



C.T. ERROR TESTER 590G-V3 DATASHEET

With optional
- Integrated five ratio
MultiTap feature



REDPHASE INSTRUMENTS

Contents

	Section
Key Features	
Application and measurements	1
Where it is used	1.1
Ratio and error measurement of an uncompensated CT	1.2
Ratio error measurement of a compensated CT	1.2.1
Multitap CT ratio error measurement	1.2.2
PT ratio error measurement	1.3
Burden measurement	1.4
Admittance measurement	1.5
Hardware features	2
Power source	2.1
Interface	2.2
Case details	2.3
Transit case	2.3.1
Case sizes (LxWxH)	2.3.2
Weight	2.3.3
Operating Ranges	3
PT Measurable test ranges	3.1
CT Measurable test ranges	3.2
Admittance measurement range	3.3
CT Burden measurement range	3.4
PT Burden range	3.5
Measurement Accuracy	4
CT Ratio accuracy	4.1
CT Phase error accuracy	4.2
Winding resistance accuracy	4.3
External burden range	4.4
PT Turns ratio measurement accuracy	4.5
PT Phase error resolution	4.6
Protection features	5
Power supply and consumption	6
Additional features	7
Compliance & certifications	8
Test procedure for PTs	9
Test procedure for CTs	10
590G-V3 connections	11
Accessories included	12
Secondary CT cable and accessories	12.1
Primary CT cable and accessories	12.2
Accessories (optional)	13
Multitap cable loom	13.1
Multitap cable loom accessories	13.2

Key Features of the 590G-V3

- **The 590G-V3 is a portable light weight instrument designed to test metering current and potential transformers offline. The instrument may be used in both 50Hz and 60Hz systems**
- **It is capable of testing an uncompensated current transformer or CT for current and phase error with an accuracy up to 0.05% across ratio ranges of 5/1 up to 30,000/5 or 6000/1.**
- **It is also able to measure the turns ratio and phase error of a potential transformer or PT up to 300kV/110V.**
- **Calculates overall CT errors under simulated load using model based test techniques which employ secondary injection stimulation and excitation measurements. This gives the field operator a very quick and accurate idea of a CTs health without the need to use expensive and unwieldy primary injection techniques to achieve a similar outcome.**
- **Prior to CT commissioning for online use the 590G-V3 is able to calculate it's offline admittance at 1.6kHz. This parameter is a reflection of a CTs core loss and may be used as a reference for future routine live CT admittance tests using a Red Phase model 505B.**
Such routine tests will reveal trends in the CTs operational health.
*The model 505B carries out live Admittance tests rapidly during normal operation with the primary 50/60Hz current present; It does **not** interrupt supply.*
- **The 590G-V3 can measure a CT and/or PT secondary circuits to ensure that the transformers are not over burdened. This is called a burden test.**
- **Users are able to create their own set of injection test points, up to six, across up to five burden test levels.**
- **CT batch testing possible.**
- **Multi-Tap CT test option with the ability to test up to 5 different ratios on one metering CT.**
- **The 590G-V3 can store to 2000 CT records, including multitap records and also 2000 PT records.**
- **Performs auto-logging of each test in case a fault occurs. If the fault cannot be remedied, Red Phase will ask that the recorded test log be downloaded and sent to them for analysis to determine likely cause of fault.**
- **Able to provide intelligent CT class, (pass or fail) results assessment and can also provide best fit class determination.**
- **Able to download test records to a USB flash drive or via Bluetooth to a connected smart device.**
- **Remote control feature via Bluetooth and PC software.**

1.0. Applications and measurements

1.1. Where it is used

The Model 590G-V3 is a modestly priced, light-weight field portable instrument designed to audit PT and CT installations in a utility system.

The Model 590G-V3 is used for many routine workshop tests, as well as field testing a metering CT's current and phase error to an accuracy of less than 0.05% but in most cases less than 0.02% across most uncompensated CT's. It is optimised for testing metering CTs, but can also test protection CTs and inductive PT's for ratio and phase error at normal burden.

1.2. Ratio error measurement of standard uncompensated CT

The 590G-V3 tests a CT by measuring the turns ratio and the 50Hz / 60 Hz losses of the CT core and secondary winding. These tests require the CT to be offline for only a few minutes.

Uncompensated CT measurement at a power factor between 0.8 and 1 is typically measured to within 0.05% or better across 10% to 120%, of rated current, but more often the measured errors are less than 0.02% when compared against a whole current CT reference.

Note: nominal primary test point loads can be customized by the user to 400% if required.

1.2.1 Ratio error measurement of a compensated CT

Measurement of a compensated CT is performed in the same way as above, however the added secondary winding cannot be separately measured which does occasionally lead to a wider variation in current error calculation, however it is still typically within 0.05% or better for compensated CT's such as: parallel reduced cross section or composite core types.

Empirically, gapped core half turn compensated CT's have shown the largest current error variation up to 0.15% at some test points.

1.2.2 Multitap CT ratio error measurement

The 590G-V3 has an optional feature for the measurement of a 5 ratio multitap metering CT. If chosen, the multitap hardware is integrated within the instrument and a dedicated cable loom is provide with accessories to facilitate connection.

1.3. PT Ratio error measurement (No Load)

The Model 590G-V3 will test the turns ratio of a single phase inductive PT at a reduced level of energization with its own internal solid state voltage source.

Tests on a variety of P.T.s up to 300kV rating has established that a reduced energization level will give results to typically within 0.02% or better in most cases. Since the conventional testing of P.T.s at rated energization levels is expensive, time consuming and frequently neglected the Model 590G-V3 can provide an affordable alternative.

1.4. Burden measurement

The burden of the metering circuit can be measured by connecting the C.T. or P.T. secondary circuit to the VA terminals of the Model 590G-V3. This will check that the C.T. and / or P.T. will not be overloaded under normal service conditions.

1.5. Admittance measurement

The integrity of a C.T. can be guaranteed in future at minimal cost by performing a 1.6kHz admittance test with the 590G-V3. The result is stored and then referred to as a characteristic blueprint for this C.T.. It may be referenced in future online (Live) admittance tests performed by the Model 505B Live C.T. Tester.

Remaining connected online the 505B takes less than a minute to perform the 1.6kHz admittance test.

The admittance of a C.T. is a very sensitive indicator of CT losses which may be representative of symptoms such as shorted turns and other common faults which can cause metering errors of 1 to 20% and be easily overlooked for years. Many hundreds of the Model 505B's have been sold in to cost conscious utilities and it is a unique answer to what is a serious revenue loss problem.

2.0. Hardware features

2.1. Power source

The Model 590G-V3 has its own internal solid state voltage source to test PT's and CT's. The source can generate up to 150V at 50Hz or 60Hz, and 2V at 1.6kHz. To avoid spurious results caused by 50Hz / 60Hz pickup from nearby equipment, the tests are carried out at 51Hz or 61Hz and the software then extrapolates the 51Hz or 61Hz test results for an actual 50Hz or 60Hz test.

2.2. Interface

The alphanumeric keyboard on the front panel can be used to enter information about the item to be tested. Above the keyboard is a backlit seven, 7" inch colour LCD screen which displays the keyed information and final test results.

2.3. Case details .

The instrument's aluminium chassis is enclosed in a hardwearing "Pelican" brand injection moulded plastic case.

2.3.1. Transit case

A foam line plastic transit case is also provided as standard for transportation.

2.3.2. Case Sizes (L x W x H)

590G-V3 case: 410 cm X 33 cm x 18 cm.
Transit case: 56 cm X 32 cm X 50 cm

2.3.3. Weight

590G-V3: ~8kgs
Transit case: ~5kgs
Test leads & accessories: ~3kgs

3.0. Operating ranges

3.1. PT Measurable test ranges

No load voltage ratio only

- Maximum ratio 300kV / 110V
- Minimum ratio 2.5kV / 100V
- VA rating from 1 to 300VA

3.2. CT Measurable Test ranges

Maximum ratio	60,000/5 or 12,000/1
Minimum ratio	5/5 or 1/1
VA Rating 1A Secondary	Up to 25VA
VA Rating 5A Secondary	Up to 300VA
Selectable % I _{PRIMARY}	1% to 400%
Selectable % Burden	10% to 100%
Selectable PF	0.5 to 1.0

Measurable CT Types:

Single and multiple tap uncompensated
Compensated
Composite core
Gapped core

3.3. Admittance measurement range

50/60Hz	100uS to 100mS + 0.5%
1.6kHz	100uS to 50mS. + 0.5%

3.4. CT Burden measurement range

1A Type	0 to 25 Ohms / 25VA
5A Type	0 to 12 Ohms / 300VA

To achieve the burden measurement the 590G-V3 typically injects 0.5A up to a limit of 25V to measure the C.T. burden value

3.5. PT Secondary burden range

100V / 110V	0 to 300VA
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4.0. Measurement accuracy

4.1. CT Ratio accuracy from 5% - 120% I_p

Ratio Ranges	Ratio Accuracy
5/5 to 10,000/5	0.02% to 0.05%
10,000/5 to 20,000/5	0.05% to 0.08%
20,000/5 to 60,000/5	0.08% to 0.15%

%Injection Ranges	Ratio Accuracy
1% to 4%	0.05% to 0.1%
5% to 120%	0.02% to 0.05%
120% to 200%	0.03% to 0.05%
200% to 400%	0.05% to 0.1%

4.2. CT Phase error accuracy

1% to 120% Primary I: 1 min

4.3. Winding resistance accuracy

Resolution to 1 mΩ + 0.2 %

4.4. External burden

Resolution to 1 mΩ + 0.2 %

The 590G-V3 will also test **gapped core CTs** to an accuracy range of between 0.02% to 0.05% at 120% and 100% of rating at 100% burden.

As the current and burden levels become lower the action of the split core causes more current ratio measurement error.

4.5. PT Turns ratio measurement accuracy

Down to 0.02% from 1.5kV/100V to 110kV/110V
Down to 0.03% from 110kV/110V to 300kV/110V

4.6. PT Phase error resolution

To 1min.

5.0. Protection features

- Fuses for Mains input, 12V battery supply and internal power amplifier.
- Flashing LED when terminals are live.
- Buzzer to indicate error conditions.

6.0. Power supply & consumption

Mains connected

Mains Supply:	85 - 264 VAC, 50/60Hz
Standby Power:	26 W at 240 Vac
Standby current:	~100mA
Maximum:	45 W at 240 Vac
Maximum current:	~190mA

Auxiliary supply

Battery:	11.5 Vdc to 14.5 Vdc
Standby current:	~ 2.2 A at 12 Vdc
Maximum current:	~ 4.0 A at 12 Vdc

Includes:

- Battery charge monitoring
- Low battery auto-shutdown

7.0. Additional features

- Auto CT class assessment to 0.1 class
- Six customizable current test points across up to 5 burdens from 0 to 100%.
- Online record viewer software with easy to understand results format.
- PC based remote control software
- Five ratio multitap CT test option

Please refer to the operating manual for more information.

8.0 Compliance & certifications

CE compliance Assessed against **EN 61010-1:2001**

In accordance with: **LVD 2006/95/EC**

EMC compliance Assessed against **EN 61326-1:2021**
EN 61326-1:2020

9.0. Test procedure for PTs

- i. Isolate the PT primary side, and connect it to VA and COM terminals of 590G-V3 using the 4 to 2 wire VA kelvin cable supplied.
- ii. Isolate the PT secondary side, and connect it to 590G-V3 "VB" and "COM" terminals with the VB cable supplied.
- iii. Key in PT test data including:
- Primary voltage
 - Secondary voltage
 - VA rating and
 - Serial number.
- iv. Start the test...
The voltage and phase error results are given on the large LCD display

10.0. Test procedure for CTs

- i. Isolate the CT primary side.
Use a length of cable to place one turn through the window of the CT and connect it to "VB" and "COM" terminals of 590G-V3.
- ii. Isolate the CT secondary side, and using the 4 to 2 wire VA kelvin test lead supplied with the 590G-V3 and connect the secondary to the group of 4 terminals marked "VA" and "COM".
- iii. Key in test data for the CT including:
- Rated primary current
 - Rated secondary current
 - Burden rating in VA
 - Power Factor, PF
 - Accuracy class
 - Test standard / type, e.g. IEC 60044-1
- iv. The test takes approximately 1 minute to complete after which the results of the CTs current and phase errors at the various primary current test points are displayed on the screen.
- v. To complete testing the PT and CT installation, the 590G-V3 can be connected to the two wires of the PT or CT secondary circuit and a burden test can be performed.
- This will give an indication if the PT or CT is operating within it's limits of rated burden.
- vi. A 1.6kHz admittance test should be carried out if the intention is to permanently commission a CT in areas where isolating the load is not possible.
This test will provide a reference of the CT's core health before commissioning and future 1.6kHz admittance tests may be performed on-line using the Red Phase model 505B admittance tester which is designed to measure the CT's 1.6kHz admittance in a live installation.

11.0. 590G-V3 connections

VA & VB Injection & Sense Terminals
CT / PT primary and secondary connection Terminals.

USB Ports – type A and type B

Type A - Flash Drive

Used to transfer records to a storage device such as a USB flash stick.

Note: Flash stick memory capacity should not exceed 32GB.

Type B - Service

Factory use only

590M

Provisional connector for future project

Multi-Tap

Dedicated connector for use with optional multitap accessory cable.

Printer

Connector for optional thermal printer

Battery Supply

Connector for external battery supply such as a car battery or any battery pack rated between 11.5 Vdc to 14.5 Vdc.

Minimum recommended capacity: 7AH

Supply

IEC socket for mains supply

12.0. Accessories included

12.1. VA Kelvin cable and accessories



Cable	Length
1 x VA Kelvin cable :	8 m / 26 ft
2 x Male to Female cables	150 mm / 5.9 in
2 x Female to spade cables	150 mm / 5.9 in

12.2. VB CT cable and accessories



Cable type/s	Length
1 x VB cable :	8 m / 26 ft
1 x Interconnection cable	350mm / 14 in
2 x Female to spade cables	150mm / 5.9 in

Other cables included

1 x Battery cable & clamps	5 m / 16.4 ft
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Other connectors included

2 x Red + 2 x Black crocodile clips

Please note:

Existing accessory cables are also used for testing PTs.

13.0. Accessories (optional)

13.1. Multitap cable loom

Cable length: 2.5 m / 8.2 ft -default size.
The cable loom length can be customized to suit specific customer requirements.

This 12 to 6 way Kelvin cable comes with a multipin amp connector on one side for direct connection to the 590G-V3.

The cable extends out to 6 CT secondary leads terminated by 4mm protective retractable plugs which connect directly or via the accessory cables to the Multitap CT secondary terminals.

The 6 extended cables are all labelled as per general convention reflecting which secondary CT terminal it must connect to.

The extended cables are labelled:

- S1 / Com - Common reference
- S2 - lowest ratio
- S3 - ratio S3 > S2
- S4 - ratio S4 > S3
- S5 - ratio S5 > S4
- S6 - ratio S6 > S5



13.2. Multitap cable loom accessories

Cable type	Length
6 x Female to spade cables	150 mm / 5.9 in

