Universal meter test system for simultaneous testing of 4 single/three phase energy meters
(ASTeL 3.24-4 type)

Technical offer

Offer no. 2019/KAL/ASTeL

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PT CETTA ENERGI MANDIRI

Manufactured by

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1 Introduction

The ASTeL 3.24-4 meter testing system is a fully automatic multi-position test system, which performs the calibration and verification of three/single phase energy meters. The offered system consists of:

- Power source Three Phase Calibrate Test Bench
- Meter suspension rack
- Laptop with software which is controlling the whole system

The offered system is fully compliant with the IEC 60736 standard and is suitable for testing meters according to the following standards:

- IEC 62052-11 and IEC 62053-11, -21, -22, -23, -24
- EN 50470-1, EN 50470-2, EN-50470-3 (standards harmonized with Measuring Instrument Directive 2014/32/EC)
- Low Voltage Directive 2006/95/EC and subsequent amendments

This means that the offered system can be used to test the following types of meters:

- Single phase two/three wire active/reactive/apparent energy meters (static and electromechanical)
- Three phase three/four wire active/reactive/ apparent energy meters (static and electromechanical)

The offered system is designed to carry out the following tests and functional checks:

- Accuracy test in all four quadrants (active, reactive and apparent energy)
- No-load test (creep test)
- Starting current test
- Register test (dial test)
- Meter constant test
- Pre-warming

The test system is suitable for simultaneously testing meters with identical circuits & ratings but having different meter constants.

1.1 *Operating principal and system arrangement*

The error of the meter under test (MUT) is determined by counting pulses generated by the **reference standard meter** within gating time defined by the pulses of the MUT. The later pulses can origin from:

- photoelectric scanning head which can detect mark on the meter disc, LED flashes and simulated mark on LCD
- low voltage outputs of the MUT

Implementation of the method can be achieved with the three phase meter test equipment of ASTeL 3.24-4 type. The offered solution comprises:

- Three Phase Power Calibrator and Tester:
- Meter suspension rack SR-3, suitable for mounting of 4 three/single phase meters; each position is equipped with:
  - Individual stand controller IPO-S with local display and keyboard
  - Photoelectric scanning head GS
  - Voltage connection panel IPOD-D
  - Leads and cables
  - Quick connecting device with accompanying top fixing device
- Software control system
- Laptop

All components of the proposed system are controlled by the Windows© based Astel software software which also performs additional tasks as monitoring, measuring, recording, visualization and archiving data. The software also allows for defining meter type, tests, test sequences, printing reports, exporting data etc.
Details of each component are explained in the next chapters.

2 Technical details of the components in ASTeL type system

2.1 FS - 305 - K Power Source

New generation of Three-Phase Power Calibrator with many easy to use functions for automatic calibrating and testing all type of measuring instruments and power engineering devices.

- Equipped with electronic phantom load power source, assuring high stability, security and large output capacity
- Advanced functions but easy to used
- Manual operations and fully automatic procedures for calibrating and testing
- Professional service and support (it doesn't matter if you have a complex or trivial issue)
- Automatic adjustment of current measurement range.

Advanced functions:

- automatic error calculation of calibrated or tested devices
- programming voltage and current harmonics with magnitude and phase
- setting interharmonics and shapes like phase fired, triangle and burst
- power quality programming like dips, interruptions, swells, shocks, flicker, fluctuations and ramp signals

Technical specification of phantom load power source:

Normal operating conditions

Operating temperature	-10 --+45 °C
Relative humidity	0 -- 85 %
Total power consumption	800 VA
External magnetic field	≤0,03 mT
Mains power supply	220VAC ± 10%
Accuracy	0.05%

Technical Parameters

Voltage output	
Output range (P-N)	3x (30V – 400V)
Output power (Max.)	3x100VA
Resolution	4mV
Stability	≤ ± 0.03%/ 150 s
Load regulation rate	≤ ± 0.01%
Distortion factor	≤ ± 0.2% (linear resistance load)
Current output	
Output range	3x (10mA – 120A)
Output power (Max.)	3x150VA
Resolution	0.02mA

Stability	≤ ± 0.03% / 150 s
Load regulation rate	≤ ± 0.01%
Distortion factor	≤ ± 0.2% (linear resistance load)
Phase output	
Output range	0 -- 360°
Resolution	± 0.01°
Frequency output	
Output range	45Hz – 65Hz
Resolution	± 0.001Hz
Physical description	
Dimensions (W x D x H)	425 x 364 x 226mm
Weight	Approx. 35kg

FR-305-K three phase reference meter, 0.05 class (optional item)

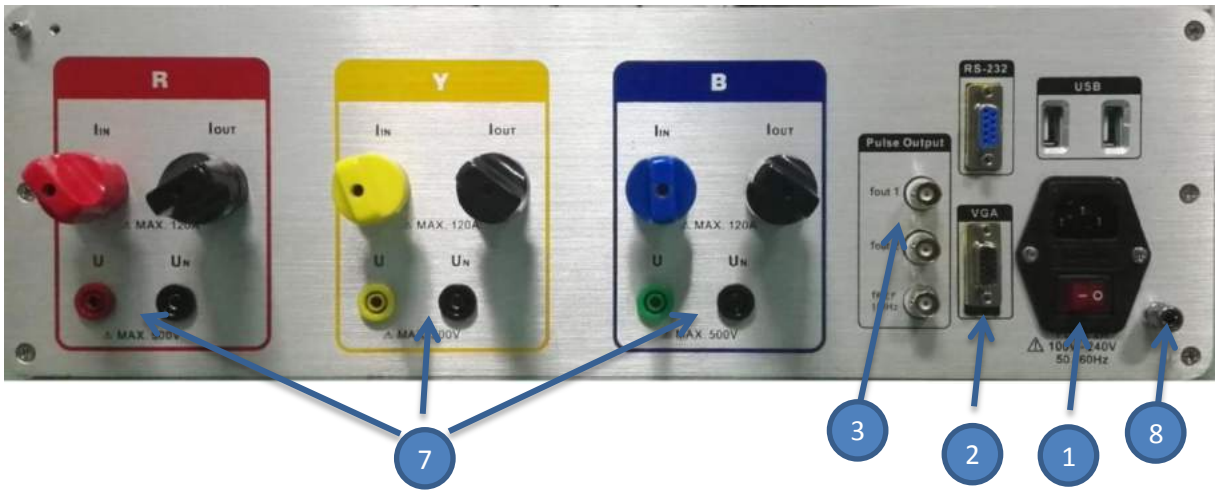
The FR-305-K Three-phase Electricity Reference Standard is a lightweight, compact package while providing a high level of accuracy through design innovations. The design of Reference Standard is based on advance special Analog to Digital Signal Conversion (ADC) combined with high precision compensated voltage & current sensors and DSP Techniques. These advancements provide a high degree of flexibility including simultaneous multifunction measurement and harmonics analysis.

The FR-305-K is especially suitable for testing of energy meters and low precision reference standards. The device offers the following features:

- High precision measurement accuracy over the wide voltage and current measuring ranges.
- Suitable for laboratory and field application.
- Single low impedance of current input, which allows it to use for testing of meter test bench with Isolating Current Transformers.
- Auto ranging.
- Long term stability.
- Two number of pulse outputs which can be programmed by user for active or reactive energy and with any constant.
- Four Quadrant Measurement.
- Harmonic measurement.
- PC Support via serial RS232 communication port.

S.no	Parameter	Specification
	General	
1	Auxiliary Power	100-240 V @50/60 Hz, <55VA
2	Operating temperature	-15° C to +40° C
3	Storage temperature	-10° C to +70° C
4	Humidity	0% to 95% non-condensing
5	Frequency	45-65 Hz
6	Warm-up time	5 Min
7	Dimension	44.45 x17.2 x 13.1 cm
8	Weight	8 kg
9	Isolation	Complete inputs/outputs/power/case/control
10	Dielectric Withstand	2 kV 50 Hz, 60 second
11	Surge Withstand	As per IEC 61326
	Metrological Parameters	
12	Voltage Measurement Range Accuracy (worst case) Long term stability Temp Coefficient	3 Phase 10 - 450 V < 0.025% < 0.001 % / √Month < 0.0008 % / °C
13	Current Measurement Range Internal range	3 Phase 1mA to 120 A <100mA 100mA –1A 1A –10A 10A – 120A

	Accuracy (worst case) Long term stability Temp Coefficient	< 0.025 % (1mA -- 50mA) of the measurement range's final value < 0.025% (50mA -- 120A) of the measured value < 0.002 % / √Month < 0.0008 % / °C
14	Phase angle Range Accuracy	 0 to 360° 0.01°
15	Frequency	45-65 Hz
16	Harmonic measurement	Up to 59th
17	Power/Energy (Active, Reactive) Accuracy Long term stability Temp Coefficient	(range 10-450V, 50mA- 120A) < 0.05% < 0.003 % / √Month < 0.001 % / °C
18	Frequency Output 1, 2 Output frequency Output level Pulse width	Freely programmable constant for active or reactive energy < 1MHz Low level <=0.4V,high level>=2.9V (max. 5V) > 0.5µs
19	Current Input	Thread 8mm
20	Voltage Input	Banana 4 mm
	Others	
21	Display	Touch Screen, Back Lit, colour LCD (optional)
22	Communication	RS232, 9 pin
23	Monitor VGA	DSUB 15
24	USB	Two USB connectors for mouse/keyboard or FLASH memory for upgrading the firmware



ID	Name
1	Auxiliary Power Supply Terminal
2	VGA monitor output
3	Frequency Output 1 and 2

ID	Name
4	USB connectors
5	RS 232 Communication Port
6	Current circuit terminal
7	Voltage input terminal
8	Guard - Chassis Ground for grounding of device

Measurement Principle

The measurement principle is based upon the fundamentals of a high-speed charge-balance integrating analog to digital signal converter. MeterTest implemented its own analog to digital converter in the family of standards which are specifically designed for power measurement with accepted metrology parameters. In order to measure power and energy with high accuracy and wide bandwidth, extensive requirements must be imposed on the converter.

By designing an analog to digital converter specifically for power and energy measurements, MeterTest is able to reduce many errors associated with commercial A/D circuits. Gain error, charge timer resolution, signal to noise ratio and signal distortion were major areas dealt with and improved in development

Output Stage

The FR-305-K's output stage and provides pulse outputs for the selected measurements. Computer control, with MeterTest software, allows for customization of output information, such as programmable pulse output constants.

Voltage & Current Input

The voltage and current inputs are completely auto ranging – a design feature. The voltage and current inputs consist of a toroidal auto ranging electronically compensated transformer which provides superior immunity to stray fields and the electronic compensation eliminates practically all the transformer error.

Pulse Output

The FR-305-K Pulse Outputs consist of BNC connectors labeled 1 and 2. These outputs are open collector. The factory default setting is Output 1 = Watthours, Output 2 = VARhours. However all three outputs are programmable by the customer.

Serial Port Communication Terminal

The communications terminal is interfaced via a DB-9 connector. Through the use of this terminal, a myriad of capabilities present themselves. Not only can each FR-305-K software package be utilized, the FR-305-K can actually be re-calibrated through this terminal.

USB Port Communication

The USB ports are additional high-speed communications ports. The USB ports enable connecting the external mouse or/and keyboard. Also their function is the upgrade of software by plug in properly formatted flash memory.

2.2 *Meter suspension rack SR-3*

The meter suspension rack SR-3 is constructed from light and rigid aluminum profiles, easy to assembly, disassembly and transport. The proposed system consists of one single sided rack, suitable for mounting of 4 Single/Three phase meters. Each test position is equipped with:

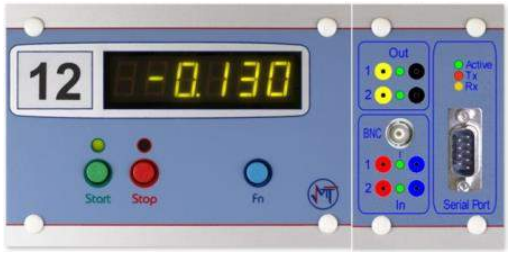
- Individual stand controller IPO-S with local display and keyboard
- Multifunction photoelectric scanning head GS-10 for electromechanical and electronic meters
- Voltage connection panel IPOD-V
- Quick connectors and top fixing device QFD-3
- Leads and cables

The following items will be also installed for operator safety and convenience:

- One emergency stop switch and additional one installed on the power source fuse bar
- Warning lamp to indicate whether test voltage is ON or OFF at the test terminals & auxiliary sockets

2.2.1 Individual stand controller IPO-S

The Individual Stand Controller **IPO-S** is responsible for the following tasks:



- Performing test on the basis of pulse received from tested meter and reference standard.
- Display the test status, accuracy test result and remaining time in case of time dependant tests
- Pulse counting & pulse output testing
- Transferring data to the host computer.
- Equipped with the local keyboard (start/stop and Fn button) it enables remote control of the power source
- Blocking and unblocking the test position (also known as disable the particular test position)
- Stop the test voltage for the test position
- Communicating with meter under test by means of serial port as per IEC 62056-21 (old IEC 1107) (in standard version RS-232 and RS-485 ports are available).

The 7 segment six LEDs are used to provide clear visibility, longer life and better reliability. Further tasks are explained in detail as below

2.2.1.1 Test performance

It is a basic function of the controller. The controller performs the tests independently. Before performing them, it receives data related to the test parameters and the information which inputs/outputs of the meter are to be used. The tests results are presented on the local display and also transferred to the host computer. During the calibration and for possible intervention inside the meter, the test may be withheld (the voltage to the meter is cut off) and/or reset/resumed and/or repeated using the controller keyboard.

2.2.1.2 Pulse inputs/outputs

The controller has the possibility of operating simultaneously a number of impulse outputs of the meter under test and controlling its inputs (e.g. tm/te).

Proposed configuration of the IPO-S stand controller:

No	Description	Value
1	General features	
1.1	Display	7-segment 6 LED display
1.2	Display height	14.2 mm
1.3	Number of characters	**6**
1.4	Display resolution	X.X %, X.XX % or X.XXX % (user programmable with the system software)
1.5	Keyboard	3 keys: RESET/START, STOP and one function key whose allocation changes depending on the test being performed
1.6	Photoelectric scanning head input	1
1.7	Input for reference pulses	1
1.8	Maximum frequency from the reference standard	100 kHz
2	Universal inputs / outputs	
2.2	Pulse input (BNC connector) — potential linked, open collector or potential free contact are acceptable; — maximum input voltage 27 V; — duplicated with Input 1	1
2.3	Potential linked outputs — 24 V, 50 mA electronic safeguard — can handle S0 inputs	2
3	Communication with meter under test	
3.1	Number of serial interfaces	1
3.2	Interface type	RS-232, RS-485
4	Interface	
4.1	Communication with the PC	RS-422
4.2	Voltage on/off control relay	Yes

2.2.2 Photoelectric scanning head GS-10

The scanning head is suitable for sensing of marks from electromechanical meters and LED blinking of electronic meters. The modern design allows to operates reliably under various ambient light conditions. Operational modes are changed automatically.

The mechanical construction of the instrument allows for very easy positioning up/down, right/left, forward/backward and rotating around the vertical axis. All scanning heads installed at one side of the suspension rack can be easily moved forward/backward with one hand only.

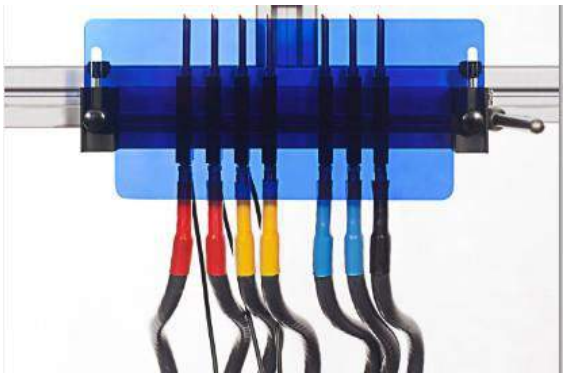
Technical details of scanning head is as follows:

No	Description	Value
1	General features	
1.1	Automatic mode selection	Yes
2	Electromechanical meters	
2.1	Mark colour	red, black
2.2	Type of surface	mat, shiny, knurled
3	Electronic meters	
3.1	LED impulse colour	infrared, red, orange, yellow, green
3.2	8 kHz modulated light	yes
3.3	Maximum frequency of input impulses	> 2 500 Hz

2.2.3 Quick fixing device QFD

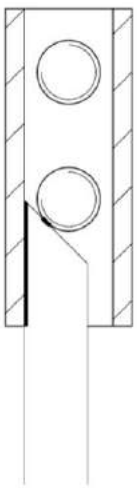
The quick fixing device QFD is a mechanical device which allows for very easy and quick installing the meters for tests and enables easy reorganization of the current pins outlay for the requirements of different standards: DIN, BS, IEC, ANSI and others. The pins are made of hard copper alloys and connected with flexible copper wires, which ensures durability and reliability for many years.

Together with the quick fixing device, a suitable adjustable top clamp device is provided. The top clamp device is helpful during installation of the tested meter on the position. With its help, hanging the meter can be done very quickly and firmly, providing a suitable pressure of the quick fixing device QFD pins to the current terminals of the meter.

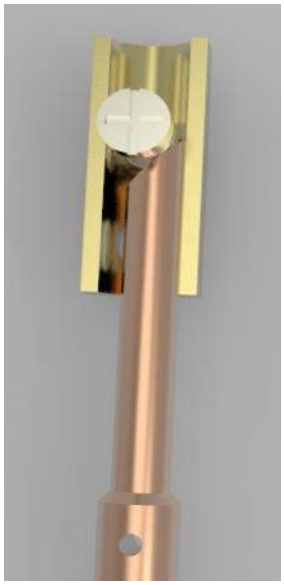


2.2.4 Contacting system

The QFD Quick Fixing Device is a mechanical device which allows for very easy and quick installing of tested meter. The pins are made of hard copper alloys and connected with flexible copper wires, which ensures durability and reliability for many years. Dimension, size and shape of the pin is related to particular tested meter terminal box. Dedicated design of the pins provide properly connection for any energy meter.



Basic and fundamental feature of proposed system is to carry out tests at all allowable load conditions without a necessity of screwing the current pins. A unique solution of chamfered current pins is used in order to obtain high performance and maintain the required, very high accuracy of the whole system. The solution originates from the past company's experience as well as from the customers all over the world.



Both drawings are presenting a cross section through the meter terminal box. The chamfered pin placed in the terminal box is automatically pressed against the side, thereby increasing the contact surface of the meter under test with current pin. The solution does not require screwing the current pins even at high loads and considerably increases the speed, efficiency and convenience of operation.

The solution, in opposite to the traditional ones, ensures larger contact surface

what results in lower resistance, lower voltage drop and thus lower power losses and lower heat generation. Traditional solutions may lead in extreme case to excessive heating of the terminal box and eventually meter damage and melting.

Lower contact resistance and thus lower voltage drop is a feature particularly important in the case of using the Current separating transformers CTS. The solution prevents the CTS from being overburden and thus promote smooth meter testing even at maximum currents.

2.2.5 Connection panel IPOD-V

The connection panel IPOD-V is the element of the rack, where the terminals for test voltages are situated. The panel is installed on each position of the rack and is individual for each tested meter.

Terminal arrangements

Description of panel items

T 2A	Fuses protecting voltage circuits
L1-L3	Test voltages
N	Neutral

The test voltage circuits are protected with fuses and they are equipped with relays for switching the voltage on and off, controlled through an IPO-S Individual Stand Controller and provided individually for each tested meter. The applied technique of zero-crossing switching totally eliminates the possibility of generating interferences during switching. The relay is necessary to put meter's rotating plate in the mark-in-front position for the starting current test and the no-load run test automatically (for electromechanical meters).

2.2.6 Leads and Cables

A set of wires for each position contains:

Voltage circuits

1 red wire for L1, banana plug OR crocodile type connector
1 yellow wire for L2, banana plug OR crocodile type connector
1 blue wire for L3, banana plug OR crocodile type connector
1 black wire for Neutral, banana plug and cooper alloy needle pin

Current circuits

1 red cable for current connecting
1 yellow cable for current connecting
1 blue cable for current connecting

Also included a current wire to bypass the positions which are not under usage during the testing process

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3 Terms of delivery and payment

As defined in commercial part**.**

3.1 *Warranty*

MeterTest Sp. z o.o. warrants that the goods to be supplied under the contract are new, unused, of the most recent or current specification and incorporate all recent improvements in design and materials. The Warranty shall also warrant that the goods have no defect arising from manufacture, materials or workmanship or from any act or omission of the customer that may develop under normal use of the goods under the conditions obtaining in customers country.

Warranty shall not cover faults or defects arising due to any misconduct, abuse, rough handling with equipment or misuse, wrong operation of equipment or abnormal use or due to operator's mistake.

Warranty does not include the normal wear & tear, drift, which may occur due to normal physical properties of components and also does not include the periodic calibration which may be required by local rules, and also does not include the consumable items like printer cartridge, paper stationary, fuses etc.

MeterTest Sp. z o.o. warrants that any item that fails within the warranty period will be replaced at our cost within a period of 30 (thirty days) from the date of failure.

MeterTest Sp. z o.o hereby confirm that the warranty period for the offered three phase power/energy calibration system equipment for electronic and electromechanical electricity energy meters is **1 years** from the acceptance of the equipment at the user facility

3.2 *Safety aspect*

Safety of the operator and equipment was the top priority during design and construction considering that these will be operated by the skilled and trained person. However we shall not be liable for any consequential or resulting injury or loss, damage of expense directly or indirectly from the mishandling of this product under any circumstances.

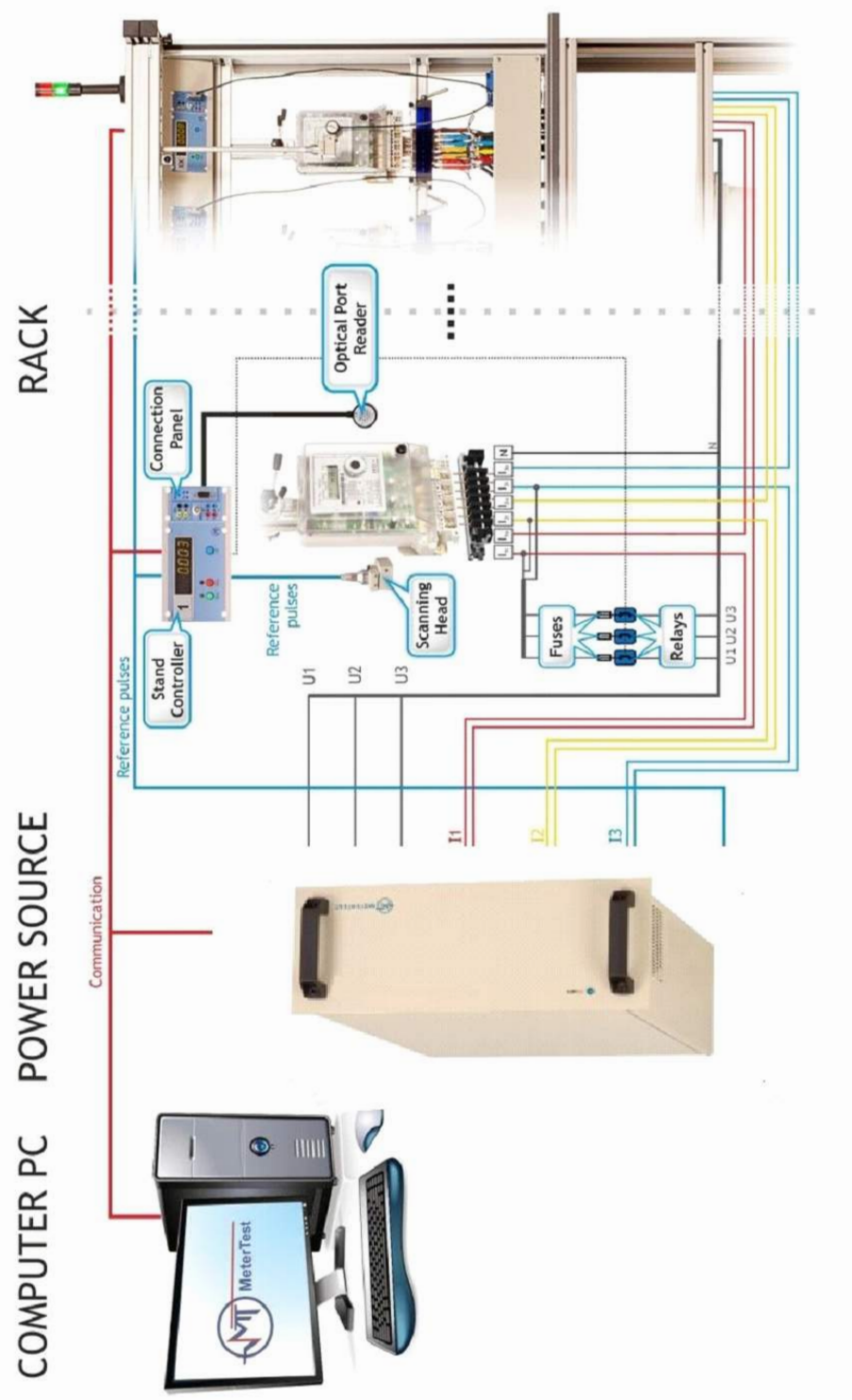
3.3 *Use of the software*

The user software developed & supplied by us for controlling the test system, is at the customer's disposal to operate test equipment. The software remains as our property, it's prohibited to copy or to transfer the software to other users. For other general software like Windows and operating system will be applicable as specified by the original manufacturer

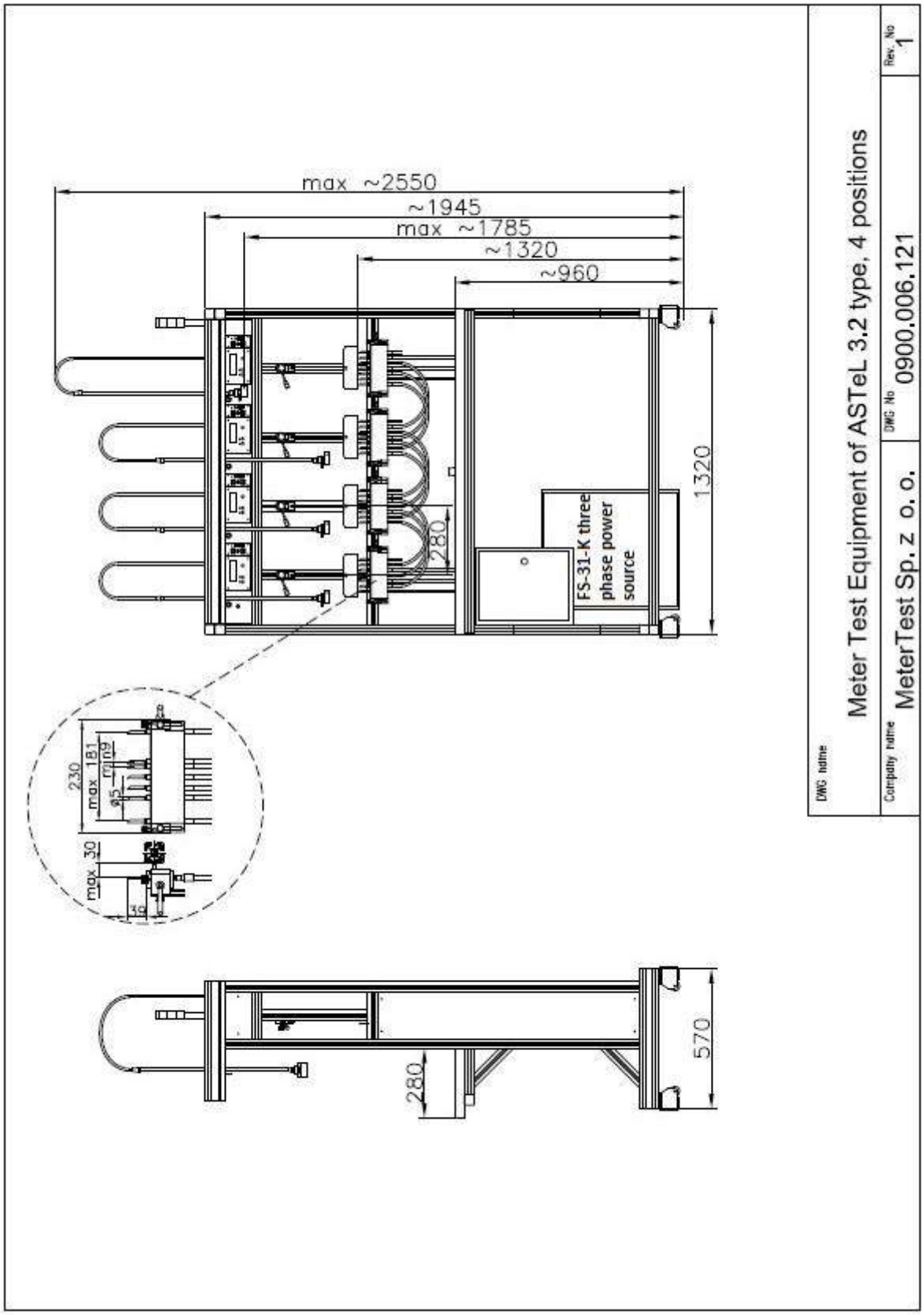
3.4 *Technical alteration*

The product is a continuous subject to alterations, improving the performance of the quoted equipment without information.

4 Appendix A: Arrangement of the three phase meter testing equipment



Drawing of the system



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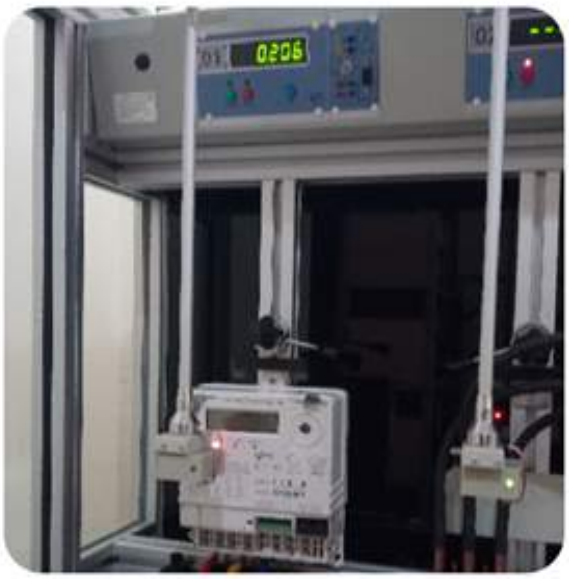
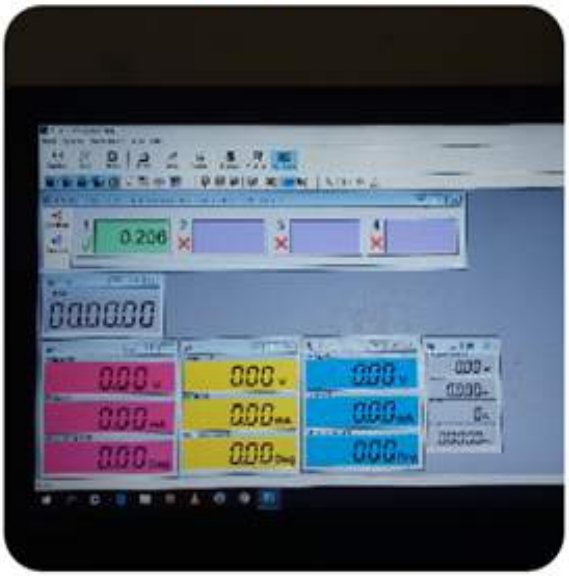
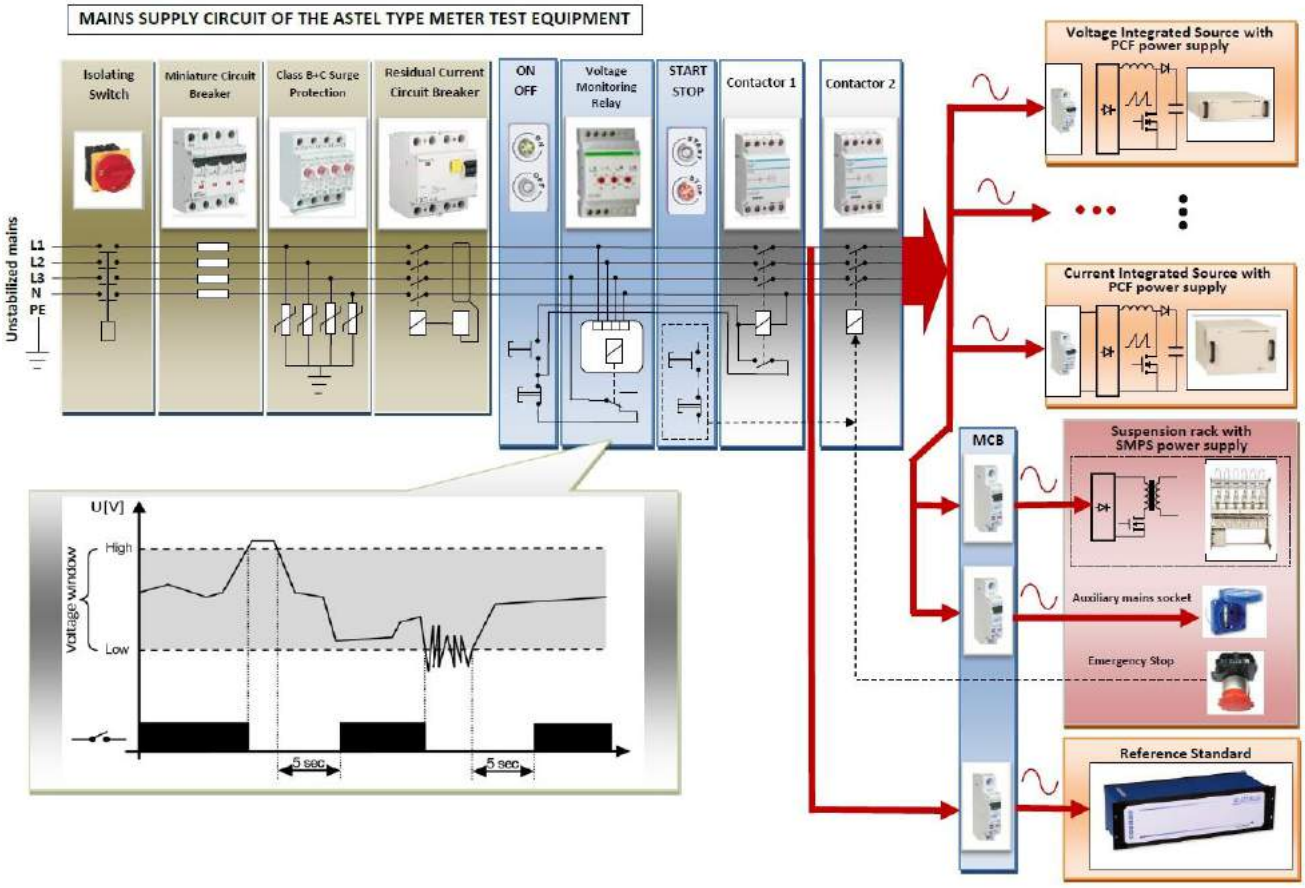




5 Appendix B: Mains supply protection system



The ASTeL meter test equipment is energized through a multistage protection and supervisory mains supply circuit. This allows operating on wide range of the mains voltage. This effectively eliminates need for an external voltage stabilizer.

The multistage mains supply circuit limits voltage range for supplying the system. The low and high voltage threshold is adjustable. The mains supply circuit comprises:

- Isolation Switch and Class B+C Surge Protection Device with supplementary Miniature Circuit Breaker.
- Residual Current Circuit Breaker.
- Under and Overvoltage protection system using voltage monitoring system
- Emergency stop (one on power source, and one on each side of meter suspension rack)
- Individual MCBs for each major component of the system such as VIS, CIS, reference standard, Rack, auxiliary circuit etc.

The ASTEL meter test equipment can be supplied from three or single phase mains. The illustration above shows the three phase mains supply.

6 Appendix C: Local, remote and factory support

REMOTE SUPPORT

The system offers remote support through Internet for maintenance and troubleshooting, hence in case of any hardware or software issue (or simple question), user is able to contact immidiately with service team.

In case of remote support, manufacturers service team, takes the control over user system. Majority of issues are solved thru remote support option.

Free of charge remote support option is being given to user for a lifetime of testing equipment, regardless of warranty period

LOCAL SUPPORT

Local support of testing equipment is provided by **PT CETTA ENERGI MANDIRI**

FACTORY SUPPORT

MeterTest Sp. z o.o., as a top quality manufacturer is also providing factory support. MeterTest Sp. z o.o. warrants that any item that fails within the warranty period will be replaced at the MeterTest Sp. z o.o. cost within a period of 30 (thirty days) from the date of failure.

MeterTest Sp. z o.o. commits to make available essential spares and other consumables needed for Testing system for Electricity Meters, for period of not less than 10 (ten) years

7 Appendix D: Warranty and essential spare parts

MeterTest Sp. z o.o., a company with registered office at 58-100 Świdnica, ul. Lukasinskiego 26/21, Poland, hereby confirm that the warranty period for the offered single/three phase power/energy calibration system equipment for electronic and electromechanical electricity energy meters is 1 year from the acceptance of the equipment at the facility.

MeterTest Sp. z o.o. warrants that the goods to be supplied under the contract are new, unused, of the most recent or current specification and incorporate all recent improvements in design and materials unless provided otherwise in the Tender. The Warranty shall also warrant that the goods in the Tenderer's bid have no defect arising from manufacture, materials or workmanship or from any act or omission of the Tenderer that may develop under normal use of the goods under the conditions obtaining in Indonesia

Warranty shall not cover faults or defects arising due to any misconduct, abuse, rough handling with equipment or misuse, wrong operation of equipment or abnormal use or due to operator's mistake.

Warranty does not include the normal wear & tear, drift, which may occur due to normal physical properties of components and also does not include the periodic calibration which may be required by local rules, and also does not include the consumable items like printer cartridge, paper stationary, fuses etc.

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MeterTest Sp. z o.o. commits to make available essential spares and other consumables needed for Testing system for Electricity Meters, for period of not less than **10 (ten) years**.