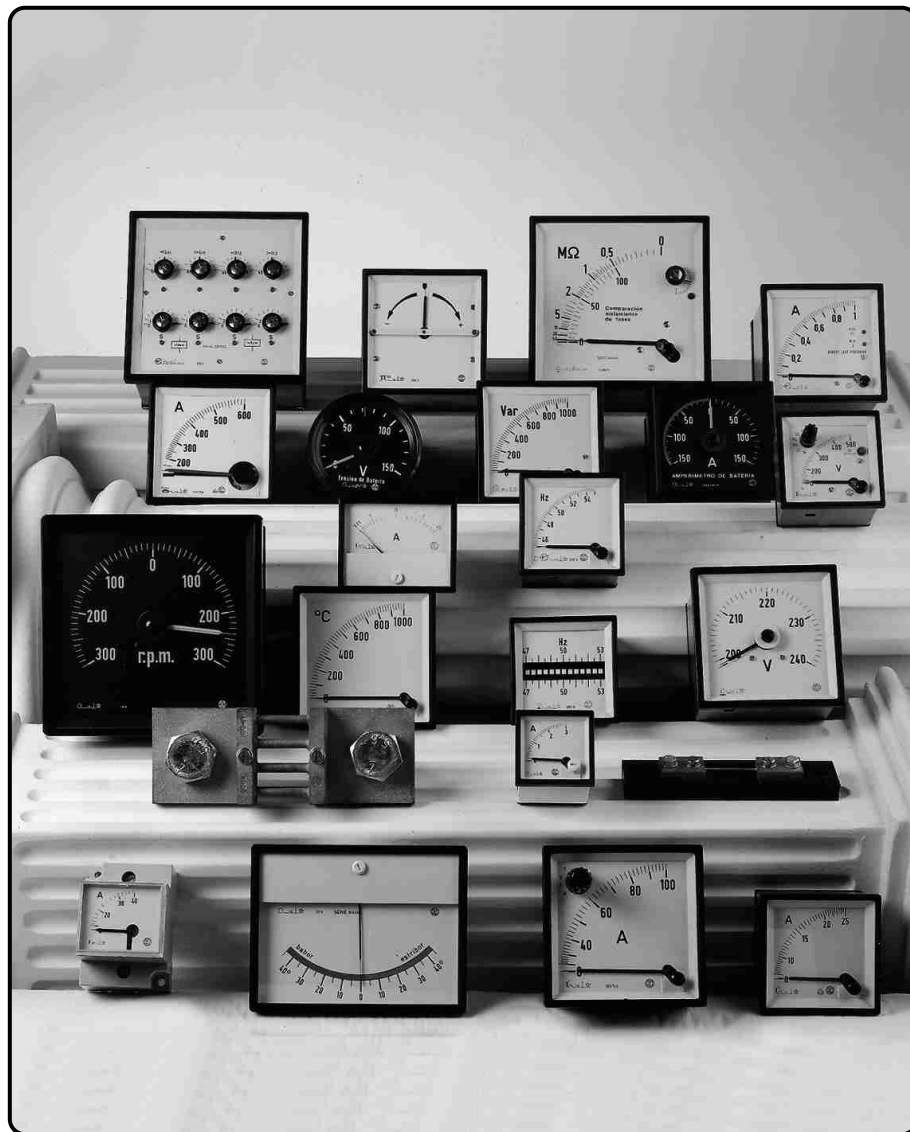


# ANALOGUE INSTRUMENTS



Analogue

# ANALOGUE INSTRUMENTS

## CONTENTS

<b>GENERAL FEATURES</b> .....	<b>A.04</b>
<b>FOR ALTERNATING CURRENT INSTRUMENTS</b>	
AMMETERS (INTERCHANGEABLE SCALE); DIRECT INPUT AMMETERS .....	A.05
AMMETERS (mA) .....	A.06
VOLTMETERS (INTERCHANGEABLE SCALE); DIRECT INPUT VOLTMETERS .....	A.06
DIMENSIONS AND CONNECTION DIAGRAMS .....	A.07
AMMETERS WITH SWITCH (INTERCHANGEABLE SCALE) .....	A.08
VOLTMETERS WITH SWITCH .....	A.08
DIMENSIONS AND CONNECTION DIAGRAMS .....	A.09
MOVING COIL WITH CONVERTER	
AMMETERS AND VOLTMETERS (240° SCALE) .....	A.10
DIMENSIONS AND CONNECTION DIAGRAMS .....	A.11
MOVING COIL WITH RECTIFIER	
AMMETERS AND VOLTMETERS (90° SCALE) .....	A.12
AMMETERS AND VOLTMETERS (240° SCALE) .....	A.12
DIMENSIONS AND CONNECTION DIAGRAMS .....	A.13
<b>RATED VALUE VOLTMETERS</b> .....	<b>A.14</b>
<b>ELAPSED TIME METER</b> .....	<b>A.15</b>
<b>PHASE SEQUENCE INDICATORS</b> .....	<b>A.15</b>
<b>INSTRUMENTS WITH CONTACTS</b> .....	<b>A.16</b>
<b>BIMETALLIC INSTRUMENTS (POWER DEMAND METERS)</b> .....	<b>A.17</b>
BIMETALLIC AMMETERS (INTERCHANGEABLE SCALE) .....	A.17
BIMETALLIC AMMETERS WITH CONTACTS .....	A.17
<b>BIMETALLIC INSTRUMENTS + MOVING IRON</b> .....	<b>A.18</b>
MAXIMUM DEMAND AMMETERS WITH MOVING IRON SYSTEM .....	A.18
MAXIMUM DEMAND AMMETERS WITH MOVING IRON SYSTEM AND CONTACTS .....	A.18
DIMENSIONS AND CONNECTION DIAGRAMS (BIMETAL) .....	A.19
<b>FOR DIRECT CURRENT INSTRUMENTS</b>	
AMMETERS (INTERCHANGEABLE SCALE) .....	A.20
AMMETERS ( $\mu$ A, mA and A) (90° SCALE) .....	A.20
DIMENSIONS AND CONNECTION DIAGRAMS (90° SCALE) .....	A.21
<b>NON-ELECTRIC UNIT INDICATORS</b> .....	<b>A.23</b>
<b>TEMPERATURE INDICATORS</b> .....	<b>A.24</b>
<b>SPECIAL INSTRUMENTS, MOBILE EQUIPMENT (RAILWAYS)</b> .....	<b>A.24</b>
<b>SHUNTS (RESISTORS)</b> .....	<b>A.25</b>
<b>REED FREQUENCY METERS</b> .....	<b>A.26</b>
<b>POINTER FREQUENCY METERS</b> .....	<b>A.27</b>
<b>DIMENSIONS AND CONNECTION DIAGRAMS</b> .....	<b>A.28</b>

# ANALOGUE INSTRUMENTS

## CONTENTS

### WATTMETERS AND VARMETERS

ELECTRONIC WATTMETERS .....	A.29
ELECTRONIC VARMETERS .....	A.30
DIMENSIONS AND CONNECTION DIAGRAMS .....	A.31-32
WATTMETERS AND VARMETERS (INDUCTION SYSTEMS) .....	A.33
DIMENSIONS AND CONNECTION DIAGRAMS .....	A.33

### PHASE METERS

ELECTRONIC PHASE METERS .....	A.34
DIMENSIONS AND CONNECTION DIAGRAMS .....	A.35
PHASE METERS (INDUCTION SYSTEM) .....	A.36
DIMENSIONS AND CONNECTION DIAGRAMS .....	A.36-37

RESISTOR BOXES .....	A.38
----------------------	------

### SYNCHRONIZING INSTRUMENTS

#### RELAYS

#### EQUIPMENT FOR VESSELS

MEASURING INSTRUMENTS FOR VESSELS (RECOMMENDATIONS) .....	A.40-41
---	---------

### FOR SYNCHRONIZING INSTRUMENTS

DOUBLE VOLTMETERS .....	A.42
DIFFERENTIAL VOLTMETERS .....	A.42
DIMENSIONS AND CONNECTION DIAGRAMS .....	A.42
DOUBLE FREQUENCY METERS (REEDS) .....	A.43
DIFFERENTIAL FREQUENCY METERS .....	A.43
DIMENSIONS AND CONNECTION DIAGRAMS .....	A.43

SYNCHRONOSCOPES .....	A.44
CONNECTION DIAGRAM .....	A.45
LAMP SYNCHRONOSCOPE .....	A.46

SYNCHRONOSCOPE / DIGITAL SYNCHRONIZING RELAY .....	A.47
--	------

SYNCHRONIZING EQUIPMENT .....	A.48
-------------------------------	------

REVERSE POWER RELAY .....	A.49
---------------------------	------

SYNCHRONISING RELAY .....	A.50
---------------------------	------

MAXIMUM CURRENT RELAY .....	A.51
-----------------------------	------

MIN-MAX VOLTAGE AND FREQUENCY RELAY .....	A.52
---	------

SEQUENCE METER / SEQUENCE RELAY WITH ALARM .....	A.46
--	------

INSULATION INDICATORS .....	A.53
-----------------------------	------

RUDDER DEGREE INDICATORS FOR VESSELS .....	A.54
--	------

R.P.M. INDICATORS FOR VESSELS .....	A.54
-------------------------------------	------

VOLTAGE AND CURRENT SURVEILLANCE RELAY .....	A.55
--	------

# ANALOGUE INSTRUMENTS

Analogue Instruments

## GENERAL FEATURES

**Standards** EN60051, VDE 0410, BS-89, EN50081, EN50082, EN61010

**Certifications** TÜV CERT (ISO 9001-2000)  
VDE, DET NORSKE VERITAS, BUREAU VERITAS  
GERMANISCHER LLOYD (relay)

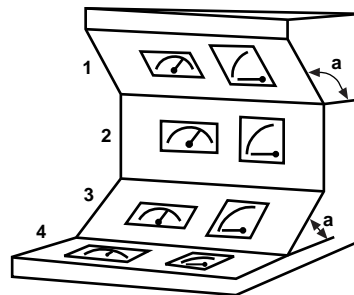
**Casings** DIN 43700  
72x72, 96x96, 144x144  
MODULAR (for DIN rail)

**Scales** Full scale value, DIN 43701  
Scale division, DIN 43802

**Pointers** DIN 43802

### Mounting position

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,  $\pm 0.25$  mm, 50 Hz

**Shock resistance** VDE 0410, Section 28: 15 g

**Operating temperature**  $-25^\circ\text{C}..+40^\circ\text{C}$

**Reference temperature**  $+10^\circ\text{C}..+30^\circ\text{C}$  (for accuracy class)

**Test voltage** 2kV, 50 Hz, 1 min.

**Tropicalization** DIN 40040 (on request)

**Protection** IP52, IP54 (on request) casings  
IP00, IP20 (on request) terminals

# ANALOGUE INSTRUMENTS

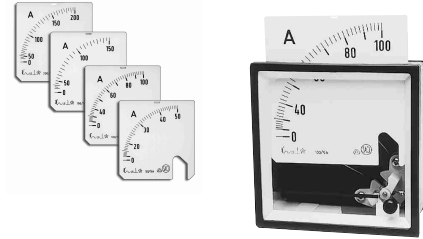
Analogue Instruments

## MOVING IRON

Voltage and alternating current. True effective value.

### AMMETERS (INTERCHANGEABLE SCALE)

- Measuring range: 5A, 1A
- Scale: 90°
- Accuracy: 1.5 %
- Frequency: 15..100 Hz
- Burden: 0.4 VA



Model	EC5VR	EC5V	EC4V	EC3V	EC4VP*	EC3VP*
Dimensions	mm 45x52,5 <small>DIN RAIL</small>	48x48	72x72	96x96	72x72	96x96
Approx.weight	Kg. 0,25	0,09	0,20	0,25	0,20	0,25
<b>CT OPERATED AMMETERS (INTERCHANGEABLE SCALE)</b>						
Module	A	X/5A or X/1A				
Scales	In	10; 15; 20; 25; 30; 40; 50; 60 or 75 A and multiples				
Module	2xIn	2X/5A or 2X/1A				
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	5xIn	5X/5A or 5X/1A				
Scales	5xIn	10..50; 15..75; 20..100; 25..125; 30..150; 40..200; 50..250; 60..300 or 75..375 A and multiples				

\* IP20 protection

### 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 <small>DIN RAIL</small>	48x48	72x72	96x96	144x144	80x64	105x80	130x100
Approx.weight	Kg. 0,20	0,09	0,20	0,25	0,50	0,14	0,18	0,25
<b>DIRECT INPUT AMMETERS</b>								
MEASURING RANGE	A	1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 30; 40; 50; 60; 75 or 100 A						
	In	1..2; 1,5..3; 2,5..5; 4..8; 5..10; 6..12						
	2xIn	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; 2,5..7,5; 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

# ANALOGUE INSTRUMENTS

Analogue Instruments

## 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 RAIL	48x48	72x72	96x96	144x144	80x64	105x80	130x100	
Approx. weight	Kg.	0,20	0,09	0,20	0,25	0,50	0,14	0,18	0,25	
MEASURING RANGE	mA	<b>AMMETERS (mA)</b>								
	In	100; 150; 250; 300; 400; 500 or 600 mA								
	2xIn	100..200; 150..300; 250..500; 300..600; 400..800; 500..1000 or 600..1200 mA								
	5xIn	100..500; 150..750; 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 RAIL	48x48	72x72	96x96
Approx. weight	Kg.	0,25	0,09	0,20	0,25
Module	V	<b>CT OPERATED VOLTMETERS (INTERCHANGEABLE SCALE)</b>			
		X/100V or X/110V			
	Vn	10; 12; 15; 20; 25; 30; 40; 50; 60; 75 or 80 V and multiples			

\* IP20 protection

## DIRECT INPUT VOLTMETERS

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



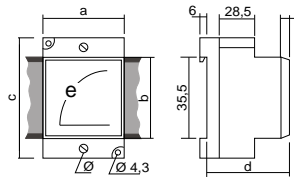
Model		EC5VR	EC5V	EC4V	EC3V	EC2V	Ecb7	Ecb3	Ecb8	EC4VP*	EC3VP*	
Dimensions	mm	45x52,5 DIN RAIL	48x48	72x72	96x96	144x144	80x64	105x80	130x100	72x72	96x96	
Approx. weight	Kg.	0,20	0,09	0,20	0,25	0,50	0,14	0,18	0,25	0,20	0,25	
MEASURING RANGE	V	<b>DIRECT INPUT VOLTMETERS</b>										
	Vn	6; 10; 15; 25; 40; 60; 100; 150; 250; 300; 400; 500 or 600 V									300 or 500 V	

\* IP20 protection

# ANALOGUE INSTRUMENTS

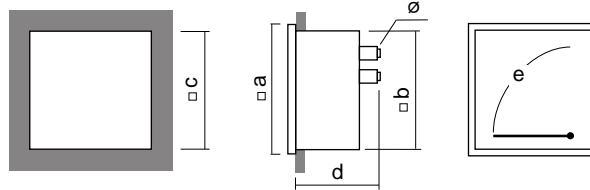
Analogue Instruments

Dimensions



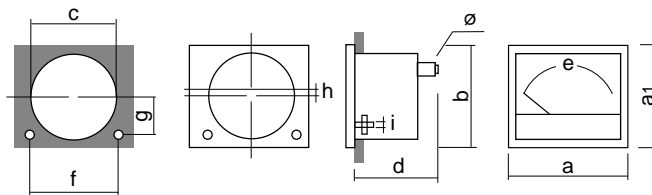
Models	Ranges	a	b	c	d	e	Ø
EC5VR	A - mA - V	52,5	45	75	60	38	M.6

Dimensions



Models	Ranges	a	b	c	d	e	Ø
EC5V	>15..40 A remainder	48	44,5	45+0,6	62	38	M.6
					59		M.4
EC4V	>15..100 A remainder	72	66,5	68+0,7	68	65	M.6
					60		M.4
EC3V	>15..100 A remainder	96	89	92+0,8	61	100	M.6
					59		M.4
EC2V	>15..100 A remainder	144	135	138+1	61	140	M.6
					59		M.4
EC4VP	A - V	72	66,5	68+0,7	58	65	M.4
EC3VP	A - V	96	89	92+0,8	58	100	M.4

Dimensions



Models	Ranges	axa1	b	c	d	e	f	g	h	i	Ø
ECb7	>15..50 A remainder	80x64	57,6	58,6+0,6	63	57	63	12,5	1,5	M.3	M.6
					55						M.4
ECb3	>15..50 A remainder	105x80	66	67+0,7	63	75	81	13	4,5	M.3	M.6
					55						M.4
ECb8	>15..50 A remainder	130x100	66	67+0,8	63	100	100	13	13	M.4	M.6
					55						M.4

Connection diagrams



# ANALOGUE INSTRUMENTS

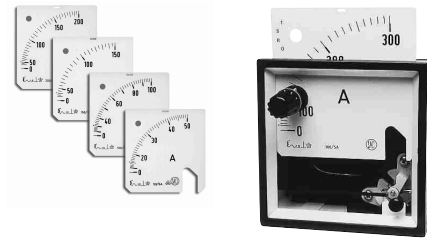
Analogue Instruments

## AMMETERS WITH SWITCH

(INTERCHANGEABLE SCALE)

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

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



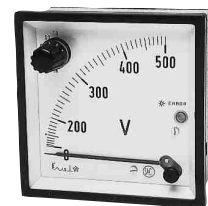
Model		EC4V4	EC3V4
Dimensions	mm	72x72	96x96
Approx. weight	Kg.	0,25	0,50
<b>AMMETERS WITH SWITCH (INTERCHANGEABLE SCALE)</b>			
Module	A	X/5A or X/1A	
Scales	In	10; 15; 20; 25; 30; 40; 50; 60 or 75 A and multiples	
Module	2xIn	2X/5A or 2X/1A	
Scales	2xIn	10..20; 15..30; 20..40; 25..50; 30..60; 40..80; 50..100; 60..120 or 75..150 A and multiples	
Module	5xIn	5X/5A or 5X/1A	
Scales	5xIn	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 (L1, L2, L3)

6-POSITION SWITCH (L1, L2, L3, L12, L13, L23)

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



Model		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
Conmutador		3 positions		6 positions		6 positions + sequence meter	
<b>CT OPERATED VOLTMETERS</b>							
Module	V	X/100 or X/110V					
Scales	Vn	10; 12; 15; 20; 25; 30; 40; 50; 60; 75 or 80 V and multiples					
<b>DIRECT INPUT VOLTMETERS</b>							
Measuring range	Vn	500 V					

\* EC4V7; EC3V7: with phase sequence indicator

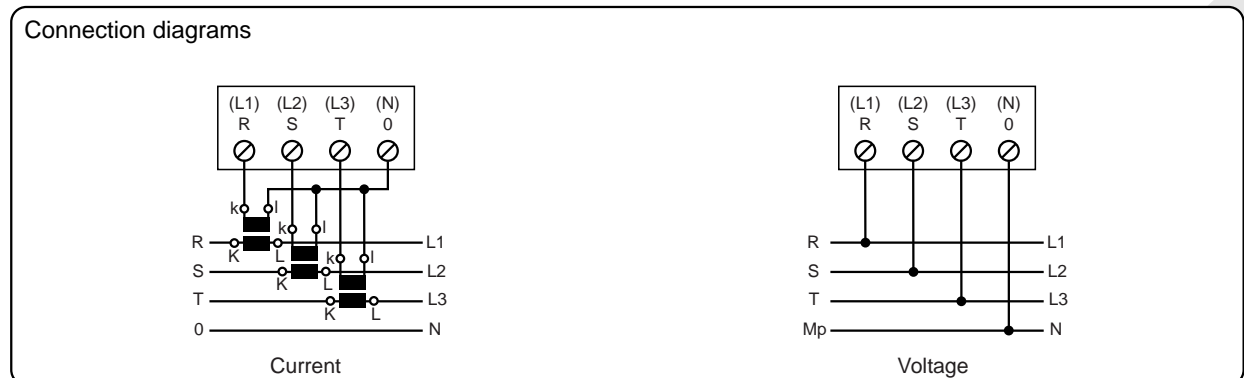


# ANALOGUE INSTRUMENTS

Analogue Instruments

Dimensions

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
		96	89	92+0,8	67	100	M.4



# ANALOGUE INSTRUMENTS

Analogue Instruments


## MOVING COIL WITH CONVERTER

Voltage and current measuring on alternating current circuits.

### AMMETERS VOLTMETERS

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

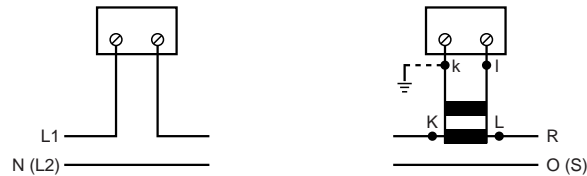


Model		EC5CE*	EC4CE	EC3CE	EC2CE
Dimensions	mm	48x48	72x72	96x96	144x144
Approx. weight	Kg.	0,84	0,84	0,87	1,55
					
<b>CT OPERATED AMMETERS</b>					
Measuring range	In	X/5A or X/1A			
Scales		10; 15; 20; 25; 30; 40; 50; 60 or 75 A and multiples			
Measuring range	2xIn	2X/5A or 2X/1A			
Scales		10..20; 15..30; 20..40; 25..50; 30..60; 40..80; 50..100; 60..120 or 75..150 A and multiples			
Measuring range	5xIn	5X/5A or 5X/1A			
Scales		10..50; 15..75; 20..100; 25..125; 30..150; 40..200; 50..250; 60..300 or 75..375 A and multiples			
<b>DIRECT INPUT AMMETERS</b>					
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			
<b>CT OPERATED VOLTMETERS</b>					
Measuring range	Vn	X/100V or X/110V			
Scales		10; 12; 15; 20; 25; 30; 40; 50; 60; 75 or 80 V and multiples			
<b>DIRECT INPUT VOLTMETERS</b>					
Measuring range	Vn	50; 60; 100; 150; 250; 300; 400; 500 or 600 V			

\* With additional module: MBRMS model

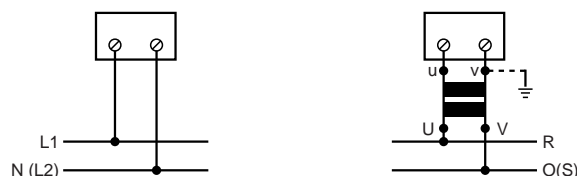
#### Connection diagrams

#### Current



#### Connection diagrams

#### Voltage



Dimensions

DIN rail MBRMS additional module

Weight = 0,240  
Plug-in connectors

Dimensions

Models	Range	a	b	c	d	e	ø
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

# ANALOGUE INSTRUMENTS

Analogue Instruments

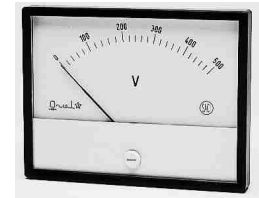
## MOVING COIL WITH RECTIFIER

Voltage and alternating current measuring (sinusoidal waveforms).

### AMMETERS ( $\mu\text{A}$ , mA and A)

### VOLTMETERS

- Scale:  $90^\circ$
- Accuracy: 1,5 %
- Frequency: 50 or 60 Hz



Model	CC5VGR	CC5VG	CC4VG	CC3VG	CC2VG	CCb7G	CCb3G	CCb8G
Dimensions mm	45x52,5 <small>DIN RAIL</small>	48x48	72x72	96x96	144x144	80x64	105x80	130x100
Approx. weight Kg.	0,10	0,10	0,20	0,28	0,50	0,15	0,19	0,25
<b>AMMETERS (<math>\mu\text{A}</math>, mA and A)</b>								
Measuring range	In	40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 $\mu\text{A}$						
		1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 mA						
		1; 1,5; 2,5; 4 or 5 A						
<b>CT OPERATED VOLTMETERS</b>								
Measuring range	Vn	X/100V or X/110V						
Scales		10; 12; 15; 20; 25; 30; 40; 50; 60; 75 or 80 V and multiples						
<b>DIRECT INPUT VOLTMETERS</b>								
Measuring range	Vn	6; 10; 15; 25; 40; 60; 100; 150; 250; 300; 400; 500 or 600 V						

### AMMETERS ( $\mu\text{A}$ , mA and A)

### VOLTMETERS

- Scale:  $240^\circ$
- Accuracy: 1,5 %
- Frequency: 50 or 60 Hz



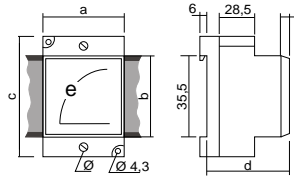
Model	CC5CG	CC4CG	CC3CG	CC2CG
Dimensions mm	48x48	72x72	96x96	144x144
Approx. weight Kg.	0,20	0,32	0,38	0,68
<b>AMMETERS (<math>\mu\text{A}</math>, mA and A)</b>				
Measuring range	In	150; 200; 300; 400; 500 or 600 $\mu\text{A}$		
		1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 mA		
		1; 1,5; 2,5; 4 or 5 A		
<b>CT OPERATED VOLTMETERS</b>				
Measuring range	Vn	X/100V or X/110V		
Scales		10; 12; 15; 20; 25; 30; 40; 50; 60; 75 or 80 V and multiples		
<b>DIRECT INPUT VOLTMETERS</b>				
Measuring range	Vn	6; 10; 15; 25; 40; 60; 100; 150; 250; 300; 400; 500 or 600 V		

Burden	
$\mu\text{A}$	1 V
mA	1 V
A	0,3 VA
V	1000 $\Omega$ / V

# ANALOGUE INSTRUMENTS

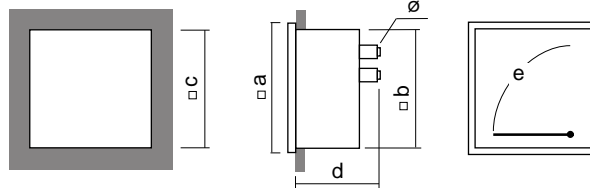
Analogue Instruments

Dimensions



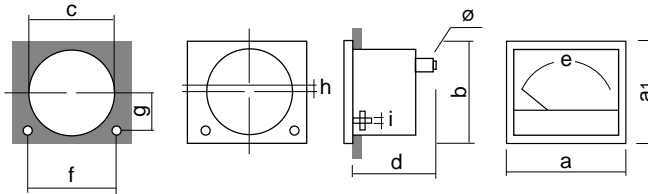
Models	Range	a	b	c	d	e	∅
CC5VRG	μA; mA; A; V	52,5	45	75	60	38	M.6

Dimensions



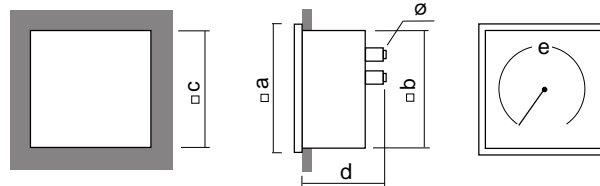
Models	Range	a	b	c	d	e	∅
CC5VG	μA; mA; A; V	48	44,5	45 <sup>+0,6</sup>	63	38	M.4
CC4VG	μA; mA; A; V	72	66,5	68 <sup>+0,7</sup>	64	65	M.4
CC3VG	μA; mA; A; V	96	89	92 <sup>+0,8</sup>	63	100	M.4
CC2VG	μA; mA; A; V	144	135	138 <sup>+1</sup>	63	140	M.4

Dimensions



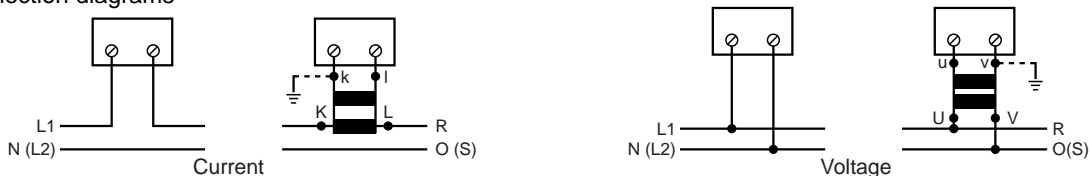
Models	Ranges	axa1	b	c	d	e	f	g	h	i	∅
CCb7G	μA; mA; A; V	80x64	57,6	58,6 <sup>+0,6</sup>	59	57	63	12,5	1,5	M.3	M.4
CCb3G	μA; mA; A; V	105x80	66	67 <sup>+0,7</sup>	59	75	81	13	4,5	M.3	M.4
CCb8G	μA; mA; A; V	130x100	66	67 <sup>+0,8</sup>	59	100	100	13	13	M.4	M.4

Dimensions



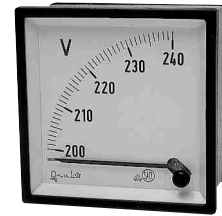
Models	Range	a	b	c	d	e	∅
CC5CG	μA; mA; A; V	48	44,5	45 <sup>+0,6</sup>	87	72	M.4
CC4CG	μA; mA; A; V	72	66,5	68 <sup>+0,7</sup>	92	101	M.4
CC3CG	..15 A	96	89	92 <sup>+0,8</sup>	92	140	M.4
	remainder				78		
CC2CG	μA; mA; A; V	144	135	138 <sup>+1</sup>	92	220	M.4

Connection diagrams



# ANALOGUE INSTRUMENTS

Analogue Instruments

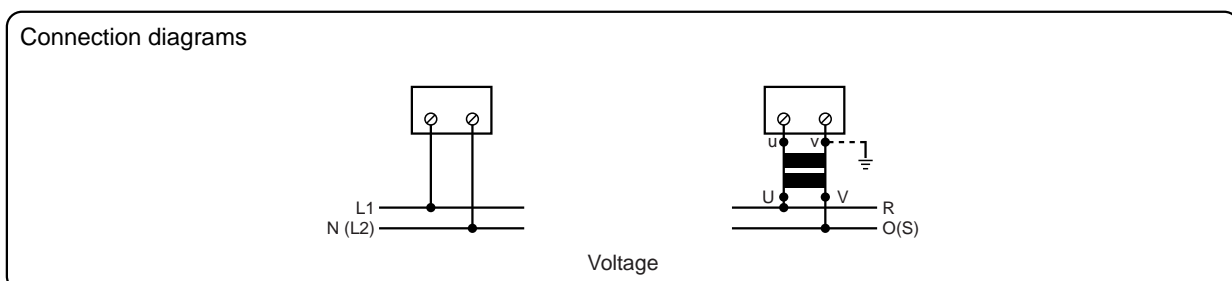


## RATED VALUE VOLTMETERS

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

Model		CC4VGN	CC3VGN	CC2VGN
Dimensions	mm	72x72	96x96	144x144
Approx. weight	Kg.	0,17	0,25	0,48
<b>VOLTMETERS</b>				
Measuring range	Vn	100; 110; 230 or 400 V		
Scales		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							
Models	Range	a	b	c	d	e	$\emptyset$
CC4VGN	V	72	66,5	68 <sup>+0,7</sup>	64	38	M.4
CC3VGN	V	96	89	92 <sup>+0,8</sup>	63	65	M.4
CC2VGN	V	144	135	138 <sup>+1</sup>	63	100	M.4



# ANALOGUE INSTRUMENTS

Analogue Instruments

## ELAPSED TIME METER

Operating time control of machines and equipment



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

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

Dimensions

Models	Range	a	b	c	d	ø
HC5	110÷400	48	44,5	45,2 <sup>+0,6</sup>	34	M.3
HC4	110÷400	72	66,5	68 <sup>+0,7</sup>	60	M.3
HC3	110÷400	96	89	92 <sup>+0,8</sup>	60	M.3

Connection diagrams

# ANALOGUE INSTRUMENTS

## PHASE SEQUENCE INDICATORS

Phase sequence detection on a three-phase system.



- Voltage (Vn): 100..600 V        - Burden: 1,2 VA
- Frequency: 50 or 60 Hz

Model		IRC4E	IRC3E
Dimensions	mm	72x72	96x96
Approx. weight	Kg.	0,20	0,26

Dimensions

Models	Range	a	b	c	d	ø
IRC4E	100÷600 V	72	66,5	68 <sup>+0,7</sup>	79	M.4
IRC3E	100÷600 V	96	89	92 <sup>+0,8</sup>	78	M.4

Connection diagrams

# ANALOGUE INSTRUMENTS

Analogue Instruments

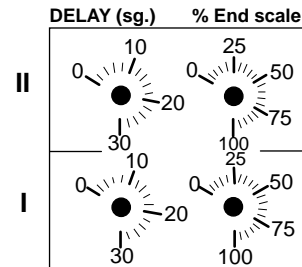
## INSTRUMENTS WITH CONTACTS

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

### MODELS

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

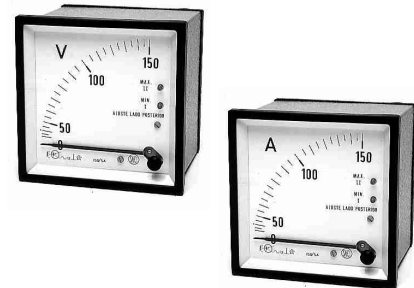
Setting: 0 - 100% of full scale value or  
 $\pm 100\%$  (bidirectional)  
Delay time: 0-30 s.  $\pm 10\%$   
Repeatability:  $\pm 1\%$  of full scale value  
Output relays: 2 (Max. 400 V, 1 A, 200 VA AC.)  
Mechanical life:  $10^7$  operations  
Control unit cover: Lockable  
Auxiliary power supply: 110, 230, 400 V AC.  
Burden, 3 VA.



Technical specifications same as pointer instruments.

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

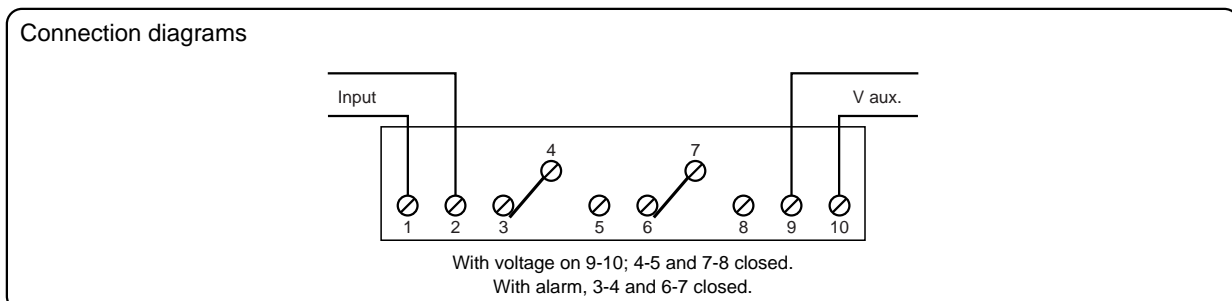
- Scale:  $90^\circ$       - Frequency: 50 or 60 Hz  
- Accuracy: 1,5 %



Model	..A/1		..A/2	
Contacts	1 Min.- and 1 Max.-		2 Max.-	
Dimensions mm	96x96		96x96	
Approx. weight Kg.	0,55		0,55	

Dimensions

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





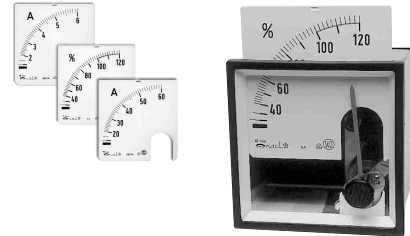
# ANALOGUE INSTRUMENTS

Analogue Instruments

## 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

Model	BC5VR*	BC5V*	BC4V	BC3V	BC2V***	BC4VP**	BC3VP**
Dimensions	mm 45x52,5 DIN RAIL	48x48	72x72	96x96	144x144	72x72	96x96
Approx. weight	Kg. 0,20	0,20	0,23	0,31	0,60	0,23	0,31
Module	A	<b>MAXIMUM DEMAND AMMETERS (INTERCHANGEABLE SCALE)</b>					
Scales	1,2xIn	1,2X/5A or 1,2X/1A 1,2; 6; 12; 18; 24; 30; 36; 48; 60; 72; 90 A or 120% and multiples					

\* 1.2X/5A only

\*\* 1.2X / 5A only, IP20 protection

\*\*\* 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



Model	BC4VA	BC3VA	BC2VA
Dimensions	mm 72x72	96x96	144x144
Approx. weight	Kg. 0,37	0,45	0,74
Module	A	<b>MAXIMUM DEMAND AMMETERS WITH CONTACTS</b>	
Scales	1,2xIn	1,2X/5A or 1,2X/1A 1,2; 6; 12; 18; 24; 30; 36; 48; 60; 72 or 90 A 120% and multiples	

#### ALARM CIRCUIT:

- Max. with contacts (red LED)
- Vaux: 100; 110; 230; 400 V (AC.)
- Burden: 3.75 VA (AC.)
- Vaux: 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

# ANALOGUE INSTRUMENTS

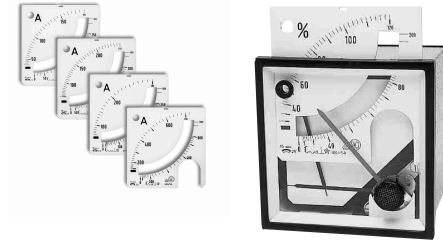
Analogue Instruments

## 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**	BEC4VP*	BEC3VP*
Dimensions	mm	72x72	96x96	144x144	72x72	96x96
Approx. weight	Kg.	0,23	0,31	0,60	0,23	0,31
		<b>DOUBLE AMMETERS (INTERCHANGEABLE SCALE)</b>				
<b>Module</b>	A					
Bimetal	1,2xIn	1,2X/5A or 1,2X/1A				
Moving iron	2xIn	2X/5A or 2X/1A				
<b>Scales</b>						
Bimetal	1,2xIn	1,2; 6; 12; 18; 24; 30; 36; 48; 60; 72; 90 A or 120%				
Moving iron	2xIn	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				

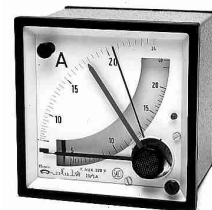
\* 1.2X/5A only

\*\* BEC2V, 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



Model		BEC4VA	BEC3VA	BEC2VA
Dimensions	mm	72x72	96x96	144x144
Approx. weight	Kg.	0,40	0,50	0,88
		<b>DOUBLE AMMETERS WITH CONTACTS</b>		
<b>Module</b>	A			
Bimetal	1,2xIn	1,2X/5A or 1,2X/1A		
Moving iron	2xIn	2X/5A or 2X/1A		
<b>Scales</b>				
Bimetal	1,2xIn	1,2; 6; 12; 18; 24; 30; 36; 48; 60; 72; 90 A or 120%		
Moving iron	2xIn	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		

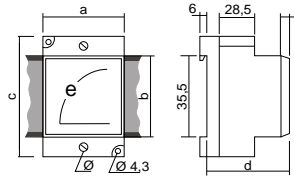
ALARM CIRCUIT:

- Max. with contacts (red LED)
- Vaux: 100; 110; 230; 400 V (AC.)
- Burden: 3.75 VA (AC.)
- Vaux: 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

# ANALOGUE INSTRUMENTS

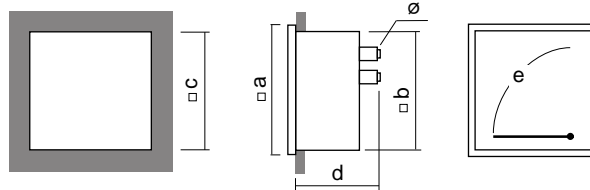
Analogue Instruments

Dimensions



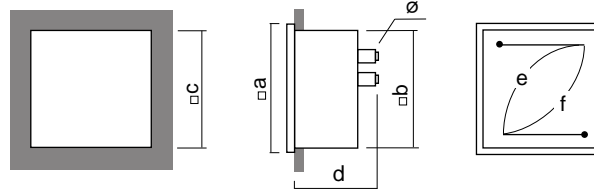
Models	Range	a	b	c	d	e	∅
BC5VR	/5 A	52,5	45	75	60	38	M.6

Dimensions



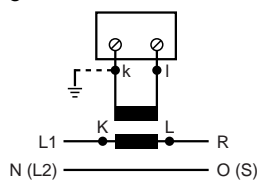
Models	Range	□ a	□ b	□ c	d	e	∅
BC5V	/5 A	48	44,5	45+0,6	59	38	M.4
BC4V	../1 ../5	72	66,5	68+0,7	88	65	M.4
BC3V	../1	96	89	92+0,8	92	100	M.4
	../5				88		
BC2V	../1 ../5	144	135	138+1	88	140	M.4
BC4VP	/5 A	72	66,5	68+0,7	58	65	M.4
BC3VP	/5 A	96	90	92+0,8	58	100	M.4
BC4VA	../1 ../5	72	66,5	68+0,7	93	65	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

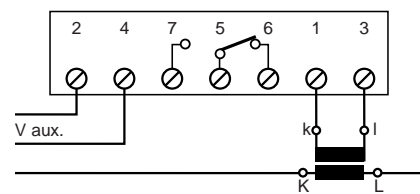


Models	Range	□ a	□ b	□ c	d	e	f	∅
BEC4V	../1	72	66,5	68+0,7	124	65	65	M.4
	../5				88			
BEC3V	../1	96	89	92+0,8	92	100	100	M.4
	../5				88			
BEC2V	../1 ../5	144	135	138+1	88	140	140	M.4
BEC4VP	/5 A	72	66,5	68+0,7	58	65	65	M.4
BEC3VP	/5 A	96	90	92+0,8	58	100	100	M.4
BEC4VA	../1 ../5	72	66,5	68+0,7	124	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



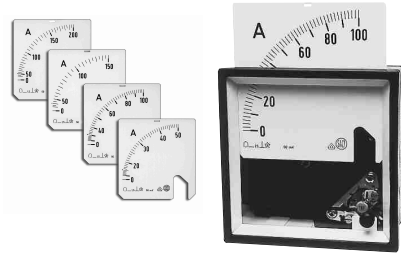
Maximum demand and double ammeters

# ANALOGUE INSTRUMENTS

Analogue Instruments

## 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	CC4VP*	CC3VP*
Dimensions mm	45x52,5 <small>DIN RAIL</small>	48x48	72x72	96x96	72x72	96x96
Approx. weight Kg.	0,10	0,09	0,21	0,28	0,21	0,28
<b>AMMETERS (INTERCHANGEABLE SCALE)</b>						
Module Vn	X/60 mV or X/150 mV					
Scales In	1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 30; 40; 50; 60; 80 or 100 A 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 <small>DIN RAIL</small>	48x48	72x72	96x96	144x144	80x64	105x80	130x100
Approx. weight Kg.	0,10	0,09	0,21	0,28	0,50	0,15	0,19	0,25
MEASURING RANGE	In	<b>AMMETERS (μA)</b>						
		40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 μA						
		<b>AMMETERS (mA)</b>						
		1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 mA						
	Vn	4-20 mA						
		<b>AMMETERS (A)</b>						
		1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 40 or 50 A						
		<b>VOLTMETERS (mV)</b>						
10; 15; 20; 25; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 mV								
<b>VOLTMETERS (V)</b>								
1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 V								

\* Up to 40 A

Internal resistor (Ω) / Burden																					
Range	1	1,5	2,5	4	5	6	10	15	20	25	40	50	60	100	150	250	300	400	500	600	4-20
μA	-	-	-	-	-	-	-	-	-	6380	1700	1520	1330	416	185	105	-	-	-	-	-
mA	31	16	5	15	12	10	6	4	3	2,4	1,5	1,2	1	0,6	0,4	0,24	0,2	0,15	0,12	0,1	-
A	60 mV approx.																				
V	1000 Ω / V approx.																				
mV	-	-	-	-	-	-	10	15	14	17	20	20	24	40	150	250	300	400	500	600	-

# ANALOGUE INSTRUMENTS

Analogue Instruments

Dimensions

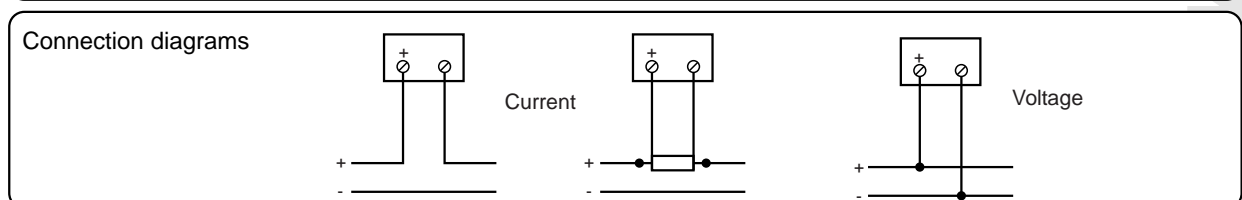
Models	Range	a	b	c	d	e	ø
CC5VR	µA; mA; A; V	52,5	45	75	60	38	M.6

Dimensions

Models	Range	a	b	c	d	e	ø
CC5V	x/60..x/150 mV	48	44,5	45 <sup>+0,6</sup>	59	38	M.4
CC4V	x/60..x/150 mV	72	66,5	68 <sup>+0,7</sup>	60	65	M.4
CC3V	x/60..x/150 mV	96	89	92 <sup>+0,8</sup>	59	100	M.4
CC5V	>4..15 A				63		M.4
	>15..50 A	48	44,5	45 <sup>+0,6</sup>	62	38	M.6
	remainder				59		M.4
CC4V	>4..15 A				63		M.4
	>15..50 A	72	66,5	68 <sup>+0,7</sup>	68	65	M.6
	remainder				60		M.4
CC3V	>4..15 A				63		M.4
	>15..50 A	96	89	92 <sup>+0,8</sup>	68	100	M.6
	remainder				59		M.4
CC2V	>4..15 A				63		M.4
	>15..50 A	144	135	138 <sup>+1</sup>	68	140	M.6
	remainder				59		M.4
CC4VP	x/60..x/150 mV	72	66,5	68 <sup>+0,7</sup>	58	65	M.4
CC3VP	x/60..x/150 mV	96	90	92 <sup>+0,8</sup>	58	100	M.4

Dimensions

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



# ANALOGUE INSTRUMENTS

Analogue Instruments

## AMMETERS ( $\mu\text{A}$ , mA and A) VOLTMETERS (mV, and V)

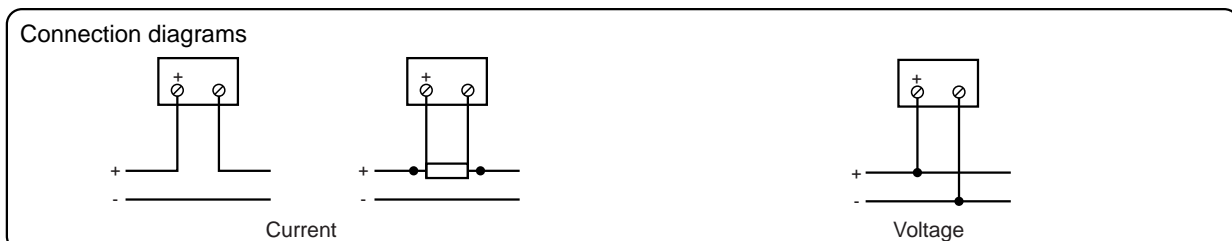
- Scale: 240°
- Accuracy: 1,5 %



Model		CC5C	CC4C	CC3C	CC2C
Dimensions	mm	48x48	72x72	96x96	144x144
Approx. weight	Kg.	0,20	0,32	0,38	0,68
MEASURING RANGE	In	<b>AMMETERS (<math>\mu\text{A}</math>, mA and A) - VOLTMETERS (mV, and V)</b>			
		150; 250; 300; 400; 500 or 600 $\mu\text{A}$			
		1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 40; 50; 60; 100; 150; 250; 300; 400; 500 or 600 mA			
		4-20 mA			
	1; 1,5; 2,5; 4; 5; 6; 10 or 15 A				
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				

Internal resistor ( $\Omega$ ) / Burden																					
Range	1	1,5	2,5	4	5	6	10	15	20	25	40	50	60	100	150	250	300	400	500	600	
$\mu\text{A}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1400			228		
mA	198	50	20	8	7	4	15	10	7,5	6	4	3	2,5	1,5	1	0,6	0,5	0,4	0,3	0,25	
A	150 mV approx.																				
V	1000 $\Omega$ / V approx.																				
mV	-	-	-	-	-	-	-	-	-	-	-	-	-	12	20	30	50	60	400	500	600

Dimensions							
Models	Range	a	b	c	d	e	$\phi$
CC5C	>4..15 A remainder	48	44,5	45 $\pm$ 0,6	87	72	M.4
					83		M.4
CC4C	>4..15 A remainder	72	66,5	68 $\pm$ 0,7	92	101	M.4
					88		M.4
CC3C	>4..15 A remainder	96	89	92 $\pm$ 0,8	78	140	M.4
					74		M.4
CC2C	>4..15 A remainder	144	135	138 $\pm$ 1	92	220	M.4
					88		M.4



# ANALOGUE INSTRUMENTS

Analogue Instruments

## 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 %

Model		CC5V	CC4V	CC3V
Dimensions	mm	48x48	72x72	96x96
Approx. weight	Kg.	0,10	0,21	0,28
<b>VOLTMETERS</b>				
MEASURING RANGE	Vn	0-1; 0-5; or 0-10 V		1-5 or 2-10 V
	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
<b>VOLTMETERS</b>				
MEASURING RANGE	Vn	0-1; 0-5; or 0-10 V		1-5 or 2-10 V
	In	0-1; 0-5; 0-10 or 0-20 mA		4-20 mA

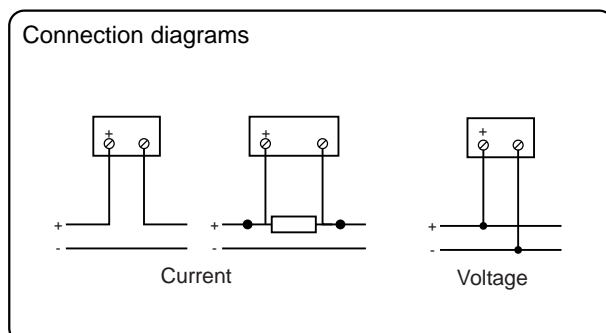
May be manufactured in several models and direct current ranges with or without suppressed zero. Other features as corresponding models.

Dimensions

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

Dimensions

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



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<sup>-1</sup> - m - l/h - pH - m<sup>3</sup>/h  
 mbar - bar - mm - m<sup>3</sup>/min - Kg - Kgcm - Kg/cm<sup>2</sup>  
 mm/sec - mmHg - mmH<sub>2</sub>O - dB - kPa - MPa

# ANALOGUE INSTRUMENTS

Analogue Instruments

## TEMPERATURE INDICATORS

Temperature measuring via thermocouples or thermoresistances.



- Scale: 90° - Accuracy: ±1,5 %

Model		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-PtRh)
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°		
Vaux	V	12, 24, 48 or 110 V D.C.				12, 24, 48 or 110 V D.C.				
						110, 230 or 400 V A.C.				

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.

### Connection diagrams

DIN thermocouple

Thermoresistances

### Dimensions

Models	Ranges	a	b	c	d	e	ø
CC4V	V	72	66,5	68 <sup>+0,7</sup>	60	65	M.4
CC3V	V	96	89	92 <sup>+0,8</sup>	59	100	M.4

## SPECIAL EXECUTIONS: MOBILE INSTRUMENTS

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

**Measuring range and scales: please enquire.**

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



### Dimensions



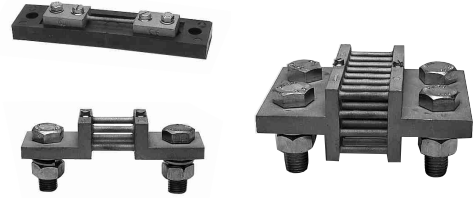
# ANALOGUE INSTRUMENTS

Analogue Instruments

## 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)

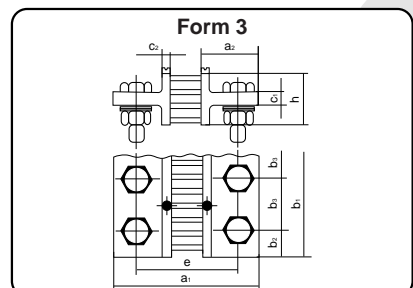
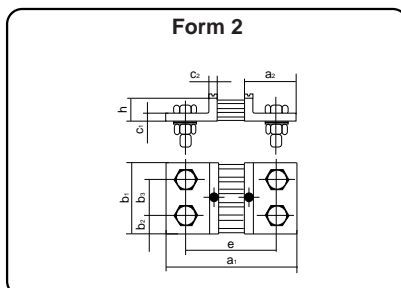
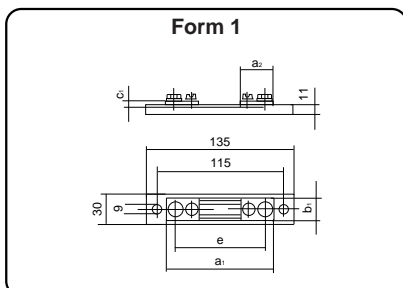


DIN 43703 standard							
Model		Form 1		Form 2		Form 3	
Voltage drop	mV	60 mV	150 mV	60 mV	150 mV	60 mV	150 mV
MEASURING RANGE	In	1; 1,5; 2,5; 4; 5; 6; 10; 15; 20; 25; 30; 40; 50; 60; 80; 100 or 150		200; 250; 300; 400; 500; 600; 750; 800; 1000; 1200; 1500; 2000 or 2500		200; 250; 300; 400; 500; 600; 750; 800 or 1000	
		3000 or 4000		1200; 1500; 2000 or 2500			

Approximate 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	c2	e	h	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	90	28	20	-	-	8	-	78	-	2 x 1	M.5x12	5,3	-	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	-	10	10	115	30	2 x 2	M.16x45	17	M.16	
	750*; 800*; 1000	2	165	65	60	30	-	10	10	115	30	2 x 2	M.20x50	21	M.20	
	1200*; 1500				90	21	48	10	10	115	30	2 x 2	M.16x45	17	M.16	
	2000*; 2500	2	165	65	120	30	60	10	10	115	30	2 x 2	M.20x50	21	M.20	
3000*; 4000	15				10	115	60	2 x 2	M.20x60	21	M.20					
150	1; 1,5; 2,5; 4; 5*; 6; 10; 15; 20*; 25	1	90	28	20	-	-	8	-	78	-	2 x 1	M.5x12	5,3	-	
	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	-	10	10	230	50	2 x 1	M.12x40	13	M.12	
	300*; 400; 500*; 600				40	20	-	10	10	240	50		2 x 1	M.16x45	17	
	750*; 800*	2	275	85	42,5	-	-	10	10	240	50	2 x 2	M.20x60	21	M.20	
	1000*				21	43	10	10	240	60	2 x 2		M.16x45	17	M.16	
	1200*; 1500	3	290	65	90	21	48	15	10	240	60	2 x 2	M.16x60	17	M.16	
2000*; 2500	120				30	60	15	10	240	60	2 x 2		M.20x60	21	M.20	

\* Non-DIN ranges, but of standard production.



# ANALOGUE INSTRUMENTS

Analogue Instruments

## FREQUENCY METERS

System frequency measuring.

### REED FREQUENCY METERS

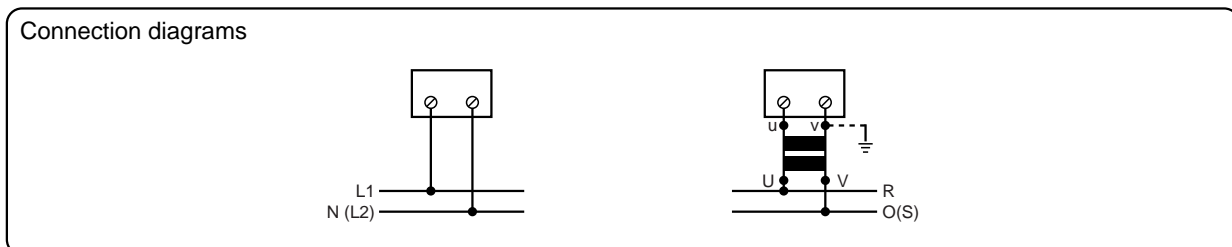
- Voltage range:  $\pm 15\% V_n$
- Accuracy: 0,5 %
- Voltage ( $V_n$ ): 100, 110
- Burden: 1,2..2,2 VA
- 230, 400, 440 V
- FC3VI, FC2VI:  
2x(1,2..2,2 VA)



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						
Reeds	7	13	13	17	21	2x17
Scales	Hz	48,5..51,5	47..53	47..53	46..54	45..55
		58,5..61,5	57..63	57..63	56..64	55..65

Dimensions

Models	Range	a	b	c	d	ø
FC5V	100÷440	48	44,5	45 <sup>+0,6</sup>	59	M.4
FC4V	100÷440	72	66,5	68 <sup>+0,7</sup>	75	M.4
FC3V	100÷440	96	89	92 <sup>+0,8</sup>	74	M.4
FC2V	100÷440	144	135	138 <sup>+1</sup>	88	M.4
FC3VI	100÷440	96	89	92 <sup>+0,8</sup>	124	M.4
FC2VI	100÷440	144	135	138 <sup>+1</sup>	88	M.4



# ANALOGUE INSTRUMENTS

Analogue Instruments

## POINTER FREQUENCY METERS

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



90° SCALE											
Model		FC5AR	FC5A	FC4A	FC3A	FC2A	FC5ARI	FC5AI	FC4AI	FC3AI	FC2AI
Dimensions	mm	45x52,5 DIN RAIL	48x48	72x72	96x96	144x144	45x52,5 DIN RAIL	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				

240° SCALE										
Model		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

DIN rail MBF module

Weight = 0,120  
Plug-in connectors

Dimensions

Models	Range	a	b	c	d	e	ø
FC5AR	100÷230	52,5	45	75	60	38	M.6
FC5AIR	100÷230	52,5	45	75	60	38	M.6

# ANALOGUE INSTRUMENTS

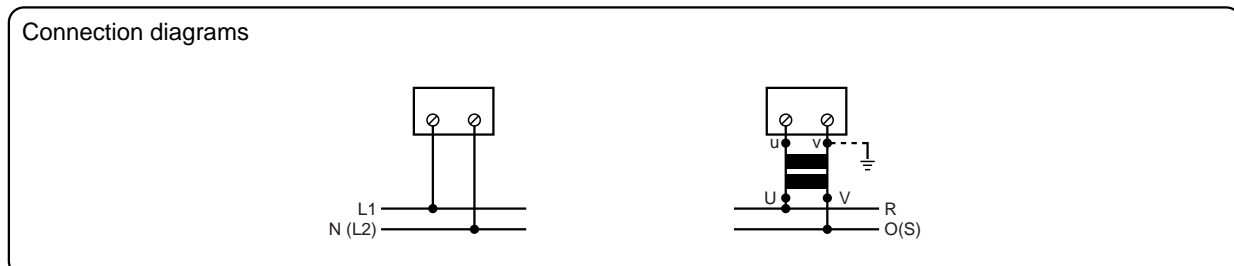
Analogue Instruments

Dimensions

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

Dimensions

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



# ANALOGUE INSTRUMENTS

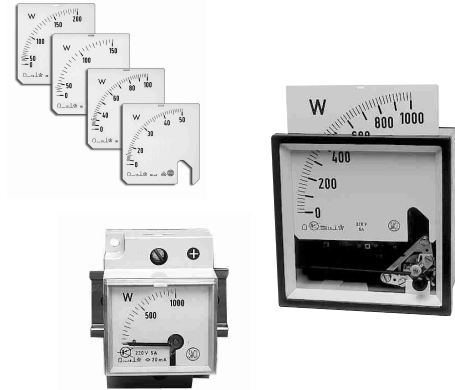
Analogue Instruments

## 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				
Dimensions	mm	45x52,5 DIN RAIL	48x48	72x72	96x96	144x144
<b>AC. SINGLE-PHASE - BALANCED THREE-PHASE</b>						
Approx. weight	Kg.	0,55	0,55	0,55	0,84	0,84
AC. Single-phase		<b>WC5VRE*</b>	<b>WC5VE*</b>	<b>WC4VE*</b>	<b>WC3VE</b>	<b>WC2VE</b>
Three-phase, 3 or 4 wire		<b>WC5VRIE*</b>	<b>WC5VIE*</b>	<b>WC4VIE*</b>	<b>WC3VIE</b>	<b>WC2VIE</b>
<b>UNBALANCED THREE-PHASE</b>						
Approx. weight	Kg.	1,00	1,00	1,00	1,55	1,55
Three-phase, 3 wire		<b>WC5VRIIE*</b>	<b>WC5VRIIE*</b>	<b>WC4VRIIE*</b>	<b>WC3VRIIE</b>	<b>WC2VRIIE</b>
Three-phase, 4 wire		<b>WC5VR3E*</b>	<b>WC5V3E*</b>	<b>WC4V3E*</b>	<b>WC3V3E</b>	<b>WC2V3E</b>

		240° SCALE			
Dimensions	mm	48x48	72x72	96x96	144x144
<b>AC. SINGLE-PHASE - BALANCED THREE-PHASE</b>					
Approx. weight	Kg.	0,55	0,55	0,84	0,84
AC. Single-phase		<b>WC5CE*</b>	<b>WC4CE*</b>	<b>WC3CE</b>	<b>WC2CE</b>
Three-phase, 3 or 4 wire		<b>WC5CIE*</b>	<b>WC4CIE*</b>	<b>WC3CIE</b>	<b>WC2CIE</b>
<b>UNBALANCED THREE-PHASE</b>					
Approx. weight	Kg.	1,00	1,00	1,55	1,55
Three-phase, 3 wire		<b>WC5CIIIE*</b>	<b>WC4CIIIE*</b>	<b>WC3CIIIE</b>	<b>WC2CIIIE</b>
Three-phase, 4 wire		<b>WC5C3E*</b>	<b>WC4C3E*</b>	<b>WC3C3E</b>	<b>WC2C3E</b>

\* 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
Transformer	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
Transformer	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 A29-30.

# ANALOGUE INSTRUMENTS

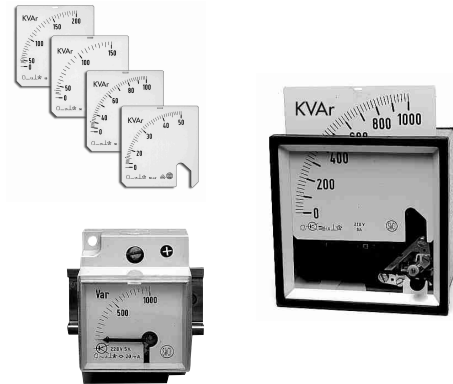
Analogue Instruments

## 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				
Dimensions	mm	45x52,5 DIN RAIL	48x48	72x72	96x96	144x144
<b>AC. SINGLE-PHASE - BALANCED THREE-PHASE</b>						
Approx. weight	Kg.	0,55	0,55	0,55	0,84	0,84
AC. Single-phase		<b>WC5VRrE*</b>	<b>WC5VrE*</b>	<b>WC4VrE*</b>	<b>WC3VrE</b>	<b>WC2VrE</b>
Three-phase, 3 or 4 wire		<b>WC5VRIrE*</b>	<b>WC5VIrE*</b>	<b>WC4VIrE*</b>	<b>WC3VIrE</b>	<b>WC2VIrE</b>
<b>UNBALANCED THREE-PHASE</b>						
Approx. weight	Kg.	1,00	1,00	1,00	1,55	1,55
Three-phase, 3 wire		<b>WC5VRlIrE*</b>	<b>WC5VlIrE*</b>	<b>WC4VlIrE*</b>	<b>WC3VlIrE</b>	<b>WC2VlIrE</b>
Three-phase, 4 wire		<b>WC5VR3rE*</b>	<b>WC5V3rE*</b>	<b>WC4V3rE*</b>	<b>WC3V3rE</b>	<b>WC2V3rE</b>

		240° SCALE			
Dimensions	mm	48x48	72x72	96x96	144x144
<b>AC. SINGLE-PHASE - BALANCED THREE-PHASE</b>					
Approx. weight	Kg.	0,55	0,55	0,84	0,84
AC. Single-phase		<b>WC5CrE*</b>	<b>WC4CrE*</b>	<b>WC3CrE</b>	<b>WC2CrE</b>
Three-phase, 3 or 4 wire		<b>WC5ClrE*</b>	<b>WC4ClrE*</b>	<b>WC3ClrE</b>	<b>WC2ClrE</b>
<b>UNBALANCED THREE-PHASE</b>					
Approx. weight	Kg.	1,00	1,00	1,55	1,55
Three-phase, 3 wire		<b>WC5ClIrE*</b>	<b>WC4ClIrE*</b>	<b>WC3ClIrE</b>	<b>WC2ClIrE</b>
Three-phase, 4 wire		<b>WC5C3rE*</b>	<b>WC4C3rE*</b>	<b>WC3C3rE</b>	<b>WC2C3rE</b>

\* 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 A29-30.

# ANALOGUE INSTRUMENTS

Analogue Instruments

Dimensions DIN rail MBW and MBWr modules

Weight = 0,240  
Plug-in connectors

Dimensions

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

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

Dimensions

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

# ANALOGUE INSTRUMENTS

Analogue Instruments

<p>Connection diagrams</p> <p>Connection: Direct input</p>	<p>Single-phase, Active and Reactive Power</p> <p>Current Transf.</p>	<p>Transf. Voltage</p>
<p>Connection diagrams</p> <p>Connection: Direct input</p>	<p>Balanced three-phase, Active and Reactive Power</p> <p>Current Transf.</p>	<p>Voltage Transf.</p>
<p>Connection diagrams</p> <p>Connection: Direct input</p>	<p>4 wire balanced three-phase, Active and Reactive Power</p> <p>Current Transf.</p>	<p>Voltage Transf.</p>
<p>Connection diagrams</p> <p>Connection: Direct input</p>	<p>3 wire unbalanced three-phase, Active and Reactive Power</p> <p>Current Transf.</p>	<p>Voltage Transf.</p>
<p>Connection diagrams</p> <p>Connection: Direct input</p>	<p>4 wire unbalanced three-phase, Active and Reactive Power</p> <p>Current Transf.</p>	<p>Voltage Transf.</p>
<p>Connection diagrams</p> <p>Connection: Direct input</p>	<p>3 syst. unbalanced three-phase, Active and Reactive Power</p> <p>Current Transf.</p>	<p>Voltage Transf.</p>



# ANALOGUE INSTRUMENTS

Analogue Instruments

## WATTMETERS (INDUCTION)

## VARMETERS (INDUCTION)

System active/reactive power measuring

### Alternating current

- Scale: 90°
- Frequency: 50, 60 Hz
- Voltage range:  $\pm 15\%$  Vn
- Voltage (Vn): 100, 110  
230, 400, 440 V
- Current input (In): 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
<b>AC. SINGLE-PHASE - BALANCED THREE-PHASE</b>					
Approx. weight	Kg.	0,55	0,84	0,55	0,84
AC. Single-phase		<b>WC3V</b>	<b>WC2V</b>	<b>WC3Vr</b>	<b>WC2Vr</b>
Three-phase, 3 or 4 wire		<b>WC3VI</b>	<b>WC2VI</b>	<b>WC3Vlr</b>	<b>WC2Vlr</b>
<b>UNBALANCED THREE-PHASE</b>					
Approx. weight	Kg.	1,00	1,55	1,00	1,55
Three-phase, 3 wire		<b>WC3VII</b>	<b>WC2VII</b>	<b>WC3VIIr</b>	<b>WC2VIIr</b>
Three-phase, 4 wire		<b>WC3VIIIn</b>	<b>WC2VIIIn</b>	<b>WC3VIIInr</b>	<b>WC2VIIInr</b>

- Full scale value: 0,6..1,2 P<sub>a</sub>

$$P_a = V_n \cdot I_n \quad (\text{Single-phase, Alternating current})$$

$$P_a = V_n \cdot I_n \cdot \sqrt{3} \quad (\text{Three-phase})$$

If not indicated otherwise, full scale value will be P<sub>a</sub> rounded up to 1; 1.2; 1.5; 2; 2.5; 3; 4; 5; 6; 7.5; 8 and MULTIPLES

Dimensions								
Active power model	Reactive power model	Range	a	b	c	d	e	ø
<b>WC3V</b>	<b>WC3Vr</b>					88		
<b>WC3VI</b>	<b>WC3Vlr</b>	..5 ..1	96	89	92 <sup>+0,8</sup>	88	100	M.4
<b>WC3VII</b>	<b>WC3VIIr</b>					135		
<b>WC3VIIIn</b>	<b>WC3VIIInr</b>					135		
<b>WC2V</b>	<b>WC2Vr</b>					88		
<b>WC2VI</b>	<b>WC2Vlr</b>	..5 ..1	144	135	138 <sup>+1</sup>	88	140	M.4
<b>WC2VII</b>	<b>WC2VIIr</b>					135		
<b>WC2VIIIn</b>	<b>WC2VIIInr</b>					135		

Connection diagrams available on page A30.

# ANALOGUE INSTRUMENTS

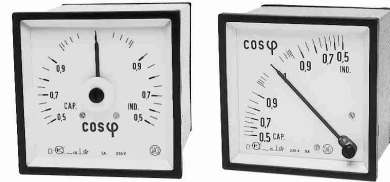
Analogue Instruments

## 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 % de 90° eléctricos
  - Burden: 6,5 mA  
(Voltage circuits)
  - Burden: 1 VA  
(Current circuits)

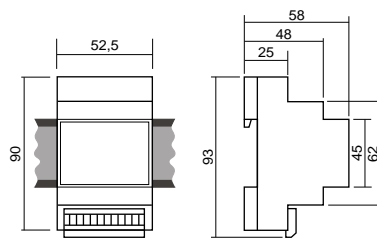


		90° SCALE		90° SCALE		
Dimensions	mm	45x52,5 DIN RAIL	48x48	72x72	96x96	144x144
<b>AC. SINGLE-PHASE - BALANCED THREE-PHASE</b>						
Approx. weight	Kg.	0,48	0,48	0,48	0,73	0,73
AC. Single-phase		<b>SC5VRE*</b>	<b>SC5VE*</b>	<b>SC4VE*</b>	<b>SC3VE</b>	<b>SC2VE</b>
Three-phase, 3 wire		<b>SC5VRIE*</b>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

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

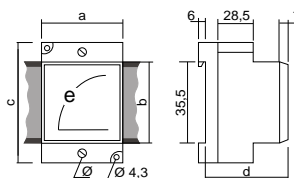
\* With additional module: MBPF model

DIN rail MBPF module



Weight = 0,120  
Plug-in connectors

### Dimensions



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

# ANALOGUE INSTRUMENTS

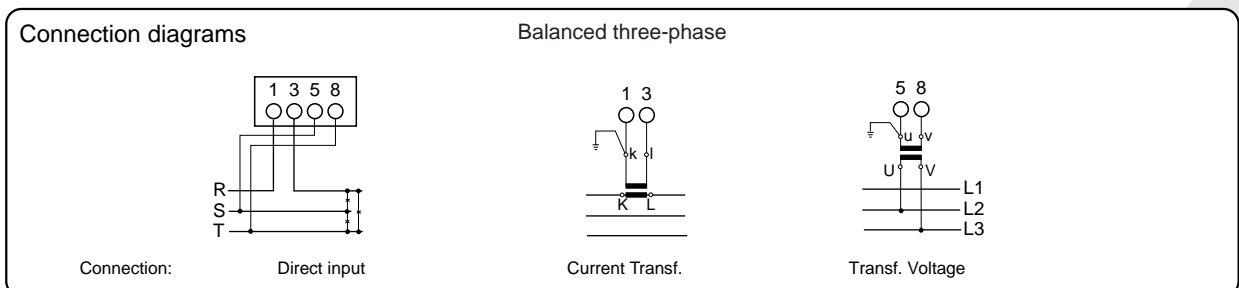
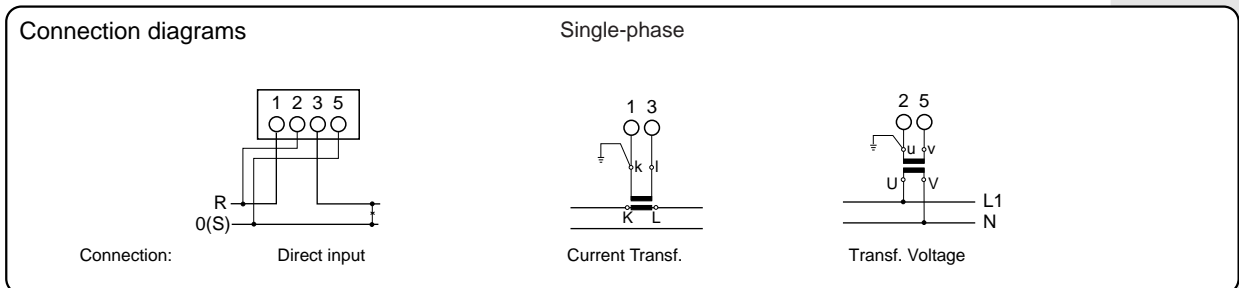
Analogue Instruments

Dimensions

Models	Range	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

Models	Range	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



# ANALOGUE INSTRUMENTS

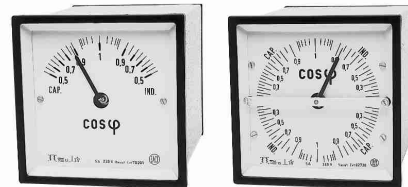
Analogue Instruments

## 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)



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

\* 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		Diagram					
<b>Models</b>	<b>Range</b>	$\square$ a	$\square$ b	$\square$ c	d	e	$\emptyset$
SC3V	100÷440				135		
SC3VI	100÷440	96	89	92 <sup>+0,8</sup>	135	73	M.4
SC3VII	100÷440				165		
SC3VIIIn	100÷440				165		
SC2V	100÷440				135		
SC2VI	100÷440	144	135	138 <sup>+1</sup>	135	160	M.4
SC2VII	100÷440				165		
SC2VIIIn	100÷440				165		

Dimensions		Diagram					
<b>Models</b>	<b>Range</b>	$\square$ a	$\square$ b	$\square$ c	d	e	$\emptyset$
SC3C	100÷440						
SC3CI	100÷440	96	89	92 <sup>+0,8</sup>	124	210	M.4
SC3CII	100÷440						
SC3CIIIn	100÷440						
SC2C	100÷440						
SC2CI	100÷440	144	135	138 <sup>+1</sup>	135	330	M.4
SC2CII	100÷440						
SC2CIIIn	100÷440						

Resistor boxes on page A34.

# ANALOGUE INSTRUMENTS

## Analogue Instruments

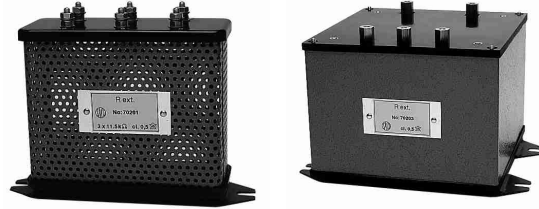
<p>Connection diagrams</p> <p>Connection: Direct input</p>	<p>Current Transf.</p>	<p>Transf. Voltage</p>
<p>Connection diagrams</p> <p>Connection: Direct input</p>	<p>Current Transf.</p>	<p>Transf. Voltage</p>
<p>Connection diagrams</p> <p>Connection: Direct input</p>	<p>Current Transf.</p>	<p>Transf. Voltage</p>
<p>Connection diagrams</p> <p>Connection: Direct input</p>	<p>Current Transf.</p>	<p>Transf. Voltage</p>
<p>Connection diagrams</p> <p>Connection: Direct input</p>	<p>Current Transf.</p>	<p>Transf. Voltage</p>
<p>Connection diagrams</p> <p>Connection: Direct input</p>	<p>Current Transf.</p>	<p>Transf. Voltage</p>
<p>Connection diagrams</p> <p>Connection: Direct input</p>	<p>Current Transf.</p>	<p>Transf. Voltage</p>

# ANALOGUE INSTRUMENTS

Analogue Instruments

## RESISTOR BOXES

Connection to measuring elements.



- Accuracy: 0,5 %

Model	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

Model	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

Model	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

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

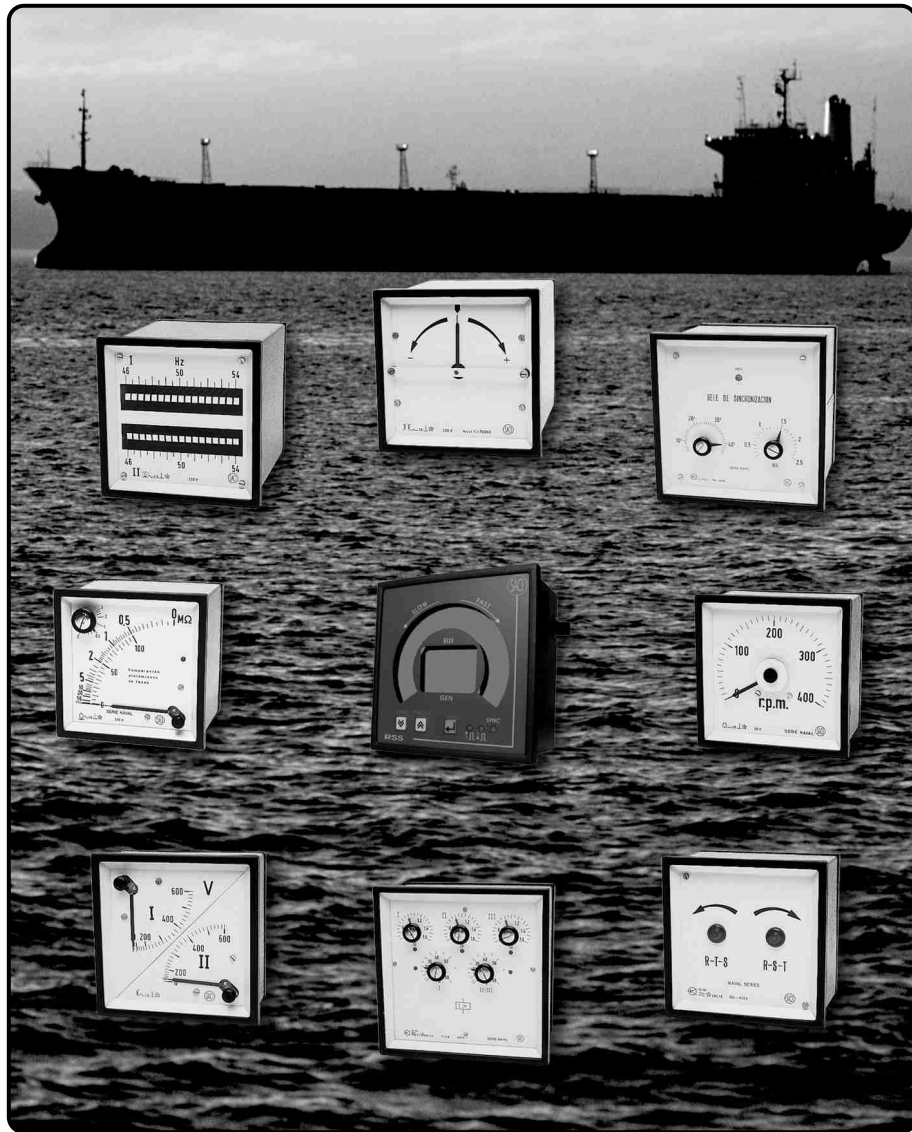
Dimensions

Model	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

Model
4.5.1
4.6.1
4.8.1

# SYNCHRONIZATION RELAYS INSTRUMENTS FOR VESSELS



Armaloué

# ANALOGUE INSTRUMENTS

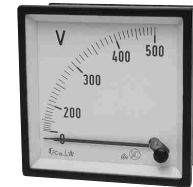
## MEASURING INSTRUMENTS FOR VESSELS

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.

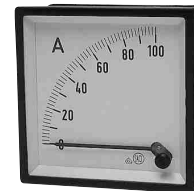
In the event of being connected to voltage transformers, the full scale will be 1.2 of the value of the transformer primary as a minimum. This will be marked with a red line.



### AMMETER

Its full scale value will be 1.3 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.





# ANALOGUE INSTRUMENTS

Analogue Instruments

## 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 parameters 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

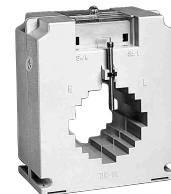
The instrument must be supplied directly by the three phases via a leakage analysis switch and never to the voltage transformer secondaries. The system power supply voltage and the available auxiliary power supply of the alarm circuit will be indicated.

This instrument must never be connected to three-phase systems with neutral connected to earth.



### CURRENT TRANSFORMERS

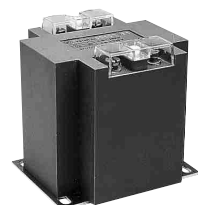
Their power depends on the consumption of the instruments to be connected. At least 10VA in class 0.5 is recommended to avoid accuracy and angle errors. Polarity must be correct.



### VOLTAGE TRANSFORMERS

The TE-15R model is specially designed for this application due to its power and accuracy (25VA, 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.



# ANALOGUE INSTRUMENTS FOR SYNCHRONIZING INSTRUMENTS

Analogue 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	
<b>DOUBLE VOLTMETERS</b>						
Measuring range	Vn	2x100 V	2x110 V	2x230 V	2x400 V	2x440 V
Scales		2x160 V	2x175 V	2x365 V	2x635 V	2x700 V

## DIFFERENTIAL VOLTMETERS

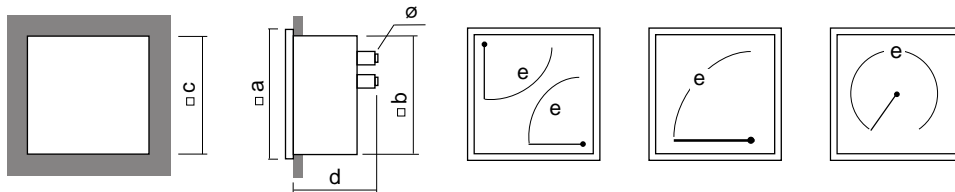
Difference (%) between two synchronizing voltages.

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



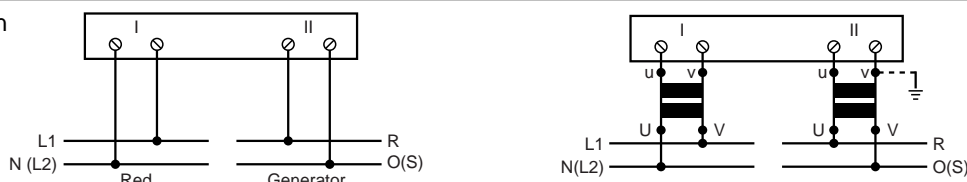
Model		CC3VGD		CC2VGD		CC3CGD		CC2CGD	
Dimensions	mm	96x96		144x144		96x96		144x144	
Approx. weight	Kg.	0,40		0,65		0,74		0,80	
<b>DIFFERENTIAL VOLTMETERS</b>									
Scales		100..15 - 0 - 15..100 % ΔV							

### Dimensions



Models	Range	a	b	c	d	e	ø
EC3VII	100÷440	96	89	92 <sup>+0,8</sup>	59	2x55	M.4
EC2VII	100÷440	144	135	138 <sup>+1</sup>	59	2x68	M.4
CC3VGD	100÷440	96	89	92 <sup>+0,8</sup>	78	100	M.4
CC2VGD	100÷440	144	135	138 <sup>+1</sup>	92	140	M.4
CC3CGD	100÷440	96	89	92 <sup>+0,8</sup>	128	140	M.4
CC2CGD	100÷440	144	135	138 <sup>+1</sup>	92	220	M.4

### Connection diagrams



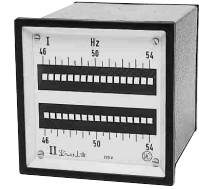
# ANALOGUE INSTRUMENTS

Analogue Instruments

## DOUBLE FREQUENCY METERS (REEDS OR POINTERS)

Double measurement (two systems) of two system frequencies.

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



Model		FC3VII	FC2VII
Dimensions	mm	96x96	144x144
Approx. weight	Kg.	0,87	1,25
<b>DOUBLE FREQUENCY METERS</b>			
Reeds		17	21
Scales	Hz	46..54 or 56..64	45..55 or 55..65

## DIFFERENTIAL FREQUENCY METERS

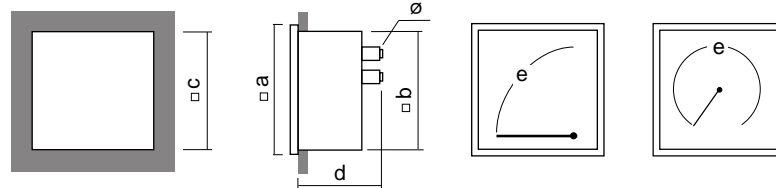
Frequency difference (%) between two systems.

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



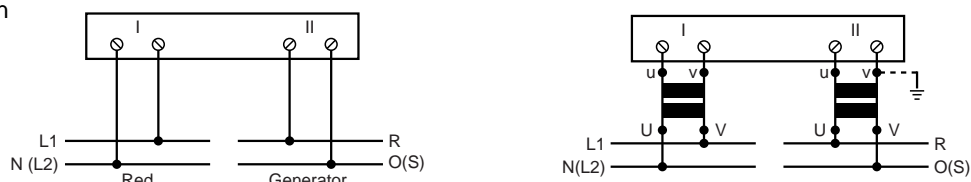
Model		FC3AD	FC2AD	FC3CD	FC2CD
Dimensions	mm	96x96	144x144	96x96	144x144
Approx. weight	Kg.	0,32	0,50	0,55	0,75
<b>DIFFERENTIAL FREQUENCY METERS</b>					
Scales	%	10 - 0 - 10 % $\Delta$ Hz			

### Dimensions



Models	Range	a	b	c	d	e	ø
FC3AD	100÷440	96	89	92 <sup>+0,8</sup>	78	100	M.4
FC2AD	100÷440	144	135	138 <sup>+1</sup>	92	140	M.4
FC3CD	100÷440	96	89	92 <sup>+0,8</sup>	128	140	M.4
FC2CD	100÷440	144	135	138 <sup>+1</sup>	92	220	M.4
FC3VII	100÷440	96	89	92 <sup>+0,8</sup>	124	-	M.4
FC2VII	100÷440	144	135	138 <sup>+1</sup>	88	-	M.4

### Connection diagrams



# ANALOGUE INSTRUMENTS

Analogue Instruments

## 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 % de 90° eléctricos
- 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							
Models	Range	a	b	c	d	e	ø
SC3V-360°	100÷440	96	89	92 <sup>+0,8</sup>	135	100	M.4
SC3VI-360°	100÷440	96	89	92 <sup>+0,8</sup>	135	100	M.4
SC2V-360°	100÷440	144	135	138 <sup>+1</sup>	135	140	M.4
SC2VI-360°	100÷440	144	135	138 <sup>+1</sup>	135	140	M.4

Resistor boxes on page A36.

# ANALOGUE INSTRUMENTS

Analogue Instruments

<p>Connection diagrams</p>		<p>Single-phase (100, 110, 230 V)</p>
<p>Connection:</p> <p>Transf. Voltage                      Direct input                      Transf. Voltage</p>		
<p>Connection diagrams</p>		<p>Single-phase (400, 440 V)</p>
<p>Connection:</p> <p>Transf. Voltage                      Direct input                      Transf. Voltage</p>		
<p>Connection diagrams</p>		<p>Three-phase (100, 110 V)</p>
<p>Connection:</p> <p>Transf. Voltage                      Direct input                      Transf. Voltage</p>		
<p>Connection diagrams</p>		<p>Three-phase (230 V)</p>
<p>Connection:</p> <p>Transf. Voltage                      Direct input                      Transf. Voltage</p>		
<p>Connection diagrams</p>		<p>Three-phase (400, 440 V)</p>
<p>Connection:</p> <p>Transf. Voltage                      Direct input                      Transf. Voltage</p>		

# ANALOGUE INSTRUMENTS

Analogue Instruments

## LAMP SYNCHROSCOPE

Genset synchronization for manual operation.

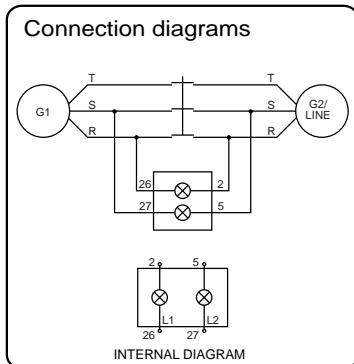


### ALTERNATING CURRENT - NAVAL SERIES

- 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.



Dimensions

Models	Range	a	b	c	d	ø
SC3VL	110÷440	96	89	92 <sup>+0,5</sup>	78	M.4
SC2VL	110÷440	144	135	138 <sup>+1</sup>	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

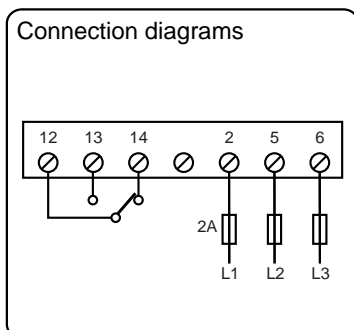
- Frequency: 50 or 60 Hz    - Burden: 1,2 VA    - Voltage: 110, 230, 400 or 440 V  $\pm 20\%$

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



Dimensions

Models	Range	a	b	c	d	ø
RSQ	110-440	96	89	92 <sup>+0,8</sup>	78	M.4

# ANALOGUE INSTRUMENTS

Analogue Instruments

## 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  $\pm 20\%$
- Accuracy: 0,5 %
- Frequency range: 45 a 65 Hz
- Accuracy: 0,1 %
- Phase-difference range:  $\pm 180^\circ$
- Accuracy: 1 %
- Voltage-difference range:  $\pm 100\%$
- Accuracy: 1 %

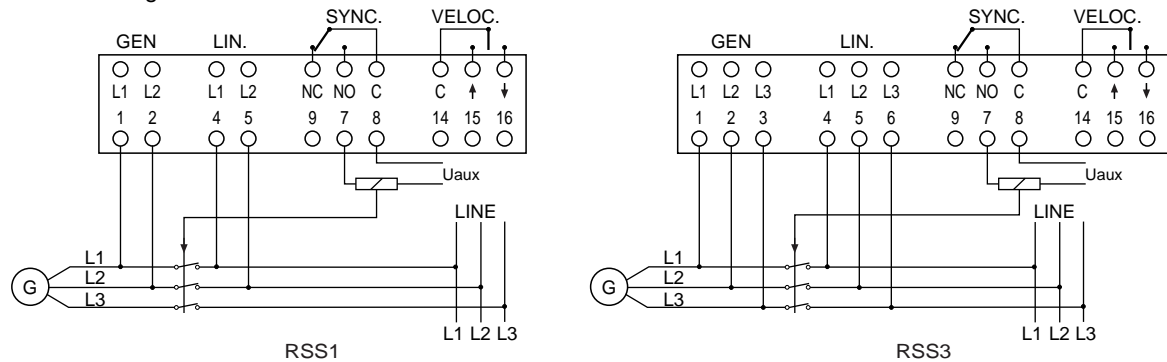
Model		RSS1 (2 wire)	RSS3 (3 wire)
Dimensions	mm	96x96	96x96
Approx. weight	Kg.	0,85	0,85
<b>SYNCHRONOSCOPE / DIGITAL SYNCHRONIZING RELAY</b>			
	V	110 or 230 V	110, 230, 400, or 440 V

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.

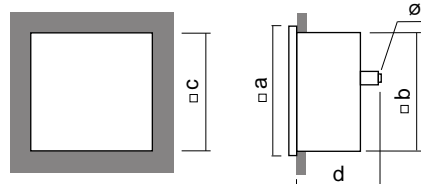
#### The front keypad programs:

- 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



Models	Range	a	b	c	d	ø
RSS-	110÷440 V	96	89	92 $\pm$ 0,8	78	Term.

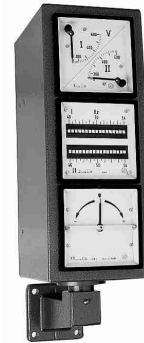
# ANALOGUE INSTRUMENTS

Analogue Instruments

## SYNCHRONIZING EQUIPMENT

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

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



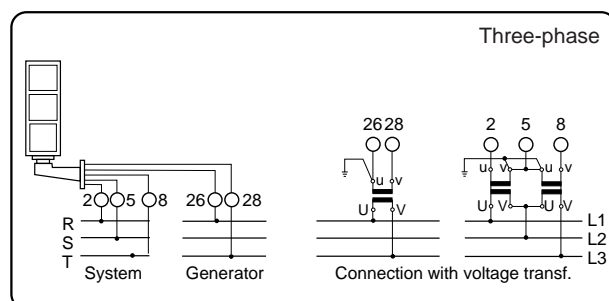
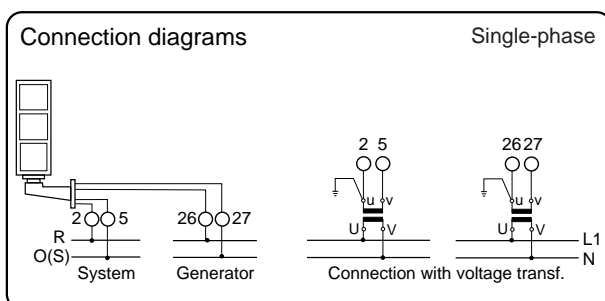
Technical specifications: see instrument data.

Model	VOLTMETERS	FREQUENCY METERS	SYNCHROSCOPES
ES3V	EC3VII or CC3VGD	FC3VII or FC3AD	SC3V-360°
ES3VI	EC3VII or CC3VGD	FC3VII or FC3AD	SC3VI-360°
ES2V	EC2VII or CC2VGD	FC2VII or FC2AD or FC2AD	SC2V-360°
ES2VI	EC2VII or CC2VGD	FC3VII or 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		240° 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
<b>SINGLE-PHASE</b>					
Single-phase		<b>ES3V</b>	<b>ES2V</b>	<b>ES3C</b>	<b>ES2C</b>
<b>BALANCED THREE-PHASE</b>					
Balanced three-phase		<b>ES3VI</b>	<b>ES2VI</b>	<b>ES3CI</b>	<b>ES2CI</b>

Dimensions

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





# ANALOGUE INSTRUMENTS

Analogue Instruments

## REVERSE POWER RELAY

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



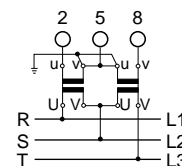
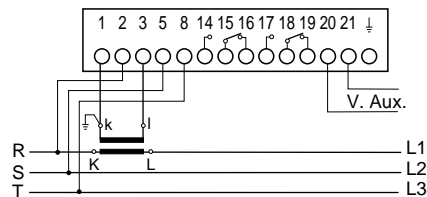
## ALTERNATING CURRENT NAVAL SERIES

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

<b>Model</b>	<b>RIC2VI</b>	
Dimensions	mm	144x144
Approx. weight	Kg.	1,25
<b>REVERSE POWER RELAY</b>		
Un	V	100, 110, 230, 400 or 440
In	A	..5
Vaux	V	100, 230 or 400

- Un range:  $-40 \div +20\%$
  - In range:  $20 \div 120\%$
  - Hysteresis:  $< 1\%$  (of Pn)
  - Delay for output signal:  $5 \pm 0.3$  secs. (optional, without delay)
  - Output contacts power: Max. 200 VA, 400 V, 5 A
  - Vaux 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 light indicators determine the period of time between overload and the closing of the output relay.

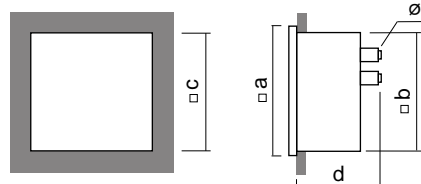
### Connection diagrams



- 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



Models	Range	a	b	c	d	ø
RIC2VI	100÷440 V	144	135	138 <sup>+1</sup>	89	M.4

# ANALOGUE INSTRUMENTS

Analogue Instruments

## SYNCHRONISING RELAY

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



## ALTERNATING CURRENT NAVAL SERIES

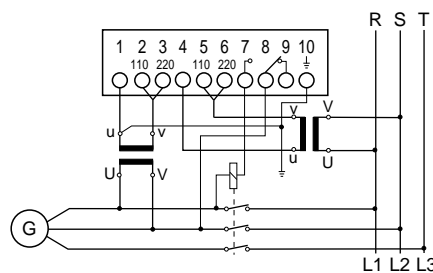
- Frequency: 50 or 60 Hz      - Un range:  $\pm 15\%$

Model	<b>RSC2</b>	
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 5 secs, during which this difference must be maintained.

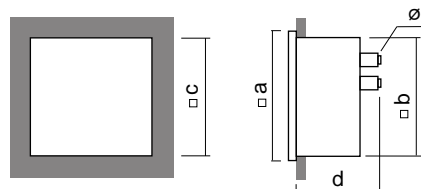
When both parameters go into the set limits, the output relay operates the synchronizing switch and an LED indicates that coupling may be carried out. To adjust operating limit, remove security cover or screw.

### Connection diagrams



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

### Dimensions



Models	Range	a	b	c	d	ø
RSC2	100÷440 V	144	135	138 <sup>+1</sup>	134	M.4

# ANALOGUE INSTRUMENTS

Analogue Instruments

## MAXIMUM CURRENT RELAY

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

## ALTERNATING CURRENT NAVAL SERIES

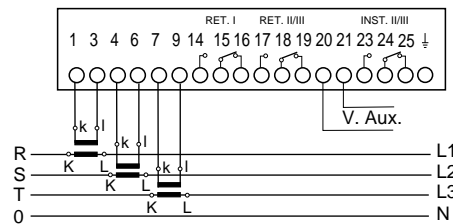


- Accuracy: Current:  $\pm 2,5\%$  (Trip set value)  
Time:  $\pm 3\% \pm 1$  sg. of set value
- Frequency: 50 or 60 Hz

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

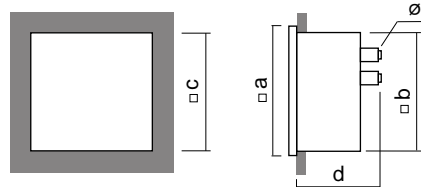
- Overload: 10 In for 1 s
- Vaux range:  $\pm 30\%$
- Hysteresis:  $< 0.16$  A
- Adjustment limit: 0.6÷1.6 (of In independent of each phase)
- Delay on output signal: (independent of overload): 1 from 2 to 60 secs in phases II and III
- Output contacts power: Max. 200 VA, 400 V, 5 A
- Indicators to check 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



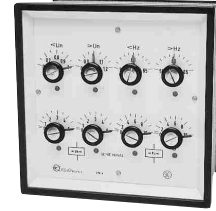
Models	Range	a	b	c	d	ø
RMC2	..5	144	135	138 <sup>+1</sup>	89	M.4
RMC2A	..5	144	135	138 <sup>+1</sup>	89	M.4

# ANALOGUE INSTRUMENTS

Analogue Instruments

## 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

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

- Un range:  $-40 \div +20\%$   
- Vaux range:  $\pm 30\%$

### MINIMUM VOLTAGE SETTING

- Un range: 60-100 % (Accuracy 1%)  
- Timer: 0-5 s. (Accuracy 2%  $\pm 0.2$  s)

### MAXIMUM VOLTAGE SETTING

- Un range: 80-120 % (Accuracy 1%)  
- Timer: 0-5 s. (Accuracy 2%  $\pm 0.2$  s)

### MINIMUM FREQUENCY SETTING

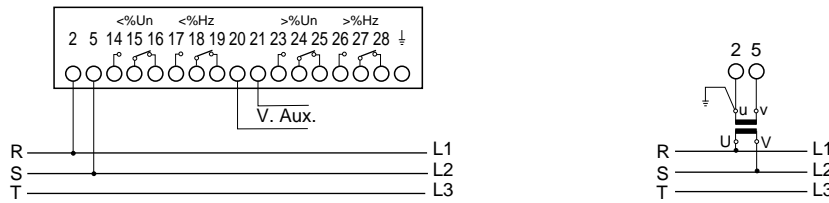
- Range: 45-55 / 55-65 Hz (Accuracy 1%)  
- Timer: 0-10 s. (Accuracy 2%  $\pm 0.2$  s)

### MAXIMUM FREQUENCY SETTING

- Range: 45-55 / 55-65 Hz (Accuracy 1%)  
- Timer: 0-10 s. (Accuracy 2%  $\pm 0.2$  s)

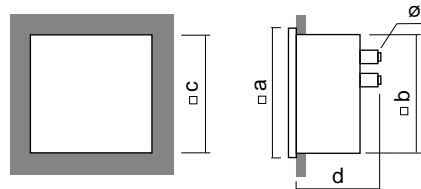
Instant alarm and relay operation indicators.  
To adjust operating limit, remove security cover or screw.

### Connection diagrams



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

### Dimensions



Models	Range	a	b	c	d	ø
RUFC2	100÷440 V	144	135	138 <sup>+1</sup>	89	M.4

# ANALOGUE INSTRUMENTS

Analogue Instruments

## 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.



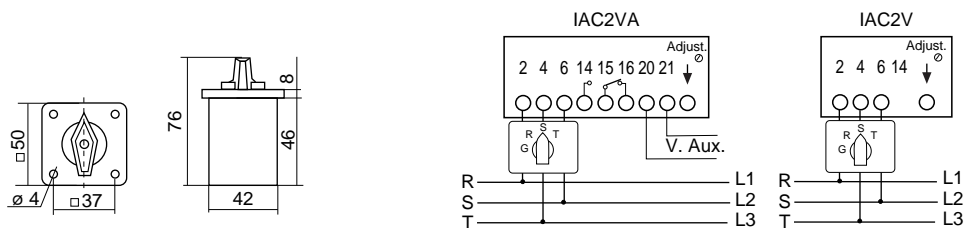
## ALTERNATING CURRENT NAVAL SERIES

- 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
<b>INSULATION INDICATORS</b>				
Vaux	V	230-400 or 440 V		110 or 230 A.C.

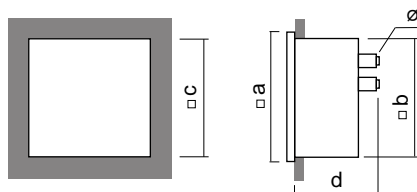
- Scale: 0..50..0 MΩ (1 MΩ to centre)
- Vaux range:  $\pm 20\%$
- Guaranteed number of operations: 107
- Output contact: Switched at 2A, 230 V AC., 200 VA
- Scale: 0-100 (Insulation comparison)
- Setting accuracy:  $\pm 3\%$  of scale value
- To adjust operating limit, remove security cover or screw.

### 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



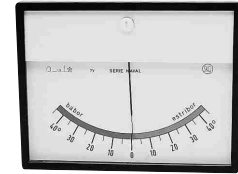
Models	Ranges	a	b	c	d	e	Ø
IAC3V IAC3VA	230÷440	96	89	92 <sup>+0,8</sup>	92	100	M.4
IAC2V IAC2VA	230÷440	144	135	138 <sup>+1</sup>	89	140	M.4

# ANALOGUE INSTRUMENTS

Analogue Instruments

## RUDDER DEGREE INDICATOR FOR VESSELS

Rudder position indicator through connection to potentiometer using resistance variations.



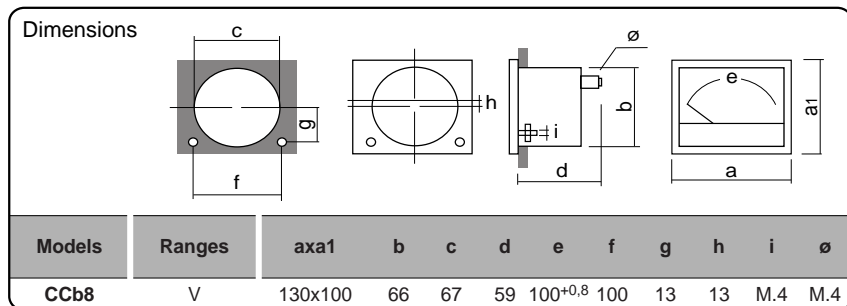
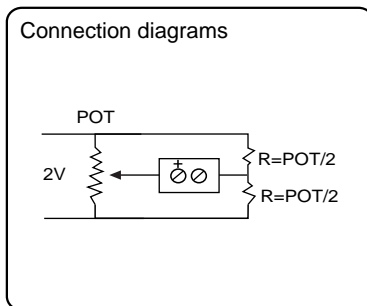
### DIRECT CURRENT - NAVAL SERIES

- Scale: 90° - Accuracy: ±1,5 %

- Burden: 2000 Ω/V

<b>Model</b>	<b>CCb8</b>	
Dimensions	mm	130x100
Approx. weight	Kg.	0,25
<b>RUDDER DEGREE INDICATOR</b>		
Scales	°	40-0-40 or 45-0-45
Ranges	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.



## 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

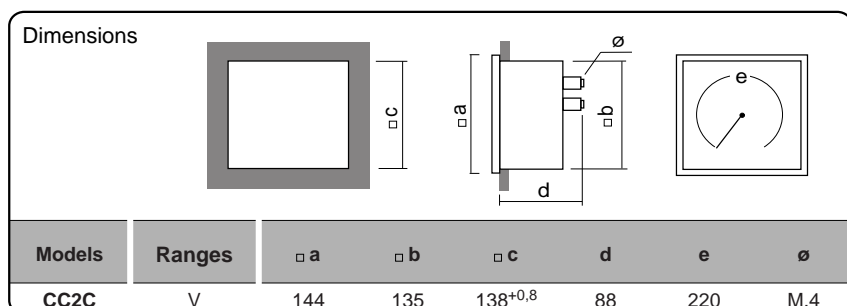
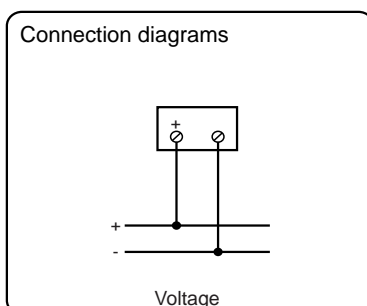
- Scale: 240°

- Accuracy: ±1,5 %

- Burden: 100 Ω/V

<b>Modelo</b>	<b>CC2C</b>	
Dimensions	mm	144x144
Approx. weight	Kg.	0,68
<b>R.P.M. INDICATOR FOR VESSELS (MAIN MOTOR)</b>		
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.



# ANALOGUE INSTRUMENTS

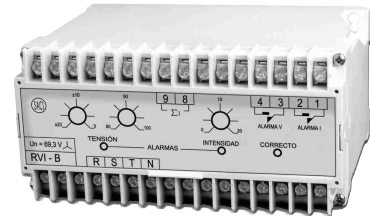
Analogue Instruments

## 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



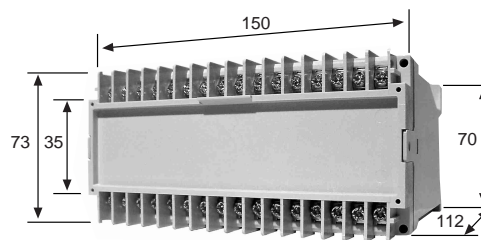
Model		RVIA (three-phase, 3 wire)	RVIB (three-phase, 4 wire)
Dimensions	mm	150x70x112	150x70x112
Approx. weight	Kg.	1,20	1,20
<b>VOLTAGE AND CURRENT SURVEILLANCE RELAY</b>			
	V	110, 230 or 400 V	
	A	..5 A or ..1/A	

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".

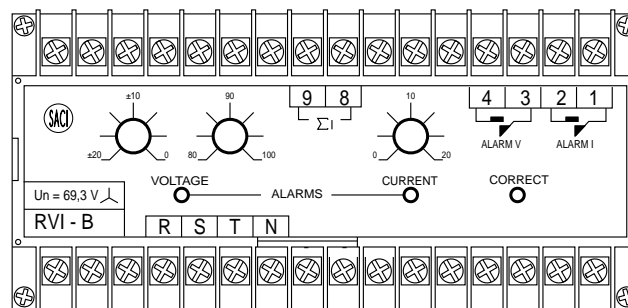
Controls on the front allow comparison levels to be selected to set off the alarm. Two controls are for voltage, for unbalance levels (from 0 to 20 %), and undervoltage levels (from 80 to 100 %) and a third for current (from 0 to 20 %).

To operate, the three phases to be supervised are connected to the voltage inputs and the three currents pass through the associated toroidal transformer.

### Dimensions



### 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  $\Sigma$  (8 and 9).

Output relays have potential-free contacts and are insulated for complete connection flexibility.