



## Introducing a New Portable Revenue Meter Calibration Instrument

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## 3 Series Overview

The NEW PowerMaster 3 Series is a highly advanced, yet economical solution for testing metering sites in the field under actual customer load conditions.



# Brief History of Powermetrix

1994 - Founded in Knoxville, TN USA

1995 - Introduced the Powermate 330

First True 3-Phase Analyzing Standard in North America that Measured Full Harmonic Content

1998 - Merged with Technology for Energy Corporation

4 Divisions - Electric Power, Nuclear, Materials Testing & Aviation

2001 - Introduced the Powermate 730

Powermate 330 with Integrated 3-Phase Current Source

2008 - Introduced the PowerMaster 7 & 5 Series

State of the Art Technology, Accuracy & Functionality

2014 - Introducing the PowerMaster 3 Series

State of the Art Technology, Lightweight, Basic Functionality



# 3 Series Overview

Testing under customer load conditions at the metering site is the best way to determine if a customer is losing revenue.

Revenue loss is mainly caused by the following errors:

- Incorrect Wiring
- Bad Current Transformers (overburdened, shunted, mislabeled, incorrect installation)
- Bad Potential Transformers (overburdened, mislabeled, incorrect installation)
- Bad Meters (not accurate under normal operating conditions at the customer's site)
- Administrative Errors (wrong billing multipliers)
- Theft

## 3 Series Overview

Errors are everywhere, especially on three phase sites with instrument transformers.

On the average, around 5% of these sites have some sort of error.

On the average, each error can cost a customer around \$25,000.00 USD.

# How Does the 3 Series Find Errors

## Installation and Wiring Errors, Site Diagnostics

- Vector Diagrams, Waveforms, RMS Data Table, Harmonics Analysis

## Meter Errors

- Customer Load Meter Tests

## CT Errors

- CT Ratio Tests and Burden Measurement

## PT Errors

- PT Ratio Tests and Burden Measurement

## Administrative Errors & Theft

- Database Control - Billing System Validation - Test in the Field

# PowerMaster 3 Series

- Ultra compact meter site testing solution
- Easy to operate
- Basic functionality
- Only test under customer load (in-service) conditions
- True three phase reference standard
- Affordable price point to equip ALL metermen
- Extremely lightweight
- Database software and printable test reports

# PowerMaster 3 Series

Ultra Compact Three Phase Analyzing Reference Standard



$\pm 0.05\%$  Accuracy Class

Customer Load (In-Service) Testing

11.6" x 6.2" x 2" (295mm x 157mm x 51mm)

3.5 lbs. (1.6kg)



# PowerMaster 3 Series



- 5.7" Ultra Bright Full Color VGA Display (640x480)
- Full Navigation Keypad
- Battery Operated (Can Charge from Site Voltage)
- Ergonomic Design
- Rubberized Over-mold for Comfort, Grip and Protection

# PowerMaster 3 Series

## Functionality

### Model 3301

- Current Clamp-On Probes Only
- In-Service Meter Testing
- Meter Register / Demand Testing
- Vectors, Waveforms, Harmonics, RMS Data Table
- Database Control & PC Software

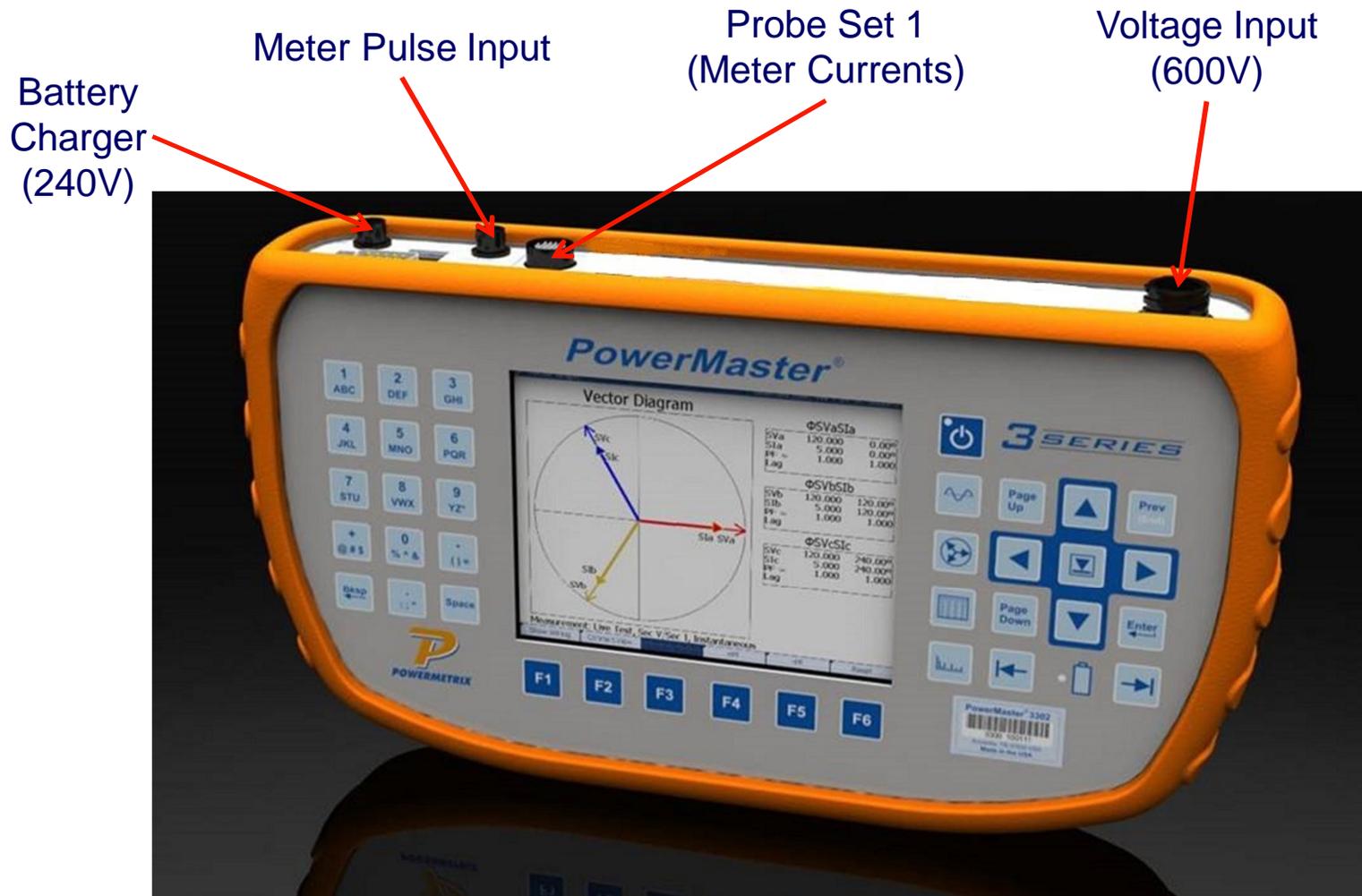
### Model 3302

- Add Direct Current Measurement (20A)
- Add In-Service CT & PT Ratio Testing
- Add in-Service CT & PT Burden Measurement



# PowerMaster 3 Series

## Model 3301



# PowerMaster 3 Series

## Model 3302

Probe Set 2  
(CT Currents or PT Voltages)

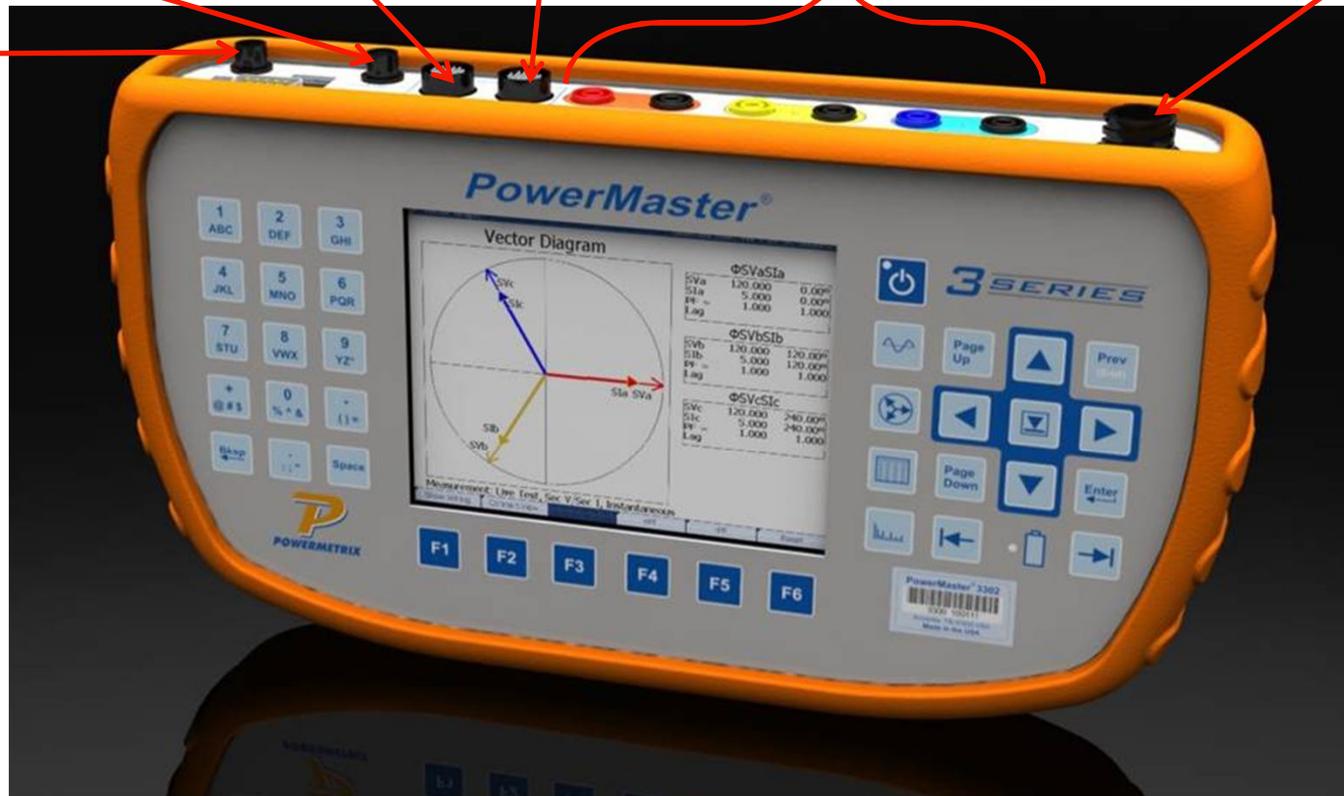
Meter Pulse Input

Probe Set 1  
(Meter Currents)

Direct Current Inputs (20A)  
Locking 4mm Banana Jacks

Voltage Input  
(600V)

Battery  
Charger  
(240V)



# PowerMaster 3 Series

The Most Innovative Field Testing Device...EVER!

Site Editor Selected Site: \*NONE\*

Site ID: 123456789 Billing Mult: 320

Service Type: 3-Phase, 4-Wire, Wye (3V, 3C) TR - S000F09

Test Setup: TEC Pri Volts: 480

Customer: POWERMETRIX Next Test: 2010 Aug 26

Account No: 12345ABCDE City: KNOXVILLE

Address 1: 10737 LEXINGTON DR State/Prov: TN Zip: 37932

Address 2: Country: USA

Substation: TEC Phone: Locator:

User 1: User 2:

Meter

Mfr	Modl	Cat#	Frm	Ty	Rt	Acc
General Elec	KV	744X900001	9S	TR	1.8	0.2

Meter SN: 123456 Comm ID:

Meter No: 987654 Kt: 1.8 IP Addr:

Section Next Page Save & Exit

## Completely Database Driven

- Store all Site Information (CTs, PTs, Meters etc.)
- Pass/Fail Dependent on Manufacturer's Specs.
- Store Historical Information
- Built-In Error Detection
- Create Specific Test Conditions
- Recall Test Data Easily
- Increase Efficiency with Integrated Site Testing

Site Editor Selected Site: \*NONE\*

CT

CT	Mfr	Model	Cat#	NPR:1	Bar	Acc	Same
CT-A	ABB	CBT-H	7882A78G10	400	0.3		<input checked="" type="checkbox"/>
CT-B	ABB	CBT-H	7882A78G10	400	0.3		<input type="checkbox"/>
CT-C	ABB	CBT-H	7882A78G10	400	0.3		<input type="checkbox"/>

SN-A: 123456 SN-B: 123456 SN-C: 123456

PT

PT	Mfr	Model	Cat#	NPR:1	Bar	Acc	Same
PT-A	ABB	PPD	7526A05G04	4	X 25.0 VA	1	<input checked="" type="checkbox"/>
PT-B	ABB	PPD	7526A05G04	4	X 25.0 VA	1	<input type="checkbox"/>
PT-C	ABB	PPD	7526A05G04	4	X 25.0 VA	1	<input type="checkbox"/>

SN-A: 987654 SN-B: 987654 SN-C: 98654

AMR

AMR	Mfr	Modl	Cat#
AMR	Hunt Technologies, Inc.	TS2	FASY-0580-AAA

SN: 123789

Section Next Page Save & Exit



# PowerMaster 3 Series

The Most Innovative Field Testing Device...EVER!

**Integrated Site Test Review** BETA TEST - p18.96M/v15.25M/c#317.04K - Selected Site: 123

Service Type: 3-Phase, 4-Wire, Wye (3V, 3C) TR  
Test Setup: Default 1

Customer Load  
Test Mode: Wh      imp/kWh: 1000.00  
 Do Demand Test  
Test Time: 0 Seconds      Test Revs: 3

Register Test  
 CT Burden Measure  
 PT Burden Measure  
 CT Ratio Test       Double Wrap  
 PT Ratio Test

Reset      Next

## Integrated Site Testing

- Create Specific Site Test Setups
- User-Definable
- Increase Efficiency
- Run ONE Test per site, NOT Multiple Tests

Simply check which tests you wish to perform!

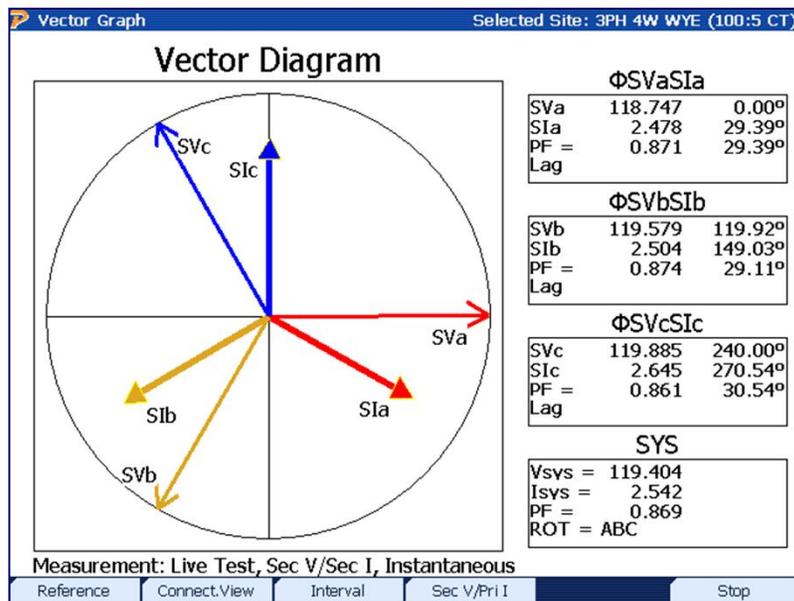
# PowerMaster 3 Series

The Most Innovative Field Testing Device...EVER!

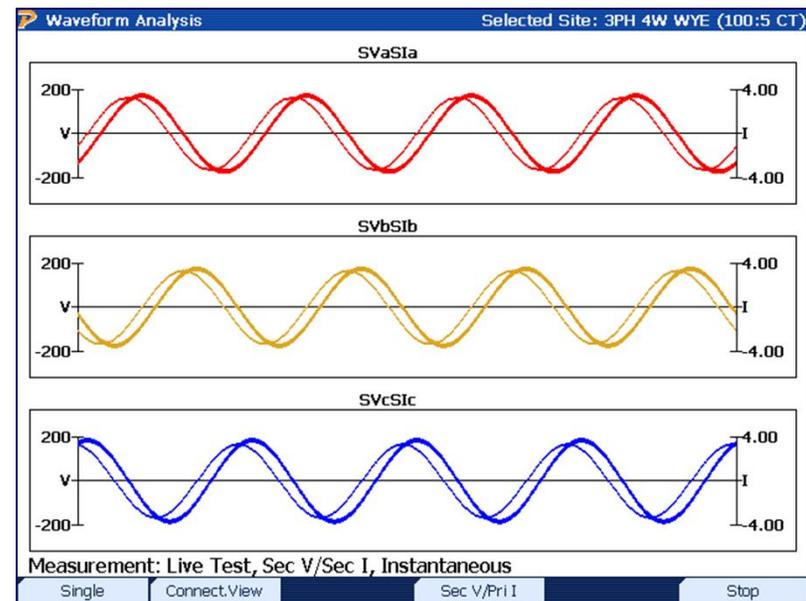
Wiring Verification and Site Diagnostics

The largest percentage of errors on sites

Vector Diagrams



Waveforms



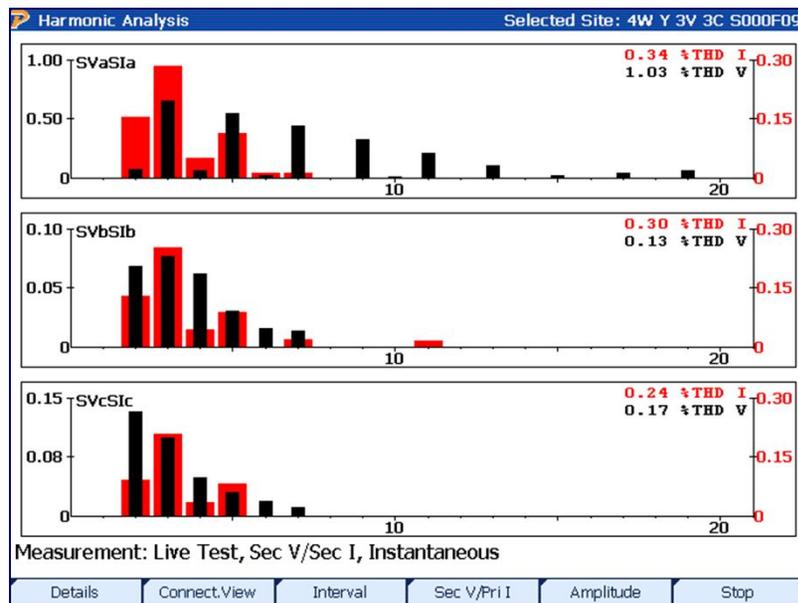
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The Most Innovative Field Testing Device...EVER!

Wiring Verification and Site Diagnostics

The largest percentage of errors on sites

Harmonics Analysis (up to 20<sup>th</sup>)



RMS Data Table

Power Meter Selected Site: 4W Y 3V 3C S000F09

**SYSTEM OVERALL SUMMARY**

	ΦSVaSIa	ΦSVbSIb	ΦSVcSIc	SYSTEM
V(FDRMS)	118.5935	119.4417	119.7183	119.2512
V(Fund)	118.5872	119.4416	119.7181	119.2490
I(FDRMS)	2.506571	2.544676	2.672775	2.574674
A(Fund)	2.506556	2.544665	2.672768	2.574663
Vθ	0.0000°	119.8656°	239.9556°	
Iθ	359.9395°	119.8011°	241.0687°	
DPFθ	-0.060506°	-0.064425°	1.113085°	
PF(PF1a)	0.999999	0.999999	0.999811	0.999937
<b>W(P1)</b>	<b>297.2454</b>	<b>303.9387</b>	<b>319.9184</b>	<b>921.1025</b>
VA(S1)	297.2456	303.9389	319.9788	921.1633
VAR(Q1)	-0.314487	-0.341550	6.216074	5.560037
THD V	1.030761%	0.125475%	0.173148%	0.443128%
THD I	0.337406%	0.297266%	0.238195%	0.290956%
FREQ	60.00011	60.00008	60.00012	60.00011

Measurement: Live Test, Sec V/Sec I, Instantaneous

Connect.View Interval Sec V/Pri I Stop

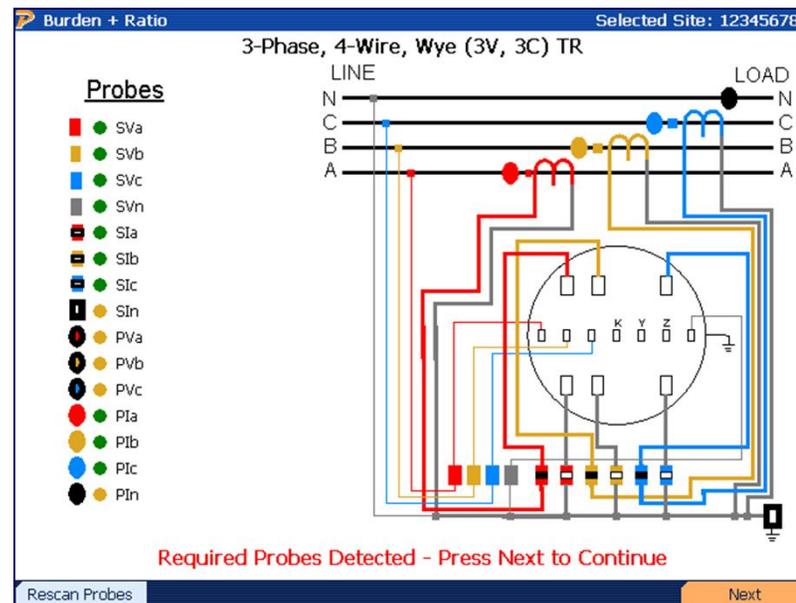
# PowerMaster 3 Series

The Most Innovative Field Testing Device...EVER!

Wiring Verification and Site Diagnostics

The largest percentage of errors on sites

Connection Diagrams



# PowerMaster 3 Series

The Most Innovative Field Testing Device...EVER!

Meter Testing  
"The Cash Register"

Customer Load Test Results Selected Site: 101

**Customer Load Meter Test**  
Wh Test

<b>% Accuracy</b>		<b>100.007</b>	
Test Info		Sys Info	
Time(sec)	16.749	Wh	3.5997
Time Left	3.251	VAh	3.6041
Pulses Exp	2.000	VARh	-0.0872
Pulses Act	2.000	V	116.435
Meter PF	0.998	I	2.2275

Restart Test in Progress

## Customer Load Meter Testing

Test the meter under its normal operating conditions.

For example:

Imbalanced Loads  
Varying Loads  
Large Harmonic Distortion  
Large Power Factors  
Extreme Temperatures

# PowerMaster 3 Series

The Most Innovative Field Testing Device...EVER!

## Meter Testing Pickups

New Magnetically Coupled IR and Visible LED Models for IEC and ANSI Markets



IR, Visible LED  
Adjustable Arm



IR, Visible LED  
Suction Cup



Mechanical  
Disk Pickup



KYZ Pickup

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The Most Innovative Field Testing Device...EVER!

## CT Testing (Ratio)

- Testing CT Ratio
- Connect all Primary and Secondary Probes
- Customer Load (In Service Testing)
- Built-In Error Detection
- Automatic Probe Recognition / Wiring Check
- Diagnose Loose Connections
- Diagnose Wiring Errors

CT Testing Results		BETA TEST - p10.51M/v10.19M/c#348.52K - Selected Site: TEST	
<b>Measured Ratio: 99.98</b>	<b>PASS</b>	<b>A</b>	
Nameplate Ratio: 100 : 5	Primary Amps: 48.49		
Ratio Error (%): -0.02%	Secondary Amps: 2.425		
Phase Error (degrees): 0.169°	Phase Error (minutes): 10' 7"		
<b>Measured Ratio: 100.08</b>	<b>PASS</b>	<b>B</b>	
Nameplate Ratio: 100 : 5	Primary Amps: 48.23		
Ratio Error (%): 0.08%	Secondary Amps: 2.410		
Phase Error (degrees): 0.373°	Phase Error (minutes): 22' 23"		
<b>Measured Ratio: 99.88</b>	<b>PASS</b>	<b>C</b>	
Nameplate Ratio: 100 : 5	Primary Amps: 48.83		
Ratio Error (%): -0.12%	Secondary Amps: 2.444		
Phase Error (degrees): 0.143°	Phase Error (minutes): 8' 33"		
<b>Test Complete</b>			
Retest	Retest All	Demagnetize	Graphs
Data	Done		

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Capture Burden Measurement BETA TEST - p21.45M/v17.19M/c#317.52K - Selected Site: 9

CT Burden Measurement

	Voltage	Current	Burden (Ohms)
Phase A:	0.5	4.90	0.1020
Phase B:	0.9	4.70	0.1915
Phase C:	2.3	4.97	0.4628

Test Failed

Retest Save

## CT & PT Burden Measurement

- Verify burden present
- Validate if circuit is currently overburdened
- Diagnose Loose Connections
- Diagnose Degraded Wiring

Capture Burden Measurement ST - p19.80M/v15.81M/c#319.25K - Selected Site: 9 With CTs

PT Burden Measurement

	Voltage	Current	Burden (VA)
Phase A:	122.7	2.33	285.891
Phase B:	119.3	2.55	304.215
Phase C:	119.6	2.39	285.844

Test Failed

Retest Save

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## CT Testing Probes



Primary Current  
Low Voltage (<600V)  
Flex CTs (3000A)



Primary Current  
Low Voltage (<600V)  
SR752 Probes (1000A)



Primary Current  
High Voltage (up to 150kV)  
Amp Litewire (2000A)



Secondary Current  
Low Voltage (<600V)  
MN375 Probes (.05 to 10A)

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PT Testing Results		BETA TEST - p16.81M/v13.56M/c-#373.30K - Selected Site: 95	
<b>Measured Ratio: 3.99</b>	<b>PASS</b>	<b>A</b>	
Nameplate Ratio: 4 : 1	Primary Volts: 454.96		
Ratio Error (%): -0.27%	Secondary Volts: 114.051		
Phase Error (degrees): -0.018°	Phase Error (minutes): -1' 3"		
<b>Measured Ratio: 3.99</b>	<b>PASS</b>	<b>B</b>	
Nameplate Ratio: 4 : 1	Primary Volts: 454.89		
Ratio Error (%): -0.30%	Secondary Volts: 114.061		
Phase Error (degrees): -0.050°	Phase Error (minutes): -3' 1"		
<b>Measured Ratio: 3.99</b>	<b>PASS</b>	<b>C</b>	
Nameplate Ratio: 4 : 1	Primary Volts: 455.07		
Ratio Error (%): -0.26%	Secondary Volts: 114.062		
Phase Error (degrees): 0.064°	Phase Error (minutes): 3' 50"		
Test Complete			
Retest	Retest All	Done	

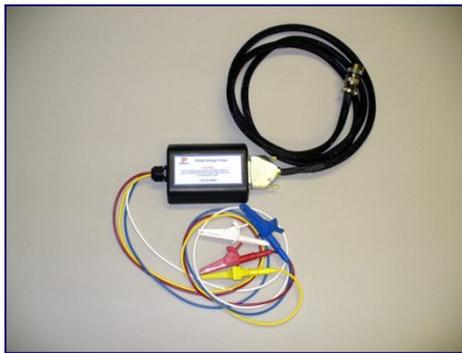
## PT Testing

- Ratio Testing
- Low Voltage Probes (<600 Volts)
- High Voltage Probes (up to 40kV)
- In Service Testing

# PowerMaster 3 Series

The Most Innovative Field Testing Device...EVER!

PT Testing Probes



Primary Voltage  
Low Voltage (<600V)  
VP600 Probe



Primary Voltage  
High Voltage (up to 40kV)  
Volt Litewire Probe

# PowerMaster 3 Series

MODEL 3301

FULL SPECIFICATIONS



# PowerMaster 3 Series

## MODEL 3301 - FULL SPECIFICATIONS

### Three Phase Reference Standard

- $\pm 0.05\%$  Accuracy: Direct Inputs
- $\pm 0.10\%$  Accuracy: Probe/Clamp Inputs

### Real Time Phasor Diagrams including Amplitude and Phase

### Voltage and Current Waveforms

### Voltage and Current Harmonics w/ THD (up to the 20<sup>th</sup>)

### Measurement Values

- AC Volts, AC Amps, Watt, VAR, VA, Phase Angle, Power Factor, Frequency

### Customer Load Meter Accuracy Testing

- Watthour, VARhour, VAhour, Demand
- IEC Meter Form: 1 Phase- 2 Wire; 1 Phase- 3 Wire, 3 Phase-4 wire, 3 Phase-3 wire
- All ANSI forms except 7s and 24s

### 3 Phase AC Voltage Inputs (46 to 600VAC RMS)

### Neutral AC Voltage Input

### 3 Phase Current Clamp Input (for meter currents)



# PowerMaster 3 Series

## MODEL 3301 - FULL SPECIFICATIONS

Power Factor Measurement (-1.00 to 1.00)

Meter Pulse Input

USB Port for Data Transfer

Display: 640 x 480 Full Color VGA 5.7"

Weight: 3.5lbs (1.6kg) not including cables

Dimensions: 11.6" x 6.2" x 2.0" (295mm x 157mm x 51mm)

Battery Operated: 11.1V Li-Ion Rechargeable

Auxiliary Power Input: 120 to 240VAC

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

Storage Temperature: -30°C to 60°C (-22°F to 140°F)

Database Software Included

- Data Storage & Test Report Generation and Printing



# PowerMaster 3 Series

MODEL 3302

FULL SPECIFICATIONS



# PowerMaster 3 Series

## MODEL 3302 - FULL SPECIFICATIONS

### Three Phase Reference Standard

- $\pm 0.05\%$  Accuracy: Direct Inputs
- $\pm 0.10\%$  Accuracy: Probe/Clamp Inputs

### Real Time Phasor Diagrams including Amplitude and Phase

### Voltage and Current Waveforms

### Voltage and Current Harmonics w/ THD (up to the 20<sup>th</sup>)

### Measurement Values

- AC Volts, AC Amps, Watt, VAR, VA, Phase Angle, Power Factor, Frequency

### Customer Load Meter Accuracy Testing

- Watthour, VARhour, VAhour, Demand
- IEC Meter Forms: 1 Phase-2 Wire; 1 Phase-3 Wire, 3 Phase-4 wire, 3 Phase-3 wire
- All ANSI forms except 7s and 24s

### Customer Load Current Transformer Testing

- Ratio Testing
- Burden Measurement



# PowerMaster 3 Series

## MODEL 3302 - FULL SPECIFICATIONS

Customer Load Potential Transformer Testing

- Ratio Testing
- Burden Measurement

3 Phase AC Voltage Inputs (46 to 600V RMS)

Neutral AC Voltage Input

3 Phase AC Current Inputs (100mA to 20A RMS)

3 Phase Current Clamp Input (for meter currents)

3 Phase Current & Voltage Probe Input

- Primary CT Currents and Primary PT Voltages

Power Factor Measurement (-1.00 to 1.00)

Meter Pulse Input

USB Port for Data Transfer



# PowerMaster 3 Series

## MODEL 3302 - FULL SPECIFICATIONS

Display: 640 x 480 Full Color VGA 5.7"

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Regards from Knoxville, Tennessee

