A2000
Multifunctional Power Meter
# Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Application</td>
<td>4</td>
</tr>
<tr>
<td>2 Instrument Description</td>
<td>4</td>
</tr>
<tr>
<td>2.1 Instrument Overview</td>
<td>4</td>
</tr>
<tr>
<td>2.2 Inputs, Outputs and Interfaces</td>
<td>5</td>
</tr>
<tr>
<td>2.3 Available Measurement Data</td>
<td>7</td>
</tr>
<tr>
<td>2.4 Factory Default Instrument Parameters</td>
<td>8</td>
</tr>
<tr>
<td>2.5 Possible A2000 Parameter Settings</td>
<td>9</td>
</tr>
<tr>
<td>3 Operating the A2000</td>
<td>10</td>
</tr>
<tr>
<td>3.1 Control Panel</td>
<td>10</td>
</tr>
<tr>
<td>3.2 Response After Auxiliary Power is Switched On</td>
<td>11</td>
</tr>
<tr>
<td>3.3 Menu Display for Measurements in 4-Wire Systems</td>
<td>12</td>
</tr>
<tr>
<td>3.4 Menu Display for Measurements in 3-Wire Systems</td>
<td>14</td>
</tr>
<tr>
<td>3.5 Error Messages</td>
<td>16</td>
</tr>
<tr>
<td>4 Configuring the A2000</td>
<td>17</td>
</tr>
<tr>
<td>4.1 Configuring the Limit Value Relays</td>
<td>18</td>
</tr>
<tr>
<td>4.2 Adjustment of Display Brightness and Filter</td>
<td>20</td>
</tr>
<tr>
<td>4.3 Measurement Inputs, Configuring the Synchronizing Input</td>
<td>22</td>
</tr>
<tr>
<td>4.4 Configuring the Analog Outputs (not with Profibus-DP)</td>
<td>24</td>
</tr>
<tr>
<td>4.5 Configuring the S0 Pulse Outputs</td>
<td>25</td>
</tr>
<tr>
<td>4.6 Data Logger Display and Configuration</td>
<td>26</td>
</tr>
<tr>
<td>4.7 Configuring the Energy Meter Mode</td>
<td>30</td>
</tr>
<tr>
<td>4.8 Interface Configuration</td>
<td>32</td>
</tr>
<tr>
<td>4.9 Uploading and Deleting Parameters, Setting the Clock</td>
<td>34</td>
</tr>
</tbody>
</table>
Contents

5 Electrical Connections and Circuits ................................................................. 36
6 Interface Description .......................................................................................... 39
  6.1 General ........................................................................................................... 39
  6.2 Communications Protocol .............................................................................. 40
7 Dimensional Drawing ....................................................................................... 41
8 Technical Data .................................................................................................... 42
9 Repair and Replacement Parts Service
  DKD Calibration Lab
  and Rental Instrument Service ........................................................................ 45
10 Product Support ................................................................................................. 45
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 power factor based upon these values.
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

<table>
<thead>
<tr>
<th>Inputs</th>
<th>A2000</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 ea. Voltage Input</td>
<td></td>
<td>2 ea. Limit Value Relay</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Relay 1, Relay 2</td>
</tr>
<tr>
<td>3 ea. Current Input</td>
<td></td>
<td>2 ea. Pulse Output (optional)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S01, S02</td>
</tr>
<tr>
<td>1 ea. Synchronizing Input</td>
<td></td>
<td>4 ea. Analog Output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A1, A2 (A3 and A4 optional)</td>
</tr>
</tbody>
</table>

Communications Interfaces

- PC RS-232
- Field Bus RS485 (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, \(I_N = 0\))

Connection with 1 current transformer in 3-wire systems (balanced load)
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 30).

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 39 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

<table>
<thead>
<tr>
<th></th>
<th>Individual Phases</th>
<th>Collective Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase Voltages</td>
<td>U1 ... U3</td>
<td>U1 max ... U3 max</td>
</tr>
<tr>
<td>Delta Voltages</td>
<td>U12, U23, U31</td>
<td>U12 max ... U31 max</td>
</tr>
<tr>
<td>Phase Current</td>
<td>I1 ... I3</td>
<td>I1 max ... I3 max</td>
</tr>
<tr>
<td>Averaged Phase Current</td>
<td>I1 avg ... I3 avg</td>
<td>I1 avg max ... I3 avg max</td>
</tr>
<tr>
<td>Line Frequency</td>
<td></td>
<td>f</td>
</tr>
<tr>
<td>Active Power</td>
<td>P1 ... P3</td>
<td>P1 max ... P3 max</td>
</tr>
<tr>
<td>Reactive Power</td>
<td>Q1 ... Q3</td>
<td>Q1 max ... Q3 max</td>
</tr>
<tr>
<td>Apparent Power</td>
<td>S1 ... S3</td>
<td>S1 max ... S3 max</td>
</tr>
<tr>
<td>Power Factors</td>
<td>PF1 ... PF3</td>
<td>PF1 min ... PF3 min</td>
</tr>
<tr>
<td>Energy Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active Energy</td>
<td>E_P1 ... E_P3</td>
<td></td>
</tr>
<tr>
<td>Reactive Energy</td>
<td>E_Q1 ... E_Q3</td>
<td></td>
</tr>
<tr>
<td>Interv. Active Energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interv. Reactive Energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interv. Apparent Energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THD, 1st... 15th harmon.</td>
<td>U1 ... U3, I1 ... I3</td>
<td></td>
</tr>
</tbody>
</table>

1) L123 = individual phases L1, L2, L3
2) LTHT = low tariff (LT) high tariff (HT)
3) L = low tariff, H = high tariff, + = import, – = export
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 apparent power.

### 2.4 Factory Default Instrument Parameters

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Primary Transformer Phase Conductor</th>
<th>Secondary Transformer Phase Conductor</th>
<th>Transformer Primary Current</th>
<th>Transformer Secondary Current</th>
<th>Synchronization Pulse</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-Wire</td>
<td>500 V</td>
<td>500 V</td>
<td>5 A</td>
<td>5 A</td>
<td>Internal, 15 minutes</td>
</tr>
<tr>
<td>Relay 1</td>
<td>Source</td>
<td>Limit Value</td>
<td>Contact Type</td>
<td>Hysteresis</td>
<td>Alarm Memory</td>
</tr>
<tr>
<td>I1</td>
<td>5 A</td>
<td>Max</td>
<td>0</td>
<td>off</td>
<td></td>
</tr>
<tr>
<td>Relay 2</td>
<td>U1</td>
<td>240 V</td>
<td>Max</td>
<td>0</td>
<td>off</td>
</tr>
<tr>
<td>Analog Output 1</td>
<td>Source</td>
<td>Output</td>
<td>Start Source</td>
<td>End Source</td>
<td></td>
</tr>
<tr>
<td>Analog Output 2</td>
<td>Source</td>
<td>Output</td>
<td>Start Source</td>
<td>End Source</td>
<td></td>
</tr>
<tr>
<td>Analog Output 3</td>
<td>Source</td>
<td>Output</td>
<td>Start Source</td>
<td>End Source</td>
<td></td>
</tr>
<tr>
<td>Analog Output 4</td>
<td>Source</td>
<td>Output</td>
<td>Start Source</td>
<td>End Source</td>
<td></td>
</tr>
</tbody>
</table>

| Relay 2 | U1 | 240 V | Max | 0 | off |
| Analog Output 1 | Source | Output | Start Source | End Source |
| Analog Output 2 | Source | Output | Start Source | End Source |
| Analog Output 3 | Source | Output | Start Source | End Source |
| Analog Output 4 | Source | Output | Start Source | End Source |

| Source Limit Value Contact Type Hysteresis 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 v/kWh | Low tariff |

| Display | Brightness 5 |
| Display | Brightness 5 |

| RS-232, RS-485 Baud Rate 9600 Address 250 Parity Even Protocol E244 |
| Energy Meter | Mode LTHT |

### 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”.

---

GOSSEN-METRAWATT GMBH
## 2.5 Possible A2000 Parameter Settings

<table>
<thead>
<tr>
<th>Inputs 4 or 3-Wire Connection</th>
<th>Primary Transformer Phase Conductor</th>
<th>Secondary Transformer Phase Conductor</th>
<th>Transformer Primary Current</th>
<th>Transformer Secondary Current</th>
<th>Synchronization Pulse</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100 V ... 750 kV</td>
<td>100 V ... 500 V</td>
<td>1 A ... 150 kA</td>
<td>1 A, 5 A</td>
<td>external or internal: 1 ... 60 minutes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relay 1, 2</th>
<th>Source 1) 3) 6)</th>
<th>Limit Value 2)</th>
<th>Contact Type</th>
<th>Hysteresis</th>
<th>Alarm Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max, Min</td>
<td>0 ... 100 Digit</td>
<td>off, on</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analog Outputs 1 ... 4</th>
<th>Source 1) 4) 5)</th>
<th>Output</th>
<th>Start Source 2)</th>
<th>End Source 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 ... 20 mA</td>
<td>4 ... 20 mA</td>
<td>-20 ... +20 mA</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pulse Outputs S01, S02</th>
<th>Source</th>
<th>Energy Type</th>
<th>Energy Direction</th>
<th>Pulse Rate</th>
<th>Tariff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L1, L2, L3, Σ</td>
<td>Active, Reactive Energy</td>
<td>Import, Export</td>
<td>1... 5000 pulses/kWh (MWh)</td>
<td>High tariff</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1... 5000 pulses/kVARh (MWh)</td>
<td>Low tariff</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Display</th>
<th>Brightness 0 ... 7</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Interfaces RS-232, RS-485</th>
<th>Address</th>
<th>Baud Rate</th>
<th>Parity</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 ... 254</td>
<td>1200, 2400, 4800, 9600, 19200</td>
<td>Even, odd, space, no</td>
<td>E244, 870, Mod</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy Meter</th>
<th>Mode</th>
<th>Low tariff source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L123 / LTHT 7)</td>
<td>Clock / S0 input</td>
</tr>
</tbody>
</table>

1) Possible sources (see below)
2) Limits are dependent upon the selected transformation ratio at the voltage or current transformer
3) Source: interface, can only be adjusted via the interface – “off” appears at the display
4) Source: interface, adjustable via A2000 menu – “ext” appears at display
5) Interval –1 applies to P_int, Q_int or S_int (for recording max. values)
6) Interval 0 applies to P_int, Q_int or S_int (current shutdown interval for shutdown options)
7) L123 = individual phases L1, L2, L3; LTHT = low tariff high tariff

### Possible Sources

<table>
<thead>
<tr>
<th>U Δ</th>
<th>U ⊥</th>
<th>I</th>
<th>I_avg</th>
<th>P</th>
<th>Q</th>
<th>S</th>
<th>PF</th>
<th>Frequency</th>
<th>P_int</th>
<th>Q_int</th>
<th>S_int</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>U12</td>
<td>U1</td>
<td>I1</td>
<td>I1_avg</td>
<td>P1</td>
<td>Q1</td>
<td>S1</td>
<td>PF1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>U23</td>
<td>U2</td>
<td>I2</td>
<td>I2_avg</td>
<td>P2</td>
<td>Q2</td>
<td>S2</td>
<td>PF2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>U31</td>
<td>U3</td>
<td>I3</td>
<td>I3_avg</td>
<td>P3</td>
<td>Q3</td>
<td>S3</td>
<td>PF3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>U_mean</td>
<td>UΣ</td>
<td>IΣ</td>
<td>IΣ_avg</td>
<td>PΣ</td>
<td>QΣ</td>
<td>SΣ</td>
<td>PFΣ</td>
<td>f</td>
<td>P_intΣ</td>
<td>Q_intΣ</td>
</tr>
</tbody>
</table>
Possible Parameter Setting, Data Logger

<table>
<thead>
<tr>
<th>Trigger: relay 1, relay 2, both, off</th>
<th>Pretrigger: 0%, 25%, 50%, 75%</th>
<th>Disable Trigger: external (synchronizing output, off)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sampling</td>
<td>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, 5 day</td>
<td>Storemode: cyclic, once</td>
</tr>
<tr>
<td>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</td>
<td>Trace 1 ... 12: on, off</td>
<td>Trace 1 ... 12: on, off</td>
</tr>
</tbody>
</table>

3 Operating the A2000

3.1 Control Panel

T1: select phase L1, L2, L3

T2: selection of measured quantities: 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

T1+T1: Delete limit value relay alarms

\( P_{long} \): Enter parameters configuration (press & hold ≥ 2 seconds)
3.2 Response After Auxiliary Power is Switched On

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

I1

P1

T1

φ1

T2

Q1

S1

f

Only in energy meter mode, individual phases (L123)

L2

See diagram L1 for L2 values

L3

See diagram L1 for L3 values

U12

U23

f

U31

PΣ

QΣ

SΣ

φΣ

PΣ

QΣ

SΣ

φΣ

PΣ

QΣ

SΣ

φΣ

U1 thd

U2 thd

U3 thd

I1 thd

I2 thd

I3 thd

LT–

LT

HT–

HT

LT–

LT

HT–

HT

0 = current interval in use

with projected final value

The maximum value since the last deletion is displayed with the max setting (with T3).

↑↓: select intervals

-n * display interval (n = 0 ... 10)

-0 = current interval in use

↓↑: select intervals

The maximum value since the last deletion is displayed with the max setting (with T3).
If a rotating field is established at the U or I inputs upon switching on the A2000, the neutral conductor current is displayed instead of the frequency.

L1, L2, L3, Δ, △ and L1 L2 L3 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
## 3.4 Menu Display for Measurements in 3-Wire Systems

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

The maximum value since the last deletion is displayed with the max setting (with T3).
3.5 Error Messages

Parameters Error

One or more parameters have been irreparably corrupted.

Remedy: Enter \textit{P}_{\text{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.

- **Relays**
- **Display**
- **Inputs**
- **Analog out**
- **Pulse out**
- **LOGGER**
- **Energy**
- **COM**
- **SET**

Sub-Menus:
- **Source**
- **Brightness and display filter adjustment**
- **Transformation ratios for external transformers, synchronizing input**
- **Source input/output range**
- **Source (active/reactive energy) number of pulses**
- **LOGGER display / configure**
- **Configure energy meter**
- **Configure interfaces**
- **Store parameters, upload parameters, delete energy values set clock**

See chap. 4.1, page 18
See chap. 4.2, page 20
See chap. 4.3, page 22
See chap. 4.4, page 24
See chap. 4.5, page 25
See chap. 4.6, page 26
See chap. 4.7, page 30
See chap. 4.8, page 32
See chap. 4.9, page 34
4.1 Configuring the Limit Value Relays

Menu Display

- **Relay 1**
  - Source: L1
  - Response: high active
  - Meas. qty.: ampere

- **Relay 1**
  - Limit value: 5000 A

- **Relay 1**
  - Hysteresis: 1 A

- **Relay 1**
  - Limit value alarm memory: not active (off)

- **T1**: Source Selection
  - L1, L2, L3, (L12), (L13), (L23)

- **T2**: Quantity Selection
  - VΔ, V, A, AAVG, W, VAr, VA, φ, Hz, Wi, VAr, VAI, external

- **Value Settings**
  - Limit values: high / low active

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

---

Alarm memory
- on = active
- off = not active

In the display mode, a stored alarm is (simultaneously) deleted with ** storage to memory**.
Example: Limit value relay 2, but with other quantities and values.

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 0, rel change = dip or on
2. Disable changes to all parameters:
   'LOCK' = position 1, rel change = dip
3. Disable changes to all parameters except for relay parameters:
   'LOCK' = position 1 and rel change = on

rel change can only be set to “on” if “LOCK” has previously been set to 0.
4.2 Adjustment of Display Brightness and Filter

Adjusting display brightness

Menu Display

<table>
<thead>
<tr>
<th>P</th>
<th>long</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time</td>
</tr>
<tr>
<td></td>
<td>≥2 minutes</td>
</tr>
</tbody>
</table>

Measuring Inputs Menu...

Adjusting display filter

<table>
<thead>
<tr>
<th>P</th>
<th>brief</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>storage to memory</td>
</tr>
</tbody>
</table>

Parameters for display brightness

- 0: Adjustment of values
- 0 ... 7
- 0: minimum brightness
- 7: maximum brightness

The values are adopted immediately upon entry.
For permanent setting, however, storage to memory is recommended.
Parameters for display filter

: Adjustment of values

Time constant $\tau$ 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 $\tau$. 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 $5 \tau$ 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

Analog Output Menu ...

3-Wire Connection

3-Wire Connection

3-Wire Connection

3L: for 3-wire non-balanced load
3L-1: for 3-wire balanced load or 4-wire balanced load with one current transformer
4L: for 4-wire non-balanced load
(see 2.2)

100 V ... 750 kV
100 V steps for \( U_t < 100 \text{kV} \)
1 kV steps for \( U_t \geq 100 \text{kV} \)
in 1 V steps

100 V ... 500 V

100 V ... 750 kV
100 V steps for \( U_t < 100 \text{kV} \)
1 kV steps for \( U_t \geq 100 \text{kV} \)
in 1 V steps

3L: for 3-wire non-balanced load
3L-1: for 3-wire balanced load or 4-wire balanced load with one current transformer
4L: for 4-wire non-balanced load
(see 2.2)
Input transformer primary current: 60.0 kA

Input transformer secondary current: 1.00 A

Synchronizing pulse every 15 minutes

---

Value Settings

1 A ... 50 kA

Value Settings

1 or 5 A

Value Settings

external, 1 ... 60 minutes

5 A steps for \( I_t < 5 \text{kA} \)

50A steps for \( I_t > 5 \text{kA} \)

500A steps for \( I_t > 50 \text{kA} \)
4.4 Configuring the Analog Outputs (not with Profibus-DP)

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

1) The source corresponds to the current \((-0)\) interval value \((P_{\text{int}}, Q_{\text{int}}, S_{\text{int}})\) for intervalic power.
4.5 Configuring the S0 Pulse Outputs

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

\[ LTHT = \text{Low tariff, high tariff, settings see chapter 4.7 on page 30} \]
4.6 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

Point indicates that a trigger event has been recognized.

Maximum number of storable trigger events (N)

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

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.

0...99%, FULL (memory occupancy level)

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!
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-)

Sampling time

Storage rate

Sampling time $T_{sa}$, storage time $T_{st}$ and number of traces $\Sigma Tr$ result in a maximum number of storable trigger events $N$ with a memory capacity of 128 kByte

$$N = \frac{63000 \times T_{sa}}{(T_{st} \times \Sigma Tr)}$$

(Round $N$ up to whole number: $N_{min} = 1$, $N_{max} = 99$)

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

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

1) with Pint, Qint, Sint source is relative to the interval value
Display: e.g. \textit{TrAcE $B$}
4.7 Configuring the Energy Meter Mode

Menu Display

Energy Meter Mode

Source for Low Tariff Activation

Low Tariff Start Time

Low Tariff End Time

Setting same as for clock, see chapter 4.9 on page 34!!
(seconds remain at zero)

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

1) L1, L2, L3, LΣ active and reactive energy, Low tariff and high tariff settings only act on pulse outputs

Mode setting

L123 = Individual phases

LTHT = Low tariff high tariff (import / export)

Active and reactive energy

Only appears for data logger:

EnEr

Node

L123

EnEr

LT Enable

EnEr

22.00 LT

EnEr

06.00.00 LT

EnEr

End

long

brief

storage to memory

no storage to memory

Time / no LT

Internal clock with data logger.

Variant without data logger does not provide for low tariff function via clock.

Switch-over via synchronizing input

LT = input short-circuited

HT = input open

Mode setting

Mode setting

Mode setting

: Mode setting

L123 = Individual phases 1)

LTHT = Low tariff high tariff (import / export)

Active and reactive energy

1) L1, L2, L3, LΣ active and reactive energy, Low tariff and high tariff settings only act on pulse outputs
4.8 Interface Configuration

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

**LON service, only if key is pressed and held**

- **coN2**
- **Lon S Er**
- **SEnd**

**LON ID: 00c000156800**

**Status: Wait Config**

- **Prof, STAT**
- **WcFG**
- **dAt ... X**
- **Err**

Only appears for LON interface variant:

Only appears for Profibus DP variant:

**T3**

storage to memory

**LON service:**

- **con2**
- **Lon S Er**
- **SEnd**

**Status:**

- **WcFG** = Wait Config
- **WPAR** = Wait Parameter
- **dAT...X** = Data Exchange
- **Err** = Error
4.9 Uploading and Deleting Parameters, Setting the Clock

Menu Display

- **P** (long) Time ≥2 minutes
- **P** (brief) storage to memory
- **no** storage to memory

Relay Menu ...

- **set**
- **def**
- **nt**

Do not upload default parameters (factory presets)

- **set**
- **dEFAuLT**
- **no**

Do not upload user parameters

- **set**
- **LoAd**
- **uSER**
- **no**

Do not store user parameters

- **set**
- **StorE**
- **uSER**
- **no**

Do not delete meter readings

- **set**
- **EnErgy**
- **0**
- **no**

---

**settings no/yes. For reasons of safety, the [1] or [2] key must be pressed and held for more than 2 sec.**

- --- yes loads/stores the corresponding parameters ---
- --- yes deletes all meter readings ---
Selection: with or without + or - sign

Only appears for data logger variant:

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

Selection and storage of day, month and year

Status:

$d_i n$ = Reactive power per DIN 40110 without + or - sign

$S_i G_n$ = Reactive power with + or - sign

$\text{comp} P$ = Compensating reactive power

Selection:

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

Adjust day, month and year
5 Electrical Connections and Circuits

Relay 1 Relay 2 I1 I2 I3 N L1 L2 L3

Power supply
(see specified values on serial plate)

N 115V 230V ∼ ∼ ±10% 45...65 Hz
20...69 V 20...72 V 73...264 V 73...276 V

Power supply max. 15 VA

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

<table>
<thead>
<tr>
<th>Sub-D plug at PC</th>
<th>A2000</th>
<th>RS-232</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of pins</td>
<td>25</td>
<td>9</td>
</tr>
<tr>
<td>DCD</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>RxD</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>TxD</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>DTR</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>Gnd</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>DSR</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>RTS</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>CTS</td>
<td>5</td>
<td>8</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Master</th>
<th>A2000</th>
<th>Match</th>
<th>Master</th>
<th>A2000</th>
<th>Match</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>------</td>
<td></td>
<td>A</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>------</td>
<td></td>
<td>B</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>------</td>
<td></td>
<td>C</td>
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</tr>
</tbody>
</table>

See separate interface description 3-349-091-03 for LON variants.
Profibus DP connection (optional)

See separate interface description 3-349-092-03.
6 Interface Description

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 because the hardware configuration only allows for installation of one of the two. See chapter 5 on page 36 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 ohms 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: $t_{ber} > 5 \text{ s}$
- Character delay time (A2000 transmitter): $t_{zvs} < 3 \text{ ms}$
- Character delay time (Master): $t_{zvm} < 100 \text{ ms}$
- Response delay time (A2000 transmitter): $10 \text{ ms} < t_{av} < 100 \text{ ms}$
- Query waiting time after response from A2000 (master): $t_{aw} > 10 \text{ ms}$
Panel Cutout $138^{+1} \times 138^{+1}$ mm

All dimensions in mm
8 Technical Data

**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: > 4 MΩ
- Power Consumption: < 150 mW

**Current Inputs**
- 0 ... 1 ... 1.2 A
- 0 ... 5 ... 6 A
- Overload: 1.4-fold cont.
- Power Consumption: < 150 mW

**Sampling Rate**
- 32 samples per period per measurement value

**Measuring Error**
- **Current**: ± (0.25 % of NV + 1 digit)
  - for MV > 2 % of NV
- **Voltage**: ± (0.25 % of NV + 1 digit)
- **Power, Energy**: ± 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
- Alternately: RS-232 and LON or RS-232 and Profibus-DP
- Baud Rate: 1200, 2400, 4800, 9600, 19200 baud
- Parity: even, odd, space, no

**Pulse Outputs**
- Contact: open collector
- Current: ON 10 mA ... 27 mA, OFF < 2 mA
- External Voltage: 8 ... 30 V
- Pulse Duration: 100 ms + 50%
- 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

**Synchronizing input**
- On: short-circuited with R < 10 Ω
- Off: open with R > 10 MΩ
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

### Power Supply
**Supply Voltage** 230 V / 115 V ≈ ± 10%
45...65 Hz
20...69 V ≈ 45...450 Hz
20 ... 72 V ≈
73...264 V ≈ 45...450 Hz
73...276 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.

---

**Display of Reactive Power**

$d_i n = $ calculation of reactive power per DIN 40110 without + or – sign

\[ Q = \sqrt{S^2 - P^2} \]

\[ Q = \frac{1}{T_N} \int_0^{T_N} u(t) \cdot i(t - \frac{T_N}{4}) \, dt \]

**Sign** = calculation of reactive power with + or –

PF = cap
PF = ind

1. Q
2. Q
3. Q
4. Q

EP– EQ–
EP+ EQ+
EP– EQ–
EP+ EQ+

PF = ind
PF = cap
\[ Q = - \frac{2}{TN} \int_0^{TN} u(t) \cdot i(t) \, dt \]

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

**Electrical Safety**

**Variants**

- Protection Class: II
- Overvoltage inputs: III
- Category relays: II
- Contamination Level: 2
- Operating Voltage: 300 V ~

**Protection**

- IEC 60529 / EN 60529
- Front Panel: IP 52
- Housing: IP 30
- Terminals: IP 20

---

**EMC**

- Interference Emission: IEC 61326-1 / EN 61326-1
- Interference Immunity: IEC 61326 / A1 / EN 61326 / A1

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

When you need service, please contact:

GOSSEN-METRAWATT GMBH
Service-Center
Thomas-Mann-Strasse 20
90471 Nürnberg, Germany
Phone +49 911 86 02 - 410 / 256
Fax +49 911 86 02 - 2 53
e-mail service@gmc-instruments.com

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

10 Product Support

When you need support, please contact:

GOSSEN-METRAWATT GMBH
Product Support Hotline
Phone +49 911 86 02 - 112
Fax +49 911 86 02 - 709
e-mail vmp.info@gmc-instruments.com