INGVAR
Primary Current Injection Test System

Megger



- **Most Advanced Primary Current Injection Test System to simplify all types of switchgear and CT commissioning, circuit breaker testing and more**
- **Up to 5000 A output current**
- **Two units, each of about 20 kg (44 lbs), simplifies transportation**
- **Unique I/30 function allows the current to be pre-set using low current to prevent test sample heating, thus eliminating corruption of test result**

DESCRIPTION

This powerful test system is designed for primary injection testing of protective relay equipment and circuit breakers. It is also used to test the turns ratio of current transformers and for other applications that require high variable currents.

The system consists of a control unit and a current unit. The two parts are portable, and INGVAR can be quickly assembled and connected.

The control unit has many advanced features – a powerful measurement section for example, that can display turns ratio as well as time, voltage and current. A second measurement channel can be used to test an additional current or voltage. Current transformer turns ratio, impedance, power, power factor (cos φ) and phase angle are calculated and shown in the display. Current and voltage can be presented as percentages of nominal value. The fast-acting hold function freezes short-duration readings on the digital display when the voltage or contact signal arrives at the stop input, the object under test interrupts the current or injection is stopped.

Note:
INGVAR is designed to inject a primary current of up to 5 000 A.

To ensure high output current, the following design criteria should be carefully considered:

- Use current cables with a large cross-sectional area
- Minimise the distance to the test object
- Avoid open loops to reduce magnetic flux
- Twist the current cables
- Ensure all connectors are clean and properly tightened

APPLICATION

- Primary current injection testing and breaker testing

These tests require high currents and the ability to measure very short duration, current flow. INGVAR has been designed especially to meet these needs. No extra contacts are needed to measure the operating time of a low-voltage breaker. Testing stops at the instant when the main breaker contacts open to interrupt the current. Output current initiation is synchronized with the currents zero-cross-over point to ensure good repeatability and minimized DC offset.

- Testing current transformers

For turns ratio testing, the primary current and either the secondary current or the turns ratio are displayed simultaneously. Since the turns ratio is displayed directly as the nominal value (1000/5 for example), no further calculation is needed. Burden of secondary circuits can be measured and presented in VA.

- Polarity testing

The currents phase displacement is shown, and the polarities of the outputs are clearly marked.

- Heat runs

INGVAR is ideal for performing heat runs. Current can be applied continuously or through programmable intervals. The times can be shown in minutes and hours which facilitates long-term testing capability.

- Automatic reclosers and sectionalizers

INGVAR can also be set to test circuit breakers with reclosing relays. Operating limits, partial times, total times and the number of operations before lockout can be measured. User-selectable reclosing sequences can be programmed for testing sectionalizers.

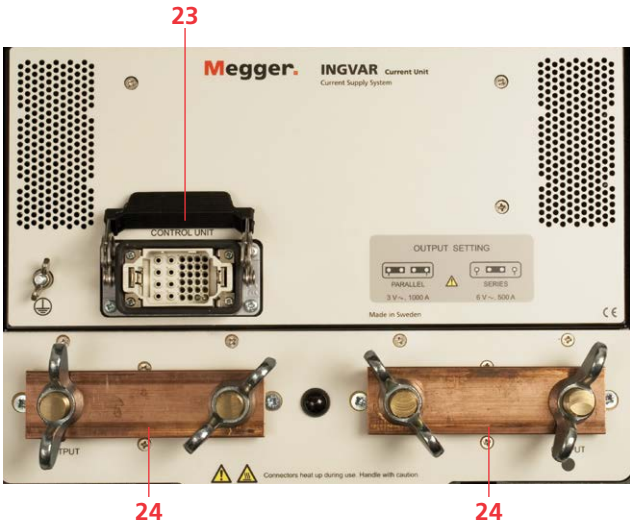
- Testing integrity of safety-ground devices

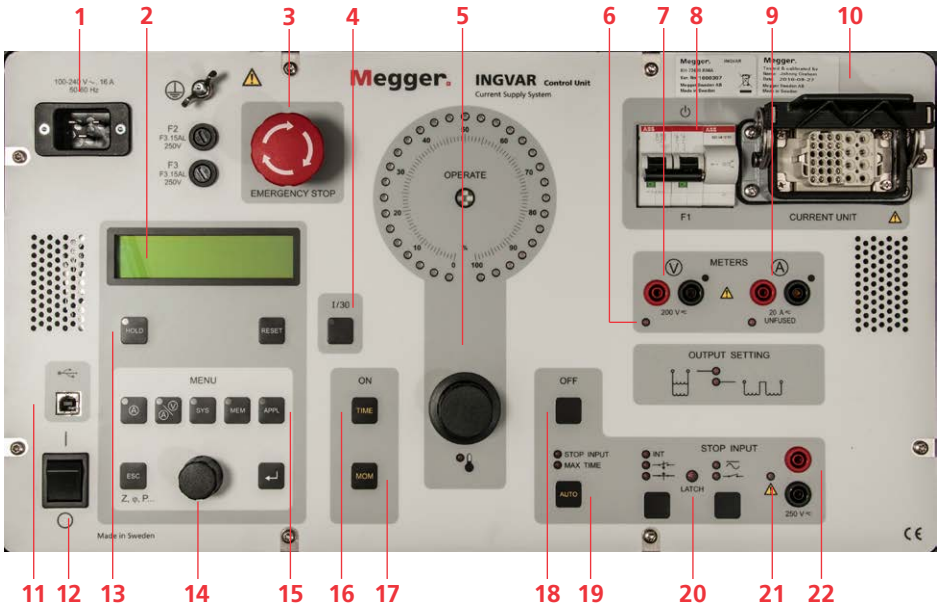
One way to test safety-ground devices is by injecting current through the safety-ground and measure the voltage drop to get the impedance.

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FEATURES AND BENEFITS

1. Mains inlet, 3 pin CEE connector (16 A)
2. Display. The display presents time, output current, voltage, current shown on ammeter 2 and phase angle. You can scroll through entities Z, P, Q, R, X, S, power factor (cos φ) and I max.
3. Emergency stop button.
4. Current reduction button. Used during setting to reduce the output current to 1/30. Useful in order to avoid for example unintentional tripping and overheating.
5. Current adjustment knob.
6. Indicator lamps. Indicate whether ammeter 2 or the voltmeter is enabled.
7. Input for voltmeter. Used to measure voltage and other quantities.
8. Miniature circuit breaker used for current output. Interrupts output current. Can also be actuated manually for safe disconnection of load.
9. Input for ammeter 2. Used to measure current in an external circuit (in a current transformer's secondary winding for example).
10. Multiconnector for interconnection of control and current units.
11. USB port, type B
12. ON/OFF switch
13. Hold function. This function freezes readings on the display.
14. Selection/setting knob. Selects the desired menu option (shown in the display window). Also used to change numerical values.
15. Setting buttons. Personnel unfamiliar with INGVAR can use the pre-defined settings very effectively, while experienced users can make their own basic settings.
    • Ammeter. Used to set the main current-output ammeter. You can select the desired range or select autoranging.
    • V/A Meter. Toggles between the voltmeter and ammeter 2. Also used to select the desired range or select autoranging.
    • System. Used for general settings.
    • Memory. Used to save or recall settings to or from the ten INGVAR memories. One of these memories contains the default (pre-defined) settings that are invoked when INGVAR is powered up.
    • Application. Used to invoke the desired measurement mode: a) automatic recloser, b) sectionalizer. INGVAR can also be set to generate pulse trains with user-selectable pulse and pause times.
16. Injection. Starts current injection and timing.
17. Momentary Injection. When this button is used, injection continues only as long as it is pressed. Useful in order to avoid for example overheating.
18. Manual shut-off. Injection and timing are stopped when this button is pressed.
19. Automatic injection stop. Generation stops after a user-specified interval or when condition at the input is met. The diodes show the selected OFF condition.
20. Stop-condition indicator. Indicates that the stop condition is fulfilled.
21. Status indicator. Indicates if a contact connected to the input is closed or if voltage is present.
22. Stop input. Used to freeze a reading or stop injection. Activated when current is interrupted by the object being tested, when an external contact is actuated or when a voltage is applied or removed.
23. Multiconnector for interconnection of current and control units.
24. Current bars for parallel or serial connection of the outputs.





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SPECIFICATIONS INGVAR

Specifications are valid for an ambient temperature of +25°C and nominal input voltage. The specifications are subject to change without notice.

System designation

An INGVAR-system consists of a Control Unit and one Current Unit.

Environment

Application field	The instrument is intended for use in medium-voltage substations and industrial environments.
Temperature	
Operating	0°C to +50°C (+32°F to +122°F)
Storage & transport	-25°C to +55°C (-13°F to +127°F)
Humidity	5% – 95% RH, Non-condensing
Altitude (operational)	<2000 m
Pollution degree	2

CE-marking

EMC	2014/30/EU
LVD	2014/35/EU
ROHS	2011/65/EU

General

Measurement category	CAT I Rated transient overvoltage: 2200 V
Mains voltage	100 – 240 V AC, 50/60 Hz
Mains inlet	IEC 60309-1, -2. 16 A

Power consumption

Input voltage	*Output current*	*Input current*
240 V	2 kA	20 A
240 V	3.8 kA	45 A
120 V	2.5 kA	30 A
120 V	1 kA	12 A

Input current	Output current x open circuit voltage /input voltage
Protection	The output transformer has a built-in thermal cut-out, and the primary side is protected by a miniature circuit breaker
Dimensions	
Control Unit	546 x 347 x 247 mm (21.5" x 13.7" x 9.7")
Current Unit	410 x 340 x 205 mm (16.1" x 13.4" x 8")
Weight	
Control Unit	20 kg (44 lbs)
Current Unit	21 kg (46.3 lbs)
Data transfer	USB Type B Female

Display

Type	LCD
Available languages	English, German, French, Spanish, Swedish.

Outputs

Outputs in parallel, 240 mains voltage

Maximal current	*Maximum generation time*	*Minimum rest time*[1)]	*Load voltage*
0A	continuously	–	3V 2)
700 A	continuously	–	2.6 V
1000 A	30 min	5 min	2.5 V
2000 A	3 min	10 min	2.1 V
3000 A	1 min	12 min	1.8 V
5000 A	2 sec	3 min	1.2 V

Outputs in series, 240 mains voltage

0 A	continuously	–	6 V [2)]
350 A	continuously	–	5.3 V
500 A	20 min	15 min	5.1 V
1500 A	2 min	12 min	3.5 V

1) Time to reset the thermal protection.
2) No load voltage

Measurement section

Ammeters

Measurement method	AC 50/60 Hz, DC RMS
Inaccuracy	1% of range ±1 digit

Ammeter 1

Ranges	
Serial Low	0 – 2.15 kA
Serial High	0 – 3.30 kA
Parallel Low	0 – 4.00 kA
Parallel High	0 – 6.50 kA
Resolution	
0-999 A	1 A
1.00 – 6.50 kA	10 A

Ammeter 2

Ranges	0 – 2 A / 0 – 20 A

Voltmeter

Measurement method	AC 50/60 Hz, DC RMS
Ranges	0 – 0.2 V, 0 – 2 V, 0 – 20 V, 0 – 200 V, AUTO
Inaccuracy	1% of range ±1 digit
Input resistance (Rin)	240 kΩ (range 0 – 200 V) 24 kΩ (other ranges)
Dielectric withstand	2.5 kV

Timer

Presentation	In seconds, mains frequency cycles or hours and minutes
Ranges	0.000 – 99999.9 s 0 – 9999 cycles
Inaccuracy	±(1 digit + 0.01% of value) For the stop condition in INT-mode 1 ms shall be added to the specified measurement error.

Stop input

Max. input voltage	250 V AC / 275 V DC
Phase angle	
Range	0 – 359°
Resolution	1°
Inaccuracy	±2° (For voltage and current readings higher than 10% of the selected range)

Z, P, R, X, S, Q and power factor (cosϕ)

The result is calculated using U, I and j

Imax

Stores highest current value that exists ≥100 ms

INT-level

Threshold indicating that current is interrupted, can be set to approx. 0.5 or 2% of range for Ammeter 1

OPTIONAL ACCESSORIES



HCP2000 — High Current Probe

The high current probe, HCP2000, is a tool that makes it possible to test Molded Case Circuit Breakers (MCCB), without removing/uninstalling the circuit breaker. The high current probe operates up to 2000 A trip current.



Current transformer switchbox

The Current Transformer (CT) Switchbox for INGVAR is a tool that is used to facilitate CT testing. The secondary windings on the CT are connected to the CT Switchbox inputs and the CT Switchbox output is connected to INGVAR Ammeter 2 terminals. The switch on the CT Switchbox is used to select which secondary winding on the CT that should be measured. The windings that aren't measured are short-circuited. The CT Switchbox can handle up to 5 secondary windings.



Cable set (GA-12052) 2 x 5 m (16 ft)

100 mm clamp jaw width.

INCLUDED ACCESSORIES



Cable set (GA-12051) 2 x 2 m (6.5 ft)

100 mm clamp jaw width.

ORDERING INFORMATION

Item			Art.No.
INGVAR			BH-72490
Including:			
GA-12700	Interconnection cable 3 m (10 ft)	1	
GA-12051	Current cable 2 m (6.5 ft) 120 mm^2	2	
04-00080	Mains cable 2.5 m (8 ft)	1	
GA-00204	Grounding cable 5 m (16 ft)	1	
Optional accessories			
HCP2000, High Current Probe			AA-90165
Current Transformer Switchbox			BH-90130
Extension interconnection cable INGVAR, 5 m (16 ft)			GA-12705
Extension interconnection cable INGVAR, 10 m (32 ft)			GA-12710
Multi-cable high current cable sets			
Length	***Impedance (Twisted-pair cables)***		
Cross section area: 240 mm^2 (2x120)			
2 x 0.5 m (1.6 ft)	0.21 mΩ		GA-12205
2 x 1 m (3.3 ft)	0.32 mΩ		GA-12210
2 x 1.5 m (4.9 ft)	0.42 mΩ		GA-12215
2 x 2 m (6.6 ft)	0.53 mΩ		GA-12220
Cross section area: 360 mm^2 (3x120)			
2 x 0.5 m (1.6 ft)	0.18 mΩ		GA-12305
2 x 1 m (3.3 ft)	0.25 mΩ		GA-12310
2 x 1.5 m (4.9 ft)	0.32 mΩ		GA-12315
2 x 2 m (6.6 ft)	0.39 mΩ		GA-12320
Cable set, 2 x 5 m (16 ft) Cross section area: 120 mm^2 Weight: 15.2 kg (33.5 lbs) Impedance: 2.2 mΩ			GA-12052

Postal address
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