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**RAAD**

Analog Panel Meters

## ▣ General Technical Characteristics

### ▲ Application

- Industrial supply system
- Power engineering (switching station, generators, turbines)
- Heat engineering (thermal-electric power stations, boiler rooms)
- Shipyard industry (supply system on ships)

### ▲ Selected Features

- The Raad analog meters are designed in accordance with IEC60051-2, IEC 61010-1/2010 (latest issue).  
The exclusive design of the meters lies in creepage and clearance distances, compatible with last edition of IEC 61010-1.  
The significant difference between IEC61010-1/Ed: 2010 and its previous version is in the amounts of creepage and clearance distances, needed in designing the meters. This amount has been increased up to 2 times more, compared to the previous amount. Thus, the possibility of electron-creepage from the surface, is far high, in meters designed due to the old version of the standard.  
Taking this requirement into account, the meters are designed so that the possibility of surface creepage from where the zero knob is located, is truly out of existence. And this by turn, augments the safety level of the meters. (See figure 1)
- Having kind of clips on the back of meter to simple fixing on the panels without using any special tools. (See figure 2)
- Direct and indirect measurements co-operation with current and voltage transformers.
- Overload scale extension of ammeter indication ranges (twice or six-times) and voltmeters.
- Interchangeable scales simple change of indication ranges in meters for indirect measurements.
- Front windows material glass

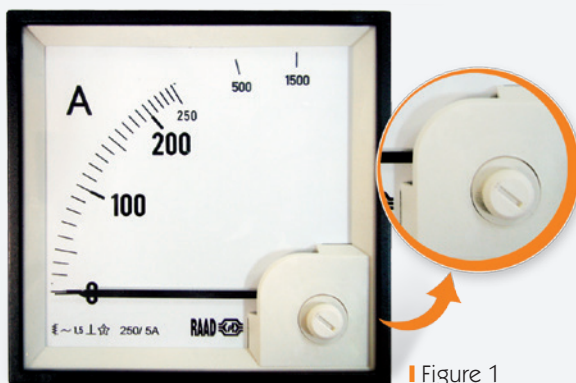


Figure 1

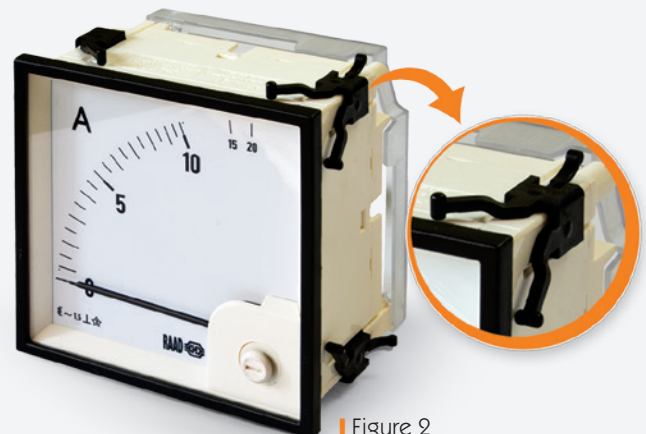


Figure 2

## ▲ Housing

The case of meters is made of self-extinguishing 10% glass filled polycarbonate, according to international regulation UL94, V-O classification, flame retardant and non-drip.

The features of polycarbonate in high toughness and light weight, make the structure of this engineering plastic material closely to metallic housing. Using of glass fibers give it extra toughness.

## ▲ Protection from hazardous condition

Using self-clicking back cover in all types of the meters, make them safe from finger touch of live parts. This technology prevents problems of loosening the screws and washers. (See figure 3)

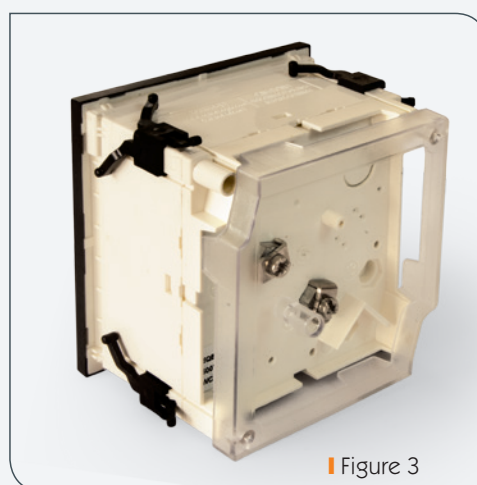
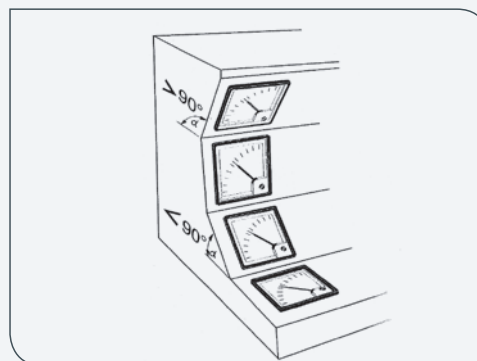


Figure 3

## ▲ Mounting Position

All meters could be mounted in two different positions at 90 deg to each other, so a number of meters are mountable in vertical and horizontal positions in one rectangular cut-out by using clips supplied on back side of the meter rim.

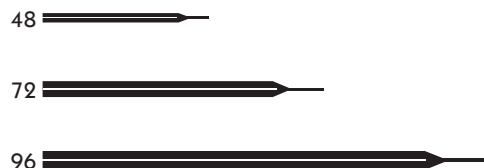
The design of meters is suitable for mounting on any panel from 1mm to 40mm thick.



## ▲ Pointer

The knife edge pointer of meters is made of aluminum sheet of 0.05 mm thick, so it is very light weight but very rigid by a specially designed V-profile.

Fitting of the pointer by special flapping process prevents disengaging of that, even in extreme temperature or shock and vibration.





## ▲ Features of terminal units

Simple assembling of conductors and time saving is the most important advantage of the meters due to using self-lifting terminal clamps. This technology makes lifting of clamps simple while inserting the cables without complete opening of screws. So, there would be no risk of losing the screws and nuts.

## ▲ IP-Protection

**IP52:** In accordance with IEC-529(DIN 40050), the meters conform to protection degree of IP52.

It is achieved by using O-ring incorporation in zero knob to ensure protection from fine dust particles and water.

**IP00:** Terminals without back cover

**IP20:** Terminals with back cover

## ▲ Applicable capacity

Table1

Type of measurment	Current and Voltage	
Type of meter	Moving Iron	Moving Coil
Name of meter	AMI , VMI	AMC , VMC , AVDC <sup>1</sup>
Angle of pointer	90°	90°
DIN sizes	48, 72, 96	48, 72, 96
Range of measurement <sup>2</sup>	Current : (10-3200) A/AC	Current : 20 mA/DC
	Voltage: (100-1000) V/AC, (4.5-45) KV/AC	Voltage : (60-150) mV/DC
Accuracy	1.5% of fiducial value.	

1: For details see table 5.

2: Optional ranges available on request.

## ▲ Movement

The meters movement has pivots of very high hardness. Movement suspended between spring loaded sapphire jewel and silicon jewel. Movement is critically damped by use of silicon oil.

## Overload

### Permanent overload:

All ammeters are capable of withstanding the overload up to 2 times the nominal current and this value is reached to 1.2 times nominal voltage for our voltmeters.

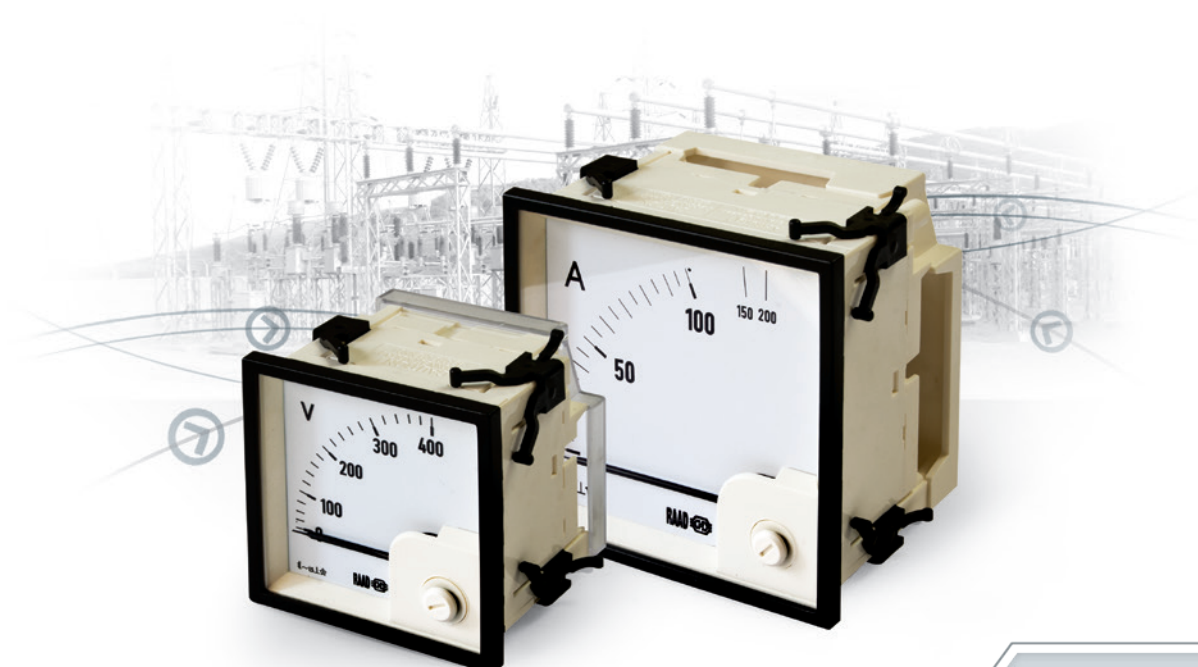
### Short duration overload

You can find the capability of voltmeters and ammeters for withstanding the overload of short circuit as table below:

Instrument	Current factor $\times I_n$	Voltage factor $\times V_n$	Number of overload	Duration of each overload (seconds)
Ammeter	10	-	9	0.5
	10	-	1	5
Voltmeter	-	2	9	0.5
	-	2	1	5

## Safety Terminal Protection

Full sized polycarbonate back cover to provide protection against accidental contact (hand and fingers) acc. to VDE 0410.





## ▣ AC. Ammeter and AC. Voltmeter

The fixed coil in this type of meters, is magnetized after determining the clockwise movement of an embedded moving iron which is integrally joined to the pointer.

The moving iron instrument, AMI,VMI 48/72/96 can be used for measuring the AC currents with frequency range of 15...100Hz.

Error of indication maybe occurred for frequencies higher than 100KHz and for extreme waveforms (e.g. phase gating controls).

Simple interchangeability of dials based on CT ratio in CT operated ammeters, is another advantage of this type of instrument.

◎ **Table 2: Reference condition related to type test:**

Accuracy class	1.5
Ambient temperature	(23±2)°C
Position of use	Nominal Position + 1°
Input wave form	Sine wave, distortion factor ≤ 5%
Frequency	45...65Hz

◎ **Table 3: The rated value of usage and environmental conditions**

Ambient temperature	0...50 °C
Operating temperature	-10...+55 °C
Storage temperature	-25...+65°C
Frequency	45...65Hz
External magnetic field	At 0.4 KA/m
Position of use	Vertical ± 5°
Relative humidity	≤75% annual average, non-condensing
Shock resistance	15 g for pulse duration 11 ms
Vibration resistance	10-55-10 Hz for amplitude. 0.15mm (1.5 g at 50 Hz)
pollution degree	2

◎ **Table 4: Construction and technical data**

Power consumption	Voltmeters	< 4.5 VA		
	Ammeters < 15A	< 0.5 VA		
	Ammeters > 15A	< 0.8 VA		
Type of clamp unit	Voltmeters	Hexagon studs, M4 screws and wire clamps E3		
	Ammeters < 30A	Hexagon studs, M4 screws and wire clamps E3		
	Ammeters > 30A	Threaded studs M6 with nuts		
	Ammeters > 60A	Threaded studs M8 with nuts		
Front facia	Glass			
Colour of bezel	Black			
Position of use	Vertical			
Panel fixing	Mounting clamp			
Panel thickness	≤ 25 mm			
Pointer deflection	0...90°			
Scale length (mm)	AMI 48 VMI	AMI 72 VMI	AMI 96 VMI	
	41	63	97	

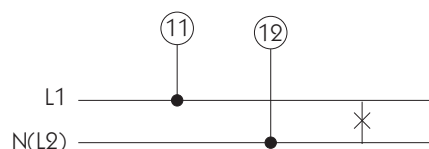


## Safety Precautions

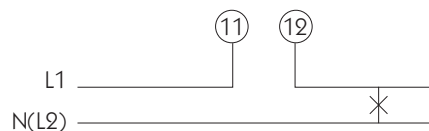
- 1) Instruments with damaged bezel or glasses must be disconnected from the mains.
- 2) Adequate safety clearance must be maintained to control panel fasteners and to sheet metal housing, if non -insulated connector wires are used.
- 3) The back cover must be snapped into place after connector wires have been clamped for protection against accidental contact.
- 4) Bezel, Scale and Glass may only be replaced under voltage free conditions.
- 5) Instruments to be used in grounded panel.

## Connections

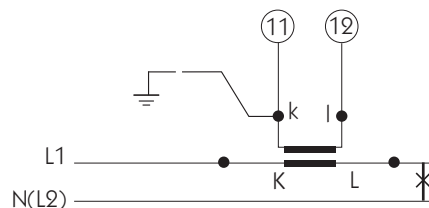
- AC Voltage (Direct connected)



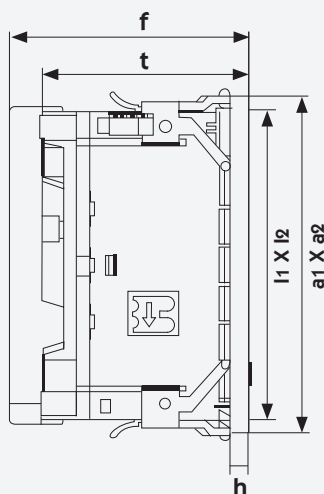
- AC Current (Direct connected)



- AC Current (for use on current Transformer)



## Dimensions



Front in mm	Nominal Dimensions mm		Cutout mm $l_1 \times l_2$	Installation Depth Including Terminal (t), mm			Installation Depth Including Full back Cover (f), mm	
	$a_1 \times a_2$	h		< 30A (M4)	30...60A(M6)	100A (M8)	< 30A	30...100A
48 × 48	48 × 48	5.5	43 × 43	54	72	-	67.6	75 (up to 60 A)
72 × 72	72 × 72	5.5	67 × 67	54	62	66	67.6	70
96 × 96	96 × 96	5.5	90 × 90	54	62	66	67.6	70



## ■ DC. Ammeter and DC. Voltmeter

In the moving coil instruments, the magnetic field generated by a fixed permanently magnet, acts on moving coil energized by current and is integrally joined to the positions, after determining the clockwise movement of the latter. The scale of this type of meters is linear.

The moving coil panel meters, AMC, VMC, AVDC 48/72/96 housed in moulded polycarbonate cases are suitable for the measurement of DC currents and voltages.

The DC Ammeters and Voltmeters (AVDC) can be connected to shunt, refer to permissible voltage drop determined as table below:

Table 5: Burden

Connection to shunt	Power Consumption:6mA Lead resistance: 0.06W	Tolerance
1A...60A	Voltage : 60 mV	±10%
≥1V	1000 W/V	±5%

◎ Table 6: Reference condition related to type test

Accuracy class	1.5
Ambient temperature	(23±2)°C
Position of use	Nominal Position + 1°
Input wave form	Sine wave, distortion factor ≤ 5%
Frequency	45...65Hz

◎ Table 7: The rated value of usage and environmental conditions

Ambient temperature	0...50 °C
Operating temperature	-10...+55 °C
Storage temperature	-25...+65°C
Frequency	45...65Hz
External magnetic field	At 0.4 KA/m
Position of use	Vertical ± 5°
Relative humidity	≤75% annual average, non-condensing
Shock resistance	15 g for pulse duration 11 ms
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pollution degree	2

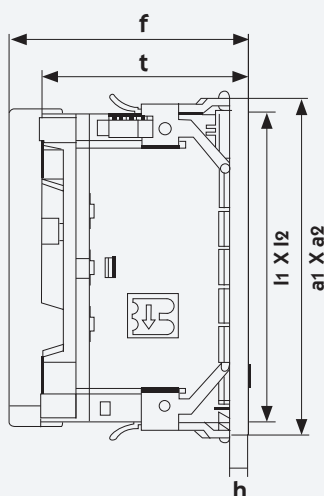
● **Table 8: Construction and technical data:**

Power consumption	Voltmeters	< 4.5 VA	
	Ammeters < 15A	< 0.5 VA	
	Ammeters > 15A	< 0.8 VA	
Type of clamp unit	Voltmeters	Hexagon studs, M4 screws and wire clamps E3	
	Ammeters < 30A	Hexagon studs, M4 screws and wire clamps E3	
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Position of use	Vertical		
Panel fixing	Mounting clamp		
Panel thickness	≤ 25 mm		
Pointer deflection	0...90°		
Scale length (mm)	AMI 48 VMI	AMI 72 VMI	AMI 96 VMI
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## ▲ Connections



## ▲ Dimensions



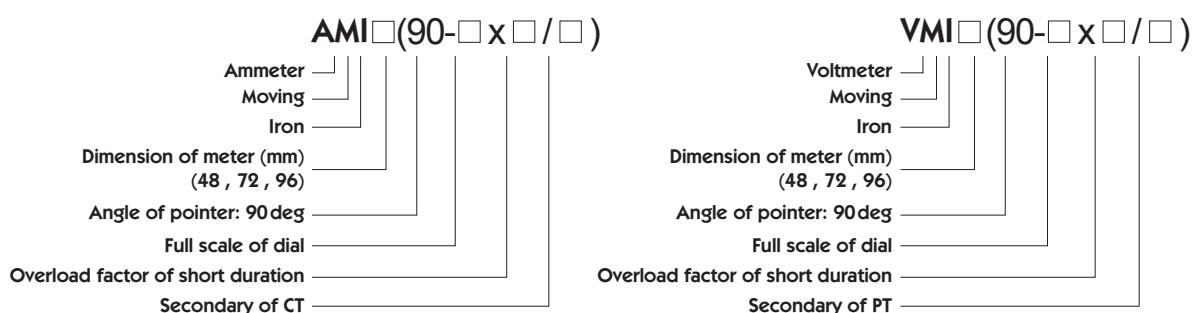
Front in mm	Nominal Dimensions mm		Cutout mm $l_1 \times l_2$	Installation Depth Including Terminal (t), mm			Installation Depth Including Full back Cover (f), mm	
	$a_1 \times a_2$	h		< 30A (M4)	30...60A (M6)	100A (M8)	< 30A	30...100A
48 × 48	48 × 48	5.5	43 × 43	54	72	-	67.6	75 (up to 60 A)
72 × 72	72 × 72	5.5	67 × 67	54	62	66	67.6	70
96 × 96	96 × 96	5.5	90 × 90	54	62	66	67.6	70

## Ordering Information

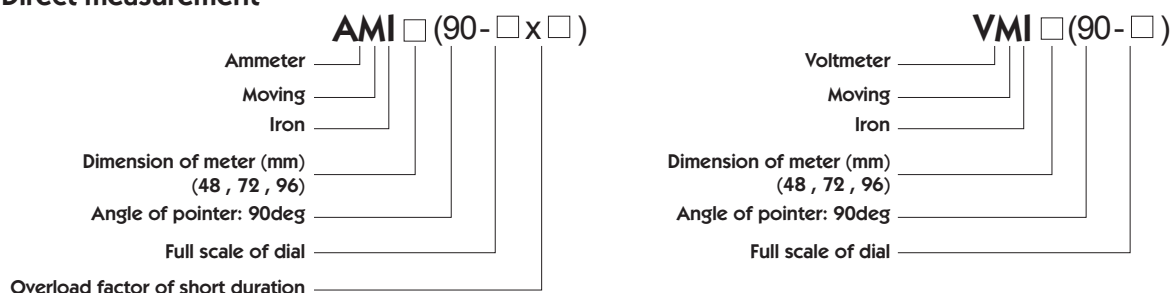
### AC. Ammeter and AC. Voltmeter

All of the moving iron meters can be ordered by coding structure identified as below:

- **Indirect measurement** (through current or voltage transformers)



- **Direct measurement**

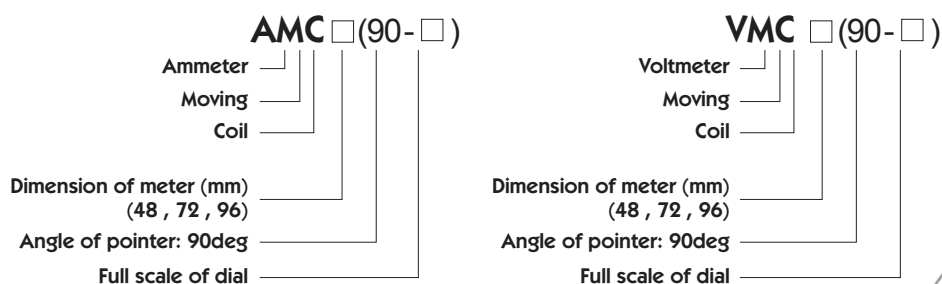


**Example of coding structure :**

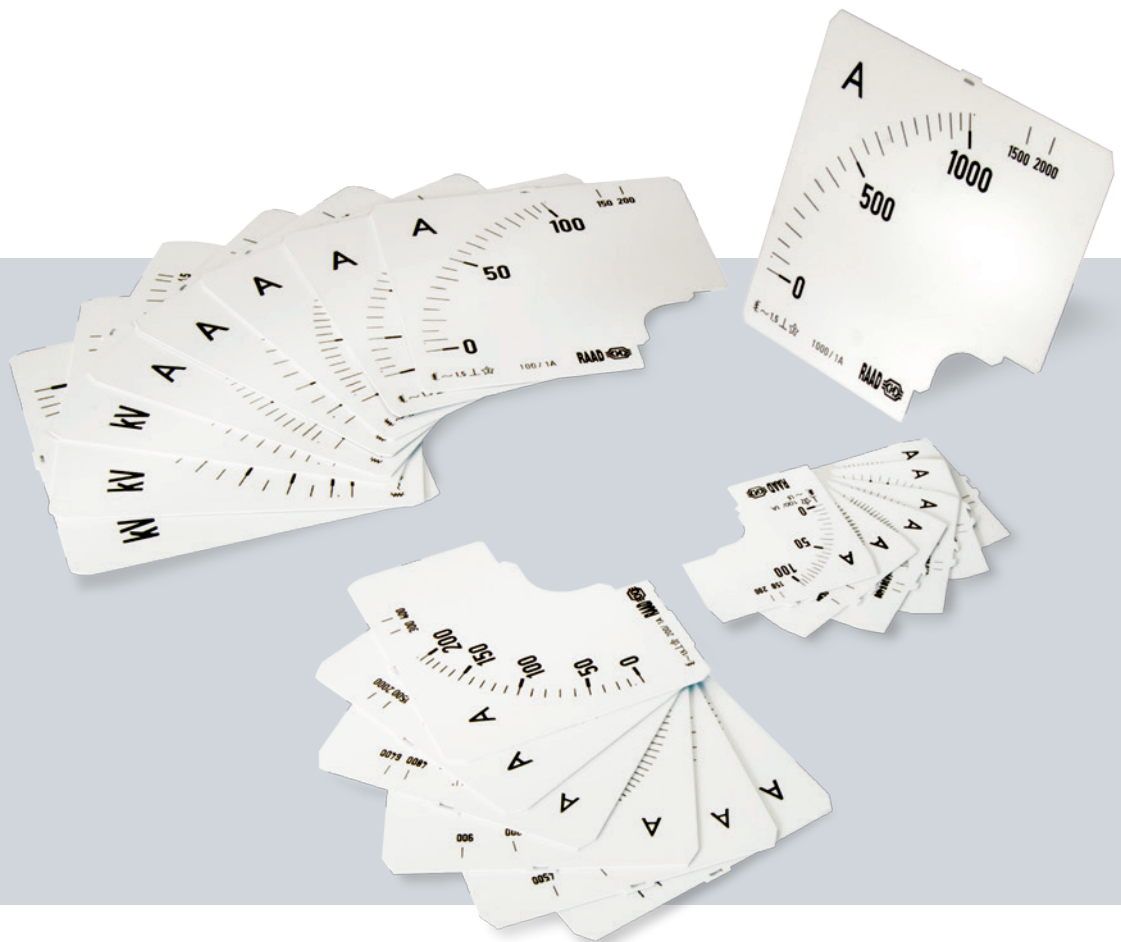
- **AMI 96 (90-100 X2/1)**: is the moving iron ammeter in dimension of (96x96), 90 deg. Its full-scale is 100A, 2In (overload factor) ammeter indirect input by CT secondary 1A.
- **VMI 96 (90-4.5K/110)**: is the moving iron voltmeter in dimension of (96x96), 90 deg. Its full-scale is 4.5KV, voltmeter indirect input by PT secondary 110 V.

### DC. Ammeter and DC. Voltmeter

All of the moving coil meters can be ordered by coding structure identified as below:







## ▣ Interchangeable Scales

### ▲ Interchangeable Scales

One of the possibility of meters is the interchangeable scales. This capability reached by plotter apparatus and printing software. So, any of your optional scales can be supplied by request.

The available scale plates for indirect ammeters identify as follows:



**Table 9:** Input by means a C.T., secondary 1A or 5A

Scale plates on CT/1A	
5/1	400/1
10/1	500/1
15/1	600/1
20/1	700/1
25/1	750/1
30/1	800/1
40/1	1000/1
50/1	1200/1
60/1	1250/1
70/1	1500/1
75/1	1600/1
80/1	2000/1
100/1	2500/1
120/1	3000/1
125/1	4000/1
150/1	5000/1
160/1	6000/1
200/1	8000/1
250/1	10000/1
300/1	

Scale plates on CT/5A	
5/5	400/5
10/5	500/5
15/5	600/5
20/5	700/5
25/5	750/5
30/5	800/5
40/5	1000/5
50/5	1200/5
60/5	1250/5
70/5	1500/5
75/5	1600/5
80/5	2000/5
100/5	2500/5
120/5	3000/5
125/5	4000/5
150/5	5000/5
160/5	6000/5
200/5	8000/5
250/5	10000/5
300/5	



## ▣ In Production Process Measuring Instruments

In order to meet our customers need in a better way, Raad manufacturing co., has offered you a vast range of measuring instruments such as: frequency meter, power factor meter, VAR meter, watt meter, selector switch ammeter/voltmeter,.... Also you can order any type of meters for both 90° and 240°. So, each type of instrument is available under request.



## ■ Applicable Standards And Related Tests

### ▲ Applicable Standards

The measurements are produced in accordance with international standards introduced as follows:

Nominal case and cutout dimensions for indicating Electrical instruments	IS 2419 DIN IEC 61554
Scale and pointer for electrical measuring instruments	IS 1248 DIN 43802
Connections and Terminal markings for panel meters	IS 1248 DIN 43807
Terminal bolts / leads	DIN 46200/46282
Clamp straps for connections	DIN 46282
Safety requirements and protective measures for Electrical indicating instruments and their accessories	IS 9249, DIN 40050 VDE 0110, VDE 0410 IEC 529 , IEC 1010
Performance specifications for direct acting indicating analog electrical measuring instruments & their accessories	IS 1248 IEC 51/DIN EN 60051 DIN 43701
Environmental condition	IS 1248, IS: 9000 VDE / VDI 3540
Front frames for indicating measuring instruments Principle dimensions	DIN 43718
UL Combustibility Class	UL 94 V-0
Technical conditions of delivery for electrical instruments	DIN 43701
Mechanical strength (Free fall test, vibration test)	IS 1248, IS 9000 VDE 0411, IEC 61010

Comply with following European directives: 2004 / 108 / EC (EMC directive), 2006 / 95 / EC (low voltage directive) & amendment 93 / 68 / EEC, For Marking.

## ▲ Voltmeter and Ammeter tests

All measuring instruments are subjected for doing Routine tests accordance to requirements of IEC60051 standard. The abstract of foregoing test specified as below:

### ⦿ Deviation from zero

If an ammeter or voltmeter has a zero position marked on the scale, it shall be tested to return zero when deenergized at the upper limit of the measuring range in the limited standard time. The deviation of zero is expressed as a percentage of the scale length, and shall not exceed a value corresponding to 50% of the class index.

### ⦿ Intrinsic error

After set zero with tapping, apply slowly increasing the value of meter to each of at least five scale marks and extremely up to 120% of the value corresponding to the upper limit of the measuring range and compare the showing value of meter with reference value. So, decrease from upper value to lower limit of measuring range.

The intrinsic error expressed as a percentage of the fiducial value, shall not exceed the limits appropriate to its accuracy class.

### ⦿ Variation due to position

After recording all of the values shown by reference instrument from lower to upper limited values of measurement under test, shall to tilt of instrument in forward about 5° from vertical position, so after set the

zero, recording the values of excitation to bring the index to each of the same scale marks from lower to upper limited value of measurement. The permissible variation expressed as 50% of class index. This test repeated again for each of back, left and right direction. After this test, tilt the instrument 90° to horizontal position and repeat again above test. In this situation the permissible variation expresses as 100% of class index.

### ⦿ Test voltage

The instruments are tested according to IEC61010-1 with an effective voltage of 3000V at 50Hz for 1 minute.

