

DRTS 3 Plus

Automatic Relay
Test System



Advanced Protection Relay Test Set and Measurement System

- Multi-tasking equipment designed for testing protection relays, energy meters, transducers
- Particularly designed to test RTU (remote terminal unit) and PMU (phasor measurement unit)
- IEC61850 Protocol interface
- High accuracy: better than 0,05%
- Up to 3 current and 4 voltage outputs plus auxiliary DC supply
- USB and RS232 port
- Laptop PC or PDA control
- Powerful and lightweight

DRTS 3 Plus has been designed to test:

- All protection relays
- Watt-hour meters
- Transducers
- Meters
- RTU and PMU

DRTS 3 Plus Specification

Three phase AC/DC current outputs

AC/DC current outputs

	CURRENT A	POWER VA	ZMAX Ohm	RESOLUTION
3 X	0...15	100	0.44	230 μ A
3 X	0...1.5		0.44	23 μ A
3 X	0...0.15		0.44	2 μ A
1 X	0...45	300	0.15	690 μ A
1 X	0...15	200	0.88	230 μ A

- Three independent current sources with a common neutral
- Independent adjustment of current outputs
- Duty cycle: continuous
- Waveform resolution: 28 bit
- Capable of stepping or ramping the current
- Rate of change programmable between ± 0.001 A/s and ± 999 A/s
- Output accuracy: $\pm 0.05\%$ typical, $\pm 0.1\%$ guaranteed
- Distortion: 0.1%
- Automatic protection for overloads and open circuit

Application

DRTS 3 PLUS can test all the following relays:

RELAY TYPE	IEEE NO
Distance relay	21
Synchronizing device	25
Under/over-voltage relay	27/59
Directional Power relay	32
Field relay	40
Reverse phase current relay	46
Phase sequence voltage relay	47
Incomplete sequence relay	48
Instantaneous over-current relay	50
Inverse time over-current relay	51
Power factor relay	55
Voltage balance relay	60
Ground detector relay	64
Directional over-current relay	67
Phase angle out of step relay	78
Automatic reclosing relay	79
Frequency relay	81
Pilot wire receiver relay	85
Lockout relay	86
Differential protection relay	87
Voltage directional relay	91
Power directional relay	92
Tripping relay	94

Four phase AC/DC voltage outputs

AC/DC voltage outputs

	VOLTAGE V	POWER VA	ZMAX Ohm	RESOLUTION
4 X	0...300	85	1125	4.6 mV
3 X	0...300	100	900	4.6 mV
3 X	0...125	100	160	1.9 mV
3 X	0...12.5		160	190 μ V
1 X	0...600	200	1800	9.2 mV
1 X	0...300	200	450	4.6 mV

- Four independent voltage sources, with a common neutral
- Independent adjustment of voltage outputs
- Duty cycle: continuous
- Waveform resolution: 28 bit
- Capable of stepping or ramping the voltage

- Rate of change programmable between ± 0.001 V/s and ± 999 V/s
- Voltage accuracy: $\pm 0.1\%$ of the value, $\pm 0.02\%$ of the range
- Distortion: 0.1% total maximum, with any load
- Automatic protection for overloads, counter-feed and short circuit
- The fourth voltage output can be selected to act as:
 - Fourth voltage output V4 (AC/DC)
 - Zero-sequence component

$$VO = (V1+V2+V3)/3 \text{ or } VO = (V1+V2 +V3/1.73)$$

Battery simulator

Output voltage: 0...260 V DC, program controlled.
 Power: 100 W or 2 A on all range; continuous duty.
 Accuracy: $\pm 1\%$.
 Automatic protection for overloads.
 Step or ramp control.

Angles

Phase angle range: $0^\circ - 360^\circ$.
 Angle resolution: 0.01° .
 Angle accuracy: $\pm 0.1^\circ$.
 Possibility of slewing all the angles.
 Variation range: $0.1^\circ/\text{s}$ to $999^\circ/\text{s}$.

Output frequency

Possibility of selecting the output frequency between 0.0000 and 1999.9999 Hz.
 Capable of generating different frequencies on any output.
 Maximum frequency error: 25 μHz (0.5 ppm).
 Resolution: 0.1 mHz.
 Possibility of slewing the frequency, with a slope from 0.001 Hz/s to 999.999 Hz/s. Resolution: 0.001 Hz/s.
 Slew accuracy: 0.01 Hz/s, with a minimum of 0.1 Hz/s.

Low Level Signal Outputs

The purpose of these low voltage outputs is to test protection relays that use transducers such as Rogowsky coils and voltage dividers; for this simulation low voltage inputs are necessary.
 Number of outputs: 6.
 Full range V & I output: 0...7.26 V rms.
 Frequency: DC to 20 kHz.
 Output current: 5 mA max.
 Resolution: 0.43 mV or 0.043 mV.
 Accuracy: 0.1% of range.
 Distortion: 0.1%.

Binary inputs

10 binary inputs clean or with voltage from 4.5 to 600 V DC (24 to 425 V AC), separated in two groups of 5, with two common points isolated at 1 kVac.
 Selection of the type of input: Voltage clean; 5 - 24 - 48 - 110 V; software controlled.
 Selection of input debounce: from 0 to 2,000 μs ; software controlled.
 Timer range: 0 - 999,999,9999 s (277 hours) or, in cycles: 0 - 50,000,000 cycles (50 Hz); 0 - 60,000,000 cycles (60 Hz).
 Resolution: 0.1 ms, 0.005 cycles.
 Timer accuracy: 0.025% of the measure ± 0.1 ms, for input changes lasting more than 1 ms.
 Frequency range for impulses: 0 to 50 kHz.

Counter inputs

These inputs allow testing energy meters, including high frequency outputs.
 Number of inputs: 2; with no common zero point.
 Frequency range: 0 to 50 kHz.

Auxiliary outputs

Four timed relay contacts; both normal open and normal closed provided.
 Characteristics of contacts with a resistive load:

- Maximum voltage: 300 V AC/DC
- Maximum current: 8 A

 Range of programmable delay: from 0 to 999.99 s.

Analog Measurements (optional):

DC Current measuring Input, Low
 Measuring range: ± 20 mA. Accuracy: 0.02%.
 DC Voltage measuring Input, Low
 Measuring range ± 10 V. Accuracy: 0.02%.
 AC/DC Current measuring Input, High
 Measuring range: ± 20 A. Accuracy: 0.1% DC; 0.2% AC
 AC/DC Voltage measuring Input, High
 Measuring range ± 250 V. Accuracy: 0.1% AC; 0.05% DC.

Interface connection

Type of interface: USB and RS232 at 57.6 kbaud.

Power supply

Mains power supply: 90 to 132 and 180 to 264 V AC, sinusoidal, single phase. Frequency: 47 to 63 Hz.
 Power consumption:

- stand-by: less than 150 W
- maximum load: 1200 W

Case

Aluminum, with carrying handle.

Weight and dimensions

Weight: 18 kg.
 Dimensions: 170 (h) x 470 (w) x 430 (d) mm.

Accessories supplied with the unit

Protective carrying bag.
 Set of test leads.
 Power supply cable.
 Serial interface cable and USB cable.
 Ground connection cable.
 Instruction and maintenance manuals.
 TDMS software.

DRTS 3 Plus HP High Precision option

This option has enhanced characteristics with respect to the standard model. This model is conceived for the test of class 0.2 energy meters.
 The following table summarizes the performances of the DRTS 3 PLUS HP (High Precision) version with respect to the standard one.

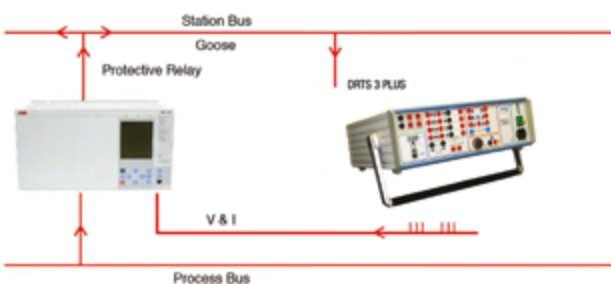
	STANDARD DRTS 3 PLUS	DRTS 3 PLUS HP
OUTPUT CURRENT	Typical: $\pm 0.05\%$	
	$\pm 0.01\%$ of range	from 0.1 to 15 A
	Maximum: $\pm 0.1\%$	Maximum: $\pm 0.05\%$
OUTPUT VOLTAGE	Typical: $\pm 0.05\%$	
	$\pm 0.01\%$ of range	from 50 to 300 V
	Maximum: $\pm 0.1\%$	Maximum: $\pm 0.05\%$
PHASE ANGLE	Typical: $\pm 0.02^\circ$	Typical: $\pm 0.01^\circ$
	Maximum: $\pm 0.1^\circ$	Maximum: $\pm 0.02^\circ$
	Maximum: $\pm 0.2\%$	Maximum: $\pm 0.1\%$
POWER	Typical: $\pm 0.05\%$	Typical: $\pm 0.05\%$
	$\pm 0.01\%$ of range	from 50 to 300 V
	Maximum: $\pm 0.1\%$	Maximum: $\pm 0.05\%$

Optional Accessories

IEC 61850 communication protocol interface

The standard IEC 61850 describes the communication of devices in substations. IEC61850 messages coming from the devices connected to the substation network (such as a relay) are also called GOOSE. GOOSE messages describe binary status signals over the substation network and are also used for relays tripping. For relay testing applications within IEC 61850 substations it is necessary to access to these data.

This new feature is performed by ISA Automatic Relay Test Set DRTS 3 PLUS and with the new software TDMS. By means of a dedicated hardware and the TDMS software, ISA DRTS 3 PLUS can expand his testing capabilities by handling those IEC61850 messages. The IEC61850 Interface option for DRTS 6 is required for relay testing with Ethernet-based substation communication protocol. The IEC61850 Interface is mounted directly on the front panel of the DRTS 3 PLUS.



IN2-CDG Current Booster for 1 A rated high burden relays

The option IN2-CDG includes a set of three current transformers, with the following characteristics:

Primaries: 12.5 A and 15 A;
 Secondaries: 0.5 A; 1 A; 2.5 A; 5 A;
 Nominal power: 100 VA;
 Current ratio error: 0.2.

Case: plastic.

For the single phase test of the CDG relay it is possible to have three times the above power, connecting current outputs in series.

GPS synchronizer

The GPS synchronizer is an external module that allows to synchronize test start of two DRTS 3 PLUS, for end to end test of differential relays. Features are:

1 digital output 0-24 Vdc, for synchronisation.

1 selector to program the following pulse intervals: 5 s; 10 s; 20 s; 30 s; 40 s; 60 s.

Maximum timing error with respect to nominal: 2 μ s.

Two test sets synchronized with GPS produce the maximum error of 50 μ s.

Power supply: 110/220 Vac.

The option includes the antenna and connection cables.

Weight: 1.7 kg.

Dimensions: 150 x 100 x 240 mm.

Case: plastic case.



GPS synchronizer

SH-2003 energy meters universal scanning head

SH-2003 is a scanning head that eases the test of energy meters. It is an universal scanning head because it can be used both with LED impulse electronic meters and Ferraris rotating disk meters. With rotating disk the sensor uses a green light beam that optimizes the recognition of any type of mark.

With LED recognition the following specification applies:

- Impulse duration: more than 60 μ s;
- Impulse frequency: less than 500 Hz;
- Duty cycle: 50%;
- Light wavelength: 500 to 960 nm (red).

The option includes:

- A support to keep the scanning head in front of the energy meter;
- The cable, 2 m long, from the scanning head to the DRTS 3 PLUS;
- The power supply transformer, for the power of 220 Vac, to supply the scanning head

The option includes a circuit that squares the sinusoidal mains waveform; the isolated output is a square-wave with an amplitude of 18 V nominal, running at the mains frequency. There are two instances where the option can be necessary:

- Generating a current or voltage into a device that is also taking a signal from the mains
- Synchronising two test sets to the mains, and then using them to test line differential relays



SH-2003

Power line synchroniser

The option is made of a plug that fits into the mains, and that has two banana sockets for the connection to the test set counting input. The purpose is to synchronize the outputs of two test sets to the mains: as the synchronisation is repeated every 2 minutes, the test set stays locked to the mains for the infinity.

Transit case

Three options are available:

- Heavy duty transit case (Discovery type) in black plastics, with handle and wheels
- Heavy duty transit case in aluminium, with handle and wheels
- Soft carrying bag

Testing cables

This option includes 28 cables in different colours.

Stand up support

The stand-up support allows using the test set in a stand-up position. This is very useful in case of too small room or no support for the test set. There is enough room for the power supply cord, and for the cooling air to flow in.



Stand up support

Additional External Amplifier AMIV 66

The three phase current and two phase voltage amplifier AMIV 66 is an accessory for the DRTS 3 Plus for tests that require nine independent currents at the same time (two secondary differential transformers), or six voltages at the same time (synchronising devices), or six currents and six voltages.

The three current outputs of AMIV 66 can be generated together with DRTS 3 Plus: this also allows paralleling current outputs, thus increasing output current and power.



Three phase current generator

AMIV 66 stand alone

	CURRENT A	POWER VA	ZMAX Ohm	RESOLUTION
3 X	0...30	160	0.18	460 μ A
3 X	0...3		0.18	46 μ A
3 X	0...0.3		0.18	4.6 μ A
1 X	0...30	320	0.35	460 μ A
1 X	0...90	480	0.06	1.38 mA

AMIV 66 with DRTS 3 Plus

	CURRENT A	POWER VA	ZMAX Ohm	RESOLUTION
3 X	0...15	100	0.44	230 μ A
3 X	0...30	160	0.18	460 μ A
3 X	0...1.5			23 μ A
3 X	0...3			46 μ A
3 X	0...0.15			2.3 μ A
3 X	0...0.3			4.6 μ A
3 X	0...45	260	0.12	690 μ A
3 X	0...4.5			69 μ A
3 X	0...0.45			6.9 μ A
1 X	0...135	780	0.042	2.07 mA

- Three independent current sources, with a common neutral
- Automatic range switch and independent range selection
- Waveform resolution: 28 bit
- Output accuracy: $\pm 0.1\%$ of the output, $\pm 0.02\%$ of the range
- Distortion: 0.1% total maximum, with any load
- Automatic protection for overloads
- Angle accuracy: $\pm 0.05^\circ$

Two phase voltage generator

AMIV 66 stand alone

	VOLTAGE V	POWER VA	ZMAX Ohm	RESOLUTION
2 X	0...300	80	1125	4.6 mV
2 X	0...125	80	195	1.9 mV
2 X	0...12.5		195	190 μ V
1 X	0...600	160	390	9.2 mV
1 X	0...300	160	97	4.6 mv

AMIV 66 with DRTS 3 Plus

	VOLTAGE V	POWER VA	ZMAX Ohm	RESOLUTION
6 X	0...300	80	1125	4.6 mV
6 X	0...125	80	195	1.9 mV
6 X	0...12.5		195	190 μ V
1 X	0...600	320	195	9.2 mV
1 X	0...300	320	50	4.6 mv

- Two independent voltage sources, with a common neutral
- Output frequency: from DC to 2000 Hz; transient 5 kHz
- Waveform resolution: 28 bit
- Output accuracy: $\pm 0.1\%$ of the output, $\pm 0.02\%$ of the range
- Distortion: 0.1% total maximum, with any load
- Automatic protection for overloads and counter-feed
- Angle accuracy: $\pm 0.05^\circ$

Power supply

Power supply voltage: 90 to 264 V AC single phase.
Frequency: 47 to 63 Hz.
Power consumption, maximum load: 500 W.

Enclosure

Aluminium, with carrying handle.

Accessories supplied with the unit

Power supply cable.
Interconnecting cable to DRTS 3 Plus.
Relay connection cables kit.
Plastic carrying bags.

Applicable Standards

The test set conforms to the EEC directives regarding Electromagnetic Compatibility and Low Voltage instruments.

A) Electromagnetic Compatibility:

Directive 2004/108/EC (CE conform).

Applicable standard: EN 61326:2006.

B) Low Voltage Directive:

Directive 2006/95/EC (CE conform).

Applicable standards, for a class I instrument, pollution degree 2, Installation category II: CEI EN 61010-1. In particular:

- Inputs/outputs protection: IP 2X - CEI EN 60529
- Operating temperature: 0°C to 55°C;
storage: -25°C to 70°C
- Relative humidity: 5 - 95% without condensing



Aluminium transport case



Plastic transport case



Soft bag



Optional set of testing cables



Standard set of testing cables

Ordering Information

CODE	MODULE
68153	DRTS 3 PLUS 3 x I 0 ÷ 15 A 4 x V 0 ÷ 300 V 1 x VDC output 0 ÷ 260 V at 100 W, 2 A Standard set of testing cables Soft carry bag TDMS - Test & Data Management Software

External Amplifier

CODE	MODULE
13156	AMIV-66 (3 x I - 0 ... 15 A at 80 VA) (2 x V - 0 ... 125 V at 80 VA)
15156	Set of testing cables
18156	Aluminium Transport Case

Optional Accessories

CODE	MODULE
81156	IEC61850 communication protocol interface
23156	High precision (HP) outputs; 0,05% accuracy outputs with SIT laboratory certificate (EU accredited)
19153	Analog AC/DC Measurement module
18153	Aluminium transport case
85153	Heavy duty plastic transport case
48153	Soft carry bag (Sky)
15156	Set of test cables
10161	GPS Synchronizer
20162	Universal scanning head for testing watt-hour meters SH-2003
98156	IN 2 CDG - Option for 1A High burden relays
24156	Power line synchronizer
19170	Stand-up support

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