GOSSEN METRAWATT

A2000

Multifunctional Power Meter

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 15th 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. Via the analog outputs 2 random measured quantities can be acquired by means of standard signal generator or temperatures via Pt1000 sensor. 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

Inputs

3 ea. Voltage Inputs

3 ea. Current Inputs

1 ea. Synchronizing Input

Analog Inputs In1, In2 (optional)

A2000

Outputs

2 ea. Limit Value Relays Relay 1, Relay 2

2 ea. Pulse Outputs (optional) S01, S02 S0 Standard

4 ea. Analog Outputs A1, A2 (A3, A4 optional)

Communication Interfaces

PC RS-232

Field Bus RS-485 (not used with LON)

LON (optional)

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)
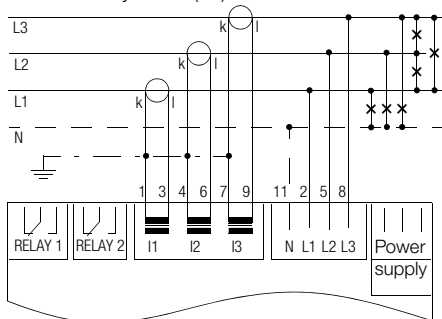
Connection with 2 current transformers
in 3-wire systems (3L)
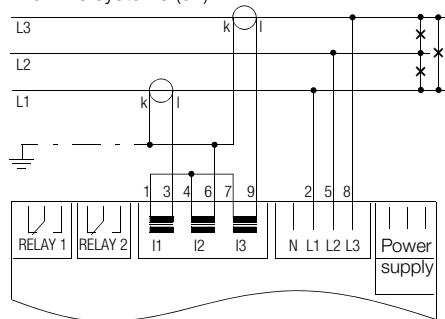
Connection with 1 current transformer
in 4-wire systems (balanced load) (3L-1)
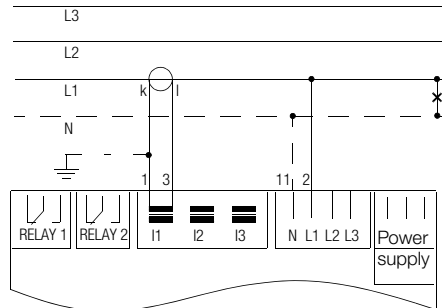
Connection with 1 current transformer
in 3-wire systems (balanced load) (3L-1)
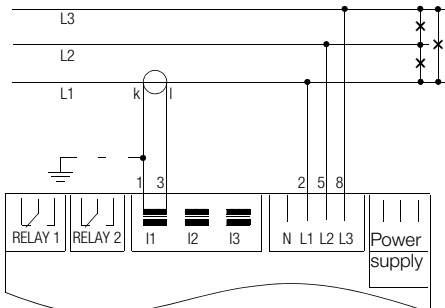
Connection with 1 current transformer
in 3-wire systems (balanced load) (3L13)

Connection with 3 current transformers
in 4-wire systems (Open Y) (4L13)
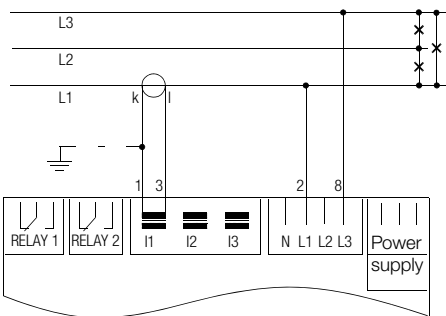
⚠ For this connection type the accuracy
values for the measurement of power, energy
and power factor are only observed in the case
of low-distortion tension. The setting „Compen-
sating reactive power" is not possible.
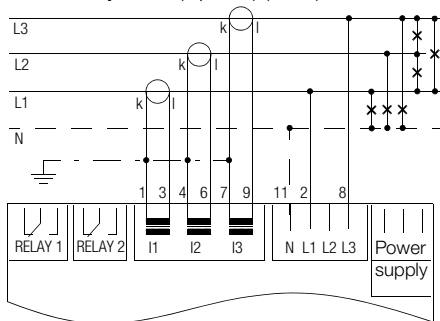
Voltage Inputs

Each voltage measurement input is provided with a safety impedance (incl. the N conductor). Measure-
ments 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 con-
nection 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 4.8 on page 35).

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.

Analog Inputs

The 2 inputs can be configured separately via DIP switch for 10 V, 20 mA or Pt1000 signal. Adjusting the possible signal input ranges as well as scaling and evaluation of measured values and the associated maximum values can be done via the operating panel and the RS232 and RS485 interfaces.

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 44 provides detailed information regarding the generation of user specific programs. The **RS485** field bus interface allows for the interconnection of up to 32 instruments.
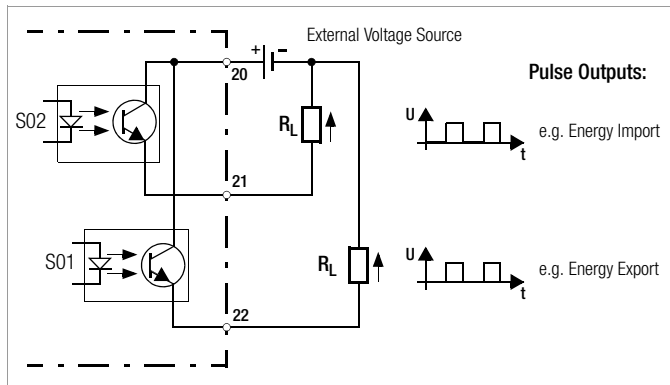
2.3 Available Measurement Data

	Individual Phases		Collective Values	
Phase Voltages	$U1 \ldots U3$	$U1_{max} \ldots U3_{max}$	U_{Σ} [4]	$U_{\Sigma\,max}$ [5]
Delta Voltages	$U12, U23, U31$	$U12_{max} \ldots U31_{max}$	$U_{\Delta avg}$ [4]	$U_{\Delta avg\,max}$ [5]
Phase Current	$I1 \ldots I3$	$I1_{max} \ldots I3_{max}$	I_{Σ} [4]	$I_{\Sigma\,max}$ [5]
Averaged Phase Current	$I1_{avg} \ldots I3_{avg}$	$I1_{avg\,max} \ldots I3_{avg\,max}$	$I_{avg\,\Sigma}$ [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	$P1 \ldots P3$	$P1_{max} \ldots P3_{max}$	P_{Σ}	$P_{\Sigma\,max}$
Reactive Power	$Q1 \ldots Q3$	$Q1_{max} \ldots Q3_{max}$	Q_{Σ}	$Q_{\Sigma\,max}$
Apparent Power	$S1 \ldots S3$	$S1_{max} \ldots S3_{max}$	S_{Σ}	$S_{\Sigma\,max}$
Power Factors	$PF1 \ldots PF3$	$PF1_{min} \ldots PF3_{min}$	PF_{Σ}	$PF_{\Sigma\,min}$

Energy Mode	L123 [1]	LTHT [2]	L123 [1]	LTHT [2]	L123 [1]	LTHT [2]
Active Energy	$E_{P1} \ldots E_{P3}$	–	–	–	$E_{P\Sigma}$	$E_{P\Sigma L-}, E_{P\Sigma L+}$ [3] $E_{P\Sigma H-}, E_{P\Sigma H+}$
Reactive Energy	$E_{Q1} \ldots E_{Q3}$	–	–	–	$E_{Q\Sigma}$	$E_{Q\Sigma L-}, E_{Q\Sigma L+}$ [3] $E_{Q\Sigma H-}, E_{Q\Sigma H+}$

	Individual Phases		Collective Values	
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, 1st ... 15th harmon.	$U1h \ldots U3h,$ $I1h \ldots I3h$	$U1hmax \ldots U3hmax,$ $I1hmax \ldots I3hmax$	–	–
In1, In2	Measured Value 1, 2 [6]	Max. Meas. Value 1, 2 [6]	—	—

[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
[6] Value range depends on configuration

- 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 $I1_{avg} \ldots I3_{avg}$, 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.

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Display of Reactive Power

$d\,i\,n$ = calculation of reactive power per DIN 40110 without + or – sign

$$Q = \sqrt{S^2 - P^2}$$

PF = cap   0   PF = ind

```
         P = -  | P = +
         Q = +  | Q = +
    E_P-            E_P+
    E_Q+   2. Q | 1. Q  E_Q+
1 ------------------------- 1
    E_P-            E_P+
    E_Q-   3. Q | 4. Q  E_Q+
         P = -  | P = +
         Q = +  | Q = +
```

PF = ind   0   PF = cap
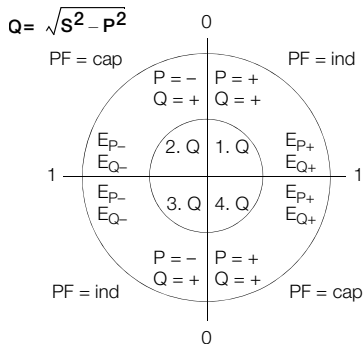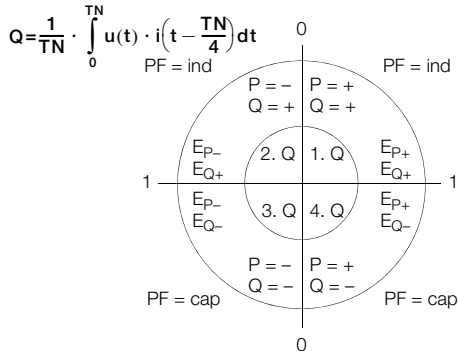
$CoNP$ = compensating reactive power
(reactive power is only produced if current and voltage have different + or - signs)

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

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

PF = 1.0   0   PF = ind

```
         P = -  | P = +
         Q = 0  | Q = +
    E_P-            E_P+
    E_Q+   2. Q | 1. Q  E_Q+
1 ------------------------- 1
    E_P-            E_P+
    E_Q-   3. Q | 4. Q  E_Q+
         P = -  | P = +
         Q = 0  | Q = -
```

PF = 1.0   0   PF = cap

$S\,i\,Gn$ = calculation of reactive power with + or–

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

PF = ind   0   PF = ind

```
         P = -  | P = +
         Q = +  | Q = +
    E_P-            E_P+
    E_Q+   2. Q | 1. Q  E_Q+
1 ------------------------- 1
    E_P-            E_P+
    E_Q-   3. Q | 4. Q  E_Q-
         P = -  | P = +
         Q = -  | Q = -
```

PF = cap   0   PF = cap
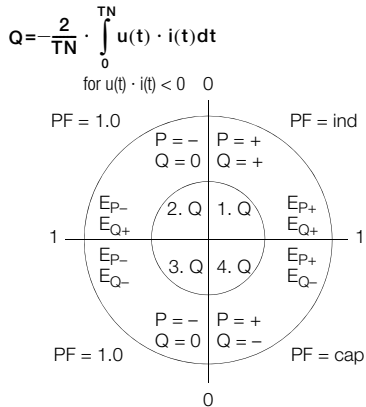
Calculation of Collective Values

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

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

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

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

$$P_{\Sigma} = P_1 + P_2 + P_3$$

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

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

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

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 ... 800 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 1) 4)	Limit Value 2)	Hysteresis	Delay	Alarm Memory
			0 ... 9999 Digit	0 ... 30 min	off, on
Analog Outputs 1 ... 4	Source 1) 3)	Output 0 ... 20 mA 4 ... 20 mA −20 ... +20 mA −10 ... +10 mA	Start Source 2)	End Source 2)	
Analog Inputs In1, In2	Source	Range of Source	Scale Range		Position of Decimal Point
			Lower Limit	Upper Limit	
	Standard Signal	0 ... 20 mA/0 ... 10 V 4 ... 20 mA/2 ... 10 V −20...+20 mA/0...10 V −10...+10 mA/−5...+5 V	−1999 ... +9999	−1999 ... +9999	1999, 199.9 19.99 1.999
	Pt1000	185.6 ... 3933 Ω	−200 °C / −328 °F −199.9 °C/°F	860 °C / 1580 °F 859.9 °C / 999.9 °F	199 199.9
		Offset	−100 °C/°F	+100 °C/°F	99 / 99.9
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

	$U \triangle$	$U \perp$	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	$P_{int\Sigma}$	$Q_{int\Sigma}$	$S_{int\Sigma}$	Action via interface (not for logger)
	U23	U2	I2	$I2_{avg}$	P2	Q2	S2	PF2					
	U31	U3	I3	$I3_{avg}$	P3	Q3	S3	PF3					
	$U_{\triangle mean}$	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 / EPΣ_{L-}	EQ1 / EQΣ_{L-}	I thd	U thd
	EP2 / EPΣ_{L+}	EQ2 / EQΣ_{L+}	I 1.hd	U 1.hd
	EP3 / EPΣ_{H-}	EQ3 / EQΣ_{H-}	. . .	. . .
	EPΣ / EPΣ_{H+}	EQΣ / EQΣ_{H+}	I 15.hd	U 15.hd

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	
Analog Inputs	Source	Range of Source	Scale Range		Position of DecimalPoint
			Lower Limit	Upper Limit	
In1	±24 mA	4 ... 20 mA	0	5000	1999,
In2	±24 mA	4 ... 20 mA	0	2500	1999,
	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 and/or measuring input In1, In2

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)

$L\,123$	Sequence OK
$L\,132$	Sequence wrong
$L---$	Other connection or no voltage on at least one phase
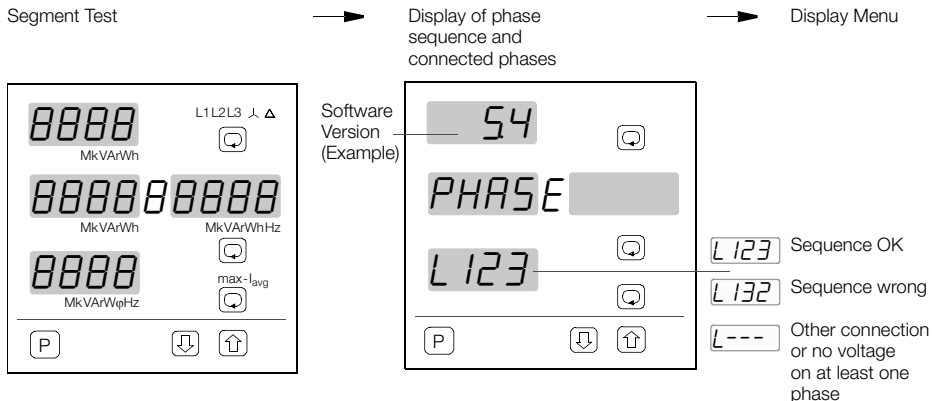
The operating mode displayed prior to shutdown is displayed when the instrument is switched on again.

3.3 Menu Display for Measurements in 4-Wire Systems

L1

U1	L1	⊝ → T1		U1	P1	Q1
I1	P1	Q1	S1	f	I1 f	E_P1	E_Q1
φ1	⊡ → T2		P1	φΣ	φΣ

⋮ ⋮ ⋮ ⋮ ⋮

Only in energy meter mode,
individual phases (L123)
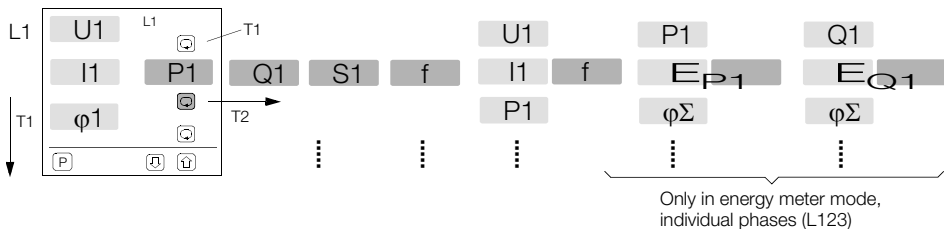
L2   See diagram L1 for L2 values

L3   See diagram L1 for L3 values

T1

PΣ	⅄	PΣ	QΣ	Pint	Qint	Sint
QΣ	SΣ	f	E_PΣ	E_QΣ	P_ΣInt	Q_ΣInt	S_ΣInt
φΣ	⊡ → T2	φΣ [1]	φΣ [1]	-n	-n	-n

LT– [2] LT– [2]

LT LT

HT– HT–

HT HT

⇑⇓: select intervals
-n * display interval (n = 0 ... 10)
0 = current interval in use
   with projected final value
The maximum value since the last deletion or
after restarting the instrument is displayed
with the max setting (with T3).

U12	△
U23	f
U31	

U1	L1 L2 L3	I1	P1	Q1	S1
U2	f	I2	P2	Q2	S2	··············
U3		I3	P3	Q3	S3
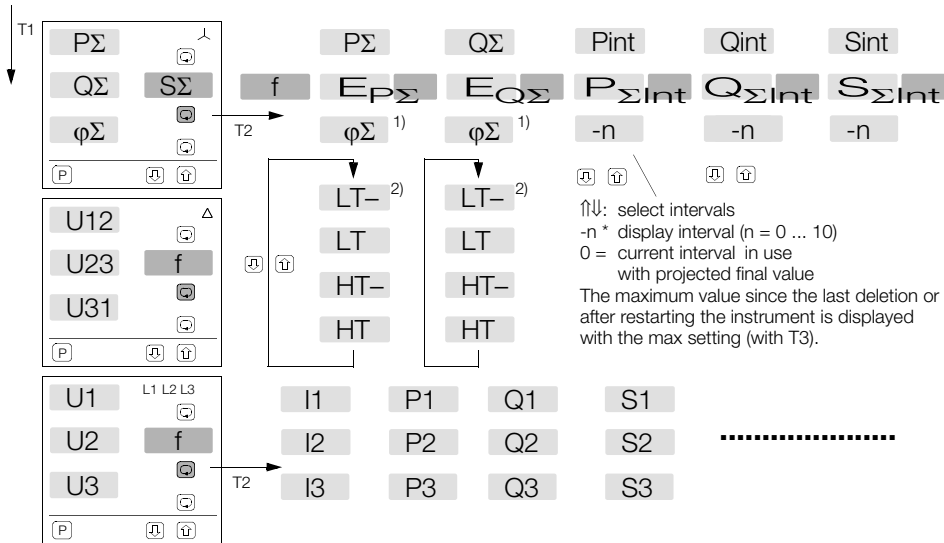
for Feature A3 only (Analog Input)

T1

In 1	△
123,4	°C
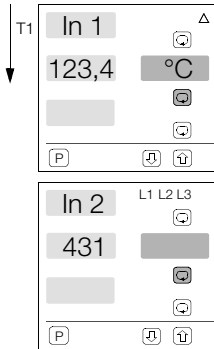
Example: Temperature 123.4 °C

In 2	L1 L2 L3
431	

Example: Standard Input

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.
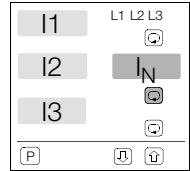
I1	L1 L2 L3
I2	I_N
I3	

L1, L2, L3, $\perp$, $\triangle$, L123, In1 and In2 comprise 8 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

U1 h		I1 h	
U2 h	% thd	I2 h	thd
U3 h	⋮	I3 h	⋮
	% 1. ↑		hd 1. ↑
	⋮		⋮
	% 15. ↓		hd 15. ↓
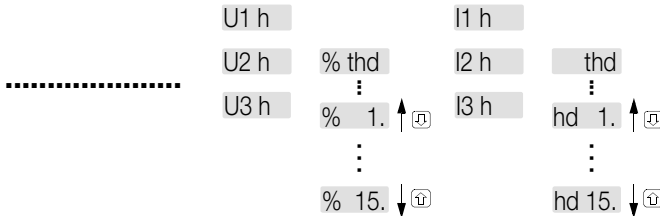
When displaying the maximum values of the harmonic, press key P to indicate the time and date when the respective maximum value occurred. (Function only available for version with data logger)

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)

| $Q\Sigma$	$Pint$	$Qint$	$Sint$
$E_{Q\Sigma}$	$P_{\Sigma Int}$	$Q_{\Sigma Int}$	$S_{\Sigma Int}$
$\varphi\Sigma$ [1)	-n	-n	-n

⟳ ⟲ \ ⟳ ⟲

$\Uparrow\Downarrow$: select intervals
-n * display interval (n = 0 ... 10)
0 = current interval in use
 with projected final value
The maximum value since the last deletion or
after restarting the instrument is displayed with
the max setting (with T3).

$LT-$ [2)

LT

$HT-$

HT

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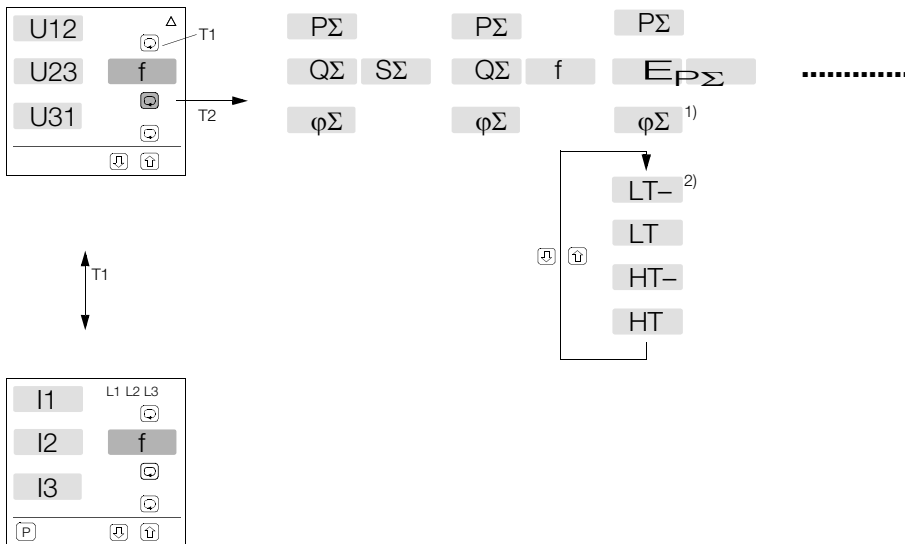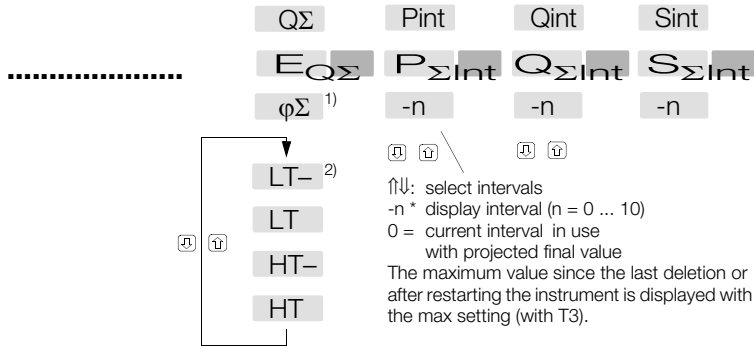
1) in energy meter mode L123
2) in energy meter mode LTHT

$LT-$ Low Tariff Export

LT Low Tariff Import
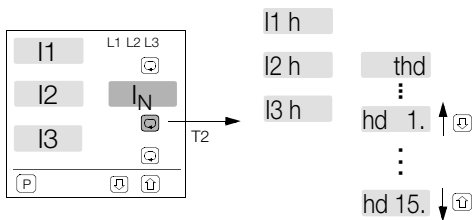
$HT-$ High Tariff Export

HT High Tariff Import

3.5 Error Messages

```
Err        ⊡
PArAMEtEr
           ⊡
           ⊡
P      ⊡ ⊡
```

Parameters Error

One or more parameters have been irretrievably corrupted or are beyond the setting range. Remedy: Enter $\boxed{P}_{long}$ configurations menu.
→ SET USER restores the user parameter set which has been stored to memory.
→ SET DEFAULT restores all factory default parameters.

```
Err        ⊡
AnALo G
           ⊡
           ⊡
P      ⊡ ⊡
```
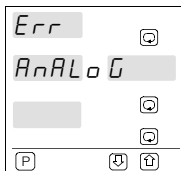
Error at Analog Component

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.

```
Err        ⊡
cALi b rAtE
           ⊡
           ⊡
P      ⊡ ⊡
```

Calibration Error

The calibration values of the A2000 are beyond the setting range or are not compatible with each other.

Send the instrument to our service department.

```
Err        ⊡
EEPr o M
           ⊡
           ⊡
P      ⊡ ⊡
```
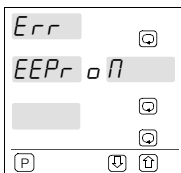
EEPROM Error

See Parameters Error

```
Err        ⊡
EnEr G Y
           ⊡
           ⊡
P      ⊡ ⊡
```
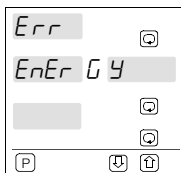
Energy Meter Error

The meter reading can only be set to zero. Remedy: Enter $\boxed{P}_{long}$ configurations menu
→ SET ENERGY 0

4 Configuring the A2000

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

Configurations Menu		Sub-Menus	
$\boxed{P}$ long ↕ Time 2 Minutes			
Relays		Limit value monitor. Min-/Max active source, hysteresis alarm memory	see chap. 4.1, page 20
Display		Brightness and display filter adjustment	see chap. 4.2, page 22
Inputs	$\boxed{P}$ brief →	Transformation ratios for external transformers, synchronizing input	see chap. 4.3, page 24
Analog in	← $\boxed{P}$ brief storage to memory	Input quantities: Standard signal Pt1000 Display ranges	see chap. 4.4, page 26
Analog out	← $\boxed{Л}$+$\boxed{û}$ no storage to memory	Source output range	see chap. 4.5, page 28
Pulse out		Source (active/ reactive energy) number of pulses	see chap. 4.6, page 29
LOGGER		Data LOGGER display / configure	see chap. 4.7, page 30
Energy		Configure energy meter low tariff	see chap. 4.8, page 35
COM		Configure interfaces	see chap. 4.9, page 36
SET		Store parameters, upload parameters, delete energy values set clock	see chap. 4.10, page 38

$\boxed{\square}$ T3

T3 storage to memory

4.1 Configuring the Limit Value Relays
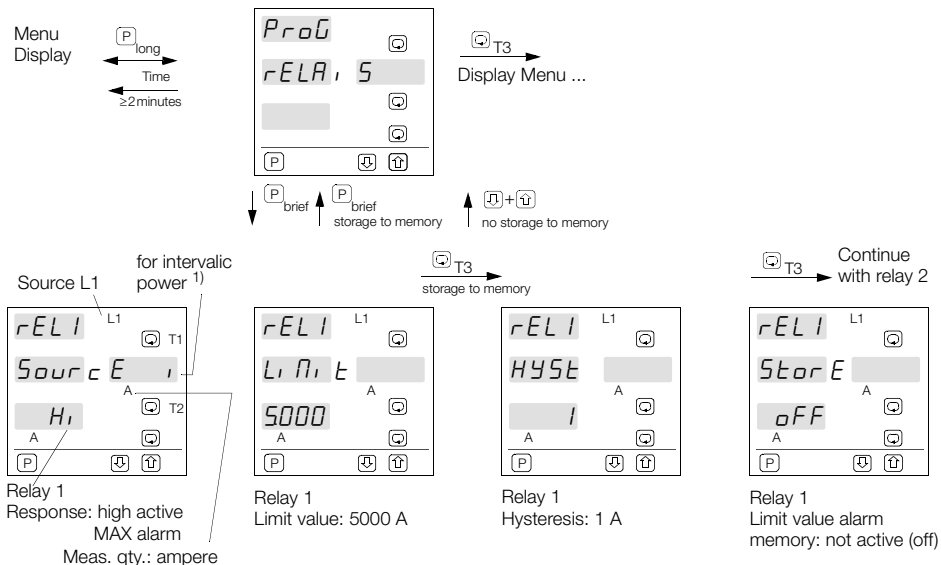
Menu Display $\xleftrightarrow[\text{Time } \geq 2 \text{ minutes}]{\boxed{P}_{\text{long}}}$

```
 ProG
        ⊡
 rELAI S
        ⊡
        ⊡
 ⊡      ⊡ ⊡
```

$\xrightarrow{\boxed{⊡}_{T3}}$ Display Menu ...

$\downarrow \boxed{P}_{\text{brief}}$ $\uparrow \boxed{P}_{\text{brief}}$ storage to memory $\uparrow \boxed{⊡}+\boxed{⊡}$ no storage to memory

Source L1 — for intervalic power [1]

```
 rEL1   L1
         ⊡ T1
 Sourc E  I
         A ⊡ T2
 HI
         A ⊡
 P       ⊡ ⊡
```
Relay 1
Response: high active
MAX alarm
Meas. qty.: ampere

$\xrightarrow{\boxed{⊡}_{T3}}$ storage to memory

```
 rEL1   L1
         ⊡
 LI MI t
         A ⊡
 5000
         A ⊡
 P       ⊡ ⊡
```
Relay 1
Limit value: 5000 A

```
 rEL1   L1
         ⊡
 HYSt
         A ⊡
 I
         A ⊡
 P       ⊡ ⊡
```
Relay 1
Hysteresis: 1 A

$\xrightarrow{\boxed{⊡}_{T3}}$ Continue with relay 2

```
 rEL1   L1
         ⊡
 Stor E
         A ⊡
 oFF
         A ⊡
 P       ⊡ ⊡
```
Relay 1
Limit value alarm memory: not active (off)

T1: Source Selection
L1, L2, L3 Individual Phases
L12,L23, L13 Phase-to-phase voltage
⅄ Collective Values
L123 Neutral Conductor Current
L123 ⅄ for all Phases
T2: Meas. Quantity Selection
V_Δ, V, A, A_{AVG}, W,
VAr, VA, φ, Hz, Wi,
VAri, VAi, external
$\boxed{⊡}\boxed{⊡}$: Value Settings
Limit values: high / low active

$\boxed{⊡}\boxed{⊡}$: Value Settings

Hz:	40.00 ... 70.00
V, A:	1 ... 9999 [2]
W, ...	-9999 ... 9999 [2]
PF:	0.01c ... 0.99c ... ... 1.00 ... 0.99L ... 0.01L

$\boxed{⊡}\boxed{⊡}$: Value Settings

0, 1, ... 9999 Digits

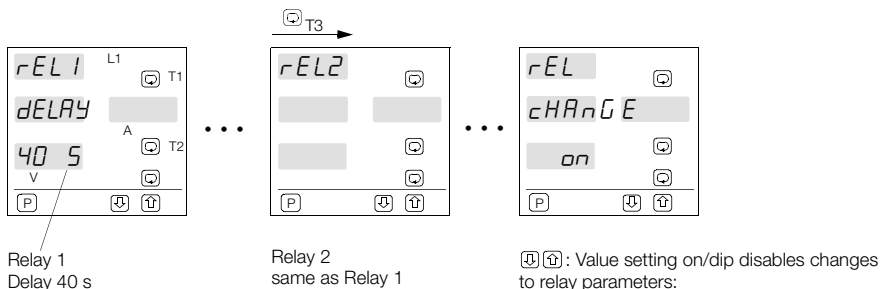$\boxed{⊡}\boxed{⊡}$: Value Settings

Alarm memory
on = active
off = not active

In the display mode,
a stored alarm is
(simultaneously) deleted
with $\boxed{⊡}\boxed{⊡}$.

---

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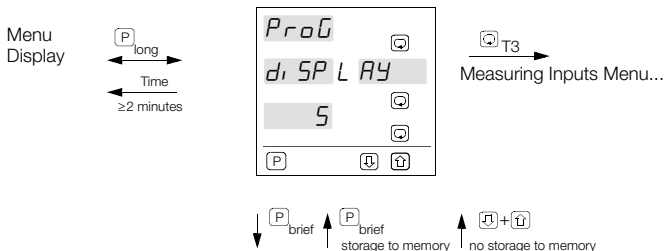1, 2, 3, 5, 8, 15, 25, 40 s
1, 2, 3, 5, 8, 15, 30 min

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:
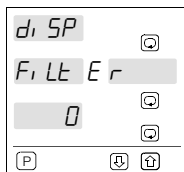   'LOCK' = position on and rel change = on

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

Menu
Display $\xrightarrow[\text{Time}]{\boxed{P}\,\text{long}}$ $\xleftarrow[\geq 2\ \text{minutes}]{}$

```
ProG          ⊡
di SP L AY
     5        ⊡
              ⊡
⊡          ⊞ ⊟
```

$\xrightarrow{\boxed{⊡}\,\text{T3}}$ Measuring Inputs Menu...

$\downarrow \boxed{P}_{\text{brief}}$ $\uparrow \boxed{P}_{\text{brief}}$ storage to memory $\uparrow \boxed{⊞}+\boxed{⊟}$ no storage to memory

Adjusting display filter

```
di SP         ⊡
Fi Lt E r
     0        ⊡
              ⊡
⊡          ⊞ ⊟
```

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

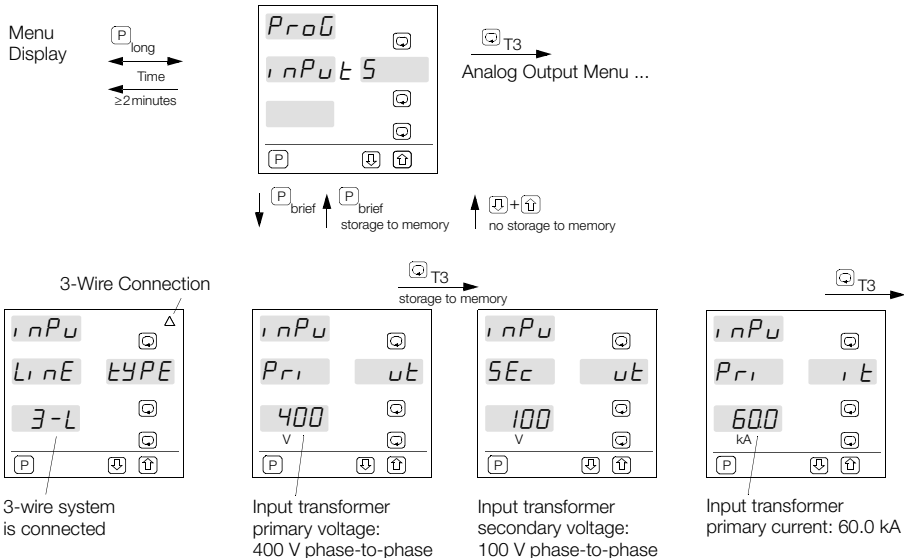Time constant τ in s
0 ... 30

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

Menu
Display

$\boxed{P}_{long}$

$\xleftarrow{\qquad}$ Time $\xrightarrow{\qquad}$
≥ 2 minutes

```
ProG          ⊡
ı nPut 5      ⊡
              ⊡
 P      ⊡ ⊡
```

$\xrightarrow{\boxed{⊡}}$T3
Analog Output Menu ...

$\boxed{P}_{brief}$ ↓ ↑ $\boxed{P}_{brief}$ storage to memory   ↑ $\boxed{⊡}+\boxed{⊡}$ no storage to memory

3-Wire Connection

```
ı nPu        △
LınE    EYPE
3 - L
 P      ⊡ ⊡
```

3-wire system
is connected

$\xrightarrow{\boxed{⊡}}$T3
storage to memory

```
ı nPu        ⊡
Prı     ut
400          ⊡
 V      ⊡ ⊡
```

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

```
ı nPu        ⊡
5Ec     ut
100          ⊡
 V      ⊡ ⊡
```

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

$\xrightarrow{\boxed{⊡}}$T3

```
ı nPu        ⊡
Prı     ı t
60.0         ⊡
 kA     ⊡ ⊡
```

Input transformer
primary current: 60.0 kA

$\boxed{⊡}\boxed{⊡}$: 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)

$\boxed{⊡}\boxed{⊡}$: Value Settings

100 V ... 700 V
in 1 V steps

500 V ... 800 kV
in 100 V steps
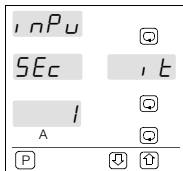
$\boxed{⊡}\boxed{⊡}$: Value Settings

100 V ... 500 V

in 1 V steps

$\boxed{⊡}\boxed{⊡}$: Value Settings

1 A ... 150 kA

5 A steps for $I_t < 5$kA
50A steps for $I_t > 5$kA
500A steps for $I_t > 50$kA

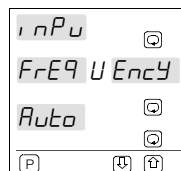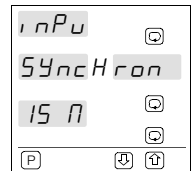|			
ınPu **SEc ıt** **1** A	**ınPu** **AdJ ıt** **1.000** A	**ınPu** **FrE9 UEncY** **Auto**	**ınPu** **SYncHron** **15 Π**
Input transformer secondary current: 1.00 A	Input transformer adjustment current transformer	Line frequency synchronization	Synchronizing pulse every 15 minutes
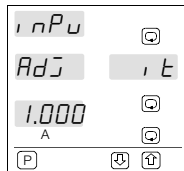
---

⊡⊡ : Value Settings

1 or 5 A

⊡⊡ : Value Settings

0.900 ... 1.100

⊡⊡ : Value Settings

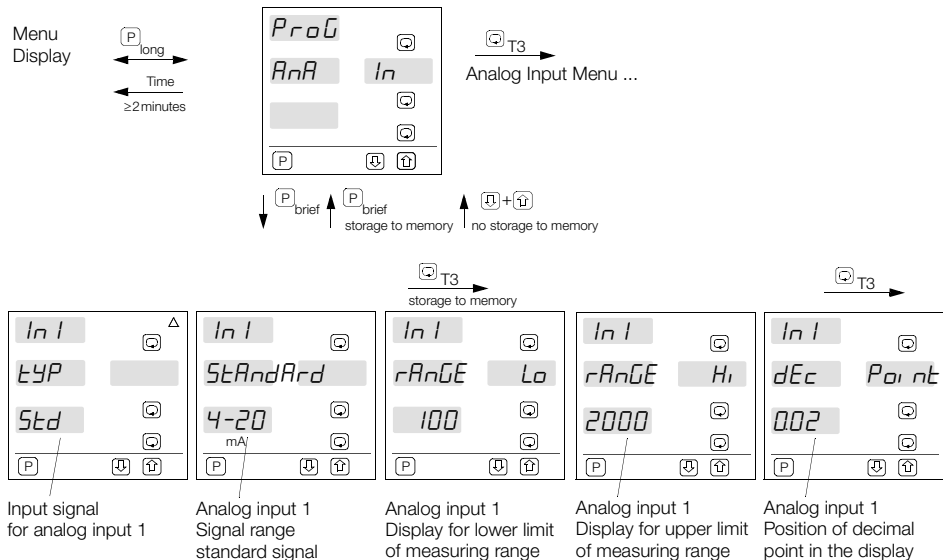**Auto**   All phases, voltage and current are scanned.

U1-3   Only voltages are used.

⊡⊡ : Value Settings

external, 1 ... 60 minutes

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

## 4.4 Configuring the Measuring Inputs, Analog Inputs (feature A3) (not with LON and Profibus-DP)

Menu Display

```
ProG
AnA    In
```
P long / Time ≥2 minutes

$\boxed{\square}$ T3
Analog Input Menu ...

$\boxed{P}$ brief ↓ / $\boxed{P}$ brief ↑ storage to memory | $\boxed{\downarrow}+\boxed{\uparrow}$ no storage to memory

$\boxed{\square}$ T3 storage to memory → $\boxed{\square}$ T3 →

```
In 1
tYP
Std
```
Input signal for analog input 1

```
In 1
StAndArd
4-20
mA
```
Analog input 1 Signal range standard signal

```
In 1
rAnGE    Lo
100
```
Analog input 1 Display for lower limit of measuring range

```
In 1
rAnGE    Hi
2000
```
Analog input 1 Display for upper limit of measuring range

```
In 1
dEc    Point
002
```
Analog input 1 Position of decimal point in the display

$\boxed{\downarrow}\boxed{\uparrow}$: Type Setting		$\boxed{\downarrow}\boxed{\uparrow}$:Value Settings			$\boxed{\downarrow}\boxed{\uparrow}$: Value Settings	$\boxed{\downarrow}\boxed{\uparrow}$:Value Settings	$\boxed{\downarrow}\boxed{\uparrow}$:Value Settings	
		Display	Volt	mA	–1999 ... 9999	–1999 ... 9999	Display	Places behind the decimal point
Std	Standard Signal 10 V/20 mA	4-20	2-10	4-20				
		0-20	0-10	0-20			0.	0
		2020	±10	±20			0.1	1
Pt1k	Temperature Sensor Pt1000	1010	±5	±10			0.02	2
		DIP In1:		ON OFF			0.003	3

The associated DIP-switches must be set correctly!

⌨ T3 →

in2	
tYP	
Pt 1k	

A

P ⏬ ⏫
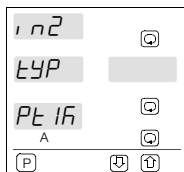
Input signal
for analog input 2

in2	
Pt 1000	
°C	

A

P ⏬ ⏫
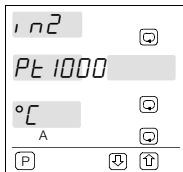
Analog input 2
Display dimension

in2	
OFFSEt	°C
-2	

P ⏬ ⏫

Analog input 2
Correction of measuring
error by cable resistance

in2	
dEc	Point
0	

P ⏬ ⏫
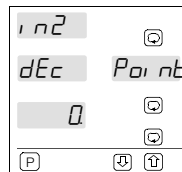
Analog input 2
Display resolution

⏬⏫ : Type Settings

Std	Standard signal 10 V/20 mA
Pt1k	Temperature sensor Pt1000

⏬⏫ : Value Settings

°C	degrees Celsius
°F	degrees Fahrenheit

DIP
In2:
ON
OFF ▮▯

The associated DIP
switches must be set
correctly!

⏬⏫ : Value Settings

The preset value is added
to the measured value.

⏬⏫ : Value Settings

Display	Resolution
0.	integral degrees
0.1	tenth of a degree

4.5 Configuring the Analog Outputs (not with Profibus-DP)
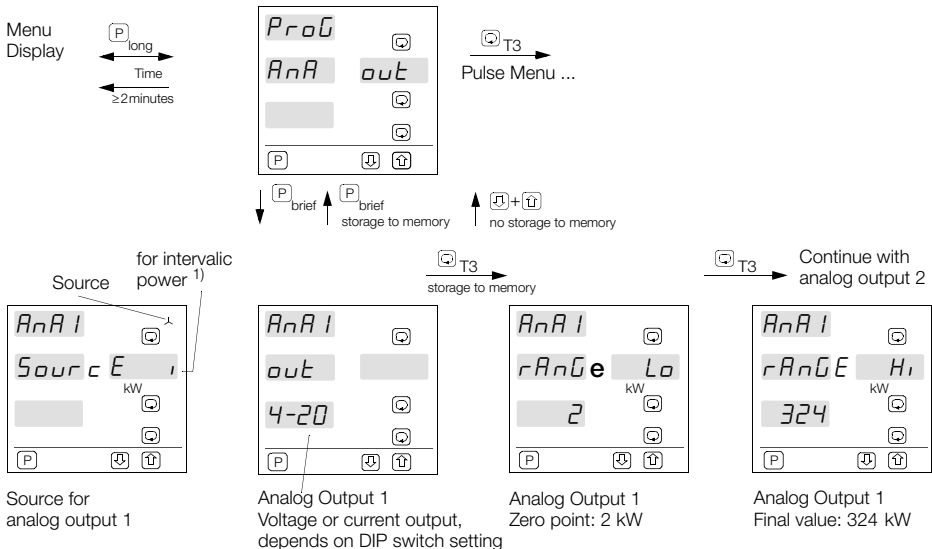
Menu Display

$\boxed{P}$ long → ← Time ← ≥ 2 minutes

```
ProG    ⊡
AnA  out  ⊡
         ⊡
⊡ [P]  [⬇] [⬆]
```

$\boxed{\boxdot}$ T3 → Pulse Menu ...

$\boxed{P}$ brief ↓ ↑ $\boxed{P}$ brief storage to memory   ↑ $\boxed{\Pi}$+$\boxed{\hat{u}}$ no storage to memory

Source — for intervalic power [1]

```
AnA1     ⊡  人
SourcE  ,
         kW
         ⊡
         ⊡
[P]   [⬇] [⬆]
```

Source for analog output 1

$\boxed{\boxdot}$ T3 → storage to memory

```
AnA1     ⊡
out
4-20     ⊡
         ⊡
[P]   [⬇] [⬆]
```

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

$\boxed{\boxdot}$ T3 → Continue with analog output 2

```
AnA1     ⊡
rAnGe  Lo
         kW
2        ⊡
         ⊡
[P]   [⬇] [⬆]
```

Analog Output 1 Zero point: 2 kW

```
AnA1     ⊡
rAnGE  Hi
         kW
324      ⊡
         ⊡
[P]   [⬇] [⬆]
```

Analog Output 1 Final value: 324 kW

T1: Source Selection
L1, L2, L3   Individual phases
L12,L23, L13 Phase-to-phase voltage
人   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

$\boxed{⬇}\boxed{⬆}$: 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
1010	±5	±10

DIP A1: ▯▮ ▮▯ ON
(Out1)   OFF
The appropriate DIP switches must be set correctly!

$\boxed{⬇}\boxed{⬆}$: Value Settings
0 ... 9999
for P:
–999 ... 9999

$\boxed{⬇}\boxed{⬆}$: 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

4.6 Configuring the S0 Pulse Outputs

Menu Display → [P]long / [←] Time ≥2 minutes

```
ProG
PuLS
```

[⟳]T3 → Interface Menu ...

[P]brief ↓ / [P]brief storage to memory ↑ / [⟶]+[⇧] no storage to memory ↑

[⟳]T3 storage to memory →

Source for pulse output 1
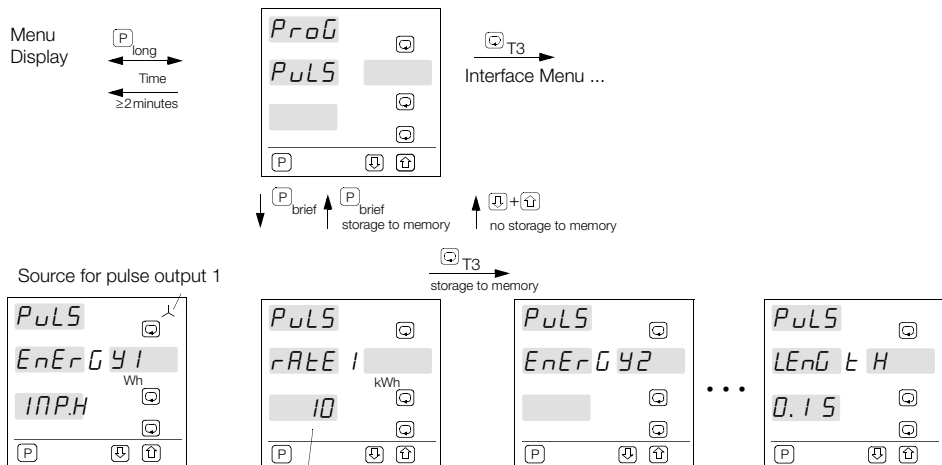
```
PuLS
EnErGY1          Wh
INP.H
```
Source, pulse output 1:
collective energy (4L)

```
PuLS
rAtE 1           kWh
10
```
Pulse output 1
Pulse rate
10 pulses / kWh

```
PuLS
EnErGY2
```
Pulse output 2:
same as pulse output 1

· · ·

```
PuLS
LEnGtH
0.1S
```
Pulse outputs
Pulse length
0.1 s

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.

4.7 Data Logger Display and Configuration

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

Rotating points indicate that data is being stored to memory.

Number of accumulated event windows 1...N, FULL

$$P r o G$$
$$L o G G E r \quad 10$$
$$3.$$

Maximum number of storable trigger events (N)

A blinking 0 indicates that too little memory remains for the selected setting. Recording cannot be started.

Point indicates that a trigger event has been recognized.
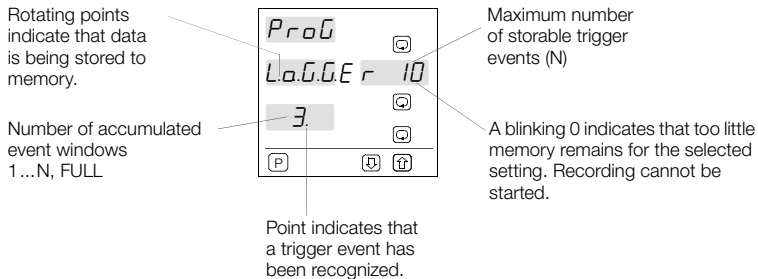
If the data logger is not recording, the display blinks alternately: Logger/stop

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

Rotating points indicate that data is being stored to memory.

```
ProG        ⊡
L.o.G.G.E r
53°o        ⊡
            ⊡
P       ⬇ ⬆
```
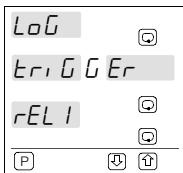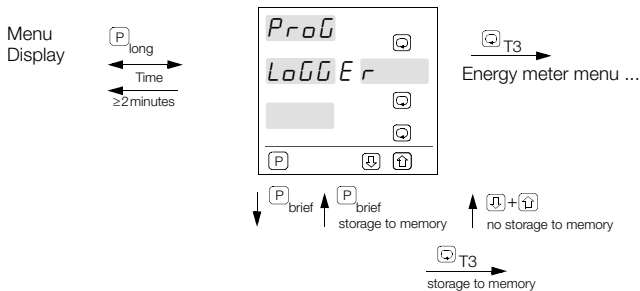
0...99%, FULL (memory occupancy level)
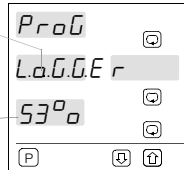
If the power supply is interrupted during a recording session, the A2000 supplements the outstanding samples after restarting the instrument:
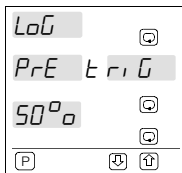
- A value of „0" is entered for all measured quantities, except for energies (last meter reading)
- If a trigger source has been selected, the beginning of power supply interruption is always considered to be a trigger.
- If the trigger source has been set to „OFF", the beginning of power supply interruption 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.
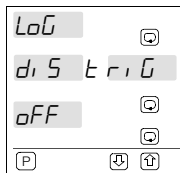-

⚠ 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.
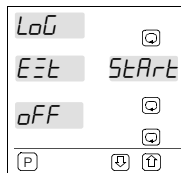
Menu Display $\boxed{P}$ long / Time ≥2 minutes

```
 ProG
          🖵
 LoGGEr
          🖵
 ┌──────┐
 │ P    🖵  ⬆
```

$\xrightarrow{\boxed{🖵} T3}$ Energy meter menu ...

$\boxed{P}$ brief / $\boxed{P}$ brief storage to memory

$\boxed{⬇}+\boxed{⬆}$ no storage to memory

$\xrightarrow{\boxed{🖵} T3}$ storage to memory

```
 LoG        🖵
 triGGEr
 rEL 1      🖵
          🖵
 ┌──────┐
 │ P    ⬇  ⬆
```
Trigger source setting

```
 LoG        🖵
 PrE triG
 50°o       🖵
          🖵
 ┌──────┐
 │ P    ⬇  ⬆
```
Trigger source setting

```
 LoG        🖵
 diS triG
 oFF        🖵
          🖵
 ┌──────┐
 │ P    ⬇  ⬆
```
External trigger disabling when trigger source ≠OFF

```
 LoG        🖵
 Eᴉt  StArt
 oFF        🖵
          🖵
 ┌──────┐
 │ P    ⬇  ⬆
```
Data logger Start/Stop when trigger source = OFF

---

rEL 1
rEL2
botH
OFF
⬇ ⬆
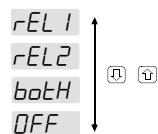
If the trigger source is set to OFF, data is recorded continuously to memory. For data logger an alarm memory is not relevant.
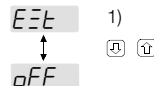
0°o
25°o
50°o
75°o
⬇ ⬆
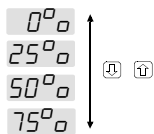
Triggering can be disabled via the synchronization input.

Eᴉt   1)
⬇ ⬆
oFF

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.
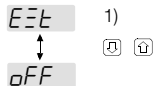
Eᴉt   1)
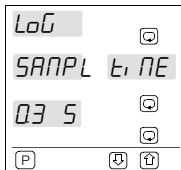⬇ ⬆
oFF

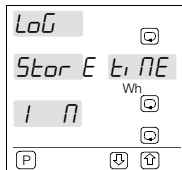1) If the external input is used as a synchronizing input, no switching to external is possible. (Display: -no-)

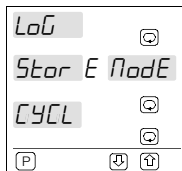|	
`LoG` ⊡	`LoG` ⊡
`SAMPL` `t¡ME`	`Stor E` `t¡ME` Wh
`03 S` ⊡	`1 M` ⊡
⊡	⊡
`P` ⊡ ⬆	`P` ⊡ ⬆

Sampling time   Storage rate

`03 S`   `1 M`
  ↕   ⊡ ⬆   ↕   ⊡ ⬆
`30 M`   `4 d`

5ec: 0.3, 0.6, 1, 2,   Min: 1, 2, 5,10, 15, 30
    5,10, 15, 30   Hour:1, 2, 4, 8, 12
Min: 1, 2, 5, 10, 15, 30   day: 1, 2, 4

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

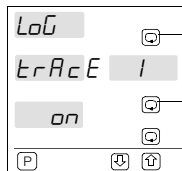$$N = (250\,000 \times T_{sa}) / (T_{st} \times \Sigma Tr)$$

(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.

LoG ⊡	LoG ⊡	LoG ⊡
Stor E ModE ⊡	trAcE 1 ⊡	trAcE 12 ⊡
CYCL ⊡	on ⊡	oFF ⊡
P ⊡ ⇧	P ⊡ ⇧	P ⊡ ⇧

Source selection see T1 below

Measuring quantity selection see T2 below

Memory is overwritten cyclically when full.

Selection of max. 12 quantities to be recorded

CYCL ↕ oncE   ⊡ ⇧
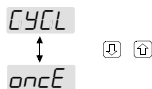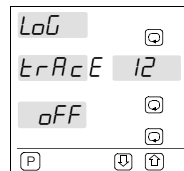
The data logger is stopped when memory is full.

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

T2: <u>Meas. Quantity Selection</u>
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).

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4.8 Configuring the Energy Meter Mode/Low Tariff

Menu
Display

P_{long} ⟷ Time ≥2 minutes

```
ProG
EnErGY
┌────┐
```
[P]   [⊕] [⇧]

$\boxed{\Box}$ T3 → Interface Menu ...

P_{brief} ↓ ↑ P_{brief} storage to memory ↑ [⊕]+[⇧] no storage to memory

$\boxed{\Box}$ T3 storage to memory →

Only appears for data logger, LON or Profibus variant

```
EnEr
ΠodE
L I23
```
[P]   [⊕] [⇧]

Energy Meter Mode

```
EnEr
Lt EnAbLE
tiΠE
```
[P]   [⊕] [⇧]

Source for Low Tariff Activation

```
EnEr
22.00.00 Lt.
bEG
```
[P]   [⊕] [⇧]

Low Tariff Start Time

```
EnEr
06.00.00 Lt
End
```
[P]   [⊕] [⇧]

Low Tariff End Time
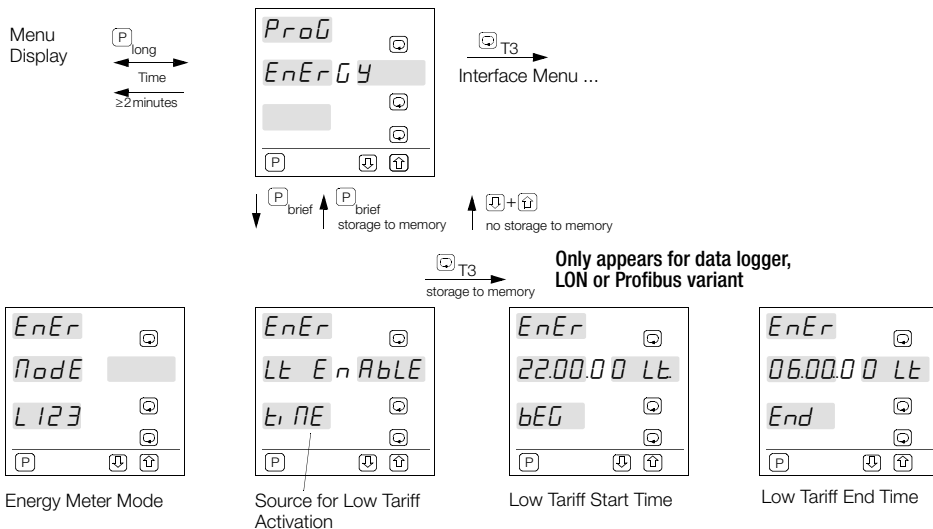
[⊕][⇧] : Mode setting
L I23 = Individual phases
LtHt = Low tariff high tariff (import / export) Active and reactive energy

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 4.10 on page 38.

[⊕][⇧] : Source setting

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

Setting same as for clock, see chapter 4.10 on page 38!! (seconds remain at zero)

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

4.9 Interface Configuration

Menu Display [P]long ← Time → ≥2minutes

ProG
coΠ

[Q]T3 → Standard Parameters Menu ...

[P]brief ↓ [P]brief ↑ storage to memory   [⬇]+[⬆] no storage to memory

[Q]T3 → storage to memory

coΠ	coΠ1	coΠ1	coΠ1
AdrESS	bAudr AtE	PAr, t Y	Protocol
55	9600	EuEn	E244
Interface Address: 55	Baud Rate: 9600 Baud	Parity: even	Protocol: E244

[⬇][⬆]: Value Settings	[⬇][⬆]: Value Settings	[⬇][⬆]: Value Settings	[⬇][⬆]: Configuring the Communications Protocol
0 ... 254	1200, 2400, 4800, 9600, 19.20k	EuEn = even odd = odd SPcE = space no = no	E244 = DIN draft 19244 870 = EN 60870 Πod1 = Modbus new version Πod2 = Modbus previous version
(for variants with Profibus-DP: all addresses > 126 are interpreted as initialization address 126!)			

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

Only appears for LON interface variant:
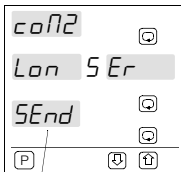
LON service, only if key is pressed and held
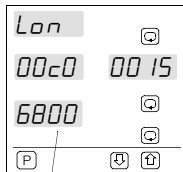
$\xrightarrow{\text{T3}}$ storage to memory

Only appears for Profibus DP variant:
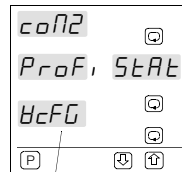
Status: Wait Config

LON ID: 00c000156800

⊕⊙ : LON service

⊕⊙ : Status:

$HcFG$ = Wait Config
$HPAr$ = 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.

4.10 Uploading and Deleting Parameters, Setting the Clock

Menu
Display
⟵ $\boxed{P}$ long ⟶
Time
≥2 minutes

```
 ProG      ⊡
 SEt
           ⊡
           ⊡
 P       ⬇ ⬆
```

$\xrightarrow{\boxed{⊡} T3}$ Relay Menu ...

$\boxed{P}$ brief ↓ ↑ $\boxed{P}$ brief
storage to memory

↑ ⬇+⬆
no storage to memory

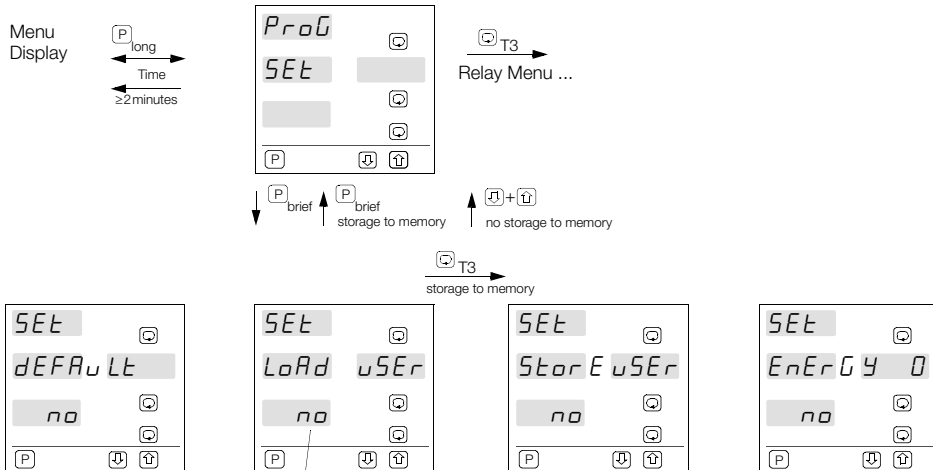$\xrightarrow{\boxed{⊡} T3}$
storage to memory

```
 SEt       ⊡
 dEFAuLt
           ⊡
   no      ⊡
 P       ⬇ ⬆
```
Do not upload default
parameters
(factory presets)

```
 SEt       ⊡
 LoAd uSEr
           ⊡
   no      ⊡
 P       ⬇ ⬆
```
Do not upload user
parameters

```
 SEt       ⊡
 StorE uSEr
           ⊡
   no      ⊡
 P       ⬇ ⬆
```
Do not store user
parameters

```
 SEt       ⊡
 EnErG Y  0
           ⊡
   no      ⊡
 P       ⬇ ⬆
```
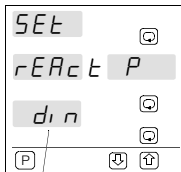Do not delete meter
readings

⬇⬆ : settings no/yes. For reasons of safety, the ⬆ or ⬇ key must be pressed and held for more than 2 sec.
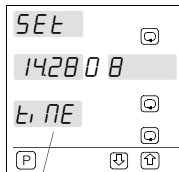
————— yes loads/stores the corresponding parameters ————— ——yes deletes all——
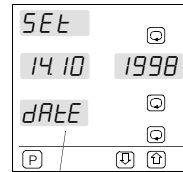meter readings

```
        ⊡ T3                    Only appears for data logger,
   ─────────────▶              LON or Profibus variant
   storage to memory
```

```
┌─────────────────┐      ┌─────────────────┐      ┌─────────────────┐
│  5EE        ⊡   │      │  5EE        ⊡   │      │  5EE        ⊡   │
│                 │      │                 │      │                 │
│  rEAcE  P       │      │  142808         │      │  14.10   1998   │
│                 │      │                 │      │                 │
│   d, n      ⊡   │      │  E, NE      ⊡   │      │  dAEE       ⊡   │
│             ⊡   │      │             ⊡   │      │             ⊡   │
│ P        ⊡  ⊡  │      │ P        ⊡  ⊡  │      │ P        ⊡  ⊡  │
└─────────────────┘      └─────────────────┘      └─────────────────┘
```

Selection: with or   Selection and storage of   Selection and storage
without + or - sign   hours and minutes (corre-   of day, month and
                                 sponding display blinks)   year

───

⊡⊡ : Status: ⊡⊡ : Selection: ⊡⊡ : Selection:

d, n = Reactive power per DIN 40110   Adjust hours and   Adjust day, month
         without + or – sign   minutes (seconds are   and year
5, Gn = Reactive power with + or – sign   set to zero when time
CoNP = Compensating reactive power   is saved to memory)
FErr = Ferraris meters

───

5 Electrical Connections and Circuits

Design with 2 or 4 analog outputs and serial interface RS-232 and RS-485 or LON

Relay 1 Relay 2 I1 I2 I3 N L1 L2 L3

51 52 53   55 56 57   1 3   4 6   7 9   11 2 5 8   13 14 15

13 14 15

N | 115V 230V
~ ~

±10% 45...65 Hz

$\sim$ 20...69 V
$=$ 20...72 V

$\sim$ 73...264 V
$=$ 73...276 V

$\sim$ 20... 27 V
$=$ 20... 36 V

Power supply
max. 15 VA

Power supply
(see specified
values on
serial plate)

LOCK   UI UI UI UI

ON
OFF

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

46 45 44   43 42 41   38 37 35 33 31   24 23   22 21 20

B A
LON
C B A

⊥ RxD
TxD

⊥ A1 A2 A3 A4

S01
S02

+

RS-232 RS-485   Analog
Output

Sync.
Input

Pulse
Output

Design with 2 analog inputs and 2 outputs and serial interface RS-232 and RS-485

Power supply
(see specified
values on
serial plate)

13	14	15
N	115V $\sim$	230V $\sim$

±10% 45...65 Hz

$\frac{\bot}{\;}\sim$ 20...69 V
$\frac{\bot}{\;}$=== 20...72 V

$\frac{\bot}{\;}\sim$ 73...264 V
$\frac{\bot}{\;}$=== 73...276 V

$\frac{\bot}{\;}\sim$ 20... 27 V
$\frac{\bot}{\;}$=== 20... 36 V

Power supply
max. 15 VA

LOCK

ON
OFF

UI UI UI UI

Analog output/input
configuration,
in this example:
Out1: U (U=on, I=off)
Out2: I   (U=off, I=on)
In1: Pt1000 (U=on, I=off)
In2: I   (U=off, I=on)

46 45 44 43 42 41

⊥ RxD   C B A
TxD

RS-232 RS-485

38 37 35 33 31

⊥   Out1   In1
   Out2   In2
Analog
Output/Input

24 23

Sync.-
Input

22 21 20

S01   +
   S02
Impuls-
Output

Relay 1 Relay 2   I1   I2   I3   N L1 L2 L3

51 52 53 55 56 57   1 3 4 6 7 9 11 2 5 8   13 14 15

k l k l k l

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	
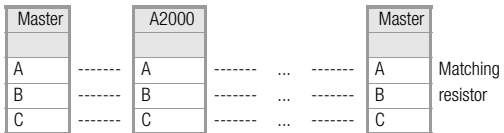
Profibus DP connection (optional)

13	14	15
N	115V	230V
	~	~
±10% 45...65 Hz		
⏚ ~ 20...69 V === 20...72 V		
⏚ ~ 73...264 V === 73...276 V		
⏚ ~ 20... 27 V === 20... 36 V		
Power supply max. 15 VA		

Power supply (see specified values on serial plate)

Relay 1 Relay 2 I1 I2 I3 N L1 L2 L3

51 52 53 55 56 57 1 3 4 6 7 9 11 2 5 8 13 14 15

Profibus-DP COM 2

46 45 44 24 23 22 21 20

⏚ RxD
TxD
RS-232

Sync. Input

S01
S02
Pulse Output
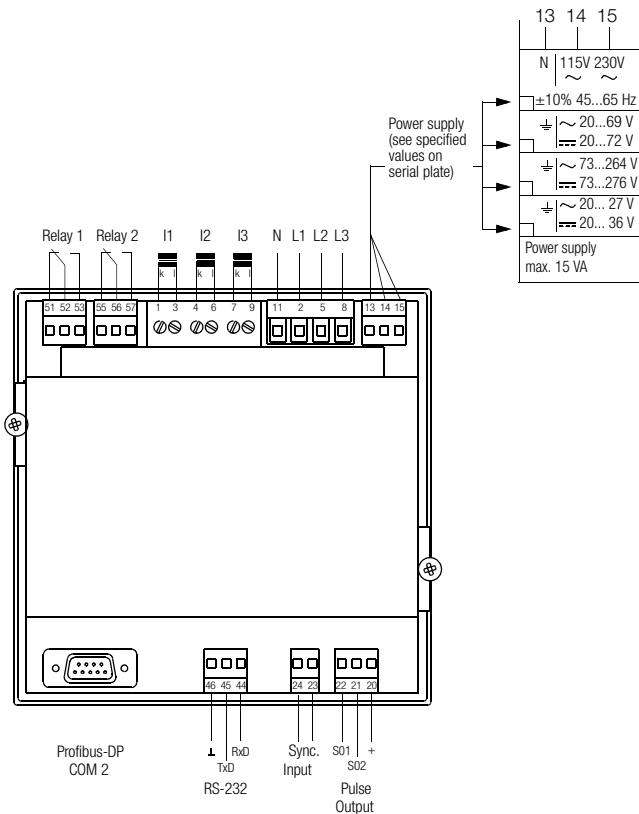
Electrically Isolated Circuits

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
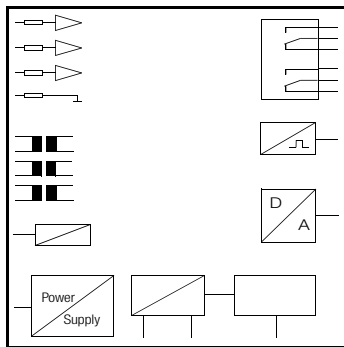
Limit Value Relay 1

Limit Value Relay 2

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

Analog Outputs
A1, A2, (A3, A4 optional)
Analog inputs
(Option In1, In2)
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 on our homepage 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 – $\mathit{Πod\ 1}$ –	Reference No. 3-349-225-03
Communications Protocol per Modbus – $\mathit{Πod\ 2}$ –	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 40 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

All dimensions in mm
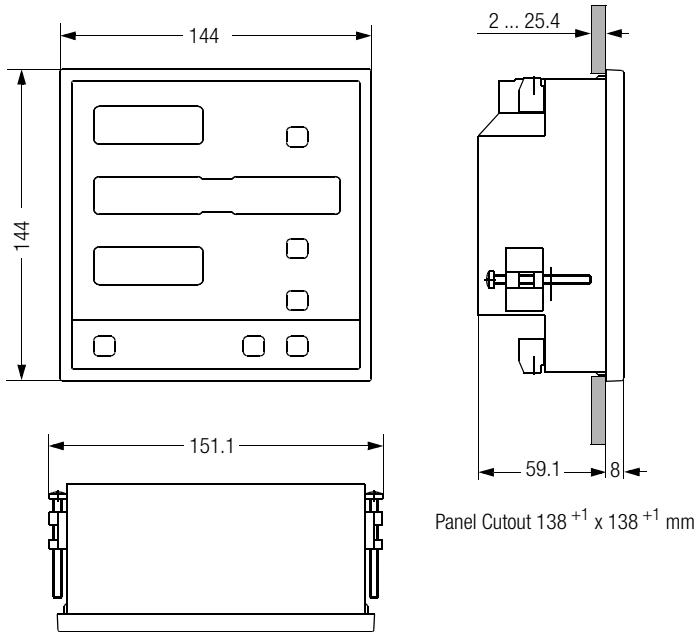
Panel Cutout 138 $^{+1}$ x 138 $^{+1}$ mm

8   Technical Data

Measurement Inputs

Voltage Inputs

Phase – Phase	0 ... <u>500</u> ... 550 V, 40 ... 70 Hz
Phase – N (ground)	0 ... <u>290</u> ... 320 V, 40 ... 70 Hz
Overload	1.2-fold
Intrinsic Impedance	> 290 kΩ
Power Consumption	< 1,1 W

Current Inputs

	0 ... <u>1</u> ... 1.2 A
	0 ... <u>5</u> ... 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

Analog Inputs

MR = Measuring Range

– Standard	*Standard signal:* (20 mA: 4 ... 20 mA, 0 ... 20 mA, ± 20 mA, ± 10 mA) or (10 V: 2 ... 10 V, 0 ... 10 V, ± 10 V, ± 5 V) *Skaling:* (range Lo / Hi)
– Temperatur	Pt1000 – Skalierung: Dimension (°C, °F), Offset, decimal point
Signal Frequency	DC
Sampling Interval	640 ms

– Current

Measuring Ranges	0 ... 20 mA, 4 ... 20 mA, ± 20 mA, ± 10 mA
Load	45 Ω
Measuring Error	± (0.2 % MV + 0,1 % of MR)
Overload permanent	50 mA

– Voltage

Measuring Ranges	0 ... 10 V, 2 ... 10 V, ±10 V, ±5 V
Input Resistance	112 kΩ
Measuring Error	±(0.3 % MV + 0,1 % of MR)
Overload permanent	100 V

– Pt1000 (according to EN 60751)

Connection	2-wire
Measuring Range	185 ... 3905 Ω (–200 ... 850 °C)
Measuring Error	±(0.5 % MV + 1 °K)

– Display Values

for Standard Signal

Lower/Upper Range Limit	−1999 ... +9999 configurable
Resolution	depending on range and position of decimal point

at Pt1000

Lower/Upper Range Limit	−200 ... 860 °C (−328 ... 1580 °F)
Resolution	0.1 or 1 °C/°F
Offset	adjustable from −100 to +100 °C/°F

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 $R < 10\ \Omega$
Off	open with $R > 10\ M\Omega$

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	$\geq$ 10 ms

Analog Outputs

Output Quantity	configurable

Current

Ranges	0 ... 20 mA, 4 ... 20 mA, $\pm$ 20 mA
Load	max. 500 Ω
Load Effect	< 0.8 µA / Ω (0 ... 250 ... 500 Ω)
Resolution	0.1 % of control range
Error Limit	$\pm$ 0.5 % of final value

Voltage

Ranges	0 ... 10 V, 2 ... 10 V, $\pm$ 10 V
Load	< 20 mA
Load Effect	no effect to > 10 KΩ
Resolution	0.1 % of control range
Error Limit	$\pm$ 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	$\sim$ / $=$ 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 $\sim$ ± 10% 45 ... 65 Hz
Feature H1	20 ... 69 V $\sim$ 45...450 Hz 20 ... 72 V $=$
Feature H2	73 ... 264 V $\sim$ 45...450 Hz 73 ... 276 V $=$
Feature H3	20 ... 27 V $\sim$ 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 $\sim$ / $=$
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.

Exception:

Devices with features L1 (LON), L2 (Profibus), R1 (Datalogger) include a 3 V/270 mAh lithium cell (CR2430FH) as a backup battery for the real-time clock and the measurement data memory. Its final life cycle extends to approximately 10 years. However, in order to prevent data loss in the event of a supply voltage failure, we recommend replacement after about 8 years. As the battery has been soldered in, replacement by the user is not advisable. Please contact our repair service for this purpose, see chapter 10.

Note: Our repair service also performs instrument calibrations, if required.

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 subject to the RoHS directive. Furthermore, we make reference to the fact that the current status in this regard can be accessed on the Internet at www.gossenmetrawatt.com by entering the search term WEEE.

We identify our electrical and electronic devices in accordance with WEEE 2012/19/EU 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
Calibration Center and Rental Instrument Service

When you need service, please contact:

GMC-I Service GmbH
Service-Center
Beuthener Str. 41
90471 Nürnberg, Germany
Phone +49 911 817718-0
Fax +49 911 817718-253
E-mail service@gossenmetrawatt.com
www.gmci-service.com

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

11 Product Support Industrial Division

When you need support, please contact:

GMC-I Messtechnik GmbH
Product Support Hotline – Industrial Division
Phone +49 911 8602-500
Fax +49 911 8602-340
E-Mail support.industrie@gossenmetrawatt.com