MAVOLOG 10
Systematic
Power Quality Analysis

- ❑ Events logger
- ❑ Measurement data recorder
- ❑ Power quality tester per EN 50160

GOSSEN METRAWATT

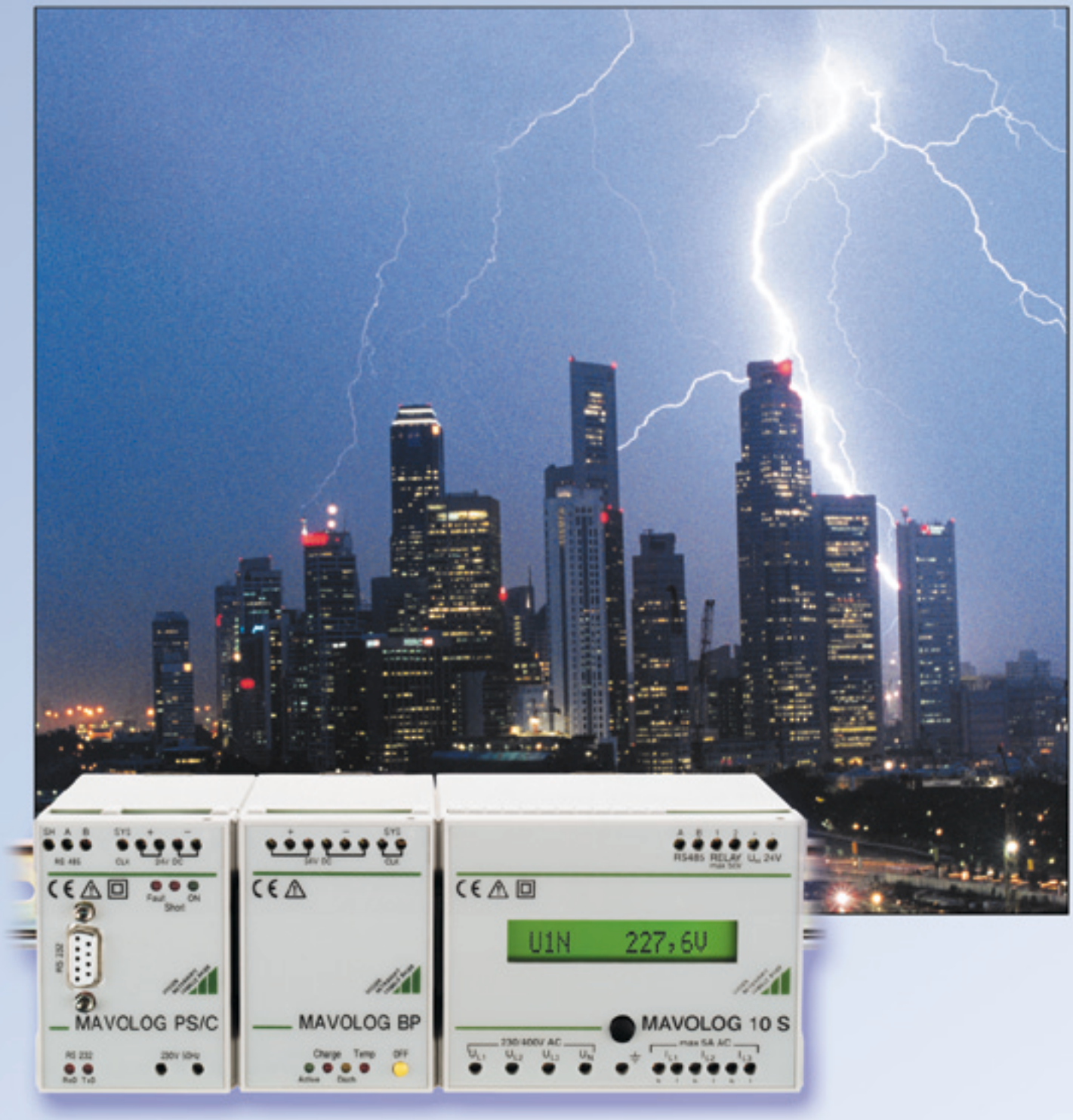


Photo: A. Baram

Applications

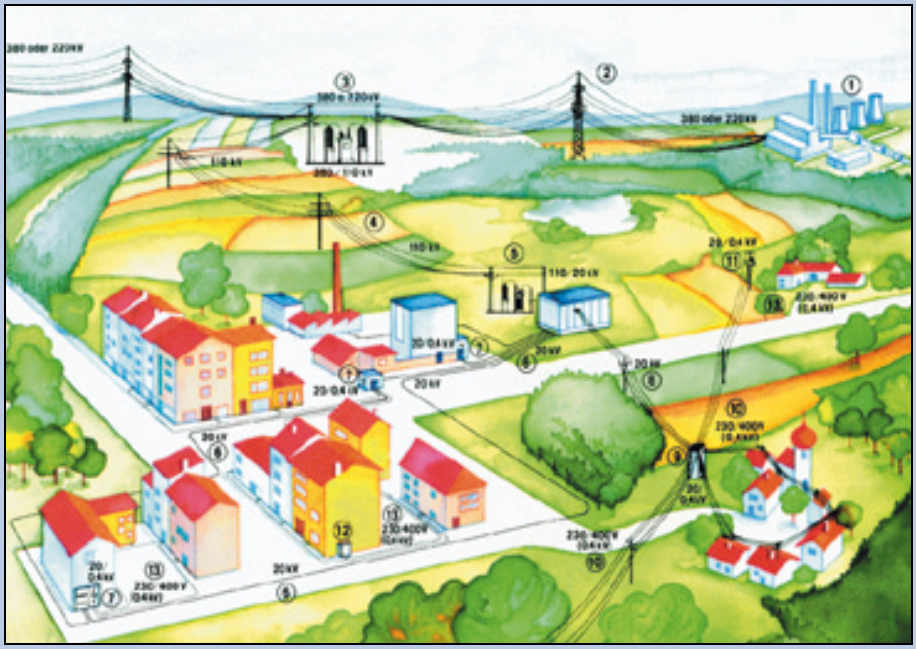
Comprehensive Power Quality Monitoring

As a result of liberalization of energy markets, various qualities of electrical power offered at correspondingly higher or lower prices will certainly become available in the future.

This necessitates continuous voltage quality monitoring. As a rule, quality data are acquired, saved to a central database and managed in a decentralized fashion upon delivery to the customer. These data substantiate the quality of supplied electrical power and thus serve as a basis for accurate billing.

The following aspects are of special importance with respect to long-term recording of measured data for voltage quality from many, widely distributed measuring points:

- All quality relevant parameters must be simultaneously acquired and recorded over a long period of time **in accordance with a power quality standard (EN 50160)**.
- Adequate **synchronization of the points in time at which recording occurs** is required in order to allow for a comparison of data from different measuring points.
- It must be feasible to utilize common communications technologies, including wireless transmission, for **long distance data transmission**.
- **Quantities of data** to be transmitted and managed must be kept **as small as possible**. For this reason, targeted **preprocessing of measurement data must take place in the measuring instrument**, i.e. prior to transfer to the analysis software.
- **Periodic querying** of recorded data should take place in an **automated** fashion.
- It must be possible to **export data** to other databases.



Systematic Voltage Quality Analysis

GMC-Instruments' business division for energy testing technology can provide you with a complete solution based upon the MAVOLOG series of instruments, allowing you to meet the challenges of a liberalized energy market as regards power quality monitoring.

Well coordinated, modular hardware and software components are supplemented with service offerings such as training seminars and technical support.

The EN 50160 Standard

EN 50160, "Voltage Characteristics in Public Distribution Networks", is intended to identify supply voltage characteristics as regards waveshape, voltage magnitude, frequency and symmetry of the three phase voltages at the point of delivery to the customer.

The standard specifies limit values for "normal operating conditions" for these parameters. Only those values which may not be fallen short of or exceeded during 95% of the monitored period are defined as limit values. Voltage dips or interruptions, e.g. resulting from defects within the system, cannot be sensibly defined by means of limit values. Parameters for values of this type can thus be freely configured in the analysis software.

Voltage Quality Criteria per EN 50160

Parameter	Characteristic	Measuring Interval	Observation Duration
Line frequency	50 Hz ± 0.5 Hz for 95% of a given week, 50 Hz + 4% / – 6% for 100% of a given week	10 second mean value	1 week
Voltage fluctuation	Un ± 10% for 95% of a given week, Un + 10 / – 15% for 100% of a given week	10 minute mean value	1 week
Flicker	Long-term flicker severity Plt < 1 for 95% of a given week	2 h (per EN 61000-4-15)	1 week
Asymmetry	Relationship U (negative phase-sequence system) / U (positive phase-sequence system) < 2% for 95% of a given week	10 minute mean value	1 week
Harmonics	U_{H2} ... U_{H25} < limit value per table, THD < 8%	10 minute mean value for each harmonic (per EN 61000-4-7)	1 week
Voltage dips	< 10 ... 1000 / year, of which > 50% have a duration < 1 s	10 ms TRMS value 40% Un ≤ $U_{10\ ms}$ ≤ 90% Un	1 year
Short voltage interruptions	< 10 ... 1000 / year, of which > 70% have a duration < 1 s	10 ms TRMS value $U_{10\ ms}$ ≤ 1% Un	1 year
Long voltage interruptions	< 10 ... 50 / year with a duration of > 3 minutes		1 year
Transient overvoltage	(L - N) < 6 kV / µs ... ms		
Inter-harmonics and signal voltages	In progress		

Applications

Line Measurements and Power Disturbance Logging in Industrial Applications

Measured quantities derived from prevailing voltages are usually sufficient for the analysis of mains quality. However, devices which are also capable of acquiring current have proven themselves especially useful, in particular in industrial applications. This added feature opens up innumerable additional applications:

- Recording phase currents and power quantities as mean and maximum values allows you to **recognize critical load conditions** and to quantify **remaining reserves** within the electrical system.
- Tariffs are generally assigned to industrial customers by the utilities based upon 15 minute power peaks. By recording the corresponding power demand values, you can determine your own **characteristic load profile** in order to realize **energy cost reductions by means of diminished load peaks**.
- Energy consumption measurements within several distribution branches provide you with **greater energy consumption clarity**, and assure **correct billing of costs** to the appropriate departments or cost centers.
- The **effectiveness of utilized compensation equipment can be tested**, and associated cost saving potential can be determined with the help of reactive energy measurements.

- A greatly increased and ever growing number of non-linear consumers such as PCs, frequency converters and electronic energy-saving lamps is increasing the occurrence of line voltage distortion (harmonics). Increased losses at power transmission equipment and certain types of consumers, as well as **overloading of compensation equipment and neutral conductors** represent additional consequences. This can be prevented by measuring harmonic voltages and currents, and neutral conductor current.
- Simultaneous logging of the load current profile in the event of voltage failures allows you to **draw conclusions regarding the cause** of this most common type of **disturbance** in industrial electrical networks. This provides you with a **basis for the clarification of guarantee issues**, e.g. in the event of machine and equipment malfunctions, or for the implementation of corrective measures.

Power supply characteristics are made transparent with MAVOLOG series of instruments.

Measured Quantities for Periodic Storage to Memory and Online Measurement

Designation	U/M	Description	Interval Memory	Online Meas.	LCD
U1N, U2N, U3N	V (rms)	Phase-to-neutral voltage	X	X	X
U12, U23, U31	V (rms)	Phase-to-phase voltage	X	X	X
UNPE	V (rms)	Neutral-to-ground voltage	X	X	X
UK	V (rms)	Combined voltage	X	X	X
U1H1, U2H1, U3H1	% Un	Fundamental voltage	X	X	X
U1H2-U1H40 U2H2-U2H40 U3H2-U3H40	% Un	Harmonic voltages 2nd to 40th harmonic	X	X	X
U1THD U2THD, U3THD	%	Harmonic content of voltage	X	X	X
UB	%	Voltage asymmetry	X	X	X
UL1, UL2, UL3	counts	Number of voltage interruptions	X		X
ZTSXY1, ZTSXY2, ZTSXY3	counts	Number of voltage dips	X		X
PST1, PST2, PST3	–	Short-term flicker	X	X	X
PLT1, PLT2, PLT3	–	Long-term flicker	X	X	X
F	Hz	Frequency	X	X	X
I1, I2, I3	A (rms)	Phase current	X	X	X

Designation	U/M	Description	Interval Memory	Online Meas.	LCD
IN	A (rms)	Neutral conductor current	X	X	X
IK	A (rms)	Combined current	X	X	X
I1H1, I2H1, I3H1	A (rms)	Fundamental current	X	X	X
I1H2 - I1H40 I2H2 - I2H40 I3H2 - I3H40	A (rms)	Harmonic currents 2nd to 40th harmonic	X	X	X
I1THD, I2THD, I3THD	%	Harmonic content of current	X	X	X
I1MAX, I2MAX, I3MAX	A (rms)	Maximum current (since reset)			X
P1, P2, P3, P	W	Active power, per phase and total	X	X	X
S	VA	3~ apparent power	X	X	X
Q	Var	3~ reactive power	X	X	X
PF	W/VA	3~ power factor	X	X	X
PMAX	W	3~ max. active power (since reset)			X
SMAX	VA	3~ max. app. power (since reset)			X
QMAX	var	3~ max. reac. power (since reset)			X
WP	Wh	3~ active energy (since reset)	X		X
WQ	varh	3~ reactive energy (since reset)	X		X

Select the ideal configuration for your application:

Analyzer Variants

MAVOLOG series instruments have been designed to allow for the selection of ideal configurations for all types of applications, from power generation to consumer applications, in combination with multiple instruments or as a stand-alone. Even the inexpensive basic model, the MAVOLOG 10L+FFT/FSA, provides for comprehensive disturbance recording and voltage quality analysis with integrated harmonic analysis (FFT) and flicker measurement (FSA).

Equipped with an LCD and additional current inputs, the top of the line MAVOLOG 10S+FFT/FSA is a universal measuring instrument which can be used for recording the characteristics of all important measured quantities in 3-phase systems, and simultaneously acquires power disturbances and characteristics for the analysis of voltage quality.

Type		MAVOLOG 10L +FFT/FSA	MAVOLOG 10N +FFT/FSA	MAVOLOG 10S +FFT/FSA	MAVOLOG 10S
FEATURES					
Voltage	Order Number	**M830S**	**M830P**	**M830R**	**M830V**
Measurement inputs		3 ea. U_{L-L}/U_{L-N} & U_{N-PE}	3 ea. U_{L-L}/U_{L-N} & U_{N-PE}	3 ea. U_{L-L}/U_{L-N} & U_{N-PE}	3 ea. U_{L-L}/U_{L-N} & U_{N-PE}
Dips, interruptions		>10 ms	>10 ms	>10 ms	>10 ms
Swells		>10 ms	>10 ms	>10 ms	>10 ms
Asymmetry		●	●	●	●
Frequency		●	●	●	●
Harmonics		1 to 40 & THD	1 to 40 & THD	1 to 40 & THD	❍
Flicker (Pst, Plt)		●	●	●	❍
EN 50160 analysis		●	●	●	❍
Current					
Measuring channels		❍	❍	3 ea. I_L & I_N	3 ea. I_L & I_N
Characteristics in case of voltage dips		❍	❍	Resolution: 10 ms	Resolution: 10 ms
Harmonics		❍	❍	1 to 40 & THD	❍
Power / Energy					
Active power P1, P2, P3, PΣ		❍	❍	●	●
Apparent power SΣ		❍	❍	●	●
Reactive power QΣ		❍	❍	●	●
Power factor PFΣ		❍	❍	●	●
Active energy WPΣ		❍	❍	●	●
Reactive energy WQΣ		❍	❍	●	●
Alphanumeric LCD					
Measured values, analyses		❍	10, selectable	10, selectable	10, selectable
Device configuration parameters		❍	●	●	●

MAVOLOG Dial-Up
Modem for long distance data transmission

MAVOLOG PS/C
Power supply and interface converter

MAVOLOG BP
Backup battery pack for power hold-up at mains failure

MAVOLOG 10S+FFT/FSA
3-phase voltage quality and power analyzer

Accessory Components

Various accessory components for auxiliary power and communications functions are available for cost optimized utilization and ideal functionality of MAVOLOG power analyzers in consideration of prevailing conditions at the installation site.

This modular design concept allows for best-suiting adaptation or expansion of the system in order to fulfill changing requirements.

MAVOLOG PS/C (Z863D)

The MAVOLOG PS/C module (PS = power supply / C = converter) includes a power pack with a 24 V DC output for supplying power to as many as five MAVOLOG 10 instruments and one MAVOLOG BP, as well as a bidirectional RS 232 – RS 485 interface converter for communication between a PC using MAVOLOG control software, and each individual instrument.

Up to 32 MAVOLOG 10 instruments can be connected to the RS 485 bus (max. length: 1 km, max. transmission speed: 115 kBps). The RS 485 and RS 232 interfaces are electrically isolated from each other, as well as from the power supply of the MAVOLOG PS/C, in order to assure maximum operating reliability and interference immunity, in particular for interconnected PCs.
The standard version is laid out for an input voltage of 230 V AC. The MAVOLOG PS/C Universal variant has a wide range input for 60 to 230 V AC / DC.

C232/485 (Z863F)

This battery powered RS 232 – RS 485 interface converter is also bidirectional and automatically switches transmission direction, but it does not include electrical isolation.

It can be used in cases where the MAVOLOG PS/C is not used to supply power to the MAVOLOG 10, and if the MAVOLOG 10 is only read out occasionally with the help of a notebook, e.g. after the occurrence of a power disturbance.

MAVOLOG BP (Z863E)

The MAVOLOG BP (BP = battery pack) is an uninterruptible DC power supply which, in combination with the MAVOLOG PS/C, automatically supplies power to connected MAVOLOG 10 instruments in the event of mains power failure.

Depending upon the number and type of instruments, they can be operated with a fully charged backup battery for up to 10 hours.

Integrated electronics regulate and monitor the charging process, assuring reliable availability of supply power and long backup battery service life.

MAVOLOG Dial-Up (Z864C)

The MAVOLOG dial-up modem connects the installed MAVOLOG power monitoring system to a master computer via public telephone lines for remote parameters configuration, control and data queries.

An SMS message can be transmitted to a cell phone or a fax machine etc., in the event of a power disturbance.

A practical solution for temporary mobile use:

The MAVOLOG Mobile Set (M830W)

Consisting of the following components:

- MAVOLOG 10S+FFT/FSA power quality analyzer
- MAVOLOG PS/C mains power pack and interface converter
- MAVOLOG BP battery pack

Wired and installed to a

- Sturdy carrying case (46 x 16 x 35 cm)

Included accessories:

- Connector cables for
  - Mains supply power
  - Voltage measurement inputs including alligator clips
  - RS 232 interface
- Parameters configuring and analysis software: METRAwin 10 for MAVOLOG

The case has ample additional space for stowing optionally available clip-on current transformers, e.g. 3 each Z3512 (1000/1 A).

Flexible Memory Organization

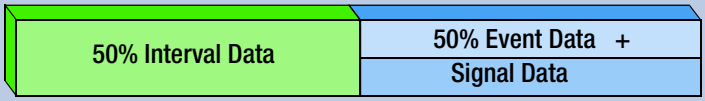
Do you require minimal data volume as well as detailed information?

The MAVOLOG 10 series fulfills these contradictory requirements, simultaneously if necessary. Available measurement data memory can be partitioned and/or used for the execution of various recording tasks. Ring mode or stop mode operation can be selected individually for both partitions.

Three-step analysis of voltage quality measurements is made possible by the functionally differentiated storage areas:

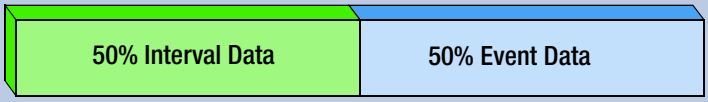
Recording Capacity for Selected Memory Configuration

e.g. 55 days for 20 measured quantities at a 10 minute interval and > 600 events, each with voltage characteristics for the event causing phase



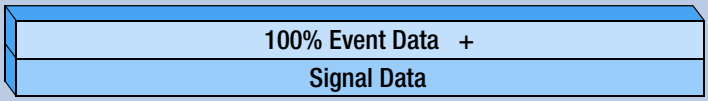
or

e.g. 27 days for 40 measured quantities at a 10 minute interval and > 25,000 events



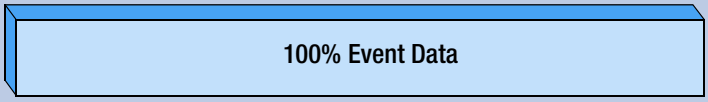
or

More than 500 events, each together with 10 ms TRMS values for all 3 voltages within a 2 second time window



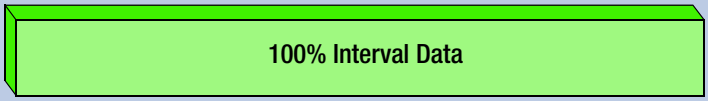
or

50,000 events with date, time, type of event, phase and measured value

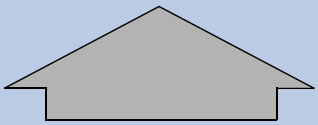


or

e.g. 85 days for 40 measured quantities at a 15 minute interval



640 kB Non-Volatile Flash Memory

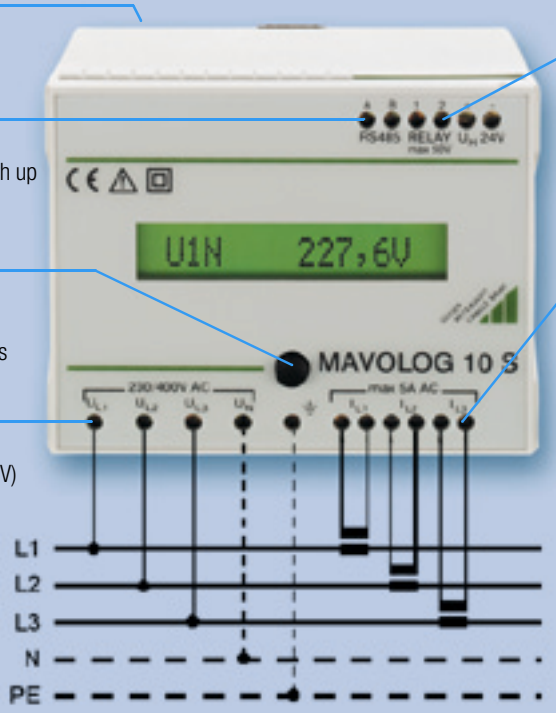


Compact Design
for wall or top-hat rail mounting

RS 485 Interface
for connection to a standardized 2-wire bus with up to 32 users (9.6 to 115 kbits per second)

LCD with Display Selector Key
for on-site monitoring of
- Measured / analyzed values for 10 quantities
- Device settings

4 Voltage Measurement Inputs
with selectable measuring range (100 V / 400 V) and programmable transformer ratio for the measurement of U_{L-L} or U_{L-N} and U_{N-PE}



Relay Output
with temporary or continuous signal for indicating events

3 Current Inputs (MAVOLOG 10 S)
with selectable measuring range (1 A/5 A) and programmable transformer ratio for the measurement of I_L and indirect acquirement of I_N via an internal summation current transformer

Step 1:
The question as to whether or not mains supply voltage fulfills the quality criteria set forth in EN 50160 is answered on the basis of **statistical data**. Measurement data memory is dedicated entirely to, for example, the recording of system load characteristics.

Step 2: Statistical and events data provide the following information: "When and where have which intensities occurred, and have the limit values established by the standard nevertheless been maintained?" Measured data memory can be used to a given extent for recording measurement series.

Step 3: Statistics, events and interval memory are used for the performance of a comprehensive evaluation of voltage quality. Above and beyond the information mentioned before, a qualitative statement regarding actual voltage quality is made possible.

Interval Memory

Continuously records measurement data using an adjustable interval (1 or 10s, 1, 5, 10 or 15 min., 1 or 24 h).
Depending upon the instrument type, up to more than 300 measured quantities or analyses are available.

Of these, up to 40 data retrieval points can be defined for simultaneous recording. Individually for each data point, logging of the instantaneous value (1 s mean value), the minimum value, the maximum value or the mean value during the interval period can be selected.

Events Memory

Records line voltage anomalies chronologically. The following, simultaneously active trigger criteria can be configured to this end:

- Upper / lower 10 minute voltage limit value
- Upper / lower 10 ms voltage limit value
- Nominal frequency with tolerance
- 10 minute asymmetry limit value
- Plt flicker limit value*
- 10 minute voltage harmonics limit value*
- 10 minute THD_U limit value*
- N-PE voltage limit value

* Fixed limit values per EN 50160

The following information is available for each event:

- Date and time
- Type of event / phase in which the event occurred
- Measured value (e.g. magnitude and duration of a voltage dip)

Signal Memory

Records time characteristics of voltage dips, failures or swells based upon 10 ms TRMS values within a 2 second window with a 25% pre-trigger.

Recording of either the affected voltage signal only, or all voltage signals can be selected, and recording of current signals can also be selected with the MAVOLOG 10 S.

Statistics Memory

Statistically acquires all relevant data for the exclusive performance of conformity evaluation with regard to EN 50160 based upon counter readings.

These include, for example, the number of voltage dips (classified) and interruptions, as well as the total duration of overvoltages and undervoltages, or other limit value violations.

This memory is always active and requires no parameters configuration.

Its contents are continuously updated after resetting.

Daily Max. Value Memory

Records extreme values for line voltage each day at midnight, as well as for each harmonic which was maintained for 95% of the day.

With the MAVOLOG 10 S, measured maximum values for active and reactive power and phase current since the last reset, as well as energy consumption, are also saved to memory.

Device settings

Device settings are entered entirely via the data interface, by means of which they can also be queried.

All settings are stored to a non-volatile flash RAM.

Online Measurement

Measured values can be queried online for all available quantities in order to acquire current system operating conditions. Assigned recording tasks continue to run in the background without interruption.

METRAwin 10 Parameters Configuring and Analysis Software

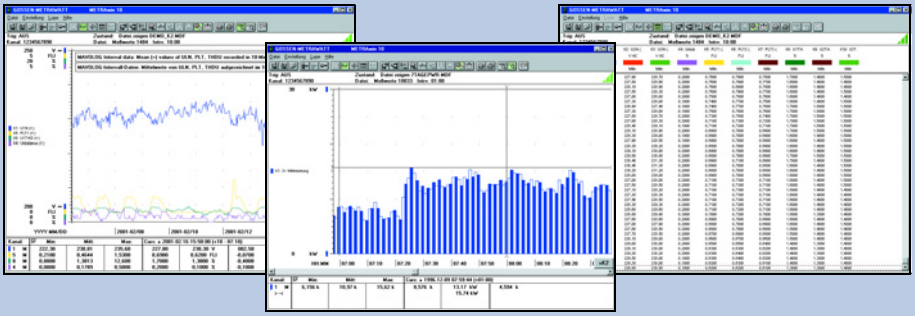
METRAwin for MAVOLOG 10 software is used for configuring parameters and visualizing data from the MAVOLOG 10.

It includes the following functions:

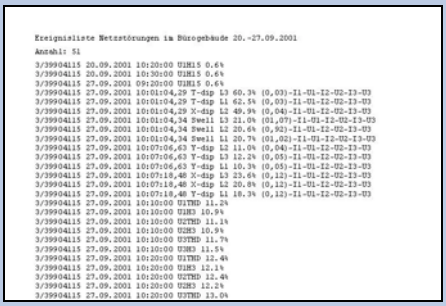
- Configuration of device parameters (connection and memory parameters)
- Memory mode initialization
- Print-out of complete or daily statistics
- Visualization of interval data
- Events data formatted as a list and visualization of 10 ms TRMS values of respective event curves
- Representation of harmonics
- Online visualization of selected measured quantities

Interval data or online recorded measurement series appear at the display as a line graph or a bar graph with horizontal time axis, and can be analyzed with two pointers.

The data logger display shows time of day and measured values in numeric format in an easy to read table, and allows for data export to other programs via the clipboard.



Event data read out from one or several MAVALOGs are listed in the order in which they occurred and can be printed out in report form.
In the event of voltage dips, interruptions or swells, these are displayed in a Y-T diagram and can be analyzed with the cursors.
If the current signals is simultaneously available, conclusions may be drawn regarding the origin of the disturbance.

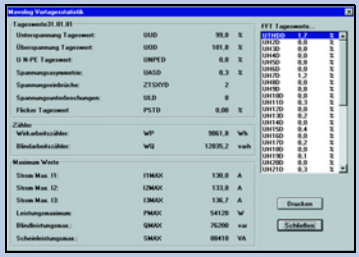


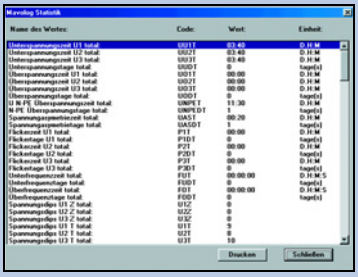
Ereignisliste Netzstörungen im Bürogebäude 20.-27.09.2001

Anzahl: 51

3/39904L15 20.09.2001 10:20:00 U1N15 0.6%
3/39904L15 20.09.2001 10:30:00 U1N15 0.6%
3/39904L15 27.09.2001 09:20:00 U1N15 0.6%
3/39904L15 27.09.2001 10:01:04,29 T-dip L3 60.3% (0,03)-I1-U1-I2-U2-I3-U3
3/39904L15 27.09.2001 10:01:04,29 T-dip L1 62.5% (0,03)-I1-U1-I2-U2-I3-U3
3/39904L15 27.09.2001 10:01:04,29 X-dip L2 49.9% (0,04)-I1-U1-I2-U2-I3-U3
3/39904L15 27.09.2001 10:01:04,34 Swell L3 21.0% (01,07)-I1-U1-I2-U2-I3-U3
3/39904L15 27.09.2001 10:01:04,34 Swell L1 20.6% (0,92)-I1-U1-I2-U2-I3-U3
3/39904L15 27.09.2001 10:01:04,34 Swell L1 20.7% (01,02)-I1-U1-I2-U2-I3-U3
3/39904L15 27.09.2001 10:07:06,63 T-dip L2 11.0% (0,04)-I1-U1-I2-U2-I3-U3
3/39904L15 27.09.2001 10:07:06,63 T-dip L3 12.2% (0,05)-I1-U1-I2-U2-I3-U3
3/39904L15 27.09.2001 10:07:06,63 T-dip L1 10.3% (0,05)-I1-U1-I2-U2-I3-U3
3/39904L15 27.09.2001 10:07:18,48 X-dip L3 23.6% (0,12)-I1-U1-I2-U2-I3-U3
3/39904L15 27.09.2001 10:07:18,48 X-dip L2 20.0% (0,12)-I1-U1-I2-U2-I3-U3
3/39904L15 27.09.2001 10:07:18,48 T-dip L1 18.3% (0,12)-I1-U1-I2-U2-I3-U3
3/39904L15 27.09.2001 10:10:00 U1THD 11.2%
3/39904L15 27.09.2001 10:10:00 U1N3 10.9%
3/39904L15 27.09.2001 10:10:00 U2THD 11.1%
3/39904L15 27.09.2001 10:10:00 U2N3 10.9%
3/39904L15 27.09.2001 10:10:00 U3THD 11.7%
3/39904L15 27.09.2001 10:10:00 U3N3 11.5%
3/39904L15 27.09.2001 10:20:00 U1THD 12.4%
3/39904L15 27.09.2001 10:20:00 U1N3 12.1%
3/39904L15 27.09.2001 10:20:00 U2THD 12.4%
3/39904L15 27.09.2001 10:20:00 U2N3 12.2%
3/39904L15 27.09.2001 10:20:00 U3THD 13.0%

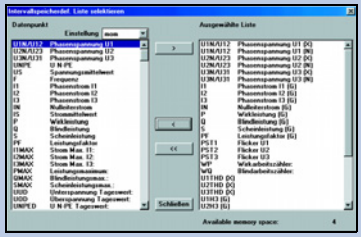
Complete statistics and daily maximum values provide information concerning all important factors at a single glance.





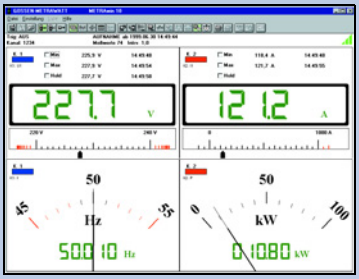
Menu driven **parameters configuring** is utilized for interconnected instruments as regards connection, recording parameters, memory configuration etc.

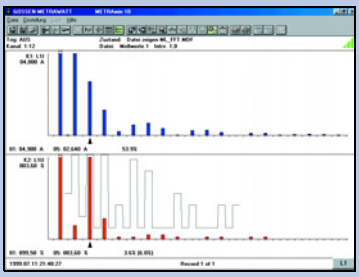
Application-specific device settings can be saved to configuration files for repeated use.



In the online mode, up to ten selectable measured quantities can be acquired at an interval of at least 1 second, visualized in various display formats and recorded to the hard disk.

When memory contents are read out, an additional, instantaneous recording of all harmonics is executed, and is represented as a frequency spectrum.



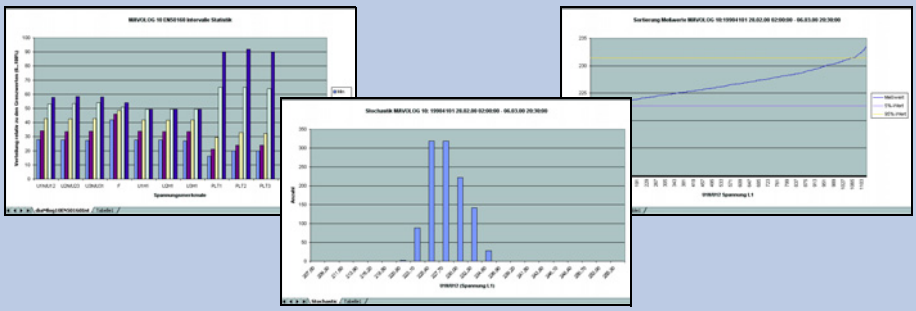


PC.doc-ACCESS Database and Report Generating Software

PC.doc-ACCESS for MAVOLOG 10 is a database program based on Microsoft Office products including WinWord, Excel and Access for the management, presentation and documentation of data recorded with the MAVOLOG 10.

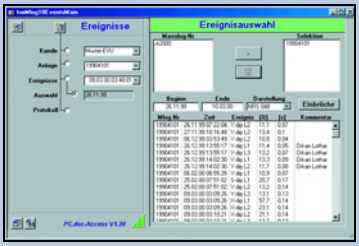
The database software allows for the management of data from any number of MAVOLOG 10 instruments, and for interactive or automated, time-controlled querying with the help of a scheduler.

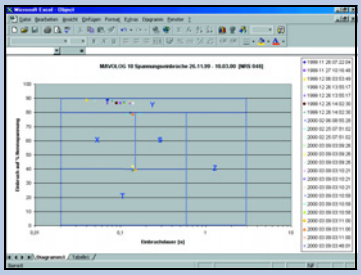
The software provides for comprehensive, detailed long-term analysis of voltage quality within a supply network including multiple measuring stations.



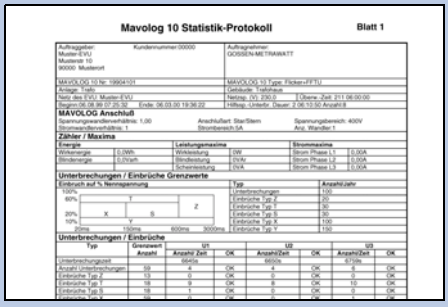
Graphics Processing with MS Excel

- Sorting of measured values according to:
  - Time
  - Value (ascending / descending)
  - Frequency distribution
- Data analysis
  (with minimum values / mean values / 95% / maximum values)
  with reference to EN 50160 and adjustable limit values

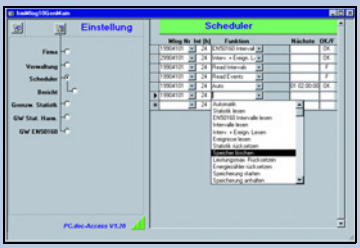




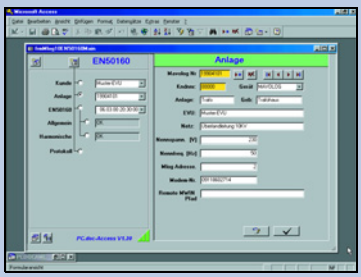
- Time sorted lists of recorded events from several MAVOLOG 10 instruments during an adjustable observation period
- Analysis of voltage dips relative to standard limit classes (ITIC, NRS048)
- Print out of events list with explanatory remarks



- Analysis of statistical data with reference to EN 50160 and adjustable limit values
- Report printing with PASS/FALL evaluation in MS Word



- Scheduler for time controlled remote read-out of the MAVOLOG 10 with the help of METRAwin 10 via RS 485 interface, modem or Ethernet using a slave PC as a gateway



System Requirements

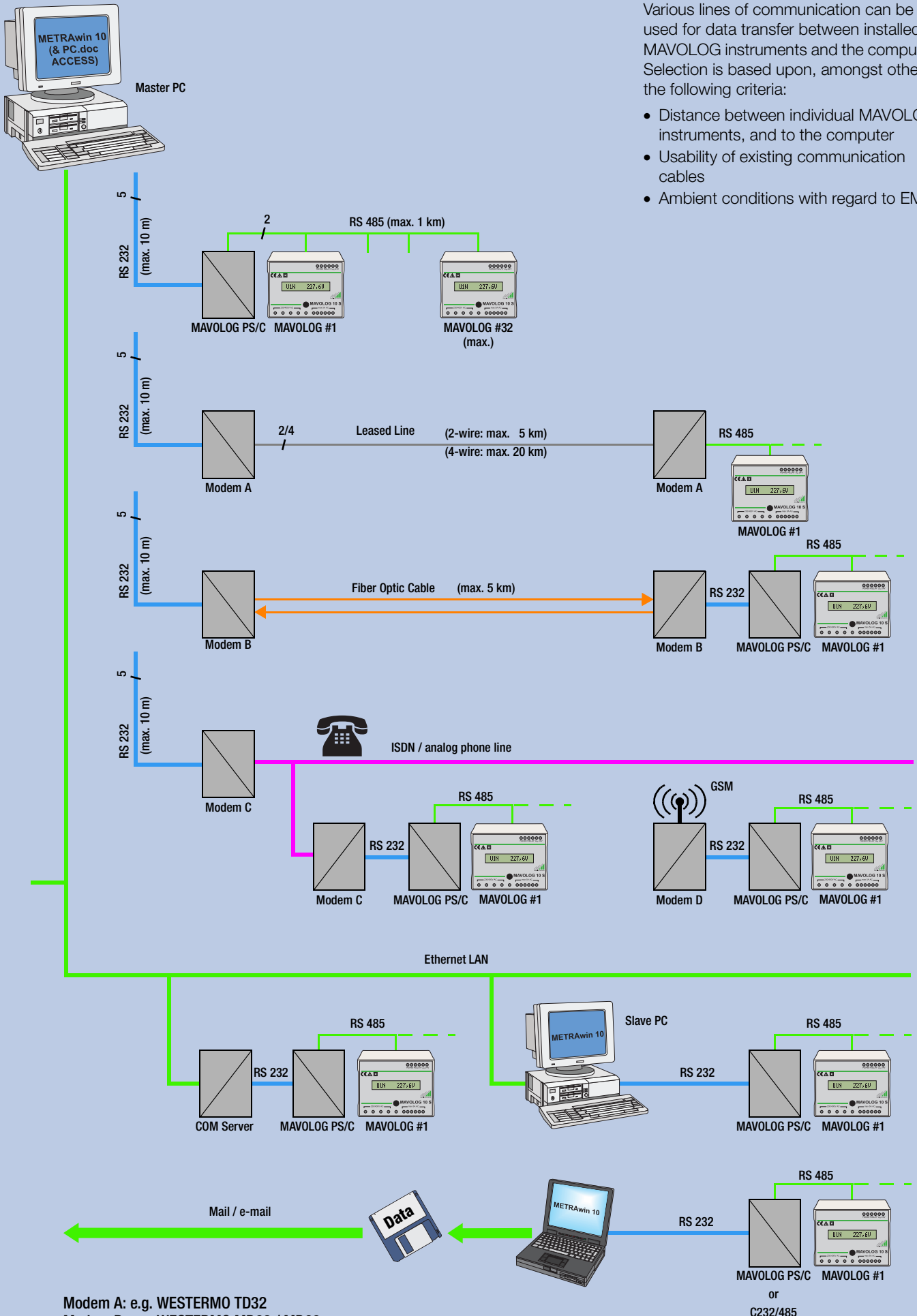
- Hardware
  - IBM compatible PC, 166 MHz Pentium or faster
  - 64 MB RAM
  - 1 available serial port
  - 20 MB available hard disk memory

  For modem operation:
  - 1 modem per MAVOLOG PS/C plus 1 per PC
- MS Windows 95, 98, NT 4.0 or 2000
  MS Office 97 or 2000 Professional

Database Functions

- Entry and management of customer and system master data
- Read-in of data from MAVOLOG memory
  - Online via METRAwin 10
  - Offline by importing files from METRAwin 10
- Retrieval of innumerable measuring points and measurement series (sorted according to customer number, MAVOLOG instrument number and date of recording)

MAVOLOG 10 Communication Links



Various lines of communication can be used for data transfer between installed MAVOLOG instruments and the computer. Selection is based upon, amongst others, the following criteria:

- Distance between individual MAVOLOG instruments, and to the computer
- Usability of existing communication cables
- Ambient conditions with regard to EMC

Modem A: e.g. WESTERMO TD32
Modem B: e.g. WESTERMO MD62 / MD63
Modem C: e.g. MAVOLOG DFÜ (analog)
e.g. INSYS ISDN-TA (ISDN)
Modem D: e.g. INSYS GSM 2.0

Technical Data

Voltage Measurement Inputs

Type	4 high impedance AC voltage inputs with common reference point for direct connection to 3~ low-voltage systems or system side voltage transformers		
Measuring channels	Y: $U_{1\text{-}N}$, $U_{2\text{-}N}$, $U_{3\text{-}N}$, $U_{N\text{-}PE}$ Δ: $U_{1\text{-}2}$, $U_{2\text{-}3}$, $U_{3\text{-}1}$, $U_{N\text{-}PE}$		
Measuring ranges	nominal Y/Δ	0...57.7/100 V~	0...230/400 V~
	maximum Y/Δ	0...75/130 V~	0...300/520 V~
Transformation ratio	Uratio range	0.01...65,535	0.01...65,535
Measuring resolution	@ Uratio=1	0.01 V	0.1 V
Overload withstand	600 V continuous		
Input Impedance	2.4 MΩ		
Nominal frequency	50/60 Hz		
Waveshape	Sinusoidal or distorted up to the 40th harmonic		

Current Measurement Inputs

Type	3 electrically isolated AC current inputs for direct current measurement or connection to a current transformer		
Measuring channels	I_{L1}, I_{L2}, I_{L3}, I_N indirect via internal summation current transformer		
Measuring ranges	nominal	0 ... 1 A~	0 ... 5 A~
	maximum	0 ... 1.2 A~	0 ... 6 A ~
Transformation ratio	Iratio range	1 ... 65,535	1 ... 65,535
Measuring resolution	@ Iratio=1	0.001 A	0.01 A
Overload withstand	12 A continuous, 50 A for 1 s		
Input Impedance	40 mΩ typ.		
Nominal frequency	50/60 Hz		
Waveshape	Sinusoidal or distorted up to the 40th harmonic		

Measuring Functions

Logging

Simultaneous sampling of voltage and current measuring inputs with A-D conversion of instantaneous values

Sampling rate	6.4 kHz
Sampling resolution	12 bit

Voltage / Current

Measuring method	RMS value measurement (RMS AC)
Measuring uncertainty	±(0.2% rdg. +3 digits)

Frequency

Measuring range	45 ... 65 Hz
Measuring resolution	0.01 Hz
Measuring uncertainty	0.05 Hz

Power

Measuring resolution	0.1 W (@ Uratio=1, Iratio=1)
Measuring uncertainty	±(0.4% rdg. +6 digits)

Harmonics

Measuring method	FFT (fast Fourier transformation), EN 61000-4-7
Measuring Range	1st to 40th harmonic and THD
Measuring uncertainty	Class B per EN 61000-4-7

Flicker

Measuring method	Flickermeter per EN 61000-4-15
Measuring Range	Pst (10 min.), Plt (120 min.)
Measuring uncertainty	per EN 61000-4-15 – 4% voltage fluctuation

Display

Display element	Alphanumeric LCD, 1 line (60 x 10 mm)
Display functions	10 selectable measured quantities, settings and device parameters, memory status active/inactive

Controls

1 key for scrolling through displays

Real-Time Clock

Time format	Date	DD.MM.YYYY
	Time	hh:mm:ss.00
Resolution	10 ms	
Drift	max. 1 minute per month (= 25 ppm)	
Adjustment / synchronization	PC system time is transferred via the data interface synchronized within approximately 0.1 s.	

Alarm Output

Function	1 isolated switching output for signaling events by continuous or pulse signal with adjustable duration
Switching element	Relay contact, NO or NC
Switching capacity	50 V / 0.5 A
Allocation	Group alarm for all events

Memory

Memory type	Non-volatile flash memory

Setup Memory

Function	Storage of device settings
Data retention time	min. 10 years

Meas. Data Memory

Function	Simultaneous storage of measurement series and events (qualitative and quantitative) to separate storage areas: **Interval memory**: time-controlled recording of up to 40 measured quantities and analyses as measuring series with memory interval: 1 / 10 seconds 1 / 5 / 10 / 15 minutes 1 / 24 hours **Event memory**: storage of event data (date and time, event type, event causing phase, value) triggered by measured values with adjustable limit values for voltage quality characteristics per EN 50160 **Signal memory**: event-triggered storage of 10 ms TRMS value characteristics for voltage and current within a 2 second time window with a 0.5 second pre-trigger
Capacity	640 kB, can be partitioned
Operating modes	FIFO memory (ring mode) Overwrite protected memory (stop mode)
Data retention time	min. 10 years

Data interface

Type	Bidirectional RS 485, 2-wire bus (conversion to RS 232 with MAVOLOG PS/C or C232/485 module)
Functions	- Configuration and querying of device parameters - Querying of currently measured data (online) - Querying of stored measurement data (offline) - Firmware update
Bus capacity	max. 32 users (without booster)
Transmission speed	9.6, 19.2, 57.6, 115.2 kBaud (kBits per second)

Auxiliary Power

Voltage range	18 to 36 V DC
Power consumption	max. 3 W
Hold-up time	Device function: 100 ms at 24 V DC typ. Real-time clock: >12 h; typ. 24 h

Reference Conditions

Ambient temperature	23°C ±2 K
Humidity	50 ± 5% relative humidity
Auxiliary power	24 V DC ±10%
Waveshape	Sinusoidal, ≤ 1% harmonic distortion
cosφ	1
Transformation ratios	Uratio = 1, Iratio = 1

Electrical Safety

Safety class	II per EN 61010-1
Overvoltage category	CAT III per EN 61010-1 for 300 V to earth
Test voltages	Meas. inputs to interface, aux. power, relay 3.7 kV~ Measurement inputs to housing 3.7 kV~

Ambient Conditions

Climatic category	3z/0/75/90% in compliance with VDI/VDE 3540	
Ambient temperature	Operation	0 … +55° C
	Storage / transport	-25 … +75° C
Humidity	max. 90% relative humidity, no condensation	
Deployment	Indoors, max. 2000 m above sea level	

Mechanical Design

Housing	Plastic „combinorm“ housing for wall or top-hat rail mounting (EN 50022/32 mm)	
Protection	per DIN VDE 0470 T1 / EN 60529	
	Housing	IP 40
	Terminals	IP 00
Dimensions	100 x 75 x 105 mm	
Weight	MAVOLOG 10 L/N	approx. 280 g
	MAVOLOG 10 S	approx. 380 g
Terminals	Screw terminals, max. 2.5 mm²	

Designation	Description	Article No.
MAVOLOG 10L+FFT/FSA	3-phase voltage quality analyzer with harmonic and flicker analysis	**M830S**
MAVOLOG 10N+FFT/FSA	3-phase voltage quality analyzer with harmonic and flicker analysis and LCD	**M830P**
MAVOLOG 10S+FFT/FSA	3-phase voltage quality and power analyzer with harmonic and flicker analysis and LCD	**M830R**
MAVOLOG 10S	3-phase voltage quality analyzer with power and energy measurement and LCD, without harmonic and flicker analysis	**M830V**
MAVOLOG 10 Mobile Set	Portable 3-phase voltage quality and power analyzer consisting of MAVOLOG 10S+FFT/FSA, MAVOLOG PS/C and MAVOLOG BP installed to a rugged case, including mains cable, RS 232 cable, voltage measurement cables with alligator clips and METRAwin 10 software	**M830W**
MAVOLOG PS/C	Mains power pack, 230 V AC – 24 V DC and RS 232 – RS 485 converter for MAVOLOG 10	**Z863D**
MAVOLOG BP	Battery pack for emergency power supply to the MAVOLOG 10	**Z863E**
C232/485	Battery powered RS 232 – RS 485 converter	**Z863F**
MAVOLOG DFU	Analog modem for communication with the MAVOLOG via public telephone lines	**Z864C**
COM Server	Direct connection, RS 232 – Ethernet LAN	**upon request**
METRAwin 10 for MAVOLOG 10	Windows software (English / German) for device setup, as well as data querying and analysis	**Z852D**
PC.doc-ACCESS for MAVOLOG 10	Database software (English / German) based on Microsoft Word, Excel and Access for data management, analysis and documentation of MAVOLOG systems	**Z852F**

International Sales

AUSTRIA
GMC-Instruments GmbH
Obere Viaduktgasse 28
A-1030 Wien

Phone +43 1 715 1500
Fax +43 1 715 1505
e-mail: info@at.gmc-instruments.com

BELGIUM
SA GMC-Instruments Belgium NV
63 Chemin des deux Maisons, b. 4
Tweehuizenweg 63, b. 4
Buxelles B-1200 Brussel

Phone +32 2 762 9276
Fax +32 2 762 6176
e-mail: info@be.gmc-instruments.com

CZECH REPUBLIC
GMC - měřicí technika s.r.o.
Fügnerova 1a
CZ-67801 Blansko

Phone +420 506 410 905
Fax +420 506 410 907
e-mail: info@cz.gmc-instruments.com

FRANCE
GMC-Instruments France S.A.
5, rue Pasteur
F-91349 Massy Cedex

Phone +33 1 6920 8949
Fax +33 1 6920 5492
e-mail: info@fr.gmc-instruments.com

GREAT BRITAIN
GMC-Instruments (UK) Ltd.
Priest House, Priest Street
GB-Cradley Heath B64 6JN

Phone +44 1 384 63 8822
Fax +44 1 384 63 9168
e-mail: info@uk.gmc-instruments.com

ITALY
GMC-Instruments Italia S.r.l.
Via Carlo Cattaneo, 9
I-20035 Lissone (MI)

Phone +39 39 245 9080
Fax +39 39 245 9088
e-mail:info@it.gmc-instruments.com

NETHERLANDS
GMC-Instruments Nederland B.V.
Daggeldersweg 18
NL-3449 AH Woerden

Phone +31 3484 211 55
Fax +31 3484 225 28
e-mail: info@nl.gmc-instruments.com

SPAIN
Electromediciones Kainos, S.A.
Polígon Industrial Est, Energía, 56
E-08940 Cornellá de Llobregat
Barcelona

Phone +34 934 742 333
Fax +34 934 743 470
e-mail: info@es.gmc-instruments.com

SWITZERLAND
GMC-Instruments Schweiz AG
Glattalstrasse 63
CH-8052 Zürich

Phone +41 1 302 3535
Fax +41 1 302 1749
e-mail: info@ch.gmc-instruments.com

Partners in:

Austria	Czech Republic	France	Iceland	Italy	New Zealand	Poland	Singapore	Sweden	Turkey
Belgium	Denmark	Great Britain	India	Luxembourg	Netherlands	Portugal	Slovenia	Switzerland	USA
Bulgaria	Egypt	Greece	Ireland	Macedonian	Norway	Rumania	Spain	Syria	
Croatia	Finland	Hungary	Israel	Malta	Peru	Saudi Arabia	South Africa		

German Sales

GMC-Instruments Deutschland GmbH

Thomas-Mann-Str. 16 - 20
90471 Nürnberg, Germany
Phone: +49 (0) 9 11 86 02–111
Fax: +49 (0) 9 11 86 02–777
e-mail: info@gmc-instruments.com
http://www.gmc-instruments.com

Printed in Germany · Subject to change without notice · 1/6.02 · Order no. 3-337-119-03

Member of GMC Instruments Group