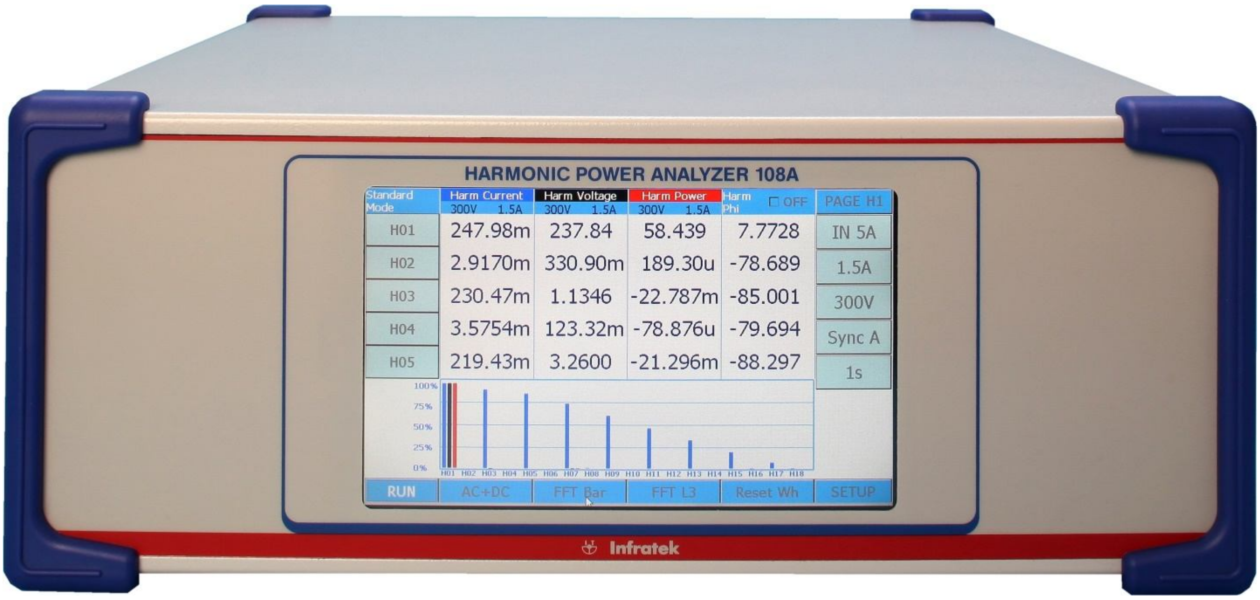
# 108A

## Harmonic Power Analyzer

INFRATEK
**Swiss Made**




# Single- to Six Phase Precision Power Analyzer with Touch Screen Operation

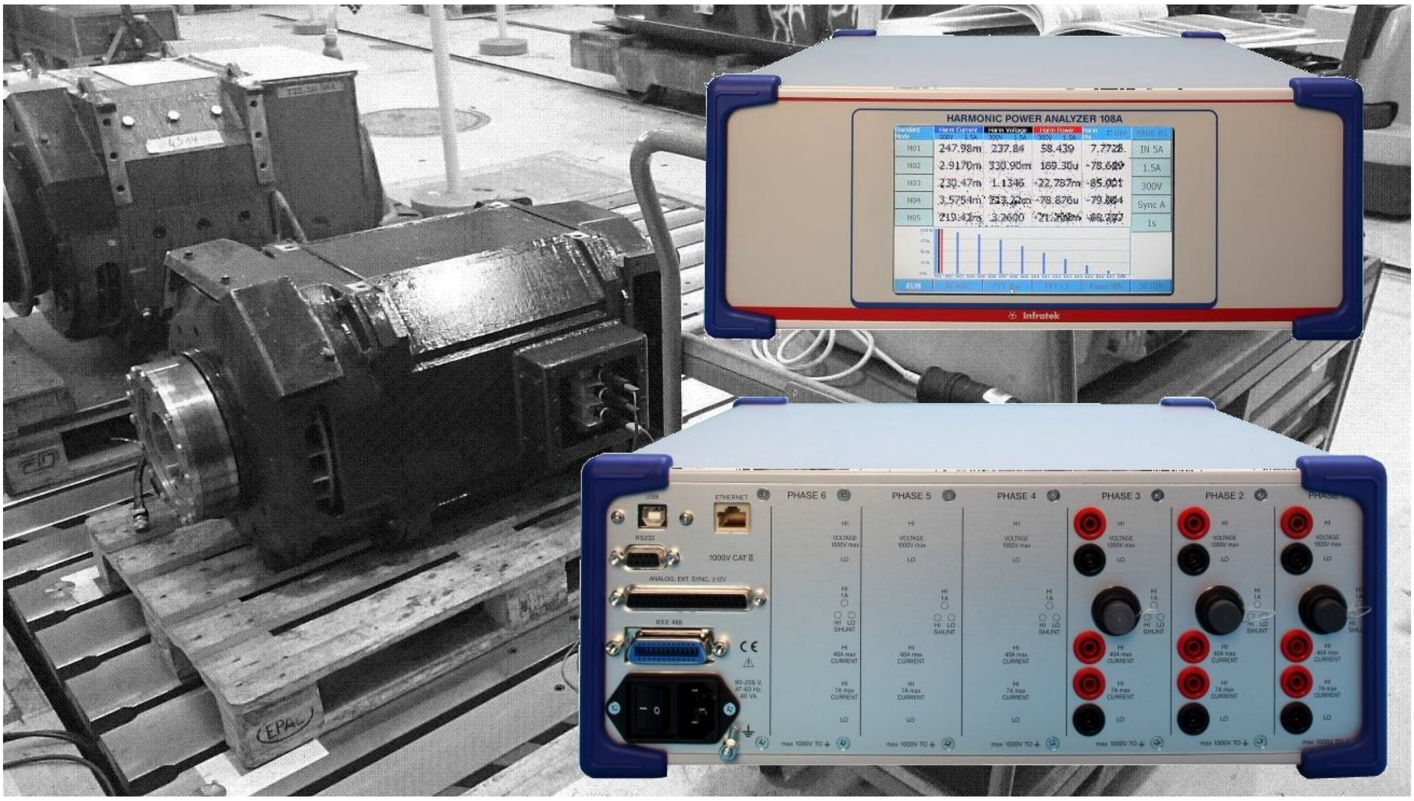
| | |
|---|---|
| **Basic Accuracy V, A, W:** | **±0.02%, 0.02%, 0.04%** |
| **Bandwidth:** | **DC to 2MHz** |
| **V-, A- Measurement:** | **0.3V - 1000V, 50µA - 40A** |
| **Hi Current Sensors:** | **10A - 700A, 0.005%** |
| **Measurement Resolution:** | **18Bit** |
| **Customized Display:** | **4 pages, 32 values/page** |
| **Individual Settings:** | **every phase, all phases** |
| **4 Measure Modes:** | **Standard, Logging, Transient, Power-Speed** |

**Reliable, simple and intuitive to use, highly accurate measurements for test and development of modern, efficient power electronics.**

**The MODEL 108A UNIVERSAL HIGH PRECISION POWER ANALYZER measures 280 electrical quantities on every phase. Energies, harmonics, motor- and transformer values, power sums, power ratios, analog- and frequency inputs can be displayed, or read via interface at any time**

# FEATURES

- Available as 1-, 2-, 3-, 4-, 5-, 6-phase instrument
- 18 bit resolution. High accuracy at 10% full scale
- Simple to operate, most settings in 2 steps (2 touches)
- Extremely fast data transfer; up to 3400 values per seconds
- 4 current inputs: 1mA–1A, 15mA–5A, 1A–50A, Shunt
- Optional interfaces: Ethernet, RS-232 / USB, IEEE-488
- Interface commands for fast data transmission
- Optional high precision, broadband, current sensors 0.004%
- 6 analog inputs and 2 frequency inputs, 12 analog outputs
- Highest precision available: 0.02% + 0.02% range
- Wide angle, touch-screen TFT display (800 x 480 pixels)
- Standard-, Logging-, Transient-, Power-Speed measure modes
- High DC precision for solar applications
- Voltage Ranges: 0.3V to 1000V
- Two optional operating softwares under Windows
- Software to read data from four 108A-6
- Simple servicing, modular concept, pre-calibrated inputs
- 4G Byte Memory for storing measurement data
- Reasonably priced by virtue of smart design
- Individual settings for every phase and all phases




## High Performance, Simple to Use

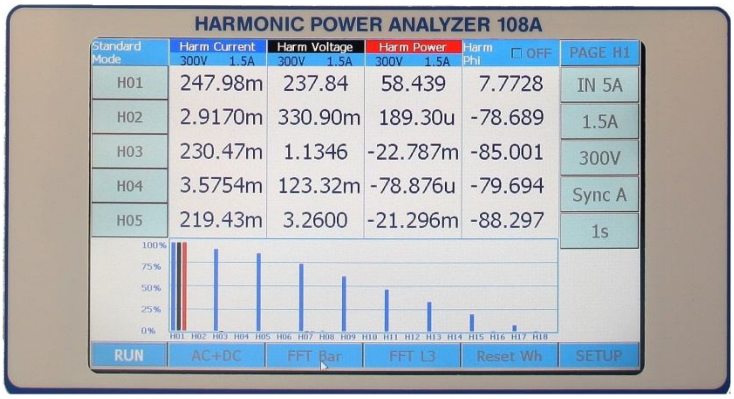
The Infratek 108A High Precision Power Analyzer is available in 1-, 2-, 3-, 4-, 5-, or 6- phase versions. All voltage inputs 0.3V up to 1500Vpeak and all current inputs (1.5mA up to 1A; 15mA up to 5A; 1A up to 40A; and shunt inputs 60mV up to 6V are potential free and exhibit low noise, high common mode suppression, excellent DC-stability, Wide frequency range (DC-2MHz) and very low self-heating on current inputs. There is no need to fiddle with dc-compensation, or changing current plug-ins. All is built into the input sections of the Power Analyzer, ready for measurements. It is simple to use, your intuition will guide you to operate the Power Analyzer touch screen correctly. Almost all setting changes are accomplished with two touches on the display screen or two clicks with the wireless mouse.

# 4 MEASUREMENT FUNTIONS

Four different measure functions enhance the 108A Power Analyzer capabilities.

### Standard Measure Mode:

In the Standard Measure Mode 280 quantities per phase are measured without gap and are continuously updated. Values can be displayed on four display pages, can be saved in internal memory, or can be transferred via Interface to a computer. The display shows voltage, current, and power wave forms. Harmonics and bar graphs can be viewed on 5 pages. Two electric motors can be tested simultaneously. External Speed and torque inputs are optionally available. Transformer values are implemented too.

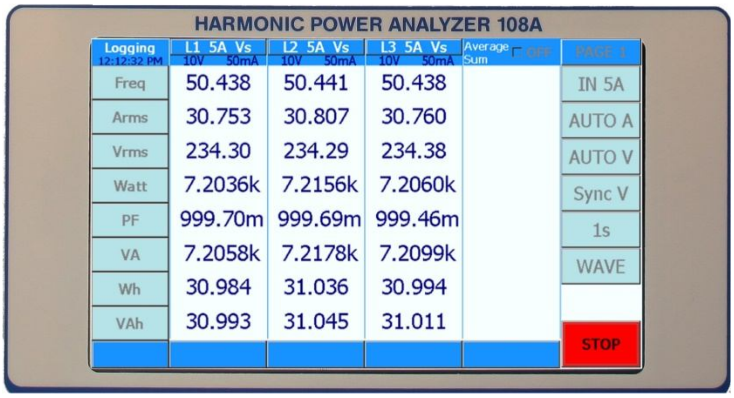



### Logging Measure Mode:

This measure mode is suitable for very fast measurements or for long time averaging of data. It is possible obtaining 6 datasets of a 6-phase instrument within 20ms or 6 datasets per 10 minutes.

From every phase you obtain 8 values: frequency, rms current, rms voltage, power, power factor, apparent power, energy Wh, and apparent energy VAh.

**Cycles**: For Logging Measure Mode set Cycles 1 to 32000. Defines the measurement duration per measurement set. Use pop-up number pad. Format 160.




### Transient Measure Mode:

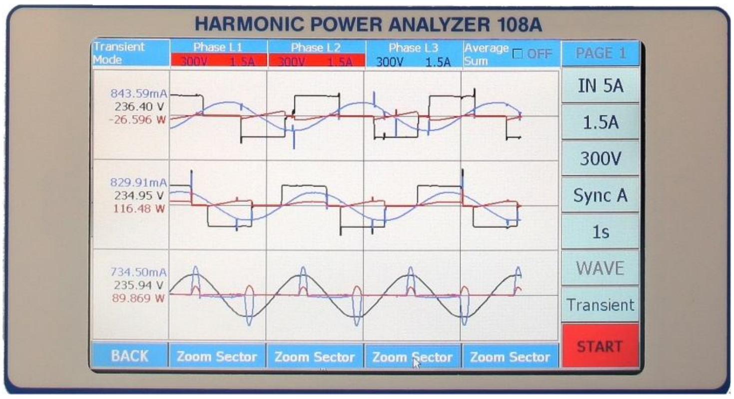
You can catch current-, voltage-, and power wave forms in a start-up on transient mode up to 6 phases simultaneously or you can view all the wave forms at a critical operating point.

Sections of the wave forms can be expanded by simply touching one of the 4 “Zoom Sectors”.

**Transient ID**: Set it to 1, 2, 3, 4, 5, 6, or 7. The transient ID determines the measurement duration after start.

Transient ID Measurement duration: 1 {0.25s}

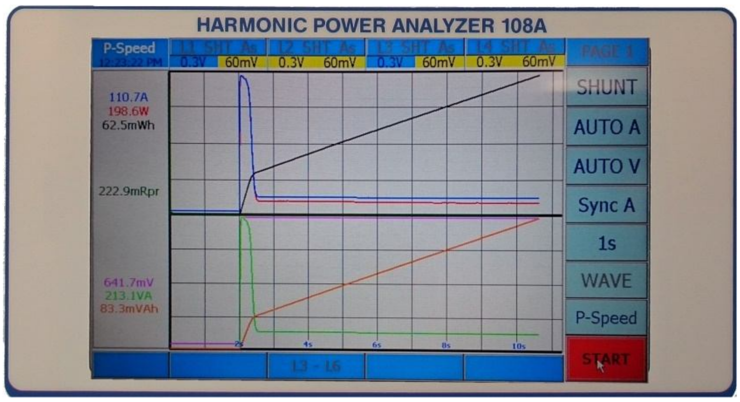
2 {0.5s} default, 3 {1s}, 4 {2s}, 5 {4s}, 6 {8s}, 7 {16s}.




### Power-Speed Measure Mode:

This measure mode analyzes the performance of devices such as electric cars. In 20ms intervals the following data are stored in internal memory: rms current, rms voltage, power, apparent power, energy, apparent energy, and rpm of a shaft.

At end of measurement, (maximum 11 seconds) data versus time are displayed, can be expanded to view details, or can be stored.



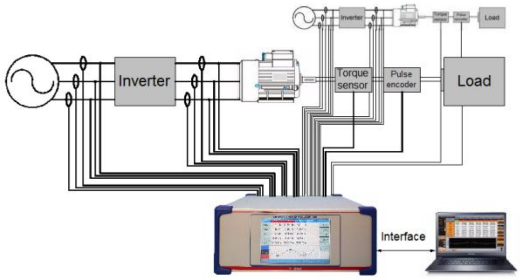
# APPLICATIONS

## Electric Motors (Railroad systems)

The 108A-6 equipped with (Option03) 6 analog inputs, 2 digital inputs and 12 outputs perform all required measurements for motor testing. The analog inputs can be used for torque-, temperature and vibration measurements. The TTL inputs for speed or torque, and the external synchronization input per phase from an encoder to synchronize to the pole position.
The 108A-6 can measure 2 motors simultaneously: input power, output power, torque, slip, speed, and efficiency of every motor, as well as all harmonics of current, voltage, power, impedance, and phase angle. For none sinusoidal signals (trapezoidal wave-forms or frequency inverters), we recommend to use the fundamental of impedance and fundamental of phase. From these values the motor inductances L, Ld, Lq and the motor resistances R = Rm + Rdc can be determined.
The motor DC-resistance is obtained by applying a DC-current: Rdc = Pdc / $I^2$dc. Rm is a magnetization dependent loss.

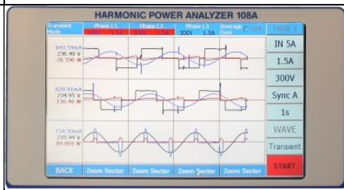
## Simultaneous Measurement of 2 Synchronous Motors (PMSM, BLDC)

A wide range of synchronous motors are on the market (PMSM, IPMSM, BLDC). The power consumption ranges from mW to 500kW. Many different constructions are in use. They all have in common that the magnetic field rotation (2 phase or 3 phase) is electronically generated. A wide range of speeds (rpm) are available.
See also the Infratek documentation: **Electric Motor Testing** (PDF)




## Inverter drive systems

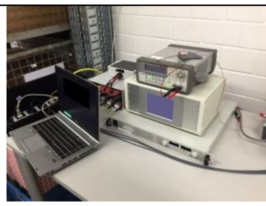
Using the 108A-6 to test the efficiency of an inverter drive, simultaneous measurement of all electrical parameters is essential. By visually inspecting the current waveform, we should see three individual currents all producing an alternating positive/negative pattern waveform. All three phases should be symmetrical. The 108A-6 measures very precisely total input power, total output power and inverter efficiency!




108A switched to transient mode to view inverter U, I, and P wave forms; expand to view details.

## Automotive

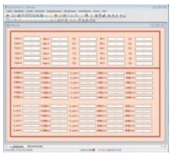
Testing fuel pumps is crucial for proper and reliable vehicle operation and long lasting product quality. Individual fuel pump tests like Start-Stop, Low-Speed/Full-Speed are used; the 108A delivers all important electrical parameters. The 108A in the power-speed measure mode measures the start performance of an electric car. In 20ms intervals current, voltage, power, energy, and speed of the vehicle are measured. Data are plotted versus speed.

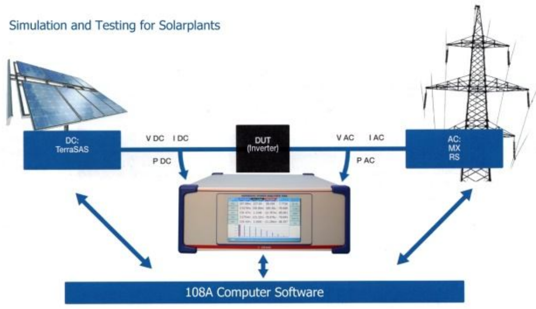


## Solar / Wind energy

Decisive for an effective technical implementation of solar plants and wind farms are various simulations and correlations for each location. In these tests, exactly defined levels are simulated. All relevant electrical parameters like frequency, voltage, current, power, efficiency, power factor and energies are measured by the 108A and can be read via computer software.

A dedicated high speed data acquisition software is available to read data from several 108A. Data are combined in a single file for simple analysis.






## Power electronics / Appliance

Wide bandwidth guarantees precise power measurement of switching power supplies or other electronically switched devices.
Some electronic devices consume power when they appear to be turned off. This power consumption is known as standby power and can be a significant contribution to product energy use. The 108A Power Analyzer precisely measure standby power on all kind of appliances like ovens, ceramic hobs, washers, dryers etc. This can be done using the 1.5mA/5mA/15mA current ranges.

## 108A Computer Software for Production Testing

For efficient production testing of 12 (or more) single phase apparatus, a dedicated high speed data acquisition software is available. It reads the data of 12 apparatus (or more) in less than 100ms and combines data in a single file for storage or analysis.

# Specifications

## Voltage Measurement

| | | |
|---|---|---|
| | 8 measuring ranges: 0.3V – 1V – 3V – 10V – 30V – 100V – 300V – 1000V | Bandwidth DC-2MHz |
| | Coupling: AC or AC + DC / Common mode rejection: | 100dB at 100kHz |
| | Input impedance: 1MΩ / 15pF. Floating input | max. 1000Vrms |
| | Crest Factor 15:1 at 10% fs. Typical accuracy at 10% is 0.1% | fs = full scale |
| | Temperature coefficient: 0.004% / °C | |
| **% reading + % range** | Standard accuracy 23°C ±1°C. 3V to 600V | **High precision** 10V to 600V |
| | 45 to 65Hz: 0.08 + 0.08 | 0.02 + 0.02 |
| | 3 to 1000Hz: 0.1 + 0.1 | 0.03 + 0.03 |
| | 1 to 10kHz: 0.2 + 0.2 | 0.1 + 0.1 |
| | 10 to 100kHz: (0.2 + 0.2) +(0.2 + 0.2)*log(f/10kHz) | (0.2 + 0.2) +(0.2 + 0.2)*log(f/10kHz) |
| | DC[1]//100-500kHz[1]: 0.1 + 0.1// 0.012*f(kHz) | |
| | Linearity 100V range: 130 % / 100 % / 50 % / 10 % / 5 %<br>130.01V / 100.00V / 49.988V / 10.000V / 5.0014V | Typical linearity at 50/60Hz |
| Voltage Scaling U1-U6 | Individual voltage scaling factors of every phase. Use pop-up number pad. Format 2000.8. | |

## Measured & Computed Voltage Values

| | | | |
|---|---|---|---|
| RMS voltage | $Vrms = (1/T \int_0^T V^2 dt)^{1/2}$, includes all harmonics | Voltage crest factor | Vcf = Vmax / Vrms |
| Mean voltage | $Vmean = 1/T \int_0^T Vdt$, dc component of voltage | Voltage form factor | Vff = Vrms / Vrect, is 1.1107 for sine wave |
| Rectified mean voltage | $Vrect = 1/T \int_0^T |V| dt$, rectified mean voltage | Voltage fundamental | V01 = fundamental voltage of FFT |
| Peak voltage | Vmax = maximum voltage in time interval | V1 line to line | $V1\ ltl = (V_{1rms} + V_{2rms}) \cdot 0.86603$ |
| Lowest voltage | Vmin = lowest voltage in time interval | V2 line to line | $V2\ ltl = (V_{2rms} + V_{3rms}) \cdot 0.86603$ |
| Peak to peak voltage | $Vptp = V_{max} - V_{min}$ | V3 line to line | $V3\ ltl = (V_{3rms} + V_{1rms}) \cdot 0.86603$ |
| Voltage distortion | $Vthd1 = (Vrms^2 - V01^2)^{1/2} / Vrms$, [2] | V4 line to line | $V4\ ltl = (V_{4rms} + V_{5rms}) \cdot 0.86603$ |
| Harmonic voltage distortion | $Vthd2 = (\Sigma Vn^2)^{1/2} / Vrms$, n = 2,3, ..., 40 | V5 line to line | $V5\ ltl = (V_{5rms} + V_{6rms}) \cdot 0.86603$ |
| | | V6 line to line | $V6\ ltl = (V_{6rms} + V_{4rms}) \cdot 0.86603$ |

## Current Measurement

| | | |
|---|---|---|
| | 4 inputs: In30A, In5A, In1A, shunt. Floating inputs. 1 sec averaging. | max. 1000Vrms to earth |
| | In1A: 6 ranges 1.5mA[1] - 5mA - 15mA - 50mA - 150mA - 500mA - 1500mA. DC-100kHz | max. 2A continuous |
| | In5A: 6 ranges: 15mA[1] - 50mA - 150mA - 500mA - 1.5A - 5A - 15A. DC-100kHz | max. 7A continuous |
| | In30A: 4 ranges: 1A[1] - 3A - 10A - 30A - 100A. DC-100kHz | max. 40A/30A cont., 1-3phase /4-6phase |
| | Shunt: 60mV - 200mV - 600mV - 2V - 6V. DC-100kHz | max. 30V continuous |
| | Coupling: AC or AC + DC / Common mode rejection: | 115dB at 100kHz |
| | Crest factor 15:1 at 10% fs. Typical accuracy at 10% fs is 0.1% | fs = full scale |
| | Temperature coefficient: 0.004% / °C | |
| **% reading + % range** | Standard accuracy 23°C ± 1°C | **High precision In1A/In5A** |
| | **Input** / **In1A,In5A,Shunt** / **In30A** | 15,50,150,500mA,1A/150,500mA,1.5,5A |
| | 45 to 65Hz: 0.08 + 0.08 / 0.08 + 0.08 | 0.02 + 0.02 |
| | 3 to 1000Hz: 0.1 + 0.1 / 0.2 + 0.2 | 0.03 + 0.03 |
| | 1 to 10kHz: 0.15 + 0.15 | 0.15 + 0.15 |
| | 10 to 100kHz: (0.15+0.15)+ (0.5+0.5)*log(f/10kHz) | (0.15+0.15)+ (0.5+0.5)*log(f/10kHz) |
| | DC[1]//100-500kHz[1]: 0.1 + 0.1// 0.023*f(kHz) | |
| | **Current Sensors** / **0-150Apeak** / **0-400Apeak** / **0-600Apeak** / **0-700Apeak**<br>45 to 65Hz: 0.004 + 0.004 / 0.004 + 0.004 / 0.002 + 0.002 / 0.01 + 0.01<br>3 to 1000Hz: 0.01 + 0.01 / 0.01 + 0.01 / 0.01 + 0.01 / 0.02 + 0.02 | Exposure of current inputs to their max. value will result in additional errors[1]<br>In1A: 0.03% * $I^2$<br>In5A: 0.003% * $I^2$<br>In30A: 0.0001% * $I^2$ |
| | **Input** / **0-100A** precision current sensor (Option 04) connected to In1A input<br>3 to 100Hz: 0.05 + 0.05<br>100 to 1000Hz: 0.1 + 0.1 | |
| | Linearity 500mA range: 130 % / 100 % / 50 % / 10 % / 5 %<br>650.02mA / 500.02mA / 250.02mA / 49.979mA / 24.997mA | Typical linearity at 50/60Hz |
| | Shunt Sensitivity: 60mV/A. For an external shunt with 1mV/A scale by 60.0 | |
| Current Scaling I1-I6 | Individual current scaling factors of every phase. Use pop-up number pad. Format 2000.8. | |

## Measured & Computed Current Values

| | | | |
|---|---|---|---|
| RMS current | $Arms = (1/T \int_0^T A^2 dt)^{1/2}$, includes all harmonics | Current distortion | $Athd1 = (Arms^2 - A01^2)^{1/2} / Arms$, [2] |
| Mean current | $Amean = 1/T \int_0^T Adt$, dc-component of current | Harmonic current distortion | $Athd2 = (\Sigma An^2)^{1/2} / Arms$, n = 2,3, ... 40 |
| Rectified mean current | $Arect = 1/T \int_0^T |A| dt$, rectified mean current | Current crest factor | Acf = Amax / Arms |
| Peak current | Amax = maximum current in time interval | Current form factor | Aff = Arms / Arect, is 1.1107 for sine wave |
| | | Current fundamental | A01 = fundamental current of FFT |

1) Typical max. Error

2) Used for frequency inverter

# Power Measurement

| | | | | |
|---|---|---|---|---|
| % reading + % range | W range = voltage range times current range | | | 112 power ranges |
| | Standard accuracy 23°C ± 1°C | | | **High precision** |
| | **Input** | **PF** | **In1A, In5A, Shunt** | **In1A, In5A, Shunt** |
| | 45 to 65Hz | 0-1 | 0.16 + 0.16 | 0.04 + 0.04 |
| | 45 to 65Hz | 0-0.05 | | 0.01 + 0.01 |
| | 3 to 1000Hz | 0-1 | 0.2 + 0.2 | 0.1 + 0.1 |
| | 1 to 20kHz | 0-1 | 0.2+(0.2 + 0.2*log (f/100Hz) + 0.08*k1*log (f/100Hz)) | |
| | 20 to 100kHz | 1 | %error (A+V) | %error (A+V) |
| | DC[1]//100-500kHz[1] | 1 | 0.2 + 0.2// add %error (V+A) | |
| | **Input** | **PF** | **In30A** / **Current Sensor 0-100A** | |
| | 45 to 65Hz | 0-1 | 0.16 + 0.16 / 0.1 + 0.1 | |
| | 3 to 1000Hz | 0-1 | 0.2+(0.2+0.2 * log(f/3Hz) + 0.1 *k1 * log(f/3Hz) | |
| | DC[1] | | 0.2 + 0.2 / 0.1 + 0.1 | |

| PF | 1 | 0.9 | 0.8 | 0.7 | 0.6 | 0.5 | 0.4 | 0.3 | 0.2 | 0.1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| k1 | 0.5 | 0.74 | 0.97 | 1.18 | 1.38 | 1.55 | 1.70 | 1.83 | 1.92 | 1.98 | 2.00 |

$k1 = (2 - PF^4) / (1+PF^2)$

[1] Typical max. error

| W Linearity | 130% | 100% | 50% | 10% | 5% | Typical linearity of voltage, current and power |
|---|---|---|---|---|---|---|
| Volt | 130.00 | 100.00 | 49.985 | 9.9992 | 4.9990 | |
| Ampere | 6.5004 | 5.0014 | 2.5020 | 500.82m | 250.40m | |
| Watt PF=1 | 844.74 | 500.07 | 125.05 | 5.0056 | 1.2522 | |

## Measured & Computed Power Values

| | | | |
|---|---|---|---|
| Active power | $W = 1/T \int_0^T u \cdot i \, dt$, total power in W | Fundamental power | W01 = A01 · V01 · cos φ01, φ01 = phase |
| Apparent power | VA = Arms · Vrms, total apparent power VA | Fundamental apparent power | VA01 = A01 · V01 |
| Reactive power | $Var = \pm(Papp^2 - Pact^2)^{1/2}$, reactive power Var | Fundamental reactive power | $Var01 = (VA01^2 - W01^2)^{1/2}$, magnitude only |
| Power Factor | PF = Pact / Papp, includes all harmonics | Power of distortion | $D = V01(\Sigma An^2)^{1/2}$, n = 2,3, ..., 40; D in Watt |
| | | Power Factor of Fundamental | PF01 = W01 / VA01 |

# Frequency Measurement

| | |
|---|---|
| SyncA: 2Hz-5kHz | Accuracy: 0.05 % |
| SyncV: 2Hz-150kHz | Accuracy: 0.05 % |
| S_ExtV: 2Hz-150kHz | Accuracy: 0.05 % |
| S_ExtV is a TTL output for SyncA/V or a TTL input for S_ExtV | Sync for each phase |

## Measured & Computed Values

| | |
|---|---|
| Frequency | Freq =zero crossing of A, V, Ext; SYNC I, SYNC U, Ext; Accuracy 0.05% |

# Energy Measurement

Wh, VAh, Varh, Ah, integration time. Add accuracy % of values involved.
Reset sets all values to zero. Integration runs uninterrupted, also in the background.

## Measured & Computed Values

| | | | |
|---|---|---|---|
| Energy | $Wh = \int_0^t Pact \cdot dt$, active energy in Wh | Battery charge | $Ah = \int_0^t Arect \cdot dt$, is positive only |
| Apparent energy | $VAh = \int_0^t Papp \cdot dt$, use it for long term PF | Elapsed time | $time = \int_0^t dt$, time in hours since RESET |
| Reactive energy | $VAR = \int_0^t Prea \cdot dt$, can be positive / negative | Time | Accuracy: 0.05 % |

# Harmonic Measurement

| | |
|---|---|
| Frequency range of fundamental 3Hz – 15kHz<br>Harmonics: V and A: 1-88; W and phase angle 1-21<br>Accuracy: Fundamental[1], use % figures of V, A, W | FFT averaging:<br>Set FFT ID = 0, 1, 2, 3, 4 which corresponds to averaging over 4, 16, 64, 256, or 1024 periods. |

Harmonic Display: Select button '**FFT Table**' to view current-, voltage-, power-, impedance-, and phase harmonics 1-40. A single harmonic can be displayed by selecting **A FFT**, **V FFT** or **W FFT**. The whole range of harmonics can be read via interface.

## Measured & Computed Values

| | | | |
|---|---|---|---|
| Magnitude impedance | Mag Z = V01 / A01 fundamental | Phase of fundamental | Phi01 = phase V01, A01 |

# Additional Computed Values

| | |
|---|---|
| Accuracy: Add % figures of values involved | 65 values per phase |

Rectified mean, VA, Var, impedance, distortion factor, power factors, motor- and transformer values, sums, ratios, analog inputs and -outputs, speed inputs, and more are continuously updated and ready for display or interface output.

[1] Typical max. Error

| Measured & Computed Values | | | |
|---|---|---|---|
| Sum1 of power | Sum1 = Pact1 + Pact2 + Pact3; Power phase 1+2+3 | Ratio1 of power | Ratio1 = Pact4 / Pact1 + Pact2 + Pact3 |
| Sum2 of power | Sum2 = Pact1 + Pact2 | Ratio2 of power | Ratio2 = Pact3 / Pact1 + Pact2 |
| Sum3 of power | Sum3 = Pact4 + Pact5 + Pact6; Power phase 4+5+6 | Ratio3 of power | Ratio3 = Pact2 / Pact1 |
| Sum4 of power | Sum4 = Pact4 + Pact5 | Ratio4 of power | Ratio4 = Pact4 + Pact5 + Pact6 / Pact1 +Pact2 +Pact3 |
| Sum5 of power | Sum5 = not used | Ratio5 of power | Ratio5 = Pact6 / Pact4 + Pact5 |
| Sum6 of power | Sum6 = not used | Ratio6 of power | Ratio6 = Pact5 / Pact4 |

## Motor Measurement

| Measured & Computed Values from phase 1, phase 2, phase 3 | | Measured & Computed Values from phase 4, phase 5, phase 6 | |
|---|---|---|---|
| Mechanical input power | Pin = electric power applied to motor | Mechanical input power | Pin = electric power applied to motor |
| Mechanical output power | Pout = Pin – Pin at no load in Watt (Loss) | Mechanical output power | Pout = Pin – Pin at no load in Watt |
| Torque | Torque = Pout · poles1 / 4 · π· frequency1 | Torque | Torque = Pout · poles / 4 · π· frequency2 |
| Slip | Slip = 1 – fout / fin | Slip | Slip = 1 – fout / fin |
| Rotation per minute | rpm = 120 · frequency1 / poles1 | Rotation per minute | rpm = 120 · frequency / poles |
| Efficiency | efficiency = 1 – Pin at no load / Pin | Efficiency | efficiency = 1 – Pin at no load / Pin |

## Transformer Measurement

| Measured & Computed Values from phase 1 and phase 2 | | | |
|---|---|---|---|
| Vrect, rms corrected | Vcorrected = 1.1107 · Vrect | Loss resistance | Equivalent loss resistance = Pact1 / $Arms^2$ |
| Corrected power | Corr power = Pact 1 / (0.5 + 0.5 · Vrms / Vcorrected) | Loss inductance | Equivalent loss reactance = Prea 1 / $Arms^2$ |
| Loss factor Q | Q = tan X/R, where Z=R + jX | Turn ratio | Turn ratio = N2 / N1 = Vrms2 / Vrms1, no load |

## Analog Input / Output

| Analog Input | | Analog Output | |
|---|---|---|---|
| 4 Analog inputs (I1-I4)<br>2 analog inputs (I5-I6)<br>2 TTL auto ranging speed inputs 20Hz-150kHz | ±5V, 100kΩ input impedance, accuracy 0.2%[1)]<br>±10V, 100kΩ input impedance, accuracy 0.2%[1)]<br>Accuracy 0.1%[1)]. Reading rate in Standard-Mode 0.5sec, reading rate in Power Speed-Mode 20ms<br>Each input can be scaled 0.0001 up to 99999 | 12 analog outputs (O1-O12) | ±5V, 1kΩ output impedance, accuracy 0.2%[1)]<br>Update rate 0.5sec. Arms, Vrms, W, VA, Var, PF, Frequency, and Wh can be sent to the analog outputs. In Logging- and Power Speed-Mode output1 is an actuator to Start/Stop ext. devices. |
| Scaling An1-An6 | Individual analog scaling. Use pop-up number pad. Format 10.0. | | |
| Scaling rpm1-rpm2 | TTL freq1/rpm1 and freq2/rpm2 scaling. Use pop-up number pad. Format 2.0. For 180 pulses per turn, scaling = 1.0000 | | |

## Four Measuring Functions

| | |
|---|---|
| Standard | 1 to 6 phase, measures all electrical values at 0.5 s updates or 100ms updates. |
| Logging | Up to 48 values in 20ms, or long time averaging up to 10 minutes. |
| Transient | Simultaneous V-, A-, W-waves on 6 phases, time 0.25 to 16 seconds. |
| Power-Speed | Measures in 20ms intervals V, A, W, VA, Wh, VAh, speed of rotating devices. |

1) Typical max. Error

## Interface

USB connection to Host Computer for downloading measurement data (Windows Mobile Device Center)

10/100 Mbps Ethernet interface (Up to 230.4kBaud)

RS232 Interface (Up to 115.2kBaud)
or
USB Interface (Up to 921.6kBaud)


Analog Input / Output connector (37-pole)

GPIB, IEEE 488.2 (Set address 1 to 30, store in setting)


## Saving and Recalling 108A Setting Configurations

Save your personal setting in **S01**, or **S02**,...., or **S20**. The 108A starts up in setting **S01**. With Load Setup you can change to your personal setting.

If start up in your setting is required store it in **S01**.

## Continuous Storing of Measurement Data

Select the storing interval (1s, 2s, 3s,...). Select storing location **D01**, or **D02**,..., or **D20**. All values displayed on page 1 are stored at set time interval in EXCEL compatible format.

## Servicing and Calibration

Servicing: Replacement amplifier boards from the factory are calibrated (no re-calibration is required). All other boards can simply be exchanged.
Calibration: Enter calibration code, follow calibration instructions. Apply 60Hz, 1.5mA - 20A, and 0.3V - 1000V. Calibration cycle 2 years.

# General Technical Data

| | |
|---|---|
| Dimensions | Metal housing H x W x D; 148 x 355 x 335mm |
| Weight | Maximum 7kg, 6-phase |
| Display | TFT color display, 155 x 94, 800 x 480 pixels, 262k Colors, Wide viewing angle (X-Y) 170° |
| Operation | By touch screen, wireless mouse or interface |
| Mains | 90 - 256V, 47 - 63Hz, 40VA |
| Warm up time | 25 minutes |
| Calibration cycle | 2 years |
| Inputs | 4mm safety sockets, 3-pol Amphenol socket |
| Temperature range | Operation 2 to 32°C, storage -10 to 50°C |
| Standards | Electrical safety EN61010-1, 1000V CAT II<br>Emission IEC 61326-1, class B<br>Immunity IEC 61326-1 |
| Dielectric Strength | Line input to case: 1500V ac<br>Measuring inputs to case: 2500V ac<br>Measuring inputs to measuring inputs: 2500V ac |

# Recommended Accessories

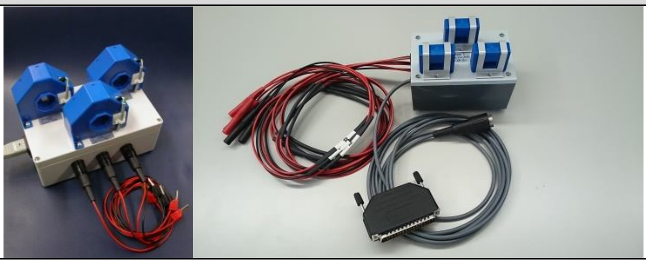
## Ultra Precise Current Transducers

| | |
|---|---|
| Nominal current measurement | 60 - 1000 ADC |
| Linearity | better than 3 ppm |
| High resolution | between 40 to 80 ppm |
| Very low offset drift | between 0.5 to 2.5 ppm/K |
| Overall accuracy @ IPN (+25°C) | ±0.0044 % and ±0.02725 % |
| Wide frequency bandwidth | up to 800 kHz (±3 dB) |
| Power supply | ±15 V |

Applications: Precise and high stability inverters, Medical equipment, Energy measurement, Power analyzers, Calibration units

## High Performance Current Transducers

| | |
|---|---|
| Nominal current measurement | 100 - 2000 A |
| Linearity error | <0.3 % |
| Basic accuracy @ IPN (+25°C) | ±0.2 % |
| Wide frequency bandwidth | DC to 100 kHz |
| Power supply | ±12 V / ±15 V |



Applications: Energy measurement, Power analyzers, Transformer, Motor

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