



creating new ideas...



GENERAL PRODUCT CATALOG

SUPER SVC



Patent no: TR2016/12146B



Measurement



Compensation



Software



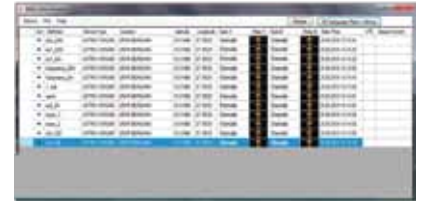
Protection



Control

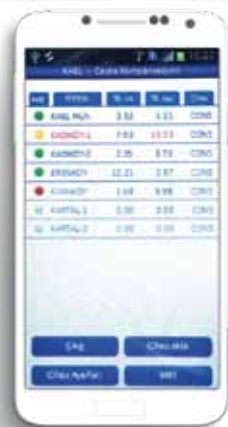
- ▶ All products & software belong to KAEL
- ▶ No imported products of component.
- ▶ Kael Factory based manufacturing.
- ▶ Export operation in over 52 countries.

Kael Astro
supplied



The interface allows to program Astronomical time switch produced by Kael via the Con - 3 USB Infrared Data Transmitter.

Kael
Compensation
mobile app
supplied



Monitoring of multiple devices.
Used with CON - 5 device.
Easy to install and use.



* Compatible with Android operating system mobile phones.



CONVERTERS

Con-1



RS485-USB converter

Con-2



RS485 - Ethernet converter

Con-3



Patent no: TR 2012 01075 Y

USB-Infrared converter
(for Astronomic time relay)

Con-5



RS485 - Ethernet converter
(for smart phone app)

Product type

Patent

No: TR2016/12146B



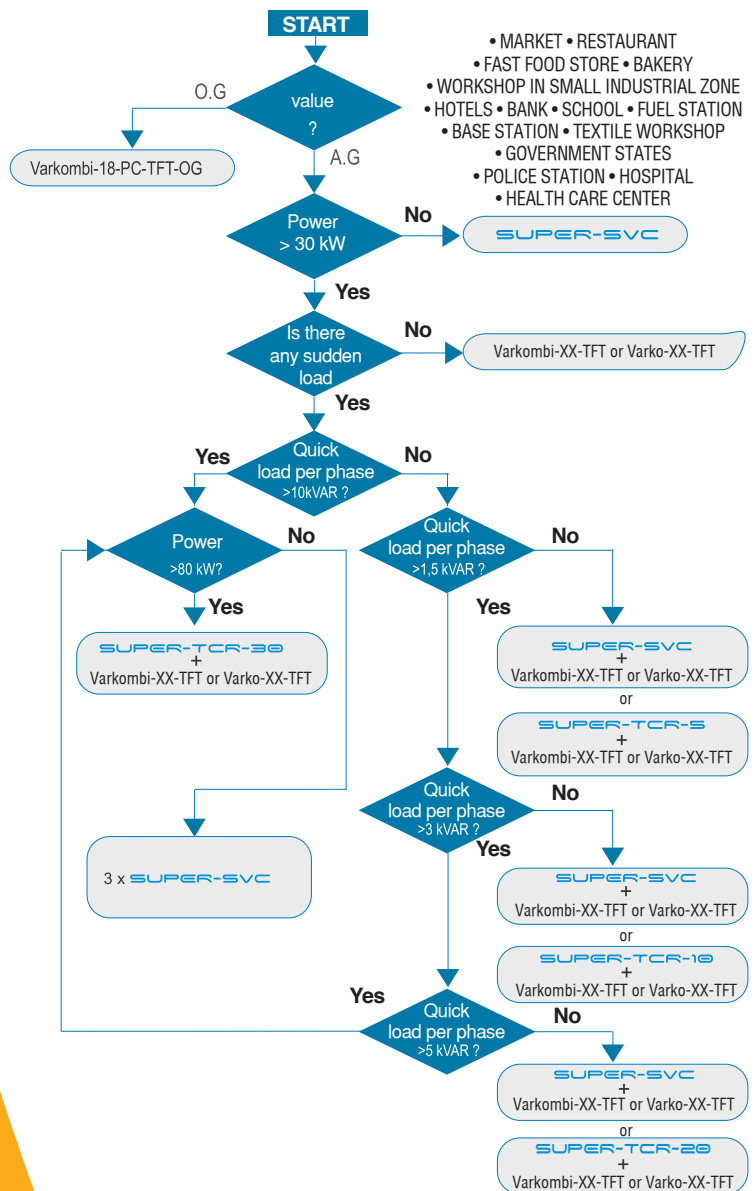
SUPER SVC



SUPER TCR

- Plug and Run
- Unique and ideal design
- Ultra Fast
- User Friendly
- Provides the most economical solution by connecting in parallel to the system. Saving place and money because of no need contactors and fuses for steps
- Bidirectional Compensation with SUPER SVC and inductive compensation with SUPER TCR
- Automatic Learning of Reactor and Capacitor Power
- Automatic learning of current directions
- 5 - 20 ms response time
- Enough for low-power facilities

ULTRA FAST DYNAMIC COMPENSATION



SUPER-SVC

- To prevent the thyristors and capacitors from deteriorating, 3x32 Amper for SUPER-SVC with 4,7 kVAR capacitors, 3x20 Amper for SUPER-SVC with 2,7 kVAR capacitors and 3x10 Amper fuses for 1,3 kVAR capacitors should be connected to the SUPER-SVC input. Features of **FUSES** should be automatic, fast character and three phase.
- A drive filter must be connected to the SUPER-SVC input to prevent distortion of thyristors and capacitors and to reduce harmonics. **DRIVE INLET FILTER**, 2,15 mH 25,4 Amper for SUPER-SVC with 4,7 kVAR capacitors, 3,743 mH 14,5 Amper for SUPER-SVC with 2,7 kVAR capacitors, 7,775 mH 7 Amper for SUPER-SVC with 1,3 kVAR capacitors, three-phase should be chosen according to these values.

SUPER-TCR

- The **FUSES** to be placed at the L1, L2 and L3 inputs must be fast and suitable for the reactor current connected per line.
- In case of the harmonic generating machines and equipment, it is very important to measure THD-V, U3h, U5h, U7h, U9h and I3h, I5h, I7h and I9h from voltage and current harmonics. In cases where THD-V is greater than 8% and / or less than 12% of I3h, I5h, I7h, I9h, and I11h harmonic currents, the current waveform deteriorates in a hazardous way. In order to understand the deterioration of the thyristors and reduce harmonics, the SUPER-TCR inputs must be connected to the **DRIVE INLET FILTER** calculated according to the maximum current of the SUPER-TCR.



DYNAMIC COMPENSATION DEVICE

| | SUPER-SVC | SUPER-TCR Series | | | |
|--|--|--|-------------------------------|--|--------------------------------|
| | | | | | |
| ● Plug and Run ● Unique and ideal design ● Ultra fast ● User friendly ● Low cost | | | | | |
| Product code | SUPER-SVC | SUPER-TCR-5 | SUPER-TCR-10 | SUPER-TCR-20 | SUPER-TCR-30 |
| Product name | Ultra fast, bidirectional reactive power stabilizer | | | | |
| Fan | Optional It should be used in case of cooling insufficient in the switchbox, fan should be specified in case of demand in the order, for models without fan | Optional It should be used in case of cooling insufficient in the switchbox, fan should be specified in case of demand in the order, for models without fan | ✓ | Optional It should be used in case of cooling insufficient in the switchbox, fan should be specified in case of demand in the order, for models without fan | ✓ |
| Total max. reactive power in three-phase connection | 3 x (± 5) kVAR Σ max = ± 15 kVAR | 3 x 1,5 kVAR Σ max = 5 kVAR | 3 x 3 kVAR Σ max = 10 kVAR | 3 x 7 kVAR Σ max = 20 kVAR | 3 x 10 kVAR Σ max = 30 kVAR |
| Total max. reactive power in single-phase connection | 9 x (± 5) kVAR Σ max = ± 45 kVAR | 9 x 1,5 kVAR Σ max = 15 kVAR | 9 x 3 kVAR Σ max = 30 kVAR | 9 x 7 kVAR Σ max = 60 kVAR | 9 x 10 kVAR Σ max = 90 kVAR |
| Automatic learning of current directions | ✓ | | | ✓ | |
| Automatic learning of reactors power values | ✓ | | | ✓ | |
| Automatic learning of capacitors power values | ✓ | | | ✓ | |
| Over current protection | 35A per line | 19A per line | 35A per line | 54A per line | 80A per line |
| Over voltage protection | ✓ | | | ✓ | |
| Thermal protection (for reactor) | ✓ | | | ✓ | |
| Thermal protection (thyristor module) In case of aluminium cooler reach to 95°C, it stop running. It start run when cooler get cold again. If fans are used for cooling on the switchbox, device will not reach to this temperature | ✓ | | | ✓ | |
| Current transformer set range | Setting by dip-switch between 5/5A and 5000/5A | Setting by dip-switch between 5/5A and 5000/5A | | | |
| Relay output | — | — | | | |
| Automatic start | ✓ | ✓ | | | |
| Compensation type | LV | LV | | | |
| Supply voltage | 400V AC 3~ (50Hz) Un x (0,9 – 1,1) | 400V AC 3~ (50Hz) Un x (0,9 – 1,1) | | | |
| Max. supply voltage | 440V AC 3~ (50Hz) | 440V AC 3~ (50Hz) | | | |
| Switching time | max . 5 – 20 ms | max. 10 ms | | | |
| Power consumption | Supply | 14 VA | | | |
| | Current | < 1VA | | | |
| | Voltage | < 1VA | | | |
| Accuracy | 0,5 class | 0,5 class | | | |
| Reactor and capacitor selection | SR-230/1.5 kVAR — SPC 16-0.23/1.3kVAR SR-230/3 kVAR — SPC 2-0.23/2.7kVAR SR-230/5 kVAR — SPC 2-0.23/4.7kVAR | SR-230/1.5 kVAR | SR-230/3 kVAR | SR-230/7 kVAR | SR-230/10 kVAR |
| Ambient temperature | -20°C - +60°C | | | | |
| Dimensions a x b x h | 133 x 200 x 200 mm | 133 x 132 x 200 mm | 133 x 165 x 200 mm | 133 x 200 x 200 mm | 133 x 233 x 200 mm |
| Weight | 4,97 kg | 3 kg | 3,5 kg | 4,5 kg | 5 kg |

SINGLE - PHASE SHUNT REACTORS for SUPER - TCR



| Product code | Power (kVAR) |
|--------------|----------------|
| SR-1 | 0,25-0,50-0,75 |
| SR-230/1 | 1,00 |
| SR-230/1,5 | 1,50 |
| SR-230/2,5 | 2,50 |
| SR-230/3 | 3,00 |
| SR-230/4 | 4,00 |
| SR-230/5 | 5,00 |
| SR-230/7 | 7,00 |
| SR-230/10 | 10,00 |



SINGLE - PHASE SHUNT REACTORS



SINGLE-PHASE LV POWER CAPACITORS

| | SR-1 | SR-230/1,5 | SR-230 / 3 | SR-230 / 5 | SPC 16-0,23/1,3 | SPC 2-0,23/2,7 | SPC 2-0,23/4,7 |
|--|----------------|-------------|-------------|-------------|-----------------|----------------|----------------|
| | | | | | | | |
| 230 V 50Hz Qn [kvar] | 0,25-0,50-0,75 | 1,5 | 3 | 5 | 1,3 | 2,7 | 4,7 |
| CURRENT In [A] | 3,4 | 6,53 | 13,1 | 21,7 | 5,65 | 11,73 | 20,43 |
| WEIGHT [Kg] | 5,5 | 8,7 | 16,9 | 29,6 | 0,5 | 0,7 | 1 |
| Thermal output | ✓ | ✓ | ✓ | ✓ | - | - | - |
| Dimensions (mm) Width x Length x Height | 108x120x105 | 125x150x132 | 155x190x160 | 210x192x160 | ∅: 65 x h:105 | ∅: 85 x h:100 | ∅: 85 x h:175 |

SUPER - SVC

REACTOR AND CAPACITOR SELECTION TABLES FOR SUPER SVC

| | | |
|------------|---|-----------------|
| SR-230/1,5 | → | SPC 16-0.23/1.3 |
| SR-230/3 | → | SPC 2-0.23/2.7 |
| SR-230/5 | → | SPC 2-0.23/4.7 |

TC-PT100 ve TC-PT100-RS

Temperature controller

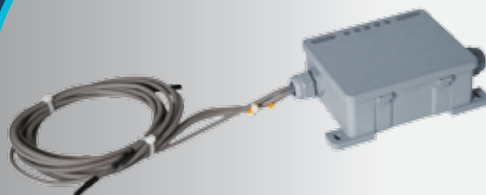
for Dry and Oil Type Medium Voltage Transformers



TC-PT100



TC-PT100-RS



PT100-KS

BOX-KS

- * **Developed for resin or dry medium voltage transformers temperature control**
- * **Based on high level electromagnetic interference**
- * **There are 4 PT100 sensor inputs**
- * **The 3-phase transformer winding temperatures can be measured separately. Transformer core temperature or ambient temperature can also be measured from 4 sensor inputs**
- * **There are 4 relay outputs ALARM, FAULT, TRIP, FAN**

- **24 - 240 Vac - Vdc 50/60Hz ultra wide feed input**
- **Easy menu design with Turkish, English and Russian language support**
- **Color TFT display (320 x 240 pixel x 2.4 ")**
- **Built on embedded system and working on operating system**
- **It has 4 Pt100 (3-Wires) RTD sensor inputs**
- **Sensor inputs are resistant to electromagnetic interference**
- **Cable lengths in Pt100 are not included in the calculation**
- **It measures temperature between -10°C and 250°C and has $\pm 1\%$ measurement accuracy**
- **1 ALARM relay output**
- **1 TRIP relay output**
- **There is a relay output (FAULT) for errors in one device operation**
- **1 FAN relay output for cooling**
- **The alarms and faults received by the device are stored in the device memory (the last 40 records)**
- **3VA supply available**
- **Intelligent Fan operation and stop algorithm saves energy in transformer cooling**
- **Continuously monitors temperature sensors for faults:**
 - "Sensor cable is broken",
 - "Sensor cable short circuit"
 - "Sensor not attached"
- **Error detection in case of data recording center failure**
- **Password Protection protects the Settings menu against unauthorized users**
- **There is a button for making the alarm silent or for Manual Fan control**

NEW REACTIVE POWER FACTOR CONTROLLERS

Solutions from KAEL
for all kinds of compensation
for MEDIUM VOLTAGE
VARkombi-18-PC-TFT-OG



The most economical and ideal solution for
Medium Voltage compensation

- For DYN5 or Dyn11 type transformers
- Qualitative compensation even when there is no load on the secondary transformer
- Possibility to implement in all facilities with 4 different operation modes
- 2 mA measurement accuracy
- RS485 – MODBUS

CURRENT TRANSFORMER

KH100 – CL0.5 100/5A

| | |
|-----------------------|---------------|
| Primary current (A) | 100 |
| Secondary current (A) | 5 |
| [Class] | 0,5 |
| [VA] | 5 |
| [kV] | 0,72 |
| [Ith] | 10kA/1sn |
| [Idyn] | 2,5 x (Ith) |
| Weight [Kg] | 5 |
| Hole [Φ] | 80 |
| Dimensions | 190x225x55 mm |

For a better result use with Varkombi-18-PC-TFT-OG
or Varkombi18-PC-TFT-OG-Solar for medium voltage
and solar power compensation



for SOLAR POWER PLANTS
VARkombi-18-PC-TFT-OG-SOLAR

Measured by Medium Voltage, it is the most economical and ideal
solution for Solar Power Plants. Disables compensation when
exporting energy to the system.

- For DYN5 or Dyn11 type transformers
- 2 mA measurement accuracy
- RS485 – MODBUS

VARko-112-PC-TFT
VARko-112-TFT
VARko-106-TFT
Economical series



- single phase
- 1 Current Transformer
- 2mA measurement accuracy
- 6 and 12 steps
- with or without RS485 MODBUS
- user friendly
- plug and run
- automatic learning (all power steps)



For Medium voltage
VARkombi 18-PC-TFT-OG



For Solar Power Plants
VARkombi 18-PC-TFT-OG-SOLAR



VARkombi 18-PC-TFT



VARkombi 18-TFT



VARkombi 15-PC-TFT



VARkombi 15-TFT



VARkombi 12-PC-TFT



Measurements

| | | | | | | | |
|---------------------------------------|--|---|-------------------------------------|-------------------------------------|-------------------------------------|-----------------------------------|-------------------------------------|
| with SVC-TCR | — | — | √ | √ | √ | √ | √ |
| Number of steps ^{3A/250 Vac} | (18) | (18) | (18) | (18) | (15) | (15) | (12) |
| Connection | 3 phases, 3 currents | 3 phases, 3 currents | 3 phases, 3 currents | 3 phases, 3 currents | 3 phases, 3 currents | 3 phases, 3 currents | 3 phases, 3 currents |
| Current transformer ratio | √ | √ | √ | √ | √ | √ | √ |
| Voltage transformer ratio | √ | √ | — | — | — | — | — |
| Voltage (phase-neutral) | 1 – 300V ac ±0.5% | 1 – 300V ac ±0.5% | 1 – 300V ac ±0.5% | 1 – 300V ac ±0.5% | 1 – 300V ac ±0.5% | 1 – 300V ac ±0.5% | 1 – 300V ac ±0.5% |
| Voltage (phase-neutral) | 2 – 600V ac ±0.5% | 2 – 600V ac ±0.5% | 2 – 600V ac ±0.5% | 2 – 600V ac ±0.5% | 2 – 600V ac ±0.5% | 2 – 600V ac ±0.5% | 2 – 600V ac ±0.5% |
| Current | 10mA – 6A ±0.5% | 10mA – 6A ±0.5% | 10mA – 6A ±0.5% | 10mA – 6A ±0.5% | 10mA – 6A ±0.5% | 10mA – 6A ±0.5% | 10mA – 6A ±0.5% |
| Cos φ and PF | [±0.000] - [±1.000] | [±0.000] - [±1.000] | [±0.000] - [±1.000] | [±0.000] - [±1.000] | [±0.000] - [±1.000] | [±0.000] - [±1.000] | [±0.000] - [±1.000] |
| Active Power (W) | √ ±1% | √ ±1% | √ ±1% | √ ±1% | √ ±1% | √ ±1% | √ ±1% |
| Reactive Power (VAR) | √ ±2% | √ ±2% | √ ±2% | √ ±2% | √ ±2% | √ ±2% | √ ±2% |
| Apparent Power (VA) | √ | √ | √ | √ | √ | √ | √ |
| Active Energy (kWh) | √ | √ | √ | √ | √ | √ | √ |
| Reactive Energy (kVARh) | √ | √ | √ | √ | √ | √ | √ |
| THD-V % ve THD-I % | √ | √ | √ | √ | √ | √ | √ |
| Harmonic (3 – 31.) | √ | √ | √ | √ | √ | √ | √ |
| Temperature measurement | √ | √ | √ | √ | √ | √ | √ |
| Fan and Alarm relay | √ | √ | √ | √ | √ | √ | √ |
| Cosp2 for generator | — | √ | √ | √ | √ | √ | √ |
| Operating type | for facilities with unbalanced load (measurements from MV) | for Solar Power Plants (measurements from MV) | for facilities with unbalanced load | for facilities with unbalanced load | for facilities with unbalanced load | for facilities with balanced load | for facilities with unbalanced load |
| Shunt reactor | √ | √ | √ | √ | √ | √ | √ |
| Single phase capacitor | √ | √ | √ | √ | √ | √ | √ |
| Three phase capacitor | √ | √ | √ | √ | √ | √ | √ |
| Equal aging | √ | √ | √ | √ | √ | √ | √ |
| Password protection | √ | √ | √ | √ | √ | √ | √ |
| RS485 MODBUS-RTU | √ | √ | — | — | √ | — | √ |
| Step learning | Auto | Auto | Auto | Auto | Auto | Auto | Auto |
| Supply voltage | 230V ac; 50/60 Hz; < 10VA | 230V ac; 50/60 Hz; < 10VA | 230V ac; 50/60 Hz; < 10VA | 230V ac; 50/60 Hz; < 10VA | 230V ac; 50/60 Hz; < 10VA | 230V ac; 50/60 Hz; < 10VA | 230V ac; 50/60 Hz; < 10VA |
| Display | 3.2" color TFT screen | 3.2" color TFT screen | 3.2" color TFT screen | 3.2" color TFT screen | 3.2" color TFT screen | 3.2" color TFT screen | 3.2" color TFT screen |

Alarms

| | | | | | | | |
|---------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Over current | √ | √ | √ | √ | √ | √ | √ |
| Under current | √ | √ | √ | √ | √ | √ | √ |
| Over temperature | √ | √ | √ | √ | √ | √ | √ |
| Over harmonic | √ | √ | √ | √ | √ | √ | √ |
| Step protection | √ | √ | √ | √ | √ | √ | √ |
| Min response time | 40 msec – in fast mode | 40 msec – in fast mode | 40 msec – in fast mode | 40 msec – in fast mode | 40 msec – in fast mode | 40 msec – in fast mode | 40 msec – in fast mode |
| Ambient temperature | - 5 C° + 50 C° | - 5 C° + 50 C° | - 5 C° + 50 C° | - 5 C° + 50 C° | - 5 C° + 50 C° | - 5 C° + 50 C° | - 5 C° + 50 C° |
| Storage temperature | - 20 C° + 70 C° | - 20 C° + 70 C° | - 20 C° + 70 C° | - 20 C° + 70 C° | - 20 C° + 70 C° | - 20 C° + 70 C° | - 20 C° + 70 C° |
| Dimensions | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm |
| Quantity in 1 box | 5 | 5 | 5 | 5 | 5 | 5 | 5 |

Note: In case of demanding leakage gasket between the device and the switchbox with 144x144 mm size products it should pointed outwhile offering.



| | VARKombi 12-TFT | VARKombi 06-PC-TFT | VARko 15-TFT | VARko 12-TFT | VARko-112-PC-TFT <small>Economical serie</small> | VARko-106-PC-TFT <small>Economical serie</small> | VARko-112-TFT <small>Economical serie</small> | VARko-106-TFT <small>Economical serie</small> |
|---------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|---|---|--|--|
| with SVC-TCR | √ | √ | √ | √ | √ | √ | — | — |
| Number of steps | 12 | 6 | 15 | 12 | 12 | 6 | 12 | 6 |
| Connection | 3 phases, 3 currents | 3 phases, 3 currents | 3 phases, 3 currents | 3 phases, 3 currents | 1 phase, 1 current | 1 phase, 1 current | 1 phase, 1 current | 1 phase, 1 current |
| Current transformer ratio | √ | √ | √ | √ | √ | √ | √ | √ |
| Voltage transformer ratio | — | — | — | — | — | — | — | — |
| Voltage (phase-neutral) | 1 – 300V ac ±0.5% | 1 – 300V ac ±0.5% | 1 – 300V ac ±0.5% | 1 – 300V ac ±0.5% | 1 – 300V ac ±0.5% | 1 – 300V ac ±0.5% | 1 – 300V ac ±0.5% | 1 – 300V ac ±0.5% |
| Voltage (phase-phase) | 2 – 600V ac ±0.5% | 2 – 600V ac ±0.5% | 2 – 600V ac ±0.5% | 2 – 600V ac ±0.5% | — | — | — | — |
| Current | 10mA – 6A ±0.5% | 10mA – 6A ±0.5% | 10mA – 6A ±0.5% | 10mA – 6A ±0.5% | 10mA – 6A ±0.5% | 10mA – 6A ±0.5% | 10mA – 6A ±0.5% | 10mA – 6A ±0.5% |
| Cos φ and PF | [±0.000] - [±1.000] | [±0.000] - [±1.000] | [±0.000] - [±1.000] | [±0.000] - [±1.000] | [±0.000] - [±1.000] | [±0.000] - [±1.000] | [±0.000] - [±1.000] | [±0.000] - [±1.000] |
| Active Power (W) | √ ±1% | √ ±1% | √ ±1% | √ ±1% | √ ±1% | √ ±1% | √ ±1% | √ ±1% |
| Reactive Power (VAR) | √ ±2% | √ ±2% | √ ±2% | √ ±2% | √ ±2% | √ ±2% | √ ±2% | √ ±2% |
| Apparent Power (VA) | √ | √ | √ | √ | — | — | — | — |
| Active Energy (kWh) | √ | √ | √ | √ | — | — | — | — |
| Reactive Energy (kVARh) | √ | √ | √ | √ | — | — | — | — |
| THD-V % ve THD-I % | √ | √ | √ | √ | √ | √ | √ | √ |
| Harmonic (3 – 31.) | √ | √ | √ | √ | — | — | — | — |
| Temperature measurement | √ | √ | — | — | √ | √ | √ | √ |
| Fan and Alarm relay | √ | √ | — | — | √ | √ | √ | √ |
| Cosφ2 for generator | √ | √ | — | — | — | — | — | — |
| Operating type | for facilities with unbalanced load | for facilities with unbalanced load | for facilities with unbalanced load | for facilities with unbalanced load | for facilities with balanced load | for facilities with balanced load | for facilities with balanced load | for facilities with balanced load |
| Shunt reactor | √ | √ | last three steps | — | — | — | — | — |
| Single phase capacitor | √ | √ | √ | √ | — | — | — | — |
| Three phase capacitor | √ | √ | √ | √ | √ | √ | √ | √ |
| Equal aging | √ | √ | √ | √ | — | — | — | — |
| Password protection | √ | √ | √ | √ | √ | √ | √ | √ |
| RS485 MODBUS-RTU | — | √ | — | — | √ | √ | — | — |
| Step learning | Auto | Auto | Auto | Auto | Auto | Auto | Auto | Auto |
| Supply voltage | 230V ac; 50/60 Hz; < 10VA | 230V ac; 50/60 Hz; < 10VA | 230V ac; 50/60 Hz; < 10VA | 230V ac; 50/60 Hz; < 10VA | 230V ac; 50/60 Hz; < 10VA | 230V ac; 50/60 Hz; < 10VA | 230V ac; 50/60 Hz; < 10VA | 230V ac; 50/60 Hz; < 10VA |
| Display | 3.2" color TFT screen | 3.2" color TFT screen | 2.4" color TFT screen | 2.4" color TFT screen | 2.4" color TFT screen | 2.4" color TFT screen | 2.4" color TFT screen | 2.4" color TFT screen |
| Over current | √ | √ | — | — | √ | √ | √ | √ |
| Under current | √ | √ | — | — | √ | √ | √ | √ |
| Over temperature | √ | √ | — | — | √ | √ | √ | √ |
| Over harmonic | √ | √ | — | — | √ | √ | √ | √ |
| Step protection | √ | √ | — | — | √ | √ | √ | √ |
| Min response time | 40 msec – in fast mode | 40 msec – in fast mode | 40 msec – in fast mode | 40 msec – in fast mode | 1 sec | 1 sec | 1 sec | 1 sec |
| Ambient temperature | -5 °C + 50 °C | -5 °C + 50 °C | -5 °C + 50 °C | -5 °C + 50 °C | -5 °C + 50 °C | -5 °C + 50 °C | -5 °C + 50 °C | -5 °C + 50 °C |
| Storage temperature | -20 °C + 70 °C | -20 °C + 70 °C | -20 °C + 70 °C | -20 °C + 70 °C | -20 °C + 70 °C | -20 °C + 70 °C | -20 °C + 70 °C | -20 °C + 70 °C |
| Dimensions | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm |
| Quantity in 1 box | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |

Note: In case of demanding leakage gasket between the device and the switchbox with 144x144 mm size products it should pointed outwhile offering.



| | VARkombi-12-PC | VARkombi-12 | VARko-312 | VARko-308 | VARko-112 | VARko-108 | VARko-106 | PFR-3 | PFR-2 | PFR-1 |
|--|-------------------------------------|-------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|--------------------------|--------------------------|--------------------------|
| with SVC-TCR | — | — | — | — | — | — | — | — | — | — |
| Number of steps <small>3A/250 Vac</small> | 12 | 12 | 12 | 8 | 12 | 8 | 6 | 3 | 2 | 1 |
| Connection | 3 phases, 3 currents | 3 phases, 3 currents | 3 phases, 3 currents | 3 phases, 3 currents | 1 phases 1 currents | 1 phases 1 currents | 1 phases 1 currents | 1 phases 1 currents | 1 phases 1 currents | 1 phases 1 currents |
| Current transformer ratio | √ | √ | √ | √ | √ | √ | √ | — | — | — |
| Voltage transformer ratio | — | — | — | — | — | — | — | — | — | — |
| Voltage (phase-neutral) | 25 – 300V ac ± 0.5% | 25 – 300V ac ± 0.5% | 25 – 300V ac ± 0.5% | 25 – 300V ac ± 0.5% | 25 – 300V ac ± 0.5% | 25 – 300V ac ± 0.5% | 25 – 300V ac ± 0.5% | 230V ac ± 0.5% | 230V ac ± 0.5% | 230V ac ± 0.5% |
| Voltage (phase-phase) | 40 – 600V ac ± 0.5% | 40 – 600V ac ± 0.5% | 40 – 600V ac ± 0.5% | 40 – 600V ac ± 0.5% | — | — | — | — | — | — |
| Current | 50mA – 6A ± 0.5% | 50mA – 6A ± 0.5% | 50mA – 6A ± 0.5% | 50mA – 6A ± 0.5% | 50mA – 6A ± 0.5% | 50mA – 6A ± 0.5% | 50mA – 6A ± 0.5% | 50mA – 6A ± 0.5% | 50mA – 6A ± 0.5% | 50mA – 6A ± 0.5% |
| Cos φ and RE | [± 0.000] - [± 1.000] | [± 0.000] - [± 1.000] | [± 0.000] - [± 1.000] | [± 0.000] - [± 1.000] | [± 0.000] - [± 1.000] | [± 0.000] - [± 1.000] | [± 0.000] - [± 1.000] | [± 0.000] - [± 1.000] | [± 0.000] - [± 1.000] | [± 0.000] - [± 1.000] |
| Active Power (W) | √ ± 1% | √ ± 1% | √ ± 1% | √ ± 1% | √ ± 1% | √ ± 1% | √ ± 1% | √ ± 1% | √ ± 1% | √ ± 1% |
| Reactive Power (W) | √ ± 2% | √ ± 2% | √ ± 2% | √ ± 2% | √ ± 2% | √ ± 2% | √ ± 2% | √ ± 2% | √ ± 2% | √ ± 2% |
| Apparent Power (VA) | √ | √ | — | — | — | — | — | — | — | — |
| Active Energy (kWh) | — | — | — | — | — | — | — | — | — | — |
| Reactive Energy (kVARh) | — | — | — | — | — | — | — | — | — | — |
| THD-V % ve THD-I % | — | — | — | — | — | — | — | — | — | — |
| Harmonic (3 – 31.) | — | — | — | — | — | — | — | — | — | — |
| Temperature measurement | √ | √ | √ | √ | √ | √ | √ | — | — | — |
| Fan and Alarm relay | √ | √ | √ | √ | √ | √ | √ | — | — | — |
| Cosφ2 for generator | — | — | — | — | — | — | — | — | — | — |
| Operating type | for facilities with unbalanced load | for facilities with unbalanced load | for facilities with balanced load | for facilities with balanced load | for facilities with balanced load | for facilities with balanced load | for facilities with balanced load | for local compensation | for local compensation | for local compensation |
| Shunt reactor | — | — | — | — | — | — | — | — | — | — |
| Single phase capacitor | √ | √ | — | — | — | — | — | — | — | — |
| Three phase capacitor | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Equal aging | — | — | — | — | — | — | — | — | — | — |
| Password protection | — | — | — | — | — | — | — | — | — | — |
| RS485 MODBUS-RTU | √ | — | — | — | — | — | — | — | — | — |
| Step learning | Auto | Auto | Auto | Auto | Auto | Auto | Auto | First in First out | First in First out | First in First out |
| Supply voltage | 230V ac, 50/60 Hz, < 6VA | 230V ac, 50/60 Hz, < 6VA | 230V ac, 50/60 Hz, < 6VA | 230V ac, 50/60 Hz, < 6VA | 230V ac, 50/60 Hz, < 6VA | 230V ac, 50/60 Hz, < 6VA | 230V ac, 50/60 Hz, < 6VA | 230V ac, 50/60 Hz, < 6VA | 230V ac, 50/60 Hz, < 6VA | 230V ac, 50/60 Hz, < 6VA |
| Display | LED Display | LED Display | LED Display | LED Display | LED Display | LED Display | LED Display | — | — | — |
| Over current | √ | √ | √ | √ | √ | √ | √ | — | — | — |
| Under current | √ | √ | √ | √ | √ | √ | √ | — | — | — |
| Over temperature | √ | √ | √ | √ | √ | √ | √ | — | — | — |
| Over harmonic | — | — | — | — | — | — | — | — | — | — |
| Step protection | √ | √ | √ | √ | √ | √ | √ | — | — | — |
| Min response time | 1 sec | 1 sec | 1 sec | 1 sec | 1 sec | 1 sec | 1 sec | 1 sec | 1 sec | 1 sec |
| Ambient temperature | -5 °C + 50 °C | -5 °C + 50 °C | -5 °C + 50 °C | -5 °C + 50 °C | -5 °C + 50 °C | -5 °C + 50 °C | -5 °C + 50 °C | -5 °C + 50 °C | -5 °C + 50 °C | -5 °C + 50 °C |
| Storage temperature | -20 °C + 70 °C | -20 °C + 70 °C | -20 °C + 70 °C | -20 °C + 70 °C | -20 °C + 70 °C | -20 °C + 70 °C | -20 °C + 70 °C | -20 °C + 70 °C | -20 °C + 70 °C | -20 °C + 70 °C |
| Dimensions | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 144 x 144 x 37 mm | 3 Modul DIN | 3 Modul DIN | 3 Modul DIN |
| Quantity in 1 box | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 |

| | |
|---------------------|---------------|
| Target setting Cosφ | : 0.70 – 1.00 |
| C/k setting | : 0.05 – 2 |
| T on | : 1 – 100 sec |
| T off | : 1 – 100 sec |

NETWORK ANALYZERS

CHOOSE THE RIGHT NETWORK ANALYZER FOR ENERGY MANAGEMENT

ADVANCED NETWORK ANALYZER, Reporter and Data Logger

MULTISER-04-PC-TFT

- Easy installation menu
- Wide screen TFT (320 x 240 pixel 3,2")
- Many leading screen displays
- Microprocessor is based on operating system
- Improved dynamic software
- Ability to enter current and voltage transformer rates
- True RMS
- Voltage, current and harmonic protection
- Multiple alarms
- Memory (upto Micro SD 32GB)
- Password protection
- Waveforms (for current and voltage)
- Graphical reports (Powers, Voltages, Currents)
- Reports according to date
- 3P&4W, 3P&3W, ARON Connection

Measurements

- Voltages (V1N, V2N, V3N ve V12, V23, V13)
- Currents (I1, I2, I3, ΣI)
- Power Factor (PF1, PF2, PF3)
- $\cos\Phi$ (Cos Φ 1, Cos Φ 2, Cos Φ 3, $\Sigma\cos\Phi$)
- Frequency (Hz)
- Active Power (P1, P2, P3, ΣP)
- Inductive Reactive Power [$\Sigma Q(\text{ind}), Q1(\text{ind}), Q2(\text{ind}), Q3(\text{ind})$]
- Capacitive Reactive Power [$\Sigma Q(\text{kap}), Q1(\text{kap}), Q2(\text{kap}), Q3(\text{kap})$]
- Apparent Power ($\Sigma S, S1, S2, S3$)
- Active Energy (ΣWh)
- Inductive Reactive Energy
- Capacitive Reactive Energy
- Neutral Current
- Total harmonic distortion for current and voltage (THD-V ve THD-I)
- Peak and Demands
- Display as list or chart of 3rd – 63rd harmonics for current and voltages
- % Current Unbalance
- % Voltage Unbalance

Inputs & Outputs

- Relay Output (2pcs)
- Pulse Output (2pcs)
- Digital Input (2pcs)
- RS-485 MODBUS-RTU



FOR ECONOMIC SOLUTIONS

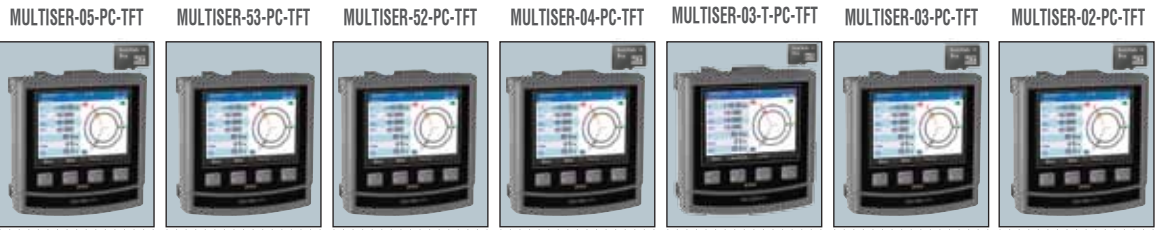
MULTISER-TFT

- Easy-to-use use menu
- Wide screen TFT (320 x 240 pixel 3,2")
- Many leading screen displays
- Microprocessor based operating system
- Improved dynamic software
- Ability to enter current and voltage transformer rates
- True RMS
- Password protection
- Waveforms (for current and voltage)
- 3P&4W, 3P&3W, ARON Connection

Measurements

- Voltages (V1N, V2N, V3N ve V12, V23, V13)
- Currents (I1, I2, I3, ΣI)
- Power Factor (PF1, PF2, PF3)
- $\cos\Phi$ (Cos Φ 1, Cos Φ 2, Cos Φ 3, $\Sigma\cos\Phi$)
- Frequency (Hz)
- Active Power (P1, P2, P3, ΣP)
- Inductive Reactive Power [$\Sigma Q(\text{ind}), Q1(\text{ind}), Q2(\text{ind}), Q3(\text{ind})$]
- Capacitive Reactive Power [$\Sigma Q(\text{kap}), Q1(\text{kap}), Q2(\text{kap}), Q3(\text{kap})$]
- Apparent Power ($\Sigma S, S1, S2, S3$)
- Active Energy (ΣWh)
- Inductive Reactive Energy
- Capacitive Reactive Energy
- Neutral Current
- Total harmonic distortion for current and voltage (THD-V ve THD-I)
- Peak and Demands
- % Current Unbalance
- % Voltage Unbalance





| | MULTISER-05-PC-TFT | MULTISER-53-PC-TFT | MULTISER-52-PC-TFT | MULTISER-04-PC-TFT | MULTISER-03-T-PC-TFT | MULTISER-03-PC-TFT | MULTISER-02-PC-TFT |
|--|--|--|--|---|-------------------------|-------------------------|-------------------------|
| Connection 3P&4W, 3P&3W, ARON | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Voltage: V1, V2, V3 | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class |
| Voltage: V12, V23, V31 | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class |
| Current: I1, I2, I3, I neutral | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class |
| Active Power: P1, P2, P3, ΣP | ✓ 1 class | ✓ 1 class | ✓ 1 class | ✓ 1 class | ✓ 1 class | ✓ 1 class | ✓ 1 class |
| Reactive Power: Q1, Q2, Q3, ΣQi, ΣQc | ✓ 2 class | ✓ 2 class | ✓ 2 class | ✓ 2 class | ✓ 2 class | ✓ 2 class | ✓ 2 class |
| Cosφ1, Cosφ2, Cosφ 3, PF1, PF2, PF3, ΣPF | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] |
| Imp-exp Active Energy kWh | ✓ 1 class | ✓ 1 class | ✓ 1 class | ✓ 1 class | ✓ 1 class | ✓ 1 class | ✓ 1 class |
| Imp-exp Reactive Energy kVARh | ✓ 2 class | ✓ 2 class | ✓ 2 class | ✓ 2 class | ✓ 2 class | ✓ 2 class | ✓ 2 class |
| Demand and Peak | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Total Harmonic: THD and THD-V | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Voltage Unbalance U% | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Current Unbalance I% | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Oscilloscope | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Harmonics | 3 – 63. harmonics | 3 – 63. harmonics | 3 – 63. harmonics | 3 – 63. harmonics | 3 – 31. harmonics | 3 – 31. harmonics | 3 – 31. harmonics |
| ALARMS Over - Under voltage - Voltage Unbalance Over - Under current - Current Unbalance Phase sequence - Phase failure Over THD-V - Over THD-I | ✓ | — | ✓ | ✓ | ✓ | ✓ | ✓ |
| Graphic reports | Power, Current, Voltage THD-V, THD-I | — | — | Power, Current, Voltage THD-V, THD-I | Power, Current, Voltage | Power, Current, Voltage | Power, Current, Voltage |
| ALARM REPORTS according to date | ✓ | — | — | ✓ | ✓ | ✓ | ✓ |
| Second energy meter for Generator | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | — |
| Temperature, alarm set range | — | — | — | — | 5 - 85 °C | — | — |
| Relay output: max. 3A/240 Vac | 2 pcs N.O. | — | 2 pcs N.O. | 2 pcs N.O. | 2 pcs N.O. | 2 pcs N.O. | 2 pcs N.O. |
| Digital input 5-24Vdc max. 30Vdc | 2 pcs | 2 pcs | 2 pcs | 2 pcs | 2 pcs | 2 pcs | — |
| Energy pulse output | — | — | — | 2 pcs | 2 pcs | 2 pcs | — |
| Programmable Analog output | 2 pcs 4-20mA, 0-10V, 0-20mA, 2-10V, 0-5V, 1-5V | 2 pcs 4-20mA, 0-10V, 0-20mA, 2-10V, 0-5V, 1-5V | 2 pcs 4-20mA, 0-10V, 0-20mA, 2-10V, 0-5V, 1-5V | — | — | — | — |
| RS485 MODBUS-RTU | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Memory | 8 GB | — | — | 8 GB | 8 GB | 8 GB | 8 GB |
| Operating time | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Password protection | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Ambient temperature | 5°C +50 °C | 5°C +50 °C | 5°C +50 °C | 5°C +50 °C | 5°C +50 °C | 5°C +50 °C | 5°C +50 °C |
| Storage temperature | - 20°C +70 °C | - 20°C +70 °C | - 20°C +70 °C | - 20°C +70 °C | - 20°C +70 °C | - 20°C +70 °C | - 20°C +70 °C |
| Display | 3.2" color TFT screen | 3.2" color TFT screen | 3.2" color TFT screen | 3.2" color TFT screen | 3.2" color TFT screen | 3.2" color TFT screen | 3.2" color TFT screen |
| Current transformer | X / 5 A | X / 5 A | X / 5 A | X / 5 A | X / 5 A | X / 5 A | X / 5 A |
| Current transformer ratio | 1 5000 | 1 5000 | 1 5000 | 1 5000 | 1 5000 | 1 5000 | 1 5000 |
| Voltage transformer ratio | 1 4000 | 1 4000 | 1 4000 | 1 4000 | 1 4000 | 1 4000 | 1 4000 |
| Auxiliary supply voltage | 85-265 Vac < 4VA | 85-265 Vac < 4VA | 85-265 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA |
| Dimensions | 96x96x56 mm | 96x96x56 mm | 96x96x56 mm | 96x96x56 mm | 96x96x56 mm | 96x96x56 mm | 96x96x56 mm |
| Quantity in 1 box | 6 | 6 | 6 | 6 | 6 | 6 | 6 |

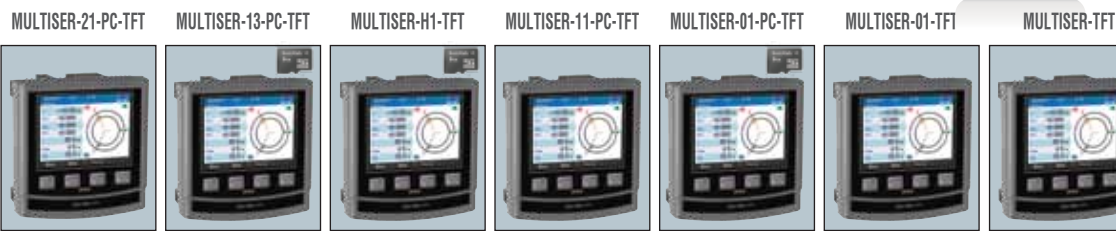
| | |
|----------------|----------------------------------|
| OPTIONS | 1-100A current transformer ratio |
| | 100A/22,5 mV LPCT model |
| | Calibration Certificate |

| |
|------------------------------------|
| Auxiliary supply voltage 18-70Vdc |
| Auxiliary supply voltage 85-265Vac |

INDUSTRIAL MICRO SD CARD



In models with memory card icon, The memory card is included in the price



| | MULTISER-21-PC-TFT | MULTISER-13-PC-TFT | MULTISER-H1-TFT | MULTISER-11-PC-TFT | MULTISER-01-PC-TFT | MULTISER-01-TFI | MULTISER-TFT |
|---|-----------------------|-------------------------|---|-----------------------|-----------------------|-----------------------|-----------------------|
| Connection 3P&4W, 3P&3W, ARON | √ | √ | √ | √ | √ | √ | √ |
| Voltage: V1, V2, V3 | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class |
| Voltage: V12, V23, V31 | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class |
| Current: I1, I2, I3, I neutral | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class |
| Active Power: P1, P2, P3, ΣP | √ 1 class | √ 1 class | √ 1 class | √ 1 class | √ 1 class | √ 1 class | √ 1 class |
| Reactive Power: Q1, Q2, Q3, ΣQi, ΣQc | √ 2 class | √ 2 class | √ 2 class | √ 2 class | √ 2 class | √ 2 class | √ 2 class |
| Cosφ1, Cosφ2, Cosφ 3, PF1, PF2, PF3, ΣPF | [± 0.000] – [±1.000] | [± 0.000] – [±1.000] | [± 0.000] – [±1.000] | [± 0.000] – [±1.000] | [± 0.000] – [±1.000] | [± 0.000] – [±1.000] | [± 0.000] – [±1.000] |
| Imp-exp Active Energy kWh | √ 1 class | √ 1 class | √ 1 class | √ 1 class | √ 1 class | √ 1 class | √ 1 class |
| Imp-exp Reactive Energy kVARh | √ 2 class | √ 2 class | √ 2 class | √ 2 class | √ 2 class | √ 2 class | √ 2 class |
| Demand ve peak | √ | √ | √ | √ | √ | √ | √ |
| Total Harmonic: THD and THD-V | √ | √ | √ | √ | √ | √ | √ |
| Voltage Unbalance U% | √ | √ | √ | √ | √ | √ | √ |
| Current Unbalance I% | √ | √ | √ | √ | √ | √ | √ |
| Oscilloscope | √ | √ | √ | √ | √ | √ | √ |
| Harmonics | 3 – 31. harmonics | — | 3 – 31. harmonics | — | 3 – 31. harmonics | 3 – 31. harmonics | — |
| ALARMS | | | | | | | |
| Over – Under voltage – Voltage Unbalance | √ | — | — | — | — | — | — |
| Over – Under current – Current Unbalance | — | — | — | — | — | — | — |
| Phase sequence – Phase failure | — | — | — | — | — | — | — |
| Over THD-V – Over THD-I | — | — | — | — | — | — | — |
| Graphic reports | — | Power, Current, Voltage | Power, Current, Voltage THD-V, THD-I (3h, 5h, 7h, 11h) | — | — | — | — |
| ALARM REPORTS according to date | — | — | — | — | — | — | — |
| Second energy meter for Generator | √ | — | — | — | — | — | — |
| Temperature, alarm set range | — | — | — | — | — | — | — |
| Relay output: max. 3A/240 Vac | 2 pcs N.O. | — | — | — | — | — | — |
| Digital input 5-24Vdc max. 30Vdc | 2 pcs | — | — | — | — | — | — |
| Energy pulse output | 2 pcs | — | — | — | — | — | — |
| Programmable Analog output | — | — | — | — | — | — | — |
| RS485 MODBUS-RTU | √ | √ | — | √ | √ | — | — |
| Memory | — | 8 GB | 8 GB | — | 8 GB | — | — |
| Operating time | √ | √ | √ | √ | √ | √ | √ |
| Password protection | √ | √ | √ | √ | √ | √ | √ |
| Ambient temperature | 5°C +50 °C | 5°C +50 °C | 5°C +50 °C | 5°C +50 °C | 5°C +50 °C | 5°C +50 °C | 5°C +50 °C |
| Storage temperature | - 20°C +70 °C | - 20°C +70 °C | - 20°C +70 °C | - 20°C +70 °C | - 20°C +70 °C | - 20°C +70 °C | - 20°C +70 °C |
| Display | 3.2" color TFT screen | 3.2" color TFT screen | 3.2" color TFT screen | 3.2" color TFT screen | 3.2" color TFT screen | 3.2" color TFT screen | 3.2" color TFT screen |
| Current transformer | X / 5 A | X / 5 A | X / 5 A | X / 5 A | X / 5 A | X / 5 A | X / 5 A |
| Current transformer ratio | 1 5000 | 1 5000 | 1 5000 | 1 5000 | 1 5000 | 1 5000 | 1 5000 |
| Voltage transformer ratio | 1 4000 | 1 4000 | 1 4000 | 1 4000 | 1 4000 | 1 4000 | 1 4000 |
| Auxiliary supply voltage | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA |
| Dimensions | 96x96x56 mm | 96x96x56 mm | 96x96x56 mm | 96x96x56 mm | 96x96x56 mm | 96x96x56 mm | 96x96x56 mm |
| Quantity in 1 box | 6 | 6 | 6 | 6 | 6 | 6 | 6 |

The following parameters can be set as analog output on the device.

VL1, VL2, VL3 (V).....Phase-Neutral Voltages
 VL12, VL23, VL31 (V).....Phase-Phase Voltages
 VLN (average) (V).....Average Phase-Neutral Voltages
 VLL (average) (V).....Average Phase-Phase Voltages
 F (Hz).....Frequency Total + Q (KVAR)
 IL1, IL2, IL3 (A).....Phase current Total -Q (VAR)
 THD VL1, L2, L3 %.....Total Voltage Harmonics Total S (kVA)
 THD IL1, L2, L3 %.....Total Current Harmonics
 + - P11, L2, L3 (kW).....Active Powers (imp-exp)
 + - QL1, L2, L3 (KVAR).....Reactive Powers
 SL1, L2, L3 (kVA).....Apparent Powers
 Total P (kW).....Total Active Power
 Total Positive Reactive Power
 Total Negative Reactive Power
 Total Apparent Reactive Power

RS485

VL1, VL2, VL3
 VL12, VL23, VL13
 IL1, IL2, IL3, INotr, Hz
 P1, P2, P3, Q1, Q2, Q3, S1, S2, S3
 Cosφ1, Cosφ2, Cosφ3
 PFD1, PFD2, PFD3, ΣPF
 ΣP, ΣQi, ΣQc, ΣQ, ΣS

imp-exp ΣkWh
 imp-exp ΣkVARh(ind)
 imp-exp ΣkVARh(kap)
 ΣkVAh
 THD-I ve THD-V
 single current harmonics
 single voltage harmonics



MULTISER-01-96

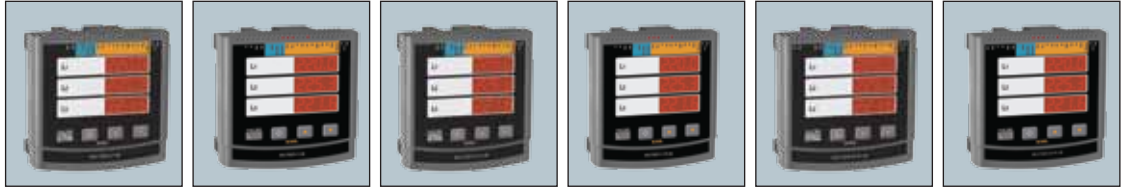
MULTISER-11-96

MULTISER-01-PC-96

MULTISER-11-PC-96

MULTISER-02-PC-96

MULTISER-03-PC-96



| | | | | | | | |
|--|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Measurements | Connection 3P&4W, 3P&3W, ARON | √ | √ | √ | √ | √ | √ |
| | Voltage: V1,V2,V3 | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class |
| | Voltage: V12,V23,V31 | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class |
| | Current: I1, I2, I3, I neutral | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class |
| | Active Power: P1,P2,P3,ΣP | √ 1 class | √ 1 class | √ 1 class | √ 1 class | √ 1 class | √ 1 class |
| | Reactive Power: Q1,Q2,Q3,ΣQi,ΣQc | √ 2 class | √ 2 class | √ 2 class | √ 2 class | √ 2 class | √ 2 class |
| | Cosφ1,Cosφ2,Cosφ3,PF1,PF2,PF3,ΣPF | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] |
| | Imp-exp Active Energy kWh | √ 1 class | √ 1 class | √ 1 class | √ 1 class | √ 1 class | √ 1 class |
| | Imp-exp Reactive Energy kVARh | √ 2 class | √ 2 class | √ 2 class | √ 2 class | √ 2 class | √ 2 class |
| | Demand and peak | √ | √ | √ | √ | √ | √ |
| | Total Harmonic: THD and THD-V | √ | √ | √ | √ | √ | √ |
| | ALARMS | | | | | | |
| | Over – Under voltage – Voltage Unbalance | – | – | – | – | √ | √ |
| Over – Under current – Current Unbalance | – | – | – | – | – | – | |
| Phase sequence – Phase failure | – | – | – | – | – | – | |
| Over THD-V – Over THD-I | – | – | – | – | – | – | |
| Inputs/Outputs | Relay output: max. 3A/240 Vac | – | – | – | – | 2 pcs NO | 2 pcs NO |
| | Digital input 5-24Vdc max. 30Vdc | – | 2 pcs | – | 2 pcs | – | 2 pcs |
| | Energy pulse output | – | 2 pcs | – | 2 pcs | – | 2 pcs |
| | RS485 MODBUS-RTU | – | – | √ | √ | √ | √ |
| | Password protection | √ | √ | √ | √ | √ | √ |
| | Password protection | –5°C +50 °C | –5°C +50 °C | –5°C +50 °C | –5°C +50 °C | –5°C +50 °C | –5°C +50 °C |
| | Storage temperature | –20°C +70 °C | –20°C +70 °C | –20°C +70 °C | –20°C +70 °C | –20°C +70 °C | –20°C +70 °C |
| | Display | LED Display | LED Display | LED Display | LED Display | LED Display | LED Display |
| | Current transformer | X / 5 | X / 5 | X / 5 | X / 5 | X / 5 | X / 5 |
| | Current transformer ratio | 1 5000 | 1 5000 | 1 5000 | 1 5000 | 1 5000 | 1 5000 |
| Voltage transformer ratio | 1 4000 | 1 4000 | 1 4000 | 1 4000 | 1 4000 | 1 4000 | |
| Auxiliary supply voltage | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | |
| Dimensions | 96x96x56 mm | 96x96x56 mm | 96x96x56 mm | 96x96x56 mm | 96x96x56 mm | 96x96x56 mm | |
| Quantity in 1 box | 12 | 12 | 12 | 12 | 12 | 12 | |

OPTIONS

- 1-100A current transformer ratio
- 100A/22,5 mV LPCT model
- Calibration Certificate
- Auxiliary supply voltage 18-70 Vdc
- Auxiliary supply voltage 85-265 Vac



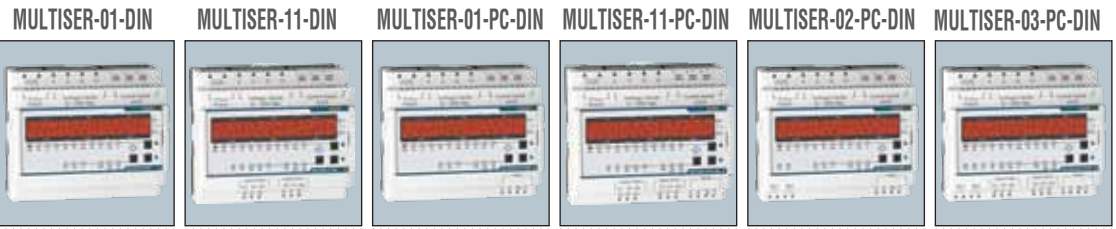
MULTISER-01-PC-96



MULTISER-02-PC-96



MULTISER-03-PC-96



| | MULTISER-01-DIN | MULTISER-11-DIN | MULTISER-01-PC-DIN | MULTISER-11-PC-DIN | MULTISER-02-PC-DIN | MULTISER-03-PC-DIN |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Connection 3P&4W, 3P&3W, ARON | √ | √ | √ | √ | √ | √ |
| Voltage: V1,V2,V3 | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class |
| Voltage: V12,V23,V31 | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class |
| Current: I1, I2, I3, I neutral | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class |
| Active Power: P1,P2,P3,ΣP | √ 1 class | √ 1 class | √ 1 class | √ 1 class | √ 1 class | √ 1 class |
| Reactive Power: Q1,Q2,Q3,ΣQi,ΣQc | √ 2 class | √ 2 class | √ 2 class | √ 2 class | √ 2 class | √ 2 class |
| Cosφ1,Cosφ2,Cosφ3,PF1,PF2,PF3,ΣPF | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] |
| Imp-exp Active Energy kWh | √ 1 class | √ 1 class | √ 1 class | √ 1 class | √ 1 class | √ 1 class |
| Imp-exp Reactive Energy kVARh | √ 2 class | √ 2 class | √ 2 class | √ 2 class | √ 2 class | √ 2 class |
| Demand and peak | √ | √ | √ | √ | √ | √ |
| Total Harmonic: THD and THD-V | √ | √ | √ | √ | √ | √ |
| ALARMS Over – Under voltage – Voltage Unbalance Over – Under current – Current Unbalance Phase sequence – Phase failure Over THD-V – Over THD-I | – | – | – | – | √ | √ |
| Relay output: max. 3A/240 Vac | – | – | – | – | 2 pcs NO | 2 pcs NO |
| Digital input 5-24Vdc max. 30Vdc | – | 2 pcs | – | 2 pcs | – | 2 pcs |
| Energy pulse output | – | 2 pcs | – | 2 pcs | – | 2 pcs |
| RS485 MODBUS-RTU | – | – | √ | √ | √ | √ |
| Password protection | √ | √ | √ | √ | √ | √ |
| Ambient temperature °C | - 5°C +50 °C | - 5°C +50 °C | - 5°C +50 °C | - 5°C +50 °C | - 5°C +50 °C | - 5°C +50 °C |
| Storage temperature °C | - 20°C +70 °C | - 20°C +70 °C | - 20°C +70 °C | - 20°C +70 °C | - 20°C +70 °C | - 20°C +70 °C |
| Display | LED Display | LED Display | LED Display | LED Display | LED Display | LED Display |
| Current transformer | X / 5 | X / 5 | X / 5 | X / 5 | X / 5 | X / 5 |
| Current transformer ratio | 1 5000 | 1 5000 | 1 5000 | 1 5000 | 1 5000 | 1 5000 |
| Voltage transformer ratio | 1 4000 | 1 4000 | 1 4000 | 1 4000 | 1 4000 | 1 4000 |
| Auxiliary supply voltage U ₁ | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA |
| Dimensions | 105x90x59 mm | 105x90x59 mm | 105x90x59 mm | 105x90x59 mm | 105x90x59 mm | 105x90x59 mm |
| Quantity in 1 box | 12 | 12 | 12 | 12 | 12 | 12 |

Measurements

Inputs/Outputs

- VL1,VL2,VL3
- VL12,VL23,VL13
- IL1,IL2,IL3,INotr,Hz
- P1,P2,P3,Q1,Q2,Q3,S1,S2,S3
- Cosφ1,Cosφ2,Cosφ3
- PFD1,PFD2,PFD3,ΣPF
- ΣP,ΣQi,ΣQc,ΣQ,ΣS
- imp-exp ΣkWh
- imp-exp ΣkVARh(ind)
- imp-exp ΣkVARh(kap)
- ΣkVAh
- THD-I ve THD-V



MULTISER-03-PC-DIN



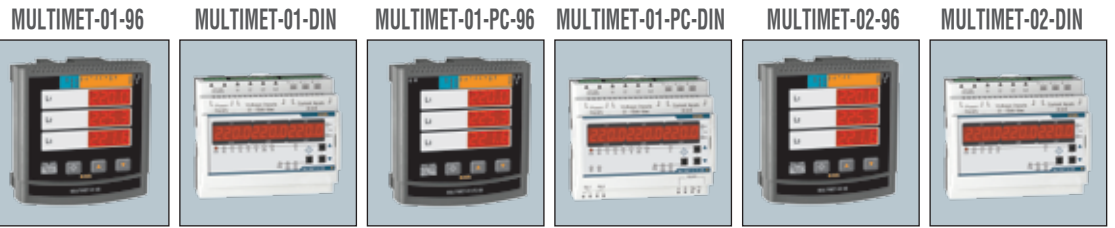
MULTISER-02-PC-DIN



MULTISER-01-PC-DIN



MULTIMETERS



| | MULTIMET-01-96 | MULTIMET-01-DIN | MULTIMET-01-PC-96 | MULTIMET-01-PC-DIN | MULTIMET-02-96 | MULTIMET-02-DIN |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Connection | 3P&4W, 3P&3W, ARON | 3P&4W, 3P&3W, ARON | 3P&4W, 3P&3W, ARON | 3P&4W, 3P&3W, ARON | 3P&4W, 3P&3W, ARON | 3P&4W, 3P&3W, ARON |
| Voltage: V1,V2,V3 | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class |
| Voltage: V12,V23,V31 | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class |
| Current: I1,I2,I3, I nötr | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class |
| Active Power: P1,P2,P3,ΣP | √ 1 class | √ 1 class | √ 1 class | √ 1 class | — | — |
| Reactive Power: Q1,Q2,Q3,ΣQi,ΣQc | √ 2 class | √ 2 class | √ 2 class | √ 2 class | — | — |
| PF1,PF2,PF3 | [± 0.000] - [± 1.000] | [± 0.000] - [± 1.000] | [± 0.000] - [± 1.000] | [± 0.000] - [± 1.000] | [± 0.000] - [± 1.000] | [± 0.000] - [± 1.000] |
| Demand and peak | √ | √ | √ | √ | √ | √ |
| Frequency | √ | √ | √ | √ | √ | √ |
| ALARMS | | | | | | |
| Over – Under voltage – Voltage Unbalance | — | — | √ | √ | — | — |
| Over – Under current – Current Unbalance | — | — | — | — | — | — |
| Phase sequence – Phase failure | — | — | — | — | — | — |
| Relay output: max. 3A/240 Vac | — | — | 2 pcs N.O. | 2 pcs N.O. | — | — |
| RS485 MODBUS-RTU | — | — | √ | √ | — | — |
| Password protection | √ | √ | √ | √ | √ | √ |
| Ambient temperature | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C |
| Storage temperature | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C |
| Display | LED Display | LED Display | LED Display | LED Display | LED Display | LED Display |
| Current transformer | X / 5 A | X / 5 A | X / 5 A | X / 5 A | X / 5 A | X / 5 A |
| Current transformer ratio | 1 5000 | 1 5000 | 1 5000 | 1 5000 | 1 5000 | 1 5000 |
| Voltage transformer ratio | 1 4000 | 1 4000 | 1 4000 | 1 4000 | 1 4000 | 1 4000 |
| Auxiliary supply voltage | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA |
| Dimensions | 96x96x56mm | 105x90x59mm | 96x96x56mm | 105x90x59mm | 96x96x56mm | 105x90x59mm |
| Quantity in 1 box | 12 | 12 | 12 | 12 | 12 | 12 |

Can be monitored with RS485

VL1,VL2,VL3
VL12,VL23,VL13

IL1,IL2,IL3,I-Nötr,Hz
P1,P2,P3,Q1,Q2,Q3,S1,S2,S3

CosΦ1,CosΦ2,CosΦ3 ΣP,ΣQi,ΣQc,ΣQ,ΣS
PFD1,PFD2,PFD3,ΣPF



ENERGY and POWER METERS

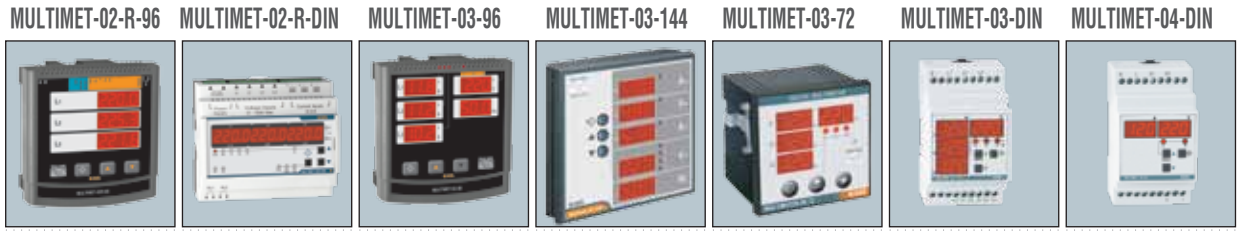
ENERGY-01-DIN ENERGY-01-DIN-100A ENERGY-11-DIN ENERGY-11-DIN-100A



| | ENERGY-01-DIN | ENERGY-01-DIN-100A | ENERGY-11-DIN | ENERGY-11-DIN-100A |
|--------------------------------------|----------------------|----------------------|----------------------|----------------------|
| Connection | 3P&4W | 3P&4W | 3P&4W | 3P&4W |
| Active Power | — | — | √ 1 class | √ 1 class |
| Reactive Power | — | — | √ 2 class | √ 2 class |
| PF1,PF2,PF3 | — | — | — | — |
| Imp-exp Active Energy kWh | √ 1 class | √ 1 class | √ 1 class | √ 1 class |
| Imp-exp Reactive Energy kVARh | √ 2 class | √ 2 class | √ 2 class | √ 2 class |
| Demand and peak | — | — | — | — |
| Energy impulse output | — | — | 2 pcs | 2 pcs |
| RS485 MODBUS-RTU | √ | √ | — | — |
| Password protection | — | — | — | — |
| Ambient temperature | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C |
| Storage temperature | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C |
| Display | LED Display | LED Display | LED Display | LED Display |
| Current transformer | X / 5 | External 100 A | X / 5 | External 100 A |
| Current transformer ratio | 1 5000 | 1 | 1 5000 | 1 |
| Voltage transformer ratio | 1 4000 | 1 4000 | 1 4000 | 1 4000 |
| Auxiliary supply voltage | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA |
| Dimensions | 105x90x59 mm | 105x90x59 mm | 105x90x59 mm | 105x90x59 mm |
| Quantity in 1 box | 12 | 12 | 12 | 12 |



MULTIMETERS



| | MULTIMET-02-R-96 | MULTIMET-02-R-DIN | MULTIMET-03-96 | MULTIMET-03-144 | MULTIMET-03-72 | MULTIMET-03-DIN | MULTIMET-04-DIN |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Connection | 3P&4W, 3P&3W, ARON | 3P&4W, 3P&3W, ARON | 3P&4W | 3P&4W | 3P&4W | 3P&4W | 1P&2W |
| Voltage: V1,V2,V3 | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class | 1 -300 Vac; 0.5 class |
| Voltage: V12,V23,V31 | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class | 2 -600 Vac; 0.5 class |
| Current: I1, I2, I3, 1 neutral | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class | 10mA - 6A; 0.5 class |
| Active Power: P1,P2,P3,ΣP | — | — | — | — | — | — | — |
| Reactive Power: Q1,Q2,Q3,ΣQi,ΣQc | — | — | — | — | — | — | — |
| PF1,PF2,PF3 | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] |
| Demand and peak | √ | √ | — | — | — | — | — |
| Frequency | √ | √ | √ | √ | √ | √ | √ |
| ALARMS | | | | | | | |
| Over – Under voltage – Voltage Unbalance | √ | √ | — | — | — | — | — |
| Over – Under current – Current Unbalance | — | — | — | — | — | — | — |
| Phase sequence – Phase failure | — | — | — | — | — | — | — |
| Relay output: max. 3A/240Vac | 2 pcs N.O. | 2 pcs N.O. | — | — | — | — | — |
| RS485 MODBUS-RTU | — | — | — | — | — | — | — |
| Password protection | √ | √ | — | — | — | — | — |
| Ambient temperature | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C |
| Storage temperature | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C |
| Display | LED Display | LED Display | LED Display | LED Display | LED Display | LED Display | LED Display |
| Current transformer | X / 5 A | X / 5 A | X / 5 A | X / 5 A | X / 5 A | X / 5 A | X / 5 A |
| Current transformer ratio | 1 5000 | 1 5000 | 1 5000 | 1 5000 | 1 5000 | 1 5000 | 1 5000 |
| Voltage transformer ratio | 1 4000 | 1 4000 | 1 4000 | 1 4000 | 1 4000 | 1 4000 | 1 4000 |
| Auxiliary supply voltage | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA |
| Dimensions | 96x96x56mm | 105x90x59 mm | 96x96x56 mm | 144x144 mm | 72x72 mm | 3 Modul DIN | 3 Modul DIN |
| Quantity in 1 box | 12 | 12 | 12 | 5 | 10 | 6 | 6 |



ENERGY and POWER METERS

ENERGY-02-PC-96 ENERGY-02-PC-DIN POWER-01-96 POWER-01-DIN



OPTION

Calibration Certificate

| | ENERGY-02-PC-96 | ENERGY-02-PC-DIN | POWER-01-96 | POWER-01-DIN |
|-------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Connection | 3P&4W, 3P&3W, ARON | 3P&4W, 3P&3W, ARON | 3P&4W, 3P&3W, ARON | 3P&4W, 3P&3W, ARON |
| Active Power | √ 1 class | √ 1 class | √ 1 class | √ 1 class |
| Rective Power | √ 2 class | √ 2 class | √ 2 class | √ 2 class |
| PF1,PF2,PF3 | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] | [± 0.000] – [± 1.000] |
| Imp-exp Active Energy kWh | √ 1 class | √ 1 class | — | — |
| Imp-exp Rective Energy kVARh | √ 2 class | √ 2 class | — | — |
| Demand and peak | √ | √ | √ | √ |
| Energy impulse output | 2 pcs | 2 pcs | — | — |
| RS485 MODBUS-RTU | √ | √ | — | — |
| Password protection | √ | √ | √ | √ |
| Ambient temperature | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C |
| Storage temperature | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C |
| Display | LED Display | LED Display | LED Display | LED Display |
| Current transformer | X / 5 | X / 5 | X / 5 | X / 5 |
| Current transformer ratio | 1 5000 | 1 5000 | 1 5000 | 1 5000 |
| Voltage transformer ratio | 1 4000 | 1 4000 | 1 4000 | 1 4000 |
| Auxiliary supply voltage | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA |
| Dimensions | 96x96x100 mm | 105x90x59 mm | 105x90x59 mm | 105x90x59 mm |
| Quantity in 1 box | 12 | 12 | 12 | 12 |

Can be monitored with RS485

VL1,VL2,VL3
 VL12,VL23,VL13
 IL1,IL2,IL3,INeutral,HZ
 P1,P2,P3,Q1,Q2,Q3,S1,S2,S3
 CosΦ1,CosΦ2,CosΦ3
 PFD1,PFD2,PFD3,ΣPF
 ΣP,ΣQi,ΣQc,ΣQ,ΣS
 imp-exp ΣkWh
 imp-exp ΣkVARh(ind)
 imp-exp ΣkVARh(kap)
 ΣkVAh
 THD-I and THD-V
 Single current harmonics
 Single voltage harmonics



AMPERMETERS

TRUE RMS

DAM-A-96



DAM-A-72



DAM-B-96



DAM-B-72



DAM-C-96



DAM-C-72



DAM-D-96



| | | | | | | | |
|--|-------------------------|-------------------------|--|--|---|---|--|
| Product name | AC Universal ammeter | AC Universal ammeter | Over current set value AC Universal ammeter | Over current set value AC Universal ammeter | Over&Under current set value AC Universal ammeter | Over&Under current set value AC Universal ammeter | 2 Over current set values AC Universal ammeter |
| Relay output | — | — | 1 | 1 | 2 | 2 | 2 |
| Current transformer 5-10000 A | √ | √ | √ | √ | √ | √ | √ |
| Direct current transformer 2-100A | — | — | — | — | — | — | — |
| Over current set value | — | — | 1 | 1 | 1 | 1 | 2 |
| Under current set value | — | — | — | — | 1 | 1 | — |
| DEMAND | √ | √ | √ | √ | √ | √ | — |
| Frequency | 50-60 Hz | 50-60 Hz | 50-60 Hz | 50-60 Hz | 50-60 Hz | 50-60 Hz | 50-60 Hz |
| Ambient temperature ↓ °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C |
| Storage temperature ↓ °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C |
| Auxiliary supply voltage ⚡ | 230 Vac | 230 Vac | 230 Vac | 230 Vac | 230 Vac | 230 Vac | 230 Vac |
| Dimensions ↔ | 96x96x80 | 72x72x80 | 96x96x80 | 72x72x80 | 96x96x80 | 72x72x80 | 96x96x80 |
| Quantity in 1 box | 12 | 10 | 12 | 10 | 12 | 10 | 12 |



VOLTMETERS

TRUE RMS

DV-96



DV-96-03



DV72



DV-72-01



DV-72-03



DV-72-01C



DV-72-03C



| | | | | | | | |
|-----------------------------------|--------------------|------------------------------------|--------------------|----------------------------------|------------------------------------|--|---|
| Product name | Voltmeter AC | Selectable 3 phase Voltmeter AC | Voltmeter AC | Voltmeter AC + Frequencymeter | Selectable 3 phase Voltmeter AC | Voltage and Frequency Protection device | 3 phase Voltage and Frequency Protection device |
| Measurement | 0-500 Vac | 0-500 Vac | 0-500 Vac | 0-500 Vac - 40-100 Hz | 0-500 Vac - 40-100 Hz | 0-500 Vac - 40-100 Hz | 0-500 Vac - 40-100 Hz |
| Over-Under Voltage range | — | — | — | — | — | 150-210 V 230-290 V | 300-370 V 390-460 V |
| Asymmetry range ⚡ | — | — | — | — | — | — | %5-%20 |
| Relay output | — | — | — | — | — | 1 | 1 |
| Phase sequence control ⚡ | — | — | — | — | — | — | √ |
| Ambient temperature ↓ °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C |
| Storage temperature ↓ °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C |
| Auxiliary supply voltage ⚡ | 230 Vac | 230 Vac | 230 Vac | 230 Vac | 230 Vac | 230 Vac | 230 Vac |
| Dimensions ↔ | 96x96x80 | 96x96x80 | 72x72x80 | 72x72x80 | 72x72x80 | 72x72x80 | 72x72x80 |
| Quantity in 1 box | 12 | 12 | 10 | 10 | 10 | 10 | 10 |

DAM-D-72**DAK-A-96****DAK-A-72****DAK-72-B****DAM-A-48****DAK-A-48-PC**

| | | | | | | |
|--|---|------------------------|------------------------|---|-------------------------|-----------------------------------|
| Product name | 2 Over current set values AC Universal ampermeter | Direct ampermeter 100A | Direct ampermeter 100A | Over current set value Direct ampermeter 100A | AC Universal ampermeter | Direct ampermeter 100A with RS485 |
| Relay output | 2 | — | — | 1 | — | — |
| Current transformer 5-10000 A | √ | — | — | — | √ | — |
| Direct current transformer 2-100A | — | √ | √ | √ | — | √ |
| Over current set value | 2 | — | — | 1 | — | — |
| Under current set value | — | — | — | — | — | — |
| DEMAND | — | — | — | — | √ | — |
| Frequency | 50-60 Hz | 50-60 Hz | 50-60 Hz | 50-60 Hz | 50-60 Hz | 50-60 Hz |
| Ambient temperature | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C |
| Storage temperature | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C |
| Auxiliary supply voltage | 230 Vac | 230 Vac | 230 Vac | 230 Vac | 230 Vac | 230 Vac |
| Dimensions | 72x72x80 | 96x96x80 | 72x72x80 | 72x72x80 | 48x96x50 | 48x96x50 |
| Quantity in 1 box | 10 | 12 | 10 | 10 | 16 | 16 |

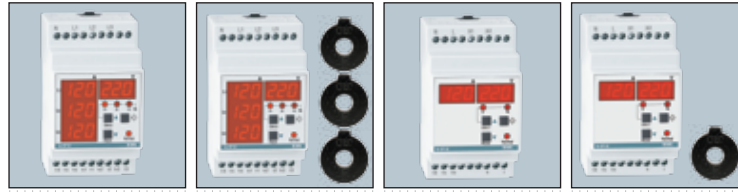
DV-72-R**DV-72-RR****DV-03-(D)****DV-48-01****DV-48-03**

| | | | | | |
|---------------------------------|------------------------------|------------------------------|---|----------------------|---------------------------------|
| Product name | Autoregulator Control device | Autoregulator Control device | Selectable 3 phase Voltmeter and Frequencymeter | Voltmeter AC | Selectable 3 phase Voltmeter AC |
| Measurement | 0-500 Vac | 0-500 Vac | 0-500 Vac - 40-100 Hz | 0-500 Vac | 0-500 Vac |
| Over-Under Voltage range | — | — | — | — | — |
| Assymetry range | — | — | — | — | — |
| Relay output | — | 1 | — | — | — |
| Phase sequence control | — | — | — | — | — |
| Ambient temperature | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C |
| Storage temperature | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C |
| Auxiliary supply voltage | 230 Vac | 230 Vac | 230 Vac | 230 Vac | 230 Vac |
| Dimensions | 72x72x80 | 72x72x80 | 35x90x58 | 48x96x50 | 48x96x50 |
| Quantity in 1 box | 10 | 10 | 10 | 16 | 16 |



VOLTAGE and CURRENT PROTECTION RELAYS

Ke-DP-01 Ke-DP-01-100A with Current transformer Ke-DP-02 Ke-DP-02-100A with Current transformer



| | | | | |
|--|--------------------|--------------------|--------------------|--------------------|
| 3 phase 3P&4W connection | ✓ | ✓ | — | — |
| 1 phase 1P&2W connection | — | — | ✓ | ✓ |
| Voltage (V) | ✓ | ✓ | ✓ | ✓ |
| Current (A) | ✓ | ✓ | ✓ | ✓ |
| Frequency (Hz) | ✓ | ✓ | ✓ | ✓ |
| True RMS | ✓ | ✓ | ✓ | ✓ |
| Phase sequence control | ✓ | ✓ | — | — |
| Phase failure | ✓ | ✓ | ✓ | ✓ |
| Over Voltage protection | $U_{>}$ | 390-460 V | 235-275 V | 235-275 V |
| Under Voltage protection | $U_{<}$ | 300-370 V | 180-225 V | 180-225 V |
| Voltage unbalance protection (assymetry) | | %5-%20 | — | — |
| Over Current protection | ✓ | ✓ | ✓ | ✓ |
| Under Current protection | ✓ | ✓ | ✓ | ✓ |
| Current unbalance protection (assymetry) | | %5-%40 | — | — |
| Over/Under Frequency protection | | 40-70 Hz | 40-70 Hz | 40-70 Hz |
| Error locking (LATCH) function | ✓ | ✓ | ✓ | ✓ |
| Current transformer ratio | ✓ | — | ✓ | — |
| 2-100 A | — | ✓ | — | ✓ |
| Relay output (max. 3A/240Vac) | 1 piece | 1 piece | 1 piece | 1 piece |
| Ambient temperature | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C |
| Storage temperature | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C |
| Auxiliary supply voltage | U_n | 230 Vac < 3VA | 230 Vac < 3VA | 230 Vac < 3VA |
| Dimensions | 3M | 3M | 3M | 3M |
| Quantity in 1 box | 16 | 16 | 16 | 16 |



Ke-DP-01

VL1,VL2,VL3
VL12,VL23,VL13
IL1,IL2,IL3

Hz

- Phase sequence control
- Over Voltage protection
- Under Voltage protection
- Voltage unbalance protection
- Over Current protection
- Under Current protection
- Current unbalance protection
- Over Frequency protection
- Under Frequency protection
- LATCH function
- TRUE RMS



LIQUID LEVEL CONTROL RELAYS

Ke-SKR SKR-DIN SE

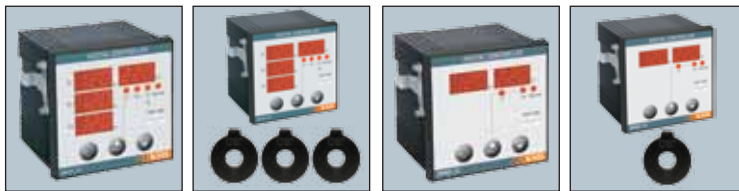


| | | | |
|--------------------------|----------------------------|----------------------------|----------------------------|
| Product name | Liquid level control relay | Liquid level control relay | Electrode |
| Sensivity adjustment | 5-100 K Ω | 5-100 K Ω | — |
| Ambient temperature | -5°C +50 °C | -5°C +50 °C | — |
| Storage temperature | -20°C +70 °C | -20°C +70 °C | — |
| Auxiliary supply voltage | U_n | 230 Vac < 3VA | — |
| Dimensions | 28x82x80mm | 35x90x58mm | \varnothing 17 - h 87 mm |
| Quantity in 1 box | 8 | 26 | 2 |



SKR-DIN

DP01-72 **DP01-72-100A** with Current transformer **DP02-72** **DP02-72-100A** with Current transformer



| | | | | |
|--|----------------------|----------------------|----------------------|----------------------|
| 3 phase 3P&4W connection | ✓ | ✓ | — | — |
| 1 phase 1P&2W connection | — | — | ✓ | ✓ |
| Voltage (V) | ✓ | ✓ | ✓ | ✓ |
| Current (A) | ✓ | ✓ | ✓ | ✓ |
| Frequency (Hz) | ✓ | ✓ | ✓ | ✓ |
| True RMS | ✓ | ✓ | ✓ | ✓ |
| Phase sequence control | ✓ | ✓ | — | — |
| Phase failure | ✓ | ✓ | ✓ | ✓ |
| Over Voltage protection | 390-460 V | 390-460 V | 235-275 V | 235-275 V |
| Under Voltage protection | 300-370 V | 300-370 V | 180-225 V | 180-225 V |
| Voltage unbalance protection (assymetry) | %5-%20 | %5-%20 | — | — |
| Over Current protection | ✓ | ✓ | ✓ | ✓ |
| Under Current protection | ✓ | ✓ | ✓ | ✓ |
| Current unbalance protection (assymetry) | %5-%40 | %5-%40 | — | — |
| Over/Under Frequency protection | 40-70 Hz | 40-70 Hz | 40-70 Hz | 40-70 Hz |
| Error locking (LATCH) function | ✓ | ✓ | ✓ | ✓ |
| Current transformer ratio | ✓ | — | ✓ | — |
| 2-100 A | — | ✓ | — | ✓ |
| Relay output (max. 3A/240Vac) | 1 piece | 1 piece | 1 piece | 1 piece |
| Ambient temperature | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C |
| Storage temperature | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C |
| Auxiliary supply voltage | 230 Vac < 3VA | 230 Vac < 3VA | 230 Vac < 3VA | 230 Vac < 3VA |
| Dimensions | 72x72x80mm | 72x72x80mm | 72x72x80mm | 72x72x80mm |
| Quantity in 1 box | 10 | 12 | 10 | 12 |



DP02-72

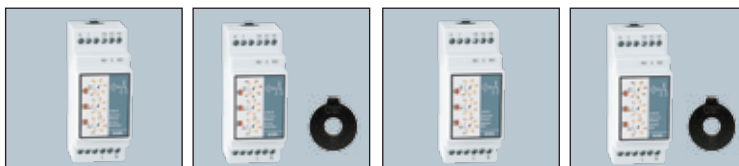
V, I, Hz

- Over Voltage protection
- Under Voltage protection
- Over Current protection
- Under Current protection
- Over Frequency protection
- Under Frequency protection
- LATCH function
- TRUE RMS



CURRENT PROTECTION RELAYS

OCM-01 **OCM-03** **UCM-01** **UCM-03**



| | | | | |
|-------------------------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|
| Product name | Over Current Protection relay | Over Current Protection relay | Under Current Protection relay | Under Current Protection relay |
| Current transformer | X / 5A | 100A | X / 5A | 100A |
| Current value range | 0,5 - 5A | 10 - 100A | 0,5 - 5A | 10 - 100A |
| Delay time | 0,5 - 2,5 sn | 0,5 - 2,5 sn | 0,5 - 2,5 sn | 0,5 - 2,5 sn |
| START Delay time | 1-6 sn | 1-6 sn | 1-6 sn | 1-6 sn |
| Relay output (max. 5A/240Vac) | 1 | 1 | 1 | 1 |
| Ambient temperature | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C |
| Storage temperature | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C |
| Auxiliary supply voltage | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA | 230 Vac < 4VA |
| Dimensions | 35x90x 58 | 35x90x 58 | 35x90x 58 | 35x90x 58 |
| Quantity in 1 box | 26 | 26 | 26 | 26 |



UCM-01

ASTRONOMICAL TIME SWITCHES

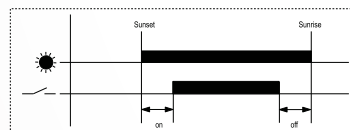
Astro-GPS Astronomical time switch

ASTRO-GPS (without the need for a battery) obtains real time and date by GPS module, and thanks to its microprocessor, calculates sunrise and sunset time. One of two potentiometers located on the panel switches on the lighting after sunset (minutes) and the other - switches off the lighting before sunrise (minutes)

Advantages:

- Dependence on batteries has been eliminated as device collects all the necessary data from the satellite, as a result no batteries to be replaced and no battery related extra costs to be handled.
- Astronomical data is updated automatically
- Easy to use as there is no need for manual astronomical data adjustments

Working mode



ASTRO1-GPS
Outdoor,
Inside polyester
panel

**Internal GPS
Antenna**



ASTRO2-GPS
Indoor-Outdoor,
Inside metal panel

**External GPS
Antenna**



Astro-11 Astronomical time switch

- English menu
- LCD display with backlight
- Replaceable battery
- Real time and Date
- Astro-01/Astro-11/Astro-30/ Astro-31 (24 programs) Astronomic and/or Time relay
- Astro-03/Astro-13 (100 programs) Astronomic and/or Time relay
- Astro-05/Astro-15 (56 programs) Astronomic, Time and /or with pray time programmable relay
- Automatic, manual or disabled winter-summer season selecton
- ON and OFF time
- 2 relay outputs; Astro-01/Astro-03/Astro-05/Astro-30 (8A)
- 2 relay outputs; Astro-11/Astro-13/Astro-15/Astro-31 (16A)
- Easily programmed through PC
- Optical software upload with **CON3**
- Graphical simulation program for every output
- Automatic sunrise and sunset time calculation is based on current coordinate and date-time information
- Different values for sunrise and sunset time +-
- Alphabetical city and county selection
- Holiday mode selection
- Two manual control modes (continuous and temporary)
- PIN code protection from unauthorized parties

Astro-13-RS485 Astronomical time switch

- English menu
- LCD display with backlight
- Rechargeable battery
 - **RS485** MODBUS-RTU
- Real time and Date
 - 100 programs
- Automatic, manual or disabled winter-summer season selecton
- ON and OFF time
 - 2 relay outputs (16A)
- Easily programmed through PC
 - Optical software upload with **CON3**
- Graphical simulation program for every output
 - Automatic sunrise and sunset time calculation is based on current coordinate and date-time information
 - Different values for sunrise and sunset time +-
 - Alphabetical city and county election
 - Holiday mode selection
 - Two manual control modes (continuous and temporary)
 - PIN code protection from unauthorized parties





ASTRONOMICAL TIME SWITCHES

ASTRO-30



ASTRO-31



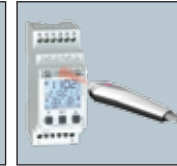
ASTRO-01



ASTRO-03



ASTRO-05



Con-3



Patent no: TR 2012 01075 Y

| | | | | | |
|---|----------------------|----------------------|----------------------|----------------------|----------------------|
| Number of programs | 24 | 24 | 24 | 100 | 56 |
| Contact current | 8 A | 16 A | 8 A | 8 A | 8 A |
| Relay output | 2 B-M contacts | 2 B-M contacts | 2 B-M contacts | 2 B-M contacts | 2 B-M contacts |
| Astronomical time function | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time function | ✓ | ✓ | ✓ | ✓ | ✓ |
| Pray time function | — | — | — | — | ✓ |
| Program installation with remote controller | — | — | ✓ | ✓ | ✓ |
| Date-Time installation with remote controller | — | — | ✓ | ✓ | ✓ |
| Additional reserve SUPERCAP | ✓ | ✓ | ✓ | ✓ | ✓ |
| Battery replacement | ✓ | ✓ | ✓ | ✓ | ✓ |
| PIN password protection | ✓ | ✓ | ✓ | ✓ | ✓ |
| Automatic Winter-Summer season | ✓ | ✓ | ✓ | ✓ | ✓ |
| Holiday mode | ✓ | ✓ | ✓ | ✓ | ✓ |
| Manual control | ✓ | ✓ | ✓ | ✓ | ✓ |
| OFFSET value | ✓ | ✓ | ✓ | ✓ | ✓ |
| Display backlight | ✓ | ✓ | ✓ | ✓ | ✓ |
| RS485 MODBUS-RTU | — | — | — | — | — |
| GSM modem | — | — | — | — | — |
| Automatic Date-Time | — | — | — | — | — |
| Coordinates autosearch | — | — | — | — | — |
| Application area | Indoor and Outdoor | Indoor and Outdoor | Indoor and Outdoor | Indoor and Outdoor | Indoor and Outdoor |
| Ambient temperature | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C |
| Storage temperature | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C |
| Display | LCD | LCD | LCD | LCD | LCD |
| Auxiliary supply voltage | 230 Vac < 3VA | 230 Vac < 3VA | 230 Vac < 3VA | 230 Vac < 3VA | 230 Vac < 3VA |
| Dimensions | 2 Modul DIN | 2 Modul DIN | 2 Modul DIN | 2 Modul DIN | 2 Modul DIN |
| Quantity in 1 box | 26 | 26 | 26 | 26 | 26 |

(for Astronomical Time relay) USB-Infrared converter

CR 2032



LIR 2032



Rechargeable battery



Models with CON-3 icon can be programmed.
CON-3 price is NOT included

ASTRO-11



ASTRO-13



ASTRO-15



ASTRO-13-RS485



ASTRO1-GPS



ASTRO2-GPS

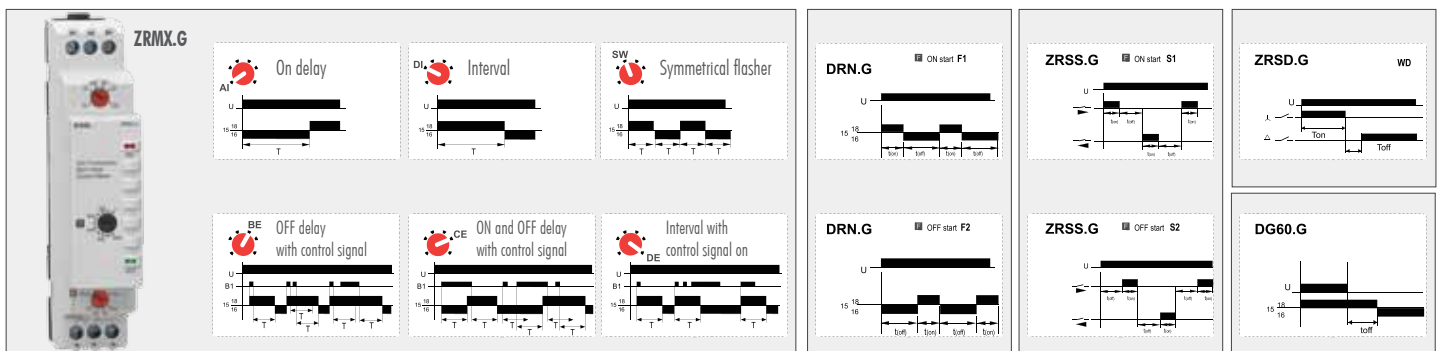


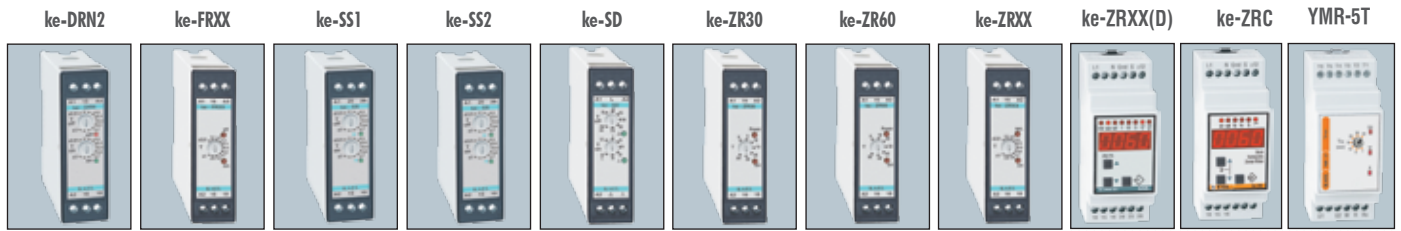
| | | | | | | |
|---|----------------------|----------------------|----------------------|----------------------|---------------------------------|--|
| Number of programs | 24 | 100 | 56 | 100 | 2 | 2 |
| Contact current | 16 A | 16 A | 16 A | 16 A | 5 A | 10 A |
| Relay output | 2 B-M contacts | 2 B-M contacts | 2 B-M contacts | 2 B-M contacts | 1 NO | 1 B-M contact |
| Astronomical time function | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Time function | ✓ | ✓ | ✓ | ✓ | — | — |
| Pray time function | — | — | ✓ | — | — | — |
| Program installation with remote controller | ✓ | ✓ | ✓ | ✓ | — | — |
| Date-Time installation with remote controller | ✓ | ✓ | ✓ | ✓ | — | — |
| Additional reserve SUPERCAP | ✓ | ✓ | ✓ | Rechargeable battery | — | — |
| Battery replacement | ✓ | ✓ | ✓ | — | — | — |
| PIN password protection | ✓ | ✓ | ✓ | ✓ | — | — |
| Automatic Winter-Summer season | ✓ | ✓ | ✓ | ✓ | — | — |
| Holiday mode | ✓ | ✓ | ✓ | ✓ | — | — |
| Manual control | ✓ | ✓ | ✓ | ✓ | — | — |
| OFFSET value | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Display backlight | ✓ | ✓ | ✓ | ✓ | — | — |
| RS485 MODBUS-RTU | — | — | — | ✓ | — | — |
| GSM modem | — | — | — | — | ✓ | ✓ |
| Automatic Date-Time | — | — | — | — | ✓ | ✓ |
| Coordinates autosearch | — | — | — | — | ✓ | ✓ |
| Application area | Indoor and Outdoor | Indoor and Outdoor | Indoor and Outdoor | Indoor and Outdoor | Outdoor, Inside polyester panel | Indoor and Outdoor, Inside metal panel |
| Ambient temperature | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 20°C + 60 °C | - 20°C + 60 °C |
| Storage temperature | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C |
| Display | LCD | LCD | LCD | LCD | — | — |
| Auxiliary supply voltage | 230 Vac < 3VA | 230 Vac < 3VA | 230 Vac < 3VA | 230 Vac < 3VA | 85-265 Vac | 85-265 Vac |
| Dimensions | 2 Modul DIN | 2 Modul DIN | 2 Modul DIN | 2 Modul DIN | 1 Modul DIN | 1 Modul DIN |
| Quantity in 1 box | 26 | 26 | 26 | 16 | 10 | 10 |



TIME RELAYS

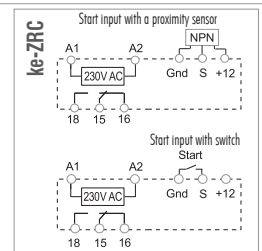
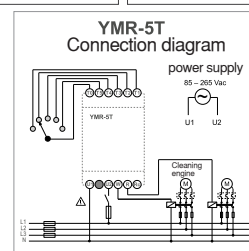
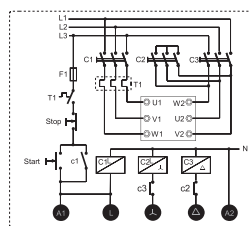
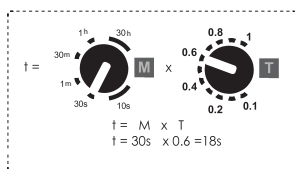
| | ZRMX.G | ZRXX.G | ZR30.G | ZR60.G | DRN.G | ZRSS.G | SD.G | DG60.G | HSR.G | ke-DRN1 |
|--|---|---|---|---|---|---|---|---|---|---|
| Product name | Multifunction timer with SIGNAL input | Multifunction timer | 30 sec Time relay | 60 sec Time relay | Multirange double time adjusted flasher | Multirange ON and OFF Adjusted DIRECTION Inverse relay | Star-Delta relay | OFF delay time relay After the power supply is switched off | Multifunction hydrophore sequencing relay | Double time adjusted flasher (ON START) |
| Operating time interval | 0.1 sec – 30 sec x 0.1 x1 | 0.1 sec – 30 sec x 0.1 x1 | 0.6 sec – 30 sec x 0.6 30 | 1 sec – 60 sec 1 60 | T (ON) 0.1 sec – 30 h x 0.1 x1 T (OFF) 0.1 sec – 30 h x 0.1 x1 | T (ON) 0.1 sec – 30 h x 0.1 x1 T (OFF) 0.1 sec – 30 h x 0.1 x1 | T (ON) 0.3 sec – 30 sec 0.3 30 T (OFF) 50 – 250 msec 50 250 | T (OFF) 0.1 sec – 60 min x 0.1 x1 | Change sequence Time interval 1 min – 100 min 1 100 | T (ON) 0.1 sec – 60 min x 0.1 x1 T (OFF) 0.1 sec – 60 min x 0.1 x1 |
| Time mode selection | 1 min 30 min 30sec 1 h 10sec 30 h | 1 min 30 min 30sec 1 h 10sec 30 h | – | – | (ON Mode) 1 min 30 min 30sec 1 h 10sec 30 h (OFF Mode) 1 min 30 min 30 sec 1 h 10 sec 30 h | (ON Mode) 1 min 30 min 30sec 1 h 10sec 30 h (OFF Mode) 1 min 30 min 30 sec 1 h 10 sec 30 h | – | 1 min 10 min 30sec 30 min 10 sec 60 min | 1 min 10 min 30sec 30 min 10 sec 60 min | ON 5sec 10sec 30sec 60sec 5min 10min 30min 60min OFF 5sec 10sec 30sec 60sec 5min 10min 30min 60min |
| Supply voltage <i>NOTE: can be produced with different voltage value</i> | A1-A2:12...240 V AC/DC (50/60) Hz U _{max} = 265V _{ac} /dc U _{min} = 10,8V _{ac} /dc | A1-A2:230V AC A2-A3:24V AC (50/60) Hz U _{max} = (1,10) x U _n U _{min} = (0,90) x U _n | A1-A2:230V AC A2-A3:24V AC (50/60) Hz U _{max} = (1,10) x U _n U _{min} = (0,90) x U _n | A1-A2:230V AC A2-A3:24V AC (50/60) Hz U _{max} = (1,10) x U _n U _{min} = (0,90) x U _n | A1-A2:230V AC A2-A3:24V AC (50/60) Hz U _{max} = (1,10) x U _n U _{min} = (0,90) x U _n | A1-A2:230V AC (50/60) Hz U _{max} = (1,10) x U _n U _{min} = (0,90) x U _n | A1-A2:230V AC A2-A3:24V AC (50/60) Hz U _{max} = (1,10) x U _n U _{min} = (0,90) x U _n | A1-A2: 85-265VAC (50/60) Hz | A1-A2: 85-265VAC (50/60) Hz | A1-A2:230V AC A2-A3:24V AC (50/60) Hz U _{max} = (1,10) x U _n U _{min} = (0,90) x U _n |
| Contact | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250V AC 5A/250V AC 5A/250V AC | 5A/250Vac |
| Ambient temperature | -20°C + 60°C | -20°C + 60°C | -20°C + 60°C | -20°C + 60°C | -20°C + 60°C | -20°C + 60°C | -20°C + 60°C | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C |
| Dimensions | | | | | | | | | | |
| Connection | | | | | | | | | | |
| Function | | | AI ON delay | AI OFF delay | F1 F2 | S1 S2 | WD Star-Delta | DC | 2H 3H 2H: 2 pumps operation 3H: 3 pumps operation | F1 |
| Quantity in 1 box | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |





| | ke-DRN2 | ke-FRXX | ke-SS1 | ke-SS2 | ke-SD | ke-ZR30 | ke-ZR60 | ke-ZRXX | ke-ZRXX(D) | ke-ZRC | YMR-5T | |
|--|---|---|---|---|---|---|---|---|--|---|--|--|
| Product name | Double time adjusted flasher (OFF START) | Flasher (ON START) | DIRECTION inverse Relay (ON START) | DIRECTION inverse Relay (OFF START) | Star - Delta relay | 30 sec Time relay | 60 sec Time relay | Multifunctional Time relay | Digital multifunctional Time relay | Time relay for counter function | Cleaning machine relay | |
| Operating time interval | T (ON) 0.1 sec – 60 min x 0.1 x 1 T (OFF) 0.1 sec – 60 min x 0.1 x 1 | 0.1 sec – 30 h x 0.1 x 1 | T (ON) 0.1 sec – 60 min x 0.1 x 1 T (OFF) 0.1 sec – 60 min x 0.1 x 1 | T (ON) 0.1 sec – 60 min x 0.1 x 1 T (OFF) 0.1 sec – 60 min x 0.1 x 1 | T (ON) 0.3 sec – 30 sec x 0.1 x 1 T (OFF) 50 – 250 msec x 0.1 x 1 | T (ON) 0.6 sec – 30 sec x 0.1 x 1 T (OFF) 50 – 250 msec x 0.1 x 1 | T (ON) 1 sec – 60 sec x 0.1 x 1 T (OFF) 50 – 250 msec x 0.1 x 1 | 0.1 sec – 30 h x 0.1 x 1 | Working time range 0.1sec-9999min Programs (P1...P19) • Double time adjustable flasher • Double time relay • Right-left relay • ON delay time relay • ON OFF time relay • OFF delay time relay • ON-OFF time relay • Impulse relay • Start input : with Npn Proximity sensor or switch • 2 Relays output | Working time range 0.1sec-9999 sec (ts) • 1 relay output • 1-99 counter (tc) • Start input with proximity sensor or switch • ON delay time relay • OFF delay time relay • ON-OFF time relay • Impulse relay • Start input; proximity sensor • Pulse counter 1-9999 stored in memory | Working time ranges -5 Different cleaning time T1 : 30 sec T2 : 60 sec T3 : 120 sec T4 : 180 sec T5 : 180 sec -Standby time: 3 sec -Durulama süresi: 1-30 sec -Buzzer warning after operation end | |
| Time mode selection | ON: 5sec, 10sec, 30sec, 60sec, 5min, 10min, 30min, 60min OFF: 5sec, 10sec, 30sec, 60sec, 5min, 10min, 30min, 60min | ON: 1sec, 5min, 10h OFF: 5min, 10min, 15min, 25h, 30min, 60min | ON: 5sec, 10sec, 30sec, 60sec, 5min, 10min, 30min, 60min OFF: 5sec, 10sec, 30sec, 60sec, 5min, 10min, 30min, 60min | ON: 5sec, 10sec, 30sec, 60sec, 5min, 10min, 30min, 60min OFF: 5sec, 10sec, 30sec, 60sec, 5min, 10min, 30min, 60min | ON: 5sec, 10sec, 30sec, 60sec, 5min, 10min, 30min, 60min OFF: 5sec, 10sec, 30sec, 60sec, 5min, 10min, 30min, 60min | ON: 5sec, 10sec, 30sec, 60sec, 5min, 10min, 30min, 60min OFF: 5sec, 10sec, 30sec, 60sec, 5min, 10min, 30min, 60min | ON: 5sec, 10sec, 30sec, 60sec, 5min, 10min, 30min, 60min OFF: 5sec, 10sec, 30sec, 60sec, 5min, 10min, 30min, 60min | ON: 1sec, 5min, 10h OFF: 5min, 10min, 15min, 25h, 30min, 60min | ON: 1sec, 5min, 10h OFF: 5min, 10min, 15min, 25h, 30min, 60min | L-N : 230V AC (50/60) Hz Umax = (1,10) x Un Umin = (0,90) x Un | L-N : 230V AC (50/60) Hz Umax = (1,10) x Un Umin = (0,90) x Un | L-N : 230V AC (50/60) Hz Umax = (1,10) x Un Umin = (0,90) x Un |
| Supply voltage <i>NOTE: can be produced with different voltage value</i> | A1-A2:230V AC A2-A3:24V AC (50/60) Hz | A1-A2:230V AC A2-A3:24V AC (50/60) Hz | A1-A2:230V AC (50/60) Hz | A1-A2:230V AC (50/60) Hz | A1-A2:230V AC A2-A3:24V AC (50/60) Hz | A1-A2:230V AC A2-A3:24V AC (50/60) Hz | A1-A2:230V AC A2-A3:24V AC (50/60) Hz | A1-A2:230V AC A2-A3:24V AC (50/60) Hz | A1-A2:230V AC A2-A3:24V AC (50/60) Hz | L-N : 230V AC (50/60) Hz | L-N : 230V AC (50/60) Hz | |
| Contact | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | cleaning relay U2 Durulama Rölesi | |
| Ambient temperature | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | - | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | |
| Dimensions | 35 mm x 82 mm x 28 mm | 35 mm x 82 mm x 28 mm | 35 mm x 82 mm x 28 mm | 35 mm x 82 mm x 28 mm | 35 mm x 82 mm x 28 mm | 35 mm x 82 mm x 28 mm | 35 mm x 82 mm x 28 mm | 35 mm x 82 mm x 28 mm | 35 mm x 82 mm x 28 mm | 35 mm x 82 mm x 28 mm | 35 mm x 82 mm x 28 mm | |
| Connectoin | A1 A2 A3 230V AC 24V AC/D Max. 5A / 250Vac | A1 A2 A3 230V AC 24V AC/D Max. 5A / 250Vac | A1 A2 230V AC Max. 5A / 250Vac | A1 A2 230V AC Max. 5A / 250Vac | A1 A2 A3 230V AC 24V AC/D Max. 5A / 250Vac | A1 A2 A3 230V AC 24V AC/D Max. 5A / 250Vac | A1 A2 A3 230V AC 24V AC/D Max. 5A / 250Vac | A1 A2 A3 230V AC 24V AC/D Max. 5A / 250Vac | A1 A2 A3 230V AC 24V AC/D Max. 5A / 250Vac | A1 A2 A3 230V AC 24V AC/D Max. 5A / 250Vac | A1 A2 A3 230V AC 24V AC/D Max. 5A / 250Vac | |
| Function | F2 | SW | S1 | S2 | WD | AI | AI | AI (AI) (DI) | AI (AI) (DI) | AI (AI) (DI) | AI (AI) (DI) | |
| Quantity in 1 box | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 26 | 26 | |

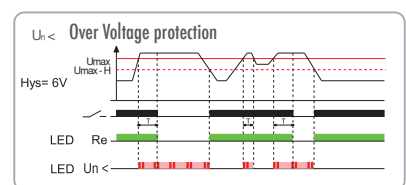
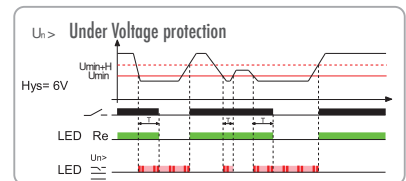
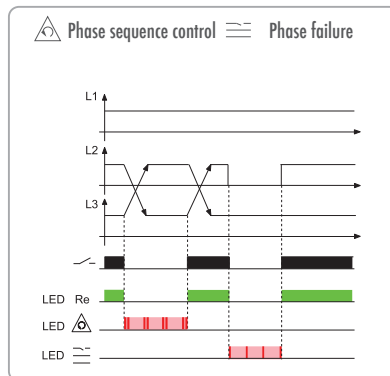
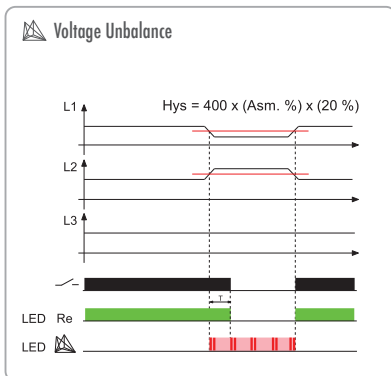
ON and OFF positions can be adjusted by dip switch



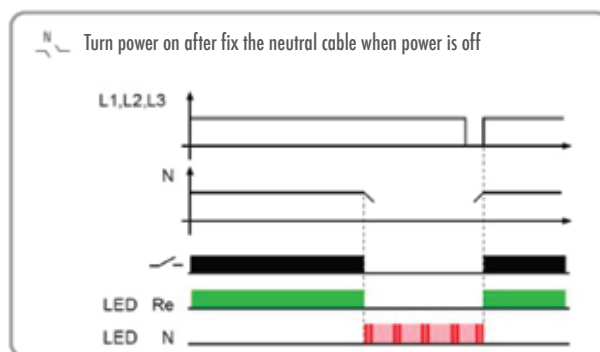
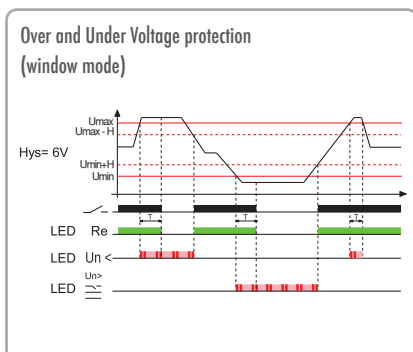


PHASE PROTECTION RELAYS

| | FKR1.G | FKR2.G.4W | FKR2.G.3W | ke-FKR1 | ke-FKR1T | ke-FKR2 | ke-FKR3 | ke-FKR4 | FKR1-DIN | FKR1T-DIN |
|--|--|--|--|--|--|--|--|--|--|--|
| Product name | Phase Failure Relay | Phase sequence relay | Phase sequence relay (without neutral) | Phase Failure Relay | Phase Failure Relay with PTC | Phase Failure & Phase sequence Relay | Phase Failure & Phase sequence Relay | Phase Failure & Phase sequence Relay | Phase Failure Relay | Phase Failure Relay with PTC |
| Phase failure | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Voltage unbalance | | | | | | | 5% 17,5% | 5% 17,5% | | |
| Phase sequence control | — | ✓ | ✓ | — | — | ✓ | ✓ | ✓ | — | — |
| Over Voltage protection $U_h <$ | — | — | — | — | — | — | — | 230V 285V | — | — |
| Under Voltage protection $U_h >$ | — | — | — | — | — | — | — | 155V 210V | — | — |
| ON Delay time (Ts) | — | — | — | — | — | — | 0 s 10 | 0 s 10 | — | — |
| Neutral failure detection | ✓ | ✓ locked | — | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Supply voltage (L - L) <i>NOTE: can be produced with different voltage value</i> | 380V AC 3~ (50/60Hz) $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | 400V AC 3~ (50/60Hz) $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | 400V AC 3~ (50/60Hz) $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | 380V AC 3~ (50/60Hz) $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | 380V AC 3~ (50/60Hz) $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | 380V AC 3~ (50/60Hz) $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | 380V AC 3~ (50/60Hz) $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | 380V AC 3~ (50/60Hz) $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | 380V AC 3~ (50/60Hz) $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | 380V AC 3~ (50/60Hz) $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ |
| Contact | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac |
| Ambient temperature | -20°C + 60°C | -20°C + 60°C | -20°C + 60°C | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C |
| Dimensions | | | | | | | | | | |
| Connection | | | | | | | | | | |
| PTC protection | — | — | — | — | ✓ | — | — | — | — | ✓ |
| Quantity in 1 box | 10 | 10 | 10 | 10 | 8 | 8 | 8 | 8 | 26 | 26 |

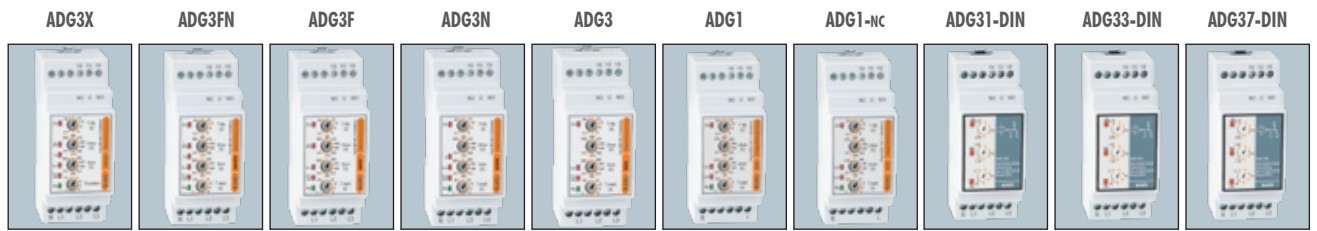


| | FKR2N-DIN | FKR2-DIN | FKR2T-DIN | FKR3N-DIN | FKR3-DIN | FKR3T-DIN | FKR4N-DIN | FKR4.4W | FKR4.3W | ke-FKR4 (D) |
|--|--|--|--|--|--|--|--|--|--|--|
| Product name | Phase Failure & Phase sequence Relay | Phase Failure & Phase sequence (without neutral) | Phase Failure & Phase sequence (without neutral) with PTC protection | Phase Failure & Phase sequence Relay | Phase Failure & Phase sequence (without neutral) | Phase Failure & Phase sequence (without neutral) with PTC protection | Phase Failure & Phase sequence Relay | Phase Failure & Phase sequence Relay | Phase Failure & Phase sequence Relay (without neutral) | Digital Phase Sequence & Phase protection Device |
| Phase failure | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Voltage unbalance | sabit %40 | %6 $\frac{\text{OFF}}$ %20 | %6 $\frac{\text{OFF}}$ %20 | %5 $\frac{\text{OFF}}$ %17,5 | %6 $\frac{\text{OFF}}$ %20 | %6 $\frac{\text{OFF}}$ %20 | %5 $\frac{\text{OFF}}$ %17,5 | %5 $\frac{\text{OFF}}$ %20 | %5 $\frac{\text{OFF}}$ %20 | %5 $\frac{\text{OFF}}$ %20 |
| Phase sequence control | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Over Voltage protection | — | — | — | — | — | — | 230V $\frac{\text{OFF}}$ 285V | 410V $\frac{\text{OFF}}$ 500V | 410V $\frac{\text{OFF}}$ 500V | 390V $\frac{\text{OFF}}$ 460V |
| Under Voltage protection | — | — | — | — | — | — | 155V $\frac{\text{OFF}}$ 210V | 300V $\frac{\text{OFF}}$ 390V | 300V $\frac{\text{OFF}}$ 390V | 300V $\frac{\text{OFF}}$ 370V |
| ON Delay time (Ts) | — | — | — | 0 $\frac{\text{OFF}}$ 10 | 0 $\frac{\text{OFF}}$ 10 | 0 $\frac{\text{OFF}}$ 10 | 0 $\frac{\text{OFF}}$ 10 | 0,1 $\frac{\text{OFF}}$ 20 | 0,1 $\frac{\text{OFF}}$ 20 | 0,1 $\frac{\text{OFF}}$ 99,9 |
| Neutral failure detection | ✓ | — | — | ✓ | — | — | ✓ | ✓ locked | — | ✓ |
| Supply voltage (L - L) <i>NOTE: can be produced with different voltage value</i> | 380V AC 3~ (50/60Hz) $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | 380V AC 3~ (50/60Hz) $U_{max} = (1,20) \times U_n$ $U_{min} = (0,70) \times U_n$ | 380V AC 3~ (50/60Hz) $U_{max} = (1,20) \times U_n$ $U_{min} = (0,70) \times U_n$ | 380V AC 3~ (50/60Hz) $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | 380V AC 3~ (50/60Hz) $U_{max} = (1,20) \times U_n$ $U_{min} = (0,70) \times U_n$ | 380V AC 3~ (50/60Hz) $U_{max} = (1,20) \times U_n$ $U_{min} = (0,70) \times U_n$ | 380V AC 3~ (50/60Hz) $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | 400V AC 3~ (50/60Hz) $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | 400V AC 3~ (50/60Hz) $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | 380V AC 3~ (50/60Hz) $U_{max} = (1,10) \times U_n$ $U_{min} = (0,80) \times U_n$ |
| Contact | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/240Vac |
| Ambient temperature | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | -20°C + 60°C | -20°C + 60°C | -5°C + 50°C |
| Dimensions | | | | | | | | | | |
| Connection | | | | | | | | | | |
| PTC protection | — | — | ✓ | — | — | ✓ | — | — | — | — |
| Quantity in 1 box | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 |





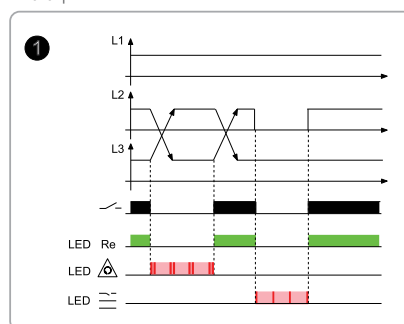
VOLTAGE PROTECTION RELAYS



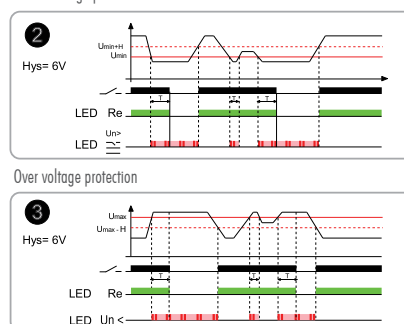
| | ADG3X | ADG3FN | ADG3F | ADG3N | ADG3 | ADG1 | ADG1-nc | ADG31-DIN | ADG33-DIN | ADG37-DIN |
|---|--|--|--|--|--|--|--|--|--|--|
| Product name | Over&Under voltage protection relay (3phase) | Over&Under voltage protection relay (3phase) | Over&Under voltage protection relay (3phase) | Over&Under voltage protection relay (3phase) | Over&Under voltage protection relay (3phase) | Over&Under voltage protection relay (singlephase) | Over&Under voltage protection relay (singlephase) Reverse work | Over&Under voltage protection relay (3phase) | Over&Under voltage protection relay (3phase) | Over&Under voltage protection relay (3phase) |
| Phase failure | ✓ | ✓ | ✓ | ✓ | ✓ | — | — | ✓ | ✓ | ✓ |
| Phase sequence control | ✓ | ✓ | ✓ | — | — | ✓ | ✓ | — | ✓ | ✓ |
| Over voltage protection $U_{>}$ | 410 V OFF 500 V | 410 V OFF 500 V | 410 V OFF 500 V | 410 V OFF 500 V | 410 V OFF 500 V | 225 V OFF 275 V | 225 V OFF 275 V | 230 V 285 V | 230 V 285 V | 230 V 285 V |
| Under voltage protection $U_{<}$ | 300 V OFF 390 V | 300 V OFF 390 V | 300 V OFF 390 V | 300 V OFF 390 V | 300 V OFF 390 V | 165 V OFF 215 V | 165 V OFF 215 V | 155 V 210 V | 155 V 210 V | 155 V 210 V |
| ON delay time (T_{Delay}) | 0,1 s 20 | 0,1 s 20 | 0,1 s 20 | 0,1 s 20 | 0,1 s 20 | 0,1 s 20 | 0,1 s 20 | 0,1 s 10 | 0,1 s 10 | — |
| OFF delaytime (T_{Reset}) | 0,1 s 20 | 0,1 s 20 | 0,1 s 20 | 0,1 s 20 | 0,1 s 20 | 0,1 s 20 | 0,1 s 20 | — | — | 0,1 s 10 |
| Neutral failure detection N | ✓ locked | ✓ locked | — | ✓ locked | — | — | — | ✓ | ✓ | ✓ |
| Sudden opening | ± 50 % | ± 50 % | ± 50 % | ± 50 % | ± 50 % | — | — | ± 35 % | ± 35 % | ± 35 % |
| Supply voltage (L - L) U_n | 400V AC 3~ (50/60Hz) | 400V AC 3~ (50/60Hz) | 400V AC 3~ (50/60Hz) | 400V AC 3~ (50/60Hz) | 400V AC 3~ (50/60Hz) | 220V AC 1~ (50/60Hz) | 220V AC 1~ (50/60Hz) | 380V AC 3~ (50/60Hz) | 380V AC 3~ (50/60Hz) | 380V AC 3~ (50/60Hz) |
| NOTE: can be produced with different voltage value | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ |
| Contact | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac |
| Ambient temperature $^{\circ}C$ | -20°C + 60°C | -20°C + 60°C | -20°C + 60°C | -20°C + 60°C | -20°C + 60°C | -20°C + 60°C | -20°C + 60°C | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C |
| Dimensions | | | | | | | | | | |
| Connection | 3 Faz 4 Telli veya 3 Faz 3 Telli | 3P&4W | Δ 3P&3W | 3P&4W | Δ 3P&3W | 1P&2W | 1P&2W | 3P&4W | 3P&4W | 3P&4W |
| Quantity in 1 box | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 |
| Operating type | A, B, C, D, E, F, G, H | off delay | off delay | off delay | off delay | off delay | contact get on in case of failure | off delay | off delay | on delay |

| Connection | Phase sequence | Delay time | Time | |
|------------|----------------|------------|------|---|
| 3P&4W | | OFF delay | sec | A |
| 3P&4W | — | OFF delay | sec | B |
| 3P&3W | | OFF delay | sec | C |
| 3P&3W | — | OFF delay | sec | D |
| 3P&4W | | ON delay | min | E |
| 3P&4W | — | ON delay | min | F |
| 3P&3W | | ON delay | min | G |
| 3P&3W | — | ON delay | min | H |

Phase sequence and failure control

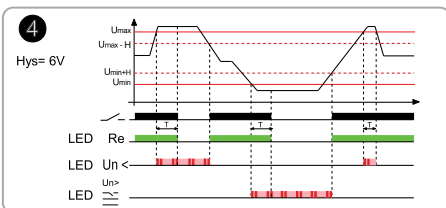


Under voltage protection

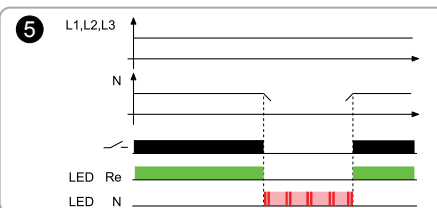


| | ke-ADG31 | ke-ADG33 | ke-ADG37 | ke-ADG11 | ke-ADG15 | ADG3FN.G | ADG3EG | ADG1.G | PSC.G.4W |
|---|--|--|--|--|--|--|--|--|--|
| Product name | Over&Under voltage protection relay (3phase) | Over&Under voltage protection relay (3phase) | Over&Under voltage protection relay (3phase) | Over&Under voltage protection relay (Single phase) | Over&Under voltage protection relay (single phase) | Over&Under voltage protection relay (3phase) | Over&Under voltage protection relay (3phase) | Over&Under voltage protection relay (single phase) | Phase sequence control relay |
| Phase failure | √ | √ | √ | — | — | √ | √ | — | √ |
| Phase sequence control | — | √ | √ | — | — | √ | √ | — | √ |
| Over voltage protection $U_{n<}$ | 230 V 285 V | 230 V 285 V | 230 V 285 V | 230 V 285 V | 230 V 285 V | 410 V OFF 500 V | 410 V OFF 500 V | 235 V OFF 285 V | — |
| Under voltage protection $U_{n>}$ | 155 V 210 V | 155 V 210 V | 155 V 210 V | 155 V 210 V | 155 V 210 V | 300 V OFF 390 V | 300 V OFF 390 V | 175 V OFF 205 V | — |
| ON delay time (T_{Delay}) | 0,1 10 | 0,1 10 | — | 0,1 10 | — | 0,1 20 | 0,1 20 | 0,1 20 | — |
| OFF delaytime (T_{Reset}) | — | — | 0,1 10 | — | 0,1 10 | 0,1 20 | 0,1 20 | 0,1 20 | 0,1 10 |
| Neutral failure detection N | √ | √ | √ | — | — | √ Mühürli | — | — | √ Mühürli |
| Sudden opening | ± 35 % | ± 35 % | ± 35 % | — | — | ± 50 % | ± 50 % | — | — |
| Supply voltage (L - L) U_n | 380V AC 3~ (50/60Hz) | 380V AC 3~ (50/60Hz) | 380V AC 3~ (50/60Hz) | 220V AC 1~ (50/60Hz) | 220V AC 1~ (50/60Hz) | 400V AC 3~ (50/60Hz) | 400V AC 3~ (50/60Hz) | 220V AC 1~ (50/60Hz) | 400V AC 3~ (50/60Hz) |
| NOTE: can be produced with different voltage value | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ | $U_{max} = (1,30) \times U_n$ $U_{min} = (0,70) \times U_n$ |
| Contact | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac | 5A/250Vac |
| Ambient temperature $^{\circ}C$ | -5°C + 50°C | -5°C + 50°C | -5°C + 50°C | 5°C + 50°C | 5°C + 50°C | -20°C + 60°C | -20°C + 60°C | -20°C + 60°C | -20°C + 60°C |
| Dimensions | | | | | | | | | |
| Connection | | | | | | | | | |
| Quantity in 1 box | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Operating type | off delay | off delay | on delay | off delay | on delay | off delay | off delay | off delay | — |

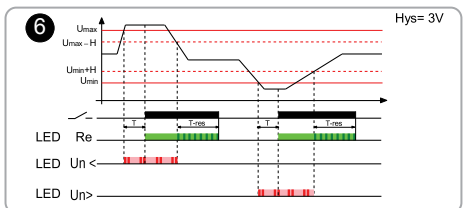
Over&Under voltage protection (Window mode)



Neutral failure detection



Over&Under voltage protection (Window mode) Reverse work





SPECIAL RELAYS



| | EK96 | HSR2 | HSR3 | ke-HSR2 | ke-HSR3 | ke-TKR1 | CLN-01 |
|---------------------------------|------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------|--|
| Product name | Electronic horn | 2 output hydrophore Sequencing relay | 3 output hydrophore Sequencing relay | 2 output hydrophore Sequencing relay | 3 output hydrophore Sequencing relay | Thermistor protection relay | Filter cleaning control device 3-12 Output |
| Operating time interval | — | sequence 10min | sequence 10min | sequence 10min | sequence 10min | — | 1-60 sec |
| Operating type | intermittent | with sequence | with sequence | with sequence | with sequence | according to temperature graph | with sequence |
| Hydrophore counter | — | 2 | 3 | 2 | 3 | — | — |
| Auxiliary supply Voltage | 230 Vac / 24vdc; < 3VA | 230 Vac; < 3VA | 230 Vac; < 3VA | 230 Vac; < 3VA | 230 Vac; < 3VA | 230 Vac; < 3VA | 230 Vac; < 3VA |
| Ambient temperature | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C | - 5°C + 50 °C |
| Storage temperature | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C |
| Dimensions | 96x96x80 | 50x75x112 | 50x75x112 | 28x82x80 | 28x82x80 | 28x82x80 | 144x144x40 |
| Quantity in 1 box | 12 | 10 | 10 | 10 | 10 | 10 | 1 |



COSØ METERS & FREQUENCY METERS



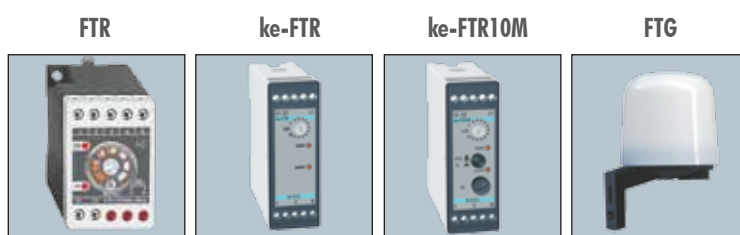
| | DC96 | DF72 | DF96 | DF48 |
|------------------------------------|----------------------|-------------------------|-------------------------|-------------------------|
| Product name | Cosometer | Digital frequency meter | Digital frequency meter | Digital frequency meter |
| CosØ measurement range | 0,00-1,00 | — | — | — |
| Frequency measurement range | — | 40-400 Hz | 40-400 Hz | 40-400 Hz |
| Auxiliary supply Voltage | 230 Vac; < 3VA | 230 Vac; < 3VA | 230 Vac; < 3VA | 230 Vac; < 3VA |
| Ambient temperature | -5°C + 50 °C | -5°C + 50 °C | -5°C + 50 °C | -5°C + 50 °C |
| Storage temperature | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C | - 20°C + 70 °C |
| Dimensions | 96x96x80 | 72x72x80 | 96x96x80 | 48x96x50 |
| Quantity in 1 box | 12 | 10 | 12 | 16 |



| | IRK-06 | IRK10 | AR24 | AR24-14A | SEK-01 | PFM |
|---------------------------------|-------------------------|-------------------------|--|---|----------------------------|---|
| Product name | Alarm relay combination | Alarm relay combination | 24V / 7Ahr Maintenance free battery | 24V / 14Ahr Maintenance free battery | Secondary protection relay | Over&Under compensation alarm device |
| Operating time interval | — | — | — | — | — | 1-100 s |
| Operating type | 6 Notice + 4 Warning | 10 Notice | — | — | 3 phase + 1 ground | 1 phase control Cos ϕ adjust. |
| Hydrophore counter | — | — | — | — | — | — |
| Auxiliary supply Voltage | 24 Vdc; < 3VA | 24 Vdc; < 3VA | 230 Vac; 50 VA | 230 Vac; < 100VA | 24 Vdc; < 6VA | 230 Vac; < 3VA |
| Ambient temperature | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C |
| Storage temperature | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C |
| Dimensions | 144x144x40 | 144x144x40 | 405x235x170 | 405x235x170 | 144x144x144 | 53x90x58 |
| Quantity in 1 box | 1 | 1 | 1 | 1 | 1 | 26 |



PHOTOCELL RELAYS



| | FTR | ke-FTR | ke-FTR10M | FTG |
|---------------------------------|--------------------|--------------------|--------------------|-----------------|
| Product name | * Photocell relay | * Photocell relay | * Photocell relay | Photocell relay |
| LUX range | 1-10 lux | 1-10 lux | 1-10 lux | — |
| Delay for ON-OFF | 3-5 s | 3-5 s | 25-40 s | — |
| Manual control | — | — | ✓ | — |
| Fuse protection | — | — | ✓ | — |
| Auxiliary supply Voltage | 230 Vac < 3VA | 230 Vac < 3VA | 230 Vac < 3VA | — |
| Ambient temperature | -5°C +50 °C | -5°C +50 °C | -5°C +50 °C | — |
| Storage temperature | -20°C +70 °C | -20°C +70 °C | -20°C +70 °C | — |
| Dimensions | 50x75x112 | 28x82x80 | 28x82x80 | — |
| Quantity in 1 box | 10 | 8 | 8 | — |



* Photocell sensor price is included.



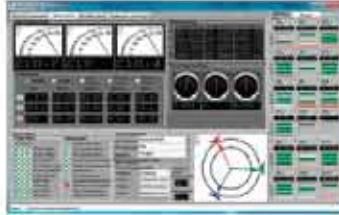
Kael Universal supplied

User-friendly interface and convenient to use. Kael universal software is compatible with reactive power control relays, analyzers, and energymeters. The software can alert about the alarms that occur in the system either via the program or via mail. All settings related to the system can be intercepted.

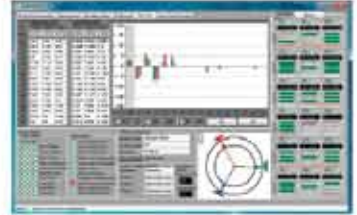
Compensation Tracking Screen



Measurements screen



Harmonics screen



Kael multiple Communication supplied

It is used to monitor multiple devices remotely at the same time, to report about accumulating energies, to make cost calculations, to monitor voltage and current changes. It has a user-friendly interface. Desired instant and accumulated values can be selected. Possibility to monitor up to 200 devices.

Main page



Statistics



Limit Value and Event Definition



Report about the measurements between selected dates is provided.

Energy cost calculation



Energy Consumption Report



Energy Measurement Report



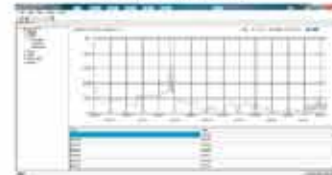
Kael SD card viewer supplied

All devices with a memory card can record all measurements. All measurements recorded within each 1 hour can be viewed in software.

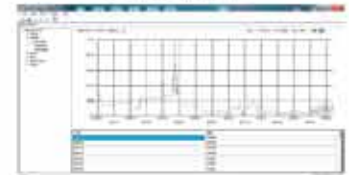
Voltage



Current Unbalance



Neutral Current



Active Power



Reactive Power



Cos φ





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