ST-3 XT3

TRANSFORMER RATED
WIRELESS SITE TESTER

USER GUIDE

PROBEWELL

ST-3/*XT3*
User Guide

Version 1.2 – February 2022

IT IS ESSENTIAL THAT OPERATORS THOROUGHLY READ THIS INSTRUCTION MANUAL BEFORE PUTTING THIS PRODUCT INTO SERVICE.

Limited Warranty

Your ST-3/XT3 comes with a two-year hardware warranty. Probewell Lab Inc., (Probewell) warrants this ST-3/XT3 against defects in materials and workmanship for a period of two (2) years from the date of purchase from Probewell. This warranty applies only to the original purchaser of the ST-3/XT3 and is not transferable.

All accessories come with a two-year hardware warranty. Probewell warrants all accessories against defects in materials and workmanship for a period of two (2) years from the date of purchase from Probewell. This warranty applies only to the original purchaser and is not transferable.

This warranty does not cover any damages caused neither by negligence, non-authorized modifications, or parts installed without prior written permission from Probewell.

This warranty does not apply if the product has been damaged by accident, abuse, misuse, or misapplication, nor as a result of service to the product by anyone other than Probewell.

PROBEWELL IS NOT RESPONSIBLE FOR ANY LOST PROFITS, LOST SAVINGS OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF OR THE INABILITY TO USE THIS PRODUCT. THIS INCLUDES DAMAGE TO PROPERTY AND DAMAGES FOR PERSONAL INJURY. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Disclaimer

Probewell Lab Inc., (Probewell) reserves the right to make changes to this document and the products it describes without notice. Probewell shall not be liable for technical or editorial errors or omissions made herein; nor for incidental or consequential damages resulting from the furnishing, performance, or use of this material.

Features and specifications are subject to change without notice.

Table of Contents

List of Abbreviations

Abbreviation	Complete term
A	Ampere
Amp	Ampere
AC	Alternating current
CFM	Cubic feet per minute
CSV	Comma-separated values
CT	Current transformer
DSP	Digital signal processor
I	Current
kW	Kilowatt
Lb	Pound(s)
NIST	National Institute of Standards and Technology
P	True power
PF	Power factor
PPE	Personal protective equipment
PPI	Pore per inch
PQ	Power quality
PT	Potential transformer (same as VT)
Q	Reactive power
RMS	Root mean square
S	Apparent power
THD	Total harmonic distortion
U	Voltage
V	Volt
VAR	Volt-ampere reactive (same as Q)
VA	Volt-ampere (same as S)
VAC	Volt AC (same as Vrms)
VDC	Volt direct current
VT	Voltage transformer

W	Watt (same as P)
Wh	Watthour
WiFi	Wireless fidelity
Y	Admittance
Z	Impedance
µWh	Micro-watthour
µVARh	Micro-VARhour

Chapter 1

Introduction

The Probewell Lab ST-3/XT3 is the first socket-type transformer-rated site tester with built-in WiFi technology.

ST-3/XT3 Overview

The ST-3/XT3 tester weighs only 4.5 lb, making it an ideal tool for field testing. With the ST-3/XT3, field technicians can accurately test a CT/PT instrument-rated installation in mere minutes. The ST-3/XT3 can perform Power Quality (PQ) tests, Real Time Waveform analyses, Voltage (V) and Current (I) Phase Angle tests, Total Harmonic Distortion (THD) analyses, CT/PT Ratio and Phase Shift tests, Burden tests and Admittance tests.

The ST-3/XT3 comes in a shock-resistant carrying bag with room for the unit, cable accessories and adapters.

The kit includes:

- ST-3/XT3 tester
- 11 removable twist tabs
    - 5 small tabs installed on the ST-3/XT3
    - 5 small spares in the pocket inside the carrying bag
    - 1 big tab for a specific 3S installation (5 o'clock position)
- Adapter for 5S, 35S and 45S installations
- Update cable
- Connection guidelines
- User guide
- Factory calibration report

Chapter 2

Description

The first part of this chapter describes the ST-3/XT3's hardware. The second part explains the theory of operation for the tester.

ST-3/XT3 tester

The ST-3/XT3 is cylinder-shaped, designed to be easily inserted into both ringless and ring-type meter bases.

The ST-3/XT3 contains three current sensors up to 20 Amps to analyze the secondary current from the meter base.

The rear of the tester has six standard fixed tabs with bypasses that can be internally rerouted for burden and admittance testing, and five small and one big (not installed) removable twist tabs, with twist-and-lock mechanism. The ST-3/XT3 gets its power directly from these back tabs and accepts an input voltage from 100 to 480 VAC. Voltage above 480 + 10% will not damage the unit, but it will keep it from starting.

The twist tabs can be placed at positions 5a, 11, 12, 13, 16 and 17 as required by the meter base where the test is being conducted. The twist tab at position 12 can be placed in two different positions to hold either forms 6S/8S/9S or forms 3S/4S. The twist tab at position 16 can be placed in two different positions to hold either forms 6S/8S/9S or form 4S. The twist tab at position 5a can be used for some 3S installations, where the jaw is in the 6 o'clock position in the meter base. Refer to refer to the Form Compatibilities and Configuration Booklet for complete information.

The front of the tester has two 12-pin connectors for the primary measurement accessories.

Front/Rear View of the ST-3/XT3

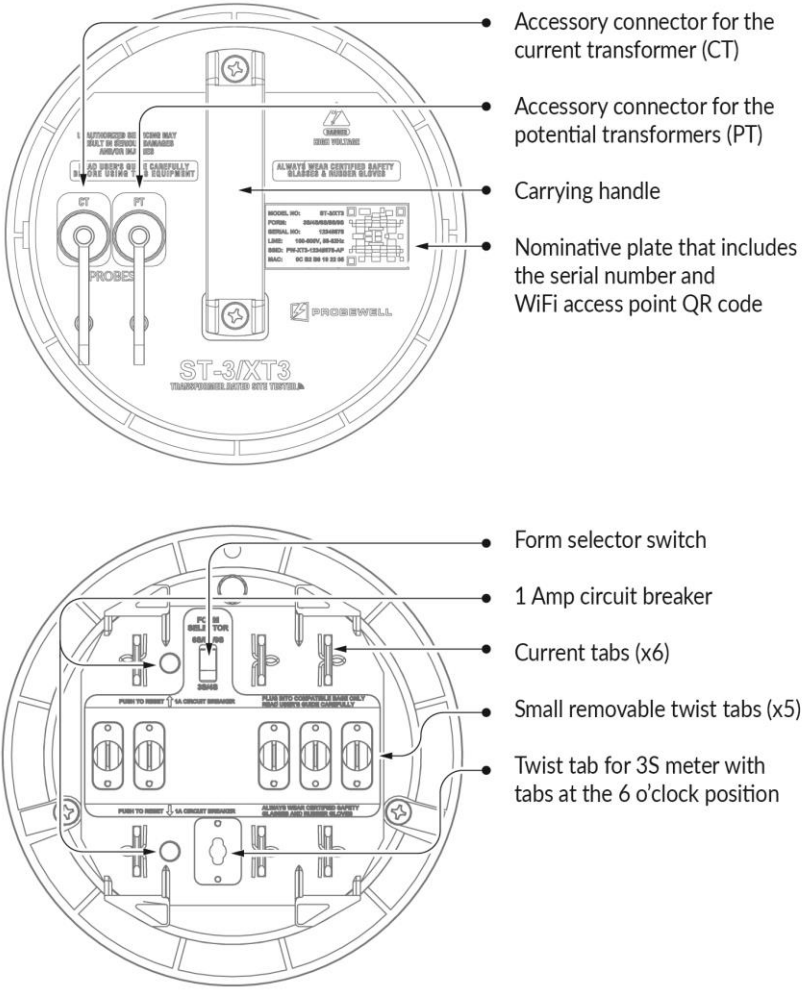


Fig. 2.1

Fig. 2.1 shows the removable twist tabs, which do not require any tools to be moved from one position to another. The above illustration shows the twist tabs positioned at 11-12-13 and 16-17.

Side View of the ST-3/XT3

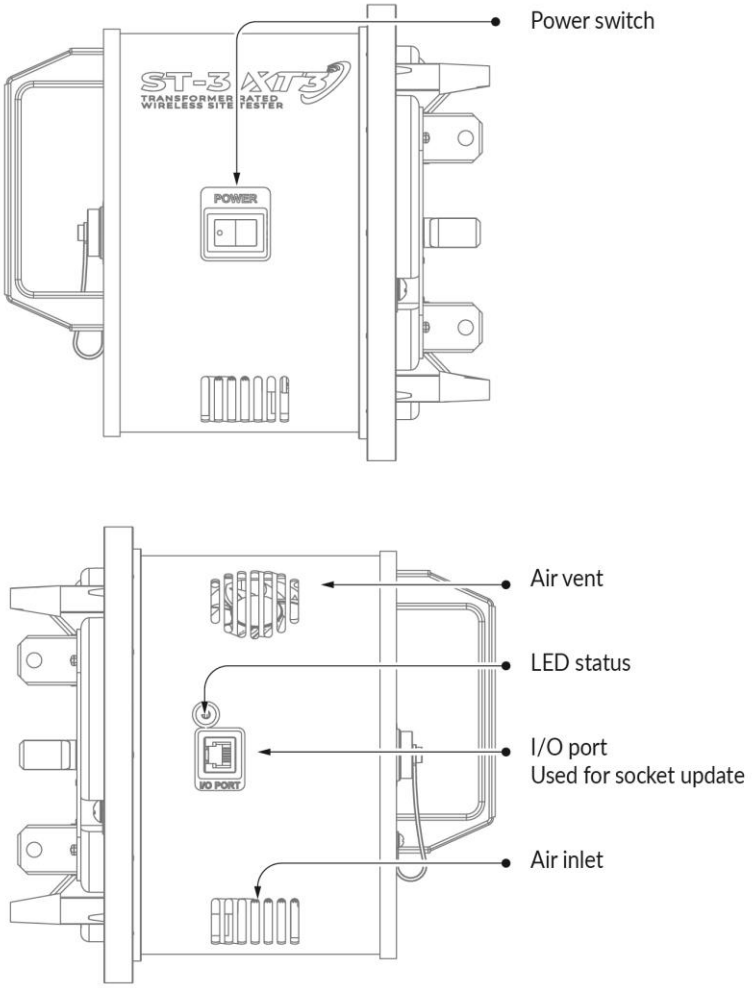


Fig. 2.2

Fig. 2.2 LED status: Solid green means the device is ready, blinking green means a test is underway and blinking red means there is a system error.

Identification	Description
Current tabs	Connect the ST-3/XT3 tester to the front jaws of the meter base.
Removable twist tabs	These tabs can easily be installed in position5a, 11, 12, 13, 16 and 17 as required by the meter base where the test is being conducted. See the Form Compatibilities and Configuration Booklet.
Form Selector	In position 3S/4S, the unit is powered from the tab at position 12 and the current tab at position 2. In position 6S/8S/9S, the unit is powered from the tab at position 11 and the current tab at position 2. In specific situations, tab 17 is used to connect the neutral to tab 2. Note: If the 5S adapter is used, the Form Selector must be set to position 6S/8S/9S
Circuit breakers	Protection for the ST-3/XT3. Two 1 A circuit breakers, which can easily be reset by pressing a spring-loaded button.
Power switch	Tester's main power On/Off switch.
Connectors	There are two 12-pin connectors located on the front of the ST-3/XT3, for accessories. The one identified as CT is to connect the primary current measurement accessory. The second connector identified as PT is to connect the primary voltage measurement accessory when PT is used.
I/O port	This connector is only used to update the ST-3/XT3's firmware.
Air vent [(1)]	Warm air exit. A 5 CFM miniature fan forces air circulation inside the unit.
Air inlet [(1)]	Cool air input. Filtered through a 45 PPI polyurethane foam filter.
[(1)] Do not block air circulation. Keep away from direct heat or flame.	

Theory of Operation

The ST-3/XT3 accurately measures and analyzes CT/PT meter installations. You can easily conduct **Power Quality** (PQ) tests, **waveform** analysis, **phasors** tests, **Total Harmonic Distortion** (THD), **CT/PT ratio**, **CT Burden** and **Admittance** tests.

Embedded in its core is high-performance, multiphase energy metering circuity enabling a full RMS and line cycle measurement of both secondary and primary currents and voltages.

With the ST-3/XT3 installed, and the bypass removed (in the meter base), the CT is never open as the ST-3/XT3 always keeps the closed loop on the secondary.

Power Quality

The power quality function gives you all the information collected by the ST-3/XT3 at the meter base, such as voltages on each phase (U), current for each phase (I), real power in watts (P), reactive power in VAR (Q), apparent power in VA (S), the phase angle for the voltage and current of each phase, the power factor (PF), THD in both voltage and current, and the frequency.

This test can be conducted with or without primary measurement accessories.

Phasors

This vectorially graphical function give you the angles between each phase in current and voltage in relation to the voltage of Phase A.

Waveform analysis

This graphical function gives you a time-based sinewave representation of the meter base's voltage and current. You can also isolate each phase to see the relation between the voltage and current. The view displays two current and voltage cycles.

Total Harmonic Distortion (THD)

This bar graph display gives you the relationship between the fundamental frequency and all the harmonics up to the 22nd harmonic.

Primary/Secondary Analysis (CT/PT Ratio and Phase Shift)

You must use an accessory to conduct this test.

This test is to ensure that the ratio between the primary current or voltage and the secondary current or voltage are the same as indicated on the transformers being tested. It is performed with the accessories provided with the ST-3/XT3.

Example: if the name plate indicates 400:5 the nominal input current is 400 A and the output at the secondary is 5 A. For example, if the ST-3/XT3 reads a primary input current of 399 and an output at the secondary of 4.98A, this gives a ratio of 400:5.

The test can also give the phase relationship between the primary and secondary.

CT Burden

Current transformer burdens are typically expressed in VA. The burden test is performed to verify that the CT can supply a known current into a known burden while maintaining its stated accuracy. A burden test is typically performed at full-rated secondary current value (e.g., 5 A or 1 A).

By applying precision resistance in series with the CT secondary, the ST-3/XT3 verifies the current sample and analyze the deviation in accordance with the value without resistance.

All the phases (A, B, C) are run sequentially until the maximum burden value selected in the Probewell Connect application is reached.

This test can be performed with or without a CT accessory, but an accessory will give the best results since the primary/secondary will be

tracked in real-time. Without a CT accessory, the test takes a snapshot of the secondary current as its baseline.

Maximum burden operating range

resistive Load in ohm	Maximum amperage at the secondary per load
0.1	20
0.2	11
0.5	10
1	5
2	5
4	5

Admittance

What is admittance?

Admittance is a measurement in millisiemens (mS) of how easily a circuit or device allows current to flow through it. Admittance (Y) is the reciprocal (opposite) of impedance (Z). Conductivity and resistance are similarly related.

An admittance test can easily detect defects in a CT, such as internally shorted turns and other common issues which can cause metering errors that might otherwise go unnoticed for years.

A CT's continued integrity can be ensured at minimal cost by performing an initial admittance test of the installation. These results can later serve as a benchmark to guarantee the CT's performance.

When another admittance test is conducted on the CT, its results should be compared to the original results. If an anomaly occurs, the admittance measurement will show a significant deviation from the initial values while in service.

High millisiemens reading:

- It is likely that the CT has an internal short

Low millisiemens reading:

- May be due to increased impedance caused by an open or damage circuit (i.e., corrosion, loose connections worn out or dirty jaws)

The ST-3/XT3 has these limits:

- Open circuit: < 0.1 mS
- Short circuit: > 5,000 mS

This test is conducted by injecting a 1,525-Hz audio frequency into the CT secondary, then measuring the audio frequency's induced current and voltage to determine the admittance value.

Analog filtering and programmable gain are used to get the best dynamic range, by removing the 60 Hz from the secondary current, for the DSP to compute the admittance at 1,525 Hz. While CT burden needs secondary current to achieve its purpose, admittance needs low or no current (max. 0.5 A) on the secondary side. If the current is higher than 0.5 A, the test will not be conducted.

All the phases are run sequentially.

This test can be performed with or without an accessory.

If testing an installation with multiple CTs of the same type and value, any CT with significantly different results suggests a problem with that CT. If a benchmark was established for that CT upon initial installation, then future changes can be detected.

Accessories

The ST-3/XT3 comes with several optional accessories for taking primary measurements.

ST-3/FLEX-CT2500

The ST-3/FLLEX-CT2500's current probes are Rogowski coils, an electrical device for measuring the primary current of a CT. They consist of a helical coil of wire with the lead from one end returning through the center of the coil to the other end, so that both connections are at the same end of the coil. The probe can easily be placed around the wire going through the CT and be secured with a latch.

The ST-3/FLEX-CT2500 is used for comparing primary to secondary current, with auto-detection, and is electronically compensated with an accuracy of 0.5% and a current range up to 5000 A for the ST-3/FLEX-CT2500. The window size is 10.67'' (271 mm), the cable is 15 feet long.

ST-3/PT600

The ST-3/PT600 is an electrical device that converts a high-voltage reading to a lower voltage to be read by the tester. The probes can easily be connected to the PT's primary voltage terminal using dolphin clamps.

WARNING

ST-3/PT600 installation instructions

1. Connect the ST-3/PT600 cable to the 12-pin connector labeled PT and secure it by turning the twist-lock until it stops.
2. Connect the ST-3/XT3 on the meter base.
3. Connect L1, L2 and L3 clamps to the primary side of the respective PT input voltage phase (A, B, C) of the transformer following company safety procedures.
4. Proceed with the test.
5. Remove the PT clamps from the PT transformers following company safety procedures.
6. Remove the ST-3/XT3 from the meter base.
7. Remove the PT accessory from the ST-3/XT3.

The three-phases primary line voltage clamps, no neutral[1], comes with auto-detection and is electronically compensated with 0.1% accuracy and a voltage range up to 600 V. Three color-coded 4 mm banana jack, dolphin clamps are included. The cable is 15 feet long.

[1] The neutral is taken from the ST-3/XT3

ST-3/ALW

The ST-3/ALW is the interface to a SensorLink®'s AMP LiteWire.

ST-3/VLW

The ST-3/VLW is the interface to a SensorLink®'s VOLT LiteWire.

ST-3/EXT

The extension cable is used when the primary CT or PT is far from the meter installation. These cables are compatible with ST-3/FLEX2500, ST-3/FLEX5000 and ST-3/PT600 accessories.

- ST-3/EXT50 is 50 feet.
- ST-3/EXT100 is 100 feet.

When plugging a previously described primary current or primary voltage accessory into one of these extensions, the accessory's performance will be derated. See the "Specifications" section for more information.

Chapter 3

Operation

CAUTION

The use of ST-3/XT3's is strictly reserved to personnel authorized to manipulate CT-rated meter installations. For safety reasons, ***certified PPE such as safety glasses and rubber gloves*** are strongly recommended but are not provided with the ST-3/XT3.

The operation of removing and inserting a meter from its meter base under power exposes live electric terminals. **Use utmost caution. Do no stick your hands or any metal objects into the open meter base. You could suffer bodily burns, electric shocks and even electrocution.**

It is imperative that you **follow your company's safety procedures**.

Do not open the CT secondary loop!

Opening the CT secondary may cause damage to the current transformer and/or operating personnel.

Summary

The ST-3/XT3 is compatible with instrument-rated installation forms 3S, 4S, 6S, 8S and 9S. It is also compatible with installation forms 5S, 35S and 45S with an adapter. Before testing a CT rated installation in the field, always make sure the meter base's electrical wiring is fully compatible with that shown in the Form Compatibilities and Configuration Booklet.

The ST-3/XT3 must first be configured to the meter base in accordance with the Form Compatibilities and Configuration Booklet. The technician must then remove the meter from the meter base as per their company's procedure and insert the ST-3/XT3 into the meter socket by aligning the meter base's jaws with the ST-3/XT3's tabs.

Please communicate with Probewell support if the needed form is not available in the Form Compatibilities and Configuration Booklet included with your device documentation: support@probewell.com

Installing the ST-3/XT3

1. Removing the Meter

WARNING

Do not remove the meter when it is under a heavy load, to avoid sparks. The front jaws of the meter base are live; do not stick your hands or any metal objects into the meter base! Certified safety glasses and rubber gloves are strongly recommended.

Carefully remove the meter from its meter base **according to your company's safety procedures**. Before removing the meter from a CT-rated meter base, **be sure to shunt the secondary CTs** to prevent equipment damage and personal injury.

Make sure that the wiring connecting the meter to the line is compatible with one of the configurations shown in the Form Compatibilities and Configuration Booklet. If not compatible, stop here and put the meter back into place. Field-testing with the ST-3/XT3 is not possible for that meter installation.

Please communicate with Probewell support if the needed form is not available in the Form Compatibilities and Configuration Booklet included with your device documentation: support@probewell.com

2. Installing the ST-3/XT3

Make sure the ST-3/XT3's power switch is set to "Off.". Check the Form Compatibilities and Configuration Booklet to set up the twist tabs and the Form Selector before inserting into the meter base.

Hold the ST-3/XT3 firmly and align the rear tabs with the front jaws of the meter base. Then firmly insert the ST-3/XT3 into the meter base.

Connecting to the ST-3/XT3

This section explains how to connect to the ST-3/XT3 over WiFi for a quick start. For more detailed information, please refer to the Probewell Connect for XT Series documentation.

Setting up the connection

First, power up the ST-3/XT3 with the “On/Off” switch.

Probewell Connect for iOS and Android

Open the application on your mobile device.

> How to get the app:
> For iOS: Go to the Apple App Store.
> For Android: Go to Google Play Store.
> Search for “Probewell Connect”

Scan the QR code for a first use or select a known SSID.

Probewell Connect for Windows

Go to “Windows Settings.”

Select “*Network & Internet.”*

Click on “*Show available networks.”*

Locate the SSID within the available networks list.

Input the SSID as the security key (i.e. PW-XT3-{serial Number}-AP). This number is located on the nominative plate located on the front of the unit, under the QR code.

Wait to be connected to the unit.

Start the Probewell Connect application from your computer.

> **Note**
> When the procedure has been completed once, the SSID will be accessible directly from the network list.
>
> The Probewell Connect for Windows is downloadable from our website.
> (https://probewell.com/pw-connect)

Running the Application

Please refer to the Probewell Connect User Guide for XT Series.

https://probewell.com/pw-connect

Available Tests

The ST-3/XT3 can perform Power Quality (PQ), CT/PT Ratio and Phase Shift, Burden and Admittance tests.

- **Power Quality:** Secondary current and voltage analysis.
  - **Table view (U, I, P, Q, S, PF, angles, THD U, THD I, frequency)**
  - **Phasor view (vector analysis)**
  - **Waveform display**
  - **Harmonic histogram**
- **Primary/Secondary Analysis (CT/PT Ratio & Phase):** Using the probes, the tester will read the current and the voltage, then conduct an analysis to give the ratio and phase between the transformer's primary and secondary current.
- **CT Secondary Burden:** By applying a resistance in series with the CT, the tester can analyze the maximum burden under which CT can still operate efficiently.
- **Admittance:** By injecting an audio frequency of 1,525 Hz, the tester can determine the CT's admittance.

The table below shows which installed accessory is needed or not for the supported tests.

	Power Quality	**Primary/ Secondary Analysis CT Ratio/Phase**	**Primary/ Secondary Analysis PT Ratio/Phase**	**CT Secondary Burden**	**Admittance**
CT Probe	Not necessary	Mandatory	Not necessary	Recom-mended	Not necessary
PT Probe	Not necessary	Not necessary	Mandatory	Not necessary	Not necessary

Recommended: Test can be conducted with (better accuracy) or without the accessory.

Test Examples

In the following examples, we will assume the ST-3/XT3 is already installed in the meter base and that the appropriate accessories are securely installed.

Below are some testing examples included in this manual. The tests are available for all meter types:

1. Power Quality Test: form 9S Wye with 3CT and 3PT
2. Primary/Secondary Analysis (CT/PT Ratio Test): form 3S single-phase with CT
3. Burden Test: form 5S Delta with CT
4. Admittance Test: form 9S Wye

For more information on how to launch and run the Probewell Connect application, refer to the Probewell Connect XT Series User Guide available on the Probewell website (www.probewell.com).

Example 1:
Power Quality Test: Form 9S Wye with 3CT and 3PT

Meter installation:	9S
Wiring Type:	Wye
Primary current:	400 A
Secondary current:	5 A
CT ratio:	400:5
CT accuracy	0.3%
CT class	B0.1
Primary voltage:	277V
Secondary voltage:	116V
PT ratio	2.4:1

1. Connecting the accessories

Connecting the accessories for a Power Quality test are not required, but if the operator will then perform a CT/PT Primary/Secondary Ratio or CT Burden test, it is recommended to connect them at this time.

Connect all accessories required to the ST-3/XT3 before inserting into the meter base even if the accessories aren't necessary for the Power Quality test, they will be required for subsequent tests (i.e., Primary/ Secondary Test).

WARNING

ST-3/PT600 installation instructions

1. Connect the ST-3/PT600 cable to the 12-pin connector labeled PT and secure it by turning the twist-lock until it stops.
2. Connect the ST-3/XT3 on the meter base.
3. Connect L1, L2 and L3 clamps to the primary side of the respective PT input voltage phase (A, B, C) of the transformer following company safety procedures.
4. Proceed with the test.
5. Remove the PT clamps from the PT transformers following company safety procedures.
6. Remove the ST-3/XT3 from the meter base.
7. Remove the PT accessory from the ST-3/XT3.

ST-3/FLEX-CT2500 installation instructions

1. Connect the ST-3/FLEX-CT2500 to the 12-pin connector labeled CT and secure it by turning the twist-lock until it stops.
2. Pass each coil loop around each of the CT input wires (i.e., L1 around phase A, L2 around phase B and L3 around phase C).
   - Caution: Polarity is important. Be sure to follow the marking on the accessory.

2. Performing the Power Quality test

Once the installation has been completed, the ST-3/XT3 has been connected and the site setup has been done (see the Probewell Connect for XT Series User Guide for more information), the test can proceed.

Select *Power Quality Test* to open that test's screen.

Enter the current transformer ratio (i.e., primary 400, secondary 5) and enter the potential transformers' input and output voltage (i.e., input 277 volts, output 116 volts, for a ratio of 2.4:1). If you performed a test at this site previously, the parameters will already be filled in.

Press *START TEST* to initiate the test sequence. The Power Quality table will fill up with information pertaining to the test being carried out such as, voltage, current, power in W (P), in VAR (Q), in VA (S), the phase angle of each phase in reference to A phase, the current phase, the power factor, the THD in both voltage and current, and the frequency.

By selecting the proper view in the app, you can see the vectoral graph (phasor) for the phase angles, the waveform display analysis, and the harmonic histogram.

3. Obtaining and saving the test results

To stop the test, press STOP TEST. It will ask you if you want to abort the test. Click YES. It will ask you if you want to save the test result. Click YES and it will create a record.

To see the results, press the "Records" tab at the bottom of the screen and select the last saved record. This will display the latest test results.

Example 2: Primary/Secondary Analysis (CT Ratio Test): Form 3S Single-Phase with CT

Meter installation:	3S
Wiring type:	Single-phase Delta
Primary current:	300 A
Secondary current:	2.5 A
CT ratio:	600:5
CT accuracy	0.3%
CT class	B0.2
Voltage:	240 V

1. Connecting the accessories

Connect all accessories required to the ST-3/XT3 before inserting it into the meter base.

- Connect the ST-3/FLEX-CT2500 cable to the 12-pin labeled “CT” and secure it by turning the twist-lock until it stops.
- Pass the L1 loop around the wire entering the CT.
    - Caution: Polarity is important. Be sure to follow the marking on the accessory.

2. Performing the CT Ratio test

Once the installation has been completed, the ST-3/XT3 has been connected and the site setup has been done (see the Probewell Connect for XT Series User Guide for more information), the test can proceed.

Select *Primary/Secondary Analysis* to open that test’s screen.

Enter the current transformer ratio (i.e., primary 600, secondary 5) and enter the potential transformers' input and output voltage (i.e., input 240 volts, output 240 volts, for a ratio of 1:1). If you performed a test at this site previously, the parameters will already be filled in.

Press *START TEST* to initiate the test sequence.

Obtaining and saving the test results

To stop the test, press *STOP TEST*. It will ask you if you want to abort the test. Click *YES*. You will be asked if you want to save the test result. Click YES and a record will be created.

To see the results, press the “Records” tab at the bottom of the screen and select the last record made. This will display the latest test results.

Example 3: Burden Test Form 5S Delta with CT

Meter installation:	5S
Wiring type:	3-wire Delta
Primary current:	400 A
Secondary current:	5 A
CT ratio	400:5
CT accuracy	0.6%
CT class	B0.5
Voltage:	240 V

This example requires the special adapter (included with the kit) that converts the voltage from the 5S meter base to a 9S that can be used by the ST-3/XT3.

1. Connecting the accessories

Connect all accessories required to the ST-3/XT3 before inserting into the meter base.

- Connect ST-3/FLEX-CT2500 to the 12-pin connector labeled “CT” and secure it by turning the twist-lock until it stops.
- Pass the L1 and L3 Rogowski loop around the wire entering the CT respectively.
    - Caution: Polarity is important. Be sure to follow the marking on the accessory.

Note: This test can be performed with or without an accessory, but an accessory will give the best results since the primary/secondary will be tracked in real time. Without an accessory, the test takes a snapshot of the secondary current as its baseline.

2. Performing the Burden test

Once the installation has been completed, the ST-3/XT3 has been connected and the site setup has been done (see the Probewell Connect for XT Series User Guide for more information), the test can proceed.

Select *Secondary Burden Test* to open that test’s screen.

Enter the following information:

CT Nameplate Ratio:	
Primary Current:	400 A
Secondary Current:	5 A
Max Burden	0.5 Ohm
Accuracy Class:	0.6

Press *START TEST* to initiate the test sequence.

A sequence of relay will go from 0 ohm all the way to the max burden of 0.5 ohm.

Once the test done the results for each phase will appear showing like this:

Burden Load	I sec	I prim	Burden Effect	Rating Error	Phase Error
Ohm	A	A	%	%	Min.
0.0	5.00	399.61	0.00	-0.10	-12’37”
0.1	5.00	399.66	-0.01	-0.08	0
0.2	5.00	399.67	-0.01	-0.07	-3’28”
0.5	5.00	400.22	-0.02	0.08	5’4”

Burden Load: The resistance applied by the test unit to the CT secondary.

I sec.: The current from the secondary read by the tester.

I prim: The current from the primary read through the ST-3/FLEX2500 coil.

Burden Effect: The effect of the applied burden on the secondary current in percentage:

Without accessory: $100\% * \frac{Isec\ (burden) - Isec\ (0)}{Isec\ (0)}$

With accessory: $100\% * \frac{Ratio\ (burden) - Ratio\ (0)}{Ratio\ (0)}$

Rating Error: The percentage error of the measured transformer ratio compared to the nameplate ratio.

Phase Error: The phase difference (in minutes and seconds) between the primary and the secondary.

3. Obtaining and saving the test results

To stop the test, press *STOP TEST*, it will ask you if you want to abort the test click *YES*. It will ask you if you want to save the test result, click yes and a record is made.

To see the results, press the record tab at the bottom of the screen and select the last record made. This will display the last information taken from the test.

Example 4: Admittance: form 9S Wye

Meter installation:	9S
Wiring type:	Wye
Accessories	None

1. Performing the Admittance test

Once the installation has been completed, the ST-3/XT3 has been connected and the site setup has been done (see the Probewell Connect for XT Series User Guide for more information), the test can proceed.

Select *Admittance Test* to open that test's screen.

Press *START TEST* to initiate the test sequence. The ST-3/XT3 will generate an audio frequency on each CT sequentially to calculate its admittance.

If the secondary current on the CT under test is greater than 0.5 A (10% nominal), the test will not be performed (current greater than 0.5 A will not damage the unit)

2. Obtaining and saving the test results

The test will stop automatically after all the phases have been sequentially tested and a record will be saved.

To see the results, press the "Records" tab at the bottom of the screen and select the last record made. This will display the latest test results.

Accuracy Test

The ST-3/XT3 provides a built-in test mode that aims to validate the accuracy of the device by comparing it to a high-accuracy, NIST-traceable polyphase test board or standard. This test is meant to be performed in a lab environment and at a rate of once or twice a year, depending on the customer's guidelines for equipment validation.

The Accuracy Test can be accessed within the Windows application, in the "Settings" section, as described in the Probewell Connect User Guide for ST-3/XT3.

Basic knowledge of the calibration tools is necessary to proceed with the accuracy test.

Required material

- ST-3/XT3 unit
- NIST-traceable polyphase test board or standard
    - 120 to 480 V
    - 0 to 20 A
    - Voltage, Amps and phase angles individually programmable for each line
- Computer (with Windows 10)
- Banana plugs and wiring to connect the ST-3/XT3 device to standard (if not socket-based)

Procedure

Points 1 to 3 work only with a 9S form.

1) Set the ST-3/XT3's Form Selector switch to 9S (refer to the Form Compatibilities and Configuration Booklet).
2) Install the removable twist tabs as a 9S installation (refer to the Form Compatibilities and Configuration Booklet).
3) Install the ST-3/XT3 device on the standard. If not socket-based, connect the standard's voltage and current terminals to the ST-3/XT3 to match a 9S meter base connection (refer to the Form Compatibilities and Configuration Booklet).

4) Power up the standard and set it to match the following specifications:
   - 240V, 60 Hz on all three lines
   - 1 A, 60 Hz on all three lines
   - 120° phase difference between voltages
   - PF = 1
5) Power on the ST-3/XT3 device.
6) Connect to the ST-3/XT3's wireless network with the computer.
7) Launch the Probewell Connect application for Windows.
8) In the app, select "Accuracy Test" in the "Settings" section.
9) Enter the following information:
   - The standard's Serial Number, model and calibration date
   - The supply voltage for the test (configurable)
   - Up to 5 current test points (tested sequentially)
10) Once the test sequence is properly configured, begin the Accuracy validation by pressing the "Start" button.
11) For each configured current test point, the application acquires and averages a set of 50 measurements and provides an error percentage by comparing with the nominal values provided by the standard.
12) Between test sequence steps, the user is prompted to configure the standard with the next supply current.
13) Once the sequence is completed, the user can save the test report and later download it in CSV or PDF format locally on the computer.

The Accuracy Test is successful if the percentage error measurement is below the ST-3/XT3's accuracy class for all current test points.

The Accuracy Test sequence can be performed at any supply voltage within the ST-3/XT3 operating range: 100 to 480 VAC.

If the device should appear to fall out of its specified accuracy range, please contact Probewell Lab's technical support (support@probewell.com).

Appendix A

Specifications

General

Physical dimensions

ST-3/XT3	6.9" x 7.4" (175x 188 mm)
Carrying bag (L x W x H)	22" x 12" x 11" (560 x 305 x 280 mm)

Weight

ST-3/XT3	4.5 lb. (2.05 kg)
Carrying bag	7.0 lb. (3.18 kg)
Overall w/ accessories	15.0 lb. (6.82 kg)

Temperature

Operation	-4 to 140°F (-20 to 60°C)
Storage	-4 to 140°F (-20 to 60°C)
Humidity	0% to 95% (non-condensing)

Test Accessories

ST-3/FLEX-CT2500	To measure primary current up to 2,500 A nominal, 5000 A max
ST-3/PT600	To measure primary voltage up to 600 V
ST-3/ALW	SensorLink® Amp LiteWire interface
ST-3/VLW	SensorLink® Volt LiteWire interface
ST-3/EXT50	50-foot extension for accessories
ST-3/EXT100	100-foot extension for accessories

ST-3/XT3

Input

Voltage	100-600 VAC (phase to phase) 100-480 VAC ±10% (phase to neutral)
Current	0.01 A-20 A
Line frequency	58-62Hz
Power consumption	15 VA (maximum)
Circuit breakers	2 x 1 A (press-to-reset mechanism)
Secondary current max.	20 A
Serial communication port	Full-duplex RS-232 (isolated), for update

Meter base forms (CT-rated)

Single-phase	3S, 4S,
Three-phase	5S*, 6S, 8S, 9S, 35S*, 45S*

Multifunction measurements accuracy

RMS voltage	±0.1%, maximum
RMS current	±0.1%, or ±50 µA maximum
Frequency	±0.01°, maximum

Power Quality

Current	±0.05%
Voltage	±0.05%
Power (W, VA, VAR)	±0.1%
Phase Angle (V & I)	±0.02˚
Power Factor	±0.001%
Frequency	±0.001 Hz

Primary/Secondary†

Voltage PT600	±0.1%
Ratio	±0.1%
Phase	±0.02˚
Current CT2500	±0.5%
Ratio	±0.5%
Phase	±0.02˚
SensorLink® ALW & VLW	±0.1%
Ratio	±0.1%
Phase	±0.02˚

CT Burden

Burden ±1%
With Primary CTs Current Ratio ±0.5%
Without Primary CT Current Ratio ±0.05%
(But the primary current must not change)

Maximum burden operating range

resistive Load in ohm	Maximum amperage at the secondary per load
0.1	20
0.2	11
0.5	10
1	5
2	5
4	5

Admittance

Repeatability with result within ±1%

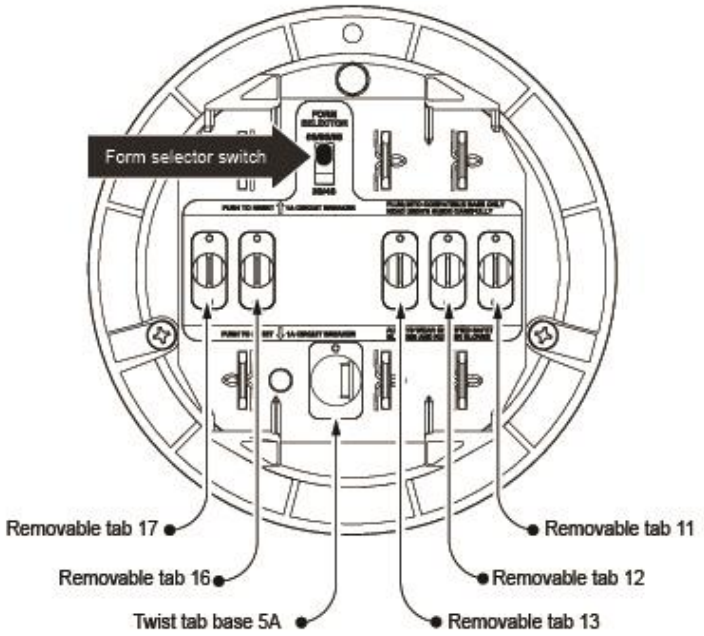
† The ST-3/XT3's internal electronic metering is calibrated using a reference standard and comes with a complete calibration report certifying measurement accuracy for voltage, current and phase angle over its entire operating range. Test accuracy can be checked using a reference standard and power source.

* To test 5S, 35S and 45S installations, an adapter must be placed between the meter base and the ST-3/XT3 tester.

Appendix B

Form Configurations

Below are various back tab configurations for the ST-3/XT3, depending on the meter base used. For detailed specifications, refer to the “Form Compatibilities and Configuration Booklet provided with the device.



Forms	Tab 17	Tab 16	Tab 13	Tab 5a	Tab 12	Tab 11	Form Selector
3S				or			
4S							
5S*/35S*							
6S							
9S/8S/45S*							

** For 5S, 35S or 45S, you must use the 5S adapter.*

Appendix C

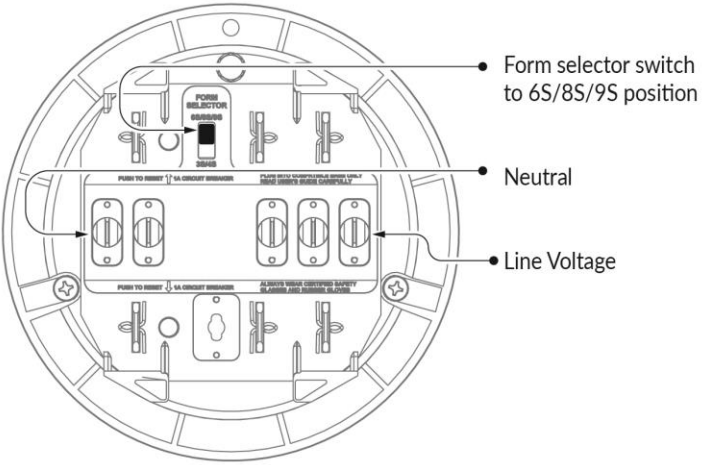
Powering the Unit in the Laboratory

To power up the unit in the shop or laboratory for accuracy testing or firmware upgrades, the following material is recommended:

- NIST-traceable polyphase test board or standard
- 120 to 480 V
- 0 to 20 A
- Voltage, Amps and phase angles individually programmable for each line

The equipment must be powered exclusively as follows:

Power unit as a 9s form
(For accuracy test and firmware)



Appendix D

Customer Service

Warranty and repairs

If your ST-3/XT3 becomes defective while under warranty (two years after original date of purchase), Probewell Lab Inc. will repair or replace it. If the unit becomes defective after the warranty has expired, Probewell Lab. Inc. will repair it, charging the cost of labor and spare parts.

Before returning a unit for repair

Please do not return your ST-3/XT3 without first contacting customer service at 1.866.626.1126 or sending an email to info@probewell.com. You will be given detailed shipping instructions.

Technical questions

If you have any technical questions regarding the ST-3/XT3's operation, you can reach the Probewell Technical Support.

Contact our technical support team at **1.866.626.1126**

Send an email to: **support@probewell.com**

Visit the Probewell Support Portal: **support.probewell.com**

Appendix E

Recommendations

Probewell Lab Inc. suggests that you respect the following recommendations to get maximum use out of the ST-3/XT3 and its accessories for many years to come. **Any unauthorized modifications or broken seals will immediately void the warranty and any further services.**

ST-3/XT3

- Do not try to open the ST-3/XT3; there are no serviceable parts inside.
- Never block the air vents on the ST-3/XT3.
- Never expose the equipment to bad weather or direct rain.
- Always put the connector dust covers when the accessories are not in use or when storing the ST-3/XT3.
- Never use **solvents** to clean the ST-3/XT3. Use a soft moist cloth with non-abrasive soap to clean the surface.
- Handle the ST-3/XT3 with care.

Current and voltage transducers

- Do not try to open; there are no serviceable parts inside.
- Never expose the equipment to bad weather or direct rain. Do not expose to direct sunlight for long periods of time.

Notes

PROBEWELL

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

Generating added value for utilities and their customers by means of innovative products that provide accurate data driven insight as well as flexibility and efficiency.

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

Probewell Lab Inc.

Phone: **1-866-626-1126**
Fax: **418-626-1424**

www.probewell.com

General Information:
info@probewell.com

Technical Support:
support@probewell.com

Printed in Canada
Edition 1.2