

A2000

Multifunctional Power Meter

3-348-980-03
6/11.00

- Capable of communications via Profibus-DP, LONWORKS interface or RS 485 interface (depending upon model)
- Measurement of current, voltage, active, reactive and apparent power, power factor, line frequency and energy
- Simultaneous display of up to 4 measurement values
- Minimal installation depth, only 59.1 mm
- 9 digit energy display
- High or low tariff meter can be selected (selection possible with internal clock or external output)
- Storage of selected measurement values (continuous or events triggered recording of measurement values)
- Adjustable transformation ratios for current and voltage transformers
- Two limit value contacts (can be assigned as desired to measurement values)
- Software for read-out and processing of measurement values as they occur, or previously stored measurement values



Applications

The measuring instrument is used for the analysis of alternating current systems, and especially for the replacement of conventional analog measuring instruments within distribution systems. Used in combination with current and voltage transformers, the instrument is capable of performing the most important measurements required in low to medium voltage systems. Analog outputs, limit value functions and interfaces are available for the monitoring and processing of measurement values. A time curve is simultaneously recorded for up to 12 measurement values if the instrument version with integrated memory is utilized. In this way, important measurement values can be monitored continuously over a long period of time, or on a short-term basis by means of triggers.

The instrument can be freely programmed and is highly flexibility.

Additional Features

- Rapid acquisition of all measurement values within 300 ms
- Adjustable triggering for data recording
- Pre-event history can be recorded with trigger controlled data acquisition
- System quantities to be displayed can be combined in a multitude of various fashions
- Clear representation of measurement values with direct display of magnitude

Applicable Regulations and Standards

IEC 61010-1 / EN 61010-1 / VDE 0411 Part 1	Safety requirements for electrical equipment for measurement, control and laboratory use
DIN 43864	Current interface for pulse transmission between impulse meters and tariff devices (for pulse output)
EN 50081-2	Electromagnetic compatibility (EMC) generic standard for interference emission: industrial sector
IEC 61000-6-2 / EN 61000-6-2	Electromagnetic compatibility (EMC) generic standard for interference immunity: industrial sector
IEC 60529 / EN 60529 / DIN VDE 0470 Part 1	Protection provided by enclosures (IP code)

Function and Operational Principle

The measuring instrument acquires instantaneous values for star-connected voltages and currents at three-phase electrical systems. If no neutral is available, the instrument automatically creates a virtual neutral point. The speed at which measurement values are logged depends upon the respective line frequency. Each measurement value is updated 32 times per period, which allows for the acquirement of measuring signals of up to the 15th harmonic. After these values have been stored to memory, analysis and calculation of data such as delta- and star-connected currents and voltages begins, as well as the determination of parameters for power, power factor and energy. These calculations are performed in accordance with DIN 40110 Part 1 and 2.

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Data Storage

Up to 12 measurement values can be selected for storage to memory. The measuring instrument acquires these measurement values once every 300 ms and stores them first to intermediate memory. These values are then averaged in accordance with the selected sampling rate and are stored to permanent memory as mean values. The sampling rate is adjustable from 300 ms to max. 30 minutes. Recording is triggered by means of internally selected limit values. The duration of the recording can be set within a range of 1 minute to 4 days. Several events can thus be stored to memory, one after the other. The trigger level which starts the recording can be set to either 0%, 25%, 50% or 75% for the duration of any given recording. This provides the user with an overview of the pre-history of the event which triggered recording, including time and date.

Continuous recording is also possible.

The memory has a capacity for up to 63,000 values. The maximum possible duration of a recording depends upon the number of recorded measurement values (1 to 12), and the sampling rate at which they are to be recorded (0.3 s to 30 min.).

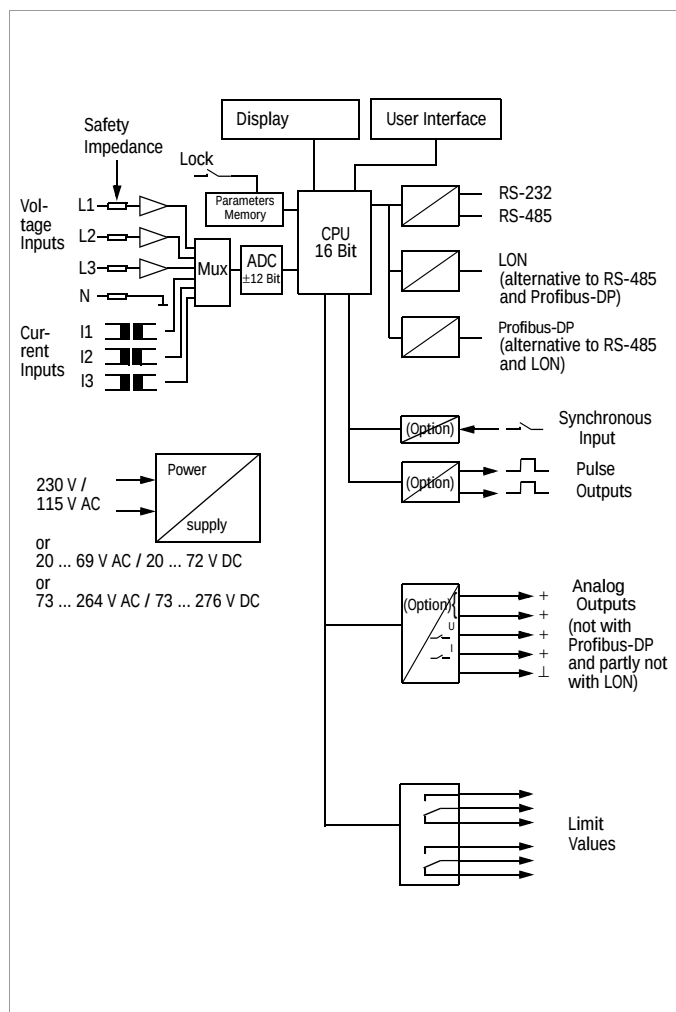


Figure 1 Schematic Diagram

Representation of Values for Power and Power Factor

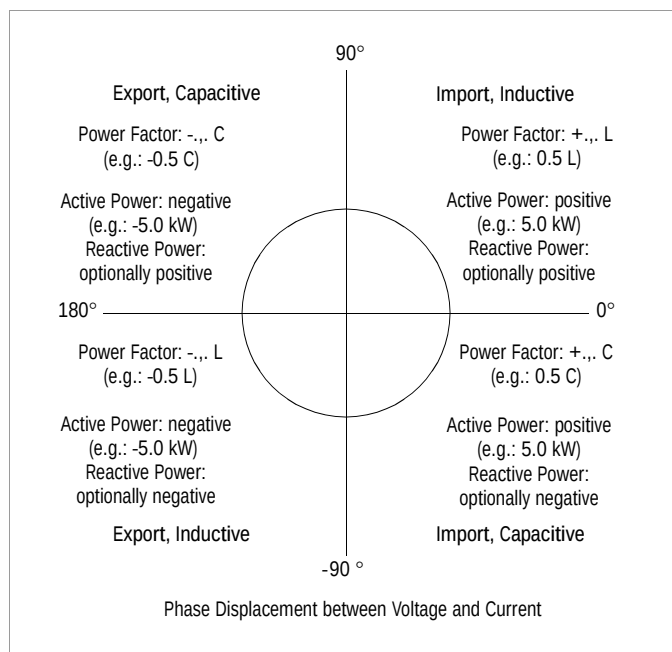


Figure 2 Values for Power and Power Factor with Inductive and Capacitive Values for Import and Export

Energy Display

The instrument is equipped with eight energy meters for the display of energy values. The following energy values appear at these displays upon shipment from the factory:

- Active energy for phases 1, 2 and 3, as well as for the overall system
- Reactive energy for phases 1, 2 and 3, as well as for the overall system

The meters can be reconfigured to display the following energy values during instrument configuration:

Active energy,	high tariff,	import for the overall system
Active energy,	low tariff,	import for the overall system
Active energy,	high tariff,	export for the overall system
Active energy,	low tariff,	export for the overall system
Reactive energy,	high tariff,	import for the overall system
Reactive energy,	low tariff,	import for the overall system
Reactive energy,	high tariff,	export for the overall system
Reactive energy,	low tariff,	export for the overall system

Switching from high to low tariff can be accomplished either by means of the synchronization input, an external contact or the data logger's internal clock (only possible if the instrument version with data logger is utilized).

Serial Interface

The measuring instrument is provided with an RS 232 and an RS 485 interface as standard equipment. Both interfaces use the same protocol. Transmission speed can be set to either 1200, 2400, 4800, 9600 or 19,200 baud. Addresses ranging from 0 to 254 can be selected for operation on a bus.

In the versions with LONWORKS interface the serial interface RS 485 has been dimensioned for the LONWORKS interface. No additional settings are required for LON.

In the versions with Profibus DP the serial interface RS 485 has been dimensioned for the Profibus DP. The selected address is

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valid for the RS 232, as well as for the Profibus DP. Addresses greater than or equal to 126 are interpreted as Profibus address 126, and can thus be used to allow for the assignment of an address to the instrument via the Profibus.

The selected baud rate only applies to the RS 232 interface for these instrument versions. The master determines transmission speed for the Profibus. The A2000 can be operated at the Profibus DP at transmission speeds of up to 12 mega-baud.

LONWORKS Interface

The power meters can be alternatively equipped with a LON interface. In this case, the LONWORKS interface replaces the RS 485. The RS 232 interface is still used for configuring parameters and for reading out the contents of the data memory. The optional data logger can be used with these instrument versions as well, in which case the read-out of recorded data is accomplished via the RS 232 interface.

Profibus DP

In the Profibus DP version the serial interface is used only for the Profibus. All measurement data, except for values stored to the data logger, can be read out via the bus link. Transmission speeds of up to 12 mega-baud are possible.

The standard Profibus 9-pin plug is used to connect these measuring instruments to the Profibus DP.

Programming

The instrument can be programmed either with the keys at the front panel or via serial interface. All selected values remain in memory, even if mains failure should occur.

All programmed parameters, except for the limit values, can be protected against inadvertent change with a switch (**LOCK**) at the instrument's rear panel.

This assures that the instrument configuration is not changed during limit value selection.

Alternatively, the LOCK switch can be programmed to protect all parameters, including limit values, against unauthorized modification.

The following values can be set during programming:

Type of Electrical System

4-wire unbalanced load or
3-wire unbalanced load
3-wire balanced load

The energy meters can be configured to display active and reactive energy for phases L1, L2 and L3, as well as for the overall system, or active and reactive energy for the overall system subdivided into energy import and export, and high and low tariff.

Inputs

Secondary Transformer Current 5 A or 1 A
Primary Transformer Current 1 A
5 A ... 5000 A in 5 A steps
to 50000 A in 50 A steps
to 150000 A in 500 A steps
Secondary Transformer Voltage from 100 V to 500 V
in 1 V steps

Primary Transformer Voltage

from 100 V to 100 kV
in 100 V steps
to 750 kV in 1 kV steps

Synchronous Input

external, or
operation with internal mean
value generation, adjustable
from 1 to 60 minutes

Outputs

Limit Value Monitoring

- Monitored measurement values (sources)
- Min-max characteristics
- Hysteresis
- Alarm message storage, on/off
- Limit value

2 or 4 Analog Outputs

- Measurement values which influence the analog outputs
- Output range 4 ... 20 mA, 0 ... 20 mA, ± 20 mA, 0 ... 10 V, 2 ... 10 V or ± 10 V
- Analog range with lower and upper range values (independent of measuring range)

Pulse Outputs

for Active or Reactive Energy

- Export, Import
- Overall energy or energy from the individual phase conductors
- Active or reactive energy
- Pulse rate:
 - 1 ... 1000 pulses per kWh in steps of 1
 - 1000 ... 5000 pulses per kWh in steps of 10

The same pulse rates can be used for MWh as well.

Serial Interface

RS-232 and RS-485 both use the same protocol.
Addresses ranging from 0 to 254,
Baud rate: 1200, 2400, 4800, 9600 or 19200

The measuring instrument is configured with the following parameters at the factory:

All parameters can be subsequently changed by the user.

The encoding switch for securing selected parameters against change is set at the factory to allow for parameter changes.

Type of Electrical System

Configuration

4-wire unbalanced
(The energy meters display active and reactive energy for phases L1, L2 and L3, as well as for the overall system.)

Inputs

Current

second. transformer current 5 A
primary current same as
secondary (= ratio 1:1)

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Voltage	secondary phase conductor voltage at the transformer 500 V primary phase conductor voltage same as secondary (= ratio 1:1)	Characteristic Values	
Synchronizing Pulse	internal, mean value over 15 min.	Display	
Outputs		Type	7 segment LED
		Display Color	red
Limit Value 1	Measurement value: I_{L1} set to: 5 A No hysteresis Relay closes when exceeded No storage of alarm messages	Character Height	13.2 mm
Limit Value 2	Measurement value: U_{L1} set to: 240 V No hysteresis Relay closes when exceeded No storage of alarm messages	Display Range	max. 9999
Analog Output 1	Meas. value: Overall active power Range: Import 0 ... 2000 W Output Value: 4 ... 20 mA	Energy	max. 999999999
Analog Output 2	Meas. value: Overall reactive power Range: Import 0 ... 1000 Var Output Value: 4 ... 20 mA	Input	
Analog Output 3 (optional)	Meas. value: I_{L2} Range: 0 ... 5 A Output Value: 4 ... 20 mA	Voltage Measurement	
Analog Output 4 (optional)	Meas. value: U_{L2} Range: 0 ... 250 V Output Value: 4 ... 20 mA	Conductor – Conductor	0 ... <u>500</u> ... 550 V, 40 ... 70 Hz overload 1.2-fold
Pulse Output 1 (optional)	Meas. value: overall system Active Energy Import 10 pulses per kWh	Conductor – N (Earth)	0 ... <u>290</u> ... 320 V, 40 ... 70 Hz
Pulse Output 2 (optional)	Meas. value: overall system Active Energy Export 10 pulses per kWh	Overload	1.2-fold
Serial Interface	Address 250 Baud Rate 9600	Input Impedance	> 4 M Ω
		Current Measurement	0 ... <u>1</u> ... 1.2 A 0 ... <u>5</u> ... 6 A
Overload		1.4-fold permanent 30 A / 10 s 100 A / 3 s	
Internal Consumption		< 150 mW	
Measurement		32 samples per period and measurement values with mean value generation over 16 periods 4 quadrant operation	
Measurement Value Display		The selected parameters for current and voltage transform- ers are taken into consideration for displayed measurement values.	
Meas. Error of			
Current and Voltage		$\pm 0.25\%$ of nom. value ± 1 digit	
Power		$\pm 0.5\%$ of nom. value ± 1 digit	
Power Factor		± 0.02 for U and I > 10% of nom. value	
Frequency		± 0.02 Hz	
Energy		$\pm 0.5\%$ with nom. values for current and voltage	
Synchronization Pulse		The synchronizing input recognizes floating contact. ON: < 10 Ω , OFF: > 10 M Ω	
Outputs			
Relays		One changeover contact per limit value	
Switching Capacity		AC / DC 250 V, 2 A 500 VA / 50 W (nominal load)	
Service Life		> 500000 switching cycles	
Hysteresis		Adjustable for each relay from ± 0 to ± 100 digits	

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Analog Outputs

Range and Values

Measurement values can be freely selected for analog outputs and read-out

Output Quantity

Configurable
current 0 / 4 ... 20 mA /
 ± 20 mA
voltage 0 / 2 ... 10 V /
 ± 10 V

Output Load, Current

max. 500 Ω

Output Load, Voltage

< 20 mA

Resolution

0.1 % of control range, or in accordance with resolution for ranges of less than 1000 digits

Error Limits

± 0.5 % of nom. value with current
 ± 1.0 % of nom. value with voltage

Load Impedance Effect

for Voltage
for Current

no effect to > 10 K Ω
< 0.8 μ A / Ω (0 ... 250 ... 500 Ω)

Pulse Output

Contact

open emitter

Current

ON 10 mA ... 27 mA
OFF < 2 mA

External Voltage

8 ... 30 V

Pulse Duration

100 ms

Interpulse Period

min. 10 ms

Error Limits

± 0.5 % with nom. values for current and voltage (= max. power)

Interfaces

RS 232 and RS 485

alternative:

RS 232 and LON or RS 232 and Profibus-DP

Protocols for

RS 232 and RS 485

adjustable:

GMC device bus (DIN Draft 19244),

EN 60870 or Modbus (RTU)

GMC device bus

Power Supply

Supply Voltage

230 V / 115 V AC ± 10 %
45 ... 65 Hz

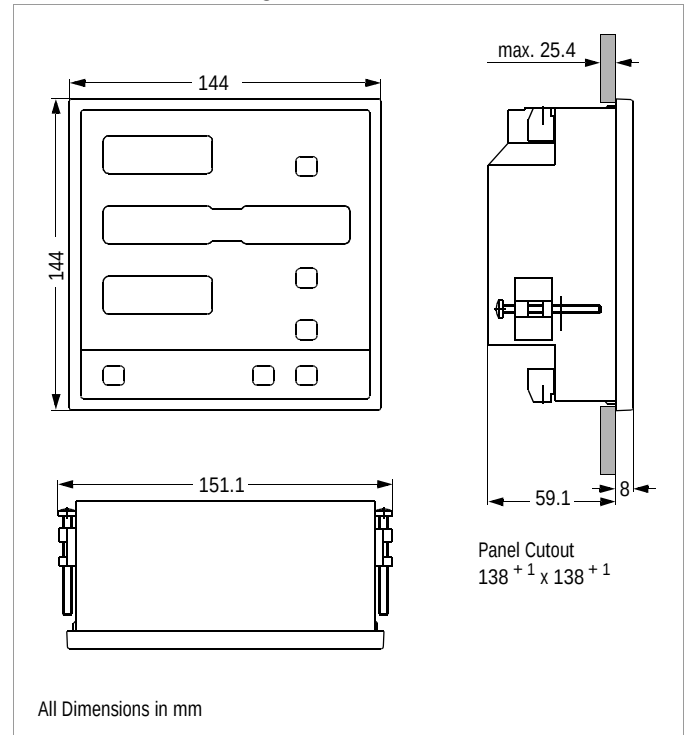
20 V ... 69 V AC 45 ... 450 Hz
20 V ... 72 V DC or

73 V ... 264 V AC 45 ... 450 Hz
73 V ... 276 V DC

Power Consumption

max. 15 VA

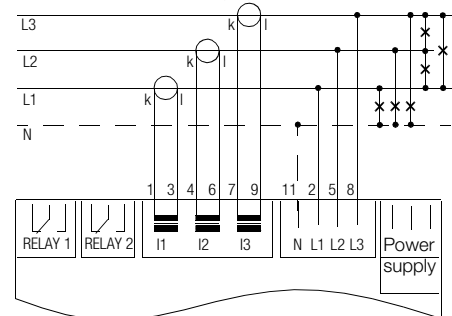
Dimensional Drawing



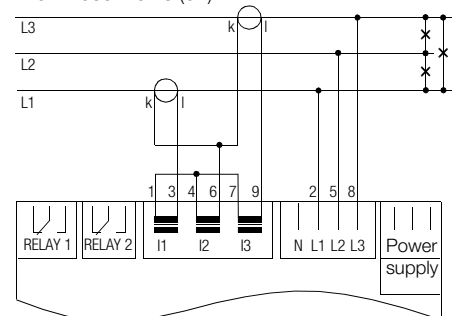
Terminal Assignments

Current Inputs

Connection with 3 Current Transformers in 3- / 4-Phase Mains (4L)



Connecton with 2 Current Transformers in 3-Phase Mains (3L)



Mechanical Design

Dimensions

144 x 144 x 67.1 mm

Panel Cutout

138 +1 x 138 +1 mm

Installation Depth

max. 59.5 mm

Protection

front panel IP 54
rear panel IP 20

Protection Class

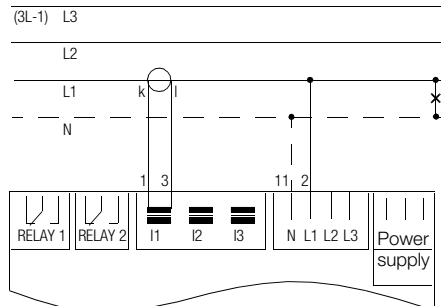
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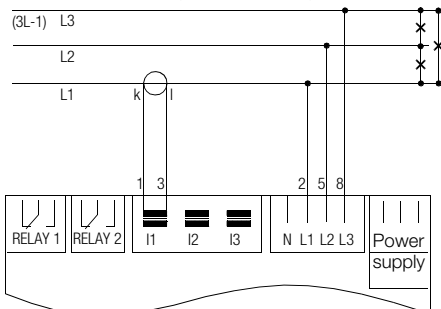
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Current Inputs

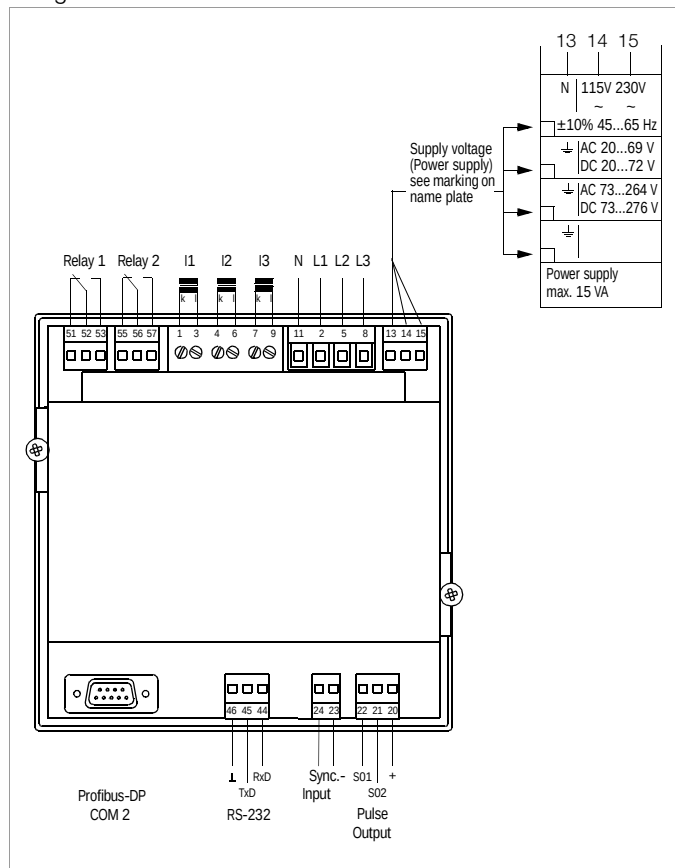
Connection with 1 Current Transformer
in 4-Phase Mains (Identical Load, $I_N = 0$)



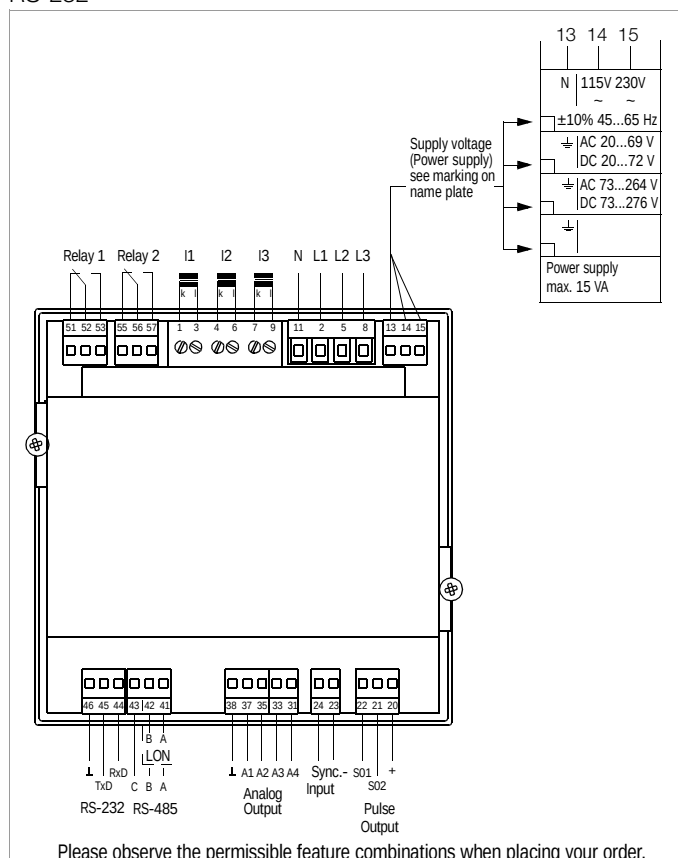
Connection with 1 Current Transformer
in 3-Phase Mains (Identical Load)



Design with Profibus-DP and RS-232 Serial Interface



Design with RS-232 and RS-485 Serial Interface or with LON and RS-232



Please observe the permissible feature combinations when placing your order.

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Software

METRAwin®10/A2000

Software for read-out and processing of measurement values as they occur, or values from the data logger in the A2000 multifunctional power meter, and for configuring parameters at the A200.

This software runs under Windows 3.11, Windows 95 or higher and Windows NT

- Read-out of measurement values from the power meter's data logger
- Continuous recording of measurement values over a given period of time
- Display of measurement values as a function of time in line recorder format or in tabular form, or individual values displayed digitally or as a bar graph
- Freely selectable time intervals
- Identification of curves for the recognition of individual measurement value sequences
- Simple, clear parameters configuration for the A2000
- Parameters configurations for frequently recurring setups can be saved to memory
- Measurement values can be exported to other Windows programs
- Mathematical functions

Software Description

Data Accusation and Display

METRAwin®10/A2000 provides for an unambiguous display of the contents of the data memory from the A2000. Alternatively, measurement values can be continuously queried from the measuring instrument by the software, and stored to a data file.

METRAwin®10/A2000 summarizes values from the data logger or online recorded values in tabular form, and documents minimum and maximum values with date and time as well.

All measurement values can be plainly represented as a function of time with a yt graph. The time scale can be expanded or contracted to allow for optimal representation. The cursor can be placed at the corresponding position within the time scale for precision readings.

Measurement values can also be displayed digitally. Up to four measurement values can be displayed at the monitor simultaneously in digital form.

Instrument Configuration with METRAwin®10/A2000

METRAwin®10/A2000 plainly displays all of the functions and possible settings included in the power meter in various windows. The desired parameter values are entered to the corresponding fields and are subsequently uploaded to the power meter.

Standard Equipment

Power meters without data memory (without optional data logger):

Measuring instruments without data logger are shipped with operating instructions in either German, English or French.

Power meters with data memory (with optional data logger):

In addition to the measuring instrument and operating instructions, in either German, English or French, power meters with data logger also include a floppy disk with METRAwin®10/A2000 software and an adapter with a subminiature plug (for connection to a PC via extension cable).

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Order Information

Designation		Article number
A2000 Multifunctional Power Meter		A2000
Supply Voltage	230 V / 115 V AC	H0
	20 V ... 69 V AC / 20 V ... 72 V DC	H1
	73 V ... 264 V AC / 73 V ... 276 V DC	H2
Analog Outputs	with 2 analog outputs (not available for the serial interface version with Profibus-DP and RS-232)	A0
	with 4 analog outputs (not available for the serial interface version with LON and RS-232 or with Profibus-DP and RS-232)	A1
	without analog outputs (not available for the serial interface version with RS-232 and RS-485 or with LON and RS-232)	A2
Pulse Outputs / Synchronizing Input	without pulse output and without synchronizing input	P0
	with 2 pulse outputs and 1 synchronizing input	P1
Data Logger	without data logger	R0
	with data logger (not available for the analog output version with 2 analog outputs and with RS-232 and RS-485 serial interface)	R1
Serial Interface	with RS-232 and RS-485	L0
	with LON and RS-232 (not available for version with RS-232 and RS-485 or with Profibus-DP and RS-232)	L1
	with Profibus-DP and RS-232 (not available for version with RS-232 and RS-485 or with LON and RS-232)	L2
Manufacturer's Certificate / Test Report	without certificate	U0
	with certificate and test report	U1
Operating Instructions	German	W0
	English	W1
	French	W2

Accessories

Designation	Article number
METRAwin®10/A2000 with adapter - software for the transmission of measurement values and for instrument configuration	Z305A
Interface cable RS-232, approx. 2 m long	GTZ3241000R0001

Standard Units

The following measuring instruments can be shipped as standard units. Only the article number needs to be indicated.

Designation	Instrument and Features Combination	Article number
A2000 with 230 V / 115 V AC supply voltage, with 2 analog outputs, with RS-232 and RS-485 interfaces, with operating instructions in German	A2000 H0 A0 P0 R0 L0 U0 W0	A2000-V001
A2000 with 230 V / 115 V AC supply voltage, with 4 analog outputs, with 2 pulse outputs and 1 synchronizing input, with RS-232 and RS-485 interfaces, with operating instructions in German	A2000 H0 A1 P1 R0 L0 U0 W0	A2000-V002
A2000 with 230 V / 115 V AC supply voltage, with 4 analog outputs, with 2 pulse outputs and 1 synchronizing input, with data logger, with RS-232 and RS-485 interfaces, with operating instructions in German	A2000 H0 A1 P1 R1 L0 U0 W0	A2000-V003
A2000 with 230 V / 115 V AC supply voltage, with 2 analog outputs, with 2 pulse outputs and 1 synchronizing input, with LON- and RS-232 interface, with operating instructions in German	A2000 H0 A0 P1 R0 L1 U0 W0	A2000-V004
A2000 with 230 V / 115 V AC supply voltage, with 2 pulse outputs and 1 synchronizing input, with Profibus-DP and RS-232, with operating instructions in German	A2000 H0 A2 P1 R0 L2 U0 W0	A2000-V005

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