

FRANEO 800

Getting Started



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The product information, specifications, and technical data embodied in this manual represent the technical status at the time of writing and are subject to change without prior notice.

We have done our best to ensure that the information given in this manual is useful, accurate and entirely reliable. However, OMICRON does not assume responsibility for any inaccuracies which may be present.

The user is responsible for every application that makes use of an OMICRON product.

OMICRON translates this manual from the source language English into a number of other languages. Any translation of this manual is done for local requirements, and in the event of a dispute between the English and a non-English version, the English version of this manual shall govern.

1 Safety instructions

1.1 Operator qualifications

Working on high-voltage assets can be extremely dangerous. Consequently, only personnel qualified, skilled and authorized in electrical engineering and trained by OMICRON are allowed to operate *FRANEO 800* and its accessories. Before starting to work, clearly establish the responsibilities.

Personnel receiving training, instructions, directions, or education on *FRANEO 800* must be under constant supervision of an experienced operator while working with the equipment. The operator is responsible for the safety requirements during the whole test.

1.2 Safety standards and rules

1.2.1 Safety standards

Testing with *FRANEO 800* must comply with the internal safety instructions and additional safety-relevant documents.

In addition, observe the following safety standards, if applicable:

- EN 50191 (VDE 0104) "Erection and Operation of Electrical Test Equipment"
- EN 50110-1 (VDE 0105 Part 100) "Operation of Electrical Installations"
- IEEE 510 "IEEE Recommended Practices for Safety in High-Voltage and High-Power Testing"

Moreover, observe all applicable regulations for accident prevention in the country and at the site of operation.

Before operating *FRANEO 800* and its accessories, read the safety instructions in this Getting Started carefully.

Do not turn on *FRANEO 800* and do not operate *FRANEO 800* without understanding the safety information in this manual. If you do not understand some safety instructions, contact OMICRON before proceeding.

Maintenance and repair of *FRANEO 800* and its accessories is only permitted by qualified experts at OMICRON Service Centers (see "Support" on page 23).

1.2.2 Safety rules

Always observe the five safety rules:

- ▶ Disconnect completely.
- ▶ Secure against re-connection.
- ▶ Verify that the installation is dead.
- ▶ Carry out grounding and short-circuiting.
- ▶ Provide protection against adjacent live parts.

1.3 Operating the measurement setup

- ▶ Before handling *FRANEO 800* in any way, connect its equipotential ground terminal with a solid connection of at least 6 mm² cross-section to the ground terminal of the power transformer under test.
- ▶ Make sure that the ground terminal of the power transformer is in good condition, clean and free of oxidation.
- ▶ Before disconnecting the power transformer under test from *FRANEO 800*, ground all transformer's connections.
- ▶ Do not open the *FRANEO 800* housing.
- ▶ Do not repair, modify, extend, or adapt *FRANEO 800* or its accessories.
- ▶ Use only the *FRANEO 800* original accessories available from OMICRON.
- ▶ Use *FRANEO 800* and its accessories only in a technically sound condition and when its use is in accordance with the regulations. In particular, avoid disruptions that could in turn affect safety.

1.4 Orderly measures

The *FRANEO 800* Getting Started or alternatively the e-book has always to be available on the site where *FRANEO 800* is operated.

The users of *FRANEO 800* must read this manual before operating *FRANEO 800* and observe the safety, installation, and operation instructions therein.

FRANEO 800 and its accessories may be used only as described in this Getting Started. Any other use is not in accordance with the regulations. The manufacturer and the distributor are not liable for damage resulting from improper usage. The user alone assumes all responsibility and risk.

Following the instructions provided in this Getting Started is also considered part of being in accordance with the regulations.

Opening *FRANEO 800* or its accessories invalidates all warranty claims.

1.5 Disclaimer

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

1.6 Compliance statement

Declaration of conformity (EU)

The equipment adheres to the guidelines of the council of the European Community for meeting the requirements of the member states regarding the electromagnetic compatibility (EMC) directive, the low voltage directive (LVD) and the RoHS directive.

FCC compliance (USA)

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Declaration of compliance (Canada)

This Class A digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

1.7 Recycling



This test set (including all accessories) is not intended for household use. At the end of its service life, do not dispose of the test set with household waste!

For customers in EU countries (incl. European Economic Area)

OMICRON test sets are subject to the EU Waste Electrical and Electronic Equipment Directive 2012/19/EU (WEEE directive). As part of our legal obligations under this legislation, OMICRON offers to take back the test set and ensure that it is disposed of by authorized recycling agents.

For customers outside the European Economic Area

Please contact the authorities in charge for the relevant environmental regulations in your country and dispose the OMICRON test set only in accordance with your local legal requirements.

2 System requirements

Table 2-1: *Primary Test Manager* system requirements

Characteristic	Requirement (*recommended)
Operating system	Windows 10 64-bit* Windows 8.1 64-bit* , Windows 8 64-bit* , Windows 7 SP1 64-bit* and 32-bit
CPU	Multicore system with 2 GHz or faster* , single-core system with 2 GHz or faster
RAM	min. 2 GB (4 GB*)
Hard disk	min. 4 GB of available space
Storage device	DVD-ROM drive
Graphics adapter	Super VGA (1280×768) or higher-resolution video adapter and monitor ¹
Interface	Ethernet NIC ² , USB 2.0 ³
Installed software required for the optional Microsoft Office interface functions	Microsoft Office 2016* , Office 2013* , Office 2010* , Office 2007*

1. We recommend graphics adapter supporting Microsoft DirectX 9.0 or later.

2. For testing with *CPC 100* and *CIBANO 500*. NIC = Network Interface Card. *CPC 100* and *CIBANO 500* can be connected with RJ-45 connectors either directly to the computer or to the local network, for example, by using an Ethernet hub.

3. For testing with *FRANEO 800*

3 Introduction

3.1 Frequency response analysis (FRA)

Power transformers are essential components of any power transmission and distribution system. The strong electrodynamic forces resulting from short-circuit faults in the power system and the high acceleration potentially emerging during transportation can give rise to severe deformations of the transformer windings and mechanical construction. Transformers can also be exposed to stress during installation and due to inrush current or seismic occurrences.

Consequently, the mechanical construction and the windings of power transformers are subject to high mechanical stress. Depending on the grade of the overstressing, this may cause mechanical deformation or defects of the transformer windings and magnetic core.

The equivalent circuit of the transformer winding includes the coil's resistance and inductance as well as parasitic capacitances between consecutive turns and between the winding and the tank wall and the core. Figure 3-1: "Equivalent circuit of the transformer winding" on page 7 shows the circuitry of discrete RLC elements. The frequency response of the particular transformer winding is a unique characteristic depending on the transformer's mechanical construction. Deformations of the transformer's mechanical construction cause altering the values of the RLC elements and, consequently, the frequency response of the transformer windings changes. By measuring the frequency response of the transformer windings in a wide frequency range, defects in the windings and magnetic core of power transformers can be diagnosed.

The following figure shows the equivalent circuit of the transformer winding.

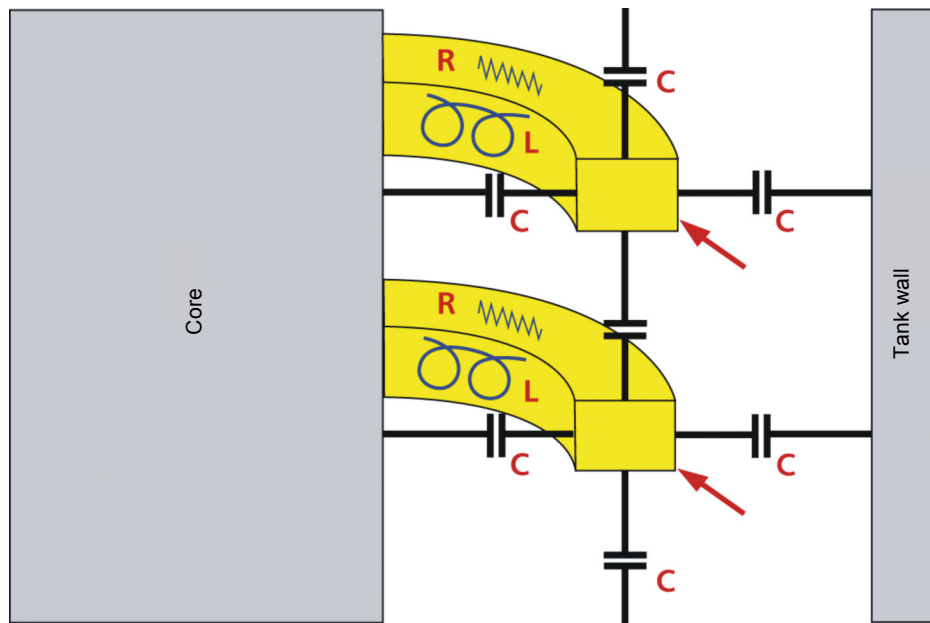


Figure 3-1: Equivalent circuit of the transformer winding

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The following figure compares the frequency responses of the phase U, V and W windings of a power transformer with those in a healthy condition. The deviations of the FRA measurement results indicate that the U and W phase windings might have a defect.

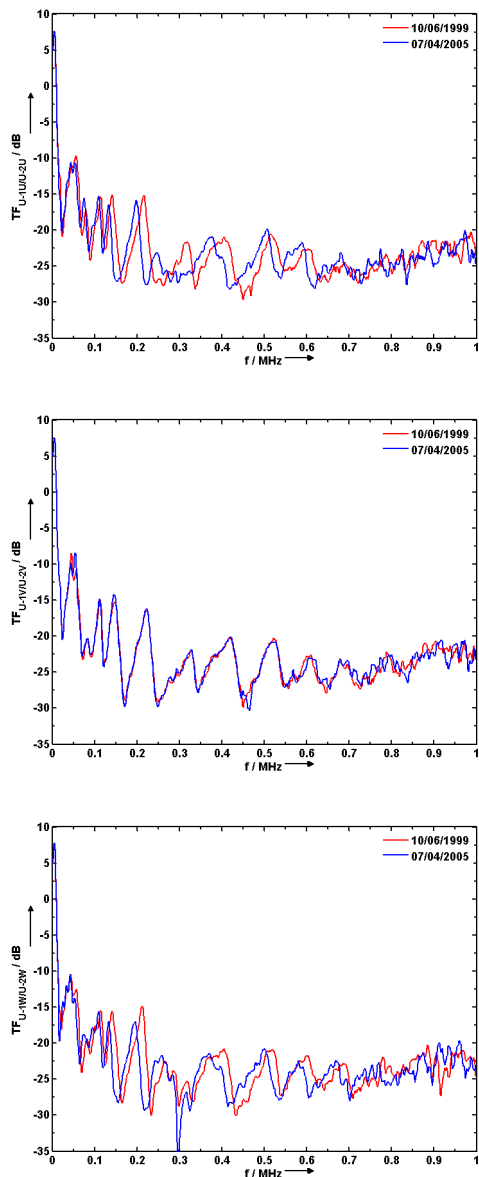


Figure 3-2: FRA measurement results

The following figure shows the windings of the phase U and the radial displacements of the windings.



Figure 3-3: Radial coil deformation

3.2 Designated use

FRANEO 800 is a sweep frequency response analyzer for power transformer core and winding diagnosis. Its concept – universal hardware controlled by *Primary Test Manager* running on a computer – makes *FRANEO 800* an efficient and flexible solution for the diagnosis of power transformer windings and magnetic cores.

FRANEO 800 evaluates the frequency response of the transformer windings by using the sweep frequency response analysis (SFRA) in the frequency domain. Figure 3-4: "Sweep frequency response analysis" shows the measurement procedure. A sinusoidal voltage with constant amplitude and variable discrete frequencies is applied to the winding under test and the frequency of the input signal is successively increased. The amplitude and phase of the output signal is measured against the frequency and the output-to-input amplitude ratio and the phase shift between the output and input signals are evaluated.

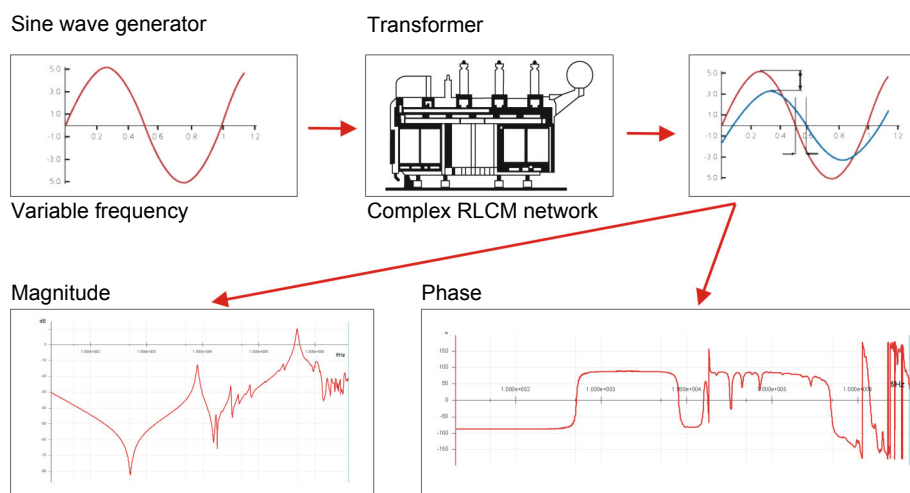


Figure 3-4: Sweep frequency response analysis

FRANEO 800 measures the frequency response of the transformer windings in a wide frequency range and compares it with that in a healthy condition. From the frequency response deviations, you can diagnose many different types of defects in the transformer winding and magnetic core. These include:

- Coil deformation – axial and radial
- Faulty core grounds
- Partial winding collapse
- Hoop buckling
- Broken or loose clamps
- Shorted turns and open windings
- Core deformation

With *FRANEO 800*, you can measure the magnitude and phase, the impedance and the admittance frequency responses of the transformer windings. The measurement results are available on your computer for further processing and documentation.

FRANEO 800 operates only when connected to an external computer with USB interface. With *Primary Test Manager* running on the computer, you can define, parametrize, and execute automated FRA tests.

3.3 Connections and operating controls

The following figures describe the connections and operating controls of *FRANEO 800*.

3.3.1 Front panel

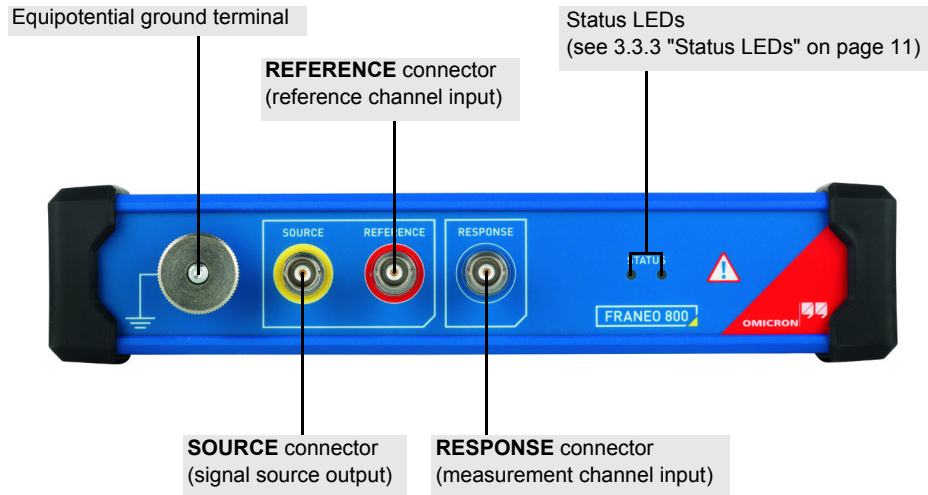


Figure 3-5: Front view of *FRANEO 800*

3.3.2 Rear panel



Figure 3-6: Rear view of *FRANEO 800*

3.3.3 Status LEDs

The following table describes the status LEDs.

Table 3-1: Status LEDs

LED	Description
Green	The LED lights when power is on and no measurement is being performed.
Red	The LED lights when power is on and a measurement is being performed.

3.4 Primary Test Manager

Primary Test Manager is a control software for testing power transformers with the *FRANEO 800* test system. *Primary Test Manager* provides a computer interface to *FRANEO 800* and assists you with the hardware configuration and test analysis.

With *Primary Test Manager*, you can create guided workflows, execute prepared jobs, and manage jobs. After you have performed a test, you can generate exhaustive test reports. *Primary Test Manager* runs on a computer and communicates with *FRANEO 800* through USB interface.

For detailed information about *Primary Test Manager*, see the relevant chapters in the *FRANEO 800* PTM User Manual.

3.5 Delivery

The *FRANEO 800* delivery includes:



Transport case



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Primary Test Manager DVD



AC power supply and battery charger (including international mains plug adapters)



FRANEO 800



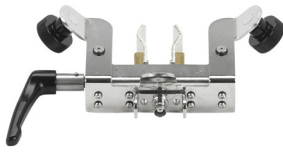
RBP1 rechargeable battery pack



Battery connection cable



USB 2.0 A/B cable 2.0 m/6.6 ft



2 × Bushing clamp



4 × Aluminum braid
25 mm² roll



Grounding cable
(GR/YE) 6 m/20 ft, 6 mm



3 × Carabiner for cable
relief



50 Ω coaxial cable
18 m/60 ft (yellow)



50 Ω coaxial cable
18 m/60 ft (red)



50 Ω coaxial cable
18 m/60 ft (blue)



4 × Screw clamp



Insulation sleeve



Crank handle



File



BNC T adapter

3.6 Cleaning

WARNING



Death or severe injury caused by high voltage or current possible

- ▶ Do not clean the *FRANEO 800* test set when connected to the test object.
- ▶ Before cleaning *FRANEO 800* and its accessories, always disconnect the test object, accessories and connection cables.

To clean *FRANEO 800* and its accessories, use a cloth dampened with isopropanol alcohol.

4 Installation

Before installing *FRANEO 800*, check the environmental and power requirements (see "Technical data" in the *FRANEO 800 PTM User Manual*).

4.1 Install *Primary Test Manager*

Note: Install *Primary Test Manager* before connecting *FRANEO 800* to the computer.

For the minimum requirements your computer needs to run *Primary Test Manager*, see 2 "System requirements" on page 6.

To install *Primary Test Manager*, put the delivered *Primary Test Manager* DVD in the DVD drive of your computer and follow the instructions on the screen. For detailed instructions about how to migrate your data from the *FRAnalyzer* software database into *Primary Test Manager*, see 4.2 "Migrate the *FRAnalyzer* data" later in this chapter.

4.2 Migrate the *FRAnalyzer* data

You can migrate your data available in the *FRAnalyzer* software into *Primary Test Manager*.

NOTICE

You can migrate data in *FRAnalyzer* 2.2 format.

- If your data is available in an earlier version of the *FRAnalyzer* software, update the software to version 2.2 before migrating the data. You can download the *FRAnalyzer* software 2.2 from the OMICRON customer area.

The migration procedure differs according to whether the *FRAnalyzer* software is installed on the same computer or on another computer as *Primary Test Manager*. The following sections describe in detail the different scenarios.

NOTICE

PTM FRAnalyzer Migration Assistant migrates all data available in the *FRAnalyzer* software database into *Primary Test Manager*. If you do not want to migrate all data:

- Back up the *FRAnalyzer* software database, delete the data you do not want to migrate, and then start *PTM FRAnalyzer Migration Assistant*.

NOTICE

Duplication of data possible

Importing .dbefra files created with *PTM FRAnalyzer Migration Assistant* that come from the same database already migrated to *Primary Test Manager* could lead to duplication of data.

Importing .fra or .tfra files that come from the same database already migrated to *Primary Test Manager* could lead to duplication of data.

Scenario I

The *FRAnalyzer* software and *Primary Test Manager* are installed on the same computer

To migrate the *FRAnalyzer* data if the *FRAnalyzer* software and *Primary Test Manager* are installed on the same computer:

1. If you selected during the installation procedure *FRANEO 800* as your test system and the *FRAnalyzer* software 2.0 or later is installed on your computer, *Primary Test Manager* Setup installs *PTM FRAnalyzer Migration Assistant* on your computer.
2. When *Primary Test Manager* Setup prompts you for migration of the *FRAnalyzer* data, do one of the following:
 - ▶ Select **Start PTM FRAnalyzer Migration Assistant after setup completion** to migrate data from the *FRAnalyzer* software database into *Primary Test Manager* automatically after *Primary Test Manager* Setup is completed.
 - ▶ Select **Create PTM FRAnalyzer Migration Assistant shortcut on the desktop** to create a shortcut on desktop for migration of data from the *FRAnalyzer* software database into *Primary Test Manager* when you want.
3. If you selected **Create PTM FRAnalyzer Migration Assistant shortcut on the desktop** and want to migrate the data now, proceed as follows.
4. Start *PTM FRAnalyzer Migration Assistant*.
5. To export the data, follow the instructions provided by the *PTM FRAnalyzer Migration Assistant*.
6. Start *Primary Test Manager*.
7. In the home view, click the **Manage** button .
8. Under **Jobs**, click the **Import** button .
9. In the **Open** dialog box, select *FRAnalyzer* 2.2 database export (*.dbefra) data format.
10. Browse to the file you want to import.

Scenario II

The *FRAnalyzer* software and *Primary Test Manager* are installed on different computers

To migrate the *FRAnalyzer* data if the *FRAnalyzer* software and *Primary Test Manager* are installed on different computers:

1. Do one of the following:
 - ▶ Put the delivered *Primary Test Manager* DVD in the DVD drive of the computer the *FRAnalyzer* software is installed on, and then go to the directory *PTM_FRAnalyzer_Migration_Assistant*.
 - ▶ Download the *PTM FRAnalyzer Migration Assistant* Setup from the OMICRON customer area.
2. Start *PTM FRAnalyzer Migration Assistant* Setup to create a shortcut on the desktop.
3. Start *PTM FRAnalyzer Migration Assistant*.
4. To export the data, follow the instructions provided by the *PTM FRAnalyzer Migration Assistant*.
5. Copy the exported data to a removable storage device such the USB flash drive.
6. Install the removable storage device on the computer *Primary Test Manager* is installed on.
7. Start *Primary Test Manager*.
8. In the home view, click the **Manage** button .
9. Under **Jobs**, click the **Import** button .

10. In the **Open** dialog box, select FRAnalyzer 2.2 database export (*.dbefra) data format.

11. Browse to the file you want to import.

4.3 Power up *FRANEO 800*

You can power *FRANEO 800* with the delivered AC power supply¹ or from the *RBP1* lithium-ion battery pack.

4.3.1 Powering with the AC power supply

To power *FRANEO 800* by using the delivered AC power supply:

1. Plug the DC output connector of the AC power supply into the **DC IN** connector on the *FRANEO 800* rear panel (see Figure 3-6: "Rear view of *FRANEO 800*" on page 11).
2. Fit the mains plug of the AC power supply to the power outlet, if necessary.
3. Connect the mains plug of the AC power supply to the power outlet.
4. Press the **POWER** switch on the *FRANEO 800* rear panel.
When power is on, the green LED on the *FRANEO 800* front panel lights up.

1. The delivered AC power supply is a battery charger for the *RBP1* lithium-ion battery pack. It is suitable for powering *FRANEO 800* directly, too.

4.3.2 Powering from the *RBP1* battery pack

To power *FRANEO 800* from the *RBP1* battery pack:

1. Plug the red marked end of the battery connection cable shipped with the *RBP1* into the **OUTPUT** connector of the battery pack.
2. Plug the blue marked end of the battery connection cable into the *FRANEO 800* **DC IN** connector.

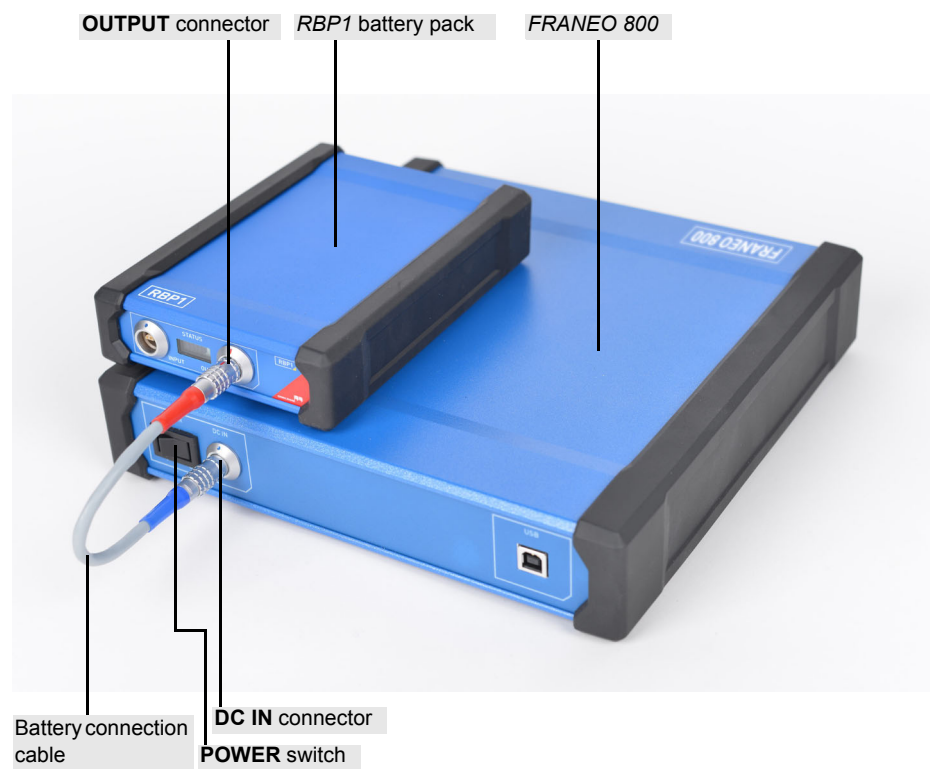


Figure 4-1: Powering *FRANEO 800* from the *RBP1* battery pack

3. Press the **POWER** switch on the *FRANEO 800* rear panel.
When power is on, the green LED on the *FRANEO 800* front panel lights up.

4.3.3 Charging the *RBP1* battery pack

Use only the delivered AC power supply to charge the *RBP1* battery pack. You can charge the *RBP1* even while powering *FRANEO 800* during a test. For more information, see "RBP1 Rechargeable battery pack" in the *FRANEO 800* PTM User Manual.

4.4 Connect *FRANEO 800* to the computer

FRANEO 800 communicates with the computer through USB interface. To connect *FRANEO 800* to the computer:

1. Connect the delivered USB 2.0 A/B cable to the *FRANEO 800* **USB** connector.
2. Connect the USB 2.0 A/B cable to the USB connector of your computer.

NOTICE

Equipment damage possible

- ▶ Do not to crush the cables when closing the transport case.
- ▶ Always place the cables carefully within the transport case when closing it.



Figure 4-2: Connecting *FRANEO 800* to the computer by using the delivered USB 2.0 A/B cable

4.5 Start *Primary Test Manager* and connect to *FRANEO 800*

To start *Primary Test Manager*, click **Start** on the task bar, and then click

OMICRON Primary Test Manager, or double-click the **OMICRON Primary Test Manager** icon  on the desktop.

To connect to *FRANEO 800*, select the device in the list, and then click **Connect**.

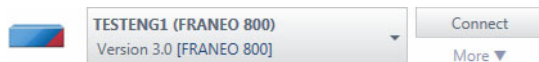


Figure 4-3: Connecting to *FRANEO 800*

Alternatively, you can manage the connection to *FRANEO 800* in the *Primary Test Manager* status bar (see "Status bar" in the *FRANEO 800* PTM User Manual).

4.6 Connect *FRANEO 800* to the power transformer

For testing a power transformer, the test traces are defined by the test. For each test trace, *Primary Test Manager* assigns the **SOURCE**, **REFERENCE** and **RESPONSE** connectors of *FRANEO 800* to the transformer's terminal bushings. To connect *FRANEO 800* to the power transformer under test:

1. Fasten a bushing clamp to the transformer's terminal bushing to be connected to the **REFERENCE** connector according to the wiring diagram displayed in the General area of the *Primary Test Manager* test view.
2. Connect the yellow and red coaxial cables to the BNC connector on the bushing clamp by using a delivered BNC adapter.

NOTICE

Equipment damage possible

- ▶ Do not connect the coaxial cables to the bushing clamp without relieving the pressure on the BNC shield.
- ▶ Always attach the coaxial cables by provided cord loops and the delivered carabiner to the ring of the bushing clamp's strap as shown in Figure 4-4: "Connecting the yellow and red coaxial cables to the bushing clamp by using the mechanism for relieving the pressure on the BNC shield" on page 20.

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3. Connect the aluminum braid to the bushing clamp by using the screw on the bushing clamp and tighten the screw. If necessary, use the delivered insulation sleeve to prevent electrical contact between the aluminum braid and the bushing.

Note: In the past, we have recommended using two aluminum braids for grounding the bushing clamps. Based on the recommendations given by the IEC 60076-18 standard, only one aluminum braid should be used. If you made previous measurements with two aluminum braids we recommend repeating the measurements with the same connection technique.

NOTICE

Equipment damage possible

- ▶ Do not apply force when handling the aluminum braids to prevent breaking the small strands.
- ▶ Always bend and pull the aluminum braids carefully.



Figure 4-4: Connecting the yellow and red coaxial cables to the bushing clamp by using the mechanism for relieving the pressure on the BNC shield

4. Connect the aluminum braid to the transformer's tank by using the screw clamp.

Note: We recommend activating the ground-loop check in *Primary Test Manager* before performing the measurement for checking the quality of the contact. This ensures a proper measurement setup and increases the reproducibility of the measurements.



Figure 4-5: Fastening the screw clamp



Figure 4-6: Alternative way of fastening the screw clamp

5. Fasten a bushing clamp to the transformer's terminal bushing to be connected to the **RESPONSE** connector according to the wiring diagram displayed in the General area of the *Primary Test Manager* test view.

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6. Connect the blue coaxial cable to the BNC connector on the bushing clamp.

NOTICE

Equipment damage possible

- ▶ Do not connect the coaxial cable to the bushing clamp without relieving the pressure on the BNC shield.
- ▶ Always attach the coaxial cable by provided cord loop and the delivered carabiner to the ring of the bushing clamp's strap as shown in the following figure.



Figure 4-7: Connecting the blue coaxial cable to the bushing clamp by using the mechanism for relieving the pressure on the BNC shield

7. To ground the bushing clamp, repeat steps 3 and 4.
8. Connect the other ends of the three BNC cables to the corresponding color-coded **SOURCE**, **REFERENCE** and **RESPONSE** connectors on the front panel of *FRANEO 800*.

Support

When you are working with our products we want to provide you with the greatest possible benefits. If you need any support, we are here to assist you!



24/7 Technical support – get support

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At our technical support hotline, you can reach well-educated technicians for all of your questions. Around the clock – competent and free of charge.

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