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**MARS**ENERGO
INSTRUMENTS FOR POWER INDUSTRY

*Making energy visible*

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# Energoforma 3.3-100

**THREE-PHASE
PROGRAMMABLE
PHANTOM POWER
SOURCE**

*Output signal:
Current — up to 120 A
Voltage — up to 264 V
Harmonics — up to 50th
Interharmonics — up to 50.5th*

# Sphere of Application

Together with reference standards Energomonitor 3.1KM or Energomonitor 3.3T1, Energoforma 3.3 makes up the test system meant for testing, calibration and adjustment of:
- Power quality analyzers (IEC 61000-4-30–2008)
- Instrument transducers
- Instruments for various electrical measurements ($U$, $I$, cos φ, $P$, $R$, $S$, THD, $F$)
- Electrical energy meters of all types.

## Functionality and Options

**1.** **Calibration of single- and three-phase energy meters** (up to $I_{max}$ = 120 A)

*Scanning Head*

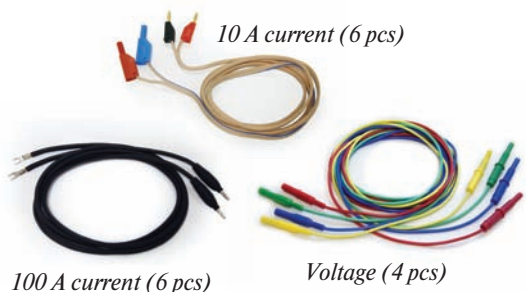*Energomonitor 3.3T1* (Reference instrument for testing energy meters of accuracy classes up to 0.5S)

*Energomonitor 3.1KM-P* (Reference instrument for testing energy meters of accuracy classes up to 0.2S and 0.05)

**Set of Cables**

*10 A current (6 pcs)*

*100 A current (6 pcs)*

*Voltage (4 pcs)*

*Software EnForm*

*Energomonitor 3.1KM-P-0.5 (0.2)*

*Current/Voltage-to-Frequency Converter Calmar-SL*

*Time Correction Module TCM-02C*

**2.** **Calibration of instrument converters**

**3.** **Calibration of power quality analyzers**

# Operating Modes

## Off-line mode (control from keypad)

### Standard signals

Energoforma generates a three-phase balanced sinusoidal signal. The angles between phase voltages are set to 120°. Programmable parameters:
- Fundamental frequency (42.50 to 70.00 Hz in 0.01 Hz steps)
- Phase angles between current and voltage (for all phases) (from –179.99° to +180.00° in 0.01° steps)
- RMS voltage (from 1 mV to 264 V in 1 mV steps)
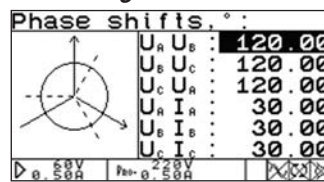- RMS current (from 1 mA to 120 A in 0.1 mA steps).
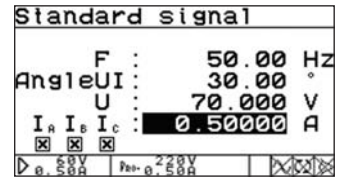
### Special (user-defined) signals

The settings are made separately for each phase. The ranges of settings are the same as in the standard signal mode.
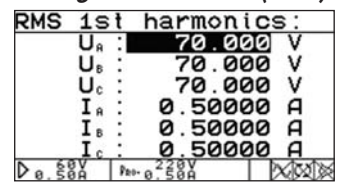
*Frequency\**
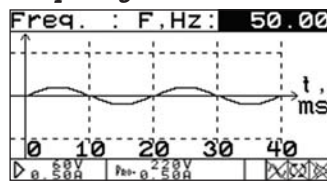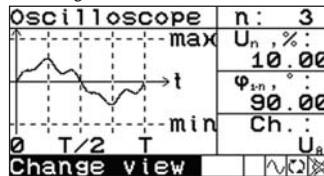
*Phase angles*

*Voltage and current (RMS)*

*\* Waveforms can be generated synchronously with mains frequency.*
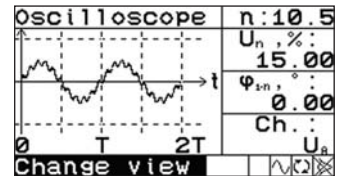
### Wave shapes

The screens representing wave shapes of signals being generated can be of 4 types:
- Oscillogram
- Linear spectrum
- Logarithmic spectrum
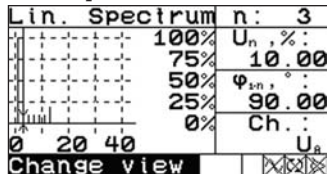- Spectrogram reflecting phase shifts of harmonics with respect to the fundamental.
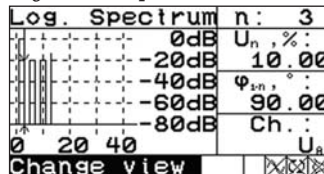
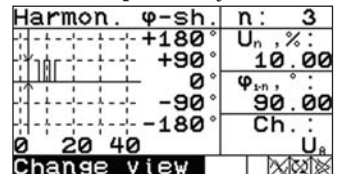*Oscillogram*

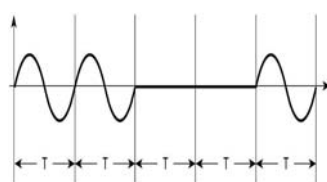Interharmonics are off

Interharmonics are on

*Linear spectrum*

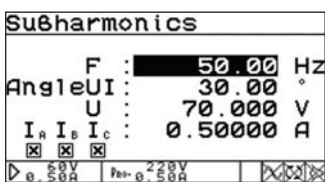*Logarithmic spectrum*

*Harmonics phase shift*

### Subharmonics

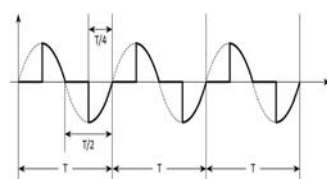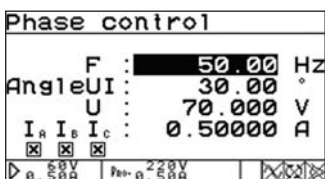*Signal shape (T is the period)*

### Phase control

*Dips and swells*
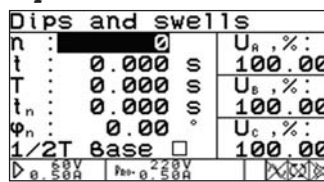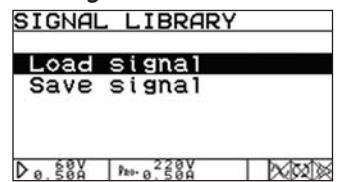
*Flicker*

*Library\**

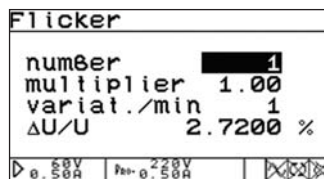*\*8 libraries with the capacity of 5 test signals per each.*

## PC-controlled mode

As part of MTS ME 3.1KM (or -3.3T1)-P test systems, Energoforma is controlled from a PC via EnForm or EnForm/MTS programs.

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## Specifications

| Parameter | Characteristics | | |
|---|---|---|---|
| | Output setting range | In increments of | Max deviation from the set value |
| RMS of the fundamental harmonic of voltage ($U_1$) | 6 ... 264 V | 0.01 V | Relative: 1 %[*] |
| | 0 ... 5.9 V | 1 mV | — |
| RMS of the fundamental harmonic of current ($I_1$) | 0.001 ... 0.1 A | 0.1 mA | Relative: 2 % |
| | 0.1 ... 100[**] A | 1 mA | Relative: 1 %[*] |
| Frequency of the fundamental harmonic ($f_1$) | 45.0 ... 70 Hz | 0.01 Hz | Absolute: ±0.01 |
| Phase angle between:<br>• Fundamental harmonics of phase voltages in different phases<br>• Fundamental harmonics of current and voltage in the same phase | −179.99° ... +180° | 0.01° | Absolute: ±2° |
| Output power of the Voltage source (at a load of 4.8 kOhm) | 10 V·A | — | — |
| Output power (per phase) | | | |
| at a current of up to 10 A, $R_{load}$ = 0.05 Ohm | 5 B·A | — | — |
| at a current of up to 120 A, $R_{load}$ = 0.012 Ohm | 150 B·A | — | — |
| Harmonic composition of the current and voltage signals: | | | |
| *Harmonics* | 2 ... 50 | — | — |
| *Interharmonics* | 0.5; 1.5; ...; 49.5; 50.5 | | |
| RMS value of the current or voltage harmonic, % of $U_1$ or $I_1$ | | | |
| For harmonics from the $2^{nd}$ to $19^{th}$ | 0 ... 100 | | |
| For harmonics from the $20^{th}$ to $50^{th}$ | 0 ... 50 | 0.01 | — |
| For interharmonics (from the $0.5^{th}$ to $50.5^{th}$) | 0 ... 15 | | |
| Phase angle between:<br>• The $1^{st}$ and $n^{th}$ voltage harmonic in the same phase<br>• The $1^{st}$ and $n^{th}$ current harmonic (interharmonic) in the same phase | −179.99° ... +180° | 0.01° | — |
| Number of voltage dips or swells | 0 to 100 000 | 1 | |
| Duration of a voltage dip or swell ($t$) ($f_1$ = (50 ± 1) Hz) | 0 to 600 s | 1 ms | Absolute: ±0.002 |
| Event repetition period (interval between adjacent dips or swells) ($T$; $T \geq t$) ($f_1$ = (50 ± 1) Hz) | 0 to 600 s | 1 ms | Absolute: ±0.002 |
| RMS value of voltage during a dip ($U_{min}$), % of $U_1$ ($f_1$ = (50 ± 1) Hz) | 0 to 9.99 | | — |
| | 10 to 29.99 | 0.01 | Relative: ±1.5 % |
| | 30 to 100 | | Relative: ±1 % |
| RMS value of voltage during a swell ($U_{max}$), % of $U_1$ ($f_1$ = (50 ± 1) Hz) | 100 to 200 | 0.01 | Relative: ±0.5 % |

[*] *Total harmonic distortion of current and voltage: 1 %, or less.*
[**] *120 A can be sustained for 3 min, as a maximum.*

## General

| Parameter | Value |
|---|---|
| Mains supply | 220 ± 22 V, 50 ± 0,1 Hz |
| Power consumption | 1000 VA, or less |
| Dimensions (L × W × H) | Maximum 564 × 423 × 250 mm |
| Weight | 20 kg, or less |

## Environmental

| | |
|---|---|
| Ambient temperature | 10 to 35 °C |
| Relative humidity | 80 % (25 °C) |
| Atmospheric pressure | 70 to 106.7 kPa |