Revalco

ELECTRICAL MEASURING INSTRUMENTS

Electrical instruments are capable of measuring an electrical parameter, on the basis of their particular application or function as classified below:

- **Indicators** which give an immediate and continuous indication of the measured value
- **Recorders** which record the variation of input throughout time
- **Integrators** which integrate throughout time the input signal applied (KWh meters)

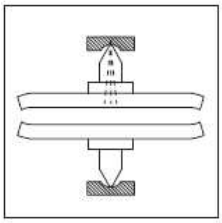
ANALOGUE INDICATING INSTRUMENTS

General characteristics

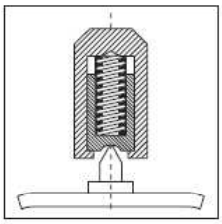
These instruments are produced having a pointer which moves over a graduated dial (scale) and assumes different positions according to the variation of the input signal being measured.

The scales of an instrument can be:
- The linear or uniform type, when the subdivisions are equally divided
- The quadratic type when the subdivision are grouped together at the beginning and are wide at the top, following a quadratic law
- Other types, some in accordance with mathematical laws (logarithmic, exponential etc...), others traced empirically

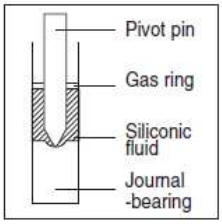
The moving components of an analogue electrical instrument is joined integrally to a rotating axle supported between two fixed brackets which ensure their free rotation. The brackets have a spherical seat with a greater radius than that of the pivots.



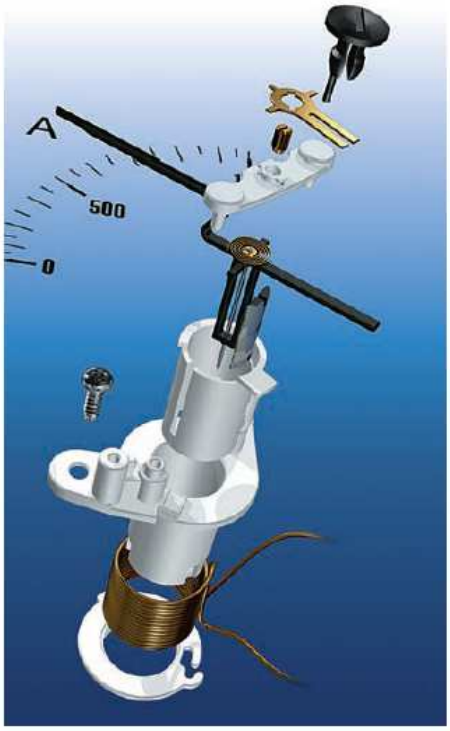
Revalco has adopted pivot suspension with external supports in hard stone which permits a minimum coefficient of wear. The axel is carried by the lower support while the upper one has the task of guiding.



In turn, the upper support has a seat provided with a spring so that it is possible to graduate and maintain throughout time the pressure exercised by the pivots, the spring also has the function of absorbing eventual impacts suffered by the instrument giving greater shock proof qualities.



To enable the pointer to reach the position in a linear and a smooth way, **Revalco** has adopted various methods of damping, causing the axel to move near to the lower support in a chamber containing a very viscous substance with a base of silicones. The vibration of the shaft and other moving parts are thus reduced and, by reducing the action developed by the viscous substance, it is possible to obtain the desired degree of damping which is maintained unaltered throughout.



General description of how the measuring instruments function

Moving iron instruments (AC)
With this type of instrument a fixed coil is magnetised which determines the clockwise movement, of a moving iron which is integrally joined to the pointer. The scale of these instruments is not linear but has a quadratic trend resulting from this type of mechanism.
Specific adjustments of the moving iron make it possible to achieve scales restricted at the bottom. With these instruments the movement is able to withstand peaks of substantial current.
Given the particular principle by which this system operates the instruments can function using either Alternating and Direct Currents, however, in the latter case there is an increase error of indication.

Moving coil instruments (DC)
With this type of instrument the magnetic field, generated by a permanently fixed magnet, acts on a moving coil energised by current and is integrally joined to the pointer, there by determining the clockwise movement of the latter.
This function results in a perfect linear scale.
These instruments function only with DC inputs as the direction in which the moving components rotate depends on the correct direction of the polarity (during connection it is therefore imperative not to invert the + and - cables).
The use of these instruments with alternating current is however possible by using a diode bridge rectifier. By operating in this way however, the instruments become very sensitive to the wave form, if not perfectly sinusoidal, and should therefore be used for measuring low values of voltage and current or if low burden is required.

Bimetal instruments
With these types of instruments the deforming of a bimetal element, heated directly or indirectly by the passing of a current, is transmitted to the equipment, integrally joined to the pointer. With these instruments the indicator drags, when moving, a second pointer (RED) which indicates the maximum value reached. The response time for signals from these instruments is generally eight or fifteen minutes so that short peaks of current are not indicated.
These instruments can also be combined with moving iron movements for instantaneous measuring of the current values.

SYMBOLS AND THEIR MEANINGS

Symbols of the main measuring units and their principal multiples and submultiples

Symbol	Specification
kA	kiloampere
A	ampere
mA	milliampere
µA	microampere
kV	kilovolt
V	volt
mV	millivolt
µV	microvolt
W	watt
MW	megawatt
KW	kilowatt
var	var
Mvar	megavar
kvar	kilovar
Hz	hertz
MHz	megahertz
kHz	kilohertz
Ω	ohm
MΩ	megaohm
KΩ	kiloohm
T	tesla
mT	millitesla
°C	Celsius

Symbols indicating the principle function of the instrument and accessory

Symbol	Specification
	Magnetoelectric instrument (with moving coil and permanent magnet)
	Instrument with moving iron
	Ferrodymanic instrument (electrodynamic with iron)
	Induction instrument
	Bimetal instrument
 (1)	Electronic device in the measuring circuit
	Electronic device in an auxiliary circuit
	Shunt for measuring instrument
 (2)	General accessory

If the (1) symbol is associated with the symbol of the instrument this means that the device is incorporated.
If the (1) symbol is associated with the (2) this means that the device is external.

Symbols indicating the characteristics of the instrument in relation to its connection with the network

Symbol	Specification
	Circuit with direct current
	Single-phase circuit with alternating current
	Single-phase direct and alternating current circuit
	Three-phase alternating current circuit (general symbol)
	Tree-phase alternating current circuit with unbalanced load (general symbol)
	A measuring element for 3 wire networks
	A measuring element for 4 wire networks
	Two measuring elements for 3 wire networks with unbalanced load
	Two measuring elemenrs for 4 wire networks with balanced load
	Three measuring elements for 4 wire networks with unbalanced load

Symbols for accuracy class

Symbol	Specification
1,5	Class indicator (eg. 1.5) with errors expressed in percentage of conventional value, except when the latter is as long as the graduation or the true value
	Class indicator (eg. 1.5) when the conventional value corresponds to the true value.
	Class indicator of an instrument with a non linear scale, contracted in the case where the conventional value is as long as the graduation and the indication of the error is expressed ad a percentage of the true value. (for example: class indicator 1: relative error limit of 5%) (par. 2.3.11.36)

Symbols indicating the working position

Symbol	Specification
	Instrument to use with the dial vertical
	Instrument to use with the dial horizontal
	Instrument to use with dial inclined (60° for example) in relation to the horizontal plane.

Symbols regarding safety

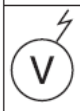
Symbol	Specification
	500V test voltage
	Test voltage of more than 500V (2kV for example)
	Instrument exempt from voltage test
	High voltage on the accessory and/or on the instrument

TABLE OF THE DEGREE OF PROTECTION

1st figure: protection agains solid bodies

IP	Tests	Specification
0		No protection
1		Protected against solid bodies of more than 50 mm (eg.: unitentional contact with a hand)
2		Protected against solid bodies of more than 12mm (eg.: a finger)
3		Protected against solid bodies of more than 2.5mm (tools, wires)
4		Protected against solid bodies of more than 1mm (fine tools, thin wires)
5		Protected against dust (no harmful deposit)
6		Totally protected against dust.

2nd figure: protection against liquids

IP	Tests	Specification
0		No protection
1		Protected against drops of water falling vertically (condensation)
2		Protected against drops of water falling at an angle of up to 15° from vertical
3		Protected against drops of water fall at an angle of up to 60° from vertical
4		Protected against jets of water from all directions
5		Protected against jets of water in all directions
6		Protected against water projections like sea waves
7		Protected against the effects of immersion

3rd figure : mechanical protection

IP	Tests	Specification
0		No protection
1		Impact energy: 0,225 joules
2		Impact energy: 0,375 joules
3		Impact energy: 0,500 joules
4		Impact energy: 2,00 joules
5		Impact energy: 6,00 joules
6		Impact energy: 20,000 joules

The first two characteristic figures are defined exactly in accordance with the UTE C 20 010 - IEC 144 and DIN 40 050 standards
The 3rd characteristic figure is defined by the French UTE C 20 010 standard. It is being studied internationally at the CEE - IEC.

QUALITY GUARANTEE

- The **Revalco** range of measuring instruments are manufactured in accordance with the standards directed by recognise a international organizations.

MEASURING CIRCUITS (CEI EN 61010-1:2001-11)

- Measuring instruments are subjected to WORKING VOLTAGES and transient stresses from the circuit to which they are connected during measurement. When the measuring circuit is used to measure MAINS, the transient stresses can be estimated by the location within the installation at which the measurement is performed. When the measuring circuit is used to measure any other electrical signal, the transient stresses must be considered by the user to assure that they do not exceed the capabilities of the measuring equipment.
- **Revalco** instruments belong to category III (CAT III - 600V AC et CAT III - 300V DC) considering the measures effected in internal houses (panel).
- The information concerned the measurement category and the RATED maximum NOMINAL WORKING VOLTAGE or RATED maximum NOMINAL CURRENT for such terminals,are putted near these terminals on a label.

GENERAL TECHNICAL CHARACTERISTICS

- ⚠ All the instruments present on this catalogue haven't internal fuses protection. It is a matter of specialised technician to consider their installation (if necessary) relating to the declared self-consumption

NORME

- The **Revalco** measuring instruments listed in this catalogue have been manufactured according to the following standards: CEI EN61010-1/CEI EN60051-1-2
- With regard to the dimensional characteristics of the instruments and shunts, reference is made to the DIN 43700/43718 standards.
- The most important among these standards are recalled in the following paragraphs relating to the electrical and mechanical characteristics of the instruments.

TEST VOLTAGE - INSULATION

- The instruments are tested according to CEI EN 61010-1 with an effective voltage of 2000V at 50Hz for 1 minute.
- Greater Test and Insulation voltages can be provided on request for certain types of instruments.

ACCURACY CLASS

- The accuracy class of the instruments is 1.5 unless otherwise specified, according to CEI EN 60688.
- Greater precision classes can be provided on request for certain types of instruments.
- The class of precision is given on the scale of each instrument.

OVERLOAD

- The current coils of all the instruments are capable of withstanding over loading of up to 10 times the nominal current value for periods of less than 1 second; and for up to 1,2 times the nominal value permanently.
- The voltage coils withstands a continuous over loading of up to 1,2 times the nominal voltage and an overloading of up to twice the nominal voltage for periods of less than 0,5 seconds (CEI EN 61010-1)
- For instruments with input by means of C.T., the overload can be greater as the transformer limits the peak of secondary current to values which are generally less than 10 In.
- The zerovoltmeters can withstand up to 4 times the full scale voltage for periods of less than 5 minutes.

OPERATING TEMPERATURE

- The instruments satisfy the requisites of the IEC standards, par. 8.7.1 for which the operating temperature is 20°C +/-10°C. They can however function in continuous service without deterrioration and with an acceptable error of class, with temperatures ranging between -10 °C and +55°C.

STORAGE TEMPERATURE

- The storage temperature should range from -40°C and +70°C. Temperatures which exceed the two limits can alter the chemical conditions of the siliconic fluid.

HUMIDITY

- The instruments are suitable for functioning with a maximum relative humidity of 85% without condensation, at a temperature of +35°C for a maximum of 60 days per year.
- The relative average annual humidity value should not exceed 65% (DIN 40040 standards).
- The instruments used in **tropicalized conditions** can exceed the above-mentioned values and function with a relative maximum humidity of 95% and at a temperature of +35°C. In this case the average annual value of relative humidity should no exceed 75%
- The instruments used in tropicalized conditions are made to the DIN 40040 standards, according to that, these type of instruments must be protected against the entry of humidity; furthermore all the connection terminals, screws, washers, bolts and magnets are galvanically protected against the rust and the printed circuits (if presents) are protected with a special varnish type "Multicolor PC52".

ENVIRONMENTAL CONDITIONS

- The equipments are designed to be safe at least under the following conditions:
  - indoor use
  - altitude up to 2000 m, or above 2000 m if specified by the manufacturer (see clause D.9 for further information on Standars EN61010-1)
  - temperature 0°C to 40°C
  - maximun relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C
  - mains supply voltage fluctuations not to exceed +/-10% of the nominal voltage -other supply voltage fluctuations as stated by the manufacturer
  - transient overvoltages according to installation categories (overvoltage categories) I, II and III (see Annex J on Standards EN61010-1). For mains supply the minimun and normal category is II
  - pollution degree 1 or 2 in accordance with IEC 664

RESISTANCE TO VIBRATION

- The instruments in the catalogue have passed resistance to vibration tests as established by the CEI 50-4 standards.

RESISTANCE TO SHOCK

- The instruments have passed shock resistance tests.

MOUNTING POSITION

- This series of instruments are made to function in a vertical position.Thanks to perfect balancing they can also be mounted horizontally.
- Please state mounting method when ordering.

FRONT HOUSING FRAME

- The front frame is narrow, according to been DIN 43718/s, and black in colour. The thermoplastic material has the same characteristics as that used for the housing.

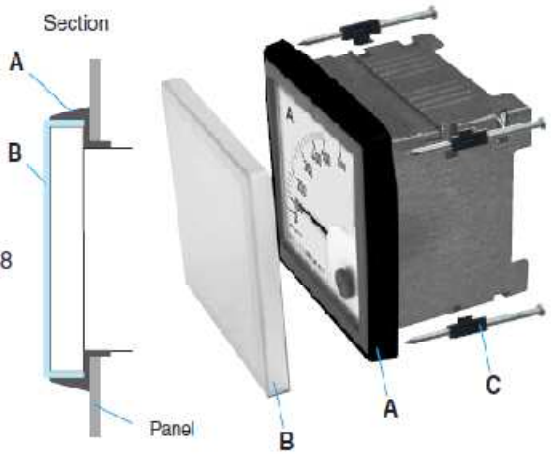
POINTERS

- The pointers of the instruments conform to the DIN 43802 standards. The pointer reaction time is about ≤2 seconds.

HOUSING

- Dimensions conform to the DIN 43700/43718 and UNEL 05111 stds.
- IP52 protection degree for the inside of the instrument (IP40 for modular version), whereas the terminals have an IP00 degree of protection according to CEI 70-1, IEC 529.
- IP40 protection degree on the terminals can be achieved with the special rear terminal covers.
- Housing are made with self-extinguishing thermoplastic according to the UL94 standards, V-O classification, resistant to termites and fungus.
- IP65 protection degree can be achieved with the correspondent accessory AKIP6548 (for instruments 48x48), AKIP6572 (for instruments 72x72), AKIP6596 (for instruments 96x96) and adopting the following instructions:

1) **The hole made in the panel may need to be increased by up 2 mm depending on the accuracy of the original cut out, in respect to the corresponding dimensions**
2) Position from the back the rubber gasket (A) as shown in the figure
3) Position the instrument into the hole made on the panel
4) Adapt the front transparent cover (B)
5) Secure the instrument against the panel using 4 fixing screws(C)



ZEROING

- Instruments can usually be zeroed by means of the special adjustor placed on the front of the instrument.
- Some types do not require this possibility (Sequencemeters, Hour Counters and meters with a Suppressed Movement).

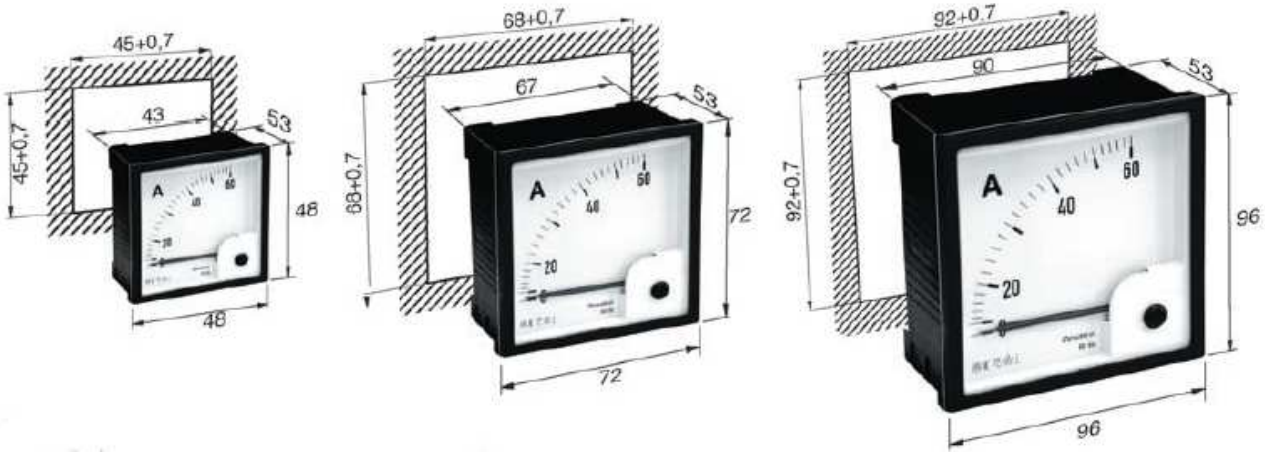
TERMINALS

- Terminals are made of brass and are provided with screws and terminal clamps for a good connection.

FITTING

- Instrument is secured by two mounting brackets. The mounting brackets can be fitted in two different positions at the rear of the instrument in the first position the bracket to rear of panel spacing is 0,5 mm and the second spacing is 19 mm. The bracket mounting system conforms to DIN 43700. For modular version the instruments can be directly fixed on the DIN rail.

DIMENSIONS IN mm



VOLTMETERS

MOVING COIL INSTRUMENTS FOR DIRECT CURRENT



VOLTMETER (90°) — ERC48 - ERC72 - ERC96 - ERC144

- The main characteristic of these instruments is their low current consumption, in circuits where high internal consumption and drop in voltage can bring about measuring errors. The low consumption means that these instruments can also be used with converters, tacho generators or thermocouples. Up to 60A they can be provided with an incorporated shunt for direct connection, above 60A use a separate shunt.
- **BURDEN** 1000Ω/V
- **CLASS** 1,5
- **RANGES**

  MILLIVOLTMETERS: 60-100-150-250-400-600mV

  VOLTMETERS: 1-1,5-2,5-4-6-10-15-25-40-60-100-150-250-300-400-500-600V

  Different capacities can be carried out on request
- **EXAMPLES WHEN ORDERING**

  ERC▪72250V▪▪D direct input, end scale value 250V, 90°

  ERC▪96▪▪5V▪▪D direct input, end scale value 5V, 90°
- **WEIGHT (kg)** ERC48 (0,10); ERC72 (0,20); ERC96 (0,25); ERC144 (0,35)

