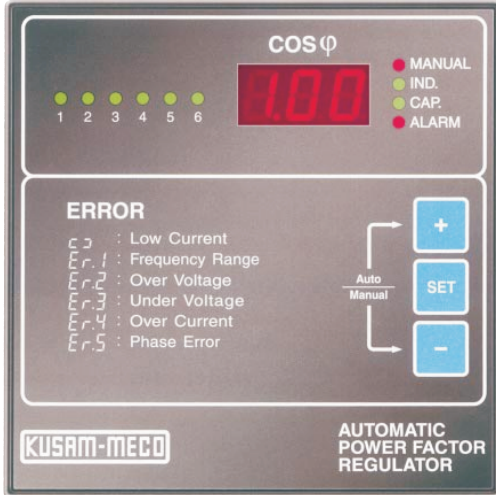


Model - KM-PFR-9-06 / KM-PFR-9-12



The pioneers & leaders in high quality power factor controllers & maximum demand controllers, now introduce 2 new economy models of power factor controllers. These controllers have microprocessors for automatic control of power factor. It has digital indication for power factor.

UNIQUE FEATURES :

- **Display :** Power Factor
- **Simple Operation.**
- **Automatic self adjustment for C/K value.**
- **Different types of Operation sequence (1:1:1:1....) (1:2:2:2....) (1:2:4:4....)... (1:4: 8...) (1 : 1 : 2 : 2)...(1 : 1 : 2 : 2..)(1 : 1 : 4 : 8..)(2 : 4:...(1 - 1 - switching in sequential Sequence)**
- **The set data is preserved for at least two months in the event of Power failure.**

SPECIFICATION

	Model KM-PFR-9-06	Model KM-PFR-9-12
No of steps	6 steps	12 steps
Voltage Burden	≤ 6 VA	≤ 7.5VA
Operation Voltage Range	AC 220 V ± 15 % & AC 415 V ± 15 %	
Input Current Range	AC 0.05 ~ 5A, max 6A	
Current Burden	≤ 0.5 VA	
Power Factor Display	Digital Display, RED LED, 14.2 mm height, 0.01PF Resolution.	
Power Factor Setting Range	CAP 0.90 ~ IND 0.90 (Factory set 0.98 P.F.).	
C/K setting Range	Automatic self adjustment for C / K value	
Operation Time Display	10 ~ 240 sec. Delay time. (Factory set 30 sec).	
Output contacts coils	AC 220V 5 A (Max. AC 380 V, 5 A, typical)	
Operation Temp. Range	0 ~ 60° C	
Storage Temp. Range	-10 ~ 70° C	
Dielectric Strength	AC 220 V, 50 Hz, 1 minute, Input / Output / Ground	
Withstanding Impulse Voltage	According to IEC 1000 - 4 - 5	
Electrical Transient burst	According to IEC 1000 - 4 - 4	
Connection	Plug in Terminal block	
Phase	Single Phase or Three Phase	
Outside Dimension	144 x 144 mm and 65mm (Depth) as Per Din standard	
Weight	About 1 kg	

All Specifications are subject to change without prior notice



AUTOMATIC POWER FACTOR REGULATOR

KM PFR-9-06
KM PFR-9-12

INSTRUCTION MANUAL

KUSAM ELECTRICAL INDUSTRIES LTD.

G-17, Bharat Industrial Estate, T.J.Road, Sewree (W),
Mumbai - 400015. (INDIA)

Tel : 91-22-2412 4540, 2418 1649, **Sales Direct:**(022) 24156638 **Fax :** 91-22-2414 9659

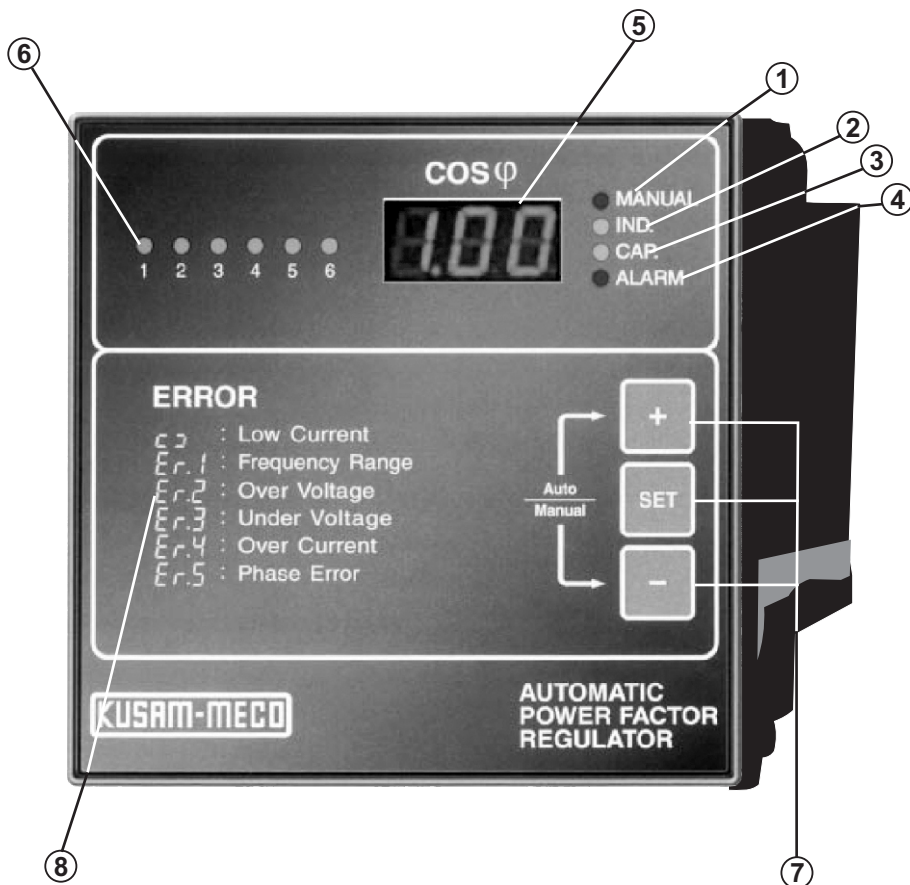
Email : kusam_meco@vsnl.net

Website : www.kusamelectrical.com, www.kusam-meco.co.in

REACTIVE POWER REGULATOR

KM-PFR-9-06, 9-12

FRONT VIEW



KUSAM-MECO

REACTIVE POWER REGULATOR KM-PFR-9-06, 9-12 INSTRUCTION MANUAL

inductive reactive current constitutes an additional load that stresses on cable and switching devices. It also results in increases in expenditure for energy to be paid to the Power Supply Company. This so-called reactive energy is no real energy consumption. This inductive reactive current can be compensated by means of shunt capacitor bank using reliable and efficient KUSAM-MECO Power Factor Controller. The KUSAM-MECO Controller incorporates state-of-art microprocessor based technology and with built-in protective devices that permanently monitors and ensure the processor for trouble-free operation.

The correct selection and coordination of measuring current referencing L1 and voltages of L2 and L3 enable reliable and optimal operation of the KUSAM-MECO Controller. The KUSAM-MECO Controller switches in the capacitors in accordance with the selected switching program by means of relay contacts.

FRONT VIEW

- | | |
|---------------------------|-----------------------------|
| ① Manual operation | ⑤ Power factor value |
| ② Switching on capacitor | ⑥ Energized capacitor steps |
| ③ switching off capacitor | ⑦ Keypad |
| ④ Fault alarm | ⑧ Fault status |

DESCRIPTION OF FAULT STATUS

- | | |
|---------------------------------------------------------------|--------------------------------------------------------------------|
| <i>Er.1</i> : sensitivity of the low current | <i>Er.1</i> : incorrect frequency range |
| <i>Er.2</i> : the measured voltage exceeds the limiting volt. | <i>Er.3</i> : the measured voltage is less than the limiting volt. |
| <i>Er.4</i> : the measured current exceeds the limiting amp. | <i>Er.5</i> : incorrect phase position |

■ TECHNICAL DATA

Voltage range	: AC 220V±15% & AC440V±15%
Power consumption	: 4.5 VA (KM-PFR-9-06), 7.5 VA (KM-PFR-9-12)
Current range	: AC 0.05 ~ 5A
Current consumption	: 0.5VA
LEDs display	: Digital display, red LED, 14.2mm high, 0.01 PF resolution
Power factor setting range	: Cap.0.95~Ind.0.85 PF. The default value (0.97) set by factory
Power factor setting mode	: Setting value to 1.00 PF.Or setting point mode
C/K value setting	: Auto/Man setting for the C/K value
Switching delay time	: 10 ~ 240 sec. The default value (30s) set by factory.
Number of steps	: 3 ~ 6 steps for KM-PFR-9-06, 3~12 steps for KM-PFR-9-12
Over voltage setting	: the default value (120%) set by factory
Relay Contact Capacity	: Max. AC 380V, 5A, typical AC 220V 5A
Operating temperature	: 0 ~ 60°C
Storage temperature	: -10 ~ 70°C
Dielectric strength	: AC 2KV, 60Hz, 1 minute, INPUT/OUTPUT/ CASE.
Wistanding impulse voltage	: IEC 1000-4-5
Wave damping	: IEC 1000-4-4
Electrostatic discharge	: IEC 1000-4-2
Electrical transient in burst	: IEC 1000-4-11
Connection	: Plug-in terminal block
Weight	: About 0.85kg for KM-PFR-9-06, 1kg for KM-PFR-9-12

SETTING PROCEDURE

● VIEW SETTING VALUE

By pressing **SET** for 2s, and then the following symbols will be shown on the display subsequently :

dLY (switching delay time) *STP* (number of switching steps) *PF*
(setting of the target cos value) *RCT* (type of switching)

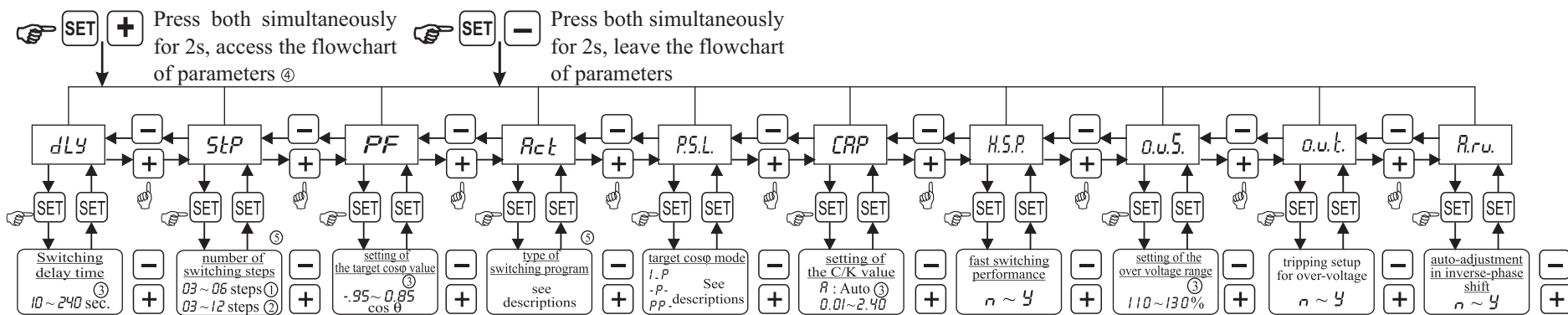
MANUAL MODE

1. Press **+** **-** simultaneously for 2s, the LEDs “MANUAL” will light up after accessing the manual mode.
2. Press **+** for 1s, the LEDs “IND” will light up once switching on capacitor manually.
3. Press **SET** for 1s, the LEDs “IND” will put out once stopping switching on capacitor.
4. Press **-** for 1s, the LEDs “CAP” will light up once switching off capacitor manually.
5. Press **SET** for 1s, the LEDs “CAP” will put out once stopping switching off capacitor.
6. Press **+** **-** simultaneously for 2s, the LEDs “MANUAL” will put out, meanwhile the auto mode will replace the manual one.

DESCRIPTION OF THE PARAMETERS

1. *dLY* : The switching delay time can be set from 10~240 seconds. The setting of the switching delay time will be reset once a few conditions (Inductive/Capacitive/Normal Load) have been changed.
2. *STP* : The number of switching steps can be set from 03 to 06 (12) steps respectively. This H.S.P. Mode will be de-activated fro proper operation if the setting of the number of switching steps is less than the switching step in circular sequence.
3. *PF* : The target power factor can be set in the range of 0.85 inductive up to (-.95) capacitive. The target power factor has to be adjusted to reach a proper controlling program in accordance with the setting of the parameter in the P.S.L. Mode.
4. *Rct* : The type of switching program has to be set in compliance with the capacity of the installed capacitors on the network distribution.

● FLOWCHART OF PARAMETERS



Remark①: Setting is applied to KM-PFR-9-06

Remark②: Setting to KM-PFR-9-12

Remark③: Press for over 3s during setting the desired value, the value will be increased/ decreased by 5 numerical value

Remark④: Access to the flowchart of parameters, it will leave out the flowchart of parameters automatically after 2 minutes without any operation on keypads

Remark⑤: All connected capacitors will be switched off in order once any setting has been changed.

111 : 1:1:1(Switching in circular sequence)	1124 : 11(AS) 2 4.4.(SICS)
122 : 1 2.2.(SICS)	1148 : 11(AS) 2 48.8.(SICS)
124 : 1 2 4.4.(SICS)	24 : 11(AS) 22(AS) 4.4.(SICS)
148 : 1 2 4 8.8.(SICS)	1-1 : 1:1:1(Switching in sequential sequence)
1122 : 11(Alternate Switching) 2.2.(SICS)	

EXAMPLE OF SWITCHING STEPS :

124 : 1 2 4.4.(SICS)	1124 : 11(AS) 2 4.4.(SICS)
Step 644	Step 64444444444.....
Step 544444444...	Step 544444444444.44444.
Step 44444444444.....	Step 444444.....44444444444
Step 34444444444.....	Step 322..22..2..22..2..2..22..2
Step 2 ..22..22..222..2....22..2..	Step 21.....1.....1.....1.....1.....1..
Step 1 .1.1.1.1.1.1.1.1.1.1.1.1.1	Step 1 .1.....1.....1.....111.....1.....1.....1
+++++-----+-+-----++	+++++-----+-----+-----
148 : 1 2 4 8.8.(SICS)	1124 : 11(AS) 2 4.4.(SICS)
Step 6888.....	Step 6444444444444444.444.
Step 5888.....	Step 54444444444444444.44....
Step 488888888...888888888	Step 422.....2222222.....22..
Step 34444...4444.4.4.4444...	Step 3 ...22.....2222222.....2.....2
Step 2 ..22..22..2..22..2.22..22..	Step 21.....1.....1.....1.....1.....1..
Step 1 .1.1.1.1.1.1.1.1.1.1.1.1.1	Step 1 .1.....1.....1.....111.....1.....1.....1
+++++-----+-+-----	+++++-----+-----+-----

4

Contd. From Pg...3

5. **P.S.L.** : The precise setting of the target cos mode for a variety of applications be set in compliance with the measuring threshold of the actual power factor value. Furthermore, the detecting band of the set C/K value is mainly derived from the actual load variations.

I-P : The setting range can be set from 1.00 to the target power factor. And further, this mode represents a fixed detecting range. (Only set as positive inductive)

-P : The target power factor can be permitted to set in the range of capacitive power factor. And further, this mode represents a fixed setting point.

PP : This mode comprises the above two modes with their specific features, but the target power factor can not be set to capacitive power.

6. **CRP** : The setting of the C/K value has two types of operating modes, which includes the manual and automatic. /R (auto-detecting) mode. The C/K value can be set from 0.01~2.40 during the manual mode. In case of selecting the manual mode, the calculation of the C/K value has to be done in compliance with the capacity of the first capacitor.

$$Ck = IC / k \quad \text{Var : K Var (the first capacitor)}$$

$$IC = \frac{\text{Var}}{\sqrt{3} \times U} \quad \text{U : Line-Volt (in the system)}$$

$$\text{For example : Var=10 K Var, U = 380V, k = 400:5 = 80}$$

$$Ck = 10K / (1.732 \times 380 \times 80) = 0.19$$

● Please refer to page 3, table of C/K value

5

7. H.S.P. : Fast switching performance, $\alpha\sim\beta\sim\gamma$: Start-up

In order to replace the gradual switching on/off capacitor step, there are two solutions to an extended life of both the contactors and the capacitors as follows.

1. Switching on/off the largest possible capacitor step is in order to reduce the frequent switching operations. And the switching program will directly start entering the step in circular sequence for switching on/off capacitor if the actual load is fitted in with the circular sequence. Furthermore, the rest of the switching program should be activated in compliance with the selected RcL mode.
 2. After starting this procedure, in case of the subsequent connection/ disconnection to capacitor again, a half of the preset switching delay time under the dLY model will be activated; meanwhile, the decimal point of the unit place also flashes. If no longer switched on/off capacitor, the switching delay time will recover the standard setting.
- This H.S.P. Mode will be de-activated for switching on/off capacitor if the setting of the number of switching step is less than the switching step in circular sequence.

For example : $dLY = 30$, $StP = 6$, $RcL = 1124$ (step 4 as circular sequence)

In case a compensation demand for the reactive power value (K Var) is 10 times of the CK value, the following explanations are as follows :

The controller will directly switch on the capacitor (step 4) after 30 seconds because the reactive power value (K Var) is higher than 4 times of the C/K value, thus the K Var value in the system should be derived from the designed formula as $10-4=6$. This way, the derived value ($10-4=6$) in K Var is still higher than 4 times of the C/K value, a half of the preset switching delay time under the dLY mode will be activated for switching on again (new default value has been automatically changed as 15s), and meanwhile, the decimal point of the unit place also flashes.

Following up the designed formula, now the latest derived value ($6-4=2$) in K Var in the system is less than the step 4 in circular sequence so the H.S.P. Mode should be de-activated.

- Select the Auto mode, the H.S.P. Mode is de-activated.

8. $\alpha.u.S$: Setting of the over-voltage range : $110\sim130\%$

It is no longer switched on capacitor once the measured mains supply exceeds the preset range.

9. $\alpha.u.L$: Tripping setup for over voltage : β : Start-up

All the steps will be switched off in order once the legend $Er2$ is shown on the display.

This tripping setting must be activated according to the setting of the dLY and RcL mode.

10. $R.r.u$: Auto-adjustment in inverted-phase shift $\alpha\sim\beta\sim\gamma$:

The phase-shift will be automatically reversed at 180 degrees as the measured phase angle exceeds 90 degrees, and the displaying screen indicates $Er5$ after 3 seconds. Moreover, it is unnecessary to alternate the cable in the electrical network system except for the phase error.

- This procedure is only applied to the following conditions.
 1. The connected voltage terminals with the reverse polarity.
 2. The direction of the measured current flow has been inverted.

■ Table of the C/K values for 380V

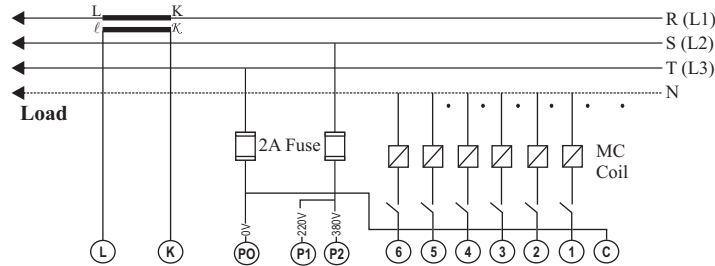
Ct 比	KVAR													
	2.5	5	7.5	10	15	20	25	30	37.5	40	50	60	80	100
150/5	0.13	0.25	0.38	0.51	0.76	1.01	1.27	1.52	1.90	2.03				
200/5	0.09	0.19	0.28	0.38	0.57	0.76	0.95	1.14	1.42	1.52	1.90	2.28		
250/5	0.08	0.15	0.23	0.30	0.46	0.61	0.73	0.91	1.14	1.22	1.52	1.82		
300/5	0.06	0.13	0.19	0.25	0.38	0.51	0.63	0.76	0.95	1.01	1.27	1.52	2.03	
400/5	0.05	0.09	0.14	0.19	0.28	0.38	0.47	0.57	0.71	0.76	0.95	1.14	1.52	1.90
500/5	0.04	0.08	0.11	0.15	0.23	0.30	0.38	0.46	0.57	0.61	0.76	0.91	1.22	1.52
600/5	0.03	0.06	0.09	0.13	0.19	0.25	0.32	0.38	0.47	0.51	0.63	0.76	1.01	1.27
800/5	0.02	0.05	0.07	0.09	0.14	0.19	0.24	0.28	0.36	0.38	0.47	0.57	0.76	0.95
1000/5	0.02	0.04	0.06	0.08	0.11	0.15	0.19	0.23	0.28	0.30	0.38	0.46	0.61	0.76
1500/5		0.03	0.04	0.05	0.08	0.10	0.13	0.15	0.19	0.20	0.25	0.30	0.41	0.51
2000/5		0.02	0.03	0.04	0.06	0.08	0.09	0.11	0.14	0.15	0.19	0.23	0.30	0.38
2500/5			0.02	0.03	0.05	0.06	0.08	0.09	0.11	0.12	0.15	0.18	0.24	0.30
3000/5				0.03	0.04	0.05	0.06	0.08	0.09	0.10	0.13	0.15	0.20	0.25
4000/5				0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.15	0.19
5000/5					0.02	0.03	0.04	0.05	0.06	0.06	0.08	0.09	0.12	0.15

■ Table of the C/K values for 220V

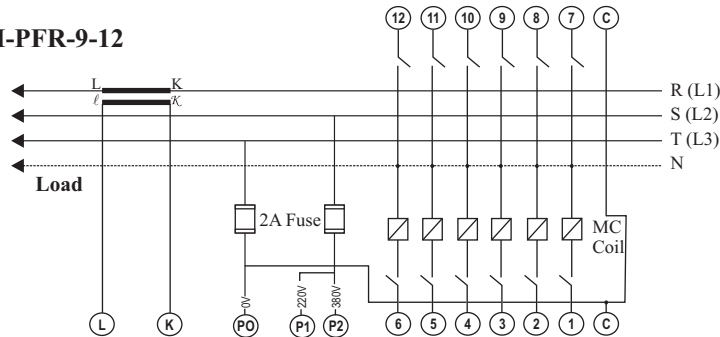
Ct 比	KVAR													
	2.5	5	7.5	10	15	20	25	30	40	50	60	80	100	
150/5	0.22	0.44	0.66	0.87	1.31	1.75	2.19							
200/5	0.16	0.33	0.49	0.66	0.98	1.31	1.64	1.97						
250/5	0.13	0.26	0.39	0.52	0.79	1.05	1.31	1.57	2.10					
300/5	0.11	0.22	0.33	0.44	0.66	0.87	1.09	1.31	1.75	2.19				
400/5	0.08	0.16	0.25	0.33	0.49	0.66	0.82	0.98	1.31	1.64	1.97			
500/5	0.07	0.13	0.20	0.26	0.39	0.52	0.66	0.79	1.05	1.31	1.57	2.10		
600/5	0.05	0.11	0.16	0.22	0.33	0.44	0.55	0.66	0.87	1.09	1.31	1.75	2.19	
800/5	0.04	0.08	0.12	0.16	0.25	0.33	0.41	0.49	0.66	0.82	0.98	1.31	1.64	
1000/5	0.03	0.07	0.10	0.13	0.20	0.26	0.33	0.39	0.52	0.66	0.79	1.05	1.31	
1500/5	0.02	0.04	0.07	0.09	0.13	0.17	0.22	0.26	0.35	0.44	0.52	0.70	0.87	
2000/5		0.03	0.05	0.07	0.10	0.13	0.16	0.20	0.26	0.33	0.39	0.52	0.66	
2500/5		0.03	0.04	0.05	0.08	0.10	0.13	0.16	0.21	0.26	0.31	0.42	0.52	
3000/5		0.02	0.03	0.04	0.07	0.09	0.11	0.13	0.17	0.22	0.26	0.35	0.44	
4000/5			0.02	0.03	0.05	0.07	0.08	0.10	0.13	0.16	0.20	0.26	0.33	
5000/5			0.02	0.03	0.04	0.05	0.07	0.08	0.10	0.13	0.16	0.21	0.26	

■ CONNECTION DIAGRAM

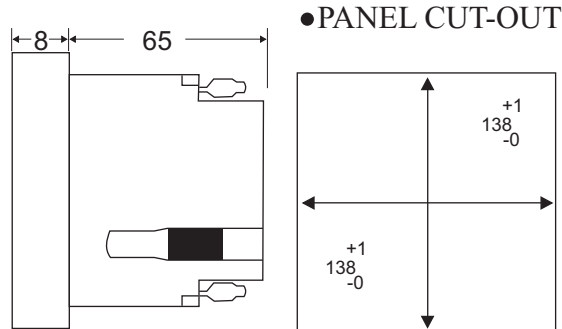
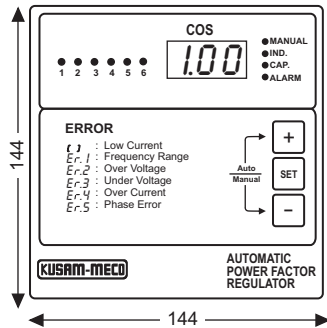
KM-PFR-9-06



KM-PFR-9-12



■ DIMENSIONS (mm)



● PANEL CUT-OUT

TEST CERTIFICATE

This Test Certificate that warrants the product has been inspected and Tested in accordance with the published specifications. The instrument has been calibrated by using equipment which has already been calibrated to standards traceable to national standards.

MODEL NO. _____

SERIAL NO. _____

DATE: _____

**ISO 9001
REGISTERED**



WARRANTY

Each "KUSAM-MECO" product is warranted to be free from defects in material and workmanship under normal use & service. The warranty period is one year (12 months) and begins from the date of despatch of goods. In case any defect occurs in functioning of the instrument, under proper use, within the warranty period, the same will be rectified by us free of charges, provided the to and fro freight charges are borne by you. This warranty extends only to the original buyer or end-user customer of a "KUSAM-MECO" authorized dealer. This warranty does not apply for damaged Ic's, fuses, burnt PCB's, disposable batteries, carrying case, test leads, or to any product which in "KUSAM-MECO's" opinion, has been misused, altered, neglected, contaminated or damaged by accident or abnormal conditions of operation or handling. "KUSAM-MECO" authorized dealer shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of "KUSAM-MECO" "KUSAM-MECO's" warranty obligation is limited, at option, free of charge repair, or replacement of a defective product which is returned to a "KUSAM-MECO" authorized service center within the warranty period.

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KUSAM-MECO®

An ISO 9001:2008 Certified company