



ANALOGUE INSTRUMENTS



ANALOGUE INSTRUMENTS

S.A. DE CONSTRUCCIONES INDUSTRIALES

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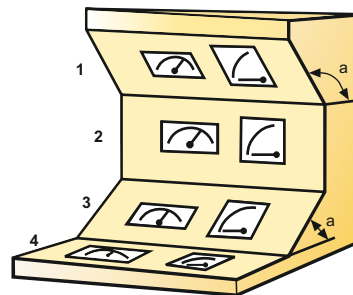
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GENERAL FEATURES

Standards	EN60051, VDE 0410, BS-89, EN50081, EN50082, EN61010
Certifications	ISO 9001-2008 DET NORSKE VERITAS, BUREAU VERITAS GERMANISCHER LLOYD (relay)
Casings	IEC 61554 72x72, 96x96, 144x144, 80x64, 105x80, 130x100 MODULAR (for DIN rail)
Scales	Full scale value, DIN 43701 Scale division, DIN 43802
Pointers	DIN 43802

1	$a > 90^\circ$
2	\perp
3	$a < 90^\circ$
4	\square



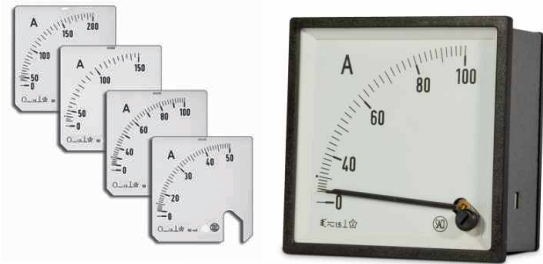
Overloads	1.2 Vn continuous, 2 Vn 5 s 1.5 In continuous, 5 In 30 s, 10 In 5 s, 40 In 1 s
Vibration resistance	VDE 0410, Section 27: 2.5 g, ± 0.25 mm, 50 Hz
Shock resistance	VDE 0410, Section 28: 15 g
Operating temperature	-25°C..+40°C
Reference temperature	+10°C..+30°C (for accuracy class)
Test voltage	2kV, 50 Hz, 1 min.
Tropicalization	DIN 40040 (on request)
Protection	IP52, (IP54, IP65 on request) casings IP00, (IP20 on request) terminals

MOVING IRON

Voltage and alternating current. True effective value.

AMMETERS (INTERCHANGEABLE SCALE)

- Measuring range: x/1 A, x/5 A
- Scale: 90°
- Accuracy: 1,5 %
- Frequency: 15..100 Hz
- Burden: 0,4 VA



Model		EC5VR	EC5V	EC4V	EC3V
Dimensions	mm	45x52,5 DIN RAIL	48x48	72x72	96x96
Approx. weight	kg.	0,15	0,14	0,20	0,25
CT OPERATED AMMETERS (INTERCHANGEABLE SCALE)					
Module		X/5A or X/1A			
Standards scales	In	10; 15; 20; 25; 30; 40; 50; 60 or 75 A and multiples			
Module		2X/5A or 2X/1A			
Standards scales	2xIn	10..20; 15..30; 20..40; 25..50; 30..60; 40..80; 50..100; 60..120 or 75..150 A and multiples			
Module		5X/5A or 5X/1A			
Standards scales	5xIn	10..50; 15..75; 20..100; 25..125; 30..150; 40..200; 50..250; 60..300 or 75..375 A and multiples			

DIRECT INPUT AMMETERS

- Scale: 90°
- Accuracy: 1,5 %
- Frequency: 15..100 Hz
- Burden: 0,3..1 VA



Model		EC5VR*	EC5V	EC4V	EC3V	EC2V	ECb7**	ECb3**	ECb8**
Dimensions	mm	45x52,5 DIN	48x48	72x72	96x96	144x144	80x64	105x80	130x100
Approx. weight	kg.	0,25	0,09	0,20	0,25	0,50	0,14	0,18	0,25
DIRECT INPUT AMMETERS									
MEASURING RANGE	In	1; 1,5; 2; 2,5; 3; 4; 5; 6; 10; 15; 20; 25; 30; 40; 50; 60; 75 or 100 A							
	2xIn	1..2; 1,5..3; 2..4; 2,5..5; 3..6; 4..8; 5..10; 6..12; 10..20; 15..30							
		20..40; 25..50; 30..60; 40..80; 50..100; 60..120; 75..150 or 100..200 A							
	5xIn	1..5; 1,5..7,5; 2..10; 2,5..7,5; 3..15; 4..20; 5..25; 6..30; 10..50; 15..75							
20..100; 25..125; 30..150; 40..200; 50..250; 60..300; 75..375 or 100..500 A									

* Maximum measuring range: 40 A, 40..80 A, 40..200 A

** Maximum measuring range: 50 A, 50..100 A, 50..250 A

AMMETERS (mA)

- Scale: 90°
- Accuracy: 1,5 %
- Frequency: 15..100 Hz
- Burden: 0,3..1 VA



Model		EC5VR	EC5V	EC4V	EC3V	EC2V	ECb7	ECb3	ECb8
Dimensions	mm	45x52,5 DIN	48x48	72x72	96x96	144x144	80x64	105x80	130x100
Approx. weight	kg.	0,15	0,14	0,20	0,25	0,50	0,14	0,18	0,25
AMMETERS (mA)									
MEASURING RANGE	In	100; 150; 200; 250; 300; 400; 500 or 600 mA							
	2xIn	100..200; 150..300; 200..400; 250..500; 300..600; 400..800; 500..1000 or 600..1200 mA							
	5xIn	100..500; 150..750; 200..1000; 250..1250; 300..1500; 400..2000; 500..2500 or 600..3000 mA							

VOLTMETERS (INTERCHANGEABLE SCALE)

- Measuring range: 100V, 110V
- Scale: 90°
- Accuracy: 1,5 %
- Frequency: 45..65 Hz
- Burden: 1,5..3 VA



Model		EC5VR	EC5V	EC4V	EC3V
Dimensions	mm	45x52,5 DIN	48x48	72x72	96x96
Approx. weight	Kg.	0,15	0,14	0,20	0,25
VT OPERATED VOLTMETERS (INTERCHANGEABLE SCALE)					
Module		1,2 x/100V or 1,2x/110V			
Scales	Vn	1,2 Vn			

DIRECT INPUT VOLTMETERS

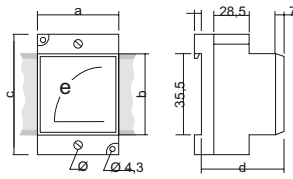
- Scale: 90°
- Accuracy: 1,5 %
- Frequency: 45..65 Hz
- Burden: 1,5..3 VA



Model		EC5VR*	EC5V	EC4V	EC3V	EC2V	ECb7	ECb3	ECb8
Dimensions	mm	45x52,5 DIN	48x48	72x72	96x96	144x144	80x64	105x80	130x100
Approx. weight	kg.	0,25	0,09	0,20	0,25	0,50	0,14	0,18	0,25
DIRECT INPUT VOLTMETERS									
Measuring range	Vn	6; 10; 15; 25; 30; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 V							

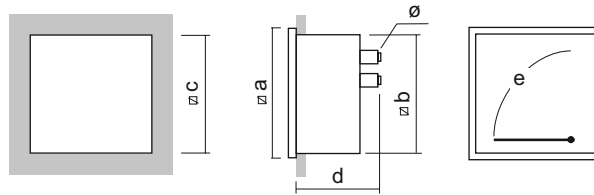
* IP20 protection

Dimensions (mm)



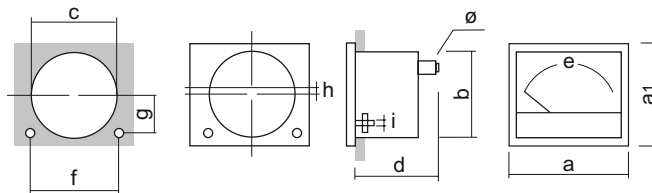
Model	Ranges	a	b	c	d	e	Ø
EC5VR	A - mA - V	52,5	45	75	60	38	M.6

Dimensions (mm)



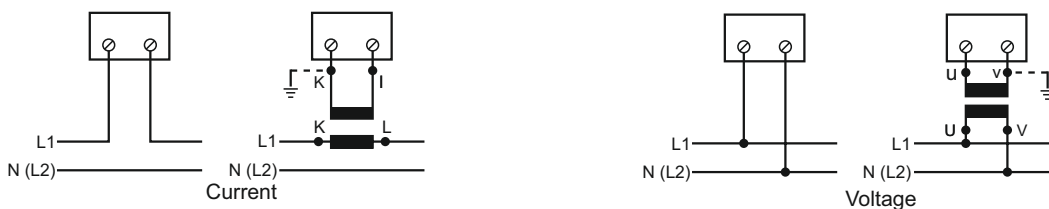
Models	Ranges	∇a	∇b	∇c	d	e	Ø
EC5V	>15..40 A	48	44,5	45 ^{+0,6}	62	38	M.6
	The rest				59		M.4
EC4V	>15..100 A	72	66,5	68 ^{+0,7}	68	65	M.6
	The rest				60		M.4
EC3V	>15..100 A	96	89	92 ^{+0,8}	61	100	M.6
	The rest				59		M.4
EC2V	>15..100 A	144	135	138 ⁺¹	61	140	M.6
	The rest				59		M.4

Dimensions (mm)



Models	Ranges	a x a1	Ø b	Ø c	d	e	f	g	h	i	Ø
ECb7	>15..50 A	80x64	57,6	58,6 ^{+0,6}	63	57	63	12,5	1,5	M.3	M.6
	The rest				55						M.4
ECb3	>15..<50 A	105x80	66	67 ^{+0,7}	63	75	81	13	4,5	M.3	M.6
	The rest				55						M.4
ECb8	>15..<50 A	130x100	66	67 ^{+0,8}	63	100	100	13	13	M.4	M.6
	The rest				55						M.4

Conection diagrams



AMMETERS WITH SWITCH

(INTERCHANGEABLE SCALE)
4-POSITION SWITCH (0, L1, L2, L3)

- Measuring range: x/1 A , x/5 A
- Scale: 90°
- Accuracy: 1,5 %
- Frequency: 15..100 Hz
- Burden: 0,4 VA



Models		EC4V4	EC3V4
Dimensions	mm	72x72	96x96
Approx. weight	kg.	0,25	0,50

AMMETERS WITH SWITCH (INTERCHANGEABLE SCALE)

Module	In	X/5A or X/1A
Standards scales		10; 15; 20; 25; 30; 40; 50; 60 or 75 A and multiples
Module	2xIn	2X/5A or 2X/1A
Standards scales		10..20; 15..30; 20..40; 25..50 30..60; 40..80; 50..100; 60..120 or 75..150 A and multiples
Module	5xIn	5X/5A or 5X/1A
Standards scales		10..50; 15..75; 20..100; 25..125; 30..150; 40..200; 50..250; 60..300 or 75..375 A and multiples

VOLTMETERS WITH SWITCH

3-POSITION SWITCH (L12, L23, L31)
6-POSITION SWITCH (L1, L2, L3, L12, L23, L31)

- Scale: 90°
- Accuracy: 1,5 %
- Frequency: 45..65Hz
- Burden: 1,5..3 VA



Models		EC4V3	EC3V3	EC4V6	EC3V6	EC4V7	EC3V7
Dimensions	mm	72x72	96x96	72x72	96x96	72x72	96x96
Approx. weight	kg.	0,25	0,50	0,25	0,50	0,25	0,50
Switch		3 positions		6 positions		6 positions + sequence meter	

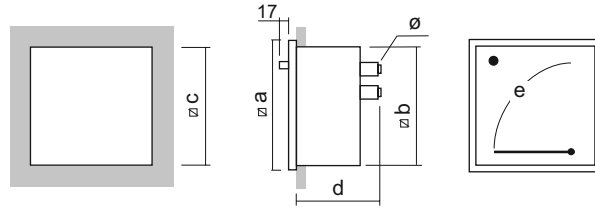
CT OPERATED VOLTMETERS

Module	Vn	1,2 x/100V or 1,2x/110V
Standard scales		1,2 times the primary of the voltage transformer

DIRECT VOLTMETERS

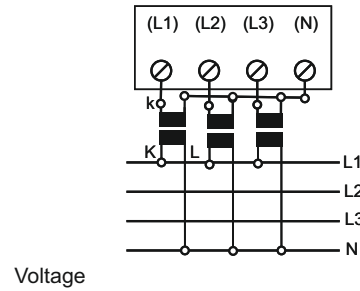
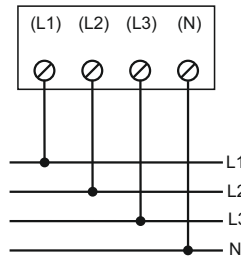
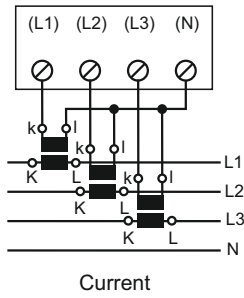
Measuring range	Vn	150, 200, 250, 300, 400, 500 and 600 V
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Dimensions (mm)



Models	Ranges	∅a	∅b	∅c	d	e	ø
EC4V3 EC4V6 EC4V7	V	72	66,5	68 ^{+0,7}	68	65	M.4
EC3V3 EC3V6 EC3V7	V	96	89	92 ^{+0,8}	67	100	M.4
EC4V4 EC3V4	A	72	66,5	68 ^{+0,7}	68	65	M.4
	A	96	89	92 ^{+0,8}	67	100	M.4

Connection diagrams



MOVING COIL WITH CONVERTER

Voltage and current measuring on alternating current circuits.

True RMS

AMMETERS

VOLTMETERS

- Scale: 240°
- Accuracy: 1,5 %
- Frequency: 20..100 Hz
- Burden: 2,5 VA



Model		EC5CE*	EC4CE*	EC3CE	EC2CE
Dimensions	mm	48x48	72x72	96x96	144x144
Approx. weight	kg.	0,84	0,84	0,87	1,55
CT OPERATED AMMETERS					
Module	In	X/5A or X/1A			
Standards scales		10; 15; 20; 25; 30; 40; 50; 60 or 75 A and multiples			
Module	2xIn	2X/5A or 2X/1A			
Standards scales		10..20; 15..30; 20..40; 25..50 30..60; 40..80; 50..100; 60..120 or 75..150 A and multiples			
Module	5xIn	5X/5A or 5X/1A			
Standards scales		10..50; 15..75; 20..100; 25..125; 30..150; 40..200; 50..250; 60..300 or 75..375 A and multiples			
DIRECT INPUT AMMETERS					
Measuring range	In	1; 1,5; 2,5; 4; 5; 6 or 10 A			
	2xIn	1..2; 1,5..3; 2,5..5; 4..8; 5..10; 6..12 or 10..20 A			
	5xIn	1..5; 1,5..7,5; 2,5..12,5; 4..20; 5..25; 6..30 or 10..50 A			
VT OPERATED VOLTMETERS					
Measuring range		1,2 x/100V or 1,2x/110V			
Standards scales	Vn	1,2 times the primary of the voltage transformer			
DIRECT INPUT VOLTMETERS					
Measuring range	Vn	50; 60; 100; 150; 250; 300; 400; 500 or 600 V			

* With additional module: MBRMS model

Connection diagrams

Current



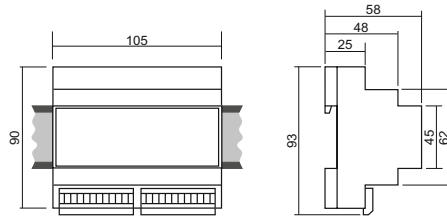
Connection diagrams

Voltage



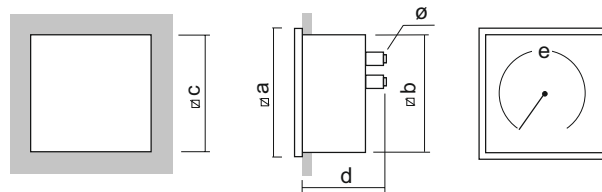
Dimensions (mm)

Din rail MBRMS additional module



Weight = 0,240
Plug-in connectors

Dimensions (mm)



Models	Ranges	$\varnothing a$	$\varnothing b$	$\varnothing c$	d	e	\varnothing
EC5CE	A - V	48	44,5	45+0,6	83	72	M.4
EC4CE	A - V	72	66,5	68+0,7	88	101	M.4
EC3CE	A - V	96	89	92+0,8	74	140	M.4
EC2CE	A - V	144	135	138+1	88	220	M.4

MOVING COIL WITH RECTIFIER

Voltage and alternating current measuring (average value of the signal)

AMMETERS (μA , mA and A) VOLTMETERS

- Scale: 90°
- Accuracy: 1,5 %

- Frequency: 50 or 60 Hz



Models		CC5VR	CC5VG	CC4VG	CC3VG	CC2VG	CCb7G	CCb3G	CCb8G
Dimensions	mm	45x52,5 DIN	48x48	72x72	96x96	144x144	80x64	105x80	130x100
Approx. weight	kg.	0,15	0,14	0,20	0,28	0,50	0,15	0,19	0,25
AMMETERS (μA, mA and A)									
MEASURING RANGE	In	40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 μA							
		1; 1,5; 2; 2,5; 3; 4; 5; 6; 10; 15; 20; 25; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 mA							
		1; 1,5; 2; 2,5; 3; 4 or 5 A							
VT OPERATED VOLTMETERS									
Measuring range	Vn	1,2 x/100V or 1,2 x/110V							
Standards scales		1,2 times the primary of the voltage transformer							
DIRECT INPUT VOLTMETERS									
Measuring range	Vn	6; 10; 15; 25; 30; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 V							

AMMETERS (μA , mA and A) VOLTMETERS

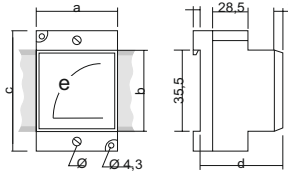
-Scale: 240°
-Accuracy: 1,5 %

-Frequency: 50 or 60 Hz



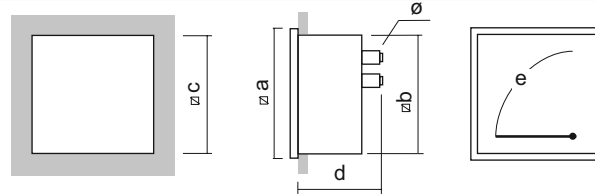
Model		CC5CG	CC4CG	CC3CG	CC2CG
Dimensions	mm	48x48	72x72	96x96	144x144
Approx. weight	kg.	0,20	0,32	0,38	0,68
DIRECT INPUT AMMETER (μA, mA y A)					
MEASURING RANGE	In	150; 200; 300; 400; 500 or 600 μA			
	In	1; 1,5; 2; 2,5; 3; 4; 5; 6; 10; 15; 20; 25; 30; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 mA			
	In	1; 1,5; 2; 2,5; 3; 4; 5; 10 or 15 A			
	2xIn	1..2; 1,5..3; 2..4; 2,5..5; 3..6; 4..8; 5..10; 10..20 or 15..30 A			
	5xIn	1..5; 1,5..7,5; 2..10; 2,5..12,5; 3..15; 4..20; 5..25; 10..50 or 15..75 A			
CT OPERATED AMMETERS					
Module	In	X/5A or X/1A			
Standards scales		10; 15; 20; 25; 30; 40; 50; 60 or 75 A and multiples			
Module	2xIn	2X/5A or 2X/1A			
Standards scales		10..20; 15..30; 20..40; 25..50 30..60; 40..80; 50..100; 60..120 or 75..150 A and multiples			
Module	3xIn	5X/5A or 5X/1A			
Standards scales		10..50; 15..75; 20..100; 25..125; 30..150; 40..200; 50..250; 60..300 or 75..375 A and multiples			
VT OPERATED VOLTMETERS					
Measuring range	Vn	1,2 x/100V ó 1,2 x/110V			
Standards scales		1,2 times the primary of the voltage transformer			
DIRECT INPUT VOLTMETERS					
Measuring range	Vn	6; 10; 15; 25; 30; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 V			

Dimensions (mm)



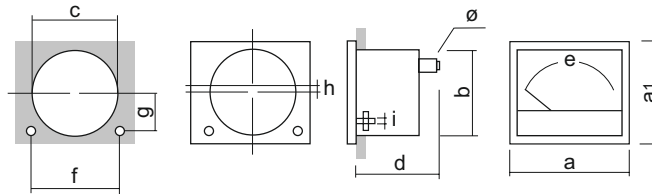
Models	Ranges	a	b	c	d	e	Ø
CC5VRG	µA; mA; A; V	52,5	45	75	60	38	M.6

Dimensions (mm)



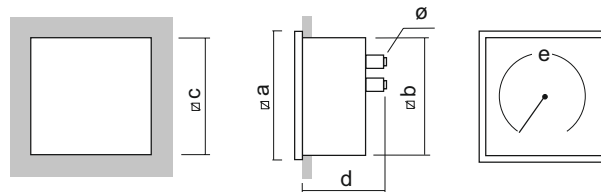
Models	Ranges	∅a	∅b	∅c	d	e	Ø
CC5VG	µA; mA; A; V	48	44,5	45 ^{+0,6}	63	38	M.4
CC4VG	µA; mA; A; V	72	66,5	68 ^{+0,7}	64	65	M.4
CC3VG	µA; mA; A; V	96	89	92 ^{+0,8}	63	100	M.4
CC2VG	µA; mA; A; V	144	135	138 ⁺¹	63	140	M.4

Dimensions (mm)



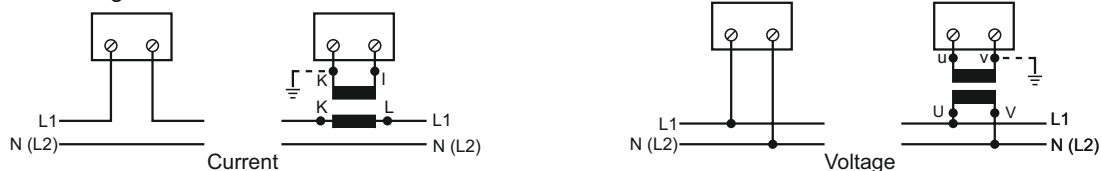
Models	Ranges	a x a1	Ø b	Ø c	d	e	f	g	h	i	Ø
CCb7G	µA; mA; A; V	80x64	57,6	58,6 ^{+0,6}	59	57	63	12,5	1,5	M.3	M.4
CCb3G	µA; mA; A; V	105x80	66	67 ^{+0,7}	59	75	81	13	4,5	M.3	M.4
CCb8G	µA; mA; A; V	130x100	66	67 ^{+0,8}	59	100	100	13	13	M.4	M.4

Dimensions (mm)



Models	Ranges	∅a	∅b	∅c	d	e	Ø
CC5CG	µA; mA; A; V	48	44,5	45 ^{+0,6}	87	72	M.4
CC4CG	µA; mA; A; V	72	66,5	68 ^{+0,7}	92	101	M.4
CC3CG	..1/5 A The rest	96	89	92 ^{+0,8}	92	140	M.4
CC2CG	µA; mA; A; V	144	135	138 ⁺¹	92	220	M.4

Connection diagrams



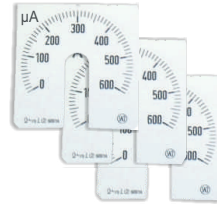
MOVING COIL WITH RECTIFIER

Voltage and alternating current measuring (sinusoidal waveforms)

AMMETERS (μA , mA and A) VOLTMETERS

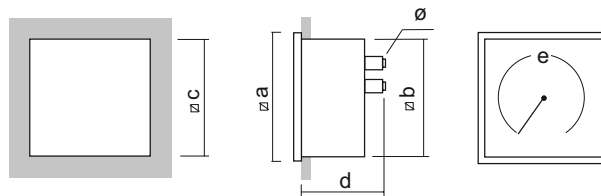
(INTERCHANGEABLE SCALE)

- Scale: 90°
- Accuracy: 1,5 %
- Frequency: 50 or 60 Hz



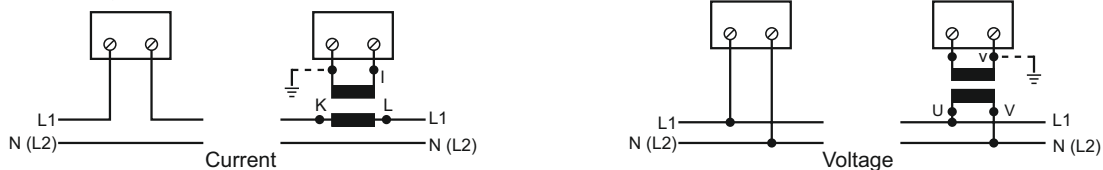
Model		CC3CGS
Dimensions	mm	96x96
Approx. weight	kg.	0,38
AMMETERS (μA, mA)		
MEASURING RANGE	In	150; 200; 300; 400; 500 or 600 μA
	In	1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 mA
AMMETERS (A)		
MEASURING RANGE	In	1; 1,5; 2; 2,5; 3; 4; 5; 10 or 15 A
	2xIn	1..2; 1,5..3; 2..4; 2,5..5; 3..6; 4..8; 5..10; 10..20 or 15..30 A
	5xIn	1..5; 1,5..7,5; 2..10; 2,5..12,5; 3..15; 4..20; 5..25; 10..50 or 15..75 A
VT OPERATED VOLTMETERS		
Measuring range	Vn	X/100V or X/110V
Standard scales		1,2 times the primary of the voltage transformer
DIRECT INPUT VOLTMETERS		
Measuring range	Vn	6; 10; 15; 25; 40; 60; 100; 150; 250; 300; 400; 500 or 600 V

Dimensions (mm)



Models	Ranges	a	b	c	d	e	ø
CC3CGS	μA ; mA; A; V	96	89	92	63	160	M.4

Connection diagrams



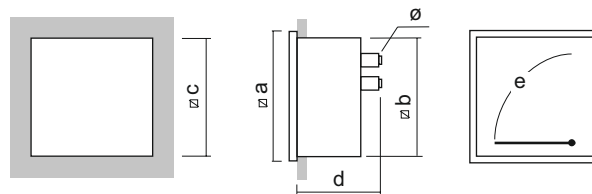
RATED VALUE VOLTMETERS

- Scale: 90°
- Accuracy: 1,5 %
- Frequency: 50 or 60 Hz
- Burden: 2 mA



Models		CC4VGN	CC3VGN	CC2VGN
Dimensions	mm	72x72	96x96	144x144
Approx. weight	kg.	0,17	0,25	0,48
VOLTMETERS				
Measuring range		100; 110; 230 or 400 V		
Standards scales	Vn	90..110 V or $\pm 10\%$ X/100 V		
		100..120 V or $\pm 10\%$ X/110 V		
		210..250 V		
		380..420 V		

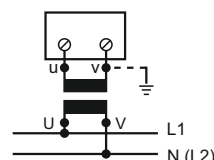
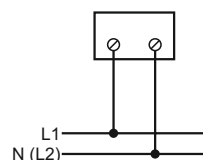
Dimensions (mm)



Models	Ranges	∇a	∇b	∇c	d	e	ø
CC4VGN	V	72	66,5	68 ^{+0,7}	64	38	M.4
CC3VGN	V	96	89	92 ^{+0,8}	63	65	M.4
CC2VGN	V	144	135	138 ⁺¹	63	100	M.4

Connection diagrams

Voltage



ELAPSED TIME METER

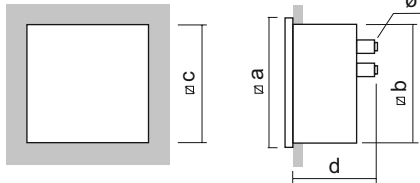
Operating time control of machines and equipment.

- Meter: mechanical, 7 digits (99999.99)
- Voltage (Vn): 110, 230, 400 V
- Voltage range: $\pm 10\%$ Vn
- Burden: 10 mA
- Frequency: 50 or 60 Hz



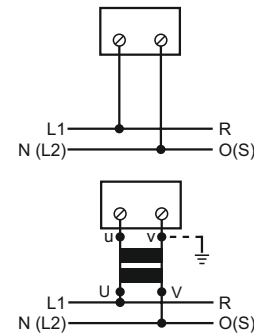
Models		HC5	HC4	HC3
Dimensions	mm	48x48	72x72	96x96
Approx. weight	kg.	0,06	0,14	0,175

Dimensions (mm)



Models	Ranges	∅a	∅b	∅c	d	ø
HC5	110÷400	48	44,5	45,2 ^{+0,6}	34	M.3
HC4	110÷400	72	66,5	68 ^{+0,7}	60	M.3
HC3	110÷400	96	89	92 ^{+0,8}	60	M.3

Connection diagrams



PHASE SEQUENCE INDICATORS

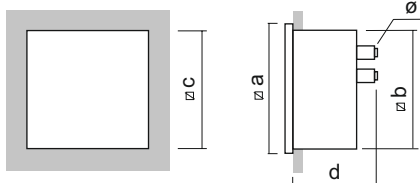
Phase sequence detection on a three-phase system.

- Voltage: (Vn): 100..600 V
- Voltage range: $\pm 10\%$ Vn
- Frequency: 50 or 60 Hz
- Burden: 1,2 VA



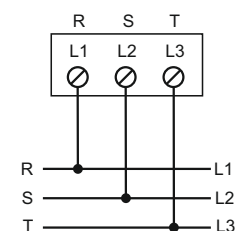
Models		IRC4E	IRC3E
Dimensions	mm	72x72	96x96
Approx. weight	kg.	0,20	0,26

Dimensions (mm)



Models	Ranges	∅a	∅b	∅c	d	ø
IRC4E	100÷600 V	72	66,5	68 ^{+0,7}	79	M.4
IRC3E	100÷600 V	96	89	92 ^{+0,8}	78	M.4

Connection diagrams



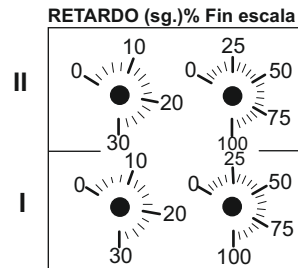
INSTRUMENTS WITH CONTACTS

- 2 contacts and 2 control LEDs.
- Rear adjustment.
- 2 channels.
- 2 potentiometers per channel.

MODELS

- ..A/1 - 1 Min. and 1 Max. contact
- ..A/2 - 2 Max. or Min contacts

- Setting: 0 - 100% of full scale value or $\pm 100\%$ (bidirectional)
- Delay time: 0-30 s. $\pm 10\%$
- Repeatability: $\pm 1\%$ of full scale value
- Output relays: 2 (Max. 400 V, 1 A, 200 VA AC.)
- Mechanical life: 107 operations
- Control unit cover: Lockable
- Auxiliary power supply: 110, 230, 400 V AC.
Burden, 3 VA.



Technical specifications same as pointer instruments.

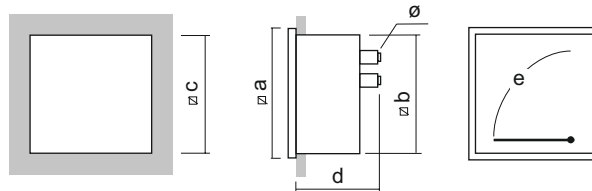
- MOVING IRON (mA y A)
- MOVING COIL (mV, V, μA , mA and A)
- MOVING COIL WITH RECTIFIER (mV, V, mA and A)
- FREQUENCY METERS (Hz)
- MEASURERS FOR CONVERTERS (mA and V)

- Scale: 90°
- Accuracy: 1,5 %
- Frequency: 50 or 60 Hz



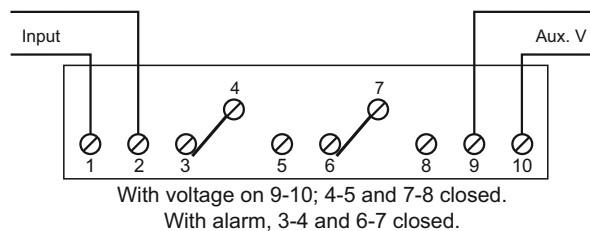
Models		..A/1	..A/2
Contacts		1 Min. - 1 Max.	2 Max.-
Dimensions	mm	96x96	96x96
Approx. weight	kg.	0,55	0,55

Dimensions (mm)



Models	Ranges	∅a	∅b	∅c	d	e	∅
C3V-A/1	-	96	89	92	98	100	M.4
C3V-A/2	-	96	89	92	98	100	M.4

Connection diagrams

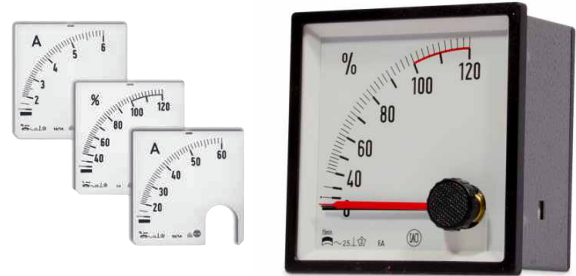


BIMETAL

Maximum demand ammeters for alternating current:
Effective current value averaged over 15 or 8 minutes.

MAXIMUM DEMAND AMMETERS (INTERCHANGEABLE SCALE)

- Measuring range: 5A, 1A
- Scale: 90°
- Accuracy: 2,5 %
- Frequency: 0..1000 Hz
- Burden: 2,3 VA



Models		BC5VR*	BC5V*	BC4V	BC3V	BC2V***
Dimensions	mm	45x52,5 DIN	48x48	72x72	96x96	144x144
Approx. weight	kg.	0,25	0,09	0,20	0,25	0,60
MAXIMUM DEMAND AMMETER (INTERCHANGEABLE SCALE)						
Module		1,2X/5A or 1,2X/1A				
Scales	1,2xIn	1,2; 6; 12; 18; 24; 30; 36; 48; 60; 72; 90 A or 120% and multiples				

* 1,2X/5A only

*** BC2V, interchangeable scale not available

MAXIMUM DEMAND AMMETERS WITH CONTACTS BIMETALLIC SYSTEM WITH ALARM CIRCUIT

- Measuring range: 5A, 1A
- Scale: 90°
- Accuracy: 2,5 %
- Frequency: 0..1000 Hz
- Burden: 2,3 VA



Models		BC4VA	BC3VA	BC2VA
Dimensions	mm	72x72	96x96	144x144
Approx. weight	kg.	0,20	0,25	0,60
MAXIMUM DEMAND AMMETERS WITH CONTACTS				
Module		1,2X/5A or 1,2X/1A		
Scales	1,2xIn	1,2; 6; 12; 18; 24; 30; 36; 48; 60; 72; 90 A or 120% and multiples		

ALARM CIRCUIT:

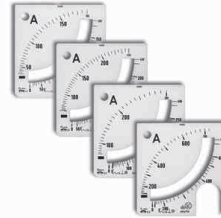
- Max. with contacts (red LED)
- Aux. V: 100; 110; 230; 400 V (AC.)
- Burden: 3.75 VA (AC.)
- Aux. V: 12; 24; 48 V (DC.)
- Burden: 66; 56; 38 mA (DC.)
- Relay output: 1 Relay (Max. 400 V, 1 A, 200 VA)
- Accuracy: 2%
- Hysteresis: ≤1%
- Adjustable from the front

BIMETAL + MOVING IRON

MAXIMUM DEMAND AMMETERS (bimetallic system)
with moving iron system.

DOUBLE AMMETERS (INTERCHANGEABLE SCALE)

- Measuring range: 5A, 1A
- Scale: 90°
- Accuracy: 2,5 % (bimetallic syst.) / 1,5% (moving iron system)
- Frequency: 15..100 Hz
- Burden: 2,7 VA



Model		BEC4V	BEC3V	BEC2V**
Dimensions	mm	72x72	96x96	144x144
Approx. weight	kg.	0,23	0,31	0,60
DOUBLE AMMETERS (INTERCHANGEABLE SCALE)				
Module				
Bimetal	1,2x1n	1,2X/5A or 1,2X/1A		
Moving iron	2x1n	2X/5A or 2X/1A		
Scales				
Bimetal	1,2x1n	1,2; 6; 12; 18; 24; 30; 36; 48; 60; 72; 90 A or 120%		
Moving iron	2x1n	1..2; 5..10; 10..20; 15..30; 20..40; 25..50; 30..60; 40..80; 50..100; 60..120 or 75..150 A and multiples		

** BC2V, interchangeable scale not available

DOUBLE AMMETERS WITH CONTACTS

BIMETALLIC SYSTEM WITH ALARM CIRCUIT

- Measuring range: 5A, 1A
- Scale: 90°
- Accuracy: 2,5 % (bimetallic syst.) / 1,5% (moving iron system)
- Frequency: 15..100 Hz
- Burden: 2,7 VA

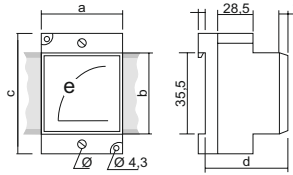


Models		BEC4VA	BEC3VA	BEC2VA
Dimensions	mm	72x72	96x96	144x144
Approx. weight	kg.	0,40	0,50	0,88
DOUBLE AMMETERS (WITH CONTACTS)				
Module				
Bimetal	1,2x1n	1,2X/5A or 1,2X/1A		
Moving iron	2x1n	2X/5A or 2X/1A		
Scales				
Bimetal	1,2x1n	1,2; 6; 12; 18; 24; 30; 36; 48; 60; 72; 90 A or 120%		
Moving iron	2x1n	1..2; 5..10; 10..20; 15..30; 20..40; 25..50; 30..60; 40..80; 50..100; 60..120 or 75..150 A and multiples		

ALARM CIRCUIT:

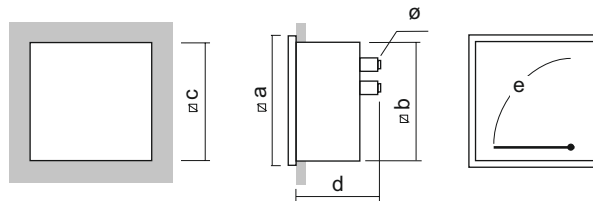
- Max. with contacts (red LED)
- Aux.V: 100; 110; 230; 400 V (AC.)
- Burden: 3.75 VA (AC.)
- Aux.V: 12; 24; 48 V (DC.)
- Burden: 66; 56; 38 mA (DC.)
- Relay output: 1 Relay (Max. 400 V, 1 A, 200 VA)
- Accuracy: 2%
- Hysteresis: ≤1%
- Adjustable from the front

Dimensions (mm)



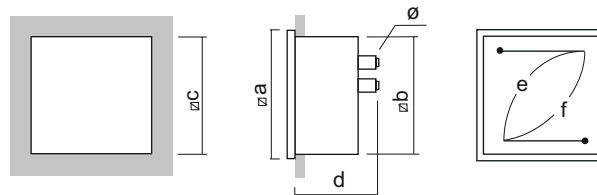
Models	Ranges	a	b	c	d	e	Ø
BC5VR	/5 A	52,5	45	75	60	38	M.6

Dimensions (mm)



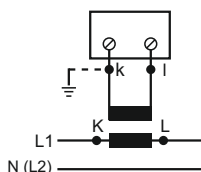
Models	Ranges	∅a	∅b	∅c	d	e	Ø
BC5V	/5 A	48	44,5	45 ^{+0,6}	59	38	M.4
BC4V	../1 ../5	72	66,5	68 ^{+0,7}	88	65	M.4
BC3V	../1 ../5	96	89	92 ^{+0,8}	92 88	100	M.4
BC2V	../1 ../5	144	135	138 ⁺¹	88	140	M.4
BC4VA	../1 ../5	72	66,5	68 ^{+0,7}	93	65	M.4
BC3VA	../1 ../5	96	89	92 ^{+0,8}	92	100	M.4
BC2VA	../1 ../5	144	135	138 ⁺¹	92	140	M.4

Dimensions (mm)

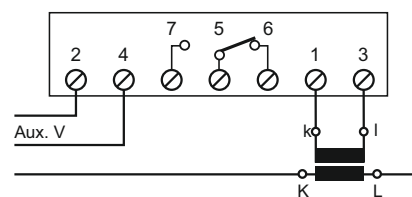


Models	Ranges	∅a	∅b	∅c	d	e	f	Ø
BEC4V	../1 ../5	72	66,5	68 ^{+0,7}	124 88	65	65	M.4
BEC3V	../1 ../5	96	89	92 ^{+0,8}	92 88	100	100	M.4
BEC2V	../1 ../5	144	135	138 ⁺¹	88	140	140	M.4
BEC4VA	../1 ../5	72	66,5	68 ^{+0,7}	124	65	65	M.4
BEC3VA	../1 ../5	96	89	92 ^{+0,8}	88	100	100	M.4
BEC2VA	../1 ../5	144	135	138 ⁺¹	88	140	140	M.4

Connection diagrams



Maximum demand and double ammeters with contacts



Maximum demand and double ammeters

MOVING COIL

Voltage and current measuring on direct current circuits.

AMMETERS (INTERCHANGEABLE SCALE)

Via resistors (Shunt)

- Scale: 90°
- Accuracy: 1,5 %
- Measuring range: 60 mV, 150 mV
- Burden: 60 - 150 Ω



Model		CC5VR	CC5V	CC4V	CC3V
Dimensions	mm	45x52,5 DIN	48x48	72x72	96x96
Approx. weight	kg.	0,10	0,09	0,21	0,28
AMMETERS (INTERCHANGEABLE SCALE)					
Module	Vn	X/60mV or X/150mV			
Scales	In	1, 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 30; 40; 50; 60; 80 or 100A and multiples			

IP20 protection

AMMETERS (μA, mA and A) VOLTMETERS (mV, and V)

- Scale: 90°
- Accuracy: 1,5 %

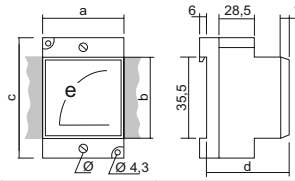


Model		CC5VR*	CC5V	CC4V	CC3V	CC2V	CCb7	CCb3	CCb8
Dimensions	mm	45x52,5 DIN	48x48	72x72	96x96	144x144	80x64	105x80	130x100
Approx. weight	kg.	0,25	0,09	0,21	0,28	0,50	0,15	0,19	0,25
AMMETERS (μA)									
MEASURING RANGE	In	40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 μA							
		AMMETERS (mA)							
		1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 mA							
	AMMETERS (A)								
	4-20 mA								
	1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 40 or 50 A								
Vn	VOLTMETERS (mV)								
	10; 15; 20; 25; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 mV								
	VOLTMETERS (V)**								
1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 V									

* Maximum measuring 40 A

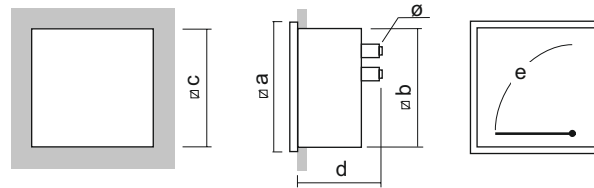
** >600-<1000 V, resistor box 1.2.1. (page 42) /1000-2000 V, resistor box - 3.3.1 / >2000-4000 V, resistor box -3.3.2 (page 42)

Dimensions (mm)



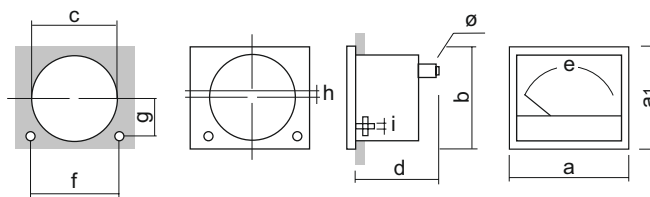
Models	Ranges	a	b	c	d	e	ø
CC5VR	µA; mA; A; V	52,5	45	75	60	38	M.6

Dimensions (mm)



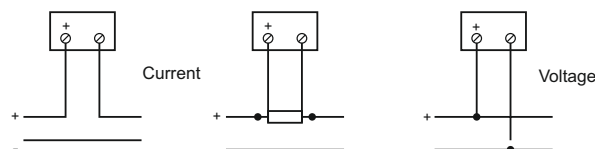
Models	Ranges	∇a	∇b	∇c	d	e	ø
CC5V	x/60..x/150 mV	48	44,5	45+0,6	59	38	M.4
CC4V	x/60..x/150 mV	72	66,5	68+0,7	60	65	M.4
CC3V	x/60..x/150 mV	96	89	92+0,8	59	100	M.4
CC5V	>4..15 A	48	44,5	45+0,6	63	38	M.4
	>15..50 A				62		M.6
CC4V	>4..15 A	72	66,5	68+0,7	63	65	M.4
	>15..50 A				68		M.6
	The rest				60		M.4
CC3V	>4..15 A	96	89	92+0,8	63	100	M.4
	>15..50 A				68		M.6
	The rest				59		M.4
CC2V	>4..15 A	144	135	138+1	63	140	M.4
	>15..50 A				68		M.6
	The rest				59		M.4

Dimensions (mm)



Models	Ranges	axa1	b	c	d	e	f	g	h	i	ø
CCb7	>15..50 A	<4...15A 80x64	57,6	58,6+0,6	63	59	63	12,5	1,5	M.3	M.4
	The rest					57					M.6
						55					M.4
CCb3	<4...15A	105x80	66	67+0,7	63	59	81	13	4,5	M.3	M.4
	>15...<50 A					75					M.6
	The rest					55					M.4
CCb8	<4...15A	130x100	66	67+0,8	63	59	100	13	13	M.4	M.4
	>15...<50 A				63	100					M.6
	The rest				55	100					M.4

Connection diagrams



MOVING COIL

Voltage and current measuring on direct current circuits.

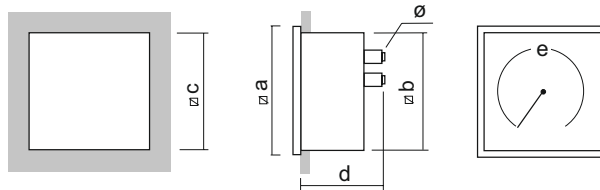
AMMETERS (μA , mA and A) VOLTMETERS (mV and V)

- Scale: 240°
- Accuracy: 1,5 %



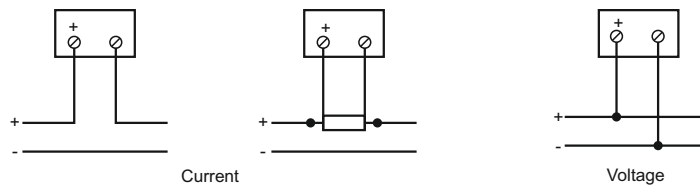
Models		CC5C	CC4C	CC3C	CC2C
Dimensions	mm	48x48	72x72	96x96	144x144
Approx. weight	kg.	0,20	0,32	0,38	0,68
AMMETERS (μA, mA and A)					
MEASURING RANGE	In	150; 200; 300; 400; 500 or 600 μA			
		1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 40; 50; 60; 100; 150; 250; 300; 400; 500; 600 mA or 4-20 mA			
		1; 1,5; 2,5; 4; 5; 6; 10; 15 A			
	VOLTMETERS (mV and V)				
MEASURING RANGE	Vn	60; 100; 150; 250; 300; 400; 500 or 600 mV			
		1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 V			

Dimensions (mm)



Models	Ranges	∇a	∇b	∇c	d	e	\emptyset
CC5C	>4..15 A	48	44,5	45 ^{+0,6}	87	72	M,4
	The rest				83		M,4
CC4C	>4..15 A	72	66,5	68 ^{+0,7}	92	101	M,4
	The rest				88		M,4
	>4..15 A				78		M,4
CC3C	>4..20 mA	96	89	92 ^{+0,8}	92	140	M,4
	The rest				74		M,4
CC2C	>4..15 A	144	135	138 ⁺¹	92	220	M,4
	The rest				88		M 4

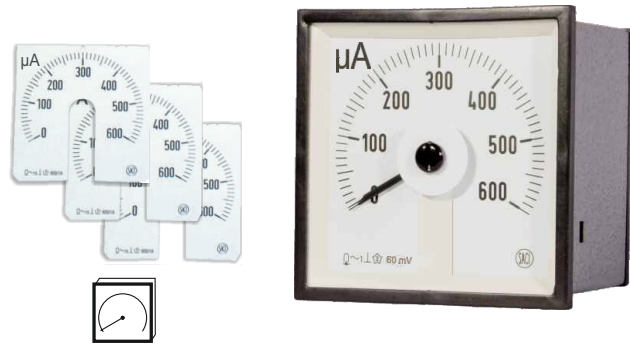
Connection diagrams



AMMETERS (μA , mA and A) VOLTMETERS (mV and V)

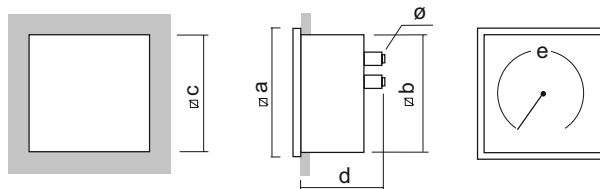
(INTERCHANGEABLE SCALE)

- Scale: 240°
- Accuracy: 1,5 %



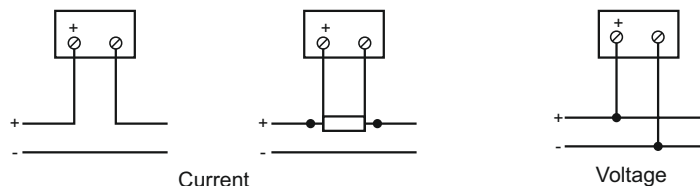
Model		CC3CS
Dimensions	mm	96x96
approx. weight	kg.	0,38
AMMETERS (μA, mA, A)		
MEASURING RANGE	In	150; 200; 300; 400; 500 or 600 μA
		1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 40; 50; 60; 100; 150; 250; 300; 400; 500; 600 mA or 4-20 mA
		1; 1,5; 2,5; 4; 5; 6; 10; 15 A
AMMETERS (INTERCHANGEABLE SCALE)		
MEASURING RANGE	Vn	X/60mV or X/150mV
	In	1, 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 30; 40; 50; 60; 80 or 100A and multiples
VOLTMETERS (mV and V)		
MEASURING RANGE	Vn	60; 100; 150; 250; 300; 400; 500 or 600 mV
		1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 V

Dimensions (mm)



Models	Ranges	a	b	c	d	e	ø
CC3CS	μA ; mA; A; V	96	89	92	63	160	M.4

Connection diagrams



NON-ELECTRIC UNIT INDICATORS

Parameter measurements from transducers or converters, calibrated according to their function curves.



DIRECT CURRENT

- Scale: 90 or 240°
- Accuracy: 1,5 %



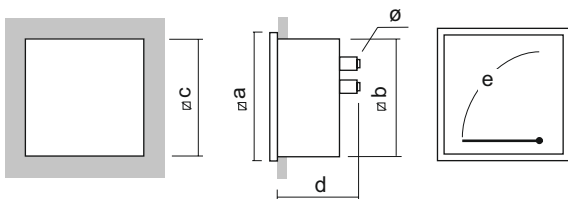
Models		CC5V	CC4V	CC3V
Dimensions	mm	48x48	72x72	96x96
Approx. weight	kg.	0,10	0,21	0,28
VOLTMETERS				
Measuring range	Vn	0-1; 0-5 or 0-10 V		1-5 or 2-10 V
MILLIAMMETERS				
Measuring range	In	0-1; 0-5; 0-10 or 0-20 mA		4-20 mA



Model		CC5C	CC4C	CC3C
Dimensions	mm	48x48	72x72	96x96
Approx. weight	kg.	0,20	0,32	0,38
VOLTMETERS				
Measuring range	Vn	0-1; 0-5 or 0-10 V		1-5 or 2-10 V
MILLIAMMETERS				
Measuring range	In	0-1; 0-5; 0-10 or 0-20 mA		4-20 mA

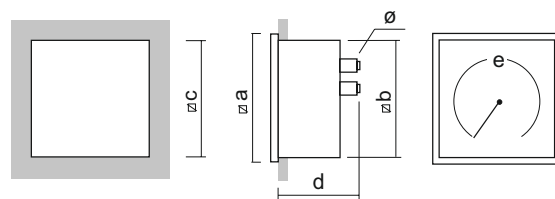
May be manufactured in several models and direct current ranges with or without zero suppressed. Other features as corresponding models.

Dimensions (mm)



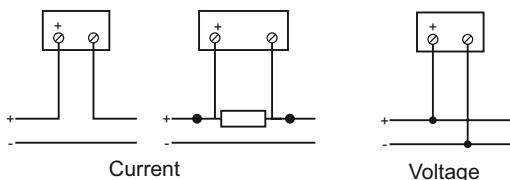
Models	Ranges	a	b	c	d	e	ø
CC5V	V - mA	48	44,5	45 ^{+0,6}	59	38	M.4
CC4V	V - mA	72	66,5	68 ^{+0,7}	60	65	M.4
CC3V	V - mA	96	89	92 ^{+0,8}	59	100	M.4

Dimensions (mm)



Models	Ranges	a	b	c	d	e	ø
CC5C	V - mA	48	44,5	45 ^{+0,6}	83	72	M.4
CC4C	V - mA	72	66,5	68 ^{+0,7}	88	101	M.4
CC3C	V - mA 4 - 20 mA	96	89	92 ^{+0,8}	74 92	140	M.4

Connection diagrams



Examples of units

- mA - A - kA - N - mV - V - kV - kN - Hz
- °φ - °C - °F - W - kW - MW - VA
- var - kvar - Mvar - kVA - kW - MW - Ω
- rpm - % - min⁻¹ - m - l/h - pH - m³/h
- mbar - bar - mm - m³/min - Kg - Kgcm - Kg/cm²
- mm/sec - mmHg - mmH₂O - dB - kPa - MPa

TEMPERATURE INDICATORS

Temperature measuring via thermocouples or thermoresistances.

- Scale: 90 - Accuracy: 1,5 %

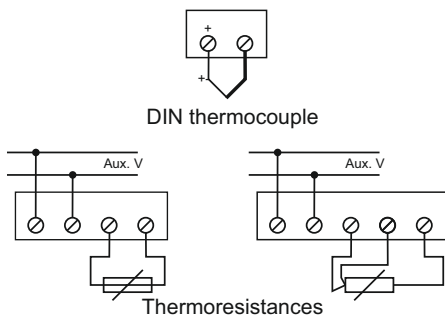


Models		CC4V					CC3V				
Dimensions	mm	72x72					96x96				
Approx. weight	kg	0,20					0,26				
TEMPERATURE INDICATORS - DIN THERMOCOUPLE											
Type		J _{FE-Const}			K _{Chr-Alu}		E _{Chr-Const}		T _{Cu-Const}		S _{Pt-PlRh}
Scales		20-400°	20-600°	20-900°	20-600°	20-900°	20-1200°	20-1000°	20-400°	20-1200°	20-1600°
Ranges		20,83	32,08	50,86	24,10	36,53	48,03	75,16	20,08	11,83	16,66
TEMPERATURE INDICATORS - THERMORESISTANCES											
Type		Pt-100 DIN					NI-100 DIN				
Scales		0-100°			0-150°		0-100°		0-150°		
Aux. V	V	12, 24, 48 or 110 V C.C					12, 24, 48 or 110 V C.C				
		-					110, 230, or 400 V C.A				

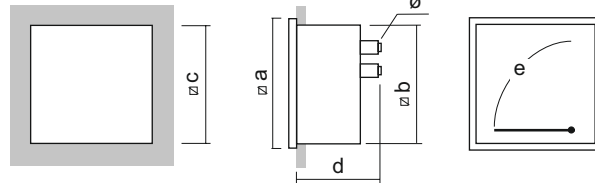
The instrument indicates the temperature difference between the thermocouple welding point and the connection point of the two thermocouple elements with the instrument interconnection line. If, in this last connection point, the temperature is 20° higher than the instrument calibration point, then a suitable correction line in each thermocouple is necessary.

The instrument is calibrated according to the thermometric resistance boards. The 2 or 3 wire connection must be specified.

Conection diagrams



Dimensions (mm)



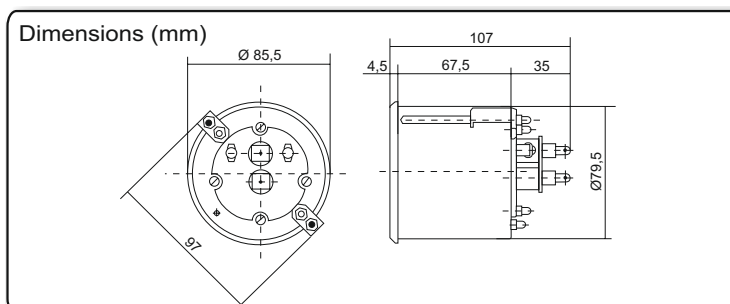
Models	Ranges	∅a	∅b	∅c	d	e	ø
CC4V	V	72	66,5	68 ^{+0,7}	60	65	M.4
CC3V	V	96	89	92 ^{+0,8}	59	100	M.4

SPECIAL EXECUTIONS: MOBILE INSTRUMENTS - CR2C

Moving coil Instrument for mobile equipment (railways, tractor).

Measuring range and scales: please enquire.

Scale: 240° Black scale
 Accuracy: 1.5% Aux. v: 12 or 24 V (DC.)
 Shock resistance: 15 g Vibration resistance: 10..55 Hz
 White or yellow pointer, numbering and division



SHUNTS

High value current connection on direct current circuits.

- Accuracy: 0,5% Operating t.: -20..+60 °C
- Overloads: 1.2 In continuously
10 In 5 s (10..500 A)
5 In 5 s (600..2000 A)
2 In 5 s (2500..4000 A)



DIN 43703 standard



Models		Form 1		Form 2		Form 3	
Voltage drop	mV	60 mV	150 mV	60 mV	150 mV	60 mV	150 mV
MEASURING RANGE	In	1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 30; 40; 50; 60; 80; 100 or 150		200; 250; 300; 400; 500; 600; 750; 800; 1000; 1200; 1500; 2000 or 2500		200; 250; 300; 400; 500; 600; 750; 800 or 1000	
		3000 or 4000		1200; 1500; 2000 ó 2500			

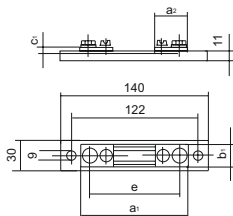
Aproximate weight (Kg).

In	1	1,5	2,5	4	5	6	10	15	20	25	30	40	50	60	80	100	150	200
60 mV	0,140	0,140	0,140	0,140	0,140	0,140	0,140	0,140	0,140	0,140	0,120	0,120	0,125	0,125	0,125	0,125	0,130	0,535
150 mV	0,140	0,140	0,140	0,140	0,140	0,140	0,140	0,140	0,140	0,140	0,160	0,170	0,175	0,180	0,190	0,210	0,240	0,750
In	250	300	400	500	600	750	800	1000	1200	1500	2000	2500	3000	4000	-	-	-	-
60 mV	0,540	0,815	0,820	0,830	0,840	1,420	1,420	1,440	1,970	1,990	2,870	2,990	4,220	4,300	-	-	-	-
150 mV	0,790	1,130	1,200	1,250	1,310	2,350	2,390	2,510	3,670	3,860	5,220	5,530	-	-	-	-	-	-

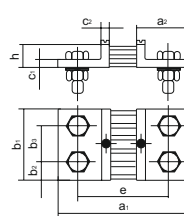
Voltage drop mV	Rated current A	Exec. according to figure	a1	a2	b1	b2	b3	c1	c	eh	Current splice				Voltage splice	
											Nº. of screws	Hexagonal screw DIN 933-5-8	Washer DIN 125-Sc	Nut DIN 934-5		
60	1; 1,5; 2,5; 4; 5*; 6; 10; 15; 20*; 25	1	100	33	20	-	-	8	-	80	-	2 x 1	M.8x16	8,4	-	2 M.5x8 cylinder-head screw DIN 84-4.8 and 2 ø 5.3 washers DIN 433-St.
	30*; 40; 50; 60; 80*; 100; 150	1	100	33	20	-	-	8	-	80	-	2 x 1	M.8x16	8,4	-	
	200*; 250	2	145	55	30	15	-	10	10	105	30	2 x 1	M.12x40	13	M.12	
	300*; 400; 500*; 600				40	20	-	-	-	-	-	-	-	2 x 1	M.16x45	
	750*; 800*; 1000	2	165	65	60	30	-	10	10	115	30	2 x 1	M.20x50	21	M.20	
	1200*; 1500				90	21	48	-	-	-	-	-	-	2 x 2	M.16x45	
	2000*; 2500	2	165	65	120	30	60	10	10	115	30	2 x 2	M.20x50	21	M.20	
3000*; 4000	15															
150	1; 1,5; 2,5; 4; 5*; 6; 10; 15; 20*; 25	1	100	33	20	-	-	8	-	80	-	2 x 1	M.8x16	8,4	-	
	30*; 40; 50; 60; 80*; 100; 150	1	225	33	25	-	-	8	-	205	-	2 x 1	M.8x16	8,4	-	
	200*; 250	2	270	55	30	15	-	-	-	-	230	2 x 1	M.12x40	13	M.12	
	300*; 400; 500*; 600				40	20	-	-	-	-	-					
	750*; 800*	2	275	85	42,5	-	-	10	10	-	240	2 x 2	M.20x60	21	M.20	
	1000*				21	43	-	-	-	-	-					
	1200*; 1500	3	290	65	90	21	48	15	10	240	60	2 x 2	M.16x60	17	M.16	
2000*; 2500	120															30

* Non-DIN ranges, but of standard production.

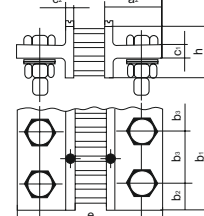
Form 1



Form 2



Form 3



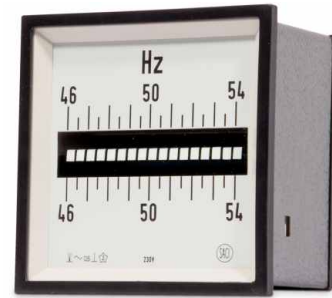
FREQUENCY METERS

System frequency measuring.

REED FREQUENCY METERS

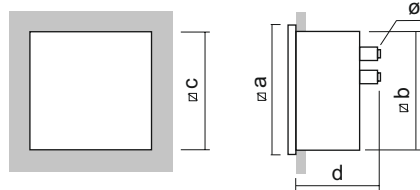
- Voltage range: $\pm 15\% V_n$
- Voltage: (V_n): 100, 110
230, 400, 440 V

- Accuracy: 0,5 %
- Burden: 1,2..2,2 VA
- FC3VI, FC2VI:
2x (1,2..2,2 VA)



Model		FC5V	FC4V	FC3V	FC2V	FC3VI	FC2VI
Dimensions	mm	48x48	72x72	96x96	144x144	96x96	144x144
Approx. weight	kg.	0,23	0,39	0,47	0,88	0,84	1,50
REED FREQUENCY METERS							
Reed		7	13	13	17	21	2x17
Scales	Hz	48,5..51,5 58,5..61,5	47..53 57..63	47..53 57..63	46..54 56..64	45..55 55..65	46..64 45..65

Dimensions (mm)



Models	Ranges	$\varnothing a$	$\varnothing b$	$\varnothing c$	d	\varnothing
FC5V	100÷440	48	44,5	$45^{+0,6}$	59	M.4
FC4V	100÷440	72	66,5	$68^{+0,7}$	75	M.4
FC3V	100÷440	96	89	$92^{+0,8}$	74	M.4
FC2V	100÷440	144	135	138^{+1}	88	M.4
FC3VI	100÷440	96	89	$92^{+0,8}$	124	M.4
FC2VI	100÷440	144	135	138^{+1}	88	M.4

Conection diagrams



POINTER FREQUENCY METERS

- Voltage range: $\pm 15\%$ Vn
- Accuracy: 0,5 %
- Voltage (Vn): 100, 110, 230, 400, 440 V
- Burden: 10 mA



SCALE 90°



Models		FC5VR	FC5A	FC4A	FC3A	FC2A	FC5ARI	FC5AI	FC4AI	FC3AI	FC2AI
Dimensions	mm	45x52,5	48x48	72x72	96x96	144x144	45x52,5	48x48	72x72	96x96	144x144
Approx. weight	kg.	0,20	0,20	0,21	0,28	0,50	0,20	0,20	0,21	0,28	0,50
POINTER FREQUENCY METERS 90°											
Scales	Hz	45..55; 48..52; 55..65; 58..62 or 380..420 Hz					45..65 Hz				

SCALE 240°

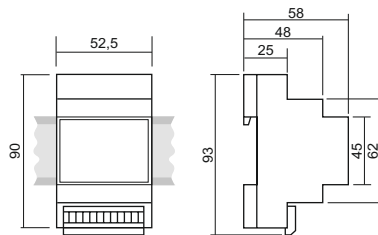


Models		FC5C	FC4C	FC3C	FC2C	FC5CI*	FC4CI	FC3CI	FC2CI
Dimensions	mm	48x48	72x72	96x96	144x144	48x48	72x72	96x96	144x144
Approx. weight	kg.	0,25	0,46	0,55	1,05	0,25	0,46	0,55	1,05
POINTER FREQUENCY METERS 240°									
Scales	Hz	45..55; 48..52; 55..65; 58..62 or 380..420 Hz				45..65 Hz			

* With additional module: MBF model

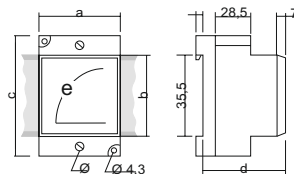
Dimensions (mm)

DIN rail MBFmodule



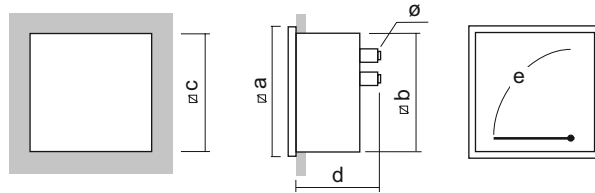
Weight= 0,120
Plug-in connectors

Dimensions (mm)



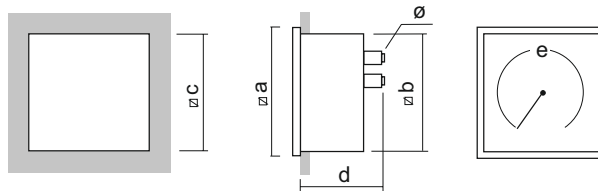
Models	Ranges	a	b	c	d	e	ø
FC5AR	100+230	52,5	45	75	60	38	M.6
FC5ARI	100+230	52,5	45	75	60	38	M.6

Dimensions (mm)



Models	Ranges	∅a	∅b	∅c	d	e	ø
FC5A	100÷440	48	44,5	45 ^{+0,6}	83	38	M.4
FC4A	100÷440	72	66,5	68 ^{+0,7}	64	65	M.4
FC3A	100÷440	96	89	92 ^{+0,8}	63	100	M.4
FC2A	100÷440	144	135	138 ⁺¹	63	140	M.4
FC5AI	100÷440	48	44,5	45 ^{+0,6}	83	38	M.4
FC4AI	100÷440	72	66,5	68 ^{+0,7}	64	65	M.4
FC3AI	100÷440	96	89	92 ^{+0,8}	63	100	M.4
FC2AI	100÷440	144	135	138 ⁺¹	63	140	M.4

Dimensions (mm)



Models	Ranges	∅a	∅b	∅c	d	e	ø
FC5C	100÷440	48	44,5	45 ^{+0,6}	83	72	M.4
FC4C	100÷440	72	66,5	68 ^{+0,7}	92	101	M.4
FC3C	100÷440	96	89	92 ^{+0,8}	128	140	M.4
FC2C	100÷440	144	135	138 ⁺¹	92	220	M.4
FC5CI	100÷440	48	44,5	45 ^{+0,6}	83	72	M.4
FC4CI	100÷440	72	66,5	68 ^{+0,7}	92	101	M.4
FC3CI	100÷440	96	89	92 ^{+0,8}	128	140	M.4
FC2CI	100÷440	144	135	138 ⁺¹	92	220	M.4

Connection diagrams



WATTMETERS (ELECTRONIC)

System active power measuring.

Alternating current

- Frequency: 50 or 60 Hz
- Voltage range: $\pm 15\%$ Vn
- Voltage: (Vn): 100, 110
230, 400, 440 V
- Current range: 20-120%
- Current input: (In): 5A, 1A
- Accuracy: 1,5 %
- Burden: 3..12 mA (Voltage circuits)
- Burden: 1..3,5 VA (Current circuits)



		90° SCALE		90° SCALE			
Dimensions	mm	45x52,5 <small>CARRIL DIN</small>		48x48	72x72	96x96	144x144
A.C SINGLE PHASE - BALANCE THREE-PHASE							
Approx. weight	kg.	0,55	0,55	0,55	0,84	0,84	
A.C. Single-phase		WC5VRE*	WC5VE*	WC4VE*	WC3VE	WC2VE	
3-phase, 3 or 4 wire		WC5VRIE*	WC5VIE*	WC4VIE*	WC3VIE	WC2VIE	
UNBALANCE THREE-PHASE							
Approx. weight	kg.	1,00	1,00	1,00	1,55	1,55	
3-phase, 3 wire		WC5VRIIE*	WC5VIIE*	WC4VIIE*	WC3VIIE	WC2VIIE	
3-phase, 4 wire		WC5VR3E*	WC5V3E*	WC4V3E*	WC3V3E	WC2V3E	



		240 ° SCALE			
Dimensions	mm	48x48	72x72	96x96	144x144
A.C SINGLE PHASE - BALANCE THREE-PHASE					
Approx. weight	kg.	0,55	0,55	0,84	0,84
A.C. Single-phase		WC5CE*	WC4CE*	WC3CE	WC2CE
3-phase, 3 or 4 wire		WC5CIE*	WC4CIE*	WC3CIE	WC2CIE
UNBALANCE THREE-PHASE					
Approx. weight	kg.	1,00	1,00	1,55	1,55
3-phase, 3 wire		WC5CIIE*	WC4CIIE*	WC3CIIE	WC2CIIE
3-phase, 4 wire		WC5C3E*	WC4C3E*	WC3C3E	WC2C3E

* With additional module: MBW.. Models

INTERCHANGEABLE SCALE (90° scale only), for models: WC5V..., WC5VR..., WC4V... and WC3V...

For 3 or 4 wire, balanced or unbalanced three-phase systems, the instruments and scales are:

Instruments	110 V, 5 A	230 V, 5 A	400 V, 5 A	440 V, 5 A
Calibration	1000 W	2000 W	3000 W	3000 W
Transformator	Scales			
10/5 A	0-2 kW	0-4 kW	0-6 kW	0-6 kW
15/5 A	0-3 kW	0-6 kW	0-9 kW	0-9 kW
20/5 A	0-4 kW	0-8 kW	0-12 kW	0-12 kW
25/5 A	0-5 kW	0-10 kW	0-15 kW	0-15 kW
30/5 A	0-6 kW	0-12 kW	0-18 kW	0-18 kW

Instruments	110 V, 5 A	230 V, 5 A	400 V, 5 A	440 V, 5 A
Calibration	1000 W	2000 W	3000 W	3000 W
Transformator	Scales			
40/5 A	0-8 kW	0-15 kW	0-24 kW	0-24 kW
50/5 A	0-10 kW	0-20 kW	0-30 kW	0-30 kW
60/5 A	0-12 kW	0-24 kW	0-36 kW	0-36 kW
75/5 A	0-15 kW	0-30 kW	0-45 kW	0-45 kW
Multiples	Multiples	Multiples	Multiples	Multiples

Dimensions and connection diagrams, available on page AN-35-36.

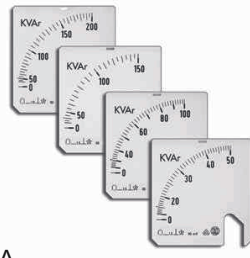
VARMETERS (ELECTRONIC)

System's reactive power measuring.

Alternating current

- Frequency: 50 or 60 Hz
- Voltage range: $\pm 15\%$ Vn
- Voltage: (Vn): 100, 110
230, 400, 440 V
- Current range: 20-120%
- Current input: (In): 5A, 1A

- Accuracy: 1,5 %
- Burden: 3..12 mA (Voltage circuits)
- Burden: 1..3,5 VA (Current circuits)



		90° SCALE		90° SCALE			
Dimensions	mm	45x52,5 DIN RAIL	48x48	72x72	96x96	144x144	
AC. SINGLE-PHASE - BALANCED THREE-PHASE							
Approx. weight	Kg.	0,55	0,55	0,55	0,84	0,84	
AC. Single-phas		WC5VRrE*	WC5VrE*	WC4VrE*	WC3VrE	WC2VrE	
Three-phase, 3 or 4 wire		WC5VRIrE*	WC5VIrE*	WC4VIrE*	WC3VIrE	WC2VIrE	
UNBALANCED THREE-PHASE							
Approx. weight	Kg.	1,00	1,00	1,00	1,55	1,55	
Three-phase, 3 wire		WC5VRIIrE*	WC5VIIrE*	WC4VIIrE*	WC3VIIrE	WC2VIIrE	
Three-phase, 4 wire		WC5VR3rE*	WC5V3rE*	WC4V3rE*	WC3V3rE	WC2V3rE	



		240° SCALE			
Dimensions	mm	48x48	72x72	96x96	144x144
AC. SINGLE-PHASE - BALANCED THREE-PHASE					
Approx. weight	kg.	0,55	0,55	0,84	0,84
AC. Single-phas		WC5CrE*	WC4CrE*	WC3CrE	WC2CrE
Three-phase, 3 or 4 wire		WC5CIrE*	WC4CIrE*	WC3CIrE	WC2CIrE
		UNBALANCED THREE-PHASE		UNBALANCED THREE-PHASE	
Approx. weight	kg.	1,00	1,00	1,55	1,55
Three-phase, 3 wire		WC5CIIrE*	WC4CIIrE*	WC3CIIrE	WC2CIIrE
Three-phase, 4 wire		WC5C3rE*	WC4C3rE*	WC3C3rE	WC2C3rE

* With additional module: MBW... Models

INTERCHANGEABLE SCALE (90° scale only), for models: WC5V...rE, WC5VR...rE, WC4V...rE y WC3V...rE
For 3 or 4 wire, balanced or unbalanced three-phase systems, the instruments and scales are:

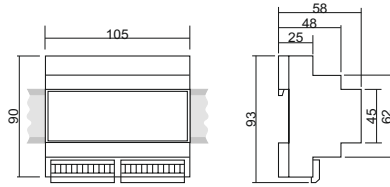
Instruments	110 V, 5 A	230 V, 5 A	400 V, 5 A	440 V, 5 A
Calibration	500 Var	1000 Var	1500 Var	1500 Var
Transformer	Scales			
10/5 A	0-1 Kvar	0-2 Kvar	0-3 Kvar	0-3 Kvar
15/5 A	0-1,5 Kvar	0-3 Kvar	0-4,5 Kvar	0-4,5 Kvar
20/5 A	0-2 Kvar	0-4 Kvar	0-6 Kvar	0-6 Kvar
25/5 A	0-2,5 Kvar	0-5 Kvar	0-7,5 Kvar	0-7,5 Kvar
30/5 A	0-3 Kvar	0-6 Kvar	0-9 Kvar	0-9 Kvar

Instruments	110 V, 5 A	230 V, 5 A	400 V, 5 A	440 V, 5 A
Calibration	500 Var	1000 Var	1500 Var	1500 Var
Transformer	Scales			
40/5 A	0-4 Kvar	0-7,5 Kvar	0-12 Kvar	0-12 Kvar
50/5 A	0-5 Kvar	0-10 Kvar	0-15 Kvar	0-15 Kvar
60/5 A	0-6 Kvar	0-12 Kvar	0-18 Kvar	0-18 Kvar
75/5 A	0-7,5 Kvar	0-15 Kvar	0-22,5 Kvar	0-22,5 Kvar
Multiples	Multiples	Multiples	Multiples	Multiples

Dimensions and connection diagrams, available on page AN-35-36.

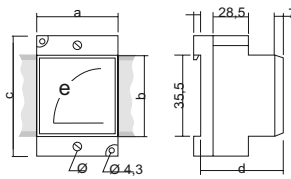
Dimensions (mm)

DIN rail MBW and MBWr modules



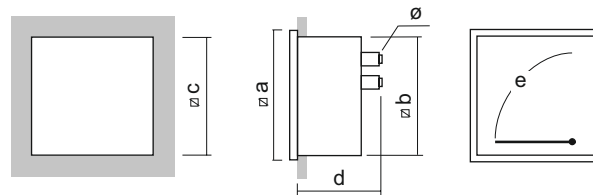
Weight= 0,24
Plug.in connectors

Dimensions (mm)



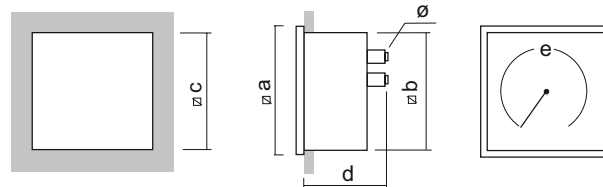
Active power model	Reactive power model	Range	a	b	c	d	e	ø
WC5VR..E	WC5VR..rE	../5 ../1	52,5	45	75	60	38	M.6

Dimensions (mm)



Active power model	Reactive power model	Range	∅a	∅b	∅c	d	e	ø
WC5V..E	WC5V..rE	../5 ../1	48	44,5	45 ^{+0,6}	59	38	M,4
WC4V..E	WC4V..rE	../5 ../1	72	66,5	68 ^{+0,7}	60	65	M,4
WC3V..E	WC3V..rE	../5 ../1	96	89	92 ^{+0,8}	75	100	M,4
WC2V..E	WC2V..rE	../5 ../1	144	135	138 ⁺¹	87	140	M,4

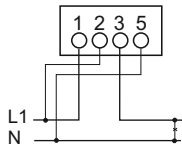
Dimensions (mm)



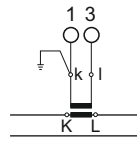
Active power model	Reactive power model	Range	∅a	∅b	∅c	d	e	ø
WC5C..E	WC5C..rE	../5 ../1	48	44,5	45 ^{+0,6}	83	72	M,4
WC4C..E	WC4C..rE	../5 ../1	72	66,5	68 ^{+0,7}	88	101	M,4
WC3C..E	WC3C..rE	../5 ../1	96	89	92 ^{+0,8}	124	140	M,4
WC2C..E	WC2C..rE	../5 ../1	144	135	138 ⁺¹	134	220	M,4

Connection diagrams

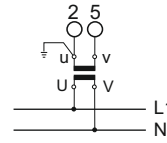
Single-phase, Active and Reactive Power



Connection: Direct input



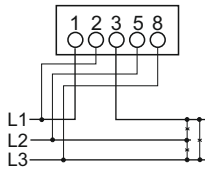
Current Transf.



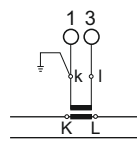
Voltage Transf.

Connection diagrams

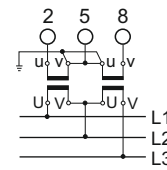
Balanced three-phase, Active and Reactive Power



Connection: Direct input



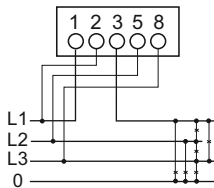
Current Transf.



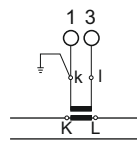
Voltage Transf.

Connection diagrams

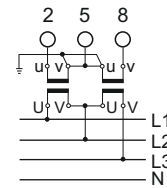
4 wire balanced three-phase, Active and Reactive Power



Connection: Direct input



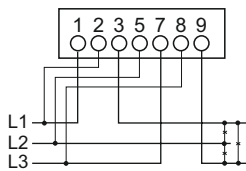
Current Transf.



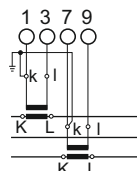
Voltage Transf.

Connection diagrams

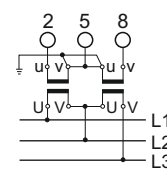
3 wire unbalanced three-phase, Active and Reactive Power



Connection: Direct input



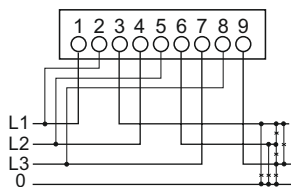
Current Transf.



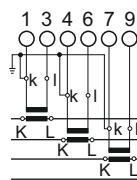
Voltage Transf.

Connection diagrams

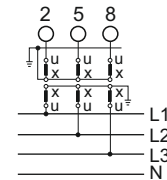
3 wire unbalanced three-phase, Active and Reactive Power



Connection: Direct input



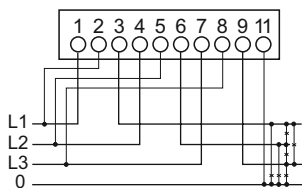
Current Transf.



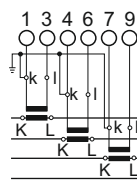
Voltage Transf.

Connection diagrams

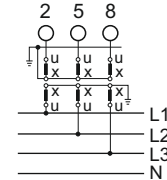
4 wire unbalanced three-phase, Active and Reactive Power



Connection: Direct input



Current Transf.



Voltage Transf.

WATTMETERS (INDUCTION) VARMETERS (INDUCTION)

System active/reactive power measuring

Alternating current

- Scale: 90°
- Frequency: 50, 60 Hz
- Voltage range: $\pm 15\%$ V_n
- Voltage: (V_n): 100, 110
230, 400, 440 V
- Current input: (I_n): 5A, 1A
- Current range: 20-120%
- Accuracy: 1,5 %
- Burden: 3..12 mA
(Voltage circuits)
- Burden: 1..3,5 VA
(Current circuits)

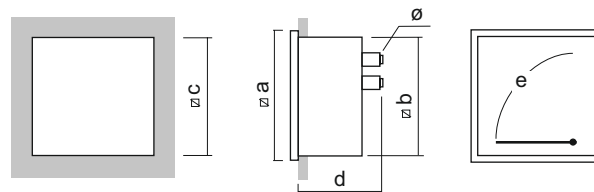


		WATTMETERS		VARMETERS	
Dimensions	mm	96x96	144x144	96x96	144x144
AC. SINGLE-PHASE - BALANCED THREE-PHASE					
Approx. weight	kg.	0,55	0,84	0,55	0,84
AC Single-phase		WC3V	WC2V	WC3Vr	WC2Vr
3-phase, 3 or 4 wire		WC3VI	WC2VI	WC3VIr	WC2VIr
UNBALANCED THREE-PHASE					
Approx. weight	kg.	1,00	1,55	1,00	1,55
3-phase, 3 wire		WC3VII	WC2VII	WC3VIIr	WC2VIIr
3-phase, 4 wire		WC3VIIIn	WC2VIIIn	WC3VIIInr	WC2VIIInr

- Full scale value: 0,6..1,2 P_a
 $P_a = V_n \cdot I_n$ (Single-phase, Alternating current)
 $P_a = V_n \cdot I_n \cdot 3$ (Three-phase)

If not indicated otherwise, full scale value will be P_a rounded

Dimensions (mm)



Active power model	Reactive power model	Range	∅a	∅b	∅c	d	e	ø
WC3V	WC3Vr	..1/5 ..1	96	89	92 ^{+0,8}	88	100	M.4
WC3VI	WC3VIr					88		
WC3VII	WC3VIIr					135		
WC3VIIIn	WC3VIIInr					135		
WC2V	WC2Vr	..1/5 ..1	144	135	138 ⁺¹	88	140	M.4
WC2VI	WC2VIr					88		
WC2VII	WC2VIIr					135		
WC2VIIIn	WC2VIIInr					135		

Connection diagrams available on page AN-36

PHASE METERS (ELECTRONIC)

System's power factor measuring.

Alternating current

- Scale: CAP 0,5 - 1 - 0,5 IND
- Frequency: 50 or 60 Hz
- Voltage range: $\pm 15\%$ Vn
- Voltage: (Vn): 100, 110
230, 400, 440 V
- Current range: 20-120%
- Current input: (In): 5A, 1A
- Accuracy: 1,5 % of 90 electrical degrees
- Burden: 6,5 mA
(Voltage circuits)
- Burden: 1 VA
(Current circuits)



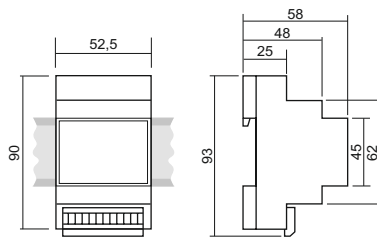
		90° SCALE		90° SCALE			
Dimensions	mm	45x52,5 DIN RAIL	48x48	72x72	96x96	144x144	
AC SINGLE PHASE - BALANCED THREE PHASE							
Approx. weight	kg.	0,48	0,48	0,48	0,73	0,73	
AC. Single-phase		SC5VRE*	SC5VE*	SC4VE*	SC3VE	SC2VE	
3-phase, 3 wire		SC5VRIE*	SC5VIE*	SC4VIE*	SC3VIE	SC2VIE	



		240° SCALE			
Dimensions	mm	48x48	72x72	96x96	144x144
AC SINGLE-PHASE - BALANCED THREE PHASE					
Approx. weight	kg.	0,48	0,48	0,73	0,73
AC. Single-phase		SC5CE*	SC4CE*	SC3CE	SC2CE
3-phase, 3 wire		SC5CIE*	SC4CIE*	SC3CIE	SC2CIE

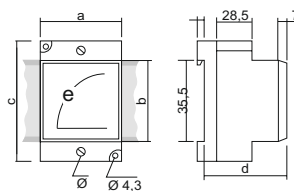
* With additional module: MBPF model

DIN rail MBPF module



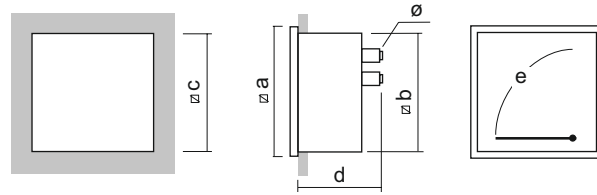
Weight = 0,120
Plug-in connectors

Dimensions (mm)



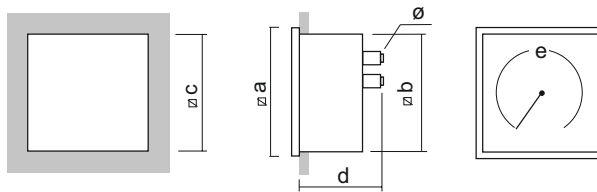
Models	Range	a	b	c	d	e	ø
SC5VRE	100+440	52,5	45	75	60	38	M.6
SC5VRIE	100+440	52,5	45	75	60	38	M.6

Dimensions (mm)



Models	Ranges	∅a	∅b	∅c	d	e	ø
SC5VE SC5VIE	100+440	48	44,5	45 ^{+0,6}	59	38	M.4
SC4VE SC4VIE	100+440	72	66,5	68 ^{+0,7}	60	65	M.4
SC3VE SC3VIE	100+440	96	89	92 ^{+0,8}	92	100	M.4
SC2VE SC2VIE	100+440	144	135	138 ⁺¹	92	140	M.4

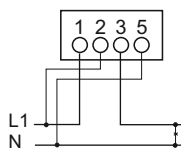
Dimensions (mm)



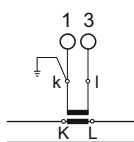
Models	Ranges	∅a	∅b	∅c	d	e	ø
SC5CE SC5CIE	100+440	48	44,5	45 ^{+0,6}	83	72	M.4
SC4CE SC4CIE	100+440	72	66,5	68 ^{+0,7}	88	101	M.4
SC3CE SC3CIE	100+440	96	89	92 ^{+0,8}	128	140	M.4
SC2CE SC2CIE	100+440	144	135	138 ⁺¹	92	220	M.4

Connection diagrams

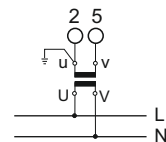
Single-phase



Direct input



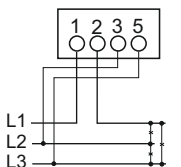
Current Transf.



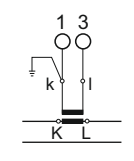
Transf. Voltage

Connection diagrams

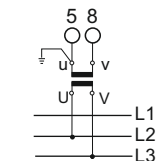
Balanced three-phase



Connection: Direct input



Current Transf.



Transf. Voltage

PHASE METERS (INDUCTION)

System's power factor measuring.

Alternating current

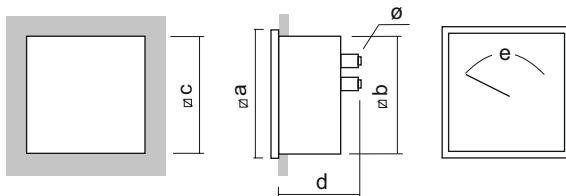
- Scale: CAP 0,5 - 1 - 0,5 IND or 0,8 - 1 0,2 IND (90°)
CAP 0,1 - 1 - 0,1 IND 4 quadrants (360°)
- Accuracy: 1,5 % of 90 electrical degrees
- Frequency: 50 or 60 Hz
- Voltage range: $\pm 15\%$ Vn
- Voltage: (Vn): 100, 110
230, 400, 440 V
- Current range: 20-120%
- Current input: (In): 5A, 1A
- Burden: 20..30 mA
(Voltage circuits)
- Burden: 1 VA
(Current circuits)



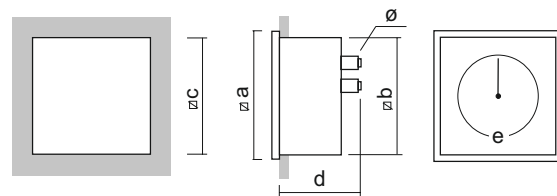
		SCALE 90°		SCALE 360°	
Dimensions	mm	96x96	144x144	96x96	144x144
AC. SINGLE-PHASE - BALANCED THREE-PHASE					
Approx. weight	kg.	1,07	1,57	1,10	1,60
A.C Single phase*		SC3V	SC2V	SC3C	SC2C
3-phase 3-4 wire**		SC3VI	SC2VI	SC3CI	SC2CI
UNBALANCED THREE-PHASE					
Approx. weight	kg.	1,40	2,35	1,43	2,38
3-Phase 3 wire**		SC3VII	SC2VII	SC3CII	SC2CII
3-Phase 4 wire***		SC3VIIIn	SC2VIIIn	SC3CIIIn	SC2CIIIn

* With additional resistor box (external): Model 4.5.1
 ** 400 V and 600 V with additional resistor box (external): Model 2.6.1
 *** 400 V and 600 V only with additional resistor box (external): Model 2.4.1

Dimensions (mm)



Dimensions (mm)



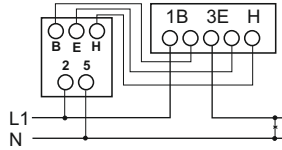
Models	Ranges	a	b	c	d	e	ø
SC3V	100÷440				135		
SC3VI	100÷440	96	89	92 ^{+0,8}	135	73	M.4
SC3VII	100÷440				165		
SC3VIIIn	100÷440				165		
SC2V	100÷440				135		
SC2VI	100÷440	144	135	138 ⁺¹	135	160	M.4
SC2VII	100÷440				165		
SC2VIIIn	100÷440				165		

Models	Ranges	a	b	c	d	e	ø
SC3C	100÷440						
SC3CI	100÷440	96	89	92 ^{+0,8}	124	210	M.4
SC3CII	100÷440						
SC3CIIIn	100÷440						
SC2C	100÷440						
SC2CI	100÷440	144	135	138 ⁺¹	135	330	M.4
SC2CII	100÷440						
SC2CIIIn	100÷440						

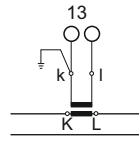
Resistor boxes on page AN-42

Connection diagrams

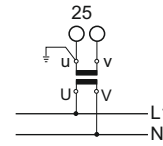
Single-phase



Connection: Direct input



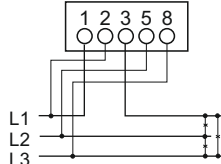
Current Transf.



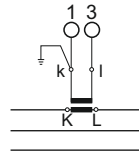
Transf. Voltage

Connection diagrams

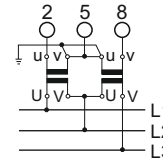
Balanced three-phase (100, 230 V)



Connection: Direct input



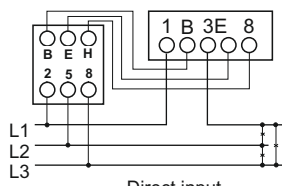
Current Transf.



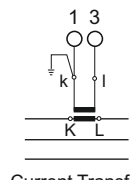
Transf. Voltage

Connection diagrams

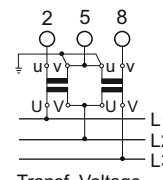
Balanced three-phase (400, 440 V)



Connection: Direct input



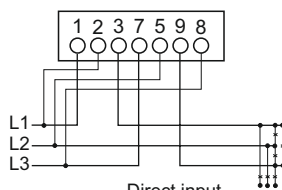
Current Transf.



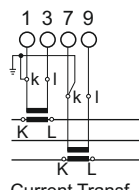
Transf. Voltage

Connection diagrams

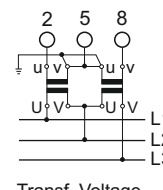
Unbalanced three-phase, 3 wire (110, 230 V)



Connection: Direct input



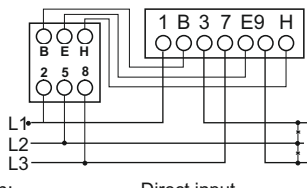
Current Transf.



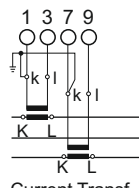
Transf. Voltage

Connection diagrams

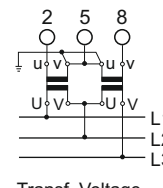
Unbalanced three-phase, 3 wire (400, 440 V)



Connection: Direct input



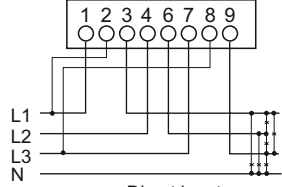
Current Transf.



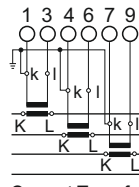
Transf. Voltage

Connection diagrams

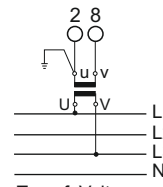
Unbalanced three-phase, 4 wire (100, 230 V)



Connection: Direct input



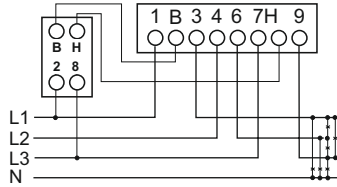
Current Transf.



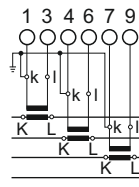
Transf. Voltage

Connection diagrams

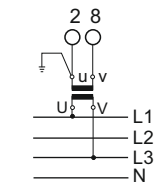
Unbalanced three-phase, 4 wire (400, 440 V)



Connection: Direct input



Current Transf.



Transf. Voltage

RESISTOR BOXES

Connection to measuring elements.



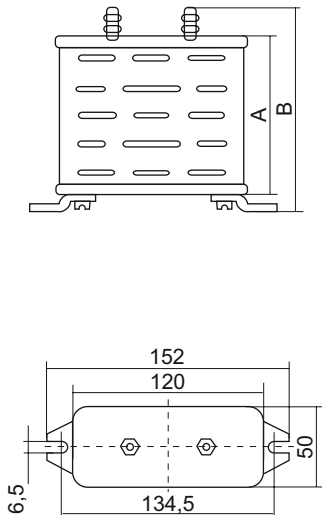
- Accuracy: 0,5 %

Models		1.2.1	1.3.1	1.4.1	1.4.2	1.5.1	1.6.1	1.6.2
Terminals		2	3	4	4	5	6	6
Approx. weight	kg.	0,23	0,23	0,24	0,31	0,50	0,25	0,40

Models		2.2.1	2.3.1	2.4.1	2.4.2	2.5.2	2.6.1	2.6.2	2.6.3	2.7.1	2.8.1	2.8.2
Terminals		2	3	4	4	5	6	6	6	7	8	8
Approx. weight	kg.	0,31	0,31	0,31	0,31	0,32	0,32	0,55	0,74	0,40	0,60	0,77

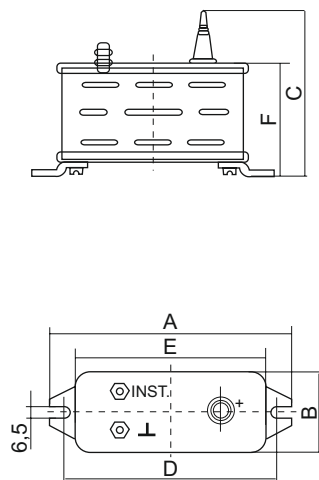
Models		3.3.1	3.3.2	4.2.1	4.3.1	4.4.1	4.5.1	4.6.1	4.8.1
Terminals		3	3	2	3	4	5	6	8
Approx. weight	Kg.	0,27	0,70	0,90	0,90	0,95	1,00	1,00	1,00

Dimensions (mm)



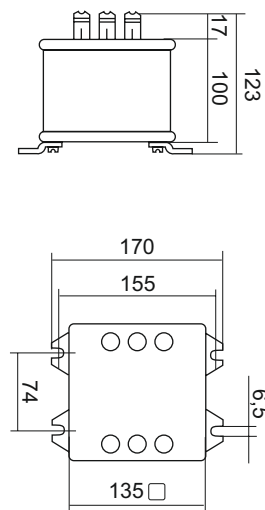
Models	1..1	2..1
A	64	99
B	86	121

Dimensions (mm)



Models	3.3.1	3.3.2
A	155	270
B	50	100
C	101	148
D	135	235
E	120	220
F	69	102

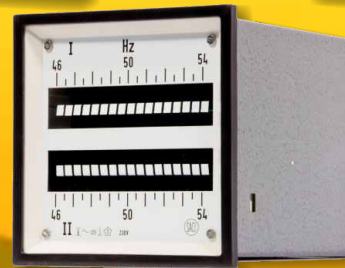
Dimensions (mm)



Models
4.5.1
4.6.1
4.8.1



SYNCHRONIZATION RELAYS INSTRUMENTS FOR VESSELS



ANALOGUE INSTRUMENTS

S.A. DE CONSTRUCCIONES INDUSTRIALES

CONTENTS



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MEASURING INSTRUMENTS FOR VESSELS

Recommendations.

VOLTMETER

Depending on the system voltage, its full scale value will be 1.2 of that voltage as a minimum. This will be marked with a red line.

In the event of being connected to voltage transformers, the full scale will be 1.2 of the value of the transformer primary as a minimum. This will be marked with a red line.



AMMETER

Its full scale value will be 1.2 of the alternator rated current as a minimum.

This will be marked with a red line.

The transformer current ratio must be as near as possible to the alternator's rated current.



WATTMETER

Its scale will have a full value between 0.6 and 1.2 of $U_n \times I_n \times \sqrt{3}$. Where (U_n) is the rated voltage or the primary of the voltage transformer, and (I_n) the primary current of the current transformer.

The alternator kW value is marked with a red line and in all cases its full scale value must exceed 20% of that value, which means that the final value will be approximately the same as its kVA.

When alternators are synchronised with others, the watt meter scale will be reversed to the left of zero. Its value must be 15% of full scale.

In each case the watt meter will be 3-wire unbalanced three-phase.



REVERSE POWER RELAY

The adjustment value will be the alternator kW value (it will match the red line on the watt meter) and its value cannot be lower than $0.6 \times U_n \times I_n \times \sqrt{3}$.

Setting is from 2 to 15% of that power. The transformer primary and secondary current and voltage values must be known. It will have a 5 s. delay.



MEASURING INSTRUMENTS FOR VESSELS

Recommendations.

MAXIMUM CURRENT RELAY

It may be connected to any x/5 A current transformer, but the available auxiliary voltage must be known.



SYNCHRONIZING RELAY

As a synchronizing auxiliary element, the selection and polarity of the voltage power supply must be correct. The width of the chosen phase and time for meters will depend on the level of response sensitivity to the alternators' speed and voltage settings and the value allowed by the group.



BAR INSULATION INDICATORS

The instrument must be supplied directly by the three phases via a leakage analysis switch and never to the voltage transformer secondaries. The system power supply voltage and the available auxiliary power supply of the alarm circuit will be indicated. This instrument must never be connected to three-phase systems with neutral connected to earth.



CURRENT TRANSFORMERS

Their power depends on the consumption of the instruments to be connected. At least 10 VA in class 0.5 is recommended to avoid accuracy and angle errors. Polarity must be correct.



VOLTAGE TRANSFORMERS

The TE-15R model is specially designed for this application due to its power and accuracy (25 VA, class 1). This allows all instruments that the control equipment usually has to be connected to the secondary without the introduction of ratio or phase errors.

No special recommendations are required for other instruments used in vessel control equipment.



FOR SYNCHRONIZING INSTRUMENTS

DOUBLE VOLTMETERS

Two moving iron systems. True effective value.

- Scale: 90°
- Accuracy: 1,5 %
- Measuring range: 100, 110, 230, 400, 440 V
- Frequency: 45..65 Hz
- Burden: 1,5..3 VA



Model		EC3VII			EC2VII	
Dimensions	mm	96x96			144x144	
Approx. weight	Kg.	0,31			0,46	
DOUBLE VOLTMETERS						
Measuring range	Vn	2x100 V	2x110 V	2x230 V	2x400 V	2x440 V
Scales		2x165 V	2x180 V	2x380 V	2x660 V	2x720 V

DIFFERENTIAL VOLTMETERS

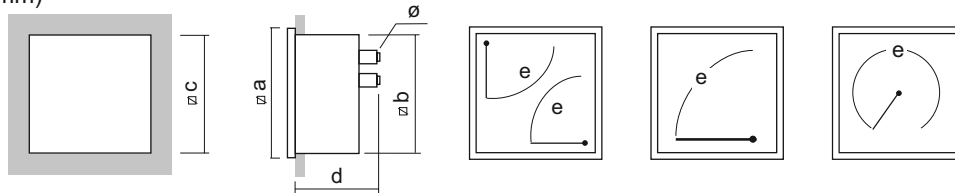
Difference (%) between two synchronizing voltages.

- Accuracy: 1,5 %
- Burden: 10 mA
- Frequency: 50 or 60 Hz
- Measuring range: 100, 110, 230, 400, 440 V



Model		CC3VGD	CC2VGD	CC3CGD	CC2CGD
Dimensions	mm	96x96	144x144	96x96	144x144
Approx. weight	Kg.	0,40	0,65	0,74	0,80
DIFFERENTIAL VOLTMETERS					
Scales		100..15 - 0 - 15..100 % ΔV			

Dimensions (mm)



Models	Ranges	∅a	∅b	∅c	d	e	∅
EC3VII	100÷440	96	89	92 ^{+0,8}	59	2x55	M.4
EC2VII	100÷440	144	135	138 ⁺¹	59	2x68	M.4
CC3VGD	100÷440	96	89	92 ^{+0,8}	78	100	M.4
CC2VGD	100÷440	144	135	138 ⁺¹	92	140	M.4
CC3CGD	100÷440	96	89	92 ^{+0,8}	128	140	M.4
CC2CGD	100÷440	144	135	138 ⁺¹	92	220	M.4

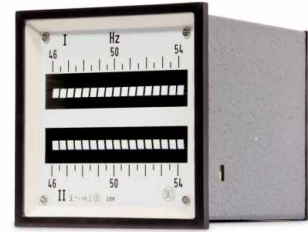
Connection diagrams



DOUBLE FREQUENCY METERS (REEDS)

Double measurement (two systems) of two system frequencies.

- Accuracy: 0,5 %
- Voltage range: $\pm 15\%$ Vn
- Burden: 1,2..2,2 mA
- Voltage: (Vn): 100, 110, 230, 400, 440 V



Model		FC3VII		FC2VII	
Dimensions	mm	96x96		144x144	
Approx. weight	Kg.	0,87		1,25	
DOUBLE FREQUENCY METERS					
Divisions		13	17	21	
Scales	Hz	47..53	46..54 or 56..64	45..55 or 55..65	

DIFFERENTIAL FREQUENCY METERS

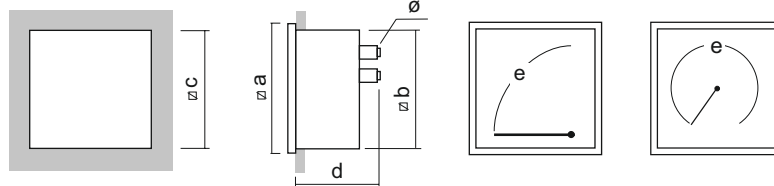
Frequency difference (%) between two systems.

- Accuracy: 0,2 %
- Voltage range: $\pm 15\%$ Vn
- Frequency: 50 or 60 Hz
- Burden: 10 mA
- Voltage: (Vn): 100, 110, 230, 400, 440 V



Model		FC3AD		FC2AD		FC3CD		FC2CD	
Dimensions	mm	96x96		144x144		96x96		144x144	
Approx. weight	Kg.	0,32		0,50		0,55		0,75	
DIFFERENTIAL FREQUENCY METERS									
Scales	%	10 - 0 - 10 % Δ Hz							

Dimensions (mm)



Models	Ranges	∅a	∅b	∅c	d	e	ø
FC3AD	100÷440	96	89	92 ^{+0,8}	78	100	M,4
FC2AD	100÷440	144	135	138 ⁺¹	92	140	M,4
FC3CD	100÷440	96	89	92 ^{+0,8}	128	140	M,4
FC2CD	100÷440	144	135	138 ⁺¹	92	220	M,4
FC3VII	100÷440	96	89	92 ^{+0,8}	124	-	M,4
FC2VII	100÷440	144	135	138 ⁺¹	88	-	M,4

Connection diagrams



SYNCHRONOSCOPES

Phase synchronisation measurement (frequency and phase equality) between two single-phase or three-phase alternating current systems, or between system and generator.

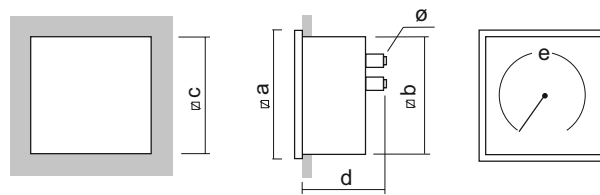
- Accuracy: 1,5 % of 90 electrical degrees
- Voltage range: $\pm 15\%$ Vn
- Voltage: (Vn): 100, 110, 230, 400, 440 V
- Burden: 20..30 mA
- Frequency: 50 or 60 Hz



SYNCHRONOSCOPES			
Dimensions	mm	96x96	144x144
Approx. weight	Kg.	1,37	1,83
AC. SINGLE-PHASE			
AC. Single-phase*		SC3V-360°	SC2V-360°
BALANCED THREE-PHASE			
Balanced three-phase**		SC3VI-360°	SC2VI-360°

- * With additional resistor box (external):
 100, 110, 230 V: Model 4.5.1
 400, 440 V: Model 4.5.1 and 2.4.1
- ** With additional resistor box (external):
 230 V: Model 1.6.1
 400, 440 V: Model 2.6.1 and 2.4.1

Dimensions (mm)



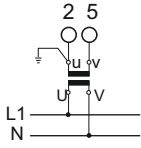
Models	Ranges	∅a	∅b	∅c	d	e	∅
SC3V-360°	100÷440	96	89	92 ^{+0,8}	135	100	M,4
SC3VI-360°	100÷440						
SC2V-360°	100÷440	144	135	138 ⁺¹	135	140	M,4
SC2VI-360°	100÷440						

Resistor boxes on page AN-42

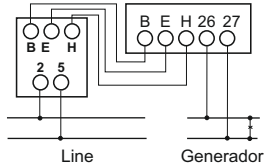
CONNECTION DIAGRAMS

Connection diagrams

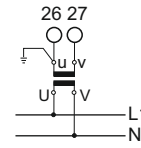
Single-phase (100, 110, 230 V)



Connection: Current Transf.



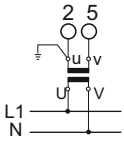
Direct input



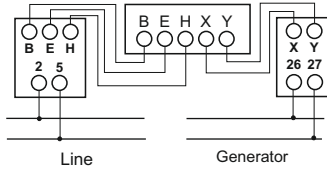
Transf. Voltage

Connection diagrams

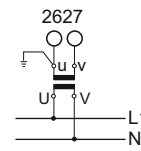
Single-phase (400, 440 V)



Connection: Voltage transf.



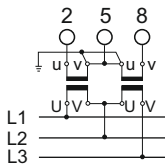
Direct input



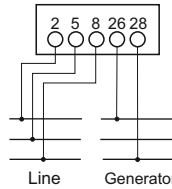
Voltage transf.

Connection diagrams

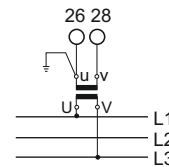
Three-phase (100, 110 V)



Connection: Voltage transf.



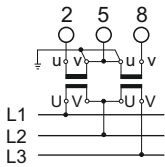
Direct input



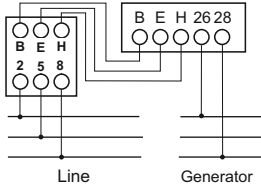
Voltage transf.

Connection diagrams

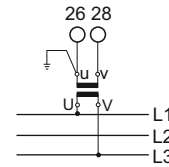
Three-phase (230 V)



Connection: Voltage transf.



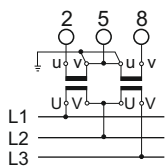
Direct input



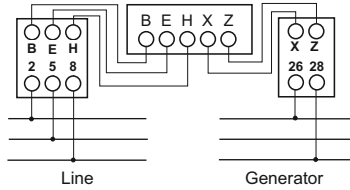
Voltage transf.

Connection diagrams

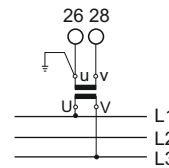
Three-phase (400, 440 V)



Connection: Voltage transf.



Direct input



Voltage transf.

LAMP SYNCHROSCOPE

Genset synchronization for manual operation.



ALTERNATING CURRENT - NAVAL SERIES

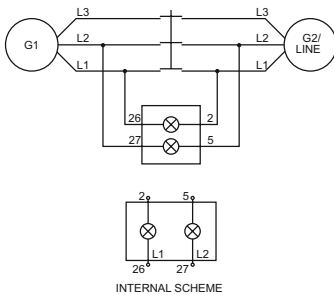
- Frequency: 50 or 60 Hz - Voltage: 110, 230, 400 or 440 V $\pm 20\%$



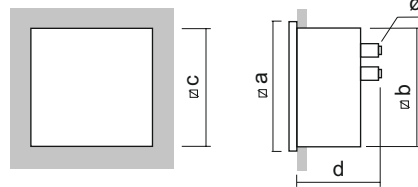
Model		SC3VL	SC2VL
Dimensions	mm	96x96	144x144
Approx weight	Kg.	0,20	0,26

Its operation is based on detecting voltage between similar phases in the two systems to be synchronized, so that when there is zero voltage the operator may give the connection order.

Connection diagrams



Dimensions (mm)



Models	Ranges	∇a	∇b	∇c	d	ø
SC3VL	110+440	96	89	92 ^{+0,5}	78	M.4
SC2VL	110+440	144	135	138 ⁺¹	78	M.4

SEQUENCE METER / SEQUENCE RELAY WITH ALARM

Displays the correct phase sequence in a three-phase system and provides a contact to allow the connection of the receiving device.



ALTERNATING CURRENT - NAVAL SERIES

- Frequency: 50 or 60 Hz - Burden: 1,2 VA - Voltage: 110, 230, 400 or 440 V $\pm 20\%$



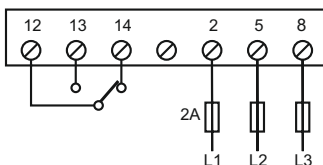
Model		RSQ
Dimensions	mm	96x96
Approx. weight	Kg.	0,35

Has three LEDs showing:

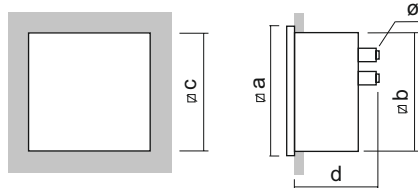
- Inverse sequence (red), marked L3-L3-L2.
- Direct sequence (green), marked L3-L2-L3.
- Operates enable relay (green), marked OK.

Close enable output: 250 V, 8A relay

Connection diagrams



Dimensions (mm)



Model	Ranges	∇a	∇b	∇c	d	ø
RSQ	110+440	96	89	92 ^{+0,8}	78	M.4

SYNCHRONOSCOPE / DIGITAL SYNCHRONIZING RELAY

Allows both the phase and parameters of the two voltages from two systems to be displayed and their synchronization.

ALTERNATING CURRENT - NAVAL SERIES

- Input: 110, 230, 400 or 440 V $\pm 20\%$
- Frequency range: 45 a 65 Hz
- Phase-difference range: $\pm 180^\circ$
- Voltage-difference range: $\pm 100\%$
- Accuracy: 0,5 %
- Accuracy: 0,1 %
- Accuracy: 1 %
- Accuracy: 1 %



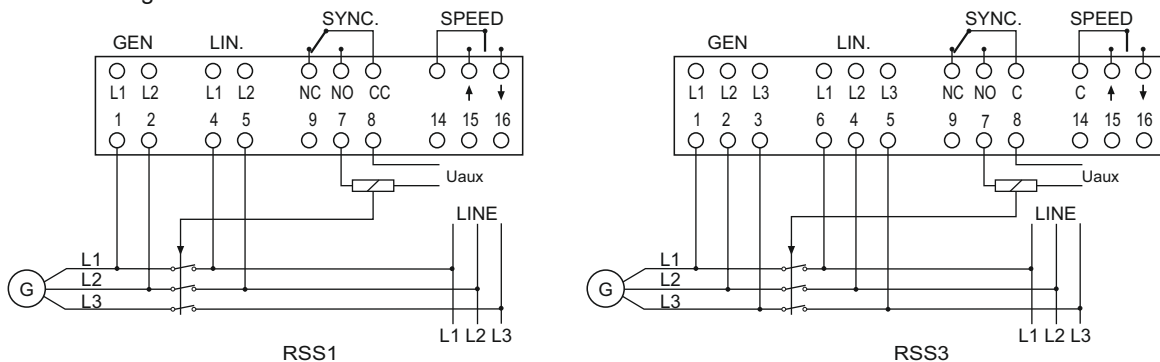
Model		RSS1 (2 wire)	RSS3 (3 wire)
Dimensions	mm	96x96	96x96
Approx. weight	Kg.	0,85	0,85
SYNCHRONOSCOPE/DIGITAL SYNCHRONIZING RELAY			
	V	110 or 230 V	110, 230, 400, or 440 V

Has a rotating display showing the phase between two voltages and two number indicators which display their module. Allows the current module difference, phase difference and trip time to be set. Once the enable conditions have been met, the output relay closes, either for a fixed time (300 ms) or continuously while the condition lasts. Receives power from the bus/bars signal. When operating as an automatic synchronizer it supplies acceleration/delay pulses for the alternator speed. LEDs on the front display the operation of the 8 output relays.

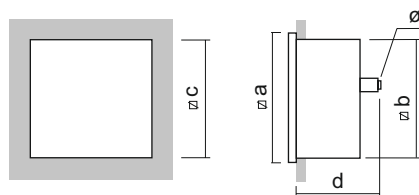
The front keypad programs:

- Voltage difference: $\pm 10\%$
- Phase difference: $\pm 20^\circ$
- Permanent time: 0,1 - 5 s.
- Operate enable relay: Pulse, 300 msg. - Continuous (SYNC)
- Operate control relays (SPEED)

Connection diagrams



Dimensions (mm)



Model	Ranges	∅a	∅b	∅c	d	ø
RSS-	110÷440 V	96	89	92 ^{+0,8}	78	Term.

SYNCHRONIZING EQUIPMENT

Equipment with three instruments, double or differential voltmeter, double or differential frequency meters and synchroscope, for connecting two generators in parallel, or connecting a generator with system.

Position: Vertical (as column with 180° turn)
Horizontal (with two supports)

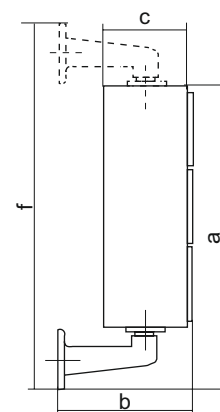
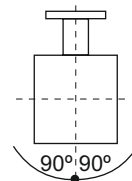
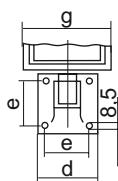
Technical specifications: see instrument data..



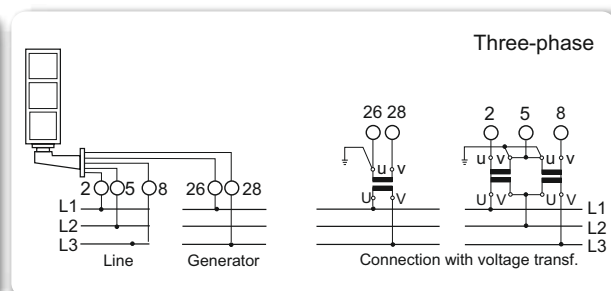
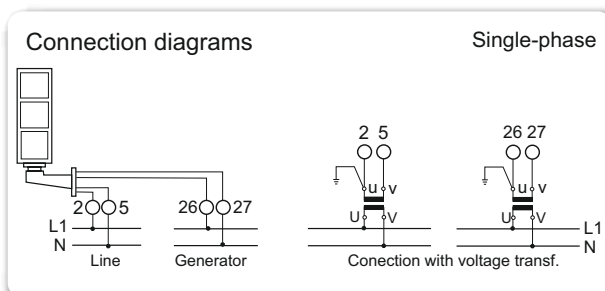
Model	VOLTMETERS	FREQUENCY METERS	SYNCHRONOSCOPES
ES3V	EC3VII or CC3VGD	FC3VII ó FC3AD	SC3V-360°
ES3VI	EC3VII or CC3VGD	FC3VII or FC3AD	SC3VI-360°
ES2V	EC2VII or CC2VGD	FC2VII , FC2AD or FC2AD	SC2V-360°
ES2VI	EC2VII or CC2VGD	FC3VII, FC3AD or FC2AD	SC2VI-360°
ES3C	CC3CGD	FC3CD	SC3V-360°
ES3CI	CC3CGD	FC3CD	SC3VI-360°
ES2C	CC2CGD	FC2CD	SC2V-360°
ES2CI	CC2CGD	FC2CD	SC2VI-360°

		90° SCALE		360° SCALE	
Dimensions EQUIPMENT	mm	410x223x120	576x258x170	410x223x120	576x258x170
Dimensions INSTRUMENTS	mm	96x96	144x144	96x96	144x144
Approx. weight	Kg.	5,70	9,00	5,80	8,70
SINGLE -PHASE					
Single-phase		ES3V	ES2V	ES3C	ES2C
BALANCE THREE-PHASE					
Balanced three-phase		ES3VI	ES2VI	ES3CI	ES2CI

Dimensions (mm)



Models	∅a	∅b	∅c	d	e	f	g
ES3V-ES3VI	410	223	176	80	60	500	120
ES2V-ES2VI	576	258	176	115	85	692	170
ES3C-ES3CI	410	223	176	80	60	500	120
ES2C-ES2CI	576	258	176	115	85	692	170



REVERSE POWER RELAY

Power relay to limit the inverse power (antimotoring) between two alternating current generators connected in parallel.



ALTERNATING CURRENT - NAVAL SERIES

- Accuracy: $\pm 1,5\%$ (Pn) - Frequency: 50 or 60 Hz

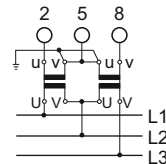
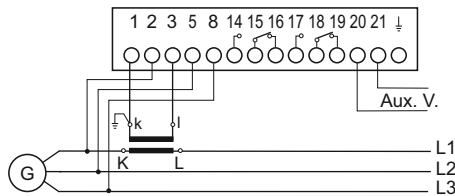


Model		RIC2VI
Dimensions	mm	144x144
Approx. weight	Kg.	1,25
REVERSE POWER RELAY		
Un	V	100, 110, 230, 400 or 440
In	A	..15
Aux. V	V	100, 230 or 400

- Un range: $-40 \div +20\%$
- In range: $20 \div 120\%$
- Hysteresis: $<1\%$ (of Pn)
- Delay for output signal: 5 ± 0.3 secs. (optional, without delay)
- Output contacts power: Max 200 Va, 400 V, 5A
- Aux. v. range: $\pm 20\%$
- Scale: $Un \times In \times \sqrt{3} \times \cos \phi$ (KW)
- Adjustment limit: 2-15% (of the alternator Pn in KW)

Two lights indicators determine the period of time between overload and the closing of the output relay

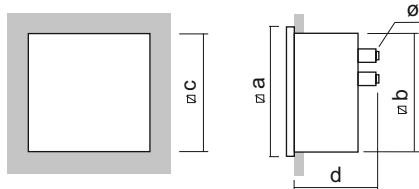
Connection diagrams



- Output contacts: Timing switch relay: 15 common
- Without auxiliary voltage: 14 open, 16 closed
- With auxiliary voltage: 15 and 14 closed

- With overload: 15 and 16 closed after time-out
- Instant relay: 18 common, 17 open, 19 closed
- With overload: 18 and 17 closed

Dimensions (mm)



Model	Ranges	∅a	∅b	∅c	d	ø
RIC2VI	100+440 V	144	135	138 ⁺¹	89	M 4

SYNCHRONISING RELAY

Electronic relay for synchronization of two alternating current generators comparing their voltage, phase and frequency.



ALTERNATING CURRENT - NAVAL SERIES

- Precisión en fase $\pm 2,5\%$
- Time: $\pm 0,5$ s.
- Frequency: 50 or 60 Hz
- Un Range: $\pm 15\%$

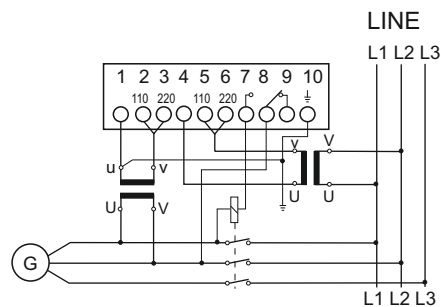


Model		RSC2
Dimensions	mm	144x144
Approx. weight	Kg.	2,00
SYNCHRONISING RELAY		
Un	V	2x110, 230, 400 or 440

A check adjusts the phase difference from 5 to 40 electrical degrees, and another adjusts the minimum time from 0.2 to 2,5 secs, during which this difference must be maintained.

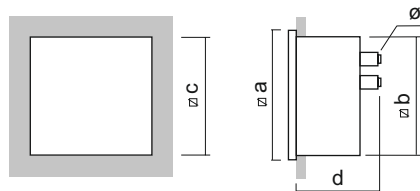
When both FORMeters go into the set limits, the output relay operates the synchronizing switch and an LED indicates that coupling may be carried out. To adjust operating limit, remove security cover or screw.

Connection diagrams



Output relay: 1 switching contact (max. 200 VA, 250 V, 5 A.A.C.)

Dimensions (mm)



Model	Ranges	∅a	∅b	∅c	d	ø
RSC2	100+440 V	144	135	138 ⁺¹	134	M.4

MAXIMUM CURRENT RELAY

Electronic overcurrent relay which detects the current level in each phase in three-phase alternators.



ALTERNATING CURRENT - NAVAL SERIES

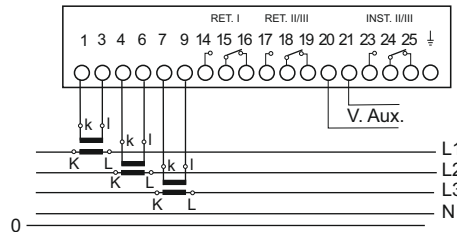
- Accuracy Current: $\pm 2,5\%$ (Trip set value)
Time: $\pm 3\% \pm 1$ sg. of set value
- Frequency: 50 or 60 Hz



Model		RMC2	RMC2A
Dimensions	mm	144x144	144x144
Approx. weight	Kg.	1,33	1,33
MAXIMUM CURRENT RELAY			
In	A	..5	..5
Aux. V	V	100, 110, 230, 400 or 440 $\pm 30\%$ C.A.	

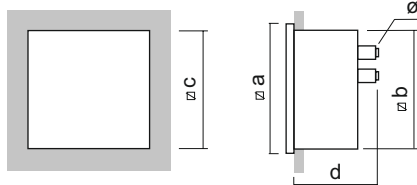
- Overload: 10 In for 1 s
- Aux. v range: $\pm 30\%$
- Hysteresis: < 0.16 A
- Adjustment limit: 0.6+1.6 (of In independent of each phase)
- Delay on output signal: (independent of overload): 1 from 2 to 60 secs in phases II and III
- Output contacts power: Max. 200 VA, 400 V, 5 A
- Indicators to check operation time.
- To adjust operating limit, remove security cover or screw.

Connection diagrams



- Output contacts: Phase I, Relay I
- 15-14 switch normally open and 15-16 closed
- In overload: 15-14 closed after time-out
- Phases II/III: Relay II/III, 18-17 switch normally open and 18-19 closed
- With auxiliary voltage, without overload, 18-17 closed
- In overload: 18-19 closed after time-out
- Instant relay.
- Switch, 24-23 open, 24-25 closed In overload, 24-23 closed
- On standby, 18-17 is open and 18-19 closed
- With auxiliary voltage, without overload, 18-19 remain closed
- In overload, 18-17 closed after time-out
- RMC2A:
The same features as RMC2 except that II/III relay operation is reversed

Dimensions (mm)



Models	Ranges	Øa	Øb	Øc	d	ø
RMC2	..5	144	135	138 ⁺¹	89	M.4
RMC2A	..5	144	135	138 ⁺¹	89	M.4

MIN-MAX VOLTAGE AND FREQUENCY RELAY

Instrument for voltage and frequency control in a three-phase or single-phase system.



ALTERNATING CURRENT - NAVAL SERIES

- Accuracy: $\pm 2\%$ - Frequency: 50 or 60 Hz



Model		RUFC2
Dimensions	mm	144x144
Approx. weight	Kg.	1,25
MINIMUM-MAXIMUM VOLTAGE AND FREQUENCY RELAY		
Un	V	100, 110, 230, 400 or 440
Aux. V	V	110, 230 ó 400 $\pm 30\%$ C.A

- Un range: $-40 \div +20\%$
 - Aux. v range: $\pm 30\%$

MINIMUM VOLTAGE SETTING
 - Un range: 60-100 % (Accuracy 1%)
 - Timer: 0-5 s. (Accuracy 2% ± 0.2 s)

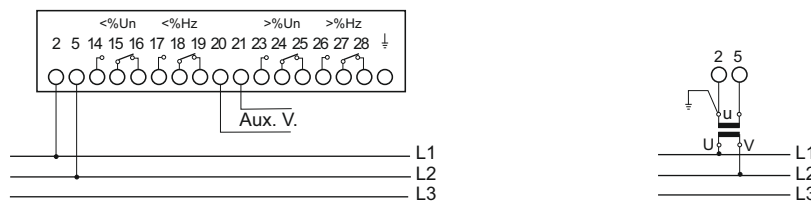
MINIMUM FREQUENCY SETTING
 - Range: 45-55 / 55-65 Hz (Accuracy 1%)
 - Timer: 0-10 s. (Accuracy 2% ± 0.2 s)

MAXIMUM VOLTAGE SETTING
 - Un range: 80-120 % (Accuracy 1%)
 - Timer: 0-5 s. (Accuracy 2% ± 0.2 s)

MAXIMUM FREQUENCY SETTING
 - Range: 45-55 / 55-65 Hz (Accuracy 1%)
 - Timer: 0-10 s. (Accuracy 2% ± 0.2 s)

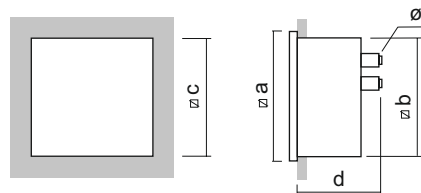
Instant alarm and relay operation indicators.
 To adjust operating limit, remove security cover or screw.

Connection diagrams



- One switch output relay each setting (max. 200 VA, 400 V).
 - Hysteresis $\lt 2\%$

Dimensions (mm)



Models	Ranges	$\varnothing a$	$\varnothing b$	$\varnothing c$	d	\varnothing
RUFC2	100+440 V	144	135	138 ⁺¹	89	M.4

INSULATION INDICATORS

Instrument which detects and measures an earth insulation failure in a three-phase circuit with insulated neutral with direct and continuous connection to the system (position G on switch). The IAC_VA models have a built-in alarm system with continuous adjustable setting device from 0 and 5 MΩ.



ALTERNATING CURRENT - NAVAL SERIES

- Accuracy: $\pm 1,5\%$ (of U_n scale arch)
- Frequency: 50 or 60 Hz

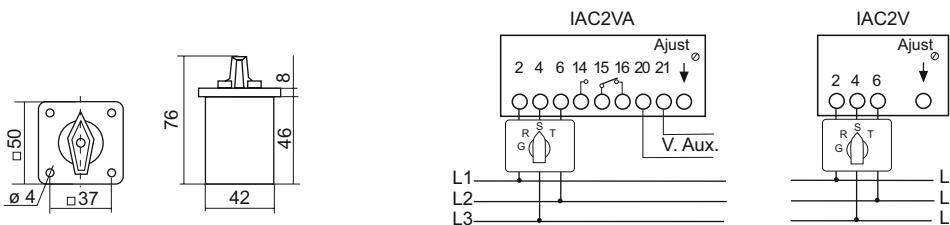


Model		IAC3V	IAC2V	IAC3VA	IAC2VA
Dimensions	mm	96x96	144x144	96x96	144x144
Approx. weight	Kg.	0,92	1,20	0,92	1,20
INSULATION INDICATORS					
	V	230-400 or 440 V		230-400 or 440 V	
Aux. V	V	---		110 or 230 C.A.	

- Scale: 0..50..0 MΩ (1 MΩ to centre)
- Aux. v. range: $\pm 20\%$
- Guaranteed number of operations: 107
- Output contact: Switched at 2A, 230 V A.C. 200 VA

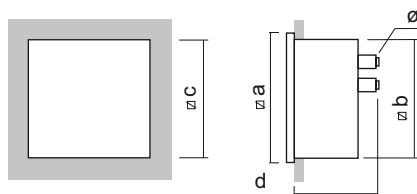
- Scale: 0-100 (Insulation comparison)
- Setting accuracy: $\pm 3\%$ of scale value
- To adjust operating limit, remove security cover or screw

Connection diagrams



If the insulation drops below the selected level, an internal spdt micro-relay closes the alarm circuit as the indicator, located beside the setting device, comes on. Moving the switch to position R, S or T, allows the faulty phase to be located. The phase with the lowest reading will have the insulation fault.

Dimensions (mm)



Models	Ranges	∅a	∅b	∅c	d	e	ø
IAC3V IAC3VA	230+440	96	89	92 ^{+0,8}	92	100	M.4
IAC2V IAC2VA	230+440	144	135	138 ⁺¹	89	140	M.4

RUDDER DEGREE INDICATOR FOR VESSELS

Rudder position indicator through connection to potentiometer using resistance variations..

DIRECT CURRENT - NAVAL SERIES

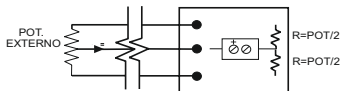
- Scale: 90° - Accuracy: ±1,5 % - Burden: 2000 Ω/V



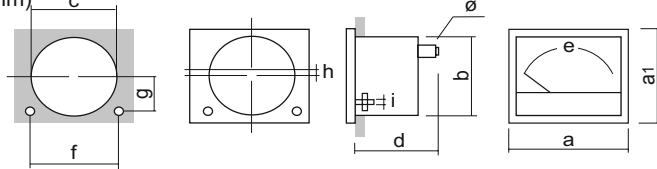
Model		CCb8
Dimensions	mm	130x100
Approx. weight	Kg.	0,25
INDICADOR DE GRADOS DE TIMÓN		
Scales	°	40-0-40 or 45-0-45
Range	V	7-0-7 or 12-0-12

Standardised scales. PORT (red arc); STARBOARD (green arc). Lighting: Grade line at 12 V (two 2W lamps). The central value or 0° on the scale coincides with the potentiometer centre.

Connection diagram



Dimensions (mm)



Models	Ranges	axa1	b	c	d	e	f	g	h	i	ø
CCb8	V	130x100	66	67	59	100 ^{+0,8}	100	13	13	M.4	M.4

R.P.M. INDICATOR FOR VESSELS

Supplied by a generator located at the propeller axis indicating its r.p.m. AHEAD or ASTERN.

DIRECT CURRENT - SERIE NAVAL

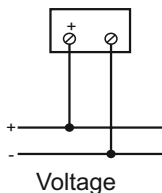
- Scale: 240° - Accuracy: ±1,5 % - Burden: 100 Ω/V



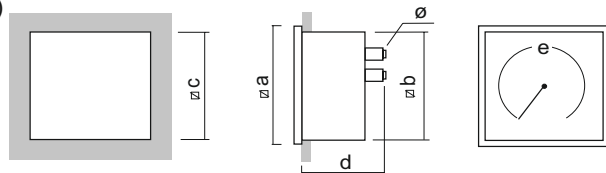
Model		CC2C
Dimensions	mm	144x144
Approx. weight	Kg.	0,68
R.P.M. INDICATOR FOR VESSELS (MAIN MOTOR)		
Scales	r.p.m.*	150-0-150, 180-0-180, 200-0-200 or 300-0-300
Ranges	V**	10-0-10

*Standardised scales. ASTERN (red arc); AHEAD (green arc). ** Standardised ranges, according to voltage/speed curve (V.DC./r.p.m.) of the generator. Full scale adjustment: With built-in potentiometer ±10 % of total value. Lighting: Translucent at 12 or 24 V.

Connection diagram



Dimensions (mm)



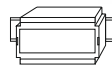
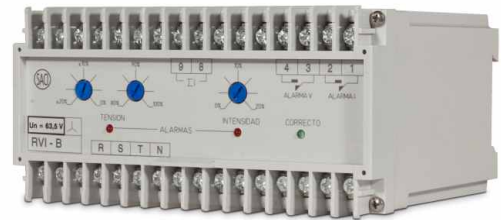
Models	Ranges	∇a	∇b	∇c	d	e	ø
CC2C	V	144	135	138 ^{+0,8}	88	220	M.4

VOLTAGE AND CURRENT SURVEILLANCE RELAY

Designed for supervising measurement board connections in installations or substations.
 Detection of Current Unbalance, Voltages, Overvoltage and Undervoltage.

ALTERNATING CURRENT

- Detection range:
 - Unbalance 0 to 20 % of V_n .
 - Undervoltage 80 to 100 % of V_n .
 - Unbalance 0 to 20 % of I_n .
 - Overvoltage 120 % of V_n .
- Class: 1
- Output features: 250 V, 3 A, 300 VA.
- Burden: 0.48 VA per phase

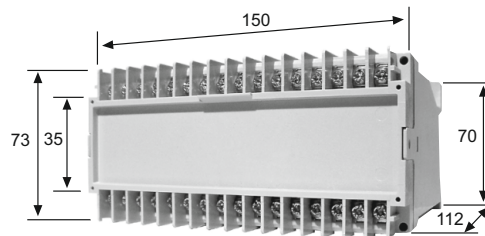


Model		RVIA (three-phase, 3 wire)		RVIB (three-phase, 4 wire)	
Dimensions	mm	150x70x112		150x70x112	
Approx. weight	Kg.	1,20		1,20	
VOLTAGE AND CURRENT SURVEILLANCE RELAY					
	V	110, 230 or 400 V			
	A	..1/5 A or ..1/A			

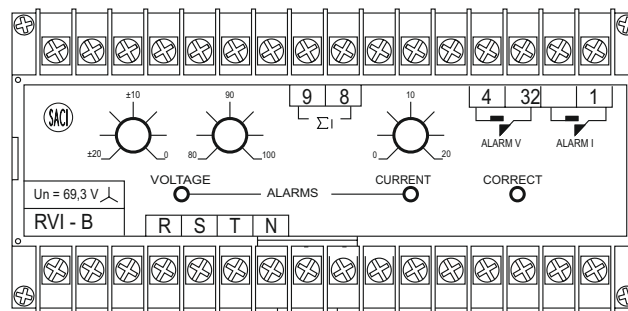
Current faults activate an alarm relay and any form of voltage fault activates a second relay. Has an indicator to show "CORRECT" status and two indicators to show "CURRENT FAILURE" and "VOLTAGE FAILURES". Controls on the front allow comparison levels to be selected to set off the alarm. Two controls are for voltage, for unbalance levels (from 0 to 20 %), and undervoltage levels (from 80 to 100 %) and a third for current (from 0 to 20 %). To operate, the three phases to be supervised are connected to the voltage inputs and the three currents pass through the associated toroidal transformer.

ANALOGUE INSTRUMENTS

Dimensions (mm)



Connection diagrams

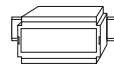


Connections:
 Voltages, connected to terminals marked R, S, T and N. For three wire equipment, obviously neutral is not connected.
 Currents, the toroidal transformer output is connected to terminals marked I (8 and 9).
 Output relays have potential-free contacts and are insulated for complete connection flexibility.

NAVAL SURVEILLANCE RELAY - RSN

PRODUCT DESCRIPTION

RSN is a naval supervision relay whose mission is to protect the generating sets usually installed on board of vessels. It is a multifunction equipment built with a microprocessor which makes RSN a versatile and reliable device. It can be connected to a centralized control board through a serial port so that the configuration and data sending of the different operations can be carried out. A liquid crystal screen facilitates the display of the measured data as well as the local configuration of the equipment through a keypad located in front of the device.



Model		RSN (Three-phase 4 wire)	
Dimensions	mm	150x75x115	
Approx. weight	Kg.	1,20	
NAVAL SURVEILLANCE RELAY - RSN			
	V	500 V (line-line) Max.	
	A	..15 A	
Aux. V	V	110,230 or 400 V A.C.	
Aux. V	V	24-48-110 V A.C.	
Aux. V	V	UNIVERSAL 85-264 V A.C. and D.C.	

MEASURING ENVIRONMENT

ELECTRICAL QUANTITY	Symbol	L1	L2	L3	Total
Voltage (Line-to-Neutral)	V	•	•	•	Average
Voltage (Line-to-Line)	V	•	•	•	
Neutral current	A	•	•	•	Average
Active Power	kW	•	•	•	•
Reactive Power	kVAr	•	•	•	•
Apparent Power	kVA	•	•	•	•
Power factor	PF	•	•	•	•
Frequency	Hz				•
THD Current	A	•	•	•	
THD Voltage	V	•	•	•	
Neutral current	A				Average

FUNCTIONAL DESCRIPTION

RSN relay can be set as:

- RMC2 Over current relay
- RU H Over voltage relay
- RU L Under voltage relay
- RUCM Maximum and minimum average voltage and maximum average current
- RIC Direct power and reverse power relay
- RUF Maximum and minimum voltages and maximum and minimum frequency relay
- RUNB Unbalanced voltages, currents, over voltages and under voltages relay

Setting can be modified through the keypad or the serial line. The different values assigned to each input, as well as the alarm values must be set for each mode.

NAVAL SURVEILLANCE RELAY - RSN

SETTING

Operations to be carried out through the keyboard:

- Rated voltage value of the installation.
- Rated current transformer value.
- Equipment identity in a RS-485 net.
- Baud rate of the serial line RS-485
- Operating mode of the output relays
- Reference value and delays used in relay operation

Operations to be carried out through the serial line:

- Equipment settings.
- Identity and serial number settings.
- Reading of the system FORMeters.
- Change of voltage, current and energy range.
- Change of the access code to keypad setting.
- Change of the baud rate
- Other functions related to different options installed in the equipment

TECHNICAL SPECIFICATIONS

Input

Current: 5 A.
Voltage: 500 V (Line-to-Line) max

Auxiliary supply: 110, 230, or 400 V AC.±20%
24, 48, 110 V DC ±20%.
Universal from 85 to 264 VDC, 47-65 Hz.

DIGITAL OUTPUTS

Number of outputs: Six
Type: SPDT relay
230 V; 3 A; 300 VA

Output relays are grouped in pairs with one common to each point which must be taken into account in the external circuit. There is no load limitation in the contacts, therefore, they must be protected by some external protection device. Connections are displayed on the previously shown diagram.

SERIAL OUTPUT

Type: RS485 (DB9 male connector)
Options
Output: RS232(DB9 female connector)
Protocol: MODBUS/JBUS

MOUNTING

Equipment can be mounted in EN 50022 DIN RAIL or through screws into a board

DIMENSIONS.

Box: ERNI LDG-A-46. 150x75x115 mm.

ACCEPTABLE OVERLOADS

Current circuits 2*In continuamente
20*In durante 3 s.
40*In durante 1 s.
Voltage circuits 1,22*Un continuous

INSULATION (as EN 61010)

Insulation grade. Double
Category of the installation III
Pollution grade 2

Rated values

Voltage, 500V (350 V to GND)
Current, 350 V
Output, 50 V
Serial line, 50 V
Digital output, 300 V

NAVAL SURVEILLANCE RELAY - RSN

Required data is displayed on screens in the following figure:

TEXT	VARIABLE	DESCRIPTION
------	----------	-------------

RMC2 - OVER CURRENT RELAY

IL1	VALUE_ALAR0	REFERENCE % FOR I L1
IL2	VALUE_ALAR1	REFERENCE % FOR I L2
IL3	VALUE_ALAR2	REFERENCE % FOR I L3
TIL1	DELAY_ALAR0	DELAY FOR I L1 IN TENTHS OF SECONDS
TIL2	DELAY_ALAR1	DELAY FOR I L2 IN TENTHS OF SECONDS
TIL3	DELAY_ALAR2	DELAY FOR I L2 IN TENTHS OF SECONDS

RUH - OVER VOLTAGE RELAY

U L1	VALUE_ALAR0	REFERENCE % FOR U L1
U L2	VALUE_ALAR1	REFERENCE % FOR U L2
U L3	VALUE_ALAR2	REFERENCE % FOR U L3
T U1	DELAY_ALAR0	DELAY FOR U L1 IN TENTHS OF SECONDS
T U2	DELAY_ALAR1	DELAY FOR U L2 IN TENTHS OF SECONDS
T U3	DELAY_ALAR2	DELAY FOR U L2 IN TENTHS OF SECONDS

RUL - UNDER VOLTAGE RELAY

U L1	VALUE_ALAR0	REFERENCE % FOR U L1
U L2	VALUE_ALAR1	REFERENCE % FOR U L2
U L3	VALUE_ALAR2	REFERENCE % FOR U L3
T U1	DELAY_ALAR0	DELAY FOR U L1 IN TENTHS OF SECONDS
T U2	DELAY_ALAR1	DELAY FOR U L2 IN TENTHS OF SECONDS
T U3	DELAY_ALAR2	DELAY FOR U L2 IN TENTHS OF SECONDS

RUCM - MAXIMUM AND MINIMUM AVERAGE VOLTAGE AND MAXIMUM AVERAGE CURRENT

UM H	VALUE_ALAR0	REFERENCE % FOR MAXIMUM RATED VOLTAGE
UM L	VALUE_ALAR1	REFERENCE % FOR MMINIMUM RATED VOLTAGE
IM H	VALUE_ALAR2	REFERENCE % FOR MAXIMUM RATED VOLTAGE
TUMH	DELAY_ALAR0	DELAY FOR U MAXIMUM RATED VOLTAGE IN TENTHS OF SECOND
TUML	DELAY_ALAR1	DELAY FOR U MAXIMUM RATED VOLTAGE IN TENTHS OF SECOND
TIMH	DELAY_ALAR2	DELAY FOR I MAXIMUM RATED VOLTAGE IN TENTHS OF SECOND

RIC - DIRECT POWER AND REVERSE POWER RELAY

P d	VALUE_ALAR0	REFERENCE % FOR DIRECT ACTIVE POWER
P I	VALUE_ALAR1	REFERENCE % FOR REVERSE ACTIVE POWER
T Pd	DELAY_ALAR0	DELAY FOR DIRECT POWER IN TENTHS OF SECOND
T PI	DELAY_ALAR1	DELAY FOR DIRECT POWER IN TENTHS OF SECOND

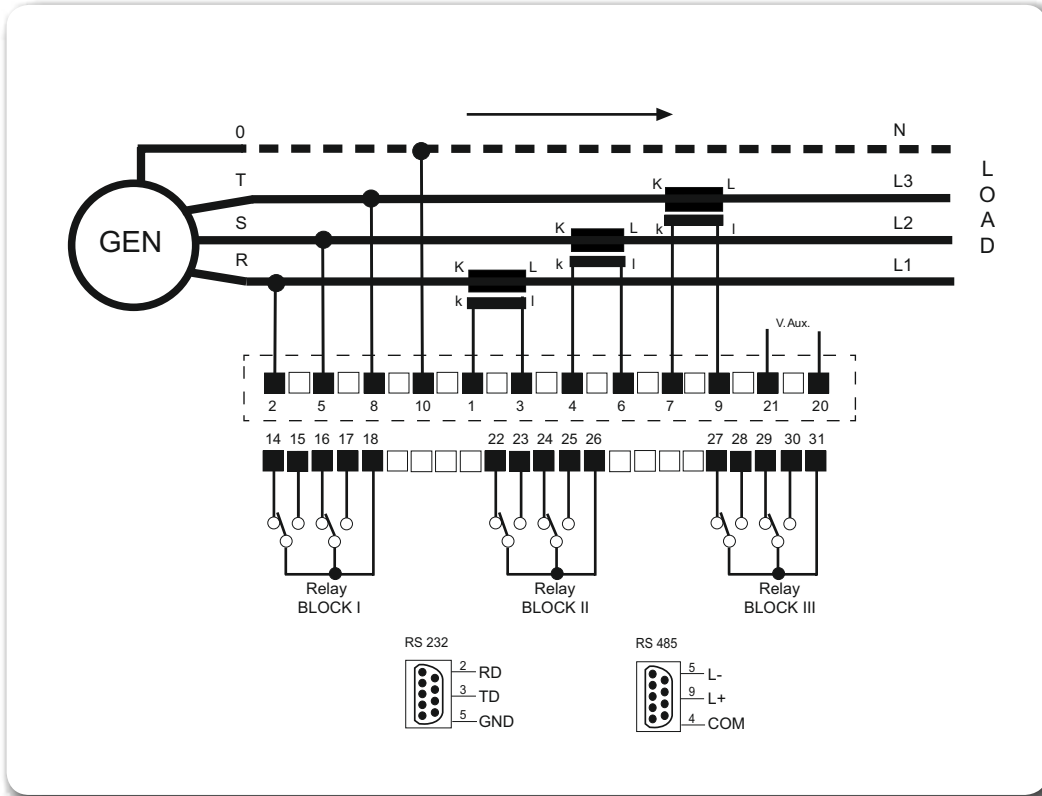
RUF - MAXIMUM AND MINIMUM VOLTAGES AND MAXIMUM AND MIN FREQUENCY

U H	VALUE_ALAR0	REFERENCE % FOR MAXIMUM VOLTAGE (1-2-3)
U L	VALUE_ALAR1	REFERENCE % FOR MAXIMUM VOLTAGE (1-2-3)
Fr H	VALUE_ALAR2	FOR MAXIMUM FREQUENCY
Fr L	VALUE_ALAR3	FOR MAXIMUM FREQUENCY
TUHL	DELAY_ALAR0	DELAY FOR MAXIMUM OR MINIMUM VOLTAGE IN TENTHS OF SECOND
TFHL	DELAY_ALAR1	DELAY FOR MAXIMUM OR MINIMUM VOLTAGE IN TENTHS OF SECOND

RUNB - UNBALANCED VOLTAGES, CURRENTS, OVER VOLTAGES AND UNDER VOLTAGES RELAY

UUnb	VALUE_ALAR0	REFERENCE % FOR VOLTAGE UNBALANCE
Iunb	VALUE_ALAR1	FOR CURRENT UNBALANCE
U H	VALUE_ALAR2	FOR MAXIMUM VOLTAGE (1-2-3)
U L	VALUE_ALAR3	FOR MINIMUM VOLTAGE (1-2-3)
TUUn	DELAY_ALAR0	DELAY FOR UNBALANCED VOLTAGE IN TENTHS OF SECOND
TIUn	DELAY_ALAR1	DELAY FOR UNBALANCED CURRENT IN TENTHS OF SECOND
TUHL	DELAY_ALAR2	DELAY FOR MAXIMUM OR MINIMUM VOLTAGE IN (1-2-3) TENTHS OF SECOND

NAVAL SURVEILLANCE RELAY - RSN



CURRENT OR POWER RELAY R2M / R2MC

R2M is an equipment that measures current or power in a three phase network. Its functioning mode is based on the activation of the contacts of a step control relay when the range, which is chosen on the frontal panel, is exceeded.

It has a x/5A current input that must be connected to the secondary of a current transformer and to the voltage input that can be directly connected to the net.

Depending on the connection and on the chosen mode it can be used as:

- R2M –CURRENT RELAY
- R2M – ACTIVE POWER RELAY
- R2M – REVERSE POWER RELAY
- R2MC – REACTIVE CURRENT RELAY



TECHNICAL FEATURES

VOLTAGE INPUT

Rated voltage (Un)	230 or 400 V A.C
Burden	< 3 VA, 2W
Frequency	50 - 60 Hz

CURRENT INPUT

Current (In)	x/5 A
Burden	< 0,2 VA
Permanent overload	1,2 In

- Current relay
- Active power relay
- Reverse power relay
- Range of the variable adjustment: 5 A; 0-100%
- Ton connection delay 4 s
- Toff disconnection delay 4 s
- Reactive current relay
- Range of the variable adjustment: 0,15...2 A
- Ton connection delay 5 s
- Toff disconnection delay 2 s

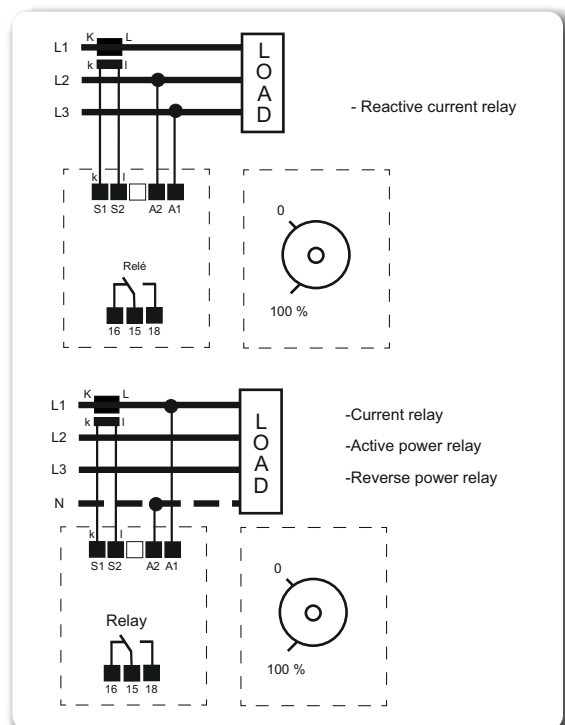
Output relay	
Insulation rated voltage Ui	250 V A.C.
	A.C.11 Ie/Ue 4 A / 240 V A.C.
	D.C.11 Ie / Ue 1 A / 110 V D.C.

Auxiliary voltage:	autosupplied
Connection indication	green LED: supply Red LED: connected relay.

GENERAL

Case material	ABS, UL94 V0
Dimensions	(2 DIN modules) 35 mm
Connection	Terminals with screw
Max. wire diameter	12 mm ² (inputs) 2,5 mm ² (pulse output)
Mounting	DIN RAIL 35 mm

CONNECTION DIAGRAM






SPECIALITIES

SPECIALITIES													
	Dimensions	∅ 48	∅ 72	∅ 96	∅ 144	80 x 64	105 x 80	130 x 100	MODULAR	∅ 48	∅ 72	∅ 96	∅ 144
POINTERS													
Knife pointer + fine divisions	---	●	●	●	---	---	---	---	---	---	---	---	---
Knife pointer + fine divisions + mirror	---	●	●	●	---	●	---	---	---	---	---	---	---
Red pointer, set externally		●				●			---				
SCALE													
Non standard scale (*)		●				●		●			●		
Antiparallax scale		---				---		---	---	---	●	●	---
Black scale, white div., figures and pointer	---	●	●	●		●		---	---	---	---	---	---
Black scale, yellow div., figures and pointer	---	●	●	●		---		---	---	---	●	●	●
Double scale	---	●	●	●		●		---	---		●		
Double numbering	---	●	●	●		●		---	---	---	●	●	●
Red line		●				●		●			●		
Colour arc (until 20 mm)		●				●		●			●		
Add text (<10 letters)		●				●		●			●		
Non electrical unit measuring													
PROTECTION													
Naval series or tropicalized		●				●		●			●		
Protection IP43		●				●		---	---		●		
Housing protection IP54		●				---		---	---		●		
Terminal cover (protection IP20)	●	●	●	---		---		---	---	●	---	---	---
Movil equipment and critical damping		●				●		---	---		●		
Frontal protection (IP65)	---	●	●	---		---		---	---	---	●	●	---
MISCELLANEOUS													
Makrolon glass		●				●		---	---		●		
Antireflecting glass		●				●		---	---		●		
Lighting 12, 24 V (with white scale)	---	●	●	●		---	●	●	---	---	●	●	●
Indirect Lighting 12, 24 V (with black scale)	---	●	●	●		---	●	●	---	---	●	●	●
Non vertical working position		●				●		●			●		
Rubber gasket (Panel)	---	●	●	---		---		---	---	---	---	---	---
MOVIN IRON METERS													
Non standard input (**)		●				●		●			---		
Calibrated for 150 or 400 Hz		●				●		●			---		
Calibrated in D.C.		●				●		●			---		
Accuracy 1%		●				●		●			---		
Insulation 3 kV		●				●		●			---		
750 to 1000V (with external box)		●				●		●			---		
Overload 200% (A, mA)		●				●		●			---		
Overload 500% (A, mA)		●				●		●			---		
Double range		●				●		●			---		
MOVING COIL AND MOVING COIL RECTIFIED METERS													
Non standard input (**)		●				●		●			●		
Insulation 3 kV		●				●		●			●		
Central zero		●				●		●			●		
Displaced zero		●				●		●			●		
Zero mechanically suppressed (max. 25%)		●				●		●			●		
Overload 200 or 500% (for Amm. A.C.)		●				●		●			●		
Non linear function scale (Ohm, db, etc.)		●				●		●			●		
Adjusted to specific internal resistance		●				●		●			●		
Accuracy		●				●		●			●		
600 up to 1000 V D.C.(with external box)		●				●		●			●		
>1.000+2.000V D.C.(with external box)		●				●		●			●		
>2.000+4.000V D.C (with external box)		●				●		●			●		
Full scale adjustable by potentiometer (±10%)	---	●	●	●		---		---	---	---	●	●	●
Double range		●				●		●			●		

(*) Scale: striped and numbered.

(**) Current or voltage required to move the needle at the end of the measurement zone.

SPECIALITIES

SPECIALITIES										
	∅ 48	∅ 72	∅ 96	∅ 144	MODULAR	∅ 48	∅ 72	∅ 96	∅ 144	
INDUCTION WATTMETERS AND VARMETERS										
Central zero		●			●			●		
Displaced zero		●			●			●		
Non standard voltage		●			●			●		
Current 1 A		●			●			●		
Calibrated between 0,4 and 0,5 of appa. power		●			●			---		
Calibrated between 0,6 and 0,8 of appa. power		---			---			●		
Calibrated between 1,3 and 1,5 of appa. power		●			●			●		
Accuracy 1%		●			●			●		
ELECTRONIC WATTMETERS AND VARMETERS										
Calibrated to 400 Hz		●			●			●		
Current 1 A		●			●			●		
Accuracy 1%		●			●			●		
INDUCTION POWER FACTOR METERS										
Non standard voltage (single phase)		●			●			●		
Non standard voltage (three phase)		●			●			●		
Current 1A		●			●			●		
ELECTRONIC POWER FACTOR METERS										
Non standard voltage		●			●			●		
Scale 0-1-0 (single phase), 0,1-1-0,1 (three phase)		●			●			●		
Current 1A		●			●			●		