Multifunctional Portable Test System
MTS-ME-3.3T1-P

Equipment Certificate

MC2.702.500 EC

2020

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Introduction

This Equipment Certificate (hereinafter referred to as EC) describes the multi-functional test system MTS-ME-3.3T1-P (the test system below) and includes information about its operation, maintenance, transportation and storage. The document also represents appropriate acceptance and packing forms and contains information about warranty conditions. The aforesaid equipment has been manufactured in compliance with Technical Specifications TS 4381-053-49976497-2013 and conforms to the Technical Requirements in force.

The test system features portable design and comes in various modifications differing in terms of the output power of current and voltage channels.
The test system includes the components listed below.

- Reference measuring instrument: the multifunctional reference standard Energomonitor 3.3T1 (EM3.3T1) registered with National Registry of measuring instruments under #39952-08
- Source of test signals: the programmable waveform generator Energoforma 3.3 (EF3.3) or the programmable waveform generator Energoforma 3.3-100 (EF3.3-100).

The legend of the test system contains information about the options as specified in the purchase order:

MTS-ME XX- P-X-XXX-XX/XXX -X/XXX TS 4381-053-49976497-2013
1 2 3 4 5 6

Meaning of the positions:

1 – relates to the reference meter in use:
- 3.3T1 – Energomonitor- 3.3T1

2 – relates to the design version option:
- P - portable

3 – relates to accuracy:
- 10 – includes Energomonitor 3.3T1

4 – relates to the maximum value of generated current I_{max} , A:
- 12
- 110

5 – relates to the power output of the current/voltage channels (VA):
- 15/5
- 45/100

6 – relates to the output voltage range U_{min}/U_{max}, V:
- 6/264 (6…264 V) (nominal values of phase / phase-to-phase voltages: 60/60*√3 V and 220/220*√3 V).

For example, MTS ME 3.3T1-P-10-12-15/5-6/264 is a meter test system intended for verification and calibration of instruments that measure AC voltage, current and power, it is equipped with the reference meter Energomonitor 3.3T1 and the source of test signals Energoforma 3.3-12.

Fig. 1. MTS-ME-3.3T1-P – general view of the basic modules

1 SAFETY REQUIREMENTS

1.1 While the test system is being used as intended, the “Interbranch rules for Labour Safety (Safety Rules) When Operating Electrical Systems” (M., Energoatomizdat, 2001) and the corresponding local electrical safety requirements must be observed.

The symbol

⚠

placed on the components of the test system is intended to alert the user to the presence of important operating instructions. See section 3.2 “Turning on”.

1.2 The test system is operated according to the safety requirements specified in IEC 61010-1; Measurement category: II; degree of protection against pollution: 1.

1.3 IEC 60529 protection code: IP20.

1.4 The components of the test system must be connected to the grounding bus before applying power to the test system.

2 DESCRIPTION

2.1 Sphere of application

The multi-functional test system MTS-ME-3.3T1-P is designed to perform accuracy testing, calibration and verification of measuring instruments listed in the next section. The system generates waveforms with the electrical parameters specified below and measures electrical parameters such as active, reactive and apparent power, AC frequency, current and voltage, phase angles, power factor, and power quality parameters, including (but not limited to):

- RMS of the fundamental harmonic of voltage (U_{C1})
- RMS of the voltage harmonic of order h (frequency $h \cdot f_1$), h = 2 … 50 (U_{Ch})

- RMS of the voltage interharmonic of order m (frequency $m \cdot f_1$), m= 0.5 … 50.5 in 1.0 increments (U_{Cm})
- RMS of the fundamental harmonic of current (I_{C1})
- RMS of the current harmonic of order h, h = 2 … 50 (I_{Ch})
- RMS of the current interharmonic of order m (frequency $m \cdot f_1$), m= 0.5 … 50.5 in 1.0 increments (I_{Cm})
- Phase angle between the voltage harmonic of order h and the current harmonic of order h in the same phase
- Voltage harmonic of order h in reference to fundamental harmonic, h= 2…50 [$K_U(h)$]
- Current harmonic of order h in reference to fundamental harmonic, h= 2…50 [$K_I(h)$]
- Active power of the fundamental harmonic (P_1)
- Reactive power of the fundamental harmonic (Q_1)
- Active power of the harmonic of order h, h=2…50 ($P_{(h)}$)
- Total Harmonic Distortion of voltage (THD_U)
- Total Harmonic Distortion of current (THD_I)
- Positive sequence voltage of the fundamental (U_1)
- Zero sequence voltage of the fundamental (U_0)
- Negative sequence voltage of the fundamental (U_2)
- Negative sequence voltage ratio (K_{2U}) and zero sequence voltage ratio (K_{0U})
- Positive sequence current of the fundamental (I_1)
- Zero sequence current of the fundamental (I_0)
- Negative sequence current of the fundamental (I_2)
- Phase angle between the voltage and current of positive, or negative, or zero sequence
- Flicker short-term severity
- Duration of voltage dip (Δt_d)
- Depth of voltage dip (δUd)
- Height of voltage swell ($K_{sw\ U}$)
- Duration of voltage swell (Δt_{sw})

Typical applications include metrological (test) laboratories at industrial enterprises.

2.2 Operating conditions

Environmental conditions for the portable test system MTS-ME-3.3T1-P are as follows:

Ambient temperature, °C	From -20 to 55
Relative humidity, %	80 at 25 °C, or less
Atmospheric pressure, kPa (mm Hg)	From 84 to 106.7 (630 to 800)

Additional measurement errors of the test system as a whole correspond to the additional measurement errors of the utilized reference instrument.
The test system is powered from mains (220±10%) V, (50 ± 5%) Hz, THD ≤ 5%.

2.3 Delivery package

Table 1 – Complete delivery package for the test system MTS-ME-3.3T1-P

Name and description	Q-ty
Three-phase phantom power source Energoforma 3.3-12 or Energoforma 3.3-100	1 unit
Reference meter Energomonitor 3.3T1 or Energomonitor 3.3T1-C	1 unit
Software (Enform, EnfCalibrationRig, EmCounter)	1 flash memory drive
PC connection cable (RS-232)	2 pcs
Power supply cables	1 set

Name and description	Q-ty
Measurement cables	1 set
User manual (MC2.702.500-01 UM)	1 pc
Equipment certificate (MC2.702.500 EC)	1 pc
Packaging	1 set
Accessories *:	
Calmar-SL (Error Calculator, DC Current/Voltage-To-Frequency Converter)	1unit
Converter USB-4 RS232	1 pc
10-turn Calibrated Coils (current boosters) for accuracy testing of devices complete with clamp-on CTs	3 pcs
20-turn Calibrated Coils (current boosters) for accuracy testing of devices complete with clamp-on CTs	3 pcs
100-turn Calibrated Coils (current boosters) for accuracy testing of devices complete with clamp-on CTs	1 set
Laptop	1 unit
Equipment Certificate for Calibrated Coils (10, 20, 100 turns)	1 pc
** The particular delivery package is agreed to contain the accessories marked in the Table*	

2.4 Technical specifications

2.4.1 The test system works in 2 modes:
- PC-controlled mode (with one of the programs from the Energoforma software package)
- Standalone mode (manually controlled from the keypads of the Energomonitor 3.3T1 and Energoforma 3.3 instruments).

Waveforms of test signals (together with their parameters) and measured values are viewed on the displays of the Energoforma 3.3 and Energomonitor 3.3T1 respectively or on a PC.

2.4.2 The test system has three channels for generating and measuring phase voltages and three independent channels for generating and measuring currents. The ways to specify a digital model of a test signal are as follows:
- By specifying signal parameters manually from the built-in keyboard
- By recording the parameters of a signal selected from the Library of standard signals into the test system via RS-232 port running the Energoforma program.

2.4.3 Waveforms and parameters of signals are viewed on either the built-in displays of the Energoforma 3.3 and Energomonitor 3.3T1 or on a PC running the dedicated software.

2.4.4 The test system provides for generating single- and three-phase AC currents and voltages within the ranges and with the errors of setting specified in Tables 2 and 3.

Table 2

Parameter of test signal	Range of setting	In increments of	Notes
1 RMS of the voltage harmonic of order n, % of U_1	0 to 100	0.01	n = 2 … 19
	0 to 50		n = 20 … 50
2 RMS of the current harmonic of order n, % of I_1	0 to 100	0.01	n = 2 … 19
	0 to 50		n = 20 … 50

Parameter of test signal	**Range of setting**	**In increments of**	**Notes**
3 RMS of the voltage interharmonic of frequency $m \cdot f_1$, % of U_1	0 to 15	0.01	m = 0.5 … 50.5 in increments 1.0
4 RMS of the current interharmonic of frequency $m \cdot f_1$., % of I_1	0 to 15	0.01	
5 Phase shift between the fundamental harmonics of:	–180 to 180		
Output voltages, degrees		0.01	U from 0.2Unom to U_{MAX}, V
Voltage and current in the same phase, degrees		0.01	I from 0.1 Inom to I_{MAX}, A
6 Phase shift between the harmonic of order n and the fundamental harmonic of voltage, degrees	–180 to 180	0.01	n = 2 … 50; U from 0.2Unom to U_{MAX}, V
7 Phase shift between the interharmonic of frequency $m \cdot f_1$ and the fundamental harmonic of voltage, degrees	–180 to 180	0.01	m = 0.5 … 50.5 in increments 1.0 U from 0.2Unom to U_{MAX}, V
8 Phase shift between the harmonic of order n and the fundamental harmonic of current, degrees	–180 to 180	0.01	n = 20 … 50 I from 0.1 Inom to I_{MAX}, A
9 Phase shift between the interharmonic of frequency $m \cdot f_1$ and the fundamental harmonic of current, degrees	–180 to 180	0.01	m = 0.5 … 50.5 in increments of 1.0 I from 0.1 to I_{MAX}, A
10 Number of dips and swells	0 to 100 000	1	
11 Residual voltage during voltage dip, % of U_{din} (declared input voltage)	10 to 100	0.01	49 Hz < f < 51 Hz
12 Maximum swell voltage magnitude, % of U_{din} (declared input voltage)	100 to 200	0.5	49 Hz < f < 51 Hz

Table 3

Parameter of test signal	**Range of setting**	**In increments of**	**Permissible limit of the error of setting**	**Notes**
1 Frequency of the fundamental (first) harmonic of output signals (f_1), Hz	42.5 to 70*	0.01	absolute 0.01	
2 RMS of the fundamental harmonic of voltage U_1, V	$(0.25...1.2)U_{nom}$ $(0.05...0.25)U_{nom}$	0.01	relative ±1% $\pm[1.0+0.5((U_{nom}/U)–1)]\%$	
3 RMS of the fundamental harmonic of current, I_1, A	$(0.2…1.2)I_{nom}$ $(0.05…0.2)I_{nom}$	0.0001	relative ±1% $\pm[1.0+0.5((I_{nom}/I)–1)]\%$	

Parameter of test signal	Range of setting	In increments of	Permissible limit of the error of setting	Notes
4 Total Harmonic Distortion of generated voltage waveforms, %	-	-	relative ≤ 1% ≤ 2.0%	(0.25...1.2) U_{nom} At a load of 10% of the nominal load At the nominal load
5 Total Harmonic Distortion of generated current waveforms, %	-	-	relative ≤ 1% ≤ 2.0%	(0.2…1.2)I_{nom} At a load of 10% of the nominal load At the nominal load
6 Phase shift specified between the first voltage harmonic and the first current harmonic, degrees	–180 to 180	0.01	absolute ±1	(0.25...1.2) U_{nom}
7 Duration of voltage dip or swell (t), s	0 to 600	0.001	absolute, s ±0.002	
8 Event (dip or swell) repetition period (T), s	0 to 600	0.001	absolute, s ±0.002	
9 Flicker short-term severity	0.25 to 10		relative, % ±1.5	49Hz < f < 51Hz 180 < U < 235V Provided that voltage envelope is meander-like 0.4<ΔU/U<10%
** Within a frequency range of 42.5 – 45 Hz, maximal values of voltage and current must not exceed the corresponding nominal values. The power output of the power source is no more than 0.5P_{nom}.*				

The test system provides for measurements of electrical parameters within the ranges and permissible error limits specified for the reference meter included in the delivery package.

The basic accuracy and technical characteristics of the reference meter Energomonitor 3.3T1 (with the power quality analyzer function, if ordered) are represented in Table 4.

Table 4

Measured values	Measurement ranges	Types and limits of permissible fundamental error	Note
1 RMS of AC voltage (U), V	$0.01U_N$ to $1.5U_N$	relative ±[0.1+0.01((U_N/U)–1)]%	U_N = 60 (100), 120 (200), 240 (415) V
2 RMS of 1st voltage harmonic (U_1), V	$0.01U_N$ to $1.5U_N$	relative ±[0.1+0.01((U_N/U)–1)]%	
3 DC voltage (U_{DC}), V	$0.01U_N$ to $1.5U_N$	relative ±[0.2+0.02((U_N/U)–1)]%	

Measured values	**Measurement ranges**	**Types and limits of permissible fundamental error**	**Note**
4 RMS of AC current (I), A	$0.005I_N$ to $1.5I_N$ * $0.05I_N$ to $1.5I_N$ ** $0.05I_N$ to $1.5I_N$ ***	relative $\pm[0.1+0.01((I_N/I)-1)]\%$ * $\pm[0.5+0.05((I_N/I)-1)]\%$ ** $\pm[1.0+0.05((I_N/I)-1)]\%$ ***	Nominal RMS values of measured AC current are determined by, and correspond to the nominal values of primary current converters (CTB, current clamp, CTCS) taken from EM-3.3T1 delivery package. The range is as follows: 0.1, 1, 0.5, 5, 10, 50, 100, 300, 500, 1000, 3000 A.
5 RMS of 1st current harmonic (I_1), A	$0.01I_N$ to $1.5I_N$ * $0.05I_N$ to $1.5I_N$ ** $0.05I_N$ to $1.5I_N$ ***	relative $\pm[0.2+0.02((I_N/I)-1)]\%$ * $\pm[0.5+0.05((I_N/I)-1)]\%$ ** $\pm[1.0+0.05((I_N/I)-1)]\%$ ***	
6 Phase angle between the 1st harmonics of phase voltages (φ_U), degrees	0 to 360	absolute ±0.1	$0.2U_N < U < 1.5 U_N$
7 Phase angle between 1st voltage and 1st current harmonics in the same phase (φ_{UI}), degrees	0 to 360	absolute ±0.2 * ±0.5 ** ±0.5 ***	$0.2I_N < I < 1.5I_N$ $0.2U_N < U < 1.5U_N$
8 Phase angle between nth voltage and nth current harmonics, n being 2 to 40, ($\varphi_{UI(n)}$), degrees	0 to 360	absolute ±1.0 * ±3.0 ** ±3.0 * ±6.0 **	Only for EM-3.3T1 with Current Transformer Block, or Precision EM-3.3T1 with Current clamps $P_{(N)} \geq 0.003I_N U_N$ $0.1 I_N \leq I \leq 1.5 I_N$ $2\% \leq K_{(n)} \leq 15\%$ $2 \leq n \leq 10$ $11 \leq n \leq 40$
9 Active power (P), W	$0.01I_N U_N$ to $1.5I_N$ $1.2U_N$	relative ±0.1% * ±0.5% ** ±1.0% *** ±0.2% * ±0.15% * ±1.0% ** ±2.0% *** ±0.25% * $\pm[0.25+0.02((P_N/P)-1)]\%$ * $\pm[1.0+0.1((P_N/P)-1)]\%$ ** $\pm[2.0+0.1((P_N/P)-1)]\%$ ***	PF = 1 $0.1 I_N \leq I \leq 1.5 I_N$ $0.01 I_N \leq I < 0.1 I_N$ PF 0.5L…1… 0.5C $0.1 I_N \leq I \leq 1.5 I_N$ $0.02 I_N \leq I < 0.1 I_N$ PF 0.2L…1… 0.2C $0.1 I_N \leq I \leq 1.5 I_N$

Measured values	Measurement ranges	Types and limits of permissible fundamental error	Note
10 Reactive power (Q), var, calculated with one of three methods: $Q_1=\sqrt{(S^2-P^2)}$ – geometrical method; Q_2=UIsinφ – phase shift method; Q_3=UIcos(φ+90°) – method of cross-connection (for three-phase networks).	$0.01I_N U_N$ to $1.5I_N$ $1.2U_N$	relative ±0.3% * ±1.0% ** ±2.0% *** ±0.5 % * ±2.0% **±4.0% ***	PF 0.45L…0…-0.45C PF 0.45C…0…-0.45L $0.1\ I_N \le I \le 1.5\ I_N$ PF 0.86L…0…-0.86C PF 0.86C…0…-0.86L $0.1\ I_N \le I \le 1.5\ I_N$
11 Apparent power (S), VA	$0.01I_N U_N$ to $1.5I_N$ $1.2U_N$	relative ±0.2% * ±1.0% ** ±2.0% *** ±2.0% * ±2.0% ** ±4.0% ***	$0.1I_NU_N$ to $1.5I_N1.2U_N$ $0.01I_NU_N$ to $0.1I_NU_N$ $0.05I_NU_N$ to $0.1I_NU_N$
12 Power factor (PF)	–1.0 to +1.0	absolute 0.02 * 0.05 ** 0.05 ***	$0.01I_NU_N$ to $1.5I_N1.5U_N$ $0.05I_NU_N$ to $1.5I_N1.5U_N$
13 AC frequency (f), Hz	45 to 75	absolute ±0.01 Hz	$0.1I_N \le I \le 1.5I_N$ $0.1U_N \le U \le 1.5U_N$
14 Frequency deviation (Δf), Hz	-5 to +25	absolute ±0.01 Hz	$0.1I_N \le I \le 1.5I_N$ $0.1U_N \le U \le 1.5U_N$
15 Steady-state voltage deviation (δU_s), %	-100 to +40	absolute ±0.2%	
16 Negative sequence voltage ratio, K_{2U}, %, and Zero sequence voltage ratio, K_{0U}, %	0 to 50	absolute ±0.2 %	
17 Total harmonic distortion of voltage THD_U), %	0 to 49.9	absolute ±0.05 relative ±5 %	$THD_U < 1.0$ $THD_U \ge 1.0$
18 Individual voltage harmonic ratio (n = 2 to 40), $K_{U(n)}$, %	0 to 49.9	absolute ±0.05 relative ±5 %	$K_{U(n)} < 1.0$ $K_{U(n)} \ge 1.0$
19 Total harmonic distortion of current (THD_I), %	0 to 49.9	absolute ±0.1% relative ±10%	$THD_I < 1.0$ $THD_I \ge 1.0$
20 Individual current harmonic ratio (n = 2 to 40), $K_{I(n)}$, %	0 to 49.9	absolute ±0.1 relative ±10%	$K_{I(n)} < 1.0$ $K_{I(n)} \ge 1.0$

Measured values	**Measurement ranges**	**Types and limits of permissible fundamental error**	**Note**
21 Active power of n^{th} harmonic (n = 1 to 40), $P_{(n)}$, W	$0.003 I_N U_N$ to $0.1 I_N U_N$	relative ±5.0% * ±10.0% ** ±5.0% * ±10.0% ** ±10.0% * ±20.0% **	Only for EM-3.3T1 with Current Transformer Block, or EM-3.3T1 with Precision Current clamps $0.1 I_N \leq I \leq 1.5 I_N$ $2\% \leq K_{(n)}$ PF = 1 PF 0.5L…1… 0.5C $2 \leq n \leq 10$ $11 \leq n \leq 40$
22 Positive sequence current ($I_{1(1)}$), Zero sequence current ($I_{0(1)}$), and Negative sequence current ($I_{2(1)}$), A	0 to I_N	absolute ±0.002 I_N A * ±0.01 I_N A ** ±0.02 I_N A ***	$0.01 I_N \leq I \leq 1.5 I_N$
23 Positive sequence voltage ($U_{1(1)}$), Zero sequence voltage ($U_{0(1)}$), and Negative sequence voltage ($U_{2(1)}$), V	0 to U_N	absolute ±0.002 U_N	
24 Positive sequence active power ($P_{1(1)}$), Zero sequence active power ($P_{0(1)}$), and Negative sequence active power ($P_{2(1)}$), W	$0.01 I_N U_N$ to 1.,5$I_N U_N$	absolute ±0.0025P_N * ±0.01P_N ** ±0.02P_N ***	$0.1 I_N \leq I \leq 1.5 I_N$
25 Phase angles between a) Positive sequence voltage and Positive sequence current (φ_{1UI}); b) Zero sequence voltage and Zero sequence current (φ_{0UI}); c) Negative sequence voltage and Negative sequence current (φ_{2UI}); degrees	0 to 360	not standardized	
26 Voltage dip duration (Δt_d), s	0.02 or longer	absolute ±0.02	49 Hz < f < 51 Hz
27 Voltage dip depth (Udip),%	10 to 100	relative ±10.0 %	49 Hz < f < 51 Hz
28 Voltage swell height (over-voltage factor) Usw ,%	110 to 799	relative ±2.0 %	49 Hz < f < 51 Hz
29 Voltage swell duration (Δt_{sw}), s	0.01 or longer	absolute ±0.02	49 Hz < f < 51 Hz
30 Flicker short-term perceptibility (P_{st})	0.25 to 10	relative ±5.0 %	49 Hz < f < 51 Hz $\Delta U/U \leq 20\%$ provided that voltage envelope is meander-like
31 Voltage instrument transformer (VT) ratio error (Δf_U), %	0.1 to 100	absolute $\pm(0.02 + 0.02\lvert\Delta f_U\rvert)$ %	$0.8 U_N \leq U \leq 1.5 U_N$

Measured values	Measurement ranges	Types and limits of permissible fundamental error	Note
32 Voltage instrument transformer (VT) phase error ($\Delta\delta_U$), angular units	0.1min to180 degrees	absolute $\pm(1.0 + 0.1\|\Delta\delta_U\|)$ min	$0.8\ U_N \le U \le 1.5\ U_N$
33 Current instrument transformer (CT) ratio error (Δf_I), %	0.1 to 100	absolute $\pm(0.02 + 0.02\|\Delta f_I\|)$ %	$0.01\ I_N \le I \le 1.5\ I_N$
34 Current instrument transformer (CT) phase error ($\Delta\delta_I$), angular units	0.2 min to180 degrees	absolute $\pm(1.0 + 0.1\|\Delta\delta_I\|)$ min	$0.01\ I_N \le I \le 1.5\ I_N$
35 Apparent load power (S), VA using CT using VT	 12 to 100 10 to 1200	 relative 2.0 % 2.0 %	
36 Tangent φ	0 to 8	absolute $\pm[0.005+0.003(tg\varphi)^2]$* $\pm[0.02+0.015(tg\varphi)^2]$** $\pm[0.02+0.015(tg\varphi)^2]$***	$0.01 I_N U_N$ to $1.5 I_N 1.2 U_N$
37 Voltage peak value, V	$0.1U_N$ to $2.1U_N$	referred ±0.2 %	Within the bandwidth of 0.6 to 2.0 kHz: $THD_U < 30$ %, $K_{U(n)} \le 10$ %
38 Voltage amplitude value, V	$0.1U_N$ to $2.1U_N$	relative $\pm[0.2 + 0.02\|2\ U_N/U-1\|]$ % $\pm[0.5 + 0.05\|2\ U_N/U-1\|]$ %	Within the bandwidth of 0.6 to 2.0 kHz: $THD_U < 30$ %, $K_{U(n)} \le 10$ % $f \le 400$ Hz 400 Hz < f < 600 Hz
39 Accuracy of time keeping (daily rate of real-time clock)	N/A	absolute ±2 s/day	Within temperature range of 10 °C to 35 °C

* For EM-3.3T1 with Current Transformers Block

** For EM-3.3T1 with a Precision Current clamp kit

*** For EM-3.3T1 with a basic Current clamp kit

Data not marked with asterisks *, **, *** are valid regardless of the type of input current converters (for EM3.3T1 with Precision current clamps, Basic current clamps, or with Current Transformers Block).

Note! Single-phase measuring instruments may be tested with a line voltage of up to 500 V.

2.4.6 When an input signal does not constitute a sine waveform, the EM-3.3T1 still supports measurement of electrical parameters, provided that the amplitude values of current and voltage do not exceed 140% of the nominal values for measurement sub-ranges.

2.4.7 The test system provides for testing of pointer-type measuring instruments, namely:

- Wattmeters, varmeters
- Voltmeters, amperemeters
- Phase meters, power factor meters
  - Frequency meters
  - Power quality meters.

2.4.8 The test system provides for testing of measuring instruments with frequency output. The specifications of the output are as follows:

- Pulse amplitude – (5…15) V
- Pulse duration – 15 microseconds, or longer
- Pulse frequency (number of pulses per second) – (0…30) kHz

2.4.9 The test system supports testing of electronic-type electricity meters with pulse output. The instrument constant for the meter under test may be set within the range of 1 to 9999999999 pulses per kWh.
The instrument constants of the Energomonitor 3.3T1 for various voltage ranges are shown in Table 5.

2.4.10 The test system provides the declared technical specifications when it is set for stable operation, namely in 30 ± 1 min after applying power.

2.4.11 The time of continuous operation of the test system is no more than 8 hours (8 hours ON, 1 hour OFF). When the test system is operated at a maximum current (or 100A), the mode is as follows: 15 min (or less) ON, 10 min OFF.

2.4.12 The test system is powered from mains (single-phase, (220 ± 10%) V, (50 ± 5%) Hz).
Power consumption is no more than 1500 VA.

2.4.14 The net weight of each case of the portable test system must not exceed 15 kg.

2.4.15 Mean time to first failure is at least 10000 hours.

Table 5

Active voltage measurement range, V	**Instrument constant of the Energomonitor 3.3T1 in terms of measuring:** **Active power, pulses / kW·h** **Reactive power, pulses / kvar·h** **Apparent power, pulses / kVA·h**				
	EM 3.3T1 with Current Transformers Block			**EM 3.3T1 with Precision Current Clamp kit**	
	I_{nom}=0.5 A	**I_{nom}=5 A**	**I_{nom}=50 A**	**I_{nom}=5 A**	**I_{nom}=10 A**
240	120000000	12000000	1200000	12000000	6000000
120	240000000	24000000	2400000	24000000	12000000
60	480000000	48000000	4800000	48000000	24000000

	EM 3.3T1 with Current Clamp kit of basic accuracy								
	I_{nom}=5 A	**I_{nom}=10 A**	**I_{nom}=50 A**	**I_{nom}=100 A**	**I_{nom}=300 A**	**I_{nom}=500 A**	**I_{nom}=1000 A**	**I_{nom}=3000 A**	**I_{nom}=5000 A**
240	12000000	6000000	1200000	600000	200000	120000	60000	20000	12000
120	24000000	12000000	2400000	1200000	400000	240000	120000	40000	24000
60	48000000	24000000	4800000	2400000	800000	480000	240000	80000	48000

3 USER MAINTENANCE

3.1 Maintenance is the care and servicing that the user provides for keeping the test system operational over its life cycle.

3.2 Every maintenance operation shall meet safety requirements described in Section 1 of this Equipment Certificate.

3.3 The routine maintenance includes self-testing and such operations as:
- cleaning the display and keyboard with a damp cloth
- cleaning the oxidized contacts and checking the reliability of their fixing

3.4 Troubleshooting

No	Fault	Correction
1	Some (or all) of the components of the test system are not powered.	Make sure that the power cables of the components are properly connected. Replace the fuses of the components not powered.
2	There is no communication between the components of the test system and PC.	Make sure that the COM port settings of the components and PC are specified correctly. Make sure that the PC communication cables are properly connected.

4 STORAGE

4.1 For a long time, the components of the test system shall be stored in the manufacturer's package in a heated storeroom.

Storage conditions (in the manufacturer's packaging):
Ambient temperature..0 to 40 °C;
Relative humidity...80 % at 35 °C

Storage conditions (without packaging):
Ambient temperature..10 to 35 °C;
Relative humidity...80 % at 25 °C

4.2 The storeroom should be free from current-conductive dust, acid or alkali fumes and other aggressive substances.

Concentration limits of corrosive components in the air:
Sulfur dioxide gas – maximum 20 mg/(m^2•day) (maximum 0.025 mg/m^3)
Chlorides – 0.3 mg/ (m^2•day)

5 TRANSPORTATION

5.1 The components of the test system shall be transported packed in the manufacturer's box in enclosed vehicles or wagons protected from rain and snow or in air-tight heated plane cargo compartments.

5.2 Ambient conditions during transportation:

- Ambient temperature –25 to 55 °C
- Relative humidity 98 % at 35 °C

6 MARKING AND SEALING

6.1 The nameplate of the test system bears:

- Model name (legend)
- Power supply type and rating
- Serial number
- Date of manufacture (month and year)

6.2 Side and face walls of the transportation boxes bear handling symbols "Fragile", "Keep dry" and "Top".

6.3 Seals are installed in a hole of a fastening screw of each test system component.
After opening the component for repair, the seal should be reinstalled by authorized Service Companies only.

7 WARRANTY

7.1 All products of MARS-ENERGO are warranted against defects in manufacture or material **for a period of 18 (eighteenth) months** from the date of purchase from MARS-ENERGO. Warranty period for the batteries is 6 (six) months from the date of purchase from MARS-ENERGO. Equipment believed to be defective may be sent within the warranty period to MARS-ENERGO for inspection (Warranty Claim enclosed, transportation prepaid). If the inspection by MARS-ENERGO confirms that the product is defective, it will be repaired or replaced (at MARS-ENERGO option) at no charge, within the underlisted limitations (paragraph 9.3), and returned prepaid to the location specified in the buyer's Warranty Claim. All replaced parts become the property of MARS-ENERGO.

Conditions

7.2 In the event of any Device's failure or defect in manufacture or material during the warranty period (provided that the transportation, storage and operating conditions outlined in this Manual are fulfilled), send the Device to MARS-ENERGO along with the sales invoice or other proof of Device's ownership and date of purchase. If the documents outlined in the previous section are absent, the warranty period is calculated from the date of Device manufacture.

MARS-ENERGO retains the right to reject a warranty claim, if the documents listed in the previous section are filled out incompletely, incorrectly or illegibly. This warranty will not be applicable for the Devices whose serial number has been altered, removed or made illegible.

This warranty will not be applicable for damages to your Device caused during shipment to and from MARS-ENERGO location.

This warranty will not be applicable:

1) For parts requiring regular maintenance or replacement due to natural wear;

2) For consumable parts (parts, the nature of which is to become worn or depleted with use, such as batteries);
3) For damages to the Device caused by:
a) Any use other than correct use described in the User manual including:
- Handling the Device resulting in mechanical damages, cosmetic defects, Device modification, or damages to the LCD;
- Damages caused by incorrect installation;
- Damages caused by any maintenance other than correct maintenance described in the User manual;
- Damages caused by installation and use inconsistent with the technical and safety standards in force in the country where the Device has been installed and used;

b) Damages caused by computer virus infection or by use of software not supplied by MARS-ENERGO, or damages caused by incorrect software installation;

c) Damages caused by condition or defects of a system or its elements with which or as part of which the Device was used, excluding the other MARS-ENERGO products intended for use with the Device;

d) Damages caused by accessories or ancillary equipment not made or authorized by MARS-ENERGO with respect to their type, condition or characteristics;

e) Damages caused by repairs or attempts to repair the Device executed by an unauthorized person or company;

f) Damages caused by adjustments or modifications made to the Device without prior written consent of MARS-ENERGO;

g) Damages caused by negligent handling;

h) Damages caused by accidents, fire, ingress of liquids, chemicals or other materials, flood, vibration, heat, improper ventilation, variations of supply voltage, improper power supply or input voltage, electrostatic discharge including lightning, or any other impacts or external actions beyond the reasonable control of MARS-ENERGO and not covered by the technical documentation for the Device.

The present warranty only covers hardware failures. This warranty does not cover failures of software (produced either by MARS-ENERGO or by other manufacturers), which are the subject of express or implied end user license agreements, separate warranties, or exclusions.

7.3 MARS-ENERGO establishes the lifetime for the products outlined above (excluding the batteries) of 4 (four) years from the date of purchase from MARS-ENERGO. Lifetime period for the batteries is 2 (two) years from the date of purchase from MARS-ENERGO. *Please note that warranty period and lifetime differ from each other.*

7.4 It is highly recommended to make a backup copy of the data from the Device's internal memory and store it on another (external) media. MARS-ENERGO shall in no circumstances be liable for any direct or indirect damages or losses, whether incidental, consequential or otherwise, including but not limited to loss of profits, loss of use or any deletion, corruption, destruction or removal of data, disclosure of confidential information or infringement of privacy, data recovery expenses, losses arising out of interruption of commercial, production or other activities based on use or loss of use of the Device.

Manufacturer’s address (for warranty claims):
Mars-Energo
V.O. 13 Line, 6 - 8, office 41H, St. Petersburg, Russia. A
Tel: (812) 327-21-11, (812) 334-72-40
E-mail: mail@mars-energo.ru
www.mars-energo.com

Manufacturer's address (Production and Service departments):
V.O. Kozhevennaja Line, 29-5, Saint-Petersburg, Russia, 199106
Tel: (812) 633-04-60
E-mail: service@mars-energo.ru

8 PACKING FORM

TEST SYSTEM MTS-ME-3.3T1-P____

_______________No_________________, firmware version_________________________

The aforesaid equipment has been packed by MARS-ENERGO in compliance with the Technical

Requirements in force.

Packer signature:_________________ (Initials and name)

Date:_____________________

9 ACCEPTANCE FORM

TEST SYSTEM MTS-ME-3.3T1-P____

_______________No _________________, firmware version__________________________

The aforesaid equipment has been manufactured and accepted in compliance with Technical Specifications TS 4381-053-49976497-2013 and conforms to the Technical Requirements in force.

Head of quality Control Department:_________________ (Initials and name)

Corporate Seal:

Date:_________________

Date of Sale: ___________________

(Corporate Seal) _________________ (Initials and Name)

10 WARRANTY CLAIM

In the event of any failure or defect of the equipment in manufacture or material during the warranty period (provided that the transportation, storage and operating conditions outlined in this Manual are fulfilled), send the equipment to MARS-ENERGO along with the Warranty Claim containing the following information:

1) Model and Serial number of the equipment

2) Date of manufacture

3) Date of putting the equipment into operation

4) Condition of the manufacturer's seals (in place, destroyed, absent). See section 6 for the location of the seals.

5) Description of the failure or defect;

6) Buyer details (Company name, address, etc., including name and phone number of whom the reply may concern).

Find the Serial number and Date of manufacture of the equipment on its nameplate.

11 CALIBRATION PROCEDURE

Test System MTS-ME-3.3T1-P__________________________________, serial number _______

The calibration procedure of the test system MTS-ME-3.3T1-P shall be carried out in compliance with the calibration methods established by D.I. Mendeleev Institute for Metrology (VNIIM, Saint-Petersburg, Russia). The test system undergoes primary post-manufacture calibration, and then it is calibrated after each repair. Regular calibration is performed during operation. A period of one calendar year is considered maximum time between calibrations.

Date of calibration	**Type of calibration**	**Calibration results**	**Calibrator's Signature, Initials and Name**