

Working Standard

Model WS 2320

Quick Guide

Version 4.4



1. How to ...

1.1 Accessories

There are 6 connectors in Working Standard (WS) body, located top and bottom. These options divide all accessories into 4 categories:

Charging (connector: +12V)

device is battery operated, which means that after any work the WS should be charged

Communication (connectors: USB, RS-232)

- WS measures and stores all data, each meters is saved in internal database. This data can be downloaded into master PC

Measurement of power variables (connectors: In A, In B)

- Device can measure wide spectrum of electrical variables such as voltage, current, angles, power factor, powers, energies, ratios, ... and for that purpose various combinations of current and voltage probes ca be used.

Error measurement and signal output (connector: Aux)

- Optical scanner provides meter's LED capturing and disk revolution gathering. On the other hand WS can be easily checked by other reference meter using proportional frequency output.

1.2 Measurement and Testing

Measurement is carried out in real time. There are several screens available right after device is turned on. The number of screens is influenced by connected probes.

For testing voltage, current and optical sensor is needed. For disk meter calibration is also required in advance. Any test results can be saved in the database.

1.3 How to start

Situation: Connection system: <u>3P4W</u>, <u>electronic meter</u>, WS probes are connected right next to the meters so WS measures exactly the same variables as the meter does. See chapter 5.1 to verify the connection and WS screens.

Connect one voltage and one current probe to WS body (while the body is turned off). Connect also the optical sensor. Turn on the WS. Go to the internal database and define new meter while entering all values. Text fields are optional.

Go to Meter Error Test screen. For electronic meter calibration is not necessary. Run the test. If the error is too far from the limit, check the optical sensor position on the meter face. Run test again or such many times you require and save any of them to the internal memory.

You can addition perform energy tests on corresponding measuring screen.

For transformer tests check chapters within chapter 5.



2. Accessories





3. **Measurement**

MEASURED QUANTITIES:	Load Values	
U Voltage		
I Current	U 220.0 2	20.3 220.1 V
P Active Power	P 1.51k 1.	.83k 1.84k W
Q Reactive Power	Q 1.06k 0.	.000 0.000 var
S Apparent Power	<u>S 1.84K 1.</u> λ 0.819 1.	
λ Power Factor	Φ, 0.000 12	20.0 240.0 °
Ψu Voltage Phase	<u>Ψ. 35.24 3</u>	3.40 40.96 ° 036 0.014 %
Φ _I Current Phase	DF, 0.015 0.	.031 0.017 %
DF _u Distortion Factor of Voltage	P _* 0.60m 0.	50m 1.10m W
DFr Distortion Factor of Current	50.001 Hz	L123 ¢
P Active Power of Higher Harmonics	E %	
f Frequency		
L1xx Phase Sequence (L123 or L132)		
ΣP Sum of Active Powers	Energy Values	Transformer Test
ΣQ Sum of Reactive Powers		
ΣS Sum of Apparent Powers	U 229.9 230.2 230.1 V I 7.984 8.019 7.986 A	U 110.3 220.8 0.000 V I 10.06 100.0 0.000 A
EP Active Energy	ΣP= 5.192k W	
EQ Reactive Energy	ΣQ= 1.046k var	$\frac{CT: r_{nom} = 10}{r_{10} r_{10} r$
ES Apparent Energy	Ep 2.41k 2.95k 2.94k Ws	erLx/L1 -0.60 0.000 %
ΣEP Sum of Active Energies	Eq 1.67k 0.000 0.000 vars	ΦLx-L1 60.12 0.000 °
ΣEQ Sum of Reactive Energies	<u>Es 2.94K 2.95K 2.94K VAs</u> Σερ= 8.308k Ws	VT: r _{nom} = 2
ΣES Sum of Apparent Energies	ΣEq= 1.673k vars	rLx/L1 2.002 0.000
(CT) Current Transformer	ΣEs= 8.831k VAs	er Lx/L1 0.090 0.000 % Ψιx-L1 29.85 0.000 °
(PT) Voltage Transformer		
ratio, r _{B/A} Measured Transmission Ratio		
phase, $\phi_{B/A}$ Measured Phase Error		
		m
Vector Diagram	L3 Harmonics	L2 L3 L1 L2 L3
U 220.0 220.3 2	20.1 V U 229.9 2	30.0 230.0 V U 229.9 230.0 230.1 V
I 10.03 10.53 1	0.94 A 84k W P 1 51k 1	Image: 1008 7.982 A Image: 8.008 8.025 7.988 A 84k 1 84k W Image: 1 8.008 8.025 7.988 A
Q 1.06k 0.000 0	.000 var Q 1.06k 0	.000 0.000 var Q 1.11k 0.000 0.000 var
	50.00 Hz	
	80	
	60 -	
		20
03 0217		
	L123 1	

Main pages for configurations other than one voltage and one current sensor:

Act	ual Value	es (I+I)		12:34		
	L1	L2	L3			
Ia	10.10	10.30	10.20	А		
φ	0.000	120.0	240.0	0		
\mathbf{DF}_{r}	0.021	0.036	0.014	%		
Ib	100.1	100.2	100.1	Α		
φ	0.000	120.0	240.0	0		
DF	0.015	0.031	0.017	%		
СТ	r:	r nom	= 10			
$\Gamma_{B/B}$	9.911	9.728	9.814			
er.	-0.89	-2.72	-1.86	%		
Ψ	0.000	0.000	0.000	0		
50	50.00132 Hz					
ľ.		E	E.	X		

Act	ual Value	es (U+U)		
	L1	L2	L3	
Ua	110.2	110.3	110.1	V
Φ_{u}	0.000	120.0	240.0	0
\mathbf{DF}_{o}	0.021	0.036	0.014	%
Ub	220.1	220.2	220.1	V
Ψ	30.00	150.0	270.0	0
DF ₀	0.015	0.031	0.017	%
٧٦	Г:	r nom	= 2	
V 1 r _{e/e}	Г: 1.997	r _{nom} 1.996	= 2 1.999	
V7 r _{8/8} er.	「: 1.997 -0.14	r _{nom} 1.996 -0.18	= 2 1.999 -0.05	%
V1 Γ _{ε/8} er. Φ _{ε-8}	「: 1.997 -0.14 30.00	r _{nom} 1.996 -0.18 30.00	= 2 1.999 -0.05 30.00	%
V1 Γ _{6/6} er. Φ _{8:6}	1.997 -0.14 30.00	r _{nom} 1.996 -0.18 30.00 2 Hz	= 2 1.999 -0.05 30.00	%

L1 I 10.03 Ψ _i 0.000 DF _i 0.015	L2 100.5 60.10 0.031	L3 0.000 0.000 0.017	A ° %	
I 10.03 Ψ ₁ 0.000 DF ₁ 0.015	100.5 60.10 0.031	0.000 0.000 0.017	A ° %	
Ψ ₁ 0.000 DF ₁ 0.015	60.10 0.031	0.000	° %	
DF, 0.015	0.031	0.017	%	
ст.	_	- 10		
U I.	Fnom	= 10		
rLx/L1	10.02	0.000		
er _{Lx/L1}	0.199	0.000	%	
ΦLx-L1	60.10	0.000	0	
49.99934 Hz				
気		ലം പ്		
		n.	\mathcal{N}	





4. Testing



Input Type:

Energy:

Const: Const Type:

Error:

Deviation:

Samples: 0

LED

Active 1000.0000 i/kWh

Secondary

0.747 %

0.464 %

5

CT-ratio: 1.000 VT-ratio: 1.000

Impulses:

Ē



5. Connection Examples



5.1 WS on Secondary Side, 3P4W

Basic Screens:

Load Values	12:34	Energy Values	12:34	Vector Diagram	1234	
↓ L1 L2 L3	•	L1 L2	L3	L1 L	2 L3	
U 220.0 220.3 220.1	V	U 230.2 229.9 2	230.1 V	U 220.0 22	0.3 220.1 V	
I 10.03 10.53 10.94	A	I 8.026 8.029 7	7.999 A	I 10.03 10	.53 10.94 A	
P 1.62k 1.84k 1.84k	W	ΣP=5.15588	κW	P 1.62k 1.8	34k 1.84k W	
Q 891.1 0.000 0.000	var	ΣQ= 1.12002	k var	Q 891.1 0.0	00 0.000 var	
s 1.85k 1.84k 1.84k	XA	Σs= 5.53414	k VA		E0 00.00	
λ 0.876 1.000 1.000		Ep 2.35k 2.95k 2	.95k Ws	Uler	50.00 HZ	
Ψ 0.000 120.0 240.0	0	Eg 1.79k 0.000 0	.000 vars		1	
Ψ. 35.24 33.40 40.96	•	Es 2.96k 2.95k 2	.95k VAs		1	
PE 0.021 0.036 0.014	l %	ΣEp= 8,24941	k Ws			
PF 0.015 0.031 0.017	9/0	$\Sigma E_0 = 1.79203$	k vars		<u> </u>	
P.0.60m0.50m1.10m	h W	$\Sigma F_{S} = 8.85462$	κ VΔs	U3 U,	² 12 [/]	
		40.000 \	1100	3000	104	
50.001 Hz L1.	23 🗣	49.999 Hz	L123	<u></u>	-10/1 L123	
Ē 🔏 🖃 💵 🛛	X	🙆 5% 🗖 🖥	888 📈		E X	C,
Harmonics	1234	Curve	1284	Harmonics	1234	
Harmonics	12:34	Curve	1234 L3	Harmonics	Phase [°]	
Harmonics L1 L2 L3 U 229.9 230.3 229.8		Curve L1 L2 U 230.2 229.9 2	L3 230.0 ∨	Harmonics	Phase [°] 0 (0.000)	
L1 L2 L3 U 229.9 230.3 229.8 I 8.002 8.024 8.027		Curve L1 L2 U 230.2 229.9 2 I 8.002 7.983 2	L3 230.0 V 7.996 A	Harmonics L1 U [%] 1. 100 2. 0.0261 3. 4.3483	Phase [°] 0 (0.000) 10.256 90.254	
Harmonics L1 L2 L3 U 229.9 230.3 229.8 I 8.002 8.024 8.027 P 1.56k 1.85k 1.84k		Curve L1 L2 U 230.2 229.9 7 I 8.002 7.983 7 P 1.58k 1.84k 1	L3 230.0 V 7.996 A 1.84k W	Harmonics L1 U [%] 1. 100 2. 0.0261 3. 4.3483 4. 0.0345	1234 Phase [°] 0 (0.000) 10.256 90.254 220.787	
L1 L2 L3 U 229.9 230.3 229.8 I 8.002 8.024 8.027 P 1.56k 1.85k 1.84k Q 978.6 0.000 0.000	V / A (W) Var	Curve L1 L2 U 230.2 229.9 2 I 8.002 7.983 2 P 1.58k 1.84k 1 Q 939.5 0.000 0	L3 230.0 V 7.996 A L.84k W 0.000 var	Harmonics L1 U [%] 1 1. 100 2. 0.0261 3. 4.3483 4. 0.0345 5. 3.0684 6. 0.0235	Phase [°] 0 (0.000) 10.256 90.254 220.787 159.456 251.654	
L1 L2 L3 U 229.9 230.3 229.8 I 8.002 8.024 8.027 P 1.56k 1.85k 1.84k Q 978.6 0.000 0.000	V A W var	Curve L1 L2 U 230.2 229.9 7 I 8.002 7.983 7 P 1.58k 1.84k 1 Q 939.5 0.000 0	L3 230.0 V 7.996 A 1.84k W 0.000 var	Harmonics L1 U [%] 1. 100 2. 0.0261 3. 4.3483 4. 0.0345 5. 3.0684 6. 0.0235 7. 0.7355	Phase [°] 0 (0.000) 10.256 90.254 220.787 159.456 261.654 0.468	
Harmonics L1 L2 L3 U 229.9 230.3 229.8 I 8.002 8.024 8.027 P 1.56k 1.85k 1.84k Q 978.6 0.000 0.000 100	1234 V A W Var I1	Curve U 230.2 229.9 2 I 8.002 7.983 7 P 1.58k 1.84k 1 Q 939.5 0.000 0	1234 L3 230.0 V 7.996 A 84k W 0.000 var	Harmonics L1 U [%] 1. 100 2. 0.0261 3. 4.3483 4. 0.0345 5. 3.0684 6. 0.0235 7. 0.7355 8. 0.0312 8. 0.0312	T234 Phase [°] 0 (0.000) 10.256 90.254 220.787 159.456 261.654 261.654 0.468 145.218	
Harmonics L1 L2 L3 U 229.9 230.3 229.8 I 8.002 8.024 8.027 P 1.56k 1.85k 1.84k Q 978.6 0.000 0.000 100- 80 -	1234 V / A (W) Var 11 12 12	Curve U 230.2 229.9 2 I 8.002 7.983 7 P 1.58k 1.84k 1 Q 939.5 0.000 0	L3 230.0 V 7.996 A 1.84k W 0.000 var	Harmonics L1 U [%] 1. 100 2. 0.0261 3. 4.3483 4. 0.0345 5. 3.0684 6. 0.0235 7. 0.7355 8. 0.0312 9. 0.4130 10. 0.0451	1234 Phase [°] 0 (0.000) 10.256 90.254 220.787 159.456 261.654 0.468 145.218 12.846 145.218 12.846	
L1 L2 L3 U 229.9 230.3 229.8 I 8.002 8.024 8.027 P 1.56k 1.85k 1.84k Q 978.6 0.000 0.000 100- 80 - 60 - -	V A V Var	Curve U 230.2 229.9 2 I 8.002 7.983 2 P 1.58k 1.84k 1 Q 939.5 0.000 0	L3 230.0 V 7.996 A L.84k W 0.000 var 11 12 13 15 16 16 17 17 18 19 10 10 10 10 10 10 10 10 10 10	Harmonics L1 U [%] 1. 100 2. 0.0261 3. 4.3483 4. 0.0345 5. 3.0684 6. 0.0235 7. 0.7355 8. 0.0312 9. 0.4130 10. 0.0451 11. 0.1723	1234 Phase [°] 0 (0.000) 10.256 90.254 220.787 159.456 261.654 0.468 145.218 12.846 181.138 23.814	
L1 L2 L3 U 229.9 230.3 229.8 I 8.002 8.024 8.027 P 1.56k 1.85k 1.84k Q 978.6 0.000 0.000 100 60 40 40	12234 1 1 1 12 13	Curve U 230.2 229.9 7 I 8.002 7.983 7 P 1.58k 1.84k 1 Q 939.5 0.000 0	L3 230.0 V 7.996 A L.84k W 0.000 var	Harmonics L1 U [%] 1. 100 2. 0.0261 3. 4.3483 4. 0.0345 5. 3.0684 6. 0.0235 7. 0.7355 8. 0.0312 9. 0.4130 10. 0.0451 11. 0.1723 12. 0.0075 13. 0.1574	1234 Phase [°] 0 (0.000) 10.256 90.254 220.787 159.456 261.654 0.468 145.218 12.846 181.138 23.814 89.231 245.674	
Harmonics L1 L2 L3 U 229.9 230.3 229.8 I 8.002 8.024 8.027 P 1.56k 1.85k 1.84k Q 978.6 0.0000 0.0000 100 60 40 40 20 4 4 4	V A W Var	Curve U 230.2 229.9 7 I 8.002 7.983 7 P 1.58k 1.84k 7 Q 939.5 0.000 0	L3 230.0 V 7.996 A L.84k W 0.000 var	Harmonics L1 U [%] 1. 100 2. 0.0261 3. 4.3483 4. 0.0345 5. 3.0684 6. 0.0235 7. 0.7355 8. 0.0312 9. 0.4130 10. 0.0451 11. 0.1723 12. 0.0075 13. 0.1574 14. 0.0180	Phase [°] 0 (0.000) 10.256 90.254 220.787 159.456 251.654 0.468 145.218 12.846 181.138 23.814 89.231 245.674 290.841	
Harmonics L1 L2 L3 U 229.9 230.3 229.8 I 8.002 8.024 8.027 P 1.56k 1.85k 1.84k Q 978.6 0.000 0.000 100- 80 - 60 - 40 - 20 -	1234 V A W Var I1 I2 I3 V	Curve L1 L2 U 230.2 229.9 7 I 8.002 7.983 7 P 1.58k 1.84k 1 Q 939.5 0.000 0	L3 230.0 V 7.996 A L.84k W 0.000 var	Harmonics L1 U [%] 1. 100 2. 0.0261 3. 4.3483 4. 0.0345 5. 3.0684 6. 0.0235 7. 0.7355 8. 0.0312 9. 0.4130 10. 0.0451 11. 0.1723 12. 0.0075 13. 0.1574 14. 0.0180 15. 0.1211 16. 0.055	Phase [°] 0 (0.000) 10.256 90.254 220.787 159.456 261.654 0.468 145.218 12.846 181.138 23.814 89.231 245.674 290.841 48.871 32.976	
Harmonics U 229.9 230.3 229.8 I 8.002 8.024 8.027 P 1.56k 1.85k 1.84k Q 978.6 0.000 0.000 100 80 60 40 20 0	1234 V A W Var 11 12 13 10	Curve U 230.2 229.9 2 I 8.002 7.983 7 P 1.58k 1.84k 1 Q 939.5 0.000 0	1234 230.0 V 7.996 A 84k W 0.000 var 11 12 13 t(ms) 20	Harmonics L1 U [%] 1. 100 2. 0.0261 3. 4.3483 4. 0.0345 5. 3.0684 6. 0.0235 7. 0.7355 8. 0.0312 9. 0.4130 10. 0.0451 11. 0.1723 12. 0.0075 13. 0.1574 14. 0.0180 15. 0.1211 16. 0.0050 17. 0.1346	T234 Phase [°] 0 (0.000) 10.256 90.254 220.787 159.456 261.654 0.468 145.218 12.846 145.218 12.846 181.138 23.814 89.231 245.674 290.841 48.871 32.876 52.211	
Harmonics L1 L2 L3 U 229.9 230.3 229.8 I 8.002 8.024 8.027 P 1.56k 1.85k 1.84k Q 978.6 0.000 0.000 100- 80 - 60 - 40 - 20 - 0 - 1 - 5	1234 V A W Var 11 12 13	Curve U 230.2 229.9 2 I 8.002 7.983 7 P 1.58k 1.84k 1 Q 939.5 0.000 0	1234 230.0 V 7.996 A 1.84k W 0.000 var 11 12 13 r(ms) 20	Harmonics L1 U [%] 1. 100 2. 0.0261 3. 4.3483 4. 0.0345 5. 3.0684 6. 0.0235 7. 0.7355 8. 0.0312 9. 0.4130 10. 0.0451 11. 0.1723 12. 0.0075 13. 0.1574 14. 0.0180 15. 0.1211 16. 0.0050 17. 0.1346	Phase [°] 0 (0.000) 10.256 90.254 220.787 159.456 261.654 0.468 145.218 12.846 181.138 23.814 89.231 245.674 245.674 245.674 245.871 32.876 52.211	
Harmonics L1 L2 L3 U 229.9 230.3 229.8 I 8.002 8.024 8.027 P 1.56k 1.85k 1.84k Q 978.6 0.000 0.000 100- 80 - 60 - 40 - 20 - 0 - 1 5 - 5 - C 2 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0	1234 V A W Var 11 12 13	Curve U 230.2 229.9 2 I 8.002 7.983 7 P 1.58k 1.84k 1 Q 939.5 0.000 0 Curve Curve P 1.58k 1.84k 1 Q 939.5 0.000 0 Curve	L3 230.0 V 7.996 A L.84k W 0.000 Var 11 12 13 r(ms) 20	Harmonics L1 U [%] 1. 100 2. 0.0261 3. 4.3483 4. 0.0345 5. 3.0684 6. 0.0235 7. 0.7355 8. 0.0312 9. 0.4130 10. 0.0451 11. 0.1723 12. 0.0075 13. 0.1574 14. 0.0180 15. 0.1211 16. 0.0050 17. 0.1346	1234 Phase [°] 0 (0.000) 10.256 90.254 220.787 159.456 261.654 0.468 145.218 12.846 181.138 23.814 89.231 245.674 245.674 245.674 245.674 245.674 245.674 245.674 29.841 48.871 32.876 52.211	*

Cyclically F1

* F3 from Harmonics screen



Load V	alues	12:34		
•	L1	•		
U	230.14	V		
I	8.0159	А		
Р	1.4764k	W		
Q	1.1061k	var		
S	1.8448k	VA		
λ	0.8003			
φ	0.9750	0		
φ	37.815	0		
DF	0.0210	%		
DFI	0.0150	%		
P,	49.048	W		
49.99933 Hz				
E	% 🛃 ∭	X		

Load V	/alues	1234		
•	L2	▲		
U	230.06	V		
I	8.0245	Α		
Р	1.8461k	W		
Q	0.000	var		
S	1.8461k	VA		
λ	1.0000			
φ	119.00	0		
φ	0.000	0		
DF	0.0360	%		
DF	0.0310	%		
P,	48.456	W		
49.99933 Hz 🗘				
E	% (≓ ∭	X		

Load V	/alues	12:34		
•	L3	¥		
U	230.13	V		
I	8.0138	Α		
Р	1.8442k	W		
Q	0.000	var		
S	1.8442k	VA		
λ	1.0000			
φ	239.00	0		
φ	0.000	0		
DF	0.0140	%		
DFI	0.0170	%		
P,	52.037	W		
50.00025 Hz 🗘				
Ē	% 🔁 ∭	X		

Cyclically button right (opposite direction by left button)

Load V	/alues	12:34		
•	L1	•		
	229.91	V		
UPP	395.85	V		
φ	0.1856	0		
ΦυΡΡ	119.39	0		
I	8.0145	A		
φ	38.355	0		
λ	0.7862			
Р	1.4486k	W		
Q	1.1387k	var		
S	1.8426k	VA		
50.00124 Hz \$				
Ē	% 🔁 ∭	X		

•	LZ	
UPN	230.11	V
UPP	398.63	V
φ	119.00	0
Φυρρ	120.63	0
I	7.9851	A
φ	0.000	0
λ	1.0000	
Р	1.8375k	W
Q	0.000	var
s	1.8375k	VA

123

Load Values

50.0	0105	Hz	\$
E	%	tţ]	X

Load V	/alues	12:34		
•	L3	+		
	230.19	V		
UPP	401.27	V		
Ψ	239.00	0		
Φυρρ	120.02	0		
I	8.0278	Α		
φ	0.000	0		
λ	1.0000			
Р	1.8479k	W		
Q	0.000	var		
S	1.8479k	VA		
50.00105 Hz \$				

Once button down and then right button several times

ad Values L1 L2 L3 **▲** ► U_{PN} 229.9 229.9 230.3 V UPP 395.8 398.6 400.9 V
 Φ₀
 0.186
 119.0
 239.0
 °

 Ψ₀
 0.186
 119.0
 239.0
 °

 Ψ₀
 119.4
 120.6
 120.0
 °

 Ι
 8.014
 7.987
 8.028
 A

 Φ₁
 38.36
 0.0000
 0.0000
 °
λ 0.786 1.000 1.000 P 1.45k 1.84k 1.85k W Q 1.14k 0.000 0.000 var s 1.84k 1.84k 1.85k VA 50.001 Hz L123 ‡ % 00 E

Load Values - Primary						
	L1	L2	L3			
U	230.2	230.1	230.0	V		
Ι	7.990	8.027	7.985	А		
Ρ	1.46k	1.85k	1.84k	W		
Q	1.12k	0.000	0.000	var		
s	1.84k	1.85k	1.84k	VA		
λ	0.794	1.000	1.000			
φ	0.468	119.0	239.0	0		
φ	37.93	0.000	0.000	0		
DF	0.021	0.036	0.014	%		
DFI	0.015	0.031	0.017	%		
P,	50.54	48.77	46.50	W		
50.001 Hz L123 \$						
Ē	%			\mathbb{X}		

Loa	ad Values	- Primar	y	12:34
	L1	L2	L3	
UPN	230.2	230.0	229.8	V
\mathbf{U}_{PP}	396.4	398.2	400.6	V
Ψ	0.096	119.0	239.0	0
ΨυΡΡ	119.5	120.5	120.0	0
Ι	7.989	8.008	7.993	А
φ	32.48	0.000	0.000	0
λ	0.845	1.000	1.000	
Ρ	1.55k	1.84k	1.84k	W
Q	984.9	0.000	0.000	var
s	1.84k	1.84k	1.84k	VA
49	9.999 H	łz	L12	з \$
<u>م</u>			THE S	2
E				\mathcal{N}
			- · · · ·	\sim

Cyclically button down

Other noticeable screens:

Meter Error	Test		12:34
L1	L2	L3	
U 229.8	230.2	230.2	٧
I 8.018	8.027	8.002	Α
< 3P4W	> <	Active	>
< LED >	1000	< i/kWt	
CT: 10 V	T: 2	< Sec.	>
SN: 13590	30103	090 0	2/2
Error:	0.	500 -	/0
Integration tir	ne:	/ 5	1s
Average		0.990	%
riverage.			





* Meter Definition in Database







Basic Screens:

Load \	/alues	12:34	Load Values - Primary		1234
U	229.94	V	U	229.99	V
Ι	8.0137	Α	Ι	8.0248	Α
Ρ	1.4550k	W	Ρ	1.6072k	W
Q	1.1307k	var	Q	907.33	var
S	1.8427k	VA	S	1.8456k	VA
λ	0.7896		λ	0.8708	
φ	38.126	0	φ	29.583	0
DFυ	0.0210	%	DFυ	0.0210	%
$DF_{\mathbf{I}}$	0.0150	%	DF_{I}	0.0150	%
f	50.001	Hz	f	50.001	Hz
P _H	49.707	W 🗢	P _H	53.349	W 🗘
Ê	% 📑	X	Ê	% [≓	×





Other noticeable screens:

Meter Error Test	Energy Test	Add meter 2/3
U 230.14 V	COUNTERS < Sec. >	CURRENT :
I 8.0172 A	#1 21.15 kWh	Primary 50 A
	#2 22.16 kWh	Secondary 5 A
< 1P2W > < Active >	AE 1.01 kwb	
< LED > 50 < i/kWh >		VOLTAGE :
CT: 10 VT: 2 < Prim. >	CT: 10 VT: 2 < Prim. >	Primary 600 V
SN: 1359030103	1P2W	Secondary 300 V
0 500 %	Error 0.876 %	VT-ratio 2
	E 1.00123 kWh	△→人 < OFF >
Samples: 0/5	E/t 75.426 kW	PROTOCOL TEXTS :
Average: 0.519 %	t 4.52 min	Current 1x50/5 A
Deviation: 0.727 %	0 15 min	Voltage 1x600/300 V
CAL 🖹 🖺 💥		

* Meter Definition in Database







Basic Screens:

Load V	/alues			12:34	
U	2	29.9	4	V	
Ι	8	.013	7	А	
Ρ	1.	4550)k	W	
Q	1.	1307	/k	var	
S	1.	1.8427k			
λ	0	.789	6		
φ	3	8.12	6	0	
DFυ	0	.021	0	%	
DFI	0	.015	0	%	
f	5	0.00	1	Hz	
P _H	4	9.70	7	W 🗘	
Ê	%	Ē.		X	

Load V	/alues - Primary	12:34
U	229.99	V
I	8.0248	Α
Р	1.6072k	W
Q	907.33	var
S	1.8456k	VA
λ	0.8708	
φ	29.583	0
DFu	0.0210	%
DFI	0.0150	%
f	50.001	Hz
P _H	53.349	W 🗢
Ē	%	X





Other noticeable screens:

Meter Error Test	Energy Test	Add meter 2/3
U 230.14 V I 8.0172 A	COUNTERS < Sec. > #1 21.15 kWh	CURRENT : Primary <mark>50</mark> A Secondary 5 A
1P2W > < Active >	#2 22.16 kWh ΔΕ 1.01 kWh	CT-ratio 10 VOLTAGE :
CT: 10 VT: 2 < Sec. >	CT: 10 VT: 2 < Sec. >	Primary 600 V Secondary 300 V
SN: 1359030103 Error: 0.509 %	Error 0.876 %	VT-ratio 2
Samples: 0 / 5 Integration time: 1s	E / t 75.426 kW	A + A < OFF > PROTOCOL TEXTS :
Average: 0.519 % Deviation: 0.727 %	0 15 min	Current 1x50/5 A Voltage 1x600/300 V
CAL 🖹 🖺 💥		· · · · · · · · · · · · · · · · · · ·

* Meter Definition in Database



5.4 Current Transformer, one 3f probe, no Voltage



Default Screen:

Act	ual Value	es (I)		121		
	L1	L2	L3			
Ι	10.03	100.5	0.000	Α		
φ	0.000	60.10	0.000	0		
DF	0.015	0.031	0.017	%		
CT: ram = 10						
L		r _{nom}	= 10			
	Lx/L1	r _{nom} 10.02	= 10 0.000			
	Lx/L1	r _{nom} 10.02 0.199	= 10 0.000 0.000	%		
	FLX/L1 FLX/L1 PLX-L1	r _{nom} 10.02 0.199 60.10	= 10 0.000 0.000 0.000	%		
49	FLX/L1 PLX/L1 PLX-L1	г _{пот} 10.02 0.199 60.10	= 10 0.000 0.000 0.000	%		







Default Screen:

Actual Values (I+I)						
	L1	L2	L3			
Ia	10.10	10.30	10.20	Α		
φ	0.000	120.0	240.0	0		
\mathbf{DF}_{I}	0.021	0.036	0.014	%		
Ib	100.1	100.2	100.1	Α		
φ	0.000	120.0	240.0	0		
$\mathbf{DF}_{\mathbf{r}}$	0.015	0.031	0.017	%		
CT: r _{nom} = 10						
СТ	r:	r nom	= 10			
<u>СТ</u> Г _{в/я}	5. 9.911	r _{nom} 9.728	= 10 9.814			
CT r _{e/a}	7: 9.911 -0.89	r _{nom} 9.728 -2.72	= 10 9.814 -1.86	%		
СТ г _{в/я} ег. Фв-я	9.911 -0.89 0.000	r _{nom} 9.728 -2.72 0.000	= 10 9.814 -1.86 0.000	%		
СТ г _{ел} ег Фын	9.911 -0.89 0.000	r _{nom} 9.728 -2.72 0.000 7 Hz	= 10 9.814 -1.86 0.000	%		





6. Database of Meters and Test Results





7. Menu





Measured Data Reading 8.

Step 1 – Installation of Control Software

It is necessary to install to the PC the software supplied in the installation CD or USB flash drive. From supplied medium start the program "install.exe" (when auto-run feature does not start it automatically).

Follow the all installation steps:

- 1 Installation of InterBase database
- 2 Installation of WS Control Software
- 3 Database creation

Step 2 – Interconnection of the Device with PC

Connect the PC to the device through the USB or RS-232 cable.

Step 3 – Communication Parameters Setting

- Start the program ws.exe
- Select menu item Configuration / Parameters from the main program window (Fig. 1) for displaying communication parameters settings window (Fig. 2)
- Select correct port to which the device is connected and communication speed same as is set in device

Surtam Configuration Halo	
synch configuration risk	
Port Foce _ Port Foc	23
Readout Folders Evaluation	
S/N Type Y/M Class Voltage Current Constant Date Connection Customer Address Note1 Note2 Note3 A	
USY100330 KG 21105 2008 1.000 3050/100 V 3X10/05 A 235.00000 3PW 3800/100 V 2X10/05 A 235.00000	
814076246 AMT803 2009 L000 3x200 X 3x65 A 1600.00000 3P4W	
8098154532 ANS 818 2008 1.000 220 V 100 A 1000.00000 2P3W	
139000103 W5 23208 2009 0.200 3000 V 2x120 A 1000.00000 3P4W Selection of Readout Meters	
1098100329 R5 21105 2008 1.000 500 V 120 A 235.00000 39-4V	
8146/0245 AMT (00) 2009 1.000 3x220 V 3x65 A 1600.00000 9P4/V Communication Port Settings	
8/96154632 AV6 558 2008 1.000 220 V 100 A 1000.00000 270 V	
8/46/67/3/5 A4/1803 200/ 1000 3/2/2 V 3/65A 1/600.00000 3P4/V Port	
8098154512 A45 838 2008 L000 220 V 100 A 1000.00000 ···· 293V ···· ··· ··· ··· ··· ··· ···	
Baudrate 57600 V	
Vector degram Hamonics Signal shapes	
ERROR [%]: Stopbits	
StDev [%]:	
Samples: 10	
Int. Period: 1 s	
Fnerrov: Aktivny / /131 112	
Constructs 125 //Mdb	
8 Basic values	
U 398.431 398.244 V	40.1
I 5.007 4.993 A 180°	👗 Cancel
A 0.866 0.996 Imax = 5.007A	
φυ 0.000 ···· 299.990 °	
v v v v v v v v v v	
$H_{1} = H_{1} + H_{2} + H_{3} + H_{4} + H_{4$	neters
Version	

Fig. 1 - Main program window

settings window

Step 4 – Measured Data Reading

Connect the device to the PC and select the appropriate port (in the upper toolbar). The adjacent Device section displays ID of connected WS. You can press the refresh button 2 to re-read these info. Now go to System / Rreadout from menu (or use Readout button located in top toolbar) to read all data from WS device.

Measured data will be transferred into the database of the PC.

🕅 Working Standard Control Software								
System Configuration Help	System Configuration Help							
Port COM3 V Device: WS 2320A /rbi	6 3	Meter	•	()-	A	8	B	
57600,8N1 SN: 1363050530 FW: 4.07/4.12/4.03		Count: 21	Readout	Filter and Sort	Print Protocol	Print Certificate	Show Protocols	



9. Optical Scanner Positioning

Positioning on dynamic (disc) meter



Positioning on static (electronic) meter

