CAMILLE BAUER

INTUITIVE NAVIGATION IN ELECTRICAL NETWORKS

COMPREHENSIVE INSTRUMENTS FOR MEASUREMENT AND MONITORING OF POWER SYSTEMS

SINEAX AM-SERIES

SINEAX AM1000 ▪ SINEAX AM2000 ▪ SINEAX AM3000

Panel installation devices for a clear view into electrical networks

The SINEAX AM-SERIES devices are compact instruments to measure and monitor in heavy current grids. They excel in display quality and intuitive operation. The devices provide a wide range of functionalities which may even be extended by optional components. They are connected to the process environment by communication interfaces, via digital I/Os, analog outputs or relays.

The devices have been designed for universal use in industrial plants, building automation or in energy distribution.

Nominal voltages of up to 690 V and measurement category CATIII can be directly connected in low voltage systems.

The universal measuring system permits the direct use of the devices in any type of grid, from single-phase mains through to 4-wire unbalanced load systems.

The AM series devices may be completely adapted to requirements on site via TFT display. Versions with an Ethernet interface permit webpage configuration without any special software.

CLEAR

High resolution, colour TFT display for the pin-sharp indication of measured data

Consistently visible status information (alarms, password protection, data recording, time/date and much more)

Clear design

INTUITIVE

Easy device operation with language-specific plain text menu guidance

Topical arrangement of measured data information for quick access to desired data

Service area for maintenance and commissioning

MULTIFUNCTIONAL

Varied monitoring options via limit values and their logical linkage

Central alarm function via display

Alarm list with plain-text information for a quick plant status overview

FLEXIBLE

Universal measuring inputs for any type of grid

Freely selectable mean value and meter measuring variables

Configurable access authorisation

SCALABLE

Combinable device version (functionality, interfaces, I/Os, power supply)

Front dimension options (96x96 or 144x144mm)

Integration as a standard object into the SMARTCOLLECT software

|	AM1000	AM2000	AM3000
Input channels voltage / current	3 / 3	3 / 3	4 / 4
Measurement interval [#cycles]	10/12 (50/60Hz); 1/2	10/12 (50/60Hz)	10/12 (50/60Hz); 1/2
MEASURED VALUES			
Instantaneous values	▪	▪	▪
Extended reactive power analysis	▪	▪	▪
Imbalance analysis	▪	▪	▪
Neutral current	calculated	calculated	measured / calculated
Earth wire current (calculated)	--	--	▪
Zero displacement UNE	calculated	calculated	measured / calculated
Energy balance analysis	▪	▪	▪
Harmonic analysis	▪	▪	▪ (incl. phase angle)
Operating hour counters device / general	1 / 3	1 / –	1 / 3
Monitoring functions	▪	▪	▪
Visualisation curve shape U/I	–	–	▪
MEASUREMENT UNCERTAINTY			
Voltage, current	±0,2%	±0,2%	±0,1%
Active, reactive, apparent power	±0,5%	±0,5%	±0,2%
Frequency	±10mHz	±10mHz	±10mHz
Active energy (IEC 62053-21/22)	Class 1	Class 1	Class 0.5S
Reactive energy (IEC 62053-24)	Class 1	Class 1	Class 0.5S
DATA LOGGER (Option, only with Ethernet)	internal (≥2GB)	Micro SD card (≥2GB)	Micro SD card (≥2GB)
Periodic recording	▪	▪	▪
Event recording	▪	▪	▪
Disturbance recorder (with pretrigger)			
a) 1/2 cycle RMS progression U/I	≤3min.	–	≤3min.
b) Curve shape U/I [#cycles]	–	–	5/6 (pretrigger) +10/12
COMMUNICATION			
Ethernet: Modbus/TCP, web server, NTP	(option)	(option)	(standard)
RS485: Modbus/RTU	(option)	(standard)	(option)
Standard I/Os	1 dig. OUT ; 1 dig. IN/OUT	1 dig. IN ; 2 dig. OUT	1 dig. IN ; 2 dig. OUT
I/O extension modules (optional)	max. 1 module	max. 4 modules	max. 4 modules
POWER SUPPLY	100-230V AC/DC 24-48V DC	110-230V AC/130-230V DC 110-200V AC/DC 24-48V DC	110-230V AC/130-230V DC 110-200V AC/DC 24-48V DC
DESIGN			
Colour display	TFT 3,5" (320x240px)	TFT 5,0" (800x480px)	TFT 5,0" (800x480px)
Front dimensions	96 x 96 mm	144 x 144 mm	144 x 144 mm
Mounting depth	85 mm	65,2 mm	65,2 mm

MEASURED VALUES

| MEASURED VALUE GROUP	APPLICATION
INSTANTANEOUS VALUES U, I, IMS, P, Q, S, PF, LF, QF … Angle between voltage phasors Min/max of instantaneous values with time stamp	Transparent monitoring of present system state Fault detection, connection check, sense of rotation check Determination of grid variable variance with time reference
EXTENDED REACTIVE POWER ANALYSIS Total reactive power, fundamental frequency, harmonics $\cos\phi$, $\tan\phi$ of fundamental frequency with min values in all quadrants	Reactive power compensation Verification of specified power factor
HARMONICS ANALYSIS (ACCORDING TO EN 61 000-4-7) Total harmonics content THD U/I and TDD I Individual harmonics U/I up to 50$^{\text{th}}$	Evaluation of the thermic load of equipment Analysis of system perturbation and consumer structure
IMBALANCE ANALYSIS Symmetrical components (positive, negative, zero sequence system) Imbalance (from symmetrical components) Deviation from U/I mean value	Equipment overload protection Fault/earth contact detection
ENERGY BALANCE ANALYSIS Meters for the demand/supply of active/reactive power, high/low tariff, meters with selectable fundamental variable Power mean values active/reactive power, demand and supply, freely definable mean values (e.g. phase power, voltage, current and much more). Mean value trends	Preparation of (internal) energy billing Determination of energy consumption versus time (load profile) for energy management or energy efficiency verification Energy consumption trend analysis for load management
OPERATING HOURS 3 operating hour counters with programmable running condition (only AM1000/AM3000) Operating hours of the device	Monitoring of service and maintenance intervals of equipments

DEMAND / SUPPLY / INDUCTIVE / CAPACITIVE

The devices of the SINEAX AM-SERIES provide information for all of the four quadrants. Depending on whether the measured system is considered from a generator or consumer perspective, the interpretation of the quadrants changes: The energy formed from active power in Quadrants I+IV can then be regarded, e.g., as supplied or demanded active energy. In order to facilitate an independent interpretation of the 4-quadrant information, the terms demand, supply as well as inductive or capacitive load are avoided in the display of data. They are expressed by stating Quadrant I, II, III or IV or a combination of these. In AM3000, the energy direction may be actively switched by selecting the generator or consumer arrow system. This inverts the direction of all currents.
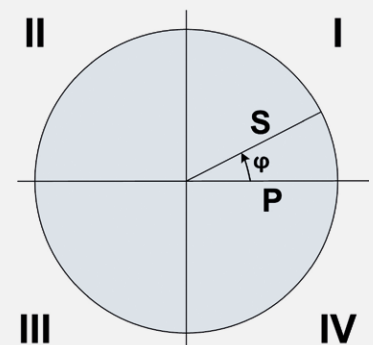
DISPLAY OPTIONS
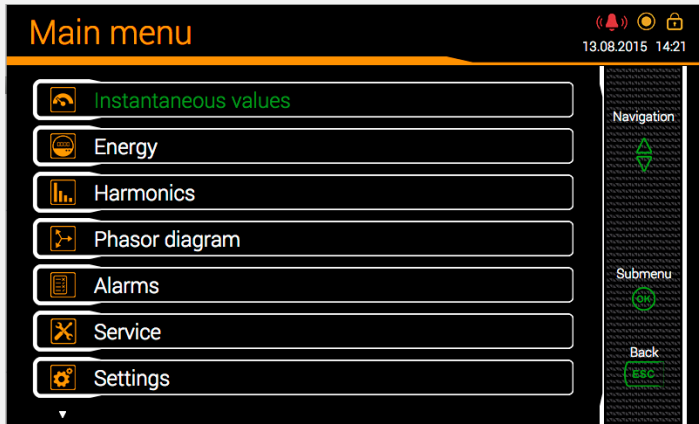
MAIN MENU - accessible via ESC

The language-specific main menu arranges the available measured data in easily comprehensible groups. AM2000 and AM3000 also provide the lateral help bar with further information concerning operation.

The status bar in the top right-hand corner is always available and displays the current statuses of alarm monitoring, the password protection system and data recording as well as time / date.
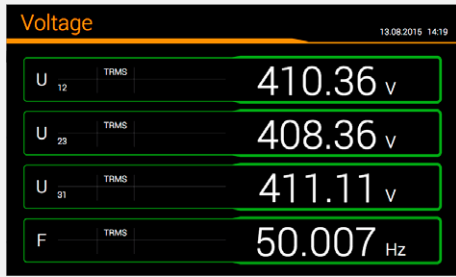

INSTANTANEOUS VALUES
The instantaneous values of voltages, currents, power values, power factors as well as imbalance values and their min/max values are provided either in numbers or graphically in an x/y matrix.
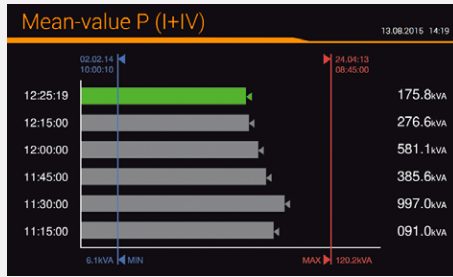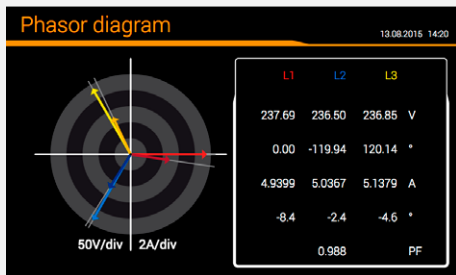
ENERGY
Contains all values required for the preparation of the energy balance, in particular, energy meters as well a mean values with progression and trend.
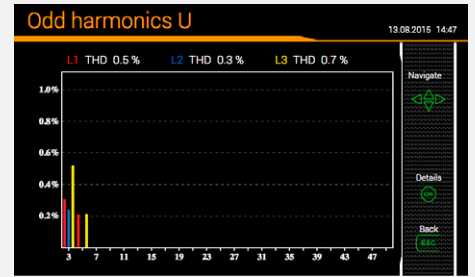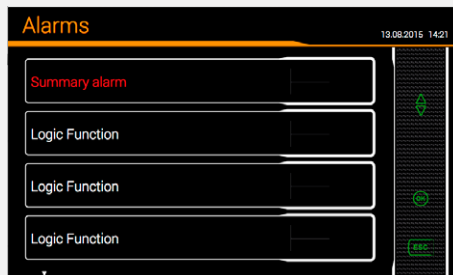
HARMONICS
Graphic representation of harmonics of all currents and voltages with TDD/THD. Reading option for individual harmonics.

PHASOR DIAGRAM
Time-correct display of voltage and current phasors and power factors of all phases. Incorrect phase sequences false senses of rotation or reverse currents can thus be safely recognised.

ALARMS
This list displays the statuses of all monitoring functions, possibly including the status of the allocated output. The first entry is the higher-ranking collective alarm which can be reset here.

FURTHER MEASURED VALUE DISPLAYS
Only AM3000 displays the curve shape of voltages and currents in addition.

MONITORING AND ALARMS

The instruments of the AM series support the on-site analysis of acquired measured data in order to initiate directly immediate or delayed measures without involving a separate control. This facilitates the protection of equipment and also monitoring of service intervals.
The following items are available:

- 12 limit values
- 8 monitoring functions with 3 inputs each
- 1 collective alarm as a combination of all monitoring functions
- 3 operating hour counters with definable running conditions

The available digital outputs may be used directly for the transmission of limit values and monitoring functions as well as the resettable collective alarm.

A text may be allocated to each monitoring function which is used both for the alarm list and the event entries in the datalogger.
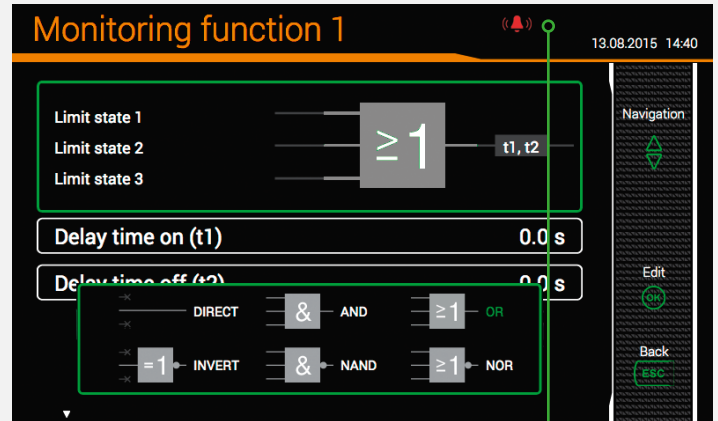
DATA RECORDING

The devices may be equipped with a high-performance data logger which has the following recording options in its comprehensive version:

- **PERIODIC DATA**
  Selectable measured values are saved in regular intervals, e.g. to acquire load profiles (intervals of 10s to 1h) or periodic meters readings (e.g. daily, weekly, monthly).

- **EVENTS**
  A type of logbook which records the occurrence of events together with time information: Triggering and declining of monitoring functions, changes in configuration, power cuts and much more.

- **DISTURBANCE RECORDER**
  Recording of current and voltage progression in case of disturbances on basis of 1/2 cycle RMS values (AM1000/AM3000 only). In AM3000, the additional registration of the curve shape during the disturbance is also possible. This type of registration corresponds to the requirements of the EN 61000-4-30 power quality standard.

The event list and the recordings of the disturbance recorder may be visualised right on the device. More extensive analyses are available via the webpage of the device.
An SD card is used as a memory element by AM2000/AM3000.
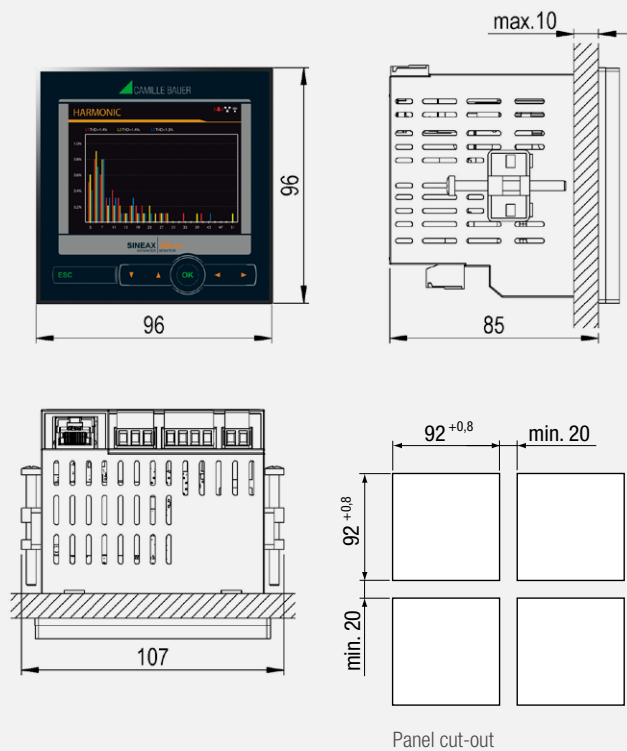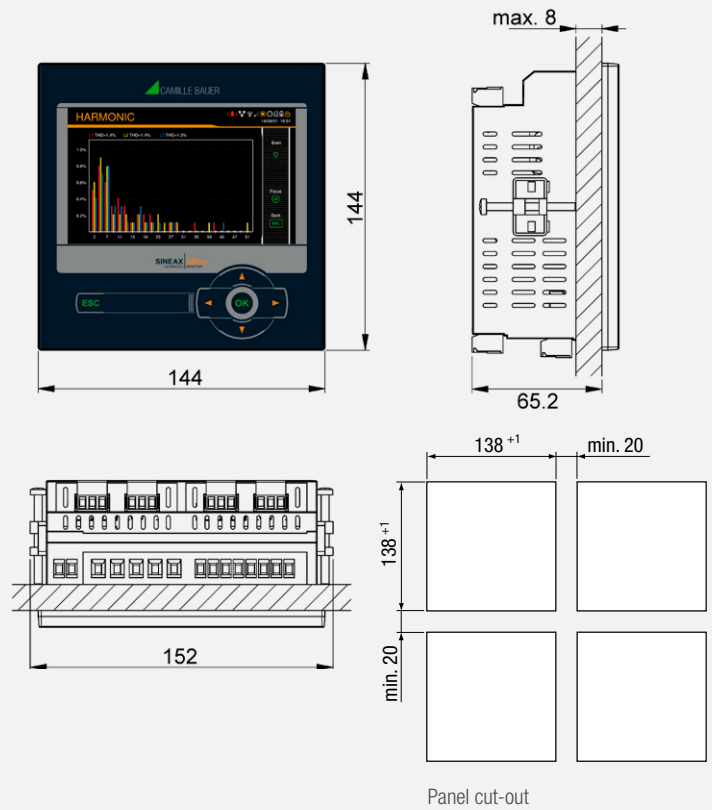AM1000 uses an internal memory element.

TECHNICAL DATA

INPUTS
NOMINAL CURRENT   1 … 5 A (max. 7.5A)
Maximum   7.5A
Overload capacity   10A permanent
100A, 5x1 s, interval 300 s

NOMINAL VOLTAGE   57.7 … 400V_{LN}, 100 … 693V_{LL}
Maximum   480V_{LN}, 832V_{LL} (sinusoidal)
Overload capacity   480V_{LN}, 832V_{LL} permanent
800V_{LN}, 1386V_{LL}, 10x1 s, interval 10 s
Nominal frequency   42 … 50 … 58 Hz, 50.5 … 60 … 69.5 Hz
Measurement TRMS   Up to 60th harmonic

POWER SUPPLY VARIANTS
Nominal voltage   100 … 230V AC/DC (AM1000)
110 … 230V AC, 130 … 230V DC (AM2000/3000)
110 … 200V AC, 110 … 200V DC (AM2000/3000)
24 … 48V DC (AM1000/2000/3000)
Consumption   ≤ 20VA

TYPES OF CONNECTION
Single phase or split phase (2-phase system)
3 or 4-wire balanced load
Only AM1000/AM3000: 3-wire balanced load [2U, 1I]
3-wire unbalanced load, Aron connection
3 or 4-wire unbalanced load
4-wire unbalanced load, Open-Y

I/O-INTERFACE
ANALOG OUTPUTS   (optional)
Linearization   Linear, kinked
Range   ±20 mA (24 mA max.), bipolar
Accuracy   ±0.2% of 20 mA
Burden   ≤ 500 Ω (max. 10 V/20 mA)
Burden influence   ≤ 0.2 %
Residual ripple   ≤ 0.4 %

RELAYS   (optional)
Contacts   Changeover contact, bistable
Load capacity   250V AC, 2A, 500VA
30V DC, 2A, 60W

DIGITAL INPUT
Nominal voltage   12/24 V DC (30V max.)
Logical ZERO   −3 to +5V
Logical ONE   11 to 30V

DIGITAL OUTPUTS
Nominal voltage   12/24 V DC (30V max.)
Nominal current   50 mA (60 mA max.)
Load capacity   400 Ω … 1 MΩ

BASIC UNCERTAINTY ACCORDING IEC/EN 60688

	AM1000/2000	AM3000	
Voltage, current	±0.2 %	±0.1 %	
Power	±0.5 %	±0.2 %	
Power factor	±0.2°	±0.1°	
Frequency		±0.01 Hz	
Imbalance U, I		±0.5 %	
Harmonic		±0.5 %	
THD U, I		±0.5 %	
Active energy	Class 1	Class 0.5S	(EN 62 053-22)
Reactive energy	Class 1	Class 0.5S	(EN 62 053-24)

INTERFACES
ETHERNET   Standard (AM3000), optional (AM1000/AM2000)
Connection   RJ45 socket
Physics   Ethernet 100Base TX
Mode   10/100 MBit/s, full/half duplex, autonegotiation
Protocols   Modbus/TCP, http, NTP (time synchronisation)

MODBUS/RTU   Standard (AM2000), optional (AM1000 / AM3000)
Physics   RS-485, max. 1200 m (4000 ft)
Baud rate   2.4 to 155.2 kBaud
Number of participants   ≤ 32

TIME REFERENCE   Internal clock
Clock accuracy   ± 2 minutes/month (15 to 30°C)
Synchronisation   NTP server
Power reserve   > 10 years

ENVIRONMENTAL CONDITIONS, GENERAL INFORMATION
Operating temperature   −10 to 15 to 30 to +55 °C
Storage temperature   −25 to +70 °C
Temperature influence   0.5 x basic uncertainty per 10 K
Long-term drift   0.5 x basic uncertainty per year
Others   Application group II (EN 60 688)
Relative air humidity   <95 % without condensation
Operating altitude   ≤2000 m above MSL
Only to be used in buildings!

MECHANICAL PROPERTIES
Installation position   Control panel installation
Housing material   Polycarbonate (Makrolon)
Flammability class   V-0 according UL94, self-extinguishing, not dripping, free of halogen
Weight   800 g (AM2000/AM3000), 400 g (AM1000)

SAFETY
Current inputs are galvanically isolated from each other.
Protection class   II (protective insulation, voltage inputs via protective impedance)
Pollution degree   2
Protection   IP54 (front), IP30 (housing), IP20 (terminals)
Measurement category   CATIII

DIMENSIONAL DRAWINGS AM1000

max.10

96

96

85

92 +0,8   min. 20

92 +0,8

min. 20

107

Panel cut-out

DIMENSIONAL DRAWINGS AM2000 / AM3000

max. 8

144

144

65.2

138 +1   min. 20

138 +1

min. 20

152

Panel cut-out

ORDER CODE

ORDER CODE AM1000- ....

1.	**BASIC DEVICE AM1000**	
	With TFT display, for control panel installation	1
2.	**INPUT | FREQUENCY RANGE**	
	Current transformer inputs, 42 … 50/60 … 69.5 Hz	1
3.	**POWER SUPPLY**	
	Nominal voltage 100 … 230 V AC/DC	1
	Nominal voltage 24 … 48 V DC	2
4.	**BUS CONNECTION**	
	Without	0
	Ethernet (Modbus/TCP + web server)	1
	RS485 (Modbus/RTU)	2
	Ethernet (Modbus/TCP + web server) + RS485 (Modbus/RTU)	3
5.	**DATA LOGGER**	
	Without	0
	Periodic Data + events [1]	1
	Disturbance recorder + events [1]	2
	Periodic Data + events + disturbance recorder [1]	3

6.	**I/O-EXTENSION**	
	Without	0
	2 relays	1
	2 analog outputs, bipolar (± 20 mA)	2
	4 analog outputs, bipolar (± 20 mA)	3
7.	**TEST PROTOCOL**	
	Without	0
	Test protocol in German	D
	Test protocol in English	E

ACCESSORIES	ARTICLE NO.
Documentation CD	156 027
Interface converter USB <> RS485	163 189

[1] Datalogger only possible for device variants with Ethernet

ORDER CODE

ORDER CODE AM2000- ....

1.	**BASIC DEVICE AM2000**	
	With TFT display, for control panel installation	1
2.	**INPUT | FREQUENCY RANGE**	
	Current transformer inputs, 42 … 50/60 … 69.5 Hz	1
3.	**POWER SUPPLY**	
	Nominal voltage 110 … 230 V AC, 130 … 230 V DC	1
	Nominal voltage 24 … 48 V DC	2
	Nominal voltage 110 … 200 V AC, 110 … 200 V DC	3
4.	**BUS CONNECTION**	
	Without	0
	RS485 (Modbus/RTU slave)	1
	RS485 (Modbus/RTU slave) + Ethernet (web server)	2
	RS485 (Modbus/RTU slave) + Ethernet (Modbus/TCP protocol + web server)	3
	RS485 (Modbus/RTU) + Ethernet (Modbus/TCP + web server) + data logger (periodic data + events)	4
5.	**I/O EXTENSION 1**	
	Without	0
	2 relays	1
	2 analog outputs, bipolar (± 20 mA)	2
	4 analog outputs, bipolar (± 20 mA)	3
6.	**I/O EXTENSION 2**	
	Without	0
	2 relays	1
	2 analog outputs, bipolar (± 20 mA)	2
	4 analog outputs, bipolar (± 20 mA)	3
7.	**I/O EXTENSION 3**	
	Without	0
	2 relays	1
	2 analog outputs, bipolar (± 20 mA)	2
	4 analog outputs, bipolar (± 20 mA)	3
8.	**I/O EXTENSION 4**	
	Without	0
	2 relays	1
	2 analog outputs, bipolar (± 20 mA)	2
	4 analog outputs, bipolar (± 20 mA)	3
9.	**TEST PROTOCOL**	
	Without	0
	Test protocol in German	D
	Test protocol in English	E

ORDER CODE AM3000- ....

1.	**BASIC DEVICE AM3000**	
	With TFT display, for control panel installation	1
2.	**INPUT | FREQUENCY RANGE**	
	Current transformer inputs, 42 … 50/60 … 69.5 Hz	1
3.	**POWER SUPPLY**	
	Nominal voltage 110 … 230 V AC, 130 … 230 V DC	1
	Nominal voltage 24 … 48 V DC	2
	Nominal voltage 110 … 200 V AC, 110 … 200 V DC	3
4.	**BUS CONNECTION**	
	Ethernet (Modbus/TCP + web server)	1
	Ethernet (Modbus/TCP + web server) + RS485 (Modbus/RTU)	2
5.	**DATA LOGGER**	
	Without	0
	Periodic data + events	1
	Disturbance recorder + events	2
	Periodic data + events + disturbance recorder	3
6.	**I/O EXTENSION 1**	
	Without	0
	2 relays	1
	2 analog outputs, bipolar (± 20 mA)	2
	4 analog outputs, bipolar (± 20 mA)	3
7.	**I/O EXTENSION 2**	
	Without	0
	2 relays	1
	2 analog outputs, bipolar (± 20 mA)	2
	4 analog outputs, bipolar (± 20 mA)	3
8.	**I/O EXTENSION 3**	
	Without	0
	2 relays	1
	2 analog outputs, bipolar (± 20 mA)	2
	4 analog outputs, bipolar (± 20 mA)	3
9.	**I/O EXTENSION 4**	
	Without	0
	2 relays	1
	2 analog outputs, bipolar (± 20 mA)	2
	4 analog outputs, bipolar (± 20 mA)	3
10.	**TEST PROTOCOL**	
	Without	0
	Test protocol in German	D
	Test protocol in English	E
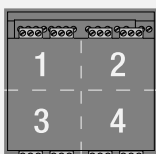
I/O EXTENSIONS AM2000/AM3000

Maximum one I/O extension with analog outputs may be provided per device.

I/O extension 4 only possible for a variant without data logger.

ACCESSORIES	ARTICLE NO
Documentation CD	156 027
Interface converter USB <> RS485	163 189

SMARTCOLLECT

SMARTCOLLECT is a data management software which can acquire measured data in an easy manner and store the same in an open SQL database. This software offers basic functionalities for data analysis and for easy energy monitoring as well as the easy preparation and disposal of reports.

Providing a mature graphic user interface, the SMARTCOLLECT software is clearly structured and easily operated.

SMARTCOLLECT is modularly designed and permits supplementing modules or functions at any time.
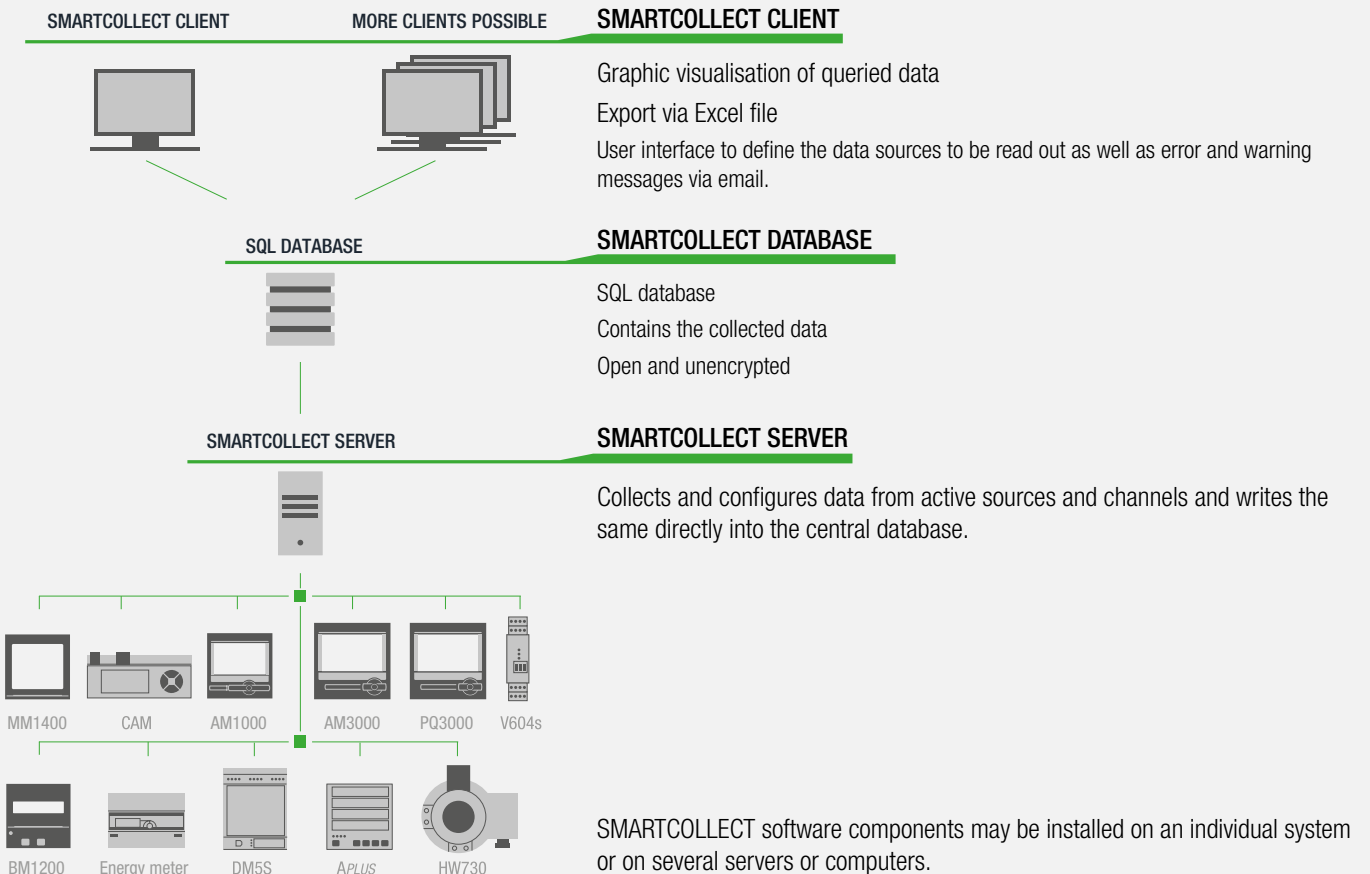
CUSTOMER BENEFITS
- Easy data communication via Modbus RTU / TCP, ECL and SmartControl-Direct
- Connection also via OPC
- Devices of Camille Bauer and Gossen Metrawatt are already predefined and selectable in the software
- Open for the devices of all manufacturers
- Data is stored in an open SQL database
- Modular cost / performance model – basic version may be extended at any time
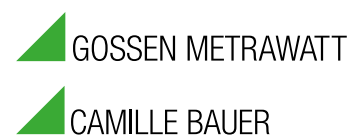
MODULAR DESIGN

COMPONENTS
The SMARTCOLLECT data management software consists of the following components:

SMARTCOLLECT CLIENT   **MORE CLIENTS POSSIBLE**

SMARTCOLLECT CLIENT

Graphic visualisation of queried data

Export via Excel file

User interface to define the data sources to be read out as well as error and warning messages via email.

SQL DATABASE

SMARTCOLLECT DATABASE

SQL database

Contains the collected data

Open and unencrypted

SMARTCOLLECT SERVER

SMARTCOLLECT SERVER

Collects and configures data from active sources and channels and writes the same directly into the central database.

MM1400   CAM   AM1000   AM3000   PQ3000   V604s

BM1200   Energy meter   DM5S   *APLUS*   HW730

SMARTCOLLECT software components may be installed on an individual system or on several servers or computers.

GMC INSTRUMENTS

GOSSEN METRAWATT

CAMILLE BAUER