DC SERVOMOTOR CONTROLLER

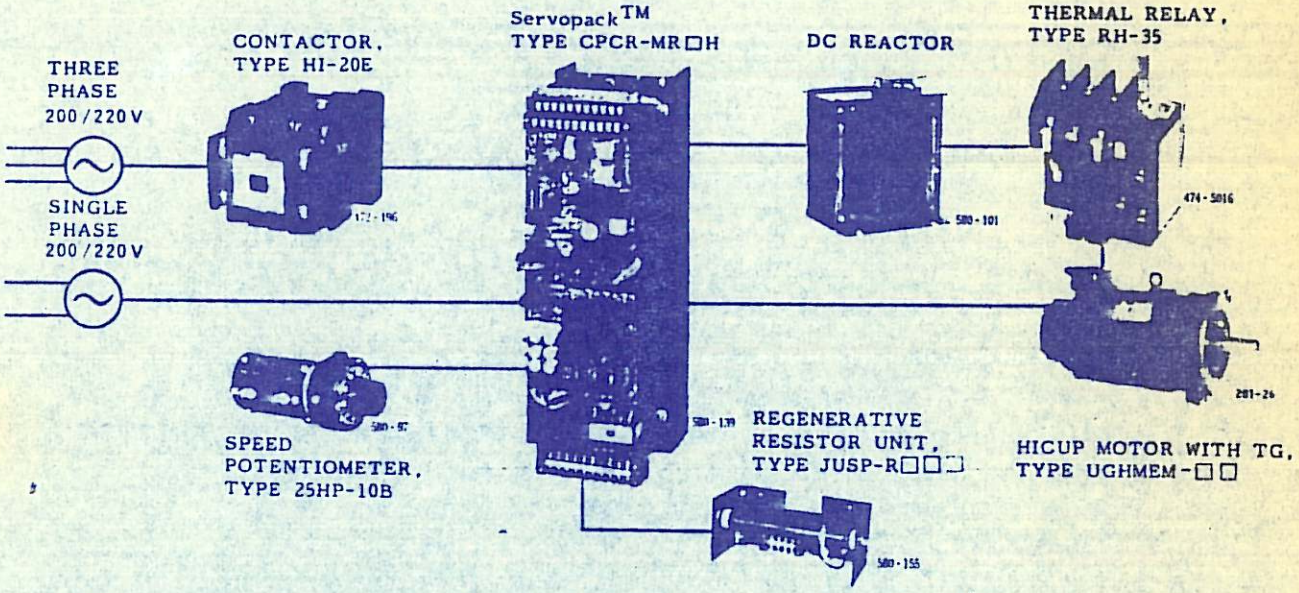
Servopack™

Transistorized/PWM Control Reversing Type CPCR-MR 08H to 75H

Instructions
TOE-C717-1(
May, 1981

When properly installed, operated and maintained, this equipment will provide a lifetime of optimum operation. Before starting, read thoroughly these instructions and keep them for future reference.

IMPORTANT: ON OPERATION OF SERVOMOTORS, SEE THE INSTRUCTION MANUALS ACCOMPANYING THE MOTOR. MAKE NO WITHSTAND VOLTAGE TEST NOR MEGGER TEST TO THE EQUIPMENT.



Combination of Servopack with Components Installed Separately

Servopack Type	Servomotor Type with TG	Components Installed Separately		
		Thermal Overload Relay	DC Reactor	Regenerative Resistor Unit
CPCR-MR08H CPCR-MR08HW	UGCMEM-08	RH-35/6.2HV	20 mH 7.5 A	JUSP-R001
	UGHMEM-06	RH-35/5.5HV		
	UGJMED-60M	RH-35/7T		
CPCR-MR15H CPCR-MR15HW	UGCMEM-15	RH-35/11.5HV	20 mH 12.5 A	
	UGHMEM-12	RH-35/10HV		
	UGMMEM-50	RH-35/12.5HV		
	UGJMED-60L	RH-35/15T1		
	UGJMED-80M	RH-35/15T2		
CPCR-MR22H CPCR-MR22HW	UGCMEM-22	RH-35/17.5HV	15 mH 17.5 A	JUSP-R003
	UGHMEM-20			
	UGJMED-80L	RH-35/26T		
CPCR-MR55H CPCR-MR55HW	UGCMEM-37	RH-35/28HV	15 mH 28 A	
	UGCMEM-55	RH-35/30HV		
	UGHMEM-30	RH-35/24.5HV		
	UGHMEM-44			
	UGMMEM-1A			
	UGJMED-80K	RH-35/30T		
CPCR-MR75H	UGCMEM-37	RH-35/28HV	20 mH 50 A	JUSP-R004
	UGCMEM-55	RH-35/30HV		
	UGCMFM-75	RH-35/41.2HV		
	UGHMEM-30	RH-35/24.5HV		
	UGHMEM-44			
	UGMMEM-1A			

Contents

RECEIVING

This unit has been put through severe test at factory before shipped. After unpacking, however, check and see the following.

- Its nameplate rating meets your requirement.
- It has sustained no damage while in transit.
- Bolts and screws are not loose.

If any part of the units is damaged or lost, immediately notify us giving full details and nameplate data.

INSTALLATION

Caution

Where installing the unit or the motor, use proper care:

- Never drop them.
- Never give them shock.
- Never grip the printed circuit board or wire-wound resistor on the unit.

Location

- Select the location free from oil, water, hot air, high humidity, excessive dust or iron particles.
- Keep the temperature on the printed circuit board at 60°C or below, if it rises due to convection and radiation of a heat source like a resistor.

  Where the controller is enclosed in a casing, the temperature inside the casing should be -10 to +60°C.
- Apply a shock absorber to the controller where a vibration source exists.
- Avoid the exposure to corrosive gases because they may roughen commutator surface resulting in deterioration of motor commutation or cause contact corrosion leading to poor contacting in command, TG, and main circuits.
- Where a high-frequency noise source such as electric welder exists, provide a noise filter to avoid the possible entrance of the noise induced through power supply or command circuit. Use a line filter for power supply, and a low-pass filter for command and TG feedback circuits.

Table 1-1 Rated Current of Servopack

Circuit (Terminals) \ Servopack Type			Rated Current (A)							
			CPCR-MR08H(W)	CPCR-MR15H(W)	CPCR-MR22H(W)	CPCR-MR55H(W)		CPCR-MR75H		
Main Circuit Terminal	AC power supply	(R,S,T)	5	9	12	3.7kW 20	5.5kW 26	3.7kW 20	5.5kW 26	7.5kW 35
	Motor main circuit	(A,B)	7	13	18	30		30		40
	DC reactor	(L,A)								
	Thermal relay	(L,A)								
	Regenerative resistor unit	(R1,R2)	6	6	16	16		21		
	Control power supply	(r,t)	0.3							
Control Circuit Terminal	Speed reference input	(1,2,9)	15 mA max.							
	Tach-gen. circuit	(3,4)								
	Over-travel limit circuit	(5,6,7)								
	Complete motor-stopping circuit	(8,11)								
	Output of ±12 V	(10,11,12)								
	External current-limit circuit	(13,14)								
	Over-heat detecting circuit	(C1,C1)	100 VA (100 VAC, 1 A), 12 W (24 VDC, 0.5 A)*							
	Blown-fuse detecting circuit	(C3,C4)	50 VA (100 VAC, 0.5 A), 30 W (30 VDC, 1 A)†							
	Servo-error detecting circuit	(16,17)	170 VA (100 VAC, 1.7 A), 36 W (24 VDC, 1.5 A)†							
Thermal relay contact		-	660 VAC (220 VAC, 3 A)†							
Temp switch of resistor unit		(C1,C2)	100 VAC (100 VAC, 1 A)*							

* Contacts capacity of temperature switch
† Contacts capacity of thermal relay

Note: Use 600 V or over insulated cable in main circuit.

Mountings

Mount the unit vertically on the wall, using the mounting holes (4) on the base plate, with main terminals (R, S, T...) at the bottom, for the unit employs cooling system taking advantage of natural air convection.

Provide a space for DC reactor, thermal overload relay, and regenerative resistor unit, for they are separately provided. For dimensions of these auxiliary units, contact the company.

Since regenerative resistors may heat to high temperature, keep a distance of more than 15 cm between external devices or wiring ducts and Servopack unit.

WIRING

Selection of Lead Size

Lead size should be determined according to rated current of each Servopack type shown in Table 1-1. Refer to Table 1-2 "Recommended Lead Size."

Wiring Precaution

1. Speed Reference Input (Terminals 1, 2, and 9)
   - Use a two-core twisted shielded cable. The shield should be grounded.
   - Lead length should be less than 10 m. If it is more than 10 m, contact the company.
   - Where relays are employed for speed reference circuit, use Yaskawa's "Bestact" I/O relays, type RB or equivalent.
   - Connect the terminal 1 or 9 to 0 V terminal 2 positively.
   - Since the speed reference circuit may be affected by noise, ground 0 V terminal 2.
   - When the circuit is affected by noise, even if the terminal 2 is grounded, it is recommended that a filter be connected across terminals 1 and 2 or 9 and 2.
2. Tach-Gen (TG) Feedback Input (Terminals 3 and 4)
   - Be sure to connect Servopack terminal 3 to TG terminal minus ⊖ and 4 to plus ⊕.
   - Use a two-core twisted shielded cable. The shield should be grounded.

Table 1-2 Recommended Lead Size

Circuit (Terminals) \ Servopack Type			Lead Size (mm2)				
			CPCR-MR08H(W)	CPCR-MR15H(W)	CPCR-MR22H(W)	CPCR-MR55H(W)	CPCR-MR75H
Main Circuit Terminal	AC power supply	(R,S,T)	2.0 or over (Heat-resisting lead)		3.5 or over (Heat-resisting lead)	5.5 or over (Heat-resisting lead)	8.0 or over (Heat-resisting lead)
	Motor main circuit	(A,B)					
	DC reactor	(L,A)					
	Thermal relay	(L,A)					
	Regenerative resistor unit	(R1,R2)	2.0 or over (Heat-resisting lead)				
	Control power supply	(r,t)	1.25 or over				
Control Circuit Terminal	Speed reference input	(1,2,9)	Two-core twisted shielded cable Type RG-108A/U made by Fujikura Cable Works, Ltd., Japan or equivalent.				
	Tach-gen. circuit	(3,4)					
	Over-travel limit switch	(5,6,7)					
	Complete motor-stopping circuit	(8,11)	1.25 or over				
	Output of ±12 V	(10,11,12)					
	External current-limit circuit	(13,14)					
	Over-heat detecting circuit	(C1,C2)					
	Blown-fuse detecting circuit	(C3,C4)					
	Servo-error detecting circuit	(16,17)					
Thermal relay contact		(-)	1.25 or over				
Temp switch of resistor unit		(C1,C2)					

Note: Number of leads in conduit - 3

Table 2 Tach-Gen Terminals and Servomotors

TG Type	TG Terminals			Servomotor
	Symbol		Connection Type	
	Plus (+)	Minus (-)		
UGPGEM-12F10	A	B	Cannon connector	· Cup motor Type UGCMEM-□FB · Hicup motor Type UGHMEM-□AA
UGTGIM-7LV	A	B	Cannon connector	· Cup motor Type UGCMEM-□GC · Hicup motor Type UGHMEM-□AA
11TG-D027	1	2	Screw terminal	· Minertia motor standard series Type UGMMEM-□AA
TG-7SV built-in feedback unit, type TFUE-□C7	G	H	Cannon connector	· Cup motor Type UGCMEM-□FB Type UGCMEM-□GC · Hicup motor Type UGHMEM-□AA · Minertia motor standard series Type UGMMEM-□AA

Note : Where positive voltage is applied to the motor terminal A, the positive voltage appears at TG plus terminals shown in the table above.

3. Signal Line

· Since Servopack provides a fine speed control over a wide speed range of 1000 : 1, the signal level should be 6 mVDC or below. Be careful not to subject the signal line to the induced noise when making a wiring of speed reference input and TG feedback circuits. Never fail to run power line and control line in the same duct or in a bundle.

· For TG terminal symbols of the motors to be used, refer to Table 2.

4. Overheat Detection (Terminals C1 and C2)

· Where the cooling fan does not rotate due to any trouble or the heat sink is overheat, terminals C_1 and C_2 circuit is opened. Make a sequence which turns off the main power supply using these terminals.

5. Servo Trouble (Terminals 16 and 17)

The following troubles open across terminals 16 and 17.

· Wrong TG connections.

· Overcurrent in Servopack.

· Abnormal main circuit voltage.

Make the sequence for turning off the main power supply using these terminals.

6. Temperature Switch in Regenerative Resistor Unit.

When the resistor unit becomes overheat for excessive start/stop operations, or a regenerative transistor 5Tr is fault, the switch is opened. To turn off the main power supply, use the both ends terminals of the switch.

7. Thermal Relay

· For motor overload protection, connect the terminal relay in series with motor main circuit. Thermal relay is separately provided for Minertia Motors J series. As for J series motor, thermal relay should be connected in series with thermostat.

· Make a sequence so that main circuit power supply is interrupted by operation of thermal relay or temperature switch, or detection of overheat or servo trouble.

8. Noise Elimination

To prevent the Servopack from malfunctioning due to the noise induced by magnetic contactor, relay, induction motor, and magnetic brake (solenoid), use surge suppressors, type CR50500 made by Okaya Electric or equivalent.

9. Protection of Power Line

Since Servopack is not provided with a protection for AC power line, MCB (molded circuit breaker) or fuse should be connected to three-phase AC power supply side according to number of Servopack. Refer to Table 3. Since Servopack is provided with capacitor input type power supply, never use a quick-acting fuse. If not so, the fuse may be blown off when the power is turned on.

10. Remedy for Radio Frequency Interference

Servopack is not provided with a protection from radio frequency interference. If the controller is troubled by radio wave, connect a line filter to power supply.

Recommended Line Filters (made by Tohoku Metal Industries, Ltd.)

Type LF305 (3-phase, 200 VAC, 5 A):
For type CPCR-MR08H

Type LF310 (3-phase, 200 VAC, 10 A):
For type CPCR-MR15H

Type LF315 (3-phase, 200 VAC, 15 A):
For type CPCR-MR22H

Type LF320 (3-phase, 200 VAC, 20 A):
For type CPCR-MR55H (3.5 kW motor)

Type LF330 (3-phase, 200 VAC, 30 A):
For type CPCR-MR55H (5.5 kW motor)

11. Power ON/OFF Sequences

Make the following power on/off sequences.

Power on sequence

1) Control power supply is turned on.
2) Main power supply is turned on approximately 0.1 second later.

Power off sequence

1) Main power supply is turned off.
2) After approximately 10 msec, control power supply is turned off.

Notes:
1. At power failure, the simultaneous interrupting is also available.
2. Never make a sequence in which control power supply is interrupted with main power supply turned on.

12. Others

When power is turned on, speed reference voltage should be 0 V.

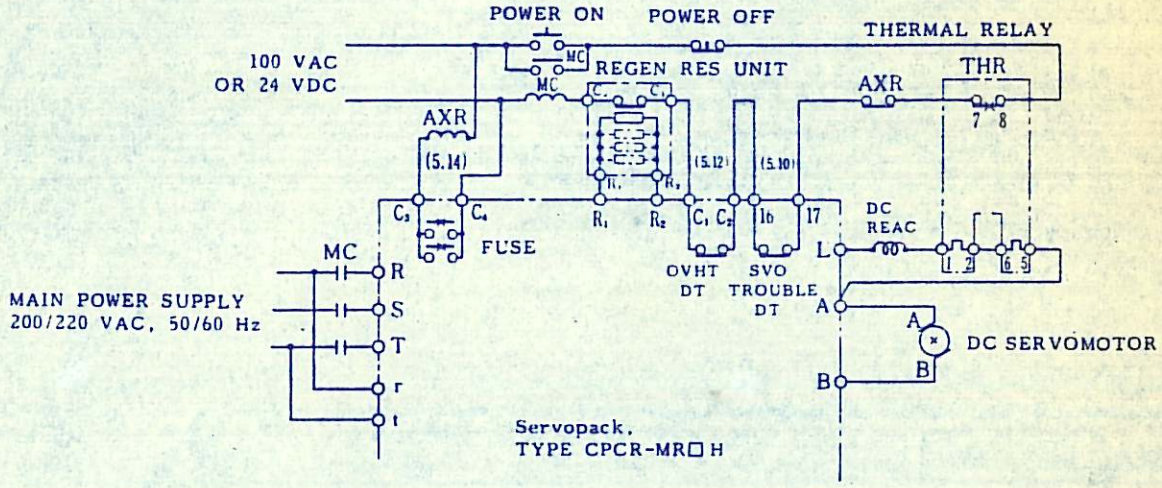


Fig. 1 Overload Protecting Circuit

Table 3 Servopack Power Capacity and Rated Current of MCB or Fuse (Motor Output)

Servopack Type	Power Capacity of Servopack	Rated Current of MCB or Fuse
CPCR-MR08H(W)	1.6 kVA	5 A
CPCR-MR15H(W)	3.0 kVA	9 A
CPCR-MR22H(W)	4.0 kVA	12 A
CPCR-MR55H(W)	6.9 kVA (3.7 kW)	20 A
	9 kVA (5.5 kW)	26 A
CPCR-MR75H	6.9 kVA (3.7 kW)	20 A
	9 kVA (5.5 kW)	26 A
	13 kVA (7.5 kW)	35 A

OPERATION

Make sure of the following before operation.

- Supply voltage should be within range of 200/220 VAC ±10%, 50/60 Hz.
- Complete TG feedback circuit by connecting the terminals 3 and 4 of the Servopack to (-) and (+) of TG, respectively.
- Speed reference voltage should be 0 V. It means that speed reference circuit is short-circuited.
- Make a sequence so that the operation of thermal relay, thermostat, servo trouble detecting circuit and overheat detecting circuit interrupts main circuit power supply.
- Shield and 0 V terminal 2 should be grounded.
- Motor terminals A and B should be connected with the Servopack terminals A and B, respectively.
- Thermal relay should be in series with motor.
- DC reactor and regenerative resistor unit should be connected to Servopack.
- The Servopack has been adjusted for a motor to be used.

After confirming the above, turn on the power. Start the operation increasing speed reference input from 0 V gradually.

Test run under no load is recommended. Test run with load should be carried out after making sure that the motor is ready to stop at emergency.

ADJUSTMENT

The Servopack has been factory-adjusted for Cup motor. The adjustment is as follows.

Speed Reference Voltage

The controller has been adjusted so that the applicable motor obtains the rated speed at ±6 V input with no load. Apply the voltage across the speed reference input terminals 1 and 2.

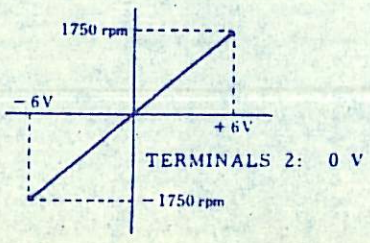


Fig. 2 Speed Reference Input—Servomotor Speed Characteristics

Servomotor Start-Stop Characteristics

Fig. 3 shows Servomotor start-stop characteristics made by applying the speed reference voltage.

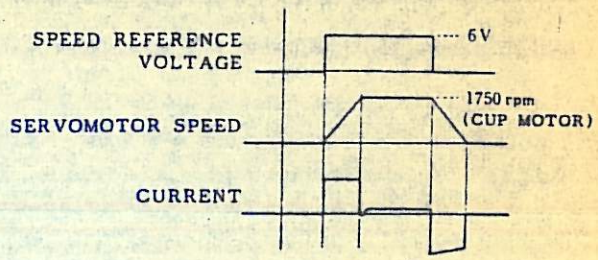
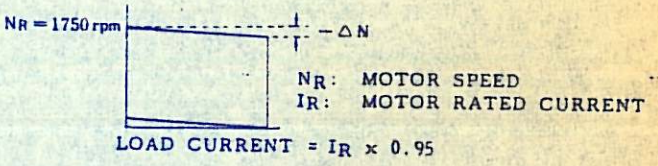


Fig. 3 Servomotor Start-Stop Characteristics

Speed Regulation

The speed regulation is caluculated as follows.



$$\text{SPEED REGULATION} = \frac{\Delta N}{N_R} \times 100\% = 0.1\% \text{ and below}$$

Fig. 4 Speed Regulation

Readjustment

When the servomotors excluding all Cup motors are controlled by the Servopack, readjustment should be made by setting the potentiometers.

Table 4 shows the setting of potentiometers corresponding to applicable motors.

Table 4 Setting of Potentiometers

Servo-pack Type	Servomotor Type	Potentiometer												
		IN-AJ (1VR)	SPD-AJ (2VR)	ZERO-AJ (3VR)	4VR	5VR	6VR	7VR	8VR	9VR	10VR	PRO-AJ (11VR)	12VR	
CPCR-MR08H CPCR-MR08HW	UGCMEM(D)-08	5/10	7/10	3-7/10	3-3.5/4	3.5-4/4	3/4	1-2/4	1.5-2.5/4	1.5-2.5/4	2-3/4	2.5-3/4	1.5-2.5/4	Ⓐ
	UGHMEM(D)-06	5/10	9/10	3-7/10	3-3.5/4	3.5-4/4	3/4	1-2/4	1.5-2.5/4	1.5-2.5/4	2-3/4	4/4	1.5-2.5/4	
	UGJMED-60M	5/10	9/10	3-7/10	3-3.5/4	3.5-4/4	3/4	1-2/4	1.5-2.5/4	1.5-2.5/4	2-3/4	4/4	1.5-2.5/4	
CPCR-MR15H CPCR-MR15HW	UGCMEM(D)-15	5/10	7/10	3-7/10	3-3.5/4	3.5-4/4	3/4	1-2/4	1.5-2.5/4	1.5-2.5/4	2-3/4	2.5-3/4	1.5-2.5/4	Ⓐ
	UGHMEM(D)-12	5/10	9/10	3-7/10	3-3.5/4	3.5-4/4	3/4	1-2/4	1.5-2.5/4	1.5-2.5/4	2-3/4	4/4	1.5-2.5/4	
	UGMMEM-50	5/10	2-3/10	3-7/10	1.5-2.5/4	3.5-4/4	1-2/4	1-2/4	1.5-2.5/4	1.5-2.5/4	2-3/4	1-1.5/4	1.5-2.5/4	
	UGJMED-60L	5/10	9/10	3-7/10	3-3.5/4	3.5-4/4	3/4	1-2/4	1.5-2.5/4	1.5-2.5/4	2-3/4	4/4	1.5-2.5/4	
	UGJMED-80M	5/10	9/10	3-7/10	3-3.5/4	3.5-4/4	3/4	1-2/4	1.5-2.5/4	1.5-2.5/4	2-3/4	4/4	1.5-2.5/4	
CPCR-MR22H CPCR-MR22HW	UGCMEM(D)-22	5/10	7/10	3-7/10	3-3.5/4	3.5-4/4	3/4	1.5-2.5/4	1.5-2.5/4	1.5-2.5/4	2-3/4	2.5-3/4	1.5-2.5/4	Ⓐ
	UGHMEM(D)-20	5/10	9/10	3-7/10	3-3.5/4	3.5-4/4	3/4	1.5-2.5/4	1.5-2.5/4	1.5-2.5/4	2-3/4	4/4	1.5-2.5/4	
	UGJMED-80L	5/10	9/10	3-7/10	3-3.5/4	3.5-4/4	3/4	1-2/4	1.5-2.5/4	1.5-2.5/4	2-3/4	4/4	1.5-2.5/4	
CPCR-MR55H CPCR-MR55HW	UGCMEM(D)-37	5/10	7/10	3-7/10	3-3.5/4	3.5-4/4	2.5-3.5/4	1.5-2.5/4	1.5-2.5/4	1.5-2.5/4	2-3/4	2.5-3/4	1.5-2.5/4	Ⓐ
	UGCMEM-55	5/10	7/10	3-7/10	3-3.5/4	3.5-4/4	2.5-3.5/4	1.5-2.5/4	1.5-2.5/4	1.5-2.5/4	2-3/4	2.5-3/4	1.5-2.5/4	
	UGHMEM(D)-30	5/10	9/10	3-7/10	3-3.5/4	3.5-4/4	2.5-3.5/4	1.5-2.5/4	1.5-2.5/4	1.5-2.5/4	2-3/4	4/4	1.5-2.5/4	
	UGHMEM-44	5/10	9/10	3-7/10	3-3.5/4	3.5-4/4	2.5-3.5/4	1.5-2.5/4	1.5-2.5/4	1.5-2.5/4	2-3/4	4/4	1.5-2.5/4	
	UGMMEM-1A	5/10	2-3/10	3-7/10	1.5-2.5/4	3.5-4/4	1-2/4	1.5-2.5/4	1.5-2.5/4	1.5-2.5/4	2-3/4	1-1.5/4	1.5-2.5/4	
	UGJMED-80K	5/10	9/10	3-7/10	3-3.5/4	3.5-4/4	2.5-3.5/4	1.5-2.5/4	1.5-2.5/4	1.5-2.5/4	2-3/4	4/4	1.5-2.5/4	
CPCR-MR75H	UGCMEM(D)-37	5/10	7/10	3-7/10	3-3.5/4	3.5-4/4	2.5-3.5/4	1.5-2.5/4	1.5-2.5/4	1.5-2.5/4	2-3/4	2.5-3/4	1.5-2.5/4	
	UGCMEM-55	5/10	7/10	3-7/10	3-3.5/4	3.5-4/4	2.5-3.5/4	1.5-2.5/4	1.5-2.5/4	1.5-2.5/4	2-3/4	2.5-3/4	1.5-2.5/4	
	UGCMFM-75	5/10	7/10	3-7/10	3-3.5/4	3.5-4/4	2.5-3.5/4	1.5-2.5/4	1.5-2.5/4	1.5-2.5/4	2-3/4	2.5-3/4	1.5-2.5/4	Ⓐ
	UGHMEM(D)-30	5/10	9/10	3-7/10	3-3.5/4	3.5-4/4	2.5-3.5/4	1.5-2.5/4	1.5-2.5/4	1.5-2.5/4	2-3/4	4/4	1.5-2.5/4	
	UGHMEM-44	5/10	9/10	3-7/10	3-3.5/4	3.5-4/4	2.5-3.5/4	1.5-2.5/4	1.5-2.5/4	1.5-2.5/4	2-3/4	4/4	1.5-2.5/4	
	UGMMEM-1A	5/10	2-3/10	3-7/10	1.5-2.5/4	3.5-4/4	1-2/4	1.5-2.5/4	1.5-2.5/4	1.5-2.5/4	2-3/4	1-1.5/4	1.5-2.5/4	

Notes:

1. Potentiometers to be used for readjustment are 1VR, 2VR, 4VR, 6VR, and 11VR.
   Never tamper with other potentiometers, especially 12VR.

2. Configuration of potentiometers:

   · 1VR to 3VR;  shows 4/10 scales.

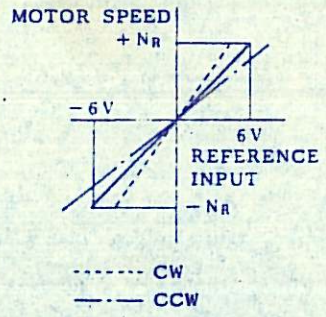
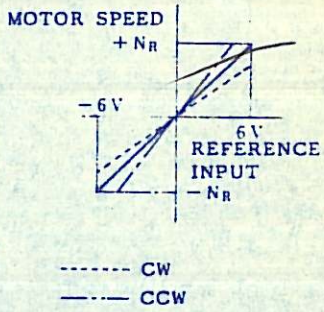
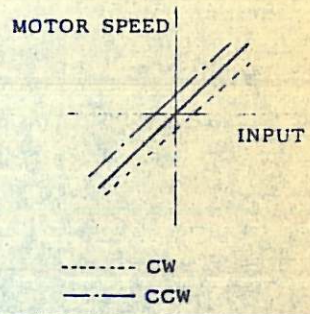
   · 4VR to 12VR;  shows 1.5/4 scales.

3. Servopack has been factory-set to scales in Ⓐ.

4. For ten-scale potentiometer in 4VR to 12VR, 2.5 times the value shown in Table 4 should be done.

   Example: 3/4 ⟶ 3 x 2.5/4 x 2.5 ⟶ 7.5/10

Table 5 Potentiometer Adjustment

Potentiometer	INPUT ADJ, 1VR	SPEED ADJ, 2VR	ZERO ADJ, 3VR
Functions	To be adjusted only when rated reference voltage (±2 V to ±10 V) is other than ±6 V.	Motor speed adjustment.	Zero speed adjustment.
How to Adjust	Turning 1VR clockwise (CW) decreases the rated reference input, and counterclockwise (CCW) increases the input.	Turning 2VR CW increases the motor speed, and CCW decreases the speed.	Since the motor runs reverse by turning 3VR CW and forward by CCW, adjust 3VR to stop the motor when input voltage is 0 V.
Characteristics			

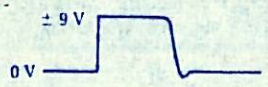
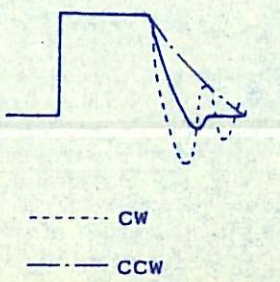
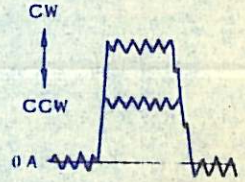
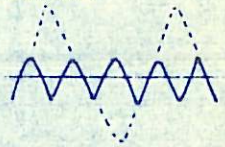
Potentiometer	PRO ADJ, 11VR	P GAIN ADJ, 4VR	CUR ADJ, 5VR
Functions	Detecting level adjustment for TG troubles.	Adjusting PI amplification waveform of speed deviation.	Starting current adjustment.
How to Adjust	Adjust the detecting level with 11VR so that output voltage 3 V is detected at check terminal CH.10 when the motor runs in rated speed.	When the motor starts or stops, adjust 4VR to form the waveform below. 	Turning 5VR CW increases the starting current. The following current should be detected at the checking terminal, CH1. CPCR-MR08H(W): 23 A/V CPCR-MR15H(W): 28 A/V CPCR-MR22H(W): 44 A/V CPCR-MR55H(W): 50 A/V CPCR-MR75H: 80 A/V
Characteristics	Turning 11VR CCW increases the motor speed for the detecting level of TG troubles. 4/4: 1200 to 1300 rpm 2.5 to 3/4: 2100 to 2300 rpm 1 to 1.5/4: 3600 to 3900 rpm		

Table 5 Potentiometer Adjustment (Cont'd)

Potentiometer	6VR	CUR GAIN, 7VR	8VR
Functions	Speed loop gain adjustment.	Current loop gain adjustment.	Carrier frequency (650 Hz set) adjustment.
How to Adjust	To increase gain, turn 6VR CW.	Turning 7VR CW increases current loop gain. Increase the gain just before starting current will not be hunting.	Where the motor is in resonance with the driven machine, adjust the frequency a little bit so that the resonance is eliminated.
Characteristics	If hunting, turn 6VR CCW to prevent it.	HUNTING  Current waveform detected at check Terminal, CH·1.	Turning 8VR CW increases the frequency, and CCW decreases the frequency.

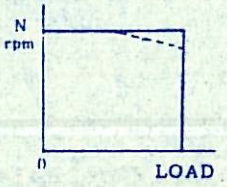
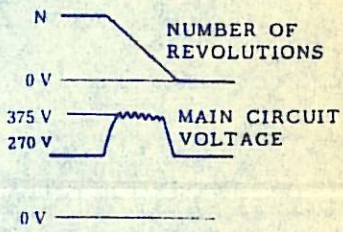
Potentiometer	9VR	10VR	12VR
Functions	Zero point adjustment in current detecting circuit.	To be adjusted so that the mode switch does not operate at rated speed and load observing the waveform at CH·8.	When the motor is decelerated, main circuit voltage increases. This potentiometer is used to crip the voltage.
How to Adjust	Adjust the zero point with 9VR so that ±5 mV is detected at check terminal CH·1.	Turning 10VR CW stops mode switch operation.	12VR has been factory-adjusted. Never tamper with it.
Characteristics	Current balance in forward running and reverse running is changed.	Rough adjustment increases the speed regulation. 	

Table 6 List of Check Terminals

Check Terminals	CUR-M (CH.1)	N.D-M (CH.2)	P.D-M (CH.3)
Description	Check terminal to detect motor armature current and starting/stopping current. CPCR-MR08H(W): 23 A/V CPCR-MR15H(W): 28 A/V CPCR-MR22H(W): 44 A/V CPCR-MR55H(W): 50 A/V CPCR-MR75H: 88 A/V	For observing the conduction angle to chopping period at the reverse running. CHOPPING PERIOD +12V HIGH 0V LOW ANGLE OF CONDUCTION	For observing the conduction angle to chopping period at the forward running. CHOPPING PERIOD +12V HIGH 0V LOW ANGLE OF CONDUCTION

Check Terminals	IN-M (CH.4)	TG-M (CH.5)	S.AMP-M (CH.6)
Description	For observing the waveform of speed reference input when the speed reference is inputted across terminals 1 and 2.	For observing the waveform of TG output. The starting/stopping speed can be observed at this terminal.	For observing the P-I amplified waveform of the speed deviation.

Check Terminals	OSC-M (CH.7)	M.S-M (CH.8)	IN.B-M (CH.9)
Description	For observing the operation of triangle pulse oscillator which determines chopper's frequency. 1.54 ms +6 V −6 V f = 650 Hz	For observing the operation of mode switch. OFF OFF +12V 0V −12V ON	For observing speed reference input when the speed reference is inputted through terminals 9 and 2.

Check Terminals	PRO-M (CH.10)
Description	For setting the detecting level of TG trouble. Output voltage should be set to be 3 V when the motor runs in rated speed.

Notes:

1. Where checking, terminal 0 V of oscilloscope should be connected to check terminal SG 0 V or external terminal 2.
2. Other check terminals not listed in Table 6 are not for customer's checking.

POTENTIOMETERS

1VR: IN-AJ
2VR: SPD-AJ
3VR: ZERO-AJ
4VR: (P·GAIN-AJ)
5VR: (C·LIM-AJ)
6VR: (L·GAIN-AJ)
7VR: (C·GAIN-AJ)
8VR: (C·FREQ-AJ)
9VR: (OFFSET-AJ)
10VR: (M.S-AJ)
11VR: PRO-AJ
12VR: (OVER·VOLT-AJ)

CHECK TERMINALS

CH·1: CUR-M
CH·2: N·D-M
CH·3: P·D-M
CH·4: IN-M
CH·5: TG-M
CH·6: S·AMP-M
CH·7: OSC-M
CH·8: M·S-M
CH·9: IN.B-N
— : SG0V
CH·10: PRO-M

CONNECTORS

1CN
2CN
3CN
4CN
5CN

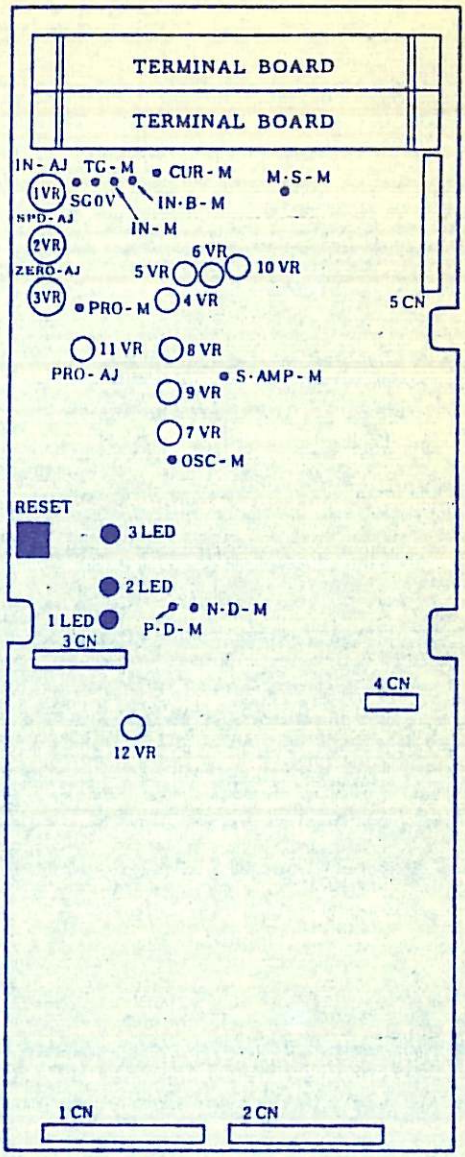


Fig. 5 Arrangement of Potentiometers and Check Terminals

MAINTENANCE

Controllers

Periodic inspection should be made to see that the controller is kept clean and free from dirts, dust and oil. Occasionally, the controller wiring should be checked and tightened where necessary.

Plug fuses used in the panel must be replaced with the ones specified as shown in Table 7 or equivalent.

Motors

Refer to the instruction manuals furnished to each individual motor. Table 8 lists the general inspection items to be applied to the servomotors made by this company such as Cup Motor, Hicup Motor, and Minertia Motor J Series.

Table 7 Fuse Selection

Fuse Application \ Servopack Type	CPCR-MR08H(W) to -MR22H(W)	CPCR-MR55H(W)	CPCR-MR75H
Main Circuit Fuse: 1FU, 2FU	Type UP200* 20 A	Type UP300* 30 A	Type BLA040+ 40 A
Alarm Fuse : 1FUX	-	-	Type P430* 3 A

* Made by Daitho Telecommunications Co., Ltd.
\+ Made by Fuji Electric Co., Ltd.

Table 8 Inspection Schedule of Servomotors

		Inspection Items of Servomotors
With motor at rest	Installation	· Any loose bolts and nuts · Any damaged parts · Coupling out of balance · Contaminated parts with dust or oil
	Electrical	· Injury to leads and terminals · Vertical slide of brush in brushholder not smooth · Excessive brush wear · Injury to brush section · Insulation resistance · Roughened, solid, discolored, or deformed commutator surface
With motor running	Commutator	· Excessive commutation sparks · Vibration of brush and brushholder
	Current	· Measurement of RMS value of armature current with AC ammeter · Current above rated
	Mechanical	· Abnormal noise due to vibration · Thrust load from driven machine · Poor ventilation due to clogging of air filter

TROUBLESHOOTING

Trouble, Cause and Remedy

1. Motor runs in reverse direction.

   Motor rotates normally CCW viewing from driven end when motor terminal A is used as plus (Fig. 8). To make motor rotate in reverse direction, interchange the motor terminals A and B and do the same for TG terminals (+) and (-). TG terminal symbols may differ depending on the motor types. Refer to Table 2.

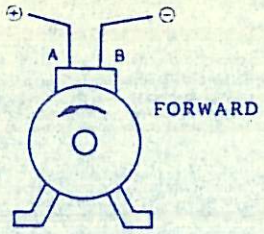


Fig. 8 Direction of Rotation of Motor

2. Motor does not stop even if input is 0 V.

   Motor can be stopped by adjusting 3VR. Motor, however, cannot be at a standstill for a long time because of existence of temperature drift as long as the position loop is not used for the operation.

   Where stopping the motor by utilizing only speed loop, use a complete motor-stopping circuit. In this case, shortcircuit across terminals 8 and 11.

3. Motor runs with speed pulsation.

   Where motor is hunted in only use of speed loop, turn 6VR CCW to exclude the hunting.

   If both of the speed and the position loop is used in motor operation, make sure whether the hunting is in the speed loop or in the position loop according to the following.

   · Remove the position loop.
   Does the hunting remain in the motor running?

   YES: The hunting is that of speed loop. Exclude it by turning 6VR CCW.

   NO: The hunting is that of position loop. To eliminate it, decrease the gain of position loop. Where 1VR is used for the gain adjustment of position loop, turn it CCW.

4. Servo following-up performance is wrong.

   Increase the gain of position loop. If the hunting break out, increase the gain of speed loop by turning 6VR CW. Where the hunting breaks out by increasing the speed loop gain, the position loop gain can not be increased.

5. Motor vibrates.

   · Oscillation frequency corresponds to commercial frequency (50/60 Hz).

   Where the wiring distance of Servopack input circuit is long, or power line and input circuit line run in the same duct or in a bandle, motor may vibrate with commercial frequency because the induced noise enters into the input line.

   To eliminate the vibration, be sure to run power line and input line separately and to give the low signal impedance (500 Ω or less) to Servopack input.circuit. Grounding SG 0 V line also removes the vibration. If the vibration remain a little, connect the line filter to the input circuit line.

   · Oscillation frequency is approximately 200 to 300 Hz.

   The high gain of speed loop results in too much high oscillation frequency.

   Decrease the speed loop gain until the vibration disappears by turning 6VR CCW.

6. Overshoot and undersoot are large in position loop.

   · Speed reference input is not overshoot and undershoot.

   Where TG is overshoot and undershoot even if the speed reference input is not overshoot and undershoot, decrease the loop gain by turning 6VR CCW to eliminate the overshoot and undershoot in TG.

   · Speed reference input is overshoot and undershoot.

   Apply the acceleration and deceleration current using an exclusive circuit in Servopack to the motor until the overshoot and undershoot are eliminated from the speed reference input.

Example of Troubleshooting

1. When turning on control power or main power, a trouble indicator light 1LED goes on. See Fig. 9.

2. When turning on main power, fuses are blown off. See Fig. 10.

3. When turning on main power, 2LED goes on and the main power is cut off. See Fig. 11.

4. Any trouble breaks out while the motor is in the operation.

   · 1LED goes on when the motor is operated with high speed. See Fig. 12.

   · 3LED goes on when the motor stops. See Fig. 13.

· Main power is turned off during motor running. In this time, LEDs do not go on. See Fig. 14.

5. The motor runs fast even if the reference input is 0 V. See Fig. 15.

6. The motor vibrates even if the reference input is 0 V. See Fig. 16.

7. The motor does not run even if the reference input is given to the motor. See Fig. 17. Table 9 shows LED functions.

Table 9 LED Functions for Trouble Indication

Trouble Indication Light (LED)	Trouble	Cause
1LED ON	TG trouble	· TG circuit open (instantaneous detection). · Wrong connection in TG circuit (detected at 120% and over of rated speed).
2LED ON	Overcurrent	· Motor insulation failure. · No reactor grounding. · Transistor failure.
3LED ON	Overvoltage	· No connection to resistor unit. · Beyond regeneration capability due to over speed and large GD^2L.

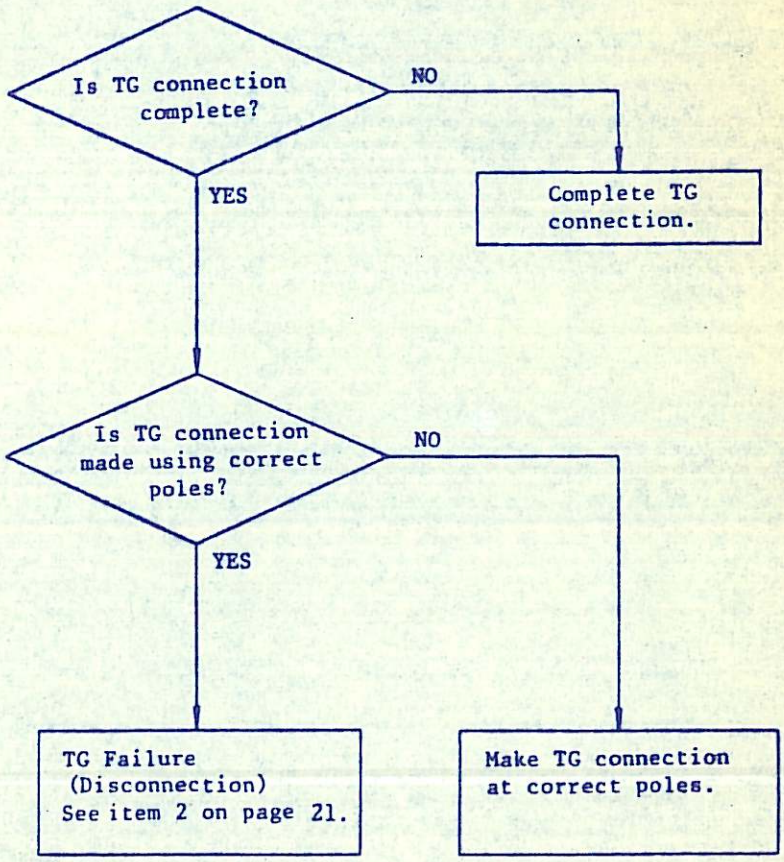


Fig. 9

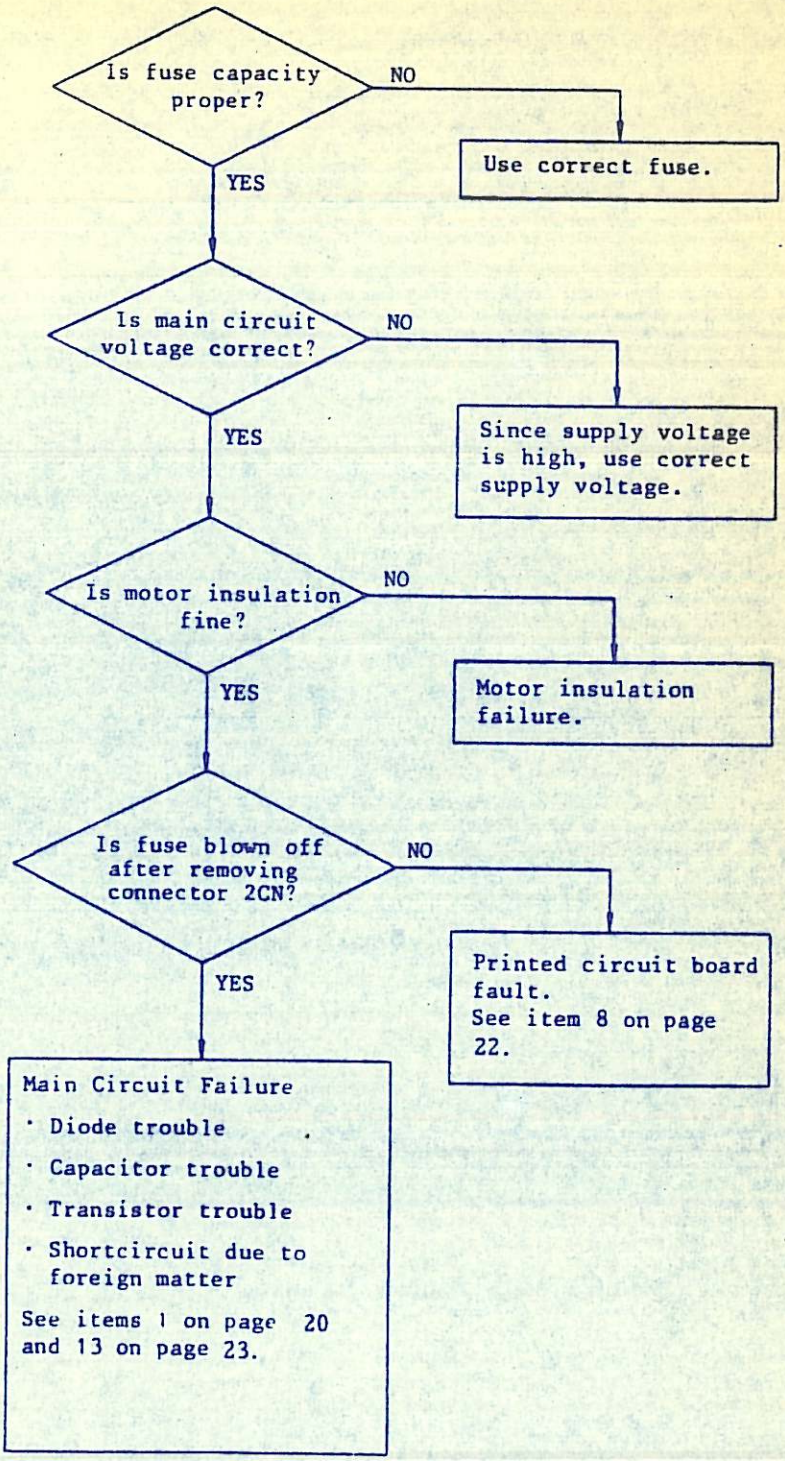

Is fuse capacity proper?
NO
Use correct fuse.
YES
Is main circuit voltage correct?
NO
Since supply voltage is high, use correct supply voltage.
YES
Is motor insulation fine?
NO
Motor insulation failure.
YES
Is fuse blown off after removing connector 2CN?
NO
Printed circuit board fault.
See item 8 on page 22.
YES
Main Circuit Failure
· Diode trouble
· Capacitor trouble
· Transistor trouble
· Shortcircuit due to foreign matter
See items 1 on page 20 and 13 on page 23.

Fig. 10

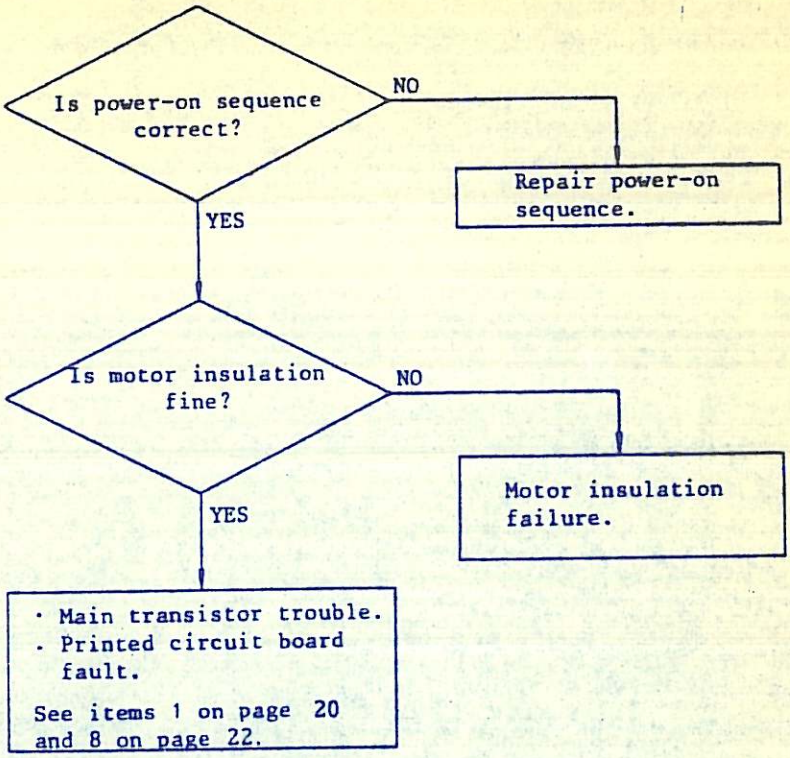

Is power-on sequence correct?
NO
Repair power-on sequence.
YES
Is motor insulation fine?
NO
Motor insulation failure.
YES
· Main transistor trouble.
· Printed circuit board fault.
See items 1 on page 20 and 8 on page 22.

Fig. 11

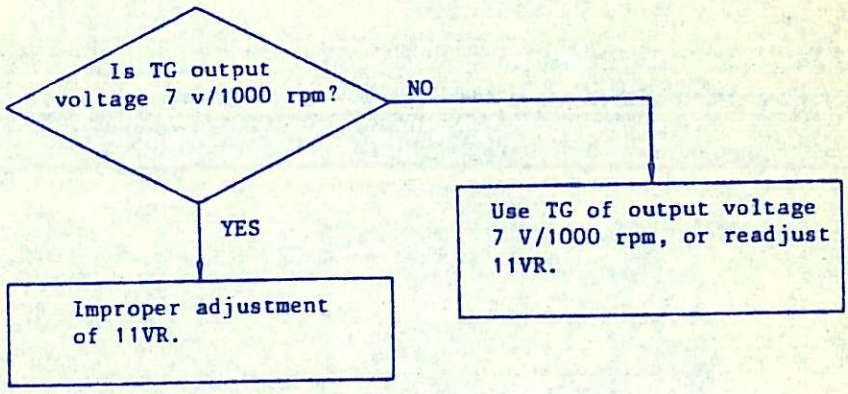

Is TG output voltage 7 v/1000 rpm?
NO
Use TG of output voltage 7 V/1000 rpm, or readjust 11VR.
YES
Improper adjustment of 11VR.

Fig. 12

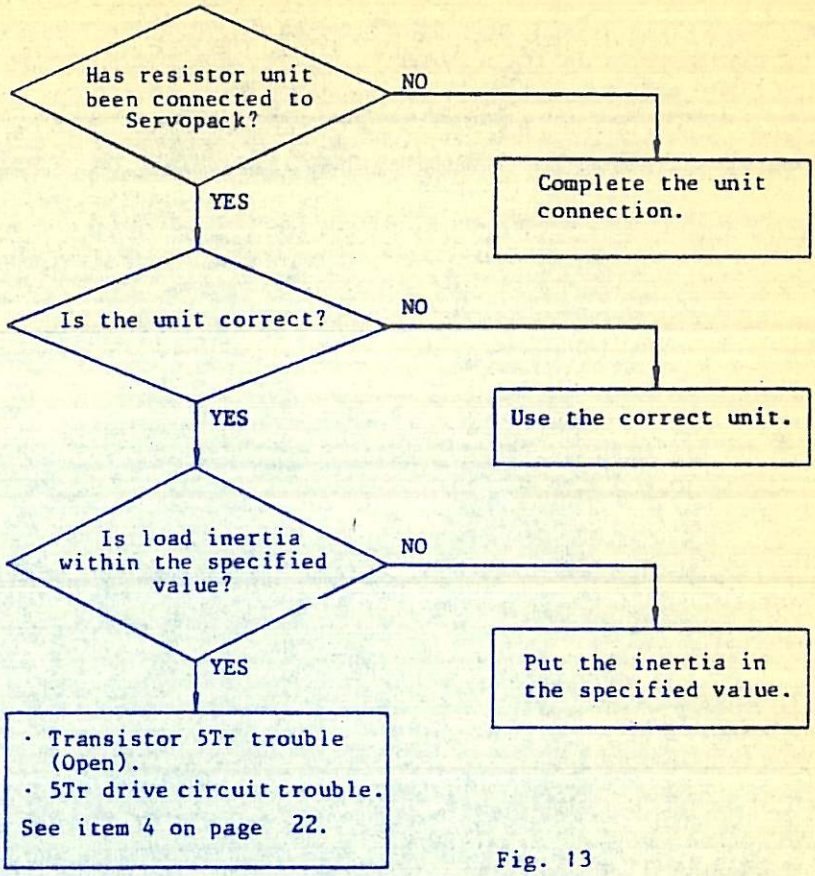

Has resistor unit been connected to Servopack?
NO
Complete the unit connection.
YES
Is the unit correct?
NO
Use the correct unit.
YES
Is load inertia within the specified value?
NO
Put the inertia in the specified value.
YES
· Transistor 5Tr trouble (Open).
· 5Tr drive circuit trouble.
See item 4 on page 22.

Fig. 13

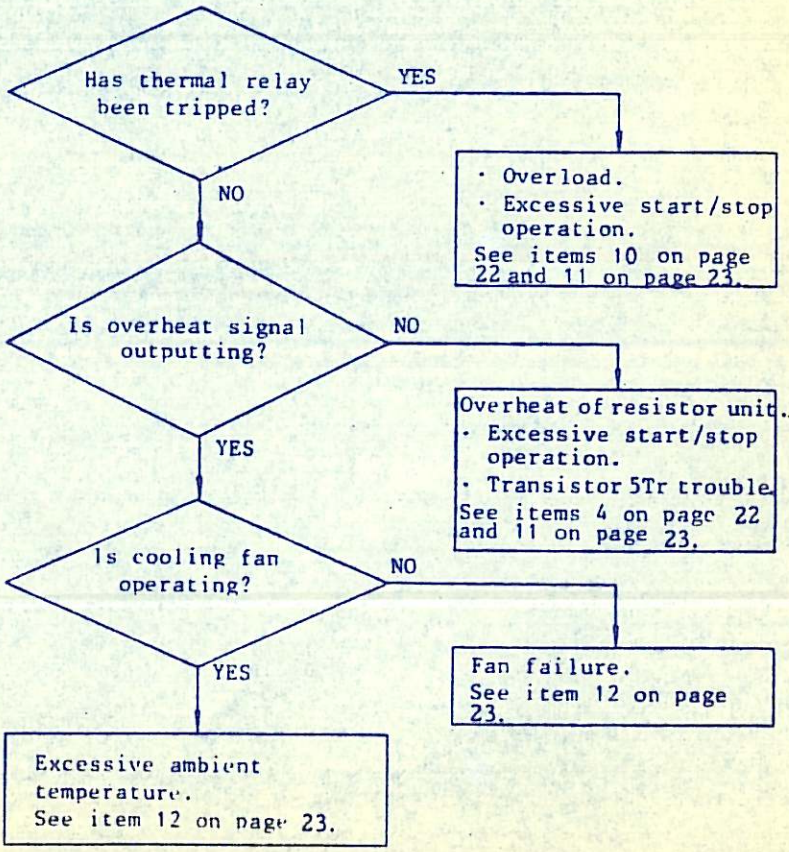

Has thermal relay been tripped?
YES
· Overload.
· Excessive start/stop operation.
See items 10 on page 22 and 11 on page 23.
NO
Is overheat signal outputting?
NO
Overheat of resistor unit.
· Excessive start/stop operation.
· Transistor 5Tr trouble.
See items 4 on page 22 and 11 on page 23.
YES
Is cooling fan operating?
NO
Fan failure.
See item 12 on page 23.
YES
Excessive ambient temperature.
See item 12 on page 23.

Fig. 14

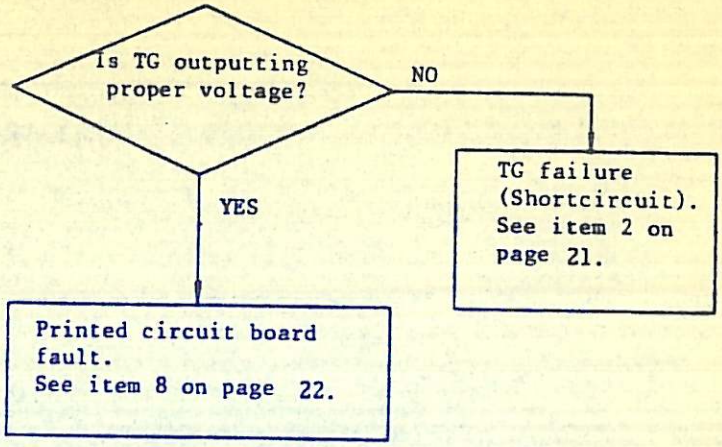

Is TG outputting proper voltage?
NO
YES
TG failure (Shortcircuit). See item 2 on page 21.
Printed circuit board fault. See item 8 on page 22.

Fig. 15

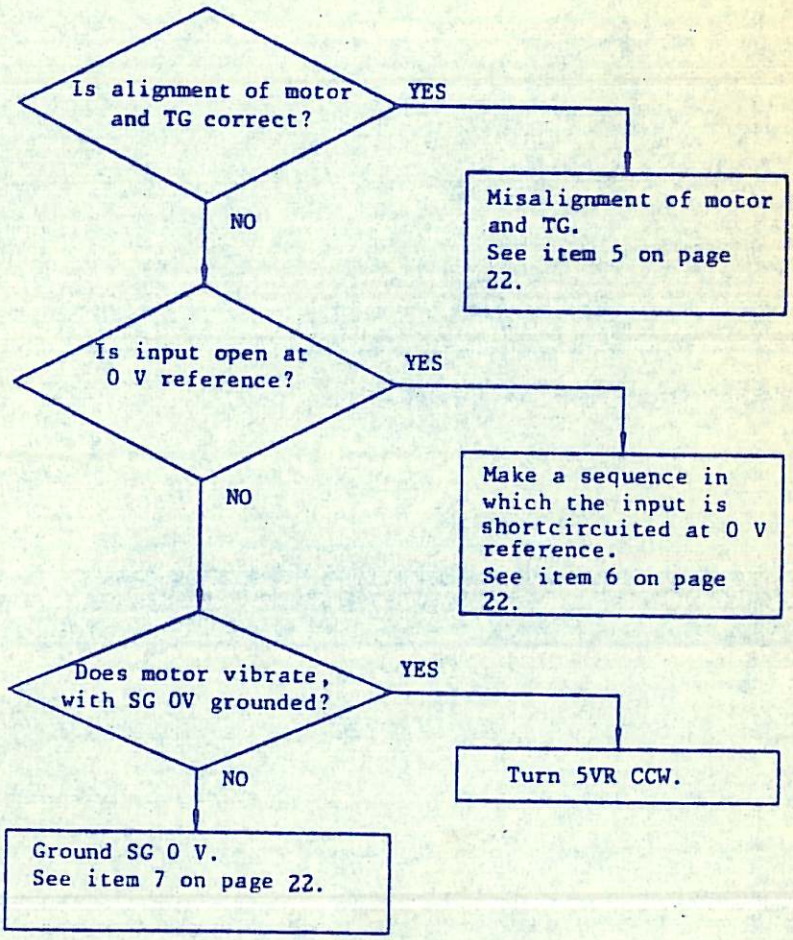

Is alignment of motor and TG correct?
YES
NO
Misalignment of motor and TG. See item 5 on page 22.
Is input open at 0 V reference?
YES
NO
Make a sequence in which the input is shortcircuited at 0 V reference. See item 6 on page 22.
Does motor vibrate, with SG 0V grounded?
YES
NO
Turn 5VR CCW.
Ground SG 0 V. See item 7 on page 22.

Fig. 16

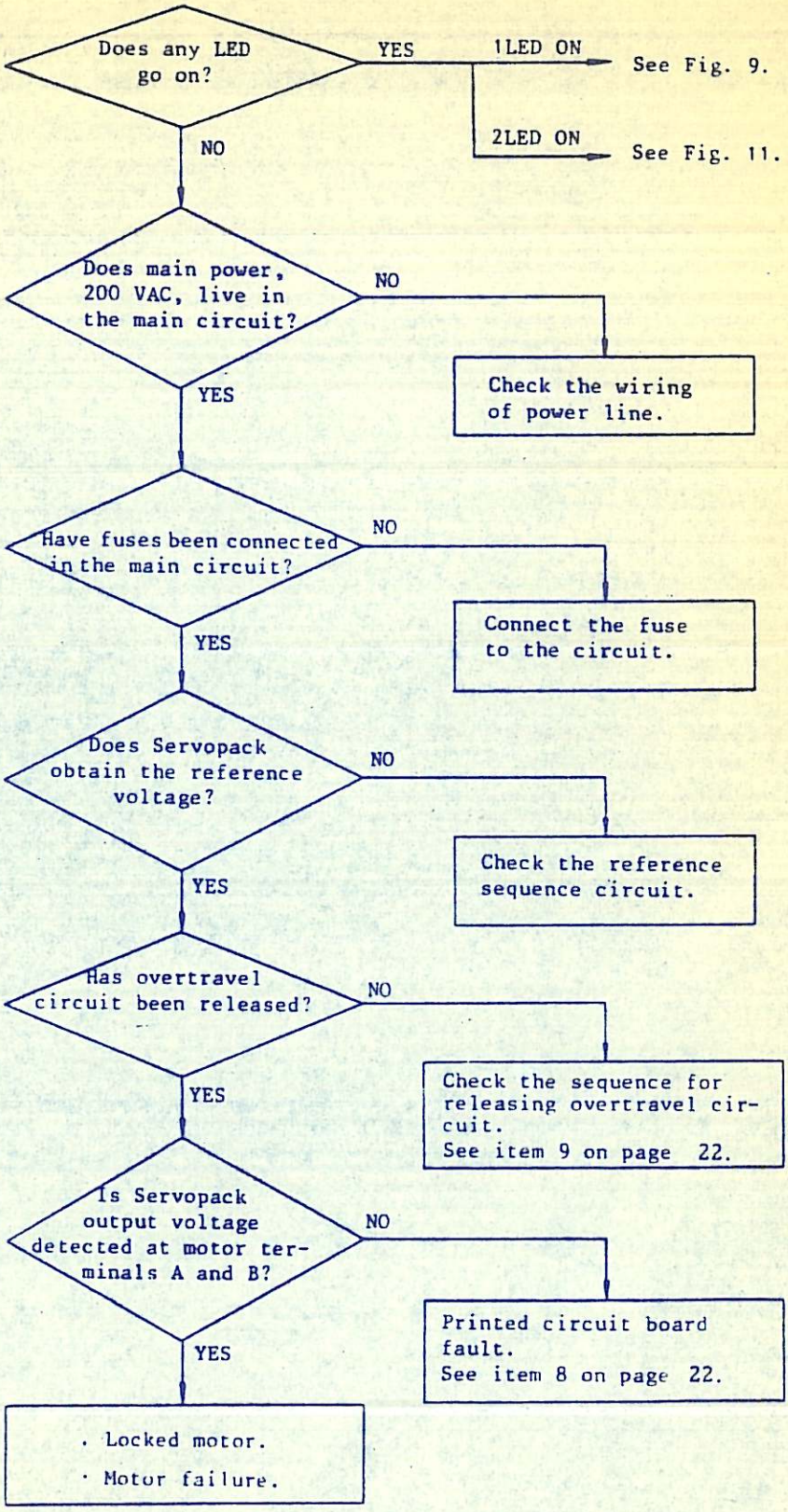

Does any LED go on?
YES
1LED ON
See Fig. 9.
2LED ON
See Fig. 11.
NO
Does main power, 200 VAC, live in the main circuit?
NO
Check the wiring of power line.
YES
Have fuses been connected in the main circuit?
NO
Connect the fuse to the circuit.
YES
Does Servopack obtain the reference voltage?
NO
Check the reference sequence circuit.
YES
Has overtravel circuit been released?
NO
Check the sequence for releasing overtravel circuit.
See item 9 on page 22.
YES
Is Servopack output voltage detected at motor terminals A and B?
NO
Printed circuit board fault.
See item 8 on page 22.
YES
· Locked motor.
· Motor failure.

Fig. 17

Checking Method in Detail

1. Checking of Main Circuit Bridge Transistors

   Transistor checking procedure is as follows. See Fig. 18.

   1. Turn off the power.
   2. Disconnect Servopack from the motor (terminals A and B).
   3. Disconnect Servopack from the resistor unit (terminals R1 and R2)
   4. Set a tester to resistance range position.
   5. Check for transistors with the tester as shown in Table 10.
   6. Remove wrong transistor from the main circuit, and check for the transistor with the tester referring to Fig. 19.
   7. If the transistor is proper, a diode in anti-parallel connection has been shortcircuited. Check for it.
   8. Proper care should be exercised in rewiring after parts replacement, as well as connector insertion on the printed circuit board.

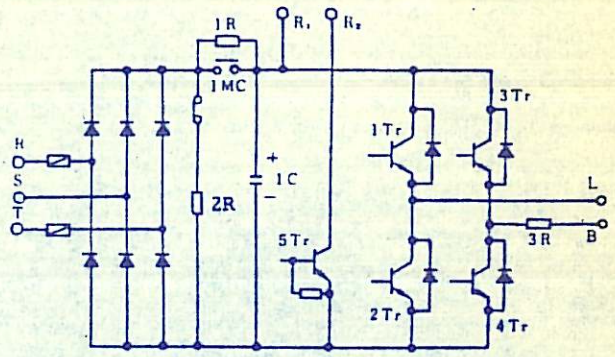
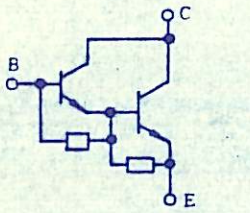
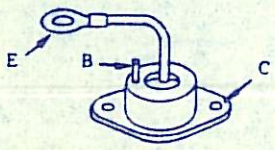


Fig. 18 Main Circuit Diagram



DARLINGTON TRANSISTOR



Checking Point	Normal Operation
C to (-)*, B to (+)†	High resistance -∞
C to (+), B to (-)	See diode V/I characteristics.
C to (-), E to (+)	High resistance -∞
C to (+), E to (-)	See diode V/I characteristics.
B to (-), E to (+)	See diode V/I characteristics.
B to (+), E to (-)	Low resistance

* Means the tester's lead plus.
† Means the tester's lead minus.

Fig. 19 Checking of Transistor

Table 10 Checking of Power Transistor with Tester

Transistor Failure (Shortcircuit)	How to Check	Abnormal Operation	Normal Operation
· 1Tr to 4Tr · 1Tr and 3Tr · 2Tr and 4Tr	L to (-)*, B to (+)† or L to (+), B to (-)	Shortcircuit (0 Ω)	1 kΩ
· 1Tr and 2Tr	R1 to (-), 1C(-) to (+)	Shortcircuit (0 Ω)	1 kΩ
· 3Tr and 4Tr	R1 to (+), 1C(-) to (-)	Shortcircuit (0 Ω)	Resistance value by diode V/I curve.
· 1Tr	R1 to (-), L to (+)	Shortcircuit (0 Ω)	1 kΩ
	R1 to (+), L to (-)	Shortcircuit (0 Ω)	Resistance value by diode V/I curve.
· 2Tr	1C(-) to (-), L to (+)	Shortcircuit (0 Ω)	Resistance value by diode V/I curve.
	1C(-) to (+), L to (-)	Shortcircuit (0 Ω)	1 kΩ
· 3Tr	R1 to (-), B to (+)	Shortcircuit (0 Ω)	1 kΩ
	R1 to (+), B to (-)	Shortcircuit (0 Ω)	Resistance value by diode V/I curve.
· 4Tr	1C(-) to (-), B to (+)	Shortcircuit (0 Ω)	Resistance value by diode V/I curve.
	1C(-) to (+), B to (-)	Shortcircuit (0 Ω)	1 kΩ

* Means the tester's lead plus.
† Means the tester's lead minus.

2. Checking of TG

1. Disconnect TG leads from Servopack.
2. Set the tester to resistance range position.
3. Check for the removed TG leads with the tester as shown in Table 11.

Table 11 TG Checking

Failure	How to Check	Abnormal Operation	Normal Operation
· TG lead disconnection · Disconnection of TG internal wiring · Wrong connection	· TG lead for Servopack's terminal number 3 to (-)* · TG lead for Servopack's terminal number 4 to (+)†	Resistance value: ∞	Approximately 2 to 300 Ω

* Means the tester's lead minus.
† Means the tester's lead plus.

3. Checking of TG Connection (Poles)

Measure TG output voltage, with TG connected to Servopack.

Table 12 Checking of TG Connection (Poles)

How to Check	Abnormal Operation	Normal Operation
· TG lead for Servopack's terminal number 3 to (-)* · TG lead for Servopack's terminal number 4 to (+)+ 	Minus voltage is detected.	Plus voltage is detected.

* Means the tester's lead minus.
\+ Means the tester's lead plus.

4. Checking of Regeneration Transistor 5Tr

Check for transistor 5Tr with the tester as shown in Table 13.

Table 13 Checking of Regeneration Transistor 5Tr

Failure	How to Check	Abnormal Operation	Normal Operation
5Tr shortcircuit	R2 to (-)*, 1C(-) to (+)+	Shortcircuit (0 Ω)	High resistance (∞)
	R2 to (+), 1C(-) to (-)	Shortcircuit (0 Ω)	Resistance value by diode V/I curve.

* Means the tester's lead minus.
\+ Means the tester's lead plus.

5. Checking of Alignment of Motor and TG

Remove the load from the motor, and then decrease the loop gain a little bit. If the motor vibrates, it is due to misalignment of the motor and TG. In this trouble, TG output is displayed as waveform on the oscilloscope.

6. Checking of Speed Reference Input Terminal

Check if the speed reference input terminal is in conduction state or not with the tester. If the input is open, the induced noise (commercial frequency, 50/60 Hz) enters Servopack.

7. Checking of Grounding of 0 V Terminal

Make sure that conduction of speed reference input terminal (number 2) and grounding terminal is proper.

8. Checking of Control Circuit (Printed Circuit Board)

As for checking of printed circuit board, refer to Table 6 List of Check Terminals.

9. Checking of Overtravel Terminals 6 and 7

These terminals are used for preventing the overtravel. If the following terminals are connected, the motor does not run.

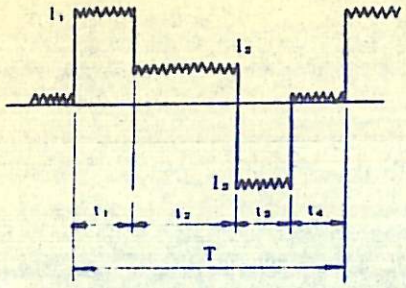
· Terminals 6 and 5 (for forward running)
· Terminals 7 and 5 (for reverse running)

10. Checking of Overload

Connect a DC ammeter to the motor in series, and then check the motor rated current. If the rated current and over, it is overload.

11. Checking of Start/Stop Frequency

Observe Start/Stop-current waveform at check terminal CH·1 using a oscilloscope. Make sure that the value calculated by the following formula is within the motor rated current.



$$I = \sqrt{\frac{1}{T}\left(I_1^2 t_1 + I_2^2 t_2 + I_3^2 t_3\right)}$$

Fig. 20 Start/Stop-Current Waveform

12. Checking of Cooling Fan and Ambient Tempearture

Use a visual inspection for the cooling fan and thermometer for the suitable ambient temperature.

13. Checking of Mounting Screws for Bridge Transistors

After turning off the power, check if the transistor is tightly mounted by the screws or not.

ELEMENTARY DIAGRAM

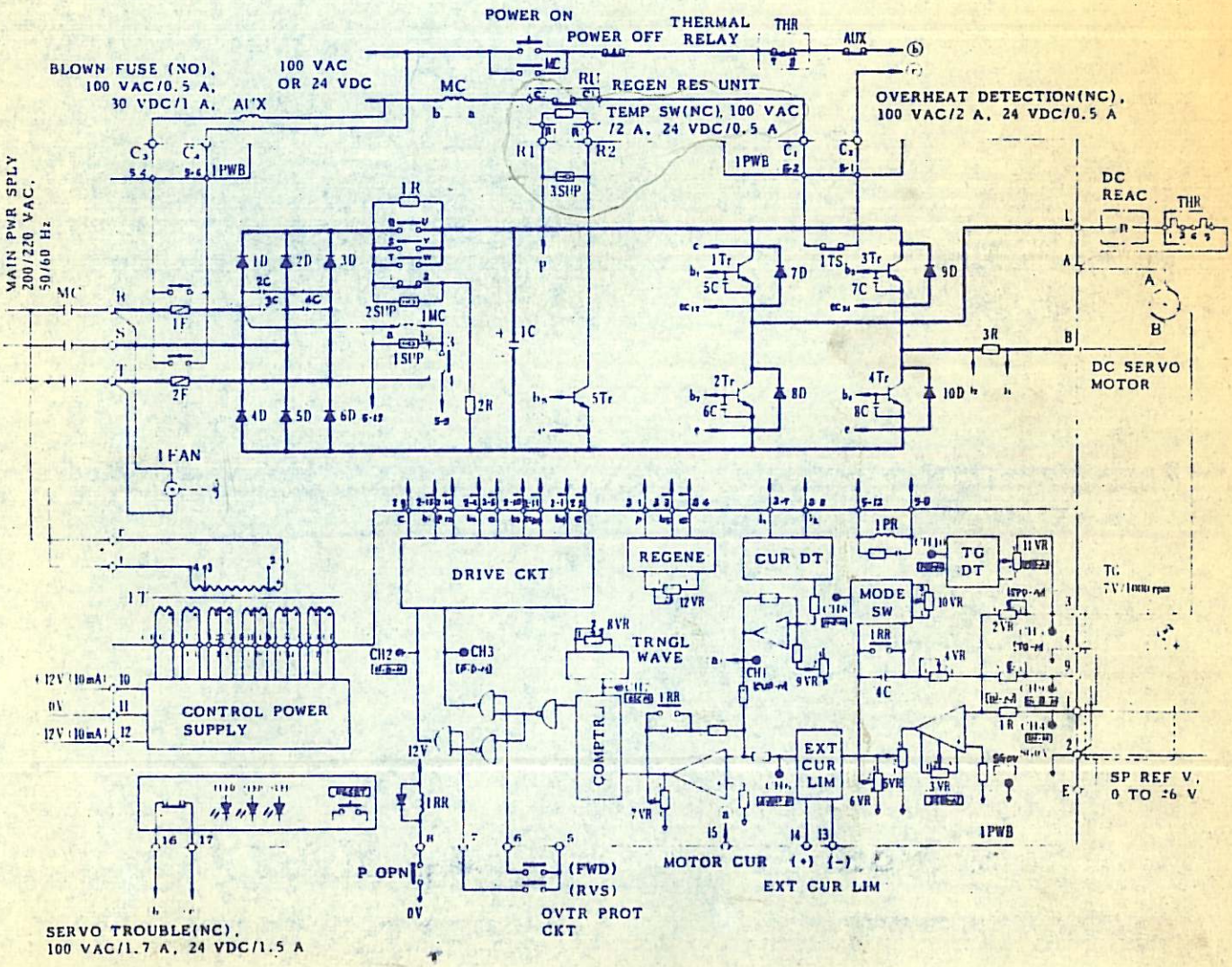


Fig. 21 Elementary Diagram for Servopack Type CPCR-MR08H to 55H

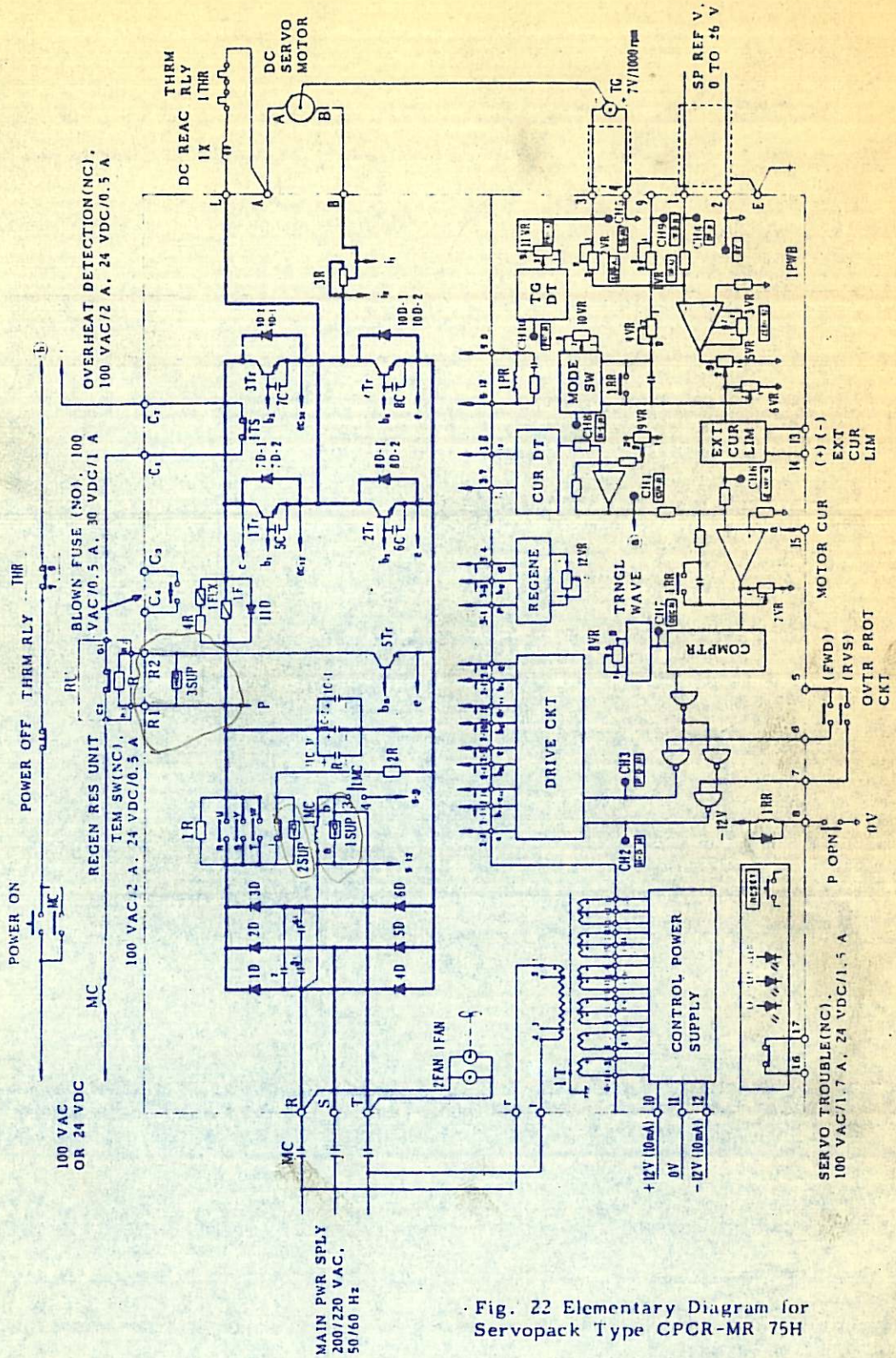


Fig. 22 Elementary Diagram for Servopack Type CPCR-MR 75H

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