CAMILLE BAUER

MEASUREMENT & MONITORING IN POWER SYSTEMS

MULTIFUNCTIONAL POWER
MEASUREMENT DEVICE FOR
DIN RAIL

SINEAX DM5000
DATA MONITOR
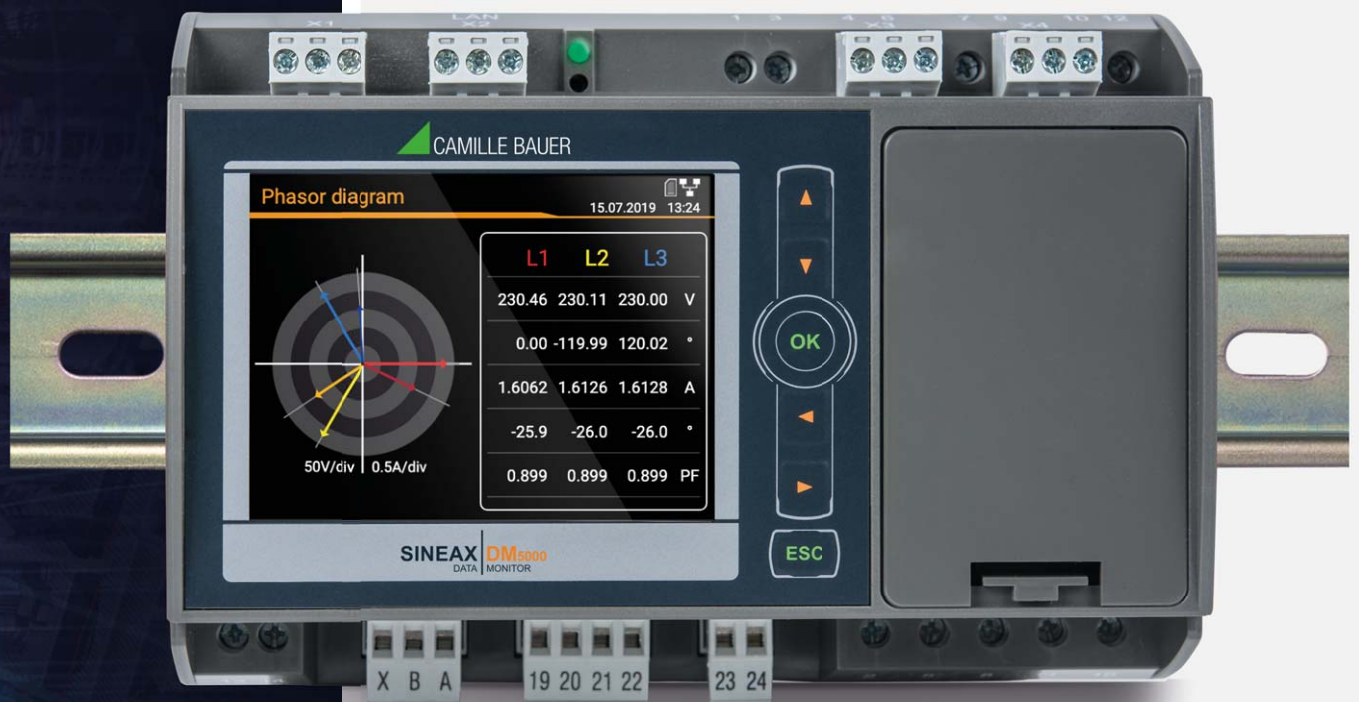
Top hat rail device
for the comprehensive
power analysis

The SINEAX DM5000 is a compact instrument to measure and monitor in heavy current grids. It provides a wide range of functionalities which may even be extended by optional components. The connection of the process environment may be performed by communication interfaces, via digital I/Os, analog outputs or relays. The optional display excels in display quality and intuitive on-site operation.

The device has 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 device may be completely adapted to the requirements on site either via web server or the optional TFT display. A special software is neither needed for configuration nor for data visualization.

FLEXIBLE

Universal measuring inputs for any type of grid

Freely selectable mean value and meter measuring variables

Configurable access authorisation

SCALABLE

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

Optional data logger (load profiles, meter readings, events, disturbances)

Integration as a standard object into the SMARTCOLLECT software

MULTIFUNCTIONAL

Varied monitoring options via limit values and their logical linkage

Central alarm function via display or web page

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

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

CLEAR

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

Consistently visible status information (alarms, password protection, data recording)

Identical design of web page and local display

Version: with display, with UPS　　　*Version: without display, without UPS*

|	DM5000
Input channels voltage / current	4 / 4
Measurement interval [#cycles]	10/12 (50/60Hz); 1/2
MEASURED VALUES	
Instantaneous values	▪
Extended reactive power analysis	▪
Imbalance analysis	▪
Neutral current	measured / calculated
Earth wire current (calculated)	▪
Zero displacement UNE	measured / calculated
Energy balance analysis	▪
Harmonic analysis	▪ (incl. phase angle)
Operating hour counters device / general	1 / 3
Monitoring functions	▪
Visualisation waveform U/I	▪
MEASUREMENT UNCERTAINTY	
Voltage, current	±0.1%
Active, reactive, apparent power	±0.2%
Frequency	±10mHz
Active energy (IEC 62053-21/22)	Class 0.5S
Reactive energy (IEC 62053-24)	Class 0.5S
DATA LOGGER	
(Option)	≥16GB
Periodic recording	▪
Event recording	▪
Disturbance recorder (with pretrigger)	
a) 1/2 cycle RMS progression U/I	≤3min.
b)　Curve shape U/I　[#cycles]	5/6 (pretrigger) +10/12
COMMUNICATION	
Ethernet: Modbus/TCP, web server, NTP	(standard)
IEC61850	(option)
PROFINET IO	(option)
RS485: Modbus/RTU	(standard)
Standard I/Os	1 dig. IN ; 2 dig. OUT
Extension modules (optional)	max. 2 modules
POWER SUPPLY	100-230V AC/DC 24-48V DC
DESIGN	
Colour display	TFT 3,5" (320x240px)

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 cosφ, tanφ 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 50th	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 Operating hours of the device	Monitoring of service and maintenance intervals of equipments

**DEMAND / SUPPLY / INDUCTIVE / CAPACITIVE**

The device 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.
The energy direction may be actively switched by selecting the generator or consumer arrow system. This inverts the direction of all currents.
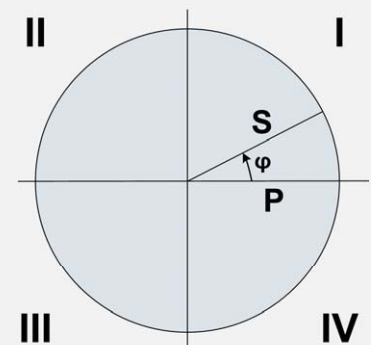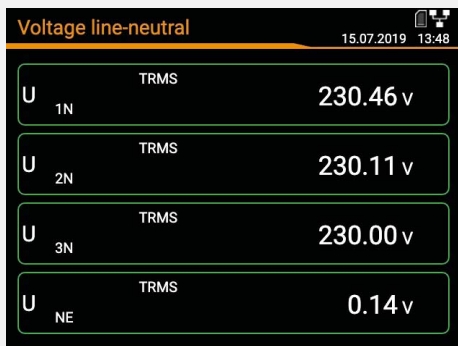
# DISPLAY OPTIONS
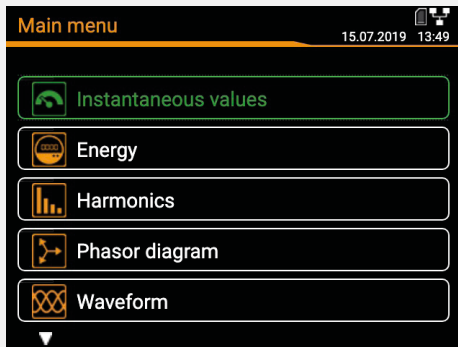
MAIN MENU - accessible via ESC
The language-specific main menu arranges the available measured data in easily comprehensible groups.
The status bar in the top right-hand corner is always available and displays the current statuses of alarm monitoring, the password protection system and data recording 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.
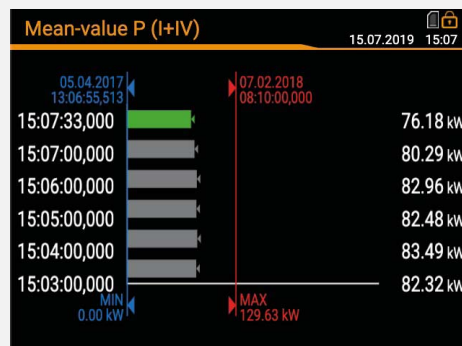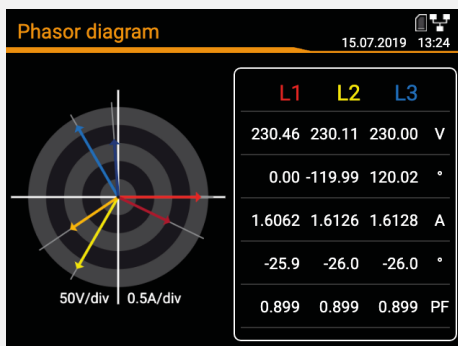

ENERGY
Contains all values required for the preparation of the energy balance, in particular, energy meters as well a mean values with progression and trend.
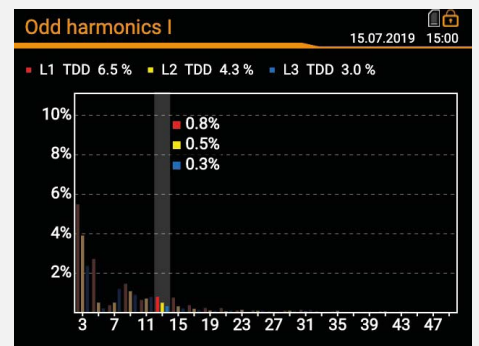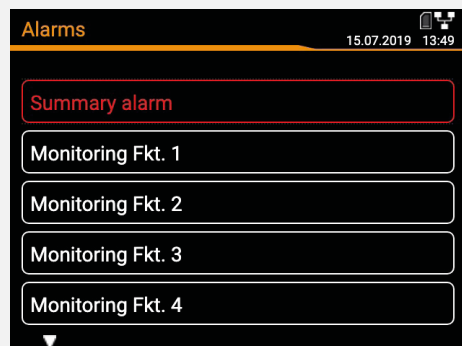

HARMONICS
Graphic representation of harmonics of all currents and voltages with TDD/THD. Reading option for individual harmonics.

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.
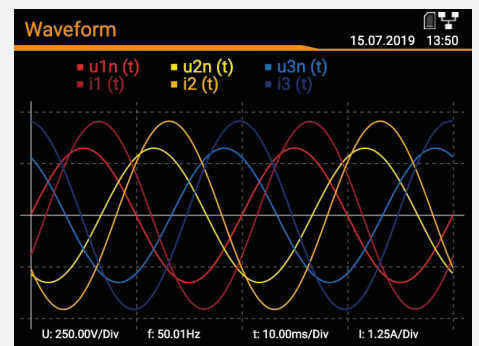
WAVEFORM
Displays the waveform of voltages and currents.

MONITORING AND ALARMS

The instruments of the DM5000 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.
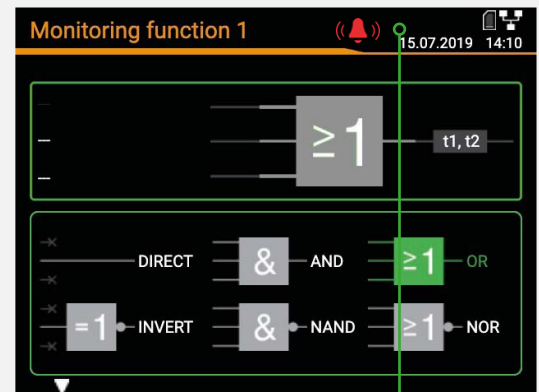
DATA RECORDING

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 meter 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. The additional registration of the waveform 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 web page of the device.

TECHNICAL DATA

INPUTS

NOMINAL CURRENT 1 … 5 A (max. 7.5 A)

Maximum	7.5 A
Overload capacity	10 A permanent
	100 A, 5x1 s, interval 300 s

NOMINAL VOLTAGE $57.7 … 400 V_{LN}$, $100 … 693 V_{LL}$

Maximum	$520 V_{LN}$, $900 V_{LL}$ (sinusoidal)
Overload capacity	$520 V_{LN}$, $900 V_{LL}$ permanent
	$800 V_{LN}$, $1386 V_{LL}$, 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 … 230 V AC/DC
	24 … 48 V DC
Consumption	≤ 27 VA, ≤ 12 W

TYPES OF CONNECTION

Single phase or split phase (2-phase system)
3 or 4-wire balanced load
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 %

DIGITAL INPUTS PASSIVE

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

DIGITAL INPUTS ACTIVE (optional)

Open circuit voltage	≤ 15 V
Short circuit current	< 15 mA
Current at R_{ON} = 800 Ω	≥ 2 mA

DIGITAL OUTPUTS

Nominal voltage	12/24 V DC (30 V max.)
Nominal current	50 mA (60 mA max.)

FAULT CURRENT MONITORING   For grounded systems (optional)

Number of meas. channels	2 (2 measurement ranges each)
Measurement range 1 (1A)	Earth current measurement
• Measuring transformer	1/1 up to 1/1000 A
• Alarm limit	30 mA up to 1000 A
Measurement range 2 (2mA)	RCM with connection monitoring
• Measuring transformer	Residual current transformer 500/1 up to 1000/1 A
• Alarm limit	30 mA up to 1 A

TEMPERATURE INPUTS (optional)

Number of channels	2
Measurement sensor	Pt100 / PTC; 2-wire

RELAYS (optional)

Contacts	Changeover contact
Load capacity	250 V AC, 2 A, 500 VA; 30 V DC, 2 A, 60 W

BASIC UNCERTAINTY ACCORDING IEC/EN 60688

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

INTERFACES

ETHERNET Standard

Connection	RJ45 socket
Physics	Ethernet 100Base TX
Mode	10/100 MBit/s, full/half duplex, autonegotiation
Protocols	Modbus/TCP, http, NTP (time synchronisation)

IEC61850 optional

Physics	Ethernet 100BaseTX, RJ45 sockets, 2 ports
Mode	10/100 Mbit/s, full/half duplex, auto-negotiation
Protocol	IEC 61850, NTP

PROFINET IO optional

Conformance class	CC-B
Physics	Ethernet 100BaseTX, RJ45-Buchsen, 2 ports
Mode	10/100 Mbit/s, full/half duplex, auto-negotiation
Protocol	PROFINET, LLDP, SNMP

MODBUS/RTU Standard

Physics	RS-485, max. 1200 m (4000 ft)
Baud rate	9.6 to 115.2 kBaud
Number of participants	≤ 32

TIME REFERENCE Internal clock

Clock accuracy	± 2 minutes/month (15 to 30°C)
Synchronisation	NTP server or GPS
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

Mounting	Top hat rail 35 x 15 or 35 x 7.5 mm
Housing material	Polycarbonate (Makrolon)
Flammability class	V-0 according UL94, self-extinguishing, not dripping, free of halogen
Weight	600 g

SAFETY

Current inputs are galvanically isolated from each other.

Protection class	II (protective insulation, voltage inputs via protective impedance)
Pollution degree	2
Protection	IP40 (front), IP30 (housing), IP20 (terminals)
Measurement category	U: 600 V CAT III, I: 300 V CAT III

DIMENSIONAL DM5000

110 mm

70 mm

160 mm
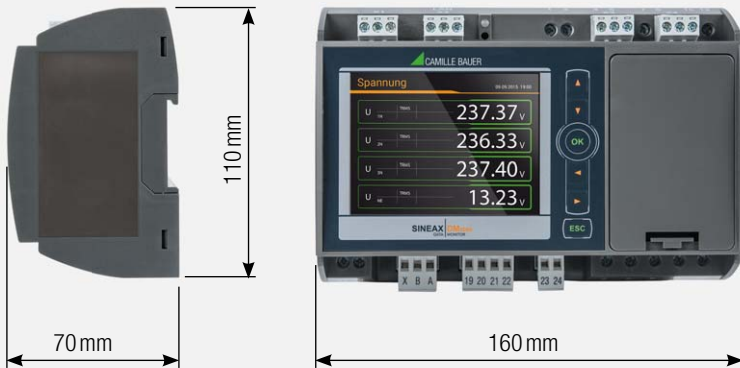
ORIENTATION DM5000

0 … 90°   0 … 90°

Not allowed for device versions with uninterruptible power supply

ORDER CODE

ORDER CODE DM5000- …. …

1.	**BASIC DEVICE FOR RAIL MOUNTING DM5000**	
	Without display	0
	With TFT display	1
2.	**INPUT | FREQUENCY RANGE**	
	4 Current transformer inputs, 42 … 50 … 58 Hz, 50.5 … 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**	
	RS485 (Modbus/RTU) + Ethernet (web server, Modbus/TCP)	1
5.	**UNINTERRUPTIBLE POWER SUPPLY**	
	Without	0
	With uninterruptible power supply	1
6.	**DATA LOGGER**	
	Without	0
	With data logger: Periodic Data + events	1
	With data logger: Disturbance recorder + events	2
	With data logger: Periodic Data + events + disturbance recorder	3
7.	**EXTENSION 1**	
	Without	0
	2 relays	1
	2 analog outputs, bipolar (± 20 mA)	2
	4 analog outputs, bipolar (± 20 mA)	3
	4 digital inputs passive	4
	4 digital inputs active	5
	Fault current detection, 2 channels	6
	GPS connection module	7
	Profinet interface	A
	IEC 61850 interface	B
	Temperature monitoring, 2 channels	C

8.	**EXTENSION 2**	
	Without	0
	2 relays	1
	2 analog outputs, bipolar (± 20 mA)	2
	4 analog outputs, bipolar (± 20 mA)	3
	4 digital inputs passive	4
	4 digital inputs active	5
	Fault current detection, 2 channels	6
	GPS connection module	7
	Temperature monitoring, 2 channels	C
9.	**TEST PROTOCOL**	
	Without	0
	Test protocol in German	D
	Test protocol in English	E

ACCESSORIES	ARTICLE NO.
Documentation on USB stick	156 027
Interface converter USB <> RS485	163 189
GPS receiver 16x-LVS, configured	181 131
Transformers for fault current detection see accessory current transformers	

SMARTCOLLECT

SMARTCOLLECT is a data management software which can acquire measured data in an easy manner and store the same in an open MS 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 MS SQL database (depending on the scope Express or Server)
- 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

- MS SQL database (depending on the scope Express or Server)
- 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　DM5000　AM3000　PQ3000　V604s

BM1200　Energy meter　DM5S　A*PLUS*　HW730
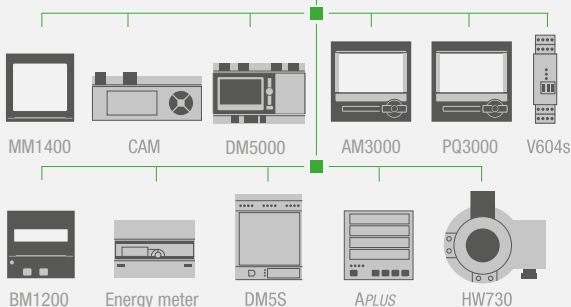
SMARTCOLLECT software components may be installed on an individual system or on several servers or computers.

SMARTCOLLECT PM10 - BASIC MODULE

The basic PM10 module acquires measured data in an easy manner and stores it in an open MS SQL database. The module offers basic functionalities for data analysis and smooth energy monitoring and facilitates the preparation and dispatch of reports. Employing a sophisticated graphic user interface, SMARTCOLLECT provides clearly arranged software and is easily operated.

Easy device selection
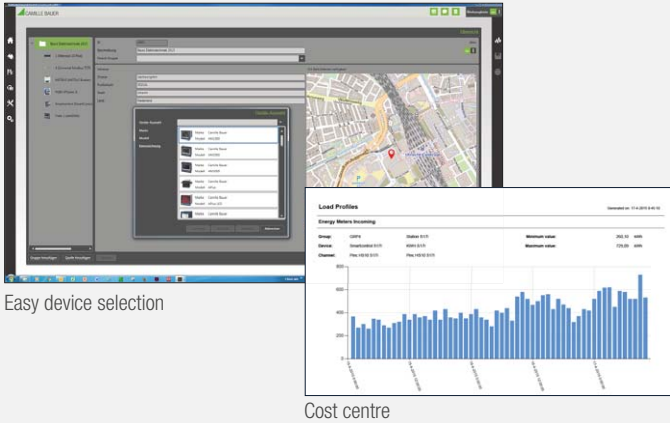
Cost centre

Camille Bauer and Gossen Metrawatt devices are easily and quickly integrated using merely a few clicks.
Energy data may be allocated to cost centres and merged into reports in relation to a desired period of time. Variables like temperature, voltages or currents may be visualised in an overview report. Users can store these reports or forward them automatically via email.

SMARTCOLLECT PM20 - POWER QUALITY

The PM20 module extents the basic PM10 module by varied visualising and analysis options for system quality instruments. The PQDIF files of system quality instruments are imported, converted and written into the database. Measured data may be issued as a report according to EN 50160.

Data visualising of different measured values

EN 50160 report

After the export of PQDIF files from the system quality instrument, they are both unpacked and stored in the database and may also be stored on a hard disk in original format, if required. The PM20 module graphic interface permits visualising of the most varied measured values of an instrument.

SMARTCOLLECT PM30 - VISUALIZATION

The PM30 module, in turn, builds on the PM20 module and supplements it to visualise plants, processes and procedures. Individual images, diagrams or drawings with live measured data, switching statuses and limit values may be linked to develop extensive visualising.

Visualizing of a photovoltaic plant
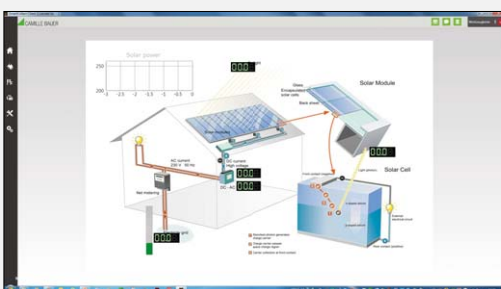
Using the integrated designer, any background can be extended to become an individual SCADA overview image. Digital displays, analog indicators, signal lamps, switches, charts and many more items may be arranged as desired and inserted in the image.

GMC INSTRUMENTS

GOSSEN METRAWATT

CAMILLE BAUER