EnergoMonitor-61850EXT

Version 0.4.5

User Manual

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Scope

The EnergoMonitor-61850EXT program (the Program below) is a software component designed to work with the multifunctional reference meter Energomonitor-61850 (EM61850 below). The Program is used to configure EM61850 and take control of measurement results.

The Program works under Windows 7, 8, 10.

1 INSTALLATION

- 1.1 Run the installer **setup.exe**
- 1.2 Click on Next

EnergoMonitor61850EXT	—		\times
Destination Directory Select the installation directories.			
All software will be installed in the following locations. To install software into a different location, click the Browse button and select another directory.			
C:\Program Files (x86)\MarsEnergo\	Bro	wse	
Directory for National Instruments products C:\Program Files (x86)\National Instruments\	Bro	wse	
<< Back Next	>>	Canc	el

1.3 Select I accept the License Agreement. Click on Next

🐙 EnergoMonitor61850EXT —		\times
License Agreement You must accept the licenses displayed below to proceed.		
NATIONAL INSTRUMENTS SOFTWARE LICENSE AGREEM	IENT	^
CAREFULLY READ THIS SOFTWARE LICENSE AGREEMENT ("AGREEMEN DOWNLOADING THE SOFTWARE AND/OR CLICKING THE APPLICABLE BUT COMPLETE THE INSTALLATION PROCESS, YOU AGREE TO BE BOUND BY THE TE THIS AGREEMENT. IF YOU DO NOT WISH TO BECOME A PARTY TO THIS AGREEMENT BOUND BY ITS TERMS AND CONDITIONS, DO NOT INSTALL OR USE THE SOFTWAI RETURN THE SOFTWARE (WITH ALL ACCOMPANYING WRITTEN MATERIALS AND CONTAINERS) WITHIN THIRTY (30) DAYS OF RECEIPT. ALL RETURNS TO NI V SUBJECT TO NI'S THEN-CURRENT RETURN POLICY. IF YOU ARE ACCEPTING THESE ON BEHALF OF AN ENTITY, YOU AGREE THAT YOU HAVE AUTHORITY TO BIND THE EN THESE TERMS.	IT"). B' Ton To Rms of And Be Re, And D Theif Will Be T Terms NTITY To	Y E D R E S D V
The software to which this National Instruments license applies is EnergoMonitor61850EXT.		
 I accept the License Agreement. 		
I do not accept the License Agreeme	ent.	
<< Back Next >>	Cancel	

1.4 Click on Next



1.5 Click on **Next.** Wait for the installation to complete.

EnergoMonitor61850EXT	-		×
Start Installation Review the following summary before continuing.			
Adding or Changing • EnergoMonitor61850EXT Files			
, Click the Next button to begin installation. Click the Back button to change the installation s	ettings.		
Save File << Back Next >:	>	Cance	el

1.6 Click on Next



1.7 Click on **Restart.** Your computer will be restarted.



2 CONNECTING EM61850 AND PC

2.1. Connect your PC to the WiFi point of EM61850.

Network name: em61850-N (where N is a serial number of EM61850) Password: 12345678

Besides a WiFi connection, it is also possible to make a wired connection between EM61850 and PC. The computer is connected to the Control port of EM61850 via a patch cord.

2.2. Launch the program EM61850EXT. In case of successful connection the indicator in the lower right corner will be displayed as shown in the figure below.

The connection can be configured in the menu Settings \rightarrow Connection (see section 3.1.5).



3 OPERATING THE PROGRAM

3.1. Settings

3.1.1 ADC

3.1.1.1 Selecting measuring ranges

On the screen you can select required ranges for analogue current or voltage inputs. The ranges are activated on clicking **Apply**. When a current range is being changed, EM61850 emits 4 specific clicks. Voltage ranges are switched soundlessly.

Caution!

The EM61850 controls its analogue inputs automatically:

On applying a value of current or voltage higher than 125% of a measurement range active at the moment to the input(s), the EN61850 will automatically set the corresponding range to the maximum one. The ranges with maximum ratings are as follows: 800 V for the voltage inputs, 10A for the current inputs 12A, and 100A for the current inputs 120 A.

Nevertheless, it is not recommended to apply signals over 125% of the nominal range value to the inputs, since this may damage the inputs or affect the accuracy of measurements due to the ADC overflow.

In the mode of comparison of two external streams External SV1 – External SV2 (see section 3.1.2), the automatic control of the inputs is not available

		1					-
ADC	Streams		Synchro	onization		Service	
ADC F	anges		Outg	oing Strea	m		
A B C tanges U, V 800 800 800	N Apply	00 (Source MA	C 05 1E	Scale x1000 OFF		
Ranges I, A 10 10 10	10 Apply	opt	tion Stream				
All phases 🖸		em61	850_5		Apply		
				CTCS			
		A	B C	N		in and	
	Voltage rang	e, V 800	800 800	800	x 1000 Source1	sin	
	A	And 10,000					The second se

3.1.1.2 Configuring the outgoing stream

The outgoing stream, generated by the own (internal) ADC module of EM61850 according to IEC 61850-9-2, contains the digital replicas of input analogue signals: 4 input currents and 4 input voltages. The MAC address of the stream source (**ADC MAC**) is displayed as reference

information. The parameters of the stream are selected from the **Parameter** drop-down list among the following options:

Stream ID – is the name of the stream, it may include characters from the Roman alphabet, digits and the underscore "_" (other characters are not allowed according to the standard).

Dest MAC – is the destination MAC address (MAC address of the data receiver).

F SV – is the sampling rate, the admissible rates are: 20, 24, 80, 96, 256, 288, 640 1280 samples per a period of the rated network frequency.

VLAN ID – is the subnetwork identifier of the stream.

APPID – is the application identifier.

Transform ratio – transformer ratio (equals 1 by default)

The **Scale x1000** button enables a scaling factor that may be applied to the voltage ranges 1V, 2V and current ranges 0.1A, 0.25A. When the factor is active, the **Scales x1000** indicator is displayed at the bottom of the screen. The button is activated to measure low currents and voltages. At this time, the readings RMS and RMS (1) are displayed in mV (voltage) and mA (current).

3.1.1.3 Configuring CTCS



Note! This information relates to the versions operating with the instruments complete with the Current Transformer Calibration Switch (CTCS).

The **ON/OFF** button enables the mode of operation with the CTCS. Within an outgoing stream, the readings from the inputs of the CTCS are assigned to the phases Ib and Ic. The button **Apply** makes it possible to select one of 8 measurement ranges available: 0.05, 0.1, 0.25, 0.5, 1, 2.5, 5, 10 A. The selection of the option < > (shown in the figure below) breaks the current circuit.



3.1.2 Streams



Selecting a stream:

○Analog only ● Analog - External SV ○ External SV1 - External SV2	Streams Marsgen256 Marsgen80	
SV Name SV1 Arsgen256 Marsgen80	Destination MAC Source MAC 00 00 00 00 00 00 00 Apply	

When external streams are connected to the EXT input, the names of the streams will be automatically displayed in the **Streams** list.

When the **Analog only** option is selected, the mode of accepting external streams is disabled, and the comparison of streams is not available

Selection of the **Analog** – **External SV** option enables the mode of comparison of an analog signal and an external stream (analogue – digital comparison). At this time, the corresponding field, where a required external stream may be selected, becomes accessible.

Selection of the **External SV1 – External SV2** option enables the mode of comparison of 2 external streams (digital – digital).

Calculation settings



The calculation settings (which are set to default each time the EM61850 is turned ON/OFF) influence the readings of the instrument in all tabs. The left part of the panel contains the fields where the calculation settings for an analog signal or for a digital stream selected can be made. The right part represents the calculation settings for an external stream only. In addition, such options as the number of harmonics and interharmoncs are backed up in the tab Multimeter >> Harmonics.

The **Frequency range** (**F range**) option sets a range across which the search for the fundamental frequency is performed. Calculation of frequency in a polyphase system is based on a signal in a channel configured as the reference channel. The corresponding **Reference channel** field contains the following options:

- Auto: The channel Ua is taken as the reference. If the RMS signal value in the reference channel appears to be less than 10% of an active measurement range, the first channel where the RMS signal value exceeds the 10% threshold will be selected as the reference automatically. The channels are scanned in the following order: Ua, Ub, Uc, Un, Ia, Ib, Ic, In. If a sufficient signal is detected in none of the channels, the search will be repeated once a second.

- Off (by default): The frequency of each channel is calculated independently of one another.

- Selection among: **Ua**, **Ub**, **Uc**, **Un**, **Ia**, **Ib**, **Ic**, **In**. The frequency of the selected channel is taken for the frequency of the system.

3.1.3 Synchronization

ADC	Streams	Synchronization	Service
PPS Internal Positive	External Apply Negative		
PPS Off Or Out Fre Pulse Pu	Inversed quency, Hz 1 duration, s 0,2 Ise delay, s 0		
CLK Off Or Out Fre Pulse Pu	Inversed quency, Hz 1 duration, s 0.2 Ise delay, s 0		

There are 2 modes of synchronization: internal (with an internal quartz generator) and external.

To use an external source of PPS (pulse per second) signal, choose the External button among the $PPS_{\ In}$ options.

To enable the internal source of PPS signal, select the **Internal** option.

To transmit PPS signal from the EM61850 to external devices, among the **PPS** _{Out} options choose **On** or **Inversed**.

Click on **Apply** to send the settings to the instrument.

CLK in (Clock Signal) is an input on the panel of the EM61850 for connection of an external synchronization signal (will be active in further versions).

The CLK out panel serves in the same way as PPS out.

3.1.4 Service

ADC	Streams	Synchronization	Service
IP 192 168 0 101 Co	onnect Change		
Software Energomon	itor-61850EXT v 0.4.4		
Internal software Energomor	itor-61850INT v 0.2.13	Update	
	ADC v 2.16.0		
	Synch block v 3.0.8		
	Serial # 30		
	Modification 1-02-00-50		
.E.	ų.		
	© Mar	s-Energo	
	http://www.ii	ens-energe.com	

This tab contains the information about actual firmware versions.

The **Connect** button is used to connect the EM61850 with the specified IP address to the Program.

The Change button will be functional in future program versions.

The **Change** button is added to make it possible to change an active IP address of the EM61850 to a new one (if the IP address has been changed, to apply a new one, it is necessary to turn the power of the EM61850 off and turn it on again).

The Update button downloads a new firmware version.

3.2. Comparator



3.2.1 General information

The mode is used to compare signals on two phase inputs. The signals may relate to one stream or to different streams.

Measurements are performed once per second.

Meanings of the fields:

Scale factor – is used when the readings RMS and RMS (1) should be multiplied by a number. The number is specified in this field (equals 1 by default).

 \mathbf{RMS} – shows the RMS value of a voltage or current signal selected in the corresponding field

RMS(1) – shows the RMS value of the first harmonic of this signal

DC – shows the DC component value of this signal

Phi – displays the phase shift (measurement units are selected in the field below)

Error – displays the calculated values of measurement error (relative or absolute)

Relative (%) is the error calculated according to the formula:

Relative_Error = (Ref - DUT) / DUT * 100

Absolute is the error calculated according to the formula:

Absolute_Error = DUT - Ref

Note! The values of phase shift error are always calculated according to the second (**absolute error** calculation) formula.

 \mathbf{F} – shows the frequency of the first harmonic of the corresponding signal

THD – shows its total harmonic distortion

COS μ SIN – these buttons are used to select one of the methods (cosine based or sine based) for determining the phase offset (phase angle) of a signal curve with reference to a time stamp (PPS pulse).



The methods are referred to the extreme positions of a signal curve with respect to a PPS pulse:



Cosine based: the phase offset is assumed to be zero, if a time stamp (at the moment of going from one second to the next) matches the curve of the fundamental signal harmonic at its maximum.

Sine based: the phase offset is assumed to be zero, if a time stamp (at the moment of going from one second to the next) matches the curve of the fundamental signal harmonic when it crosses the X axis from below.

3.2.2 Amplitude graphs

A set of the amplitude curves of compared signals measured over 1 second is displayed on the upper graph panel. The horizontal axis contains fractions of a second adjusted with a slider **Scale**. By moving the slider to the rightmost position you can view the complete 1-second graph.

The lower graph panel represents the curves of the parameters selected from the dropdown list (RMS, RMS(1), Phi, F, DC, THD).

The error graphs located in the next tab are managed in the same way.



3.3 Verification



3.3.1 Verification of transformers

Full description for the accuracy testing (verification) of transformers is provided in the user manual for the Energomonitor 61850 (MC3.055.501 UM).

3.3.1.1 Specification tab for the transformer under test

Transformer		
DUT	Current transformer	
	Voltage transformer	
	Current&Voltage transformer	\$
		+
	Pass	
	Pass	-
		+

The fields for entering the details of the transformer under test (DUT) become accessible only if a transformer type has been selected.

DUT	Voltage transformer	Ŧ
Name	Transf1	-
Analog/SV stream	Analog	•
Single-phase/Three-phase	Single-phase	•
Visual inspection and verification of terminal markings	Pass	•
Software check	Pass	•
Insulation check	Pass	•
Serial	1	
Year of manufacture	2020	
Accuracy class	0.2	
Primary rated voltage, V	1000	
Secondary rated voltage, V	10	
Rated frequency, Hz	50	
Rated load, VA	100	
Istallation place	Saint Petersburg	
Owner	Company Name	
Last verification date	01.01.2019	

Note! The other tabs in the window are inaccessible if the fields **Primary rated voltage** (or **Primary rated current**) and **Secondary rated voltage** (or **Secondary rated current**) are not filled.



Reference	Current&Voltage transformer	-			
Name	Ref Transf1	-		Save to my devices	Remove from my devices
Analog/SV stream	Analog	•		Reference devices	
Serial	1			Analog / Ref Transf1	18
Accuracy class	0.01				
Primary rated voltage, V	1000		< <		
Secondary rated voltage, V	10				
Primary rated current, A	1000				
Secondary rated current, A	10				
					_
Temperature, °C	11				
Humidity, %	70				
Pressure, kPa	100				
Network frequency, Hz	50				
THD, %	0.1				
Network voltage, V	220				
Analog input: (ADC/CTCS)	ADC	-			

If you have been selected a device saved earlier, its data will appear in the fields automatically.

Name	Transf 2	-	Save to my devices	Remove from my devices
Analog/SV stream	Transf 1	ŀ		
Single-phase/Three-phase	Transf 2	-	,	

3.3.1.3 Performing verification

Load	U / U_nom., 9	%	Ratio error, %	Phase error, min	Permissible ratio erro	or. %	Permissible	e phase error, min	
0.00	9.71		0.01	0.13	0.02			0.01	
									В
									С
	Voltag	je						Error calculation	
Refere	ence		DUT	Load power					
Analog / v1	•	Anal	og	000.000		Cor	rection	D01 - Ref	* 100
` 60 40	80		\$ 60 / 40 80			of cl	hannels	Ref	. 100
20	100	`2 -0-	0 100 120 -					IEC 61869-6:2016	
% of rated va	alue 9.7	% of	f rated value 1.2						
		Ch	RMS	Ratio error, %	Phase error, min	[,	Add		
Ch. RMS		CII.							
Ch. RMS A ▼ 009.70)7	B	• 009.709	000.012	000.350				
Ch. RMS A ▼ 009.70 A ▼ 000.00)7	B ·	009.709000.000	000.012	000.350	D	elete]	
Ch. RMS A ✓ 009.70 A ✓ 000.00 A ✓ 000.00		B B C	 009.709 000.000 000.000 	000.012 000.000 000.000	000.350 000.000 000.000	D	elete Save	Filename	

The tab is used to record measurement results in the table on the basis of which the test report is created (in the form of an rtf file). To add an actual reading to the table, press the **Add** button. To delete a record from the table, highlight it with the mouse and press the **Remove** button. To create a test report, press **Save**.

If readings in the fields **Ratio error**, % and **Phase error**, **min** exceed their permissible threshold values, the fields are highlighted in red.



3.3.1.4 Correction of channels

The procedure of channel correction should be performed before testing (verification) of analog current or voltage transformers to provide considerably better comparison accuracy.

The correction of channels mode is applicable to testing of conventional transformers only. Correction should be made in 30 min (or later) after applying power to the EM61850.

Note! Prior to starting the Correction mode make sure that the measurement range set in the EM-61850 is no less than the nominal value of the secondary of the reference transformer. Correction should be repeated each time after changing any measurement range.

To start correction, apply voltage/current to the primary of the reference transformer (that equals its primary rated value) and apply the voltage/current from the secondary of the reference transformer to the both voltage/current channels A and B of the EM61850.

Click on the Start button. At this time, the EM-61850 will carry out correction, namely it will electronically compensate both amplitude and phase shift differences between signals in channels A and B.

To obtain the highest possible measurement accuracy, it is recommended to carry out the correction of channels after a considerable (greater than 5 $^{\circ}$ C) drop in ambient temperature and after each measurement range change.

3.3.2 Verification of Merging Units

The Merging Unit menu allows the user to perform verification over all channels (phase voltages, line voltages and current).

nase voltage ne voltage	Cha	innel A			Add Line		Delete lin	ie 📄	Op	en in othe	er window	
Test # 1		U, V	U ref. V	U dut., V	ΔU, V	δυ, %	Error limit δU, %	αU ref., °	αU dut., °	ΔαU, °	Error limit Δαυ, °	
		10	9.707	9.7	-0.007286	-0.07511	0.1	11.61	-9.263E-8	-11.61	0.1	
11 10	1	10	9.707	9.7	-0.007194	-0.07416	0.1	10.98	-7.83E-8	-10.98	0.1	
mor limit SIL 0.1	2	0	0	0	Ð	0	0	0	0	D	0	
From Minine GO, 10,1	3	0	0	0	0	0	0	0	0	0	0	
or limit $\Delta \alpha U$, 0.1	4	0	0	0	0	0	0	0	0	0	0	
	5.	0	0	0	0	0	0	0	0	0	0	
Save	7	0	0	0	0	0	0	0	0	0	0	
Load	8	0	0	0	0	0	0	0	0	0	0	
	9	0	0	0	0	0	0	0	0	0	0	
Export report	10	0	0	0	0	0	0	0	0	0	0	
									Signal	quality:	ok	

3.3.2.1 Verification

The **Add line** button adds an actual measurement (made for the channel selected in the topleft fields) to the table of measurements. The **Delete line** button deletes the latest record.

The **Open in other window** button allows the user to open the tables of measurements for all channels.

The **Save** button saves current test results to a file. Thus a verification procedure can be interrupted and then resumed by pressing the **Load** button.

The **Export report** button is used to create a test report (in the form of an rtf file).

3.3.2.2 Specification

v1					
	Ref. name	EM61850			
	Serial #	5			
5	Accuracy class	0,02			
)					
)		Temperature, °C 20			
		Humidity, % 80			
	Pressure, kPa 100 rsburg Network frequency, Hz 50				
Petersburg					
mpany name		THD, % 0.1			
Software check 🗹 Insulation check 🗹	Network voltage, V 220				
on of terminal markings 🖂					
5) Pe m	tersburg pany name Software check ⊠ Insulation check ⊠ n of terminal markings ⊠	Serial # Accuracy class tersburg Ne pany name Software check ☑ Insulation check ☑ n of terminal markings ☑	Serial # 5 Accuracy class 0,02 Temperature, °C 20 Humidity, % 80 Pressure, kPa 100 tersburg Network frequency, Hz 50 pany name THD, % 0,1 Software check ⊠ Network voltage, V 220 Insulation check ⊠ n of terminal markings ⊠		

The **Specification** tab contains the fields where the data for the device under test, reference device and test conditions are specified.

3.3.2.3 Procedure

Verification Specification	Proc	edure	Cor	ntro	bl			
Phase voltage Line voltage					U, V	Error limit δU, %	Error limit ΔαU, °	
Current		0.05 ×	Urated	=	10	0.1	0.1	^
		0.2 ×	Urated	=	40	0.1	0.1	
		1 x	Urated	=	200	0.1	0.1	
Delete line		1.2 ×	Urated	=	240	0.1	0.1	
		0 x		=	0	0	0	
Save		0 x		=	0	0	0	
		0 x		=	0	0	0	
Load		0 x		=	0	0	0	
Procedure		0 x		=	0	0	0	
MU_8.28.2020_7		0 x		=	0	0	0	~
,								

The tab contains the fields where the user can specify a verification procedure as a set of test points, save it to a file (with the **Save** button) and then activate it at any time (with the **Load** button). The tab is optional, and the fields can remain empty. However, if specified, the test points are used in the Verification tab as pop-up tips for signals to be applied to the device under test.

AℤBℤC□N						
U, V	100					
Error limit δU,	0.1					
Error limit ΔαU,	0.1					

3.3.2.4 Control



The Control menu is used to keep watch on the signal quality by monitoring such parameters as total harmonic distortion (THD) and the difference in frequencies of the merging unit under test and the reference one (F). The parameters are highlighted, if their values fall outside the permissible range. Verification is useless and cannot be performed if THD is more than 5% and F is more than 0.001 Hz. Please note that the quality is checked just for the channels marked in the verification tab.

3.3.3 Verification of electrical energy meters

The function will be available in future versions.

3.4 Streams

21.00000 SV1 , RMS 00 RMS(1) 00 F(1), Hz 00 THD, % 00 i (abs), * 00 DC 00	Analog A 009,707 009,706 050,000 001,752 041,499 000,021	B 009.708 009.707 050.000 001.732 041.502 000.032	C 000.028 000.003 057.002 083.498 -79.054 000.027	N 000.115 000.005 056.999 083.148 104.381 -00.114	001.00000 RMS RMS(1) F(1), Hz THD, % Phi (abs), °	SV2 Marsgen0 A 009.700 009.700 050.000 000.001 -00.000	B 009.700 009.700 050.000 000.001 -00.000	C 000.000 000.000 000.000 000.000	N 000.000 000.000 000.000 000.000	
RMS O RMS(1) O F(1), Hz O THD, % O (abs), * O DC O	A 009,707 009,706 050,000 001,752 041,499 000,021	B 009.708 009.707 050.000 001.732 041.502 000.032	C 000.028 000.003 057.002 083.498 -79.054 000.027	N 000.115 000.005 056.999 083.148 104.381 -00.114	RMS RMS(1) F(1), Hz THD, % Phi (abs), °	A 009.700 009.700 050.000 000.001 -00.000	B 009.700 050.000 000.001 -00.000	C 000.000 000.000 000.000 000.000	N 000.000 000.000 000.000 000.000	
RMS O RMS(1) O F(1), Hz O THD, % O i (abs), * O DC O	009.707 009.706 050.000 001.752 041.499 000.021	009.708 009.707 050.000 001.732 041.502 000.032	000.028 000.003 057.002 083.498 -79.054 000.027	000.115 000.005 056.999 083.148 104.381 -00.114	RMS RMS(1) F(1), Hz THD, % Phi (abs), °	009.700 009.700 050.000 000.001 -00.000	009.700 009.700 050.000 000.001 -00.000	000.000 000.000 000.000 000.000	000.000 000.000 000.000 000.000	
RMS(1) 00 F(1), Hz 00 THD, % 00 i (abs), * 00 DC 00	009.706 050.000 001.752 041.499 000.021	009.707 050.000 001.732 041.502 000.032	000.003 057.002 083.498 -79.054 000.027	000.005 056.999 083.148 104.381 -00.114	RMS(1) F(1), Hz THD, % Phi (abs), °	009.700 050.000 000.001 -00.000	009.700 050.000 000.001 -00.000	000.000 000.000 000.000	000.000	
F(1), Hz 0: THD, % 0 (abs), * 0 DC 0	050.000 001.752 041.499 000.021	050.000 001.732 041.502 000.032	057.002 083.498 -79.054 000.027	056.999 083.148 104.381 -00.114	F(1), Hz THD, % Phi (abs), °	050.000 000.001 -00.000	050.000	000.000	000.000	
THD, % 0 (abs), * 0 DC 0	001.752 041.499 000.021	001.732 041.502 000.032	083.498 -79.054 000.027	083.148 104.381 -00.114	THD, % Phi (abs), °	000.001 -00.000	000.001	000.000	000.000	
(abs), * 0- DC 0	041.499 000.021	041.502 000.032	-79.054 000.027	104.381 -00.114	Phi (abs), °	-00.000	-00.000	000.000	000 000	
DC 0	000.021	000.032	000.027	-00.114				050.000	090.000	
					DC	000.000	000.000	000.000	000.000	
						A	В	С	N	
					RMS	-00.072	-00.083	-100.000	-100.000	
					RMS(1)	-00.057	-00.068	-100.000	-100.000	
	-	Reference		Error	F(1), Hz	-00.001	-00.001	-100.000	-100.000	
		Analog	One-by-one	Relative %	THD, %	-99.940	-99.940	-100.000	-100.000	
					Phi, °	-100.000	-100.000	-213.846	-13.777	
					DC	-100.000	-100.000	-100.000	-100.000	
	_							_		 ų,
					A B	C N				
			Volt	age range V	800 800	800 800	x 1000 Source1	sin		

The Streams mode makes it possible to compare 2 streams across all voltage or current phases. The streams are configures in the same way as described for the Comparator tab. Fields:

Scale factors (the fields adjacent to those with the names of streams) – set the multiplier to be applied to the RMS and RMS (1) readings.

Reference – this drop-down list makes it possible to select one of the streams as a reference stream.

The adjacent list is used to select one of the phases as a reference phase. The **One-by-one** option means that each phase signal from one stream will be compared with the corresponding phase signal from another stream.

The Error field is used to select the error type (absolute or relative).



Note! The phase shifts of an internal and external stream can only be compared if the sources of these streams are synchronized. In the case of comparison of two external streams, the synchronization mode of EM61850 is of no importance (see section 3.1.3).

3.5 Multimeter

3.5.1 U, I

Energomonitor-618	50 # 5											~		×
Analog		Points t average	0 3 🜒	3										
U, I	P, 0	2, 5	Phasors	Harmonics	Oscillo	oscope								
		Vol	tage				Curre	int						
	A	В	с	N		A.	В		с	N	Digits after			
RMS, V, A	009.709	009.709	009.707	000.115	004.9	90	004.989) (004.990	004.990	dec. point 3			
RMS(1), V, A	009.707	009.708	009.706	000.005	004.9	90	004.989		004.990	004.990				
DC, V, A	000.021	000.031	000.039	-00.115	-00.0	01	-00.000		000.000	-00.001				
Phi(abs), deg	-36.558	-36.560	-36.559	-120.765	-95.8	47	-95.847		-95.847	-95.847				
F, Hz	050.000	050.000	050.000	056.988	050.0	00	050.000) (050.000	050.000				
THD, %	001.750	001,733	001.743	084,250	000.0	91	000.09	k i	000.091	000.091				
			Ş	symmetrical compo	nents									
		U1 000.0010-	4			11	000.000	13						
		U2 000.00070	0			12	000.000	13						
		U0 009.70692	2			10	004.989	54						
		K2 066.96430	0			K2	103.948	8						
		K0 1.60958E	+6			ко	3.92993	+6						
														,
	10				A	В	C	N				6	0	
ስ 🚆	FO	31	3	Voltage range, V	800	800	800	800	x 1000	Source1	sin	1		
₩	Caro I			Current range, A	10	10	10	10	CTCS	Source2	sin	10	ENG	-100
vected: 192.168.0.101	005120-00			11-176 J										

Fields:

RMS – RMS values of voltage/current
RMS (1) – RMS values of the 1st harmonics of voltage / current
Phi, deg – absolute angles (between voltage/current and PPS per each phase)
F – frequency
DC – DC components of voltages and currents per each phase
THD – Total harmonic distortion
Symmetrical components:

U1(I1) – positive sequence component

U2(I2) – negative sequence component

 $U0 \; (I0) - {\sf zero} \; {\sf sequence} \; {\sf component}$

 $\mathbf{K2}$ – negative sequence ratio

K0 – zero sequence ratio

 $K2 = \frac{U2(I2)}{U1(I1)}$ $K0 = \frac{U0(I0)}{U1(I1)}$

3.5.2 P, Q, S

An	alog	Points to 3	d 3		
U, I	I P, Q, S	Phasors	Harmonics	Oscilloscope	
	А	В	С	N	
U, V	6.47241	6.47284	6.47176	0.076729	
I, A	3.32657	3.3263	3.32655	3.32654	Sum
P, W	16.4927	16.4932	16.4918		49.4776
Q, Var	27.7678	27.7669	27.7642		83.2989
S, VA	32.2964	32.2959	32.2929		96.8852
PF	0.510666	0.510689	0.510694		0.510683
P(1), W	16.4926	16.4931	16.4917		49.4775
Q(1), Var	27.7619	27.7611	27.7583		83.2812
S(1), VA	32.2913	32.2909	32.2877		96.8699
cos(phi)1	0.340496	0.340512	0.340516		
sin(phi)1	0.573155	0.573146	0.573143		
U^I, °	39.52282	39.52319	39.5218		

Fields:

U, V – RMS values of voltage

I, A - RMS values of current

P, **W** – active power

Q, Var – reactive power

S, **VA** – apparent power

 \mathbf{PF} – power factor

P(1), W – active power of the first harmonic

Q (1), Var – reactive power of the first harmonic

S (1), **VA** – apparent power of the first harmonic

Cos(phi)1 – cosine of the angle between the first harmonics of voltage and current Sin(phi)1 – sine of the angle between the first harmonics of voltage and current U^{I} – angle between the first harmonics of voltage and current per each phase Sum – the fields relate to the corresponding parameters of the three-phase system

3.5.3 Phasors



The tab displays numeric values of phase shifts among signals in the channels. The vector diagram shows phasors (angles with respect to PPS).

3.5.4 Harmonics



The buttons **Current / Voltage** allows you to select between current and voltage readings. The **Phase** buttons are used to select a phase to be displayed.

The **Harmonics** field is used to specify a number of harmonics to be measured.

The Interharmonics field provides the same for interharmonics.

Four amplitude graphs related to phases A, B, C, and N are displayed on the right. Harmonic or interharmonic numbers are displayed along the horizontal axis. The vertical axis corresponds to magnitudes.

3.5.5 Oscilloscope



In the **Oscilloscope** mode, the waveforms on the selected channels (based on the measurements over the latest second) are displayed. At the leftmost position of the logarithmic scaling slider the amplitudes within 0 to 0.001 s are plotted. By moving the slider to the rightmost position you can view the complete 1-second curves.

VERIFICATION REPORT

Type: analogue voltage transformer Name: Accuracy class: <u>0</u> Serial No: Rated primary voltage: <u>0</u>, V Rated secondary voltage: <u>0</u>, V Rated frequency: <u>0</u>, Hz Site: Owner: Last verification date, time:

Reference means of verification:

	Reference standard:	Comparator:
Name		Energomonitor-61850
Serial No		
Accuracy class		0.02

Conditions during verification: Temperature $\underline{0}$ °C, Humidity $\underline{0}$, %

Atmospheric pressure **0**, kPa

Network frequency <u>0</u>, Hz, network THD <u>0</u>, %, network voltage <u>0</u>, V

1) Visual inspection and verification of terminal markings: <u>pass</u>

pass, fail

2) Software check: <u>pass</u>

pass, fail

3) Insulation check: <u>pass</u> pass, fail

4) Accuracy test results:

U/Un, %	S, VA	DUT	error
		δ_{f} , %	$\Delta\delta$, min
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Summary result

pass, fail

Verification performed by

Signature

Name and surname

18.08.2020 Date

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INSTALLING EM-61850EXT ON ANOTHER COMPUTER

When installing the program on another PC, some aspects that need to be considered are as follows:

a) EM-61850 has no DHCP server, thus, to provide connection between the EM-61850 and a client computer, it is necessary to set up a static IP address of LAN or WLAN of the client.

For example:

	WLAN	LAN
IP address	192.168.0.11	192.168.0.10
Subnet mask	255.255.255.0	255.255.255.0

b) EM-61850 uses the following IP addresses:

WLAN	LAN
192.168.0.111 (for connection)	192.168.101 (for connection) 192.168.0.2 (in-service) 192.168.0.3 (in service)