

INSTRUCTION MANUAL

FOR

1 Ø / 2 Ø, All Features Version,

A. C. POWER CONTROLLER

Manufactured by :

SUDARSHAN ELECTRONICS

Registered Office & Works

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THE AC POWER CONTROLLER IS A COMPACT, OPEN EXECUTION, CHASSIS-MOUNTED MODULE. IT CONSISTS OF MAINLY TWO SECTIONS – **POWER SECTION AND CONTROL SECTION**. THE **POWER SECTION** COMPRISES OF LAVISHLY RATED ANTI-PARALLEL CONNECTED SCRs MOUNTED ON ELECTRICALLY ISOLATED HEAT-SINK (UPTO 500 AMPS), RC SNUBBER CIRCUIT (MOV) AND CT. THE **CONTROL SECTION** CONSISTS OF POWER SUPPLY TRANSFORMER / GATE FIRING AND TRIGGER CONTROL / SOFT STARTING AND SOFT STOPPING / CURRENT LIMIT / OVER-LOAD TRIP / SYNCHRONIZATION / BIAS / MAXIMUM VOLTAGE / CURRENT AND VOLTAGE STABILITY CIRCUITS.

THE CONTROL CARD IS USED FOR PHASE ANGLE FIRING CONTROL, WHICH ALLOWS A SMOOTH VARIATION OF THE POWER THROUGHOUT THE CONTROL RANGE. IT MAINTAINS CONSTANT POWER AT THE PRE-SELECTED VALUE (SET BY THE USER) IRRESPECTIVE OF THE LOAD, TEMPERATURE OR SUPPLY VOLTAGE VARIATION.

IT CAN BE USED IN TWO MODES – **AUTO MODE & MANUAL MODE**. IN AUTO MODE, THIS CARD CAN ACCEPT INPUT SIGNALs FROM ANY OF THE AUTOMATION SYSTEMs, VIZ. : PLC, PID, DCS, COMPUTER INTERFACE SYSTEM, etc., AND THE SIGNAL CAN BE 4 TO 20 mA DC OR 0 TO 5 V DC OR 0 TO 10 V DC. IN MANUAL MODE, THIS CARD CAN ACCEPT 0 TO 10 V FROM AN EXTERNAL 10k, 3W POTENTIOMETER.

IF A 0 TO 5 V DC SIGNAL INPUT IS TO BE GIVEN, THEN REMOVE LINK “LK3” AND GIVE THE INPUT SIGNAL ACROSS TERMINALS 2 & 3 OF TB2.

A HIGH RATE OF CHANGE OF VOLTAGE (dV/dt) CAN CAUSE AN SCR TO TURN ON. MOVs ARE CONNECTED ACROSS SCRs OF ALL POWER CONTROL UNITS FOR dV/dt PROTECTION.

CONTROL CARD DESCRIPTION :

1. SOFT STARTING :

THE POWER CONTROLLER UNIT HAS A FACILITY OF SOFT STARTING. WHEN AC POWER IS APPLIED TO THE POWER CONTROL UNIT, A TIME DELAY OF APPROXIMATELY 3 SECONDS INHIBITS ALL GATE SIGNALS TO THE SCRs. AFTER THIS INITIAL DELAY, WHEN THE ENABLE SIGNAL IS APPLIED TO THE CONTROL UNIT, THE SCRs ARE RAMPED ON TO THE LEVEL DETERMINED BY THE CONTROL SIGNAL. THIS UNIQUE CIRCUITRY PREVENTS EXCESSIVE INRUSH CURRENT TO THE HEATERS OR TRANSFORMERS. ENABLE IS INDICATED BY LED “L3”.

2. SYNCHRONIZATION CIRCUIT :

THE MAINS SIGNAL REQUIRED FOR SYNCHRONIZING THE FIRING IS DERIVED FROM THE SECONDARY OF THE MAINS POWER SUPPLY TRANSFORMER. THIS SIGNAL IS FILTERED TO PREVENT LINE DISTURBANCES FROM AFFECTING THE RAMP. THIS FILTER IS FREQUENCY COMPENSATED FOR 50 Hz.

3. BIAS SETTING :

BIAS (ZERO) POT ADJUSTMENT IS USED FOR SETTING THE OUTPUT OF THE POWER CONTROL UNIT TO MINIMUM WITH THE CONTROL SIGNAL AT ITS MINIMUM. THE BIAS IS FACTORY ADJUSTED SUCH THAT THE OUTPUT VOLTAGE INCREASES WITH INCREASE IN THE CONTROL SIGNAL. THERE ARE TWO MULTI-TURN POTENTIOMETERS ON THE CONTROL CARD, VIZ. P1 AND P7. P1 IS WITH RESPECT TO 4–20 mA DC SIGNAL INPUT AND P7 IS WITH RESPECT TO 0–10V DC SIGNAL INPUT.

4. **MAXIMUM VOLTAGE** :

MAXIMUM (SPAN) POT ADJUSTMENT IS USED FOR SETTING THE MAXIMUM OUTPUT VOLTAGE OF THE POWER CONTROL UNIT. SET THE CONTROL SIGNAL TO ITS MAXIMUM VALUE AND THEN ADJUST THE MAXIMUM VOLTAGE POTENTIOMETER (P4) SUCH THAT THE OUTPUT VOLTAGE IS AT ITS DESIRED MAXIMUM VALUE. THIS POT IS FACTORY SET SUCH THAT THE MAXIMUM OUTPUT VOLTAGE IS JUST EQUAL TO THE INPUT VOLTAGE. THIS POT CAN ALSO BE USED FOR CLAMPING THE UPPER LIMIT.

5. **CURRENT LIMIT** :

NORMALLY, CURRENT LIMIT ADJUSTMENT IS SET FOR THE RATED OUTPUT CURRENT OF THE POWER CONTROL UNIT. THIS IS HOWEVER ADJUSTABLE ANYWHERE FROM 20% TO 100% OF THE RATED VALUE. CLOCKWISE TURNING OF THE CURRENT LIMIT POTENTIOMETER (P6) WILL INCREASE THE OUTPUT CURRENT AND ANTI-CLOCKWISE TURNING WILL REDUCE THE OUTPUT CURRENT. IT IS RECOMMENDED THAT THE CURRENT LIMIT SHOULD BE SET AT ITS REQUIRED VALUE BECAUSE THE CURRENT LIMIT TAKES PRECEDENCE OVER THE CONTROL SIGNAL AND WILL PREVENT THE OUTPUT CURRENT FROM INCREASING BEYOND THE SET VALUE EVEN IF THE CONTROL SIGNAL IS INCREASED.

FOR OPERATING THE POWER CONTROL UNIT AT ITS DESIRED MAXIMUM OUTPUT CURRENT, FIRST TURN THE POT ANTI-CLOCKWISE TILL THE OUTPUT CURRENT JUST BEGINS TO DECREASE, THEN TURN THE POT SLIGHTLY CLOCKWISE.

FACILITY IS ALSO AVAILABLE TO SET THE CURRENT LIMIT EXTERNALLY. FOR THIS, REMOVE LINK “LK2” AND USE AN EXTERNAL, 10k, 1W POTENTIOMETER ACROSS THE 2 WAY CONNECTOR “TB4”. THIS FACILITY WILL HELP TO CONTROL THE CURRENT FROM ZERO TO A VALUE SET BY POTENTIOMETER P6.

6. **OVER-LOAD TRIP :**

NORMALLY, OVER-LOAD TRIP ADJUSTMENT IS SET FOR 150% OF THE RATED OUTPUT CURRENT OF THE POWER CONTROL UNIT. THIS IS HOWEVER ADJUSTABLE ANYWHERE FROM 110% TO 200% OF THE RATED VALUE. CLOCKWISE TURNING OF THE OVER-LOAD TRIP POTENTIOMETER (P9) WILL INCREASE THE TRIP CURRENT AND ANTI-CLOCKWISE TURNING WILL REDUCE THE TRIP CURRENT. IT IS RECOMMENDED THAT THE OVER-LOAD TRIP SHOULD BE LEFT AT ITS FACTORY PRE-SET VALUE OF 150%, OTHERWISE THIS MAY BECOME A CAUSE FOR NUISANCE TRIPPING. OVERLOAD TRIP IS INDICATED BY LED “L4”.

7. **VOLTAGE AND CURRENT STABILITY :**

IN THE AC POWER CONTROLLER UNIT, THE OUTPUT HAS TO BE STABLE IN TERMS OF BOTH THE VOLTAGE AND CURRENT. THIS IS ACHIEVED BY MAKING USE OF THE MULTI-TURN TRIM POTENTIOMETERS P5 AND P8 RESPECTIVELY. THESE POTENTIOMETERS ARE FACTORY PRE-SET, AND IN CASE OF ANY FINE SETTING REQUIRED, CLOCKWISE TURNING OF P5 WILL MAKE THE VOLTAGE MORE STABLE AND CLOCKWISE TURNING OF P8 WILL MAKE THE CURRENT MORE STABLE.

AS SHOWN IN THE LAYOUT DIAGRAM, 9 MULTI-TURN POTENTIOMETERS ARE MOUNTED ON THE CONTROL CARD. THEIR FUNCTIONS ARE AS FOLLOWS :

<u>Sl.No.</u>	<u>LEGEND ON CARD</u>	<u>FUNCTION OF THE POTENTIOMETER</u>
01.	P 1	BIAS SETTING FOR 4–20mA DC SIGNAL INPUT (FACTORY PRE-SET. NOT TO BE ADJUSTED)
02.	P 2	ACCELERATION (RAMP-UP) TIME SETTING (FACTORY PRE-SET.CAN BE ADJUSTED IF REQD.)
03.	P 3	DECELERATION (RAMP-DOWN) TIME SETTING (FACTORY PRE-SET.CAN BE ADJUSTED IF REQD.)
04.	P 4	MAXIMUM OUTPUT VOLTAGE SETTING (FACTORY PRE-SET.CAN BE ADJUSTED IF REQD.)
05.	P 5	VOLTAGE STABILITY SETTING (FACTORY PRE-SET.CAN BE ADJUSTED IF REQD.)
06.	P 6	CURRENT LIMIT SETTING (FACTORY PRE-SET.CAN BE ADJUSTED IF REQD.)
07.	P 7	BIAS SETTING FOR 0–10V DC SIGNAL INPUT (FACTORY PRE-SET. NOT TO BE ADJUSTED)
08.	P 8	CURRENT STABILITY SETTING (FACTORY PRE-SET.CAN BE ADJUSTED IF REQD.)
09.	P 9	OVER-LOAD TRIP SETTING (FACTORY PRE-SET. NOT TO BE ADJUSTED)

TESTING CHART FOR CONTROL CARD

NOTE : ALL THE TEST POINTS ARE WITH RESPECT TO ELECTRONIC GROUND, I. E. TERMINAL No. 2 OF TB 2.

<u>Sl. No.</u>	<u>IC/TR No.</u>	<u>IC/TR. DES.</u>	<u>PIN No(s).</u>	<u>DESIRED RESULT</u>	<u>REPL –ACE</u>
01.	U 03	LM 339	13	+10V DC (Enable Output)	U 03
02.	U 04	LM 348	08	0 to +10V DC, Var.(4–20mA DC I/P Signal Foll.)	U 04
03.	U 05	LM 348	07	0 to +10V DC, Variable (Ramp O/P)	U 05
04.	U 07	CD 4013	01	+15V DC (On Over Load Trip)	U 07
05.	U 03	LM 339	02	+15V DC (On Over Load Trip)	U 03
06.	U 06	LM 348	08	0 to –13V DC, Variable (I/P Signal to U 03)	U 06
07.	U 03	LM 339	01	–15V to +10V DC,Variable(Invrtd. I/P Sig. Foll.)	U 03
08.	Q 02	TIP 122	TIP 122	+24V DC to +20V DC, Variable (I/P Sig. Foll.)	Q 02
09.	Q 05	TIP 122	TIP 122	+24V DC to +20V DC, Variable (I/P Sig. Foll.)	Q 05
10.	TB3–1 w.r.t. TB3–2 (R)			0 to +0.4V DC (max.), Var. (corres. to I/P Sig.)	T 2
11.	TB3–3 w.r.t. TB3–4 (R')			0 to +0.4V DC (max.), Var. (corres. to I/P Sig.)	T 3

TECHNICAL SPECIFICATIONS & FEATURES OF A.C. POWER CONTROLLER :

FEATURES :

01. Instantaneous Over Current Trip Protection.
02. Fault / Over–Current Trip LED Indication.
03. Trip Relay Potential–Free Contact available.
04. External Trip–Reset Facility.
05. External Interlock Facility.
06. Separate Bias Settings for Voltage and Current Input Signals.
07. Current Limit Facility.
08. Separate Voltage Stability and Current Stability Adjustments available.
09. Maximum Voltage Limit Facility available.
10. Can accept 0–5V DC or 0–10V DC or 4–20mA DC as the Input Signal.
11. Can take 10% Overload for 2 Hours.
12. Output Voltage linear to the Input Signal, except when working in Current Limit Mode.
13. Type of Control : Phase Angle Firing.
14. Conservatively designed Heat Sink with Heat Sink Over Temperature Protection for Force–Cooled Units.

SPECIFICATIONS :

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| 01. Voltage Rating | : 110V/230V/380V/415V/440V/460V/480V, 50Hz / 60Hz. |
| 02. Supply System | : 1 Phase or 2 Phase. |
| 03. Current Rating | : From 15Amps upto 300Amps, Higher Ratings on request. |
| 04. Control Signal | : 4–20mA DC, 0–10V DC or through a 10k Potentiometer. |
| 05. Control Method | : P, PI, PD or PID. |

ENVIRONMENT :

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| 01. Operating Temperature | : 0 °C to +50 °C |
| 02. Storage Temperature | : –25 °C to +55 °C |
| 03. Shipping Temperature | : –25 °C to +70 °C |
| 04. Enclosure Rating | : IP 20, Panel Mounting. |
| 05. Humidity | : Max. 90% RH at 40 °C, Non Dripping. |
| 06. Altitude | : Upto 1000 metres above MSL. Above 1000 metres, derate by 1% per 10 metres. |

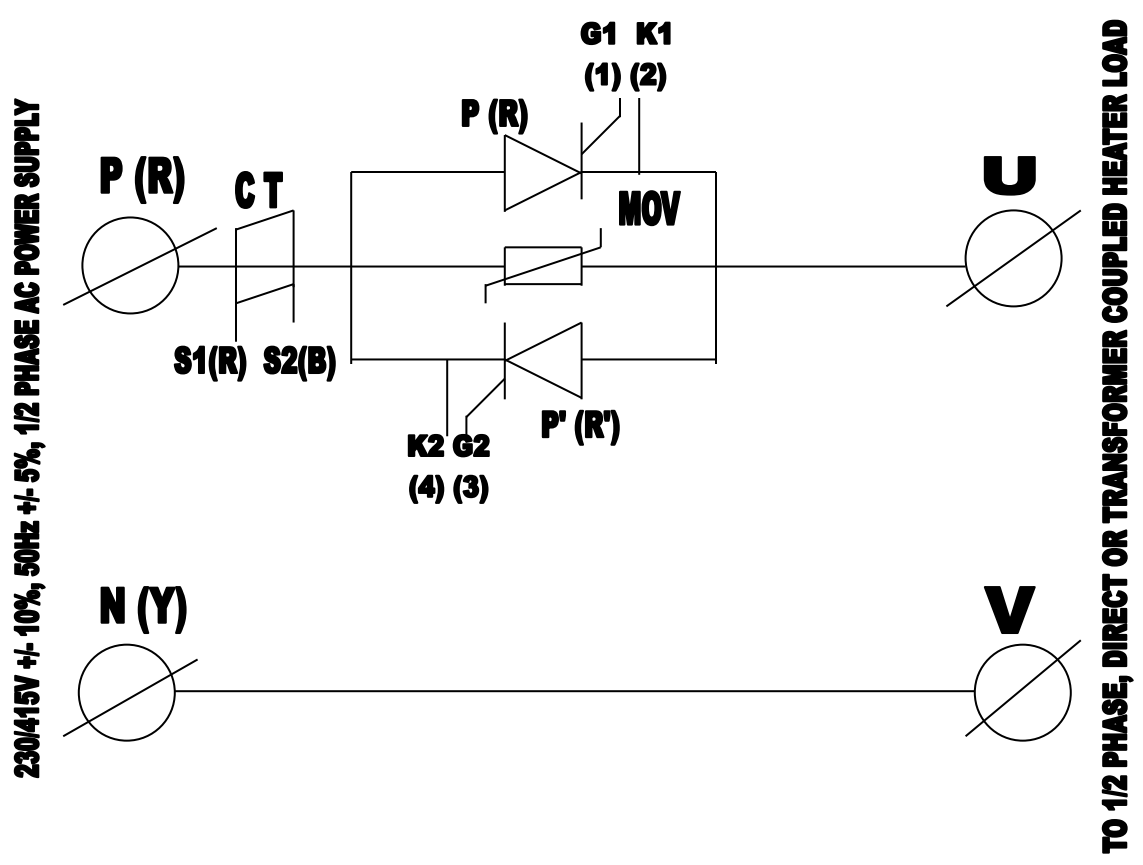
TROUBLE SHOOTING CHART

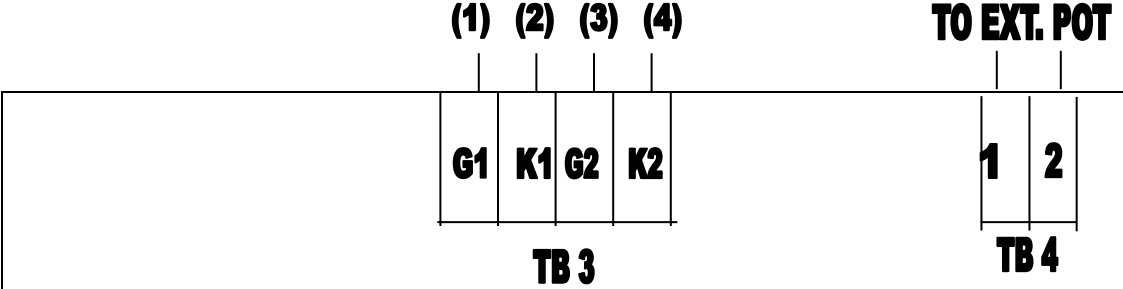
<u>Sl. No.</u>	<u>FAULT</u>	<u>POSSIBLE CAUSE</u>	<u>REMEDIAL MEASURE</u>
01.	NO OUTPUT	Blown Fuse at Input Faulty Thyristor Over Load at Output Enable Signal not present Control Card Failure	Check & Replace Fuse Replace with New Thyristor Press Reset Button on Card Make available Enable Signal Change Card or Consult Factory
02.	ERRATIC OUTPUT	Faulty Control Signal RC Card/MOV Failure One Thyristor in TT Block faulty Control Card Failure	Check & Rectify Control Signal Replace RC Card/MOV Replace with New TT Block Change Card or Consult Factory
03.	ALWAYS FULL OUTPUT	Faulty Control Signal Shorted/Faulty RC Card/MOV Shorted TT Block Control Card Failure	Check & Rectify Control Signal Replace RC Card/MOV Replace with New TT Block Change Card or Consult Factory

NOTE :

THE CONTROL CARD CONTAINS CMOS DIGITAL ICs AND THEY ARE IRREPAIRABLE AT SITE. CONSULT FACTORY FOR NECESSARY HELP.

1 (2) PHASE AC – AC CONVERTOR POWER CIRCUIT DIAGRAM





1 / 2 PHASE, 2 PULSE THYRISTOR TRIGGER CONTROL CARD

