

PFRS-25

Transformer Frequency Response Analyzer



Outstanding Features

- Wide dynamic range > -150 dB
- USB and Bluetooth communication interfaces
- Optional battery backup
- Analysis and decision support built into user friendly software.
- Import data traces of other instruments.
- Test templates for increased productivity in the field
- Test performance in accordance with IEEE and IEC standard
- Customized test report
- Light-weight field portable enclosure

Product Overview

The PFRS-25 can confirm the mechanical integrity of a transformer by comparing the frequency response of the transformer with the previous known results. Every transformer has a unique frequency response which changes if the mechanical geometry of the transformer is changed. These changes can occur due to physical movement or transportation. The physical geometry can also change if the transformer experiences high current due to internal or external faults. The fingerprint comparison of the transformer's frequency response can be used to detect power transformer problems such as:

- Core movements
- Shorted turns or open windings
- Winding displacements or deformations
- Winding connection problems
- Broken clamping structures.

Measuring Principle

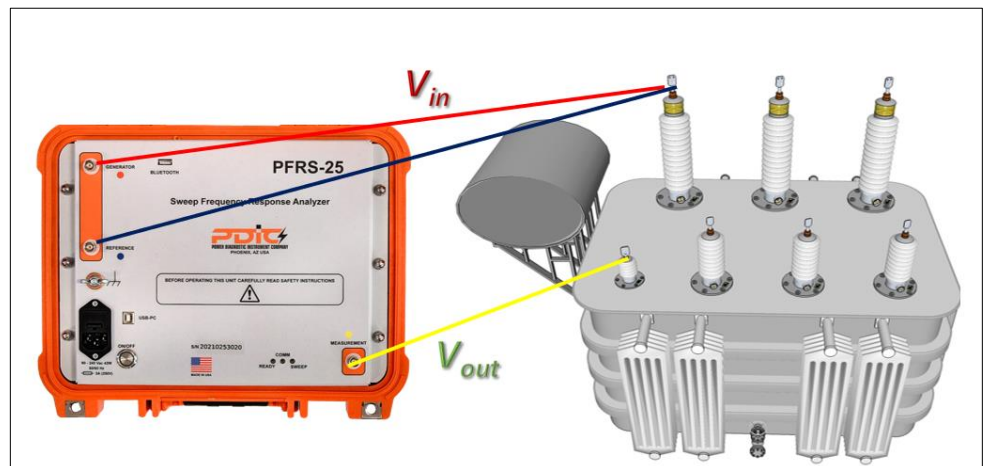
The PFRS-25 injects the voltage of the known value (generator/Reference) at one end of the winding and measures the voltage at the other end of the winding (measure Voltage) over a wide frequency range. The result is plotted at the ratio of measure voltage to the reference voltage. The test result plot can be compared with the reference of previous results. When variation is found, it may indicate damage to the transformer. Frequency response analysis can detect many types of faults such as turns to turn short circuit, the condition of transformer oil, and mechanical displacement.

Applications

A transformer winding can be represented as an RLC network. Any type of fault that occurs may be a result of a change in this RLC network. Due to these changes, the frequency response may change before shipment, transport, or relocation of the transformer or post fault, etc.

By examining the trace of the transformer with the reference trace following defects of the transformer can be effectively detected with a PFRS-25:

- Shorted turn
- Winding movement/looseness
- Hoop buckling
- Magnetized core
- Core looseness
- Core grounding
- Oil degradation

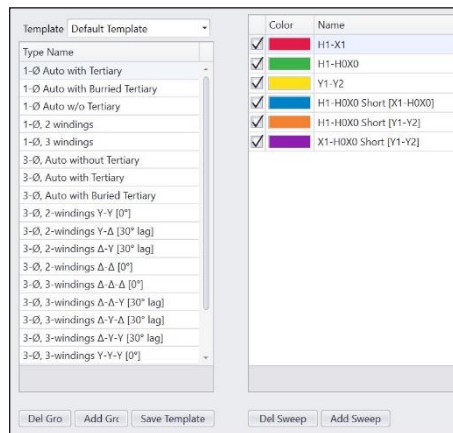


The included PFRA user-friendly software from PDIC can be used to control the PFRS-25 and analyze test results. It can compare the test results from a previous test or a reference trace.

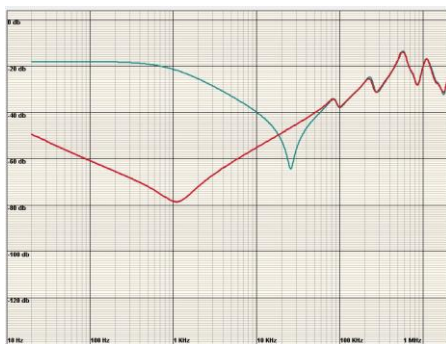
Test Plan Templates

The PFRA features a test plan templates library for commonly used transformers. This allows users to quickly create a test plan for a specific transformer for improved productivity. A new test plan can be added very easily by modifying the existing test plan or starting a new test plan from scratch.

Graph and Data Views



The PFRA software can display the test results in Amplitude, phase angle and test data (Excel-like) mode.



Frequency Hz	Magnitude dB	Phase °	Impedance Ω
[1] 20.000 Hz	-15.99881	-1.99500	0.009
[2] 20.962 Hz	-15.96084	-2.06400	0.009
[3] 21.971 Hz	-15.91116	-2.10500	0.009
[4] 23.028 Hz	-15.91037	-2.18200	0.009
[5] 24.136 Hz	-15.91050	-2.24400	0.009
[6] 25.297 Hz	-15.90659	-2.31600	0.009
[7] 26.514 Hz	-15.90954	-2.40400	0.009
[8] 27.790 Hz	-15.91557	-2.49300	0.009

Test Voltage

The test voltage is settable from 0.2-24 Vp-p and allows the user to set the test voltage to the value used for previous tests if it is different than the typical 20 V p-p.

Customized Number of Test Points

The number of test points between a defined frequency band can be customized. The maximum number of test points for a defined trace can be set up to 32,000.

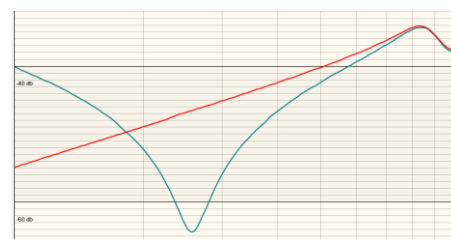
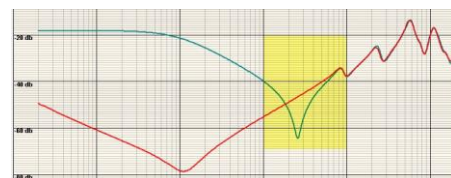
Low Frequency	High Frequency	Measurements
20	200	50
200	2000	100
2000	20000	200
20000	200000	300
200000	2000000	400

Customized Trace Data Acquisition

The trace can be configured to start from high frequency to low frequency or low frequency to high frequency to match the process followed for the previous trace. This features shows for different methods of acquiring data for the frequency trace.

Trace Zoom Feature

Any part of the trace can be zoomed in on by just drawing a square using the computer pointing device around the area to be zoomed for easy analysis. When the pointing device is placed on the trace, the software will indicate the frequency (x axis) and dB value (y axis) which helps the user to compare the traces.



Quick Test Function

The PFRA's quick test feature can scan the trace in under 6 seconds to confirm that the connections to the instrument are good. Any wrong, loose, or bad ground connections can be detected quickly if the quick test scan does not show the expected trace shape or shows a noisy trace.

Test Data Import Feature

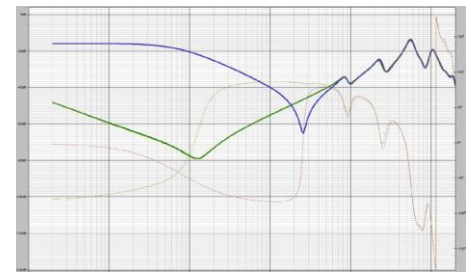
The PFRA software can import test results (without any conversion) of all other manufacturers of SFRA instruments. It can also import test results in IEC, CIGRE or CSV

format.

Trace Customization

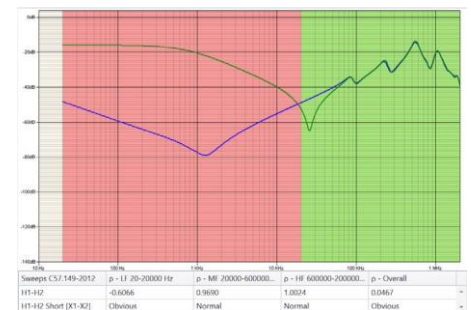
The PFRA software does not limit the number of traces that can be displayed. All or individual traces can be shown or hidden and each trace's color can be configured for easy analysis.

The trace display line thickness can be customized for better visibility and easy analysis.



IEEE C57.146 and DL/T 911 Visual Indications

Comparison of traces with visual indication of Normal, suspect, severe and Obvious condition can be done per IEEE C57.149 and DL/T 911 standard.



Test Report Customization

Test reports can be customized with a custom header and logo.

Test: 2017-04-14 15:20 Shop transformer #2 1 ph 2
 Type: 1-0, 2 windings
 mfg

Company: Howard Industries
 Vector Group: Single Phase
 Impedance %: 5%
 Substation: Shop
 Serial Number: 466454

Designation: Lab use
 Date of Mfg: 1997
 KV: 466454 123 456
 MVA: 123 456 789
 Type: Pole Mount
 Transformer ID: shop sample

DETIC pos: N/A
 Air Temp: 72F
 Top oil temp: 71F
 LTC pos: N/A
 Tested By: HN

Weather: Nice
 Cooling: Air
 Oil Status: Full
 % RH: 20%

Hardware Features

Fastest Sweep Time

PFRS-25 is a lightweight, field portable single box for diagnostic of transformer mechanical integrity. It offers high measurement accuracy of ± 0.1 dB for all ratios between +10 dB and -60 dB and ± 0.3 dB at ratios above -60 dB. At under 20 seconds (20 Hz-2MHz), the PFRS-25 has the fastest sweep time of all current FRA instruments, considerably reducing transformer testing time.

Computer Interfaces

Built-in Bluetooth communication enables users to be at a convenient and safe distance from the instrument and the transformer under test. This feature is very convenient when the weather is severe. The PFRS-25 instrument can be put on the transformer while a user with a PC can be at a comfortable and safe distance. The unit also provides a visual indication on the front panel and in the software that a connection is active. A standard USB 2.0 interface is also provided.

Optional Battery Backup

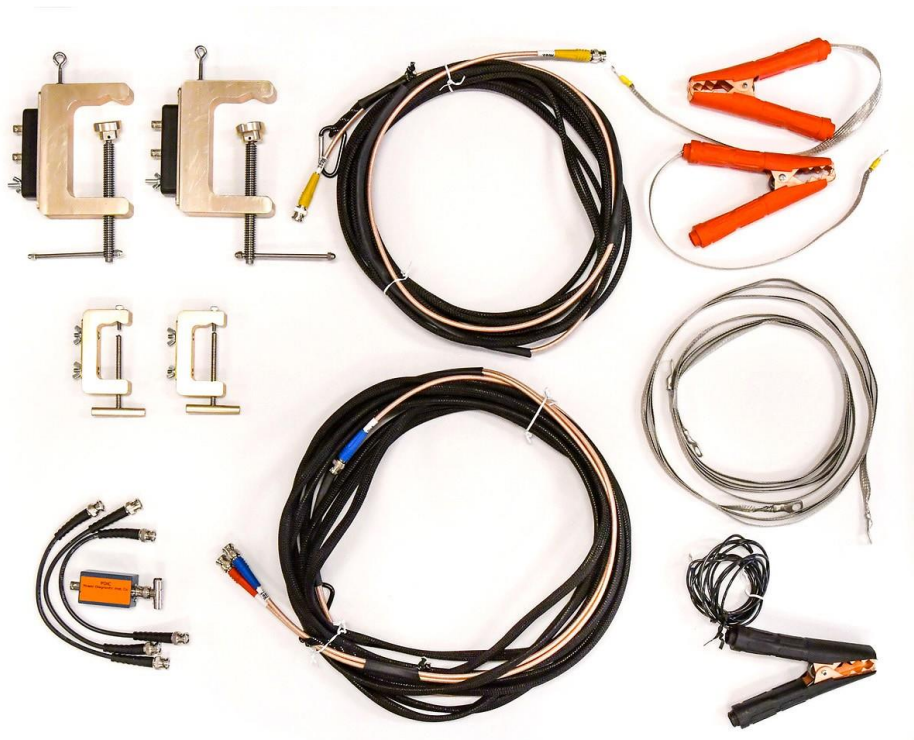
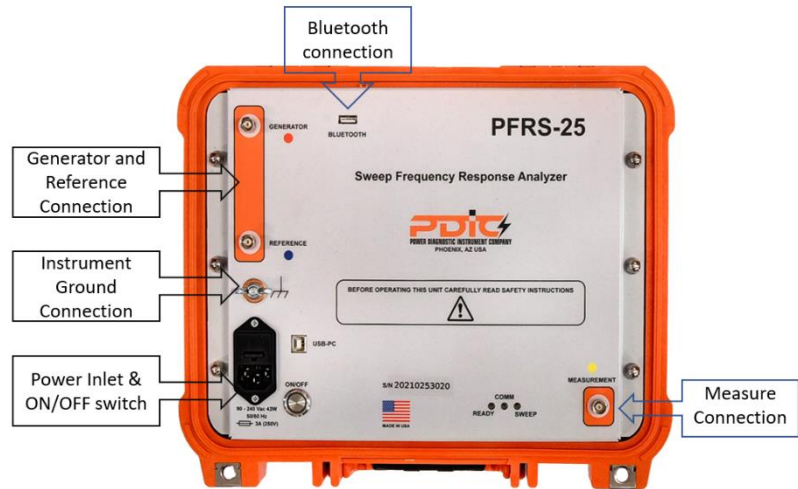
An optional built-in battery backup can be added for situations where an AC power source is not readily available. The 12V, 3AH battery allows a user to test for up to 4 hours without recharging. The instrument can also be used with the AC power while the battery is charging. The software, when connected with the instrument, indicates the charge on the battery.

Clamps and Test Cables

Simple universal C clamps with BNC connectors are suitable for all different types of bushing connections. They can easily accommodate copper flat and round bushing terminations. Similar ground clamps facilitate fast and easy connections for the ground braid.

Documentation

A user's manual is provided with each unit. Also, a quick start guide sticker is provided in the instrument lid. The quick start guide provides the connection information for short circuit as well as open circuit connection and guides the user on how to make proper connections.





PFRS-25 Technical Specifications

ENVIRONMENT

Ambient Temperature	Operating: -26°C to +55°C (-14°F to +131°F) Storage: -26°C to +70°C (-14°F to +158°F)
Humidity	< 95% RH, non-condensing

CE MARKING

EMC	2004/108/EC
LVD	2006/95/EC

GENERAL

AC Power Supply	90 – 264 V AC, 47 – 63 Hz
Internal Battery	3.2 Ah, 38 Watts
Dimensions	13" x 11" x 6" (34 cm x 29 cm x 15 cm)
Weight	10.0 lbs. (4.5 Kg) Includes the field rugged ABS Enclosure
Transportation Case	24.5" x 19.37" x 12.22" (62.33 cm x 49.2 cm x 31.04 cm)

MEASUREMENT SECTION

Frequency Range	0.1 Hz – 25 MHz, user selectable
Frequency Resolution	0.01% OR 0.001Hz
Frequency Accuracy	0.01% (measurement error)
Level Resolution	0.0005 dB
Number of Points	Default 1046, Up to 32 000 points, user selectable
Measurement Time	< 20 S, fast setting 6 S (20 Hz – 2 MHz)
Points Spacing	Log, linear, or both
Sweep Settings	20 Hz to 2 MHz
Internal Noise Level (average)	> 140 dB
Dynamic Range	> 150 dB
Accuracy	±0.1 dB from +10 to -60 dB and ±0.3 dB (min) below -60 dB
IF Bandwidth	User selectable, default <10%
PC Communication	USB and Blue Tooth
Software	Windows compatible
Standards / Guides	Fulfills requirements in IEC 60076-18, IEEE C57.149-2012, CIGRE Technical Brochure 342, DLT 911-2004, as well as other international standards and recommendations

ANALOG OUTPUT

Channels	1
Compliance Voltage	0.2 – 24 V p-p
Measurement voltage at 50Ω	0.1 - 12 V p-p
Channel Protection	Short-circuit and over voltage protection
Sweep Direction	Low to high or high to low
Frequency Range	0.1 Hz – 25 MHz, user selectable

ANALOG INPUT

Channels	2
Sampling	Simultaneous
Frequency Range	0.1 Hz – 25 MHz
Input Impedance	50 Ω
Sampling Rate	100 MS/s

Specifications are valid at nominal voltage and ambient temperature of +25°C (+77°F)