

## FREJA546 and 546N Relay Test System



- **Small, rugged, lightweight, and powerful**
- **Operate with or without a computer**
- **Intuitive manual operation with Smart Touch View Interface or the integrated onboard display**
- **High current, high power output (60 A/319 VA rms) per phase**
- **Four voltage channels, three current channels, with convertible voltage channels provides one voltage and six currents**
- **Dynamic, transient, and GPS satellite synchronised end-to-end testing capability**
- **IEC 61850 GOOSE testing capability and IEC 61850 9-2 LE sampled values compliant**

### DESCRIPTION

The FREJA546 is a multi-purpose, lightweight, field portable test set capable of testing a wide variety of electro-mechanical, solid-state, and microprocessor-based protective relays, motor overload relays, and similar protective devices. The FREJA546 has the “smart” combination of being both small and light weight, while also providing high power.

The FREJA546 test system can be manually controlled with the integrated onboard display on the FREJA546 running the new RTMS, Relay Testing Management Software. The onboard display, with its large, easy-to-read full colour, high resolution, TFT LCD touch screen allows the user to perform manual, steady-state, and dynamic testing quickly and easily using the manual test screen, as well as using built-in pre-set test routines for most popular relays.

The onboard display eliminates the need for a computer when testing virtually all types of relays. Menu screens and touch screen function buttons are provided to select the desired test function quickly and easily. Tests results can be saved to the internal memory for later download to a USB Thumb drive to transfer or print test reports.

For fully automatic testing every FREJA unit is supplied with Relay Testing Management Software (RTMS) for installing on a PC. It does not require a security dongle or license to operate and can be loaded on as many customer-owned computers as required. There are two different levels of RTMS: Standard and enhanced, see ordering information for details.

### APPLICATIONS

The test system may be customised by adding the number of voltage current, “VIGEN”, modules needed for specific test applications, with a maximum of three channels. For example, the FREJA546 with three VIGEN modules provides complete three-phase testing of three-phase impedance, directional power, negative sequence overcurrent, and other devices that require a three-phase four-wire wye connected sources. The fourth voltage channel provides an AC reference/synchronising/polarising voltage, or a DC battery simulator voltage source.

Each current channel is rated for 32 A at 200 VA rms continuous, and up to 60 A at 319 VA rms for short durations. For testing relay panels or electromechanical relays, it has a unique flat power curve from 4 to 32 A that always ensures maximum compliance voltage to the load.

With a maximum compliance voltage of 50 V rms per phase, two channels in series provide 100 V to test high impedance relays. Three currents in parallel provide test currents up to 120 A at 600 VA for testing ground overcurrent relays at high multiples of tap rating. With three currents in parallel it can provide up to 180 A at 900 VA for testing all instantaneous overcurrent relays.

Each voltage channel can provide variable outputs of 0–30/150/300 V at 150 VA of output power. Automatic range changing is done on-the-fly and under load. For testing a panel of relays or older electromechanical impedance relays, it has a unique flat power curve from 30 to 150 V always insuring maximum output power to the load. With the VIGEN voltage channels converted to currents, a three-channel unit can provide six currents for testing three phase current differential relays, including harmonic restraint transformer differential relays.

## FREJA546 and 546N Relay Test System

### MANUAL OPERATION

The RTMS software in conjunction with the onboard display allows the user to perform manual, steady-state, and dynamic testing quickly and easily. Ergonomically designed with the control knob and touch screen, the powerful RTMS software is extremely easy to use.

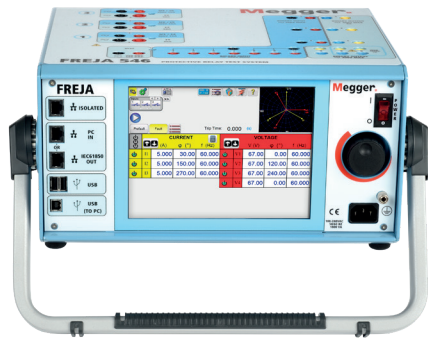


Figure 1: FREJA546 unit

The most significant feature of the RTMS software is its ability to provide the user with a very simple way to manually test, for both commissioning and maintenance, from the simple overcurrent relay to the most complex relays manufactured today. Manual operation is simplified using a built-in computer operating system and onboard display. The touch screen display and RTMS software eliminates the need for a computer when testing virtually all types of relays. Enhanced graphics, intuitive menu screens, and touch screen icon buttons are provided to select the desired test function quickly and easily.

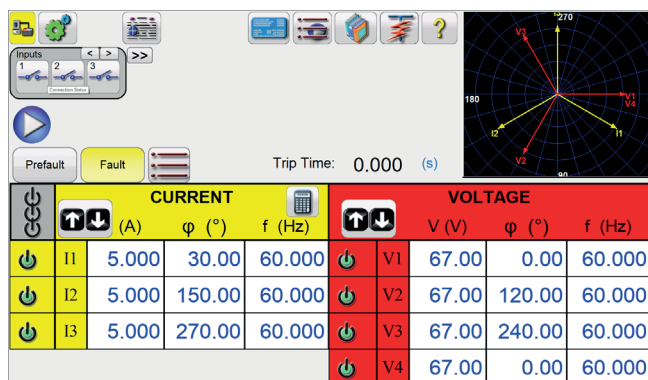


Figure 2: RTMS advanced user interface

For more details on the RTMS software test capability, see the RTMS data sheet.

### FEATURES AND BENEFITS

**Touch screen display** – Easy to use and read, the display provides manual control of the test set. Colour contrasts accentuate vital information. This reduces human error and time in testing relays.

**Constant power output** – The current amplifier delivers maximum compliance voltage to the load constantly during the test, and range changing is done automatically under load. This ensures better test results and saves time by not having to turn the outputs off to change ranges. Constant power output in many cases eliminates the need to parallel and/or series current channels together to test high burden relays, which also saves time.

**High output current** – The FREJA546 provides up to 32 A at 200 VA per phase continuous, or up to 60 A at 319 VA with a 1.5 second duty cycle. Three current amplifiers can be paralleled to provide a maximum of 180 A at 900 VA for testing all instantaneous overcurrent relays.

**PowerV™ Voltage Amplifier high power output** – The FREJA546 provides a high VA output on the voltage channel at the lower critical test voltages (from 30 to 150 V). Users who want to test a panel of relays at one time, or certain older electromechanical impedance relays, find it impossible using lower VA rated voltage amplifiers.

**RTMS graphics and intuitive navigation** – New test graphics and intuitive screen navigation saves test time and reduces human error.

**Steady-State and Dynamic test capability** – The FREJA546 provides, either through manual control or computer control, both steady-state and dynamic testing of protective relays. This includes programmable waveforms with DC offset and harmonics.

**Digital inputs and outputs** – Up to ten programmable inputs, and six programmable outputs provide timing and logic operations in real-time with the output voltage and currents. Binary inputs can be programmed, using Boolean logic, for more complex power system simulations. This provides a low cost, closed loop, power system simulator.

**Circuit breaker simulator** – Binary outputs provide programmable normally closed and normally open contacts to simulate circuit breaker operation for testing reclosing relays. Sequence of operation, timing, and lockout are easily tested.

**Performs transient tests** – The FREJA546 can perform acceptance or troubleshooting tests by replaying digitally recorded faults, or EMTP/ATP simulations, in the IEEE- C37.111 / IEC 60255-24, COMTRADE Standard format.

**Perform end-to-end tests** – Using the RTMS sequencer test with a Megger MGTR GPS satellite receiver (or suitable IRIG-B time code source input into Binary Input #1), the FREJA546 perform satellite-synchronised end-to-end tests.

**Perform multi-phase tests** – The FREJA546 can be interconnected with other FREJA units to increase the total number of test currents for testing multi-phase bus differential protection schemes. For example, a three-channel FREJA546 may be interconnected with four more FREJA546 units, providing up to a maximum of 30 current channels.

**Ethernet ports** – The PC IN port is the primary PC connection port. The OUT ethernet port is primarily used to interconnect multiple FREJA units together for synchronous multi-unit operation may be used to connect to the IEC 61850 substation bus. The ISOLATED ethernet port provides secure isolation when testing IEC 61850 devices (for customers who require secure isolation from their IEC 61850 substation bus).

**Immediate error indication** – Audio and visual alarms indicate when amplitude or waveforms of the outputs are in error due to short circuit, open circuit, or thermal overload.

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**IEC 61850** – Optional integrated interface provides real-time testing using the IEC 61850 GOOSE and Sampled Values (IEC 61850 9-2 LE) protocols.

**Low-level output capability<sup>2/3</sup>** – The current generators can provide very low current outputs ranging from 0 to 50 mA full scale or be enabled to provide a voltage output simulating a Rogowski output. In Rogowski mode, the current channel will change from a current source to a voltage source. This will allow the current channel to simulate a low-level voltage source from a Rogowski coil. There are three ranges for the Rogowski outputs: 2, 10, and 40 Volts. In the 50 mA mode, the feedback loop will stay on down to test currents as low as 5 mA. This provides test capability for generator anti-motoring and network relays, which can be set as low as 10 to 7.5 mA.

**Variable voltage threshold<sup>2/3</sup>** – The variable voltage threshold will either start or stop the timer. The continuity indicator will glow (application) or not glow (removal) upon the application or removal of either an AC or DC voltage. The programmable voltage threshold is available on binary inputs 1 and 2, with a programmable range from 5 to 150 Volts AC/DC.

**Open communication architecture** – The FREJA546 can be used with third party software for more flexible automated control.

### NON-DISPLAY MODEL

A non-display model is offered for those who prefer to only run the RTMS software from a PC. This reduces cost for those not requiring a touch screen display.

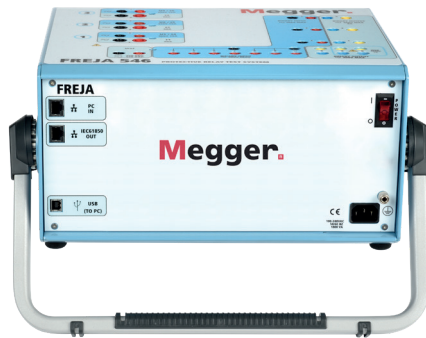


Figure 3: FREJA546N non-display unit

### SPECIFICATIONS<sup>1</sup>

#### Input power

90 to 264 Volts AC, 1Ø, 50/60 Hz, 1800 VA.

#### Outputs

All outputs are independent from sudden changes in line voltage and frequency. All outputs are regulated so changes in load impedance do not affect the output. Each output (VIGEN) module consists of one voltage amplifier, and a current amplifier. The voltage amplifier may be converted to a current source. Therefore, one amplifier module may be used to test single phase current differential relays, including harmonic restraint.

#### Output current sources

The FREJA546 with three VIGEN modules can provide up to six current sources: three high current/high power, and three convertible voltage channels providing lower current/high power. The per channel output current and power ratings are specified in AC RMS values and peak power ratings.

#### Per channel output

Output current	Power	Max V
50 mA <sup>2</sup>	5 VA	10.0 V RMS
1 A	5 VA	15.0 V RMS
4 A	200 VA (282 peak)	50.0 V RMS
15 A	200 VA (282 peak)	13.34 V RMS
32 A	200 VA (282 peak)	6.25 V RMS
60 A	319 VA (430 peak)	5.32 V RMS

DC 200 Watts

**Duty cycle:** 32 A Continuous, 60 A 1.5 seconds

#### Three currents channels in parallel

Output current	Power	Max V
12 A	600 VA (848 peak)	50.0 V RMS
45 A	600 VA (848 peak)	13.4 V RMS
96 A	600 VA (848 peak)	6.25 V RMS
180 A	957 VA (1290 peak)	5.32 V RMS

#### AC Low-level Rogowski output (converted current channels)<sup>2/3</sup>

Each current channel can provide the following voltage outputs with the following Ranges:

Output voltage	Max I
0 - 2 V RMS	10 mA
0 - 10 V RMS	100 mA
0 - 40 V RMS	25 mA

**Duty cycle:** Continuous

#### Two current channels in series

With two current channels in series, the compliance voltage doubles to provide 4 A at 100 V RMS and up to 32 A at 12.5 V RMS.

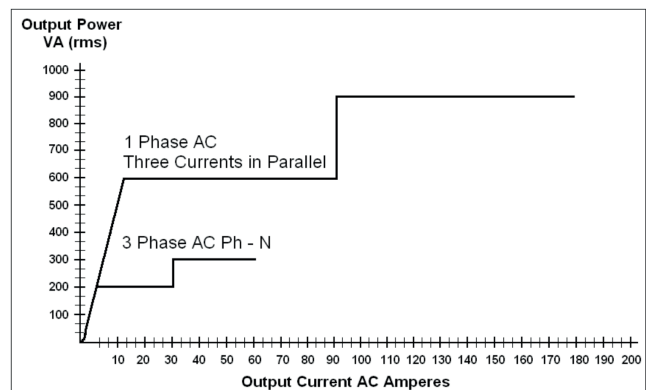


Figure 4: Current output power curve

#### Current amplifier – extended power range

The FREJA546's current amplifier provides a unique flat power curve from 4 to 32 A per phase to permit testing of electromechanical high impedance relays, and other high burden applications, with an extended operating range up to 60 A at 319 VA RMS for short durations.

## FREJA546 and 546N Relay Test System

### AC voltage output

The FREJA546 can provide three voltage sources 0 to 300 V AC/DC. The unit can provide a fourth AC/DC voltage source to serve as either a reference synchronising voltage or as a battery simulator, see AC/DC AUX voltage channel.

Outputs are rated with the following ranges:

Output voltage	Power	Max I
2 V <sup>2</sup>	0.02 VA	10 mA
30 V	150 VA	5 A
150 V	150 VA	Variable <sup>4</sup>
300 V	150 VA	0.5 A
DC 150 Watts		

**Duty cycle:** Continuous

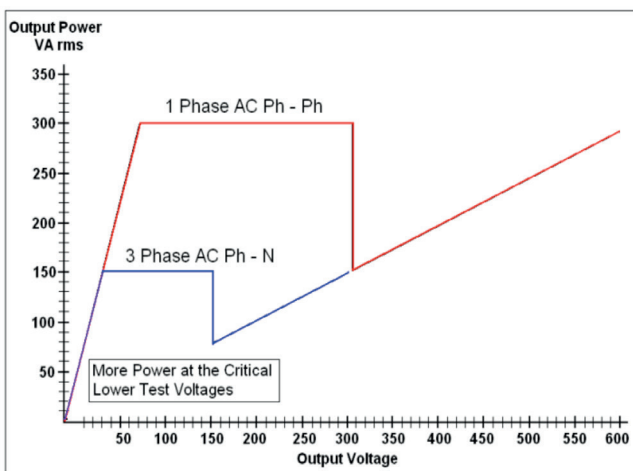


Figure 5: Voltage output power curve

### "PowerV™" voltage amplifier - extended power range

The FREJA546's voltage amplifier provides a flat power curve from 30 to 150 V in the 150 V range to permit testing of high current applications such as panel testing, and older electromechanical distance relays which demand a higher power voltage source to properly test.

### Voltage amplifier in current mode

The voltage channels are convertible to a current source with the following output capability. Output power ratings are specified in AC RMS values and peak power ratings.

Output current	Power	Max V
5 A	150 VA (212 peak)	30.0 V RMS
15 A	120 VA	8.0 V RMS

**Duty cycle:** 5 A Continuous, 15 A for 1.5 seconds

### AC/DC AUX voltage channel

The AC/DC AUX voltage channel can be either a variable AC voltage source to use as a polarising or synchronising voltage source, or a battery simulator with a variable DC output voltage.

Ranges (AC)	Power	Max I
30 V	100 VA	3.33 A
150 V	100 VA	0.67 A
Ranges (DC)	Power	Max I
30 V	100 Watts	3.33 A
250 V	100 Watts	0.4 A

### Phase angle, voltage and current

#### Ranges

0.00 to 359.99 degrees, counter clockwise, or clockwise rotation, or 0.00 to ± 180.00 degrees

**Accuracy:** ± 0.02° typical, < 0.1 ° guaranteed at 50/60 Hz

**Resolution:** 0.001

#### Frequency

The output modules provide a variable frequency output with the following ranges and accuracy.

#### Ranges

DC: 0.001 to 1000.000 Hz

Output amplifiers can provide transient signals with a range of DC to 10 kHz for transient playback using IEEE-C37.111 Standard COMTRADE files.

**Resolution:** 0.001 Hz

**Frequency accuracy:** 2.5 ppm typical

25 ppm, 0° to 50° C, at 50/60 Hz maximum

AC/DC AUX: 250 ppm, 50/60 Hz maximum

### Metering

Measured output quantities such as AC Amperes, AC Volts, DC Volt, DC Amperes, and time may be simultaneously displayed on the touch screen. Pre-set AC and DC outputs display the approximate voltage/current output prior to initiation. This provides a fast, easy method for pre-set of outputs. Other values that may be displayed, depending on which test screen is in view, are phase angle, frequency, Ohms, Watts, VA, and power factor. Accuracies are specified from 10 to 100 % of range, 25 °C ± 5 °C, 50 to 60 Hz.

### AC voltage amplitude

**Accuracy:** ± 0.05 % reading + 0.02 % range typical  
± 0.15 % reading + 0.05 % range maximum

**Resolution:** 0.01

**Measurements:** AC RMS

**Ranges:** 30, 150, 300 V

### AC low-level voltage output<sup>2</sup>

**Range:** 2 V

**Accuracy:** 0 – 1 V: 0.5 mV typical and 1 mV guaranteed  
1 – 2 V: 0.5 mV typical and 2 mV guaranteed

**Resolution:** 0.001

**Measurements:** AC RMS

### AC low-level Rogowski output (converted current channels)<sup>2/3</sup>

**Range:** 2 V

**Accuracy:** 0 – 1 V: 0.5 mV typical and 1 mV guaranteed  
1 – 2 V: 0.5 mV typical and 2 mV guaranteed

**Resolution:** 0.001

**Measurements:** AC RMS

**Ranges:** 10, 40 V

**Accuracy:** ± 0.05 % of reading + 0.02 % of range typical  
± 0.15 % of reading + 0.05 % of range

guaranteed

**Resolution:** 0.001

**Measurements:** AC RMS

## FREJA546 and 546N Relay Test System

### AC current amplitude

**Accuracy:** ± 0.05 % reading + 0.02 % range typical  
± 0.15 % reading + 0.05 % range maximum

**Resolution:** 0.001/0.01

**Measurements:** AC RMS

**Ranges:** 32, 60 A

### AC low current<sup>2</sup>

**Range:** 50 mA

**Accuracy:** ± 0.5 mA typical and 1 mA guaranteed

**Resolution:** 0.0001

**Measurements:** AC RMS

### DC voltage amplitude

**Accuracy:** 0.1 % range typical, 0.25 % range maximum

**Resolution:** 0.01

**Measurements:** RMS

**Ranges:** 30, 150, 300 V

### DC current amplitude

**Accuracy:** ± 0.05 % reading + 0.02 % range typical  
± 0.15 % reading + 0.05 % range maximum

**Resolution:** 0.001/0.01

**Measurements:** RMS

**Range:** 30 A

### Convertible source in AC current mode

**Accuracy:** ± 0.05 % reading + 0.02 % range typical  
± 0.15 % reading + 0.05 % range or ± 12.5 mA  
whichever is greater

**Resolution:** 0.001

**Measurements:** AC RMS

**Ranges:** 5, 15 A

### AC/DC AUX voltage channel

**AC Accuracy:** ± 0.05 % reading + 0.02 % range typical  
± 0.15 % reading + 0.05 % range

**DC Accuracy:** 0.1 % range typical, 0.25 % range maximum

**Resolution:** 0.01

**Measurements:** RMS

**Ranges:** 30, 150 AC/DC

### Battery Simulator

The AUX voltage channel can also be used as a battery simulator with a variable DC output ranging from 5–250 V at 100 W, 4 A max, providing capability to power up relays with redundant power supplies. At the 250 V range the accuracy is ±5% of reading.

### Total harmonic distortion

Less than 0.1 % typical, 2 % maximum at 50/60 Hz

### Timer

The timer-monitor input is designed to monitor and time-tag inputs, like a sequence of events recorder. In addition, the binary input controls enable the user to perform logic and/or functions, and conditionally control the binary output relay to simulate circuit breaker, trip, reclose, and carrier control operation in real-time. The 'Timer' function displays in 'Seconds' or 'Cycles', with the following range and resolution:

**Seconds:** 0.0001 to 99999.9 (**Auto ranging**)

**Cycles:** 0.01 to 99999.9 (**Auto ranging**)

± 0.001 % of reading, typical

± 2 least significant digit

± 0.005 % of reading from 0 to 50 °C maximum

### Binary input – start/stop/monitor gate

Up to 10 independent, galvanically isolated inputs monitor operation of relay contacts or trip SCR, continuity light is provided for the input gate. Upon sensing continuity, the lamp will glow. In addition to serving as wet/dry contacts the binary inputs may be programmed to trigger binary output sequence(s).

**Input rating:** Up to 300 V AC/DC

#### Variable voltage threshold:

**Range:** 5 – 150 V AC/DC

**Accuracy:** 5 – 30 V, ± 3 V

31 – 150 V, ± 6 V

### Binary output relays

FREJA546 have up to six independent, galvanically isolated, output relay contacts to accurately simulate relay or power system inputs to completely test relays removed from the power system. The binary output simulates normally open, or normally closed, contacts for testing breaker failure schemes. The binary output can be configured to change state based on binary input logic.

#### High current output relays 1 to 4:

**AC rating:** 400 V max., I max: 8 A, 2000 VA max.

**DC rating:** 300 V max., I max: 8 A, 80 W

**Response time:** < 10 ms

#### High speed output relays 5 and 6:

**AC/DC rating:** 400 V peak, I max: 1 A

**Response time:** < 1 ms typical

### Waveform storage

Each output channel can store waveforms for playback on command. End-to-end playback of stored waveforms is possible, when triggered externally by a GPS receiver. Each channel can store up to 256 000 samples.

### Protection

Voltage outputs are protected from short circuits and prolonged overloads. Current outputs are protected against open circuits and overloads.



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### DC IN inputs (optional transducer feature)

#### DC IN voltage

<b>Range:</b>	0 to ± 10 V DC
<b>Accuracy:</b>	± 0.001 % reading + 0.005 % range typical ± 0.003 % reading + 0.02 % range max
<b>Resolution:</b>	0.001
<b>Measurements:</b>	Average

#### DC IN Amperes

<b>Ranges:</b>	0 to ± 1 mA DC 4 to ± 20 mA DC
<b>Accuracy:</b>	± 0.001 % reading + 0.005 % range typical ± 0.003 % reading + 0.02 % range max
<b>Resolution:</b>	0.001
<b>Measurements:</b>	Average

### Environmental

<b>Operating temperature:</b>	32 to 122 °F (0 to 50 °C)
<b>Storage temperature:</b>	-13 to 158 °F (-25 to 70 °C)
<b>Relative humidity:</b>	5 – 95 % RH, non-condensing

### CE-marking

EMC	EN 61326:
LVD	EN/IEC 61010-1:2001 (Second Edition)

### Conformance standards

<b>Safety:</b>	EN 61010-1
<b>Shock:</b>	EN/IEC 60068-2-27
<b>Vibration:</b>	EN/IEC 60068-2-6
<b>Transit drop:</b>	ISTA 1A
<b>Free fall:</b>	EN/IEC 60068-2-32
<b>Drop/topple:</b>	EN/IEC 60068-2-31

### Electromagnetic compatibility

<b>Emissions:</b>	EN 61326-2-1, EN 61000-3-2/3, FCC Subpart B of Part 15 Class A
<b>Immunity:</b>	EN 61000-4-2/3/4/5/6/8/11

### Weight

30.09 lb. (13.65 kg)

### Dimensions

13.25 W x 6.75 H x 10.75 D in  
337 W x 172 H x 273 D mm

### Enclosure and transit cases

The unit comes mounted in a rugged metal enclosure for field portability.

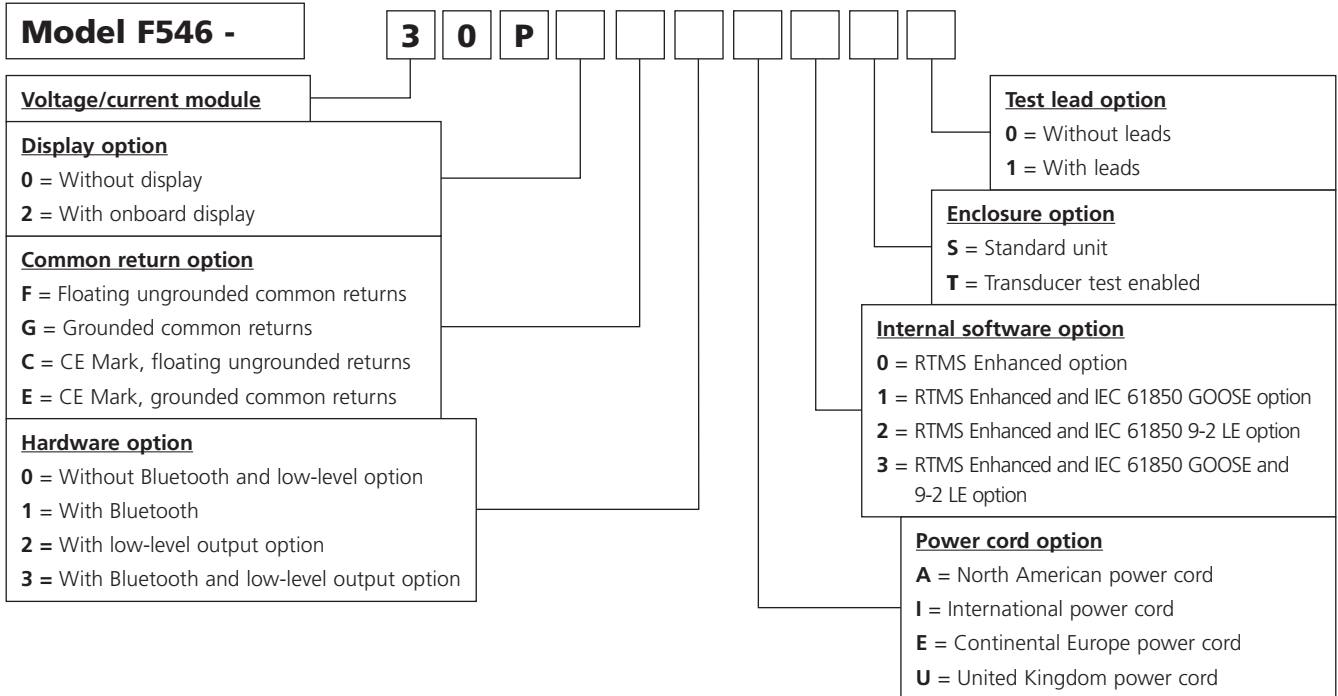
#### IEC enclosure rating: IP30

Optional hard-sided transit case is available. The robust design of the optional hard-sided transit case provides protection when transporting the unit over rugged terrain and long distances. An optional soft-sided case has approximately 1 inch of padding, which provides moderate protection against rain, dust, vibration, and shock.

## FREJA546 and 546N Relay Test System

### ORDERING INFORMATION

#### STYLE NUMBER IDENTIFICATION



#### DESCRIPTIONS OF HARDWARE OPTIONS

This modular system lets you select the testing capabilities you need and expand as testing requirements change. Customise the system by selecting floating or grounded common returns, power cord, IEC 61850 test capable, standard hardware or transducer feature added, and with or without test leads. See the following descriptions:

**Voltage/current module:** The FREJA546 has three voltage/current modules.

**Display option:** Enter the number **0** for the unit to be supplied without a display or the number **2** for the unit to be supplied with an onboard display.

**Common returns option:** The floating returns option provides independent isolated return terminals for each output channel. The grounded common returns option, the return terminals are interconnected internally and connected to chassis ground. The CE Mark, **C** and **E** units, have been certified to the IEC standards for EMC for both the grounded and floating options. The **F** and **G** units are designed to operate in countries which do not require the CE mark.

#### Hardware option:

- 0** = Enter the number **0** for the unit to be supplied without the Bluetooth and low-level option.
- 1** = Enter the number **1** for the unit to be supplied with the Bluetooth option.
- 2** = Enter the number **2** for the unit to be supplied with the low-level option.
- 3** = Enter the number **3** for the unit to be supplied with the Bluetooth and low-level option.

**Power cord option:** Customers can choose which type of power cord they want the unit to come with.

- **A** option – NEMA 5-15 to IEC60320 C13 connectors, UL and CSA approved for countries with NEMA outlets.
- **I** option – International colour-coded wires (light blue, brown, and green with yellow stripe) insulation jacket stripped ready for male connector with IEC 60320 C13 connector. CE marked.
- **E** option – CEE 7/7 “Schuko” plug to IEC 60320 C13 connector is CE marked.
- **U** option – United Kingdom power cord with IEC 60320 C13 connector, and 13 A fuse. BS 1363 / CE marked.

#### Internal software option:

- 0** = Enter the number **0** for the unit to be supplied with RTMS Enhanced option.
- 1** = Enter the number **1** for the unit to be supplied with the IEC 61850 GOOSE hardware license enabled on the unit. The Megger GOOSE Configurator/Sampled Values Analyser (MGC/SVA)\* software is required to test and commission IEC 61850 GOOSE compliant devices.
- 2** = Enter the number **2** for the unit to be supplied with the IEC 61850 9-2 LE hardware license enabled on the unit. The Megger GOOSE Configurator/Sampled Values Analyser (MGC/SVA)\* software is required to test and commission IEC 61850 9-2 LE compliant devices.
- 3** = Enter the number **3** for the unit to be supplied with IEC 61850 GOOSE and IEC 61850 9-2 LE hardware licenses enabled. The Megger GOOSE Configurator/ Sampled Values Analyser (MGC)\* software is required to test and commission IEC 61850 GOOSE.

# FREJA546 and 546N Relay Test System

**Hardware/enclosure option:** **S** = Standard unit. **T** = With transducer test capability enabled (requires 3 channel configuration). When equipped with the transducer test feature the total number of binary inputs and outputs are reduced by 1.

**Test leads option:** Enter the number **1** for the unit to be supplied with test leads. Enter **0** for the unit without test leads.

## DESCRIPTION OF SOFTWARE OPTIONS

Included software	Part Number
RTMS Enhanced software	84973
<b>Optional software</b>	
Megger GOOSE Configurator and Sampled Values Analyser stand-alone software	1007-246
IEC 61850 GOOSE hardware upgrade kit	83646
IEC 61850-9-2LE Sampled Values hardware upgrade kit	1013-856
FREJA IEC 61850 GOOSE and IEC 61850-9-2LE Sampled Values hardware upgrade kit	1013-938
Low-level hardware upgrade kit (includes Rogowski, low-current and variable voltage on B/I 1 feature) <sup>2/3</sup>	87416

## DESCRIPTIONS OF SOFTWARE

### Included software

Every unit is supplied with Relay Testing Management Software (RTMS) for installing on a PC. The software does not require a security dongle or license to operate and can be loaded on as many customer-owned computers as required. The powerful RTMS software can be run directly from a PC providing both manual and automatic test capabilities. See the RTMS data sheet for more detailed descriptions of test features and capabilities.

### Additional optional software

**Megger GOOSE Configurator software** – The FREJA unit is certified by KEMA as being compliant with IEC 61850 protocol. With the IEC 61850 GOOSE hardware enabled, in conjunction with the Megger GOOSE Configurator (MGC) software, the FREJA unit can be used in the testing or commissioning of IEC 61850 compliant devices. See RTMS datasheet for details.

GOOSE	GOOSE Subscription	GOOSE Publication	Test
IEC GOOSEMGC_T5ASCTRLLLN9SG09Control_DataSet[01-0C-CD-01-00-00]	BOUT 1,2	BOUT 1,2	Attr (False) DS (T 0 F 2)
IEC GOOSEMGC_T5ASCTRLLLN9SG09Control_DataSet[01-0C-CD-01-00-00]	BOUT 1	BOUT 1	True
IEC GOOSEMGC_T5ASCTRLLLN9SG09Control_DataSet[01-0C-CD-01-00-00]	BOUT 2	BOUT 2	False
IEC GOOSEMGC_T5ASCTRLLLN9SG09Control_DataSet[01-0C-CD-01-00-00]	BIN 1,2,3	BIN 1,2,3	Attr (False) DS (T 0 F 1)
IEC GOOSEMGC_T5ASCTRLLLN9SG09Control_DataSet[01-0C-CD-01-00-00]	BIN 1	BIN 1	-No Mapping-
IEC GOOSEMGC_T5ASCTRLLLN9SG09Control_DataSet[01-0C-CD-01-00-00]	BIN 2	BIN 2	-No Mapping-
IEC GOOSEMGC_T5ASCTRLLLN9SG09Control_DataSet[01-0C-CD-01-00-00]	BIN 3	BIN 3	-No Mapping-
IEC GOOSEMGC_T5ASCTRLLLN9SG09Control_DataSet[01-0C-CD-01-00-00]	BIN 4	BIN 4	-No Mapping-
IEC GOOSEMGC_T5ASCTRLLLN9SG09Control_DataSet[01-0C-CD-01-00-00]	RELUC	RELUC	-No Mapping-
IEC GOOSEMGC_T5ASCTRLLLN9SG09Control_DataSet[01-0C-CD-01-00-00]	RELUC	RELUC	Attr (False) DS (T 0 F 4)

Figure 6: Megger GOOSE Configurator software

**Megger Sampled Values Analyser software** – The FREJA unit is certified by KEMA as being compliant with IEC61850-9-2LE guidelines. With the IEC 61850 Sampled Values hardware enabled, in conjunction with the Megger Sampled Values Analyser software, the FREJA unit is user configurable to provide Sampled Values for testing or commissioning devices which require Sampled Values. When configured, the FREJA unit can provide three data streams of four voltages and four currents each.

Megger SV Analyzer (version 1.0.0.23)

File Edit Tools Help

SCL

SV 9-2 LE Configurator SV 9-2 LE Snapshot SV 9-2 LE Viewer SV 9-2 LE MU 4V x 4I Test Report SV 9-2 LE MU 6I Test Report SV 9-2 LE SMRT410 MU 4V x 4I Test Report

Stream 1	Stream 2	Stream 3
MAC: 01-0C-CD-04-00-01	MAC: 01-0C-CD-04-00-02	MAC: 01-0C-CD-04-00-03
VLAN ID (hex): 0	VLAN ID (hex): 0	VLAN ID (hex): 0
VLAN Priority (hex): 0	VLAN Priority (hex): 0	VLAN Priority (hex): 0
APP ID (hex): 4000	APP ID (hex): 4000	APP ID (hex): 4000
Reserved 1 (hex): 0000	Reserved 1 (hex): 0000	Reserved 1 (hex): 0000
Reserved 2 (hex): 0000	Reserved 2 (hex): 0000	Reserved 2 (hex): 0000
SV Quality (hex): 00000000	SV Quality (hex): 00000000	SV Quality (hex): 00000000
CT Ratio (int): 200	CT Ratio (int): 200	CT Ratio (int): 200
PT Ratio (int): 2000	PT Ratio (int): 2000	PT Ratio (int): 2000
SV ID: SMRT_SVID01	SV ID: SMRT_SVID02	SV ID: SMRT_SVID03
Config Rev (int): 1	Config Rev (int): 1	Config Rev (int): 1
Force Signal Sync: <input checked="" type="radio"/> No Sync <input type="radio"/> Local	Force Signal Sync: <input checked="" type="radio"/> No Sync <input type="radio"/> Local	Force Signal Sync: <input checked="" type="radio"/> No Sync <input type="radio"/> Local
SV Channel Map: [1-14 : V1 - V4]	SV Channel Map: [5 - 18 : V5 - V8]	SV Channel Map: [9 - 112 : V9 - V12]
Sample Rate: /s	Sample Rate: /s	Sample Rate: /s

Test Set IP Address: 169.254.8.0

Detect Test Set IP Download SV Configuration

Figure 7: Megger Sampled Values Configurator



## FREJA546 and 546N Relay Test System

**FREJA IEC 61850 GOOSE license upgrade kit** – The IEC 61850 GOOSE test feature is a hardware enabled option. RTMS software will automatically recognize if the GOOSE feature if enabled in the FREJA. There are two ways to determine if the unit has the IEC 61850 test capability enabled: First there is nameplate or a sticker on the back of the unit that will state “IEC 61850 ENABLED”. The second way to determine if the unit has been enabled is to power up the unit and go to the Configuration Screen in the RTMS software and it will either state IEC 61850 ENABLED or DISABLED. The IEC 61850 GOOSE test feature can be enabled by the customer in the field by purchasing the IEC 61850 GOOSE license upgrade kit, part number 1001-044. The kit will include an IEC 61850 GOOSE license certificate, with a unique 32-digit code number assigned specifically to the unit (requires the customer to provide the unit serial number when ordering the kit). The kit also includes step-by-step instructions on how to enable the feature with the 32-digit code.

**FREJA IEC 61850 Sampled Values license upgrade kit** – The IEC 61850-9-2LE Sampled Values test feature is a hardware enabled option. The IEC 61850-9-2LE Sampled Values test feature can be enabled by the customer in the field by purchasing the FREJA IEC 61850-9-2LE Sampled Values License Upgrade Kit, part number 1013-856. The kit will include an IEC 61850-9-2LE Sampled Values License Certificate, with a unique 32-digit code number assigned specifically to the unit (requires the customer to provide the unit serial number when ordering the kit). The kit also includes step-by-step instructions on how to enable the feature with the 32-digit code.

**FREJA IEC 61850 GOOSE and IEC 61850-9-2LE Sampled Values hardware upgrade kit** – The IEC 61850 GOOSE the IEC 61850-9-2LE Sampled Values test feature is a hardware enabled option. The IEC 61850 GOOSE and IEC 61850-9-2LE Sampled Values test feature can be enabled by the customer in the field by purchasing the IEC 61850 GOOSE and FREJA IEC 61850-9-2LE Sampled Values hardware upgrade kit, part number 1013-938. The kit will include IEC 61850 GOOSE and IEC 61850-9-2LE Sampled Values license certificates, with unique 32-digit code numbers assigned specifically to the unit (requires the customer to provide the unit serial number when ordering the kit). The kit also includes step-by-step instructions on how to enable these features with the 32-digit code.

### TEST LEADS AND ACCESSORIES








All units are supplied with a power cord, an Ethernet communication cable, and instruction manual on a USB stick.

Included standard accessories	Part number
Power Cord - Depending on the style number, the unit will be supplied with one of the following:	
Line cord, North American	620000
Line cord, Continental Europe with CEE 7/7 Schuko Plug	50425
Line cord, International colour-coded wire	15065
Line cord, United Kingdom	90002-989
Ethernet cable for interconnection to PC, 210cm (7 ft.) long (Qty. 1 ea.)	90003-684
Instruction manual USB	80989

## FREJA546 and 546N Relay Test System




### TABLE OF ACCESSORIES

Test leads and accessories are supplied with the selection of the test leads option. With the test leads option, the number and type of leads varies depending on the unit that is ordered. Test leads and accessories can be ordered individually, see part numbers below.

	Descriptions of test leads and accessories	Quantity	Part number
	<b>Accessory carry case:</b> Used to carry power cord, ethernet cable, optional STVI, test leads and accessories.	1	2003-725
	<b>Sleeved pair of test leads:</b> Sleeved test leads, one <b>red</b> , one <b>black</b> , 200 cm (78.7") long, 600 V, 32 A CAT II	2	2008-539-2
	<b>Cable/spade lug adapter (small):</b> Small lug fit most new relay small terminal blocks. Lug adapter, <b>red</b> , 4.1 mm, rated up to 1000 V/20 A CAT II	12	684004
	<b>Cable/spade lug adapter (small):</b> Small lug fit most new relay small terminal blocks. Lug adapter, <b>black</b> , 4.1 mm, rated up to 1000 V/20 A CAT II	12	684005
	<b>Jumper lead:</b> Jumper lead, <b>black</b> , 12.5 cm (5 in) long, use with voltage/current outputs, 600 V, 32 A CAT II	4	2001-573
	<b>Sleeved combination voltage test leads:</b> Three common leads connect to the test set, which are interconnected to one black common to connect to the relay. Sleeved, three <b>red</b> and <b>black</b> , 200 cm (78.7 in) long, 600 V, 32 A CAT II*	1	2008-540-2
	<b>Sleeved combination current test leads:</b> Three pairs of leads connect to the test set, and to the relay under test. Sleeved, three <b>red</b> and <b>black</b> , 200 cm (78.7") long, 600 V, 32 A CAT II*	1	2008-541-2

### TEST LEADS AND ACCESSORIES (TRANSDUCER OPTION)

The following additional test leads, and accessories are supplied with the selection of the **Transducer option**. Test leads and accessories can be ordered individually, see part numbers and descriptions below.

	Descriptions of optional test leads and accessories	Quantity	Part number
	<b>Sleeved pair of test leads:</b> Sleeved test leads, one <b>red</b> , one <b>black</b> , 200 cm (78.7 in) long, 600 V, 32 A CAT II.	2	2008-539-2
	<b>Cable/spade lug adapter (small):</b> Small lug fit most new relay small terminal blocks. Lug adapter, <b>red</b> , 4.1 mm, rated up to 1000 V/ 20 A CAT II	2	684004
	<b>Cable/spade lug adapter (small):</b> Small lug fit most new relay small terminal blocks. Lug adapter, <b>black</b> , 4.1 mm, rated up to 1000 V/ 20 A CAT II	2	684005

## FREJA546 and 546N Relay Test System






### OPTIONAL TEST LEADS AND ACCESSORIES (NOT INCLUDED IN THE FREJA546 TEST LEAD OPTION)

Optional test leads and accessories can be ordered individually, see description and part numbers below. **The following accessories and part numbers are in quantities of 1 each. Order the appropriate number required.**

	Descriptions of optional test leads and accessories	Quantity	Part number
	<b>Individual (non-sleeved) test leads:</b> Excellent for widely separated individual terminal test connections. Test lead, <b>red</b> , use with voltage/current output, or binary I/O, 200 cm long (78.7 in) 600 V/32 A CAT II.	1	620143
	<b>Individual (non-sleeved) test leads:</b> Excellent for widely separated individual terminal test connections. Test lead, <b>black</b> , use with voltage/current output, or binary I/O, 200 cm long (78.7 in) 600 V/32 A CAT II.	1	620144
	<b>Individual (non-sleeved) extra-long test leads:</b> Excellent for widely separated individual terminal test connections. Extra-long test lead, <b>black</b> , use with voltage/current output, or binary I/O, 360 cm long (12 ft) 600 V/ 32 A CAT II.	1	2003-172
	<b>Individual (non-sleeved) extra-long test leads:</b> Excellent for widely separated individual terminal test connections. Extra-long test lead, <b>red</b> , use with voltage/current output, or binary I/O, 360 cm long (12 ft) 600 V/ 32 A CAT II.	1	2003-173
	<b>Cable/spade lug adapter (large):</b> Large spade lug fits older relay terminal blocks, or STATES® Company FTP10 or FTP14 test paddles, ABB, or General Electric test plugs with screw down terminals. Lug adapter, <b>red</b> , 6.2 mm, use with test leads up to 1000 V/20 A CAT II.	1	684002
	<b>Cable/spade lug adapter (large):</b> Large spade lug fits older relay terminal blocks, or STATES® Company FTP10 or FTP14 Test paddles, ABB, or General Electric test plugs with screw down terminals. Lug adapter, <b>black</b> , 6.2 mm, use with test leads up to 1000 V/20 A CAT II.	1	684003
	<b>Alligator/crocodile clip:</b> Excellent for test connections to terminal screws and pins where spade lugs cannot be used. Alligator clip, <b>red</b> , use with test leads up to 1000 V/32 A CAT III.	1	684006
	<b>Alligator/crocodile clip:</b> Excellent for test connections to terminal screws and pins where spade lugs cannot be used. Alligator clip, <b>black</b> , use with test leads up to 1000 V/32 A CAT III.	1	684007
	<b>Flexible test lead adapter with retractable insulated sleeve:</b> Use for connection to old style non-safety sockets with retractable protective sleeve on one end. Retractable sleeve test lead, <b>red</b> , 50 cm (20 in) long, use with test leads up to 600 V/32 A CAT II.	1	90024-780
	<b>Flexible test lead adapter with retractable insulated sleeve:</b> Use for connection to old style non-safety sockets with retractable protective sleeve on one end. Retractable sleeve test lead, <b>black</b> , 50 cm (20 in) long, use with test leads up to 600 V/32 A CAT II.	1	90024-781
	<b>Flexible test lead adapter:</b> Use with rail-mounted terminals or screw clamp connections where spade lugs and crocodile/alligator clips cannot be used. Flexible test lead adapter, <b>black</b> , 1.8 mm male pin, use with test leads up to 1000 V/32 A CAT III.	1	90001-845
	<b>Parallel test lead adapter:</b> Used when paralleling up to three current test leads together to a common test point. Usually used when connecting to a test paddle (like the pictured States Company test paddle.)	1	1002-286
	<b>RLC, Relay Lead Connector:</b> Excellent for easily connecting three-phase voltage and current leads to the test system. Two sets of test leads (one for voltages and one for currents), sleeved, 4 mm (0.16 in) terminals with retractable safety shrouds, colour coded <b>red, yellow, blue, black</b> , 200 cm long (78.7") 600 V/ 32 A CAT II	1	RLC
	<b>Arc Flash Simulator:</b> The Megger arc flash simulator provides a focused high-intensity bright white light to simulate an arc flash for testing arc flash protection relays and systems.	1	AFS
	<b>Megger Low Level Adapter (Set of three filters):</b> The MLLA provides filtering of the low-level outputs from the latest version2 of voltage/current generators in the Megger FREJA series test sets. It also provides the interface from the low-level outputs to the device under test using appropriate interface cables. <b>For individual filters and interface cables, see the MLLA datasheet.</b>	Set of three filters	MLLA

# FREJA546 and 546N

## Relay Test System

	Descriptions of optional test leads and accessories	Quantity	Part number
	<b>Megger GPS timing reference:</b> The MGTR is a small, lightweight, field portable, GPS satellite receiver system specifically designed to perform end-to-end tests of line protection schemes. Unit comes GPS Antenna, power supply, and a stainless-steel antenna mount. Cable length depends on the ordering part number.		
	GPS unit with all-weather antenna, power supply, and 15 m cable	1	MGTR-II-50
	GPS unit with all-weather antenna, power supply, and 30 m cable	1	MGTR-II-100
	<b>STATES® 10-pole test paddle:</b> Use with STATES FMS test switch or ABB FT-1 10-pole test switch. Test paddle features knobs which also serve as insulated Ø 4 mm rigid socket accepting spring loaded Ø 4 mm plugs with rigged insulating sleeve, or retractable sleeve. Use with test leads up to 600 V, 32 A CATII.	1	V1TP10
	<b>STATES® 10-pole test paddle attachment:</b> Use with STATES V1TP10 test paddle. The test paddle attachment provides an additional 10 insulated connection points for front connection, as well as the standard top connections for test leads. Adapter can provide convenient parallel test connections of test currents to two terminals at one time. Use with test leads up to 600 V, 32 A CAT II.	1	TPA10
	<b>Hard-Sided Transit Case:</b> Includes custom designed foam inserts for the FREJA546 unit, and accessories. Transit case includes retractable handle, built-in wheels, twist and lock-down latches, spring loaded fold-down handles, with O-ring seal.	1	1007-364
	<b>Soft-sided carry case:</b> The soft-sided carry case protects the FREJA546 unit from light rain and dust. The padded sides provide moderate protection while in transit.	1	2006-066

<sup>1</sup> Megger reserves the right to change product specifications at any time.

<sup>2</sup> Requires VIGENS with hardware version 3.5.1 or higher.

<sup>3</sup> For the ability to test relays with low level inputs by simulating signals from non-conventional CTs and VTs with low level interfaces, i.e., Rogowski coils will require the Megger MLLA (Low Level Adapter).

<sup>4</sup> PowerV™ voltage amplifier output current varies depending on the voltage setting on the 150 Volt range, see curve.

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### FREJA546\_546N\_DS\_EN\_v9

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