



DRTS-6

Advanced Protection Relay Test Set and Measurement System

- MULTI-TASKING EQUIPMENT DESIGNED FOR TESTING PROTECTION RELAYS, ENERGY METERS, TRANSDUCERS
- POWERFUL AND LIGHTWEIGHT
- HIGH ACCURACY: BETTER THAN 0.1% (STANDARD); HP MODEL BETTER THAN 0,05%
- UP TO 9 CURRENT AND 4 VOLTAGE OUTPUTS PLUS AUXILIARY D.C. SUPPLY
- USB AND RS232 PORT
- LAPTOP PC OR POCKET PC CONTROL

DRTS-6 has been designed to test:

- ALL PROTECTION RELAYS;
- WATT-HOUR METERS;
- TRANSDUCERS;
- METERS.

Application

DRTS-6 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



DRTS-6 Specification

Six phase ac/dc current outputs

AC/DC current outputs

	CURRENT A	POWER VA	ZMAX Ohm	RESOLUTION
6 X	0...15	80	0.35	230 μ A
6 X	0...1.5		0.35	23 μ A
6 X	0...0.15		0.35	2 μ A
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
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	5 μ A
3 X	0...15	160	0.71	230 μ A
2 X	0...45	240	0.12	690 μ A
1 X	0...90	480	0.06	1.38 mA
1 X	0...30	320	0.35	460 μ A

- Six 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: $\pm 0.025\%$ typical, $\pm 0.1\%$ guaranteed.
- Distortion: 0.03% total maximum.
- Automatic protection for overloads and open circuit.

Four phase AC/DC voltage outputs

AC/DC voltage outputs

	VOLTAGE V	POWER VA	ZMAX Ohm	RESOLUTION
4 X	0...125	85	195	1.9 mV
3 X	0...12.5		195	190 μ V
3 X	0...1		195	19 μ V
1 X	0...250	160	390	3.8 mV
1 X	0...125	160	97	1.9 mV
OPTIONAL 300 V OUTPUT				
4 X	0...300	85	1125	4.6 mV
3 X	0...125	85	195	1.9 mV
3 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

- 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.
- 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
$$V_0 = (V_1+V_2+V_3)/3$$
 or
$$V_0 = (V_1+V_2 +V_3/1.73).$$

Battery simulator

Output voltage: 0...260 V D.C., 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° - 360°.

Angle resolution: 0.01°.

Angle accuracy: $\pm 0.1^\circ$.

Step or ramp control with a rate of change between $\pm 0.1^\circ$ /s and 999° /s.

Output frequency

Frequency range: from d.c. (0 Hz) to 2000 Hz.

Transient 5 kHz.

Capable of generating different frequencies on any output.

Maximum frequency error: 25 μ Hz (0.5 ppm).

Resolution: 0.1 mHz.

Programmable df/dt between ± 0.01 Hz/s and 999

Hz/s for easy testing of load shedding relays.

Capable of generating waveform with superimposed harmonic distortion.

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: 0.02% typical, 0.1% guaranteed.

Distortion: 0.01% typical.

Binary inputs

10 binary inputs clean or with voltage from 24 to 250 Vac and 4 to 300 Vdc, 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 μ s; 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: 0.01% of reading \pm 0.1 ms.
 Event recording resolution: 1 ms.

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: \pm 20 mA. Accuracy: 0.02%.

DC Voltage measuring Input, Low

Measuring range \pm 10 V. Accuracy: 0.02%.

AC/DC Current measuring Input, High

Measuring range: \pm 20 A. Accuracy: 0.2% D.C.; 0.3% A.C.

AC/DC Voltage measuring Input, High

Measuring range \pm 250 V. Accuracy: 0.1% D.C.; 0.2% A.C.

Interface connection

Type of interface: USB and RS232 at 57.6 kbaud.

Power supply

Mains power supply: 90 to 264 VAC single phase.
 Frequency: 47 to 63 Hz.
 Power consumption:
 . at rest: less than 150 W;
 . maximum load: 1600 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.
 Power supply cable.
 Serial interface cable.
 Instruction and maintenance manuals.

DRTS-6 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-6 HP (High Precision) version with respect to the standard one.

	STANDARD DRTS 6	DRTS 6 HP
OUTPUT CURRENT	Typical: \pm 0.05% \pm 0.01% of range Maximum: \pm 0.1% \pm 0.02% of range	Typical: \pm 0.02% from 0.1 to 15 A Maximum: \pm 0.05% from 0.1 to 15 A
OUTPUT VOLTAGE	Typical: \pm 0.05% \pm 0.01% of range Maximum: \pm 0.1% \pm 0.02% of range	Typical: \pm 0.02% from 50 to 300 V Maximum: \pm 0.05% from 50 to 300 V
PHASE ANGLE	Typical: \pm 0.02° Maximum: \pm 0.05°	Typical: \pm 0.01° Maximum: \pm 0.02°
POWER	Typical: \pm 0.05% Maximum: \pm 0.2%	Typical: \pm 0.05% Maximum: \pm 0.1%

Additional External Amplifiers for DRTS-6

AMI-99

Three phase current amplifier



Application

The three phase current amplifier AMI-99 is an additional device to the DRTS-6. DRTS-6 in connection with AMI-99 allows to have 9 currents or 6 currents at 30 A per phase or three currents at 60 A per phase.

AMI-99 Specification

AMI-99 with DTRS-6

	CURRENT A	POWER VA	ZMAX Ohm	RESOLUTION
9 X	6 x 0...15	80	0.35	230 μ A
	3 x 0...30	160	0.18	460 μ A
9 X	6 x 0...1.5			23 μ
	3 x 0...3			46 μ A
9 X	6 x 0...0.15			2.3 μ A
	3 x 0...0.3			4.6 μ A
6 X	0...30	160	0.18	460 μ A
6 X	0...3		0.18	46 μ A
6 X	0...0.3		0.18	4.6 μ A
3 X	0...60	320	0.09	920 μ A
3 X	0...6		0.09	92 μ A
3 X	0...0.6		0.09	9.2 μ A
1 X	0...180	760	0.023	2.8 mA

AMI-99 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
3 X	0...30	320	0.35	460 μ A
1 X	0...90	480	0.06	1.38 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 value, $\pm 0.02\%$ of the range.
- Distortion: 0.1% total maximum, with any load.
- Automatic protection for overloads.
- Angle accuracy: $\pm 0.1^\circ$.

Power supply

Mains power supply: 90 to 264 V a.c., single phase.
 Frequency: 47 to 63 Hz.
 Power consumption:
 . at rest: less than 100 W;
 . maximum load: 1000 W.

Weight and dimensions

Weight: 16 kg.
 Dimensions without the handle:
 170 (h) x 470 (w) x 430 (d) mm.

Case

Case: aluminium, with carrying handle.

Accessories supplied with the unit

Protective plastic bag. Mains supply cable to DRTS-6.
 Interconnecting cable to DRTS-6

AMI-150

Three phase high current amplifier



Application

If high current or high power (or 9 current outputs) are needed for testing old electromechanical relays or for testing two secondary transformers, the DRTS-6 can control the external high current, three phase amplifier model AMI-150.

AMI-150 Specification

AC/DC current outputs

	CURRENT A	POWER VA	ZMAX Ohm	RESOLUTION
3 X	0...50	150	0.06	760 μ A
3 X	0...25	150	0.24	380 μ A
3 X	0...12.5	150	0.96	190 μ A
3 X	0...2.5	150	24	38 μ A
3 X	0...0.05	0.01	24	1 μ A
1 X	0...50	450	0.18	760 μ A
1 X	0...150	450	0.02	2.28 mA

- Three independent current sources, without a common neutral.
- Accuracy: 0.5% of the range.
- Automatic protection for overloads.
- Waveform resolution: 24 bit.
- Frequency range: from 0 Hz to 2 kHz; transient 5 kHz.

Power supply

Mains power supply: 110 or 230 Vac, single phase; to be specified at order.
 Frequency: 47/63 Hz.
 Power consumption, maximum load: 800 W.

Weight and dimensions

Weight: 20 kg.
 Dimensions: 200 (h) x 470 (w) x 380 (d) mm.

Case

Aluminium, with handle.

Accessories supplied with the unit

Power supply cable. Connection cable to DRTS-6.

AMI-66

Three phase current amplifier



Application

The three phase current amplifier AMI-66 is an accessory for DRTS-6 for tests that require nine independent currents at the same time (two secondary differential transformers). The three current outputs of AMI-66 can be generated together with DRTS-6: this also allows paralleling current outputs thus increasing output current and power.

AMI-66 Specification

AMI-66 with DTRS-6

	CURRENT A	POWER VA	ZMAX Ohm	RESOLUTION
3 X	0...15	80	0.35	230 μ A
3 X	0...1.5		0.35	23 μ A
3 X	0...0.15		0.35	2.3 μ A
1 X	0...15	160	0.71	230 μ A
1 X	0...30	160	0.18	460 μ A

AMI-66 stand alone

	CURRENT A	POWER VA	ZMAX Ohm	RESOLUTION
9 X	0...15	80	0.35	230 μ A
9 X	0...1.5		0.35	23 μ A
9 X	0...0.15		0.35	2.3 μ A
3 X	0...45	240	0.12	690 μ A
3 X	0...4.5		0.12	69 μ A
3 X	0...0.45		0.12	7 μ A
1 X	0...120	640	0.04	2 mA

- Three independent current sources, without a common neutral.
- Accuracy: 0.1% of the value, \pm 0.02% of the range.
- Automatic protection for overloads.
- Waveform resolution: 24 bit.
- Frequency range: from 0 Hz to 2 kHz; transient 5 kHz.

Power supply

- Mains power supply: 110 or 230 Vac, single phase; to be specified at order.
- Frequency: 47/63 Hz.
- Power consumption, maximum load: 800 W.

Weight and dimensions

Weight: 7 kg.

Dimensions: 200 (h) x 470 (w) x 360 (d) mm.

Case

Aluminium, with handle.

Accessories supplied with the unit

Power supply cable. Connection cable to DRTS-6.

AMIV-66

Three phase current and voltage amplifier



Application

The three phase current and voltage amplifier AMIV-66 is an accessory for the DRTS-6 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-6: this also allows paralleling current outputs, thus increasing output current and power.

AMIV-66 Specification

Three phase current generator

AMIV-66 with DTRS-6

	CURRENT A	POWER VA	ZMAX Ohm	RESOLUTION
9 X	0...15	80	0.35	230 μ A
9 X	0...1.5		0.35	23 μ A
9 X	0...0.15		0.35	2.3 μ A
3 X	0...45	240	0.12	690 μ A
3 X	0...4.5		0.12	69 μ A
3 X	0...0.45		0.12	7 μ A
1 X	0...120	640	0.04	2 mA

AMIV-66 stand alone

	CURRENT A	POWER VA	ZMAX Ohm	RESOLUTION
3 X	0...15	80	0.35	230 μ A
3 X	0...1.5		0.35	23 μ A
3 X	0...0.15		0.35	2.3 μ A
1 X	0...15	160	0.71	230 μ A
1 X	0...30	160	0.18	460 μ A

- Three independent current sources, with a common neutral.
- Output frequency: from 0 Hz to 2000 Hz; transient 5 kHz.
- Waveform resolution: 28 bit.
- Output 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.
- Angle accuracy: \pm 0.1°.

Three phase voltage generator

AMIV-66 with DTRS-6

	VOLTAGE V	POWER VA	ZMAX Ohm	RESOLUTION
6 X	0...125	80	195	1.9 mV
6 X	0...12.5		195	190 µV
6 X	0...1		195	19 µV
1 X	0...250	320	195	3.8 mV
1 X	0...125	320	50	1.9 mV
OPTIONAL 300 V OUTPUT				
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 µV
1 X	0...600	320	1125	9.2 mV
1 X	0...300	320	280	4.6 mV

AMIV-66 stand alone

	VOLTAGE V	POWER VA	ZMAX Ohm	RESOLUTION
2 X	0...125	80	195	1.9 mV
2 X	0...12.5		195	190 µV
2 X	0...1		195	19 µV
1 X	0...250	160	390	3.8 mV
1 X	0...125	160	97	1.9 mV
OPTIONAL 300 V OUTPUT				
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 µV
1 X	0...600	160	2250	9.2 mV
1 X	0...300	160	560	4.6 mV

- Three independent voltage sources, with a common neutral.
- Output frequency: from 0 Hz to 2000 Hz; transient 5 kHz.
- Waveform resolution: 28 bit.
- Output accuracy: ± 0.1% of the value, ± 0.02% of the range.
- Distortion: 0.1% total maximum, with any load.
- Automatic protection for overloads.
- Angle accuracy: ± 0.1°.

Power supply

Power supply voltage: 90 ... 264 Vac single phase.

Frequency: 47/63 Hz.

Power consumption, maximum load: 1000 W.

Case

Aluminium, with carrying handle.

Accessories supplied with the unit

Power supply cable. Interconnecting cable to DRTS-6.

Plastic carrying bags.

Weight and dimensions

Weight: 13 kg.

Dimensions: 170 (h) x 470 (w) x 360 (d) mm.

AMV-66

Two phase voltage amplifier



Application

The two phase voltage amplifier AMV-66 is an accessory for the DRTS-6, for tests that require six voltages at the same time (synchronising devices).

AMV-66 Specification

Two phase voltage generator

AMV-66 with DTRS-6

	VOLTAGE V	POWER VA	ZMAX Ohm	RESOLUTION
6 X	0...125	80	195	1.9 mV
6 X	0...12.5		195	190 µV
6 X	0...1		195	19 µV
1 X	0...250	320	195	3.8 mV
1 X	0...125	320	50	1.9 mV
OPTIONAL 300 V OUTPUT				
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 µV
1 X	0...600	320	1125	9.2 mV
1 X	0...300	320	280	4.6 mV

AMV-66 stand alone

	VOLTAGE V	POWER VA	ZMAX Ohm	RESOLUTION
2 X	0...125	80	195	1.9 mV
2 X	0...12.5		195	190 µV
2 X	0...1		195	19 µV
1 X	0...250	160	390	3.8 mV
1 X	0...125	160	97	1.9 mV
OPTIONAL 300 V OUTPUT				
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 µV
1 X	0...600	160	2250	9.2 mV
1 X	0...300	160	560	4.6 mV

- Three independent voltage sources, with a common neutral.
- Output frequency: from 0 Hz to 2000 Hz; transient 5 kHz.

- Waveform resolution: 28 bit.
- Output 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.
- Angle accuracy: $\pm 0.1^\circ$.

Power supply

Power supply voltage: 90 ... 264 Vac single phase.
Frequency: 47/63 Hz.
Power consumption, maximum load: 500 W.

Case

Aluminium, with carrying handle.

Accessories supplied with the unit

Power supply cable. Interconnecting cable to DRTS-6.

Weight and dimensions

Weight: 7 kg.
Dimensions: 170 (h) x 230 (w) x 360 (d) mm.

Optional Accessories

IO-6432

Digital input and output expansion

Application

The option IO-6432 increases the number of logic inputs and outputs that can be monitored by the DRTS-6. The option adds to inputs and outputs that are located in the DRTS-6. The IO-6432 is fitted internally in the DRTS-6 unit.

IO-6432 Specification

Inputs

Number of inputs: 64, by 4 groups of 16.
Inputs: logic, voltage from 5 to 130 V d.c.; maximum load current 3 mA.

Input and output groups are isolated from each other; they are also isolated from the rest of the instrument, from the mains supply and from the ground.

It is possible to separately program each input as Normally Open or Normally Closed or Disabled.

It is possible to separately program the timer stop of each programmed input as Trip or Reset.

Logic input time measurement resolution: 1 ms.

Logic input time measurement accuracy: 2 ms.

Outputs

Number of outputs: 32, in 4 groups of 8.
Type of outputs: open collector; maximum voltage 130 V; minimum current capability 15 mA.

It is possible to separately program each logic output as Normally Open or Normally Closed.

It is possible to separately delay each logic output with respect to currents and voltages.

Logic output time accuracy: 1 ms.

OUT32 for the IO6432 option

IO6432 outputs drive the load to zero. If the output must be driven with the voltage, or if the current is not sufficient, it is available the module OUT32, that has the following characteristics:

Inputs: 32, from IO6432 of DRTS.

Outputs: 32 relay contacts (both ends), with the following characteristics.

. Vmax: 250 V;

. Imax: 0.5 A;

. Outputs protected against over-voltage;

. Time delay: less than 10 ms.

Connection to DRTS: with a cable 1 m long, provided.

Lights that turn on when the relay is closed.

Output connection: by two 50-way connectors.

Power supply: from the mains; 220 V 50 Hz.

Weight: 3 kg.

Dimensions: 25 x 19 x 11 cm.

Case: plastic, with graved front face.

Optional GPS synchronizer



Application

External module for synchronization of two DRTS-6 sets via GPS system, for end to end test of differential relays.

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.

SHA-1 energy meters universal scanning head

Application

SHA-1 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 us;
- . 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-6;
- . The power supply transformer, for the power of 220 Vac, to supply the scanning head.

Palm control

The Palm Control is an innovative control of the DRTS-6 and for DRTS and DRTS-3 too, which uses a PDA (Personal Digital Assistant) or Pocket PC that runs under the Windows Mobile operating system. We have

developed a simple graphical interface that allows the users to have a low cost interface, extremely compact



for simple and fast testing operations. The Palm Control has a colour touch screen that allows a simple graphical control of the DRTS's outputs.

The Palm Control is made by a PDA and the Mobile XPRO software module.

Applicable standards

Electromagnetic compatibility

Directive no. 89/336/CEE dated May 3, 1989, modified by the directive 92/31/CEE dated May 5, 1992.

Applicable Standards: EN 50081-2; EN 50082-2; EN 55011; EN 61000-3-3; EN 50082-2; ENV 50140; ENV 50141; ENV 50204; IEC 1000-4-2; IEC 1000-4-4; IEC 1000-4-6; IEC 1000-4-8.

Low voltage directive

Directive n. 73/23/CEE, modified by the directive 93/68/CEE.

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

In particular:

Operating temperature: 0 - 50°C; storage: - 25°C to 70°C.

Relative humidity: 5 - 95% without condensing.

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