MARSENERGO
INSTRUMENTS FOR POWER INDUSTRY
www.mars-energo.com

Making energy visible

V.O. 13 Line, 6-8, office 41H
Saint-Petersburg, Russia, 199034
Tel./fax: +7 812 327-21-11, +7 812 331-87-36
E-mail: mars@mars-energo.com

PORTABLE PROGRAMMABLE THREE-PHASE PHANTOM POWER SOURCE

Energoforma 3.3-120M

Output signals:
Current — up to 120 A
Voltage — up to 480 V
Order of harmonics — up to 50
Order of interharmonics — up to 50.5

Output power (max):
Current — 60 VA
Voltage — 30 VA

As part of an MTS-ME test system, the EF 3.3-120M phantom power source is applied to testing conventional and smart energy meters of various types.

Application

Together with reference meters Energomonitor 3.3T1 or Energomonitor 3.1KM, the Energoforma 3.3-120M serves as part of a portable test system of MTS-ME series, which is designed to test:

1. Conventional and smart energy meters (single- or three-phase) including meters with power quality measurement function according to IEC 61000-4-30
2. Instruments measuring electrical energy values with a nominal frequency of 400 Hz including on-board equipment

Accuracy class of device under test	0.5S	0.2S	0.05
Suitable reference instrument	*EM3.3T1 Accuracy class 0.1*	*EM3.1KM-P-05 Accuracy class 0.05*	*EM3.1KM-P-02 Accuracy class 0.02*

Customers

Who needs Energoforma 3.3-120M?
- Manufacturers of energy meters
- Industrial metrological labs
- Metrology certification services

3. Power quality analysers (IEC 61000-4-30class A, класс S)

Energomonitor 3.1KM-P-05, -02

4. Measuring converters

Calmar - SP Volt/mA calibrator and Current/Voltage-to-Frequency converter

Components of MTS-ME 3.1KM(3.3T1) test system

1. Phantom power source Energoforma 3.3-120M
2. a) Reference meter Energomonitor-3.3T1:
- Measures current directly with the assembly of CTs (accuracy class 0.1)
- Measures current with current clamps 10A and/or 100A (accuracy class 0.5)
b) Reference meter Energomonitor-3.1KM:
- Measures current directly (accuracy class 0.02 or 0.05)
- Measures current with 10 A and/or 100A current clamps (accuracy class 0.2)
3. Error calculator Calmar-SP
4. Software Energoforma-MTS»
5. Converter USB-4RS-232
6. Scanning head

Accessories:
7. Time Correction Module TCM-02C
8. Thermo-Hygrometer IVTM-D
9. Laptop
10. Printer
11. Sets of measuring cables up to 12 A and up to 120 A

Operating modes

1. PC-controlled mode

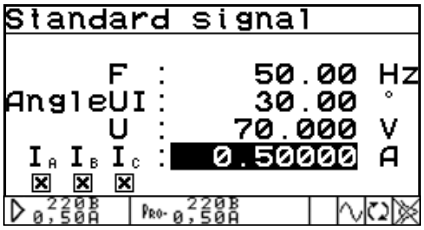
As a signal source within MTS-ME 3.1KM(3.3T1)-P, Energoforma-120M works under control of Energoforma-MTS software.

2. Off-line mode (keypad control)

2.1. Standard signals

The Energoforma-120M produces a three-phase pure sine signal. Angles between phase voltages are set to 120°. In this mode you can specify:

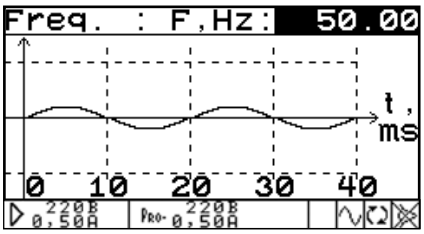
- Fundamental frequency (from 16 to 450 Hz in steps of 0.01 Hz)
- Phase shifts between currents and voltages for all phases (–179.99° to +180.00° in steps of 0.01°)
- Voltage values (3 to 480 V in steps of 1 mV)
- Current values (1 mA to 120 A in steps of 0.1 mA).



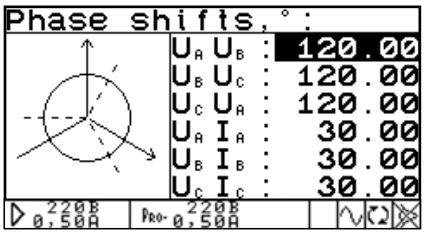
2.2. Special signals

The EF-120-M produces custom waveforms individually programmed for each phase. The output setting ranges are the same as for the standard signals.

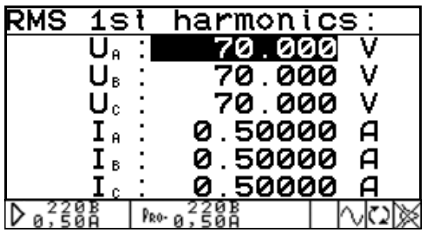
Frequency*



Phase shifts



RMS values of voltage and current



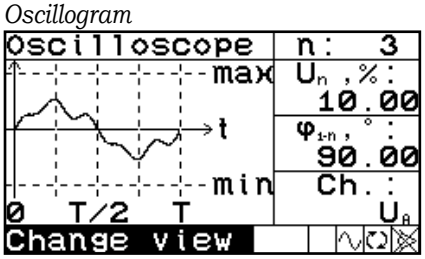
** Synchronization with mains frequency is available.*

Wave shape

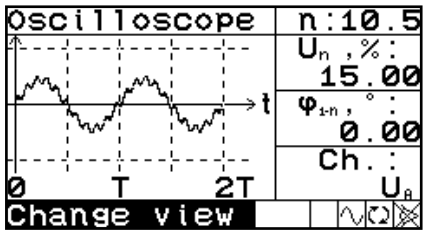
Generated waveform may be represented in 4 ways:

- Oscillogram
- Linear spectrogram
- Logarithmic spectrogram
- Spectrogram showing phase shifts of harmonics with reference to the fundamental (1st) harmonic.

Oscillogram

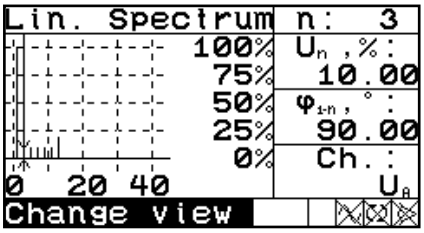


With interharmonics off

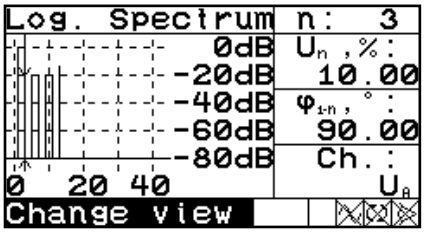


With interharmonics on

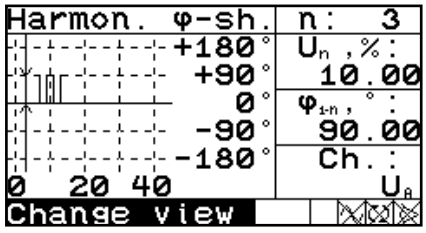
Linear spectrum



Logarithmic spectrum

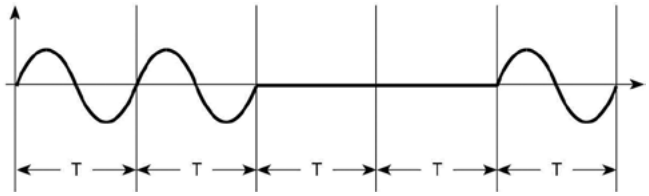


Spectrum of harmonic phase shifts



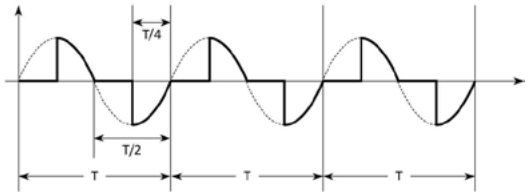
Subharmonics

Waveform at the output (with period T)

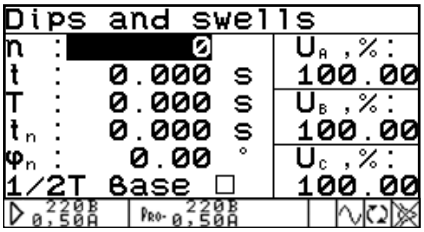


Phase control

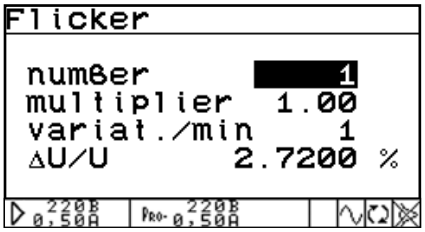
Waveform at the output (with period T)



Dips and swells



Flicker



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Specifications

Phase voltage (1st harmonic RMS voltage U_1)	3 to 480 V
Max. output power of voltage source (per each phase)	30 VA
Output THD of sinusoidal voltage	<0.5 % [1], <0.05% [2]
Voltage setting increments	0.001 V
Voltage setting deviation	<1.5% [1], <1% [2]
Instability of generated RMS voltage	<0.03 %/min
Current (1st harmonic RMS current I_1)	0.001 to 120 A
Max. output power of current source	60 VA
Max. voltage within subranges of current	0.6 V (100 A) 6 V (1.1...12 A); 10 V (10 mA...1 A)
Output THD of sinusoidal current	<0.1 % [3], [4], <1 % [5]
Current setting increments	0.1 mA
Current setting deviation	<1% [3], <2% [4], <5% [5]
Instability of generated RMS current	<0.03 %/min
Instability of generated phantom power (P, Q, S)	<0.05 %/min
Output 1st harmonic frequency (f_1)	16 to 450 Hz
Frequency setting increments	0.01 Hz
Frequency setting deviation	<0.005 Hz
Phase shift between the 1st harmonics of: - voltages in different phases - voltage and current in the same phase Phase shift between the 1st voltage harmonic and the current harmonic of order k ($f = k \cdot f_1$) in the same phase (k from 2 to 50) Phase shift between the 1st current harmonic and the current harmonic of order k ($f = k \cdot f_1$) in the same phase (k = 2 to 50) Phase shift between the 1st voltage harmonic and the voltage interharmonic of order k ($f = k \cdot f_1$) in the same phase (k = 0.5 to 50.5) Phase shift between the 1st current harmonic and the current interharmonic of order k ($f = k \cdot f_1$) in the same phase (k = 0.5 to 50.5)	–179.99 to +180.00 °
Phase shift setting increments	0.01°
Phase shift setting deviation	<0.5°
Power quality setting specifications	
RMS value of voltage during a dip (dip depth - U_{min}), % of U_1	30 to 100 % [6]
RMS value of voltage during a swell (swell height - U_{max}), % of U_1	100 to 200 % [6]
Voltage dip or swell setting increments	0.01% [6]
Dip depth setting deviation	<1% [6]
Swell height setting deviation	<0.5% [6]
Dip/swell duration (t)	0 to 600 s [6]
Dip/swell duration increments	0.001 s [6]
Deviation of setting dip/swell duration	<0.002 s [6]
RMS value of voltage (current) harmonic (with the fundamental frequency f_1 within 40 to 400 Hz) expressed in % of U_1 (I_1): For a harmonic of order k ($f = k \cdot f_1$) where k = 2 to 19 For a harmonic of order k ($f = k \cdot f_1$) where k = 20 to 50 For an interharmonic of order k ($f = k \cdot f_1$) where k = 0.5 to 50.5	 0 to 100 % [7] 0 to 50 % [7] 0 to 15 % [7]
General	
Power supply voltage	230 ± 23 V
Max. power consumption	<700 VA
Operating temperature	from -10 to 50 °C
Operating relative humidity at 25 °C	<80 %
Overall dimensions (length × width × height)	550 × 425 × 250 mm
Weight	<20 kg
Safety	
Protection class according to IEC 60529 (in operation)	IP20
Protection class according to IEC 60529 (in transportation)	IP67
Electrical shock protection	I

[1] 3 to 6 V
[2] From 20 V
[3] 0.1 to 12 A
[4] 0.005 to 0.09999 A
[5] 0.001 to 0.00499 A
[6] f_1 from 40 to 70 Hz
[7] Max frequency of spectral component $k \cdot f_1$ is 2500 Hz

Edition 28.10.2021