

Technical Specifications

	Moving Iron A.C. Ammeters & Voltmeters - R-EC (90° Scale)	Moving Coil A.C. with Rectifier Ammeters & Voltmeters - R-RBC (90° Scale)/ R-RZC (240° Scale)	Moving Coil D.C. Ammeters & Voltmeters - R-BC (90° scale) / R-ZC (240° scale)	Maximum Demand Ammeters - R-MC (90° Scale)	Combined Moving Iron Ammeter & Maximum Demand Meters - R-EMC (90° Scale)	Synchroscope Meters - R-STC (90° Scale)	Power Factor Meters (90° & 240° Scale)	Frequency Meters (90° & 240° Scale)	Wattmeters (90° & 240° Scale)	Varmeters (90° & 240° Scale)	Process Indicator (90° Scale)
Standard	IEC 51, VDE 410, DIN 43780, EN 60051										
Measuring System	Moving Iron system formed by two irons, a fixed one and a moving one which is connected to the indicating pointer through a shaft. The turn arc of the moving iron depends on the current flowing by the coil. The braking, which practically eliminates the overranges, is produced by the action of a silicon viscous fluid.	Composed by a 90° or 240° moving coil indicator system and an electronic converter circuit in the same box.	Formed by a permanent magnet and a magnetic ring between which a coil, with two opposed spiral springs with place the pointer at the zero scale, twists. The mechanism ring protects the instrument against the external magnetic fields.	It consists of two bimetallic whorls mounted in opposition over a same axis. One of them is connected to the current circuit and the other one compensates the changes due to the temperature. The rotation torque moves a black pointer which pulls an auxiliary red one. The final position of the red one indicates the maximum overload value. A sealable button resets the auxiliary pointer to its zero position.	It consists of two bimetallic whorls mounted in opposition over a same axis. One of them is connected to the current circuit and the other one compensates the changes due to the temperature. The rotation torque moves a black pointer which pulls an auxiliary red one. The final position of the red one indicates the maximum overload value. A sealable button resets the auxiliary pointer to its zero position.	The instrument scale is divided in two areas marked with (+) and (-) signs. These signs indicate whether the machine has a higher or lower frequency than the other one. The adjustment is made up to the pointer is in the side (-) but slowly rotating to (+) direction. If the pointer is off the synchronizing mark, both machines are at the same frequency but the voltages are not in phase.	R-FEMC / R-FETC (90° Scale) System of a 90° moving coil and electronic converter circuit built in the same box. Connection by mean of .../ 5A transformer { .../ 1A transformer on request). R-FMZ / R-FTZ (240° Scale) Formed by a moving coil system and an electronic converter circuit built-in the same box. Connection by mean of .../ 5A transformer { .../ 1A transformer on request).	Pointer Type: System of 90° or 240° moving coil and electronic converter circuit built in the same box. Reed Type: Consisting of several reed with the same size which vibrate under the action of the magnetic field produced by the voltage coils. Each reed is adjusted to vibrate at its frequency value. Double Reed Type: It is formed by two devices with the same number of vibrating reeds. Each device vibrates under the action of the magnetic field produced by their own voltage coils. Each reed is adjusted to vibrate at a determinate frequency value.	The system consists of an electronic circuit formed by 1 or 5 A current transformers, a multiplier per phase, an adding amplifier and a filter. The output is applied to a moving coil device. The pointer movement corresponds to the following multiplications: • $V \times I \times \cos \varphi$ for single phase circuits. • $\sqrt{3} \times V \times I \times \cos \varphi$ for three phase circuits. • $V_{x1} \times \cos \varphi_1 + V_{x2} \times \cos \varphi_2 + V_{x3} \times \cos \varphi_3$ for unbalanced 3-phase circuits.	The instrument consists in an electronic circuit with .../1A or .../5A current transformers, a multiplier per phase, an adding amplifier and a filter. The output is applied to a moving coil device. The pointer displacement corresponds to the following multiplications: • $V \times I \times \sin \varphi$ for single phase circuits. • $\sqrt{3} \times V \times I \times \sin \varphi$ for single phase circuits. • $V_{x1} \times \sin \varphi_1 + V_{x2} \times \sin \varphi_2 + V_{x3} \times \sin \varphi_3$ for unbalanced 3-phase circuit.	Nil
Application	For measuring the true RMS value of voltages and currents in A.C. networks with independent of their wave form. On request, they can be supplied suitable for direct current or rectified and filtered altern current.	For measuring the current in sinusoidal A.C. circuits	For measuring voltage or current in D.C. circuits, even pulsing type ones, within a very wide range of values.	R-MC types measure the long time overloads of any electric equipment. The display corresponds to the maximum RMS average value in periods of time of 15 minutes, optionally 8 and 30 minutes.	R-EMC types measure the long time overloads of any electric equipment. The display corresponds to the maximum RMS average value in periods of time of 15 minutes, optionally 8 and 30 minutes.	For the indication of the difference of frequencies and phase angle between two generators, or a generator and a system. When the difference is zero, the instrument pointer remains at the synchronizing mark at the scale center.	For measuring the power factor in single phase or balanced three-phase circuits.	Pointer Type: For an easy and quick reading of the frequency in a.c. circuits. The distortion of the voltage to be measured can reach up to the 15% of the rated voltage for the third harmonic, without affecting the accuracy class. Reed Type: For measuring the frequency in A.C. circuits with any wave form and where the environmental and physical conditions are significant. Double Reed Type: For measuring and comparing frequencies from two generators, or from the mains and one generator, when both are connected parallel. The measuring is independent from the wave form. The instruments can work under very hard environmental and physical conditions.	For measuring the power in single phase or balanced or unbalanced three-phase circuits.	For measuring the reactive power in single phase or balanced or unbalanced three-phase circuits.	For measuring signals from all type of sensors and transducers, used in process control operations.
Accuracy	For A.C.: ± 1.5% For A.C. and D.C.: ± 1.5% and 3% respectively and optional	Class 1.5	Class 1.5	Class 3.0, bimetallic operation. • Voltage influence: the accuracy class is kept for a voltage alteration of ±15% U_n . • Current influence: the accuracy class is kept between 40% and 100% of I_n . • Using range: between 20 and 100% of I_n . • Frequency influence: the accuracy class is kept for a frequency alteration of ±5% fn.	Bimetallic system: ±3% Instantaneous system: ±1.5%	Class 1.5	Class: 1.5 • Voltage influence: the accuracy class is kept for a voltage alteration of ±15% U_n . • Current influence: the accuracy class is kept between 40% and 100% of I_n . • Using range: between 20 and 100% of I_n . • Frequency influence: the accuracy class is kept for a frequency alteration of ±5% fn.	Class 0.5	Class 1.5. Voltage influence: the accuracy class is kept for a voltage alteration of ±15% U_n .	Class 1.5. Voltage influence: the accuracy class is kept for a voltage alteration of ±15% U_n .	Class 1.5
Specification	Ammeters 0.1A, 0.5A, 1A, 1.5A, 3A, 5A, 7.5A, 10A, 15A, 20A, 25A, 30A, 50A. For 75A-10kA, use external current transformer with secondary current 5A. Note: When 60A, 75A & 100A meters are directly connected to circuit, the accuracy is class 2.5 Voltmeters 30V, 50V, 75V, 100V, 120V, 150V, 200V, 250V, 300V, 400V, 450V, 500V, 600V. For 450V-450kV, meters can use potential transformer with secondary voltage 100V/110V.	Ammeters 0.5A, 1A, 1.5A, 3A, 5A, 7.5A, 10A, 15A, 20A, 25A, 30A, 50A. For 75A-10kA, use external current transformer with secondary current 5A. Voltmeters 15V, 20V, 25V, 30V, 50V, 75V, 100V, 120V, 150V, 200V, 250V, 300V, 400V, 500V, 600V. For 450V-450kV, meters can use potential transformer with secondary voltage 100V/110V.	Ammeters 25μA, 30μA, 50μA, 1mA, 3mA, 5mA, 10mA, 20mA, 30mA, 50mA, 75mA, 100mA, 150mA, 200mA, 250mA, 300mA, 500mA, 1A, 3A, 5A, 7.5A, 10A, 20A, 30A, 50A. For 75A-10kA, use external 75mV or 60mV shunt. Note: When 60A, 75A & 100A meters are directly connected to circuit, the accuracy is class 2.5 Voltmeters 3V, 5V, 7.5V, 10V, 15V, 20V, 30V, 50V, 75V, 100V, 120V, 150V, 200V, 250V, 300V, 400V, 450V, 600V. Measuring range over 600V with external resistor (rated current 5mA)	8 min 5A, 15 min 5A, 8 min 1A, 15 min 1A	8 min 5A, 15 min 5A, 8 min 1A, 15 min 1A With bimetal movement and thermal delayed indicator for measuring the maximum mean load during a period of 8 or 15 minutes. Resetting knob of maximum pointer can be protected by lead seal. Scale compressed at the beginning; convenient reading from 25% of full-scale deflection. Accuracy of maximum load indication ±3%, referred to the maximum pointer. Response time 8 or 15 minutes.	Voltage 100V, 220V, 380V, 500V	Voltage 100V, 380V, 440V	Nil	Nil	Nil	90-110V, 100-120V, 180-240V, 200-240V, 340-420V
Frequency	20 to 100Hz	Class limits: from 45 to 55 Hz (50Hz) from 55 to 65 Hz (60Hz)	Nil	Reference frequency: 50 Hz Frequency range: 0-1000 Hz and D.C.	Reference frequency: 50 Hz Frequency range: 0-1000 Hz and D.C.	The pointer starts turning in the correct sense when frequency difference is 1.5 Hz for these-phase networks or 0.5 Hz for single-phase networks.	Rated values: 50 or 60 Hz.	Nil	Rated values: 50 or 60 Hz. The accuracy class is kept within 45 and 65 Hz.	Rated: 50 or 60 Hz. The accuracy class is kept: • Single phase varmeters fn = 50 Hz: class range from 49.5 to 50.5 Hz fn = 60 Hz: class range from 59.5 to 60.5 Hz • Three phase varmeters Class range from 45 to 65 Hz.	Nil
Consumption	Voltmeters: from 1 to 4VA: 1.8VA for 250V, 3.3VA for 500V Ammeters: from 0.3 to 1.5VA: 0.7VA for 1A, 1.2VA for 5A	0.25 VA for .../5A 1.5 VA for .../1A	Nil	Bimetallic: 3.25 VA	Bimetallic: 3.25 VA	Single phase: network:5 VA generator:1.5 mA Three phase: network:20 mA per circuit. generator:1.5 mA per circuit.	R-FEMC / R-FETC (90° Scale) • Voltage circuit: 1 VA. • Current circuit: 1.5 VA for 5A, 0.8 VA for 1A R-FMZ / R-FTZ (240° Scale) • Voltage circuit: 4 VA. • Current circuit: 0.75 VA for 5A, 0.15 VA for 1A	Pointer Type: 2-3VA, depending on frequency or voltage Reed & Double Reed Type: 1 to 3.6VA	Voltage circuit: 3 to 10 mA. Current circuit: 0.2 to 0.5 VA.	Voltage circuit: 3 to 10 mA. Current circuit: 0.2 to 0.5 VA.	Nil
Overload	Voltmeters: 1.5 I_n permanently 5 I_n for 30 seconds Ammeters: 1.2 I_n permanently, 5 I_n for 30s, 10 I_n for 5s, 40 I_n for 1s	1.2 I_n permanently 5 I_n for 30 seconds 10 I_n for 5 seconds 40 I_n for 1 second	Nil	1.5 I_n permanently, 15 I_n for 1 s.	1.5 I_n permanently, 15 I_n for 1 s.	1.2 U_n permanently, 2 U_n for 5 s.	Voltage circuit: 1.2 U_n permanently, 2 U_n for 5 seconds. Current circuit: 1.2 I_n permanently, 5 I_n for 30 s, 10 I_n for 5 s, 40 I_n for 1 s	1.2 U_n permanently, 2 U_n for 5s	Voltage circuit: 1.2 U_n permanently, 2 U_n for 5 s Current circuit: 1.2 I_n permanently, 5 I_n for 30 s, 10 I_n for 5 s, 40 I_n for 1s	Voltage circuit: 1.2 U_n permanently, 2 U_n for 5 s Current circuit: 1.2 I_n permanently, 5 I_n for 30 s, 10 I_n for 5 s, 40 I_n for 1 s	Nil
Temperature	Reference temperature: 20°C Rated temperature: 20°C ± 10°C Thresholds: -25°C/ +40°C	Reference temperature: 20°C Rated temperature: 20°C ± 10°C Thresholds: -25°C/ +40°C	Nil	Reference temperature: 20°C. Rated temperature range: 20°C ± 10°C. Thresholds: -25°C / +40°C.	Reference temperature: 20°C. Rated temperature range: 20°C ± 10°C. Thresholds: -25°C / +40°C.	Reference temperature: 20°C. Rated temperature range: 20°C ± 10°C. Thresholds: -25°C / +40°C.	Reference temperature: 20°C. Rated temperature range: 20°C ± 10°C. Thresholds: -25°C / +40°C.	Rated temperature range: 20°C ±10°C Thresholds: -25°C / +40°C	Reference temperature: 20°C. Rated temperature range: 20°C ± 10°C. Thresholds: -25°C / +40°C.	Reference temperature: 20°C. Rated temperature range: 20°C ± 10°C. Thresholds: -25°C / +40°C.	Nil
Benefits	<ul style="list-style-type: none"> Changeable scale: Scale can be changed without opening the instrument, in some cases even in mounted position. Ammeters can have overload scales x1, x2, x3, x5 or x6 for motor starting. Can be used to measure d.c. at reduced accuracy. Ammeters can be scaled for use with -/1A or -/5A current transformers. Voltmeters can be scaled for use with voltage transformers. These meters indicate true r.m.s. values and independent of their waveform. Heavy damping is available as an option. 	<ul style="list-style-type: none"> Changeable scale: Scale can be changed without opening the instrument, in some cases even in mounted position. For higher frequency or linear full scale a.c. measurements. These instruments measure average values of sinusoidal waveforms and are scaled in r.m.s. values. The high quality silicon bridge rectifier gives a linear scale down to near zero, where some compression occurs. 	<ul style="list-style-type: none"> Moving coils meters are suitable for all d.c. system The linear scale is calibrated down to zero and the accuracy maintained down to 10%. High currents are measured with separate shunts and suitably scaled indicators. Suppressed, centre and offset zero models are available. 	<ul style="list-style-type: none"> The thermal / time characteristics of an MDI monitors the most economic use of cable, fusegear and transformers. The Directly heated bimetal element indicates mean r.m.s. current over 8, 15 or 20 mins. A red slave pointer shows the highest value reached, to which it was driven by the indicator and shows the maximum current taken by the load. The reset knob is wire sealable. Scales are calibrated to match the C.T. primary plus 20% overload (e.g 0-5/6A): 120% overscaling The optional saturating C.T. limits the power into the indicating movement and is used where this product is connected in series with a protection C.T. and protection relay. 	<ul style="list-style-type: none"> Where the instantaneous and maximum demand currents are required, these instruments combine both movements in one case. It can also replace an existing moving iron ammeter. 	<ul style="list-style-type: none"> Where manual paralleling of two a.c. systems is necessary, the frequency of both systems can be monitored by a Synchroscope. The systems are synchronised when the pointer is stationary in the 12 o'clock position. Silicon oil damping is employed. The instrument is rated for continuous operation and connection. 	<ul style="list-style-type: none"> Suitable for 240V single phase or 415V 3 phase 3 wire balanced load installation. Power factor meter consists of a moving coil indicator and a transducer. 	<ul style="list-style-type: none"> These frequency meters use an integral electronic converter and a moving coil indicator. This meter is easy to read with a resolution of 0.1Hz 	<ul style="list-style-type: none"> These wattmeters are ideal for clear precise analogue indication of power in applications such as power generation, industrial control panels and power distribution. 	The Varmeters include a transducer accessory and a moving coil indicator. These meters are used with potential transformer which secondary voltage is 100V/110V or current transformer which secondary current is 5A. Varmeters with built-in converter for three-phase three wire or four wire and single phase.	Nil