

# Revalco®

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

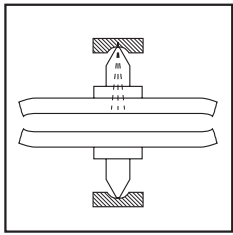
### General characteristics

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.

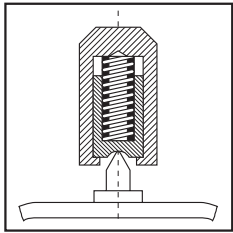
The scales of an instrument can be:

- 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

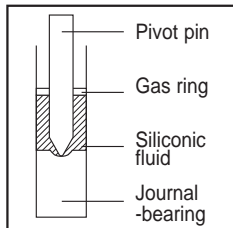
The moving components of an analogue electrical instrument is joined integrally to a rotating axle supported between two fixed brackets which ensure their free rotation. The brackets have a spherical seat with a greater radius than that of the pivots.



**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 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
	Ferrodynamic instrument (electrodynamical with iron)
	Induction instrument
	Bimetal instrument
	Electronic device in the measuring circuit
	Electronic device in an auxiliary circuit
	Shunt for measuring instrument
	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)
	Three-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 elements 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 as 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 against solid bodies**

IP	Tests	Specification
0		No protection
1		Protected against solid bodies of more than 50 mm (eg.: unintentional 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.

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

## 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

### STANDARDS

- The **Revalco** measuring instruments listed in this catalogue have been manufactured according to the following standards: CEI EN 61010-1  
CEI EN 60051-1-2
- 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 deterioration 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.

### 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 and the assembly is carried out by clipping onto a DIN EN 50022 rail.

### HOUSING

- Dimensions in conformity with the DIN 43700 standards.
- IP40 degree of protection.
- In self-extinguishing thermoplastic material according to the UL94 standards, V-O classification, resistant to termites and fungus.

### POINTERS

- The pointers of the instruments conform to the DIN 43802 standards. 
- The pointer reaction time is about 1 second.

### ZEROING

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

### TERMINALS

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

The scales of the instruments in this catalogue conform to the DIN 43802 standards. **The instruments for use by means of a C.T. or Shunt can have interchangeable scales** and are made in such a way that it is impossible to touch the pointer or damage the movement while the change is carried out.

The interchangeable nature of the scale has been specially designed to provide substantial advantages:

- **Reduction in Storage Costs**
- **Reduction in Storage Space**
- **Reduction in delivery time**
- **Rapid replacement of the scales**

It is in fact no longer necessary to store a vast assortment of instruments (eg. 40/5A, 80/5A, 300/5A etc., or 500A/60mV, 1000A/60mV, 5000A/60mV etc.) but only a few instruments without a scale and a number of loose scale plates provide savings in storage costs.

As it is no longer necessary to have a large assortment of complete instruments but only loose scales, it is evident that there is a considerable saving of storage space which is always welcome.

Those who do not consider it necessary to create their own instrument stocks will be able to find a large assortment of instruments and scales at wholesalers, agents and the central headquarters of **Revalco**.

The replacement can be carried out by unskilled personnel as it is not necessary to dismantle the instrument. It is however necessary to pay a minimum amount of attention during this operation in order not to damage the front of the scale and to ensure that it has been pressed down fully towards the bottom of the instrument.

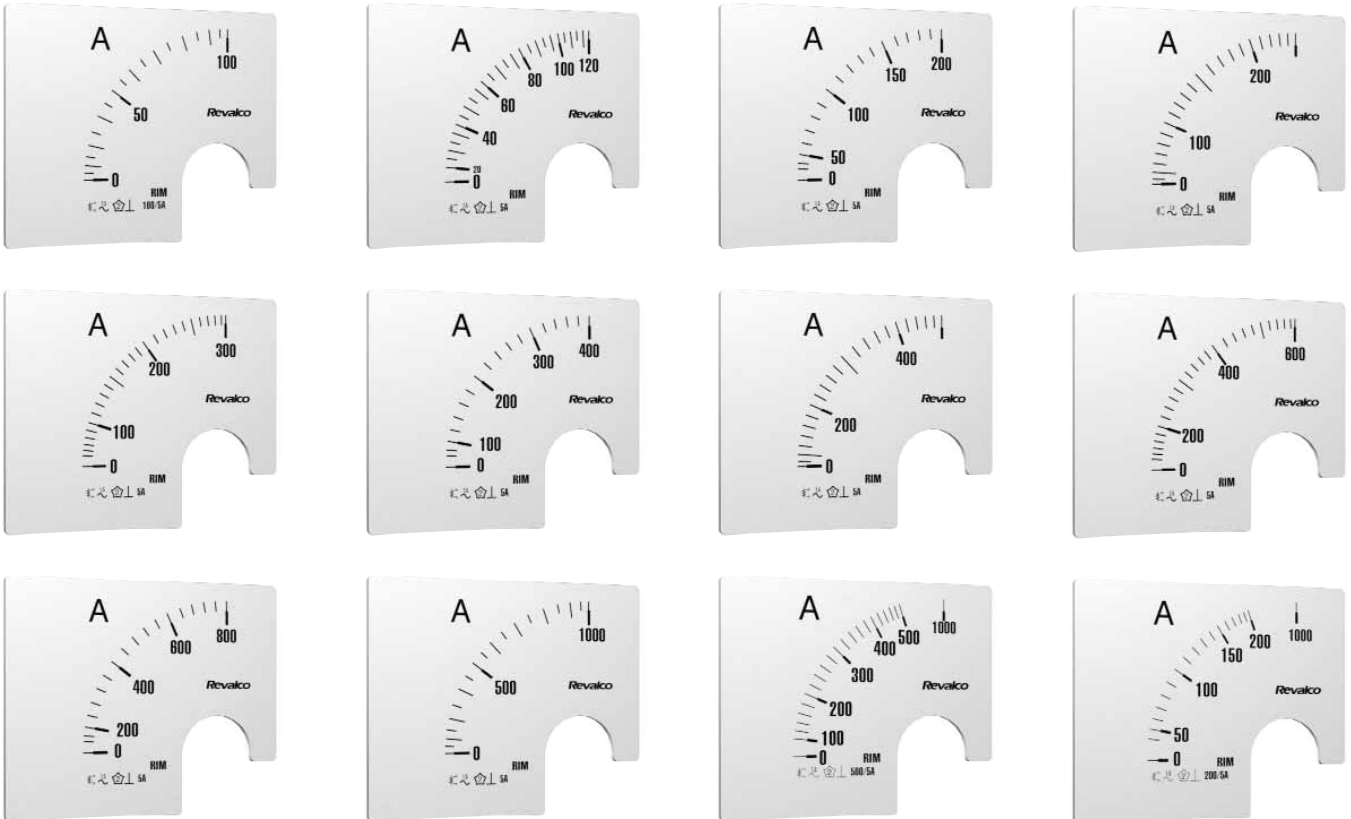
Remove the cover placed in the upper part of the instrument in the direction of the arrows to obtain access to the aperture; when this operation has been completed, replace the cover accurately in its seat to ensure the aperture is completely closed.

**Warning: the instrument should not be connected to power during the replacement operation.**

In order to avoid problems caused by incorrect insertions, note the following:  
 the instruments marked 5A1 will only accept scales with a 1 In scale (eg.: 100/5A)  
 the instruments marked 5A2 will only accept scales with a 2 In scale (eg.: 100/200/5A)  
 the instruments marked 5A5 will only accept scales with a 5 In scale (eg.: 100/500/5A)



- **The normal scales (1 In) of the instruments are as follows:**



The scales are also available in the 2 In version, for 100% over load where the full scale deflection is twice that of this full load current and in

the 5 In version for 500% over load where the full scale deflection is five times that of the full load current.



## 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 - 500V 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.

## 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 Standards EN61010-1)
  - temperature 0°C to 40°C
  - maximum 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 minimum and normal category is II
  - pollution degree 1 or 2 in accordance with IEC 664

## SPECIAL IMPLEMENTATIONS

- The instruments in the catalogue can be provided, in special housings, with some variations regarding the scales and equipment. The following table indicates the possible implementation for each series of instruments.

	For all the Instruments	For all the moving iron instruments (DC)	For all the moving coil instruments (AC)
<b>Special implementations for scale plates</b>			
Linear scale plates hand drawn		✓	
Non linear scale plates hand drawn			✓
Red or green mark	✓		
Scale plates with unique trace and double or triple numbering	✓		
Scale plates with double or triple trace and double or triple numbering	✓		
Black scale plates with yellow numbering and divisions	✓		
Antiparallax scale plates	✓		
Special words or symbols	✓		
Coloured sectors	✓		
Personalised logo	✓		

### special implementations for equipments

Central or offset zero			✓
Class 1 calibration	✓		
D.C. calibration		✓	
Non standard frequency calibration (400Hz at 5A)		✓	
Calibration for other capacities according to curve	✓		
Different capacities from the standard	✓		

### Certificates

Certificate of conformity	✓		
Test certificate	✓		
Type test certificate	✓		

## INDICATIONS FOR ORDERING

- For simplicity and clarity the codes are not numerical but nominal; i.e. they immediately indicate the products to order. On the pages of each family of instruments however some clarifying examples are given.