GGT series
Ground Grid Testers

- Ground Grid Integrity Test (as per IEEE 80)
- Micro Ohmmeter (test current up to 200 A / 300 A)
- Lightweight – less than 15 kg / 33 lbs
- Measuring range: 0 – 999,9 mΩ
- Best resolution: 0,1 μΩ
- Wireless remote control module (GGT-M)
- Typical accuracy ± (0,1 % rdg + 0,1 % FS)
- Testing Both Sides Grounded (BSG) Circuit Breakers

Description

Ground Grid Testers – GGT series (hereafter referred to as "GGT") contain two models, ***GGT200*** and ***GGT300.*** The main difference between these models is the maximum test current (200 A for GGT200 and 300 A for the GGT300 model).

GGT is the test set specially designed for inspection of the substation ground grid integrity. The test is done as per IEEE 80. During a measurement, the instrument generates continuous current (up to 300 A / 60 s for GGT300 model and up to 200 A / 60 s for GGT200). During the test, current and voltage drops are measured and displayed simultaneously. The voltage drop between two measurement points (red and black clamps) is the main parameter that should be checked. The voltage drop on the current cables does not affect this parameter, since it is measured directly using the voltage sense cables.

The test can be controlled remotely by the battery-operated GGT-M module that has wireless communication (RF) with GGT main unit. The GGT-M module also enables current flow inspection, by using the current clamps for measurement of the "DOWN" current parameter.

GGT can also be used as a micro-ohmmeter for the contact resistance measurement of non-inductive test objects. GGT generates a true DC (ripple-free) current up to 300 A (for the GGT300 model), with automatically regulated test ramps. This significantly decreases the influence of magnetic transients.

The GGT instrument can store internally up to 500 measurements. All measurements are time and date stamped. Using the DV-Win software a test can be controlled from the PC, with additional features of test results analysis and fully customized test reports. Communication between the GGT and PC is through a USB (as standard), or RS232/Bluetooth (as an option).

Instead of thermal fuses, the GGT devices are now provided with the circuit breaker with thermal overload protection – 20 A / 240 V AC.

The GGT instrument has five separate test modes:

- Ground Grid mode
- SINGLE mode
- CONTIN mode
- BSG *(Both Sides Grounded)* mode
- DTR *(Dead Tank Resistance)* test mode

Application

A typical application is to measure the resistance of non-inductive test objects:

- Substation ground grid integrity test (as per IEEE 80)
- High- and medium-voltage circuit breakers test (live and dead tank)
- High- and medium-voltage disconnecting switches test
- Gas isolated switchgear test (GIS)
- High-current bus bar joints test
- Cable splices, welding joints, fuses, etc.

Ground Grid Integrity Test

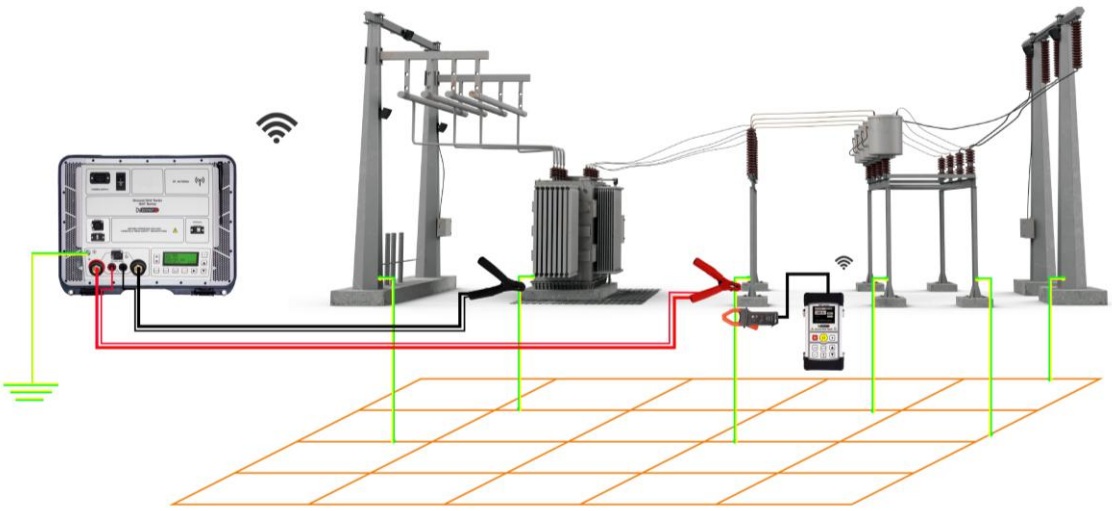


Figure 1. GGT connection for ground grid test

One of the fundamental parts of the electrical substation is a ground grid that ensures the proper grounding of the substation equipment. The grounding grid is placed underneath the entire electrical substation which has a dual purpose: operating grounding, carrying faulty currents into the earth, and safety for personnel assuring that they are not exposed to electrical shocks.

Neither the ground impedance measurements nor the touch potential measurements provide information on the ability of grounding conductors and connections to carry ground-fault currents safely to earth.

Therefore, it is necessary to make the additional ground grid integrity test to ensure that a proper ground system has been installed and maintained throughout its service life. In this way, any open circuit or isolated structure, or equipment in a substation can be easily detected.

When performing a test with GGT, a single pair of current cables should be used, together with the appropriate voltage sense cables. The black marked cable (e.g., 10 m / 33 ft.) is connected to the reference grounding point in the substation (usually transformer's grounding). The red marked current cable (e.g., 50 m / 165 ft.) is connected to the substation ground point under test.
Since an operator needs to check several grounding points, it is very practical to use the GGT-M module for setting/changing the test parameters and remote control of the test.

The test is performed by injecting continuous DC current by the GGT main unit.

Ground Grid Integrity Test

The best way to check the integrity (continuity) of the ground grid is to use a high but practical current and to record the voltage drop caused by this current.

During the test, the following parameters should be checked:

- **Voltage drop**
  When 300A is passing through the ground grid between a reference point and the ground point under test, the acceptable voltage drop should rise approximately 1.5 V for each 50 ft. (15,24 m) of straight distance from the reference point. Voltage drop higher than 1,5 V indicates a potential bad ground connection.

- **Current flow inspection**
  The current measurement is done by the current clamps connected to GGT-M module (Figure 2).
  a) For single grounding connection, “DOWN” current can be considered satisfactory if the voltage drop is in line as explained above and at least 200A flows to the ground conductor (300A is a total generated current).

  b) For the equipment in substation with multiple grounds, a ground can be considered satisfactory if the voltage drop is in line as explained above and at least 150A flows to the ground conductor (300A is a total generated current).

Note: These are only guidelines, and each ground should be inspected subjectively on its regulations and standards.

- **Inspection of the resistance values**
  In such cases when the instrument cannot generate the selected current (e.g., 300A), because of the high burden, then the calculated resistance values can also be used for the analysis.
  The GGT-M module besides the current and voltage values is also displaying the resistance values calculated by using the total generated current and current recorded by current clamps.

  These values can be compared with the obtained resistance values from the previous testing or with the expected values, or to compare the results between the test risers and search for those with abnormally high resistance values.

  The objective is to determine whether the equipment, frames, structures, etc. are connected properly to the ground grid with very low resistance (less than a couple of mOhm).

GGT-M Module

The GGT-M module is specially designed for the GGT instrument and can be used during the substation ground grid integrity test. It has wireless communication and allows remote control of the GGT from a long distance in substation.

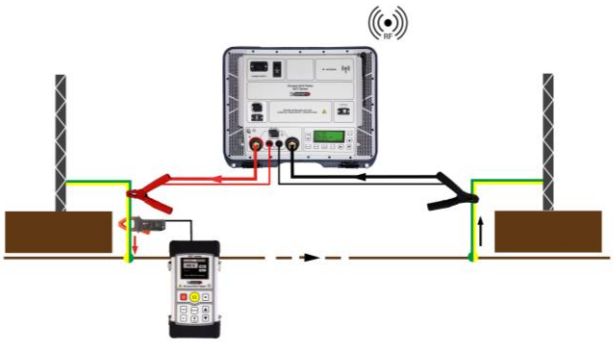


Figure 2. GGT-M module application

Using GGT as Micro-ohmmeter

GGT can also be used as a powerful micro-ohmmeter for the contact resistance measurement of non-inductive test objects. The GGT generates a true DC (ripple-free) current up to 200 A (GGT200) or 300 A (GGT300), with automatically regulated test ramps.

Connecting the GGT to Test Object

The connection diagram for contact resistance measurement (e.g., a micro-ohmmeter function of GGT) corresponds to Kelvin's (four-point) measurement principle.

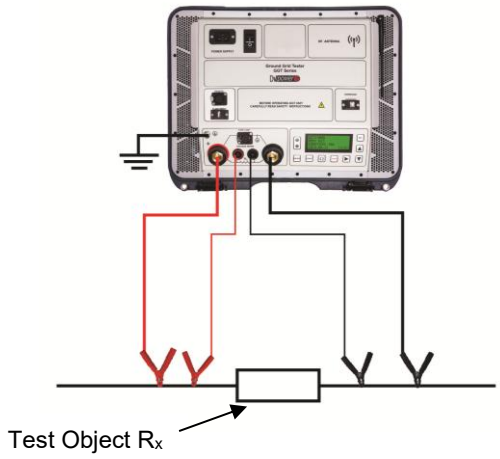


Figure 3. Connecting GGT to test object

The connection to the live tank circuit breakers is presented in the following figure:

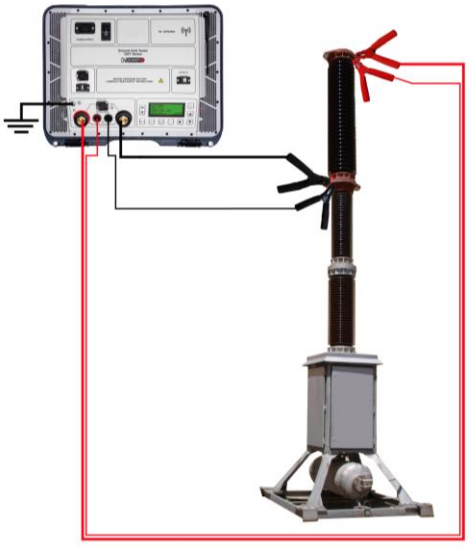
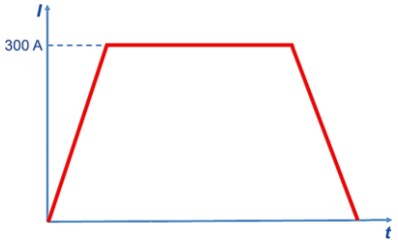


Figure 4. GGT connection on live-tank circuit breaker

Single Test

The GGT instrument generates a filtered (true ripple-free) DC current up to 200 A/300 A and outputs it in an automatically regulated current ramp. By sloping the current up and down, magnetic transients are virtually eliminated. Below is an example of a single test ramp for 300 A current.



Continuous Test

The GGT can generate DC current continuously in predefined test durations, as presented in the table below.

Test current [A]	Maximum test duration time
5, 10, 20, 50, 100, 200	Unlimited
300*	**10 min

Available for GGT300 model only
****In Ground Grid Mode, max. test duration at 300 A is 60 s***

To prevent overheating, certain duty cycles apply depending on the test current being used.

Remote Control Unit

The GGT Remote Control Unit is an optional control unit that is used to start and stop the tests from a remote location during contact resistance measurement (micro-ohmmeter use of GGT).

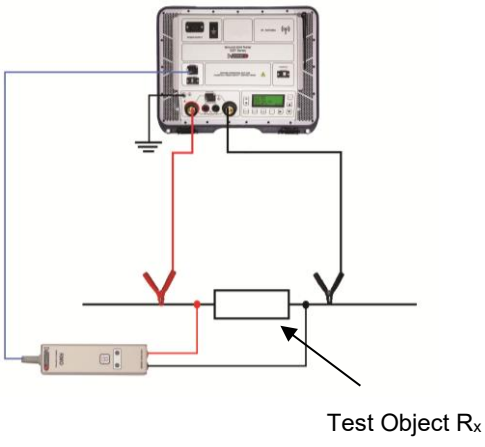


Figure 5. Connecting remote control unit to GGT

BSG test

Grounding circuit breakers from both sides provide increased safety for testing personnel compared with only one-side grounding method.

The BSG test mode within GGT allows contact resistance measurement of the CBs while grounded from both sides.

A special current clamp supplied with the instrument are used to measure the current through the groundings which will be added to the output test current.
The test setup is very simple (same as for the SINGLE test), and all calculations are made automatically by the device's internal algorithm.

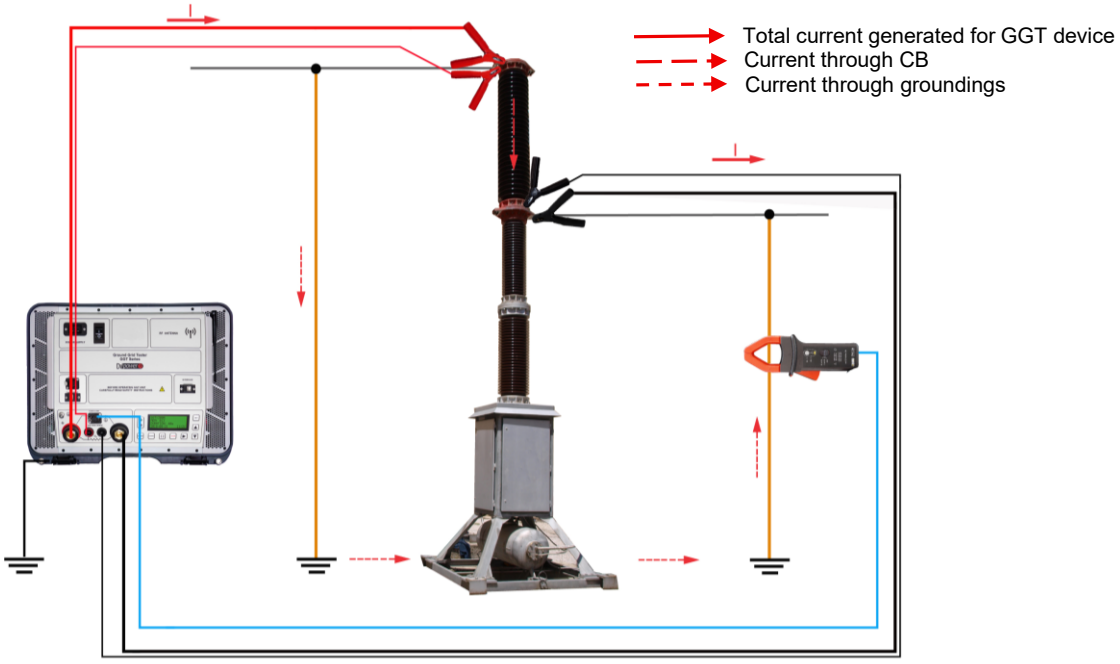


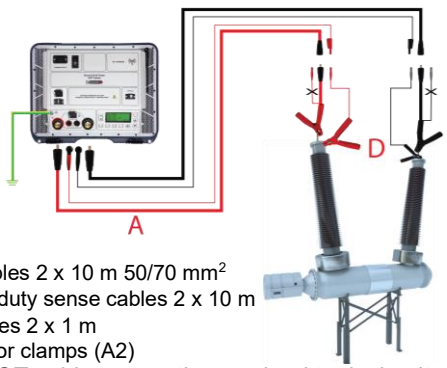
Figure 6. GGT cable connection during BSG testing

DTR test

The presence of a current transformer (CT) inside the dead tank circuit breakers may introduce errors during contact resistance measurement due to CT magnetizing process. For this reason, it is necessary to saturate the CT's core before measurement.

DTR test mode is specially designed for resistance measurement of dead tank circuit breakers.

Calculations for detecting the saturated condition of a CT are done by an internal algorithm. The process of setting the measurement parameters and testing in this mode is very simple and does not differ much from live tank circuit breaker testing (in SINGLE / CONTIN test modes).



A – Current cables 2 x 10 m 50/70 mm^2
and heavy-duty sense cables 2 x 10 m
D – Sense cables 2 x 1 m
with alligator clamps (A2)

Figure 7. GGT cable connection on dead tank circuit breaker

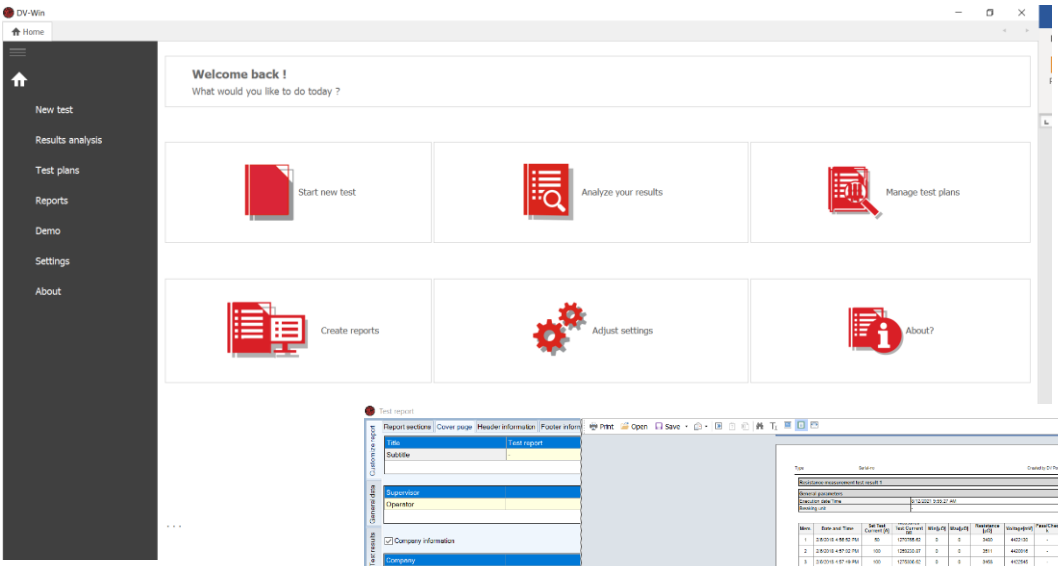
DV-Win software

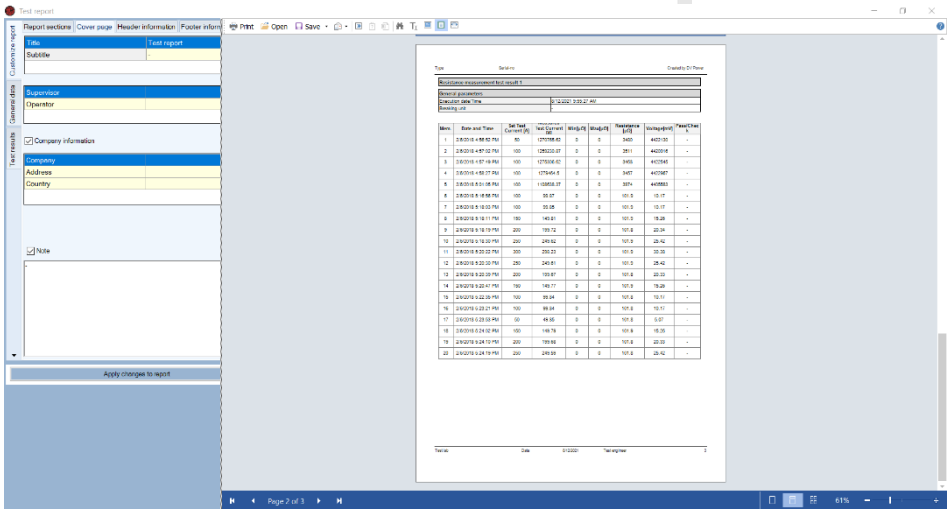
DV-Win software performs acquisition and analysis of the test results, as well as control of all the GGT functions from a PC. The DV-Win also provides several advanced features as a supplement to multiple functions of GGT device. Testing in Ground Grid and Continuous modes is upgraded with a sample time feature allowing a user to record test results in specific time intervals set in seconds.

After completed measurements, the results can be saved in various formats and test report can be generated and saved or printed. Results can also be downloaded from the device to the PC using several different search filters.

DV-Win Main Features

- Full control of the device in test
- Test reports available in several formats
- Several filters for results download to PC
- Sampling time feature for CONTIN modes





Technical data

Mains power supply

- Connection according to IEC/EN60320-1; C320
- Mains supply: 90 V – 264 V AC
- Frequency: 50 / 60 Hz
- Circuit Breaker with thermal overload protection - 20A / 240V AC
  - Designed according to UL 1077 standard (Supplementary Protectors for Use in Electrical Equipment)
  - For primary protection of the electrical panel, a circuit breaker according to the UL 489 standard shall be used

Output data

- Test current ranges and load intervals:

up to 200 A	unlimited test time
300 A*	10 min maximum test time

Available with GGT300 model

- Full Load Voltages:

Main supply voltage	Output current	Maximum output voltage
230 V AC	300 A	8,2 V DC
	200 A	8,6 V DC
115 V AC	300 A	7,2 V DC
	200 A	7,5 V DC

Measurement

- Resistance range: 0 – 999,9 mΩ
- Resolution

0,1 µΩ – 999,9 µΩ	0,1 µΩ
1,000 mΩ – 9,999 mΩ	1 µΩ
10,00 mΩ – 99,99 mΩ	10 µΩ
100,0 mΩ – 999,9 mΩ	0,1 mΩ

- Typical accuracy ± (0,1 % rdg + 0,1 % FS)

Display

- LCD screen 20 characters by 4 lines
- LCD display with backlight, visible in bright sunlight

Test result storage

- 500 measurements
- USB flash drive feature

Interface

- USB communication with PC
- Optional: RS232 and Bluetooth
- Wi-Fi (RF) communication between GGT device and GGT-M module

Dimensions and weight

- GGT200 & GGT300 dimensions:
  503 x 406 x 193 mm / 19.8 x 15.9 x 7.6 in
- GGT-M module dimensions:
  226 x 116 x 50 mm / 8.9 x 4.5 x 1.9 in
- GGT200 & GGT300 devices weight:
  14,6 kg / 32.1 lbs
- GGT-M module weight: 0,95 kg / 2.1 lbs

Environment protection

- Ingress protection rating:
  - GGT200 & GGT300: IP67 with closed lid
  - GGT-M module: IP40

Environment conditions

- Operating temperature
  -20 ºC – +55 ºC / -4 ºF – +131 ºF
- Storage & transportation:
  -40 ºC – +70 ºC / -40 ºF – +158 ºF
- Up to 95 % relative humidity

Applicable Standards

- Installation/overvoltage: category II
- Pollution: degree 2
- Safety: LVD 2014/35/EU (CE Conform)
  EN 61010-1
- EMC: Directive 2014/30/EU (CE Conform)
  Standard EN 61326-1:2006
- CAN/CSA-C22.2 No.61010-1, 2nd edition, Including Amendment 1

Warranty

- 3 years + additional 1 (one) year upon registration on DV Power official website (www.dv-power.com)

All specifications herein are valid at ambient temperature of + 25 °C and standard accessories.
Specifications are subject to change without notice.

Accessories

Alligator clamps red/black

Current and sense cables

Voltage sense cables

Current clamp 30/300A power supplied from the instrument with 5 m cable

Plastic transport case for GGT-M

Cable case

Current clamp 200/2000A with internal battery supply with 5 m cable

GGT models selection

GGT200 device

Maximum test current:

- Ground grid testing: 200 A
- Micro-ohmmeter: 200 A

RF communication with antenna installed for communication with GGT-M:

- YES

Weight:

- 14,6 kg / 32.1 lbs

Standard cables:

- 2 x 10 m, 50 mm^2 cables

GGT300 device

Maximum test current:

- Ground grid testing: 300 A
- Micro-ohmmeter: 300 A

RF communication with antenna installed for communication with GGT-M:

- YES

Weight:

- 14,6 kg / 32.1 lbs

Standard cables:

- 2 x 10 m, 70 mm^2 cables

GGT-M module

- Wireless (RF) communication with GGT200 and GGT300 devices
- Setting the test parameters for ground grid testing:
  - Test current value
  - Test duration
  - Memory location
- Built-in Li-Po battery
- LED & Buzzer indication during testing
- LED indication during battery charging
- Current clamp input (current clamps on GGT-M are used for measurement of the “DOWN” current)
- Weight: 0,95 kg / 2.1 lbs

Order info

GGT300 instrument with included accessories	Article No
Ground Grid Tester GGT300 – DV-Win PC software including USB cable – Mains power and ground (PE) cable – Plastic transport case	GGT300-N0-03
GGT200 instrument with included accessories	**Article No**
Ground Grid Tester GGT200 – DV-Win PC software including USB cable – Mains power and ground (PE) cable – Plastic transport case	GGT200-N0-03
GGT-M module with included accessories	**Article No**
Ground Grid Module for Remote Control GGT-M – Power supply adapter 3 A – Transport bag and carrying belts	GGTMRC-MOD-0
GGT-M module with included accessories	**Article No**
Ground Grid Module for Remote Control GGT-M – Power supply adapter 3 A – Plastic transport case and carrying belts	GGTMRC-MOD-3

Standard accessories	Article No
Current cables 2 x 10 m 70 mm2 and heavy-duty sense cables 2 x 10 m *	CSHD-10-70VMFM
Current cables 2 x 10 m 50 mm2 and heavy-duty sense cables 2 x 10 m *	CSHD-10-50VMFM
Current and sense cables 2 x 35 cm 70 mm2 with alligator clamps (A4) *	CS-0Z35-70VMA4
Current and sense cables 2 x 35 cm 50 mm2 with alligator clamps (A4) *	CS-0Z35-50VMA4
Sense cables 2 x 1 m with alligator clamps (A2)	S2-01-02BPA2
Sense cables with test probes **	S2-0122-BPTP
Current clamp 30/300 A power supplied from the instrument with 5 m cable **	CCCA-0300-01
Cable plastic case – medium size ***	CABLE-CAS-02
Cable plastic case with built-in wheels – large size ****	CABLE-CBU-W3
Optional accessories	**Article No**
Current cables 2 x 5 m 70 mm2 and heavy-duty sense cables 2 x 5 m *	CSHD-05-70VMFM
Current cables 2 x 5 m 50 mm2 and heavy-duty sense cables 2 x 5 m *	CSHD-05-50VMFM
Red current cable extension 20 m 70 mm2 and sense cable 20 m *	RECS-20-70VMFM
Red current cable extension 20 m 50 mm2 and sense cable 20 m *	RECS-20-50VMFM
Current and sense cables 2 x 35 cm 70 mm2 with C clamps *	CS-0Z35-70VMC0
Current and sense cables 2 x 35 cm 50 mm2 with C clamps *	CS-0Z35-50VMC0
Current clamp 200/2000 A with internal battery supply with 5 m cable**	UTCA-2000-06
Remote control unit + cable set	RMORCU-09-00
Remote control test probes (with trigger button)	RMO-RCTP-TB0
Test shunt 100 µΩ (600 A/60 mV)	SHUNT-600-MK
Cable plastic case – large size	CABLE-CAS-03
Plastic transport case for handheld instruments**	HARD-CASE-PS2

**** 70 mm² current cables are for GGT300 and 50 mm² current cables are for GGT200***

***** For GGT-M module***

****** For GGT200's standard accessories***

******* For GGT300's standard accessories***

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