



PROBEWELL
MAKING FIELD TESTING EASY

ACCURACY TEST KIT

USER GUIDE FOR ATK-3 & ATK-4

Version 3.0 – February 2023



BEFORE PUTTING THIS PRODUCT INTO SERVICE,
IT IS ESSENTIAL THAT THIS INSTRUCTION BOOK BE
READ THOROUGHLY.



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Chapter 1

Description

The accuracy of MT-1/NT3, MT-1/NT4, MT-1/NT5, MT-1/NT9, MT-1/WT1 and MT-1/WT3 can be checked against a **NIST** traceable standard using the following test procedure. By default the accuracy is tested on 6 different current test points: 1.5, 3.0, 5.0, 15.0, 30.0 and 50.0A, but users can customize their test points by choosing from a list of 17 more optional test points at both 1 (0°) and 0.5 lag (60°) power factors in Wh. Additionally the MT-1/NT9 and MT-1/WT3 do VARh at 30° and 90°. The accuracy test can be done using a stabilized and isolated AC power source at either 120, 240 or 480 volts.

Equipment Required

- A primary or secondary electronic watt-hour standard traceable to NIST, with an output of 3μWh, 10μWh or 20μWh per pulse, from the BNC port. The standard must have at least one isolated current input port of a minimum capacity of 50 A with autoranging capability. We recommend a standard with the accuracy of 0.02% or better.
- The Probewell Accuracy Test Kit (single-phase or three-phase). The Kit includes the following items:
 - An Accuracy Test Interface (PW-8967), a BNC coaxial cable and a Probewell extension cable RJ12 type connection.
 - An Accuracy Test Jack.
 - Three-phase (ATK-3) for MT-1/NT3, MT-1/NT9 and MT-1/WT3
Discontinued models: MT-1/NT3 and MT-1/NT7
 - Single-phase (ATK-4) for MT-1/NT4, MT-1/NT5 and MT-1/WT1
- A laboratory stabilized and isolated AC power source with fundamental waveform selectable at 120V, 240V or 480V ±5%, 58~62 Hz, rated at least 150VA.



A laboratory stabilized, and isolated AC power source is preferred rather than a small isolated line transformer or autotransformer. Such small transformers could generate severe harmonics and voltage fluctuations which could cause small additional measuring errors. Always fuse the power leads going to the rear tabs 1 & 3 of the unit with a quick action 1 A fuse. The power leads and fuses are not provided with the Accuracy Test Kit (ATK).

How it works

The previously described setup is used to check the accuracy of the internal Wh standard of the unit under test against a NIST traceable Wh standard. By default, the unit is tested at six (6) current test points: 1.5, 3.0, 5.0, 15.0, 30.0 and 50.0 A at both 1 and 0.5 lag power factors, but users can customize their test points by choosing from a total list of 17 optional test points.

The meter that is normally inserted in the front of the unit is replaced by a NIST traceable standard. The standard is hooked up through a test jack in the front of the unit. A pair of #4 AWG cables connect the test jack to the input current terminals of the standard. Also, a pair of #18 AWG test leads are connected to the standard's voltage terminals. The current and voltage are both generated by the unit. The current produced by the unit is the same current as the one circulating through the input current terminals of the standard.

The internal wiring of the test jack connects the unit's current elements in series to a single element of the standard.

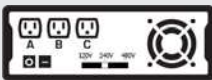
The standard sends a set number of pulses to the Accuracy Test Interface through the coaxial cable. These pulses correspond to very precise units of energy. These pulses can be $3\mu\text{Wh}$ and $10\mu\text{Wh}$ (high pulse rate) or $20\mu\text{Wh}$ (medium pulse rate) depending on the model of the standard used. The Probewell Connect 2.0 Accuracy Test Interface accepts any of them. It processes these pulses from the standard and then sends them to the unit's embedded processor. The Accuracy Test Interface is made up of digital circuitry only. It acts as a programmable digital divider which is not sensitive to heat and will not drift in time.

During the test, the embedded controller of the unit registers the energy measured by the standard (cumulated pulses converted to Wh) and the energy measured by the unit being tested (internal Wh standard). These two measurements are independent of one another. When they converge toward the same value, the unit's internal Wh standard is considered well calibrated and the % error is very close to zero. A summary is shown when the test is completed.

AC Power source recommendations

It is advisable to perform an accuracy check of your device:

- On a laboratory stabilized and isolated AC power source with fundamental waveform selectable at 120V, 240V or 480V $\pm 5\%$
- 58~62 Hz
- Rated at least 150VA.



For detailed information about the AC power source recommendations, see Appendix B.

Chapter 2

Connection

 **Caution: This procedure involves high voltage.** Use extreme caution in working with and making connections. Always wear appropriate protective equipment.

1. With insulated alligator clips, connect the power leads from the AC power source to tabs 1 and 4 located at the back of the Probewell unit. Always leave the Form Selector switch in the 2S position (leftmost).

Three-phase Unit Power Connection

Single-phase Unit Power Connection

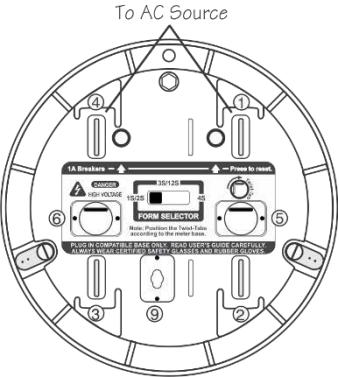
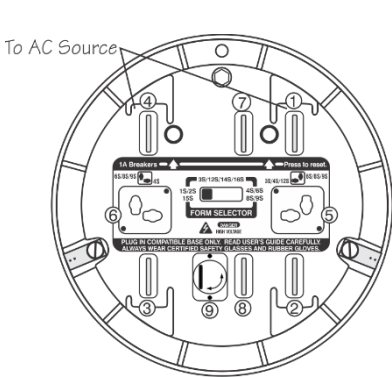


Fig. 1: MT-1/NT3*, MT-1/NT7*, MT-1/NT9 and MT-1/WT3

Fig. 2: MT-1/NT4, MT-1/NT5 and MT-1/WT1

*MT-1/NT3 and MT-1/NT7 (discontinued models)

- Install the test jack on the front of the unit to be tested. Connect the current and voltage wires between the test jack and the standard while respecting the polarity (see Fig. 3). Refer to the Standard's manufacturer for details on how to connect the Aux. Power ports.

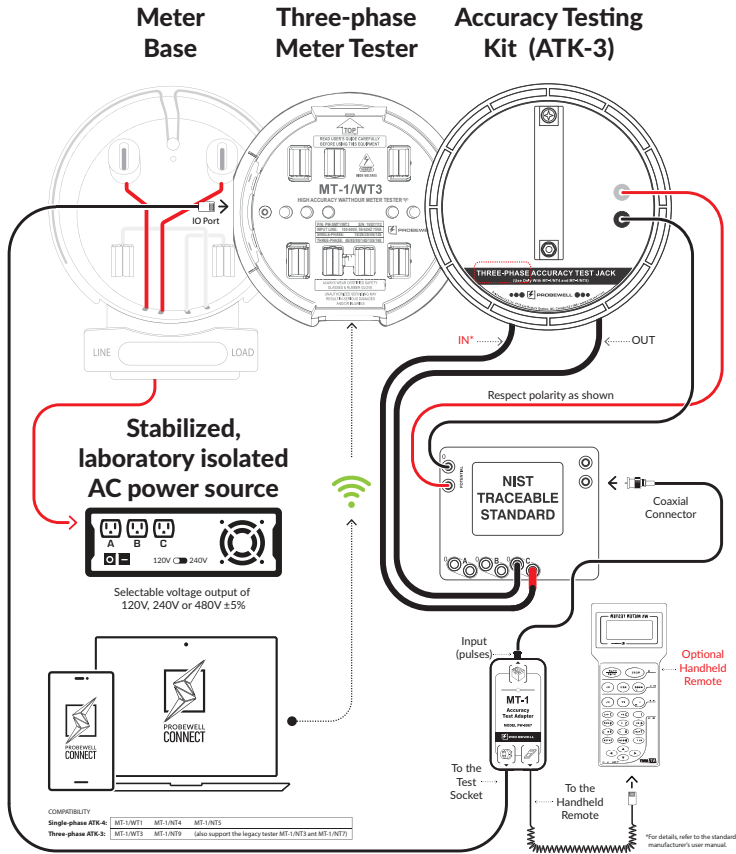


Fig. 3 – Test jack (ATK-3 or ATK-4) to Standard Connection



To remove the test jack, power off the unit and insert a large flat screwdriver in the notch located on the bottom side of the rim to pry it out of the unit being tested.

- Connect the coaxial cable from the Input (pulses) BNC connector on the Accuracy Test Interface to the output pulses BNC connector of the Standard. Then, connect the unit under test I/O Port to the Accuracy Test Interface (port 1, left) with the provided RJ12 extension cable. For NT series, connect the handheld remote to the other port of the Accuracy Test Interface (port 2, right) using an RJ12 extension cable. For WT series, port 2 of the Accuracy Test Interface is unused.

The Accuracy Test Interface is powered by the test socket itself. A red LED indicates the presence of power.

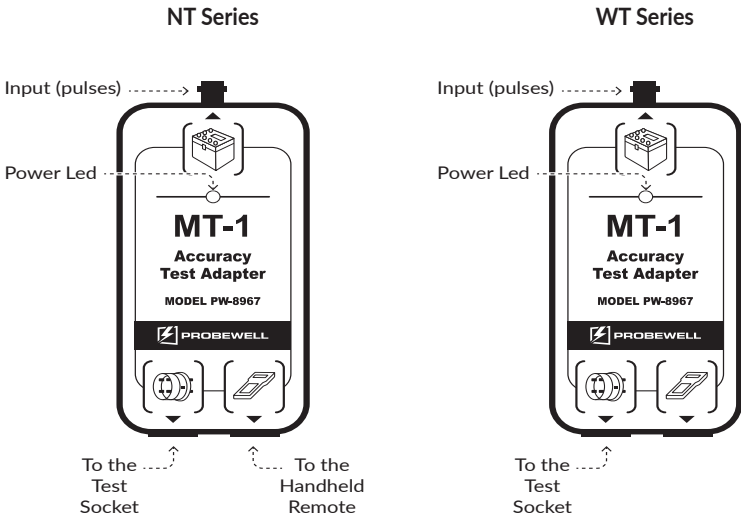


Fig. 4 - Accuracy Test Interface

Chapter 3

NT Series Tester

Accuracy Testing Procedure (NT Series)

1. Turn on the AC power source. Hold the **Reset** Key of the handheld remote and turn on the unit being tested. After a few seconds, the Configuration Menu appears on the handheld. The **Reset** Key must be held until the following screen appears:

```

MT-1 CONFIG MENU
  Kh Edition
<MODE>↓ <ENTER>
  
```

2. Use the **Mode** Key (press multiple times) to navigate to the Accuracy Test submenu which will appear on the second line of the display screen. The following display should appear.

```

MT-1 CONFIG MENU
  Accuracy Test
<MODE>↓ <ENTER>
  
```

3. Press the **ENTER** Key to access the Accuracy Test submenu. The following display should appear.

```

  ACCURACY TEST
  Ref:10uWh PF:1.0
<START>   <←>
  
```


By default, the pulses are set at 10 μ Wh/pulse. Use the arrows to select the pulse rate (10 or 20 μ Wh) and power factor (PF) which can be either 1 (0°) or 0.5 (60°) lag. For MT-1/NT9 you also have the option to verify the VARh at 30° and 90° lag.




The μ Wh/pulse values of the standard and handheld must match.

4. Press the **Start** Key to begin the test. The unit in test runs an initialization sequence which includes checking the wiring setup and auto-scaling.

```
ACCURACY TEST
MT-1 0.0000Wh
REF. 0.0000Wh
Waiting .....
```

 If the cables are not properly connected, an error message appears on the remote. For maximum safety, turn off both the AC power source and unit under test. Check all the connections (polarity) and go through steps 4 to 7 again.

 Don't forget to configure the standard in Wh (watthour) mode. Make sure that the coaxial cable between the Standard's output pulse and the Accuracy Test Interface is properly connected.

5. After initialization, the test begins automatically. The second line displays the energy (Wh) recorded by the unit under test. The third line displays the energy (Wh) measured by the standard. The fourth line shows the current test point being tested in amps and the % error. The % error shall converge (less than 20 seconds) towards the result.
6. At the end of each test point, the unit being tested emits a single beep. The result is displayed for a period of 5 seconds after each test point.

```
ACCURACY TEST
MT-1 6.0240Wh
REF. 6.0232Wh
T1: 1.5A +0.006%
```

7. When all 6 test points are completed, the unit under test emits a triple beep. This indicates the end of the test. At this step, the handheld displays results for the first 3 current points.

```
ACCURACY REPORT
T1: 1.5A +0.006%
T2: 3A -0.008%
T3: 5A -0.003%
```

8. Press the **Mode** Key to navigate through the results.

```
ACCURACY REPORT
T4: 15A +0.000%
T5: 30A -0.005%
T6: 50A -0.003%
```

- Press the **Mode** Key again and a summary report showing the accuracy of the unit test appears on the display.

ACCURACY	REPORT
Average	-0.002%
Maximum	+0.006%
Minimum	-0.008%

If the average error of the unit is within specification, it does not need to be calibrated in shop. Otherwise, please follow the User Calibration procedure to apply a user-defined calibration factor.



The unit's internal Watthour Standard does not contain potentiometers or any other type of mechanically adjusted device that could shift or become unstable with time. This means that the accuracy should not change much over the lifetime of the product. However, if a unit does need to be recalibrated, follow the User Calibration procedure on the next page.

- To save the Accuracy Report, press the **Reset** Key once and the Saving Menu appears. Press the **PF** Key to save the Accuracy Report in the non-volatile memory of the handheld.

User Calibration (NT Series)

Once the test procedure is complete, the user may choose to apply a specific, single percentage calibration offset to the unit. This is useful when the unit calibration must match a NIST traceable standard. The maximum value for this offset is $\pm 0.05\%$, by steps of 0.001% . The deviation is set at 0.000% (nil) by default. The User Calibration correction factor is stored in the non-volatile memory of the unit socket.

Procedure

- Write down the average error percentage result given by the accuracy test. Exit the Accuracy Test Menu by pressing twice on the **Reset** Key, then press the **Mode** Key to reach the User Calibration menu entry and press the **ENTER** Key to access. The following submenu appears:

USER CALIBRATION	
+0.000%	
<MODE>↓	<←→>

To change the calibration factor, use the arrows to decrease or increase the deviation percentage.

Calibration Factor

When the average error given at the end of the accuracy test is positive, the unit measures more energy than it should and must be slowed down by that amount. Therefore, the absolute value of the error should be subtracted.

When the average error given at the end of the accuracy test is negative, the unit measures less energy than it should and must be sped up by that amount. Therefore, the absolute value of the error should be added.

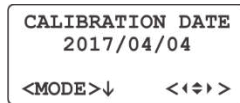
Example 1: If the average error is +0.028%, and the value in the sub-menu is -0.005%, subtract 0.028% and the value shown on the display becomes -0.033% [-0.005% - 0.028%].

Example 2: If the average error is +0.028%, and the value in the sub-menu is +0.035%, the new value would be +0.007% [+0.035% - 0.028 %].

Example 3: If the average error is -0.026%, and the value in the sub-menu is -0.035%, the new value would be -0.009% [-0.035% + 0.026%].

Example 4: If the average error is -0.029%, and the value in the sub-menu is +0.008%, the new value would be +0.037% [+0.008% + 0.029%].

2. Once the new value is written in, press the **Reset** Key. You are then asked to enter the calibration date (the default date is the current one). The following appears:



3. Once the date is set (using the editing keys), press the **Reset** Key twice and the Saving Menu appears. Press the **PF** Key to save the new value in the non-volatile memory of the NT Series socket meter tester. The unit is now calibrated against your traceable Standard.



At power on, the message Cal yyyy/mm/dd appears on the display. Without parentheses, the date indicates when the unit was calibrated by Probewell before shipment. When the message is shown between parentheses, it means that the unit has been calibrated according to your specifications in your own shop.

Troubleshooting (NT Series)

The following are some of the common issues that may occur when using the Accuracy Test Kit and suitable solution to resolve them. If the issue persists, please contact Probewell Technical Support by email at support@probewell.com or visit www.support.probewell.com.

Wrong Setup

- This message appears when no pulse is detected from the Wh standard. Check the wiring setup at fig. 2. Be sure that the polarity is respected.
- Make sure that the standard is set up in Wh (watt-hour) mode.
- Make sure that the coaxial cable linking the Standard's pulse output to the Accuracy Test Interface input is properly connected.
- Make sure that the energy/pulse constant (in $\mu\text{Wh}/\text{pulse}$) from the Standard matches the input pulse selected on the handheld.

Line Voltage Out of Range

- Line voltage is off by more than 5% of the nominal voltage. Check the voltage of the AC power source.

High Burden could affect calibration

- Make sure that the screws of the voltage and current ports on the Standard are tight enough. If necessary, use a $\frac{1}{2}$ " box wrench to tighten.
- An abnormally high burden may prevent the current from reaching 40 A. The calibration cannot be completed under such conditions.
- With a medium, but still acceptable burden load, the maximum test current will be limited. The max value will lie between 40 A and 50 A. The calibration can still be done, but only up to the highest load that can be reached (e.g., 45 A).
- Make sure that the front jaws of the unit being tested are clear of corrosion and debris. If the problem persists, try switching to another output port of the Standard for current.

Please keep these points in mind if your accuracy check report differs from the one provided by Probewell.

- There may be small deviations in the AC power source. Distortion on the AC voltage waveform will result in a reduction of accuracy proportional to the order and magnitude of the harmonics. To minimize waveform errors, the AC voltage waveform must be sinusoidal and as pure as possible.
- Avoid using line regulators that contain a self-resonant transformer. Those generate strong harmonics of several kHz.
- Avoid using small (100 VA and less) transformers as the AC power source. Such small transformers produce strong harmonics of several kHz and introduce measuring errors on both the MT-1 unit and the standard that can reach $\pm 0.05\%$. Harmonics are produced by the magnetizing current drawn by the core (not sinusoidal) and the relative high winding resistance.

Chapter 4

Accuracy Testing Procedure (WT Series)

Pairing the device

1. Turn on the AC power source. Turn on the unit under test. Once started, the unit emits a triple-tone sound notification.
2. Launch the Probewell Connect 2.0 application from your computer.

The following screen should appear:

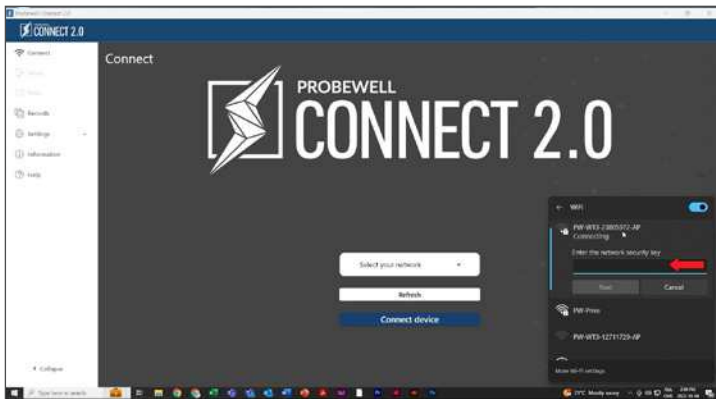


Fig. 5 – Probewell Connect 2.0 initial display

3. Pair the computer to the unit's wireless network.

For detailed instructions on how to connect to the unit's network, please refer to the **Connecting to the MT-1/WT** section in the tester User's Guide or the connection guidelines provided with the unit.

REMINDER: Ensure to configure the removable twist tabs and set the Form Selector switch according to the meter base form you are testing. Secure the socket to the meter base and attach the meter to the front of the socket. Power up the device with the ON/OFF switch.

To connect, go to Windows Settings, Select Network & Internet

- A. Locate the socket SSID in the list of available networks.
- B. When connecting to a socket's network for the first time, input the SSID name as the security key. (i.e., PW-WT3-{Your Serial Number}-AP).

Note: Once the connection process has been completed, the socket's SSID will appear on the network list in future sessions.

Accuracy Test Settings

1. Upon connection, Probewell Connect 2.0 displays the main screen. Click tests and then Accuracy from the left side menu, this will open Accuracy **Setup screen**.
2. The **Measurements** section (A) of the Accuracy Test screen displays the configurable test parameters, the **Standard** section (B) shows the reference Wh standard selection parameter, users can add as many standards as needed then select them under this drop-down menu (the configurable standard identification parameters are self-explanatory and are only used for traceability, but the date field is mandatory and will be used as the standard's calibration date). The **Current Test Points** section (C) let users choose between the default 6 points or customized up to 17 test points options from the list.

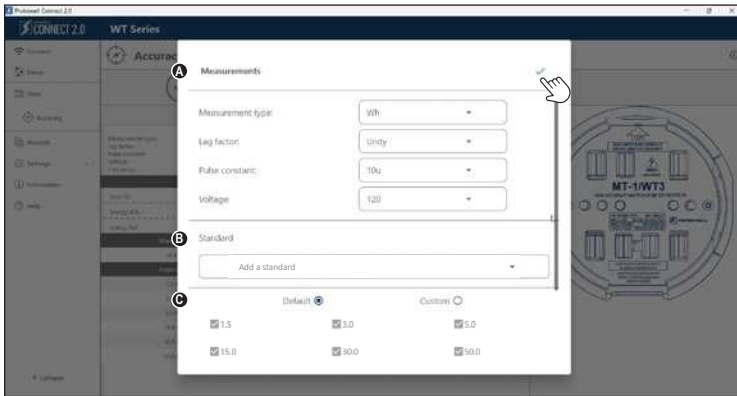


Fig. 6 – Probewell Connect 2.0 Accuracy Test (Test Parameters)

The configurable Accuracy Test parameters are:

Measurement type

Watt-hour or VARHour. Must match the pulse output parameter of the reference standard.

Lag factor

Unity (100% PF) or Half-Power (50% PF). Translates to a 0° or -60° phase angle in Wh and to a 90° or 30° phase angle in VARh.

Pulse constant

3 μWh/pulse, 10 μWh/pulse or 20μWh/pulse. Must match the pulse output parameter of the reference standard.

Voltage

120, 240 or 480 Volts. Must match the AC voltage source and be within 5% of the specified value.

Frequency

Not configurable. Set at 60 Hz.

3. Configure the measurement parameters and fill in the **Standard** section, then click the **green checkmark** ✓ to confirm the settings.

Main Accuracy Test Screen

- Once the information on the Setup tab have been filled in and confirmed, the user is taken to the main test screen.



Fig. 7 – Probewell Connect 2.0 Accuracy Test screen

- | | |
|----------------------------------|--|
| A. Test ID and description | F. Edit <i>Measurement</i> and <i>Standard</i> field |
| B. Status field | G. Tester model |
| C. Control (Start and Stop test) | H. Results |
| D. Measurement parameters | I. Minimum, Maximum and Average |
| E. Reference Standard ID | J. Test points (up to 17) |
- Press the **Play ▶** button to begin the test. The unit in test runs an initialization sequence which includes checking the wiring setup and auto-scaling.



- If the cables are not properly connected, the application displays an error message. For maximum safety, turn off both the AC power source and unit being tested. Check all the connections (polarity) and validate the value of the measurement parameter section.
- Don't forget to configure the standard to the match measurement type of the test in the application: Wh (watt-hour) or VARh (VAR hour) mode. Make sure that the coaxial cable between the Standard's output pulse and the Accuracy Test Interface is properly connected.

- After proper initialization, the test begins automatically.

While performing the Accuracy Test

4. The status field beside the play button displays a spinning status wheel
5. In the results section, the current test point being tested is also identified by a status wheel to its right.
6. At the end of each test point, the tested unit will emit a single sound notification. The % error of the test point is registered, and the test result table is duly updated.

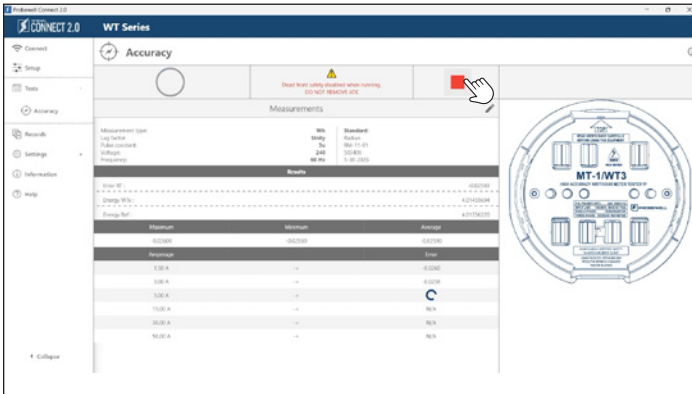


Fig. 8 – Probewell Connect Accuracy Test (Test in progress)

7. Users can stop the test at any time by clicking the stop button.

Accuracy Test completed

- The test will run autonomously until all the test points have been reviewed. The unit will then emit a triple sound notification that indicates the end of the test. At this step, the test result table shows the results for every test points and the average, maximum and minimum % errors are displayed.

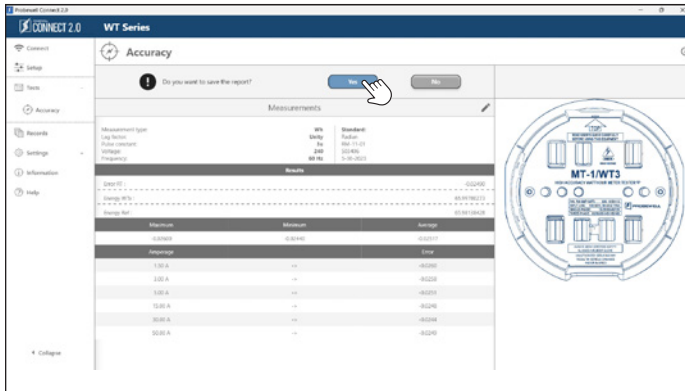


Fig. 9 – Probewell Connect Accuracy Test (Test completed)

If the average error of the unit is within specification, it does not need to be calibrated in shop.

Otherwise, please follow the User Calibration procedure to apply a user-defined calibration factor.

- The Probewell Connect 2.0 application will prompt users to save the report. Click on **Yes** to save the test data. Alternatively, click on **Cancel** to discard the test.



The unit's internal Watthour Standard does not contain potentiometers or any other type of mechanically adjusted device that could shift or become unstable with time.



This means that the accuracy should not change much over the lifetime of the product. However, if a unit does need to be recalibrated, follow the User Calibration procedure on the next page.

User Calibration (WT Series)

After the accuracy testing procedure is complete, the user may choose to apply a specific, single percentage calibration offset to the unit. This is useful when the unit calibration must match a NIST traceable standard. The maximum value for this offset is $\pm 0.05\%$, by steps of 0.001% . The deviation is set at 0.000% (nil) by default. The User Calibration correction factor is recorded and displayed in the Accuracy report.

This procedure picks up where the Accuracy Test Procedure left off. If starting anew, please follow step 1 through 6 of Chapter 2 to wire the unit in tests and power it up.

Procedure

1. In the Probewell Connect 2.0 application, click the **Settings**  button on the left side vertical menu and click on **Calibration** to expand the section.
2. Updating the **User Calibration value** can only be achieved by clicking the **Update user calibration factor**  button. This option only become available once an Accuracy test has been performed on the device currently connected.
3. Once the new value is updated, click on the **green checkmark** beside the field. The User Calibration date is automatically updated in the non-volatile memory of the unit socket. The unit is now calibrated against your traceable standard.

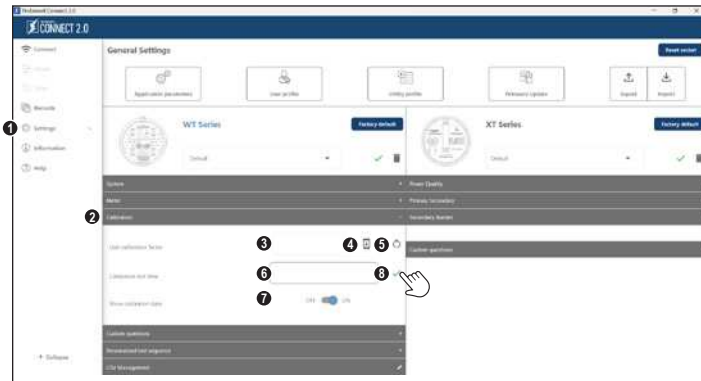


Fig. 10 – Probewell Connect 2.0 WT Settings (Calibration)

- | | |
|---|--|
| 1. Probewell Connect 2.0 Settings | 5. Reset device user calibration factor to zero |
| 2. WT3 Calibration Section | 6. Calibration test time field |
| 3. User calibration factor field | 7. Show calibration date On/Off toggle |
| 4. Update user calibration factor, (only available if an Accuracy test was performed on a device that is connected) | 8. Click the Green checkmark to confirm the changes. |

User Calibration Factor

When the average error given at the end of the accuracy test is positive, the unit measures more energy than it should and must be slowed down by that amount. Therefore, the absolute value of the error should be subtracted.

When the average error given at the end of the accuracy test is negative, the unit measures less energy than it should and must be sped up by that amount. Therefore, the absolute value of the error should be added.

- Example 1:** If the average error is +0.028%, and the value in the sub-menu is -0.005%, subtract 0.028% and the value shown on the display becomes -0.033% [-0.005% - 0.028%].
- Example 2:** If the average error is +0.028%, and the value in the sub-menu is +0.035%, the new value would be +0.007% [+0.035% - 0.028 %].
- Example 3:** If the average error is -0.026%, and the value in the sub-menu is -0.035%, the new value would be -0.009% [-0.035% + 0.026%].
- Example 4:** If the average error is -0.029%, and the value in the sub-menu is +0.008%, the new value would be +0.037% [+0.008% + 0.029%].

Troubleshooting (WT Series)

The following are some of the common issues that may occur when using the Accuracy Test Kit and suitable solution to resolve them. If the issue persists, please contact Probewell Technical Support by email at support@probewell.com or visit www.support.probewell.com.

Line Voltage Out of Range (error 502)

- Line voltage is off by more than 5% of the nominal voltage. Check the voltage of the AC power source.

Current Out of Range (error 503)

- Current on front jaws is off by more than 5% of the nominal voltage. Check reference standard wiring and configuration.

Line Frequency Out of Range (error 504)

- Frequency on front jaws is off by more than 5% of the nominal value (60 Hz).

Calibration burden is too high (error 506)

- The system cannot reach the maximal calibration current value. Check the wiring between the unit and the reference standard.
- Make sure that the screws of the voltage and current ports on the Standard are tight enough. If necessary, use a ½" box wrench to tighten.
- An abnormally high burden may prevent the current from reaching 40 A. The calibration cannot be completed under such conditions.
- With a medium, but still acceptable burden load, the maximum test current will be limited. The max value will lie between 40 A and 50 A. The calibration can still be done, but only up to the highest load that can be reached (e.g., 45 A).
- Make sure that the front jaws of the tested unit are clear of corrosion and dirt. If the problem persists, try using another current output port of the Standard.

Pulse not detected (error 507)

- This message appears when no pulse is detected from the Wh standard. Check the wiring setup at fig. 2. Be sure that the polarity is respected.
- Make sure that the standard is set up in Wh (watthour) mode.
- Make sure that the coaxial cable linking the Standard's pulse output to the Accuracy Test Interface input is properly connected.
- Make sure that the energy/pulse constant (in $\mu\text{Wh}/\text{pulse}$) from the Standard matches the input pulse selected in the Probewell Connect application.

Please keep these points in mind if your Calibration results differ from the one provided by Probewell.

- There may be Small deviations in the AC power source. Distortion on the AC voltage waveform will result in a reduction of accuracy proportional to the order and magnitude of the harmonics. To minimize waveform errors, the AC voltage waveform must be sinusoidal and as pure as possible.
- Avoid using line regulators that contain a self-resonant transformer. Those generate strong harmonics of several kHz.
- Avoid using small (100VA and less) transformers as the AC power source. Such small transformers produce strong harmonics of several kHz and introduce measuring errors on both the MT-1 unit and the standard that can reach $\pm 0.05\%$. Harmonics are produced by the magnetizing current drawn by the core (not sinusoidal) and the relative high winding resistance.

Chapter 5

Accuracy Report (WT Series)

The WT series testers export the Accuracy Test report in PDF format. The following procedure outlines the steps required to generate such reports.

Generating Accuracy Reports is now supported on both the Windows and mobile version of the Probewell Connect 2.0 application.

1. Launch the Probewell Connect 2.0 application, the following screen should appear:



Fig. 11 – Probewell Connect initial display

2. Click on the **Records** button on the left side of the screen.
3. In **the Records section**, the Accuracy Test button for the WT Series is located in the upper right of the control bar (Figure 12).

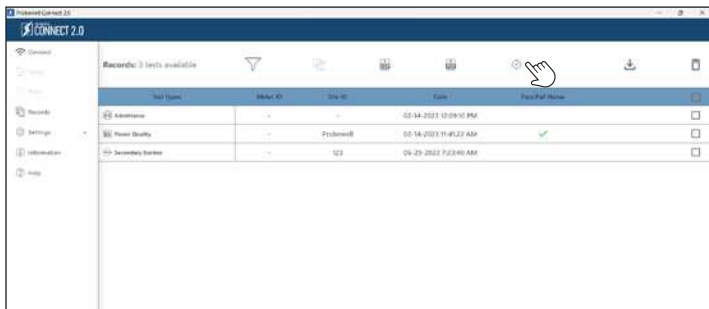


Fig. 12 – Probewell Connect 2.0 Records section: Export Accuracy Report (PDF)

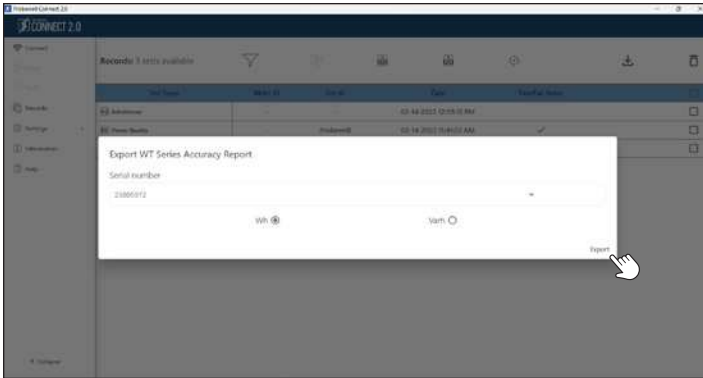


Fig. 13 – Probewell Connect 2.0 Records: Export Accuracy Report options (Wh of VARh)

Export to PDF (Wh)

This button exports the latest Accuracy Test reports that match a specific set of parameters to a single PDF file. The application logic expects the following value to be present in the Accuracy Report:

- Measurement = Wh, Lag = Unity, Voltage = 120V
- Measurement = Wh, Lag = Half-Power, Voltage = 120V
- Measurement = Wh, Lag = Unity, Voltage = 240V
- Measurement = Wh, Lag = Half-Power, Voltage = 240V
- Measurement = Wh, Lag = Unity, Voltage = 480V
- Measurement = Wh, Lag = Half-Power, Voltage = 480V

If one or more reports are absent, the application generates the PDF file and adds placeholder values “-” for the missing data.

Export to PDF (VARh)

This button exports the latest Accuracy Test reports that match a specific set of parameters to a single PDF file. The application logic expects the following value to be present in the Accuracy Report:

- Measurement = VARh, Lag = Unity, Voltage = 120V
- Measurement = VARh, Lag = Half-Power, Voltage = 120V
- Measurement = VARh, Lag = Unity, Voltage = 240V
- Measurement = VARh, Lag = Half-Power, Voltage = 240V
- Measurement = VARh, Lag = Unity, Voltage = 480V
- Measurement = VARh, Lag = Half-Power, Voltage = 480V

If one or more reports are absent, the application generates the PDF file and adds placeholder values (N/A) for the missing data.

4. Click **Export Option** to generate the PDF report
5. The Accuracy Report is automatically saved in the Windows document folder

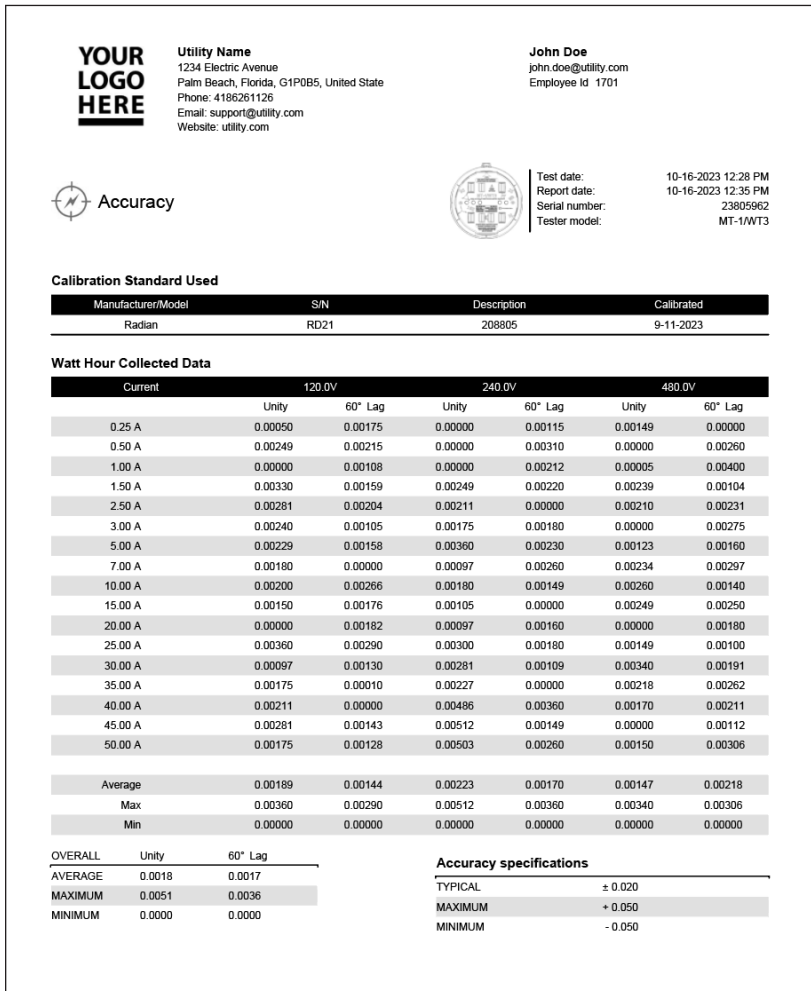


Fig. 14 – Probewell Connect 2.0 Records: Accuracy Test Sample Report

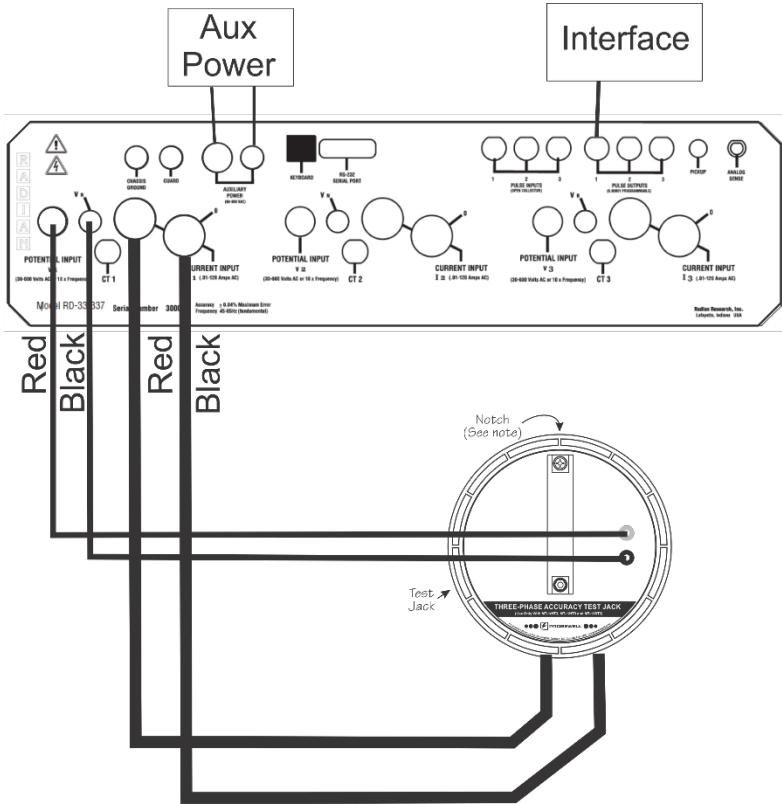


For PDF export, all matching Accuracy Tests must have been completed within a 24-hour time frame. This ensures that the reference standard's accuracy has not drifted in between Accuracy Tests.

Appendix A

Additional Connection Diagrams

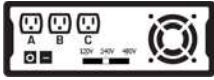
The figure below shows how to connect the test jack to a Radian™ RX-3x standard.



Appendix B

AC Power source recommendations

It is advisable to perform an accuracy check of your device:



- On a laboratory stabilized and isolated AC power source with fundamental waveform selectable at 120V, 240V or 480V $\pm 5\%$
- 58~62 Hz
- Rated at least 150VA.

Avoid small, isolated line transformer or autotransformer.

Such small transformers could generate severe harmonics and voltage fluctuations which could cause small additional measuring errors.

Avoid distortion on the AC voltage waveform

Distortion on the AC voltage waveform will result in a reduction of accuracy proportional to the order and magnitude of the harmonics. To minimize waveform errors, the AC voltage waveform must be sinusoidal and as pure as possible.

Avoid using line regulators that contain a self-resonant transformer.

Those generate strong harmonics of several kHz.

Avoid using small (100 VA and less) transformers as the AC power source.

Such small transformers produce strong harmonics of several kHz and introduce measuring errors on both the WT or NT series tester and the standard that can reach $\pm 0.05\%$. Harmonics are produced by the magnetizing current drawn by the core (not sinusoidal) and the relative high winding resistance.

Avoid instrument such as WECO 4330, TESCO 2100, and TESCO 2199 or similar devices

These are made to test meters, and meters don't require as much VA as our testers. Our testers have current sensors that generates up to 50A, this is why they drown so much VA.



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We believe that field testers should be portable, safe and easy to use.

Probewell generates added value for electric utility companies and their customers by means of innovative metering solutions that provide accurate data-driven insight as well as flexibility and efficiency.

Through our expertise and constant innovation, we develop cutting-edge field-testing technologies that deliver a premier solution for utility companies when it comes to quality, ease of use, sturdiness and customer satisfaction.

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