

3-Phase Power Quality Analyzer

MEMOBOX

MEMOBOX is the ideal tool for power quality analysis, disturbance investigation and network optimisation in low and medium voltage networks. Application oriented test functions record all relevant parameters for the actual application:

MEMOBOX is applicable for 50 Hz or 60 Hz systems.

Measuring parameters

MEMOBOX type	300 P	300 A	808 A
Measurement parameter	✓	✓	✓
Voltage: Mean-, Min-, Max-value	✓	✓	✓
Current: Mean-, Max-value	✓	✓	✓
Neutral conductor current	✓	✓	✓
Voltage events	✓	✓	✓
Power: P, $ P ^{1)}$, Q, S, $PF^{2)}$, $TAN^{3)}$	✓	✓	✓
Power 3-phase: P, $ P ^{1)}$, Q, S, $PF^{2)}$, $TAN^{3)}$	✓	✓	✓
Energy	✓	✓	✓
Flicker: Pst, Plt	✓	✓	✓
THD voltage	✓	✓	✓
THD current	✓	✓	✓
Voltage harmonics	-	✓	✓
Current harmonics	-	✓	✓
Interharmonics, ripple control signals	-	✓	✓
CF (crest factor current)	-	✓	✓
Unbalance voltage, current	-	✓	✓
Frequency	-	✓	✓
Intervals (maximum)	14.221	5.643	12.331
Recording period 10 min intervals	98 d	39 d	85 d
Recording period 15 min intervals	148 d	58 d	128 d
Dust/water resistance	IP 65	IP 65	IP 50
Display	LEDs	LEDs	LCD
UPS	-	-	> 5 hrs
Memory	4 MB	4 MB	8 MB
EN 50160	✓	✓	✓

- 1) $|P|$: Absolute value of power
- 2) PF: Power factor
- 3) TAN: Tangent phi
- 4) D: Distortion power

MEMOBOX 300 P, A

MEMOBOX 808 A



General Data

Intrinsic error: Refers to the reference conditions and is guaranteed for two years

Warranty: 2 years

Recalibration interval: 2 years recommended

Quality system: developed, designed, and manufactured according to DIN ISO 9001

Reference conditions: 23°C ±2K, $U_m=230\text{ V} \pm 10\%$, 50 Hz ±0.1 Hz or 60 Hz ±0.1 Hz phase sequence L1, L2, L3, interval length: 10 minutes Star connection (L1, L2, L3 to N) Power supply: 88 V ... 265 V AC

Environment conditions:

Working temp. range: -10°C ... +55°C

Operating temp. range: 0°C ... +35°C

Storage temp. range: -20°C ... +60°C

Reference temp. range: 23°C ± 2K

Relative humidity: 10...80 %, no dewing

Safety: IEC/EN 61010-1 600 V CAT III, 300 V CAT IV, pollution degree 2, double insulation

Type test voltage: 5.2 kV r.m.s., 50 Hz / 60 Hz, 5 s

EMC:

Emission: IEC/EN 61326-1, EN55022

Immunity: IEC/EN 61326-1



Power Supply:	88 V ... 440 V AC, 50 Hz / 60 Hz
Functional range:	100 V ... 400 V DC
	Internal fuse: 630 mA T
Safety:	IEC/EN 61010-1 300 V CAT IV
	pollution degree 2, double insulation
Via test leads:	in parallel to measuring input (max. 440V)
Power consumption:	max. 7 VA
Intervals:	see table on page 1
Events:	>13.000
Memory model:	linear, circular
Interface:	RS 232, 9600...115 000 Baud, automatic
	Baud rate selection, 3-wire communication
Dimensions, weight:	MEMOBOX 808 A:
	282 mm x 216 mm x 74 mm, 2.4 kg
	MEMOBOX 300 P, A:
	170 mm x 125 mm x 55 mm, 1.1 kg
Measurements:	
A/D converter:	16 bit, sample rate: 10.24 kHz
Anti-aliasing filter:	FIR-Filter, $f_c = 4.9$ kHz
Frequency response:	Error < 1 % for $U_N = 230$ V
	for 40 Hz...2500 Hz
Interval length:	5, 10, 30 s, 1, 5, 10, 15, 60 minutes
Averaging time for	
Min/max values:	½, 1 mains period, 200 ms, 1, 3, 5 s
Time base:	deviation: max. 2s/day at 23°C

Inputs

Voltage	
Input range V_I P-N:	69 V / 115 V / 230 V / 480 V AC
Input range V_I P-P:	120 V / 200 V / 400 V / 830 V AC
Max. overload voltage:	1.2 V_I
Input range selection:	by job programming in CODAM software
Connections:	P-P or P-N, 1- or 3-phase
Nominal voltage U_N :	≤ 999 kV
Input resistance:	appr. 820kΩ per channel
Intrinsic error :	0.1 % of V_I
Voltage transformer:	ratio: <999 kV / V_I
Current measurement with LEM~flex	
Input ranges I_I	
A, B, C, N:	15 A / 150 A / 1500 A / 3000 A AC
Measurement range:	0.75 A ... 3000 A AC
Intrinsic error:	<2 % of I_I
Position influence:	max. ±2% of m.v. – for distance
	conductor to meas. head >30 mm
Stray field influence:	<±2 A AC for $I_{ext} = 500$ A AC and distance to
	measuring head
	>200 mm
Temperature coefficient:	< 0.05% / °C
Transformer ratio:	≤ 999 kA / ≤ I_I
Ratio selection:	by job programming
Connection:	3-phase, 3-phase and Neutral
	2-phase L1, L3 (2W-meter-method)
Current measurement with clamps	
(instrument without sensors)	
Input ranges I_I	
A, B, C, N:	0.5V nominal, 1.4 Vpeak
Intrinsic error:	<0.3 % of I_I
Overload capacity:	10 V AC max.
Input resistance:	appr. 8.2 kΩ
Transformer ratio:	≤ 999 kA / ≤ I_I
Connections:	3-phase, 3-phase and Neutral wire
	2-phase L1, L3, (2W-meter-method)

Technical specification – general

RMS measurements

Slow voltage variations

Measuring values:	Mean-value: RMS values averaged over interval length
Min-, Max-values:	Averaging with selectable averaging time 0.5 periods to 5 s
Max-value:	Max. r.m.s. value per interval
Min-value:	Min. r.m.s. value per interval
Current	
Measuring values:	RMS values integrated over interval length
Mean-value:	Highest r.m.s. value per interval
Max-value:	

Events

Dips, swells, interruptions	
Limit value:	variable,
	lower limit: 0...95 % V_N
	upper limit: 105...120 % V_N
	set in CODAM PLUS
Range:	0... U_I + 20 %
Measuring value:	½ period RMS value
Intrinsic error:	< 2 % of V_I
Response time:	½ mains period (10ms in 50 Hz systems)

Flicker

Measuring value:	Flicker level (P_f/P_{st}) according to IEC 61000-4-15
Intrinsic error P_{st}	< 5 % of m.v.
Measuring range P_{st} :	0.4 ... 4

Power

P, Q, S, P 	
Active power P:	as per EN 61036, class 2
Reactive power Q:	as per EN 61268, class 2
Mean- value:	averaged over interval length
Max-value:	highest value per interval
Min-value:	smallest value per interval
Phase error:	< 0.5 degrees
Conditions:	conductor centred within clamp/LEM~flex

Harmonics

$U_m, I_m, THD V, THD I$ as per IEC/EN61000-4-7:2002

Voltage harmonics	
Intrinsic error:	for $V_m < 3\% U_N$: < 0.15% V_N
	for $V_m \geq 3\% U_N$: < 5% V_m

Current harmonics	
Intrinsic error:	for $I_m < 10\% I_N$: < 0.5% I_N
	for $I_m \geq 10\% I_N$: < 5% I_m

THD V (MEMOBOX 300 P)

Intrinsic error at U_N :	for THD V < 3%: < 1%
	for THD V ≥ 3%: < 5%

THD V (MEMOBOX 300 A, 808 A)

Intrinsic error at U_N :	for THD V < 3%: < 0.15%
	for THD V ≥ 3%: < 5%

THD I

Intrinsic error at I_N :	for THD I < 3%: < 2%
	for THD I ≥ 3%: < 5%

Statistics:

Frequency:	42 classes for 10 s mean values
Ripple control signals,	
Interharmonics:	21 classes for 3 s mean values

Analysis of measurement data

Programming and analysis with PC software CODAM PLUS.

Applications

Quality assurance

- Voltage quality analysis according to EN 50160 over a 1-week period
- Examination of measurement quantities as per standards

Disturbance analysis

- Long-term analysis of mains voltage
- Examination of voltage dips and harmonic problems
- Flicker measurement
- Examination of ripple control signals (level)
- Specific search for disturbances through correlation of relevant measurement quantities (e.g. current, voltage, and flicker) considering the time of occurrence and their periodicity.

Power measurement

- Long-term analysis of active, reactive, distortion and apparent power
- Long-term analysis of power factor, unbalance

Network optimisation

- Load measurements, acceptance of new loads
- Adjustment of compensation systems
- Examination of voltage dips and harmonic problems
- Flicker measurement
- Examination of ripple control signals (level)
- Specific search for disturbances through correlation of relevant measurement quantities (e.g. current, voltage, and flicker) considering the time of occurrence and their periodicity.
- Current measurement (with flexible sensors LEM~flex 5 – 3.000A)
- Capture of current peaks

Software CODAM PLUS

CODAM PLUS is the universal application software for **MEMOBOX 300 P, A** and **MEMOBOX 808 A**. Job processing, verification of actual measurement values with ONLINE-function and data transfer from the **MEMOBOX** to the PC are the main functions. The user interface is intentionally kept easy, evaluations are optimised for practical applications: Graphical presentations provide an overview of power quality, statistics and measurement value tables show the details. The measured values can be exported to ASCII-files for post-processing in spreadsheet calculation software.

CODAM PLUS is operative on PCs with all usual operating systems: Windows® 98/ME/NT4.0/2000/XP.

CODAM PLUS is part of the delivery of the **MEMOBOX**.

Job processing allows for setting:

- Interval length
- Memory model
- Voltage input range, nominal voltage, nominal current
- Response time for Min-, Max-values
- Connection type (P-N, P-P)
- Thresholds for event detection, interruptions

The configuration of the **MEMOBOX** can be done offline without a connected **MEMOBOX**. If a **MEMOBOX** is connected to the PC during job processing session the connected accessory is detected automatically. Faulty scaling is impossible.

Time activated jobs, switch activated jobs and immediate jobs can be programmed.

Setup

- Internal clock (date/time)
- Define **MEMOBOX 808** designation
- Parameters for data export
- Software-Updates

Analysis

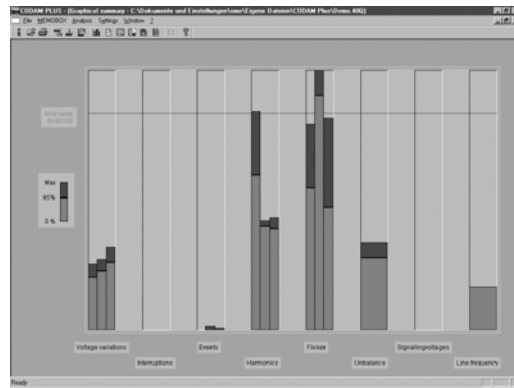
For detailed analysis the following presentations are available:

- ONLINE TEST function
- Graphical summary of all EN50160 parameters
- Level time diagrams
- table summaries
- event tables (UNPEDE DISDIP table)
- application oriented analysis (AOA)
- list of measurement values
- cumulative frequency diagram of harmonics
- Statistical presentations
- table of all limit exceedings
- table of critical values
- export to ASCII data files

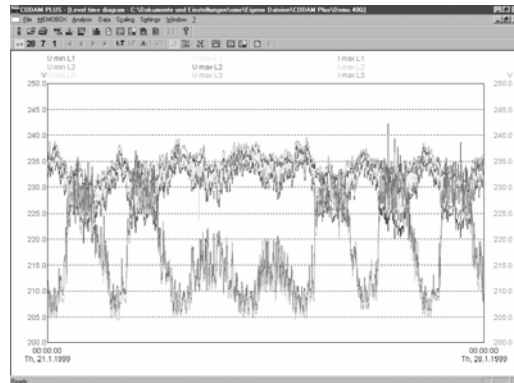
The remote data transfer of measurement data via analogue modems, ISDN-modems or GSM-modems is provided.

The optional communication software **PERMLINK** establishes a transparent connection from the PC via the modems to the **MEMOBOX** installed onsite.

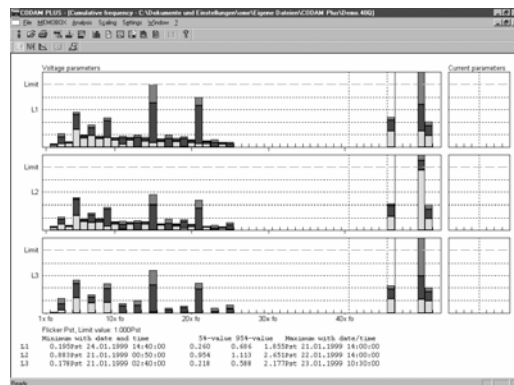
Graphical EN50160 overview:



Level-time diagram



Harmonics:



UNPEDE DISDIP table for voltage events:

Phase L1, L2, L3	< 20 ms	20 - < 100 ms	100 - < 500 ms	0.5 - < 1 s	1 - < 3 s	3 - < 20 s	20 - < 60 s	>= 1 min
Surge > 10.00%								
Dip > 10.00%								
10 - < 15 %	2	1						
15 - < 30 %								
30 - < 60 %								
60 - < 99 %								
Interruption								

Recording as events from -10.00%+10.00% of the nominal voltage
 Dip according to UNPEDE measurement guide

Number of surges	0
Number of Dips	3
Number of short interruptions (<3 min)	0
Number of long interruptions (>=3 min)	0
Number of interruptions	0
Total events and interruptions	3
Total number of allowed events	100
Total number of allowed interruptions	100

Optional accessories

Current clamp sets

Current clamp sets with measurement ranges between 1 A and 200 A AC for 3-phase and 3-phase+N-measurements:

EP 0450A, 0451A:	1A/10 A AC
EP 0452A, 0453A:	5A/50 A AC
EP 0455A, 0456A:	20A/200 A AC



Technical specification

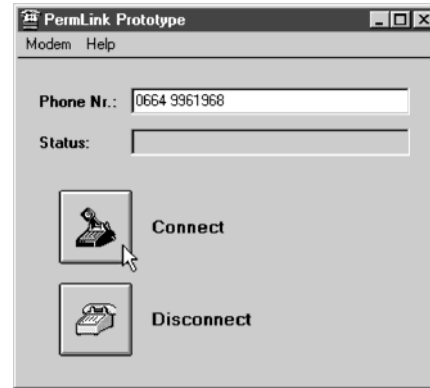
Conductor cross section:	max. 15 mm diameter, 15 mm x 17 mm bus bars
Intrinsic error:	< ±0.5% of m. v.
Phase angle error:	<1°
Safety:	600 V CAT III

The clamp sets use a memory device for calibration data, and sensor identity. Thus high accuracy and small phase angle errors can be achieved – each set is calibrated individually.

One of the two measurement ranges can be selected during job processing within the **CODAM BASIC/PLUS** software.

The sensor type is detected automatically by the MEMOBOX, only ranges which are supported by the hardware can be selected.

Remote data upload, remote control - PERMLINK communication-software



PERMLINK establishes a modem connection to the remote **MEMOBOX** installed onsite. **CODAM PLUS** can operate the **MEMOBOX** via the serial COM-port of the PC and the modem connection.

Analogue or ISDN-modems, GSM-terminals can be used to configure a **MEMOBOX** and to upload measurement data to the PC in the control centre, and to monitor the measurement parameters **ONLINE** on the PC.

PERMLINK supports modems of the following manufacturers: US-Robotics (3Com), Zyxel, GSM-modems of SIEMENS, WAVECOM and others.

Standard accessories, contents of delivery

MEMOBOX is delivered with a carrying bag which has room for the MEMOBOX standard and optional accessories:



Contents of delivery:

- **MEMOBOX**
- Carrying bag
- Test certificate with measurement values
- Manuals for **MEMOBOX** and **CODAM PLUS**
- CD-ROM with **CODAM PLUS** software
- RS 232 serial cable, 3m
- Supply cables with safety plugs
- Voltage test leads 3-phase
- Set of 4 flexible current probes for A, B, C, and N with selectable range - 15 A / 150 A / 1500 A / 3000 A AC
- 4 dolphin clips: 3 red for A, B, C, 1 blue for N-conductor

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In June 2005
Fluke Corporation
acquired LEM Instruments.



Standard accessory: 4 flexible current probes



Technical specification

Measuring head length: 61cm, 2m cable
Intrinsic error: <math>< \pm 0.5\% \text{ of. m. v.}</math>
Phase angle error: <math>< 0.5^\circ</math>
Safety: 600 V CAT III

Sets of flexible current sensors (LEM~flex) with measurement ranges from 15A up to 3000A AC are available in versions for 1-phase, 3-phase and 3-phase+N measurements.

The ranges for each set are: 15A/150A/1500A/3000A AC
The LEM~flex set contains a memory device with calibration data and sensor identity. Thus best precision and small phase angle errors can be achieved.

The range selection is done in **CODAM PLUS** software during job processing. The sensor type is detected by the **MEMOBOX**, ranges that are supported by the hardware can be selected only.

Non standard accessories

Clamp set 1 A / 10 A, 3-phase	EP 0450A
Clamp set 1 A / 10 A, 3-phase+N	EP 0451A
Clamp set 5 A / 50 A, 3-phase	EP 0452A
Clamp set 5 A / 50 A, 3-phase+N	EP 0453A
Clamp set 20 A / 200 A, 3-phase	EP 0455A
Clamp set 20 A / 200 A, 3-phase+N	EP 0456A
Dolphin clip black	EP 0327Z
PERMLINK communication software	E631820090

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