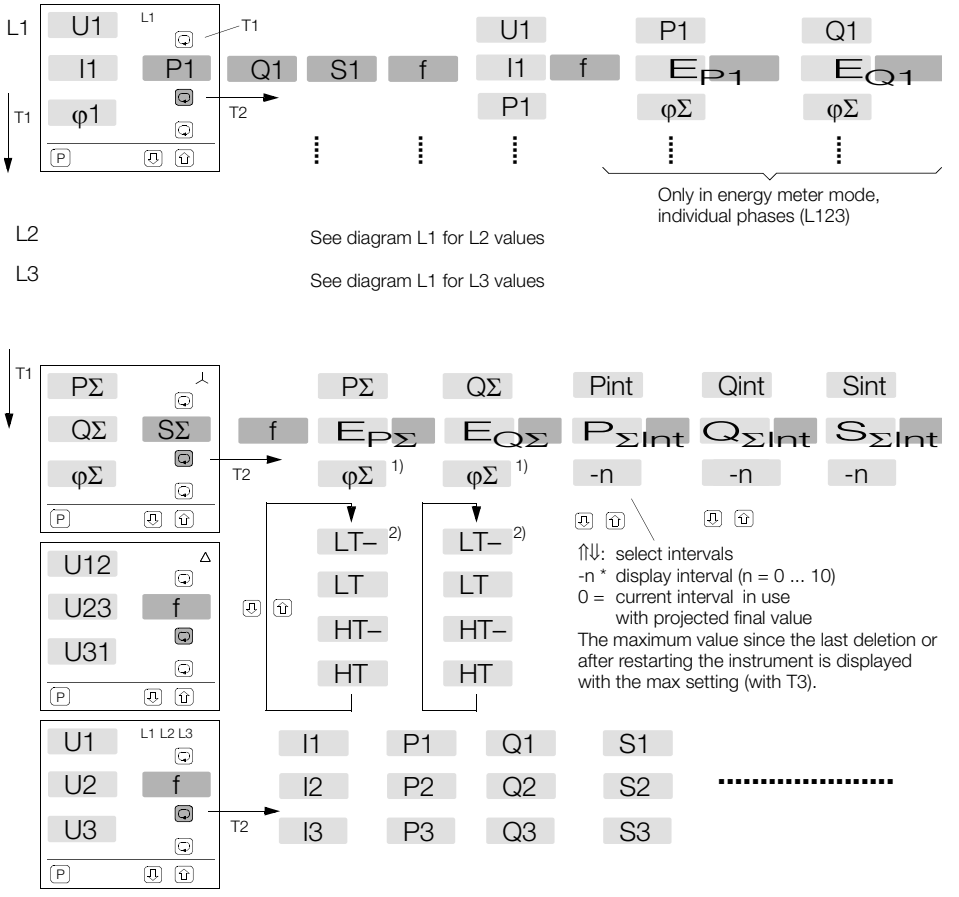
L123 Sequence OK

L132 Sequence wrong

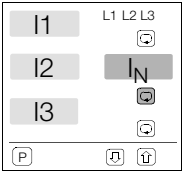
L--- Other connection or no voltage on at least one phase

The operating mode displayed prior to shutdown is displayed when the instrument is switched on again.

3.3 Menu Display for Measurements in 4-Wire Systems



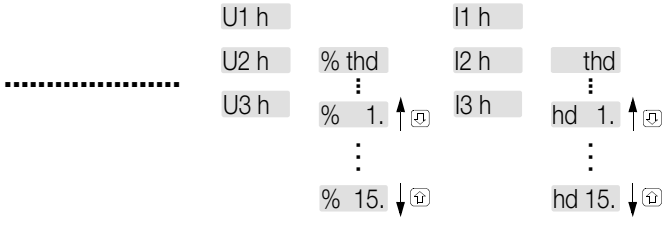
If a rotating field is established at the U or I inputs of the A2000, the neutral conductor current is displayed instead of the frequency.



L1, L2, L3, ⅄, △ and L123 comprise 6 display groups. If a given group is exited, the current display mode is stored to memory and is re-initialized when the group is queried again.

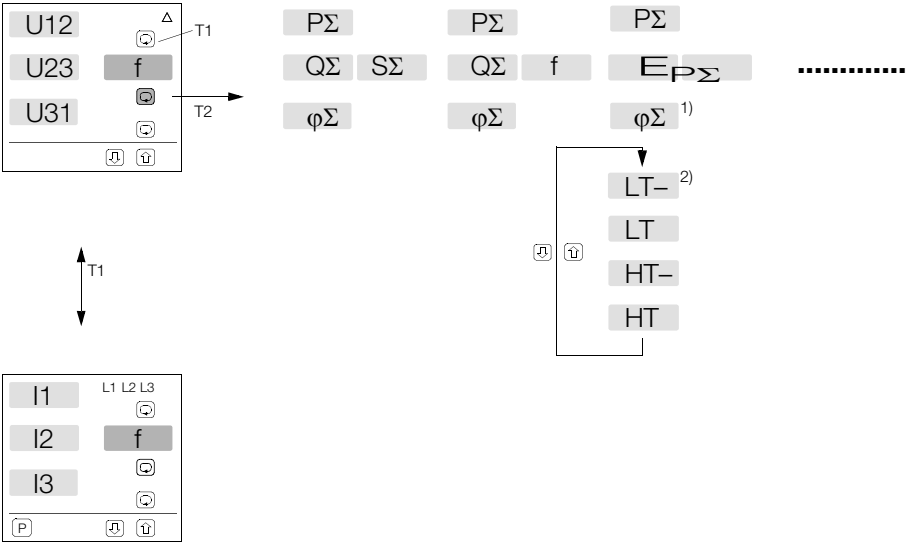
1) in energy meter mode L123
2) in energy meter mode LTHT

LT–	Low Tariff Export
LT	Low Tariff Import
HT–	High Tariff Export
HT	High Tariff Import

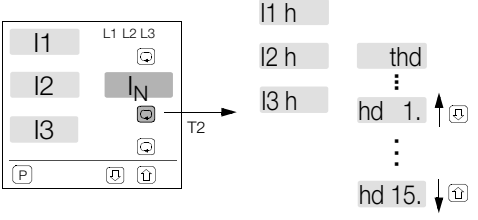


When displaying the maximum values of the harmonic, press key P to indicate the time and date when the respective maximum value occurred. (Function only available for version with data logger)

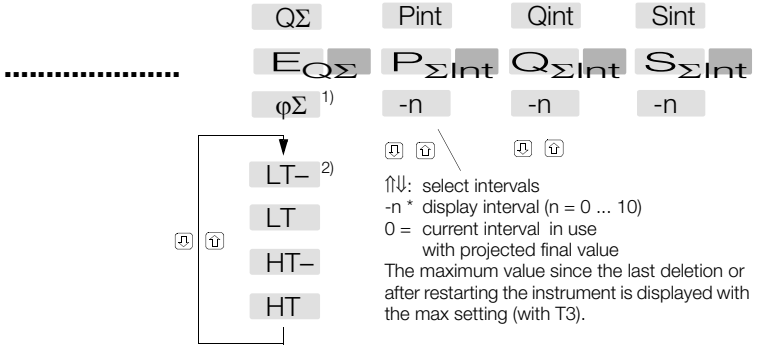
3.4 Menu Display for Measurements in 3-Wire Systems



If a rotating field is established at the U or I inputs of the A2000,
the neutral conductor current is displayed instead of the frequency.



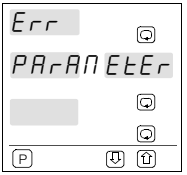
When displaying the maximum values of the harmonic, press key [P] to indicate the time and date when the respective maximum value occurred. (Function only available for version with data logger)



1) in energy meter mode L123
2) in energy meter mode LTHT

LT–	Low Tariff Export
LT	Low Tariff Import
HT–	High Tariff Export
HT	High Tariff Import

3.5 Error Messages



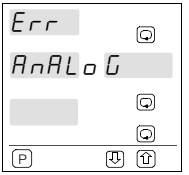
Parameters Error

One or more parameters have been irreparably corrupted.

Remedy: Enter P long configurations menu.

SET USER restores the user parameter set which has been stored to memory.

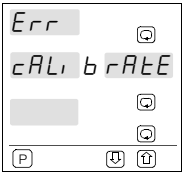
SET DEFAULT restores all factory default parameters.



Error at Analog Component

Check the measuring voltages with a multimeter in the direct current measuring range to see whether or not they demonstrate a direct current component of greater than 6 V.

If this is not the case, the analog component is defective. Send the instrument to our service department.



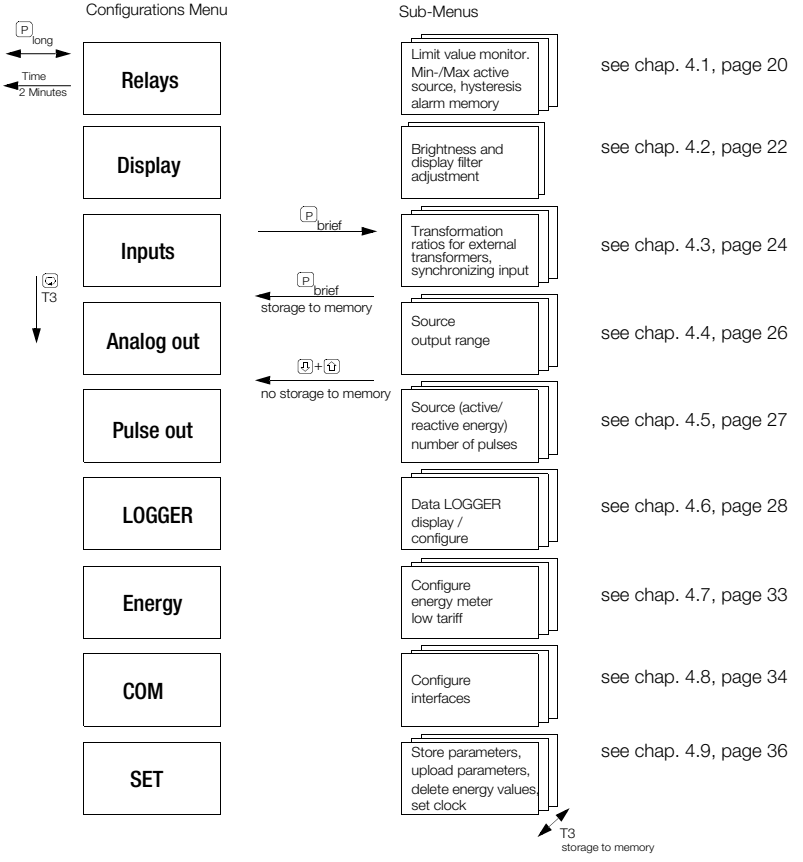
Calibration Error

The calibration values in the EEPROM have been corrupted.

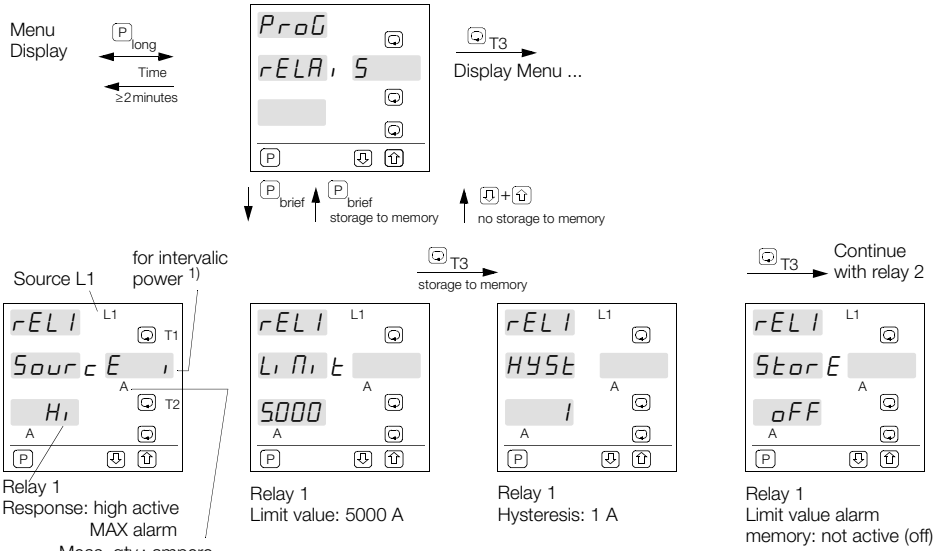
Send the instrument to our service department.

4 Configuring the A2000

Configuration changes are only possible if the 'LOCK' DIP switch is in the 'off' position.



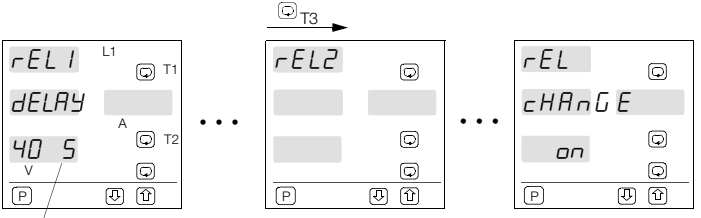
4.1 Configuring the Limit Value Relays



T1: Source Selection	⇩⇧: Value Settings			⇩⇧: Value Settings	⇩⇧: Value Settings
L1, L2, L3 Individual Phases					
L12,L23, L13 Phase-to-phase voltage	Hz:	40.00	... 70.00	0, 1, ... 9999 Digits	Alarm memory on = active off = not active In the display mode, a stored alarm is (simultaneously) deleted with ⇩⇧.
⊥ Collective Values	V, A:	1	... 9999 2)		
L123 Neutral Conductor Current	W, ...				
L123 ⊥ for all Phases		-9999	... 9999 2)		
T2: Meas. Quantity Selection	PF:	0.01c	... 0.99c ...		
V_{Δ}, V, A, A_{AVG}, W, VAr, VA, φ, Hz, Wi, VAri, VAi, external			... 1.00 ...		
		0.99L	... 0.01L		
⇩⇧: Value Settings					
Limit values: high / low active					

1) The source is relative to the current (–0) interval value ($P_{\Sigma int}$, $Q_{\Sigma int}$, $S_{\Sigma int}$) for intervalic power
2) Decimal point depending upon settings of the transformation ratio

Example: Limit value relay 2, but with other quantities and values.



Relay 1
Delay 40 s

Relay 2
same as Relay 1

⇩⇧: Value setting on/dip disables changes to relay parameters:

⇩⇧: Value setting

0
1, 2, 3, 5, 8, 15, 25, 40 s
1, 2, 3, 5, 8, 15, 30 min

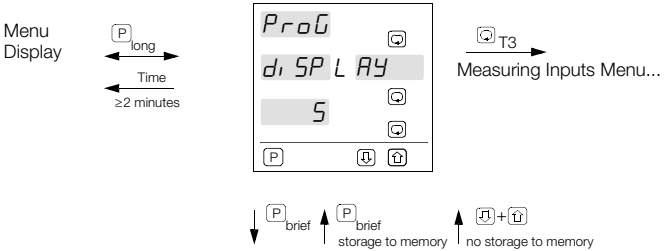
Changes to relay parameter settings can be either disabled or enabled with the “LOCK” DIP switch. For example:

1. Enable changes to all parameters:
   ’LOCK‘ = position oFF, rel change = dip or on
2. Disable changes to all parameters:
   ’LOCK‘ = position on, rel change = dip
3. Disable changes to all parameters
   except for relay parameters:
   ’LOCK’ = position on and rel change = on

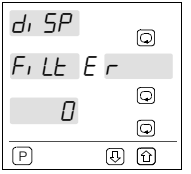
rel change can only be set to “on” if “LOCK” has previously been set to oFF.

4.2 Adjustment of Display Brightness and Filter

Adjusting display brightness



Adjusting display filter



Parameters for display brightness

⇩⇧: Adjustment of values	The values are adopted immediately upon entry. For permanent setting, however, storage to memory is recommended.
0 ... 7	
0 minimum brightness	
7 maximum brightness	

Parameters for display filter

⇩⇧: Adjustment of values

Time constant τ in s
0 ... 30

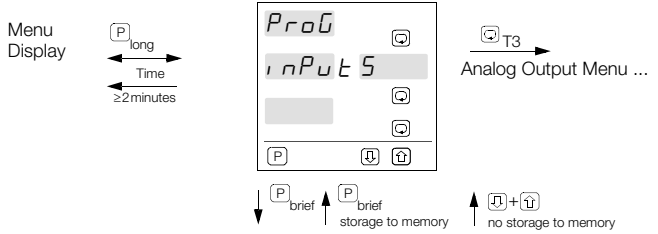
0 no filter effect

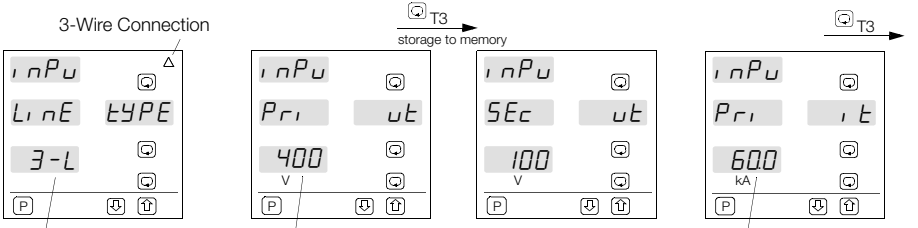
30 maximum filter effect

The display filter is a software filter which acts as a lowpass function with the time constant τ.
A time constant between 0 and 30 s can be set to stabilize the display in the event of fluctuating input signals or interfering signals. If an input signal soars abruptly, the displayed value adjusts only gradually to the actual value, in line with the selected time constant. After 5 τ almost 100 % of the input signal are displayed.

Set the time constant to 0, if the changes are to be displayed immediately and in an unfiltered manner.

4.3 Measurement Inputs, Configuring the Synchronizing Input





3-wire system is connected

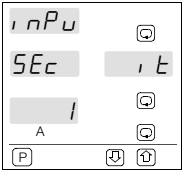
Input transformer primary voltage: 400 V phase-to-phase

Input transformer secondary voltage: 100 V phase-to-phase

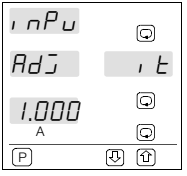
Input transformer primary current: 60.0 kA

⇩⇧: Value Settings 4L and display of ⅄ for 4-wire non-balanced load 3L and display of △ for 3-wire non-balanced load 3L-1 and display of △ for one current transformer 3L13 and display of △ for one current transformer and one phase-to-phase voltage 4L13 and display of ⅄ for 4-wire non-balanced load and open-Y connection (see chapter 2.2)	⇩⇧: Value Settings 100 V ... 700 V in 1V steps 500 V ... 750 kV in 100 V steps	⇩⇧: Value Settings 100 V ... 500 V in 1 V steps	⇩⇧: Value Settings 1 A ... 150 kA 5 A steps for I_t < 5kA 50A steps for I_t > 5kA 500A steps for I_t > 50kA

T3

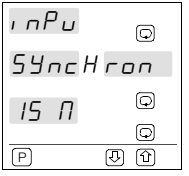


Input transformer
secondary current: 1.00 A



Input transformer
adjustment
current transformer

Line frequency
synchronization



Synchronizing pulse
every 15 minutes

⇩⇧: Value Settings

1 or 5 A

⇩⇧: Value Settings

0.900 ... 1.100

⇩⇧: Value Settings

Auto All phases, voltage and current are scanned.

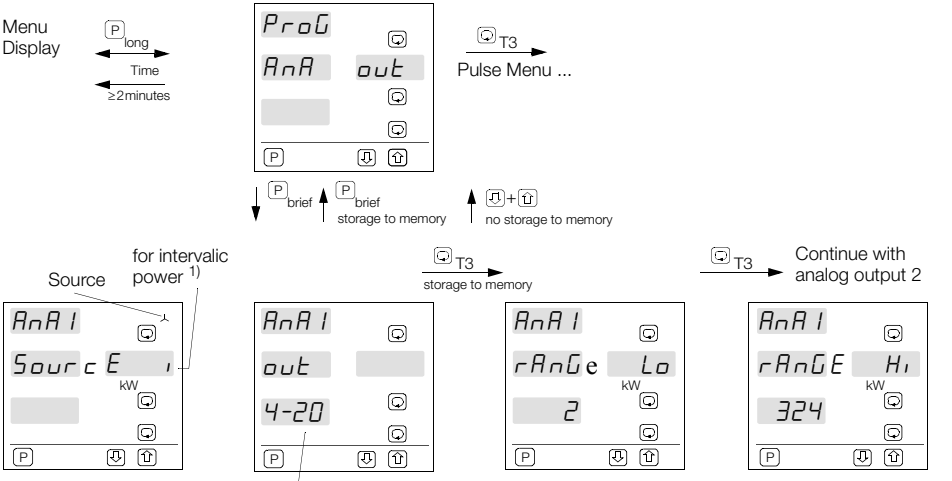
U1-3 Only voltages are used.

⇩⇧: Value Settings

external, 1 ... 60 minutes

EXt ext. synchronizing pulse to synchronizing input, or internal with selection of interval from 1 to 60 min.

4.4 Configuring the Analog Outputs (not with Profibus-DP)



Source for analog output 1

Analog Output 1
Voltage or current output, depends on DIP switch setting

Analog Output 1
Zero point: 2 kW

Analog Output 1
Final value: 324 kW

T1: Source Selection
L1, L2, L3 Individual phases
L12,L23, L13 Phase-to-phase voltage
⅄ Collective Values
L123 Neutral conductor current

T2: Meas. Quantity Selection
V_{Δ}, V, A, A_{AVG}, W, VAr, VA, φ, Hz, Wi, VAri,VAi, external

: Value Settings
4-20 = 2-10V or 4-20mA

Output Quantities		
Display	Volt	mA
0-20	0-10	0-20
4-20	2-10	4-20
2020	±10	±20

DIP A1: U=on I=on
I=off U=off
The appropriate DIP switches must be set correctly!

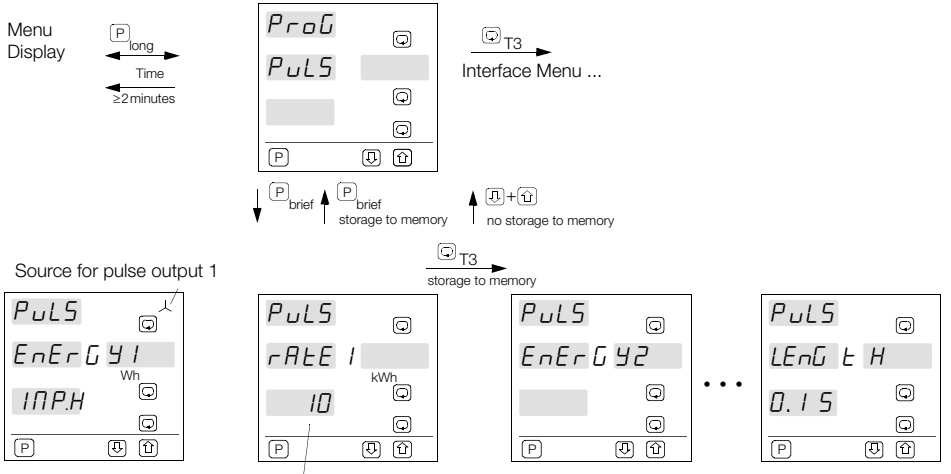
: Value Settings
0 ... 9999
for P:
–999 ... 9999

: Value Settings
0 ... 9999
for P:
–999 ... 9999

The same windows and values apply to analog output 2.
Analog outputs 3 and 4 may also be optionally included.

1) The source is relative to the latest completed interval value ($P_{\Sigma int}$, $Q_{\Sigma int}$, $S_{\Sigma int}$) for intervalic power

4.5 Configuring the S0 Pulse Outputs



T1: Source Selection
L1, L2, L3,
T2: Quantity Selection
Active/reactive energy
kWh, kVArh,
Mwh, MVArh

: Value Settings

: Value Settings

1 ... 5000 pulses / kWh (MWh)
or kVArh (MWArh)
Resolution:
1 pulse if rate < 1000
10 pulses if rate ≥ 1000

: Value Settings

0.1 s ... 0.8 s

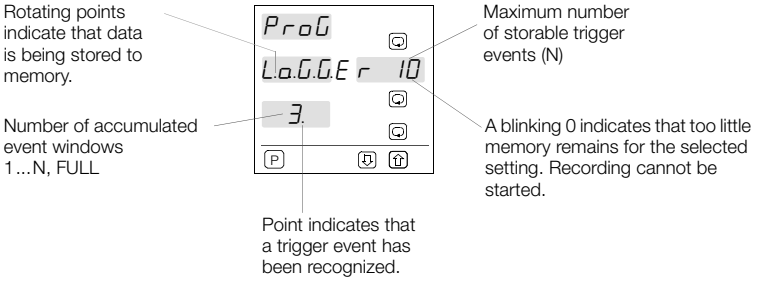
INP.L = import, low tariff; INP.H = import, high tariff, Import energy from the system (positive sign)

EXP.L = export, low tariff; EXP.H = export, high tariff, Export energy to the system (negative sign)

The import and export settings are without significance for reactive energy, which is always indicated with a positive value.

4.6 Data Logger Display and Configuration

Display for Trigger Source Setting rel 1, rel 2, both



If the data logger is not recording, the display blinks alternately: Logger/stop

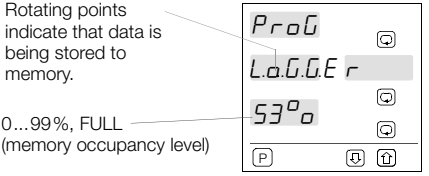
Attention:
If the real-time clock has stopped, the display blinks alternately: Logger/time date

Operation of the data logger is interrupted if:

- Memory is full and the memory mode is set to „once“
- If a data logger parameter is changed (display: Logger/stop)
- The data logger is started with ⇧ long
- The data logger is stopped with ⇩ long

Attention: Memory is cleared when the data logger is started!

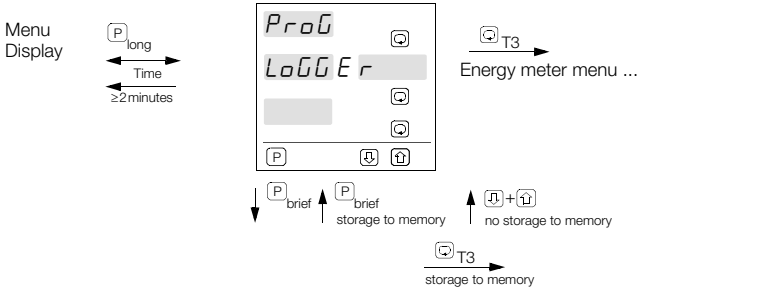
Display for parameter setting Trigger Source OFF



If the power supply is interrupted during a recording session, the A2000 supplements the outstanding samples after restarting the instrument:

- A value of „0“ is entered for all measured quantities, except for energies (last meter reading)
- If a trigger source has been selected, the beginning of power supply interruption is always considered to be a trigger.
- If the trigger source has been set to „OFF“, the beginning of power supply interruption is recorded in the time stamp of the last trigger. (Time stamp of the first trigger = start of recording)
- If power supply interruption takes longer than the remaining storage rate, the current window is completed and a new untriggered window is produced if a trigger source has been selected.
-

In the case of trigger source „OFF“, cyclical memory mode and a power supply interruption which takes longer than the storage rate, the complete memory will be overwritten.

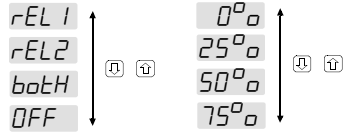


Trigger source setting

Trigger source setting

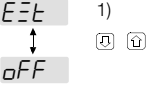
External trigger disabling when trigger source ≠OFF

Data logger Start/Stop when trigger source ≠ OFF



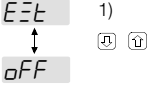
If the trigger source is set to OFF, data is recorded continuously to memory. For data logger an alarm memory is not relevant.

Triggering can be disabled via the synchronization input.

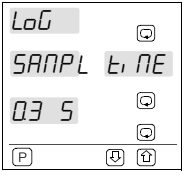


1) If the external input is used as a synchronizing input, no switching to external is possible. (Display: -no-)

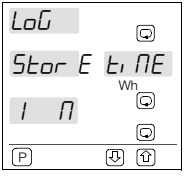
The data logger can be launched and stopped via the synchronization input. Start and Stop via keyboard are not possible in this case.



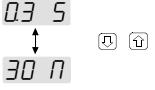
1) If the external input is used as a synchronizing input, no switching to external is possible. (Display: -no-)



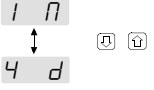
Sampling time



Storage rate



*S*ec: 0.3, 0.6, 1, 2, 5,10, 15, 30
*M*in: 1, 2, 5, 10, 15, 30



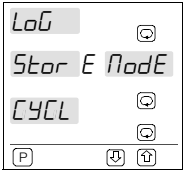
*M*in: 1, 2, 5,10, 15, 30
*H*our: 1, 2, 4, 8, 12
*d*ay: 1, 2, 4

Sampling time T_{sa}, storage time T_{st} and number of traces ΣTr result in a maximum number of storable trigger events N with a memory capacity of 512 kByte

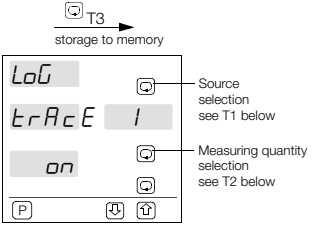
$$N = (250\,000 \times T_{sa}) / (T_{st} \times \Sigma Tr)$$

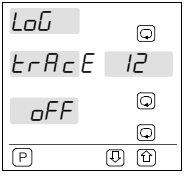
(Round N up to whole number: Nmin = 1, Nmax = 99)

If the display blinks when the value is selected, the memory is too small for the selected setting.

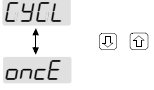


Memory is overwritten cyclically when full.





Selection of max. 12 quantities to be recorded



The data logger is stopped when memory is full.

T1: Source Selection

L1, L2, L3	Individual phases
L12,L23, L13	Phase-to phase voltage
⅄	Collective Values
L123	Neutral conductor current

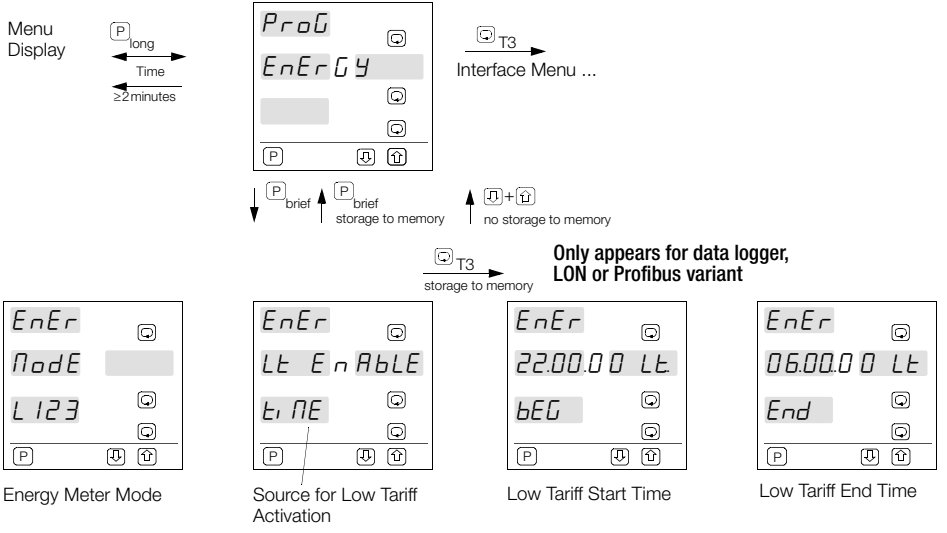
T2: Meas. Quantity Selection

V_{Δ}, V, A, A_{AVG}, W,
VAr, VA, φ, Hz, Wi,
VAri,VAi, Wh,
VArh, Ahd, Vhd, OFF

The source is relative to the latest completed interval value for intervalic power ($P_{\Sigma int}$, $Q_{\Sigma int}$, $S_{\Sigma int}$)

If source is set to “off”, all subsequent traces are of no significance (menu jumps to start trigger).

4.7 Configuring the Energy Meter Mode/Low Tariff



: Mode setting
L123 = Individual phases
LtHt = Low tariff high tariff (import / export) Active and reactive energy

This setting only refers to the energy meters and not to the pulse outputs.
After switch-over it is advisable to delete the meter readings, see chapter 4.9 on page 36.

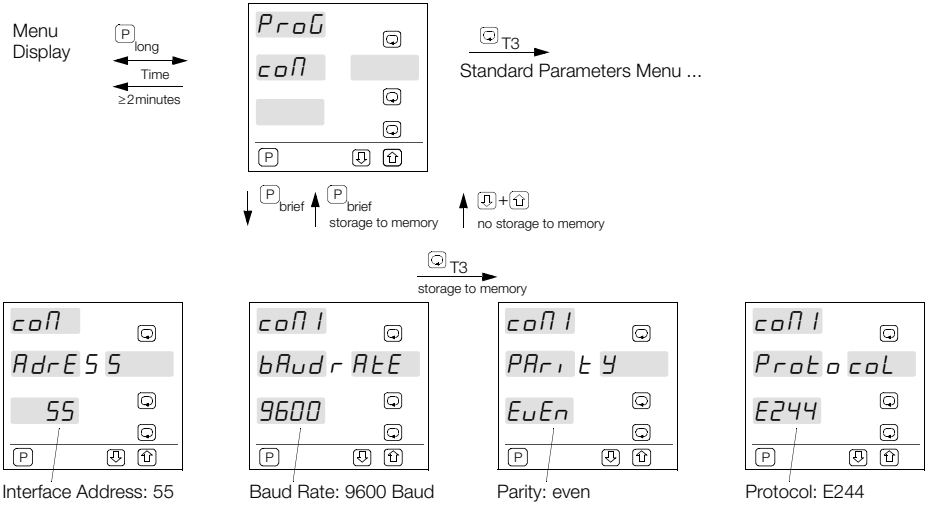
: Source setting

t1 ME=Internal clock with data logger.
noLt= Variant without data logger does not provide for low tariff function via clock.
EXt= Switch-over via synchronizing input
Lt = input short-circuited
Ht = input open

Setting same as for clock, see chapter 4.9 on page 36!!
(seconds remain at zero)

If only high tariff is requested, select the same value for start time and end time.

4.8 Interface Configuration



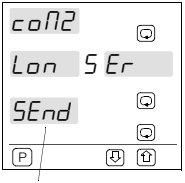
: Value Settings 0 ... 254 (for variants with Profibus-DP: all addresses > 126 are interpreted as initialization address 126!)	: Value Settings 1200, 2400, 4800, 9600, 19.20k	: Value Settings EUEn = even odd = odd SPcE = space no = no	: Configuring the Communications Protocol E244 = DIN draft 19244 870 = EN 60870 Nod1 = Modbus new version Nod2 = Modbus previous version

These values apply to both the RS485 and the RS232. However, both interfaces cannot be operated simultaneously.

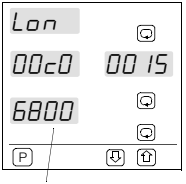
Only appears for LON interface variant:

T3 storage to memory

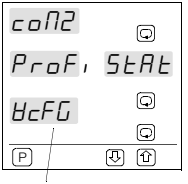
Only appears for Profibus DP variant:



LON service, only if key is pressed and held



LON ID: 00c000156800



Status: Wait Config

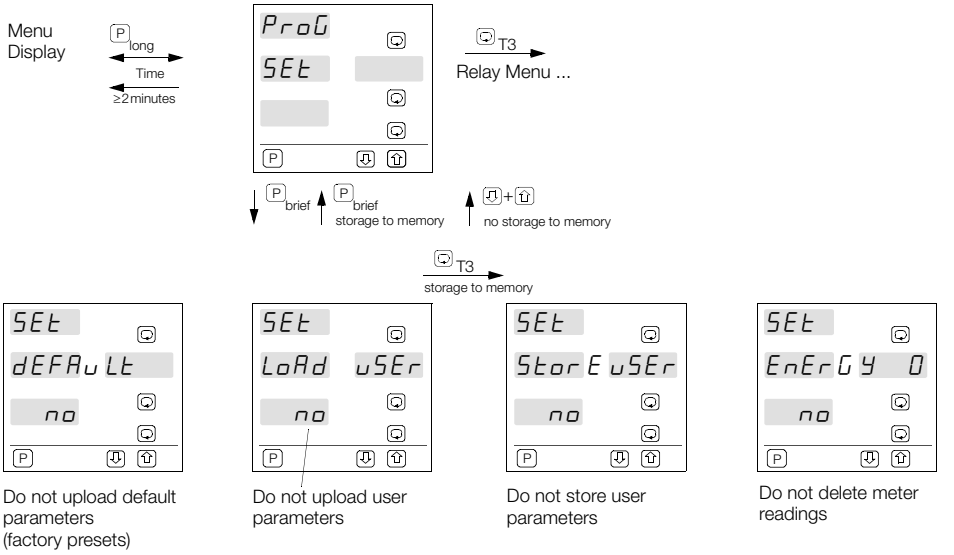
⇩⇧: LON service

⇩⇧: Status:

WcFG = Wait Config
WPAr = Wait Parameter
dAt.E = Data Exchange
Err = Error

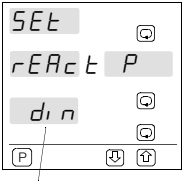
Only one of these two variant options can be installed. The RS-485 interface is omitted for the LON interface variant, and the RS-485 interface with analog outputs is omitted for the Profibus DP variant.

4.9 Uploading and Deleting Parameters, Setting the Clock

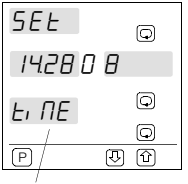


T3
storage to memory

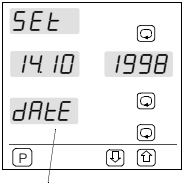
Only appears for data logger, LON or Profibus variant



Selection: with or without + or - sign



Selection and storage of hours and minutes (corresponding display blinks)



Selection and storage of day, month and year

⇩⇧: Status:

- di n = Reactive power per DIN 40110 without + or – sign
- Si Gn = Reactive power with + or – sign
- CoMP = Compensating reactive power
- FErr = Ferraris meters

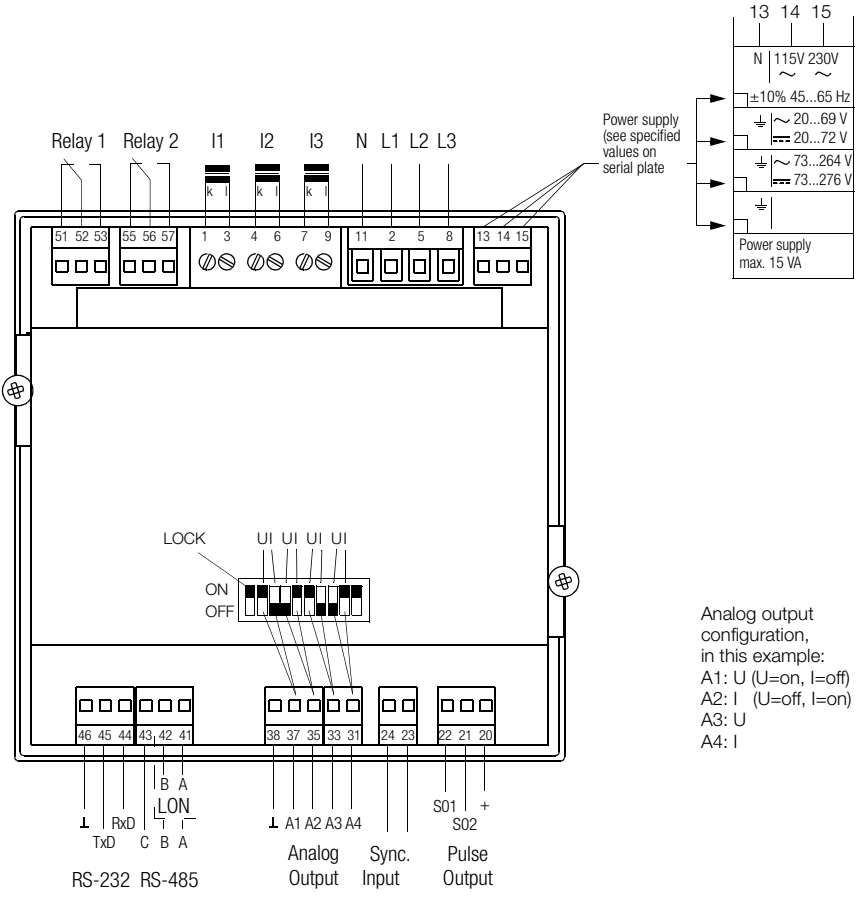
⇩⇧: Selection:

Adjust hours and minutes (seconds are set to zero when time is saved to memory)

⇩⇧: Selection:

Adjust day, month and year

5 Electrical Connections and Circuits



Analog output configuration, in this example:
A1: U (U=on, I=off)
A2: I (U=off, I=on)
A3: U
A4: I

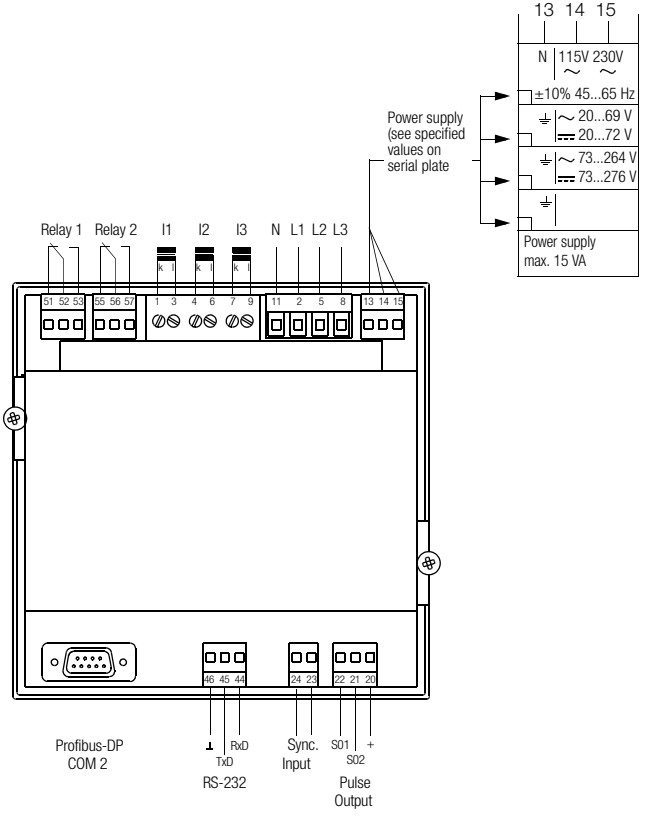
RS-232 Pin Assignments

Sub-D plug at PC				A2000
No. of pins	25	9		RS-232
DCD	8	1		
RxD	3	2	----------	TxD
TxD	2	3	----------	RxD
DTR	20	4		
Gnd	7	5	----------	⊥
DSR	6	6		
RTS	4	7		
CTS	5	8		

RS-485 Pin Assignments (not included with LON variant)

Master		A2000				Master	
A	-------	A	-------	...	-------	A	Matching
B	-------	B	-------	...	-------	B	resistor
C	-------	C	-------	...	-------	C	

Profibus DP connection (optional)



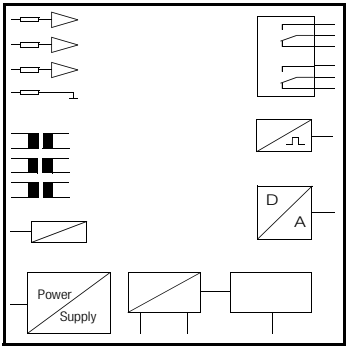
Electrically Isolated Circuits

Voltage Inputs L1 L2 L3 N

Current Inputs I1 I2 I3

Synchronizing Input

Power Supply (per serial plate specs)
Attention:
The device is not equipped with an integrated circuit-breaker



Limit Value Relay 1

Limit Value Relay 2

Pulse Outputs
S01, S02 (optional)
common reference point +

Analog Outputs
A1, A2, (A3, A4 optional)
common reference point ⊥

RS232, RS485 Interface

LON or Profibus-DP-Interface (optional)

6 Interface Description

The following sub-chapters include a brief description of the interfaces.
Please refer to the following manuals if you require a detailed description of the interface protocols:

Communications Protocol per DIN draft 19244	Reference No. 3-349-125-03
Communications Protocol per EN 60870	Reference No. 3-349-128-03
Communications Protocol per Modbus – Mod 1 –	Reference No. 3-349-225-03
Communications Protocol per Modbus – Mod 2 –	Reference No. 3-349-129-03
LON Interface	Reference No. 3-349-091-03
Profibus Interface	Reference No. 3-349-092-03

6.1 General

The instrument is equipped with an RS232, as well as an RS485 interface as standard equipment. However, only one interface may be operated at any given time. If a LON interface has been installed (optional), the RS485 interface is not included. See chapter 5 on page 38 for electrical connections. If the optional Profibus DP interface has been installed instead of the LON interface, the RS-485 and the analog outputs are omitted. See the Profibus DP interface description for electrical connections.

- Char. format: 8 data bits, 1 parity bit, 1 stop bit
- Parity: even, odd, space, no
  The following settings are required in order to fulfill the requirements set forth in the respective standards:
  – DIN draft 19244: even, if operated at a modem: no
  – EN 60870: even
  – Modbus: even, odd, no

RS-232

Depending upon the driver software, it may be necessary to install jumpers at the master, e.g. DCD+DTR+DSR and RTS+CTS.

RS-485

If the RS485 interface is used, up to 32 instruments can be interconnected via the bus. In this case, all ABC terminals are connected to one another in parallel. Wiring must be carried out from one instrument to the next; star networks may not be implemented. For bus cables of greater than 5 meters in length, the bus should be terminated at both ends with a surge impedance (e.g. 200 Ω between A and B).

6.2 Communications Protocol

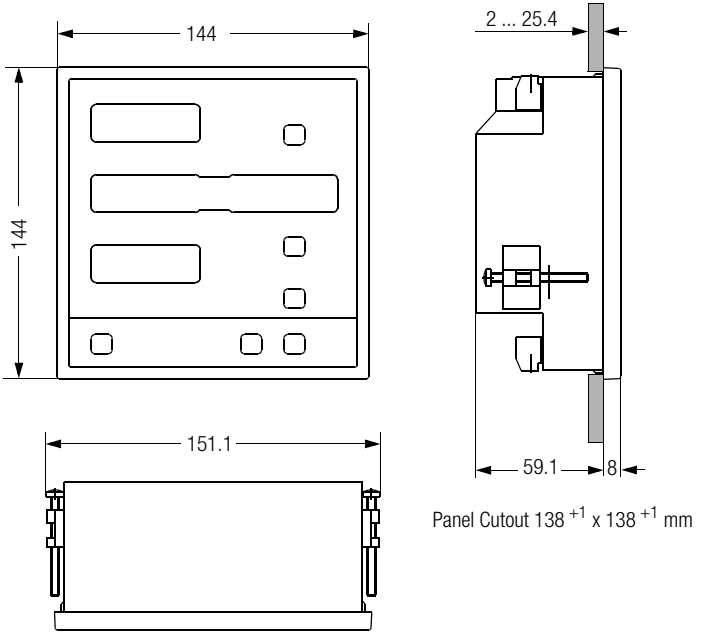
The communications protocol in accordance with DIN draft 19244, EN 60870 or the Modbus protocol is used for communications between the field control and device levels. The A2000 utilizes only a subset of the functions defined in the protocol. Separate descriptions are available for each of the individual communications protocols.

The following functions are not used: query acknowledgement for individual characters and transmission control by means of record sequence bit.

Time Response Characteristics

Ready to transmit/receive after start-up	$t_{ber} > 5$ s
Character delay time (A2000 transmitter)	$t_{zvs} < 3$ ms
Character delay time (Master)	$t_{zvm} < 100$ ms
Response delay time (A2000 transmitter)	10 ms < t_{av} < 100 ms
Query waiting time after response from A2000 (master)	$t_{aw} > 10$ ms

7 Dimensional Drawing



Panel Cutout 138^{+1} x 138^{+1} mm

All dimensions in mm

Measurement Inputs

Voltage Inputs

Phase – Phase	0 ... 500 ... 550 V, 40 ... 70 Hz
Phase – N (ground)	0 ... 290 ... 320 V, 40 ... 70 Hz
Overload	1.2-fold
Intrinsic Impedance	> 290 kΩ
Power Consumption	< 1,1 W
Current Inputs	0 ... 1 ... 1.2 A 0 ... 5 ... 6 A
Overload	1.4-fold cont. 30 A / 10 s, 100 A / 3 s
Power Consumption	< 150 mW
Sampling Rate	32 samples per period per measurement value
Measuring Error	NV = nominal value, MV = measurement value
Current	± (0.25 % of NV + 1 digit) for MV > 2 % of NV
Voltage	± (0.25 % of NV + 1 digit)
Power, Energy	± (0.5 % of NV + 1 digit)
Power Factor	± 0.02 for U, I > 10 % of NV
Frequency	± 0.02 Hz
4-Quadrant Operation	Measurement: import and export, inductive and capacitive

Interfaces

	RS-232 and RS-485 alternatively: RS-232 and LON or RS-232 and Profibus-DP
Baud Rate	1200, 2400, 4800, 9600, 19200 baud
Parity	even, odd, space, no
Protocol for RS-232 and RS-485	selectable: GMC device bus (DIN draft 19244), EN 60870 or Modbus (RTU)

Synchronizing input

On	short-circuited with R < 10 Ω
Off	open with R > 10 MΩ

Pulse Outputs

Contact	open collector
Current	ON 10 mA ... 27 mA OFF < 2 mA
External Voltage	8 ... 30 V
Pulse Duration	selectable 100 ... 800 ms
Interpulse Period	≥ 10 ms

Analog Outputs

Output Quantity	configurable
Current	
Ranges	0 – 20 mA, 4 – 20 mA, ± 20 mA
Load	max. 500 Ω
Load Effect	< 0.8 µA / Ω (0 ... 250 ... 500 Ω)
Resolution	0.1 % of control range
Error Limit	± 0.5 % of final value
Voltage	
Ranges	0 – 10 V, 2 – 10 V, ± 10 V
Load	< 20 mA
Load Effect	no effect to > 10 KΩ
Resolution	0.1 % of control range
Error Limit	± 1.0 % of final value

where control range = upper range limit – lower range limit, e.g. 1200 W = 1500 W – 300 W (freely selectable values)

Relay Outputs

Switching Capacity	~ / ⎓ 250 V, 2 A 500 VA / 50 W (nominal load)
Service Life	> 500000 switching cycles

Display

Type	7-Segment LED
Display Color	red
Character Height	13.2 mm
Display Range	
Energy	999999999
Power Factor	1.00
Other Quantities	9999
Internal Clock	
(only in version with datalogger, LON or Profibus)	
Accuracy	< 2.5 s/day
Power Supply	lithium cell, life cycle appr. 8 years

Power Supply

Supply Voltage	
Feature H0	230 V / 115 V ~ ± 10% 45 ... 65 Hz
Feature H1	20 ... 69 V ~ 45...450 Hz 20 ... 72 V ⎓
Feature H2	73 ... 264 V ~ 45...450 Hz 73 ... 276 V ⎓
Feature H3	20 ... 27 V ~ 45...450 Hz 20 ... 36 V ⎓
Power Consumption	max. 15 VA

The instrument is not equipped with an integrated circuit breaker. Therefore, during installation, care should be taken to ensure that

- the building where the instrument is installed includes a circuit breaker,
- the circuit breaker is positioned in close proximity to the instrument and is easily accessible to the operator,
- it is clearly marked as a circuit breaking device for the instrument.

Electrical Safety

Variants	IEC 61010-1 / EN 61010-1
Protection Class	II
Measuring Category	inputs: III, relays: II
Contamination Level	2
Operating Voltage	300 V ~ / ⎓
Test Voltage	measuring inputs: 3.7 kV
Protection	IEC 60529 / EN 60529
Front Panel	IP 52
Housing	IP 30
Terminals	IP 20

Fuses

The supply circuit is protected by an internally soldered fuse.

Feature H0	T160mA/250V
Feature H1	T1A/250V
Feature H2	T250mA/250V
Feature H3	T1.25A/250V

EMC

Interference Emission/ Interference Immunity	IEC 61326 / EN 61326

Ambient Conditions

Operating Temp.	0 ... 50 °C
Storage Temp.	– 25 ... 70 °C
Relative Humidity	75% no condensation

Housing

Front Dimensions	144 x 144 mm
Panel Cutout	138^{+1} x 138^{+1} mm
Bezel Height	8 mm
Installation Depth	59.1 mm
Weight	1 kg (without packaging)
Mounting	DIN screw clamps
Terminals	screw clamp terminal blocks

9 Maintenance – Device Return and Environmentally Sound Disposal

Maintenance

The A2000 does not require maintenance at regular intervals.

Device Return and Environmentally Sound Disposal

The A2000 is a category 9 product (monitoring and control instrument) in accordance with ElektroG (German electrical and electronic device law). This device is not subject to the RoHS directive.

We identify our electrical and electronic devices (as of August 2005) in accordance with WEEE 2002/96/EC and ElektroG with the symbol shown to the right per DIN EN 50419.

These devices may not be disposed of with the trash. Please contact our service department regarding the return of old devices (see chapter 9).

10 Repair and Replacement Parts Service DKD Calibration Lab and Rental Instrument Service

When you need service, please contact:

GMC-I Gossen-Metrawatt GmbH
Service-Center
Thomas-Mann-Strasse 20
90471 Nürnberg, Germany
Phone +49 911 86 02 - 0
Fax +49 911 86 02 - 2 53
E-mail service@gossenmetrawatt.com

This address is only valid in Germany.
Please contact our representatives or subsidiaries for service in other countries.

11 Product Support

When you need support, please contact:

GMC-I Gossen-Metrawatt GmbH
Product Support Hotline
Phone +49 911 86 02 - 500
Fax +49 911 86 02 - 340
E-mail support@gossenmetrawatt.com

Edited in Germany • Subject to change without notice • A pdf version is available on the internet

GMC-I GOSSEN METRAWATT

GMC-I Gossen-Metrawatt GmbH
Thomas-Mann-Str. 16-20
90471 Nürnberg • Germany
Phone +49 911 8602-111
Fax +49 911 8602-777
E-Mail info@gossenmetrawatt.com
www.gossenmetrawatt.com