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.

**MEMOBOX 300 P, A** **MEMOBOX 808 A**


## 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

## 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, Um=230 V ±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:**

| | |
|---|---|
| Functional range: | 88 V …440 V AC, 50 Hz / 60 Hz<br>100 V … 400 V DC<br>Internal fuse: 630 mA T |
| Safety: | IEC/EN 61010-1 300 V CAT IV<br>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:**<br>282 mm x 216 mm x 74 mm, 2.4 kg<br>**MEMOBOX 300 P, A:**<br>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<br>for 40 Hz…2500 Hz |
| Interval length: | 5, 10, 30 s, 1, 5, 10, 15, 60 minutes |
| Averaging time for<br>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 $I_I$<br>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<br>2-phase L1, L3 (2W-meter-method) |

**Current measurement with clamps (instrument without sensors)**

| | |
|---|---|
| Input ranges $I_I$<br>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<br>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: | |
| Mean-value: | RMS values integrated over interval length |
| Max-value: | Highest r.m.s. value per interval |

## Events

Dips, swells, interruptions

| | |
|---|---|
| Limit value: | variable,<br>lower limit: 0…95 % $V_N$<br>upper limit: 105…120 % $V_N$<br>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 ($P_{lt}$/$P_{st}$) 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 $V_m$ ≥ 3% $U_N$: | < 5% $V_m$ |

**Current harmonics**

| | | |
|---|---|---|
| Intrinsic error: | for $I_m$ < 10% $I_N$: | < 0.5% $I_N$ |
| | for $I_m$ ≥ 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 $I_E$: | for THD I < 3%: | < 2% |
| | for THD I ≥ 3%: | < 5% |

**Statistics:**

| | |
|---|---|
| Frequency: | 42 classes for 10 s mean values |
| Ripple control signals,<br>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 spread sheet 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**

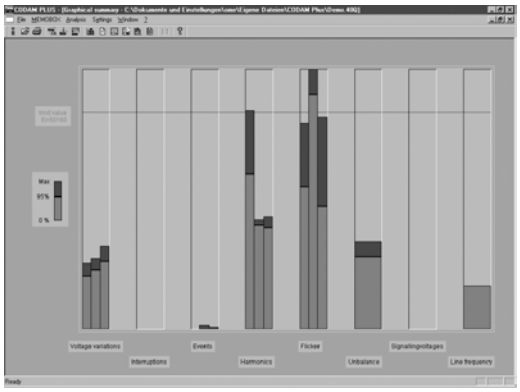
- Internal clock (date/time)
- Define **MEMOBOX 808** designation
- Parameters for data export
- Software-Updates

**Analysis**
For detailed analysis the following presentations are available:

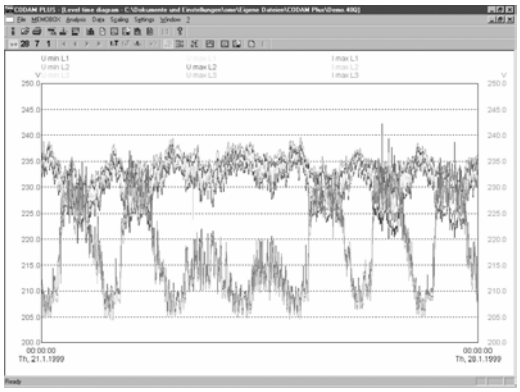
- ONLINE TEST function
- Graphical summary of all EN50160 parameters
- Level time diagrams
- table summaries
- event tables (UNIPEDE DISDIP table)
- application oriented analysis (AOA)
- list of measurement values
- cumulative frequency diagram of harmonics
- Statistical presentations
- table of all 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.

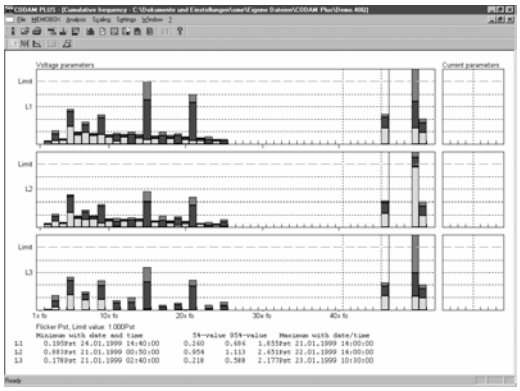
**Graphical EN50160 overview:**



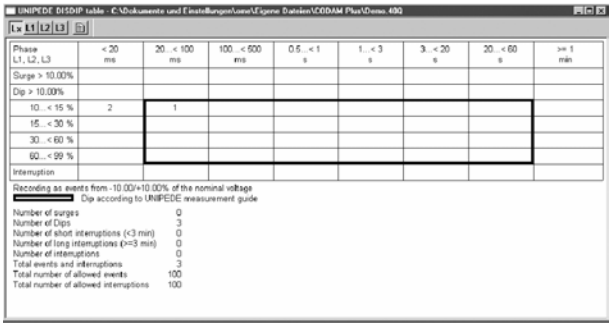
**Level-time diagram**



**Harmonics:**



**UNIPEDE DISDIP table for voltage events:**



# 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:

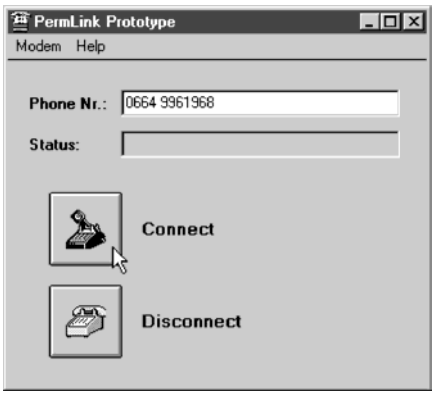
| | |
|---|---|
| **EP 0450A, 0451A:** | 1A/10 A AC |
| **EP 0452A, 0453A:** | 5A/50 A AC |
| **EP 0455A, 0456A:** | 20A/200 A AC |

**Technical specification**

| | |
|---|---|
| Conductor cross section: | max. 15 mm diameter,<br>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

**Standard accessory: 4 flexible current probes**

**Technical specification**

| | |
|---|---|
| Measuring head length: | 61cm, 2m cable |
| Intrinsic error: | < ±0.5% of. m. v. |
| Phase angle error: | <0.5° |
| Safety: | 600 V CAT III |

Sets of flexible current sensors (LEM~flex) with measurement ranges form 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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