

# INGVAR

## Primary Current Injection Test System



- **Most Advanced Primary Current Injection Test System to simplify all types of switchgear and CT commissioning, ground grid, 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 ( $\cos \phi$ ) 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.

### 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 current's zero-crossover 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 current's 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.

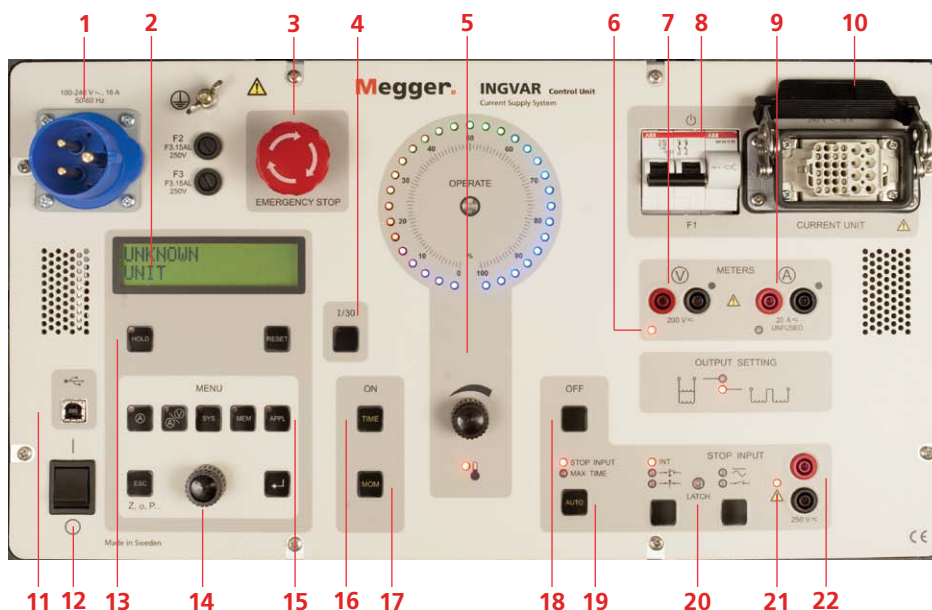
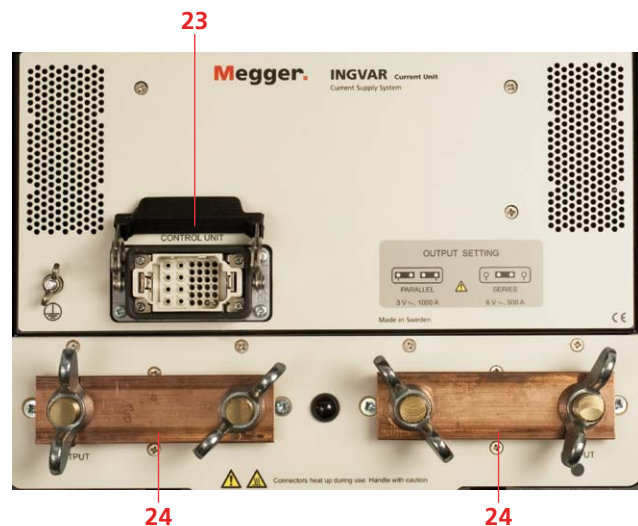
#### ■ Testing integrity of ground grids and safety-ground devices

One way to test ground grids is by injecting current between a reference ground and the ground to be tested and measuring the voltage drop and the percentage of current flowing through the ground grid.

### 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 ( $\cos \phi$ ) 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.



## 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** <2000 m

**(operational)**

**Pollution degree** 2

### CE-marking

**EMC** 2004/108/EC

**LVD** 2006/95/EC

### 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

**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** 20 kg (44 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 <sup>1)</sup>	Load voltage
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

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.

## Measurement section

### Ammeters

**Measurement method** AC 50/60 Hz, DC RMS

**Inaccuracy** 1% of range ±1 digit

#### Ammeter 1

##### Ranges

**Serial Low** 0 – 1.00 kA

**Serial High** 0 – 2.00 kA

**Parallel Low** 0 – 3.25 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

**Maximum current** 20 A (The input is not protected by a fuse)

### 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 (R<sub>in</sub>)** 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 φ

#### 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 from 16 A up to 1500 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.

**Primary Current Injection Test System**

**Application example**



MCCB testing using the HCP2000

**Ordering information**

Item	Art.No.
<b>INGVAR</b>	BH-72490

*Including:*

GA-12700	Interconnection cable 3 m (10 ft)	1
GA-12051	Current cable 2 m (6.5 ft) 120 mm <sup>2</sup>	2
04-00087	Mains cable 3 m (10 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)	
<b>Cross section area: 240 mm<sup>2</sup> (2x120)</b>		
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
<b>Cross section area: 360 mm<sup>2</sup> (3x120)</b>		
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 <sup>2</sup>		
Weight: 15.2 kg (33.5 lbs)		
Impedance: 2.2 mΩ		
		GA-12052