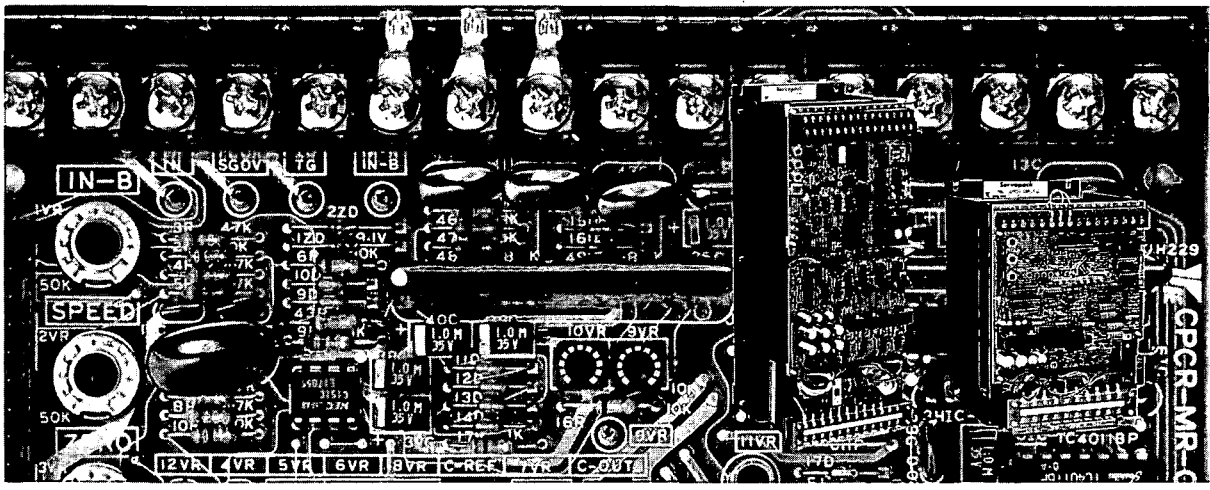
SERVOPACK

DC SERVOMOTOR CONTROLLER

FOR SPEED CONTROL
TYPE CPCR-MR01C TO -MR99C



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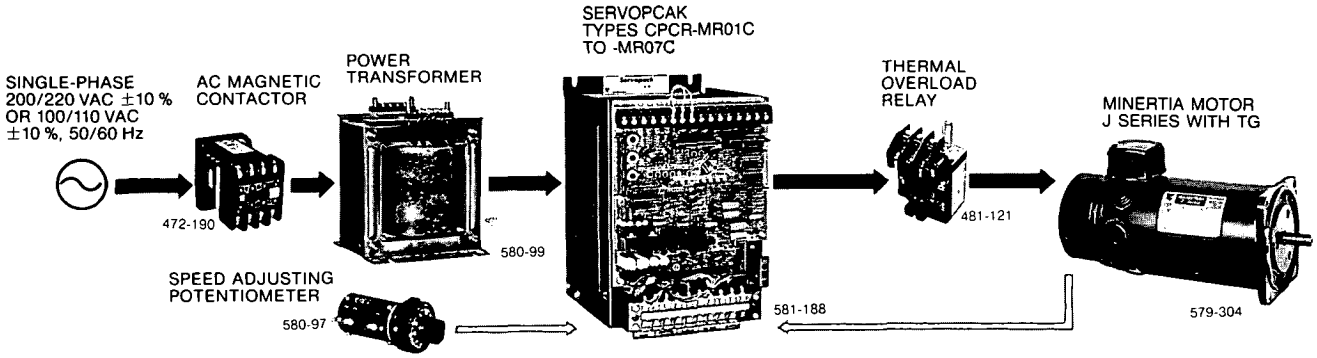
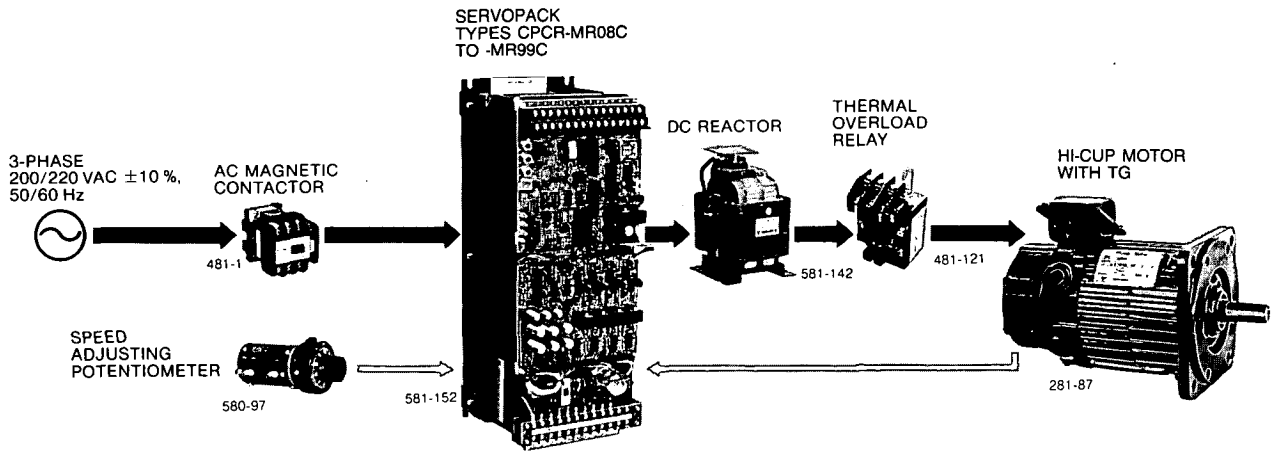
SERVOPACK type CPCR-MR□C is a speed controller for power servomotors such as Print Motor Standard Series, Cup Motor, Hi-Cup Motor, Minertia Motor, and Minertia Motor J Series. The speed of these servomotors, forward or reverse, is precisely controlled through a wide range.

The SERVOPACK type CPCR-MR□C, thus, is useful for industrial machines in the fields where the following requirements are especially high:

- Wide range of variable speed control (1000 : 1)
- Frequent start and stop operations (1000 operations/min)
- Frequent reversing operations (1000 operations/min)
- High-speed precise positioning (10 μm or less)
- High-level servo characteristics (Frequency response: DC to 100 Hz).



Configuration of SERVOPACK Types CPCR-MR01C to -MR07C, Servomotor and Optional Components



Configuration of SERVOPACK Types CPCR-MR08C to -MR99C, Servomotor and Optional Components

CONTENTS

INDEX

INDEX (Cont'd)

1. RATINGS AND SPECIFICATIONS

1.1 SERVOPACK RATINGS AND SPECIFICATIONS

Table 1.1 SERVOPACK Ratings and Specifications

SERVOPACK Types CPCR-			MR01C	MR01CJ	MR02C	MR02CJ	MR05C	MR07C
Motor Output		kW	0.1 max	0.1	0.2	0.2	0.5	0.77
Control Method			Single-phase bridge rectifying (power transformer installed separately), transistorized PWM control					
Power Supply	Main Circuit	Voltage	Single-phase, 200/220VAC ±10% or 100/110VAC ±10%, 50/60Hz ±5%					
		Capacity* kVA	0.3	0.3	0.5	0.5	1	1.5
	Control Circuit		Single-phase, 100/110VAC ±10%, 50/60Hz, 50VA (with power transformer installed separately)					
Max Output Voltage (V_{MAX})		VDC	±30 (at ±6A)	±100 (at ±3A)	±45 (at ±7A)	±100 (at ±6A)	±85 (at ±8A)	±80 (at ±13A)
Instantaneous Max Output Current (I_{MAX})		A	±15 ±10%	±11 ±10%	±20 ±10%	±15 ±10%	±20 ±10%	±30 ±10%
Continuous Output Current (I_{out})		A	±6	±3	±7	±6	±8	±13
Current Limiting Range		A	±3 to ±15	±1 to ±11	±3 to ±20	±3 to ±15	±3 to ±20	±6 to ±30
Waveform Factor			1.05 and below					
Derating Factor			0.95 and below					
Speed Control Range			1000 : 1					
Speed Regulation	Load Regulation 0 to 100%		0.1% and below at rated speed, ±0.05% and below at 1/1000 rated speed					
	Voltage Regulation ±10%		±0.1% and below at rated speed, ±0.02% and below at 1/1000 rated speed					
	Temperature Regulation 25 ±35°C		±0.5% and below at rated speed, ±0.1% and below at 1/1000 rated speed					
	Tach-gen (TG) Temperature Regulation		−0.05%/°C					
Speed Reference Input	Rated Reference Voltage		±6VDC (forward running at plus reference)					
	Resistance		20kΩ ±10%					
	Circuit Time Constant		35μs ±20%					
Auxiliary Input†	Rated Reference Voltage		±2 to ±10V					
	Resistance		3.3kΩ/V					
	Circuit Time Constant		45μs and below					
Speed Feedback			DC tachometer generator feedback control (7V/1000r/min)					
Built-in Reference Power Supply			±12VDC, ±30mA					
Ambient Temperature			−10°C to +60°C (−10°C to +40°C in panel)					
Storage Temperature			−20°C to +60°C					
Humidity			85% and below (non-condensing)					
Allowable Load Inertia			Print motor standard series, Minertia motor: 3 times motor inertia Cup motor, Hi-cup motor, Minertia motor J series: 2 times motor inertia					

*For rated output

†Used for application at a rated reference voltage other than ±6 V.

Type Designation

CPCR-MR□□C□-□

- SERVOPACK Series
- Transistorized/PWM Control, Reversing
- Motor Output
  - 08: 0.75 kW
  - 15: 1.5 kW
  - 22: 2.2 kW
  - 55: 5.5 kW
  - 75: 7.5 kW
  - 99: 9.9 kW
- Design Revision Order
  - C: Second Revision
- Servomotor to be Applied
  - Blank: Standard Motor (Cup Motor) See Table 1.2.
  - J: Minertia Motor J Series (JM)
  - M: Minertia Motor Standard Series (MM)
  - H: Hi-Cup Motor (HM)
  - C: Cup Motor (CM)
  - P: Print Motor (PM)
- Optional
  - Blank: Standard type
  - W†: Externally ventilating fan type
  - L: Built-in overload detection type
  - J: Overspeed drive type for JM
  - Y□: Special order

†Type CPCR-MR□C and Type CPCR-MR□CW differ in the shapes and cooling systems. For ventilating construction with overload detection circuit, the type CPCR-MR□CWL is applied.

Notes:

1. Make sure that the power voltage is limited to less than 220 V +10% (242 V). For voltages higher than 220 to 242 V, use a step down transformer to reduce the voltage.
2. The drive characteristic of type CPCR-MR□C differs for *Servopacks* and applicable motors as shown in Fig. 1.1 (a) and (b). The allowable current-conduction time for the instantaneous rating depends on combinations with the applicable motor and is guaranteed only for time of start and stop (approx. 1s or less) in the allowable inertia range. An overload protection such as motor locking is therefore necessary depending on the application conditions.
3. When a servomotor is driven by thyristor drive units, the armature current generally pulsates, differing from that of battery-driven units. This reduces the average value (component to produce torque) of armature current when the motor rated current equals armature current (r/min), and therefore, it is necessary to reduce the rated torque for the motor.

   The reduction rate is termed the derating factor. The derating factor of *Servopack* type CPCR-MR□C is very excellent, 95% or greater.

   Example: When type CPCR-MR□C or 95% derating factor is combined with a motor of rated output 1.5kW(8.183N·m), the effective output(torque) is 1.5kW (8.183N·m) × 0.95(14.25kW).
4. In the speed control range, the lowest speed is defined under the condition not stopped by 100% load variation.
5. Speed regulation is generally defined as follows:

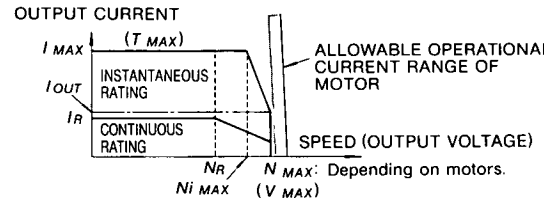
$$Speed\ regulation = \frac{No\ load\ speed - Full\ load\ speed}{Rated\ speed} \times 100\ \%$$

	MR08C MR08CW	MR15C MR15CW	MR22C MR22CW	MR55C MR55CW		MR75C		MR99C	
	0.8	1.5	2.2	3.7	5.5	6.0	7.5	6.2	9.9
	Three-phase bridge rectifying, transistorized PWM control								
	Three-phase, 200/220VAC ±10%, 50/60Hz ±5%								
	1.6	3.0	4.0	6.9	9	10	13	10	17
	Single-phase, 200/220VAC ±10%, 50/60Hz, 50VA								
	±200 (at ±7A)	±200 (at ±13A)	±200 (at ±18A)	±200 (at ±30A)		±200 (at ±40A)		±200 (at ±55A)	
	±20 ±10%	±25 ±10%	±40 ±10%	±60 ±10% (±55 ±10%)		±55 ±10%	±75 ±10%	±120 ±10%	±100 ±10%
	±7	±13	±18	±30		±40		±55	
	±1.5 to ±20	±2.5 to ±25	±3.5 to ±40	±6 to ±60		±7 to ±55	±7 to ±75	±10 to ±120	±10 to ±100
	1.05 and below								
	0.95 or more								
	1000 : 1								
	0.1% and below at rated speed, ±0.05% and below at 1/1000 rated speed								
	±0.1% and below at rated speed, ±0.05% and below at 1/1000 rated speed								
	±0.5% and below at rated speed, ±0.1% and below at 1/1000 rated speed								
	−0.05%/°C								
	±6VDC (forward running at plus reference)								
	20kΩ ±10%								
	0.5 ms ±20%								
	±2 to ±10V								
	3.3kΩ/V								
	0.1 ms and below								
	DC tachometer generator feedback control (7V/1000r/min)								
	±12VDC, ±30mA								
	−10°C to +60°C (−10°C to +40°C in panel)								
	−20°C to +70°C								
	85% and below (non-condensing)								
	Up to 3 times motor inertia			Up to 2 times motor inertia					

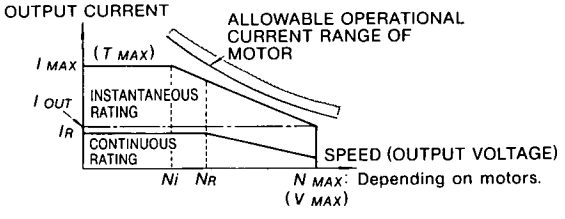
Actually, however, the calculated resistance value is varied by amplifier drift due to voltage and temperature fluctuations, and such an effect appears as a speed change. The percentage ratio of this speed change to the rated speed is the respective speed regulation due to voltage and temperature fluctuations.

The speed regulation due to temperature fluctuation must consider the effect of TG temperature fluctuation. The TG temperature fluctuation, relating to the ratio to TG generation voltage, is not significant at a low speed, but cannot be ignored when the speed is high.

6. When housed in a panel, the inside temperature must not exceed ambient temperature range.
7. Type CPCR-MR□C is limited in its regenerative control capability and therefore its load inertia is limited. (At a constant motor speed, the regenerative energy of the motor is proportional to inertia.) When the load inertia exceeds the allowable range, make sure to follow Par. 3.4.6 "Load Inertia" and 3.8.2 "Regenerative Unit Type JUSP-RG."



(a) Combination of Type CPCR-MR□C and DC Servomotors (PM, CM, HM, MM)



(b) Combination of Type CPCR-MR□CJ, -MR□C-J, and DC Servomotors (JM)

NR: Rated Motor Speed
NMAX: Maximum Drive Speed (Maximum Output Voltage VMAX)
IR: Rated Motor Current
IMAX: Instantanious Maximum Output Current (Instantaneous Maximum Torque TMAX)
IOUT: Continuous Output Current
NiMAX: Instantaneous Maximum Torque Drive Speed

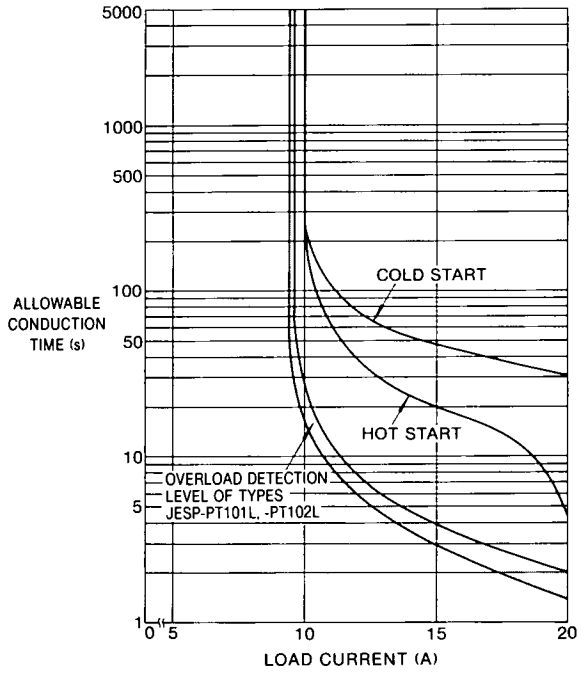
Fig. 1.1 Type CPCR-MR□C Drive Characteristic

1.2 SERVOPACK OVERLOAD CHARACTERISTICS

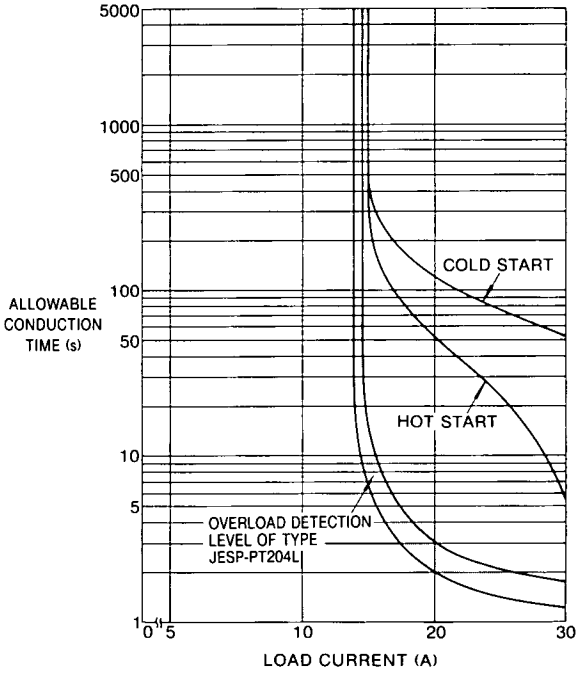
The allowable conduction time of CPCR-MR□C is shwon in Fig. 1.2 (a) through (h).

In Fig. 1.2, cold and hot starts mean the following:

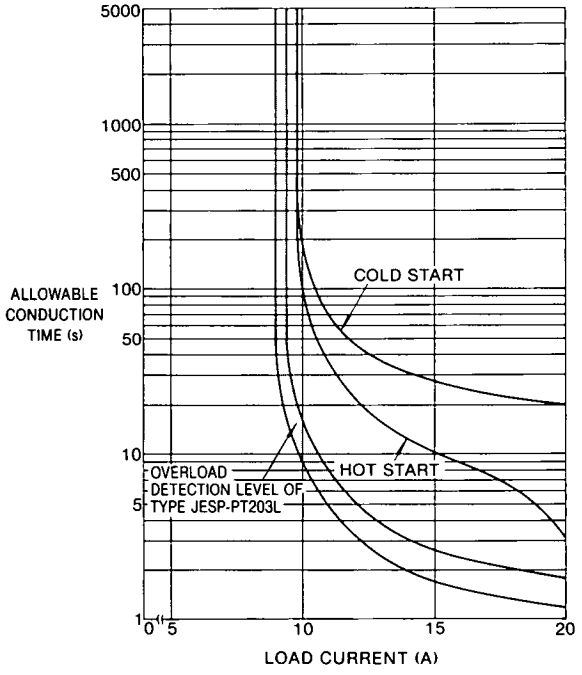
- Cold start: The overload characteristic when Servopack at the ambient temperature starts to operate.
- Hot start: The overload characteristic when Servopack is running at the rated load and so saturated thermally.
- Ambient temperature: For these data, the ambient temperature is 60° C. At lower ambient temperatures, the allowable conduction time increases.



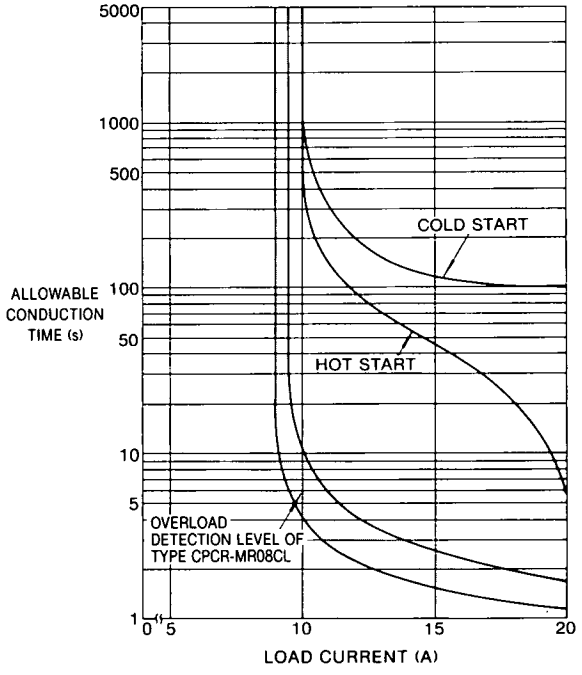
(a) Types CPCR-MR01C and -MR02C



(c) Type CPCR-MR07C

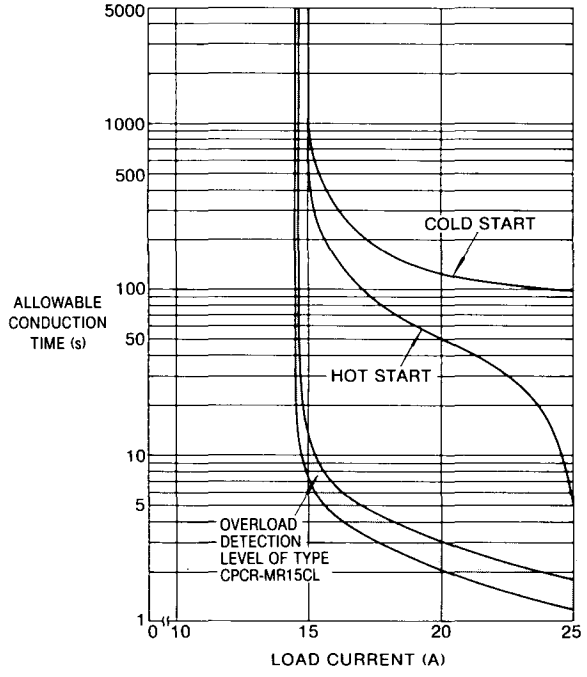


(b) Type CPCR-MR05C

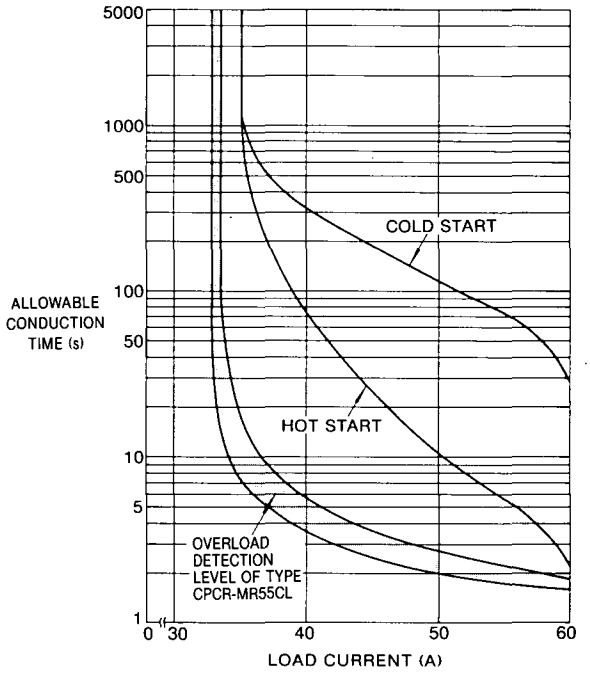


(d) Type CPCR-MR08C

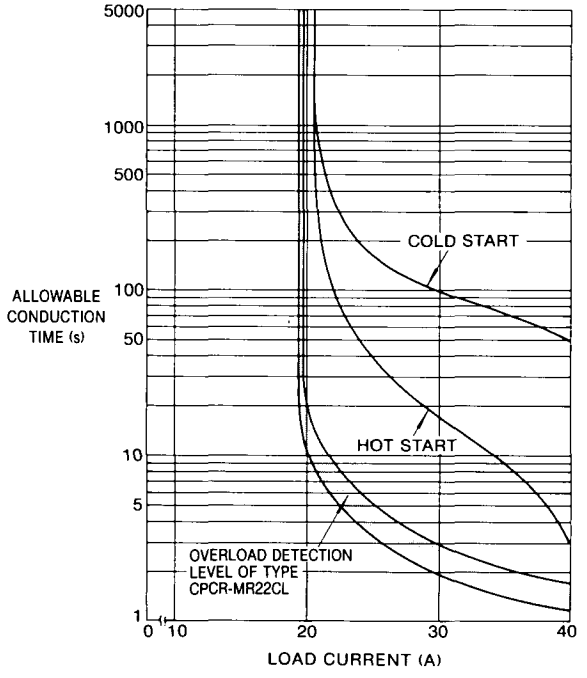
Fig. 1.2 Allowable Conduction Time of SERVOPACK



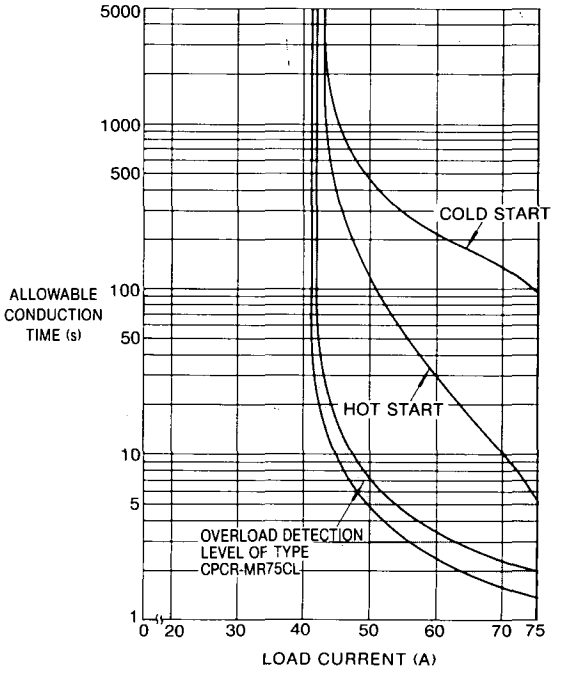
(e) Type CPCR-MR15C



(g) Type CPCR-MR55C



(f) Type CPCR-MR22C



(h) Type CPCR-MR75C

Fig. 1.2 Allowable Conduction Time of SERVOPACK (Cont'd)

1.3 SERVOMOTOR RATINGS FRO SERVOPACK

Table 1.2 Servomotor Ratings for SERVOPACK

SERVOPACK Type CPCR-	DC Servomotor								
	Type	Effective Output kW	Rated Speed r/min	Effective Rated Torque N·m	Instantaneous Max Torque N·m	Effective Current A	Allowable Inertia kg·m²×10⁻⁴	Max Drive Speed r/min	Max Torque Drive Speed r/min
MR01C	UGPMEN-08	0.047	4000	0.114	0.451	4.9	1.175	5000	4000
	PMES-09	0.095	4000	0.225	0.745	5.5	1.375	4500	4000
	UGPMEN-09	0.095	4000	0.225	0.745	5.7	1.3	4500	4000
MR01CJ	UGJMED-10M	0.095	1000	0.904	4.9	2.3	12	1700	100
MR02C	PMES-12	0.19	3000	0.603	2.156	6.4	4.5	3250	3000
	UGPMEN-12	0.19	3000	0.603	2.156	6.6	4.8	3250	3000
MR02C-M	UGMMEM-06	0.18	3000	0.559	1.96	6.2	2.85	3400	3000
MR02CJ	UGJMED-40M	0.152	1000	1.452	5.586	5.0	32	2100	700
	UGJMED-40L	0.24	1000	2.272	7.546	5.6	40	2050	700
MR05C	PMES-16	0.47	2500	1.813	5.488	7.3	18.6	2550	2500
	UGPMEN-16	0.47	2500	1.813	5.488	7.5	18.9	2550	2500
MR05C-C	UGCMED-04AA	0.37	1750	2.029	5.88	8.0	44.75	2300	1750
	UGCMEM-04	0.38	1750	2.078	5.88	8.0	46	2250	1750
MR05C-H	UGHMED-03GG	0.24	1000	2.234	6.566	7.8	40.75	1850	1200
MR05-M	UGMMEM-13	0.38	3000	1.205	3.528	7.4	4.25	3850	3000
MR07C*	UGMMEM-25	0.73	3000	2.323	5.488	13.1	8.5	3400	3000
MR08C	UGCMED-08AA	0.71	1750	3.881	13.132	6.7	132.5	2500	2000
MR08CW	UGCMEM-08GC	0.71	1750	3.881	13.134	6.4	108	2500	2000
MR08C-H	UGHMED-06AA	0.57	1000	5.439	19.6	6.2	219	1600	1200
MR08CW-H	UGHMEM-06AA	0.57	1000	5.439	21.56	5.5	163.75	1500	1200
	UGHMED-06GG	0.49	1000	4.655	15.974	6.5	99	1800	1200
MR08C-J MR08CW-J	UGJMED-60MA	0.43	1000	4.096	17.64	6.0	132	1800	1000
MR15C	UGCMED-15AA	1.43	1750	7.771	19.6	11.2	303	2250	2000
MR15CW	UGCMEM-15GC	1.43	1750	7.771	18.13	11.9	255	2400	2000
MR15C-P	PMES-20	0.95	3000	3.018	9.996	8.3	61	3900	3600
MR15C-H	UGHMED-12AA	1.14	1000	10.898	28.42	10.6	402	1450	1200
MR15CW-H	UGHMEM-12AA	1.14	1000	10.898	29.106	10.0	260	1450	1200
	UGHMED-12GG	1.14	1000	10.898	28.42	10.6	402	1450	1200
MR15C-J	UGJMED-60L	0.81	1000	7.713	21.56	11.0	189	1700	1000
MR15CW-J	UGJMED-80M	1.05	1000	9.967	25.48	11.5	420	1700	1000
MR15C-M MR15CW-M	UGMMEM-50AA	1.46	3000	4.655	10.486	12.1	27	4000	3000
MR22C	UGCMED-22AA	2.09	1750	11.456	30.38	16.1	456	2350	2000
MR22CW	UGCMEM-22GC	2.09	1750	11.456	29.106	17.2	369	2400	2000
MR22C-H	UGHMED-20AA	1.90	1000	18.159	49	16.6	876	1400	1200
MR22CW-H	UGHMEM-20AA	1.90	1000	18.159	46.256	16.9	708	1450	1200
	UGHMED-20GG	1.71	1000	16.297	45.08	16.2	702	1500	1200
MR22C-J MR22CW-J	UGJMED-80L	1.54	1000	14.671	39.2	18.0	735	1700	1000
MR55C	UGCMED-37AA	3.52	1750	19.179	48.02	27.0	596	2250	2000
MR55CW	UGCMEM-37FB	3.52	1750	19.179	45.472	27.6	750	2400	2000
	UGCMED-55AA	5.23	1750	28.489	63.504	30.0	946	1750	1750
MR55C-H	UGHMED-30AA	2.85	1000	27.185	70.756	23.3	988	1300	1000
MR55CW-H	UGHMEM-30AA	2.85	1000	27.185	66.346	24.2	788	1450	1200
	UGHMED-30GG	2.74	1000	26.068	73.99	21.0	730	1250	1000
	UGHMED-44AA	4.18	1000	39.847	94.472	24.7	2276	1000	1000
MR55C-J MR55CW-J	UGJMED-80K	2.47	1000	23.745	77.028	23.0	670	1450	650
MR55C-M MR55CW-M	UGMMEM-1AA	2.93	3000	9.31	24.5	24.9	50.5	4000	3000
MR75C	UGCMFD-75AA	6.92	1750	37.701	78.4	40.0	1446	1750	1750
MR75C-H	UGHMFD-60AA	5.70	1000	54.37	98.98	33.6	2276	1000	1000
MR99C	GEELM-K	9.14	1750	47.784	98	53.5	1000	1750	1750
MR99C-M	UGMMKR-2AA	5.86	3000	18.62	45.08	54.1	105	4000	3000

*Specifications are the same as those for type CPCR-MR08.

Notes:

1. Motors in [ ] are applied to *Servopack* with standard adjustment.
2. The instantaneous maximum torque means the motor-generated torque when the *Servopack* is at the maximum instantaneous output current, when *Servopack* and a servomotor are combined for start and stop operations (Fig. 1.2).
3. The maximum drive speed is the speed that can be driven at the rated motor torque or below.
4. The instantaneous maximum torque drive speed is the maximum speed available at the instantaneous maximum torque (Fig. 1.2).
5. For the details of combination of types CPCR-MR75C-H and UGHMFD -60, contact the company.
6. In the combination of CPCR-MR99C and GEELM-K, the rated speed differs from the rated speed of the motor.
7. Motor types PM: Print motor standard series, JM: Minertia motor J series, MM: Minertia motor standard series, CM: Cup motor, HM: Hi-Cup motor
8. Allowable inertia is the value at rated motor speed or below. When operating speed exceeds rated speed, the values of allowable inertia are smaller than those listed in the table above.

1.4 SERVOMOTOR CHARACTERISTICS FOR SERVOPACK

1.4.1 Starting and Stopping Time

The starting time and stopping time of servomotor under a constant load is shown by the formula below. Viscous or friction torque of the motor is neglected.

Starting Time:

$$t_r = 104.7 \times \frac{N_R (J_M + J_L)}{K_t I_R (\alpha - \beta)} \text{ (ms)}$$

Stopping Time:

$$t_f = 104.7 \times \frac{N_R (J_M + J_L)}{K_t I_R (\alpha + \beta)} \text{ (ms)}$$

Where,

N_R: Rated motor speed (r/min)

J_M: Motor inertia (kg·m²)

J_L : Load inertia converted to the motor shaft. (kg·m²)

K_t : Torque constant of motor (N·m/A)

I_R : Motor rated current (A)

$\alpha = I_P / I_R$: Acceleration/deceleration current constant

I_P : Acceleration/deceleration current (Acceleration/deceleration current α times the motor rated current) (A)

$\beta = I_L / I_R$: Load current constant

I_L : Current equivalent to load torque (Load current β times the motor rated current) (A)

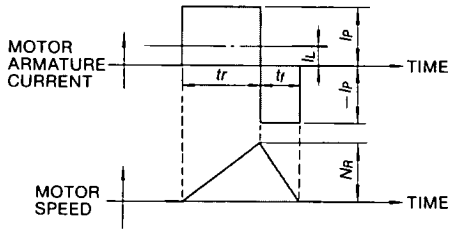
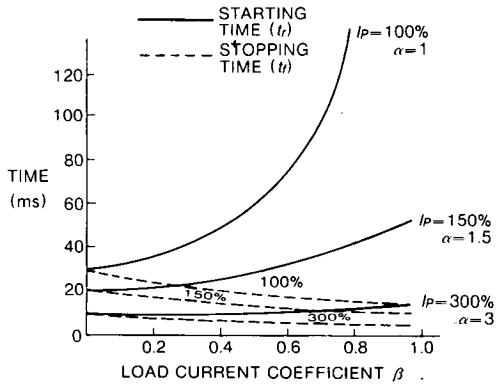


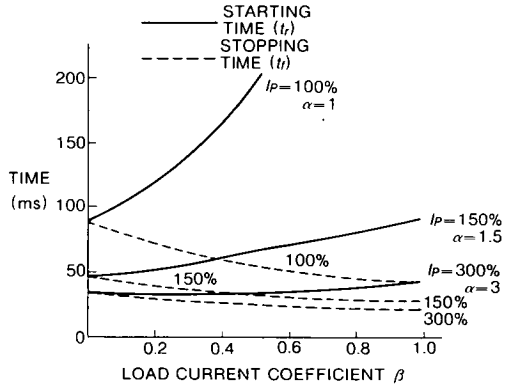
Fig. 1.3 Timing Chart of Motor Armature Current and Speed

Fig. 1.4(a) shows the starting and stopping time when Servopack type CPCR-MR02-M is combined with servomotor type UGMMEM-06. Fig. 1.4 (b) shows the starting and stopping time when Servopack type CPCR-MR15C-H is combined with servomotor type UGHMED-12AA.

The values shown in Fig. 1.4 are measured when operating motor at no load ($J_L = 0$). When J_L is equal to J_M, the starting and stopping time is twice the value in Fig. 1.4. When J_L is double J_M, the starting and stopping time is three times the value in Fig. 1.4.



(a) Combination of SERVOPACK Type CPCR-MR02C-M and Servomotor Type UGMMEM-06AA1



(b) Combination of SERVOPACK Type CPCR-MR15C-H and Servomotor Type UGHMED-12AA

Fig. 1.4 Motor Starting and Stopping Time

1.4.2 Allowable Frequency of Operation

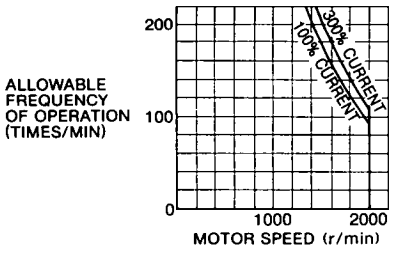
The allowable frequency of operation is restricted by the servomotor and Servopack, and both the conditions must be considered for satisfactory operation.

(1) Allowable Frequency of Operation restricted by the Servopack

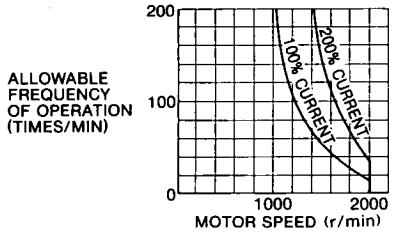
The allowable frequency of operation is restricted by the heat generated in the regenerative resistor in the Servopack and varies depending on the motor type, capacity, load inertia, acceleration/deceleration current values, and motor speed.

Figs. 1.5 to 1.7 show the allowable frequency of operation when Servopack is combined with servomotors such as Cup Motor, Hi-Cup Motor or Minertia Motor.

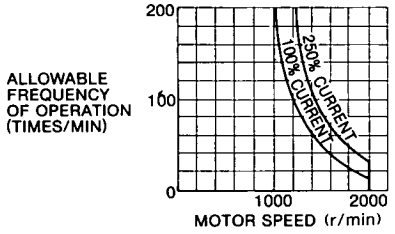
The values in Figs. 1.5 to 1.7 are shown when load inertia is 0. When load inertia is m times of motor inertia, the frequency is $\frac{1}{m+1}$ times the value in the figure. If load inertia exceeds three times the motor inertia or if the combination of Servopack type CPCR-MR 99C and industrial DC motor type GEELM-K is applied, contact your Yaskawa representative.



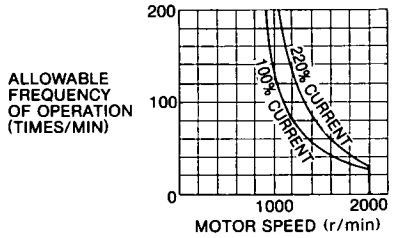
(a) Combination of Type CPCR-MR08C and Type UGCMED-08



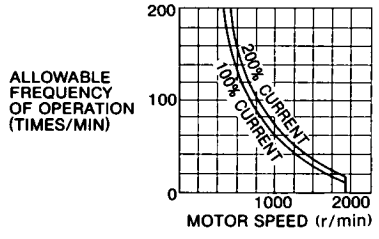
(b) Combination of Type CPCR-MR15C and Type UGCMED-15



(c) Combination of Type CPCR-MR22C and Type UGCMED-22

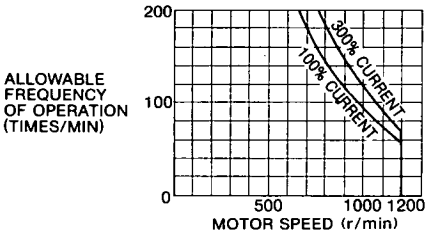


(d) Combination of Type CPCR-MR55C and Type UGCMED-37

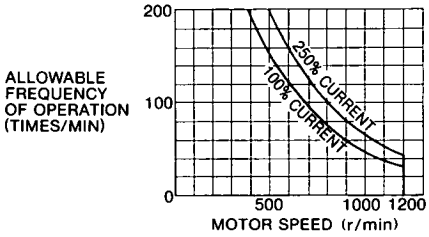


(e) Combination of Type CPCR-MR55C and Type UGCMED-55 or Type CPCR-MR75C and Type UGCMFD-75

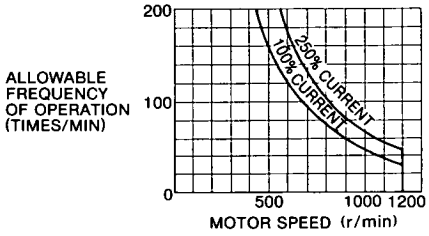
Fig. 1.5 Allowable Frequency of Operation of Combination of SERVOPACK and Cup Motor



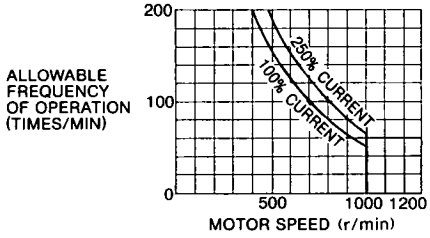
(a) Combination of Type CPCR-MR08C-H and Type UGHMED-06



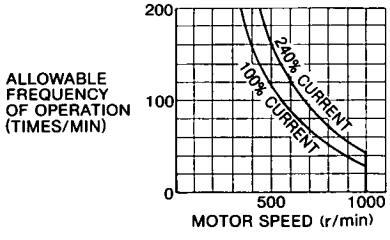
(b) Combination of Type CPCR-MR15C-H and Type UGHMED-12



(c) Combination of Type CPCR-MR22C-H and Type UGHMED-20

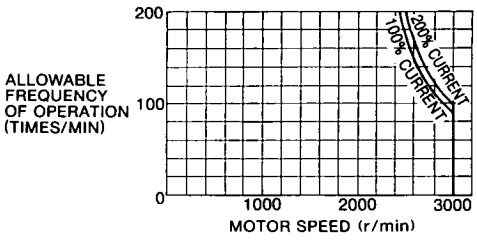


(d) Combination of Type CPCR-MR55C-H and Type UGHMED-30

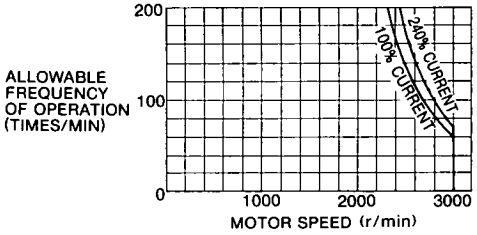


(e) Combination of Type CPCR-MR55C-H and Type UGHMED-44

Fig. 1.6 Allowable Frequency of Operation of Combination of SERVOPACK and Hi-Cup Motor



(a) Combination of Type CPCR-MR15C-M and Type UGMMEM-50



(b) Combination of Type CPCR-MR55C-M and Type UGMMEM-1A or Type CPCR-MR99C-M and Type UGMMKR-2A

Fig. 1.7 Allowable Frequency of Operation of Combination of SERVOPACK and Minertia Motor

(2) Allowable Frequency of Operation restricted by the Servomotor

The allowable frequency of operation varies depending on the load conditions, motor running time and the operating conditions. Typical examples are shown below. See Par. 1.4.1 "Starting and Stopping Time" for symbols.

- When motor repeats rated-speed operation and being at standstill.

  Cycle time (T) should be determined so that RMS value of motor armature current is lower than the motor rated current:

$$T \geq \frac{I_P^2 \ (t_r + t_f) + I_L^2 t_s}{I_R^2} \ (s)$$

Where cycle time (T) is determined, values Ip, tr, tf satisfying the formula above, should be specified.

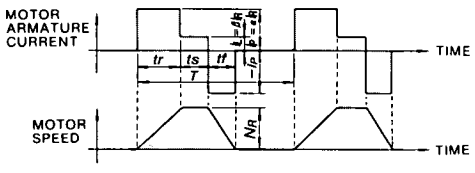


Fig. 1.8 Time Chart of Motor Armature and Motor Speed

· When the motor remains at standstill between cycles of acceleration and deceleration without continuous rated speed running.

The timing chart of the motor armature current and speed is as shown in Fig. 1.9. The allowable frequency of operation "n" can be calculated as follows:

$$n = 286.5 \times \frac{Kt \cdot I_R}{N_R \ (J_M + J_L)} \times (1/\alpha - \beta^2/\alpha^3) \quad \text{(times/min)}$$

Fig. 1.10(a) and (b) indicate allowable frequency of operation of Minertia Motor type UGMMEN-06AA1 and Hi-Cup Motor type UGHMED-12AA, respectively.

The values in Fig. 1.10 are measured when operating motor at no load. When J_L is equal to J_M, the frequency is half of the value in the figure. When J_L is twice of J_M, the frequency is one-third of the value in the figure.

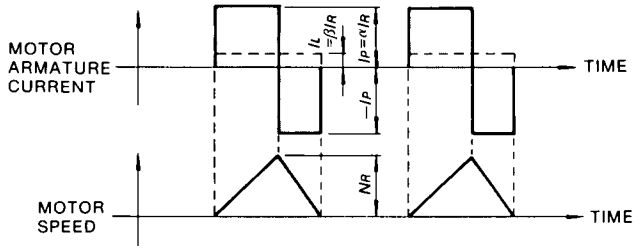
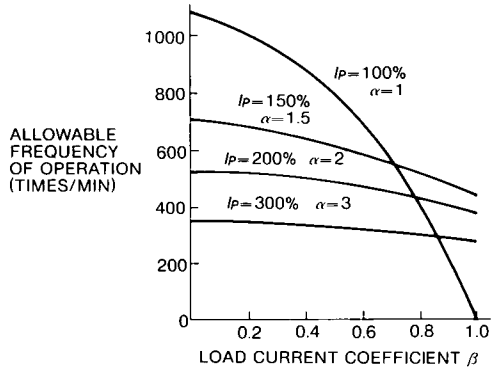
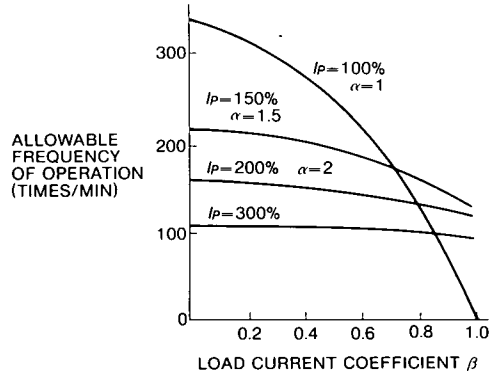


Fig. 1.9 Timing Chart of Motor Armature Current and Speed



(a) Minertia Motor Type UGMMEM-06AA1



(b) Hi-Cup Motor Type UGHMED-12AA

Fig. 1.10 Allowable Frequency of Operation

· When the motor accelerates, runs at constant speed, and decelerates in a continuing cycle without being at standstill.

The timing chart of the motor armature current and speed is as shown in Fig. 1.11. The allowable frequency of operation "n" can be calculated as follows.

$$n = 286.5 \times \frac{Kt \cdot I_R}{N_R \ (J_M + J_L)} \times (1/\alpha - \beta^2/\alpha) \quad \text{(times/min)}$$

Fig. 1.12(a) and (b) indicate allowable frequency of operation of Minertia Motor type UGMMEN-06AA1 and Hi-Cup Motor type UGHMED-12AA, respectively.

The values in Fig. 1.12 are measured when operating motor at no load. When J_L is equal to J_M, the frequency is half of the value in the figure. When J_L is twice of J_M, the frequency is one-third of the value in the figure.

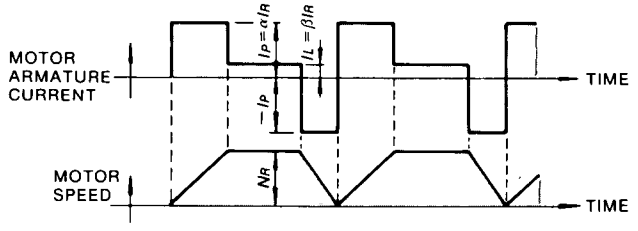
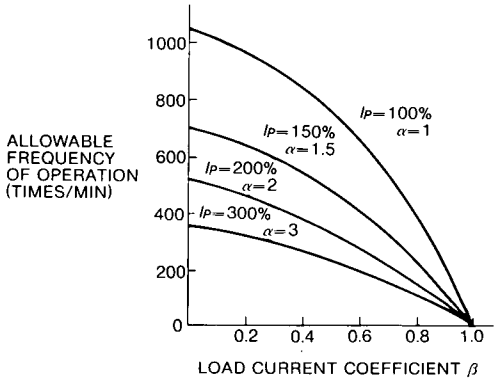
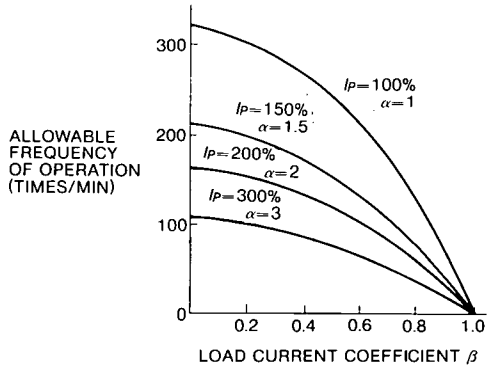


Fig. 1.11 Timing Chart of Motor Armature Current and Speed



(a) Minertia Motor Type UGMMEM-06AA1



(b) Hi-Cup Motor Type UGHMED-12AA

Fig. 1.12 Allowable Frequency of Operation

1.4.3 Servomotor Frequency

In the servo drive consisting of Servopack and servomotor, motor speed amplitude is restricted by the maximum armature current controlled by Servopack.

The relation between motor speed amplitude (N) and frequency(f) is shown by the formula below:

$$N = 1.52 \frac{\alpha \times Kt \times I_R}{(J_M + J_L)} \quad [r/min]$$

Fig. 1.14 shows servomotor frequency of Hi-Cup Motor type UGHMED-12AA. The values in Fig. 1.14 are measured when operating motor at no load. When J_L is equal to J_M , the speed is half of the value in the figure. When J_L is twice of J_M , the speed is one-third of the value in the figure.

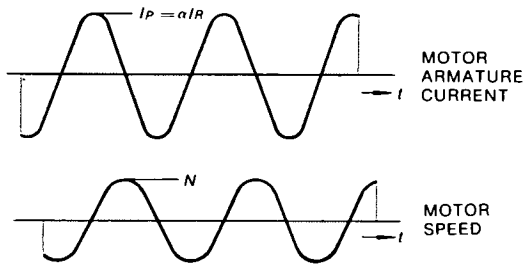


Fig. 1.13 Timing Chart of Motor Armature Current and Speed

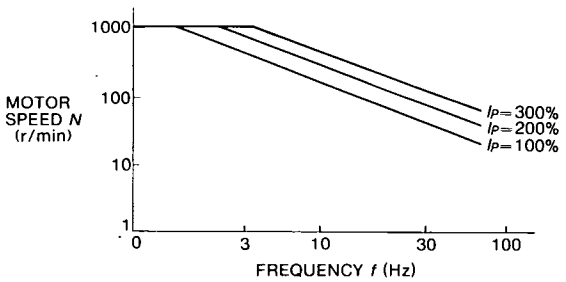


Fig. 1.14 Servomotor Frequency of Hi-Cup Motor Type UGHMED-12AA

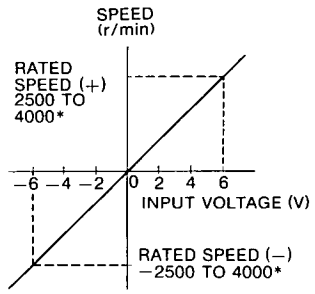
1.4.4 Speed-Input Voltage Characteristic

Fig. 1.15 shows motor speed and input voltage curve when speed reference input terminals 1CN-① and ② are used.

When the auxiliary input terminals ⑨ and ② are used, by adjusting Servopack IN-B , the rated speed can be obtained by input voltages of ± 2 to ± 10 V (Fig. 1.16).

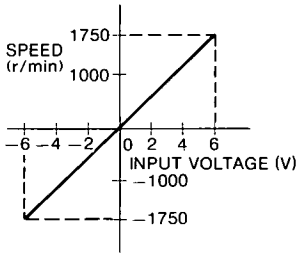
The forward motor rotation (+) means counter-clockwise rotation when viewed from the drive end (Forward motor rotation is given by connection as shwon in Figs. 2.1 to 2.5.)

(a) Combination of SERVOPACK and Print Motor

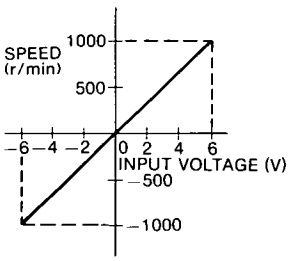


*Varies depending on motor type.

(b) Combination of SERVOPACK and Cup Motor



(c) Combination of SERVOPACK and Minertia Motor J Series or Hi-Cup Motor



(d) Combination of SERVOPACK and Minertia Motor Standard Series

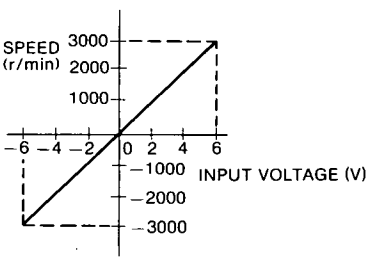


Fig. 1.15 Speed—Input Voltage Characteristics

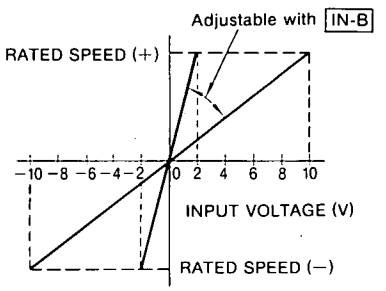


Fig. 1.16 Speed—Input Voltage Characteristic when Auxiliary Input Terminal ⑨ and ② are used.

2. CONFIGURATION

2.1 COMPONENTS

Table 2.1 shows optional components to be combined with Servopack.

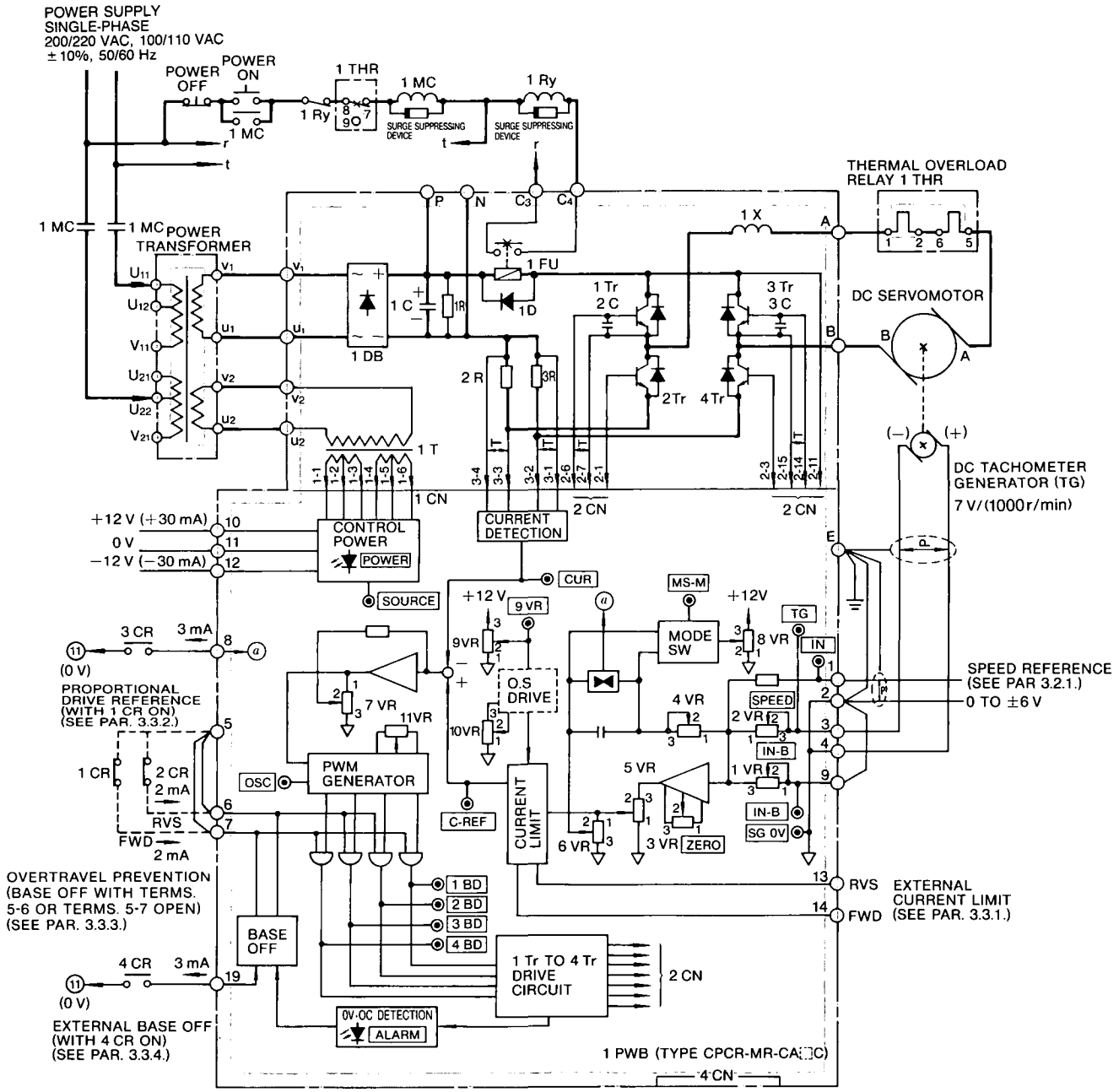
Table 2.1 Combination of SERVOPACK and Servomotors and Optional Component

SERVOPACK Type CPCR-	Servomotor Type with TG (7V/1000 r/min)	Optional Components to be Combined							
		Thermal Overload Relay Type	Power Transformer Type	DC Reactor Type	Speed Adjusting Potentiometer Type	Magnetic Contactor Type	Protection Device Type	Regenerative Unit	Magnetic Field Power Unit Type
MR01C	UGPMEN-08	RHP-15/4.9	CPT8585 (300 VA)	—	25HP-10B 2 kΩ	HI-10E	JESP -PT101(L)	JUSP -RG003	—
	PMES-09	RHP-15/5.7							
	UGPMEN-09								
MR01CJ	UGJMED-10M	RH-18/2.2PV	CPT8589 (300 VA)				JESP -PT201(L)	JUSP -RG001	
MR02C	PMES-12	RHP-15/6.6	CPT8624 (500 VA)				JESP -PT102(L)	JUSP -RG002	
	UGPMEN-12								
MR02C-M	UGMMEM-06	RH-35/6.2HV							
MR02CJ	UGJMED-40M	RH-18/5.0PV	CPT8630 (500 VA)				JESP -PT202(L)	JUSP -RG001	
	UGJMED-40L	RH-18/5.5PV							
MR05C	PMES-16	RHP-15/7.5	CPT8660 (1 kVA)				JESP -PT203(L)	JUSP -RG001	
	UGPMEN-16								
MR05C-C	UGCMED-04AA	RH-35/7.8HV					JESP -PT203(L)-C		
	UGCMEM-04GC								
MR05C-H	UGHMED-03GG						JESP -PT203(L)-H		
MR05C-M	UGMMEM-13	RH-35/6.9HV					JESP -PT203(L)-M		
MR07C	UGMMEM-25	RH-35/12.5HV	CPT8665 (1.5 kVA)				JESP -PT204(L)		
MR08C(W)	UGCMED-08AA	RH-35/6.9HV	—	X3055 (10mH8A)		HI-15E5	—	—	
	UGCMEM-08GC	RH-35/6.2HV							
MR08C(W)-H	UGHMED-06AA	RH-35/6.2HV							
	UGHMEM-06AA	RH-35/5.5HV							
	UGHMED-06GG	RH-35/6.2HV							
MR08C-J	UGJMED-60MA	RH-35/7T							
MR15C(W)	UGCMED-15AA	RH-35/11.5HV	—	X3056 (10mH13A)					
	UGCMEM-15GC								
MR15C-P	PMES-20	RHP-15/8.3F							
MR15C(W)-H	UGHMED-12AA	RH-35/10.5HV							
	UGHMEM-12AA	RH-35/10HV							
	UGHMED-12GG	RH-35/10.5HV							
MR15C(W)-J	UGJMED-60L	RH-35/15T1							
	UGJMED-80M	RH-35/15T2							
MR15C(W)-M	UGMMEM-50AA	RH-35/12.5HV							
MR22C(W)	UGCMED-22AA	RH-35/17HV	—	X3057 (10mH18A)					
	UGCMEM-22GC	RH-35/17.5HV							
MR22C(W)-H	UGHMED-20AA	RH-35/17HV							
	UGHMEM-20AA	RH-35/17.5HV							
	UGHMED-20GG	RH-35/16HV							
MR22C(W)-J	UGJMED-80L	RH-35/26T							
MR55C	UGCMED-37AA	RH-35/27HV	—	X3058 (10mH28A)		3.7 kW or below: HI-18E 3.7 to 5.5 kW: HI-25E 5.5 to 11 kW: HI-35E			
	UGCMEM-37FB	RH-35/28HV							
	UGCMED-55AA	RH-35/30HV							
MR55C(W)-H	UGHMED-30AA	RH-35/23.5HV							
	UGHMEM-30AA	RH-35/24.5HV							
	UGHMED-30GG	RH-35/21HV							
	UGHMED-44AA	RH-35/24.5HV							
MR55C(W)-J	UGJMED-80K	RH-35/30T							
MR55C(W)-M	UGMMEM-1AA	RH-35/24.5HV							
MR75C	UGCMFD-75AA	RH-35/41.2HV	—	X3066 (10mH40A)					
MR75C-H	UGHMFD-60AA	RH-35/33HV							
MR99C	GEELM-K	RH-35/53HVW	—	X3067 (10mH55A)				Regenerative resistor unit JUSP-RA03	NPSA-TM -20(RH)Y1
MR99C-M	UGMMKR-2AA								

Notes:

1. *Servopacks* in ☐ are standard products.
2. Thermal overload relay, RH-35/☐HV comes attached to the motor. Others must be procured separately.
3. For CPCR-MR99C and CPCR-MR99C-M, the regenerative resistor unit must be installed separately.
4. When ordering, see Par. 6. "Order."
5. When power supply 100/110 VAC is used for CPCR-MR07C, use magnetic contactor, HI-15E.

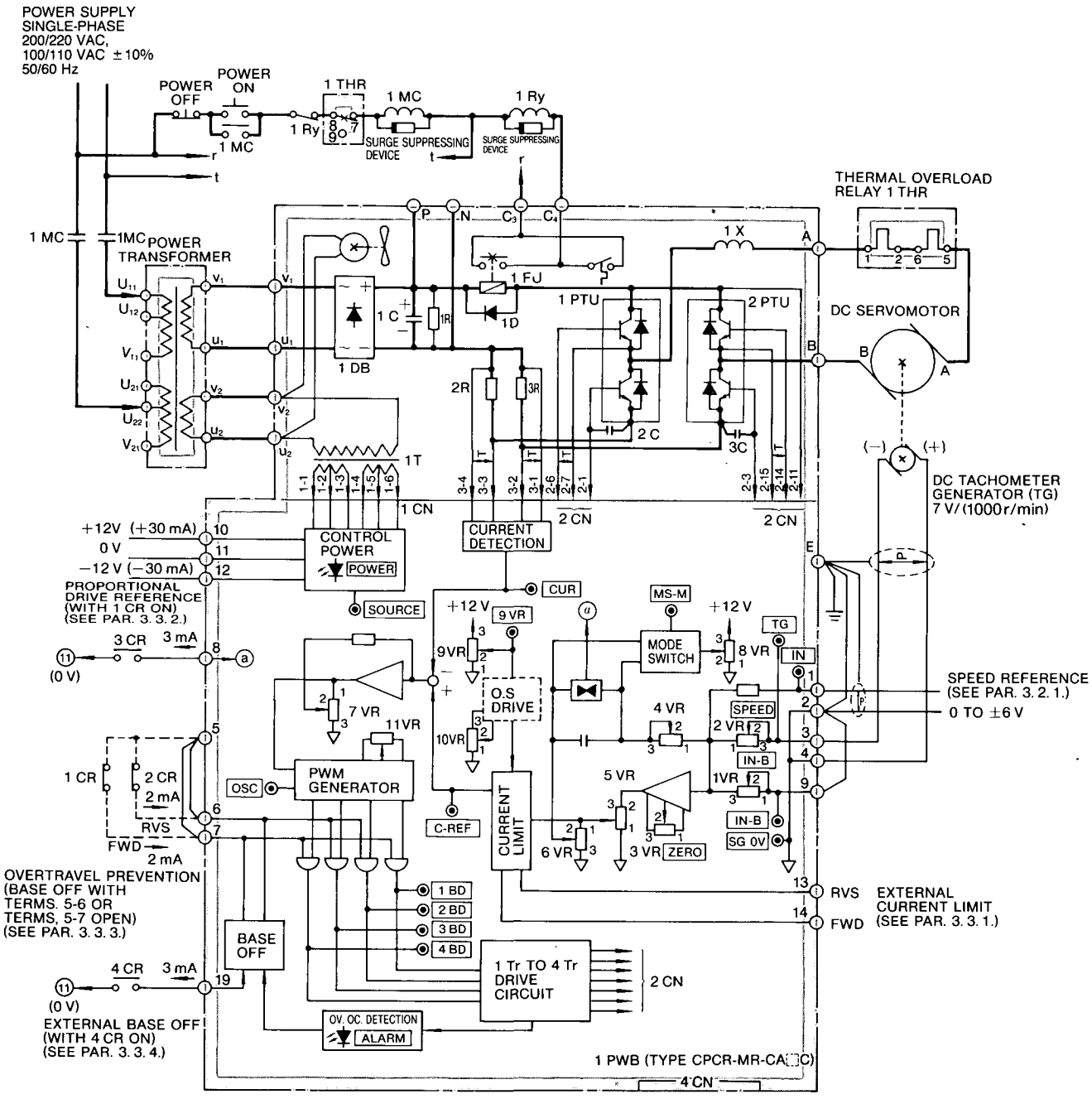
2. 2 INTERNAL BLOCK DIAGRAM



Notes:

1. Terminals C3 and C4 are normally open contact. They are different from terminals C1 and C2 (normally closed contacts) of the previous types (CPCR-MR01 to -MR05).
2. Thermal overload relay is directly connected to terminal A and the motor in series. Previous types (CPCR-MR01 to -MR05) have connection terminal TH.
3. Terminal E is not connected internally. In the previous types (CPCR-MR01 to -MR05) it is common to SG 0V.
4. O·S drive works only for type CPCR-MR□CJ.

Fig. 2. 1 Internal Block Diagram of SERVOPACK Types CPCR-MR01C to -MR05C

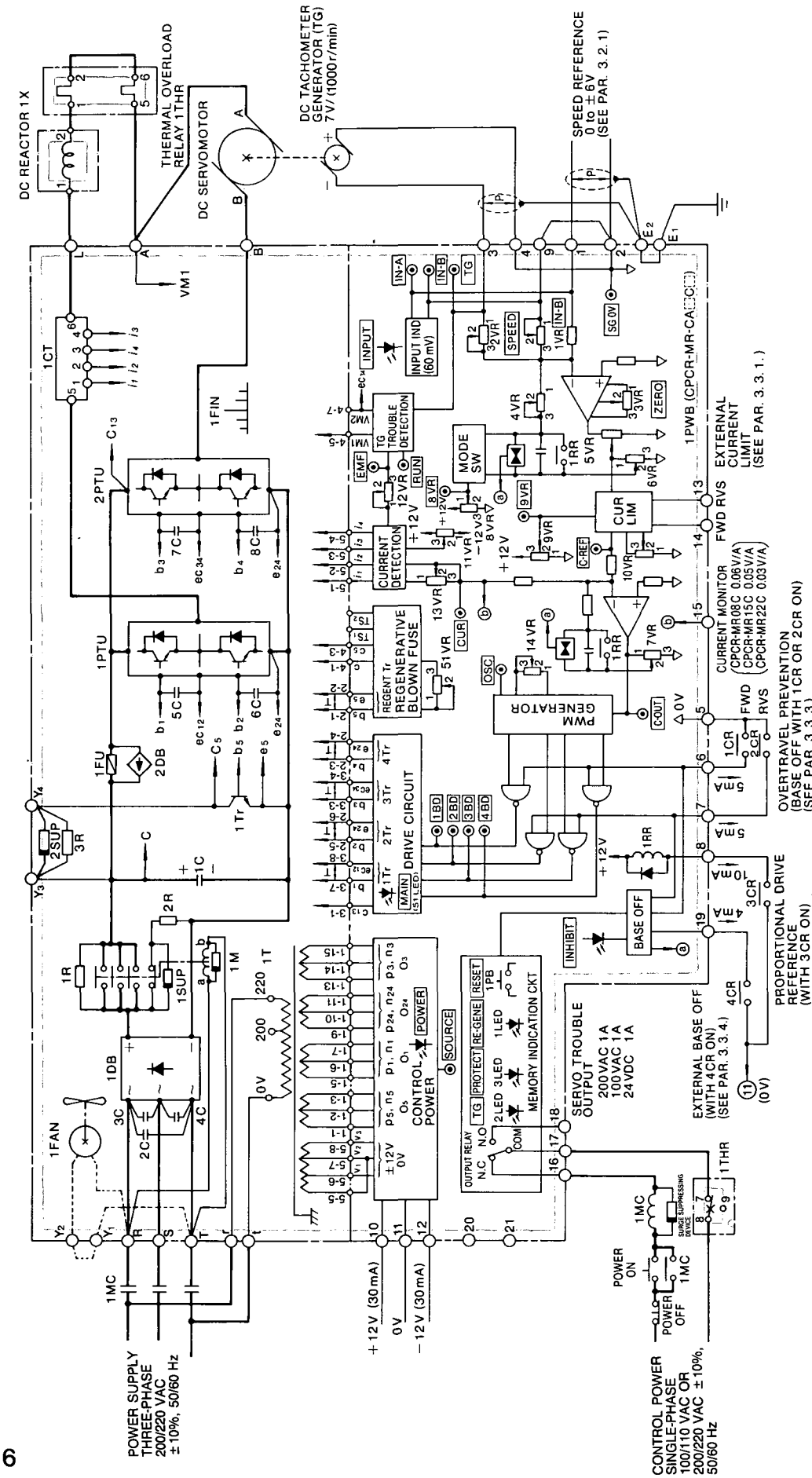


Notes:

1. Terminals ⓒ3 and ⓒ4 are normally open contact. They are different from terminals ⓒ1 and ⓒ2 (normally closed contacts) of the previous types (CPCR-MR01 to -MR05).
2. Thermal overload relay is directly connected to terminal Ⓐ and the motor in series. Previous types (CPCR-MR01 to -MR05) have connection terminal ⓉⒽ.
3. Terminal Ⓔ is not connected internally. In the previous types (CPCR-MR01 to -MR05) it is common to SG 0V.
4. O·S drive works only for type CPCR-MR□CJ.

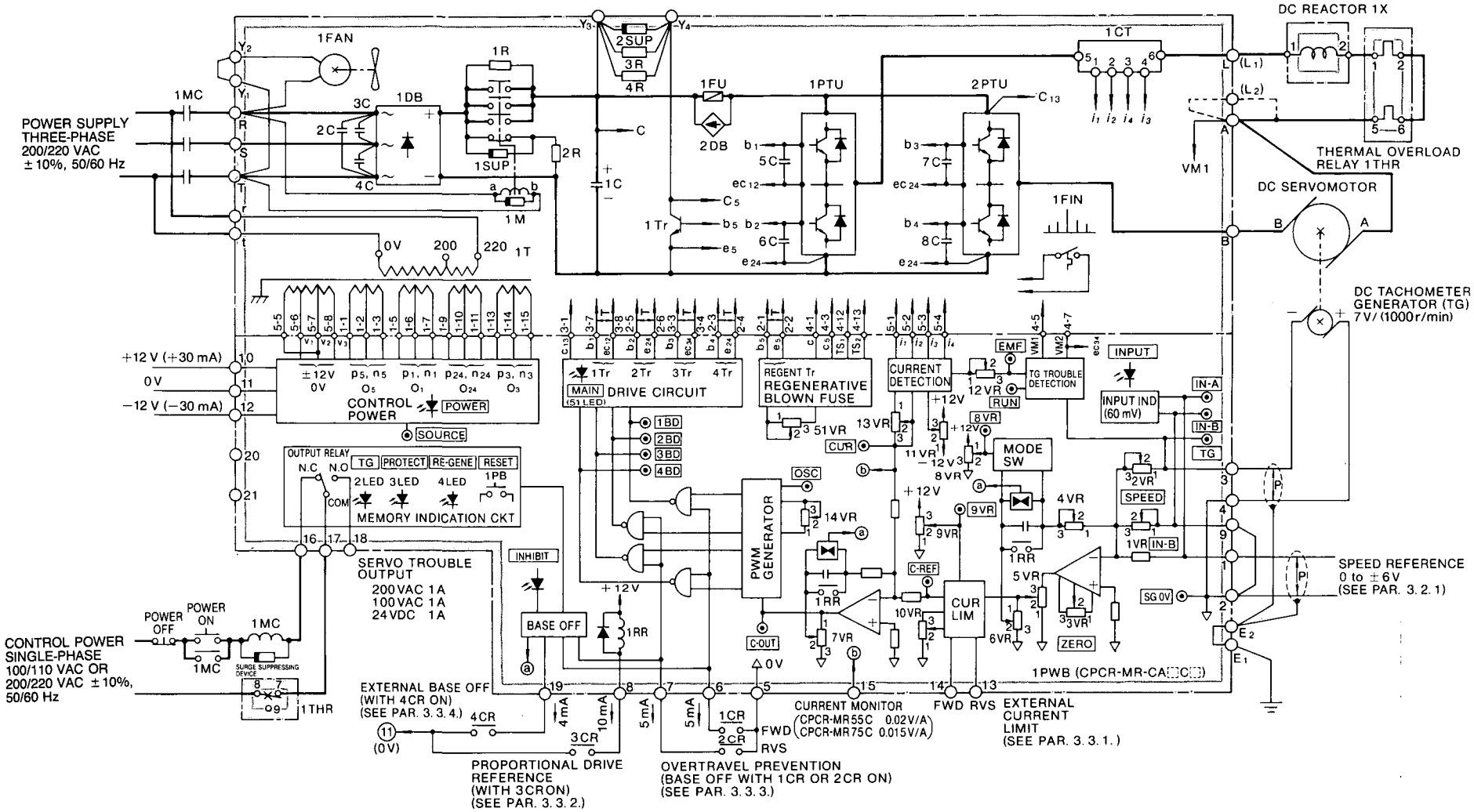
Fig. 2. 2 Internal Block Diagram of SERVOPACK Type CPCR-MR07C

2. 2 INTERNAL BLOCK DIAGRAM (Cont'd)



Notes:
1. The regenerative resistor is built-in. The resistor unit JUSP-R00□ for previous types (CPCR-MR08H to -MR22H) is not used.
2. Plug fuse is connected to the DC circuit. For previous types (CPCR-MR08H to -MR22H), alarm fuse is connected to the AC circuit.
3. Cooling fan 1FAN is attached to only type CPCR-MR□CW.

Fig. 2.3 Internal Block Diagram of SERVOPACK Types CPCR-MR08C to -MR22C

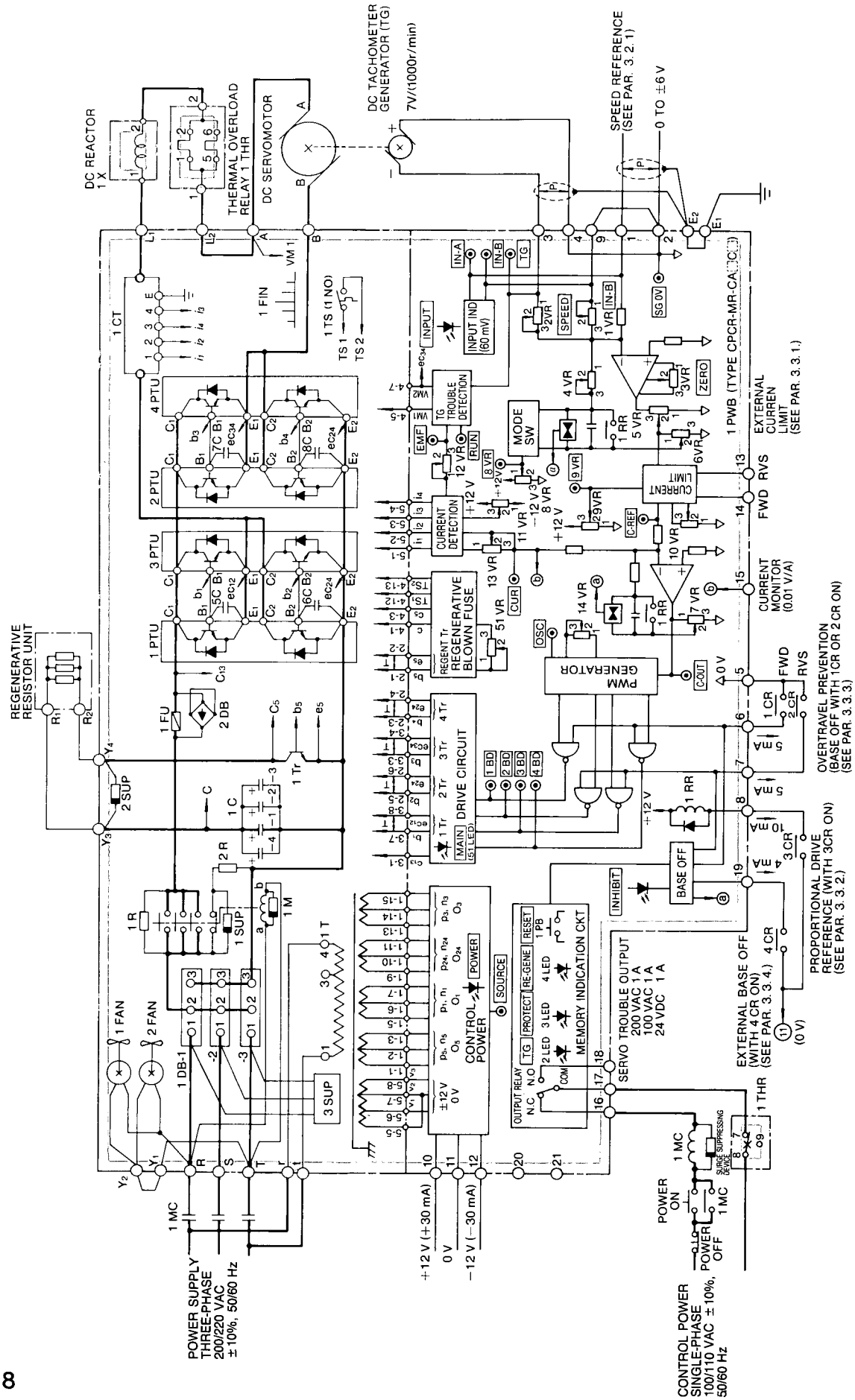


Notes:

1. The regenerative resistor is built-in. The resistor unit JUSP-R00□ for previous types (CPCR-MR55H to -MR75H) is not used.
2. Plug fuse is connected to the DC circuit. For the previous types (CPCR-MR55H to -MR75H), alarm fuse is connected to the AC circuit.
3. Terminals (L1) and (L2) are attached to only type CPCR-MR□CW.

Fig. 2.4 Internal Block Diagram of SERVOPACK Types CPCR-MR55C and -MR75C

2. 2 INTERNAL BLOCK DIAGRAM (Cont'd)



Note: The resistor unit type JUSP-RA03 (procured separately) is used.

Fig. 2.5 internal Block Diagram of SERVOPACK Type CPCR-MR99C

2. 3 EXTERNAL TERMINALS

2. 3. 1 External Terminals for Types CPCR-MR01C to -MR07C

Table 2. 2 External Terminals for Types CPCR-MR01C to -MR07C

Terminal Symbol		Name	Description
Main Circuit	Ⓤ1 Ⓥ1	Main Circuit Power Input	Connected to terms. u1/v1 of secondary side of power transformer.
	Ⓤ2 Ⓥ2	Control Circuit Power Input	Connected to terms. u2/v2 of secondary side of power transformer.
	Ⓐ Ⓑ	Thermal Relay and Motor Connection	Connects term. Ⓐ to motor term. Ⓐ, and term. Ⓑ of thermal relay (connected in series) to motor term. Ⓑ.
	Ⓟ Ⓝ	Optional	Connected to term. P/N of regenerative processing unit type JUSP-RG□.
	Ⓒ3 Ⓒ4	Alarm Output	Detects main circuit fuse blown-out or fin overheat (only for type CPCR-MR07C). Normally open, 220 VAC at 1 A.
Control Circuit	① ②	Speed Reference Input	② is at SG 0V. The rated forward rotation is given at +6 V.
	③ ④	TG Input	④ is at SG 0V. Connect TG(−) to ③ and TG(+) to ④.
	⑨ ②	Auxiliary Input	Used to provide the rated speed at voltages (±2 to ±10 V) other than the ±6 V rated reference voltage.
	⑤ ⑥	Overtravel Base off at Reverse Running	Reverse-side base off with open across ⑤ and ⑥. Used with a limit switch.
	⑤ ⑦	Overtravel Base off at Forward Running	Forward-side base off with open across ⑤ and ⑦. Used with a limit switch.
	⑧ ⑪	Proportional Drive	⑪ is at 0 V. Proportional drive when shortcircuiting across ⑧ and ⑪ At this time, set the speed reference to 0 V.
	⑩ ⑪ ⑫	±12 V Power Output	⑪ is at 0 V, ⑩ at +12 V, and ⑫ at −12 V. 30 mA can be supplied. Used for speed setting, etc..
	⑬ ⑪	External Current Limiting at Reverse Running	Used to limit the current from external at reverse running.
	⑭ ⑪	External Current Limiting at Forward Running	Used to limit the current from external at forward running.
	⑲ ⑪	External Base off	⑪ is at 0 V. Shortcircuiting across ⑲ and ⑪ breaks bases at forward and reverse running.
	Ⓔ	Grounding	This is a free terminal to be used for shielded wires for TG and input or as a junction terminal for grounding.

2.3.2 External Terminals for Types CPCR-MR08C to -MR99C

Table 2.3 External Terminals for Types CPCR-MR08C to -MR99C

Terminal Symbol		Name	Description
Main Circuit	Ⓡ Ⓢ Ⓣ	Main Circuit Power Input	Three phase 200/220 VAC ±10 %, 50/60 Hz
	ⓡ ⓣ	Control Circuit Power Input	Single phase 200/220 VAC ±10 %, 50/60 Hz
	Ⓛ Ⓐ	DC Reactor and Thermal	Connects DC reactor to thermal overload
	(Ⓛ1 Ⓛ2*)	Overload Relay Connection	Relay in series
	Ⓐ Ⓑ	Motor Connection	Connects terminal Ⓐ to motor terminal Ⓐ, and terminal Ⓑ to motor terminal Ⓑ.
	(Ⓨ3 Ⓨ4)	Regenerative Resistance Junction Terminal	Used as the internal junction terminal of the regenerative resistor unit. Cannot be connected from the outside†.
	(Ⓨ1 Ⓨ2)	Thermo Switch Junction Terminal	Used for only CPCR-MR55C(W) to -MR99C shortcircuiting across Ⓨ1-Ⓨ2 externally. Cannot be connected from the outside.
Control Circuit	① ②	Speed Reference Input	② is at SG 0V. The rated forward rotation is given at ±6 V.
	③ ④	TG Input	④ is at SG 0V. Connect TG(−) to ③ and TG(+) to ④.
	⑨ ②	Auxiliary Input	Used to provide the rated speed at voltages (±2 to ±10V) other than the rated reference voltage, ±6 V.
	⑤ ⑥	Overtravel Base off at the Forward Running	Forward-side base off when shortcircuiting across ⑤ and ⑥. Used with a limit switch.
	⑤ ⑦	Overtravel Base off at the Reverse Running	Reverse-side base off when shortcircuiting across ⑤ and ⑦. Used with a limit switch.
	⑧ ⑪	Proportional Drive	⑪ is at 0 V. Proportional drive when shortcircuiting across ⑧ and ⑪. At this time, set the speed reference to 0 V.
	⑩ ⑪ ⑫	±12 V Power Output	⑪ is at 0 V, ⑩ at +10 V, and ⑫ at −12 V. 30 mA can be supplied. Used for speed setting, etc.
	⑬ ⑪	External Current Limiting at the Reverse Running	Used to limit the current from external at reverse running.
	⑭ ⑪	External Current Limiting at the Forward Running	Used to limit the current from external at forward running.
	⑮ ⑪	Current Monitor	⑪ is at 0 V. Armature current is observed at ⑮.
	⑯ ⑰ ⑱	Servo Trouble Output	Terminal to output servo trouble. 1 NONC contact (⑯: NC, ⑰: common, ⑱: NO) Current capacity: 100/200 VAC 1 A, 24 VDC 1 A
	⑲ ⑪	External Base off	⑪ is at 0 V. Shortcircuiting across ⑲ and ⑪ breaks bases at the forward and reverse running.
	⑳ ㉑	Optional	Not used.
	Ⓔ1 Ⓔ2	Grounding	This is a free terminal to be used for shielded wires for TG and input or grounding.

*Only for CPCR-MR75C and -MR99C.

†Only for CPCR-MR99C, separate regenerative resistor unit JUSP-RA03 is connected (Fig. 3.23).

Note: Do not use empty terminals to connect the external circuit (some unused terminals may be used in product modification, so reserve them for possible *Servopack* replacement).

2.3.3 External Terminal for Components to be combined

(1) Tachometer-generator Terminals and Servomotors

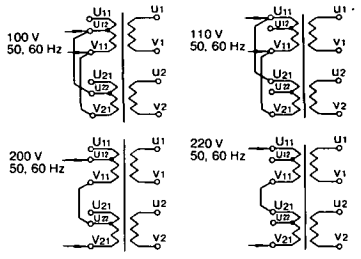
Table 2.4 Tachometer-generator Terminals and Servomotors

Servomotor Type	DC Tachometer Generator (TG)			
	Type	Connection Type	Symbol	
			Plus (+)	Minus (−)
UGCMEM-□GC	UGTGIM-7LV	Cannon Connector	A	B
		Terminal board or outgoing lead opening	1	2
UGJMED-□	UGTGIM-7LVC	Terminal board or outgoing lead opening	1	2
UGCMED-□AA				
UGHMED-□GG				
UGPMEN-□	11TG-D027	Screw terminal	1	2
PMES-□		Cannon Connector	C	D
UGMMEM-□		Cannon Connector	C	D
UGPMEN-□	TG-7SV built-in feedback unit, type TFUE-□C7	Cannon Connector	G	H
PMES-□				
UGCMEM-□				
UGCMED-□				
UGHMEM-□				
UGHMED-□				
UGJMED-□				
UGMMEM-□				

Note: When positive voltage is applied to motor terminal Ⓐ, plus side terminal shown in Table 2.4 becomes positive.

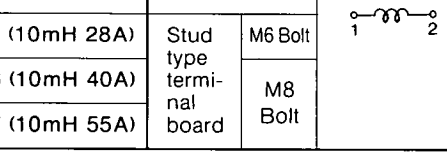
(2) Power Transformer Terminals

Table 2.5 Power Transformer Terminals

SERVOPACK Type CPCR-	Power Transformer Type	Voltage across U_1 and V_1	Voltage across U_2 and V_2	Primary Side Connection of Power Transformer
MR01C	CPT8585 (300VA)	35VAC ±10%	100 VAC ±10% (50 VA)	
MR01CJ	CPT8589 (300VA)	100VAC ±10%		
MR02C	CPT8624 (500VA)	47VAC ±10%		
MR02CJ	CPT8630 (500VA)	100VAC ±10%		
MR05C	CPT8660 (1 kVA)	85VAC ±10%		
MR07C	CPT8665 (1.5kVA)	80VAC ±10%		

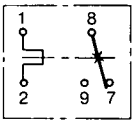
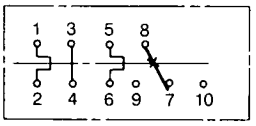
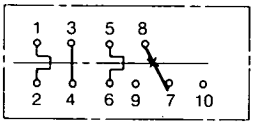
(3) DC Reactor Terminals

Table 2.6 DC Reactor Terminals

SERVOPACK Type CPCR-	DC Reactor Type	DC Reactor Terminals		
		Terminal Type		Number
MR08C	X3055 (10mH 8 A)	Terminal board M4 screw		
MR15C	X3056 (10mH 13A)			
MR22C	X3057 (10mH 18A)			
MR55C	X3058 (10mH 28A)	Stud type terminal board	M6 Bolt	
MR75C	X3066 (10mH 40A)		M8 Bolt	
MR99C	X3067 (10mH 55A)			

(4) Thermal Overload Relay Terminals

Table 2.7 Thermal Overload Relay Terminals

Thermal Overload Relay Type	Terminal Arrangement
RHP-15	
RH-18□PV	
RH-35/□HV	
RH-35/□T	

3. OPERATION

3.1 POWER ON AND OFF

For CPCR-MR[ ]C, the input must be made separately for the main circuit power (types CPCR-MR01 to -MR07C: u_1, v_2 input; types CPCR-MR08C to -MR99C: R,S,T input) and for the control circuit power (types CPCR-MR01C to -MR07C: u_2, v_2 input; types CPCR-MR08C to -MR99C: r,t input)

3.1.1 SERVOPACK Types CPCR-MR01C to -MR07C

(1) When Only One Servopack is used (Fig. 3.1)

The main circuit power and the control power must be supplied or cut at the same time, via a power transformer. Speed reference must be 0V while power is applied. If motor is started or stopped (power on or off) while applying speed reference voltage, trouble may result.

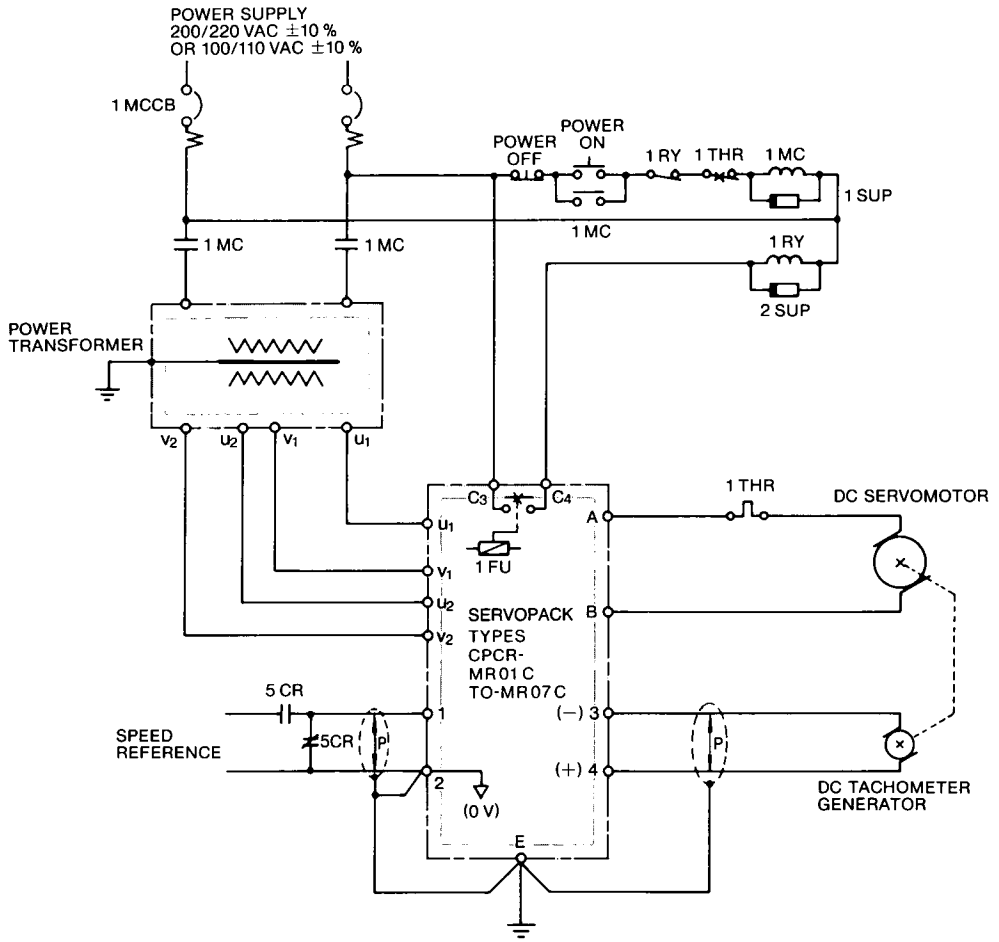


Fig. 3.1 Power Sequence Example for Types CPCR-MR01C to -MR07C

(2) Combination of Servopack and Protection Device Type JESP-PT (Fig. 3.2)

When protection device type JESP-PT is used with Servopack, make sequence so that only the main circuit power is cut off in the case of servo alarm. (For details, refer to Par. 3.8.1 "Protection Device".)

For precautions at power on, refer to Par. 3.1.1 (1). If 1MC is turned off during trouble, fault indicator will be out.

(3) Combination of Servopack and Regenerative Unit Type JUSP-RG (Fig. 3.3)

When regenerative unit type JUSP-RG is used with Servopack, make sequence so that the power is cut off by an alarm signal of regenerative unit. (For details, refer to Par. 3.8.2 "Regenerative Unit".)

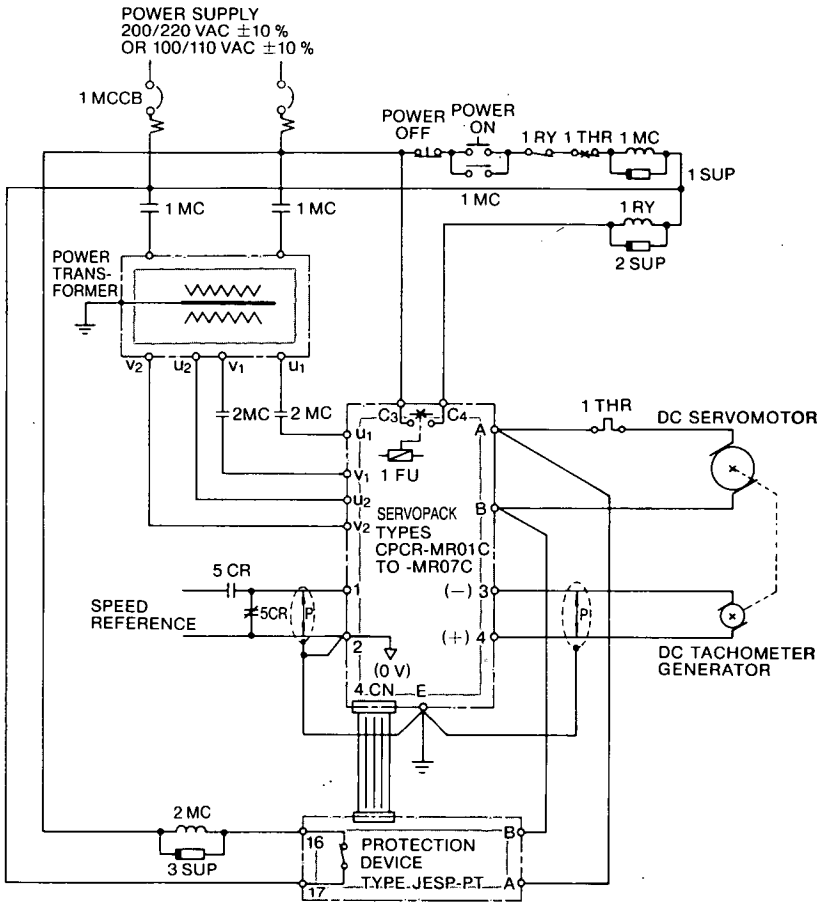
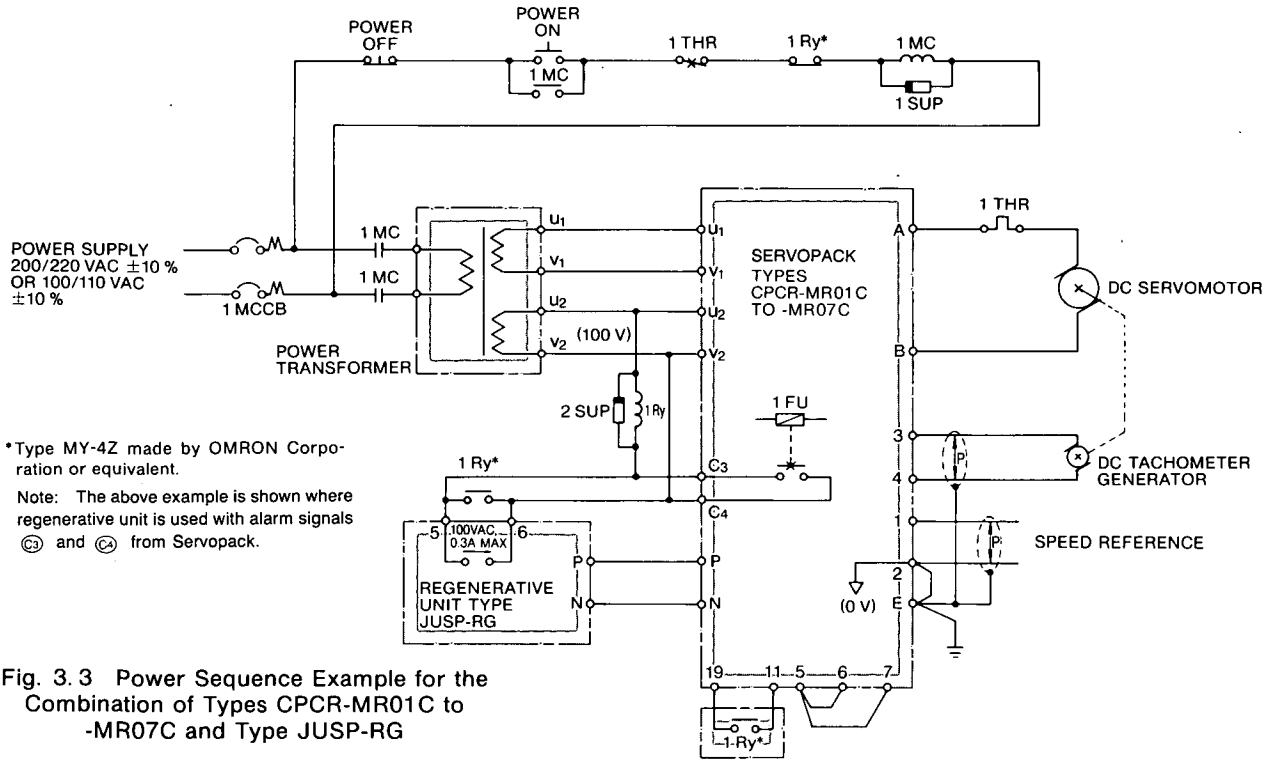


Fig. 3.2 Power Sequence Example for the Combination of Types CPCR-MR01C to -MR07C and Type JESP-PT



*Type MY-4Z made by OMRON Corporation or equivalent.

Note: The above example is shown where regenerative unit is used with alarm signals (C3) and (C4) from Servopack.

Fig. 3.3 Power Sequence Example for the Combination of Types CPCR-MR01C to -MR07C and Type JUSP-RG

(4) Combination of Servopack, Protection Device Type JESP-PT and Regenerative Unit Type JUSP-RG (Fig. 3.4)

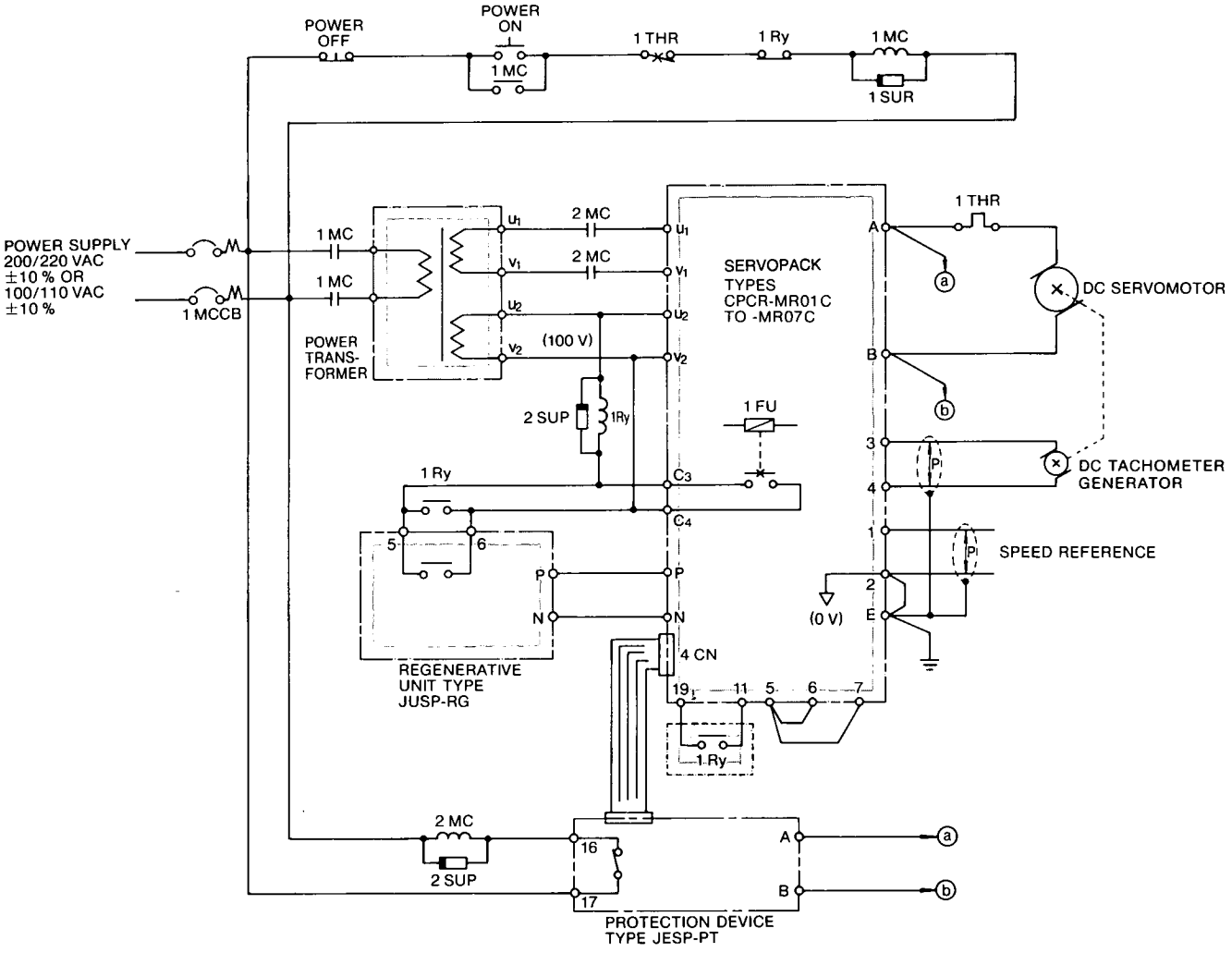


Fig. 3.4 Power Sequence Example for the Combination of Types CPCR-MR01C to -MR07C, Type JESP-PT and Type JUSP-RG

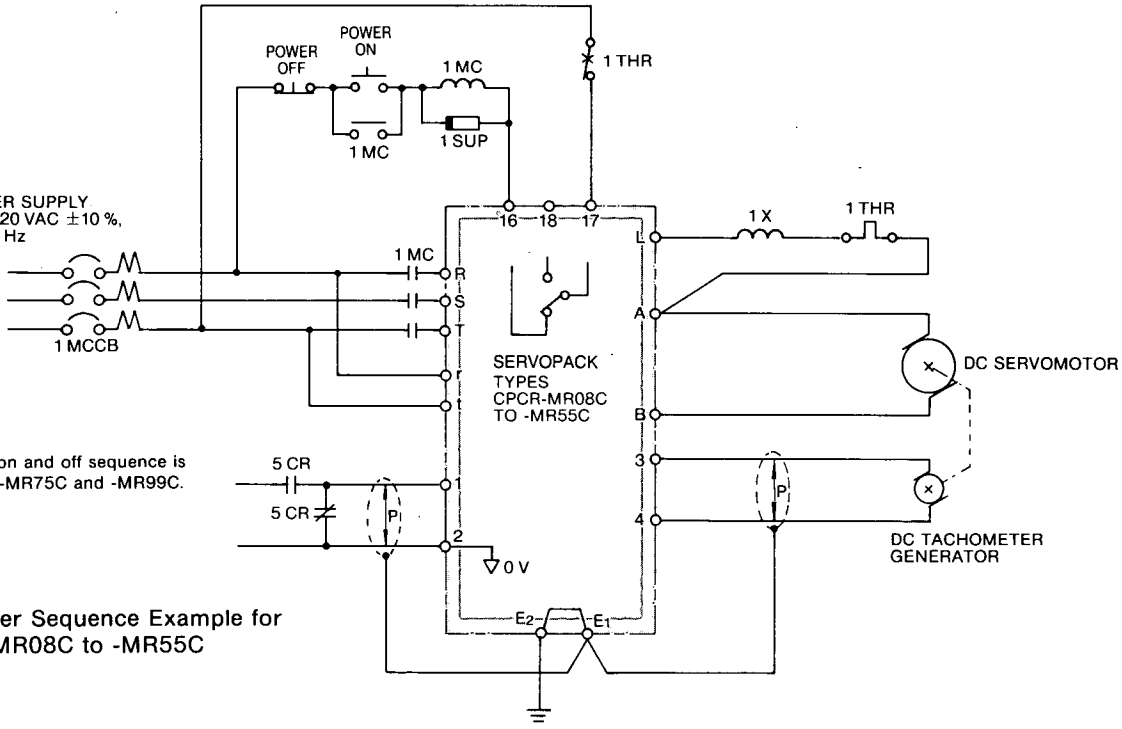
3.1.2 SERVOPACK Types CPCR-MR08C (W) to -MR99C

The main circuit power (R, S, T) and the control power (r, t) must be input either at the same time, or the control power first followed by the main circuit power.

They must be cut off either at the same time (instantaneous power failure included), or the main circuit first followed by the control power. Thus, the sequence for power on and off is reversed.

In the case of trouble (servo alarm), only the main circuit power is to be cut off (Fig. 3.5).

Troubleshooting is described in Par. 3.3.5 (2)



Note: The power on and off sequence is the same for CPCR-MR75C and -MR99C.

Fig. 3.5 Power Sequence Example for CPCR-MR08C to -MR55C

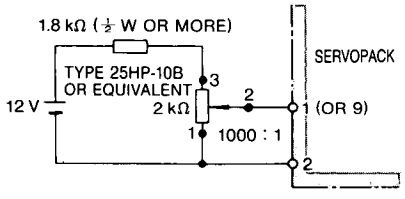
3.2 SPEED REFERENCE

3.2.1 Speed Reference Circuit

From the Servopack built-in control power (terminals ⑩, ⑪, ⑫) or the external power, the speed reference voltage is given to terminals ① and ② or to terminals ⑨ and ②. When the Servopack built-in control power is used, the motor speed fluctuates in the range of ± 2% of the speed set value. When external power is used to give the speed reference voltage to Servopack, use the range of 0 to ± 12 V.

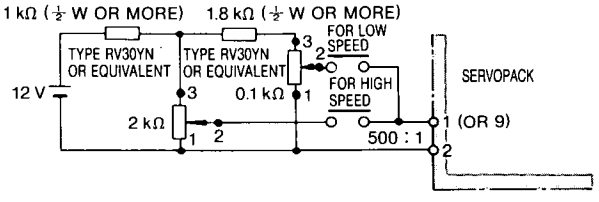
The method for giving speed reference voltage is described below.

(1) For Accurate (Inching) Speed Setting:



• Type 25HP-10B: Multiple-rotation type, wire wound variable resistor (with dial MD10-30B4) made by Sakae Tsushin Inc.

(a) When Multiple-rotation Type, Wire Wound Variable Resistor is used



• Type RV30YN: Carbon-film variable resistor made by Tokyo Cosmos Electric.

• Low-and high-speed relays: Reed relay (PG series) made by Nippon Electric or equivalent, or low-level relay (G_2A-432) made by OMRON Corporation or equivalent.

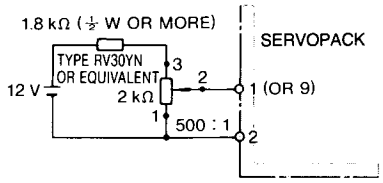
Note: When a carbon resistor is used, a great residual resistance remains, and so the speed control range becomes approximately 500:1.

(b) When Carbon Variable Resistor is used

Fig. 3.6 Method for Giving Speed Reference Voltage (for Accurate Speed Setting)

3.2.1 Speed Reference Circuit (Cont'd)

(2) For relatively Rough Speed Setting

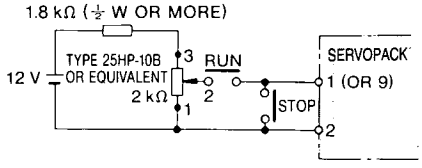


Note: When a carbon resistor is used, a great residual resistance remains, and so the speed control range becomes about 500:1.

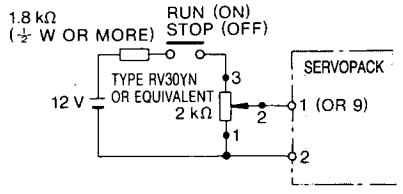
Fig. 3.7 Method for Giving Speed Reference Voltage (for relatively Rough Speed Setting as compared with Fig. 3.6)

3.2.2 Stop Reference Circuit

When commanding a stop, do not open the speed reference circuit (terminal ① or ⑨), but set to to 0 V [Fig. 3.8 (a) and (b)].



(a) When Multiple-rotation Type, Wire Wound Variable Resistor is used

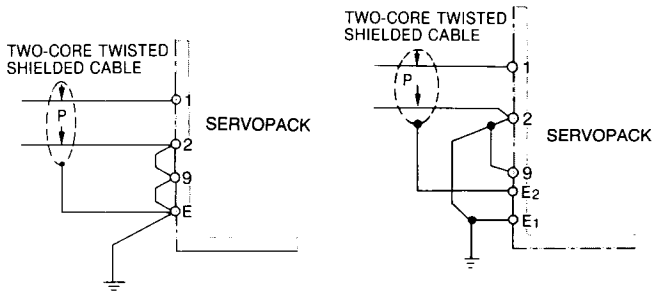


(b) When Carbon Variable Resistor is used

Fig. 3.8 Method for Giving Stop Reference

3.2.3 Handling of Speed Reference Input Terminal

The unused terminal, out of the speed reference terminal ① and the auxiliary input terminal ⑨, must be short-circuited to SG 0 V (terminal ②), which is then grounded (Fig. 3.9.) If it cannot be grounded, the speed reference circuit and TG feedback circuit must be carefully connected to prevent noise.



(a) Types CPCR-MR01C to -MR07C (b) Types CPCR-MR08C to -MR99C

Fig. 3.9 Handling of Speed Reference Input Terminal

3.2.4 Auxiliary Input Terminal (±2 to ±10 V)

When using the auxiliary input terminals, adjust the input resistance to 3.3 kΩ/V (10 kΩ for 3 V rating, 33 kΩ for 10 V rating, for example).

3.3 BUILT-IN FUNCTION

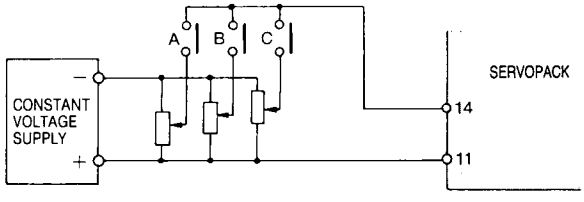
3.3.1 External Current Limiting Reference Circuit

Current can be limited from the outside as well as within Servopack.

The external current limit is used for the following cases:

- To protect the motor from overload current when an abnormal load lock occurs in the load.
- To change the current limit value according to the external sequence.

The current can be limited by multi-stage setting by the use of relays (Fig. 3.10). The same effect can be obtained by giving voltage signals making analog change.



Relay: Low-level relay type G2A-432A made by OMRON Corporation.

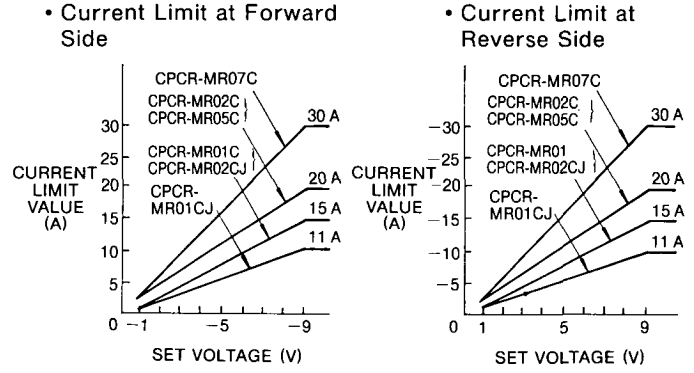
Fig. 3.10 Multi-stage Switching of Current Value at Forward Side

(1) Method of Giving External Current Limit Reference

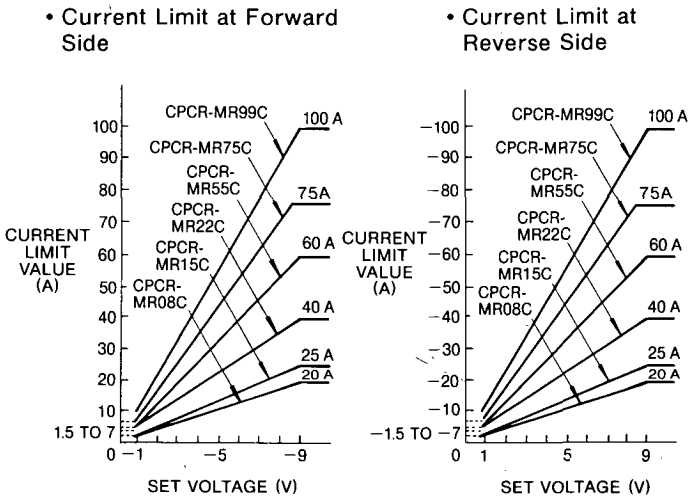
The forward current (current from motor terminal Ⓐ to Ⓑ) and reverse current can be controlled independently. The forward current can be controlled by giving a reverse voltage (0 to -9 V) to Servopack terminal ⑭; the reverse current by a forward voltage (0 to 9 V) to terminal ⑬. The power supply must use an internal resistance less than 2 kΩ. The input resistance at Servopack side must be greater than 5 kΩ. When external current is not restricted, terminals ⑬ and ⑭ are opened.

(2) Set Voltage and Current Limit Values

The relationship between set voltages of 0 to ± 9 V and current limit values are shown in Fig. 3.11.



(a) Types CPCR-MR01C to -MR07C



Note: Types CPCR-MR55C-H and -MR75C-H have been designed in 55A limit.

(b) Types CPCR-MR08C to -MR99C

Fig. 3.11 Set Voltage—Current Limit Characteristics

(3) Current Limit when Motor is locked

When locking a motor by applying a current limit, determine the current limit value less than the rated current of the motor. If the load condition requires a current limit exceeding the rated motor current, refer to Par.1.2."SERVOPACK OVERLOAD CHARACTERISTIC", and make sure to unlock the motor before reaching the overload level.

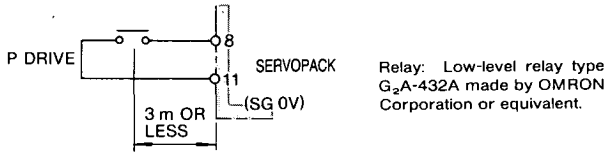
Note that when the speed reference voltage is less than tens or so millivolts (affected by setting of gain of 4VR and 6VR), the motor lock current sometimes pulsates. If this is not desirable, the current pulsation can be removed by increasing the speed reference voltage.

For motor locked more than one minute, consult your Yaskawa representatives.

3.3.2 Proportional Drive Reference Circuit (Complete Stop Reference Circuit)

If a position loop is not set for positioning, and after completion of positioning, has been left for quite a long time, the positioned point may have moved due to preamplifier drift. This can be avoided by shortcircuiting terminals ⑧ and ⑪ immediately after the positioning (Fig. 3.12). This switches the speed amplifier from PI drive to P drive and the loop gain in the control system drops and the drift decreases. The P drive reference circuit can be controlled also by non-contact signal (0 V common, open collector operation). See Fig. 3.13.

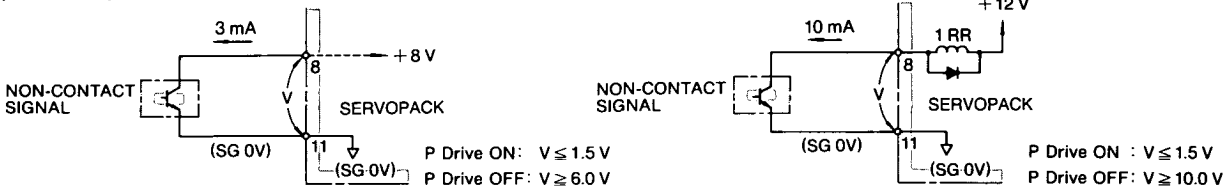
In this case, pay attention to the voltage and currnet of the drive element. P drive reference ON/OFF timing is shown in Fig. 3.14.



Note: When P drive reference is input, if the speed reference voltage is not 0 V, the motor rotates.

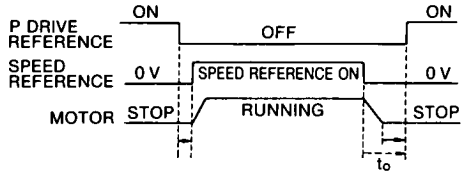
Fig. 3.12 Proportional (P) Drive Reference Circuit

3.3.2 Proportional Drive Reference Circuit (Complete Stop Reference Circuit) (Cont'd)



(a) Types CPCR-MR01C to -MR07C (b) Types CPCR-MR08C to -MR99C

Fig. 3.13 Example of P Drive Reference Circuit Non-Contact Signal



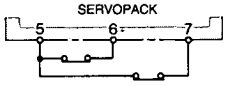
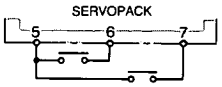
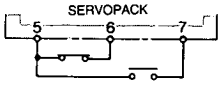
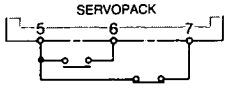
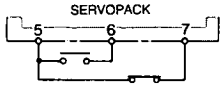
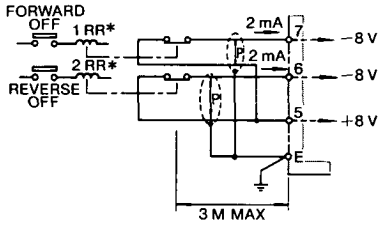
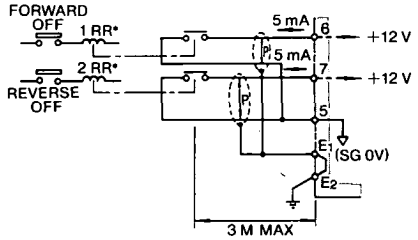
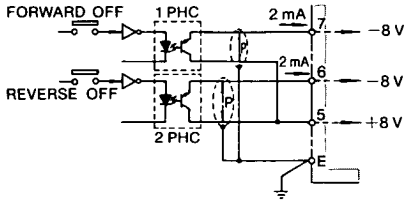
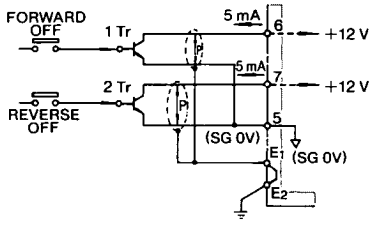
Notes:
1. Arrow → means a delay time greater than the operating time for one relay (10 ms).
2. P drive reference OFF → ON timing is done after the motor has stopped (after completion of positioning). When the operation does not include positioning, the timing can be set by setting timer (t_0) instead of the speed reference OFF. (Set (t_0) longer than the time needed for motor stop.)

Fig. 3.14 P Drive Reference Timing

3.3.3 Overtravel Preventive Circuit (Forward OFF, Reverse OFF Circuit)

This circuit is used to stop the motor drive at forward running (counterclockwise direction when viewed from the drive end) and at reverse running. The circuit, however, only cuts off the output voltage that drives the motor, and therefore, the motor stops after coasting. To apply brake action, set the speed reference voltage to 0 V, or use the dynamic brake circuit (generator control).

Table 3.1 Overtravel Preventive Circuit

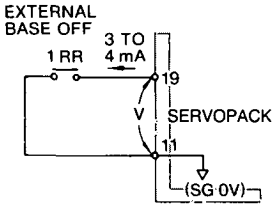
Action \ Type	CPCR-MR01C to -MR07C	CPCR-MR08 to -MR99C
Motor Running (Normal Operating State)	Closed across terminals ⑤-⑥ and ⑤-⑦. 	Open across terminals ⑤-⑥ and ⑤-⑦. 
Forward Running Stop (Forward OFF Action)	Open across terminals ⑤-⑦ and closed across terminals ⑤-⑥. 	Closed across terminals ⑤-⑥ and open across terminals ⑤-⑦. 
Reverse Running Stop (Reverse OFF Action)	Open across terminals ⑤-⑥ and closed across terminals ⑤-⑦. 	Closed across terminals ⑤-⑦ and open across terminals ⑤-⑥. 
Forward OFF, Reverse OFF Circuit Configuration using Relay	NC contact 	NO contact 
Forward OFF, Reverse OFF Circuit Configuration using Non-contact Signal	 Terminals ⑤, ⑥ and ⑦ cannot be operated by 0 V common.	 Transistors 1 Tr and 2 Tr are operated by open collector with 0 V common.

*1RR, 2RR: Low-level relay, type G2A-432A made by OMRON Corporation or equivalent.

3.3.4 External Base off Circuit

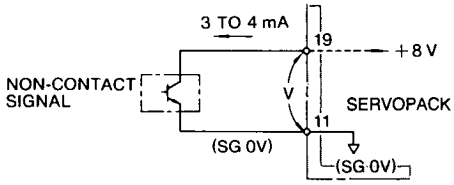
When one Servopack is used to control several motors, the motors and TG must be switched with the drive circuit off. To keep the motor in standstill, the drive circuit must be off. In this case, by shortcircuiting across terminals ⑲ and ⑪, the drive circuits for the forward and reverse sides can be stopped at the same time [Fig. 3.15 (a) and (b)].

When the external base off circuit operates, the proportional drive command circuit in Par. 3.3.2 operates at the same time. To prevent an abnormal operation due to saturation of the speed amplifier when releasing the base off, it is unnecessary to use the proportional drive command circuit. As reference, Fig 3.16 shows the external base off methods when overtravel preventive circuits are used.



1RR: Low-level relay type G_2A-432A made by OMRON Corporation or equivalent.

(a) External Base off Circuit using Low-level-Relay



External Base off ON: $V \leqq 1.5$ V

External Base off OFF: $V \geqq 6.0$ V

(b) External Base off Circuit using Non-contact Signal

Fig. 3.15 External Base off Circuit

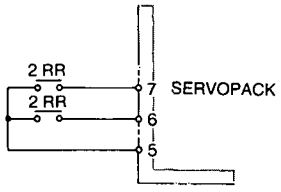


Fig. 3.16 External Base off Method when using Overtravel Preventive Circuit

3.3.5 Protective Circuit

Servopack CPCR-MR□C provides various functions to protect the body and motor from malfunctions.

(1) Trouble Detecting Function

The trouble detecting functions are shown in Table 3.2.

Table 3.2 Trouble Detecting Function

Trouble Protecting Function \ SERVOPACK Type		CPCR - MR 01 C to - MR 07 C			CPCR-MR08C to -MR99C	
		SERVOPACK only	SERVOPACK and Type JESP-PT	SERVOPACK and Type JUSP-RG	Standard Type	Type CPCR-MR□CL
TG Trouble Detection: Detects, broken, or shorted wiring or reverse connection in TG circuit.		–	◎	–	◎	
Overcurrent Detection*: Detects an overcurrent in transistor due to malfunctioning such as motor insulation problems.		○	◎	○	◎	
Overvoltage Detection: Detects abnormal DC voltage in the main circuit due to large load inertia.		○	◎	◉	◎	
Blown Fuse Detection: Detects that the SERVOPACK main fuse is blown.		□ (Output: Contact output across terminals ⑬-⑭)			◎	
Overload Detection: Detects overload of motor or SERVOPACK	Motor Overload	Accomplished by a separately installed thermal overload relay.				
	SERVOPACK Overload†	–	◎ (For type JESP-PT)	–	–	◎
Heat Sink Overheat Detection†: Detects excessively overheated heat sink by cooling fan malfunction etc.		◎ (For type CPCR - MR 07 C)			◎ (For types CPCR-MR55C to -MR99C)	
Regenerative Circuit Trouble Detection: Detects breakdown of regenerative resistance, or trouble in regenerative transistor or regenerative circuit.		–		◎	◎	
Protective Circuit ON	Indication	See the next Par. (2). Take corrective action when protective circuit operates.				
	Output†	–	Item ◎ contact output 1NONC contact	Item ◉ Lead relay contact output	Item ◎ contact output	
	Reset	Power off	Reset BS	Power off	Reset BS	

*Overcurrent means an instantaneous (100 μs or less) current (greater than 1.2 to 2.0 times the instantaneous maximum current of Servopack) passing through the power transistor used in the main circuit.

† Specification for the special type.

†○: External signals are not output.
◎, ◉, □: External signals are output.
Output contact specification
◎: Power relay 1NONC contact; 200 VAC 1A, 24 VDC 1A
◉: Lead relay 1NO contact; 100 VAC 0.3A (15 VA max)
□: 1NO contact; 200 VAC 1A, 24 VDC 1A

3. 3. 5 Protective Circuit (Cont'd)

(2) Corrective Action when Protective Circuit Operates

When the protective circuit operates, the drive circuit in Servopack is turned OFF, the content of operation is displayed with LEDs, and alarm signals are output from the external terminals ⑯, ⑰, and ⑱. This state continues until reset. The output of an alarm signal shows some trouble, so check the cause and take the proper corrective action to restart the operation.

Do not check the cause while power is applied to the main circuit. Make a sequence to cut off only the main circuit power supply, (terminals u_1 and u_2, or ®, Ⓢ, and Ⓣ) using an alarm signal. See Fig. 3.5. Do not cut off the control power (terminals u_2 and v_2, or ⓡ and ⓣ) at this time, because this will turn off LEDs in CPCR-MR or JESP-PT indicating the cause of alarm.

NOTE

Before restarting the operation, set the speed reference to 0 V. Then turn on the main circuit power. (Due to saturation of the speed amplifier, an instantaneous high-speed rotation may occur momentally.)

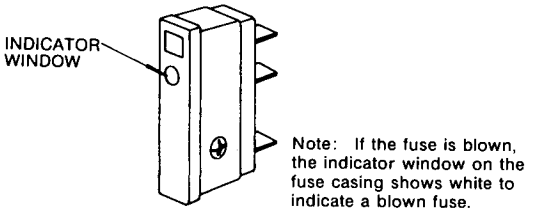
3. 3. 6 Display

Servopack CPCR-MR□C is provided with a variety of LEDs for indicating the operating conditions in protective circuit and control section. Table 3.3 shows indicating specifications.

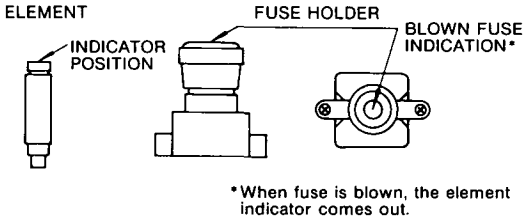
Table 3. 3 LED Indication Specification

Indicating Function		LED Name	Lighting Condition	SERVOPACK Types CPCR-MR01C to -MR07C	Protection Device Type JESP-PT	SERVOPACK Types CPCR-MR08C to -MR09C
Power Supply		POWER (Green)	Control power is supplied. (CPCR-MR01C to -MR07C: 100 VAC ±10 %, single-phase across terminals u_2-v_2: CPCR-MR08C to -MR99C: 200 VAC ±10 %, single-phase across terminals ⓡ-ⓣ.)	○	–	○
		MAIN (Green)51LED	Main circuit power is supplied.	–	–	○
Speed Reference Input		INPUT (White)	Speed reference (±60 mV or more) is input across terminals ①-② or ⑨-②.	–	○	○
Base off		INHIBIT (White)	Base is off in both forward and reverse rotations: • Overtravel preventive circuit (terminals ⑤, ⑥, ⑦) operates in both forward and reverse rotations. • External base off circuit (terminals ⑲-⑪) operates. • Servo trouble detecting circuit operates. • Main power is not applied to SERVOPACK. (200VAC ±10%, three-phase, 50/60Hz across terminals ®-Ⓢ-Ⓣ).	–	○	○
Servo Trouble	TG Trouble	TG (Red)	TG trouble detecting circuit operates.	–	○	○
	Overcurrent	PROTECT (Red)	Overcurrent detecting circuit operates.	–	○	○
		ALARM (Red)		○	–	–
	Overvoltage	RE·GENE (Red)	Overvoltage detecting circuit operates.	–	○	○
		ALARM (Red)		○	–	–
	Blown Fuse	RE·GENE (Red)	Blown-fuse detecting circuit operates.	–	–	○
		Fuse Element	Blown-fuse indicator comes out from fuse element itself.	See Fig. 3. 17 (a).	–	See Fig. 3. 17 (b).
	Overload	OL (Red)	SERVOPACK overload detecting circuit operates. (Protection device: type JESP-PT□L only; SERVOPACK, type CPCR-MR□CL only)	–	△	△
	Heat Sink Overheat	TG (Red) PROTECT (Red)	Heat sink overheat detecting circuit operates. (For SERVOPACK types CPCR-MR55C to -MR99C)	–	–	△
	Regenerative Trouble	RE·GENE (Red)	Trouble detecting circuit operates.	–	–	○

Notes:
1. Mark △ is for specification of special types.
2. Mark ○ or △ is displayed with *Servopack*.



(a) Types CPCR-MR01C to -MR07C



(b) Types CPCR-MR08C to -MR99C

Fig. 3.17 Blown Indication of Built-in Fuse

3.3.7 Current Monitor

Motor current appears as a voltage signal at terminal ⑮ of Servopack types CPCR-MR08C to -MR99C or protection device type JESP-PT (Table 3.4). The signal is used to detect overload of the motor. The connecting load must have input impedance of 10 kΩ or greater (Normally open).

Table 3.4 Voltage Level of Current Monitor Terminals

SERVOPACK Type (Protection Device Type)	Current Monitor Terminal Voltage (With Terminal ⑮ opened)
CPCR-MR01C to -MR07C + (JESP-PT)	0.045 V ± 10 % / A
CPCR - MR 08 C	0.06 V ± 10 % / A
CPCR - MR 15 C	0.05 V ± 10 % / A
CPCR - MR 22 C	0.03 V ± 10 % / A
CPCR - MR 55 C	0.02 V ± 10 % / A
CPCR - MR 75 C	0.015 V ± 10 % / A
CPCR - MR 99 C	0.01 V ± 10 % / A

3.3.8 Overspeed Drive (O·S Drive)

To fully develop the characteristic of Minertia Motor J series (large torque at low speed), CPCR -MR ☐ CJ and CPCR-MR ☐ C-J provides the O.S drive function enabling an overspeed drive up to approximately 1.5 to 2 times the rated speed within the allowable speed range of the motor. It is therefore unnecessary to control the current limit characteristic determined by the motor (according to the speed, automatic current limit is applied from the outside).

3.4 PRECAUTIONS FOR APPLICATION

3.4.1 Coating (Varnish) Treatment

When used in ambients where oil mist is likely to deposit or humidity is high, Servopack internal insulating resistance drops due to oil mist or moisture and malfunction may occur. For use in a severe ambient condition, the type of treatment for severe environment should be applied.

For the severe ambient condition, types having control board coated with varnish are available.

3.4.2 Minus Load

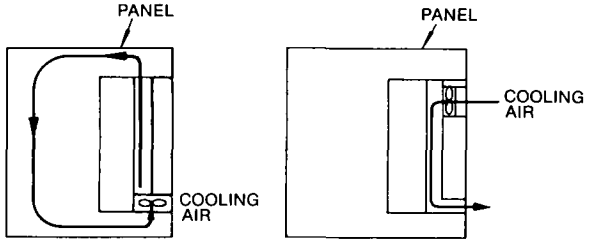
The motor is rotated by the load; it is impossible, by the use of CPCR-MR☐C, to apply brake (regenerative brake) against this rotation and achieve continuous running.

Example: Driving a motor to lower objects (with no counterweight)

Since Servopack types CPCR-MR08C to -MR99C has the regenerative brake capability of short time (corresponding to the motor stopping time), for application to a minus load, contact the company. For regenerative unit type JUSP-PG used with types CPCR-MR01C to -MR07C, refer to Par. 3.8.2.

3.4.3 Type CPCR-MR☐CW Application

Types CPCR-MR08CW to -MR55CW are applicable to harmful ambients containing iron powder and cutting oil, such as in cutting and milling machines or car factories. The characteristics are the same as those of types CPCR-MR08C to -MR55C, but the construction differs in that cooling air is taken from the outside of the unit and discharged to the outside [Fig. 3.18 (a) and (b)].



(a) Cooling System for Type CPCR-MR☐C

(b) Cooling System for Type CPCR-MR☐CW

Fig. 3.18 Cooling System

3.4.4 Type CPCR-MR□CL and Type JESP-PT□L Application

For continuous running of Servopack, the load conditions must be checked thoroughly. Special care is needed for application to an operation mode in which the load varies and the Servopack continuous output current is exceeded (except for overload due to start and stop), or where the motor locking current may continue for 1 second or longer when the motor is locked due to machine trouble. In such an application, use Servopack type CPCR-MR□CL or type JESP-PT□L with the overload detecting function to prevent trouble made by exceeding Servopack overload capability.

The protective circuit detecting level is set under condition of a motor locked during motor running, and therefore the safety factors and allowable conduction times are different for each Servopack. See Fig. 1.2 (a) to (h).

Servopack operates at an early time for frequent start and stop application in this set level. In application, thorough consideration is necessary for the value to be set. Note that the thermal overload relay for motor overload protection does not protect all the overload characteristics of Servopack.

3.4.5 Special Power Voltage

(1) Types CPCR-MR01C to -MR07C

Where the supply voltage is 400 or 440 V, it is necessary to charge power supply transformer. The transformer is available on order.

(2) Types CPCR-MR08C to -MR99C

For power voltage of 400 V class, a transformer must be added. In such a case, contact the company. Single-phase power of 100 V class cannot be used.

3.4.6 Load Inertia

Type CPCR-MR□C has a limit in its regenerative control capability and therefore the load inertia is restricted. When the motor speed is constant, the regenerative energy of the motor is proportional to inertia.

The allowable load inertia converted to the motor shaft is as follows:

(1) Types CPCR-MR01C to -MR07C

- Print Motor standard series (PM)
- Minertia Motor standard series (MM)

$\Big\}\ J_L \leqq 3J_M$

- Cup Motor
- Hi-Cup Motor
- Minertia Motor J series

$\Big\}\ J_L \leqq 2J_M$

(2) Types CPCR-MR08C to -MR22C: $J_L \leqq 3J_M$

(3) Types CPCR- MR55C to -MR99C: $J_L \leqq 2J_M$

If load inertia exceeds the above values, contact your Yaskawa representatives for types CPCR-MR-08C the available range of load inertia is max five times of motor inertia by using regenerative unit. (Refer to Par. 3.8.2.)

3.4.7 Motor Overload Protection

If a motor runs continuously under overload, motor coil may burn out. To protect the motor, use a thermal overload relay that matches the thermal characteristic of the motor. Make sure to connect the specified thermal overload relay as shown in Figs. 2.1 to 2.5. Make a sequence circuit so that the main circuit power is turned off when the thermal overload relay operates.

For Minertia Motor J series, the thermoguard may be contained in the motor as an optional. In this case, the contact of the thermal overload relay is connected in series to the contact of the thermoguard (Fig. 3.19). Note that the thermal overcurrent relay is not attached to the motor and must be procured separately.

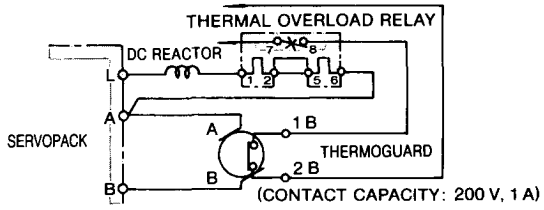
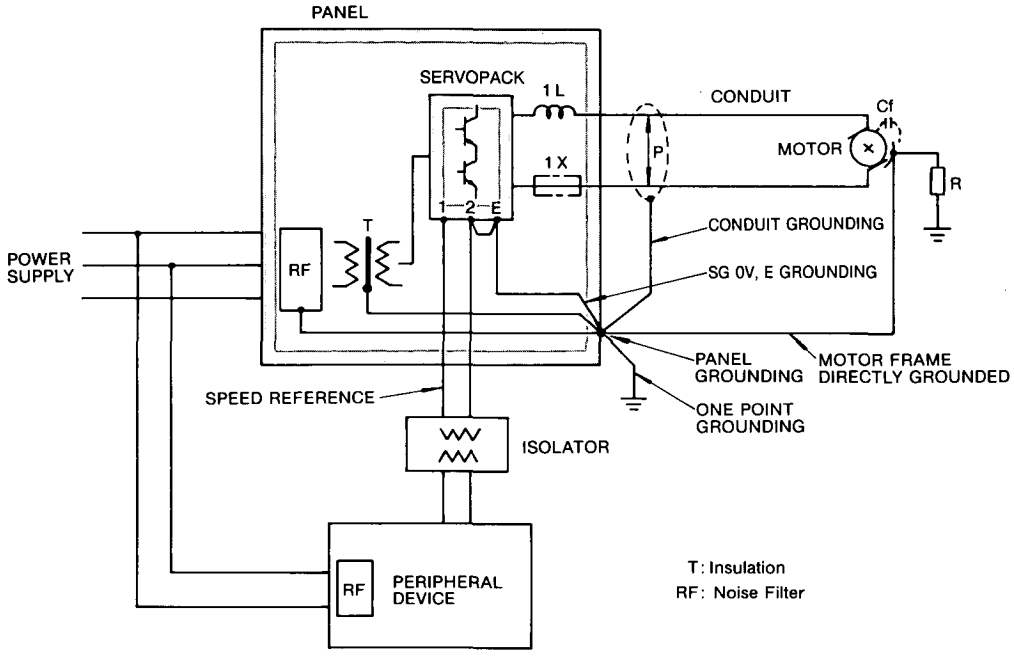


Fig. 3.19 Minertia Motor J Series Overload Protection

3.5 PRECAUTIONS FOR OPERATION

3.5.1 Noise Treatment (Fig. 3.20)

Servopack CPCR-MR□C uses a power transistor in the main circuit. When these transistors are switched, the effect of $\frac{di}{dt}$ or $\frac{dv}{dt}$ (switching noise) may sometimes occur depending on the wiring or grounding method. To reduce switching noise as much as possible, the recommended method of wiring and grounding is shown below.



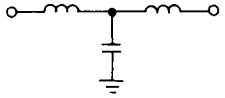
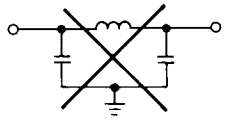
Note: By balancing the ground impedance viewed from PWM power (by adding 1 X = 1 L equivalent reactor), the normal mode noise is converted to the common mode noise. This is an effective action for R. F. I. However, readjustment may be required.

Fig. 3.20 Noise Treatment (Example)

(1) Noise Filter Installation

When noise filters are installed to prevent noise from the power line, the preventive type must be used. The recommended noise filter is shown in Table 3.5. The power supply to peripherals also needs noise filters.

Table 3.5 Recommended Noise Filter*

SERVOPACK Type CPCR-	Kind of Applicable Noise Filter	Recommended Noise Filter	
		Type	Specifications
MR 01 C	 Correct	LF - 205 A	Single-phase 200, 100 VAC class 5 A
MR 02 C		LF - 210	Single-phase 200, 100 VAC class 10 A
MR 05 C		LF - 215	Single-phase 200, 100 VAC class 15 A
MR 07 C		LF - 215	Single-phase 200/100 VAC class 15 A
MR 08 C		LF - 305	Three-phase 200 VAC class 5 A
MR 15 C	 Wrong	LF - 310	Three-phase 200 VAC class 10 A
MR 22 C		LF - 315	Three-phase 200 VAC class 15 A
MR 55 C		LF - 330	Three-phase 200 VAC class 30 A
MR 75 C		LF - 340	Three-phase 200 VAC class 40 A
MR 99 C		LF - 350	Three-phase 200 VAC class 50 A

* Made by Tokin Corp.

3.5.1 Noise Treatment (Fig. 3.20) (Cont'd)

(2) Grounding Method

· Motor frame grounding

When the motor is at the machine side and grounded through the frame, Cf $\frac{dv}{dt}$ current flows from the PWM power through the floating capacity of the motor. To prevent this effect of current, the motor frame is directly grounded.

· Servopack SG 0 V

Noise may remain in the input signal line, so make sure to ground SG 0 V (terminal ②).

The terminals Ⓔ, $Ⓔ_1$, and $Ⓔ_2$ are connected to nowhere into Servopack. These terminals must be grounded outside. When motor wiring is contained in metal conduits, the conduits and boxes must be grounded.

The above grounding uses one-point grounding. For wiring, see Par. 4.2.2.

(3) Grounding when Multiple Servopacks are used

When Servoapck types CPCR-MR□C are housed in the same control panel, ground them as shown in Fig. 3.21.

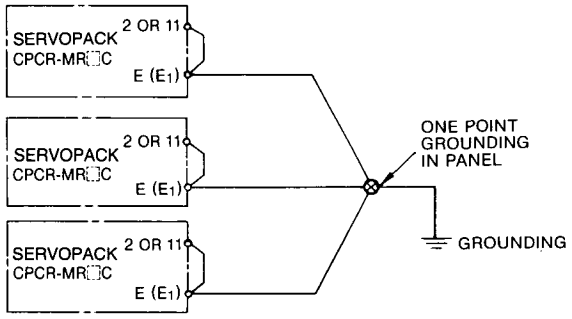


Fig. 3.21 Grounding when Multiple SERVOPACKs are used

(4) Others

· For an effective action due to R. F. I., use three-phase insulation transformer for the power supply (for types CPCR-MR08C to -MR99C).

· For preventing noise from the speed reference circuit, use an isolator.

Example: V/V Isolator M3000B Type made by M. T. T. Co.

3.5.2 Power Line Protection

Servopack CPCR-MR08C to -MR99C are the line operation type using the commercial power line. To protect the power line from grounding or contact accidents or the system from a fire, it is necessary to use molded-case circuit breakers (MCCB) or fuses depending on the number of Servopacks to be used (Table 3.6).

The fuses contained in Servopack are to protect the DC circuit, but not to protect the power line. Quick-melting fuses cannot be used. Servopack CPCR-MR□C has the capacity-input type power and so quick-melting fuses may be blown at the time of power input.

Table 3.6 Power Capacity and MCCB or Fuse

SERVOPACK Type CPCR-	Power Capacity per SERVOPACK	Current Capacity per MCCB or Fuse
MR 08 C	1.6 kVA	5 A
MR 15 C	3.0 kVA	9 A
MR 22 C	4.0 kVA	12 A
MR 55 C	3.7 kW 6.9 kVA	20 A
	5.5 kW 9 kVA	26 A
MR 75 C	6 kW 10 kVA	26 A
	7.5 kW 13 kVA	35 A
MR 99 C	9.9 kW 17 kVA	50 A

3.5.3 Driving Motor with Cooling Fan and Motor with Separate Excitation

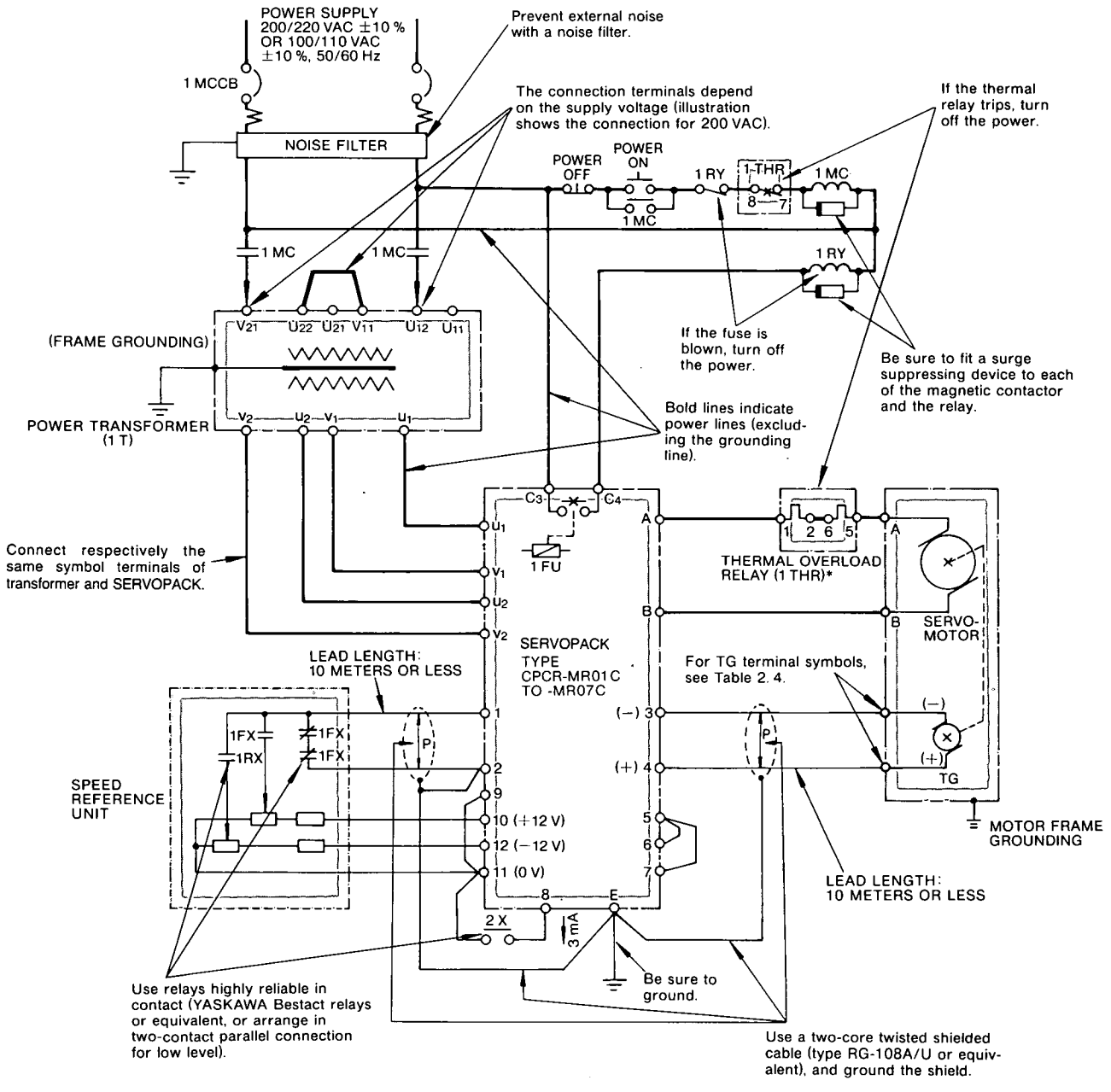
· The cooling fan comes attached to Cup motor type UGCMFM-75FB, Hi-Cup motor type UGHMFM-60, industrial DC motor type GEELM-K, and Minertia motor type UGMMKR-2AA, respectively. For the cooling fan specifications (power requirement, number of phases, thermal overload relay type for protection, connection method, and air flow), see the individual motor specifications and make correct connection.

Make the sequence so that the motor-drive main circuit is cut off when the fan-protecting thermal overload relay operates.

Minertia motor type UGMMKR-2AA requires a field power supply in addition to Servopack. Our company offers the field power unit NPSA-TM-20(RH)Y1 for type UGMMKR-2AA. For details, contact your Yaskawa representative.

3.6 CONNECTION DIAGRAM OF SERVOPACK

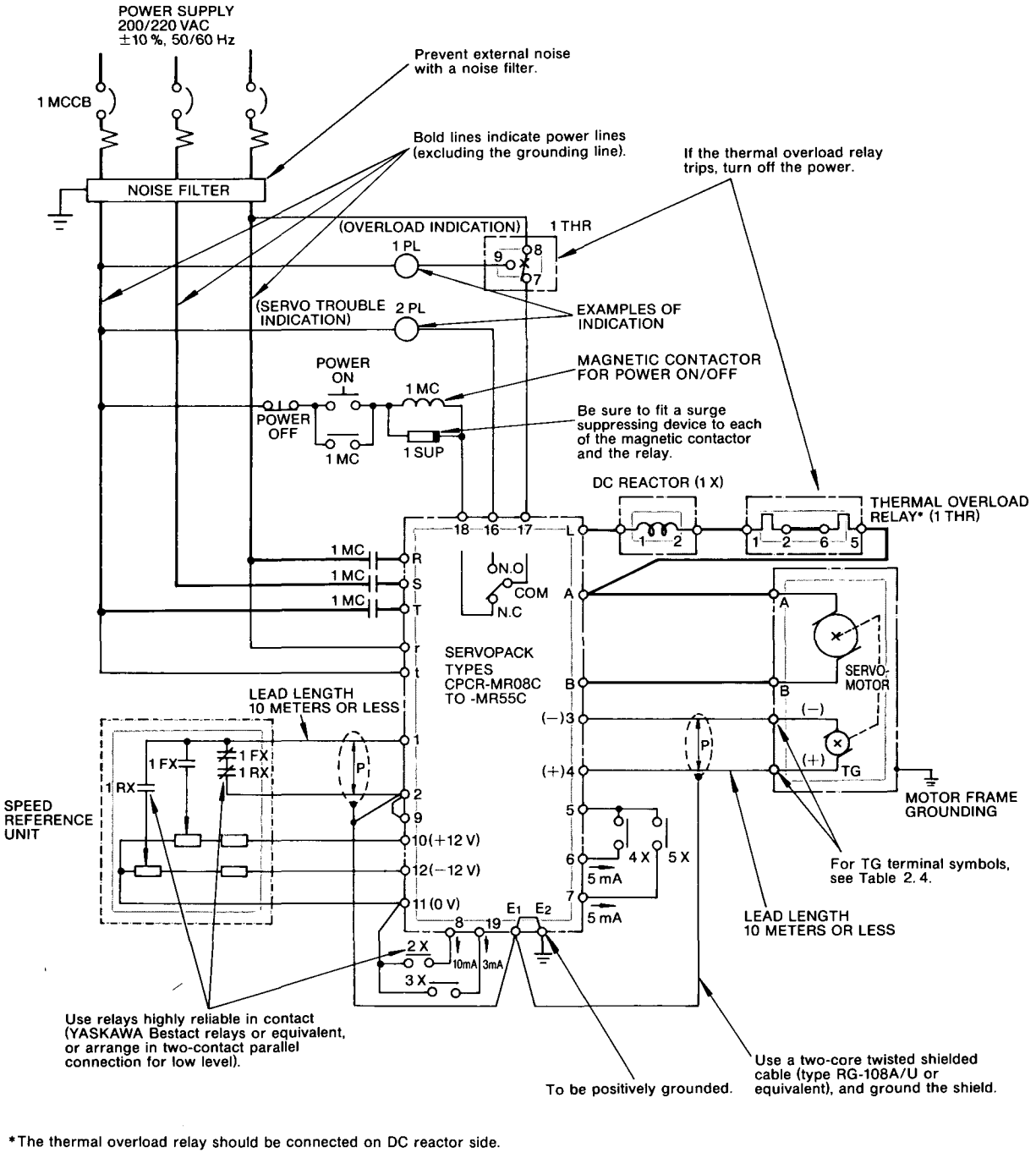
3.6.1 Types CPCR-MR01C to -MR07C



*The thermal overload relay (1THR) for PM or JM provides neither terminal ⑤ nor ⑥.

Fig. 3.22 Example of Connection Diagram of SERVOPACK Types CPCR-MR01C to -MR07C

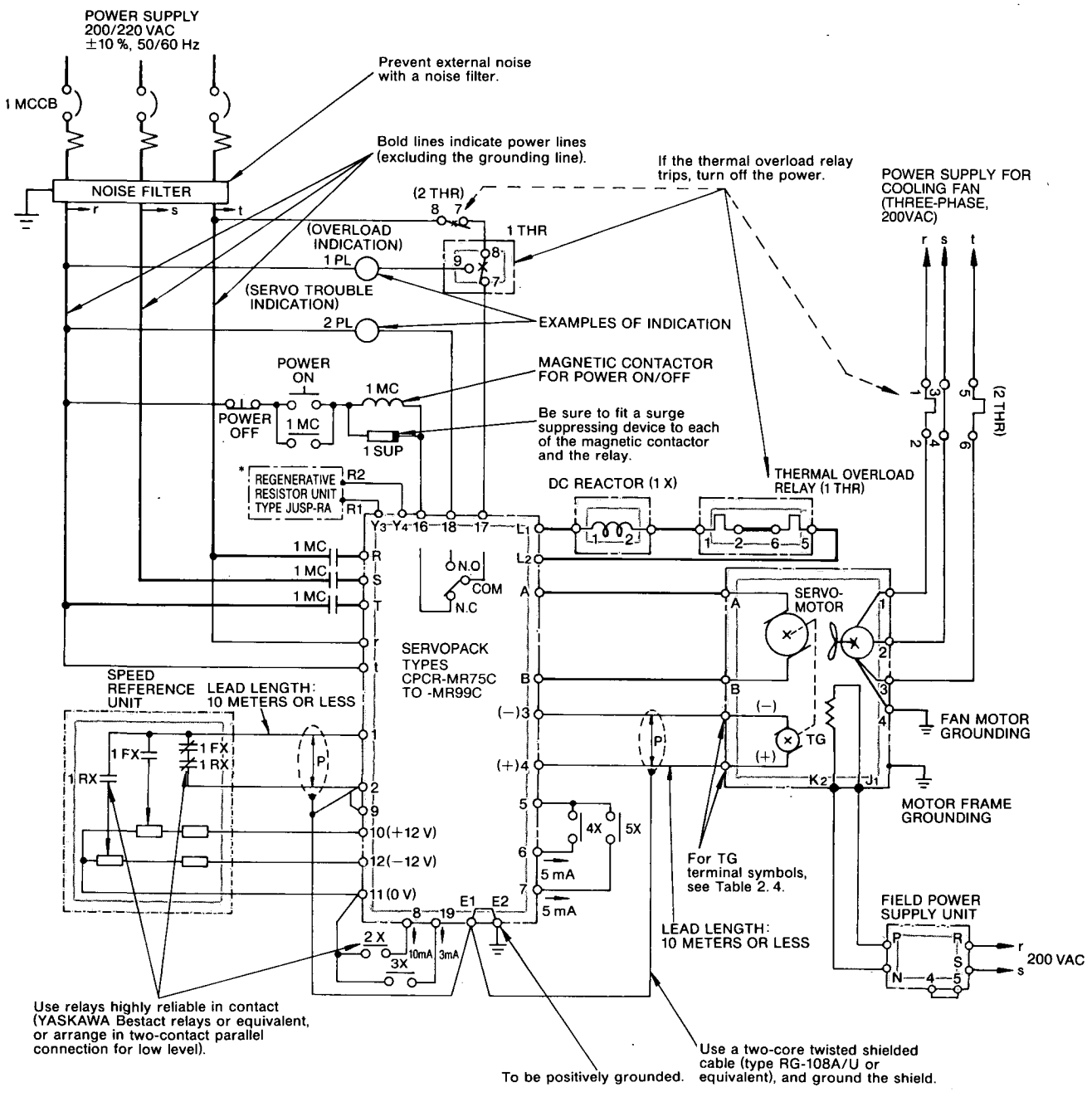
3.6.2 Types CPCR-MR08C to -MR55C



*The thermal overload relay should be connected on DC reactor side.

Fig. 3.23 Example of Connection Diagram of SERVOPACK Types CPCR-MR08C to -MR55C

3.6.3 Types CPCR-MR75C, -MR99C



*For only *Servopack* type CPCR-MR99C-M.

Notes:

1. The thermal overload relay should be connected on DC reactor side.
2. The regenerative unit, type JUSP-RA03, is used only for type CPCR-MR99C.
3. Connect a power supply for cooling fan to motor using correct terminals according to motor specifications.

Fig. 3.24 Example of Connection Diagram of SERVOPACK Types CPCR-MR75C and -MR99C

3.7 APPLICATION

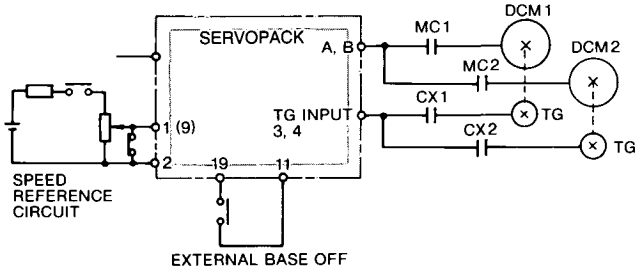
3.7.1 Switching Operation of Multiple Servomotors

When one Servopack is used for switching operation of multiple servomotors (the same type and capacity), follow the procedure below [Fig. 3.25 (a) and (b).]

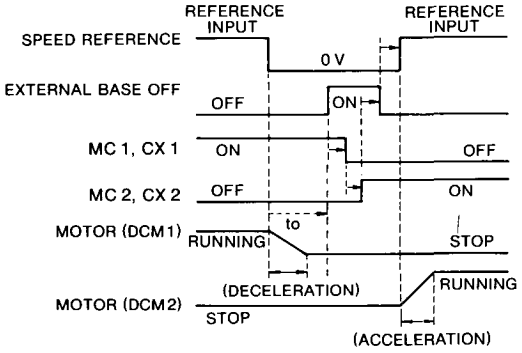
- Input stop reference (speed reference voltage: 0 V) [DCM1 stop].
- ↓
- Input external base off (terminals ⑲ and ⑪: ON).
- ↓
- Release DC output for DCM1 (MC1: OFF).
- ↓
- Break TG circuit for DCM1 (CX1: OFF).
- ↓
- Input DC output for DCM2 (MC2: ON).
- ↓
- Make TG circuit for DCM2 (CX2: ON).
- ↓
- Release external base off (terminals ⑲ and ⑪: OFF).
- ↓
- Input speed reference [DCM2 run].

NOTES

1. Arrow ↓ shows a delay time greater than the operating time (10 ms) of one relay.
2. Input the external base off after a delay of one relay from the time the motor has stopped.



(a) Switching Operation Circuit for Multiple (Two) DC Servomotors



Notes:
1. Arrow→shows a delay time greater than the operating time (10 ms) of one relay.
2. Turn on the external base off after the motor has stopped completely. This can be done normally by setting timer to from the speed reference OFF (set to greater than the motor stopping time).
3. For MC1 and MC2, use magnetic contactor with high contact reliability.

(b) Switching-operation Timing-chart for Multiple (Two) DC Servomotors

Fig. 3.25 Switching Operation for Multiple DC Servomotors

3.7.2 Emergency Stop Dynamic Braking (DB) Circuit

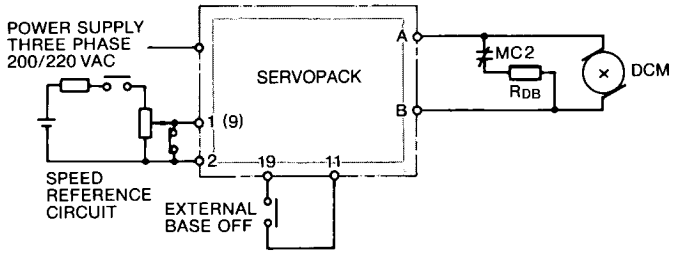
When an external DB circuit for emergency stop is used, make and break the DB circuit in the sequence shown in Fig. 3.26 (a) and (b). The DB resistance value differs depending on the applicable motors and conditions. Examples are shown in Table 3.7 as reference.

When making a DB circuit with the overtravel preventive circuit, contact your Yaskawa representative.

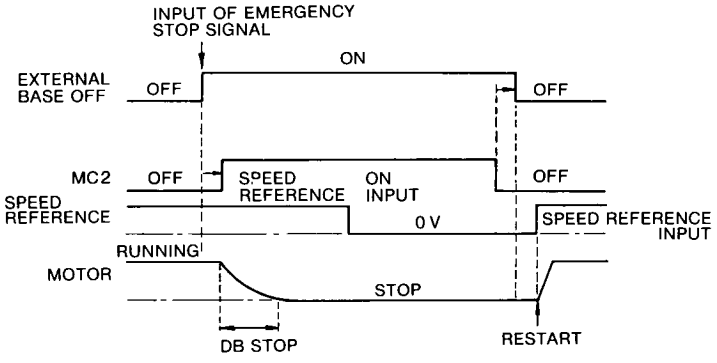
- Input the external base off with an emergency stop signal (terminals ⑲ and ⑪: ON).
- ↓
- Input DB circuit (MC2: ON)
  - (Motor stop)
  - (Speed reference voltage: 0 V)
- ↓
- Break DB circuit (MC2: OFF)
- ↓
- Release the external base off (terminals ⑲ and ⑪: OFF).

NOTES

1. Arrow ↓ shows a delay time greater than the operating time of one relay.
2. Release the DB circuit after setting the speed reference to 0 V.



(a) DB Circuit for Emergency Stop



Note: Arrow → shows a delay time greater than the operating time of one relay.

(b) Timing Chart when Making and Breaking DB Circuit for Emergency Stop

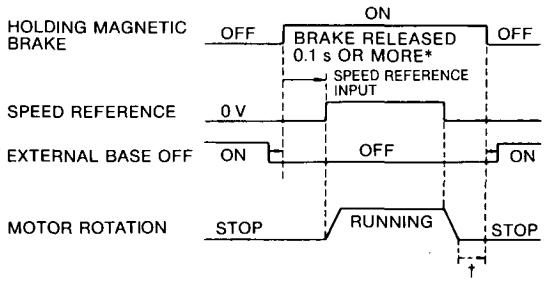
Fig. 3.26 Use of DB Circuit for Emergency Stop

Table 3.7 DB Resistor for DC Servomotor

DC Servomotor Type		DB Resistor Type (R_{DB})	DB Contactor Type (MC2)
Print Motor Standard Type	UGPMEN-08	QHZ10W 1Ω×2P	RA-6E2 (B×3P)
	PMES-09		
	PMES-12	QHZ-Y30W1Ω	
	PMES-16	QHY60W 2Ω	
	PMES-20	QHY60W 5Ω	
Minertia Motor J Series	UGJMED-10M	QHY30W 2Ω	RA-6E2 (B×3P)
	UGJMED-40M		
	UGJMED-40L		
	UGJMED-60M	QHY30W 2Ω+QHZ10W 1Ω	
	UGJMED-60L	QHY60W 2Ω	
	UGJMED-80M		
	UGJMED-80L		
	UGJMED-80K		SGC50-4 (B×4P)
Cup Motor	UGCMED-04	QHY60W 2Ω	RA-6E2 (B×3P)
	UGCMED-08	QHY60W 2Ω	
	UGCMED-15		
	UGCMED-22		
	UGCMED-37		
	UGCMED-55		SRC50-4 (B×4P)
	UGCMFD-75		
Hi-Cup Motor	UGHMED-06	QHY30W 2Ω	RA-6E2 (B×3P)
	UGHMED-12	QHY60W 2Ω	
	UGHMED-20		
	UGHMED-30		
	UGHMED-44		SRC50-4 (B×4P)
Minertia Motor Standard Series	UGMMEM-06	QHY60W 2Ω	RA-6E2 (B×3P)
	UGMMEM-13		
	UGMMEM-25		
	UGMMEM-50		
	UGMMEM-1A		
	UGMMKR-2A	QHY60W 2Ω×2P	SRC50-4 (B×4P)

3.7.3 Use of Servomotor with Holding Magnetic Brake

When servomotor with holding magnetic brake is used, use the following timing for signals ON and OFF. The holding magnetic brake is released by current conduction.



*Input speed reference 0.1 second or more after the brake release reference has been input.

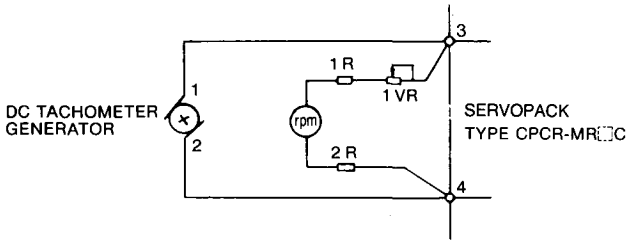
†Apply brake after the motor has stopped completely. (Do not use the brake to decelerate the motor.)

Note: Arrow → shows a delay time greater than the operating time (10 ms) of one relay.

Fig. 3.27 Holding Magnetic Brake ON-OFF Timing

3.7.4 Tachometer Connection

When a tachometer is connected to the tachometer generator, make the connection as shown in Fig. 3.28, using a DC ammeter of ±1 mA (both swing). Using resistances 1R and 2R and a potentiometer 1 VR, set the maximum speed per full scale.



Notes:
1. Instrument: ±1 mA (both swing) ammeter.
2. 1R, 2R and 1VR should be selected according to the setting of maximum speed per full scale. (select 1R = 2R; 1VR is for fine adjustment)
3. Use ammeter of type DCF-6 or DCF-12N by Toyo Instrument or equivalent.

Fig. 3.28 Tachometer Connection

3.7.5 Transformer for Multiple SERVOPACKs

Power transformer is needed when Servopack types CPCR-MR01C to -MR07C are used. The capacity of one power transformer is usually limited to one Servopack. Where multiple Servopacks are applied to one transformer, a special transformer is required. In this case, contact your Yaskawa representative.

3.8 OPTIONAL COMPONENTS

3.8.1 Protection Device Type JESP-PT□

Protection device type JESP-PT□ for Servopack types CPCR-MR01C to -MR07C is available as an option. Protection device type JESP-PT□ contains protective circuits to detect overcurrent and overvoltage protection. If any trouble occurs, the protective circuit is actuated and the indicator LED lights to indicate the status. Operating status cannot be output outside of Servopack.

By using Servopack with protective device type JESP-PT□, trouble status can be indicated and output by built-in relays. The protection devices can be easily connected to Servopack using connectors.

Protection device type JESP-PT□ contains functions such as TG trouble detection and input/output prohibition indication, and current monitor terminal. Type JESP-PT□L containing overload detection is available upon request.

3.8.1 Protection Device Type JESP-PT□ (Cont'd)

(1) Specifications

Table 3.8 Specifications of Protection Device

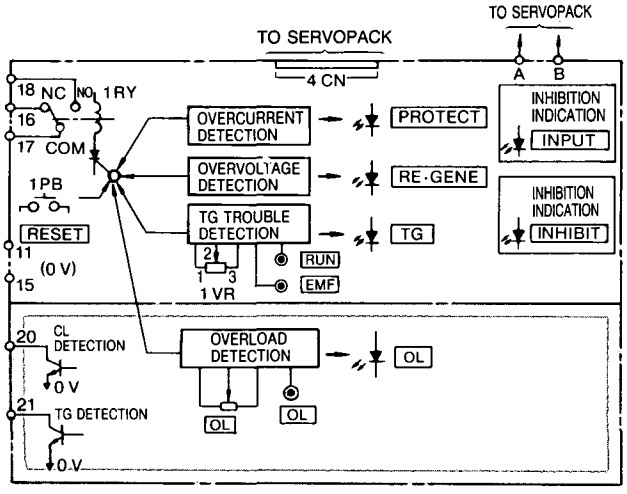
Protection Device Type JESP-		PT101 PT101L	PT102 PT102L	PT201 PT201L	PT202 PT202L	PT203 PT203L	PT203-C PT203L-C	PT203-M PT203L-M	PT203-H PT203L-H	PT204 PT204L
SERVOPACK Type CPCR-		MR01C	MR02C	MR01CJ	MR02CJ	MR05C	MR05C-C	MR05C-M	MR05C-H	MR07C
Indicating Functions*	Reference Input	LED [INPUT] (white): Indicates speed reference status of SERVOPACK.								
	Inhibition (Base off)	LED [INHIBIT] (white): Indicates base-off status of SERVOPACK.								
	Servo Trouble	LED [TG] (red): Indicates operating status of TG trouble detecting circuit.								
		LED [PROTECT] (red): Indicates operating status of overcurrent detecting circuit.								
		LED [RE·GENE] (red): Indicates operating status of overvoltage detecting circuit.								
		LED [OL]† (red): Indicates operating status of overload detecting circuit.								
Protective Functions	TG Trouble Detection	Activates when disconnected or shorted wiring or reverse connection in TG circuit is detected. Prevents motor overrun.								
	Overcurrent Detection	Activates when overcurrent flows in the transistor due to malfunction such as motor insulation problems. Prevents transistor breakdown.								
	Overvoltage Detection	Prevents troubles due to excessive regenerative power due to large load inertia.								
	Overload Detection	Prevents troubles due to excessive overload of SERVOPCAK.								
Servo Trouble Output Specifications (Terminals ⑯, ⑰, ⑱)		When the protective circuit is actuated, a servo trouble signal is sent to SERVOPACK from terminals ⑯, ⑰ and ⑱, to stop the action of the motor drive circuit. Contact rating: Transfer 1 contact (1 C) 200/100 VAC 1 A, 24 VDC 1 A								
Reset		For resetting, depress the 1PB on the surface of the protection device (the alarm circuit [ALARM] of SERVOPACK is reset simultaneously.)								
Current Monitor (Terminals ⑮-⑪)‡		0.045 V ±10 %/A at terminal ⑮.								

*Refer to Per. 3.3.6, "Display."

†Only for type JESP-PT□L.

‡At terminal ⑮, forward direction current gives ⊕ voltage and reverse direction current gives ⊖ voltage.

(2) Elementary Diagram



Notes:
1. Diagram in [▭] is only for type JESP-PT□L.
2. Terminals ⑳ and ㉑ are used when Yaskawa Programmable Motion Controller is connected.

Fig. 3.29 Elementary Diagram of Protection Device

(3) Connection

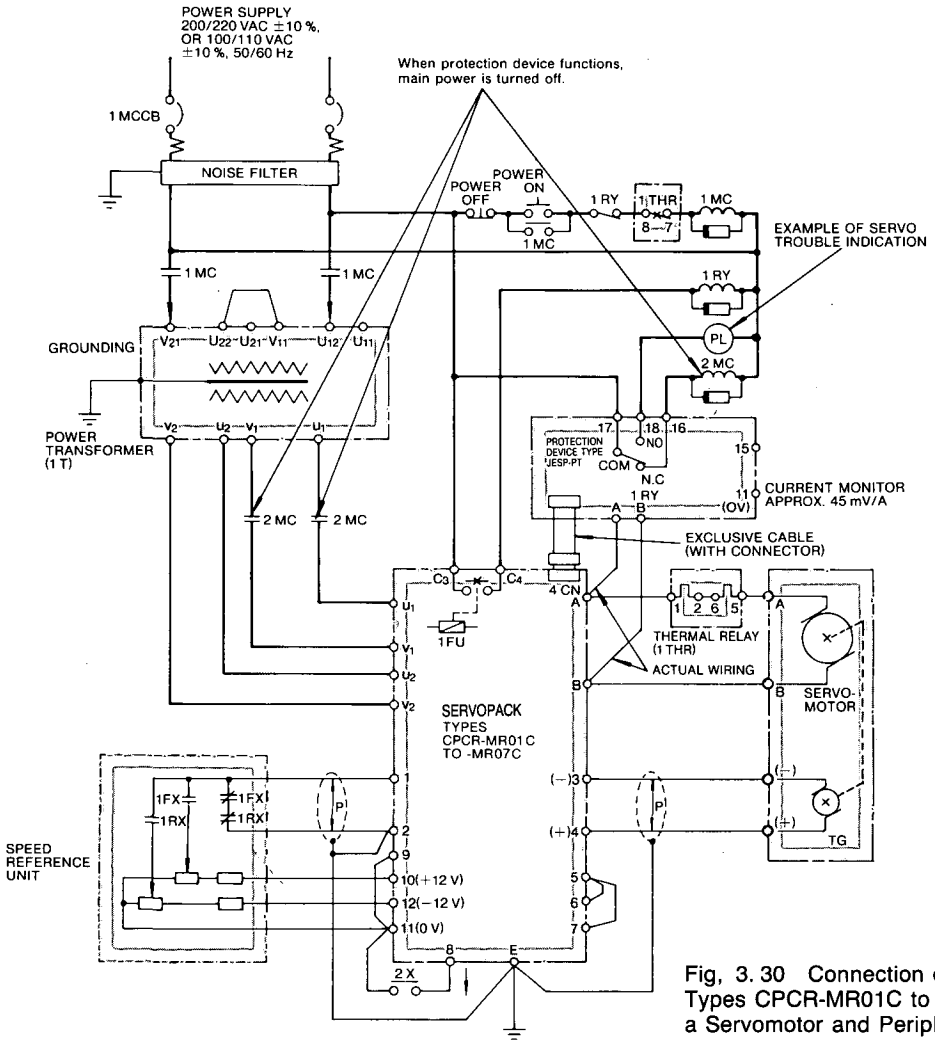


Fig. 3.30 Connection of SERVOPACK Types CPCR-MR01C to -MR07C with a Servomotor and Peripherals

(4) Precautions in Use

(a) Installation

- Be sure to mount the protection device on the left side of Servopack.
- Mount it on Servopack as shown in Fig. 3.31.

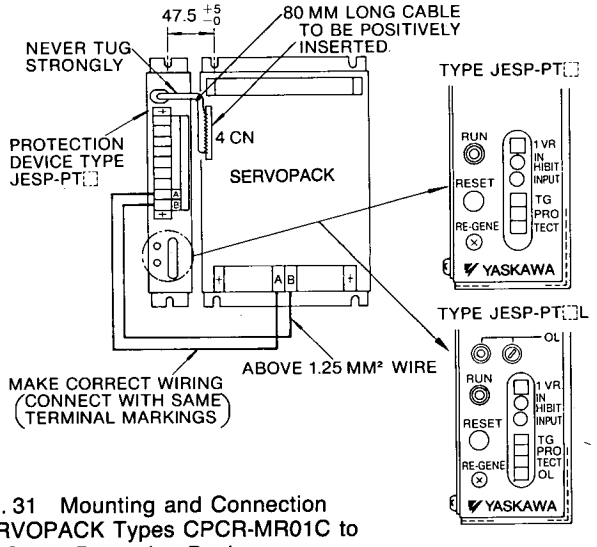


Fig. 3.31 Mounting and Connection of SERVOPACK Types CPCR-MR01C to -MR07C and Protection Device

3.8.1 Protection Device Type JESP-PT[ ] (Cont'd)

(b) Wiring

- Do not pull, tug or jerk the connector leads.
- When fitting the connector, insure proper direction of insertion and avoid bending pins. Do not insert forcibly.
- When wiring, do not obscure the reset push-button and the indicating LEDs.

(c) Procedures when the protectior device has been actuated

The protection device contains two indicators; a white LED which turns red to indicate an input/output signal and a red LED which lights to indicate the protecting-circuit operation mode.

If the protecting circuit ("overcurrent protection," "overvoltage protection" and "TG trouble protection") is actuated, a servo trouble signal is sent to Servopack, to stop the action of the motor drive circuit.

The protecting circuit continues to function unless the protection device is reset. For resetting the protecting circuit, locate the cause of trouble, and take a proper action.

For resetting, depress the 1BS pushbutton on the surface of the protection device (the alarm circuit of Servopack is reset simultaneously). While the pushbutton is kept depressed, the LEDs [PROTECT], [TG] and [RE-GENE] and [ALARM] on the circuit board of Servopack light.

3.8.2 Regenerative Unit Type JUSP-RG

Regenerative unit type JUSP-RG[ ] for Servopack types CPCR-MR01C to -MR07C is available as an option. Servopack type CPCR-MR[ ]C utilizes regenerative braking system to stop the motor, so that the main circuit voltage increases by regenerative power when applying dynamic brake.

When a load with large inertia is driven or when motor is driven with minus load and regenerative energy is continuously generated, main circuit parts may be damaged due to overvoltage. Type JUSP-RG[ ] caps the increase of voltage at a constant value and prevents Servopack main circuit parts from damage.

Type JUSP-RG[ ] contains protective circuits to detect overvoltage and regenerative circuit trouble caused by defective regeneration, and outputs operation status as alarm signals (lead relay contact). Therefore if any trouble occurs, or when an increase of regenerative processing performance is required, depending on load conditions, or prompt corrective action can be taken.

(1) Specifications

Table 3.9 shows the specifications of regenerative unit type JUSP-RG.

Table 3.9 Specifications of Regenerative Unit

Regenerative Unit Type JUSP-		RG 001	RG 002	RG 003
SERVOPACK Type CPCR-		MR 05 C, MR 07 C MR 01 CJ, MR 02 CJ	MR 02 C	MR 01 C
Regenerative Voltage		170 VDC	85 VDC	65 VDC
Regenerative Current		8 ADC	8 ADC	6 ADC
Protective Functions	Overvoltage Detection*	192 V ± 5 V	96 V ± 3 V	73 V ± 2 V
		The protective circuit operates instantaneously at the above voltage.		
	Regenerative Trouble Detection†	The protective circuit operates when regenerative circuit is in failure status for approx 0.5 s.		
	Protective Circuit Operation Output Relay (Alarm Relay)†	Lead relay (Type SRF-14B made by Nippon Electric); 1NO contact Contact capacity—100 V, 0.3 A max (15 VA max)		
External Additional Resistor #		20 Ω or more (100 W or more)	10 Ω or more (100 W or more)	10 Ω or more (100 W or more)

*This works when main circuit voltage increases more than the value in the table due to regenerative circuit trouble or regenerative processing shortage.

†Abnormal (failure) status of the regenerative circuit means; abnormal short circuit in the power transistor for regeneration; disconnection of the wire-wound resistor for regeneration.

† Overvoltage detection signals and regeneration trouble detection signals are output from the same relay.

This external resistor will be connected to terminals Ⓡ and Ⓡ₂ in the unit to increase regenerative current in the case of regenerative processing shortage.

(2) Elementary Diagram

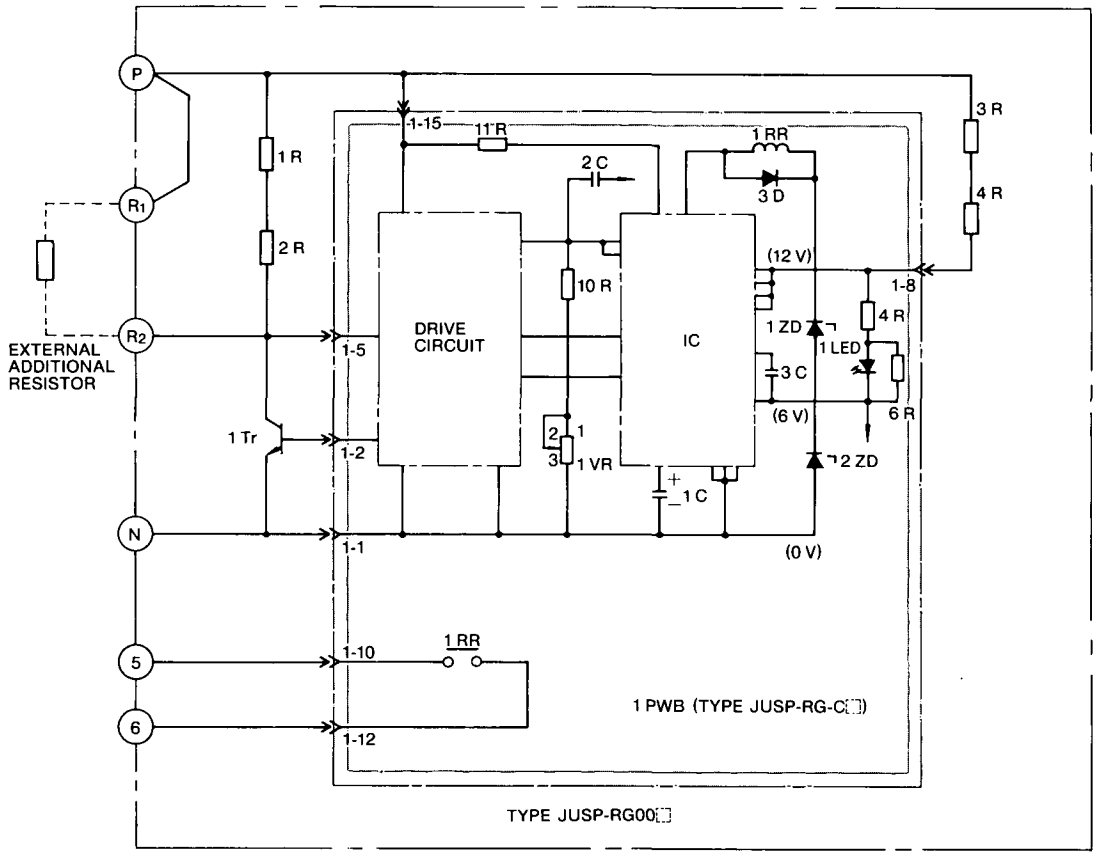


Fig. 3.32 Elementary Diagram of Regenerative Unit

(3) Connection

See Fig. 3.3.

(4) Precautions in Use

(a) Installation

Frequent start/stop operation of the regenerative unit results in high temperature. Components having low heat-resistance should not be installed within 150 mm of the resistor unit.

(b) Procedures when the protection device has been actuated

- When the protection device has been actuated while braking.

  Cause: Regenerative processing shortage due to very large load inertia

  Action: Connect an additional resistor (installed separately) between terminals (R1) and (R2) on the regenerative unit.

- When the protection device has been actuated approx 0.5 seconds after power is applied.

  Cause: Power transistor failure for regeneration (short circuit failure) or disconnection of wire-wound resistor for regeneration

- Action: Check the power transistor and the resistor. If any trouble is found, replace it.

  LED (red) in the regenerative unit lights while power is applied. It does not indicate alarm status.

4. INSTALLATION AND WIRING

4.1 INSTALLATION

Servopack type CPCR-MR□C is to be mounted on a base as standard.

4.1.1 Location

(1) When installed in A Panel:

Keep the temperature around Servopack at 60°C or below. Avoid blowing cooling air directly against the transistors on the printed circuit board. (Fig. 4.1)

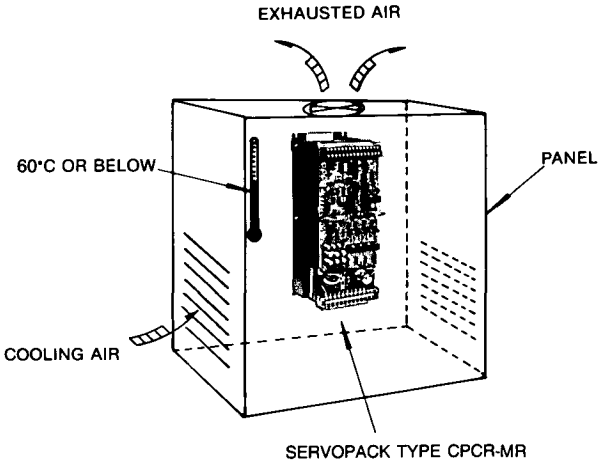


Fig. 4.1 Typical Layout for Panel Mounting

(2) When installed near A Heat Source:

Keep the temperature around Servopack below 60°C. (Fig. 4.2)

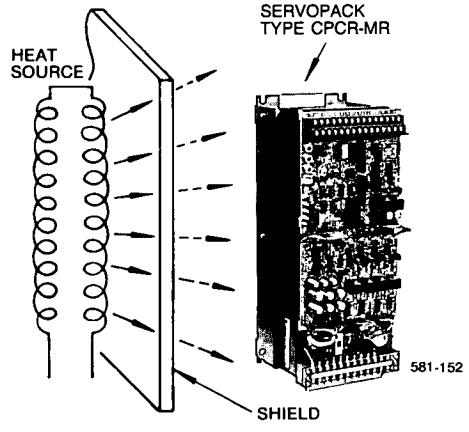


Fig. 4.2 Protection against Heat Radiation

(3) If subjected to Vibration:

Mount the unit on shock absorbing material.

(4) If Corrosive Gases Prevailing:

Avoid the location where corrosive gases exist as it may cause extensive damage with long use, especially:

- Poor commutation of the motor commutator
- Defective switching operation of contactors and relays.

(5) Where Unfavourable Atmospheric Conditions considered:

Select a location with minimum exposure to oil, water, hot air, high humidity, excessive dust or metallic particles.

4.1.2 Mounting

(1) Direction

Mount the unit vertically on the wall using the mounting holes (4) on the base plate, with main terminals at the bottom. (Fig. 4.3)

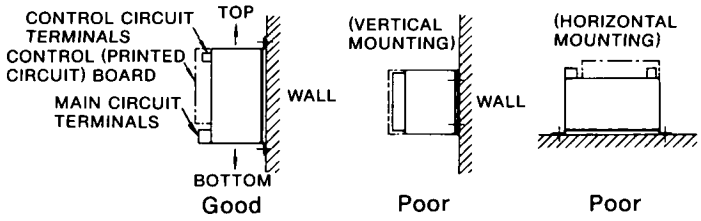


Fig. 4.3 Mounting Direction of SERVOPACK

(2) Effect on Peripheral Equipment

Air contained in the upper side of Servopack will be heated due to the heat dissipation of the heat sink in Servopack. Other equipment and cable ducts having low heat-resistance should be located at least 150 mm from the upper part of Servopack.

4.2 WIRING

4.2.1 Selection of Cable Size

Cable size should be determined according to the rated currents of each Servopack type shown in Table 4.1. Table 4.2 shows recommended cable sizes for the use at ambient temperature of 40°C, with 3 cables harnessed in a bundle, and at the rated current of Servopack, shown in Table 4.1. Table 4.3 shows recommended cable types.

Table 4.1 (a) Rated Current of SERVOPACK Types CPCR-MR01C to -MR07C

Circuit Terminals		Servopack Type CPCR- / Terminal Symbol	Rated Current A				AC/DC
			MR 01 C MR 01 CJ	MR 02 C MR 02 CJ	MR 05 C	MR 07 C	
Main Circuit	AC Power Supply	(u1) (v1)	9	10.5	12	19	AC
	Motor Main Circuit and Thermal Overload Relay	Ⓐ Ⓑ	6	7	8	13	DC
	Optional	Ⓟ Ⓝ	6	8	8	8	
	Control Circuit Power Supply	(u2) (v2)	0.2				AC
	Blown Fuse Detecting Circuit	(C3) (C4)	220 VAC, 1 A*				—
Control Circuit	Speed Reference Input	① ②	0 to ± 6 V, 0 to 0.3 mA; 0 to ± 7 V (± 30 V), 0 to 1 mA (4 mA)				DC
	Tachometer-generator Circuit	③ ④					
	Overtravel Circuit	⑤ ⑥ ⑦	+ 8 V, 3 mA				
	Proportional Drive	⑧ ⑪					
	Aux. Speed Reference Input	⑨ ②	± 2 to ± 10 V, 0 to ± 0.5 mA				
	Output of ± 12 V	⑩ ⑪ ⑫	± 12 V, 30 mA max.				
	External Current-limit Circuit	⑬ ⑭	0 to ± 6 V, 2 mA				
	External Base-off	⑲ ⑪	+ 8 V, 3 mA				
Power Transformer Primary Side		At 200 V	1.5	2.5	5	7.5	AC
		At 100 V	3	5	10	15	

*Allowable operational current.

Table 4.1 (b) Rated Current of SERVOPACK Types CPCR-MR08C to -MR99C

Circuit Terminals		Terminal Symbol / SERVOPACK Type CPCR-	Rated Current (A)							AC/DC
			MR 08 C MR 08 CW	MR 15 C MR 15 CW	MR 22 C MR 22 CW	MR 55 C MR 55 CW		MR 75 C	MR 99 C	
Main Circuit	AC Power Supply	Ⓡ Ⓢ Ⓣ	5	9	12	20 at 3.7kW	26 at 5.5kW	26 at 6 kW 35 at 9.9kW	50 at 9.9 kW	AC
	Control Circuit Power Supply	ⓡ ⓣ	0.3							
	DC Reactor and Thermal Overload Relay	Ⓛ Ⓐ*	7	13	18	30		40	50	DC
	Motor Main Circuit	Ⓐ Ⓑ								
	Regenerative Resistor†	(Y3) (Y4)	6		16	32			48	
	Thermal Switch	(Y1) (Y2)	—			0.5				AC
Control Circuit	Speed Reference Input	① ②	0 to ± 6 V, 0 to ± 0.3 mA							DC
	Tachometer Generator Circuit	③ ④	0 to ± 7 V (± 21 V), 0 to ± 1 mA (± 3 mA)							
	Aux. Speed Reference Input	⑨ ②	0 to ± 2 V (± 10 V), 0 to ± 0.1 mA (± 0.5 mA)							
	Overtravel Circuit at Forward Running	⑤ ⑥	+ 12 V, + 5 mA							
	Overtravel Circuit at Reverse Running	⑤ ⑦								
	Proportional Drive	⑧ ⑪	+ 12 V, ± 10 mA							
	Output of ± 12 V	⑩ ⑪ ⑫	12 V, ± 30 mA							
	External Current-limit Circuit at Reverse Running	⑬ ⑪	0 to + 6 V, 0 to + 2 mA							
	External Current-limit Circuit at Forward Running	⑭ ⑪	0 to − 6 V, 0 to − 2 mA							
	Current Monitoring Circuit	⑮ ⑪	0 to ± 1.2 V, 0 to ± 0.05 mA							
	Servo Trouble Detecting Circuit	⑯ ⑰ ⑱	100 VAC or 200 VAC, 1 A‡ 24 VDC, 1 A‡							—
	External Base-off	⑲ ⑪	+ 8 V, + 3 mA							DC
	Optional	⑳ ㉑	—							
	Grounding	(E1) (E2)	—							

*Terminals L_1 and L_2 are used for types CPCR-MR75C, -MR99C.

†Junction terminals in *Servopack* and not used for external wiring.

‡Allowable operational current.

4.2.1 Selection of Cable Size (Cont'd)

Table 4.2 (a) Recommended Cable Size of SERVOPACK Types CPCR-MR01C to -MR07C

Circuit Terminal		SERVOPACK Type / Terminal Symbol	Cable Size mm²			
			MR 01 C MR 01 CJ	MR 02 C MR 02 CJ	MR 05 C	MR 07 C
Main Circuit	AC Power Supply	(u1) (v1)	2.0 or more*			3.5 or more*
	Motor Main Circuit and Thermal Overload Relay	Ⓐ Ⓑ				
	Optional	Ⓟ Ⓝ	1.25 or more			
	Control Circuit Power Supply	(u2) (v2)				
	Blown Fuse Detecting Circuit	(C3) (C4)				
Control Circuit	Speed Reference Input	① ②	Two-core twisted shielded cable type RG-108A/U made by Fujikura Ltd., or equivalent.			
	Tachometer-generator Circuit	③ ④				
	Overtravel Circuit	⑤ ⑥ ⑦	1.25 or more			
	Proportional Drive	⑧ ⑪				
	Aux. Speed Reference Input	⑨ ②	Two-core twisted shielded cable type RG-108A/U			
	Output of ± 12 V	⑩ ⑪ ⑫	1.25 or more			
	External Current-limit Circuit	⑬ ⑭	Twisted Cable 0.3 or more			
	External Base-off	⑲ ⑪				
Power Transformer Primary Side		—	2.0 or more*			

*Heat-resistant cable

Notes:
1. For the main circuit, use cables of 600 V or more.
2. Where cables are bundled or put in a duct (unplasticized polyvinyl chloride conduit or metallic conduit), determine the cable size considering the current drop rate of the cables.
3. Where the ambient temperature (in the panel) is high (40 to 60°C), use heat-resistant cables.

Table 4.2 (b) Recommended Cable Size of SERVOPACK Types CPCR-MR08C to -MR99C

Circuit Terminals		SERVOPACK Type CPCR- / Terminal Symbol	Cable Size mm²					
			MR 08 C MR 08 CW	MR 15 C MR 15 CW	MR 22 C MR 22 CW	MR 55 C MR 55 CW	MR 75 C	MR 99 C
Main Circuit	AC Power Supply	Ⓡ Ⓢ Ⓣ	2.0 or more*	2.0 or more*	3.5 or more*	5.5 or more*	8.0 or more*	14.0 or more*
	Control Circuit Power Supply	ⓡ ⓣ	1.25 or over					
	DC Reactor and Thermal Overload Relay	Ⓛ Ⓐ	2.0 or more*	2.0 or more*	3.5 or more*	5.5 or more*	8.0 or more*	14.0 or more*
	Motor Main Circuit	Ⓐ Ⓑ						
	Regenerative Resistor	(Y3) (Y4)	—					5.5*
	Thermal Switch	(Y1) (Y2)	—					
Control Circuit	Speed Reference Input	① ②	Two-core twisted shielded cable type RG-108A/U made by Fujikura Ltd., or equivalent.					
	Tachometer-Generator Circuit	③ ④						
	Aux. Speed Reference Input	⑨ ②						
	Overtravel Circuit at Forward Running	⑤ ⑥						
	Overtravel Circuit at Reverse Running	⑤ ⑦						
	Proportional Drive	⑧ ⑪	1.25 or more					
	Output of ± 12 V	⑩ ⑪ ⑫						
	External Current-limit Circuit at Reverse Running	⑬ ⑪	Twisted cable 0.3 or more					
	External Current-limit Circuit at Forward Running	⑭ ⑪						
	Current Monitoring Circuit	⑮ ⑪						
	Servo Trouble Detecting Circuit	⑯ ⑰ ⑱	1.25 or more					
	External Base-off	⑲ ⑪	Twisted cable 0.3 or more					
	Optional	⑳ ㉑	—					
	Grounding	(E1) (E2)	2.0 or more					

*Heat-resistant cable

Notes:
1. For the main circuit, use cables of 600 V or more.
2. Where cables are bundled or put in a duct (unplasticized polyvinyl chloride conduit or metallic conduit), determine the cable size considering the current drop rate of the cables.
3. Where the ambient or panel inside temperature is high (40 to 60°C), use heat-resistant cables.

Table 4.3 Recommended Cable Type

Conductor Max Allowable Temperature °C	Cable Type	
75	Heat-resistant vinyl	HIV SHIV
80	Ebic (made by Sumitomo Electric Industries, Ltd.)	IP LP
90	Polyethylene heat-resistant	H-CV

4.2.2 Precautions for Wiring

Servopack is a divice for speed control of 1000:1, and thus its wiring needs great precaution. The signal level must process 6 mV or less and therefore the following precautions are necessary:

(1) Run the power line and signal line in separate ducts; do not run them in the same duct or in a bundle.

(2) The signal line and TG feedback line must use two-core twisted shielded cable [Type RG 108A/U made by Fujikura Ltd.] or coaxial cable. Do not bundle them with the power line or contain in the same duct.

(3) When the same power as for an electric welder or electrical discharge machine is used for Servopack, or when a high-frequency noise source is present in the neighborhood, use filters in the power and input circuits.

(4) Type CPCR-MR□C uses a switching amplifier, and noise may remain in the signal line.

Ground SG 0 V (terminal ②). Ground resistance should be 100Ω or below.

When noise cannot be avoided due to the necessity of wiring route and length, use a filter in the input circuit.

(5) Remedy for Radio Frequency Interference (R.F.I)

Servopack is not provided with a protection from radio frequency interference. If the controller is troubled by radio wave, connect a noise filter to power supply. See Par. 3.5.1.

(6) Replacing Previous Type CPCR-MR□H with Type CPCR-MR08C to -MR75C

The resistor unit (type JUSP-R00□) is not used because type CPCR-MR□C incorporates the regenerative resistor, when replacing type CPCR-MR□H with type CPCR-MR□C.

4.3 POWER LOSS

The power loss of Servopack and peripheral devices is shown in Table 4.4.

Table 4.4 Power Loss of SERVOPACK and Optional Components

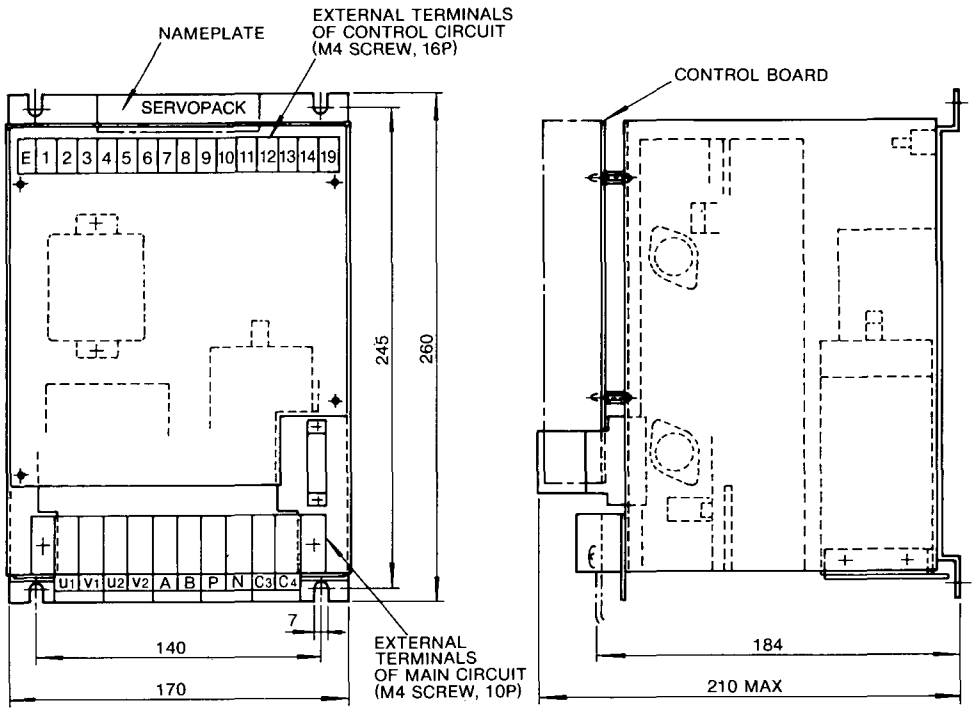
SERVOPACK				Optional Components		Total Power Loss
Type CPCR-	Output Current A	Power Loss W	Regenerative Resistor* W	Power Transformer W	DC Reactor W	W
MR01C	6	60	—	26	—	86
MR02C	7	60		33		93
MR05C	8	80		50		130
MR07C	13	130		66		196
MR08C	7	75	30	—	35	140
MR15C	13	110	30		45	185
MR22C	18	180	60		60	300
MR55C	25	250	180		110	540
	28	280				570
	30	310				600
MR75C	40	400	180		140	720
MR99C	55	750	250		200	1200

*The loss of regenerative resistor occurs when the motor stops. The loss can be ignored when the start and stop are not frequent.

5. DIMENSIONS in mm

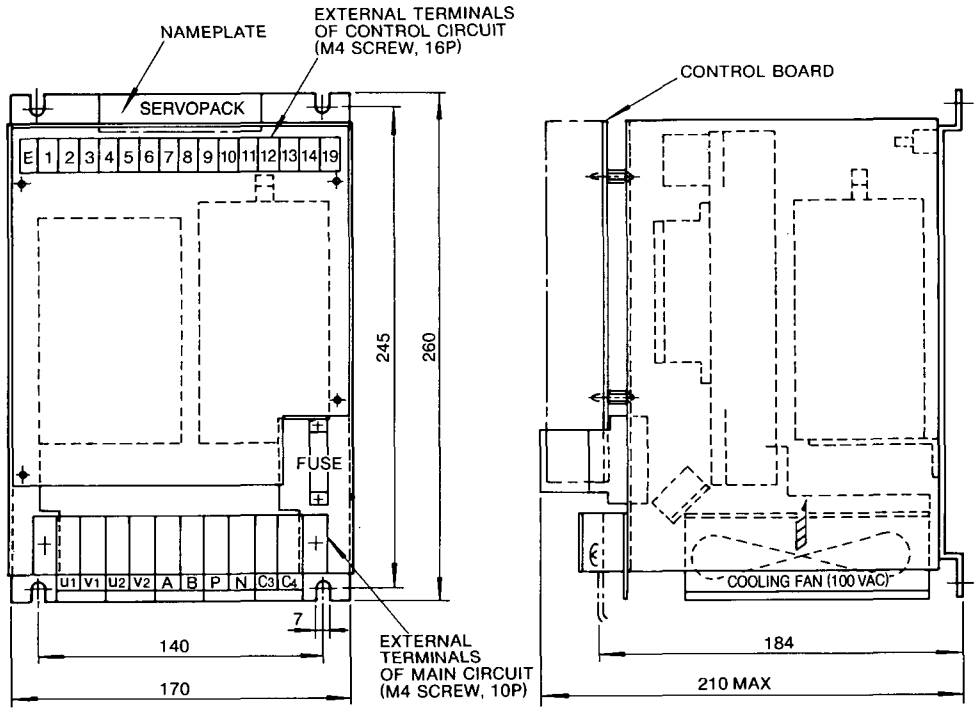
5.1 SERVOPACK

(1) Types CPCR-MR01C to -MR05C



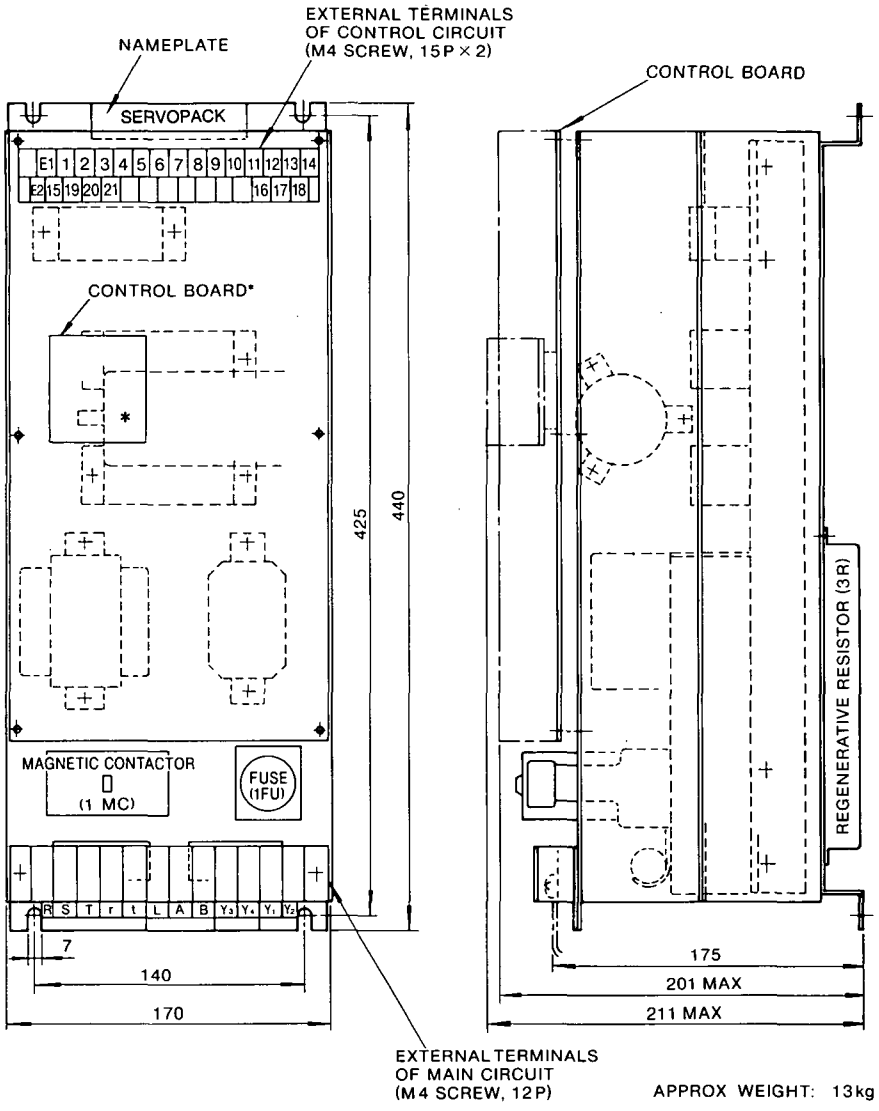
APPROX WEIGHT: 6.3kg

(2) Type CPCR-MR07C



APPROX WEIGHT: 7.8 kg

(3) Types CPCR-MR08C, -MR15C

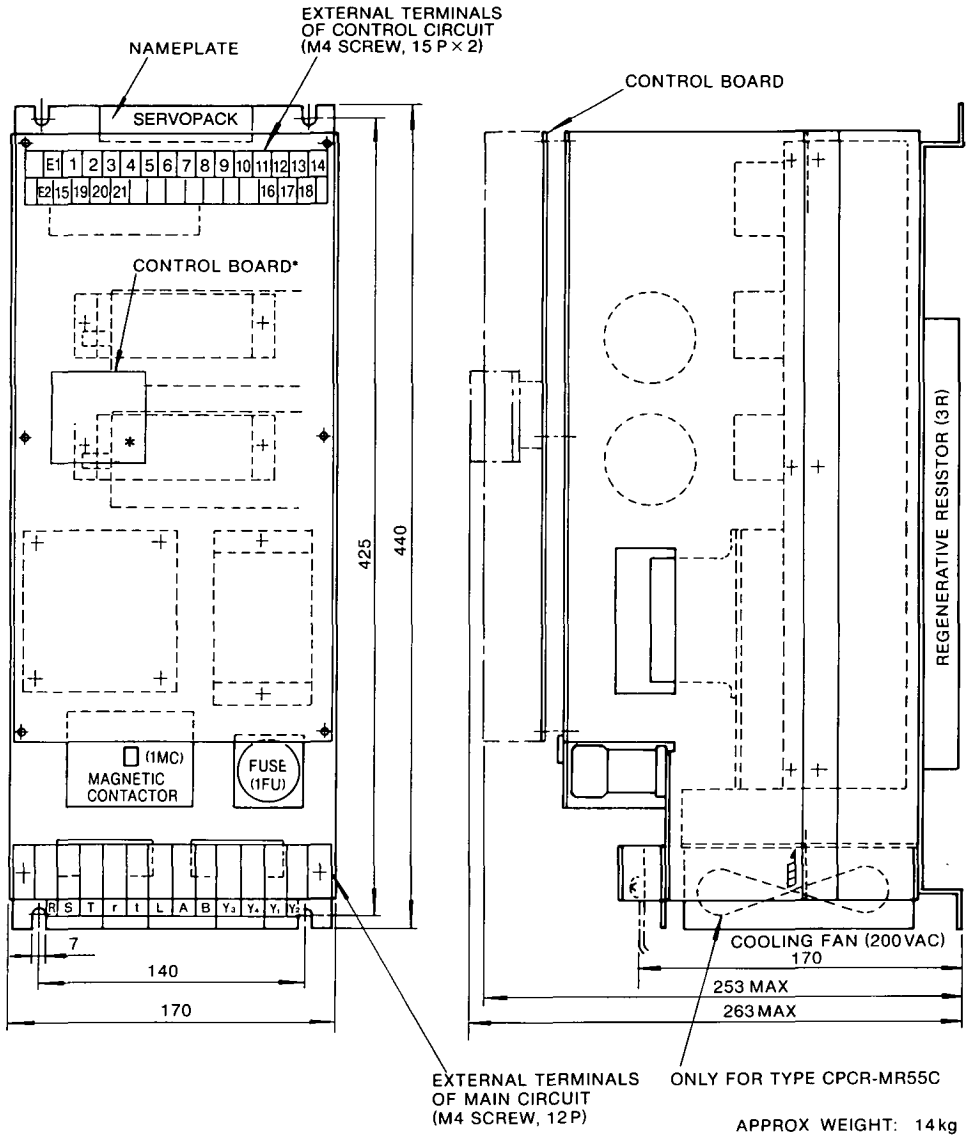


*Furnished for types CPCR-MR08CL and -MR15CL.

Note: Parallel installation requires space more than 30 mm.

5. 1 SERVOPACK (Cont'd)

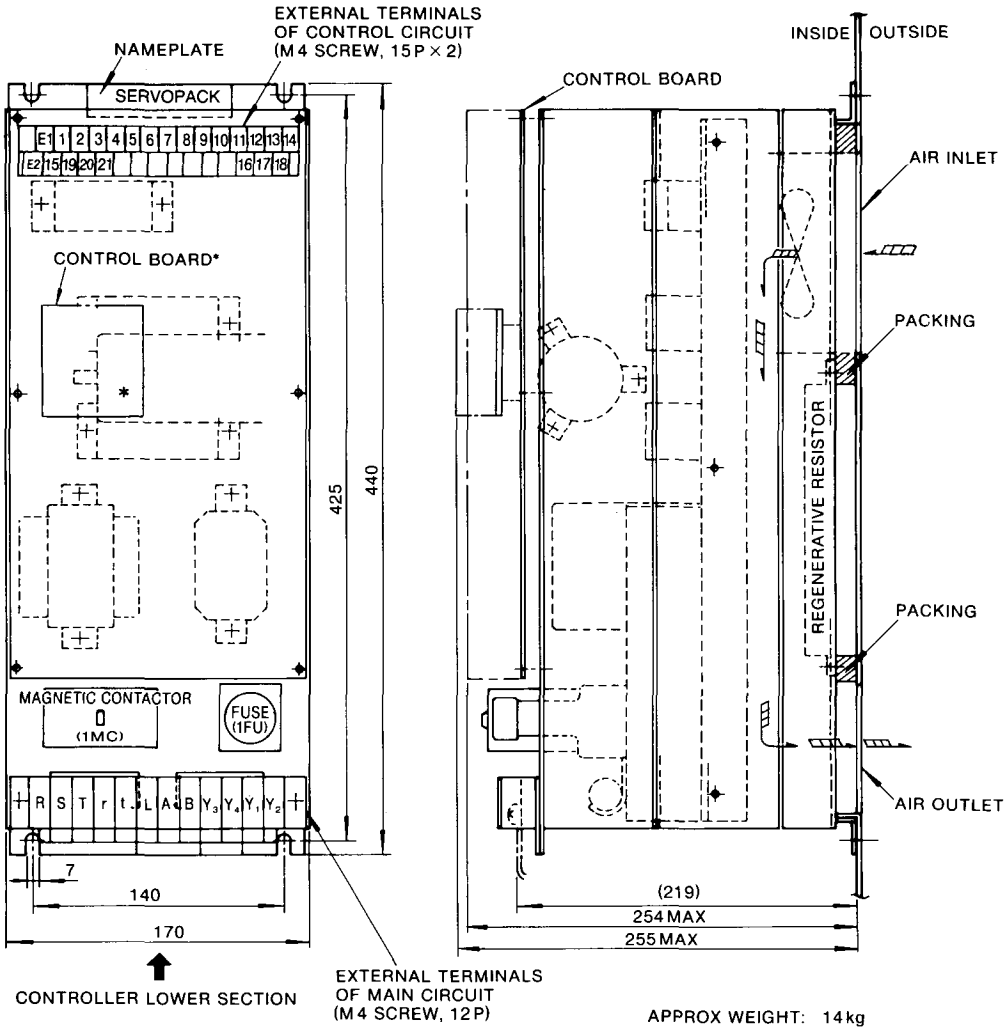
(4) Types CPCR-MR22C, -MR55C

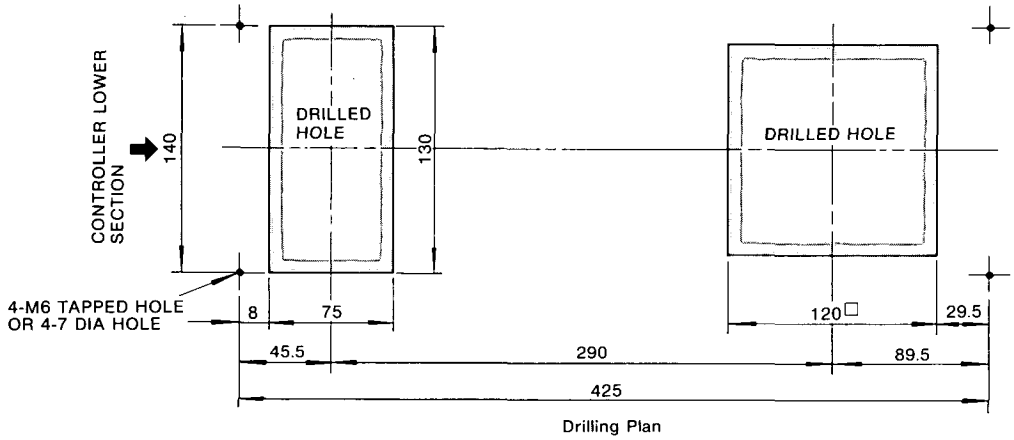


*Furnished for types CPCR-MR22CL and MR55CL.

Note: Parallel installation requires space more than 30 mm.

(5) Types CPCR-MR08CW, -MR15CW





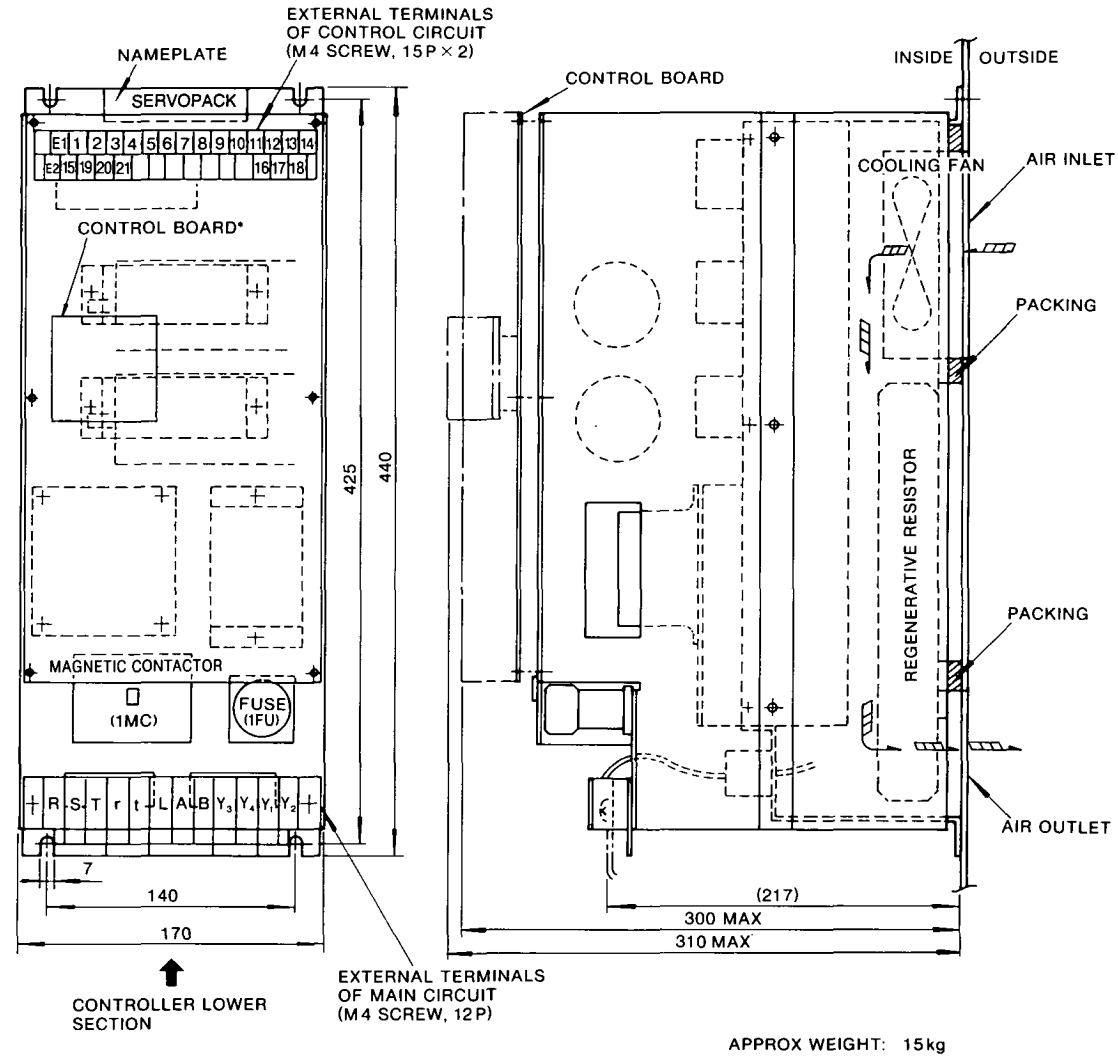
Drilling Plan

*Furnished for types CPCR-MR08CWL and -MR15CWL.

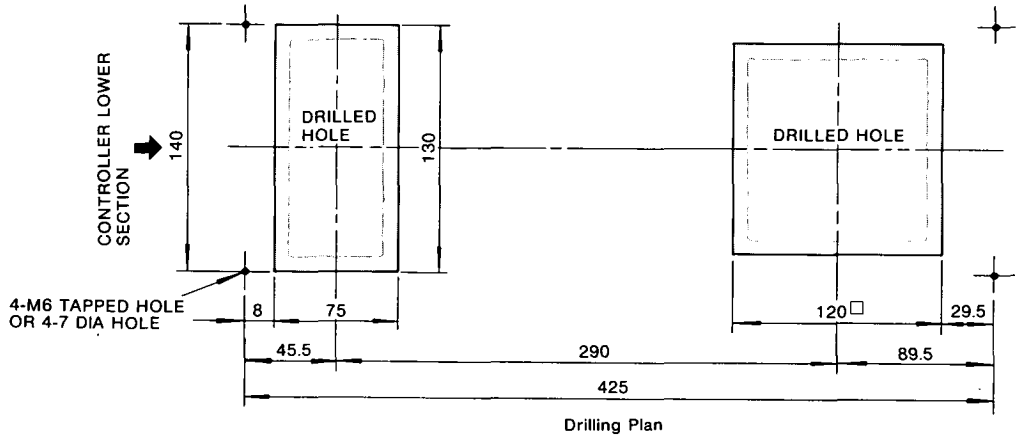
Note: Parallel installation requires space more than 30 mm.

5.1 SERVOPACK (Cont'd)

(6) Types CPCR-MR22CW, -MR55CW



APPROX WEIGHT: 15kg

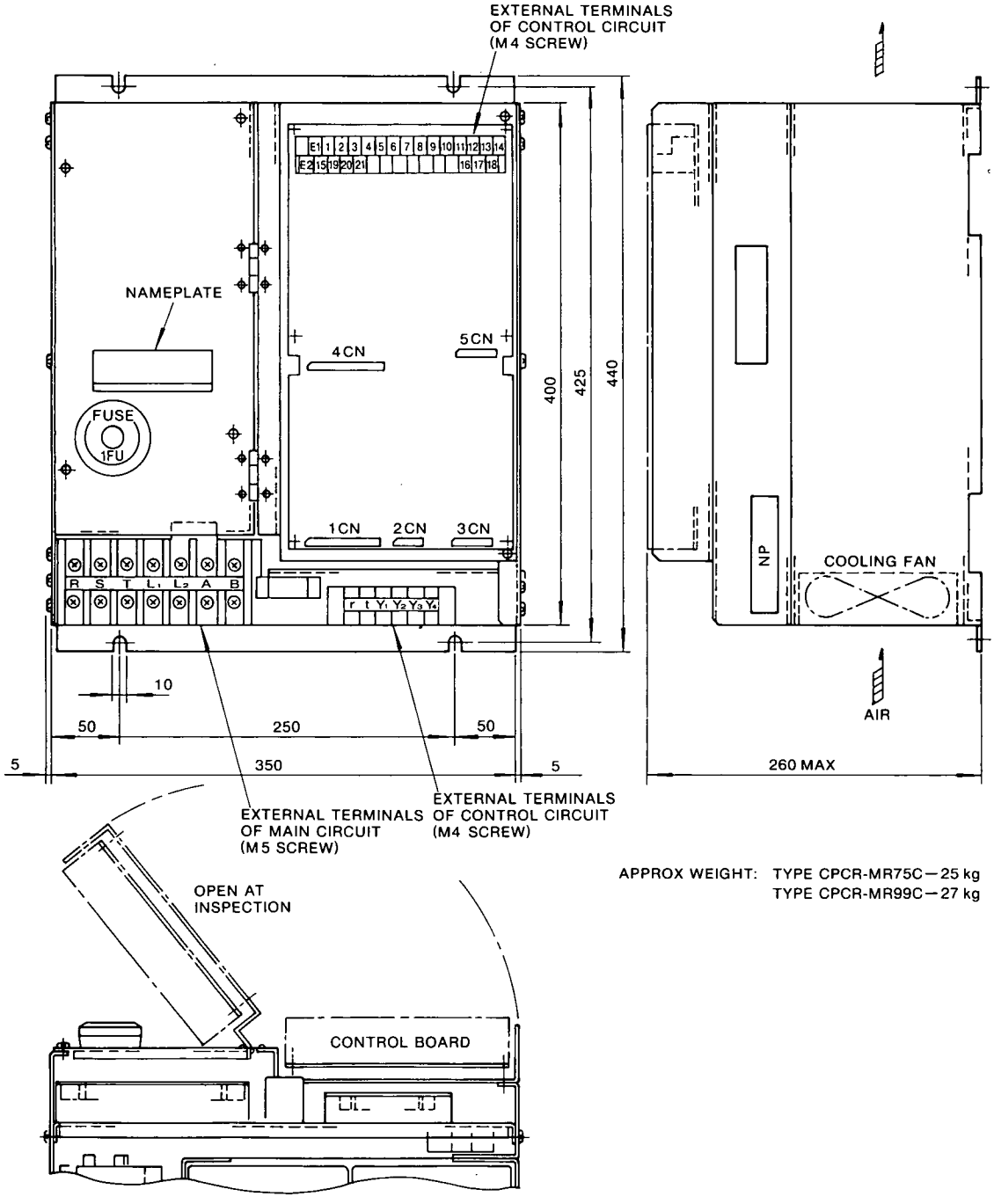


Drilling Plan

*Furnished for types CPCR-MR22CWL and -MR55CWL.

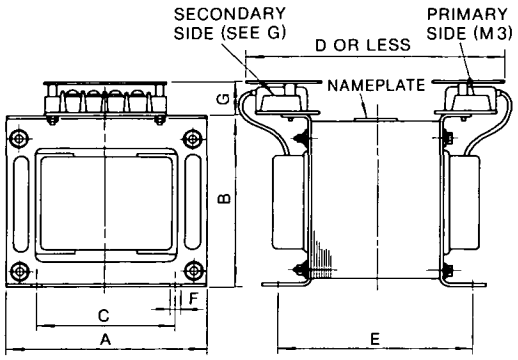
Note: Parallel installation requires space more than 30 mm.

(7) Type CPCR-MR75C, -MR99C



APPROX WEIGHT: TYPE CPCR-MR75C—25 kg
TYPE CPCR-MR99C—27 kg

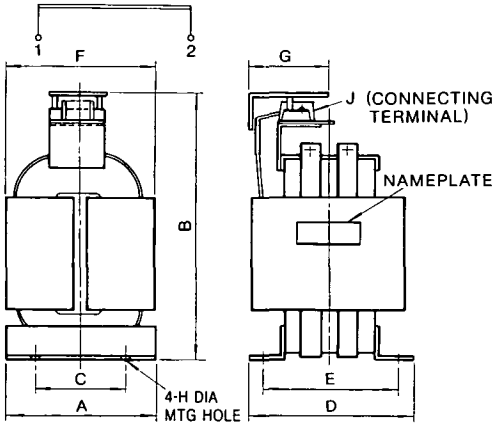
5. 2 POWER TRANSFORMER



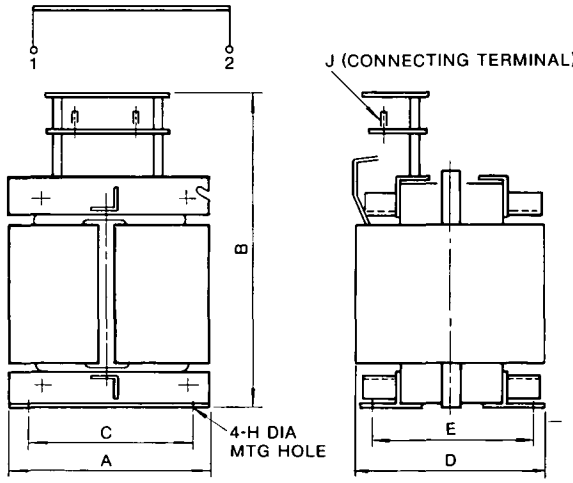
Type	Capacity VA	A±2	B±2	C±1	D	E_{-3}^{0}	F	G	Approx Weight kg
CPT8585	300	130	117	90	140	95	7	30 (M3)	6.2
CPT8624	500	130	117	90	165	120	7	30 (M3)	9.5
CPT8660	1k	150	160	104	170	125	7	30 (M3)	16
CPT8665	1.5k	185	173	125	215	175	10	30 (M3)	27
CPT8589	300	130	117	90	140	95	7	30 (M3)	6.2
CPT8630	500	130	117	90	165	120	7	30 (M3)	9.5

5. 3 DC REACTOR

• Types X3055 to X3058

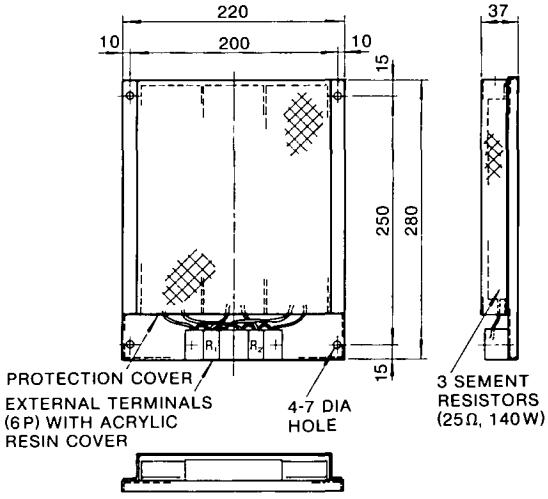


• Types X3066 and X3067

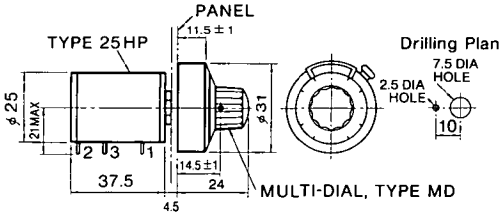


Type	Specification	A	B	C	D	E	F	G	H	J	Approx Weight kg
X3055	10 mH 8 A	73	175	50	101	89	90	50	6	M 4	4
X3056	10 mH 13 A	73	180	50	111	99	90	55	6	M 4	5
X3057	10 mH 18 A	110	185	70	141	124	130	55	6	M 4	8.5
X3058	10 mH 28 A	150	240	80	160	135	(150)	100	7	6 dia bolt	14
X3066	10 mH 40 A	240	355	190	220	170	—	—	10	M 8	37
X3067	10 mH 55 H	250	400	200	230	180	—	—	10	M 8	47

5. 4 RESISTOR UNIT TYPE JUSP-RA03

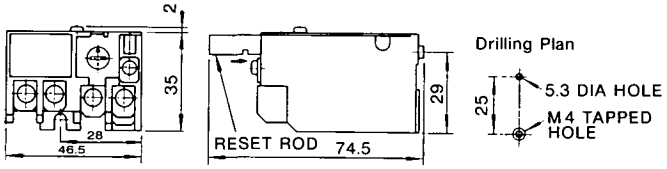


5. 5 SPEED ADJUSTING POTENTIOMETER



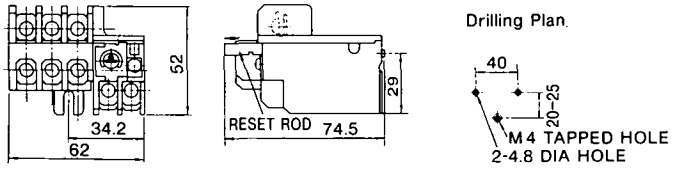
5.6 THERMAL OVERLOAD RELAY

(1) Type RHR-15



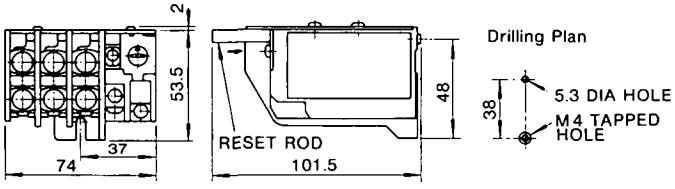
APPROX WEIGHT: 0.1kg

(2) Type RH-18□PV



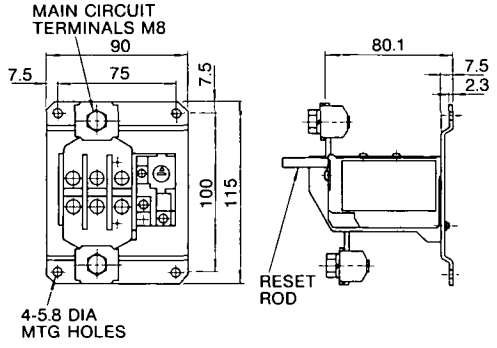
APPROX WEIGHT: 0.125kg

(3) Type RH-35□HV

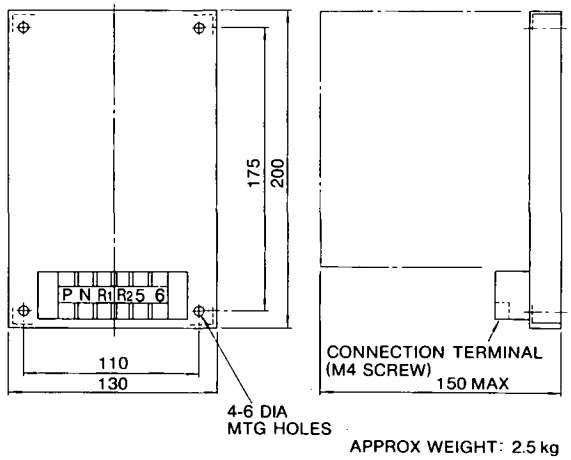


APPROX WEIGHT: 0.24kg

(4) Type RH-35/□HVW

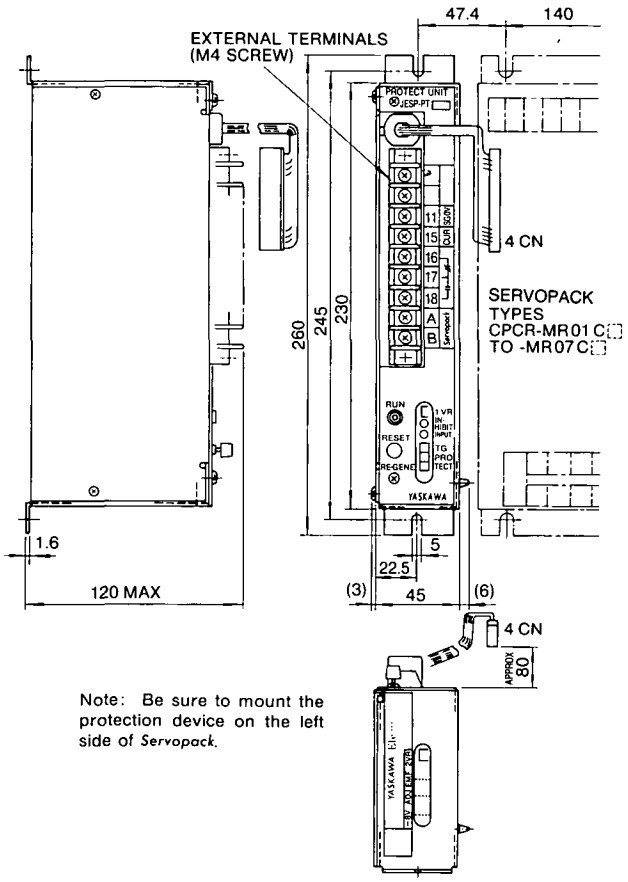


5.7 REGENERATIVE UNIT (TYPES JUSP-RG001 TO -RG003)



APPROX WEIGHT: 2.5 kg

5.8 PROTECTION DEVICE TYPE JESP-PT



Note: Be sure to mount the protection device on the left side of *Servopack*.

6. ORDER

Servopack types CPCR-MR□C has a spare fuse as the standard accessary. If the fuse is blown off, it should be replaced by one of the same specification. Table 4.5 shows the types and capacities of alarm fuses used for type CPCR-MR□C.

To order Servopack and optional components, the type must be specified. When ordering, pay attention to the following:

Table 6.1 Types and Capacities of Alarm Fuses

SERVOPACK Type CPCR-		MR01C	MR01CJ	MR02C	MR02CJ	MR05C	MR07C
Alarm Fuse	Type	PL-475	PL-450	PL-475	PL-475	PL-4100	PL-4150
	Capacity	7.5 A	5 A	7.5 A	7.5 A	10 A	15 A

SERVOPACK Type CPCR-		MR08C (W)	MR15C (W)	MR22C (W)	MR55C (W)	MR75C	MR99C
Alarm Fuse	Type	C-10	C-15	C-20	C-30	C-40	C-60
	Capacity	10 A	15 A	20 A	30 A	40 A	60 A

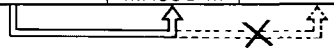
6. ORDER (Cont'd)

(1) Servopack

Table 6.2 shows combination of DC servomotors and Servopacks.

Table 6.2 Combination of DC Servomotors and SERVOPACK

DC Servomotor Type with TG (7 V/1000 rpm)	SERVOPACK Type		
	Standard	Order I *	Order II *
UGPMEN-08	CPCR-MR01C	—	—
PMES-09 (10-pole)			
UGPMEN-09			
UGJMED-10M	CPCR-MR01CJ	—	—
PMES-12 (10-pole)	CPCR-MR02C	—	—
UGPMEN-12			
UGMMEM-06		MR02C-M	
UGJMED-40M	CPCR-MR02CJ	—	—
UGJMED-40L			
PMES-16 (10-pole)	CPCR-MR05C	—	—
UGPMEN-16			
UGCMED-04AA		MR05C-C	
UGCMEM-04			
UGHMED-03GG		MR05C-H	
UGMMEM-13		MR05C-M	
UGMMEM-25	CPCR-MR07C	—	—
UGCMED-08AA	CPCR-MR08C	—	MR08CW-□ MR08CL-□ MR08CWL-□
UGCMEM-08GC			
UGHMED-06AA		MR08C-H	
UGHMEM-06AA			
UGHMED-06GG			
UGJMED-60MA		MR08C-J	
UGCMED-15AA	CPCR-MR15C	—	MR15CW-□ MR15CL-□ MR15CWL-□
UGCMEM-15GC			
PMES-20		MR15C-P	
UGHMED-12AA		MR15C-H	
UGHMEM-12AA			
UGHMED-12GG			
UGJMED-60L		MR15C-J	
UGJMED-80M			
UGMMEM-50AA		MR15C-M	
UGCMED-22AA	CPCR-MR22C	—	MR22CW-□ MR22CL-□ MR22CWL-□
UGCMEM-22GC			
UGHMED-20AA		MR22C-H	
UGHMEM-20AA			
UGHMED-20GG			
UGJMED-80L		MR22C-J	
UGCMED-37AA	CPCR-MR55C	—	MR55CW-□ MR55CL-□ MR55CWL-□
UGCMEM-37FB			
UGCMED-55AA			
UGHMED-30AA		MR55C-H	
UGHMEM-30AA			
UGHMED-30GG			
UGHMED-44AA			
UGJMED-80K		MR55C-J	
UGMMEM-1AA		MR55C-M	
UGCMFD-75AA	CPCR-MR75C	—	MR75CL-□
UGHMFD-60AA		MR75C-H	
GEELM-K	CPCR-MR99C	—	MR99CL-□
UGMMKR-2AA		MR99C-M	



• Adjustment only. • Not adjustment only.

* The price and delivery time of ordered products are different from those of the standard stock products. Contact your Yaskawa representative for information when ordering.

Note: Adjusting method is described in the separate instructions (TOE-C717-12.1 and TOE-C717-12.2).

Adjustment
- Speed setting (HM, JM, MM)
- Loop gain (MM)
- Drive characteristic
- EMF (HM, JM, MM)

(2) Power Transformer

- Power transformer type: CPT□□□□
- Order power transformer separately.

(3) DC Reactor

- DC reactor type: X□□□□
- Order DC reactor separately.

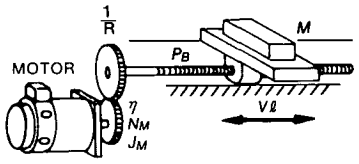
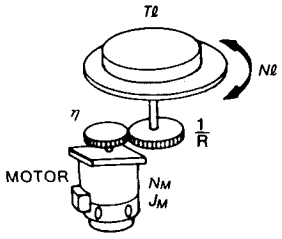
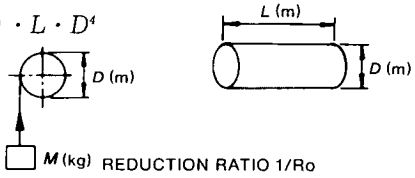
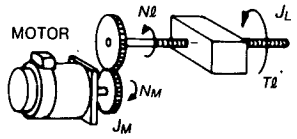
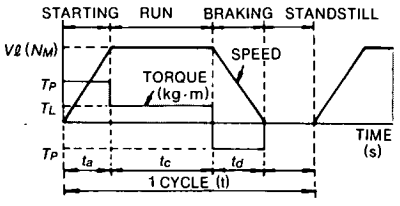
(4) Thermal Overload Relay

Type RHP for the Print motor standard series and types RH-18 and RH-35/□T for Minertia motor J series does not come attached to the motor. They should be ordered separately. Other thermal overload relays come attached to the motor.

7. SELECTION GUIDE

7.1 DYNAMICS FORMULA FOR ELECTRIC FORCE

The drive system calculation is possible by knowing the efficiency of the inlet (motor), the outlet (load), and intermediate (reduction gear), etc.

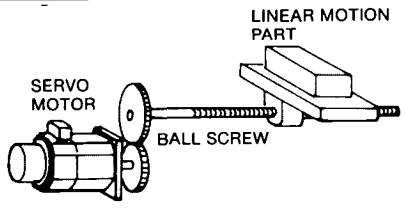
Item		Linear Motion	Rotating Motion
Basic Dynamics Formula	Reference Figure		
	Load Running Power	$P_O = \frac{2\pi \cdot N_M \cdot T_L}{60}$	$P_O = \frac{2\pi \cdot N_M \cdot T_L}{60}$
	Load Accelerating Power	$P_a = \left[\frac{2\pi}{60} \cdot N_M\right]^2 \times \frac{J_L}{ta}$	$P_a = \left[\frac{2\pi}{60} \cdot N_M\right]^2 \times \frac{J_L}{ta}$
	Load Torque	$T_L = \frac{9.8 \times \mu \cdot M \cdot P_B}{2\pi \cdot R \cdot \eta}$	$T_L = \frac{T_\ell}{R \cdot \eta}$
	Load Inertia	$J_L = M \cdot \left[\frac{P_B}{2\pi \cdot R}\right]^2$	$J_L = \frac{1}{R^2} \times J_k$
	Starting Time	$ta = \frac{2\pi \times N_M\ (J_M + J_L)}{60\ (T_P - T_L)}$	$ta = \frac{2\pi \times N_M\ (J_M + J_L)}{60\ (T_P - T_L)}$
	Braking Time	$td = \frac{2\pi \times N_M \cdot (J_M + J_L)}{60\ (T_P + T_L)}$	$td = \frac{2\pi \times N_M \cdot (J_M + J_L)}{60\ (T_P + T_L)}$
Optimum Reduction Ratio	Solid Cylinder Inertia	$J_K = \frac{1}{8} \times M_K \cdot D^2$ or $J_K = \frac{\pi}{32} \cdot \rho \cdot L \cdot D^4$ M_K : Weight of solid cylinder (kg) ρ : Density (kg/m³) J_K : $= M \cdot D^2$	
	Linear Motion Body Equivalent Inertia		
	Optimum Reduction Ratio	$R_O = \sqrt{\frac{\frac{J_L + N_t}{94 \cdot ta} + T_t}{\frac{J_M \cdot N_t}{94 \cdot ta}}}$	
Torque RMS Value	Torque RMS Value	$Trms = \sqrt{\frac{T_P^2 \cdot ta + T_L^2 \cdot tc + T_P^2 \cdot td}{t}}$	

P_O : Running Power (W)
P_a : Accel Power (W)
N_t : Driven Motor Speed (r/min)
N_M : Motor Speed (r/min)
V_t : Load Speed (m/min=100cm/min)
η : Speed Reducer Efficiency

μ : Friction Coefficient
M : Weight of Linear Motion Part (kg)
J_t : Load Inertia (kg·m²)
J_L : Load Inertia (kg·m²)
J_M : Motor Inertia (kg·m²)
T_t : Load Torque

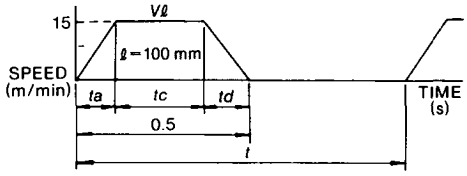
T_L : Load Torque (N·m)
T_P : Average Motor Start Torque (N·m)
$Trms$: Effective Average Torque (N·m)
ta : Starting Time (s)
tc : Running Time (s)
td : Braking Time (s)
P_B : Ball Screw Lead (m)

7. 2 SERVOMOTOR SELECTION GUIDE



- Load speed : $V\ell = 15$ m/min
- Weight of linear motion part : $M = 100$ kg
- Length of ball screw : $L_B = 1.0$ m
- Diameter of ball screw : $D_B = 0.02$ m
- Ball screw lead : $P_B = 0.01$ m
- Reduction ratio : 1/R = 1/2
- Speed reducer inertia : $J_G = 1\times10^{-4}$ kg·m²
- Number of feed : $n = 60$ cycles/min
- Feed length : $\ell = 0.1$ m
- Feed time : $t_m = 0.5$ s or below
- Friction Coefficient : $\mu = 0.2$
- Machine efficiency : $\eta = 0.8$ (including speed reducer)

(1) Speed Diagram



$$t = \frac{60}{n} = \frac{60}{60} = 1.0 \text{ (s)}$$

Assumes $t_a = t_d$

$$t_a = t_m - \frac{60\ell}{V_\ell} = 0.5 - \frac{60\times0.1}{15} = 0.1 \text{ (s)}$$

$$t_c = 0.5 - 0.1\times2 = 0.3 \text{ (s)}$$

(2) Rotating Speed

Load shaft speed $N_\ell = \frac{V_\ell}{P_B} = \frac{15}{0.01} = 1500$ (r/min)

Motor shaft speed $N_M = N_\ell \cdot R = 1500\times2 = 3000$ (r/min)

(3) Load Torque

$$T_L = \frac{9.8\,\mu\cdot M\cdot P_B}{2\pi R\cdot\eta} = \frac{9.8\times0.2\times100\times0.01}{2\pi\times2\times0.8} = 0.195 \text{ (N·m)}$$

(4) Load Inertia

Linear motion part $J_{LI} = M\left(\frac{P_B}{2\pi R}\right)^2 = 100\times\left(\frac{0.01}{2\pi\times2}\right)^2$

$= 0.633\times10^{-4}$ (kg·m²)

Ball screw $J_B = \frac{\pi}{32}\rho\cdot L_B\cdot D_B^4\cdot\left(\frac{1}{R}\right)^2$

$= \frac{\pi}{32}\times7.87\times10^3\times1.0\times(0.02)^4\times\left(\frac{1}{2}\right)^2$

$= 0.309\times10^{-4}$ (kg·m²)

Speed reducer $J_G = 1.0\times10^{-4}$ (kg·m²)

Load inertia (motor shaft conversion)

$J_L = J_{LI} + J_B + J_G = 1.942\times10^{-4}$ (kg·m²)

(5) Load Running Power

$$P_O = \frac{2\pi N_M\cdot T_L}{60} = \frac{2\pi\times3000\times0.195}{60} = 61.3 \text{ (W)}$$

(6) Load Acceleration Power

$$P_a = \left(\frac{2\pi}{60}N_M\right)^2\times\frac{J_L}{t_a} = \left(\frac{2\pi}{60}\times3000\right)^2\times\frac{1.942\times10^{-4}}{0.1}$$

$= 191.7$ (W)

(7) Temporary Servomotor Selection

〈Selectoin condition〉

- $T_L \leqq$ Motor rated torque *
- $P_a + P_o =$ (1 to 2) × Motor rated output *

  * Value when combining Servomotor with Servopack
- $N_M \leqq$ Motor rated speed
- $J_L \leqq$ Allowable load inertia of Servopack

From the conditions, select temporarily Servomotor and Servopack.

- Servomotor : Minertia motor standard series, 185 W, Type UGMME-06AA10F
- Servopack : For speed control, Type CPCR-MR02C-M

〈Combination Characteristics of Servomotor and Servopack〉

Rated output :	165 (W)
Rated speed :	3000 (r/min)
Rated torque :	0.559 (N·m)
Instantaneous max. torque :	1.96 (N·m)
Motor inertia :	0.567×10^{-4} (kg·m²)
Servopack allowable load inertia :	2.85×10^{-4} (kg·m²)

(8) Check of Temporary Selected Servomotor

① Required starting torque

$$T_P = \frac{2\pi N_M (J_M + J_L)}{60\, t_a} - T_L = \frac{2\pi \times 3000 \times (0.567 + 1.942) \times 10^{-4}}{60 \times 0.1}$$

$+0.195 = 0.983$ (N·m) < Instantaneous max. torque ····· Usable

② Required braking torque

$$T_P = \frac{2\pi N_M (J_M + J_L)}{60\, t_d} - T_L = \frac{2\pi \times 3000 \times (0.567 + 1.942) \times 10^{-4}}{60 \times 0.1}$$

$-0.195 = 0.593$ (N·m) < Instantaneous max. torque ····· Usable

③ Torque effective value

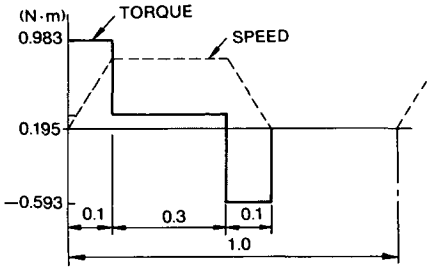
$$Trms = \sqrt{\frac{T_P^2 \cdot t_a + T_L^2 \cdot t_C + T_S^2 \cdot t_d}{t}}$$

$$= \sqrt{\frac{(0.983)^2 \times 0.1 + (0.195)^2 \times 0.3 + (0.593)^2 \times 0.1}{1}}$$

$= 0.378$ (N·m) < Rated torque ····· Usable

(9) Selection Results

From the above conditions, temporary selected Servomotor and Servopack are usable. The torque diagram becomes as shown below.



SERVOPACK

DC SERVOMTOR CONTROLLER

FOR SPEED CONTROL
TYPE CPCR-MR01C TO -MR99C

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