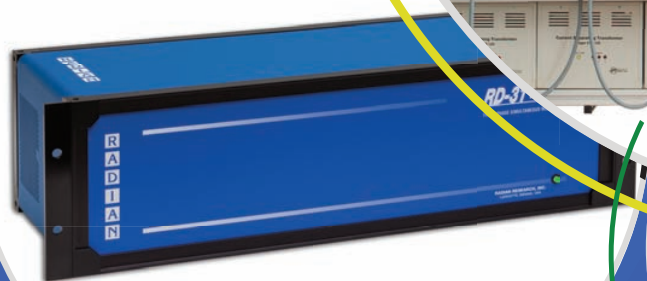
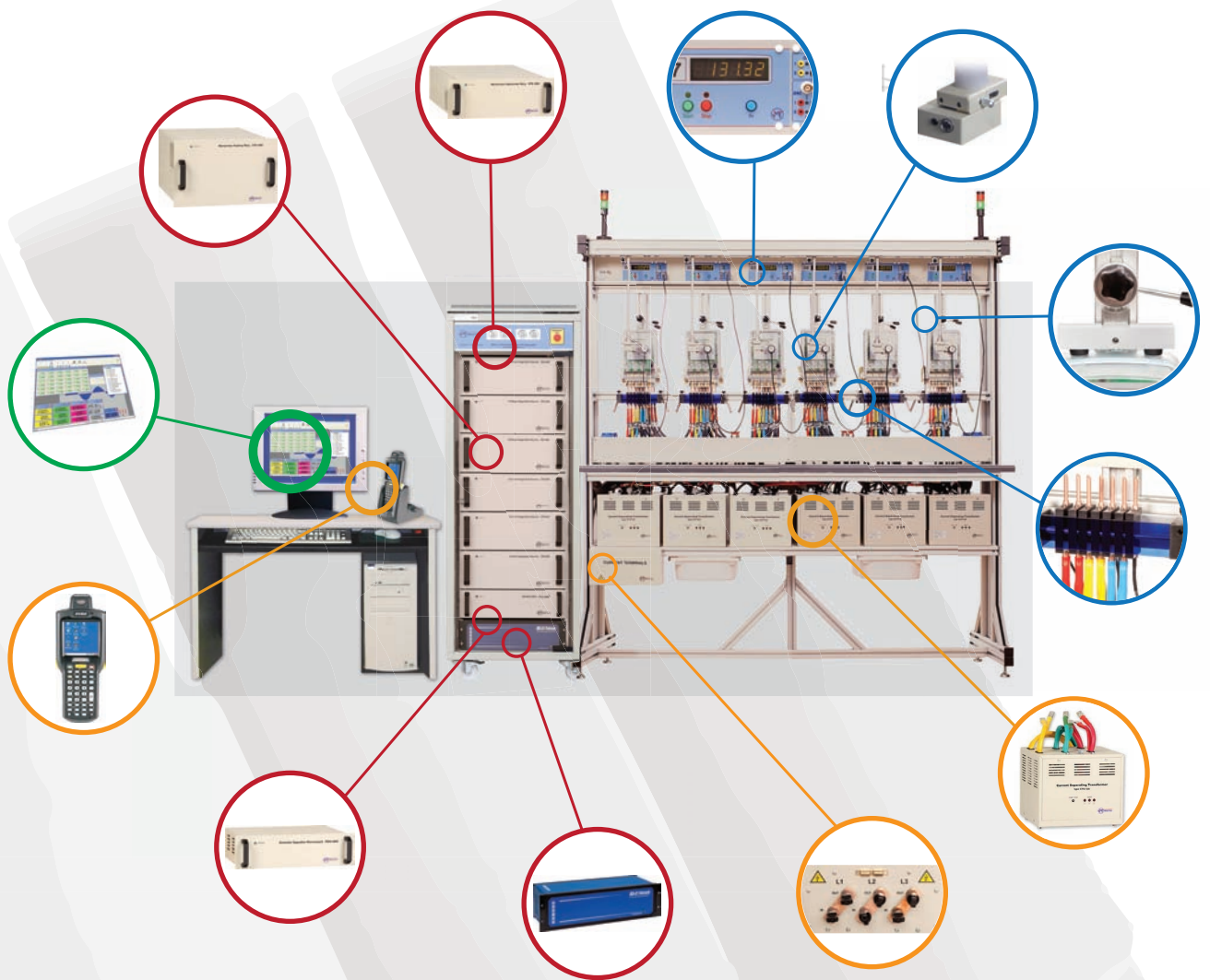


Advanced Equipment for electricity meter testing



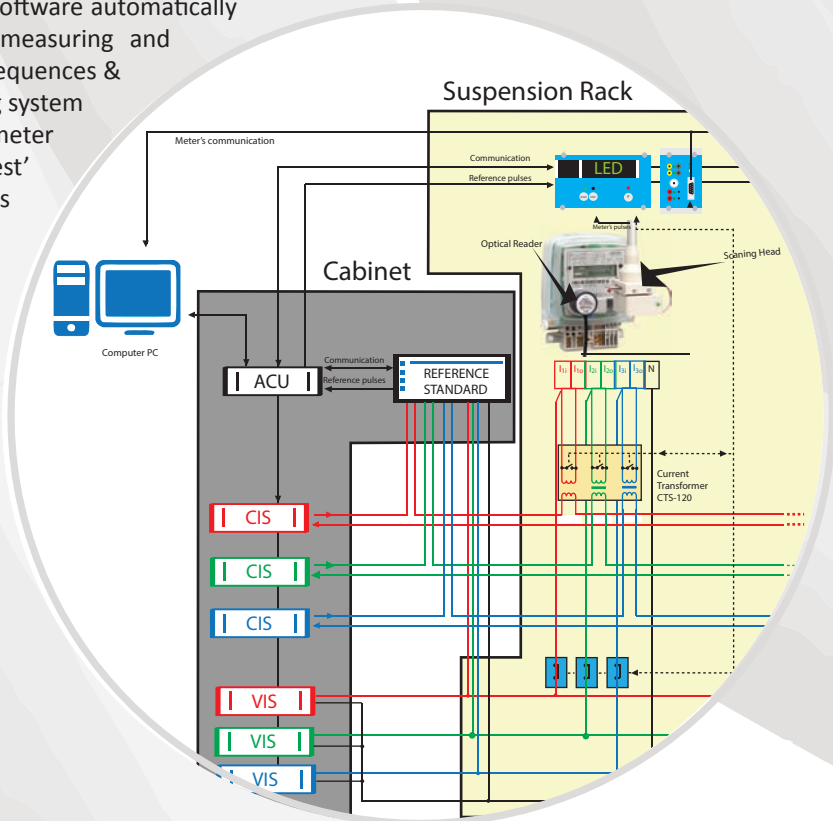
RADIAN RESEARCH COMPANY OVERVIEW

Radian Research, Inc. is a recognized world leader of Energy Reference Standards, Energy Meter Testing Systems, Current Transformer Testers, DC to AC Transfer Standards, and Automated Laboratory Energy Reference Systems. Radian provides both portable and primary energy reference standards that are absolutely unequalled in accuracy, stability and reliability. Radian customers typically consist of electric utility companies, energy meter manufacturers, energy meter test system manufacturers and national metrology institutes located throughout the world.



Operating Principle

The Windows-based software controls all components either directly or through an automatic control unit. The software automatically controls all components, monitoring, measuring and recording on the basis of prepared test sequences & meter type data. The ASTeL meter testing system employs the reference standard meter method. The error of 'meter under test' (MUT) is determined by counting impulses generated by the reference standard within gating time determined with the photoelectric scanning head, which detects the meter disc movement or with the LED flash of MUT. The test system is suitable for simultaneously testing meters with identical circuits & ratings but with different meter constants.





The ASTeL meter testing system is a fully automatic multi-position test system which performs the adjustment and calibration of single- and two- and three-phase energy meters simultaneously. Use of latest digital signal processing, high precision signal synthesis and quality makes the system suitable for testing a multitude of electric energy meters available in the market, from simple electromechanical devices to modern smart meters.

The system includes a power source, a reference standard, a meter suspension rack with stand controllers, scanning heads, isolating transformers, and Windows-based control software.

The system contains many useful features to test meters efficiently and safely, including “Smart Disconnection System”, which provides control of the voltage terminals and isolating current transformer for safe and fast removal of a defective meter while a test is in progress.

The modular nature of ASTeL allows for easy adaptation for a number of test positions, required precision levels and specific functionality. As well as wide range of accessories and options are available to best meet your specific testing needs.

The ASTeL system has multi-stage safety & protection, and control and monitoring system which accepts a wide range of mains voltages and effectively eliminate the need for an external voltage stabilizer.

Thanks to excellent parameters, high precision, great functionality and flexibility, the ASTeL system is widely used by electrical utilities, meter manufacturers, the National Metrology Institutes and other customers interested in the finest in electricity meter testing.



The ASTeL metering testing system is ideally suited for testing a wide range of electronic and electro-mechanical meters, as per IEC and other relevant standards and norms:

- ✓ Single-phase two/three wire active/reactive and apparent energy meters
- ✓ Two-phase two/three wire active/reactive and apparent energy meters
- ✓ Three-phase three/four wire active/reactive and apparent energy meters
- ✓ Direct connected meters with closed link and CT/VT operated meters
- ✓ Maximum demand meters
- ✓ Meters with multi-functional inputs & outputs & tariffs
- ✓ Reference standard meters

The system is designed to carry out the following testing and functional checks on meters as per IEC 62052-11, 62053-11, 21,22,23,24 and other relevant metering standards and norms:

- ✓ Pre-warming
- ✓ Accuracy test
- ✓ No-load (creep test)
- ✓ Starting current test
- ✓ Dial test (register test)
- ✓ Pulse input and output test
- ✓ Influence quantity test (voltage, frequency, harmonic distortion, etc.)
- ✓ Calibration of reference standard (to maintain the traceability)
- ✓ Calibration of reference standard having lower accuracy than employed reference standard

Power Source:

The power source offers:

- ✓ Wide range of output voltages & currents
- ✓ High accuracy & stability
- ✓ Fast setting
- ✓ Low distortion
- ✓ Compatibility with linear & nonlinear loads
- ✓ Harmonic generation
- ✓ High efficiency
- ✓ Easy replaceable voltage integrated source (VIS) & current integrated source (CIS)
- ✓ Multilevel protection system

The power source is designed to generate the AC current and voltage required for meter testing. The main components of the power source are:

- ✓ Voltage Integrated Source (VIS)
- ✓ Current Integrated Source (CIS)
- ✓ Controller Unit (ACU)



The power stage of the source (VIS & CIS) utilizes the PWM technology and is driven by an on-board DSP signal generator. The internal DSP-controlled digital feedback loops and advanced algorithms ensure quick setting, high stability and very low distortion in output current and voltage signals. The system allows users to set the phase angles and harmonics in each channel required for testing. The output voltage & current are independent from each other, isolated and free from mains supply.

An additional precise regulation system enables the power source to generate the low distortion signals even at wide range of load (resistive, capacitive, inductive or hybrid).

A multi-level protection system in the sources (VIS & CIS) protects them against overload, short circuit, and overheating, and makes operation of the device reliable and safe. The power source's automatic settings and adjustments make it a highly reliable device and guarantee continuity of work.

The source (VIS & CIS) is equipped with an isolated serial interface and can be operated by a PC or other controlling device (host). A number of sources can be synchronized and operated together to form a poly-phase system. The integrated source VIS & CIS are freely replaceable with other VIS & CIS without affecting the system, without re-wiring or a change of code switch.

The communication protocol is provided to control output settings as well as to access all internal registers.

The source components are designed for a 19" rack mounting system suitable for indoor laboratory applications.

The overall technical parameters of the power source are as follows:

No.	Description	Value
1	Output Phase(s)	1 - phase PS1 - xxyy 3 - phase PS3 - xxyy
2	Output voltage range (Phase - Neutral)	1 x 30 to 350 V 3 x 30 to 350 V
3	Output current range	1 x 1mA to 120 A 3 x 1mA to 120 A
4	Voltage output power for linear loads	400 VA xx=04 1200 VA xx=12 2600 VA xx=26
5	Current output power for linear loads	600 VA yy=06 800 VA yy=08 1600 VA yy=16 3000 VA yy=30 3600 VA yy=36
6	Frequency of the fundamental component	45 Hz to 65 Hz
7	Harmonics	Up to 20th harmonic preprogrammed in accordance to the standards + user programmable
8	Phase angle range (independently for each voltage and current signal)	0° to 360°
9	Resolution of output current/voltage adjustment	0.002%
10	Resolution of phase angle adjustment	0.001°
11	Resolution of frequency adjustment	0.001Hz
12	Stability of the output current	<< 50 ppm/min (T _{int} =5s)
13	Stability of the output voltage	<< 50 ppm/min (T _{int} =5s)
14	The accuracy of the output voltage/current adjustment	According to the accuracy of the Reference Standard*
15	The accuracy of phase angle adjustment	According to the accuracy of the Reference Standard*
16	The accuracy of frequency adjustment	0.001Hz
17	Total Harmonic Distortion (THD) of the output voltage and current	< 0.1% typical <0.3% max
18	Efficiency of the output power stages	> 85%
19	Protection	overcurrent, overvoltage, short circuit, open circuit, thermal, earth leakage
20	Operation indication & Failure diagnose	Voltage and current integrated source have status LED to indicate the operation status. In the event of a failure (internal) the same LED will blink/flash to indicate the causes of failure.
21	PF compensation of the mains connection according to EN 60555/IEC555	Yes

*Values are ensured by employing Reference Standard external closed - loop parameter regulations

Single Phase Reference Standard (RD-2x)

The RD-2x offers:

- ✓ High accuracy
- ✓ High stability
- ✓ Four quadrant measurement
- ✓ Negligible temp. effect on measurement
- ✓ Light weight



Three Phase Reference Standard (RD-3x)

The RD-3x offers:

- ✓ High accuracy and stability
- ✓ Versatility
- ✓ Light weight
- ✓ Negligible temp. effect on measurement
- ✓ Low input resistance of current circuit
- ✓ 3 nos. of programmable pulse input/output



The reference standard RD-3x is a four-quadrant three-phase measuring instrument that registers both forward and reverse energy flow and provides per phase voltage, current, power factor, power and energy (active, reactive and apparent) information.

The RD-3x is the lightest reference standard in the industry and available in 0.04%, 0.02%, 0.01% accuracy class. The worst-case accuracy specification includes the variables of stability normal temperature range (20 to 30°C), power factor ≥ 0.5 , traceability uncertainty and test system errors.

High stability allows it to be used for long periods without frequent calibration/ adjustment. The negligible effect of temperature on the accuracy makes it a versatile instrument suitable for use in laboratory and onsite testing, in a temperature range of -20 to +70°C.

Its low input impedance of the current circuit makes it unique to test the complete modern meter test bench having isolating current transformers without use of any additional compensated transformer. Thus maintaining traceability and finding the overall error of the test system becomes much easier and simpler.

The RD-3x has 3 pulse inputs so it can test 3 meters or reference standards simultaneously. The RD-3x has three pulse outputs which can be programmed for individual phase energy or total active, reactive apparent or other measurement functions. It also has an optional built-in computer with Windows CE and a color display with touch screen. Internal software runs the testing and analysis functions, and a power quality option adds valuable functionality. Details on its features and options are available in the catalogue.

Type	Worst accuracy in %	Typical Accuracy in %
RD -30/RD -20	0.04	0.01
RD -31/RD -21	0.02	0.005
RD -33/RD -23	0.01	Within traceability uncertainty

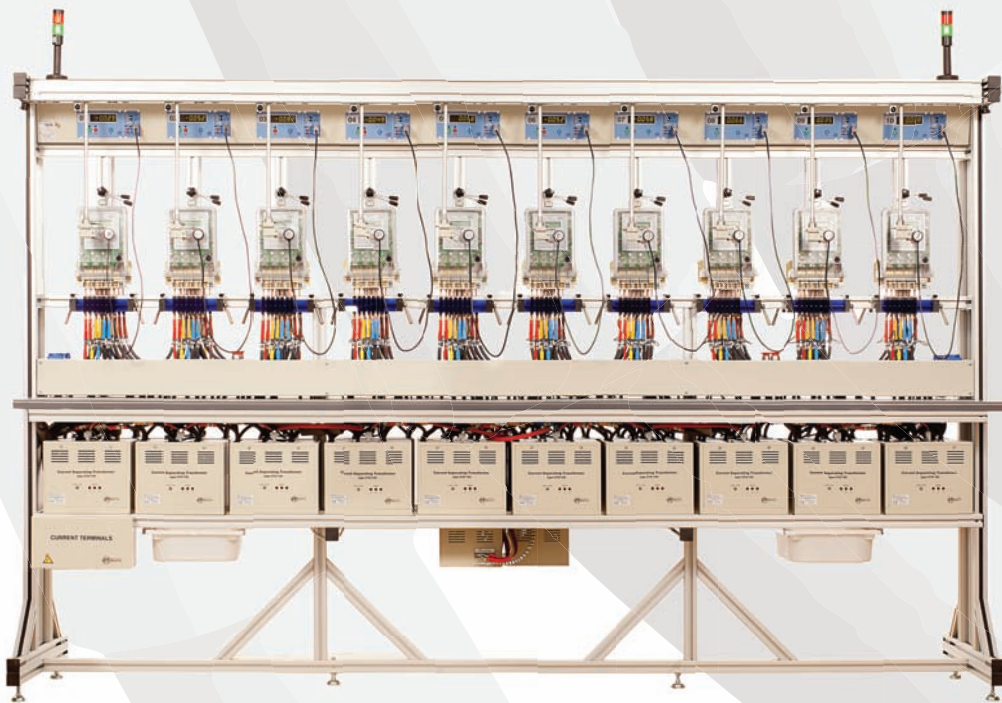
Rack

The rack offers:

- ✓ Stability for operator safety
- ✓ Option to install the isolating current and construction of light and rigid aluminum profiles
- ✓ Controller with keys & error calculator display on each position
- ✓ Relays for switching the test voltage on/off for the meter under test on each position
- ✓ Safety cut-outs
- ✓ Warning lamp



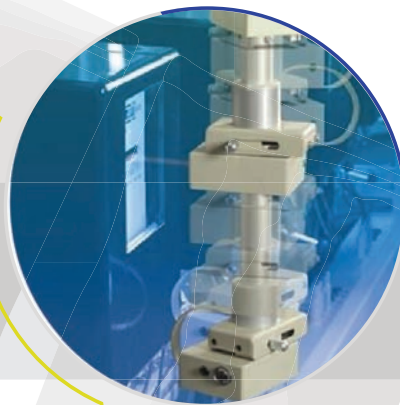
The suspension rack is constructed from light, corrosion-free and rigid aluminium profiles, so it is easy to assemble and disassemble. The standard version is available in 3, 5, 10, & 20 position options. Modular construction allows assembly for any number of test positions as per customer requirements. The SR is equipped with a photoelectric scanning heads and error calculator/indicator at each test position.



GS Photoelectric Scanning Head

The photoelectric scanning head offers:

- ✓ Readout of rotor marks and LED blinking
- ✓ Readout of 8 kHz modulated optical impulses
- ✓ Easy positioning
- ✓ Reliable operation under various ambient light
- ✓ Automatic switching operation between electro-mechanical and electronic meter sensing



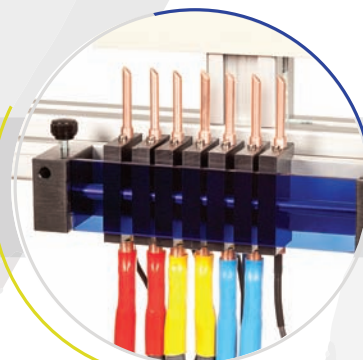
The GS-10 is suitable for sensing of both electro-mechanical and electronic meters, while the GS-20 is designed to sense the LED blinking of electronic meters only. Modern design allows for high operational efficiency and reliability under various ambient light conditions. The mechanical construction of the instrument allows for easy and specific positioning up/down, right/left, forward/backward as well as horizontal rotation.

Parameter	Model	
	GS - 10	GS - 11
Method of switching the operation mode	automatically by the system	manual switch
Electromechanical meters		
Rotor mark colour	Red, black	
Type of surface	Matte, shiny, knurled	
Sensitivity	3 level	
Electronic meters		
LED impulse colour	Infrared, red, orange, yellow, green	
8 kHz modulated light	yes	
Maximum frequency of input impulses	>2500 Hz	

Parameter	Model	
	GS - 20.1	GS - 20.2
LED impulse colour	Infrared, red, orange, yellow, green	
8 kHz modulated light	yes	
Maximum frequency of input impulses	>2500 Hz	
Sensitivity distance	0...100 mm	
Voltage supply	5V	10...30 V
Maximum supply current	15 mA	
Output	Open collector OC (max 30V/80mA)	
Dimension (H x W x D)	25 x 48 x 60 mm	

Quick Connection Device

Quick connection devices are used to achieve high testing efficiency and to avoid any connection mistakes. Various type of quick connection devices are designed to meet customer requirements for single-phase/three-phase connection flexibility.



Individual Stand Controller

- ✓ Clear legible presentation of result at each test position
- ✓ Information on the test current status
- ✓ Remote control of the power source
- ✓ Smart disconnection device
- ✓ Control of sensitivity of the scanning head
- ✓ Pulse input/output testing
- ✓ BNC input for Reference Standard testing



Application

The primary task of the Individual Stand Controller (IPO) is to receive the pulses from scanner, count and compare these pulses with pulses from reference standard, calculate and indicate the percentage error of the meter under test at each test position of the system. Additionally IPO perform the following tasks:

- ✓ Receive the data (related to meter under test) before starting the test
- ✓ Transfer the error results and data to PC
- ✓ Remote control of source directly from the controller's key board, in order to facilitate the load change-over during meter adjustment
- ✓ Smart disconnection system: This allows user to remove the meter safely while test is going on and no need of bypass jumper
- ✓ Communication with meter under test through RS232 and RS 485 universal serial port. Further extension to other standards with a dedicated adapter..
- ✓ Pulse input/output testing
- ✓ Status of the test displayed during test
- ✓ Remaining time display (in time dependent test)

The display is made of 7 segment LEDs. LEDs provide clear visibility, longer life, legibility in brighter light, and better reliability, as compare to LCD displays.

Technical Specification

Parameter	Value
Display (IPO-S)	6 nos. of 7 segmented LED Display, Height 14.2mm
Display resolution	User programmable, 1,2 or 3 digits after decimal dot
Key board in IPO-S	3 keys: RESET/START, STOP and one function key whose allocation changes depending on the test being performed
Maximum frequency from the Reference Standard	100kHz
Universal input/output	1 input for Scanning Head 1 input for internal Reference Standard 1 BNC input for external Reference Standard 2 SO pulse input 2 potential linked output
Communication with meter under test	RS232, RS485 (support DLMS & IEC62056)
Communication with the PC	RS422
Voltage ON/OFF control relay	Yes
Communication with Isolating Current Transformer CTS -120	Yes

CTS High-Precision Current Transformer

- ✓ Wide current range with typical accuracy 0.01%
- ✓ High output power
- ✓ Built in protection against open circuit and overload
- ✓ Smart disconnection system
- ✓ Easy mounting



High-Precision Current Transformer (CTS) enables testing of three phase closed link meters. The built-in electronic compensation system guarantees the excellent metrological properties in the whole current range with high output power. This property makes the device ideal to use also with CT/VT operated meters and single phase meters as well. Smart disconnection system allows user to remove the meter safely while test is going on and no need of bypass jumper.

Parameter	Model		
	CTS - 120 - 1	CTS - 120 - 2	CTS - 120 - 3
Working current range	3 phase (1mA ÷ 120A)		
Ratio	1:1		
Maximum output voltage @100A	1.2	0.8	0.5
Error	(Ratio error in % and phase angle error in min.)		
0.5A ≤ < 120A	≤± 0.01%, 0.3'		
0.1A ≤ < 0.5A	≤± 0.02%, 0.6'		
0.05A ≤ < 0.1A	≤± 0.03%, 1'		
Protection against open circuit & over load fault	Yes		
Working with open secondary	Yes		

PVT Multisecondary Voltage Isolating Transformer

- ✓ Typical accuracy 0.05%
- ✓ High power for each test position

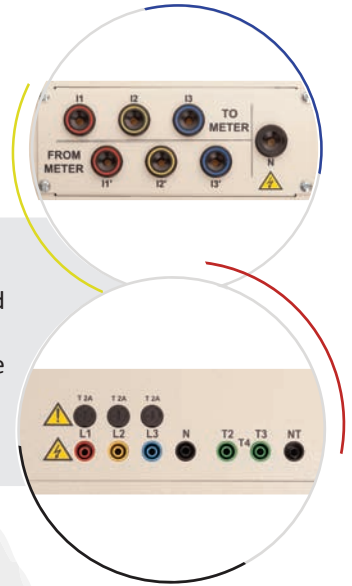
Multi-Secondary Voltage Isolating Transformer (MSVT) enables the testing of single phase closed link meters. High precision of MSVT is compulsory to maintain the basic principal of meter testing i.e. voltage and current to meter under test should be same as reference standard. Each test position will have separate voltage winding. User can test the meter with or without use of MSVT if required.

Parameter	Value
Nominal voltage	220/230/240
Voltage ratio	1:1
Number of secondary winding	Number of test position +1 for Reference Standard
Output power	20VA / per winding
Maximum error	≤ 0.1% ratio & ≤ 2 minutes phase angle error
Maximum variation between any two secondary windings	± 0.03% ratio error ± 1 minute phase angle error

Meter Connection terminal panel

Number of various voltage and current termination panels are available to provide:

- ✓ Quick & Safe connection
- ✓ Safety to operator , system & meter under test
- ✓ Voltage terminals are part of smart disconnection system, hence can be off and on from individual stand controller or PC
- ✓ Flexibility in managing different type and forms of terminal arrangements like BS and DIN
- ✓ Switching ON/OFF various tariffs
- ✓ Possible to simulate various tamper condition in single phase meters

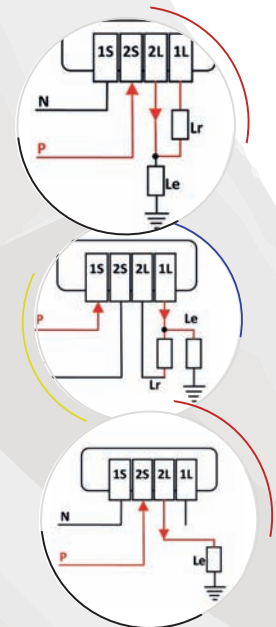


Testing of Single phase meter under tamper condition

Energy theft is a worldwide problem that contributes heavily to revenue losses. A large portion of these revenue losses can be recovered by installing electronic meters because, unlike electromechanical meters they can detect tampering conditions and bill properly in their presence.

ASTeL Meter Test Equipment makes it possible to test meters in the following tampering conditions:

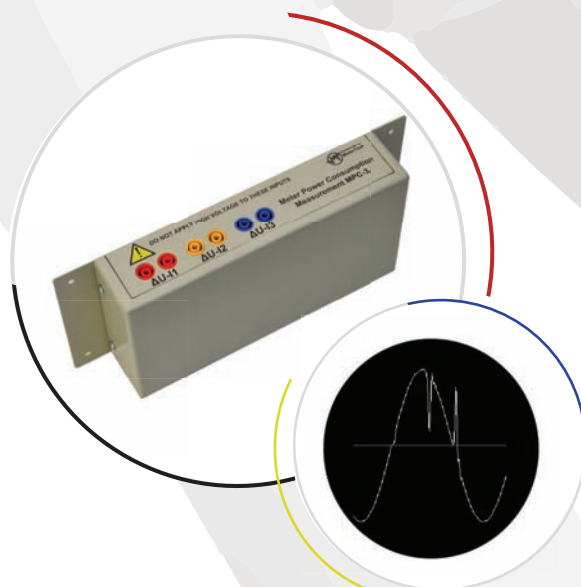
- ✓ Misconnection Condition
- ✓ Reverse Power Condition
- ✓ Earth Fault Condition
- ✓ Missing Neutral Condition



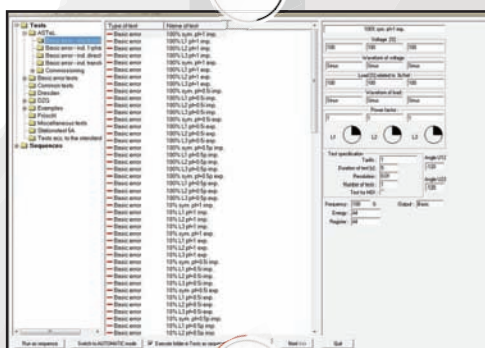
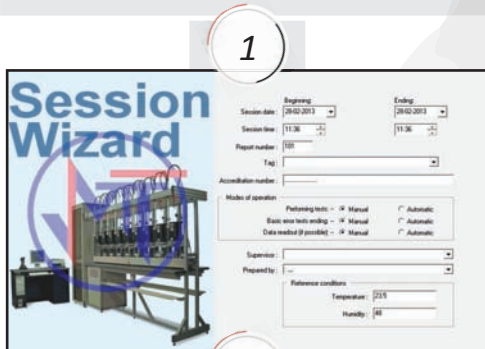
Meter Power Consumption Measuring Module

MPC-3 Meter Consumption Measuring Module is designed for measuring power consumption by voltage and current circuits of tested meters. The module is installed individually for each meter test position.

Power consumption results are available to PC Software.



The session wizard is a systematic well guided approach of meter testing which increases the testing efficiency and eliminates the mistakes.



Features

AsTest software is designed for efficient testing of a wide range of energy meters and relevant product ranging from simple meters to smart meters; can be easily operated by different level of expertise from beginner to expert while fully meeting test requirements.

User friendly graphical design, better visualization and the Session Wizard makes the whole process of the meter testing very easy and efficient. Furthermore AsTest software is extremely flexible offering the numerous possibilities to cater for the need of various users.

The Session Wizard

The Session Wizard is a very convenient tool for guiding the user throughout the whole process of meter testing, calibration and verification. It consists of five steps, which start with selection, defining the reference condition and general parameter, followed by meter type selection, test sequence selection, execution of tests and storage & printing of the result as the last steps. All necessary information will be displayed side by side on each step of test including meter information, test details, error results, pass/fail status and many others.

Libraries

Prior definition of meter types, tests, test sequence and other parameters is necessary for the correct, efficient and error free operation of the AsTest software. These definitions are arranged in libraries i.e. systematically arranged database, creating, amending and storing them is very easy and intuitive.

The Session Wizard requires that the libraries are prepared by the user. To simplify the user's task and better understanding the AsTest software is supplied with various preprogrammed library and examples, which can be modified by the user at any time or the user can create a new one.

The elements of the libraries may be additionally arranged and stored in folders, according to the user's preferences. The number of the library elements is practically unlimited. The software is supplied with definitions of some popular meters, basic definitions of tests and programs.

The following libraries are available in AsTest software.

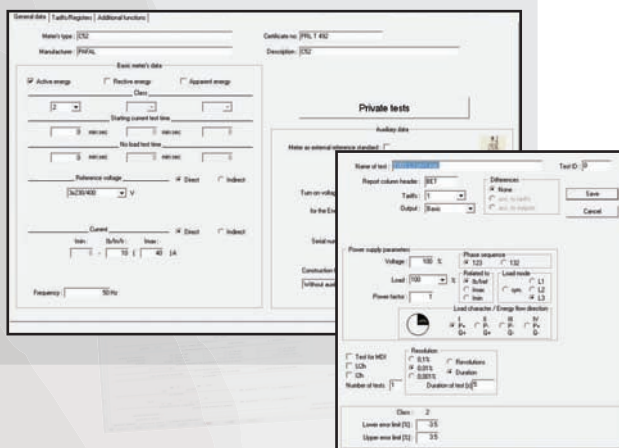
Meter Library

This enables easy defining of the meters, from the very simple induction ones to smart meters.

Tests library

This enables the users to define test conditions, type of test, acceptance criteria and includes all types of test elements which may be required for simple to complex meters testing

- ✓ Accuracy test
- ✓ No-load run test
- ✓ Starting current test
- ✓ Meter Constant test
- ✓ Maximum demand indicator test
- ✓ Pulse output test
- ✓ Tariff register test
- ✓ Influence quantity test
- ✓ Pre-warming
- ✓ Dial Test (register test)
- ✓ Influence quantity test
- ✓ Calibration of Reference Standard



Tests Sequences

This enables the user to align and organize all tests in a systematic way to carry out the testing. The test sequence works in both automatic and manual mode.

Additional Libraries

AsTest has the following additional libraries useful in performing the various testing and administration related tasks

Library of waveform offers the possibility to define the waveform shape (including harmonic order, amplitude, phase angle, and sub-harmonics) of the voltage and current output signals. This can be used in the tests element for influence quantity tests.

Library of users allows defining the various rights and authorisation for the users.

Library of supervisor finds its application in case regulation required that verification/legalisation process need to be performed in the presence of designated authority of measurement office.

Visualisation

AsTest offers the numerous possibilities to visualise the test parameter (Set value and actual instantaneous electrical values)

- ✓ Panel meters
- ✓ Vectorial diagrams
- ✓ Waveforms curves
- ✓ Harmonic Display
- ✓ Test Results
- ✓ Accuracy trend
- ✓ Reports
- ✓ Statistics

Additional functionality

AsTest offers the following additional functionality:

- ✓ Archiving the data
- ✓ Search function based on various criteria like meter type, serial number, manufacturer, User, repairer and dates etc.
- ✓ Report creation using easy and flexible module for individual meter or complete lot. User can use the readymade template or create his own template using multilevel arrays.
- ✓ Automatic adjustment of meters (for manufacturer)
- ✓ Export data to: xls,txt, xmls

Optical port reader

The optical port reader IEC 1107 (IEC 62056) is a device enabling communication between any type of electronic meters equipped with a port according to IEC 62056 standard and reading device equipped with USB 2.0 /RS 232 port.



Hand-Held Terminal

Wireless portable terminal facilitates data collection from the meter under test during the tests. The data may be read from the meter and entered into the terminal memory using integrated keyboard or a laser barcode reader. The docking port provides connection to a computer as well as fast and convenient data transmission. One terminal may be used for servicing a number of the meter test systems which are equipped with docking ports.

The SYMBOL[®] wireless hand-held terminal is a portable computer working under control of the Windows[®] CE operating system. The high resolution, touch LCD display with backlight makes operation of the unit very easy.

Fast and convenient entering the data is facilitated by a humidity-resistant keyboard with 28 or 38 keys or an alpha-numeric keyboard with 48 keys.

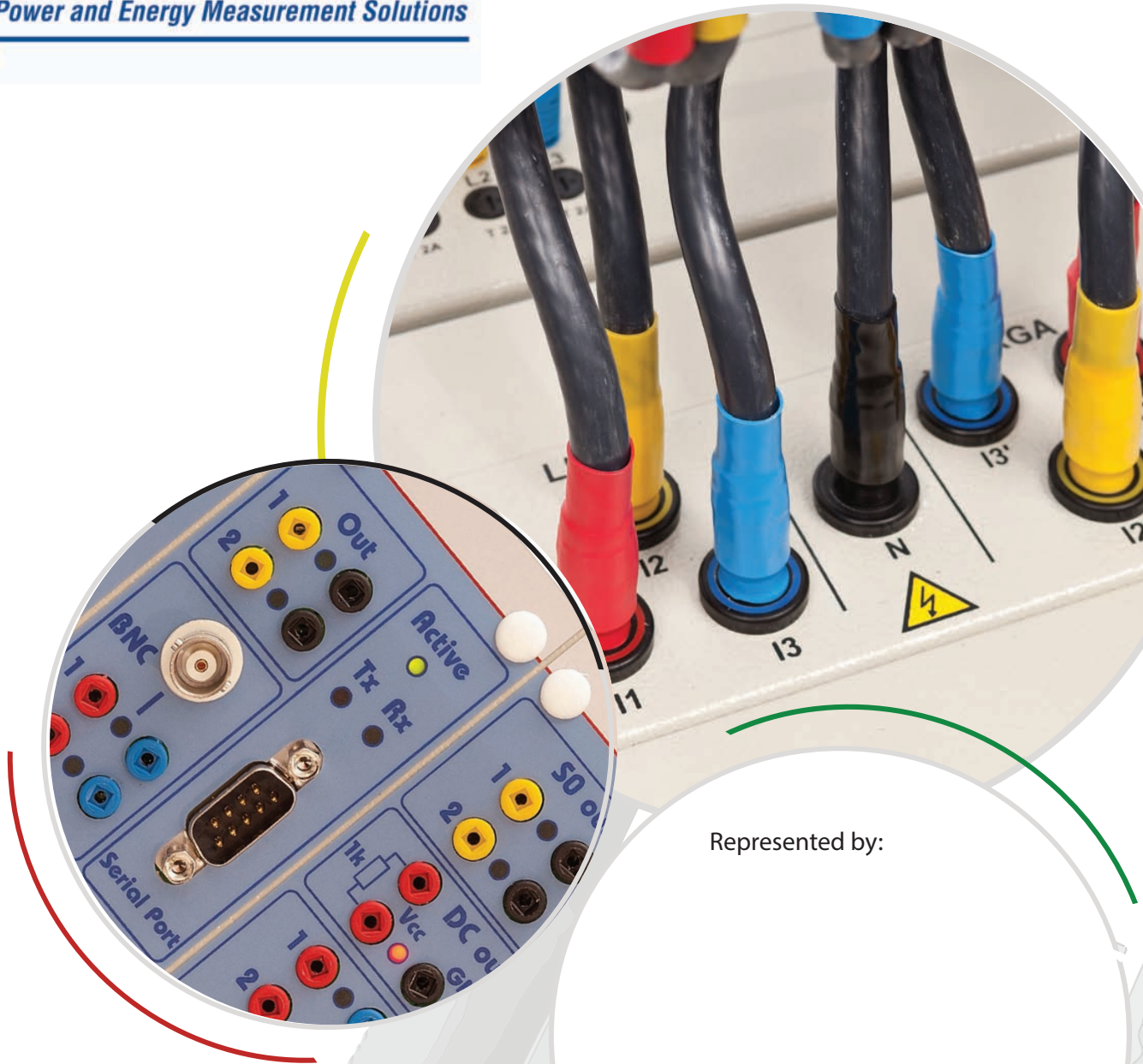
The optional laser barcode reader significantly accelerates the operations of data collecting and makes the work far more effective. The rotating laser scanner head enables quick adjustment for left-handed as well as right-handed people.



Notes:

RADIAN

Power and Energy Measurement Solutions



Represented by:

Radian Research, Inc.
3852 Fortune Drive
Lafayette, Indiana 47905 USA
Ph: 765-449-5500

www.radianresearch.com