MATUSCHEK

POWERAnalyzer LK-601

MEASURABLE PRECISION

POWER*Analyzer* LK-601

The LK601 is a custom, configurable, flexible, and high-precision power analyzer specially designed for e-drive component testing, verification, and EOL applications.

Right from the beginning we focused on developing a highly accurate and easy to operate system which perfectly fits into stationary automated test bench environments. Therefore, we intentionally designed the device without any display or buttons.

Moreover, the LK601 is completely operated by the corresponding powerful and intuitive **POWER***Studio* software. Alternatively, the device can also be integrated within any LabVIEW environment. As the system operation is software driven, future feature integration is easily performed by remote firmware and/or software updates.

LK601 HARDWARE

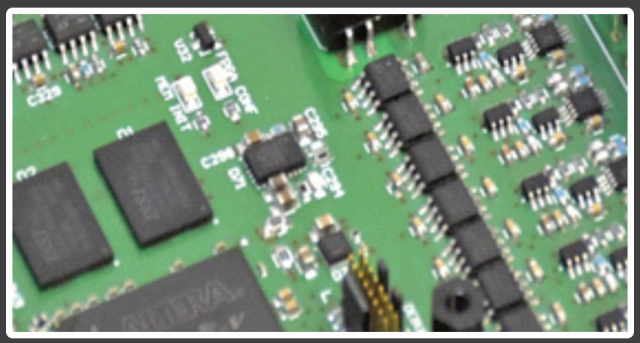
The LK-601 hardware setup can be configured individually. Besides the high-precision power channels (LK-CS1), the device is off-the-shelf equipped with CAN, the widely used automotive interface for transmitting various types of signals like speed, torque, or temperature. In case more dynamic mechanical data wave forms are needed, it can also be extended with the LK-MC1 motor acquisition card, which is capable of connecting two motors.

POWER MEASUREMENT

A power channel consists of a high-resolution current and voltage measurement path. Both paths, which are separated from each other by optical isolating, offer a high degree of safety and a high-speed data rate. For data acquisition, the signals are sampled with 10 MS/s. Up to six power measurement channels can be synchronously acquired and analyzed by one POWERAnalyzer. The run-time compensated measurement channels ensure a maximum of synchronity.

16 BIT HIGH SPEED ADC

10 MS/s



VOLTAGE MEASUREMENT

For voltage measurement, 12 ranges from 1.5 V up to 1000 V (RMS) are available.
Therewith low and high voltage applications are covered. A crest factor of 3 offers a high dynamic range of measurement.*

electrical power DAQ card LK-CS1

CURRENT MEASUREMENT

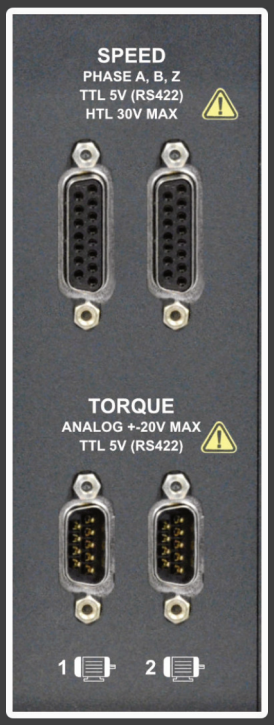
The current measurement is performed with external current sensors. Measurement losses resulting from more complex wiring are avoided. Another advantage is the wide range of current sensors that can be used. Depending on the application, currents up to 1200 A** (RMS) can be measured. The transducer's supply is already integrated in the channel itself, which reduces costs and effort for the customer's test setup.

MECHANICAL POWER MEASUREMENT

Torque, speed, and position are further important values which are required for motor analysis. The optional motor card is capable of processing the signals from up to two torque sensor shafts and two encoders synchronously with the power values.

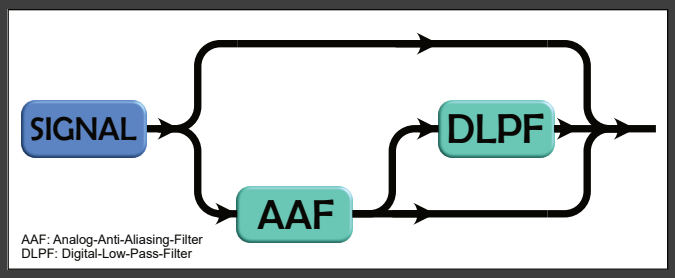
The card supports all common signal types of the sensors (frequency RS422, TTL, HTL, analog).

Encoder interface (speed, rotation angle)			**D-SUB15, Female**
Encoder power supply (5 V / 400 mA, short-circuit proof)			
Differential:	TTL 5 V (RS422)	A/AN, B/BN, Z/ZN	10 MHz max.
	HTL 30 V max.	A/AN, B/BN, Z/ZN	400 kHz max.
Single Ended:	TTL 5 V	A, B, Z	1 MHz max.
	HTL 30 V max.	A, B, Z	200 KHz max.
Torque sensor interface (torque)			**D-SUB9, Male**
Analog:	0-5 V, 0-10 V	Unipolar	15 kHz @ -3 dB
	+-2.5 V, +-5 V, +-10 V	Bipolar	15 kHz @ -3 dB
Digital:	TTL 5 V (RS422)	A/AN	1 MHz max.



motor card LK-MC1

*for 1000 V RMS range the crest factor is 2
**depends on current sensor



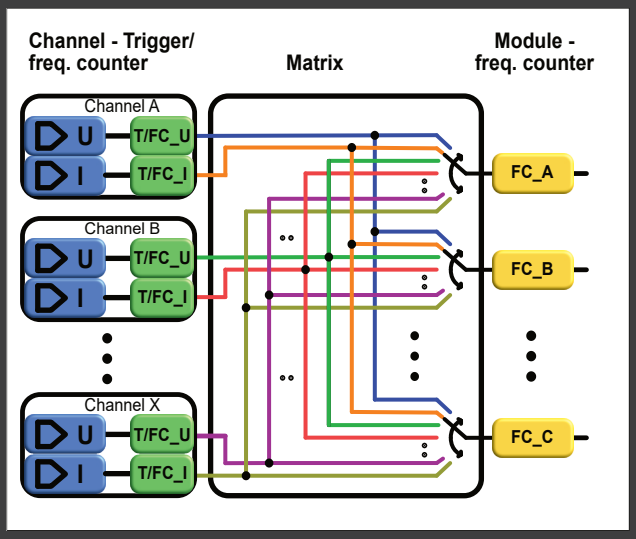
SIGNAL FILTER

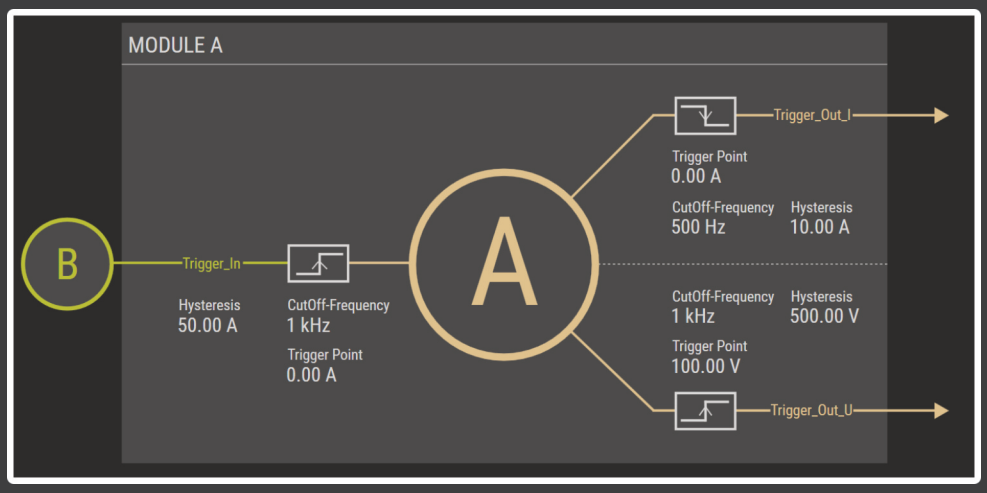
Each channel is equipped with a switchable analog anti-aliasing filter. In combination with a user-adjustable digital low-pass filter, a clear signal waveform can be achieved by the reduction of interfering disturbances.

TRIGGER MATRIX

The configurable trigger matrix allows a trigger assignment that is completely adapted to the application's requirements. The channels can be combined in groups or set individually. A separate frequency counter is assigned to each trigger input and output. This is required when testing signals with different frequencies.

In addition to the electrical driven signals, external sources can also be used as triggers. Often the position signal of a shaft speed sensor is used to synchronize the power evaluation to the corresponding mechanical cycle.



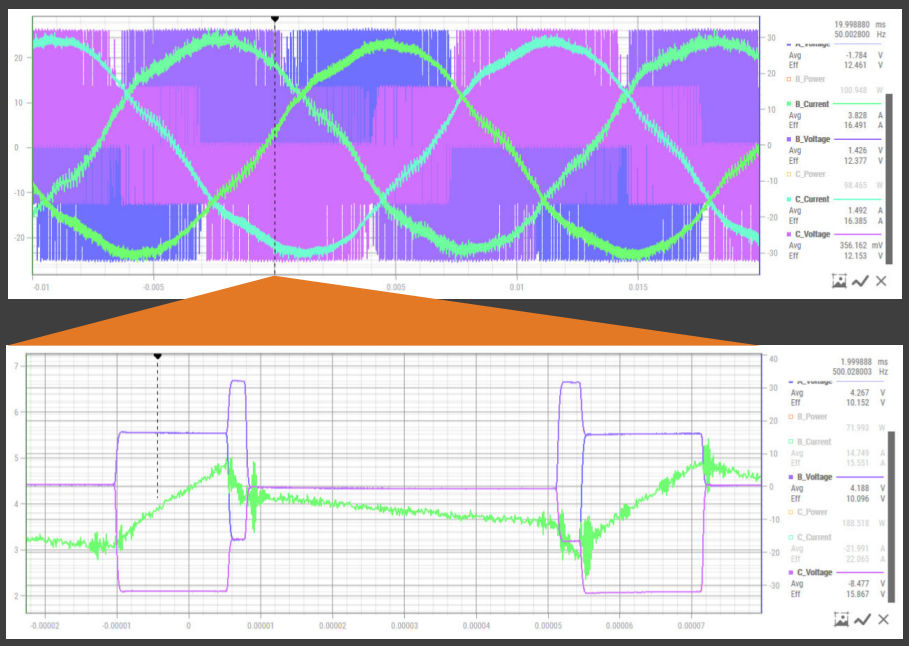


trigger settings in **POWER***Studio*

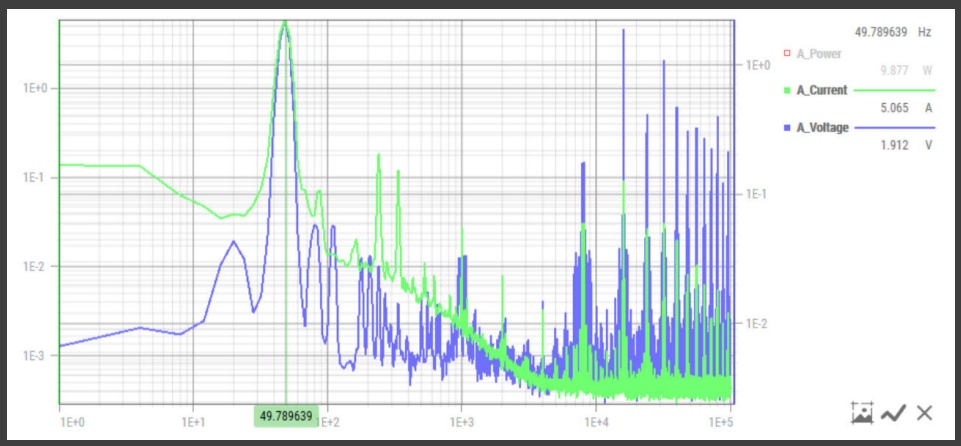
Thanks to the integrated real-time measurement, important quantities like current, voltage and power curves can be precisely and dynamically recorded for all channels simultaneously.
This oscilloscope-like feature can be used independently of any other ongoing measurements.

With an adjustable sampling rate of up to 10 MS/s a highly precise analysis of signals with a bandwidth of 1 MHz is possible. These wave-forms are sampled and recorded on the LK-601, the data is then transferred to **POWER***Studio* for display and evaluation purposes. Sufficient internal memory is reserved to allow parallel acquisition of up to 6 channels.

Different trigger and pre-trigger settings extend the set of useful applications using real time data measurements.



Besides the real time data analysis, investigations can be extended to frequency component evaluation using the integrated FFT analysis. This can be done for each signal and channel discretely but also in parallel.

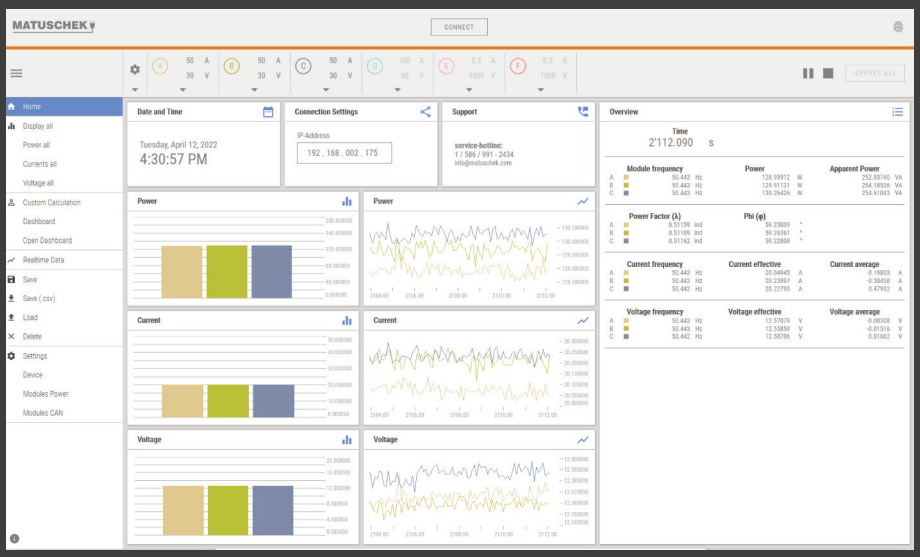


- 6 channels in parallel
- Up to 10 MS/s
- Pre-trigger, Cursor
- Integrated FFT

DEVICE OPERATION

The **POWER***Analyzer* does not have any buttons or display, every setting and every measurement is done/initiated using software tools. Particularly with respect to measurement settings this reduces the possibility of errors when having measurements with different parameter sets.

The preferred and most beneficial way to operate the power analyzer is using the **POWER***Studio* software.

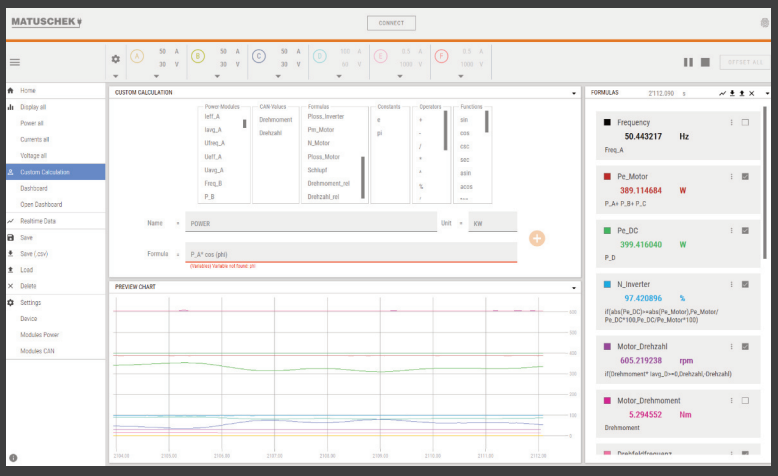


The clear and well structured user interface significantly simplifies the operation and interaction with the device. Additionally, the **POWER***Studio* offers a high degree of customization. It's simple to arrange it the way you need it.

CUSTOM CALCULATION

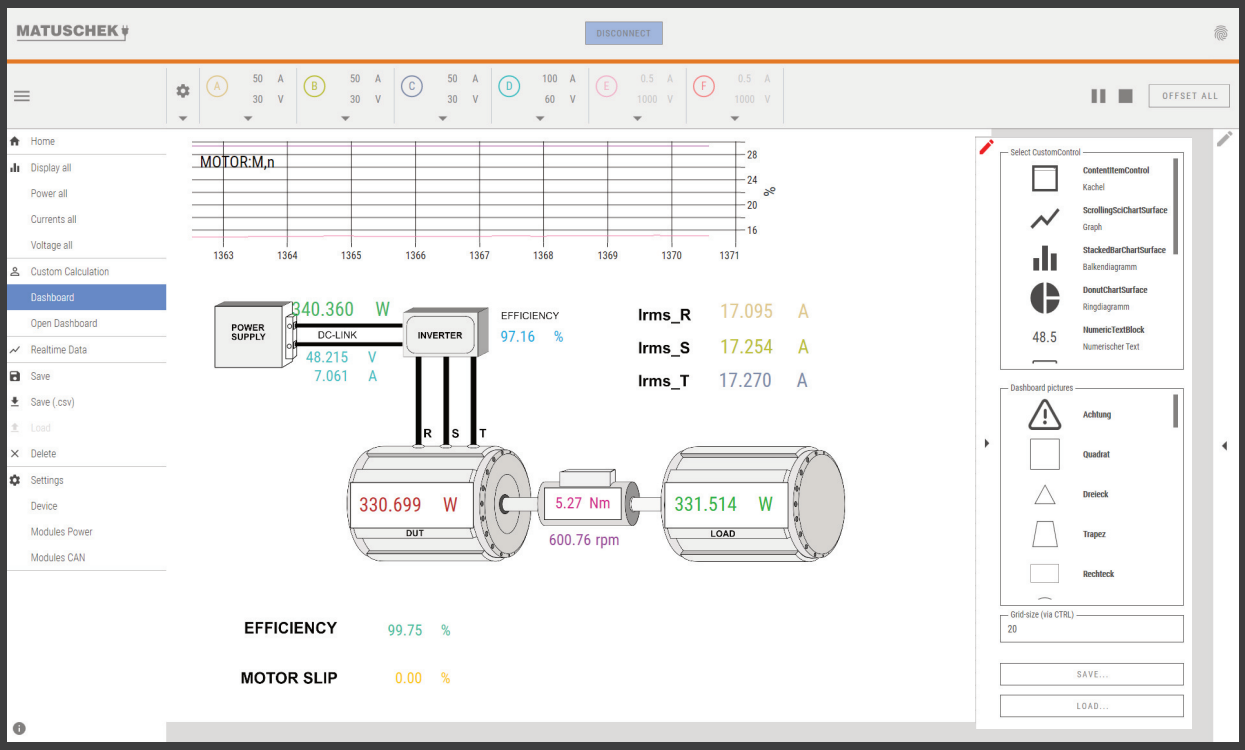
Besides the standard and pre-defined electrical quantities, custom value definitions can easily be created with the help of an UX-friendly editor. Not only can electrical values be combined, all available data e.g. CAN-data, mechanical data, or even custom-defined formulas can be used as well.

Furthermore, conditional scripting allows you to take care of special circumstances and display meaningful data.



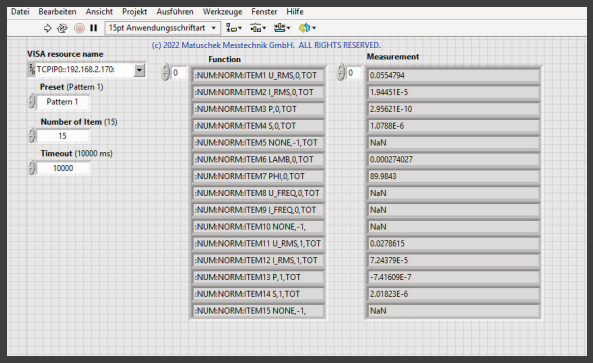
DASHBOARD

The custom dashboard can be freely and individually configured by the user to suit the specific measuring arrangement. It helps to display all relevant data clearly and concisely. A large library of user controls ensures a vast variety of possible arrangements.

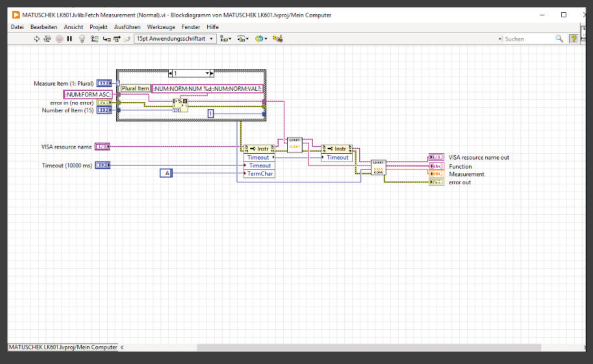


LABVIEW

Besides using **POWER***Studio* to operate the LK-601, a LabVIEW driver is also available. Therewith it is very easy to integrate the **POWER***Analyzer* into any existing test bench environment. You can configure and record data via SCPI commands which are encapsulated into LabVIEW VI blocks.



Additionally, the parallel operation of LabVIEW and **POWER***Studio* is also possible. This is useful in case you want to check real time data while running a test cycle via LabVIEW.



POWER*Analyzer* LK-601

ACCURACY (LK-CS1)

current

frequency	selected range Isens_factor	accuracy ± (% measured value + % range value)
DC	1 mA - 5 mA	0,05 + 0,15
	10 mA - 500 mA	0,05 + 0,1
0,05 Hz - 45 Hz	all ranges	0,04 + 0,04
45 Hz - 65 Hz	all ranges	0,015 + 0,03
65 Hz - 1 kHz	all ranges	0,04 + 0,04
1 kHz - 10 kHz	1 mA - 5 mA	0,25 + 0,05
	10 mA - 500 mA	0,15 + 0,05
10 kHz - 20 kHz	1 mA - 5 mA	0,5 + 0,2
	10 mA - 500 mA	0,3 + 0,2
20 kHz - 50 kHz	1 mA - 5 mA	1,5 + 0,5
	10 mA - 500 mA	0,7 + 0,5
50 kHz - 100 kHz	1 mA - 5 mA	3,5 + 0,5
	10 mA - 500 mA	2 + 0,5
100 kHz - 300 kHz	all ranges	5 + 0,5

voltage

frequency	accuracy ± (% measured value + % range value)
DC	0,05 + 0,1
0,05 Hz - 45 Hz	0,04 + 0,04
45 Hz - 65 Hz	0,015 + 0,03
65 Hz - 1 kHz	0,04 + 0,04
1 kHz - 10 kHz	0,1 + 0,05
10 kHz - 20 kHz	0,3 + 0,2
20 kHz - 50 kHz	0,4 + 0,2
50 kHz - 100 kHz	0,65 + 0,2
100 kHz - 300 kHz	5 + 0,5

active power

frequency	selected range Isens_factor	accuracy ± (% measured value + % range value)
DC	1 mA - 5 mA	0,1 + 0,15
	10 mA - 500 mA	0,1 + 0,1
0,05 Hz - 45 Hz	all ranges	0,08 + 0,04
45 Hz - 65 Hz	all ranges	0,02 + 0,03
65 Hz - 1 kHz	all ranges	0,08 + 0,04
1 kHz - 10 kHz	1 mA - 5 mA	0,35 + 0,05
	10 mA - 500 mA	0,25 + 0,05
10 kHz - 20 kHz	1 mA - 5 mA	0,8 + 0,2
	10 mA - 500 mA	0,6 + 0,2
20 kHz - 50 kHz	1 mA - 5 mA	1,9 + 0,5
	10 mA - 500 mA	1,1 + 0,5
50 kHz - 100 kHz	1 mA - 5 mA	4,2 + 0,5
	10 mA - 500 mA	2,7 + 0,5
100 kHz - 300 kHz	all ranges	10 + 0,5

GENERAL SPECIFICATION (LK-601)

Sample rate	10 MS/s
Sample resolution	16 bit
Voltage ranges	12 ranges 1.5 - 1000 V (RMS)
Current ranges	9 ranges 0.5 A - 250 A (RMS) or 1.5 A - 750 A (RMS) or 1.5 A - 1200 A (RMS)
Bandwidth	1 MHz
Precision	< 0.05 % (for power value)
Signal latency	< 5 ns
Max. count of channels	6 per device (max. 30 channels in multi device operation)
Optional Extension	Motor card: 2x torque 2x rotary encoders
Interfaces	Ethernet, CAN
Misc.	Includes power supply for external current sensors

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