Applied Precision
Measurement and Test Solution

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: 3P4W, electronic meter, 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.

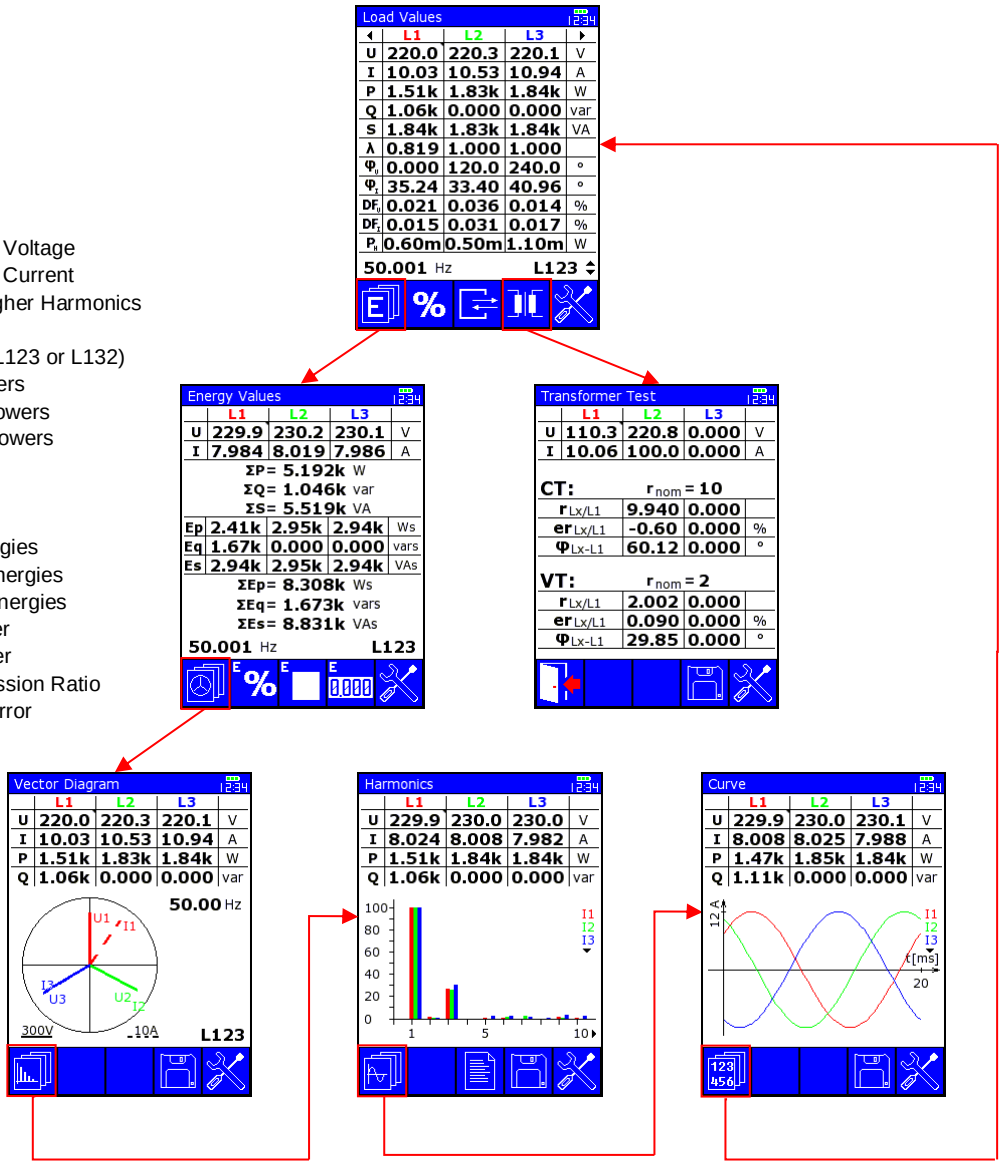
2. Accessories

1 - Voltage Transducer VT 2350A
2 - Voltage Transducer VT 3350A
3 - Current Clamps CC 2312B (120A)
4 - Current Clamps CC 3324C (240A)
5 - Flexible Current Probe FCP 3321
6 - Current Transducer CT 2320
7 - Impulse SO Cable OPTI 2000
8 - Snap Switch WSSS 3000
9 - Optical Sensor OPTS 2100 with Fixing Clamp
10 - Optical Communication Head OPTH 1200
11 - Impulse Output Cable WSIO 2000
12 - USB Communication Cable
13 - Car Outlet Adapter (12 V)
14 - Power Adapter (100 – 240 V)
15 - Portable Printer PP 1000 with Communication Cable

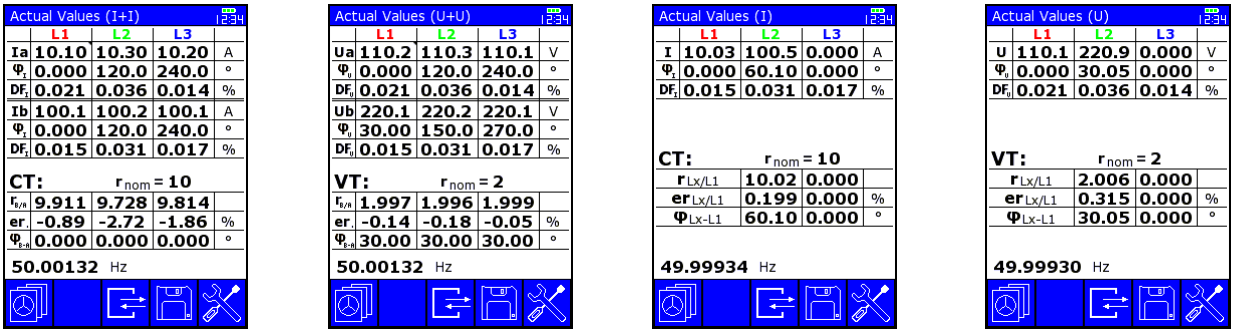
3. Measurement

MEASURED QUANTITIES:

U ..... Voltage
I ..... Current
P ..... Active Power
Q ..... Reactive Power
S ..... Apparent Power
λ ..... Power Factor
φ_U ..... Voltage Phase
φ_I ..... Current Phase
DF_U ..... Distortion Factor of Voltage
DF_I ..... Distortion Factor of Current
P_H ..... Active Power of Higher Harmonics
f ..... Frequency
L1xx ..... Phase Sequence (L123 or L132)
ΣP ..... Sum of Active Powers
ΣQ ..... Sum of Reactive Powers
ΣS ..... Sum of Apparent Powers
EP ..... Active Energy
EQ ..... Reactive Energy
ES ..... Apparent Energy
ΣEP ..... Sum of Active Energies
ΣEQ ..... Sum of Reactive Energies
ΣES ..... Sum of Apparent Energies
(CT) ..... Current Transformer
(PT) ..... Voltage Transformer
ratio, $r_{B/A}$ ..... Measured Transmission Ratio
phase, $\varphi_{B/A}$ .... Measured Phase Error



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

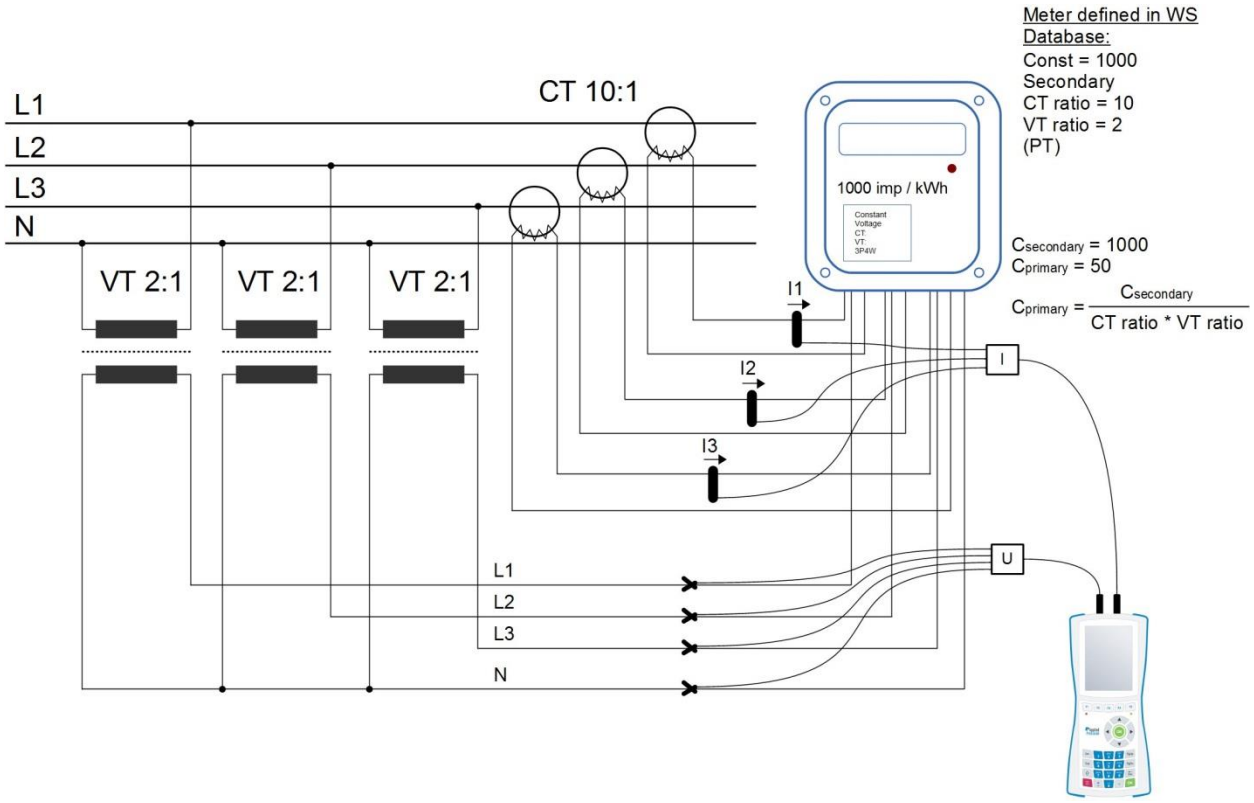


4. Testing

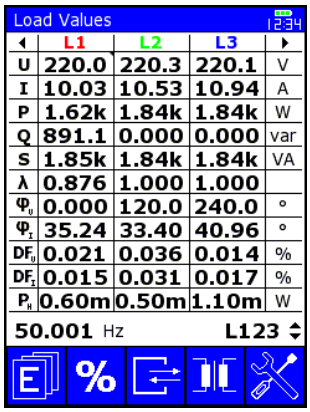

%
Meter Error Test
L1 L2 L3
U 229.9 229.9 230.1 V
I 8.025 7.995 8.029 A
3P4W
Active
LED
1000
i/kWh
CT: 10
VT: 2
Sec.
SN: 1359030103
Error: 0.244 %
Samples: 0 / 5
Integration time: 1s
Average: 0.254 %
Deviation: 0.452 %
CAL
Meter Error Test
L1 L2 L3
U 230.0 230.0 229.9 V
I 8.004 8.008 8.023 A
SN: 1359030103
Error: 0.626 %
Samples: 0 / 5
Impulses: 0 / 5 10s
Average: 0.636 %
Deviation: 0.960 %
Meter Error Test
L1 L2 L3
U 230.3 230.2 229.9 V
I 8.026 8.020 8.005 A
CALIBRATION...
Test result details
SN: 1359030103
Error: 0.122 %
Deviation: 0.619 %
Impulses: 10
Energy: 0.000 Ws
No Error[%] Exp. / Meas. imp.
1. 2989 40000 / 39480
2. 1.3013 40000 / 39479
3. 1.3345 40000 / 39466
4. 1.2998 40000 / 39480
5. 1.3324 40000 / 39467
6. 1.3311 40000 / 39468
7. 1.3320 40000 / 39466
8. 1.3324 40000 / 39465
9. 1.3025 40000 / 39479
Add meter
SN: 1359030103
Type: WS 2320B
Input Type: LED
Energy: Active
Const: 1000.0000 i/kWh
Const Type: Secondary
CT-ratio: 1.000 VT-ratio: 1.000
Error: 0.747 %
Deviation: 0.464 %
Samples: 0 Impulses: 5

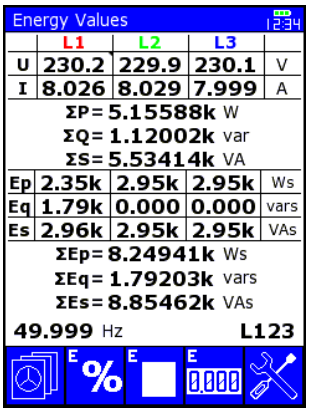
5. Connection Examples

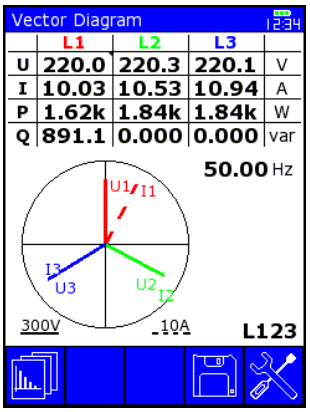
5.1 WS on Secondary Side, 3P4W



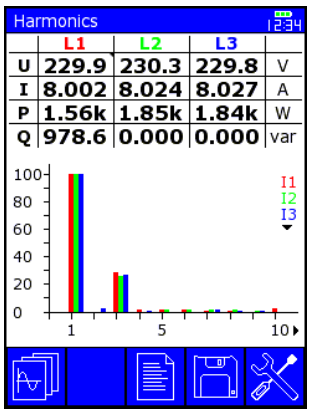
Basic Screens:

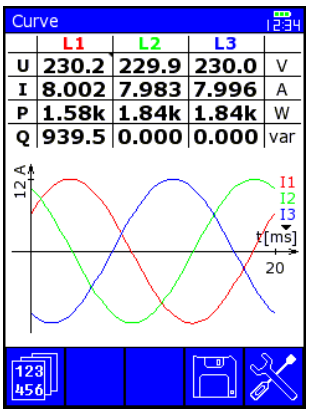


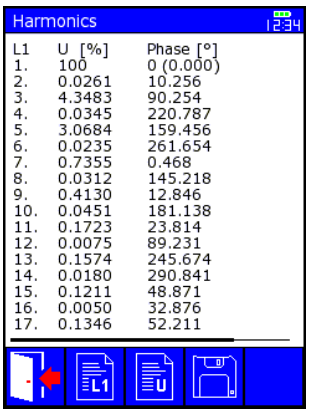




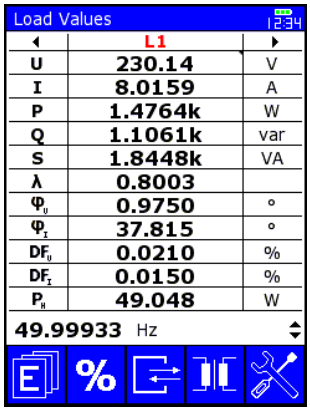
Cyclically F1

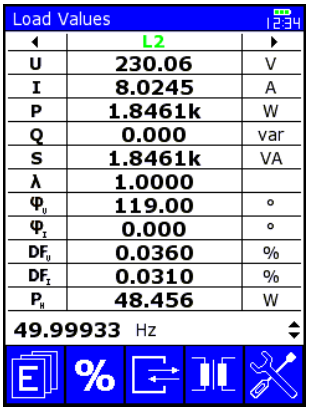


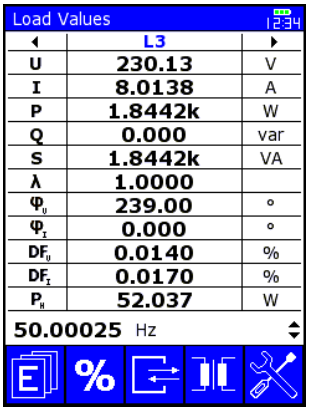




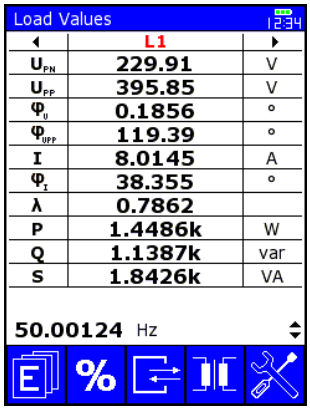
* F3 from Harmonics screen

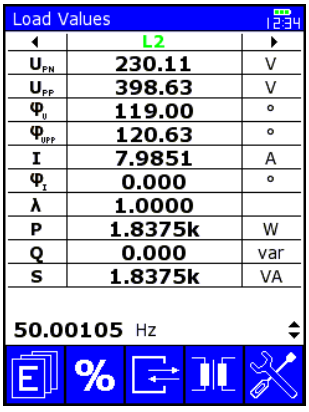


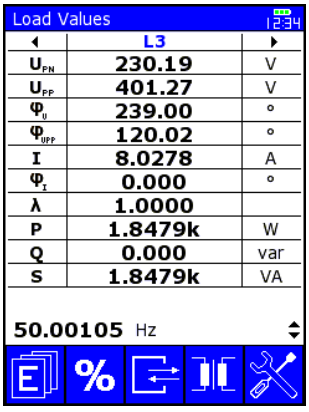




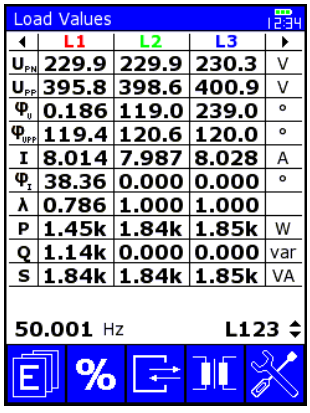
Cyclically button right (opposite direction by left button)

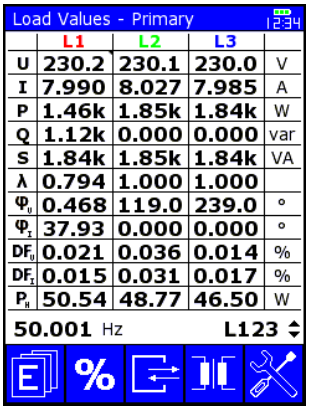


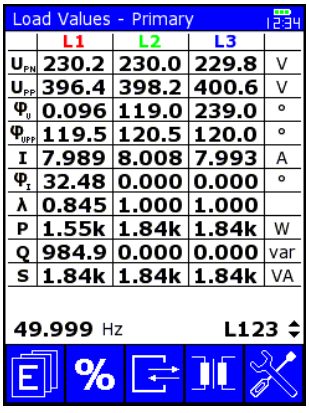




Once button down and then right button several times

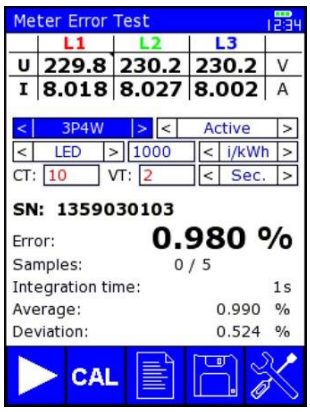


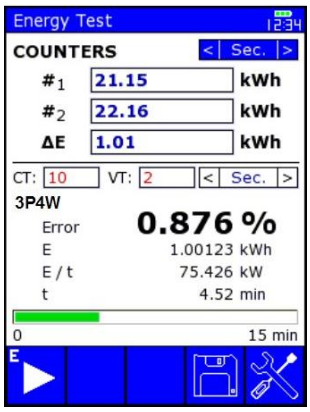


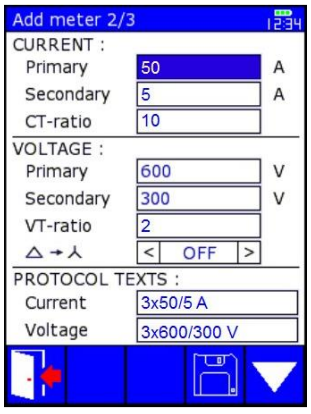


Cyclically button down

Other noticeable screens:







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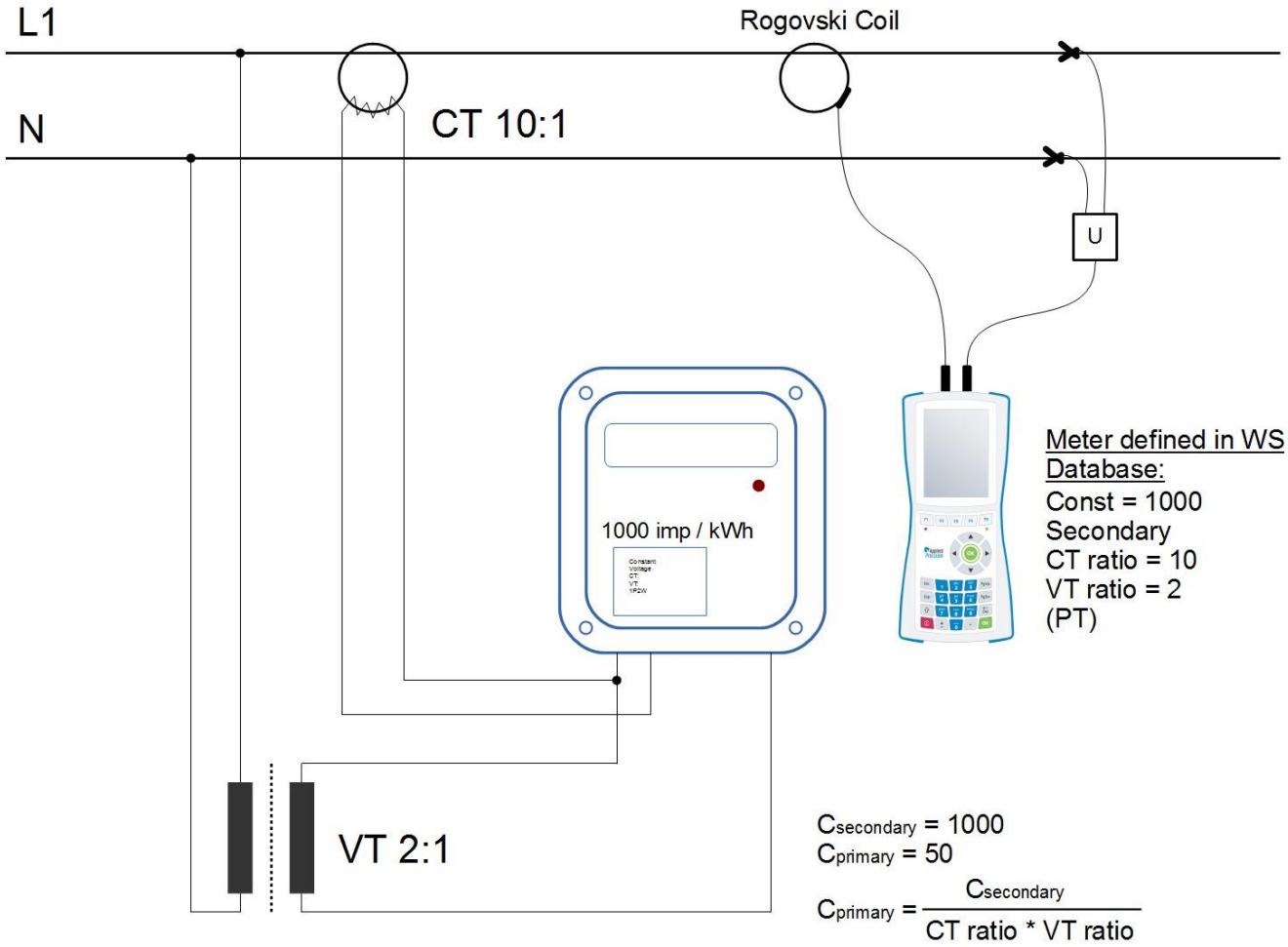
* Meter Definition in Database

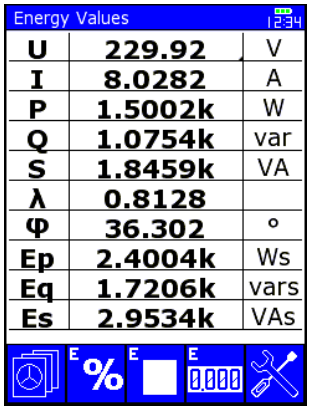
5.2 WS on Primary Side, 1P2W, Rogovski Coil

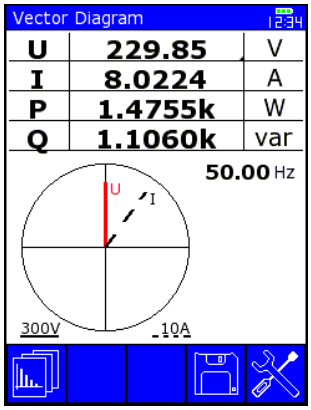


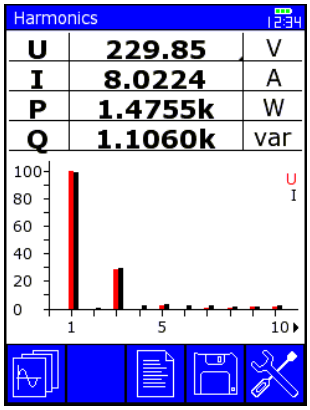
Basic Screens:

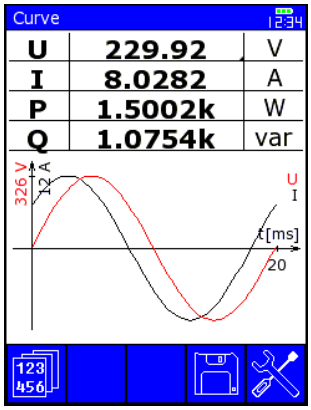
Load Values		
U	229.94	V
I	8.0137	A
P	1.4550k	W
Q	1.1307k	var
S	1.8427k	VA
λ	0.7896	
φ	38.126	°
DF_U	0.0210	%
DF_I	0.0150	%
f	50.001	Hz
P_H	49.707	W

Load Values - Primary		
U	229.99	V
I	8.0248	A
P	1.6072k	W
Q	907.33	var
S	1.8456k	VA
λ	0.8708	
φ	29.583	°
DF_U	0.0210	%
DF_I	0.0150	%
f	50.001	Hz
P_H	53.349	W

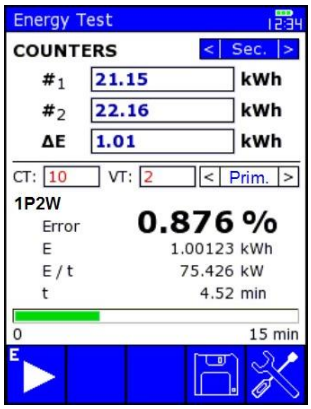


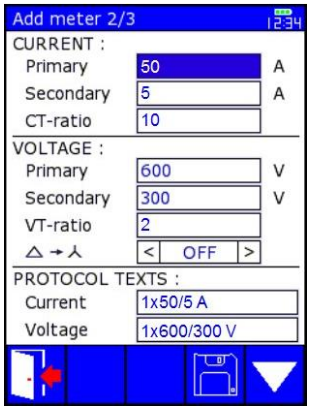






Other noticeable screens:





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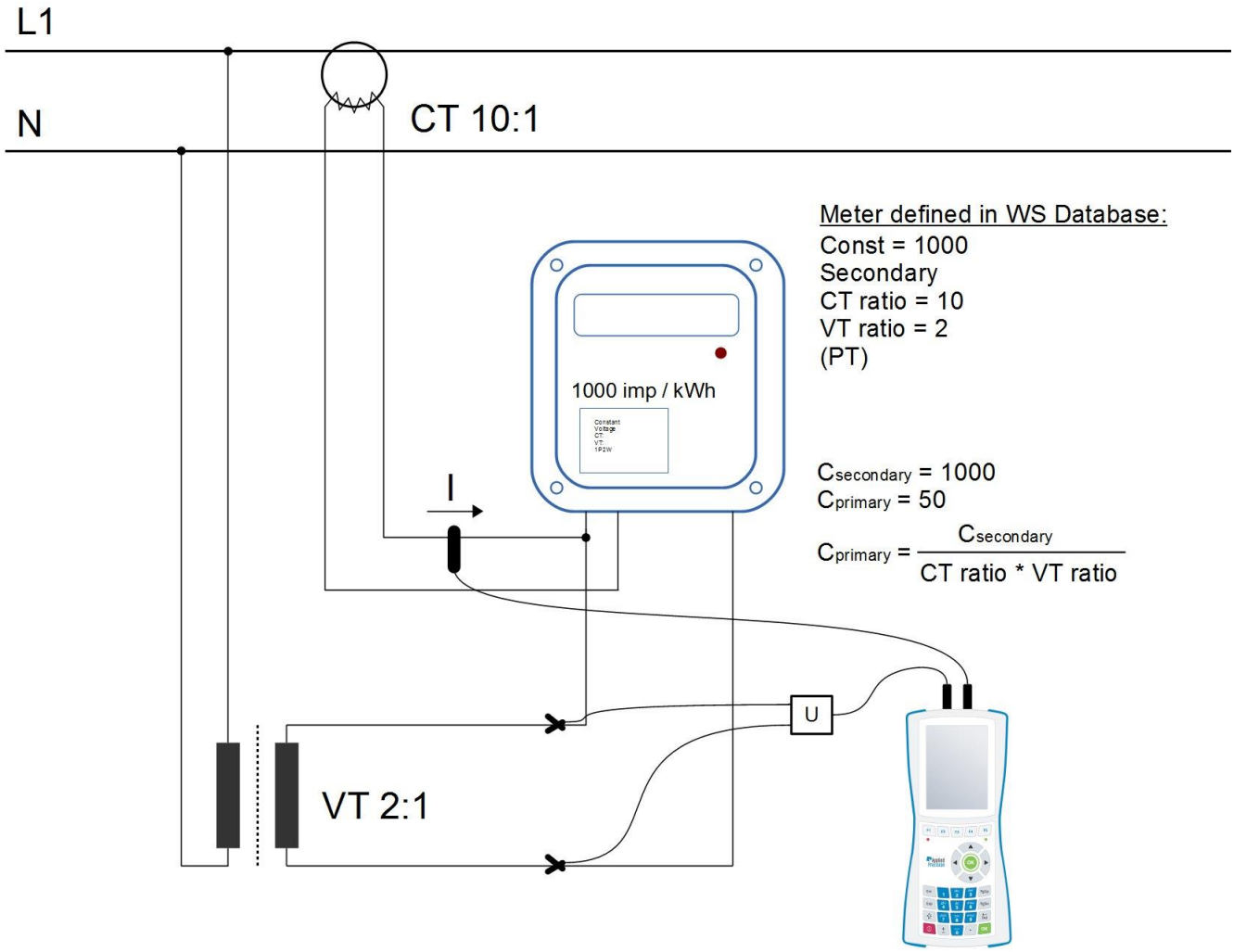
* Meter Definition in Database

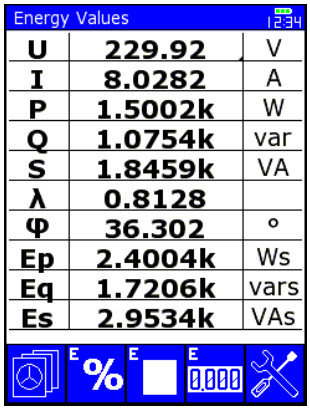
5.3 WS on Secondary Side, 1P2W

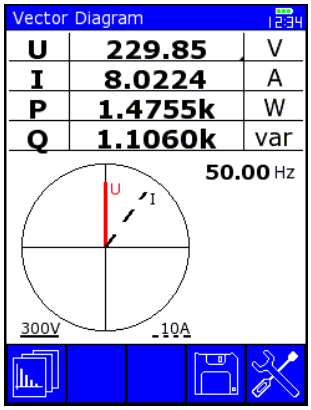


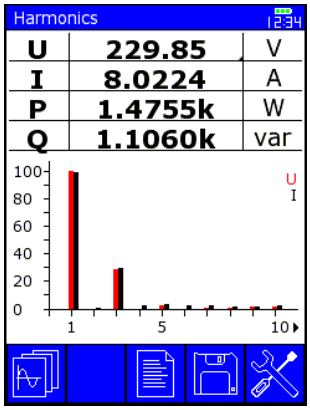
Basic Screens:

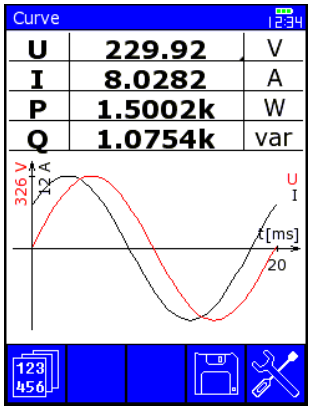
Load Values		
U	229.94	V
I	8.0137	A
P	1.4550k	W
Q	1.1307k	var
S	1.8427k	VA
λ	0.7896	
φ	38.126	°
DF_U	0.0210	%
DF_I	0.0150	%
f	50.001	Hz
P_H	49.707	W

Load Values - Primary		
U	229.99	V
I	8.0248	A
P	1.6072k	W
Q	907.33	var
S	1.8456k	VA
λ	0.8708	
φ	29.583	°
DF_U	0.0210	%
DF_I	0.0150	%
f	50.001	Hz
P_H	53.349	W

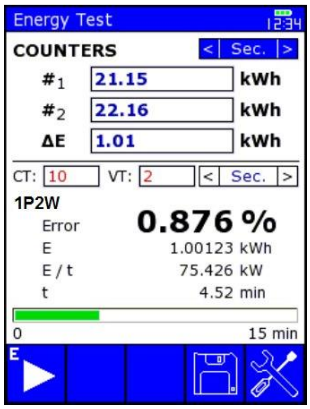


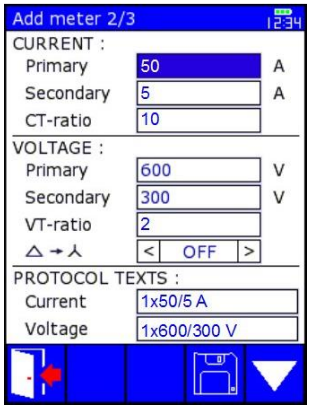






Other noticeable screens:





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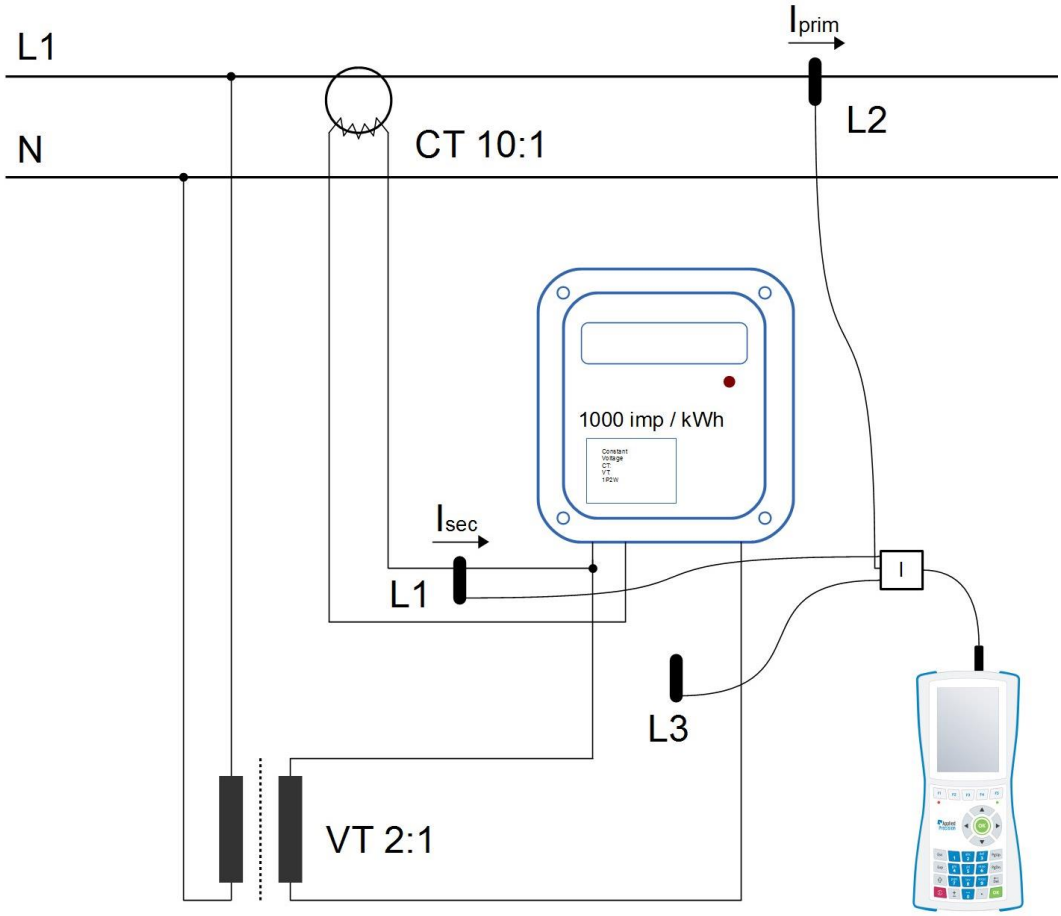
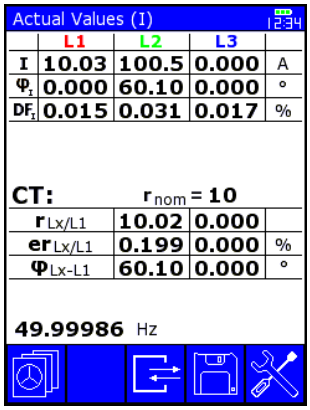
* Meter Definition in Database

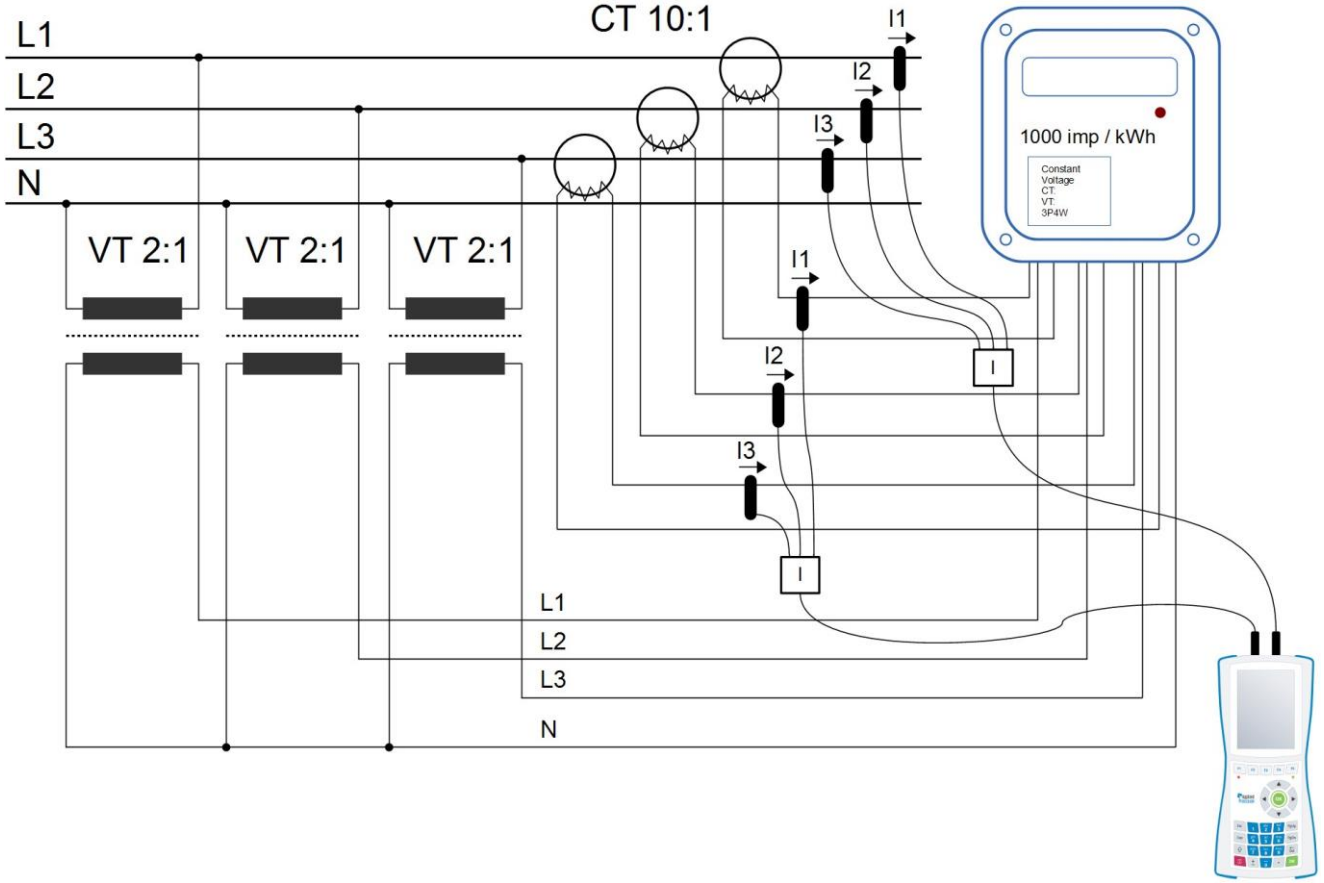
5.4 Current Transformer, one 3f probe, no Voltage



Default Screen:



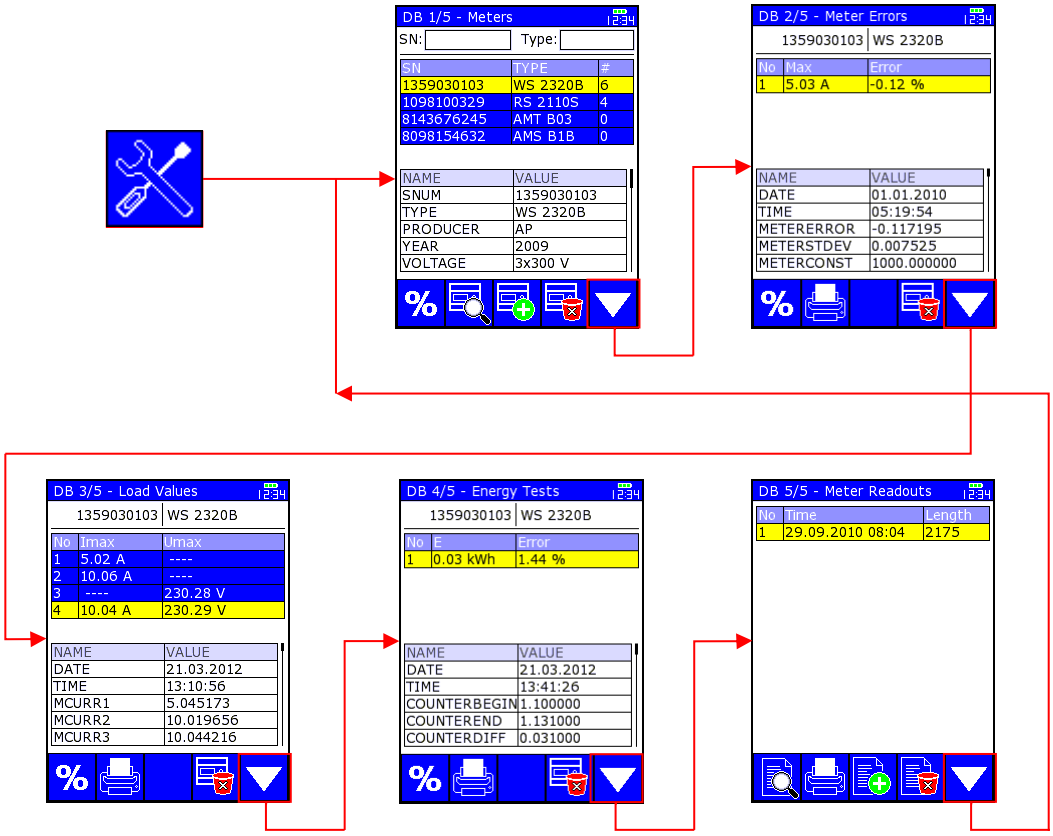
5.5 Current Transformer, two 3f probes, no Voltage



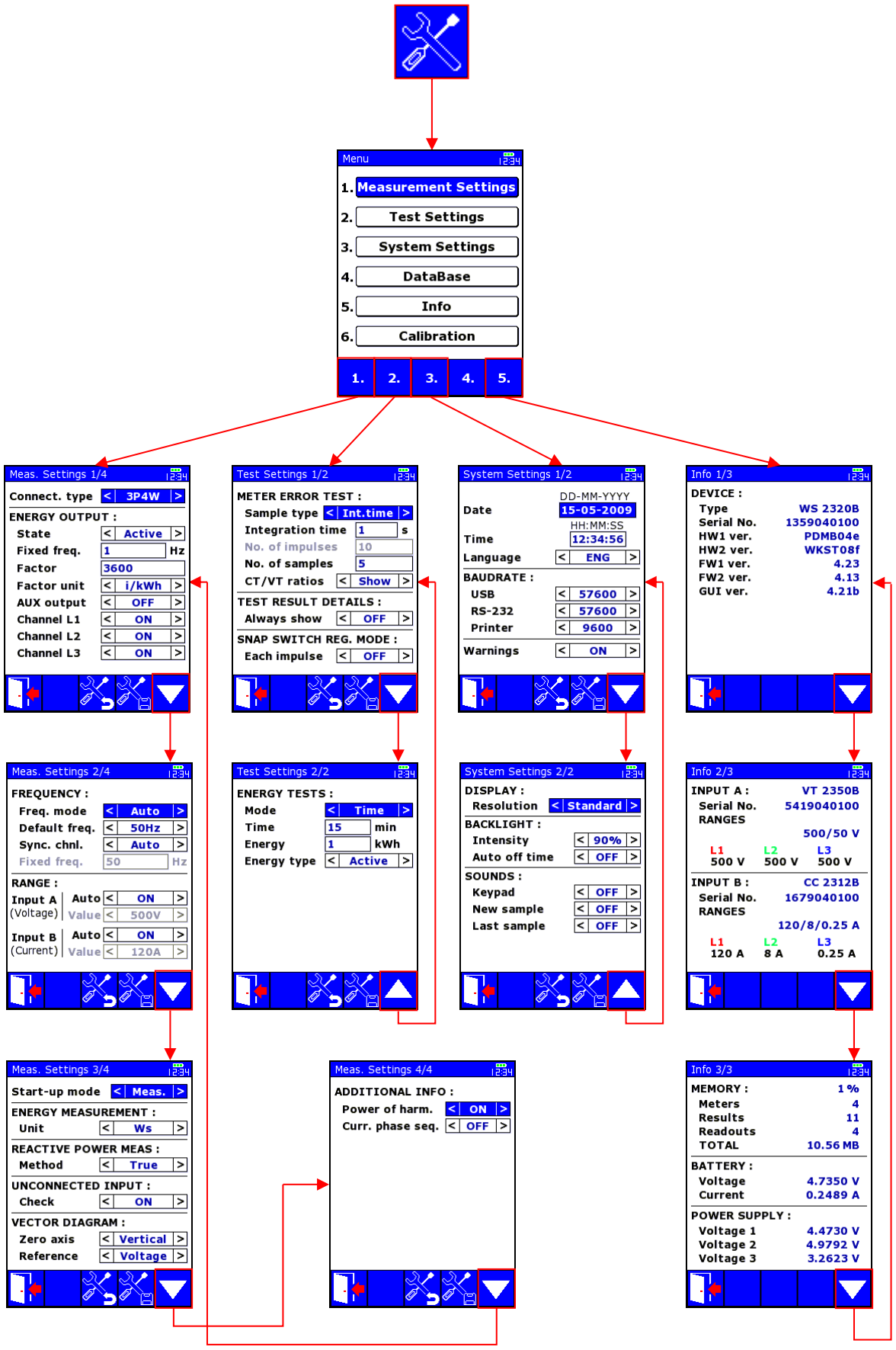
Default Screen:

Actual Values (I+I)				
	L1	L2	L3	
Ia	10.10	10.30	10.20	A
Φ_I	0.000	120.0	240.0	°
DF_I	0.021	0.036	0.014	%
Ib	100.1	100.2	100.1	A
Φ_I	0.000	120.0	240.0	°
DF_I	0.015	0.031	0.017	%
CT:		r_{nom} = 10		
$r_{a/b}$	9.911	9.728	9.814	
er	-0.89	-2.72	-1.86	%
Φ_{a-b}	0.000	0.000	0.000	°
50.00017 Hz				

6. Database of Meters and Test Results



7. Menu


Menu
1. Measurement Settings
2. Test Settings
3. System Settings
4. DataBase
5. Info
6. Calibration
1. 2. 3. 4. 5.
Meas. Settings 1/4
Connect. type 3P4W
ENERGY OUTPUT :
State Active
Fixed freq. 1 Hz
Factor 3600
Factor unit i/kWh
AUX output OFF
Channel L1 ON
Channel L2 ON
Channel L3 ON
Test Settings 1/2
METER ERROR TEST :
Sample type Int.time
Integration time 1 s
No. of impulses 10
No. of samples 5
CT/VT ratios Show
TEST RESULT DETAILS :
Always show OFF
SNAP SWITCH REG. MODE :
Each impulse OFF
System Settings 1/2
Date DD-MM-YYYY 15-05-2009
Time HH:MM:SS 12:34:56
Language ENG
BAUDRATE :
USB 57600
RS-232 57600
Printer 9600
Warnings ON
Info 1/3
DEVICE :
Type WS 2320B
Serial No. 1359040100
HW1 ver. PDMB04e
HW2 ver. WKST08f
FW1 ver. 4.23
FW2 ver. 4.13
GUI ver. 4.21b
Meas. Settings 2/4
FREQUENCY :
Freq. mode Auto
Default freq. 50Hz
Sync. chnl. Auto
Fixed freq. 50 Hz
RANGE :
Input A (Voltage) Auto ON Value 500V
Input B (Current) Auto ON Value 120A
Test Settings 2/2
ENERGY TESTS :
Mode Time
Time 15 min
Energy 1 kWh
Energy type Active
System Settings 2/2
DISPLAY :
Resolution Standard
BACKLIGHT :
Intensity 90%
Auto off time OFF
SOUNDS :
Keypad OFF
New sample OFF
Last sample OFF
Info 2/3
INPUT A : VT 2350B
Serial No. 5419040100
RANGES 500/50 V
L1 500 V L2 500 V L3 500 V
INPUT B : CC 2312B
Serial No. 1679040100
RANGES 120/8/0.25 A
L1 120 A L2 8 A L3 0.25 A
Meas. Settings 3/4
Start-up mode Meas.
ENERGY MEASUREMENT :
Unit Ws
REACTIVE POWER MEAS :
Method True
UNCONNECTED INPUT :
Check ON
VECTOR DIAGRAM :
Zero axis Vertical
Reference Voltage
Meas. Settings 4/4
ADDITIONAL INFO :
Power of harm. ON
Curr. phase seq. OFF
Info 3/3
MEMORY : 1 %
Meters 4
Results 11
Readouts 4
TOTAL 10.56 MB
BATTERY :
Voltage 4.7350 V
Current 0.2489 A
POWER SUPPLY :
Voltage 1 4.4730 V
Voltage 2 4.9792 V
Voltage 3 3.2623 V

8. Measured Data Reading

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

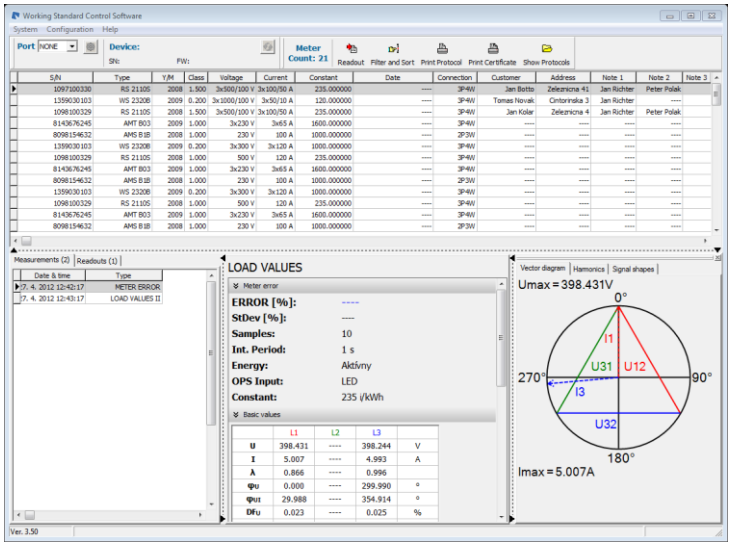


Fig. 1 - Main program window

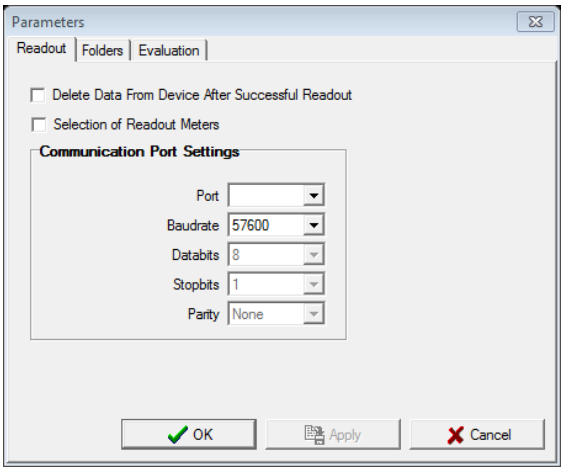
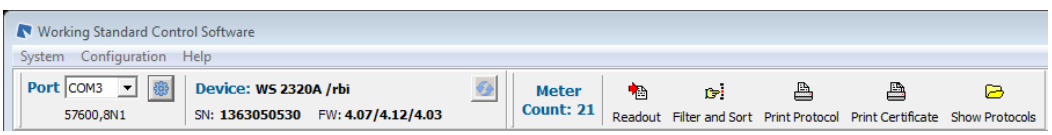


Fig 2 – Communication parameters settings window

Step 4 – Measured Data Reading

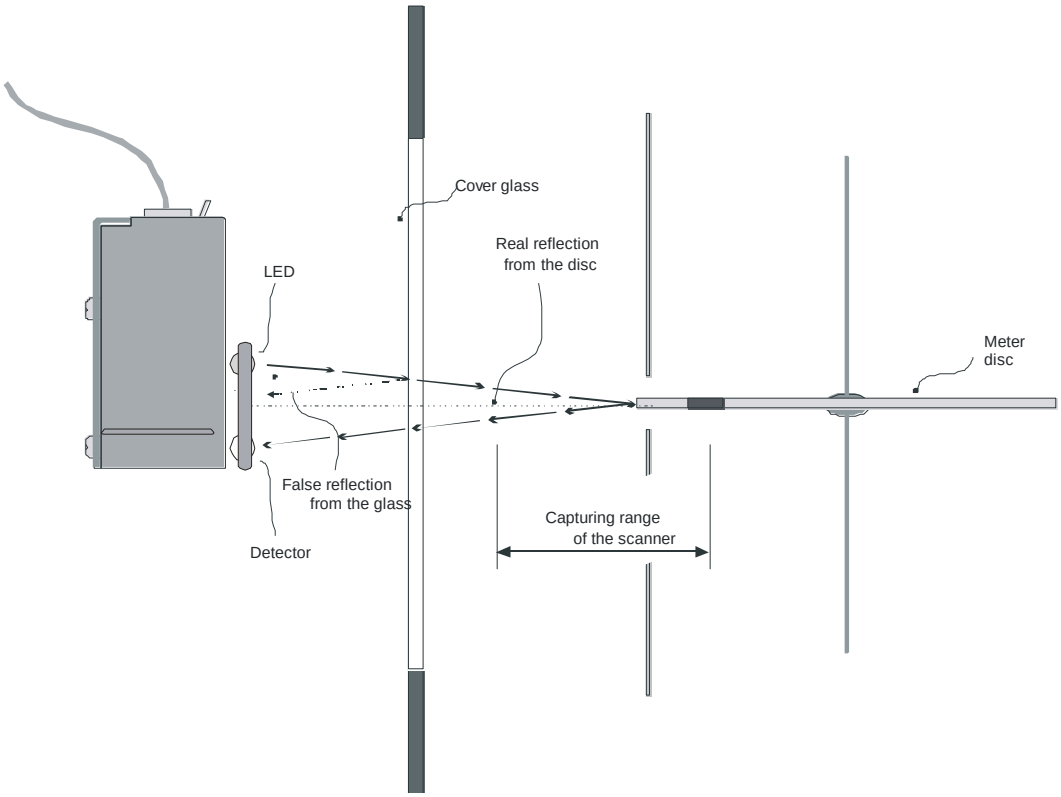
Connect the device to the PC and select the appropriate port (in the upper toolbar). The adjacent Device section displays ID of connected WS. You can press the refresh button  to re-read these info. Now go to ***System / Rreadout*** from menu (or use *Readout* button located in top toolbar) to read all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

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



9. Optical Scanner Positioning

Positioning on dynamic (disc) meter



Positioning on static (electronic) meter