

# Programma

## FREJA 300 Relay Test System



- Manual and automatic control
- Easy to use
- Excellent software provides great visuals and simple setup
- Lightweight and portable
- Highly accurate
- User can calibrate unit

### DESCRIPTION

The FREJA™ 300 relay testing system is a computer-aided relay testing and simulation system. The weight of FREJA 300 is only 15 kg. The rugged hardware design is built for field use over a wide temperature range, with the possibilities of intelligent software to perform rapid testing.

FREJA 300 can be operated with or without a PC. After being put into the Local mode, FREJA 300 can be used stand-alone without a PC. Using the Local mode is easy. The function of each key is described on the display, which also presents the settings and measured values.

The very accurate (typically 0.01%) low level analogue inputs are designed for transducer measurements. The high level inputs can be used as a normal volt- and ammeter. FREJA 300 can generate 4x150 V (82 VA) and 3x15 A (87 VA) or 1x45 A (250 VA) and the FREJA 306 can generate 6x15 A (3x15 A + 3x35 A) or 1x100 A (750 VA). Each output can be varied independently. Both static and dynamic testing can be performed, such as pre-fault and fault generation, simultaneous ramping of several quantities and wave form editing.

FREJA 300 can also be used as a disturbance simulator and create and generate simulated disturbances, or import actual recorded disturbances from e.g. EMTP or COMTRADE files (and edit the wave forms), by using the FREJA SIM Disturbance Simulator Software. With the built-in DC source you can supply the relay protection.

### APPLICATION

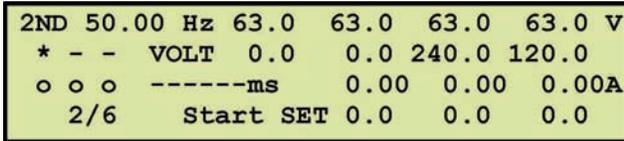
#### Relay Testing

FREJA 300 is intended primarily for secondary testing of protective relay equipment. Virtually all types of protection relays can be tested.

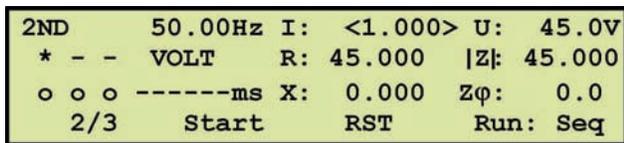
Examples of what FREJA 300 can test	IEEE® No.
Distance protection equipment	21
Synchronising or synchronism-check relays	25
Undervoltage relays	27
Directional Power relays	32
Undercurrent or underpower relays	37
Negative sequence overcurrent relays	46
Overcurrent-/ ground fault relays	50
Inverse time overcurrent-/ ground fault relays	51
Power factor relays	55
Overvoltage relays	59
Voltage or current balance relays	60
Directional overcurrent relays	67
DC overcurrent relays	76
Phase-angle measuring or out-of-step protective relays	78
Automatic reclosing devices	79
Frequency relays	81
Differential protective relays	87
Directional voltage relays	91
Voltage and power directional relays	92

**Local Mode - without PC**

Using the dial by turning and clicking it is easy to make the settings. All settings are saved automatically when you exit, but if you prefer you can assign the settings a name and save them separately for convenient access when you conduct your next test. The display can also show the measured value that is being generated. This feature is equivalent to three voltmeters and three ammeters that present RMS values for all generators.



Local Mode General



Local Mode Rx (I)

**With a PC - FREJA Win**

**FREJA Win Control center**

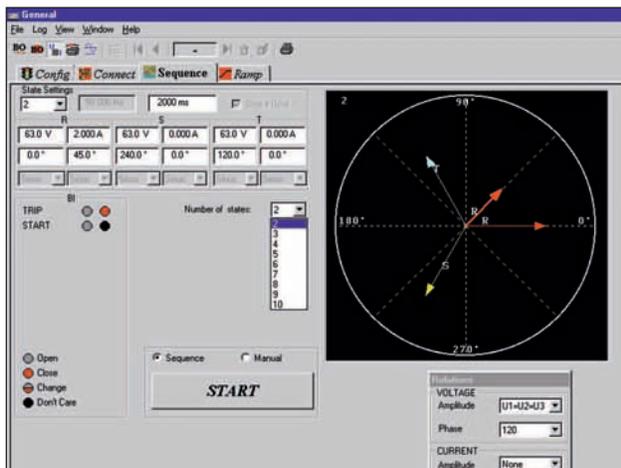
There are a number of instrument programs. You start the different programs at the Control center, where you also save and recall results. Since the test set-ups/results are saved via a regular Microsoft® Explorer display, you can create your own test object structures.



Control center

**General**

The all-round General instrument program serves as a convenient, easy to understand, user-friendly toolbox. On the Connect page, you can enter information about how to connect the relay, including pictures if so desired.

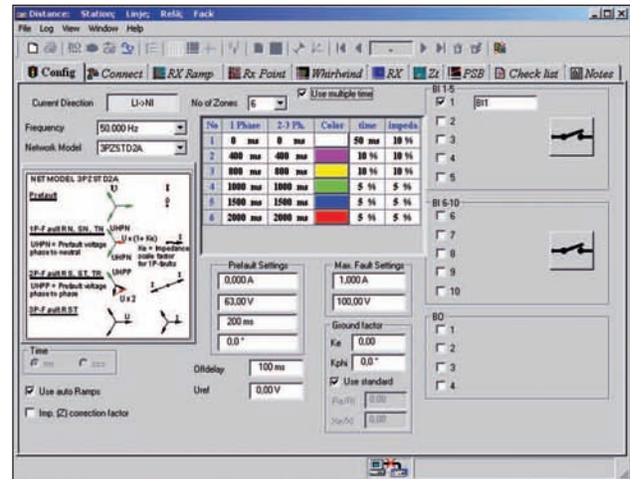


General Instrument

On the Sequence page, you can vary all generator parameters independently. You can have up to 25 different states (prefault, fault1, fault2, fault3 etc.). This is useful when testing autoreclose relays or motor protection.

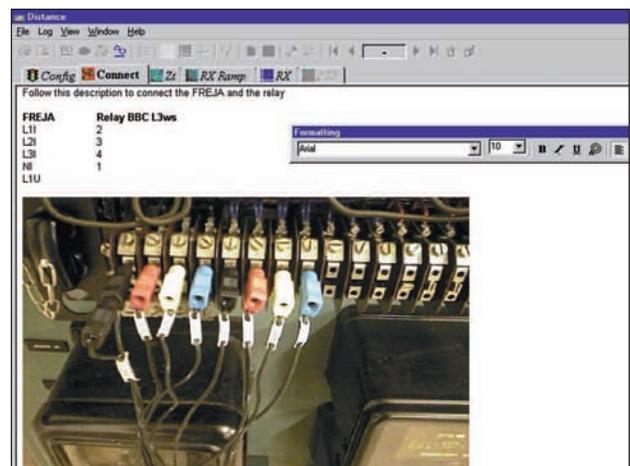
On the Ramp page, you can ramp all generator parameters independently. Amplitudes and angles are shown on a vector diagram, and values can be set with a dial, keyboard or mouse. It's also possible to generate up to the 25th harmonic.

**Distance**



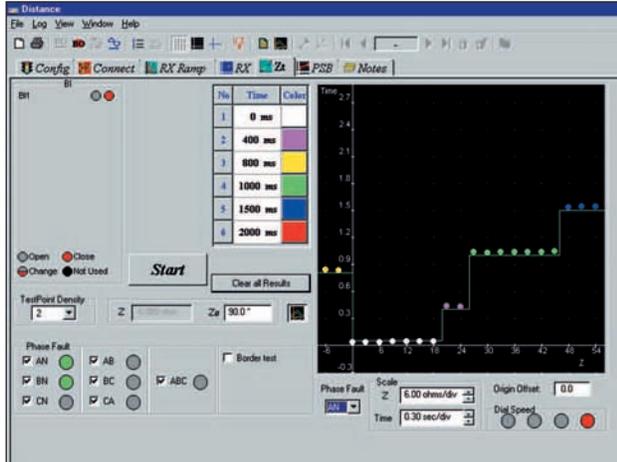
Distance, Configuration

The Distance instrument program is designed to test distance relays. On the Configuration page, you enter the number of zones that are to be tested and also the time and impedance tolerances, thereby creating an automatic test. No programming is needed. Later, when you recall this object via the Control center, all settings are re-established so that you can start testing immediately.



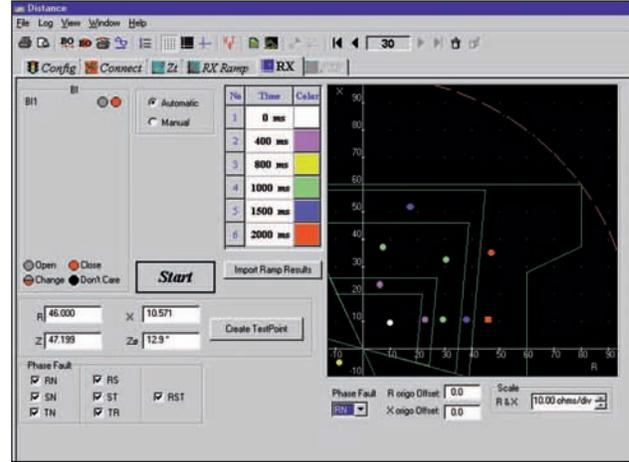
Distance, Connect

On the Connect page you enter information about how to make connections to the relay, including pictures if so desired. Since this information is saved together with the object in the Control center, it can be displayed again the next time you want to test this relay.



Distance, Zt

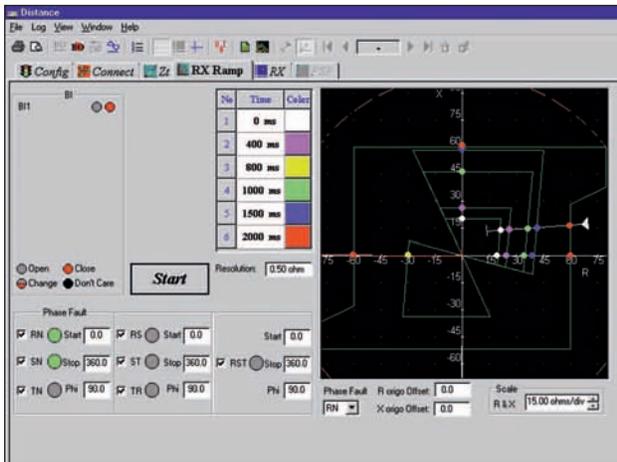
The Zt page is designed for time testing of a distance relay. Normally, you test one type of fault at a time when testing relays. With FREJA Win, however, you can test all seven fault types automatically if so desired. All you have to do is press the <Start> button. FREJA will test all seven fault types automatically and then compare the readings with the theoretical values that you entered on the Configuration page. If the readings are OK, a green lamp lights. If not, a red lamp lights. If you want to check the reverse direction, the test can start below zero ohms in the 3rd quadrant.



Distance, RX

The RX page enables you to define test points manually. You can define different points on the oscilloscope using the mouse or keyboard. Select the automatic mode and press the <Start> button. FREJA will test all points for the selected fault types. The points will be assigned different colors, depending on the trip time. If you select the manual mode, you can use the dial to search for a boundary.

The RX point page, a new feature in FREJA Win 5.2, speeds up the reach tests.

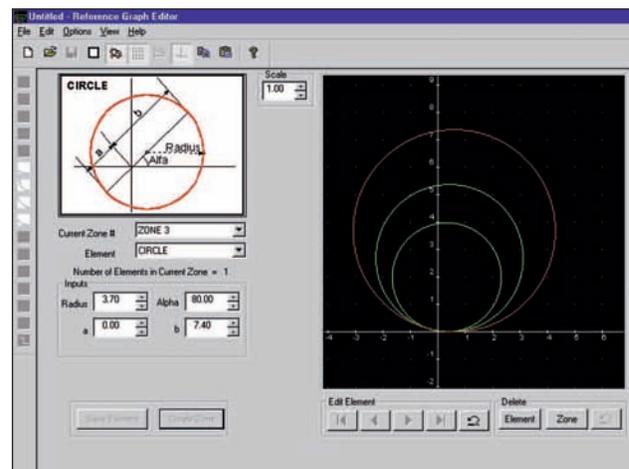


Distance, RX Ramp

The RX-ramp page, which is part of the Distance instrument program, is designed to test the reach of a distance relay. First, you define the start and stop angles and the delta phi between the ramps. Then press the <Start> button and relax. FREJA will automatically test all seven types of faults using the timesaving "search-half" method. You can also define your own ramps, using the mouse to specify starting and ending points wherever desired. If you have defined a theoretical reference graph, the program will compare the actual test result with your graph and check for any deviations from the tolerances entered on the Configuration page. If the results are OK, a green lamp lights. If not, a red lamp lights.

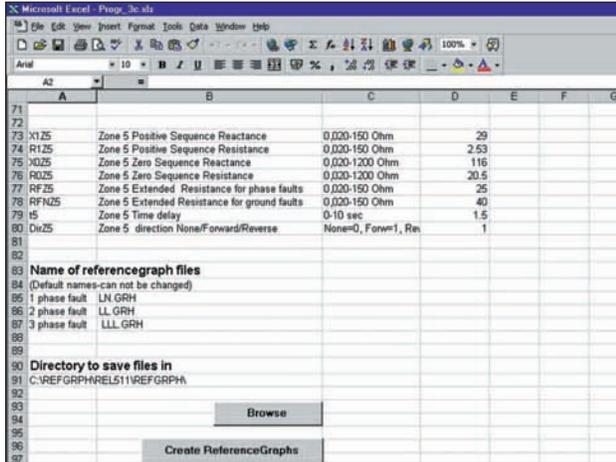
### Reference graphs

Efficient testing and performance analysis require well-defined reference values. FREJA can automatically create the IEC and IEEE® standard curves for overcurrent relays. It is also possible to create reference graphs in the impedance plane using the included library of distance relays made by major manufacturers and/or create other characteristics using the standard circular lens and linear elements (including mho, quadrilateral and ice-cream cone shapes).



Edit a reference graph

The cut and paste buttons make it easy to take copies of the first zone and then edit these copies by inserting zone 2 and zone 3 values.



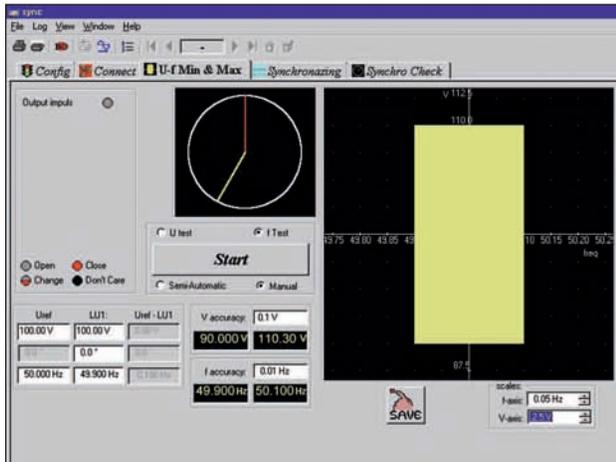
**Edit a reference graph**

State-of-the-art distance relays having sophisticated impedance characteristics and several setting groups require many parameter settings. The optional ProGraph feature enables you to import the parameter settings from a master selectivity plan prepared in Microsoft® Excel. This eliminates manual transfer errors, and the FREJA software creates the reference graph automatically.

Some relay manufacturers can create a RIO-file with the settings of the relay. Using the FREJA RIO-converter you can create reference graphs based on these settings.

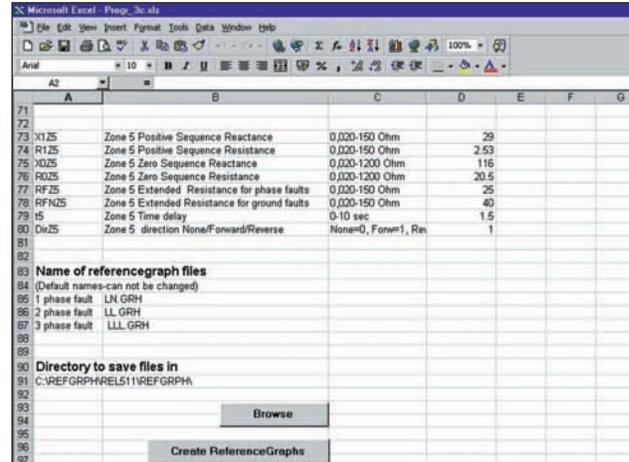
A new feature is the ready-made current curves available for many relay types.

**Sync**



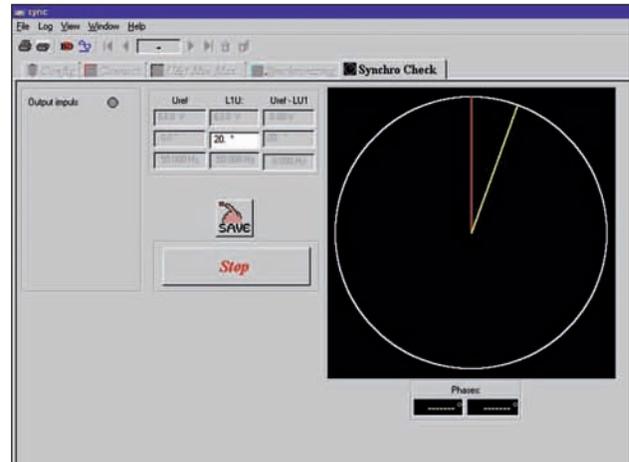
**Sync, U-f Min & Max**

The U-f Min & Max part of the Sync instrument program is designed especially to test voltage and frequency boundaries for a synchronizing relay. This test is carried out automatically. Simply press the <Start> button, whereupon the program itself searches for the boundaries.



**Sync, Synchronizing**

The Synchronizing page is designed to measure lead-time. It also enables you to measure the pulses sent out from the synchronizing relay.



**Sync, Synchro Check**

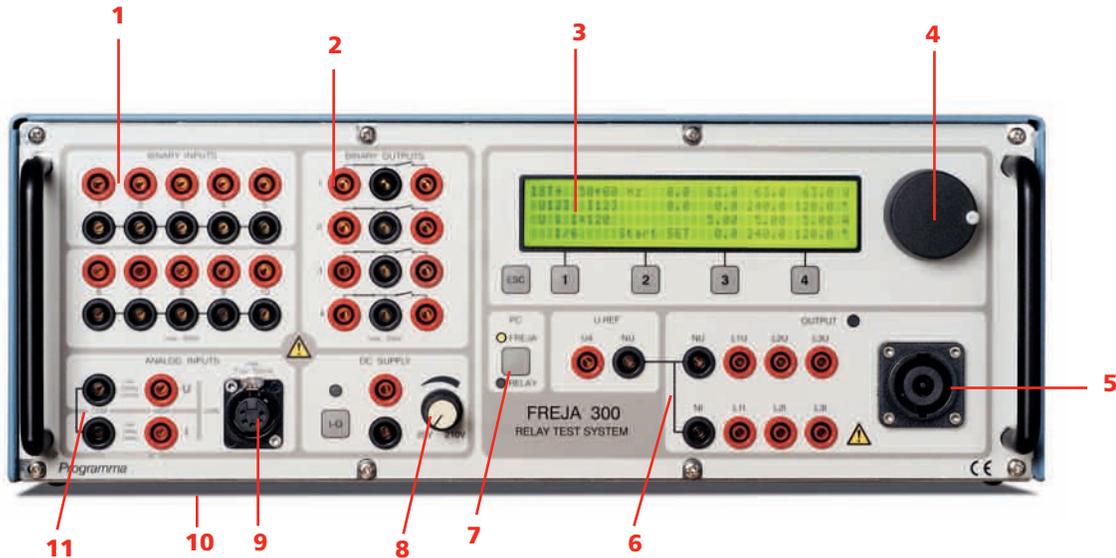
The Synchro Check page is designed to test synchrocheck relays.

First set the phase angle to +20° (or some other starting point). Then change the phase angle until you reach the boundary. You press the <Save> button to store the result. Now test on the other side, starting at -20°, change the phase angle until you reach the other boundary.

**FEATURES AND BENEFITS**

1. Binary inputs.
2. Binary outputs (normally-closed and normally-open).
3. Display and buttons used in the Local Mode.
4. Dial, press to Enter.
5. Multiconnector for voltage (L1U, L2U, L3U, NU) and current (L1I, L2I, L3I, NI).

6. Current and voltage outputs.
7. Switch, PC to Freja 300 or relay.
8. DC-supply, connect to (11) to read the values (in General mode page 5/6 on the display).
9. Analog inputs, LOW, for measurement transducers.
10. Fuse (50 mA) at the bottom, for Analog inputs LOW (9).
11. Analog inputs, HIGH, for volt- and ammeter.



**SPECIFICATIONS**

Specifications Specifications are valid for resistive load, nominal voltage supply and ambient temperature +25° C ±3° C, (77° F ±5.4° F) after 30 minutes warm up time. All hardware data are for full scale values. Specifications are subject to change without notice.

**Environment**

Application field	For use in high-voltage substations and industrial environments.
Temperature	
Operating	0° C to +50° C (32° F to +122° F)
Storage & transport	-40° C to +70° C (-40° F to +158° F)
Humidity	5% – 95% RH, non-condensing

**CE-marking**

LVD	Low Voltage Directive 73/23/ EEC am. by 93/68/EEC
EMC	EMC Directive 89/336/EEC am. by 91/263/EEC, 92/31/EEC and 93/68/EEC
General	
Mains input (nominal)	90 – 264 V AC, 47 – 63 Hz
Power consumption	600 VA typical (1200 VA max.)
Dimensions	
Instrument	450 x 160 x 410 mm (17.7" x 6.3" x 16.1")
Transport case	560 x 240 x 575 mm (22" x 9.5" x 22.6")
Weight	
Instrument	15 kg (33.1 lbs)
Transport case	7.5 kg (16.5 lbs)
Display	LCD
Available languages	English, French, German, Spanish, Swedish

**Measurements**

**Binary inputs**

Number	10 Inputs (2 groups of 5 independent)
Type	Dry or wet contacts 275 V DC, 240 V AC
Internal resolution time	50 µs
Galvanic isolation	Galvanically separated from the amplifier section. Two galvanically separated groups: 1 to 5 and 6 to 10
Max measuring time	15264 h (636 days)
Range	Resolution
0 - 9.9 ms	0.1 ms
10 ms - 60 min	1 ms
1 h - 15264 h	1 s

**DC current measuring input, LOW**

Measuring range	±20 mA
Resolution	SW 0.1 µAHW 0.6 µA
Inaccuracy	0.01% typical, 0.03% guaranteed (= 6 µA)

**DC voltage measuring input, LOW**

Measuring range	±10 V
Resolution	SW 0.1 mVHW 0.3 mV
Inaccuracy	0.01% typical, 0.03% guaranteed (= 3 mV)

**AC/DC current measuring input, HIGH'**

Measuring range	±14 A DC, 10 A AC RMS
Inaccuracy	DC <0.1%, AC <0.3%

**AC/DC voltage measuring input, HIGH'**

Measuring range	±220 V DC, 150 V AC RMS
Inaccuracy	DC <0.05%, AC <0.2%

**Measurement, internally generated values**

Inaccuracy	
Voltage AC/DC	<1% ±1digit
Current AC/DC	<2% ±2digit

**Binary outputs**

Number	2 x 4 (NO & NC)
Type	Zero-potential contacts, controlled via software
Break capacity AC	240 V AC, max 8 A, max load 2000 VA
Break capacity DC	275 V DC, max 8 A, max load 240 W

**Low level outputs (ROGOW)**

Setting range	
LLU	3 X 0...2 VRMS
LLI	3 X 0...2 VRMS
Max. output current	5 mA
Inaccuracy	<0.1% typ. (<0.2% guaranteed)
Resolution	250 µV
Distortion (THD+N) <sup>2</sup>	<0.05% typ. (<0.1% guaranteed)
Max. generating time	5 minutes

**Generator section**

**Voltage outputs**

**Range**

4-phase AC	4 x 150 V
1-phase AC (L-L)	2 x 300 V
DC (L-N)	180 V

**Power**

3-phase AC	3 x 82 VA at 150 V
1-phase AC (L-L)	1 x 140 VA at 300 V
DC (L-N)	87 W

**Resolution**

SW	10 mV
HW	6.5 mV
Inaccuracy <sup>3</sup> (guaranteed)	(±0.01% of range) + (±0.05% of reading)
Distortion (THD+N) <sup>2</sup>	0.02% typical (0.04% max)

**Current outputs<sup>4</sup>**

**Range**

3-phase AC	3 x 15 A
1-phase AC <sup>5</sup>	1 x 45 A
DC (L-N)	15 A

**Power**

3-phase AC	3 x 87 VA
1-phase AC <sup>5</sup>	1 x 250 VA
DC (L-N)	3 x 87 W (max)

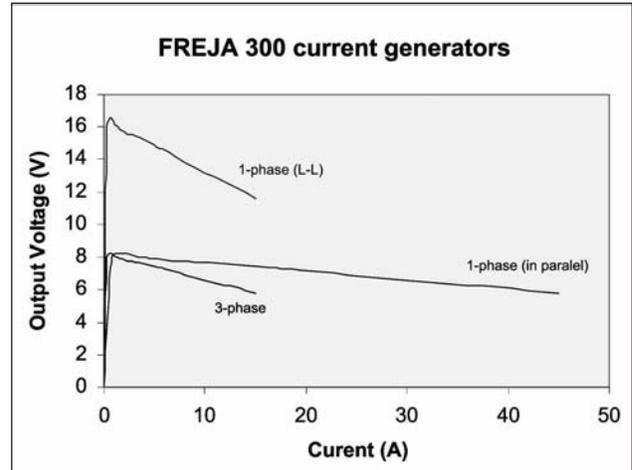
**Resolution**

SW	1 mA
HW	0.65 mA
Inaccuracy <sup>3</sup> (guaranteed)	(±0.01% of range) + (±0.3% of reading)
Distortion (THD+N) <sup>2</sup>	0.1% typical (0.2% max)

**Generators, general**

**Frequency range**

Continuous signals	DC – 2000 Hz
Transient signals	DC – 3.5 kHz
Frequency resolution	1 mHz
Frequency inaccuracy	0.01%
Phase angle range	0 – 360°
Phase resolution	0.1°
Phase inaccuracy <sup>3</sup>	±0.1°
Connection (Amplifier outputs)	4 mm stackable safety plugs or 8-pin amplifier multiconnector



All seven generators are continuously and independently adjustable in amplitude and phase. No switching of range is necessary. All current and voltage outputs are fully overload- and short-circuit-proof and protected against external high voltage transient signals and overtemperature.

**Note:** To allow continuous generation of high DC current (12 - 15 A), a minimum load impedance of 0.2 Ohm is required. For lower load impedances, e.g. short-circuit, the time is limited to 1 minute.

**DC auxiliary voltage output**

Range	20 – 210 V DC
Output power	75 W at 210 V

**Other**

On-line measurement of the current and voltage output, presented on the built-in display.

Calibration check when the temperature is changed. Full calibration can be conducted a any time using the FREJA calibration box. This means you do not need to send away FREJA for calibration. Only the calibration box needs to be sent for calibration once per year.

Connection to IBM compatible PC (minimum Pentium II 266 MHz, 32 Mb RAM, Win 95/98/2000, NT 4.0) via the serial port. The FREJA has a built-in switch that enables you to switch communication back and forth between the PC and your relay.

- 1) 50 or 60 Hz AC + harmonics only.
- 2) THD+N: Values at 50/60 Hz, at max amplitude, 50% power and resistive load. Measurement bandwidth 22 Hz – 22 kHz.
- 3) For sinusoidal signals at 50/60 Hz.
- 4) For higher current or output power you can use amplifier CA3.
- 5) Parallel connection.



**Test lead set**



**Calibration box**



**Multi cable**



**GPS 100**

**Accessories**

**FREJA Win Standard**

incl. software key  
CF-8203X

**FREJA Win upgrade**

Freja Win Standard upgrade  
CF-8282X

**Transient instrument (SW)**

The Transient instrument is used to generate transient waveforms from a disturbance recorder.  
CF-8214X

**Transducer instrument (SW)**

Transducers are used to measure e.g. current, voltage, power, phase angle or frequency. The output from the transducer is then either a DC voltage or a DC current. Standard ranges are 0-10 V or 4-20 mA (or 0-1 mA).

The transducers input signals are connected to FREJA's voltage and/or current generators. The transducer's output signal is connected to the Low Analog input. The accuracy of the measurement is very high.

You can test all different types of transducers in a fully automatic way. Just press START, and the program will test the transducer and present the full scale, absolute, and relative error. In the report you get both graphs and a table of the result.

CF-8215X

Auto 21 instrument (SW) The AUTO21 converts FREJA RTS 11, 21, 21D and FREJA 300 DOS testplans to FREJA Win. This will make it possible to run and printout in a Microsoft® Windows® environment.  
CF-8221X

**FREJA Win ProGraph**

Automatic reference graph program. Contact Megger for more information.

**Cables**

FREJA Multi-cable Shortens hookup time considerably. Consists of a multi-pole connector that connects to FREJA's three voltage and three current outputs, and a number of banana plugs that connect to the protective relay equipment that is to be tested.

GA-00103

**Test lead set**

With touch-proof contacts. 2 x 0.25 m (0.8 ft) / 2.5 mm<sup>2</sup>, 2 x 0.5 m (1.6 ft) / 2.5 mm<sup>2</sup>, 8 x 2 m (6.5 ft) / 2.5 mm<sup>2</sup>.

Weight: 0.8 kg (1.8 lbs). Normally you need two sets. X X GA-00032

**Other**

**GPS100**

The GPS100 makes it possible to synchronize two or more FREJA to conduct end-to-end testing. End-to-end testing provides quick, reliable results showing how two or more protective relay systems interact. The GPS100 includes a power pack, an antenna with 20-metre cable and a carrying case.

**CA30**

Current amplifier, see CA30 section X

Soft transport case  
Dimensions:  
470 x 440 x 190 mm (18.5" x 17.3" x 7.5")

Weight: 1.8 kg (4 lbs)  
GD-00215

Soft transport case

Soft transport case

Cable organizer  
Velcro straps, 10 pcs.  
AA-00100

For test leads and other standard cables, please see the appropriate catalogue pages.

Please also see the application notes for specialized accessories, available at [www.megger.com](http://www.megger.com).

For more information about optional accessories please contact Megger.

**ORDERING INFORMATION**

Item (Qty)	Cat. No.	Item (Qty)	Cat. No.
<b>FREJA 300</b> Complete with: FREJA Win Standard, FREJA PC software key, Two test lead sets, Calibration box, Hard transport case	CF-19091	<b>FREJA 300 basic unit</b> Incl. calibration box	CF-19000
Same as above but with soft transport case	CF-19090	FREJA 300, LLA (Rogowski option) Complete with: FREJA Win Standard Freja 300 PC software key Two test lead sets Calibration box Hard transport case	CF-19095
<b>FREJA 300 Expert</b> Incl. data base	CF-19098	Same as above but with soft transport case	CF-19094
<b>FREJA 300 Expert LLA</b> Incl. data base	CF-19099	<b>FREJA 300 Basic Unit, LLA</b> Incl. calibration box	CF-19004
		<b>Optional accessories</b>	
		See relay testing Accessories	

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Trappes FRANCE, Kingdom of BAHRAIN,  
Mumbai INDIA, Johannesburg SOUTH  
AFRICA, and Chonburi THAILAND

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ISO 14001:2004  
Cert. no. GBG0005937  
**FREJA300\_DS\_en\_V01**  
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