

## TTRU3-BASIC 3 Phase Transformer Turns Ratiometer



- **Guaranteed accuracy  $\pm 0.10\%$  from  $-20^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$**
- **Up to 125V test voltage**
- **Step up ratio technique**
- **Magnetic balance test capabilities**

### DESCRIPTION

The Megger TTRU3-BASIC transformer turns ratiometer uses a revolutionary design to perform turns ratio testing utilizing the step-up ratio technique.

The TTRU3-BASIC is an important tool for determining the mechanical condition of transformers. All ratio tests are performed in one instrument, with only one 3Ø lead-set connection. The TTRU3-BASIC utilizes the latest 7 inch (180 mm) color touch display, as well as an optional printer so results are never lost. This is complimented with the ability to download results to a USB memory device.

### TYPICAL PROBLEMS FOUND USING THE TTRU3-BASIC

- Loose connections
- Turn-to-turn shorts
- Broken Strands
- Winding deformation
- Tap changer contact problems
- Core problems

### TESTING PERFORMED

All with one instrument and 3Ø lead-set connection!

- Ratio - 3Ø Step-up testing for power transformers
- Phase shift and phase deviation
- Polarity
- Magnetic balance/flux distribution
- Excitation current characteristics
- Auto vector detection/recognition

### FEATURES

- Step-up ratio testing
- Step-down ratio testing
- Confirmation of expected nameplate vector configuration
- Ability to measure actual vs expected phase shift
- Unique kelvin clamps with adjustable 3-inch jaw
- Banana plug input for connection to terminal blocks
- Turns ratio % error vs nameplate with pass/fail

### STEP-UP TURNS RATIO TESTING SIMPLIFIED

From IEEE C57.152 2013, under requirement for ratio measurement, the standard states:

*The term "transformer turns ratio" (TTR) meter is commonly used to describe these instruments even though the actual turns ratio is not being measured.*

Now you can measure "transformer turns ratio" as described in the standard with the TTRU3-BASIC. No need for higher voltage, heavy instruments that are more expensive and complex to operate - the TTRU3-BASIC automatically chooses the best test voltage and gives you the correct ratio the first time! All with one instrument and 3Ø lead-set connection!

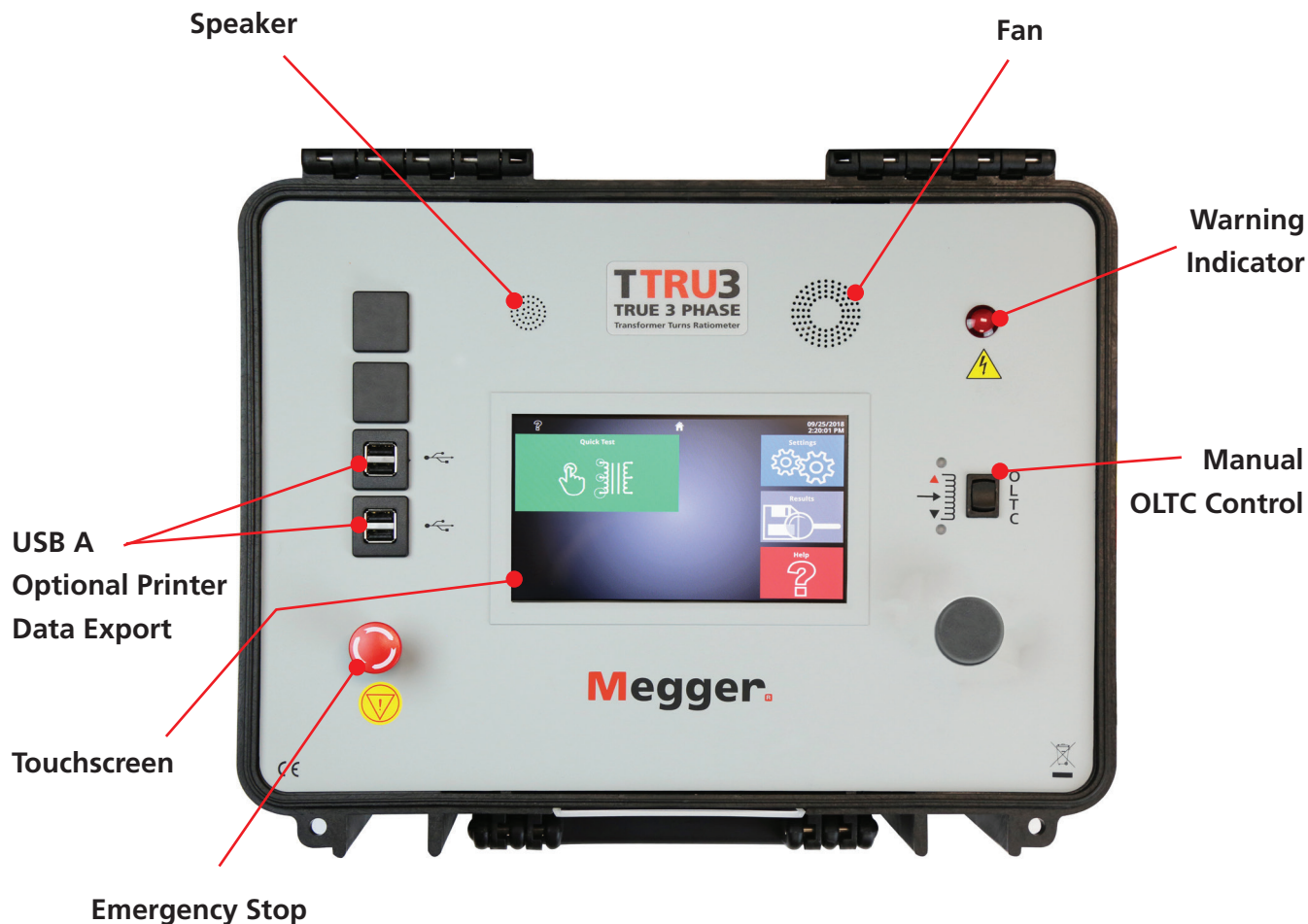
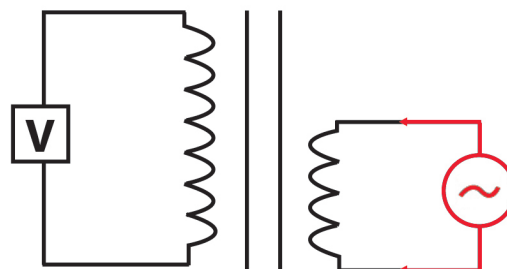
The information herein is subject to change without notice.

## STEP-UP TURNS RATIO TESTING

The technology within the TTRU3-BASIC is based on step-up ratio testing. When compared to traditional 1Ø step down test instruments, the TTRU3-BASIC removes the inaccuracy associated with test voltage. The user is no longer required to know the "proper" test voltage required to obtain a "valid" result. This makes testing much easier, as repetition of testing at proper voltage is no longer required.

## SAFE WITH STEP UP

Safety is the first priority at Megger, which is why the TTRU3-BASIC is CE Certified to IEC 61010 - Safety requirements for electrical equipment for measurement, control, and laboratory use. During a test, software will perform safety checks before applying full test voltage. In addition, the TTRU3-BASIC utilizes modern hardware to protect the operator in the event of faults.



**DETAILED DESCRIPTION**

The TTRU3 BASIC is designed to test ALL power, instrument (CTs and PT/VTs), and distribution transformers without the need of traditional high voltage excitation. With our patented step up technique, you are no longer required to know the “proper” test voltage to apply to obtain a “good” result - the test set decides for you - all in a box that is up to 35% smaller and lighter than other turns ratio meters.

**POLARITY**

The TTRU3-BASIC quickly and efficiently checks for correct polarity between high and low side windings.

**VECTOR RECOGNITION**

The TTRU3-BASIC provides the capability for automatic vector group detection. This is very useful in validating “expected” versus “measured” vector group. This does not mean one does not require knowledge about the windings, as this is critical to the proper operation of a transformer. Vector recognition is an effective tool in validating the expected nameplate vector configuration, and should be used as such. Windings such as Zig Zag, can be MISTAKENLY seen as a Delta configuration. This mistake could have catastrophic consequences when line voltage is applied to the transformer, thus supporting the importance of proper use of vector recognition.

**PHASE ANGLE DEVIATION**

Phase angle deviation (not to be confused with phase shift) is the phase relationship between in-phase vectors of the high side versus the low side windings. Phase deviation denotes the quality of the core and the winding, and when functioning properly should exhibit very low values (< 0.1 degrees). Shorted or partial shorted turns and/or a deteriorated or damaged core can cause significant changes in the phase deviation values.

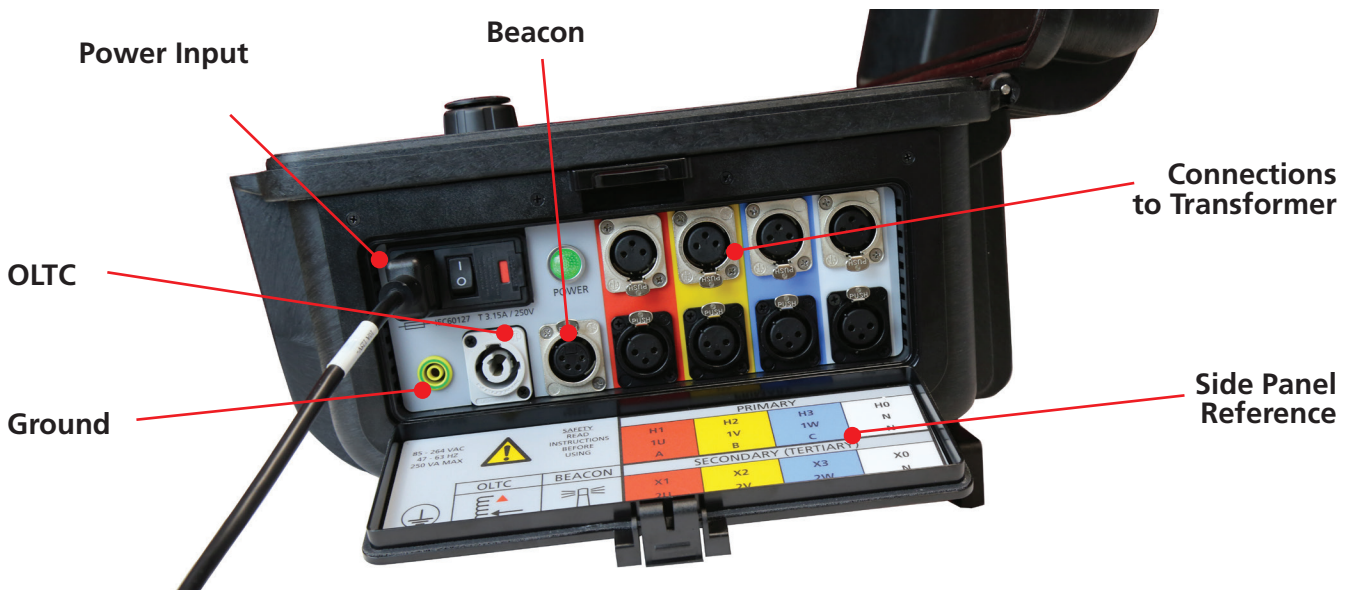
Together with ratio error, phase deviation can also be used as a reliable method of quickly verifying accuracy class of PTs and CTs at “zero burden” rating. This allows for proper validation of accuracy class of incoming CTs or PTs from the factory, or field validation during routine maintenance.

**EXCITATION CURRENT**

The excitation current test is very useful in locating problems such as defects in magnetic core balance, magnetic core structure, shifting of windings, failures in the turn-to-turn insulation, or problems in tap changers.

**WINDING BALANCE**

Winding balance (also referred to as magnetic balance) is performed to assess the health of the windings, core assembly condition, and flux distribution within the transformer. This test, performed safely and efficiently by the TTRU3-BASIC, is a measure of how well balanced (electrically) the transformer is versus nameplate specifications.



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**CONTROL SOFTWARE, SAVING, & PRINTING RESULTS**

The intuitive user interface of the TTRU3-BASIC has large, self-explanatory buttons. Vectors are displayed on screen, making it easy to match them to a nameplate, giving you confidence that your test setup is correct. Whether using Quick test or setting up a Test Plan, minimal training is required. When exported, results are grouped by file name, producing an XLS/PDF report that is easy to read, email, or import into PowerDB. If you need results on the spot, use the optional USB printer!

**AUTOMATION**

Maximize your time in the field with automation options.

**Automatic OLTC**

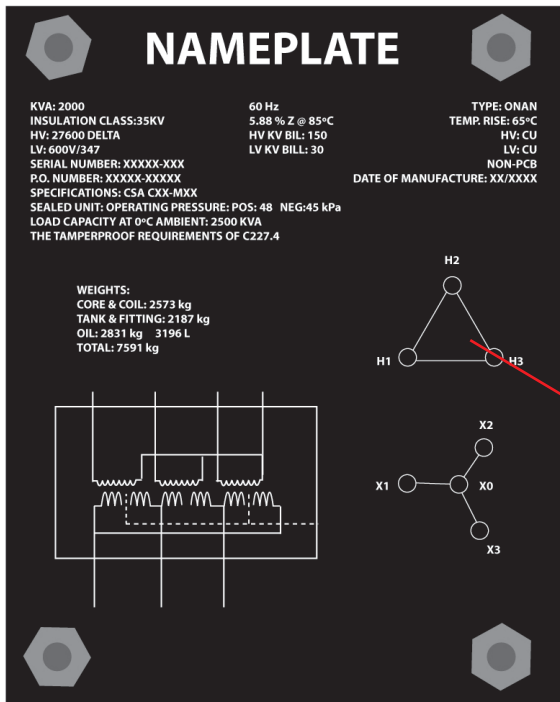
Automatic OLTC allows you to run through an entire OLTC with one click; just confirm the calculated tap voltages in the Test Plan and choose when the test should stop!

**VERSATILITY**

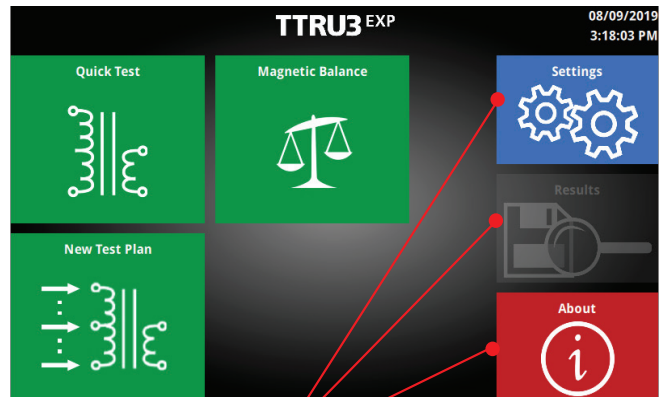
Be prepared for any situation with versatile software features.

**Magnetic Balance**

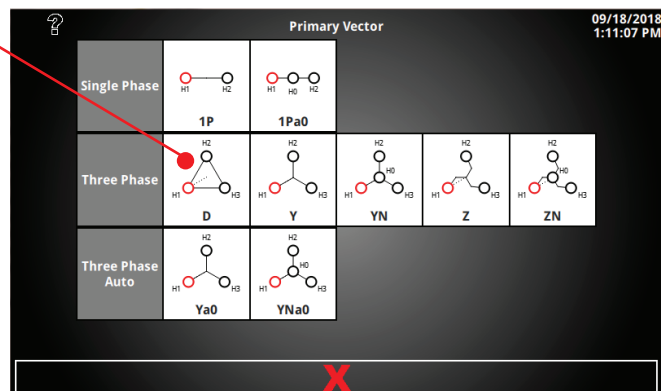
Magnetic balance is an advanced diagnostic test typically performed during transformer construction used to detect problems such as inter-turn and inter-strand shorts, external loops around the core, and wrong interleaving joints. It is also useful in determining if a transformer core is magnetized and checking that the mechanical properties of the core and windings have not changed after a fault.



Compare nameplate vector to images on screen



Self-explanatory buttons



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## UNIVERSAL LEAD SET

The 3Ø Universal lead set simplifies connecting to any transformer. The durable kelvin clamps extend up to 3" for connecting to any bushing size. Lead spans range from 5m (15ft) to 30m (100ft), ensuring you can connect and test any transformer configuration. All of the leads can be connected in one ladder climb, reducing the risk of fall injuries.

The kelvin clamps also accept safety banana plugs, making it easy to connect the 3Ø lead set to a CT terminal block. Electrical shock and potential markings are clearly displayed on the clamp, informing operators how to connect safely and securely.

The TTRU3 lead set can be used with most existing MTOs, MWAs, and TTRs. Requires PNs

- 2008-009 - H lead breakout
- 2008-010 - X lead breakout



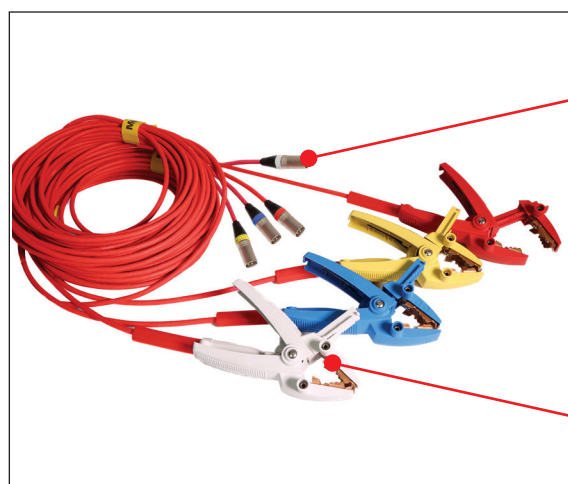
You can even use your old lead set with the TTRU3! Applies to PNs

H leads:

- 2008-001-XX
- 2008-002-XX
- 2008-003-XX
- 2008-004-XX

X-leads:

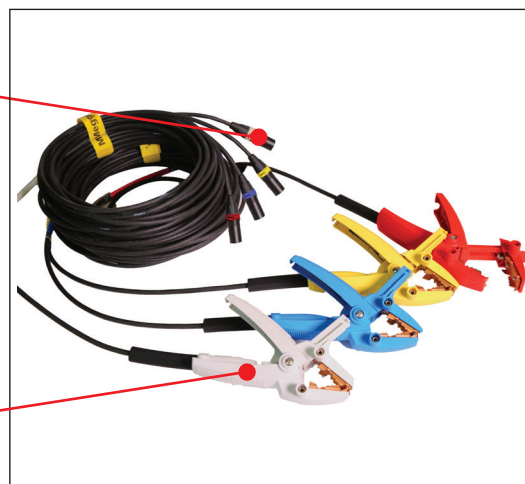
- 2008-005-XX
- 2008-006-XX
- 2008-007-XX
- 2008-008-XX



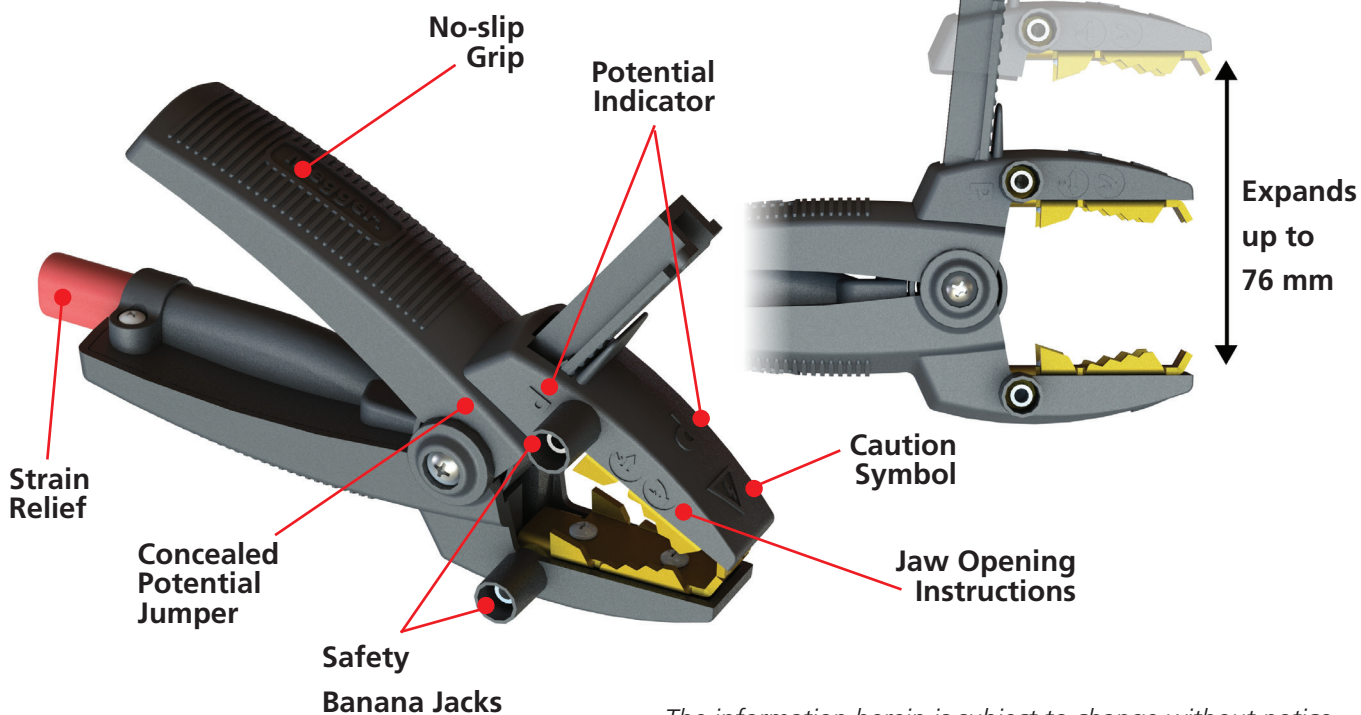
H Leads

**Color-coded Connectors**

**Color-coded Clamps**



X Leads



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## SPECIFICATIONS

### Input Power

90-264VAC, 47-63Hz, 250VA Max

### Output

Voltage: 3Ø, 1 - 48VAC, up to 125V on Primary

Frequency: 50-480Hz

Current: 0.1mA - 1A, Max 2A @ 48V

### Turns Ratio Measurement Methods

1Ø Step Up

1Ø Step Down

### Turns Ratio Range and Accuracy - Guaranteed accuracy from -20°C to +50°C

#### Step Down Excitation

25-48V

±0.10% 0.8 - 1000

±0.20% 1001 - 2000

±0.60% 2001 - 15000

±1% 15001 - 50000

1-24V

±0.10% 0.8 - 1000

±0.20% 1001 - 2000

±0.60% 2001 - 15000

#### Step Up Measurement

25-125V

±0.10% 0.8 - 200 (most Power Tx)

1-24V

±0.10% 0.8 - 200

5 digit resolution

### Excitation Current Measurement

Resolution: 0.1mA 0.1mA - 100mA

1mA 101-2000mA

Accuracy: ± 1% ±0.1 mA

### Frequency Measurement

Resolution: 0.1 Hz

Accuracy: ±0.1% ±0.1 Hz

### Transformer Phase Measurement

Range: 0 - 360 Degrees

Accuracy: ± 0.05 Degrees

### Weight

6.5kg 14lbs

### Dimensions

406 x 304 x 254mm 16 x 12 x 8in

### Environmental

Operating -20°C to +50°C (-4°F to +122°F)

Storage -30°C to +70°C (-22°F to +158°F)

Relative Humidity 0-90%, non-condensing

### Ingress Protection

**TTRU3:** IP 51

**TTRU3 in transit case:** IP 67

### Regulatory

Safety

IEC 61010-1:2010 + AMD1:2016

EM/EMC

IEC 61326-1:2012

RoHS2

EN50581

Vibration/Drop/Shock

MIL-STD-810G

### Touchscreen

180mm (7 in.)

800 x 480 Resolution

1100 NITS

### Transformer Testing Standards

IEEE C57.152-2013

IEC 60076-1:2011

AS/NZS 6076 1:2014

CIGRE 445 2011

### Case

Ruggedized case with fold out feet

Canvas carrying bag for leads and accessories

### Internal/External Data Storage

Up to 2000 sets of 3 phase results internal storage

Transferable via USB 2.0/3.0 thumb drive

### Communication/Control Software

180mm (7in) built in display running custom GUI

### Printer Output

51mm (2in) thermal printer

Prints all measurement data displayed on GUI



## TTRU3 STANDARD FEATURES:

- OLTC Control
- Test Plans
- Predictive OLTC Voltage
- PowerDB Import
- Vector Rotation on Screen
- Auto Vector Recognition
- Thumb Drive Export

## ORDERING INFORMATION

Item (Qty)	Cat. No.	Item (Qty)	Cat. No.
3Ø Transformer Turns Ratio Test Set	TTRU3-BASIC	<b>Accessories Required for Operation</b>	
<b>Included Accessories</b>		<b>Lead P/Ns 2008-XXX-XX (8 total) can be used with the TTRU3 and qualify as required accessories</b>	
AC Adapters & Power Cord - 2.5m (8ft)	2009-874	3Ø universal shielded test lead sets compatible with MTO3XX, MWA3XX, TTRU3 instruments (up to 10A max), complete with color-coded Kelvin Clamps: Choose Kit or mix & match H & X	
OLTC Tap Changer cable - 9m (30ft)	1011-622	5m (15ft) H & X	2008-15KIT2
Cable bag - backpack	2012-180	9m (30ft) H & X	2008-30KIT2
Ground Cable - 5m (16ft)	1011-352	18m (60ft) H & X	2008-60KIT2
Thumb Drive	1011-585	30m (100ft) H & 18m (60ft) X	2008-100KIT2
Triple Function Pen	2011-538	5m (15ft) H	2008-300-15
<b>Optional Hardware Accessories</b>		5m (15ft) X	2008-301-15
1:1 Test Jig	2005-249	9m (30ft) H	2008-300-30
Safety Beacon – 18m (60ft)	1004-639	9m (30ft) X	2008-301-30
Transit Case (for instrument)	2012-236	18m (60ft) H	2008-300-60
TRS1+ Calibration Standard	TRS1PLUS	18m (60ft) X	2008-301-60
Calibration Certificate	CERT-NIST	30m (100ft) H	2008-300-100
USB Printer	90029-573	<b>Optional Lead Accessories</b>	
USB Printer Paper (x48 rolls)	90029-573-P	9m (30ft) H extensions	2008-300-30X
OLTC Tap Changer cable adapters	1011-622-A	9m (30ft) X extensions	2008-301-30X
<b>Software Options</b>		9m (30ft) H & 9m (30ft) X extensions	2008-30XKIT2
AutoOLTC	SW-AUTOOLTC		
Magnetic Balance	SW-MAGNETICBAL		