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INSTRUMENTS FOR POWER INDUSTRY

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REFERENCE STANDARD FOR
DIGITAL SUBSTATION EQUIPMENT

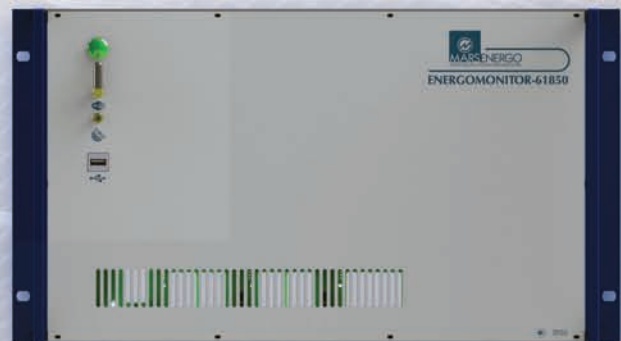
Energomonitor 61850

A new generation instrument for testing conventional and non-conventional (digital) current and voltage transformers and Merging Units

Accuracy class 0.02; 0.05



1. Energomonitor-61850-P Portable



2. Energomonitor-61850-S Stationary

Application

- Determining modular and angle errors of conventional transformers (CTs according to IEC 60044-1 and VTs according to IEC 60044-2 with analogue outputs) or digital transformers (CTs and VTs with digital Sampled Value outputs according to IEC 61850-9-2LE)
- Determining accuracy characteristics of IEC 61869-13 Merging Units
- Measurements of current and voltage signals with further conversion into digital streams of instantaneous values according to IEC 61850-9-2LE
- Power measurements (active, reactive, and apparent)
- Energy measurements in single-phase and three-phase circuits.

Portable instruments: functionality and options

1. On-site accuracy testing of current transformers

(accuracy class of CTs under test – up to 0.2S; rated primary current – up to 5000A)



CTCS (Current Transformer Calibration Switch)



Reference Current Transformers TTIP-100 and TTIP-5000



Source of test current IT-5000



PC with Energomonitor-61850EXT software

2. On-site accuracy testing of voltage transformers

(accuracy class of VTs under test – up to 0.2; rated primary voltage – from 6 to 330 kV)



Reference device (Capacitive HV transducer 6 ÷ 330 kV)



Burden set

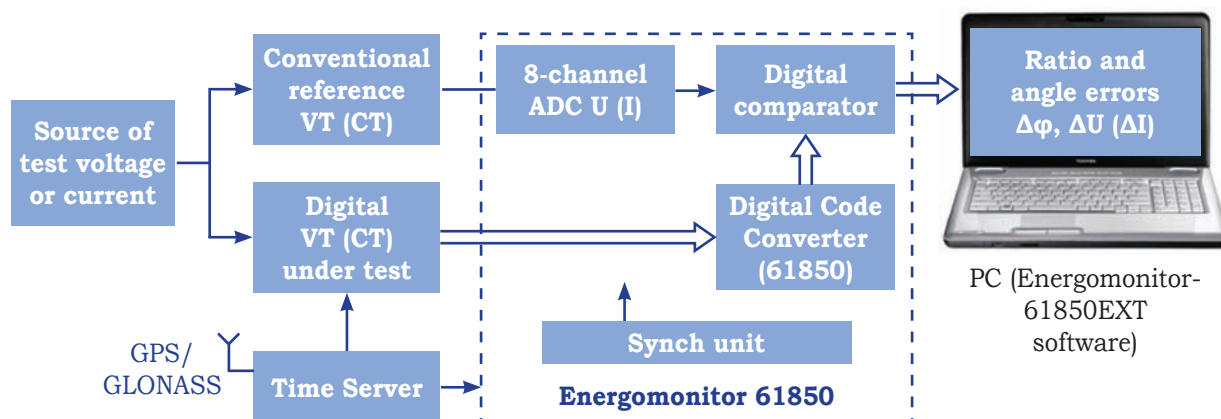
Source of test voltage 50, 100, 150, 230 kV

Control panel (Console)



PC with Energomonitor-61850EXT software

Block diagram for accuracy testing of digital current and voltage instrument transformers



3. On-site accuracy testing of Merging Units



Phantom power and test signal source
Energoforma 61850

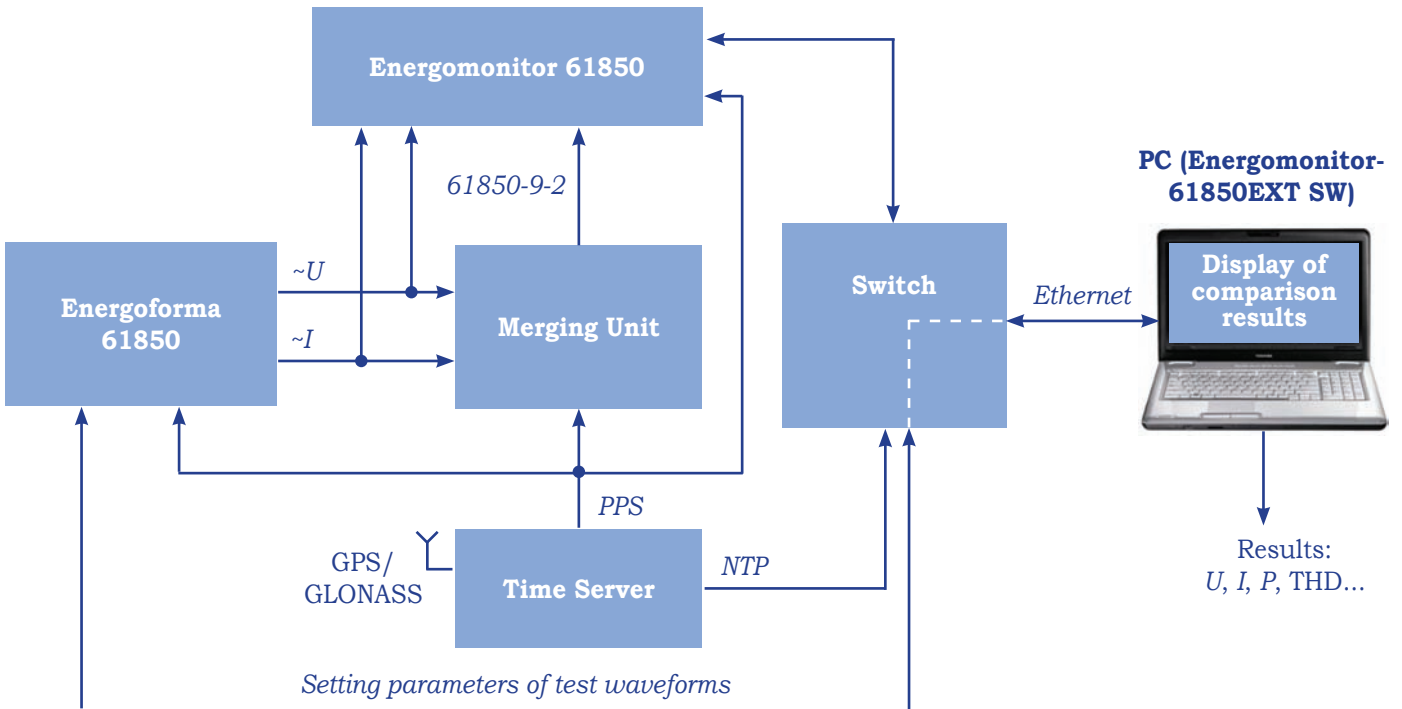
Time Server

Switch



PC with Energomonitor-61850EXT software

Block diagram for testing of Merging Units



Testing of digital VTs and CTs by means of Energomonitor 61850 and conventional (analogue) reference current or voltage transformers



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Accuracy specifications

Measured parameter	Measurement range	Intrinsic measurement error	
		Accuracy class 0.02	Accuracy class 0.05
AC voltage	0.1 to 960 V ($U_{NOM} = 1, 2, 5, 10, 30, 60, 120, 240, 480, 800$ V)	±0.01 %	±0.02 %
AC current	5 mA to 120 A ($I_{NOM} = 0.05; 0.1; 0.25; 0.5; 1; 2.5; 5; 10; 25; 50; 100$ A)	±0.01 %	±0.02 %
Phase angle between the 1st voltage harmonics or between the 1st voltage harmonic and the 1st current harmonic in the same phase	0° to 360°	Absolute:	
		±0.003°	±0.01°
Apparent power		Relative:	
		0.02 %	0.04 %
Active power	0.1 U_{NOM} to 1.2 U_{NOM} V 0.1 I_{NOM} ≤ I < 1.2 I_{NOM}	Relative:	
		±0.01 %	±0.05 %
Reactive power	0.01 Q_{NOM} to 1.44 Q_{NOM} Var 0.9 ≤ sin φ ≤ 1.0 0.2 ≤ cos φ ≤ 0.9	Relative:	
		±0.03 %	±0.1 %
		±0.05 %	
AC frequency	40 to 70 Hz	Absolute:	
		±0.0002 Hz	±0.001 Hz
Total harmonic distortion of voltage	0 to 50 %	Absolute: ±0.1 % ($THD_U < 1.0$)	
		Relative: ±1 % ($THD_U ≥ 1.0$)	
RMS of voltage harmonic of order h	0 to 0.6 U_{NOM}	Absolute:	
	$U_{Ch} ≤ 0.01 U_{NOM}$	±0.0001 U_{NOM}	±0.0002 U_{NOM}
	$U_{Ch} > 0.01 U_{NOM}$	Relative:	
		±1 %	±2 %
Voltage harmonic of order h in reference to the fundamental	0 to 49.9	Absolute:	
	$K_i(h) < 1.0$	±0.003 %	±0.01 %
	$K_i(h) ≥ 1.0$	Relative:	
		±0.3 %	1.0 %
Total harmonic distortion of current	0 to 50 %	Absolute: ±0.01 % ($THD_I < 1.0$)	
		Relative: ±1.0 % ($THD_I ≥ 1.0$)	
RMS of current harmonic of order h	0 to 0.6 I_{NOM}	Absolute:	
	$I_{Ch} ≤ 0.01 I_{NOM}$	±0.0001 I_{NOM}	±0.0002 I_{NOM}
	$I_{Ch} > 0.01 I_{NOM}$	Relative:	
		±1 %	±2 %
Current harmonic of order h in reference to the fundamental	0 to 49.9	Absolute:	
	$K_i(h) < 1.0$	±0.003 %	±0.01 %
	$K_i(h) ≥ 1.0$	Relative:	
		±0.3 %	±1 %
Phase angle between the fundamental harmonic of voltage (current) and the 1 Hz reference frequency signal (PPS)	0° to ±180°	Absolute:	
		±0.015°	±0.025°
Frequency of the reference signal (PPS)	1 Hz	±2 · 10 ⁻⁶ (error in producing reference frequency)	

Accuracy specifications when testing CTs and VTs

Error (absolute)	Conventional CTs and VTs	Digital transformers (IEC 61580)
Ratio	±0.002 %	±0.015 %
Angle	±0.1 minute	±1 minute

Technical specifications

Parameter	Value
Mains supply	220 ± 22 V 47 ... 63 Hz
AC power consumption	100 VA, or less
Dimensions (length × width × height)	no more than - stationary 483 × 430 × 266 mm - portable 555 × 432 × 223 mm
Weight	no more than - stationary / portable 14 kg / 15 kg
Operating temperature	+5 to +40 °C