Multi Channel Precision Power Meter

LMG 500

0.03% Accuracy • 10MHz Bandwidth • 3MSamples/s
Sampling and Evaluation Absolutely Non Gapping
All Inrush Currents and Signal Changes will be Captured

The New Dimension of Power Measuring
• For use in all applications

• Measuring inputs for ultimate requirements

• Separated HF current inputs $I_{HF}^*$: 20mA to 3A/DC to 5MHz
• Capacity to earth <20pF
• Current inputs $I^*$, high dynamic of range: 20mA to 32A/120Apeak by only one socket pair
  No need and incommode change of external shunts!

• Measuring with external sensors: Inputs $I_{Sensor}$ and $U_{Sensor}$
  30mV to 4V/DC to 10MHz
• Voltage inputs $U^*$:
  3V to 1000V/3200Vpeak
• Auxiliary voltage ±15V and Identification of external sensors

• All inputs isolated against each other and against earth (1000V/CAT III)
• Gap free sampling and evaluation with 3MSamples/s at any duration
• Up to 8 power measuring channels in synchronous 3MHz sampling made up with two LMG500
The Precision Power Meter LMG500, modular for 1 to 8 power channels (phases), designed with most advanced technologies will give best measuring results with all applications, conventional devices as motors and transformers, as well as with equipment designed in sophisticated power electronics as inverters, lighting and automotive components.

The LMG500 performance is based on and featured by:

- its measuring bandwidth from DC to above 10 MHz. Pulsed signals with less than 100ns duration will be captured and measured most precisely.
- its high sampling rate of 3 MSamples per second, synchronous and simultaneous at all channels non-gapping, so all steady state as well as dynamic events can be measured and analysed. For the computation of rms and average values all data of the continuous 3 MHz-sampling will be used, thus preventing any gaps between those values. This non-gapping sampling and computing technology guarantees highest precision also at fast signal changes.
- its high common mode rejection due to minimisation of all parasitic influences.
- low earth capacities down to their physical limits (less than 20pF) yielding a negligible impact of measuring device onto the measuring object.
- very high precision at low cosphi, e.g. down to 0.001 at 50Hz, is inherent in the instrument due to bandwidth and precisely matched delays of U and I channel. The guaranteed accuracy is mainly determined by the calibration procedure and used standards. The usable accuracy can be amended by more laborious calibration and better standards. The traceable measuring of transformer efficiency needs an amended calibration at low power factor, ZES ZIMMER Part No. KR-L50-LPF.

ZES ZIMMER’S experience and skill to design easy to use ergonomic operation shells give LMG500 another pole position. The graphical display gives real time visualisation of the measurement with figures and graphs.

The powerful transfer and evaluation software TERM-L5 for your PC is another powerful tool for analysis.

Software PQA enables an easy and efficient analysis of power quality.

Easy operation by use of colour graphics display and hotkeys for important measured values

Various value tables can be called onto the colour graphics display by pressing one key only, either with 6 values in large letters, which can also be read at a glance from a greater distance, with 12 values or with up to 40 values e.g. in range setting or in harmonics table.

The graphics display allows scope and plot functions for waveform and timing diagrams, as well as xy diagrams or bar charts for the harmonics. The status bar at the top of each display menu shows the input level of the 4 (8) voltage and the 4 (8) current inputs – an important item of information for the quality of the measurement.

The display also indicates in what groups, A and B (C and D), the input channels are wired and which signals the groups are synchronised to.
Measurements with up to 8 power channels

Example for a measuring with 8 power channels: Uninterruptible power supply with intermediate direct current link, determination of efficiencies at different states.

8 channel measuring at uninterruptible power supply with intermediate DC link

Efficiency at asynchronous in- and output (measurement example)

The following block diagram applies wiring A:1+2+3 B:4 and is typical for a low power speed variable drive. This example is used to explain the settings and displays of the LMG500.

The screenshots were made with the free software BMP2PC from ZES ZIMMER.

Arrangement of measurement example described with the screenshots below

1. Setting of global parameters, e.g. wiring
2. Conditioning of measuring signal, setting of synchronisation source for group A
3. Conditioning of measuring signal, setting of synchronisation source for group B
4. Measuring ranges, “autorange” or “manual”, setting of scaling factors for current and voltage of group A
5. Measuring ranges, “autorange” or “manual”, setting of scaling factors for current and voltage of group B
6. Recognizing, displaying and activation of connected external current sensor devices
Wave form (scope menu) of power (yellow), current (red) and voltage (green) of the frequency converter single phase input.

Wave form of the low pass filtered 3φ output, the chopper frequency is no more contained because of being outside the filtered range.

Large display with 6 important values of the frequency converter input, measured in group B.

Phase values and summing values of the frequency converter 3φ output gives a quick overview (group A).

Efficiency, slip, speed and other interesting values, calculated with formula editor programmed for this purpose.

The formula editor provides the individual calculations shown in picture.

Vector display of 3φ systems immediately checks the phase sequence and shows phase interchanges.

Plot display works like a strip chart recorder and can plot all measured or formula calculated values (trend).

Harmonic analysis according to CE standards.

Frequency spectrum for current, voltage (as bar chart), with CE-limits, linear or logarithmic.
All necessary functions in the basic device:
- Printer interface
- RS232 Interface
- Formula editor
- 3,5” Floppy drive

Options:
- Star-Delta Conversion
  Part No. L50-06

50Hz -> f=variable, instrument for motor measurement in I*U\^\Delta\wiring

For detailed test and evaluation of 3\phi motors the electrical quantities for each winding phase are needed. In some cases you have access to the motor terminal block with start and end of all three windings. Then you can measure all what you need. But in most cases the motor has only 3 terminals and the internal star point or the delta winding as to measure its current is not accessible. Also far away from the motor you have only the three wires. With the option star-delta conversion you have the capability to calculate the not accessible values (e.g. voltages, currents, power, harmonics). This intelligent solution with an additional DSP works well at all wave forms and every unbalance of mains and load. Simply connect the voltage paths in delta and click the current clamps around the wires. Select the internal connection of your load and press the „Link“ softkey.

The LMG500 can be expanded with the options mentioned here.

The IEEE488 interface (Part No. L50-01) is able to interpret the complete SCPI as well as the LMG500-specific command set. It has a data rate up to 1 MByte/sec.

The Flicker measurement (Part No. L50-04) option consists of a flicker meter in accordance with EN61000-4-15, and signals are evaluated in accordance with EN61000-3-3.

Besides the current/voltage inputs for power measurement, further analog and digital measuring inputs and signal outputs are available in the so-called Process signal interfaces, digital and analog inputs and outputs (Part No. L50-03).

Process magnitudes such as rotational speed and torque can be fed to the device to determine the efficiency level, using the formula editor. Signals can be derived from the measured values and can be output again as control signals.

The Harmonics up to 99th from U, I and P (Part No. L50-08) option can be used to analyse current, voltage and power, related to the fundamental ranging from 0.1Hz to 150kHz. It is possible to detect Inter-harmonics by a selectable division factor giving a new fundamental as reference. Harmonic analysis up to 1.5MHz possible on external PC with ZES ZIMMER software TERM-L5.

CE-Harmonics (Part No. L50-09) up to 40th acc. to EN61000-3-2.

DSP Modules (Part No. L50-010) One piece necessary for operating with options CE-harm L50-09, and/or flicker L50-04 and/or Harm 99 L50-08. Two pieces necessary for operating the above mentioned options in combination with star to delta conversion L50-06. The respective quantity of DSP modules has to be doubled in case a second LMG500 or the Extension box (Part No. LMG500-E) is connected.

The Transients (Part No. L50-05) option detects peaks and dips up to a resolution of 330ns, sampling with 3 MSamples/s.
### Technical Data

**Voltage measuring ranges U**
- **Nominal value /V:** 3, 6, 12.5, 25, 60, 130, 250, 400, 600, 1000
- **Maximum trms value /V:** 7.2, 16.4, 30, 60, 130, 270, 560, 1000, 1000
- **Maximum peak value for full scale /V:** 6.25, 12.5, 25, 50, 100, 200, 400, 800, 1600, 3200
- **Input impedance:** >4.5MΩ || <3pF

**Current measuring ranges I**
- **Nominal value /A:** 20mA, 40mA, 80mA, 150mA, 300mA, 600mA, 1.25A, 2.5A, 5A, 10A, 20A, 32A
- **Maximum trms value /A:** 225mA, 450mA, 900mA, 1.8A
- **Maximum peak value for full scale /A:** 37m, 75m, 150m, 300m, 600m, 1.2A, 2.5A, 5A
- **Input impedance:** 560mΩ

**Current measuring ranges lmn**
- **Nominal value /A:** 150mA, 300mA, 600mA, 1.2A, 2.5A, 5A, 10A, 20A, 32A
- **Maximum trms value /A:** 25mA, 50mA, 100mA, 1.8A
- **Maximum peak value for full scale /A:** 37m, 75m, 150m, 300m, 600m, 1.2A, 2.5A, 5A
- **Input impedance:** 0.1Ω

**Sensor Inputs U Harvey**
- **Nominal value /V:** 30m, 60m, 120m, 250m, 500m, 1V, 2V
- **Maximum trms value /V:** 37m, 75m, 150m, 300m, 600m, 1.2A, 2.5A, 5A
- **Maximum peak value for full scale /V:** 63m, 125m, 250m, 500m
- **Input impedance:** 100kΩ || 34pF

**Measuring Accuracy**
- Accuracies based on:
  1. Sinusoidal voltage and current
  2. Average temperature 23°C
  3. Warmup time 1h
- Other Values:
  - All other values are derived from the current, voltage and active power values. Accuracies for derived values depend on the functional relationship (e.g., S = I * U, AS = ∆I / AS / ∆U / ∆I)}
Isolation

All current and voltage inputs isolated against each other, against remaining electronic and against earth (1000V/CATIII)

Synchronization

The measurement is synchronized on the signal period. There is a choice to determine the period from “line”, “extern”, u(t), i(t) as well as their envelopes, combined with selectable filters. By this very stable readings are achieved, even at signals of pulse width modulated frequency inverters and amplitude modulated electronic ballasts.

Harmonic analysis

(option CE Harm L50-09)

Measuring of current, voltage and power up to 99th harmonics, in total 100 harmonics including DC component.

(option Harm100 L50-08)

Fundamental in the range from 0.1Hz to 150kHz. By integer divider (1...128) a new reference fundamental can be created as to detect inter-harmonics. Externally on PC up to 1.5MHz with ZES ZIMMER software TERM-L5

Flicker measuring (option L50-04)

Flicker meter according to EN61000-4-15 with evaluation in full compliance with EN61000-3-3

Transients (option L50-05)

Detecting and recording of transients >330ns

Scope function (standard)

Graphical representation of sampled values versus time

Plot function (standard)

Time diagram of max. 4 readings, minimal resolution 50ms, respectively 10ms in 50Hz half-wave (flicker) mode

Star delta conversion (option L50-06)

Sums and differences between channels on sample basis

Computer interfaces

RS232 (standard) and IEEE488.2 (option L50-01), only one interface can be used at the same time, additional USB 2.0 Typ B and Ethernet 10/100 Base-T RJ45 (option L50-02) available.

Remote control

All functions can be remote-controlled, keyboard lock for measuring parameters

Output data

Output of all readings, data formats BIN/ASCII, SCPI command set

Transfer rate

RS232: max. 115200 Baud, IEEE488.2: max. 1MByte/s

Floppy drive (standard)

3.5”, 1.44MB

Printer interface (standard)

Parallel PC-Printer interface with 25-pin SUB-D socket, printing measuring values, tables and graphics to matrix, inkjet or laser printers

Processing signal interface

(option L50-03)

2 x 25 pin SUB-D socket with:
• 8 analog inputs for process magnitudes (16Bit, ±10V)
• 8 analog outputs (16Bit, ±10V)
• 8 digital inputs
• 8 digital outputs
• 2 input for frequency (0.1Hz...500kHz) and rotation direction
• in- and outputs are isolated against other electronics (test voltage 500V)

Other data

Dimensions

Bench case, W 433mm x H 147mm x D 400mm

Weight

About 12kg

Protection class

EN61010 (IEC61010, VDE0411), protection class I, overvoltage category III

Electromagnetic compatibility

EN50081, EN50082

Protection system

IP20 in accordance to DIN40050

Operating/storage temperature

0...40°C, -20...50°C

Climatic class

KYG in accordance to DIN40040

Power supply

85...264V, 47...440Hz, about 100W

Adapter for 3-phase measurements

Part No. LMG-MAK3

• CEE-Plug, 5 pins, 16A, 2m supply cord
• CEE-Socket, 5 pins, 16A, for EUT
• Socket for supplying the meter LMG500/LMG450
• 4mm safety sockets, measuring access to current and voltage
• Safety acc. IEC61010: 300V/CATIII

Longtime Data Logging NDL5

Part No. NDL5

• Longtime-data logging to harddisk for LMG500/LMG450/LMG95, configuration with ZES ZIMMER software TERM-L5
• Communication via Internet/ Ethernet, even when recording
• Uninterruptible power supply integrated
• W 320mm x H 50mm x D 307mm

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