MARSENERGO
INSTRUMENTS FOR POWER INDUSTRY

MTS ME 3.3-10
Portable Multipurpose Test System

(accuracy class 0.1)

The System is meant for automatic on-site testing and calibration of service-class measuring instruments including electric energy meters, instrument transformers etc.

Testing of electric energy meters

MTS ME 3.3 portable test system is specifically designed to provide on-site meter test conditions identical to in-lab tests.

A portable computer as part of the system makes it possible to automatically conduct and facilitate test procedures. Energoform program oriented at the Test System users makes it possible, among other functions, to create and manage user-defined test signals, profiles and test procedures, e.g. the user can specify and store on the hard disc any load conditions, parameters of test points etc. for the three-phase system.

Requirements for meters under test are as follows:

Design: Single- or three-phase electromechanical and electronic meters.
Measured power (energy): active or reactive.
Input current: up to 12 A.
Actual standards: IEC standards defined as series 62053 (11-23).
Accuracy: 0.5 or 0.5S accuracy class (or less accurate).

On-site testing of meters

Competitive advantages of the Test System:

1. In addition to on-site testing and calibration of meters and some other instruments, the system can also be used for various purposes owing to the extended functionality of reference standard Energo-monitor 3.3T1 (class 0.1), namely:

■ To measure power quality parameters and, with EmWorkNet program, perform power quality analysis); e.g., before testing meters, mains frequency, THD and deviation of voltage can be measured;

■ To record basic electrical quantities and power quality parameters of electrical networks (e.g., 1-min averaged parameters acquired over 8-days can be recorded into the internal memory without rewriting).

2. Waveform generator Energoforma 3.3 provides test signals applicable to test instruments measuring power quality as per Class A 61000-4-30 power quality measurement standard.

Test signals generated with a high degree of accuracy and stability are distinguished by the following characteristics:

■ 1st harmonic: 42.5...57.5 Hz.
■ Harmonic composition: harmonics in the range of (1st...50th) ; interharmonics and subharmonics in the range of (0.5^{th}; 1.5^{th}; 2.5^{th};...50.5^{th}).
■ Desired network conditions (distorted or not) can be imitated by specifying signal parameters either directly via the menu or from a PC.

Three-phase reference meter; power quality and network analyzer
Energomonitor 3.3T1

Functionality and options

1 Testing and calibration of single-/three-phase meters and other instruments (0.5 or 0.5S class) with:

SH-I, SH-E (scanning heads for reading pulses from discs or LEDs)

CTB (Block of Current Transformers 0.5;1; 5; 50 A)

"EmCounter" and "Energoform" SW

Phantom Power Source Energoforma 3.3

2 Logging of power quality and network parameters

- Logging of averaged values

Averaging period	Continuous logging	Parameters
3 s	9.5 h	U I P Q S PF φ f, THDu; THDi; Ku(n); Ki(n); negative and zero sequence ratios
1 min	8 days	
30 min	7.5 months	

- Logging of instantaneous values (like in an oscilloscope) that are captured with 78 μs intervals (3 phase voltages and three phase currents). Time of continuous logging is 9 minutes.

"EmWorkNet" SW   *"Oscilloscope" SW*

Current clamps:

10, 100 A   1000 A   1000 A (high-precision)   ME FLEX 30/300/3000 A

Measurements

Measured values
- *Voltage and current*:
    * RMS of phase and phase-to-phase voltages and currents,
    * RMS of 1st voltage and current harmonics,
    * Average-rectified values of phase voltages and currents,
    * Average (DC component) values of phase voltages;
- *Energy*;
- *Frequency*;
- *Phase angles* (display of current and voltage vectors);
- *Current and voltage harmonics* from 1st to 40th;
- *Harmonic powers and phase angles between harmonics*;
- Waveforms (phase voltages and currents);
- *Power*:
    * Each phase and total values of active, reactive and apparent power,
    * Power factor and tg φ.

Testing of meters

EM 3.3T1 provides for performance and accuracy testing of electric energy meters (class 0.5 and 0.5S or less accurate). Test results acquired from up to 200 meters (up to 10 measurements per test) can be kept in the internal memory. With EmWorkNet, test results are loaded to a PC for viewing and managing. Test reports are generated automatically.
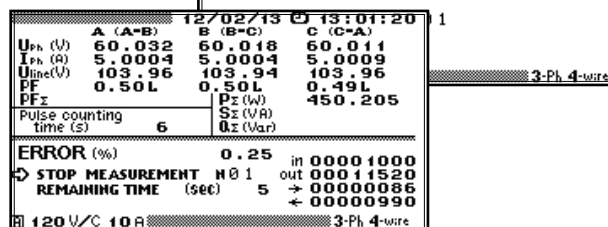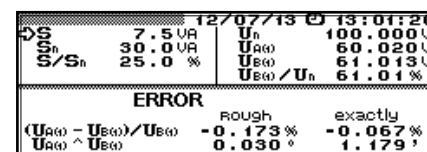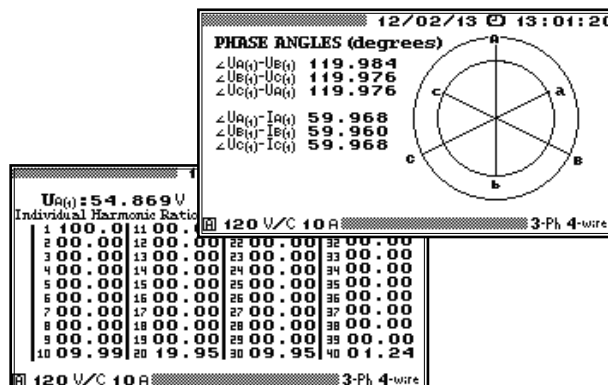
Energomonitor 3.3T1

Metrological data

Measured values	Measurement ranges	Limits of permissible fundamental error	
		with Current Transformers Block (CTB)	with High Precision Current Clamps
RMS of AC voltage (U)	1 to 360 V (U_N = 60; 120; 240 V)	0.1 %[1]	
RMS of AC current (I)	5 mA to 60 A (CTB: I_N = 0,5; 5; 50 A)	0.1 %[2]	—
	50 mA to 4500 A (Clamps: I_N = 10; 100; 1000; 300; 3000 A)	—	0.5 %[3]
Phase angle between 1st harmonics of phase voltages	0° to 360°	Absolute: 0.1°	
Phase angle between 1st voltage and 1st current harmonics in the same phase	0° to 360°	Absolute	
		0.2°	0.5°
Active power (P), W	$0.01U_N$ to $1.5U_N$, PF = 1	Relative	
	$0.1I_N \leq I < 1.5I_N$	0.1 %	0.5 %
	$0.01I_N \leq I < 0.1I_N$	0.2 %	—
Reactive power (Q), Var	$0.05I_N U_N$ to $1.5I_N \cdot 1.2U_N$	Relative	
	$PF_R = 1$	0.3 %	1.0 %
	$PF_R = 0.45L…0…-0.45C$	0.5 %	2.0 %
Power Factor	–1.0 to +1.0	Absolute	
		0.02	0.05
AC frequency	45 to 70 Hz	Absolute: 0.01 %	
Negative and zero sequence voltage ratios, %	0 to 50 %	Absolute: 0.2	
Total Harmonic Distortion of voltage THD_U and individual voltage harmonic ratios $K_{U(n)}$ (n from 2 to 40)	0 to 49.9 %	Absolute: 0.05 % ($THD_U; K_{U(n)} < 1.0$) Relative: 5.0 % ($THD_U; K_{U(n)} \geq 1,0$)	
Total Harmonic Distortion of current THD_I and individual current harmonic ratios $K_{I(n)}$ (n from 2 to 40)	0 to 49.9 %	Absolute: 0.1 ($THD_I; K_{I(n)} < 1.0$) Relative: 10.0 % ($THD_I; K_{I(n)} \geq 1,0$)	
Ratio (modular) error of current and voltage instrument transformers δ	1 to 100 %	Absolute: $(0.02 + 0.02|\delta|)$ %	
Angle error of current and voltage instrument transformers Δ	0.1' to 180°	$(1.0 + 0.1|\Delta|)'$	
Duration of voltage dips and swells	from 0.02 s	0.02 s	
Voltage dip depth	10 to 100 %	Relative: 10.0 %	
Voltage swell height (over-voltage factor)	1.10 to 7.99 relative units	Relative: 2,0 %	
Flicker short-term perceptibility	0.25 to 10	5.0 % ($\Delta U/U \leq 20$ %)	

[1] $\pm[0.1 + 0.01((U_N/U) – 1)]$ %
[2] $\pm[0.1 + 0.01((I_N/I) – 1)]$ %
[3] $\pm[0.5 + 0.05((I_N/I) – 1)]$ %
[4] $\pm[0.25 + 0.02((P_N/P) – 1)]$ %
[5] $\pm[1.0 + 0.1((P_N/P) – 1)]$ %

Pulse input and output

Parameter	Input	Output
Level	5...15 V	5 V
Max. frequency	36 kHz	18 kHz
Pulse duration	>10 μs	10 ± 2 μs
Constant	1...999 999 999 pulses/(kW · h)	C = 14 400 000/($I_N \cdot U_N$) pls/(W • h)

Technical data

Mains supply	100…264 V, (50 ± 5) Hz
Power consumption from mains	20 VA, or less
Consumed DC power (12 V from Power Adaptor or Rechargeable Power Supply)	8 VA, or less
Time of operation when powered from Rechargeable Power Supply	minimum 2 h
Safety requirements per IEC 61010-1	
Ingress protection rating	IP 40
Category of measurements	II or III
Electric shock protection	Double insulation

Overall dimensions (Length × Width × Height)	Maximum 250 × 280 × 80 mm
Weight	2.0 kg, or less
Operating conditions	
Ambient temperature	–20 to 55 °C
Relative humidity	up to 90 % at 30 °C
Atmospheric pressure	70–106.7 kPa (537–800 mm Hg)

Waveform Generator
Energoforma 3.3

Purpose and fields of application

Hand-held Waveform Generator Energoforma 3.3 generates single- and three-phase system of current/voltage signals that can be used for testing and adjustment of instruments that measure:

- Active, reactive or apparent electric power and energy;
- Power quality parameters as per IEC61000-4-30;
- RMS of currents and voltages within commercial frequency range.

The sphere of application includes mobile calibration (testing) laboratories and meter/transformer test systems where the Generator is used together with reference meters, e.g. Energomonitor-3.1K or Energomonitor 3.3T1.

Description

Energoforma 3.3 supplied as a self-contained hand-held module is provided with three channels for generating voltages (phase voltages) and three independent channels for generating currents. Waveforms and signal parameters are viewed either on the built-in graphic LCD or PC via "Energoform" software.

Delivery package

Item description	Quantity
Energoforma 3.3	1
Power supply cable	1
User manuals	1 copy
PC-connection cable (RS-232)	1
Energoform software	1 CD
Optional accessories (included when specified in the Supply Agreement)	
Set of measurement cables (7 pcs.)	1

Technical characteristics

Parameter	Value
Range of output voltage setting per each phase, V	20...264
Increments of voltage setting	0.01
Range of output current setting per each phase, A	0.005...12
Increments of current setting	0.0001
1st harmonic frequency, Hz	42.5...57.5
Increments of frequency setting	0.01
Phase angle between 1st and nth voltage harmonics of the same phase, angular degrees	0...360
Phase angle between 1st and nth current harmonics of the same phase, angular degrees	0...360
Increments of phase angle setting	0.01
Harmonic composition, n	1...50
Power instability (during 1 minute or less), %	±0.05
Power output of current source, VA	5
Power output of voltage source, VA	10