

# ODEN AT

## 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**
- **Modular design to permit optimal user configuration of output current vs. unit size**
- **Compact transport cart facilitates portability into switchgear rooms with limited space**
- **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 together with one, two or three current units. There are three versions of the current unit: S, X and H. The S and X current units are identical except that the X unit has an additional 30/60 V output. The H unit is rated for even higher current. This makes it possible to configure an ODEN AT system in a suitable way. All parts are portable, and ODEN AT 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 measure an additional current or voltage. Current transformer turns ratio, impedance, resistance, 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. ODEN AT 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-

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

#### ■ Heat runs

ODEN AT 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

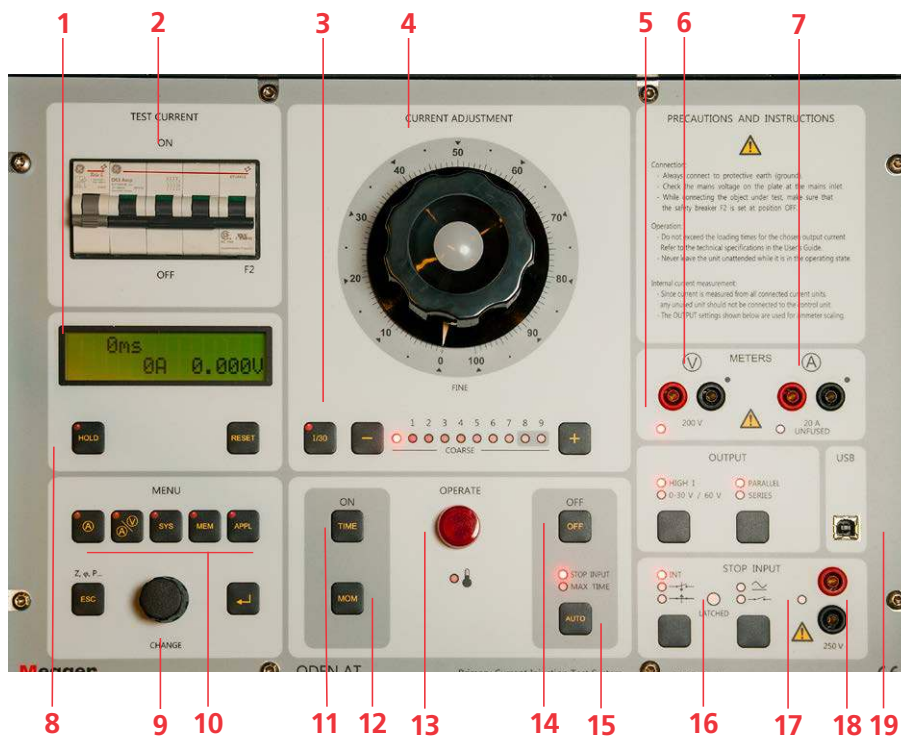
ODEN AT can also be set to test circuit breakers with reclosing relays. Operating limits, partial times, total times and the number of operations before lockout can be measured. User-selectable reclosing sequences can be programmed for testing sectionalizers.

#### ■ 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. The type X current unit included with ODEN AT is designed for this type of application. Personal safety grounds must be tested at rated current, a task for which ODEN AT is well suited.

**FEATURES AND BENEFITS**

1. 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.
2. Miniature circuit breaker used for current output. Interrupts output current. Can also be actuated manually for safe disconnection of load.
3. 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.
4. Fine adjustment knob. Knob for fine adjustment of current and +/- buttons for coarse adjustment.
5. Indicator lamps. Indicate whether ammeter 2 or the voltmeter is enabled.
6. Input for voltmeter. Used to measure voltage and for micro-ohmmeter measurement.
7. Input for ammeter 2. Used to measure current in an external circuit (in a current transformer's secondary winding for example).
8. Hold function. This function freezes readings on the display.
9. Selection/setting (CHANGE) knob. Selects the desired menu option (shown in the display window). Also used to change numerical values.
10. Setting buttons. Personnel unfamiliar with ODEN AT 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 ODEN AT memories. One of these memories contains the default (pre-defined) settings that are invoked when ODEN AT is powered up.
  - Application. Used to invoke the desired measurement mode: automatic recloser, sectionalizer or micro-ohmmeter. ODEN AT can also be set to generate pulse trains with user-selectable pulse and pause times.
11. Injection. Starts current injection and timing.
12. Momentary Injection. When this button is used, injection continues only as long as it is pressed. Useful in order to avoid for example overheating.
13. Red warning lamp, lit during current generation.
14. Manual shut-off. Injection and timing are stopped when this button is pressed.
15. 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.
16. Stop-condition indicator. Indicates that a stop condition is met, voltage or contact triggered.
17. Status indicator. Indicates if a contact connected to the input is closed or if voltage is present.
18. 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.
19. USB port for communication with PC (for transfer of test data).



## SPECIFICATIONS ODEN AT

Specifications are valid at nominal input voltage and an ambient temperature of +25°C, (77°F). Specifications are subject to change without notice.

### System designation

An ODEN AT-system consists of a control unit and one, two or three current units. There are three different versions of the current units: S-unit (standard), X-unit (extra 30/60 V outlet) and H-unit (high current). The system designation indicates the number and version of current units included.

Example: ODEN AT/2X

2 = Number of current units

X = Version of current unit (S, X or H)

### Environment

*Application field* The instrument is intended for use in high-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

### CE-marking

*LVD* 2006/95/EC

*EMC* 2004/108/EC

### General

*Mains voltage* 240/400 V AC, 50/60 Hz  
480 V AC / 60 Hz

*Mains inlet* IEC 60309-2, 63 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 AT* 570 x 310 x 230 mm  
(22.4" x 12.2" x 9")

*Current unit S, X H* 570 x 310 x 155 mm  
(22.4" x 12.2" x 6")

*Complete with cart* 690 x 350 x 860 mm  
(27.2" x 13.8" x 33.9")

### Weight

*Control unit AT* 25 kg (55 lbs)

*Current unit S* 42 kg (92.6 lbs)

*Current unit X* 45 kg (99.3 lbs)

*Current unit H* 49 kg (108 lbs)

*Cart* 11 kg (24.3 lbs)

*Display* LCD

*Available languages* English, German, French, Spanish, Swedish

### Measurement section

#### Ammeters

*Measurement method* AC, true RMS (or DC if function is activated)

*Inaccuracy* 1% of range  $\pm 1$  digit

#### Ammeter 1

*Ranges* Current unit S 0 – 4800 A / 0 – 15 kA  
Current unit H 0 – 9600 A / 0 – 30 kA  
Current unit X 0 – 960 A / 0 – 3 kA  
Above valid for one current unit or units in parallel, for further information see section "11.8 Ammeter 1" on page 96

#### Ammeter 2

*Ranges* 0 – 2.000 A / 0 – 20.00 A

#### Voltmeter

*Measurement method* AC, true RMS (or DC if activated)

*Resolution* 0 – 9.999 V  
10.00 – 99.99 V  
100.0 – 200.0 V

*Inaccuracy* 1% of range  $\pm 1$  digit

*Input resistance (Rin)* 240 k $\Omega$  (range 0 – 200 V)  
24 k $\Omega$  (other ranges)

*Dielectric withstand* 2.5 kV

#### Timer

*Presentation* In seconds, mains frequency cycles or hours and minutes

*Ranges* 0.000 – 999.9 s  
0 – 9999 cycles  
0.001 s – 99 h 59 min

*Inaccuracy*  $\pm(1$  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*  $\pm 2^\circ$  (for voltage and current readings that are higher than 10% of the selected range)

#### Z, P, R, X, S, Q and power factor (cos $\phi$ )

For these measurements the result is calculated using U, I and sometimes  $\phi$ .

#### I<sub>max</sub>

Stores highest current value that exists  $\geq 100$  ms

#### INT-level

Threshold indicating that current is interrupted. Can be set to 0.7% or 2.1% of Ammeter 1 range.

For these measurements the result is calculated using U, I and sometimes  $\phi$ .

**OUTPUTS**

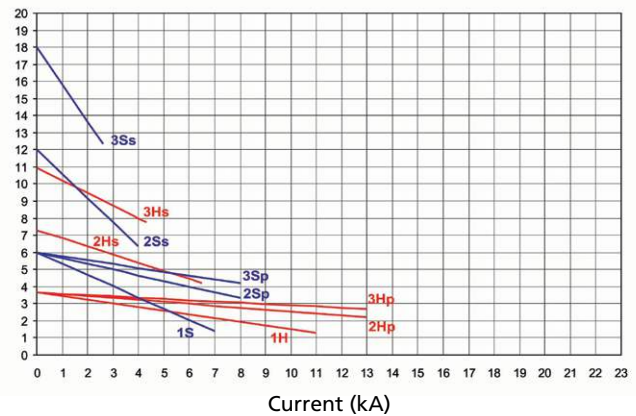
ODEN AT, 240 V mains voltage, 50/60 Hz					
		Open circuit voltage	Max. continuous current 3)	Max. current, 3 minutes 3)	Max. current, 1 sec 3)
<b>ODEN AT/1S</b>					
		6 V	1000 A	2000 A	7000 A
<b>ODEN AT/2S</b>					
	1)	6 V	1680 A	3600 A	8000 A
	2)	12 V	1000 A	2000 A	4000 A
<b>ODEN AT/3S</b>					
	1)	6 V	2500 A	5200 A	8000 A
	2)	18 V	840 A	1700 A	2600 A
<b>ODEN AT/1X</b>					
High current output		6 V	1000 A	2000 A	7000 A
<b>Output 0 – 30/60 V</b>					
30 V range		30 V	160 A	300 A	1200 A
60 V range		60 V	80 A	150 A	600 A
<b>ODEN AT/2X</b>					
High current output	1)	6 V	1680 A	3600 A	8000 A
	2)	12 V	1000 A	2000 A	4000 A
<b>Output 0 – 30/60 V</b>					
30 V range	1)	30 V	320 A	600 A	1600 A
30 V range	2)	60 V	160 A	300 A	800 A
60 V range	2)	120 V	80 A	150 A	400 A
<b>ODEN AT/3X</b>					
High current output	1)	6 V	2500 A	5200 A	8000 A
	2)	18 V	840 A	1700 A	2600 A
<b>Output 0 – 30/60 V</b>					
30 V range	1)	30 V	480 A	900 A	1600 A
30 V range	2)	90 V	160 A	300 A	520 A
60 V range	2)	180 V	80 A	150 A	260 A
<b>ODEN AT/1H</b>					
		3.6 V	1250 A	2600 A	11 kA
<b>ODEN AT/2H</b>					
	1)	3.6 V	2500 A	5500 A	13 kA
	2)	7.2 V	1250 A	2800 A	6500 A
<b>ODEN AT/3H</b>					
	1)	3.6 V	3800 A	8000 A	13 kA
	2)	10.7 V	1250 A	2800 A	4300 A

ODEN AT, 400 V mains voltage, 50/60 Hz					
		Open circuit voltage	Max. continuous current <sup>3)</sup>	Max. current, 3 minutes <sup>3)</sup>	Max. current, 1 sec <sup>3)</sup>
<b>ODEN AT/1S</b>					
		6 V	1000 A	2000 A	7000 A
<b>ODEN AT/2S</b>					
	1)	6 V	1900 A	4000 A	13 kA
	2)	12 V	900 A	2000 A	6000 A
<b>ODEN AT/3S</b>					
	1)	6 V	1900 A	4000 A	13 kA
	2)	18 V	600 A	1400 A	4400 A
<b>ODEN AT/1X</b>					
High current output		6 V	1000 A	2000 A	7000 A
<b>Output 0 – 30/60 V</b>					
30 V range		30 V	160 A	300 A	1200 A
60 V range		60 V	80 A	150 A	600 A
<b>ODEN AT/2X</b>					
High current output	1)	6 V	1900 A	4000 A	13 kA
	2)	12 V	900 A	2000 A	6000 A
<b>Output 0 – 30/60 V</b>					
30 V range	1)	30 V	320 A	600 A	2500 A
30 V range	2)	60 V	160 A	300 A	1200 A
60 V range	2)	120 V	80 A	150 A	600 A
<b>ODEN AT/3X</b>					
High current output	1)	6 V	1900 A	4000 A	13 kA
	2)	18 V	600 A	1400 A	4400 A
<b>Output 0 – 30/60 V</b>					
30 V range	1)	30 V	380 A	850 A	2600 A
30 V range	2)	90 V	120 A	290 A	880 A
60 V range	2)	180 V	60 A	145 A	440 A
<b>ODEN AT/1H</b>					
		3.6 V	1250 A	2600 A	11 kA
<b>ODEN AT/2H</b>					
	1)	3.6 V	2500 A	5300 A	21 kA
	2)	7.2 V	1250 A	2500 A	10.9 kA
<b>ODEN AT/3H</b>					
	1)	3.6 V	3800 A	7700 A	21.9 kA
	2)	10.7 V	1250 A	2600 A	7200 A

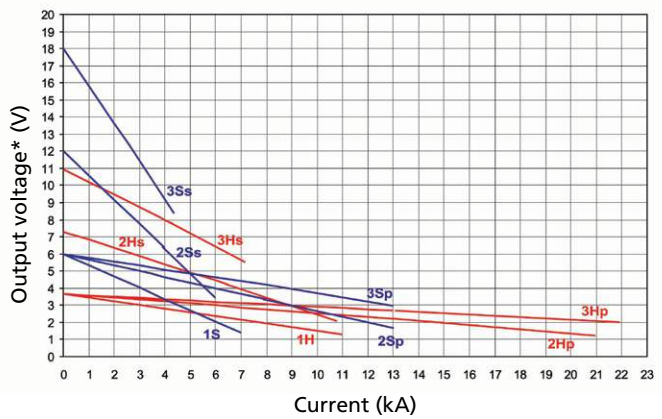
ODEN AT, 480 V mains voltage, 60 Hz					
	Open circuit voltage	Max. continuous current <sup>3)</sup>	Max. current, 3 minutes <sup>3)</sup>	Max. current, 1 sec <sup>3)</sup>	
<b>ODEN AT/1S</b>					
	7.2 V	1000 A	2000 A	7000 A	
<b>ODEN AT/2S</b>					
1)	7.2 V	1900 A	4000 A	13 kA	
2)	14.4 V	900 A	2000 A	6000 A	
<b>ODEN AT/3S</b>					
1)	7.2 V	1900 A	4000 A	13 kA	
2)	21.6 V	600 A	1400 A	4400 A	
<b>ODEN AT/1X</b>					
High current output	7.2 V	1000 A	2000 A	7000 A	
<b>Output 0 – 30/60 V</b>					
30 V range	36 V	160 A	300 A	1200 A	
60 V range	72 V	80 A	150 A	600 A	
<b>ODEN AT/2X</b>					
High current output	1) 7.2 V 2) 14.4 V	1900 A 900 A	4000 A 2000 A	13 kA 6000 A	
<b>Output 0 – 30/60 V</b>					
30 V range	1) 36 V	320 A	600 A	2500 A	
60 V range	1) 272 V	160 A	300 A	1200 A	
60 V range	2) 144 V	80 A	150 A	600 A	
<b>ODEN AT/3X</b>					
High current output	1) 7.2 V 2) 21.6 V	1900 A 600 A	4000 A 1400 A	13 kA 4400 A	
<b>Output 0 – 30/60 V</b>					
30 V range	1) 36 V	380 A	850 A	2600 A	
30 V range	2) 108 V	120 A	290 A	880 A	
60 V range	2) 216 V	60 A	145 A	440 A	
<b>ODEN AT/1H</b>					
	4.3 V	1250 A	2600 A	11 kA	
<b>ODEN AT/2H</b>					
1)	4.3 V	2500 A	5300 A	21 kA	
2)	8.7 V	1250 A	2500 A	10.9 kA	
<b>ODEN AT/3H</b>					
1)	4.3 V	3800 A	7700 A	21.9 kA	
2)	13.0 V	1250 A	2600 A	7200 A	

1) Current units connected in parallel  
 2) Current units connected in series  
 3) Maximum possible current is also limited by the impedance in the test circuit. The current value can not exceed output voltage / impedance value.

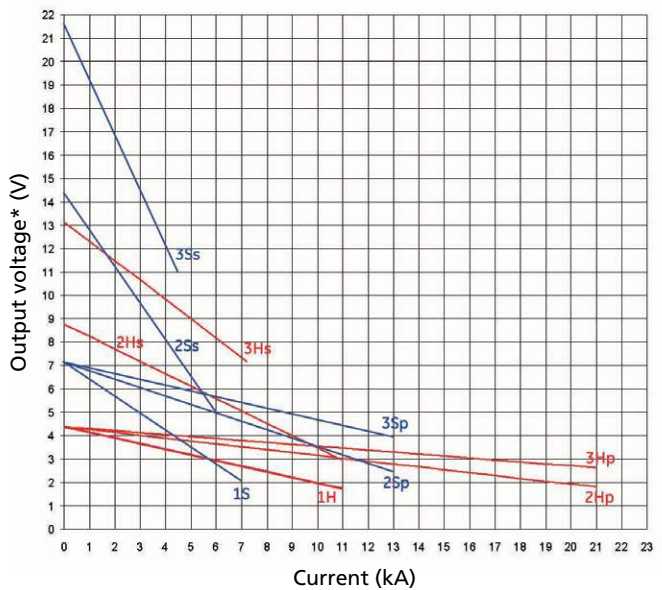
High current output - ODEN AT systems for 240 V, 50 Hz



High current output - ODEN AT systems for 400 V, 50 Hz



High current output - ODEN AT systems for 480 V, 60 Hz



— S or X units  
 — H units  
 p = units in parallel, s = units in series  
 \*) Voltage between output terminals

**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.



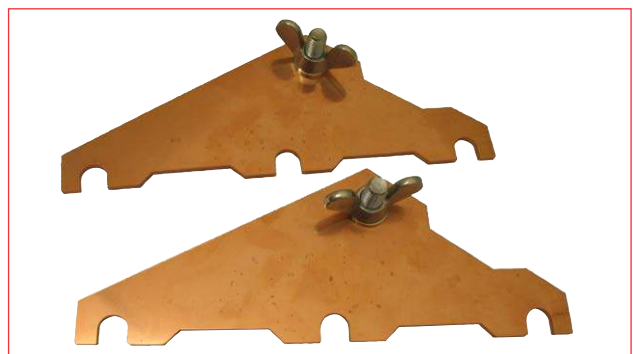
**High current serial bar**

For serial connecting of ODEN current units.



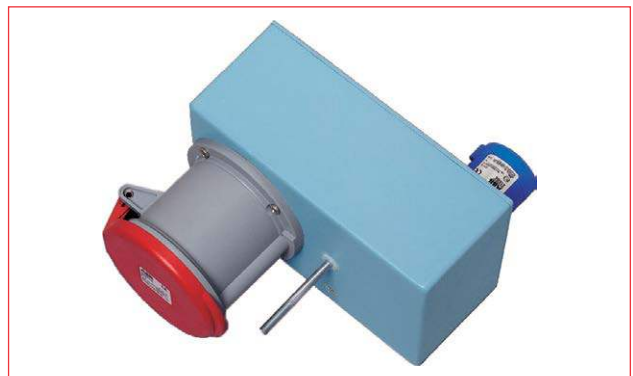
**Current transformer switchbox**

The Current Transformer (CT) Switchbox for ODEN AT 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 ODEN AT 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.



**High current parallel bars**

The parallel bars can be used when up to three current units are connected in parallel.



**Input power adapter 240/400V**

Used to run a 400 V ODEN AT at 240 V.



**Multi-cable high current cable sets**

Low-impedance multi-cable sets for higher output current. Available with 2, 3, 4 or 6 parallel cables, and in lengths of 0.5, 1.0, 1.5 or 2 meters.



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

Cable cross section area 120 mm<sup>2</sup> and 100 mm clamp jaw width.

## ORDERING INFORMATION

Item	Art.No.	Item	Art.No.
<p>A cart (Art.No. 50-00092) is always included with purchase of a complete ODEN system. The cable set(s) for connection to the object under test must however be stated as a separate item in the order. High current cable(s) for connecting current units in series is included with purchase of two or three current units.</p>			
<b>ODEN AT/1S</b>			
240 V Mains voltage	BH-62411		
400 V Mains voltage	BH-64011		
480 V (60 Hz) Mains voltage	BH-64811		
<b>ODEN AT/2S</b>			
240 V Mains voltage	BH-62412		
400 V Mains voltage	BH-64012		
480 V (60 Hz) Mains voltage	BH-64812		
<b>ODEN AT/3S</b>			
240 V Mains voltage	BH-62413		
400 V Mains voltage	BH-64013		
480 V (60 Hz) Mains voltage	BH-64813		
<b>ODEN AT/1X</b>			
240 V Mains voltage	BH-62421		
400 V Mains voltage	BH-64021		
480 V (60 Hz) Mains voltage	BH-64821		
<b>ODEN AT/2X</b>			
240 V Mains voltage	BH-62422		
400 V Mains voltage	BH-64022		
480 V (60 Hz) Mains voltage	BH-64822		
<b>ODEN AT/3X</b>			
240 V Mains voltage	BH-62423		
400 V Mains voltage	BH-64023		
480 V (60 Hz) Mains voltage	BH-64823		
<b>ODEN AT/1H</b>			
240 V Mains voltage	BH-62431		
400 V Mains voltage	BH-64031		
480 V (60 Hz) Mains voltage	BH-64831		
<b>ODEN AT/2H</b>			
240 V Mains voltage	BH-62432		
400 V Mains voltage	BH-64032		
480 V (60 Hz) Mains voltage	BH-64832		
<b>ODEN AT/3H</b>			
240 V Mains voltage	BH-62433		
400 V Mains voltage	BH-64033		
480 V (60 Hz) Mains voltage	BH-64833		
		<b>Optional accessories</b>	
		HCP2000	AA-90165
		Current Transformer Switchbox	BH-90130
		High Current Serial Bar	BH-90102
		High Current Parallel Bars, 2 pcs Weight: 3 kg	BH-90171
		Mains Adapter 240/400V Note: Can only be used together with an ODEN AT prepared for this feature. Contact Megger Sweden.	BH-90120
		ODEN-Select Software tool for finding the best ODEN AT configuration. Free-ware, can be downloaded from: <a href="http://www.megger.com">www.megger.com</a>	
		Multi-cable high current cable sets	
		<b>Length</b>	<b>Impedance</b> <i>(Twisted-pair cables)</i>
		<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
		<b>Cross section area: 480 mm<sup>2</sup> (4x120)</b>	
		2 x 0.5 m (1.6 ft)	0.16 mΩ GA-12405
		2 x 1 m (3.3 ft)	0.21 mΩ GA-12410
		2 x 1.5 m (4.9 ft)	0.27 mΩ GA-12415
		2 x 2 m (6.6 ft)	0.32 mΩ GA-12420
		<b>Cross section area: 720 mm<sup>2</sup> (6x120)</b>	
		2 x 0.5 m (1.6 ft)	0.14 mΩ GA-12605
		2 x 1 m (3.3 ft)	0.18 mΩ GA-12610
		2 x 1.5 m (4.9 ft)	0.21 mΩ GA-12615
		2 x 2 m (6.56 ft)	0.25 mΩ GA-12620
		Cable set, 2 x 5 m (16 ft), 120 mm <sup>2</sup> Cross section area: 120 mm <sup>2</sup> Weight: 15.2 kg (33.5 lbs) Impedance: 2.2 mΩ	GA-12052
		Cable set, 2 x 5 m (16 ft), 25 mm <sup>2</sup> Cross section area: 25 mm <sup>2</sup> For the 30/60 V output of current unit X. Weight: 4 kg (8.8 lbs)	GA-02052