

# SCOPE

## HISAC Ultima Circuit Breaker Dynamic Test Set



Ultimate solution for testing circuit breakers  
of all types has grounded...

## The Product

**HISAC Ultima – new generation Circuit Breaker Dynamic Test Set from SCOPE .... the ultimate solution for testing Circuit Breakers of all types with both sides grounded.. HISAC Ultima is the most complete analyser for checking the complete dynamic performance of CBs in live EHV switchyards upto 765 kV.**

The portable analyzer is based on DIN standard modular and up-gradable 19" configuration having intelligent measuring modules controlled by an external laptop through an Ethernet link.

The Ultima can carry out Dynamic Contact Resistance Measurement on SIX breaks of THREE poles in one operation thereby significantly reducing stress on CB & testing downtime.

It offers flexibility to create pre-programmed Test Plans including all test settings for all types of circuit breakers available in a switchyard, that can simply be recalled at the time of actual testing. This saves you from doing all settings in switchyards.

The Analysis software offers a range of utilities which enables effective Condition Monitoring of CB by comparing present test data with previous signatures and predicting future performance.

HISAC Ultima with DCRM+ ensures end users safety by providing Dual Earth Test, in which Circuit Breaker will be grounded from both sides while conducting the test.

HISAC Ultima actually gives you the power to design your own condition based maintenance strategy and obtain optimum breaker performance with minimum maintenance shutdowns.

## The Measurement

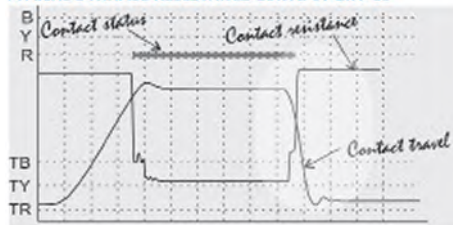
- TESTS all types of CB - LV, HV & EHV for all critical performance parameters of all the poles / breaks in a single shot - saves downtime & number of operations during testing.
- MEASURES Main / PIR contact timings, bounce, non-simultaneity of contacts and auxiliary contact timings.
- ANALYSIS contact travel characteristics for speed, insertion, contact gap, over-travel and rebound with suitable transducer and mounting fixture.
- RECORDS trip and close coil current characteristics.
- REGISTERS the signature of Dynamic Contact Resistance of main and arcing contacts, of all the 6 breaks simultaneously - helps assessing condition of the contacts without opening the interrupter.
- DISPLAYS settings, graphical and tabulated test results.
- DISPLAYS Static Contact Resistance values of all 6 breaks.
- PRINTS test report in graphical format with test header and calculation footer, on external printer.
- INCORPORATES a powerful and practical Windows™ based Test Manager software to control & operate instrument; view, analyse and handle graphical test data on a laptop at high resolution.
- SELECTS pre-programmed setup parameters and pass / fail limits through software.
- CONNECTS to CB with wear resistant test leads of sufficient length, having quick-fit connectors, suitable for EHV CBs.
- MOVES easily within switchyard as the set can be mounted on a specially designed trolley having large wheels & mains supply distribution board.
- TRANSPORTS over long distance in rugged industrial aluminium cases.
- OFFERS additional options to measure PIR value and configurable analog channels that can be used for monitoring Station DC Voltage, Motor current, first trip test or other static parameters for enhanced performance assessment of CB.



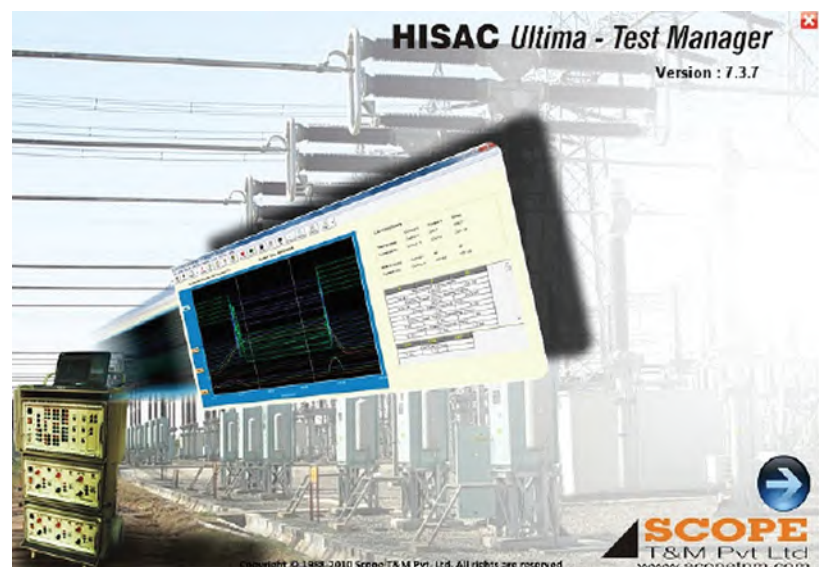
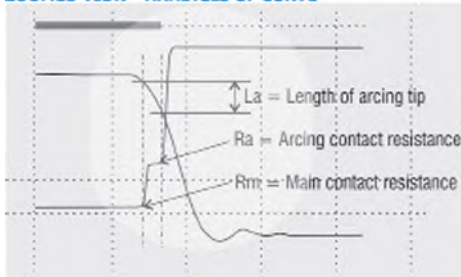
## Dynamic Contact Resistance Measurement ... DCRM signature

- Advent of DCRM given condition monitoring of CBs a new dimension. It enables user to see what was not visible before.... Condition of main & arcing contacts, without opening the interrupter for physical inspection!
- Change in micro-ohm values during C-O operation, as first the arcing & then the main contacts of moving and fixed contacts engage and disengage is plotted against time and a graphical record is obtained. For this DCRM+ injects 100A DC through contact assembly, reads the voltage drop at high sampling speed during this short time span & relays it to Analyser, which calculates dynamic resistance by doing high speed V/I calculation.
- This dynamic micro-ohm signature of the circuit breaker can be used as a periodic inspection parameter for condition monitoring of contacts. Any abnormal jitters or deviation from the standard signature is helpful in identifying between good contact and worn out contact. Any change in the dynamic/frictional characteristics of the whole system, immediately reflects as a change in the dynamic resistance signature. When co-related with travel curve the DCRM helps in estimating the wipe of arcing contacts.
- Specially engineered test lead set having special kelvin clamps ensure correct implementation of classical four wire measurement method and excellent accuracy and repeatability of results.

TYPICAL DYNAMIC RESISTANCE CURVE OF EHV CB



ZOOMED VIEW - ANALYSIS OF CURVE



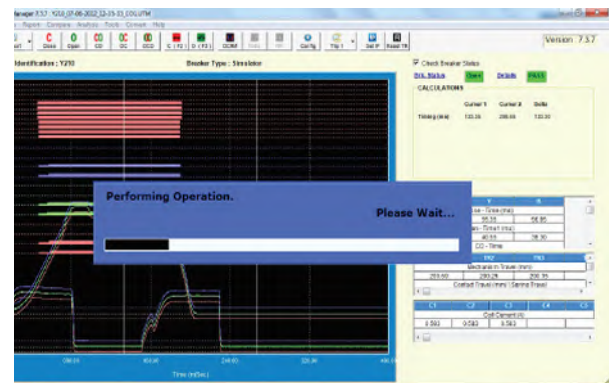
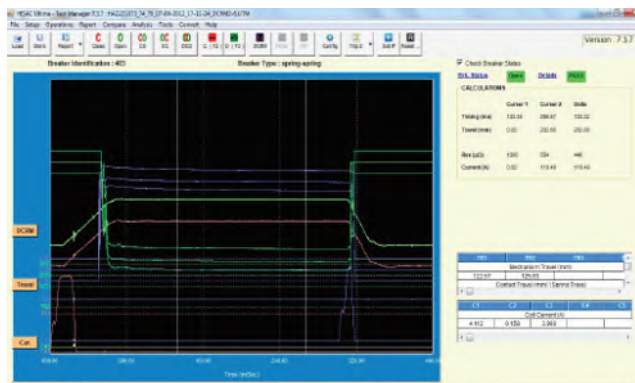
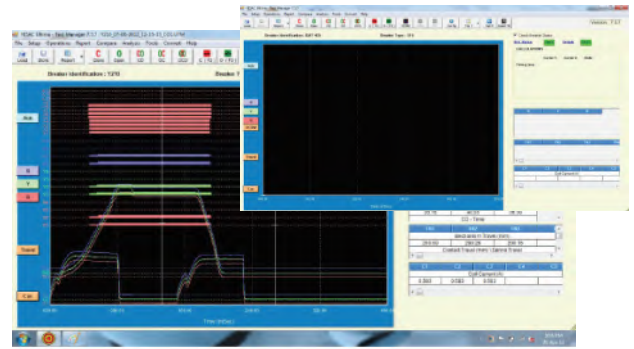
## Dual Earth Tests... Improving Human Safety and Environment

- Traditional testing method involves frequent connection & disconnection of earthing and need to follow the correct sequence of the same which could lead to human error having grave consequences. There have been incidences of severe accidents due to this. Working with both sides earthed continuously during maintenance, without need of frequent connection / disconnection provides much safer operation and is recommended by authorities & standardization organizations. Increased awareness about overall safety and growing concern for environment mandated innovative technological solutions not only for human safety issue, but also for how we can reduce the carbon footprint of this testing activity.
- When CB is grounded from both sides, it creates an earth loop parallel to CB contacts, posing real challenge to measuring both closing / opening time along with bounces and capturing signature of dynamic contact resistance. During DCRM test depending on resistance of earth loop, partial test current will pass through this loop and for timings this loop will show permanent closure of CB contacts irrespective of actual CB contact status.
- The technology is developed to dynamically measure & compensate the current flowing through the earth loop and get the correct results. Special intelligent firmware algorithms are developed to compensate this current during high-speed sampling of dynamic 2 contact resistance. Similar technology is used with different algorithms for measurement of contact timings. Measurement of bounces in contact has also become possible with this method.



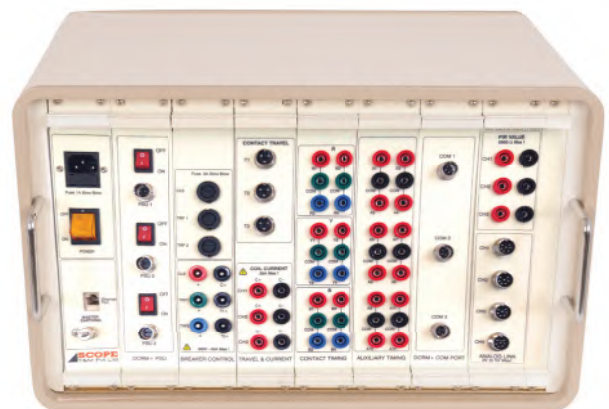
## HISAC Ultima Test Manager Software

- Controls the operation of HISAC Ultima through laptop
- Pre-programmable Test Plans facilitate creation of Test Setup library which is very easy to use & time saving during testing
- User defined, structured storage of test data for easy future retrieval. Dynamic calculations on graphical information with cursor movement facilitating easy on-screen analysis
- Comparison of test results with manufacturer's test certificate using programmable limit checks
- Assessment of present condition & prediction of future performance by multiple signature comparison and Trend Analysis
- Comprehensive report generation including graphs and numerical results for all important parameters
- Back up & restoration of test data
- Save graphs as bitmap images for incorporating in user reports
- Facility to export test report to Pdf & Excel format.
- This powerful test manager software really makes condition monitoring & condition based preventive maintenance feasible for the Power Utilities.



## Standard Configuration of HISAC Ultima Analyser rack consists of following modules

- Base CPU module having Ethernet connection for laptop
- Breaker Control module – Close, Trip1 & Trip2
- Travel & Current module – 3 Travel & 3 Coil Current channels
- Contact Timing module for Main & PIR contacts – 12 Main + 12 PIR
- Auxiliary Timing module for 4 dry & 4 wet auxiliary contacts
- DCRM+ module as per DCRM modules selected (1 for 2 DCRM+ modules, 2 for 4 DCRM+ modules, 3 for 6 DCRM+ Modules)



**Optional Accessories** extend the capabilities of the basic instrument making it complete test equipment for testing circuit breakers.

## DCRM+ Modules for Dual Ground Testing (Optional)

This test allows users to test the Circuit Breaker keeping it's both sides connected to Earth. It captures dynamic resistance variation of Circuit breaker contact and also captures Circuit Breaker contact timing with bounces while CB is kept connected to earth from both sides. For this test two independent isolated DC current sources are provided of 100 Amps each. One module is capable of testing 2 breaks simultaneously. Three modules use at a time makes simultaneous testing of 6 breaks possible. Innovative hardware & testing arrangements were evolved to significantly reduce the Test Kit size & to make it multi-channel. These portable modules will be placed directly on the top of Circuit Breaker and connections to DUT will be done through drastically reduced Test Leads. Sampled data in modules will be transmitted to base unit 'HISAC Ultima' and after data processing the graphical presentation of DCRM+ results or Timing results will be done.



## Additional Measurement Modules

- Additional optional modules are available to measure PIR value and for monitoring Station DC (Coil voltage), Motor current, first trip test or other static parameters through configurable Analog channels.
- Standard configuration of Travel & Current module having 3 Travel & 3 Coil Current channels can be further expanded to have additional 3 Travel & 3 Coil Current channels.
- Standard configuration of Auxiliary Timing module having 4 dry & 4 wet auxiliary contacts
- Timing channels can be further expanded to have additional 2 dry & 2 wet auxiliary contact channels.
- The combination of these optional modules should be confirmed with SCOPE before ordering.

## Travel Transducers with Mounting Fixtures

For evaluating travel characteristics of operating mechanisms, SCOPE offers rotary and linear resistive travel transducers with universal / specially designed fixtures to suit a variety of CBs available. More details are given on subsequent pages.

## Trolley

For easy movement within the substation, safe storage & transportation.

## Travel Transducer with Mounting Fixture

In order to evaluate the travel mechanism / contact behavior of circuit breakers, it is necessary to mount the travel transducers at the appropriate point on the operating mechanism of CB. Depending on type of motion to be tapped either a rotary or a linear travel transducer having correct length as dictated by the stroke of circuit breaker is required. To hold this travel transducer rigidly on breaker mechanism suitable mounting fixture is required. This fixture is generally common (universal) for rotary transducers, however it may be custom built for different make / type & travel stroke of breaker mechanisms.

HISAC Ultima with such suitable travel transducer with mounting fixture can record travel graph & measure various travel related parameters like Total Travel, Default & Datum Velocities, Default Travel (Contact Gap / Contact Insertion), Over-travel & Rebound etc. For meaningful analysis of DCRM signature, it is recommended to have travel curve of circuit breaker along with DCRM curve.

SCOPE has rich experience in designing and providing solutions for travel measurement. It offers following options for facilitating this:

## Standard Travel Transducer

SCOPE offers linear and rotary transducers manufactured by specialist manufacturers. These are rugged, reliable and suited for recording of circuit breaker travel characteristics. Detailed specifications of these transducers are available on request. Standard transducers are available from 25 to 600 mm linear stroke lengths and 360 degrees rotation, with a conductive plastic resistive element.



## LTF Series Travel Transducer-cum-Fixtures

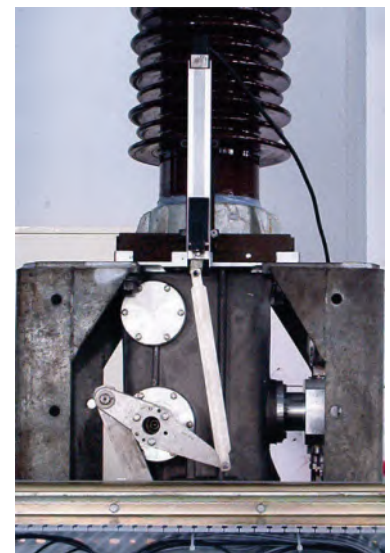
Sometimes, it is difficult to mount commercially available linear or rotary transducers on the mechanisms of some circuit breakers. This may be due to complicated geometry of the mechanism or due to conditions of special linkages or problems of vibration. SCOPE has studied the construction of some of these and designed and manufactured rugged and reliable transducer-cum-fixtures that make it possible to perform travel measurement on such circuit breakers.



## LTH Series Mounting Fixtures for Standard Travel Transducers

SCOPE has designed and standardized fixtures for mounting standard transducers which are commercially available.

SCOPE has capability to design special fixtures for any new CB on request !



Actual pictures of Transducers mounted with their fixtures



## Benefits

Analysis of test results provides inputs to assess and correct:

- Settings for Contact Timings
- Closing and Opening speeds, over-travel, rebound and contact wipe
- Auxiliary contact settings for obtaining specified C-O times
- Trip/Close release mechanism settings
- DCRM Signature gives information on:
  - Useful information on contact conditions, especially arcing contacts
  - Prior indication of deterioration in operating mechanism linkages
  - Certain mechanical weaknesses, undetected by travel measurement, are reflected in DCRM measurement.



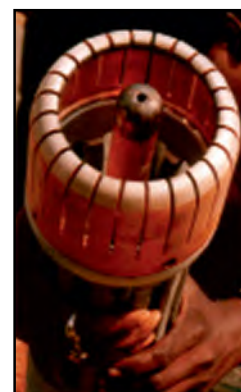
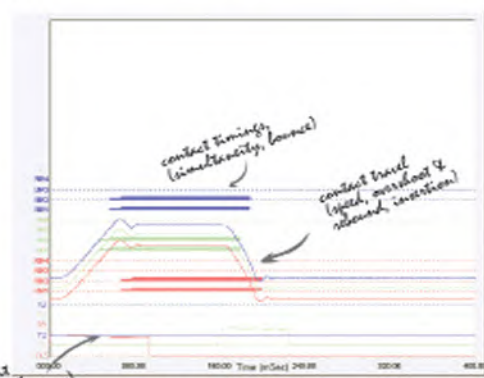
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SCOPE

PARAMETER	UNIT	MEASUREMENT	DESIGN VALUE
Closing speed (mm/s)	mm/s	1500	1500
Opening speed (mm/s)	mm/s	1500	1500
Over-travel (mm)	mm	10	10
Rebound (mm)	mm	5	5
Release mechanism			
DCRM Signature			

*Test settings*

*Breaker identity*

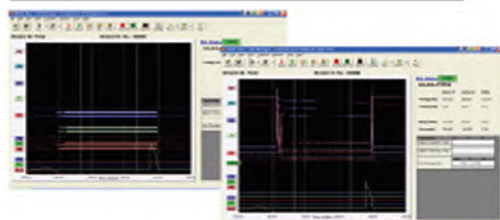


PARAMETER	UNIT	MEASUREMENT	DESIGN VALUE
Closing speed (mm/s)	mm/s	1500	1500
Opening speed (mm/s)	mm/s	1500	1500
Over-travel (mm)	mm	10	10
Rebound (mm)	mm	5	5
Release mechanism			
DCRM Signature			

PARAMETER	UNIT	MEASUREMENT	DESIGN VALUE
Closing speed (mm/s)	mm/s	1500	1500
Opening speed (mm/s)	mm/s	1500	1500
Over-travel (mm)	mm	10	10
Rebound (mm)	mm	5	5
Release mechanism			
DCRM Signature			

*automatic calculations*

PARAMETER	UNIT	MEASUREMENT	DESIGN VALUE
Closing speed (mm/s)	mm/s	1500	1500
Opening speed (mm/s)	mm/s	1500	1500
Over-travel (mm)	mm	10	10
Rebound (mm)	mm	5	5
Release mechanism			
DCRM Signature			



## SPECIFICATIONS

CHANNELS	CONFIGURATION	RANGE	RESOLUTION	ACCURACY
Contact Timing	24: 4 Main, 4 PIR per pole, on 3 poles simultaneously	Measurement duration 1ms to 40 sec at 1kC, 0.05ms to 2sec at 20 kC. Below additional and optional ranges: 10 ms to 400 sec at 0.1 kC, 0.025 ms to 1 sec at 40kC	10 ms at 0.1 kC, 0.025 ms at 40 kC	Value $\pm$ 0.01% $\pm$ 0.05 mS
Auxiliary Contact Timing	8: 4 dry, 4 wet. Optionally expandable to 12: 6 dry + 6 wet or 12 dry or 12 wet.	24 to 250 V DC	10 ms at 0.1 kC, 0.025 ms at 40 kC	Value $\pm$ 0.05% $\pm$ 1 digit
Coil Current	3: Trip / Close Coil current Optionally expandable to 6	1, 2, 5, 10, 25 A DC	0.1% of range at 1 A, 0.004% of range at 25 A	Value $\pm$ 0.5% $\pm$ 1 digit
Voltage (Travel)	3: Travel characteristics Optionally expandable to 6	0-5 V DC	1.2 mV	Value $\pm$ 0.5% $\pm$ 1 digit
DCRM	3 or 6: Each for Resistance & Test Current as per configuration ordered	1000, 2000, 4000, 8000 $\mu\Omega$	0.1 % of selected range	Value $\pm$ 2% $\pm$ 1 digit
Optional Configurable Analog Inputs	4 or 6: Optional, for conditioned analog signal inputs	0-5V DC	1.2 mV	Value $\pm$ 0.5% $\pm$ 1 digit
PIR Value	3: Optional, for Pre-Insertion Resistor value measurement	0-5 k $\Omega$	1 $\Omega$	Value $\pm$ 5 % $\pm$ 1 digit

Note : for dual ground mode using DCRM+ PIR value measurement is not possible

- Breaker Control : Three solid state contacts rated at 35A, 300V AC/DC for breaker operation (Close, Trip1 & Trip2)
- Trigger Options : Open, Close, C-O, O-C, O-C-O, delay between operations configurable. Command duration is also configurable
- Sampling Speed : 20kC, 10kC, 5kC, 1kC selectable. Additional sampling speeds of 40kC, 0.4kC and 0.1kC are optional and can be provided on request.
- Plot Length : 1 sec at 40kC, 2 sec at 20kC, 4 sec at 10kC, 8 sec at 5kC, 40 sec at 1kC, 160 sec at 0.4kC and 400 sec at 0.1kC
- Travel Channels : For linear / rotary resistive transducers. 0-5V DC excitation source in-built
- Test Report : Clear graphical result with test header and computation footer
- Control Through : External laptop
- Communication Port : Ethernet port for communication between laptop and instrument
- Test Leads : Suitable to test EHV Circuit breakers. Leads supplied are of suitable length, thickness, insulation quality & mechanical strength. They have colour coded terminators, quick-fit type rugged clamps & identification labels
- Environment : 0°C to 50°C (operating temperature), 0°C to 70°C (storage temperature), 95% RH (non-condensing)
- Power : 230V AC  $\pm$  15%, 50Hz  $\pm$  10%, 150 VA



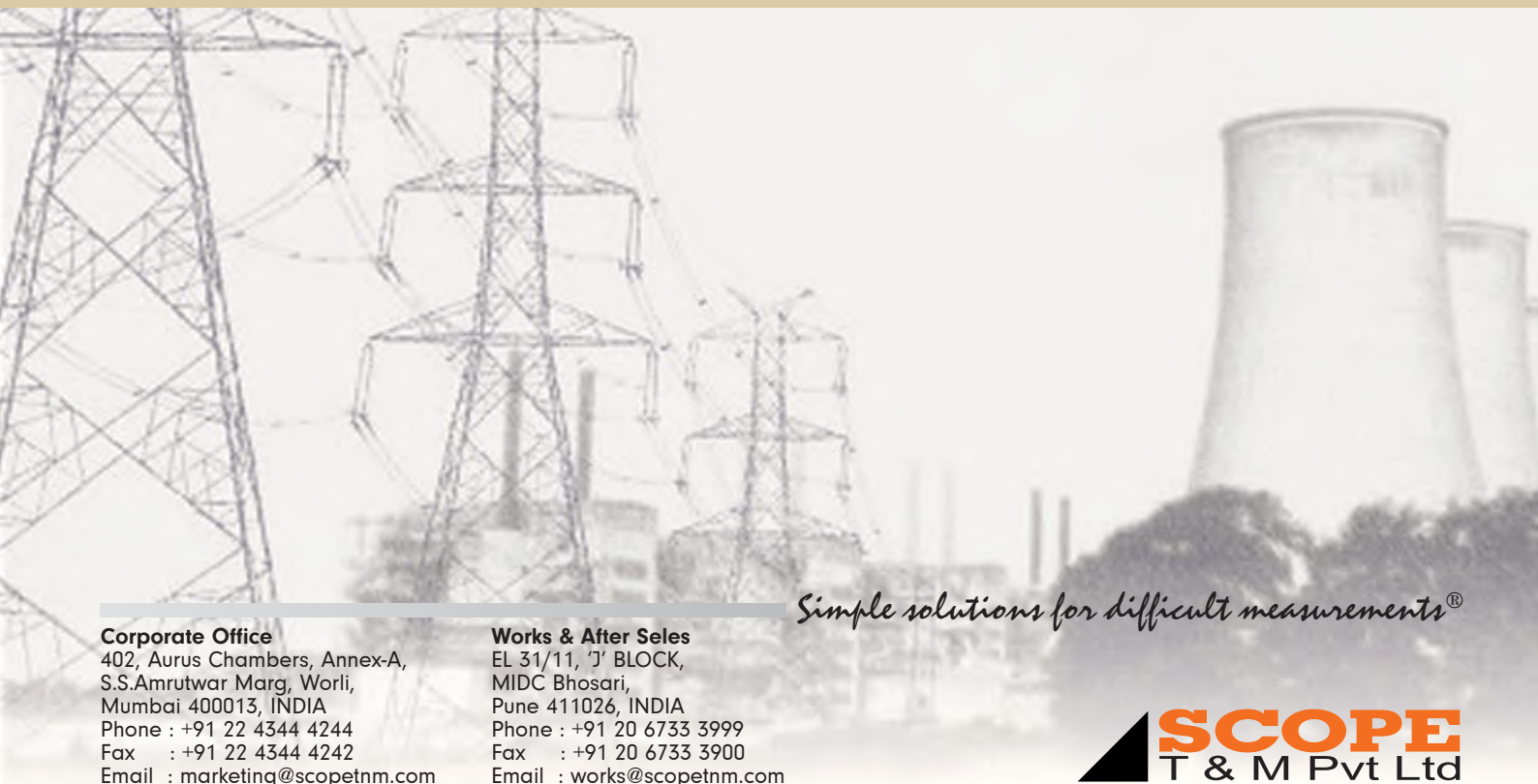
- Dimensions : HISAC Ultima Analyser Rack: 500 x 270 x 300 mm, DCRM+ Dimension - 178 mm(L) X 289 mm (W) X 128 mm (H)
- Weight : HISAC Ultima : 12 Kg, DCRM+ Each Module : 4 Kg
- Type Testing : As per IEC 60068 / IS 9000 for Supply Voltage Variation, Dry Heat, Damp Heat, Change of Temperature, Bump, Vibration, Mechanical Shock
- As per IEC 61326-1 for EMI/EMC & As per IEC 61010-1 & EN 51010-1 for Safety

## Ordering Information

<b>HISAC Ultima Analyser Rack with Standard Configuration is supplied with following standard accessories</b>	
<b>Description</b>	<b>Quantity</b>
<b>Standard Accessories</b>	
Contact Cables for R1R2,R3R4, Y1Y2, Y3Y4 & B1B2,B3B4 of 15m	6 Nos.
Current Cables for CH1, CH2 and CH3 of 7m	3 Nos.
Travel Cables for TR, TY and TB of 7m	3 Nos.
Breaker Control Cable CLS, TRIP1, TRIP2 of 7m	3 Nos.
Auxiliary DRY Cable A1,A2,A3,A4 of 7m	4 Nos.
Auxiliary WET Cable A5,A6,A7,A8 of 7m	4 Nos.
AC Mains Cord of 3m, Master Earthing Cable of 7m & Ethernet Cable of 1.5m	1 No. each
Spare Fuses	10 Nos.
Aluminium Carrying Case with wheels for Instrumen	1 No.
Carrying Case with Wheels for Test Lead Set	1 No.
HISAC Ultima Test Manager Software on CD	1 No.
Instruction Manual & Test & Calibration Report	1 Set Each
<b>Optional Accessories</b>	
<b>HISAC Ultima DCRM+ Rack : 2 or 4 or 6 Channel as per confi guration ordered is supplied with following Standard Accessories.</b>	
<b>Description</b>	<b>Quantity</b>
Calibrated Test Cables for C+, C- & V+, V- , 5m with Ck clamp of 75mm opening	3 Sets
DCRM+ Link Cable of 15m	3 Nos.
Power Supply Unit cable - 15 meter	1 No. Each
Soft Carrying Case for Instrument	1 No.
Carrying Case with Wheels for Test Lead Set	1 No.
Test & Calibration Report	1 Set
• For DCRM+ module Test Lead Set for DCRM+ link cable with 20 m & 35 m (specially designed for 765 kV CBs) lengths are optionally available	
<b>Travel Transducers &amp; Fixtures for various types of CBs</b>	
<ul style="list-style-type: none"> <li>• Standard Linear Travel Transducer, Resistive, 25 to 600 mm travel</li> <li>• Standard Rotary Position Transducer, Resistive, 360° rotation</li> <li>• LTF Series Travel Transducers-cum-Fixtures</li> <li>• LTH/NLTH/NRTF Series Fixtures for Standard Linear or Rotary Transducer</li> </ul>	
• SCOPE has capability to design special Fixtures for any new CB on request.	
<b>Configurable Analog Inputs Module - 4 or 6 Channels for Station DC, Motor Current etc.</b>	
<b>Pre-Insertion Resistor (PIR) Value Measurement Module - 3 Channels (In dual ground mode DCRM+ this feature is not available)</b>	
<b>Trolley - for easy portability</b>	
<b>Laptop for operating HISAC Ultima, with standard configuration available in market</b>	

Generation, Transmission,  
Distribution, Industry ...

... there is **SCOPE**  
*always!*



*Simple solutions for difficult measurements®*

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