Analogue instruments

CIRCUTOR
Energy efficiency technology

Moving iron ammeters (AC)

Moving-coil Ammeter

Analogue indicator to measure alternating current

Description

- No need for auxiliary power supply
- DIN boxes with dimensions: 48, 72, 96 and 144.
- Precision class 1.5
- Measurement in true root mean square 100 mA ... 100 A
- Exchangeable scales for **EC48, EC72, EC96**

Application

In alternating current applications, to control the state of the current quickly and visually.

Features

	EC
Auxiliary power supply	-
Consumption	-
Frequency	-
Input circuit	
Consumption	0.3 ... 1.5 V·A
Frequency	20 ... 100 Hz
Overloads	1.2 I_n permanent 5 I_n during 30 s 10 I_n during 5 s 40 I_n during 1 s
Class	1.5 % FS
Ambient conditions	
Operating temperature	+10 ... +30 ºC
Limit temperature	- 25 ... +40 ºC
Altitude	2000 m
Build features	
Dimensions	See the following table
Weight	See the following table
Type of box	panel
Degree of protection:	
Front panel	IP 52
Terminals	IP 00
Insulation voltage	2 kV, 50 Hz, 1 min, between the mechanism and the box
Standards	**BS 89, EN 60051, IEC 144, UL 94, DIN 43780, IEC 51, UNE 21318, CE**

EC

Moving Iron Miliammeters and Ammeter

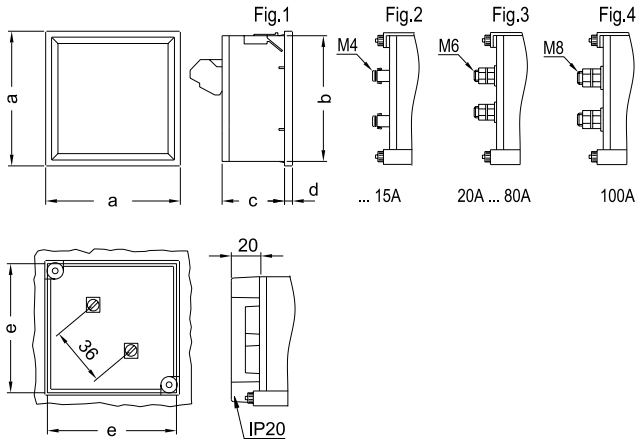
Miliammeters and Ammeters, 90º - P2 - Class 1,5

Type	EC 48	EC 72	EC 96	EC 144
a b c	48 48 86,2	72 72 69,2	96 96 69,2	144 144 91,8
A				
5	[*] M10212.	[*] M10222.	[*] M10232.	[3] M10242.
10	[*] M10213.	[*] M10223.	[*] M10233.	[3] M10243.
15	[*] M10214.	[*] M10224.	[*] M10234.	[3] M10244.
20	[*] M10215.	[*] M10225.	[*] M10235.	[3] M10245.
25	[*] M10216.	[*] M10226.	[*] M10236.	[3] M10246.
30	[*] M10217.	[*] M10227.	[1] M10237.	[3] M10247.
40	[*] M10218.	[*] M10228.	[*] M10238.	[3] M10248.
50	[*] M10219.	[*] M10229.	[*] M10239.	[3] M10249.
60	[*] M1021A.	[*] M1022A.	[*] M1023A.	[3] M1024A.
75	-	[*] M1022B.	[1] M1023B.	[3] M1024B.
100	-	[*] M1022C.	[*] M1023C.	[3] M1024C.
.../5 A (*1)	[*] M10210.	[*] M10220.	[*] M10230.	[3] M10240.

(*1) Exchangeable scales. See next page.

Dimensions

EC



Typ	Fig. EC	a	b	c	d	e
48	1-3	48	44,7	61	5,2	45
72	1-3-4	72	67,2	43,5	5,7	68
96	1-3-4	96	91	43,5	5,7	92
144	2-3-4	144	137	64,5	7,3	138

Moving iron voltmeters (AC)

Moving iron voltmeter

Analogue indicator to measure alternating current

Description

- No need for auxiliary power supply
- DIN boxes with dimensions: 48, 72, 96 and 144
- Precision class 1.5
- Measurement in true root mean square or V ... 600 V ac
- Exchangeable scales for **EC48, EC72, EC96**

Application

In alternating current applications, to control the state of the voltage quickly and visually.

Features

	EC
Auxiliary power supply	-
Consumption	-
Frequency	-
Input circuit	
Consumption	1 ... 4 V·A
Frequency	20 ... 100 Hz
Overloads	1.5 U_n permanent 2 U_n during 5 s
Class	1.5 % FS
Ambient conditions	
Operating temperature	+10 ... +30 ºC
Limit temperature	- 25 ... +40 ºC
Altitude	2000 m
Build features	
Dimensions	See the following table
Weight	See the following table
Type of box	panel
Degree of protection:	
Front panel	IP 52
terminals	IP 00
Insulation voltage	2 kV, 50 Hz, 1 min, between the mechanism and the box
Standards	**BS 89, EN 60051, IEC 144, UL 94, DIN 43780, IEC 51, UNE 21318, CE**

EC
Moving Iron Voltmeters

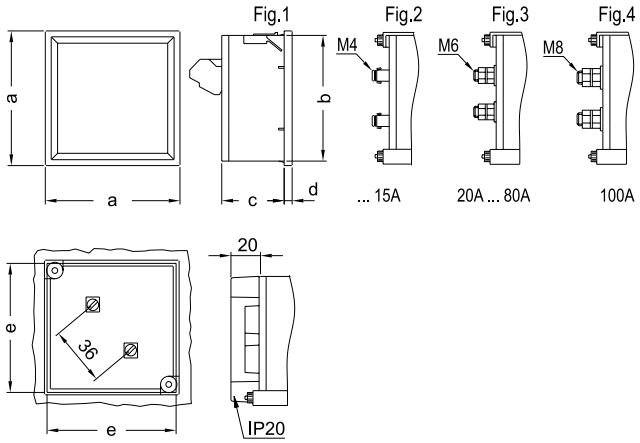
Voltmeters, 90°

Type	EC 48	EC 72	EC 96	EC 144
Class	1,5			
Scale	90° , P1			
a b c 	48 48 86,2	72 72 69,2	96 96 69,2	144 144 91,8
W				
250	[*] M10415.	[*] M10425.	[*] M10435.	[3] M10445.
300	[*] M10416.	[*] M10426.	[*] M10436.	[3] M10446.
400	[*] M10417.	[*] M10427.	[*] M10437.	[3] M10447.
500	[*] M10418.	[*] M10428.	[*] M10438.	[3] M10448.
600	[1] M10419.	[*] M10429.	[*] M10439.	[3] M10449.
.../110 V(*1)	[1] M10410.	[*] M10420.	[*] M10430.	[3] M10440.

(*1) Exchangeable scales, Voltmeters 90°

Dimensions

EC



Typ	Fig. EC	a	b	c	d	e
48	1-3	48	44,7	61	5,2	45
72	1-3-4	72	67,2	43,5	5,7	68
96	1-3-4	96	91	43,5	5,7	92
144	2-3-4	144	137	64,5	7,3	138

Power demand meters

Analogue indicator to measure alternating current and its maximeter

Description

- Does not need an auxiliary power supply
- DIN boxes with dimensions 96
- Class 3
- Measurement in AC of .../5 A (on demand.../1 A)
- Exchangeable scales for **MC96**
- Thermal inertia times of 15 min (on demand, 8 and 30 min)

Application

To control the alternating current and measure long overloads in the same unit, integrated within a determined period.

Features

	MC
Input circuit	
Consumption	3.25 V·A
Overloads	
Accuracy	±3 % FS
Ambient conditions	
Operating temperature	+10 ... +30 ºC
Limit temperature	- 25 ... +40 ºC
Altitude	2000 m
Build features	
Dimensions	See the following table
Weight	See the following table
Type of box	panel
Degree of protection:	
Front panel	IP 52
terminals	IP 00
Insulation voltage	2 kV, during 1 min, between the mechanism and the box
Standards	**BS 89, EN 60051, IEC 144, UL 94, DIN 43780, IEC 51, UNE 21318**

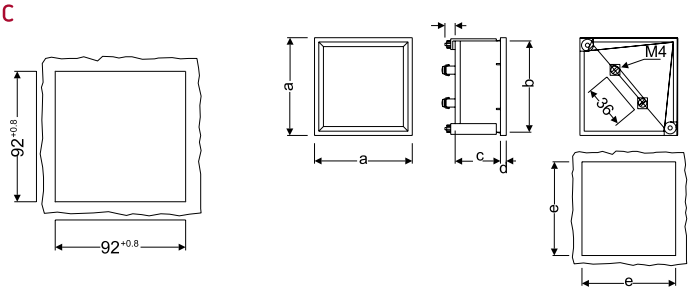
MC / MMC / EMC
Maximeter ammeters

Bimetallic maximeter ammeter

	
Type	MC 96
Class	
Scale	
a b c 	96 96 69,2
A	
.../ 5 A	[*] M12231.

Dimensions

MC



	a	b	c	d	e
96	96	91	43,5	5,7	92 +0,8

Reed Frequency- meters

Analogue indicator to measure frequency

Description

- Does not need an auxiliary power supply
- DIN box with dimensions: 72, 96 and 144 mm
- Class 0.5
- Independent measurement of the wave shape

Application

Measurement of the frequency in alternating current circuits, for any type of wave shape and under adverse environmental and physical conditions.

Features

	HLC
Input circuit	
Consumption	1 ... 3.6 V·A
Nominal operating frequency	50 or 60 Hz
Overloads	1.2 U_n permanent 2 U_n during 5 s
Measurement voltage	Standard 230 Vac Optional 100...120 Vac / 380...440 Vac
Accuracy	0.5 % FS
Ambient conditions	
Operating temperature	+10 ... +30 ºC
Limit temperature	- 25 ... +40 ºC
Altitude	2000 m
Build features	
Dimensions	See the following table
Weight	See the following table
Type of box	panel
Degree of protection:	
Front panel	IP 52
Terminals	IP 00
Insulation voltage	2 kV, during 1 min, between the mechanism and the box
Standards	**BS 89, EN 60051, IEC 144, UL 94, DIN 43780, IEC 51, UNE 21318**

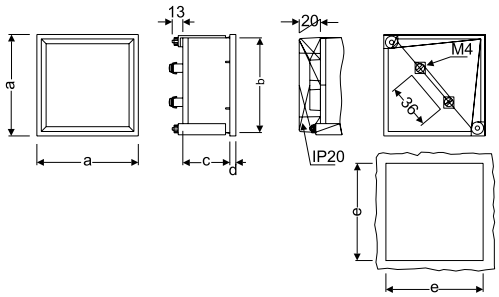
HLC

Reed type frequencymeters

Tipo	HLC 72	HLC 96	HLC 144
Class	0,5		
a b c	72 72 69,2	96 96 69,2	144 144 91,8
Hz			
47...53 Hz / 13 reeds.	[c] M1292100C0000	[c] M1293100C0000	
45...55 Hz / 21 reeds.(*)			[c] M129410060000

Dimensions

HLC



	a	b	c	d	e
72	72	67,2	43,5	5,7	68 $^{+0,8}$
96	96	91	43,5	5,7	92 $^{+0,8}$
144	144	137	64,5	7,3	138 $^{+1}$

Wattmeters

Analogue indicator to measure active power

Description

- Does not need an auxiliary power supply
- DIN box with dimensions 96 and 144. Class 1.5
- Built-in electronic converter
- Balanced and unbalanced single and three-phase circuits.

Application

Measurement of active power in balanced or unbalanced single and three-phase circuits.

Features

	WTC
Voltage circuit	
Voltage	400 V
Consumption	1 ... 4 V·A
Frequency	45 ... 65 Hz
Overloads	1.25 U_n permanent 2 U_n during 5 s
Current circuit	
Nominal current	... 5 A
Consumption	0.3 ... 1.5 V·A
Frequency	45 ... 65 Hz
Overloads	1.2 I_n permanent 5 I_n during 30 s 10 I_n during 5 s 40 I_n during 1 s
Accuracy	± 1.5 % FS
Ambient conditions	
Operating temperature	+10 ... +30 ºC
Limit temperature	- 25 ... +40 ºC
Altitude	2000 m
Build features	
Dimensions	See the following table
Weight	See the following table
Type of box	panel
Degree of protection:	
Front panel	IP 52
Terminals	IP 00
Insulation voltage	2 kV, during 1 min, between the mechanism and the box
Standards	**BS 89, EN 60051, IEC 144, UL 94, DIN 43780, IEC 51, UNE 21318**

WTC
Wattmeters

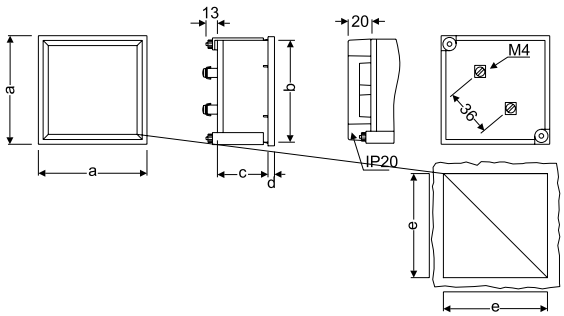
WATTMETERS, 45 ... 65 Hz

Type			
	 		
	Three-phase 3 wire (ARON)	Three-phase 4 wire	
	WTC 96A	WTC 96AN	WTC 144AN
Class			
Scale			
a 	96	96	144
b	96	96	144
c	82,9	82,9	91,8
$U_{phase-phase}$	110 V (*1)	400 V	
	[3] M13034.	[*] M13033.	[4] M13043.

Exchangeable scales for the WMC 96, WTC 96E and WTC 96AN equipment. Scales NOT included
(*1) Specify primary voltage and current of the measuring transformers, and power at full scale

Dimensions

WTC



	a	b	c	d	e
96A/AN	96	91	57,2	5,7	92 $^{+0,8}$
144	144	137	94,7	7,3	138 $^{+1}$

Electronic Phase-meters

Analogue indicator to measure cos φ

Description

- Does not need an auxiliary power supply
- DIN box with dimensions 96 and 144 mm
- Class 1.5
- Built-in electronic converter
- Balanced single and three-phase circuits

Application

Measurement of cos φ in balanced or unbalanced single and three-phase circuits.

Features

	FETC
Voltage circuit	
Consumption	1 V·A
Frequency	40 ... 70 Hz
Overloads	1.2 U_n permanent 2 U_n during 5 s
Current circuit	
Nominal current	... 5 A
Consumption	1.5 V·A
Frequency	20 ... 100 Hz
Overloads	1.2 I_n permanent 5 I_n during 30 s 10 I_n during 5 s 40 I_n during 1 s
Accuracy	± 1.5 % FS
Ambient conditions	
Operating temperature	+10 ... +30 ºC
Limit temperature	- 25 ... +40 ºC
Altitude	2000 m
Build features	
Dimensions	See the following table
Weight	See the following table
Type of box	panel
Degree of protection:	
Front panel	IP 52
Terminals	IP 00
Insulation voltage	2 kV, during 1 min, between the mechanism and the box
Standards	**BS 89, EN 60051, IEC 144, UL 94, DIN 43780, IEC 51, UNE 21318**

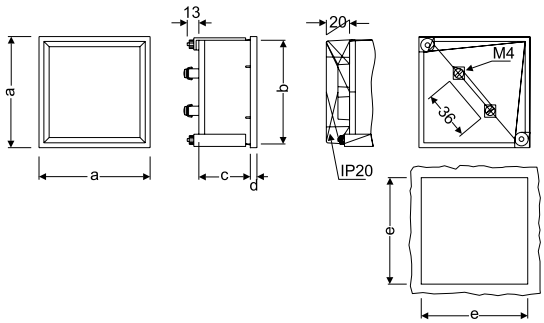
FETC
Electronic Phasemeters

	90 °, 50 Hz	
		
	Balanced three-phase	
Type	FETC 96	FETC 144
Class		
Scale		
a b c 	96 96 82,9	144 144 91,8
V		
100/√3	-	-
110/√3	-	-
100	[1] M1343C.	[3] M1344C.
110	[1] M1343D.	[3] M1344D.
230	[3] M1343E.	[3] M1344E.
400	[*] M1343F.	[3] M1344F.
440	[1] M1343G.	[3] M1344G.
500	[1] M1343H.	[3] M1344H.

Current range: from 0,1 to 1,2 In. To connect to .../ 5 A transformers. Electronic converter included.

Dimensions

FEMC / FETC



	a	b	c	d	e
96	96	91	57,2	5,7	$92^{+0,8}$
144	144	137	64,5	7,3	138^{+1}

Synchronisation and marine applications equipment

2 EC / 2 HLC

Description

- Does not need an auxiliary power supply
- DIN box with dimensions 96 and 144 mm
- Class 1.5
- Double scale

Application

2 EC

Double moving iron voltmeter (AC)

For the measurement and comparison of alternating currents from two generators or a generator in the network, when connected in parallel.

2 HLC

Double reed frequency-meter

For the measurement and easy comparison of frequencies in alternating current circuits coming from generators or between the network and generator, when connected in parallel. The measurement is independent of the wave shape.

For applications in severe environmental and physical conditions.

Features

	2 EC	2 HLC
Input circuit		
Consumption	1 ... 4 V·A	1 ... 3.6 V·A
Working frequency	20 ... 100 Hz	depending on the type (see table)
Overloads		1.2 U_n permanent 2 U_n during 5 s
Measurement voltage		Standard 230 Vac Optional 100-120 Vac380-440 Vac
Accuracy	1.5 % FS	0.5 % FS
Ambient conditions		
Operating temperature		+10 ... +30 ºC
Limit temperature		- 25 ... +40 ºC
Altitude		2000 m
Build features		
Dimensions		See the following table
Weight		See the following table
Type of box		panel
Degree of protection:		
Front panel	IP 52	IP 52
Terminals	IP 00	IP 00
Insulation voltage		2 kV, during 1 min, between the mechanism and the box
Standards		**BS 89, EN 60051, IEC 144, UL 94, DIN 43780, IEC 51, UNE 21318**

2EC / 2HLC , Synchronization and marine applications equipment

2EC, Double voltmeters

Type	2 EC 96	2 EC 144
Class	1,5	
Scale	90°	
a b c 	96 96 69,2	144 144 91,8
V		
2 x .../100	[3] M13831.	[4] M13841.
2 x .../110	[3] M13832.	[4] M13842.
2 x 220	[3] M13833.	[4] M13843.
2 x 380	[3] M13834.	[*] M13844.
2 x 440	[3] M13835.	[4] M13845.

Specify voltage transformers

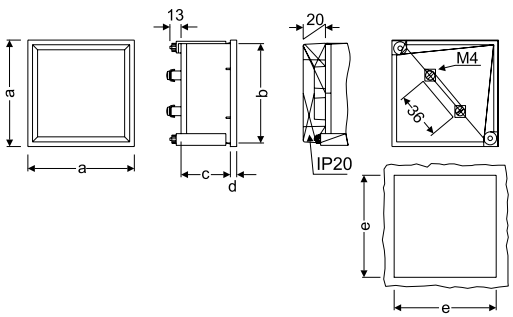
2HLC, Double Reed type frequencymeters

Reed, 230 V

Tipo	2 HLC 96	2 HLC 144
Class	0,5	
Scale	-	
a b c 	96 96 82,9	144 144 91,8
Hz		
47...53 Hz / 13 reed	[c] M1293200C0000	
45...55 Hz / 21 reed (*1)		[c] M129420060000

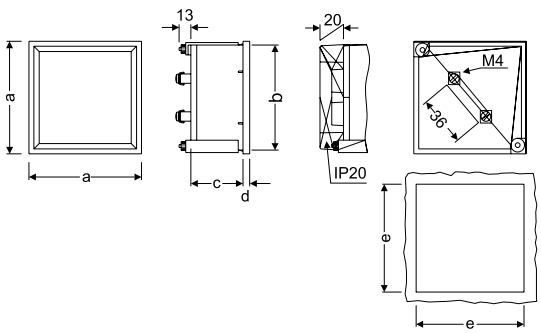
Dimensions

2 EC



	a	b	c	d	e
96	96	91	43,5	5,7	$92^{+0,8}$
144	144	137	64,5	7,3	138^{+1}

2 HLC



	a	b	c	d	e
96	96	91	57,2	5, 7	$92^{+0,8}$
144	144	13 7	64,5	7, 3	138^{+1}

Synchronisation and marine applications equipment

STC

Description

STC

Synchroscopes

- Does not need an auxiliary power supply
- DIN box with dimensions: 96 and 144mm
- Class 1
- For single and three-phase circuits

Features

	STC
Input circuit	
Consumption	Line: 20 mA per circuit Generator: 15 mA per circuit
Frequency	20 ... 100 Hz
Overloads	1.2 U_n permanent 2 U_n during 5 s
Measurement voltage	Standard 230 Vac Optional 100-120 Vac380-440 Vac
Accuracy	1.5 % FE
Ambient conditions	
Operating temperature	+10 ... +30 °C.
Front panel	+25 ... +50 °C.
Altitude	2000 m
Build features	
Dimensions	See the following table
Weight	See the following table
Type of box	panel
Degree of protection:	
Front panel	IP 52
terminals	IP 00
Insulation voltage	2 kV, during 1 min, between the mechanism and the box
Standards	BS 89, EN 60051, IEC 144, UL 94, DIN 43780, IEC 51, UNE 21318

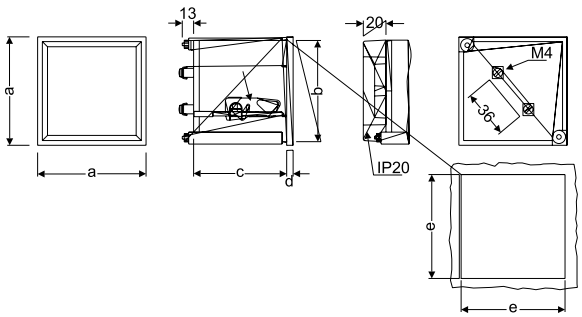
STC Synchronization and marine applications equipment

STC, Synchroscopes, 50 Hz

Type	Three-phase	
	STC 96	STC 144
Class	1,5	
a 	96	144
b	96	144
c	121,2	122
V		
110	[*] M14435.	[4] M14445.
230	[3] M14436.	[4] M14446.
400	[*] M14437.	[4] M14447.
500	[3] M14438.	[4] M14448.

Dimensions

STC



	a	b	c	d	e
96	96	91	95,5	5,7	92 +0,8
144	144	137	64,5	7,3	138 +1

Synchronisation and marine applications equipment

Synchro MAX

Synchro MAX /

Equipment used to synchronise a generator with the network

Description

- All parameters can be programmed on the keyboard on the front panel.
- Digital unit with 4-digit display and 30 auxiliary LEDs.
- Voltage, generator frequency and network measurement and display (TRMS), including the unbalance between the generator and the network.
- Automatic synchronisation by simply programming the contactor closing time.
- Wide range of frequencies (35...80 Hz)
- Standard power supply: 110, 230 and 400 V ac
- 2 operating modes: Manual, automatic and assisted
- Digital adjustment (without potentiometers)
- Protection with password.

Features

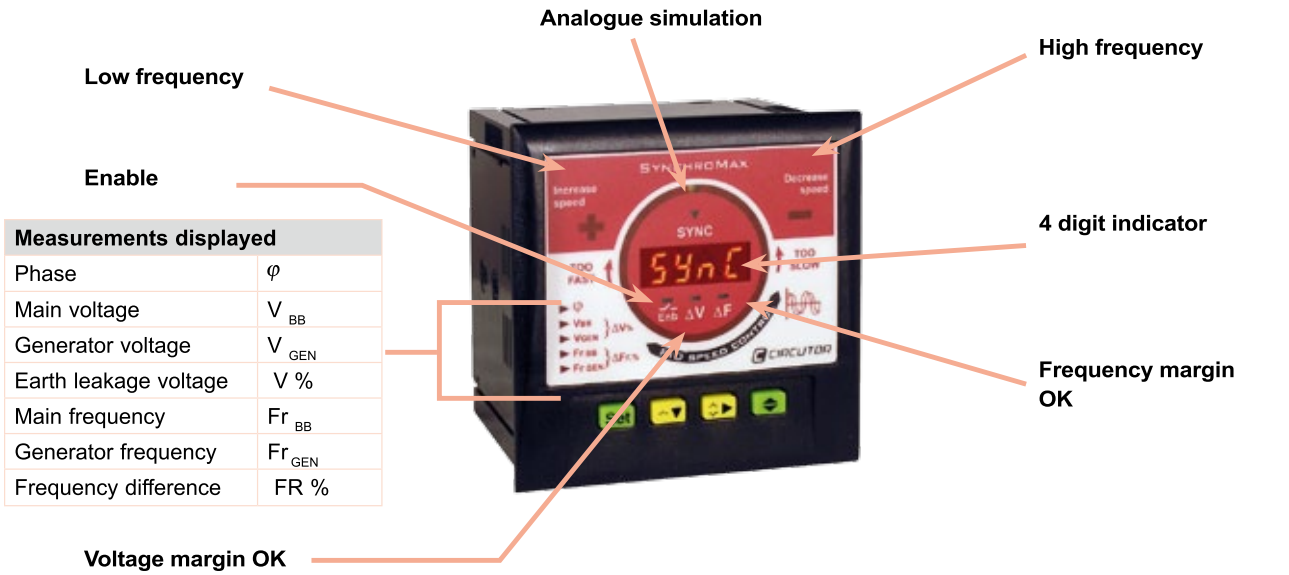
Auxiliary power supply	Alternating voltage
Standard values	110, 230, 400 V ac (-10 / +15 %)
Frequency margin	35 ... 450 Hz
Maximum consumption	10 V·A
Measurement circuit	
Measurement range	30 ... 150 V, 110 ... 600 V
Frequency	35 ... 80 Hz
Overload (permanent)	800 V
Consumption	< 500 uA
Accuracy	
Voltage (R .M .S .)	Cl 1 +/- 2 dig.
Frequency	+/- 0.01 Hz
Phase angle	+/- 0.5 º
Display	4 digits
Colour	Red, high efficiency
Presentation cycle	2 / s
Auxiliary LEDs	30
Ambient conditions	
Storage temperature	- 40 . .+70 ºC
Operating temperature	-10 . .+ 65 ºC
Altitude	2000 m
Build features	
Box colour	Grey anthracite
Box material	Self-extinguishing ABS
Degree of protection	Front panel IP 54 (optional IP 65)
Weight	0.35 kg
Insulation voltage	2 kV, during 1 min, between the mechanism and the box
Standards	

BS 89, EN 60051, IEC 144, UL 94, DIN 43780, IEC 51, UNE 21318

Synchronisation and marine applications equipment

Synchro MAX

Unit's front panel



Measurements displayed	
Phase	φ
Main voltage	V_{BB}
Generator voltage	V_{GEN}
Earth leakage voltage	V %
Main frequency	Fr_{BB}
Generator frequency	Fr_{GEN}
Frequency difference	FR %

Application

SynchroMax is a synchronism relay that has been designed to synchronise a generator with the network or with another generator used as reference. We can connect both in parallel in emergency or support applications when a greater power is needed.

Description

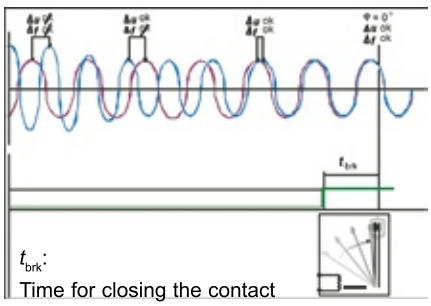
CIRCUTOR has two types of synchronism relays: **SYNCHRO MAX**

Synchro Max

Synchro Max is capable of adapting the gen - erator's frequency with an integrated PI regulation algorithm, in order to connect it in paral - lel to the electrical network. In addition, it can be used to measure and display the voltage, phase and frequency parameters of the generator and network, as well as its differences.

hydraulic power plants, among many other applications.

Here is an example of how SYNCHRO MAX moves forward to a time t_{brk} (previously programmed by the user) to take into account the connection delay of the generator's contactor.



t_{brk}:
Time for closing the contact

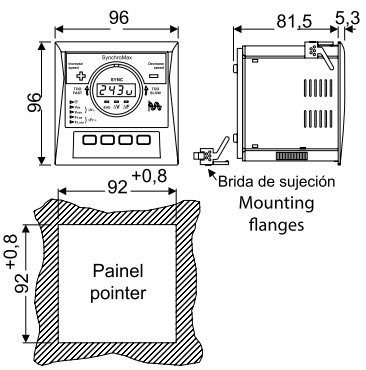
SynchroMAX, Synchronization equipment

Power Supply 400 V

Type	
	SynchroMAX
PID Control	No
 a a a b b c c	96 96 82,9
Frequency	30 ... 70 Hz
$V_{Measurement}$	
30...150	[*] M14624.
110...600	[*] M14625.

Dimensions

SYNCROMAX



CVM
Power Analyzers

www.circutor.es

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