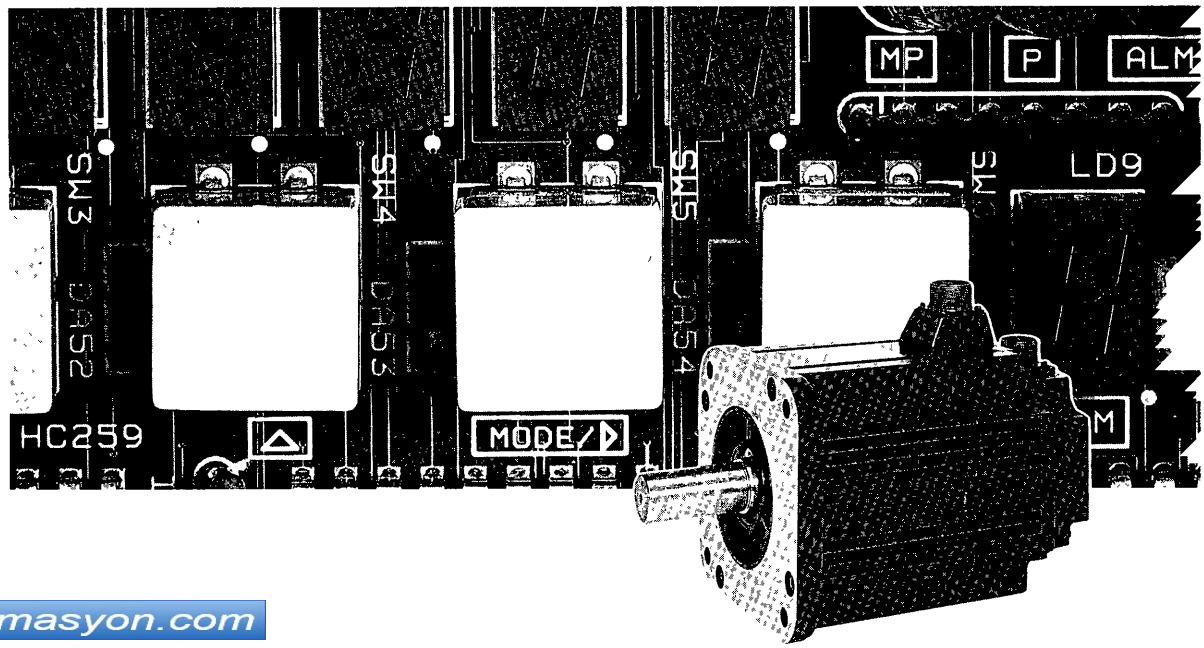
AC SERVO DRIVES HR SERIES
DESCRIPTIVE MANUAL

FOR MULTI-FUNCTIONS/POSITIONING CONTROL

SERVOMOTOR M,F,G SERIES
SERVOPACK CACR-HR□□UB (BASE-MOUNTED TYPE)



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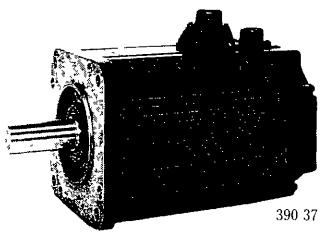
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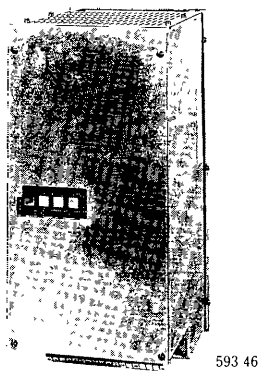
Yaskawa AC Servos have been developed for the most advanced FA and FMS. The extensive servo manufacturing technology accumulated through half a century of servo drive applications has created this series.

AC Servopack CACR-HR is a general-purpose multi-function position controller which applies YASKAWA's long-term positioning control technologies to software.

In addition to realization of high-accuracy and quick response control even under adverse conditions, easy and flexible operation is available with excellent maintainability due to various display functions and protective functions.



AC SERVOMOTOR



SERVOPACK
(Base-mounted Type)

CAUTION

Never conduct voltage resistance or megger tester.

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1 OUTLINE

Servopack type CACR-HR □□□ UB is single axis position controller and servo amplifier for AC servomotor.

Input method of positioning data (speed, position) can be selected from Table 1.1 by setting parameters. Each input method has four operation modes described in Table 1.2. All servo constants are set by parameters. Therefore, adjustment can be performed properly without dispersion.

This manual describes functions and use of Servopack type CACR-HR□□□UB and to realize its full performance. Read this manual to customize the use of this drive and improve performance for the machines.

Table 1.1 Input Method

Input Method	Description
Serial Communication Input	Positioning data are input by serial commands. Commands can be sent to 16 Servopacks with one master controller by connecting with multi-drop method.
Station No. Input	Indexing positioning is performed. Numbers provided to indexing points (station numbers) are input as position data. Speed data are selected from four types of speed set in the Servopack by parameters, by speed selection signals. Both "one-way rotation" and "short-cut rotation" are possible. • Range of station numbers Binary coded decimal (BCD): 0 to 999 Binary: 0 to 4095
Digital Switch(DG-SW) (Thumbwheel Switch) Input	Positioning data are input by contacts from digital switches, relays or sequencers. • Range of positioning data Speed: Up to 6 digits Position: Sign + up to 8 digits Note: According to strobe signal, HR drive reads DG-SW input data in time divisions of 2 digits. Therefore, YASKAWA's exclusive digital switch is recommended. When another digital switch or relay is used, use "contact input unit". When data are directly input from the PLC, it is necessary to set scan time of HR drive (24 to 2000 ms, variable) to match sequencer's scan time.
Command Table Input	Positioning data are selected from the command table set in the Servopack by using the positioning data selection signals. Positioning data are selected in the form of position and speed as a pair : Up to 64 patterns can be selected.

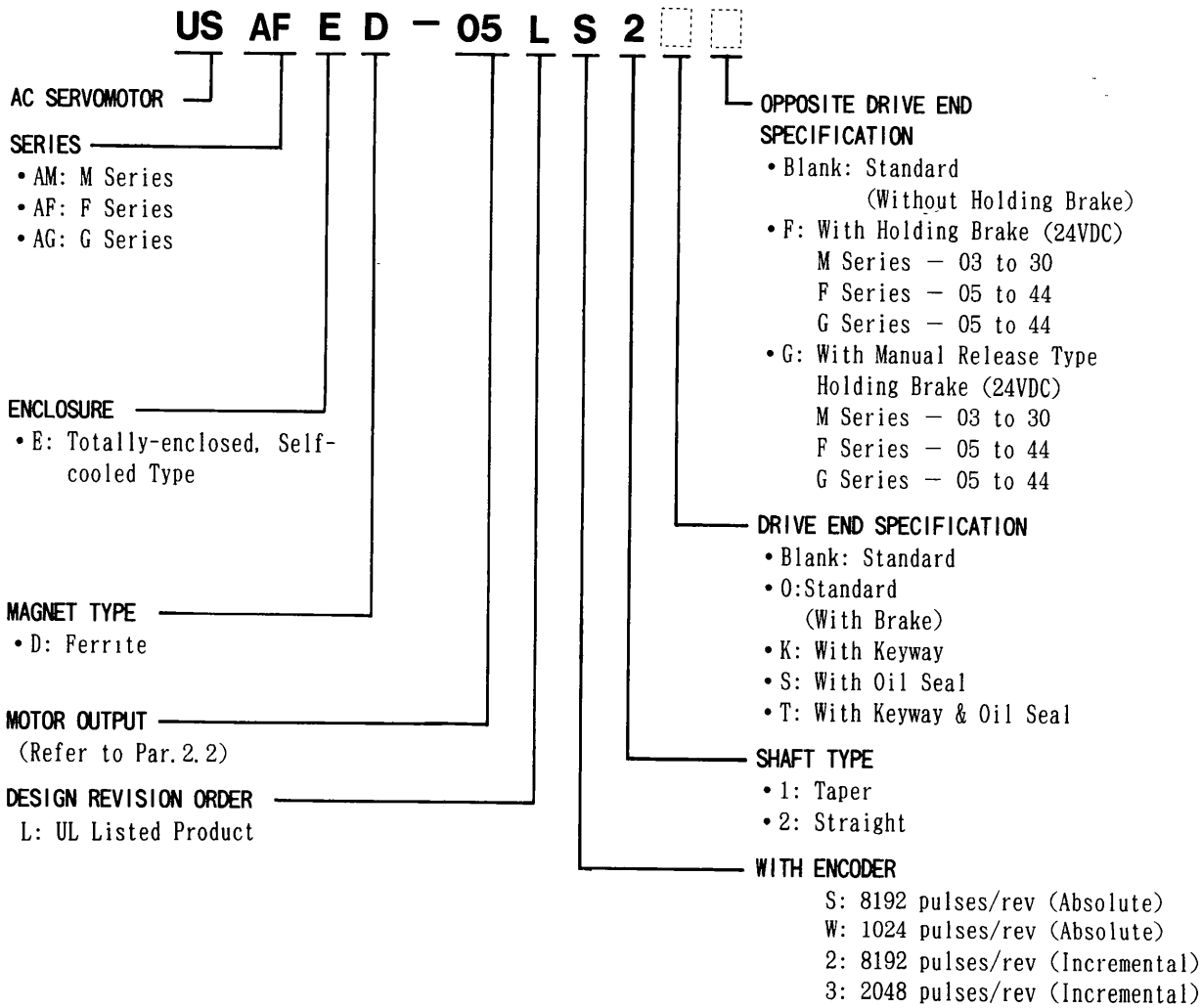
Table 1.2 Operation Modes

Operation Mode	Contents
Automatic Mode	After positioning data are input, positioning is performed based on the data by turning ON start signal.
Manual Mode	While manual operation signal is turned ON, operation is performed at constant speed.
Pulse Mode	Positioning is performed by pulse train command given by an external pulse generator. • Pulse method: Line driver/line receiver method • Pulse form: 90° phase difference 2-phase pulse train (up to 1.6 Mpps) Sign + pulse train (up to 400 kpps) CW + CCW pulse train (up to 400 kpps) • Pulse multiplication: ×1, ×10, ×100
Zero-point Return (Homing) Mode	Used for zero-point return (homing) when incremental encoder is used. Two types of methods can be selected. (1) Decel limit switch and encoder Cϕ-pulse signal are used. (2) Only stop limit switch is used.

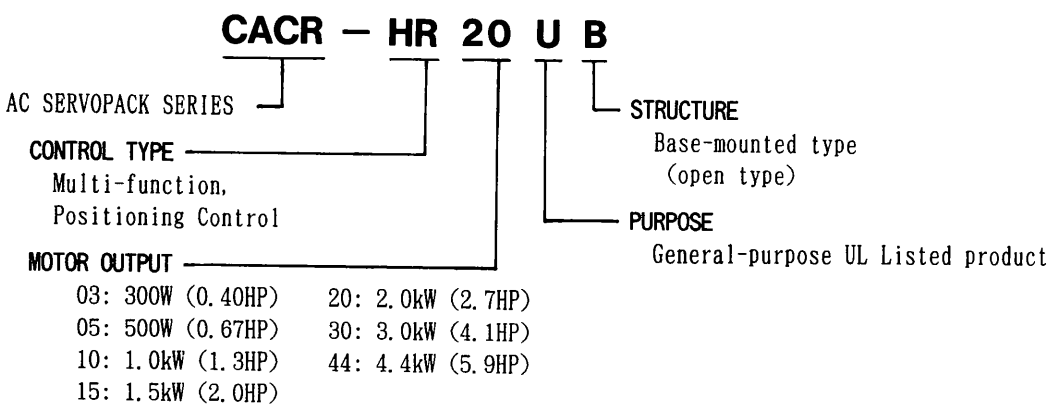
2 TYPE DESIGNATION AND CONFIGURATION

2.1 TYPE DESIGNATION

(1) SERVOMOTOR



(2) SERVOPACK



2.2 COMBINATION OF AC SERVOPACK AND SERVOMOTOR

Table 2.1 Combination of AC SERVOPACK and SERVOMOTOR

Configuration, Main Circuit Voltage			Base-mounted Type, 3-phase 200VA							
Type CACR-HR			03UB	05UB	10UB		15UB	20UB	30UB	44UB
M Series	Type USAMED-		03L □ 1	—	06L □ 1	09L □ 2	12L □ 2	20L □ 2	30L □ 2	44L □ 2
	Applicable Servomotor Output	kW	0 3	—	0 6	0 9	1 2	2 0	3 0	4 4
		HP	0 4		0 8	1 2	1 6	2 7	4 1	5 9
	Speed	r/min	Rating 1000/ Max 2000	—	Rating 1000/Max 2000					Rating 1000/ Max 1500
	Continuous Output Current	Arms	3 0	—	5 8	7 6	11 7	18 8	26 0	33 0
	Max Output Current	Arms	7 3	—	13 9	16 6	28 0	42 0	56 5	70 0
	Allowable Load Inertia $J_L(=GD^2_L/4)$	kg・cm²	67 5	—	121 5	183 5	290	550	715	1200
		lb・in・S²×10⁻³	60		107 5	162 5	256	486	633 5	1063
F Series	Type USAFED-		—	05L □ 1	—	09L □ 1	13L □ 2	20L □ 2	30L □ 2	44L □ 2
	Applicable Servomotor Output	kW	—	0 45	—	0 85	1 3	1 8	2 9	4 4
		HP		0 6		1 1	1 7	2 4	3 9	5 9
	Speed	r/min	—	Rating 1500/ Max 2500	—	Rating 1500/Max 2500				
	Continuous Output Current	Arms	—	3 8	—	6 2	9 7	15 0	20 0	30 0
	Max Output Current	Arms	—	11 0	—	17 0	27 6	42 0	56 5	77 0
	Allowable Load Inertia $J_L(=GD^2_L/4)$	kg・cm²	—	67 5	—	121 5	183 5	290	550	715
		lb・in・S²×10⁻³		60		107 5	162 5	256	486	633 5
G Series	Type USAGED-		—	05L □ 1	—	09L □ 1	13L □ 2	20L □ 2	30L □ 2	44L □ 2
	Applicable Servomotor Output	kW	—	0 45	—	0 85	1 3	1 8	2 9	4 4
		HP		0 6		1 2	1 8	2 4	3 9	5 9
	Speed	r/min	—	Rating 1500/ Max 3000	—	Rating 1500/Max 3000				
	Continuous Output Current	Arms	—	3 8	—	7 6	11 7	19 0	26 0	33 0
	Max Output Current	Arms	—	11 0	—	17 0	28 0	42 0	56 5	70 0
	Allowable Load Inertia $J_L(=GD^2_L/4)$	kg・cm²	—	67 5	—	121 5	183 5	290	550	715
		lb・in・S²×10⁻³		60	—	107 5	162 5	256	486	633 5

Note: Combination of SERVOMOTOR and encoder is as shown below:

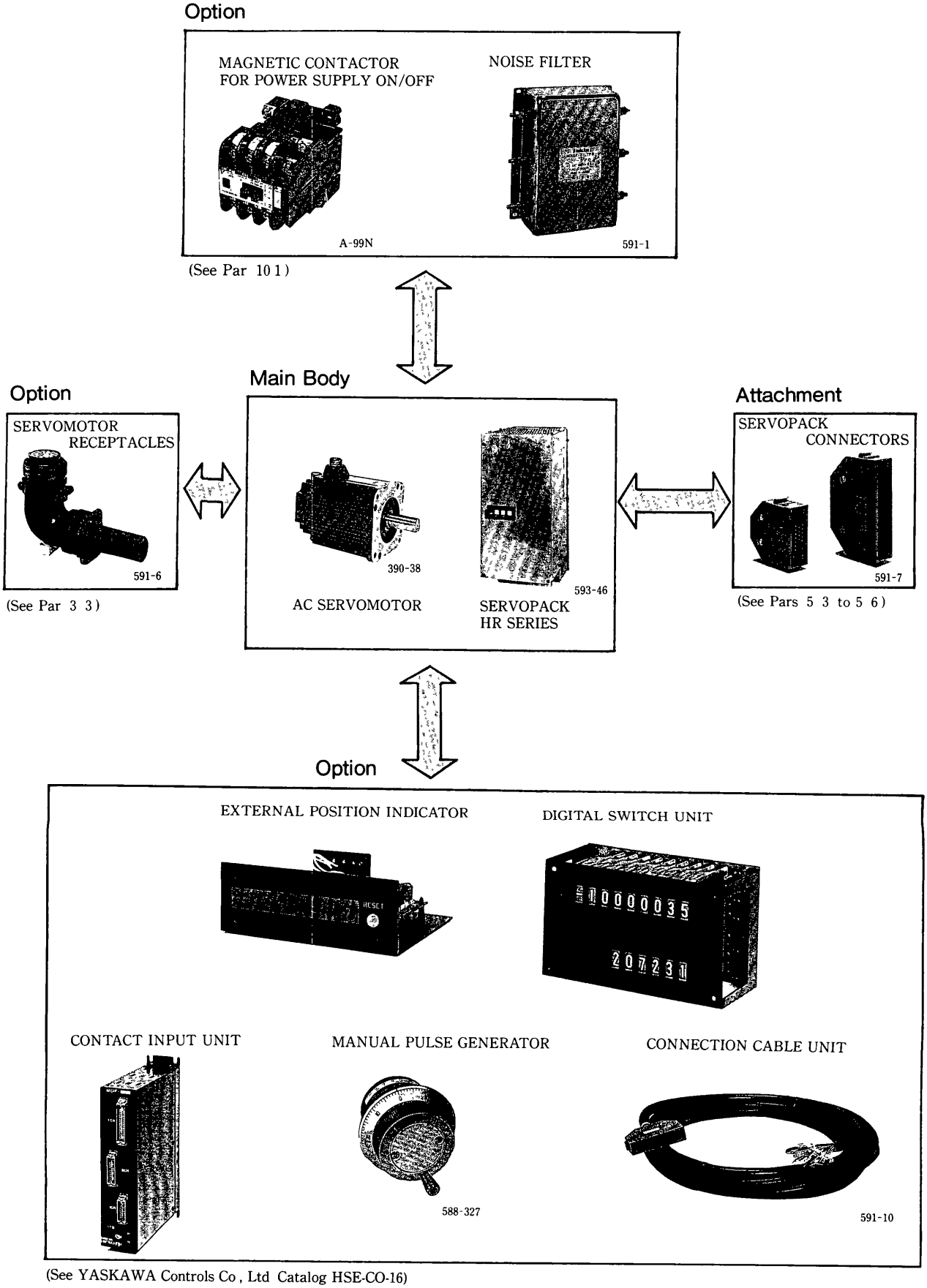
Table 2.2 Combination of Servomotor and Encoder

No. of Pulses / Servomotor	Incremental Encoder		Absolute Encoder	
	2048	8192	1024	8192
M Series	○	◎	○	◎
F Series	○	◎	○	◎
G Series	○	◎	○	◎

◎ Standard

○ Semi-standard

2.3 CONFIGURATION WITH PERIPHERAL DEVICES



3 RATINGS AND SPECIFICATIONS OF AC SERVOMOTOR

3.1 RATINGS AND SPECIFICATIONS

3.1.1 M Series

(1) Ratings

Time Rating: Continuous
Insulation: Class F
Isolation Voltage: 1500 VAC, one minute
Insulation Resistance: 500 VDC, 10MΩ or more
Enclosure: Totally-enclosed, self-cooled; equivalent to IP65 exclusive shaft opening
Ambient Temperature: 0 to + 40℃
Ambient Humidity: 20% to 80% (non-condensing)
Vibration: 15μm or below
Finish in Munsell Notation: N1.5
Excitation: Permanent magnet
Mounting: Flange mounted
Drive Method: Direct drive

(2) Combination with encoder

- Standard
  USAMED -□□□ LS □ : With absolute encoder (8192 pulses/rev)
  USAMED -□□□ L2 □ : With incremental encoder (8192 pulses/rev)
- Semi-Standard
  USAMED -□□□ LW □ : With absolute encoder (1024 pulses/rev)
  USAMED -□□□ L3 □ : With incremental encoder (2048 pulses/rev)

Table 3.1 Ratings and Specifications of M Series AC SERVOMOTORS

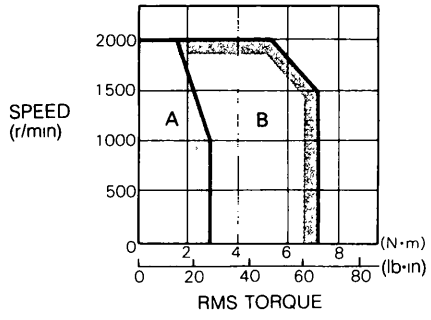
Item \ Motor Type USAMED-		03L	06L	09L	12L	20L	30L	44L
Rated Output*	kW (HP)	0.3 (0 4)	0 6 (0 8)	0 9 (1 2)	1 2 (1 6)	2 0 (2 7)	3 0 (4 0)	4 4 (5 9)
Rated Torque*	N•m (lb•in)	2 84 (25)	5 69 (50)	8.63 (76)	11 5 (102)	19 1 (170)	28 4 (253)	41.9 (373)
Continuous Max Torque*	N•m (lb•in)	2 94 (26)	5 88 (52)	8.82 (78)	11 8 (105)	21 6 (192)	32 3 (287)	46.1 (409)
Instantaneous Peak Torque*	N•m (lb•in)	7 17 (64)	14.1 (125)	19 3 (172)	28 0 (249)	44 0 (391)	63 7 (566)	91 1 (810)
Rated Current*	A	3 0	5 8	7 6	11 7	18 8	26	33
Rated Speed*	r/min	1000						
Instantaneous Max Speed*	r/min	2000						1500
Torque Constant	N • m/A (lb • in/A)	1.01 (9 0)	1 04 (9.2)	1 21 (10 7)	1 02 (9 0)	1 07 (9 5)	1 16 (10.3)	1.33 (11.8)
Moment of Motor Inertia J_M (=$GD_M^2/4$)	$Kg•m^2×10^{-4}$ $(lb•in•S^2×10^{-3})$	13 5 (12 0)	24 3 (21 5)	36 7 (32 5)	58 (51 5)	110 (97 2)	143 (127)	245 (213)
Power Rate*	kW/s	6.0	13 3	20 3	22 7	33 2	57.0	74.0
Inertia Time Constant	ms	12 8	6 3	4 4	6 0	5 2	3.5	3.6
Inductive Time Constant	ms	2-7	5.1	6 5	10 4	12 9	15.3	16 2

* Typical value at armature winding temperature of 20℃, in combination with Servopack

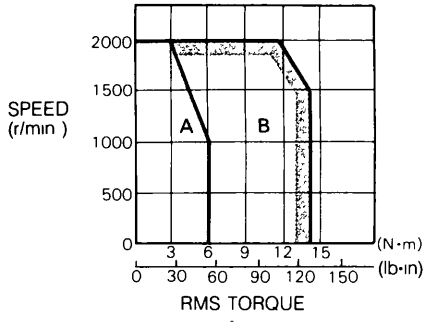
efesotomasyon.com

(3) Torque-Speed Characteristics

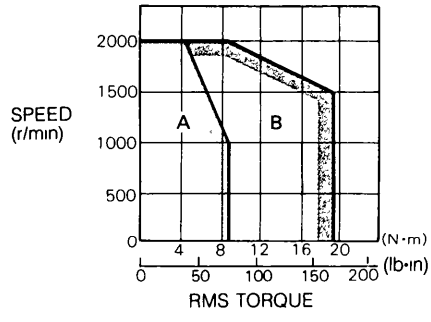
• TYPE USAMED-03L



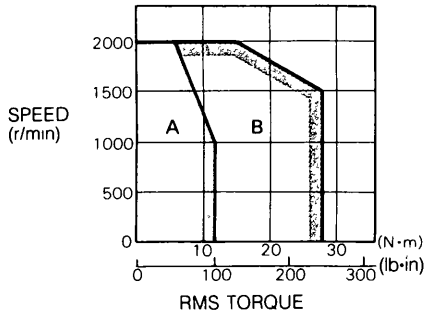
• TYPE USAMED-06L



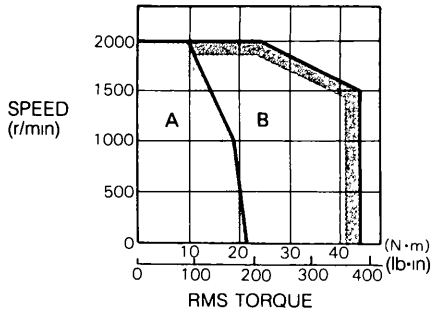
• TYPE USAMED-09L



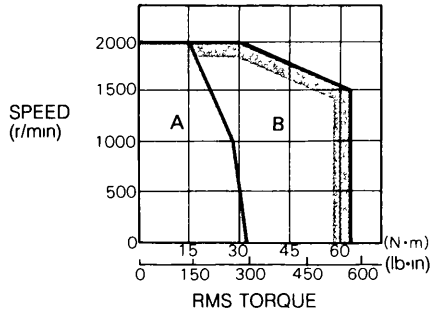
• TYPE USAMED-12L



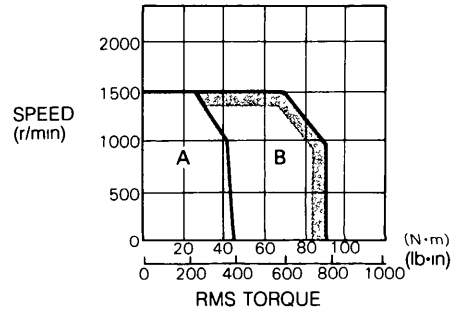
• TYPE USAMED-20L



• TYPE USAMED-30L



• TYPE USAMED-44L



A CONTINUOUS DUTY ZONE
B INTERMITTENT DUTY ZONE
POWER SUPPLY 200 V
Typical at 20℃ (Armature Winding Temp)

3.1.2 F Series

(1) Ratings

Time Rating: Continuous
Insulation: Class F
Isolation Voltage: 1500 VAC, one minute
Insulation Resistance: 500 VDC, 10MΩ or more
Enclosure: Totally-enclosed, self-cooled
Equivalent to IP-65 exclusive shaft opening
Ambient Temperature: 0 to + 40℃
Ambient Humidity: 20% to 80% (non-condensing)
Vibration: 15μm or below
Finish in Munsell Notation: N1.5
Excitation: Permanent magnet
Mounting: Flange mounted
Drive Method: Direct drive

(2) Combination with encoder

- Standard
  USAFED- □□□ LS □ : With absolute encoder (8192 pulses/rev)
  USAFED- □□□ L2 □ : With incremental encoder (8192 pulses/rev)
- Semi-Standard
  USAFED- □□□ LW □ : With absolute encoder (1024 pulses/rev)
  USAFED- □□□ L3 □ : With incremental encoder (2048 pulses/rev)

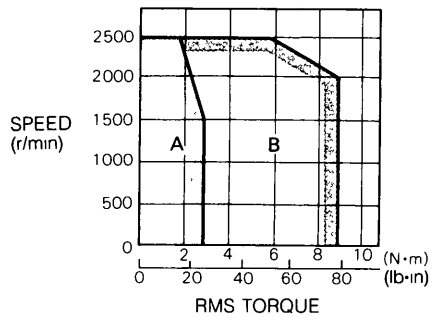
Table 3.2 Ratings and Specifications of F Series AC SERVOMOTORS

Item \ Motor Type USAFED-		05L	09L	13L	20L	30L	44L
Rated Output*	kW (HP)	0.45 (0 6)	0 85 (1.1)	1.3 (1.7)	1.8 (2.4)	2.9 (3.9)	4.4 (5.9)
Rated Torque*	N•m (lb•in)	2.84 (25)	5.39 (48)	8.34 (74.0)	11.5 (102)	18.6 (165)	28.4 (253)
Continuous Max. Torque*	N•m (lb•in)	2.94 (26)	5.88 (52)	8.83 (78)	11 8 (102)	22.6 (200)	37 3 (330)
Instantaneous Peak Torque*	N•m (lb•in)	8.92 (79)	15.2 (135)	24 7 (219)	34.0 (302)	54.1 (479)	76.2 (675)
Rated Current*	A	3.8	6.2	9.7	15	20	30
Rated Speed*	r/min	1500					
Instantaneous Max. Speed*	r/min	2500					
Torque Constant	N • m/A (lb • in/A)	0.8 (7.1)	0.92 (8.2)	0.92 (8.2)	0.82 (7.3)	0.98 (8.7)	1 02 (9.06)
Moment of Motor Inertia J_M (=$GD^2/4$)	$Kg•m^2×10^{-4}$ ($lb•in•S^2×10^{-3}$)	13 5 (12.0)	24.3 (21.6)	36.7 (32.6)	58 (51.5)	110 (97.7)	143 (127)
Power Rate*	kW/s	6.0	12	18.9	22 7	31.5	57
Inertia Time Constant	ms	10.9	6.0	4.4	5.9	5 2	3.7
Inductive Time Constant	ms	3 2	5.2	6.1	10.4	13	15 2

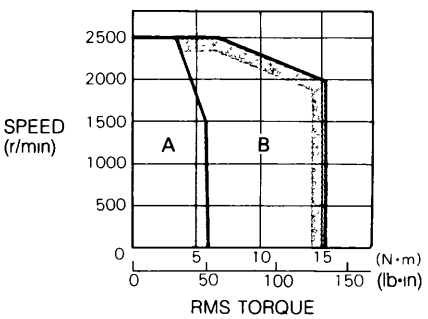
* Typical value at armature winding temperature of 20℃, in combination with Servopack.

(3) Torque-Speed Characteristics

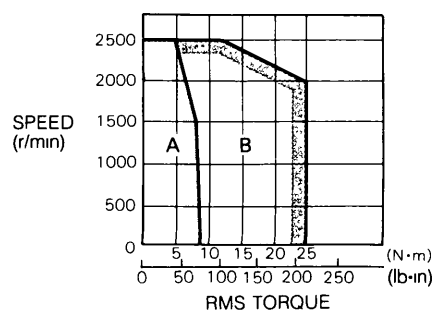
• TYPE USAFED-05L



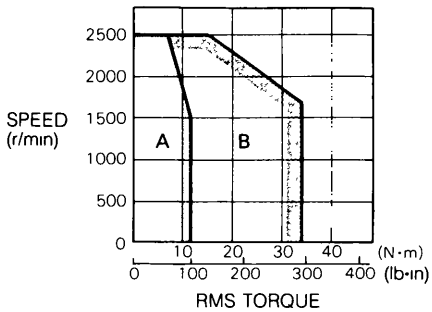
• TYPE USAFED-09L



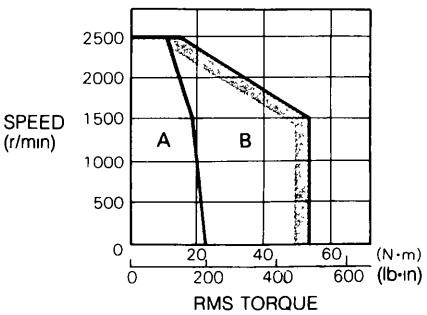
• TYPE USAFED-13L



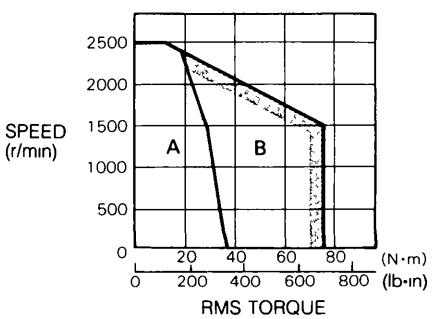
• TYPE USAFED-20L



• TYPE USAFED-30L



• TYPE USAFED-44L



A CONTINUOUS DUTY ZONE
B INTERMITTENT DUTY ZONE
POWER SUPPLY 200 V
Typical at 20℃ (Armature Winding Temp)

3.1.3 G Series

(1) Ratings

Time Rating: Continuous
Insulation: Class F
Isolation Voltage: 1500 VAC, one minute
Insulation Resistance: 500 VDC, 10MΩ or more
Enclosure: Totally-enclosed, self-cooled
Equivalent to IP-65 exclusive shaft opening
Ambient Temperature: 0 to + 40℃
Ambient Humidity: 20% to 80% (non-condensing)
Vibration: 15μm or below
Finish in Munsell Notation: N1.5
Excitation: Permanent magnet
Mounting: Flange mounted
Drive Method: Direct drive

(2) Combination with encoder

- Standard
  USAGED- □□□ LS □ : With absolute encoder (8192 pulses/rev)
  USAGED- □□□ L2 □ : With incremental encoder (8192 pulses/rev)
- Semi-Standard
  USAGED- □□□ LW □ : With absolute encoder (1024 pulses/rev)
  USAGED- □□□ L3 □ : With incremental encoder (2048 pulses/rev)

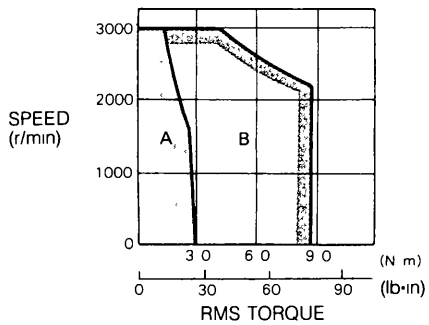
Table 3.3 Ratings and Specifications of G Series AC SERVOMOTORS

Item \ Motor Type USAGED-		05L	09L	13L	20L	30L	44L
Rated Output*	kW (HP)	0.45 (0 6)	0 85 (1 1)	1.3 (1.7)	1.8 (2.4)	2 9 (3 9)	4 4 (5 9)
Rated Torque*	N•m (lb•in)	2 84 (25)	5.39 (48)	8.34 (74.0)	11 5 (102)	18.6 (165)	28 4 (253)
Continuous Max. Torque*	N•m (lb•in)	2 94 (26)	5 88 (52)	8 83 (78)	11.8 (102)	22 6 (200)	37 3 (330)
Instantaneous Peak Torque*	N•m (lb•in)	8.92 (79)	13 3 (118)	23.3 (207)	28.0 (249)	45.1 (401)	66.2 (589)
Rated Current*	A	3.8	7.6	11.7	19.0	26 0	33.0
Rated Speed*	r/min	1500					
Max. Speed*	r/min	3000					
Torque Constant	N•m/A (lb•in/A)	0.80 (7 1)	0 80 (7.1)	0.83 (7.4)	0 67 (5 9)	0 80 (7 1)	0.95 (8 4)
Moment of Inertia $J_M(=GD_M^2/4)$	kg•m²×10⁻⁴ (lb•in•s²×10⁻³)	13.5 (12 0)	24.3 (21 6)	36.7 (32.6)	58 (51 5)	110 (97.7)	143 (127)
Power Rate*	kW/s	6.0	12.0	18.9	22.7	36 5	57 0
Inertia Time Constant	ms	10.9	6.1	4.3	5 8	5.2	3 4
Inductive Time Constant	ms	3.2	5.2	6.7	10.6	13.2	15 9

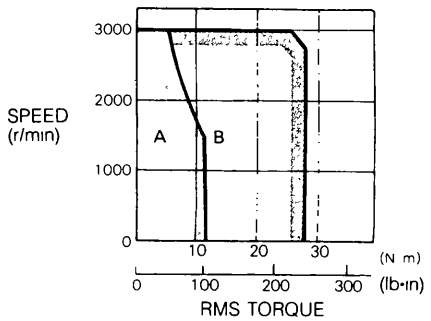
* Typical value at armature winding temperature of 20℃. in combination with Servopack.

(3) Torque-Speed Characteristics

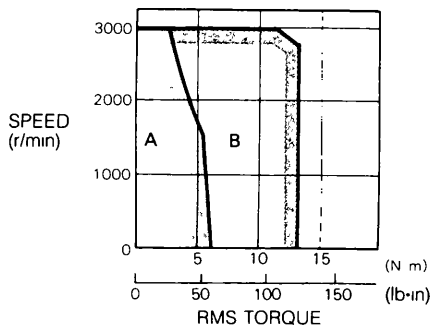
• TYPE USAGED-05L



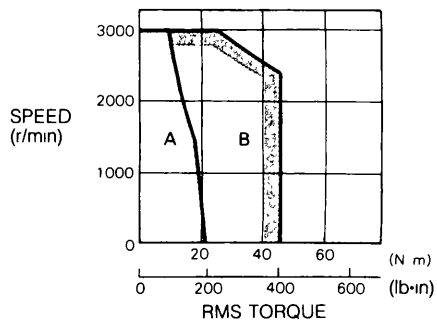
• TYPE USAGED-20L



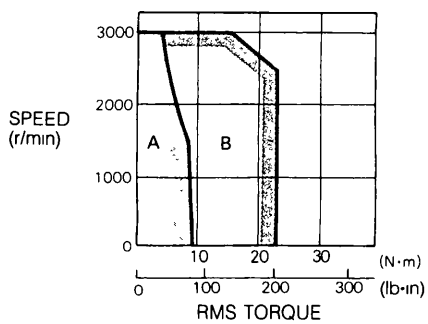
• TYPE USAGED-09L



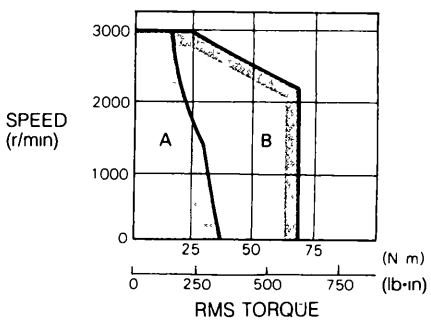
• TYPE USAGED-30L



• TYPE USAGED-13L



• TYPE USAGED-44L



A CONTINUOUS DUTY ZONE
B. INTERMITTENT DUTY ZONE
POWER SUPPLY 200 V
Typical at 20℃ (Armature Winding Temp)

3.2 MECHANICAL CHARACTERISTICS

3.2.1 Mechanical Strength

AC servomotors can carry up to the momentary maximum torque of each motor at output shaft.

3.2.2 Allowable Radial Load and Thrust Load

Table 3.4 shows allowable loads according to AC servomotor types.

Table 3.4 Allowable Radial Load and Thrust Load

• M Series

Motor Type USAMED-	Allowable Radial Load* N(lb)	Allowable Thrust Load N(lb)
03L □ 1	490(110)	98(22) †
06L □ 1		
09L □ 2	686(154)	343(77)
12L □ 2	1470(330)	490(110)
20L □ 2		
30L □ 2		
44L □ 2	1764(397)	588(132)

• F Series

Motor Type USAFED-	Allowable Radial Load* N(lb)	Allowable Thrust Load N(lb)
05L □ 1	490(110)	98(22) †
09L □ 1		
13L □ 2	686(154)	343(77)
20L □ 2	1470(331)	490(110)
30L □ 2		
44L □ 2		

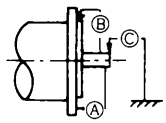
• G Series

Motor Type USAGED-	Allowable Radial Load* N(lb)	Allowable Thrust Load N(lb)
05L □ 1	490(110)	98(22) †
09L □ 1		
13L □ 2	686(154)	343(77)
20L □ 2	1470(331)	490(110)
30L □ 2		
44L □ 2		

* Maximum values of the load applying to the shaft extension.
† Do not apply the exceeding load because motor can not be rotated.

3.2.3 Mechanical Specifications

Table 3.5 Mechanical Specifications in mm

Accuracy(T. I. R.)*1		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0.04	
Flange diameter concentric to shaft Ⓑ	0.04	
Shaft run out Ⓒ	0.02 (0.04)*2	

*1 T. I. R. (Total Indicator Reading)
*2 Accuracy for motor type USAMED-44L □ 2

3.2.4 Rotating Direction

AC Servomotor rotates CCW viewed from the load side when connection shown in Par. 3. 3. 1 is performed and forward command is given to Servopack with parameter 14, b0 setting = 0 (Fig. 3. 11).

3.2.5 Impact Resistance

When mounted horizontally and exposed to vertical shock impulses, the motor can withstand up to two incidents with shock acceleration of 98m/s²(10G) (Fig. 3. 12).

Note

A precision detector is mounted on the opposite drive end of AC servomotor. Care should be taken to protect the shaft from impacts that could damage the detector.

3.2.6 Vibration Resistance

When mounted horizontally, the motor can withstand vibration (vertical, lateral, axial) of 24. 5m/s²(2. 5G) (Fig. 3. 13).

3.2.7 Vibration Class

Vibration of the motor running at rated speed is 15μm or below (Fig. 3. 14).

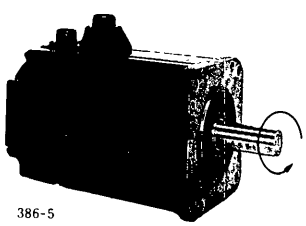


Fig. 3.11 Forward Rotation Direction

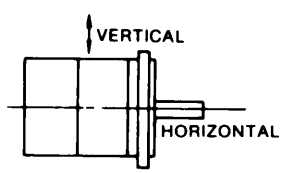


Fig. 3.12 Impact Resistance

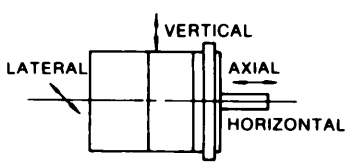


Fig. 3.13 Vibration Resistance

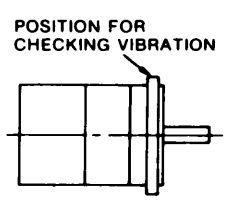


Fig. 3.14 Vibration Checking

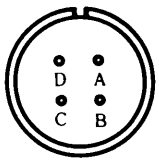
3.3 RECEPTACLES

3.3.1 Connector Specifications

(1) Without brake (M, F, G series)

(a) Motor receptacle

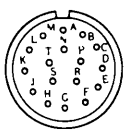
• M, F, G series



A	Phase U
B	Phase V
C	Phase W
D	Frame Ground

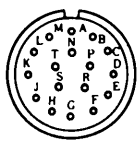
(b) Detector receptacle

• Incremental encoder



A	Channel A output	K	–
B	Channel $\overline{A}$ output	L	–
C	Channel B output	M	–
D	Channel $\overline{B}$ output	N	–
E	Channel C output	P	–
F	Channel $\overline{C}$ output	R	–
G	0V	S	–
H	+5VDC	T	–
J	Frame Ground	-	–

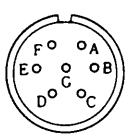
• Absolute encoder



A	Channel A output	J	Frame Ground
B	Channel $\overline{A}$ output	K	–
C	Channel B output	L	–
D	Channel $\overline{B}$ output	M	–
E	Channel Z output	N	–
F	Channel $\overline{Z}$ output	P	–
G	0V	R	Reset
H	+5VDC	S	0V(battery)
-	–	T	3.6V(battery)

(2) With brake

• M, F, G series



A	Phase U	E	Brake terminal
B	Phase V	F	Brake terminal
C	Phase W	G	–
D	Frame Ground	-	–

NOTE

3.3.2 List of Standard Combination

Table 3.6 M Series: Characteristics of AC SERVOMOTOR, Detector, and Holding Brake (Option) for Standard Combination

AC SERVOMOTOR Type USAMED-	AC SERVOMOTOR				Detector			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
03L □ 1	MS3102A 18-10P	MS3108B 18-10S	MS3106B 18-10S	MS3057 -10A	97F3102E 20-29P	MS3108B 20-29S	MS3106B 20-29S	MS3057 -12A
06L □ 1								
09L □ 2								
12L □ 2	MS3102A 22-22P	MS3108B 22-22S	MS3106B 22-22S	MS3057 -12A				
20L □ 2								
30L □ 2								
44L □ 2	MS3102A 32-17P	MS3108B 32-17S	MS3106B 32-17S	MS3057 -20A				

Table 3.7 F Series: Characteristics of AC SERVOMOTOR, Detector, and Holding Brake (Option) for Standard Combination

AC SERVOMOTOR Type USAFED-	AC SERVOMOTOR				Detector			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
05L □ 1	MS3102A 18-10P	MS3108B 18-10S	MS3106B 18-10S	MS3057 -10A	97F3102E 20-29P	MS3108B 20-29S	MS3106B 20-29S	MS3057 -12A
09L □ 1								
13L □ 2								
20L □ 2	MS3102A 22-22P	MS3108B 22-22S	MS3106B 22-22S	MS3057 -12A				
30L □ 2								
44L □ 2								

Table 3.8 G Series: Characteristics of AC SERVOMOTOR, Detector, and Holding Brake (Option) for Standard Combination

AC SERVOMOTOR Type USAGED-	AC SERVOMOTOR				Detector			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
05L □ 1	MS3102A 18-10P	MS3108B 18-10S	MS3106B 18-10S	MS3057 -10A	97F3102E 20-29P	MS3108B 20-29S	MS3106B 20-29S	MS3057 -12A
09L □ 1								
13L □ 2								
20L □ 2	MS3102A 22-22P	MS3108B 22-22S	MS3106B 22-22S	MS3057 -12A				
30L □ 2								
44L □ 2								

	Holding Brake			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp
	MS3102A 20-15P	MS3108B 20-15S	MS3106B 20-15S	MS3057 -12A
	MS3102A 24-10P	MS3108B 24-10S	MS3106B 24-10S	MS3057 -16A
	—	—	—	—

Note: These connectors are made by DAI-ICHI DENSHI KOGYO Co., Ltd.

	Holding Brake			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp
	MS3102A 20-15P	MS3108B 20-15S	MS3106B 20-15S	MS3057 -12A
	MS3102A 24-10P	MS3108B 24-10S	MS3106B 24-10S	MS3057 -16A

Note: These connectors are made by DAI-ICHI DENSHI KOGYO Co., Ltd.

	Holding Brake			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp
	MS3102A 20-15P	MS3108B 20-15S	MS3106B 20-15S	MS3057 -12A
	MS3102A 24-10P	MS3108B 24-10S	MS3106B 24-10S	MS3057 -16A

Notes:
1. For connection parts(plugs, clamps, etc) contact your Yaskawa representative. For connecting method, there are two types·soldering(MS type)and caulking(JA type).
2. These connectors are made by DAI-ICHI DENSHI KOGYO Co. Ltd.

4 RATINGS AND SPECIFICATIONS OF AC SERVOPACK

4.1 RATINGS AND SPECIFICATIONS

Table 4.1 AC SERVOPACK Ratings and Specifications

SERVOPACK Type CACR-HR				03UB	05UB	10UB	15UB	20UB	30UB	44UB
Max. Applicable Motor Capacity kW (HP)				0 3 (0 40)	0 5 (0 67)	1 0 (1 3)	1 5 (2.0)	2 0 (2 7)	3 0 (4 1)	4 4 (5 9)
Basic Specifications	Input Power Supply	Main	No of Phases	3-phase AC						
			Voltage	200 to 230V +10 to -15% 50/60Hz						
		Control		Single-phase 200 to 230VAC +10 to -15% 50/60Hz						
	Control Method			Full-wave rectifying, transistorized PWM control, sine-wave drives						
	Feedback			Absolute encoder (8192 or 1024 pulses/rev), incremental encoder (8192, 2500, or 2048 pulses/rev)						
	Environmental Conditions	Ambient Temp		0 to +55℃						
		Storage Temp		-20 to +85℃						
		Ambient/Storage Humidity		90% or less (non-condensing)						
		Vibration-/Shock Resistance		4 9m/s²(0 5G)/19 6m/s²(2G)						
	Configuration, Dimensions in mm (in)			Base-mounted 185W × 450H × 270D (7.28W × 17 72H × 10 63D)						
Positioning Control Specifications	Station No. Command Method	Operation Spec		Constant point positioning by station No command (contact data)						
		Command Input		Position command BCD (up to 3-digit 000 to 999) or BIN (up to 12-bit 0 to 4095)						
		System		Both absolute and incremental commands available						
	DG-SW Command Method	Operation Spec		Positioning by DG-SW command data						
		Command Input		Position command Sign + up to 8 digits (-99999999 to +99999999) Speed command Up to 6 digits (000000 to 240000), to be less than motor max speed						
		System		Both absolute and incremental commands available						
	Serial Communication Command Method	Operation Spec		Positioning by serial communication						
		Command Input		RS422, asynchronous, communication speed 9 6/4 8/2 4/1 2 kBaud						
		System		Both absolute and incremental commands available						
	Command Table Method	Operation Spec		Positioning by position No and speed No command (contact data)						
		Command Input		Position command Sign + up to 8 digits (-99999999 to +99999999) Speed command · Up to 6 digits (000000 to 240000), to be less than motor max. speed Position/speed No command BIN (up to 6 bits 1 to 64)						
		System		Only absolute value command available						
	Others	Operation Spec.		Positioning by pulse train (line PG or pulse train input)						
		Command Input		Position command· Number of pulses — A + B or UP + DN or P + SIGN Speed command Up to 400 kpps (A + B : 1 6 Mpps)						
		System		Only incremental command available						
Common Built-in Function	Dynamic Brake (DB)			Operated at main power OFF, servo alarm, servo OFF						
	Holding Brake Interface			Output signal for turning brake power supply ON/OFF (brake timing is set by parameter)						
	Regeneration			Built-in (regenerating resistor included)						
	Overtravel Protection			By soft limit and hard LS internal command stop at operation						
	External Current Limit			Current limit value switching by contact input Current limit value. Common in FWD/REV, FWD only, REV only (parameter setting)						
	Protective Functions			OV, OC, OL, OS, FAN, PG, UV, CPU, ABS, POS, O-PH, RWY, PG, HARD, OF, PRM, OH (See Table 4 2)						
	Display			Main circuit power supply green LED, control power supply green LED, alarm red LED Alarm contents code output in 7-segment, fault contents display in data display section						
	Monitor			Serial communication (position, speed, torque, etc.) Speed command, torque command or speed output in analog value						
	Positioning Control Function			Linear accel/decel, exponential accel/decel, A/B function, pulse multiplication, soft OT, backlash compensation, COIN NEAR, motor · line PG switching (incremental operation), etc.						
Control Interface I/O		Input		Serial 1 port and digital 24V system× 20 (Max)						
		Output		Serial 1 port and digital 24V system× 18 (Max), 5V system 2 circuits (PG output)						
Gain and Parameter Settings				Serial communication (RS422, asynchronous, communication speed 9.6/4.8/2.4/1 2 kBaud) or selection by AC SERVOPACK switch						
Absolute Encoder Battery				Provided on SERVOPACK board						
Applicable Inertia J_L				5 times or less of rotor inertia J_M (motor GD²) for M, F or G series						

4.2 INTERNAL BLOCK DIAGRAM

• Servopack Type CACR-HR03UB to -10UB

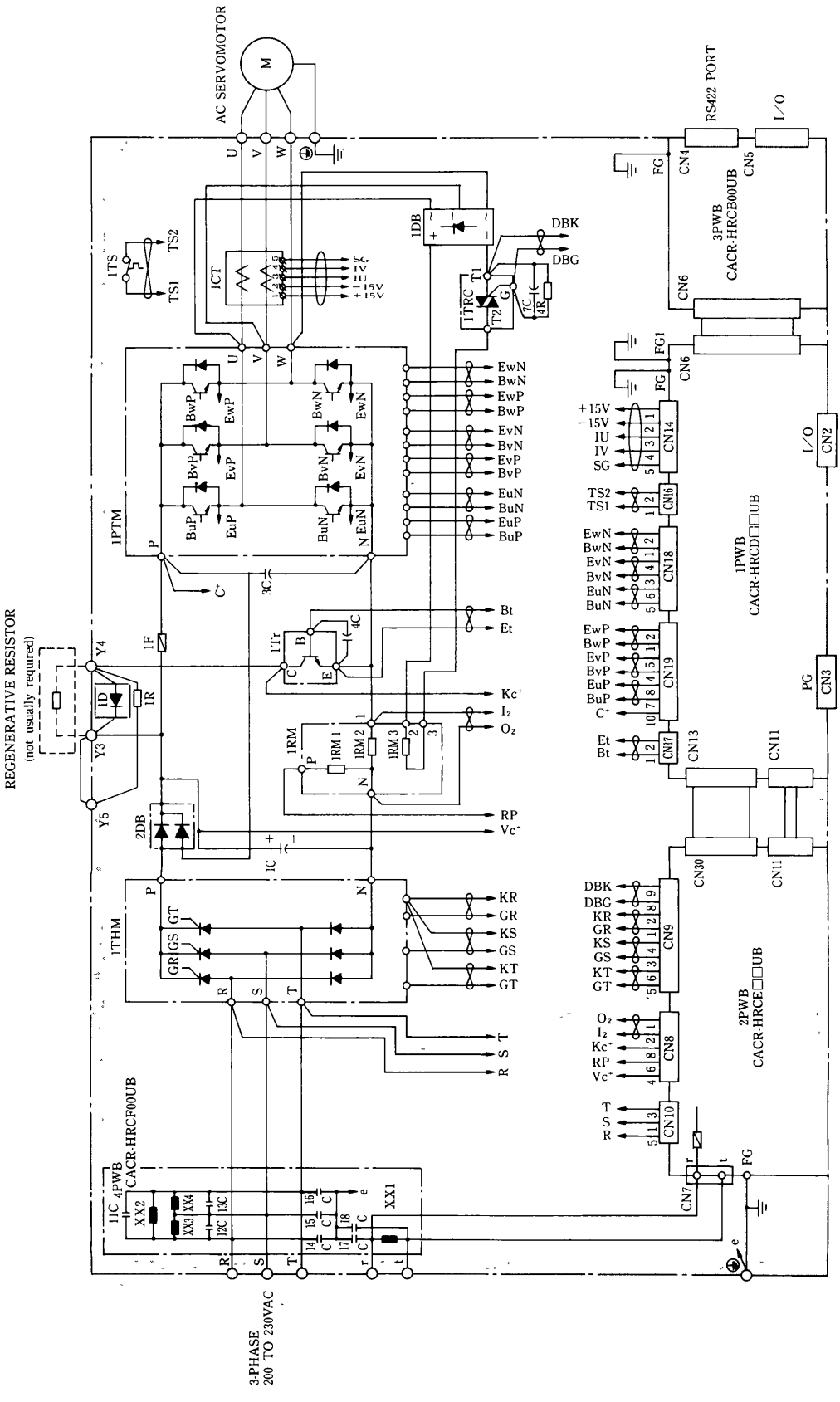


Fig. 4.1 Internal Block Diagram of Servopack Type CACR-HR03UB to-10UB

• Servopack Type CACR-HR15UB to -44UB

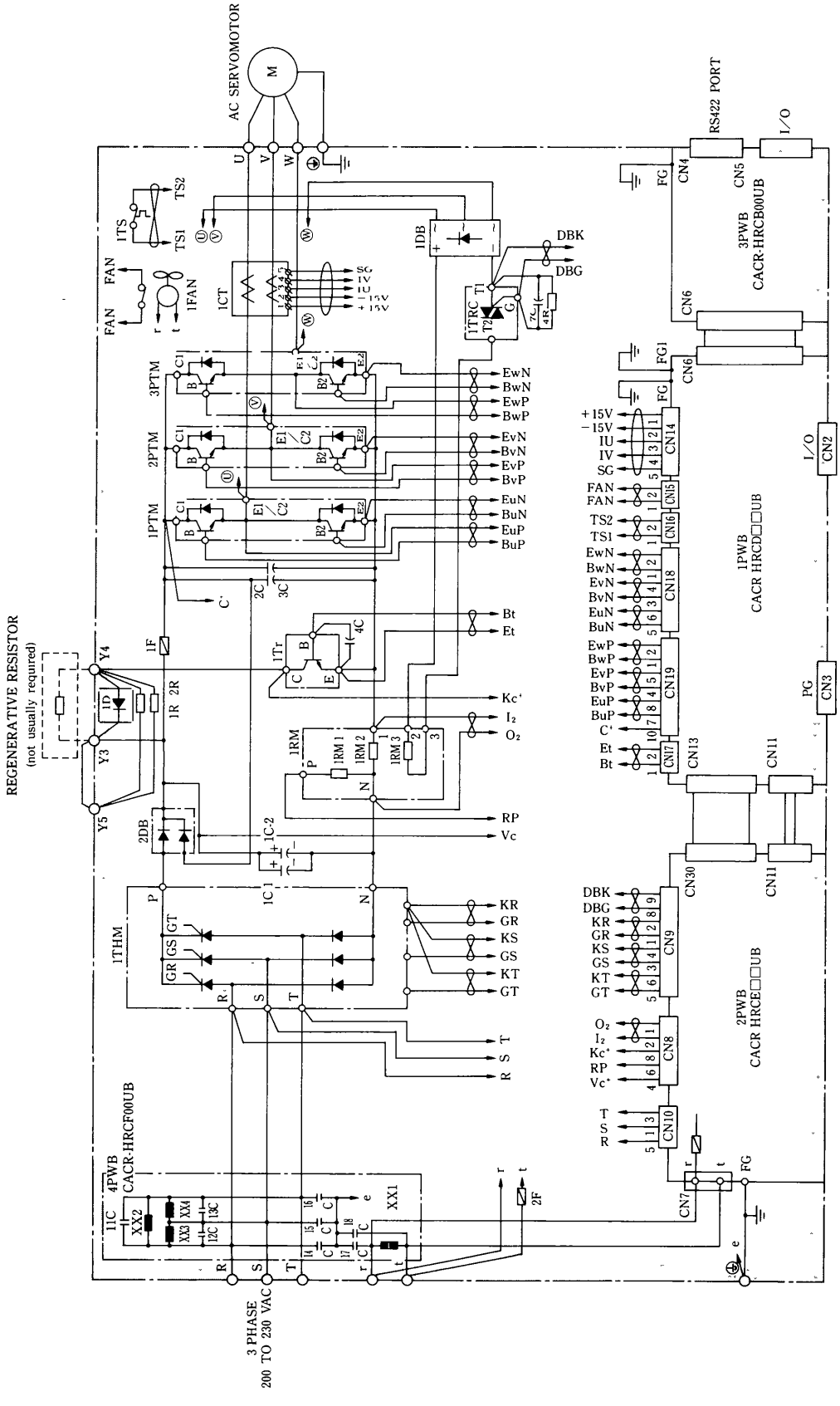


Fig. 4.2 Internal Block Diagram of Servopack Type CACR-HR15UB to-44UB

4.3 PROTECTIVE CIRCUIT

Servopack provides functions to protect the Servopack and motor from malfunctions.

(1) Dynamic brake function

Servopack incorporates a dynamic brake for emergency stop. This brake operates when:

- Alarm (fault detection) occurs.
- Servo ON command is turned OFF.
- Main power supply is turned OFF.

(2) Fault detecting functions

Table 4.2 Fault Detecting Functions

Fault	Detection
Overcurrent (OC)	Overcurrent flow in the main circuit (at 1.2 times or more of inst. max. current)
FAN STOP (FAN)	FAN stop.
Regeneration Trouble (RG)	Regenerative circuit not activated in Servopack.
Overvoltage (OV)	Excessively high DC voltage in the main circuit (approx 420V.)
Overspeed (OS)	Excessively large speed feedback detected.
Under Voltage (UV)	Low DC voltage in the main circuit after power ON. (150V or less.)
Overload (OL)	Overload condition of motor and Servopack.
Heatsink Overheat (OH)	Overheat of heatsink (approx. 90℃ min.)
PG Disconnection (PG)	Encoder signal disconnection.
Overflow Deviation (OF)	Excessive following error.
Open Phase (O-PH)	Any one phase open in three-phase power input.
Overrun Prevention (RWY)	Wrong wiring of motor circuit or PG signal line.
CPU Error (CPU)	Errors related to CPU.
Hardware Error (HARD)	
Absolute Control Error (ABS)	Errors related to absolute encoder.
Position Error (POS)	
Parameter Error (PRM)	Data set value error of parameter.
Battery Voltage Low	Battery voltage drop or battery disconnection.

(3) Overload Detection (OL) Level

Overload detection level is set as shown in Fig. 4.4 when motor rated current = 100%. (When allowable current applying time at motor locking is at the maximum, operating time at higher rotating speed is shorter for the same overload.)

NOTE

Overload detection level is determined with hot start conditions of ambient temperature 55° C. The set value cannot be changed.

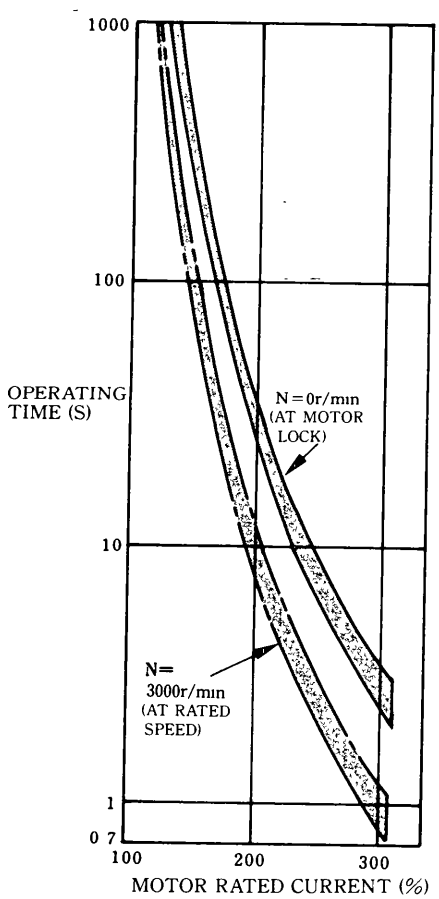


Fig. 4.4 Overload Characterisitics

(4) Servo alarm output [ALM]

If any fault detection circuits in Table 4.2 functions, the power drive circuit in the Servopack is turned OFF, 7-segment LEDs indicate the operation status and a servo alarm signal is output.

(5) Protective circuit operation

An alarm signal indicates some fault. Check the cause and fix the problem, and restart the operation. Before checking the cause, turn OFF the main power supply to avoid danger. Apply the sequence so that the alarm signal turns OFF only the main circuit (Ⓡ , Ⓢ , Ⓣ), as shown in Figs. 5.17 and 5.18. This allows rapid reaction in the event of a malfunction.

If the power to the control circuit (ⓡ, ⓣ) is simultaneously turned OFF, this also turns OFF the LED in the Servopack indicating the cause of the alarm signal.

(6) Resetting servo alarm

To reset the servo alarm, turn on alarm reset signal $\overline{\text{RST}}$ (or serial communication command ARES).

If 7. is ON (e.g., Servopack is over loaded), it takes a few minutes to reset the alarm condition.

4.4 PRECAUTIONS FOR APPLICATION

4.4.1 Overhanging Load

The motor is rotated by the load; Additional regenerative resistor may be required against this rotation and achieve continuous running.

Example: Vertical axis without counterweight

Since Servopack has the regenerative brake capability of short time (corresponding to the motor stopping time), for application to a minus load, contact your Yaskawa representative.

4.4.2 Load Inertia (J_L)

The allowable load inertia J_L converted to the motor shaft must be within five times (M, F, G series) the inertia of the applicable AC servomotor. If the allowable inertia is exceeded, an overvoltage alarm may be given during deceleration. If this occurs, take the following actions:

- Reduce the current limit.
- Slow down the deceleration curve.
- Decrease the maximum speed.

For details, contact your Yaskawa representative.

4.4.3 Allowable Cyclic Operating Frequency

Start/Stop cyclic operating frequency is limited separately by Servopack and Servomotor. It is necessary to satisfy both conditions.

(1) Allowable cyclic operating frequency limited by Servopack

Servopack limitation is due to Servopack built-in regenerative resistor generating power. Allowable frequency differs depending on combined motor types, capacities, load inertia J_L, accel/decel current and motor speed.

For the following cases, contact your Yaskawa representative.

- When start/stop cyclic operating frequency up to rated speed exceeds 60 times/min at load inertia $J_L = 0$.
- When start/stop cyclic operating frequency up to rated speed exceeds $\frac{60}{m+1}$ times/min at load inertia J_L = motor inertia $J_M \times m$ times.

(2) Allowable cyclic operating frequency limited by Servomotor

When AC Servomotor rms torque in an operation cycle is within the continuous duty zone of motor performance (Par. 3.1), the operation can be repeated in the operation cycle.

4.4.4 High Voltage Line

If the supply voltage is 400/440 V, the voltage must be dropped from 400/440V to 200V by using a power transformer. Table 5.12 shows the transformer selection.
Connection should be made so that the power is supplied and cut at the primary side of the transformer.

4.5 POWER LOSS

The power loss of Servopack is shown in Table 4.2.

Table 4.2 Power Loss at Rated Output

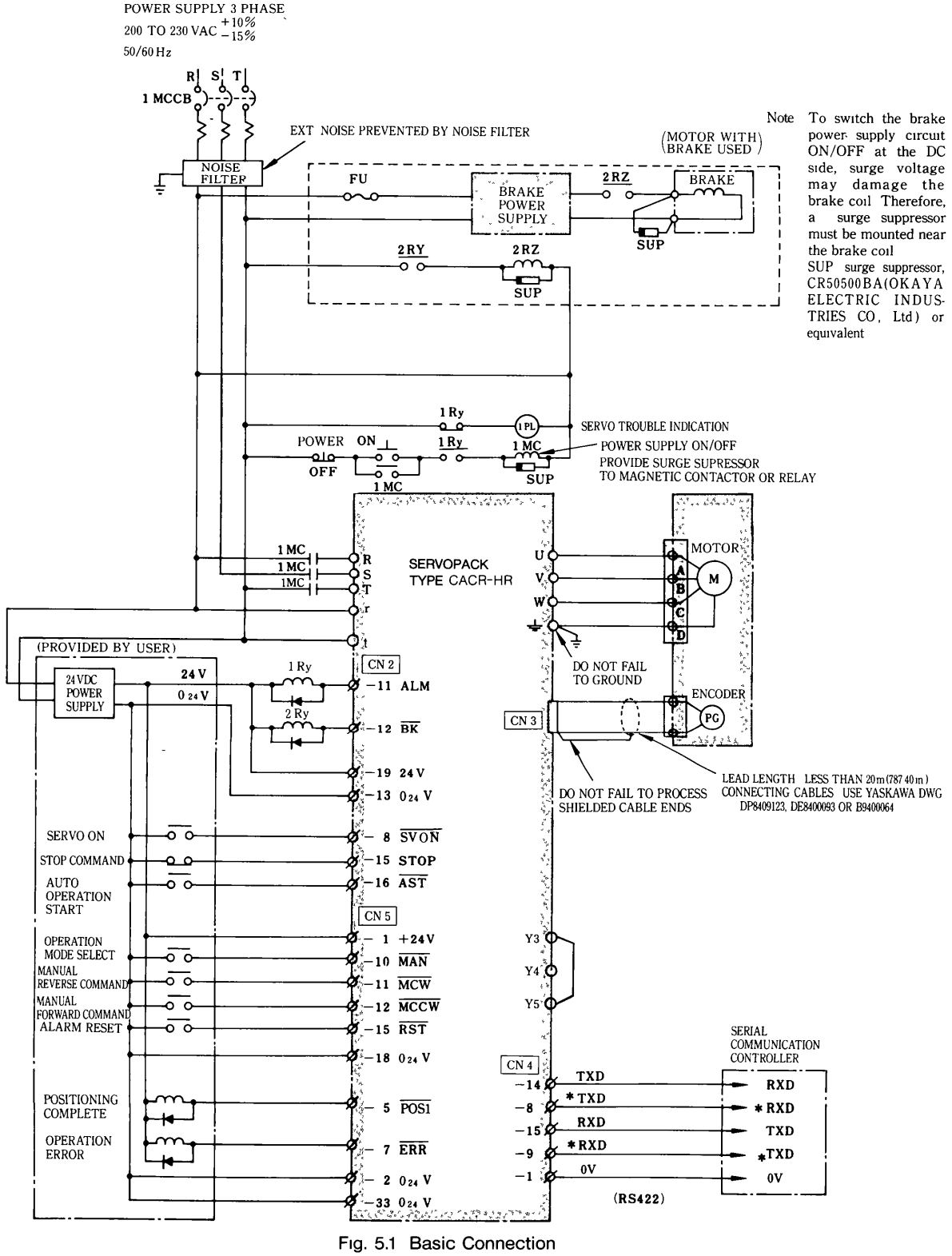
SERVOPACK Type CACR-	Output Current A	Power Loss			
		Main Circuit W	Regenerative Resistor * W	Control Circuit W	Total W
HR03UB	3.0	20	10	60	90
HR05UB	4.2	40	10		110
HR10UB	7.6	70	20		150
HR15UB	11.7	80	20		160
HR20UB	18.8	100	40		200
HR30UB	26.0	160	80		300
HR44UB	33.0	210	100		370

* Power loss in regenerative resistors occurs at motor deceleration. The maximum allowable value of average power loss is shown. When a motor operates in a duty cycle exceeding this value, a regenerative resistor must be provided.

5 CONNECTION

5.1 TYPICAL CONNECTION

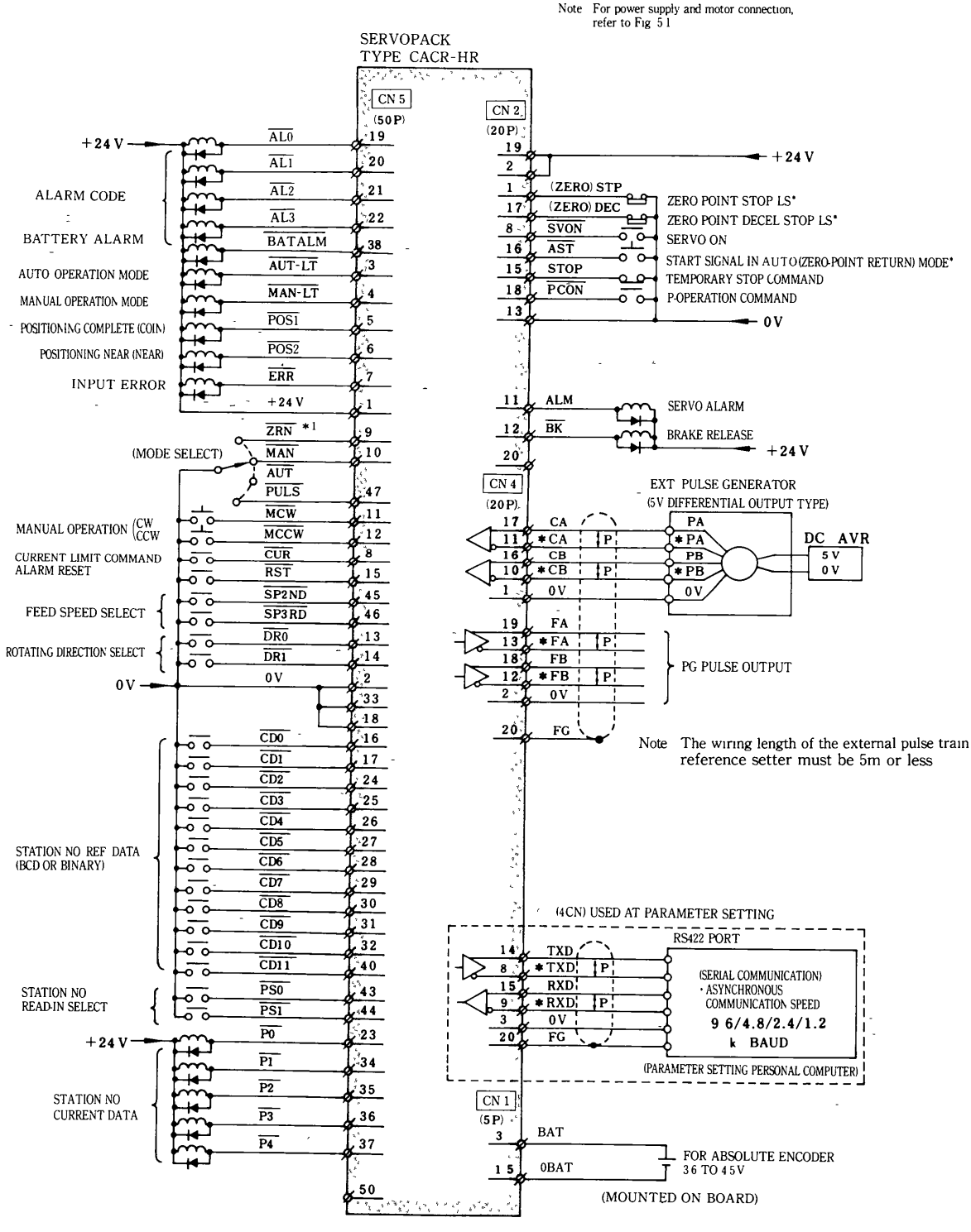
5.1.1 Basic Connection



Note To switch the brake power supply circuit ON/OFF at the DC side, surge voltage may damage the brake coil Therefore, a surge suppressor must be mounted near the brake coil
SUP surge suppressor, CR50500BA(OKAYA ELECTRIC INDUSTRIES CO, Ltd) or equivalent

Fig. 5.1 Basic Connection

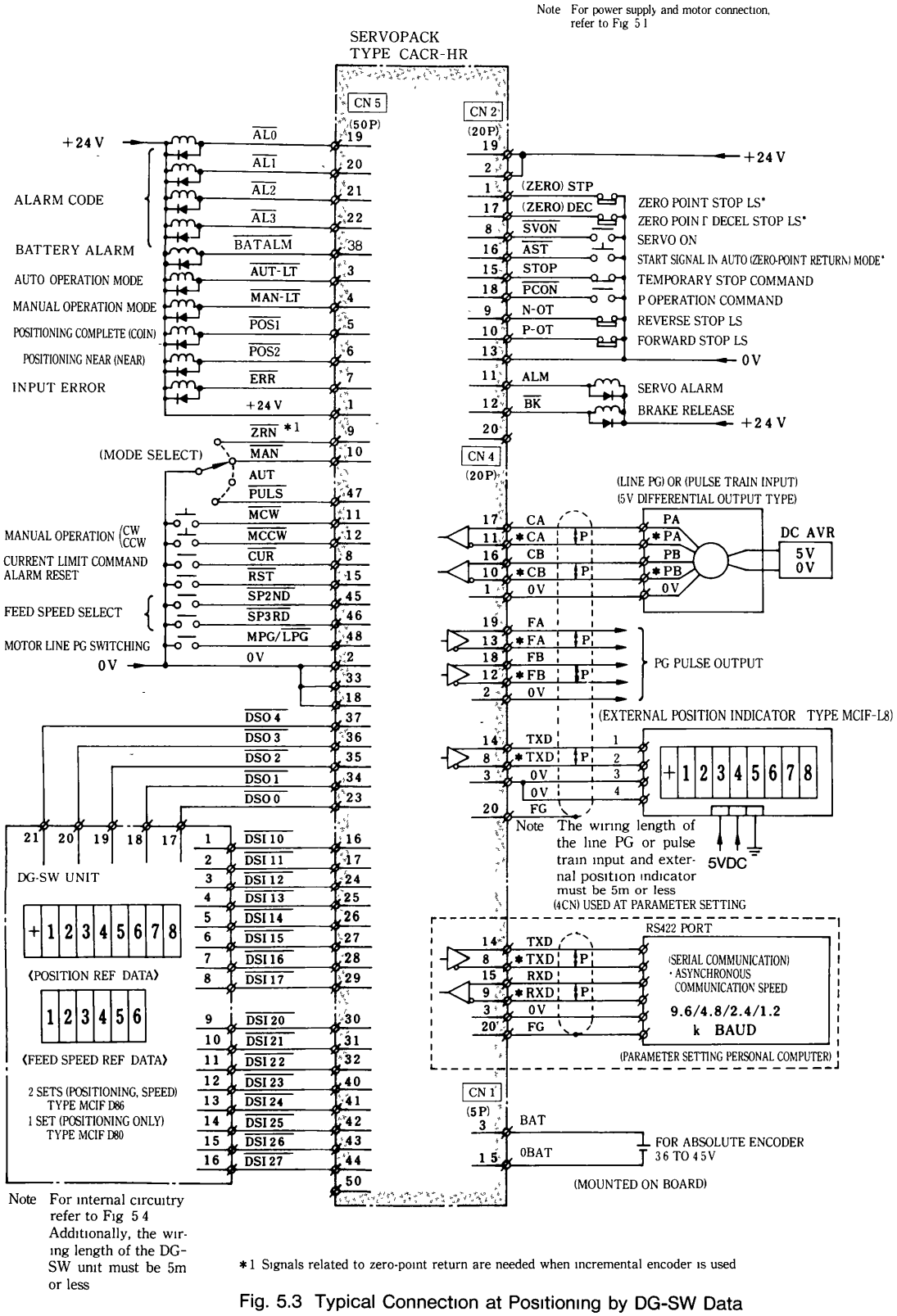
5.1.2 Typical Connection at Positioning by Station No.



*1 Signals related to zero-point return are needed when incremental encoder is used
LS Limit Switch

Fig. 5.2 Typical Connection at Positioning by Station No.

5.1.3 Typical Connection at Positioning by DG-SW Data



*1 Signals related to zero-point return are needed when incremental encoder is used

Fig. 5.3 Typical Connection at Positioning by DG-SW Data

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5.1.3 Typical Connection at Positioning by DG-SW Data (Cont'd)

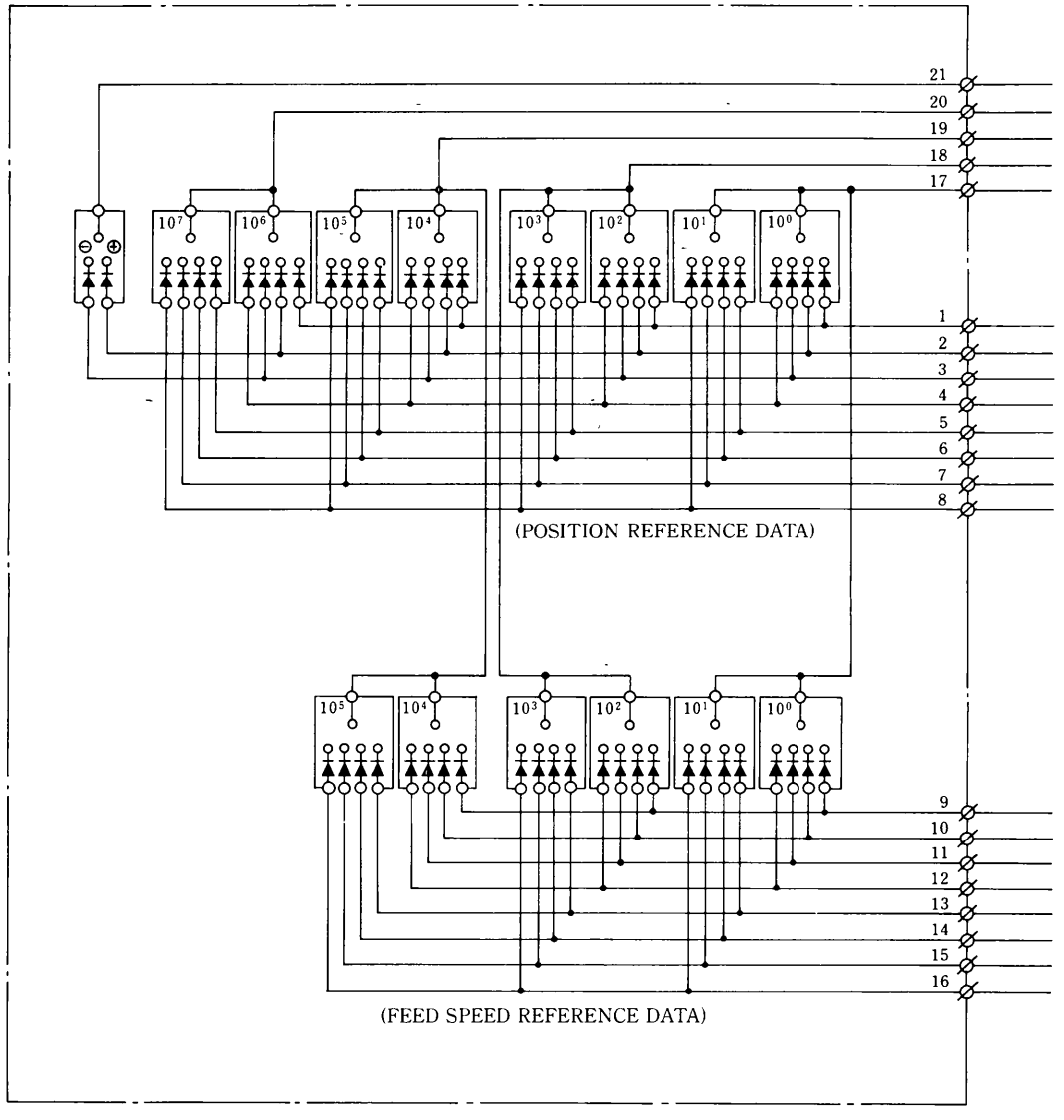


Fig 5 4 Details in DG-SW Unit

5.1.4 Typical Connection at Positioning by Serial Communication

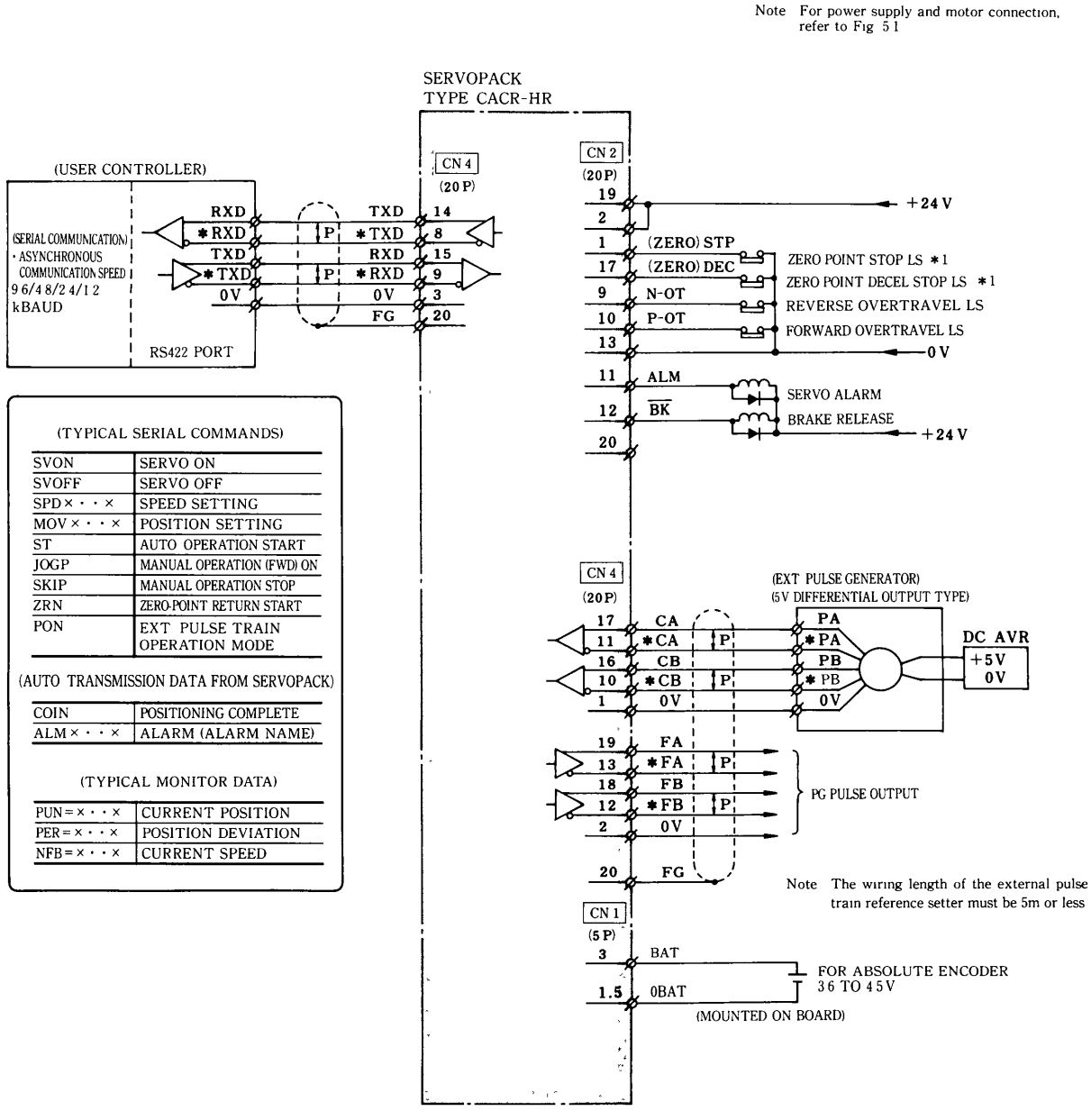
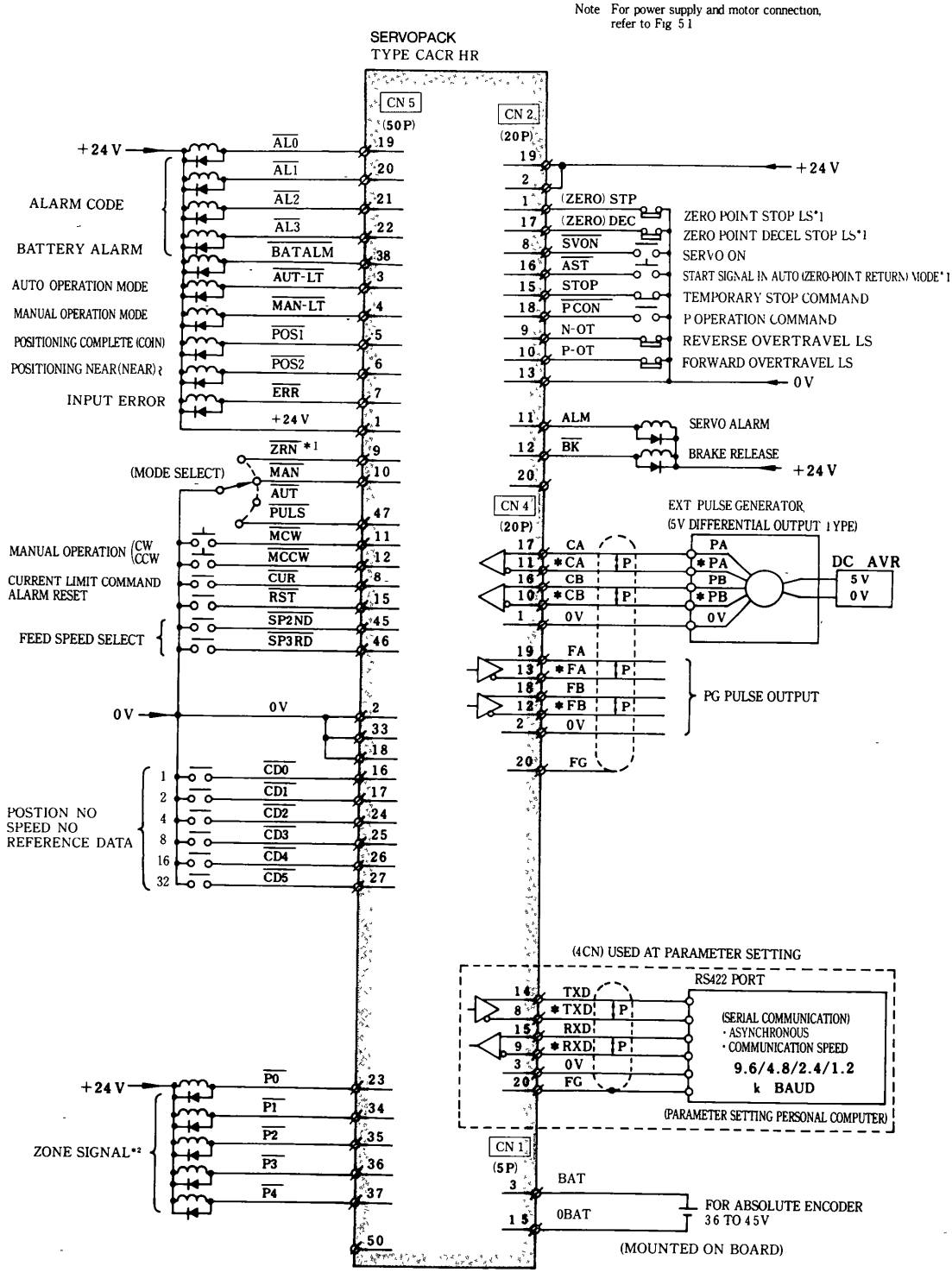


Fig. 5.5 Typical Connection at Positioning by Serial Communication Input

5.1.5 Typical Connection at Positioning by Command Table



*1 Signals related to zero-point return (homing) are needed when incremental encoder is used
LS Limit Switch
*2 Set PRM20b5=1, PRM65b0=1 when zone signals are used

Fig. 5.6 Typical Connection at Positioning by Command Table

5.2 MAIN CIRCUIT TERMINAL NAMES AND OUTLINE

Table 5.1 Main Circuit Terminal Names and Outline

Symbol	Name	Outline
Ⓡ Ⓢ Ⓣ	Main curcuit power supply input terminal	3-phase 200 to 230VAC $^{+10\%}_{-15\%}$, 50/60Hz
Ⓤ Ⓥ Ⓦ	Motor connection terminal	Ⓤ and motor terminal A; Ⓥ and motor terminal B; Ⓦ and motor terminal C connected
ⓡ ⓣ	Control power supply input terminal	Single-phase 200 to 230VAC $^{+10\%}_{-15\%}$, 50/60Hz
⏚	Grounding terminal	Connected with motor terminal D to ground.
Ⓨ3 Ⓨ4 Ⓨ5	Regenerative resistor connecting terminal	Ⓨ3 Ⓨ4 : External regenerative resistor connecting terminal (Normally, no connection is necessary) Ⓨ3 Ⓨ5 : Shorted when external regenerative resistor is not used.

5.3 CONNECTOR TERMINAL (CN2) FOR I/O SIGNALS

5.3.1 Applicable Receptacle Specifications

Table 5.2 Applicable Receptacle Specifications

Specifications of Connector Used in SERVOPACK	Applicable Receptacle Type			
	Soldered Type	Caulking Type	Case	Maker
MR-20RFA Right angle 20P	MR-20M*	MRP-20M01	MR-20L*	HONDA Tsushin Co., Ltd.

* Standard attachment of Servopack

5.3.2 Connector CN2 Layout and Connection

Table 5.3 shows the terminal layout of connector CN2 and Fig. 5.7 shows the wiring diagram for CN2.

Table 5.3 -Connector CN2 Layout

1	2	3	4	5	6	7
STP	+24V	—	—	—	(BAT+)	(BAT-)
(At Zero-Point Return) Zero-Point Stop LS Input	STP 24V	—	—	—	(Battery Input for Absolute Encoder)	

8	9	10	11	12	13
$\overline{SVON}$	N-OT	P-OT	ALM	$\overline{BK}$	0V
Servo ON Input	Overtravel LS Input: Reverse Side	Overtravel LS Input: Forward Side	Servo Alarm Output	Brake Release Command Output	0V for ALM BK Signal

14	15	16	17	18	19	20
—	STOP	$\overline{AST}$	DEC	$\overline{PCON}$	24V	FG
—	Temporary Stop Command Input	Start Command Input	(At Zero-Point Return) Decel LS Input	Proportional Operation Command Input	24V for Input Signal	Frame Ground (Shielding Process)

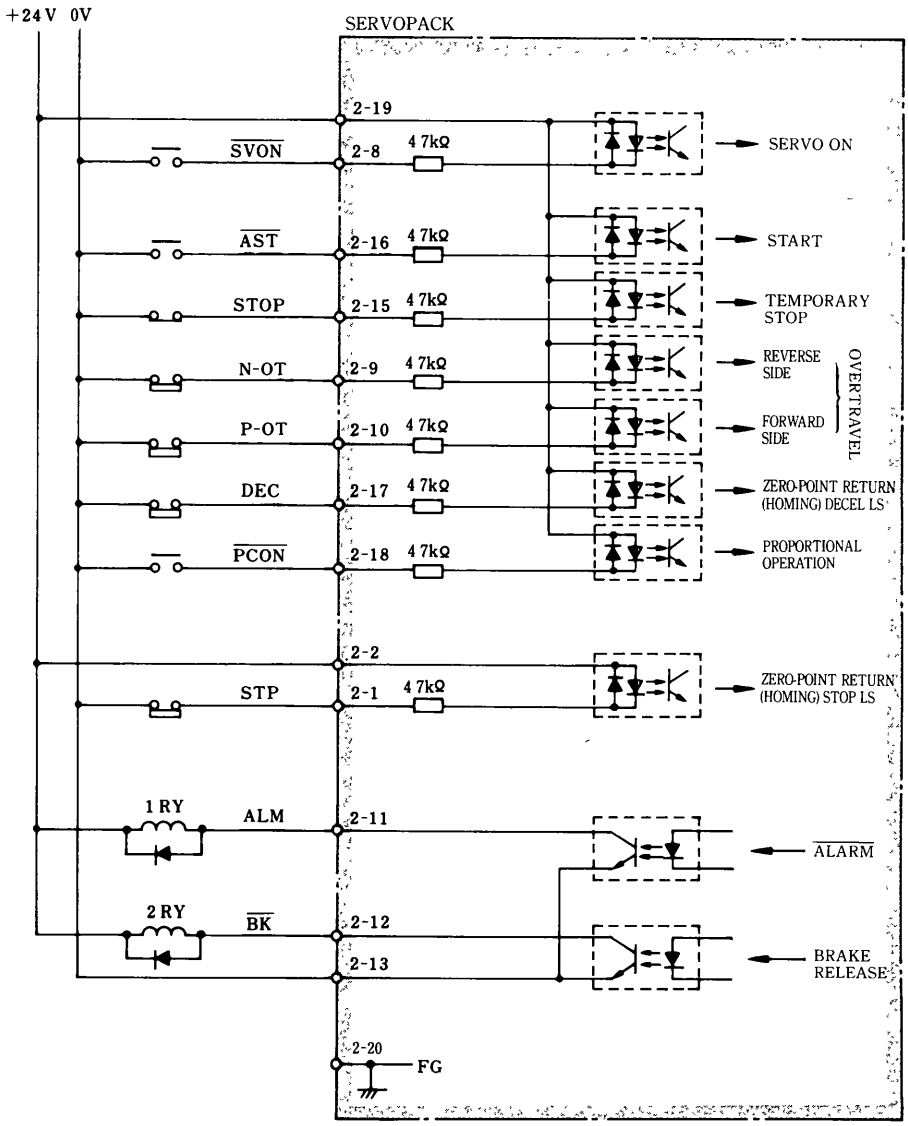
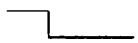
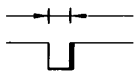
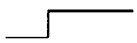
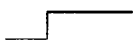
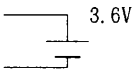


Fig. 5.7 Wiring Diagram for CN2

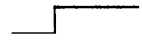
5.3.3 Description and Usage of I/O Signals of Connector CN2

(1) Input Signals

L level when contact closed, H level when opened.

Signal Name	Pin No.	Name	Effective Logic	Function
$\overline{\text{SVON}}$	8	Servo ON		Base block on main circuit transistors is released. Motor becomes in current conduction, when this signal is ON
$\overline{\text{AST}}$	16	Operation start	5ms or more  Starts by rising edge.	Operation start signal in automatic operation mode or zero-point return mode
STOP	15	Temporary stop reference	5ms or more 	Operation stop command in automatic operation mode or zero-point return (homing) mode. When this signal is OFF, operation stops at specified accel/decel speed (parameter setting).
N-OT	9	Forward side overtravel LS		Connects overtravel limit switch signal according to forward or reverse side This signal is turned on at normal operation and off when limit switch is active
P-OT	10	Reverse side overtravel LS		
DEC	17	Zero-point return(homing) decel LS		Used in zero-point return (homing) mode I (refer to Par.6.2.3 (1) d). After 2-step deceleration by DEC signal and phase-C pulse signal, zero-point return is performed.
STP	1	Zero-point return(homing) stop LS		Used in zero-point return (homing) mode II (refer to Par.6.2.3 (1) d) After deceleration by STP signal, zero-point return is performed.
$\overline{\text{PCON}}$	18	Proportional operation command		Speed loop control mode is switched from PI (proportional-integer) to P (proportional) operation.
(BAT+)	6	Absolute encoder battery input	3.6V 	Not used normally. (Battery provided on the board)
(BAT-)	7			

(2) Output Signals

Signal Name	Pin No.	Name	Effective Logic	Function
ALM	11	Servo alarm		Output transistor is turned off when an alarm occurs (Normally ON)
$\overline{BK}$	12	Brake release signal		Output transistor is turned on by brake control circuit when servo ON status

5.4 CONNECTOR TERMINAL (CN3) FOR ENCODER

5.4.1 Applicable Receptacle and Cable Specifications

Table 5.4 Applicable Receptacle and Cable Specifications

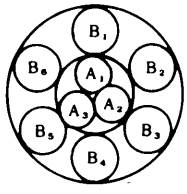
Specifications of Connector Used in SERVOPACK	Applicable Receptacle Type				Connecting Cable Specifications
	Soldered Type	Caulking Type	Case	Maker	
MR-20RFA Right angle 20P	MR-20F*	MRP-20F01	MR-20L*	HONDA Tsushin Co., Ltd.	DP8409123, B9400064 or DE8400093

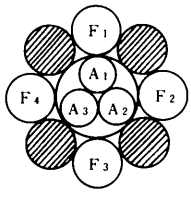
* Standard attachment of Servopack

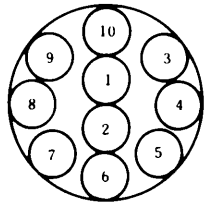
Note: For connecting cables, YASKAWA supply the cables with the following specifications. However, they are not attached to Servopack or motor. They can be purchased at prepared length on request. (Table 5.5)

Table 5.5 Applicable Cable Specifications

Applicable Encoder	Absolute Encoder	Incremental Encoder	Absolute Encoder, Incremental Encoder
Connecting Method	Soldered type	Soldered type	Caulking type
Cable Specification	YASKAWA DWG No DP8409123	YASKAWA DWG No B9400064	YASKAWA DWG No. DE8400093
Maker	Fujikura Cable Co		
Finished Dimension	ϕ8.0mm	ϕ7 5mm	ϕ10.0mm
(Recommended Receptacle Type)	(For soldered type)	(For soldered type)	(For caulking type)







Internal Configuration and Lead Colors (DP8409123 and B9400064 are standard)

A_1	Red	Twisted cable
A_2	Black	
A_3	Green-yellow	
B_1	Blue-white-blue	
B_2	Yellow-white-yellow	
B_3	Green-white-green	
B_4	Orange-white orange	
B_5	Purple-white-purple	
B_6	Grey-white-grey	

A_1	Red	Twisted cable
A_2	Black	
A_3	Green/yellow	
F_1	Blue-white/blue	
F_2	Yellow-white/yellow	
F_3	Pale green-white/pale green	
F_4	Orange-white/orange	

1	Blue-white	Twisted cable
2	Yellow-white	
3	Green-white	
4	Red-white	
5	Purple-white	
6	Blue-brown	
7	Yellow-brown	
8	Green-brown	
9	Red-brown	
10	Purple-brown	

YASKAWA Specifications	Standard length 5m, 10m, 20m Terminal ends are not provided (without connectors)

NOTES

1. When applicable cable is used, allowable wiring distance between Servopack and motor (PG) is up to 20m.
2. When wiring distance between Servopack and motor (PG) exceeds 20m, cable which can be used for up to 50m (YASKAWA DWG No. DP8409179) is available. Contact your YASKAWA representative

5.4.2 Connector CN3 Layout and Connection

The terminal layout for the Servopack connector (CN3) is shown in Table 5.6, the connection with absolute encoder in Figs. 5.8 and 5.9 and the connection with incremental encoder in Figs. 5.10 and 5.11.

Table 5.6 Connector CN3 Layout

1	2	3	4	5	6	7
PGOV	PGOV	PGOV	PG5V	PG5V	PG5V	—
8	9	10	11	12	13	
—	—	—	—	BAT†	BATO†	
14	15	16	17	18	19	20
PC	*PC	PA	*PA	PB	*PB	FG

† Required only when absolute encoder is used.

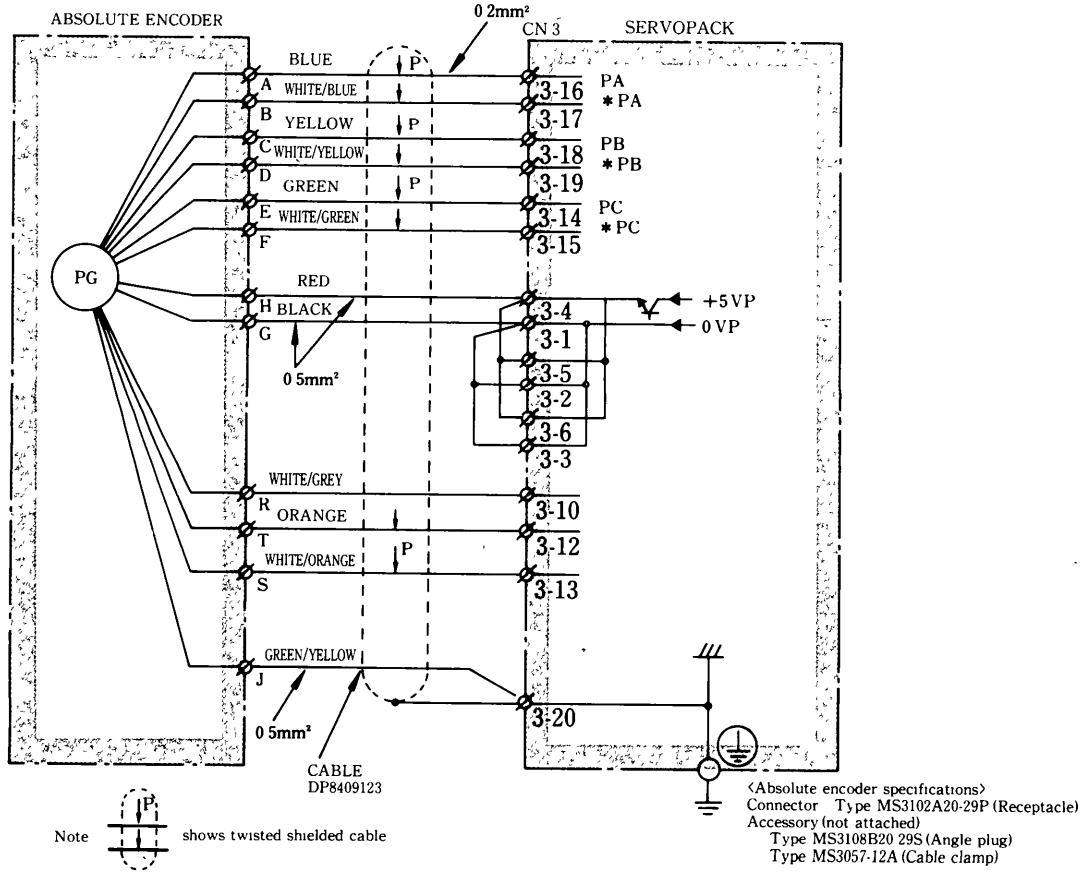


Fig. 5.8 Connection between CN3 and Absolute Encoder
(When soldered type cable DP8409123 is used)

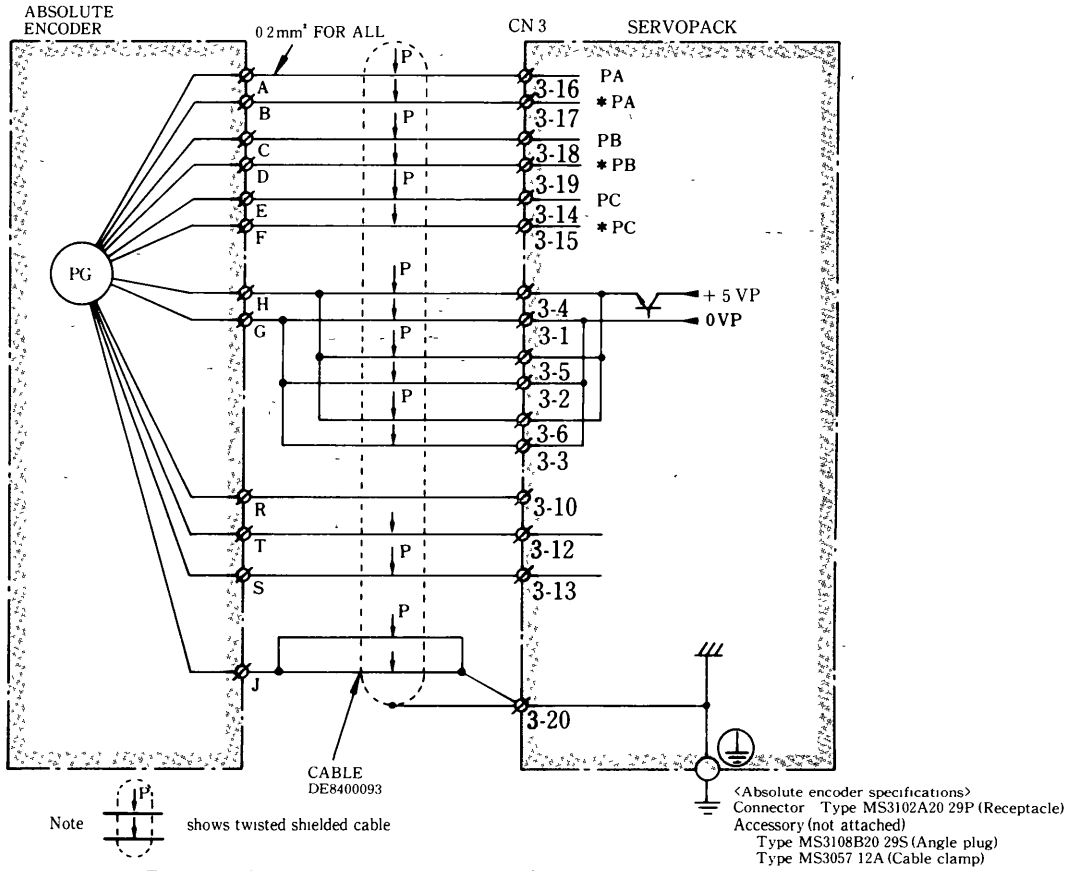


Fig. 5.9 Connection between CN3 and Absolute Encoder
(When caulking type cable DE8400093 is used)

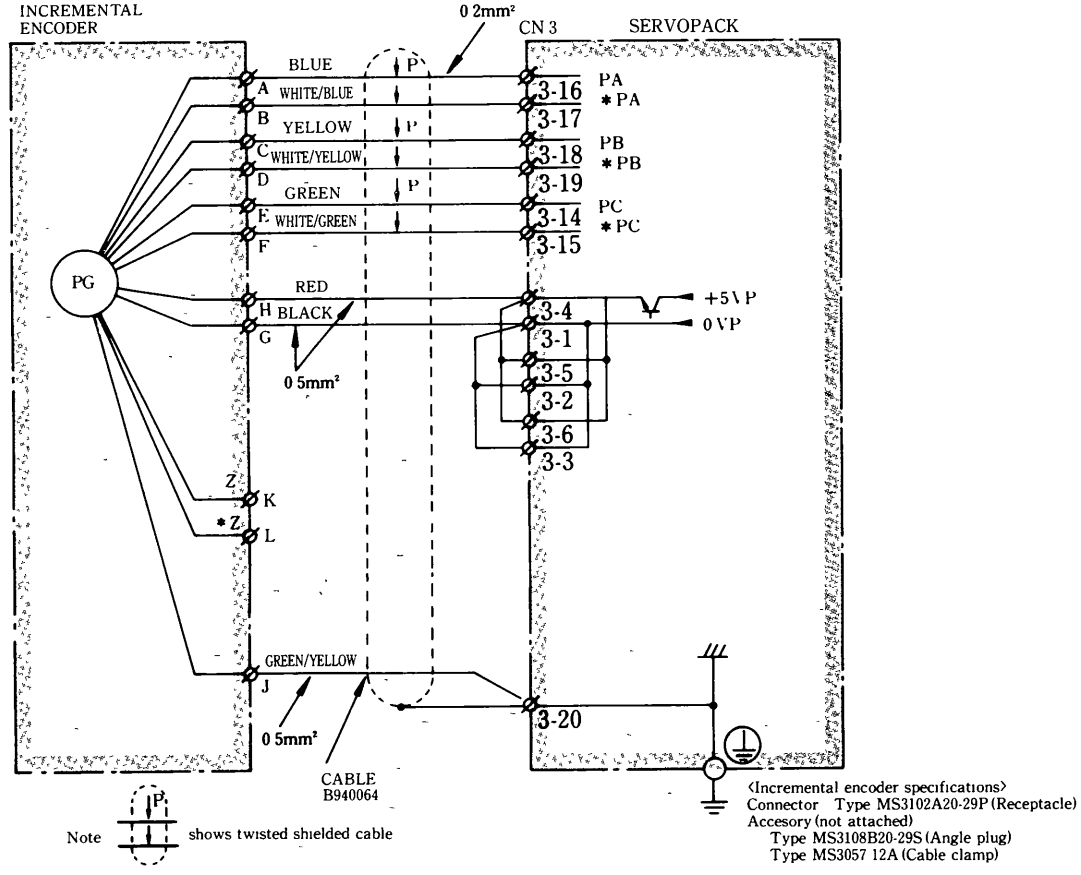


Fig. 5.10 Connection between CN3 and Incremental Encoder
(When soldered type cable B9400064 is used)

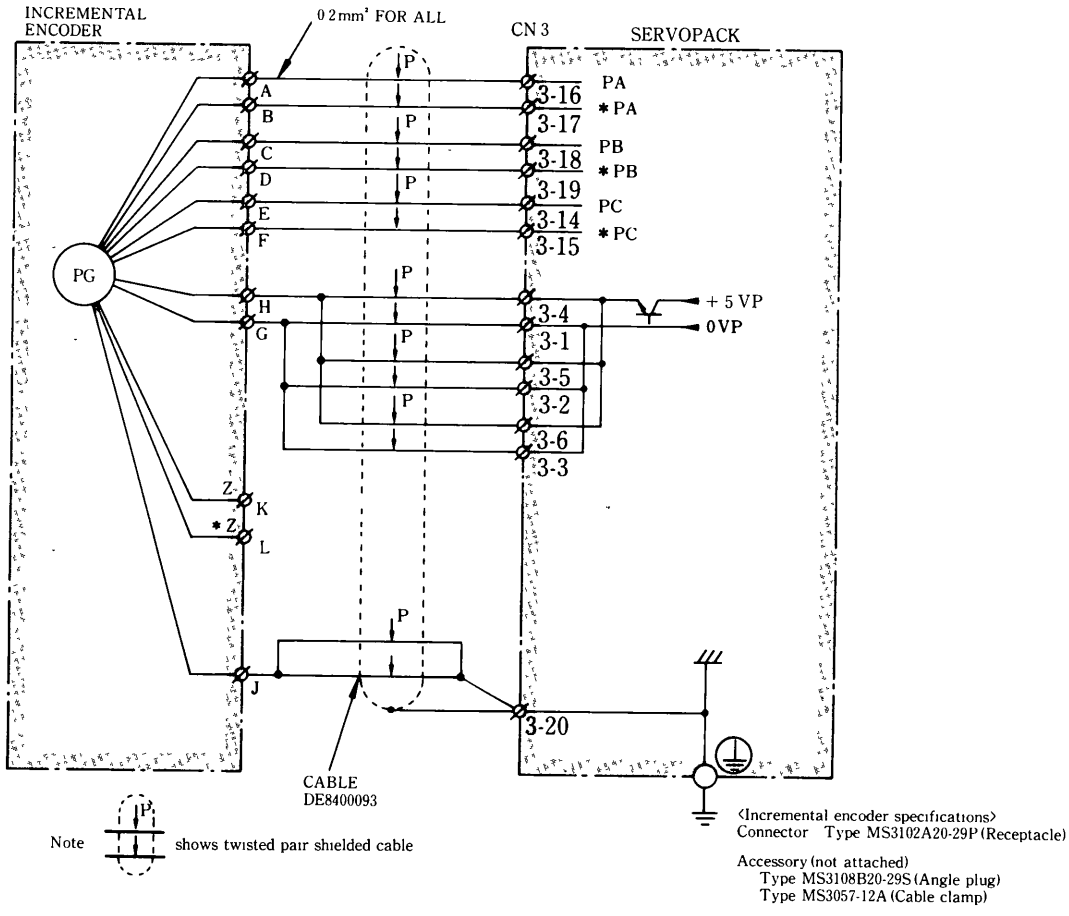


Fig 5.11 Connection between CN3 and Incremental Encoder
(When caulking type cable DE8400093 is used)

5.5 CONNECTOR TERMINAL (CN4) FOR I/O SIGNALS

5.5.1 Applicable Receptacle

Table 5.7 Applicable Receptacle

Specifications of Connector Used in SERVOPACK	Applicable Receptacle Type			
	Soldered Type	Caulking Type	Case	Maker
MR-20RMA Right angle 20P	MR-20F*	MRP-20F01	MR-20L*	HONDA Tsushin Co., Ltd.

* Standard attachment of Servopack

5.5.2 Connector CN4 Layout and Connection

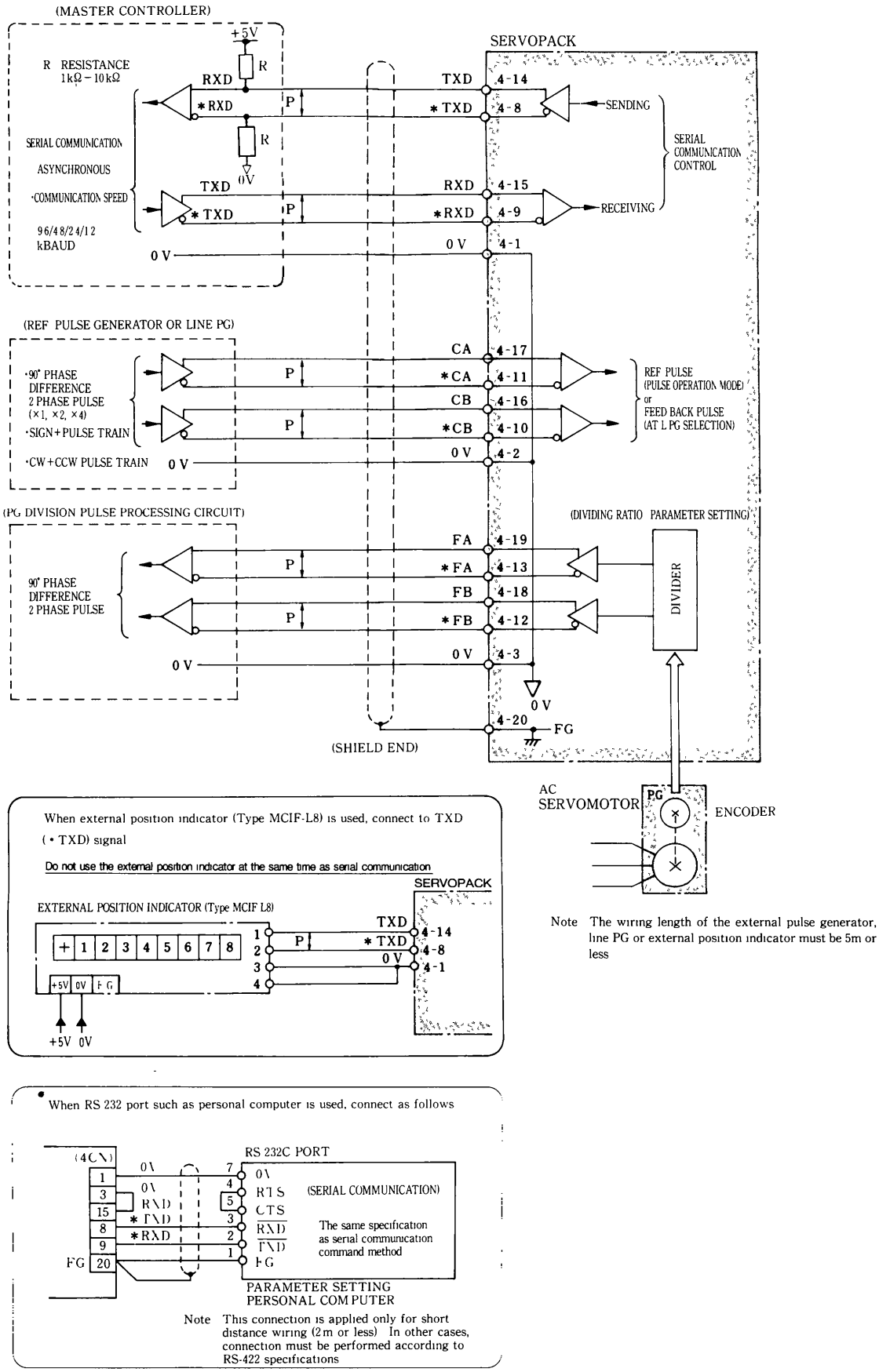
Table 5.8 shows the terminal layout of connector CN4 and Fig. 5.12 shows the wiring diagram for CN4.

Table 5.8 Connector CN4 Layout

1	2	3	4	5	6	7
0V	0V	0V	—	(+5V)	—	—
0V for (Serial communication) (Pulse train command) (PG division output) signal			—	+5V output (Pull-up resistor connection)	—	—

8	9	10	11	12	13
*TXD	*RXD	*CB	*CA	*FB	*FA
For serial communication (RS 422)		Line receiver negative side input for pulse train command		PG division output line driver negative side output	
Line driver negative side output	Line receiver negative side input	$\overline{B\phi}$ Input	$\overline{A\phi}$ Input	$\overline{B\phi}$ Output	$\overline{A\phi}$ Output

14	15	16	17	18	19	20
TXD	RXD	CB	CA	FB	FA	FG
For serial communication (RS 422)		Line receiver positive side input for pulse train command		PG division output line driver positive side output		Frame Ground (Shielding process)
Line driver positive side output	Line receiver positive side input	Bφ Input	Aφ Input	Bφ Output	Aφ Output	



Note The wiring length of the external pulse generator, line PG or external position indicator must be 5m or less

Note This connection is applied only for short distance wiring (2m or less) In other cases, connection must be performed according to RS-422 specifications

Fig. 5.12 Wiring Diagram for CN4

5.5.3 Description and Usage of I/O Signals of Connector CN4

Signal Name	Pin No.	Name		Circuit Configuration	Function
TXD	14	Data transmit signal	Positive side output	(Line driver) TXD	Data transmit signal from Servopack by serial communication with RS422 specifications When external position indicator (MCIF-L8) is used, current position data are sent When data are not sent, signal line becomes high impedance.
*TXD	8		Negative side output	*TXD	
RXD	15	Data receiving signal	Positive side input	(Line receiver) RXD	Data receiving signal from master controller (personal computer, etc.) by serial communication with RS422 specifications.
*RXD	9		Negative side input	*RXD	
0V	1	0V for signal			TXD(*TXD), RXD(*RXD), 0V for signal
CA	17	Pulse train input signal	Aφ	(Line receiver) CA	1. Reference pulse is input for positioning in external pulse train operation mode. (For pulse forms, refer to Par. 8.2 "PARAMETER 19".) 2. When line PG (refer to Par. 6.2.5 (5)), feedback pulse is input.
*CA	11		$\overline{A\phi}$	*CA	
CB	16		Bφ	(Line receiver) CB	
*CB	10		$\overline{B\phi}$	*CB	
0V	2	0V for signal			CA(*CA), CB(*CB), 0V for signal
FA	19	PG division output signal	Aφ	(Line driver) FA	PG (encoder) division output can be obtained Dividing ratio is set by parameters Refer to Par. 8.2 "Parameter 64" Note Even if motor rotating direction setting (b0 of parameter 14) is changed to 1 (rotating direction is reversed), phase relation between phases A and B is not changed.
*FA	13		$\overline{A\phi}$	*FA	
FB	18		Bφ	(Line driver) FB	
*FB	12		$\overline{B\phi}$	*FB	
0V	3	0V for signal			0V for signal FA(*FA), FB(*FB)

Note Serial data sending signal
When data are not sent, signal line becomes high impedance. Therefore, mount pull-up and pull-down resistors on the host controller data receiving section.

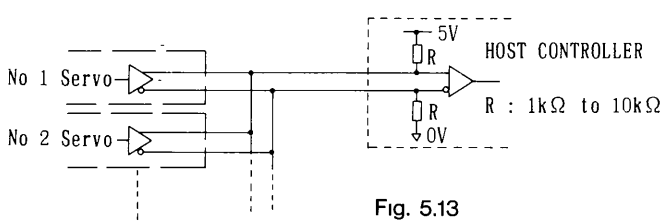


Fig. 5.13

When CACR-HR□□□UB is used on one axis and shorting pins TM-1 and TM-2 are at 2-3 side, no resistor at the host controller side is needed since pull-up and pull-down resistors are connected at Servopack side.
For multi-axis configuration, switch TM-1 and TM-2 to 1-2 side and connect pull-up and pull-down resistors in the host controller side

5.6 CONNECTOR TERMINAL (CN5) FOR I/O SIGNALS

5.6.1 Applicable Receptacle Specifications

Table 5 9 Applicable Receptacle Specifications

Specifications of Connector Used in SERVOPACK	Applicable Receptacle Type			
	Soldered Type	Caulking Type	Case	Maker
MR-50RMA Right angle 50P	MR-50F*	MRP-50F01	MR-50L*	HONDA Tsushin Co., Ltd.

* Standard attachment of Servopack

5.6.2 Connector CN5 Layout and Connection

The layout for the Servopack connector (CN5) differs partially depending on position reference method (set by parameter 15). Table 5.10 shows "Station No. Command Method", Table 5.11 shows "DG-SW Command " and Table 5.12 shows "Command Table Method". "Common I/O signal" described in Par. 5.6.3(1) can be used for serial command method.

Figs. 5.14, 5.15 and 5.16 show the wiring diagram for CN5.

Table 5.10 Connector CN5 Layout (Station No. Command Method)

Parameter 15 set value = 0

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
+24V	0_{24}V	$\overline{\text{AUT-LT}}$	$\overline{\text{MAN-LT}}$	$\overline{\text{POS1}}$	$\overline{\text{POS2}}$	$\overline{\text{ERR}}$	$\overline{\text{CUR}}$	$\overline{\text{ZRN}}$	$\overline{\text{MAN}}$	$\overline{\text{MCW}}$	$\overline{\text{MCCW}}$	$\overline{\text{DRO}}$	$\overline{\text{DR1}}$	$\overline{\text{RST}}$	$\overline{\text{CD0}}$	$\overline{\text{CD1}}$	0_{24}V
I/O 24V input	Output common 0V	Operation mode display output: Auto mode	Operation mode display output: Manual mode	Positioning complete output (COIN)	Positioning near output (NEAR)	Command error output	Current limit command input	Operation mode setting input: Zero-point return (homing) mode	Operation mode setting input: Manual mode	Manual operation command input: CW operation	Manual operation command input: CCW operation	Rotating direction select input: • No. increase direction • No decrease direction • Short-cut direction		Alarm reset input	Reference data input: 1 (1)	Reference data input: 2 (2)	0V pin for I/O 24V

		19	20	21	22	23	24	25	26	27	28	29	30	31	32
		$\overline{\text{AL0}}$	$\overline{\text{AL1}}$	$\overline{\text{AL2}}$	$\overline{\text{AL3}}$	$\overline{\text{P0}}$	$\overline{\text{CD2}}$	$\overline{\text{CD3}}$	$\overline{\text{CD4}}$	$\overline{\text{CD5}}$	$\overline{\text{CD6}}$	$\overline{\text{CD7}}$	$\overline{\text{CD8}}$	$\overline{\text{CD9}}$	$\overline{\text{CD10}}$
		Alarm code output (Binary)				Current station No data output	Ref data input								
		"1"	"2"	"4"	"8"	1	4 (4)	8 (8)	16 (10)	32 (20)	64 (40)	128 (80)	256 (100)	512 (200)	1024 (400)

33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
0_{24}V	$\overline{\text{P1}}$	$\overline{\text{P2}}$	$\overline{\text{P3}}$	$\overline{\text{P4}}$	$\overline{\text{BATALM}}$		$\overline{\text{CD11}}$			$\overline{\text{PS0}}$	$\overline{\text{PS1}}$	$\overline{\text{SP2ND}}$	$\overline{\text{SP3RD}}$	$\overline{\text{PULS}}$			FG
Output common 0V	Current station No data output: 2	4	8	16	Battery voltage low alarm output		Ref data input: 2048 (800)			Station No reading select input (P0 to P4 output control)		Speed select code input: (1st speed) to (4th speed)		Pulse operation mode selection input			Frame ground

Table 5.11 Connector CN5 Layout (DG-SW Command Method)

Parameter 15 set value = 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
+24V	0_{24}V	$\overline{\text{AUT-LT}}$	$\overline{\text{MAN-LT}}$	$\overline{\text{POS1}}$	$\overline{\text{POS2}}$	$\overline{\text{ERR}}$	$\overline{\text{CUR}}$	$\overline{\text{ZRN}}$	$\overline{\text{MAN}}$	$\overline{\text{MCW}}$	$\overline{\text{MCCW}}$			$\overline{\text{RST}}$	$\overline{\text{DSI10}}$	$\overline{\text{DSI11}}$	0_{24}V
I/O 24V input	Output common 0V	Operation mode display output		Positioning complete output (COIN)	Positioning near output (NEAR)	Command error output	Current limit command input	Operation mode setting input		Manual operation command input				Alarm reset input	Ref data input		0V pin for I/O 24V
		Auto mode	Manual mode					Zero-point return (homing) mode	Manual mode	CW operation	CCW operation				1	2	

	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	$\overline{\text{AL0}}$	$\overline{\text{AL1}}$	$\overline{\text{AL2}}$	$\overline{\text{AL3}}$	$\overline{\text{DS00}}$	$\overline{\text{DSI12}}$	$\overline{\text{DSI13}}$	$\overline{\text{DSI14}}$	$\overline{\text{DSI15}}$	$\overline{\text{DSI16}}$	$\overline{\text{DSI17}}$	$\overline{\text{DSI20}}$	$\overline{\text{DSI21}}$	$\overline{\text{DSI22}}$
	Alarm code output (Binary)				Data strobe output	Position ref data input						Speed ref. data input		
	"1"	"2"	"4"	"8"	1 (LSB)*	4	8	1	2	4	8	1	2	4

33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
0_{24}V	$\overline{\text{DS01}}$	$\overline{\text{DS02}}$	$\overline{\text{DS03}}$	$\overline{\text{DS04}}$	$\overline{\text{BATALM}}$		$\overline{\text{DSI23}}$	$\overline{\text{DSI24}}$	$\overline{\text{DSI25}}$	$\overline{\text{DSI26}}$	$\overline{\text{DSI27}}$	$\overline{\text{SP2ND}}$	$\overline{\text{SP3RD}}$	$\overline{\text{PULS}}$	$\overline{\text{LPG}}$		FG
Output common 0V	Data strobe output				Battery voltage low alarm output		Speed ref. data input					Speed select code input		Pulse operation mode selection input	Line PG select input		Frame ground
	2	3	4 (MSD)†	(Sign)			8	1	2	4	8	(1st speed) to (4th speed)					

*LSD : Least Significant Digit
†MSD : Most Significant Digit

Table 5.12 Connector CN5 Layout (Command Table Method)

Parameter 15 set value = 4

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
+24V	0_{24}V	$\overline{\text{AUT-LT}}$	$\overline{\text{MAN-LT}}$	$\overline{\text{POS1}}$	$\overline{\text{POS2}}$	$\overline{\text{ERR}}$	$\overline{\text{CUR}}$	$\overline{\text{ZRN}}$	$\overline{\text{MAN}}$	$\overline{\text{MCW}}$	$\overline{\text{MCCW}}$			$\overline{\text{RST}}$	$\overline{\text{CD0}}$	$\overline{\text{CD1}}$	0_{24}V
I/O 24V input	Output common 0V	Operation mode display output		Positioning complete output (COIN)	Positioning near output (NEAR)	Command error output	Current limit command input	Operation mode setting input		Manual operation command input				Alarm reset input	Ref. data input		0V pin for I/O 24V
		Auto mode	Manual mode					Zero-point return mode	Manual mode	CW operation	CCW operation				1	2	

	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	$\overline{\text{AL0}}$	$\overline{\text{AL1}}$	$\overline{\text{AL2}}$	$\overline{\text{AL3}}$	$\overline{\text{PO}}$	$\overline{\text{CD2}}$	$\overline{\text{CD3}}$	$\overline{\text{CD4}}$	$\overline{\text{CD5}}$					
	Alarm code output (Binary)				Zone signal output	Ref. data input								
	"1"	"2"	"4"	"8"	1	4	8	16	32					

33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
0_{24}V	$\overline{\text{P1}}$	$\overline{\text{P2}}$	$\overline{\text{P3}}$	$\overline{\text{P4}}$	$\overline{\text{BATALM}}$							$\overline{\text{SP2ND}}$	$\overline{\text{SP3RD}}$	$\overline{\text{PULS}}$			FG
Output common 0V	Zone signal output				Battery voltage low alarm output							Speed select code input		Pulse operation mode selection input			Frame ground
	2	3	8	16								(1st speed) to (4th speed)					

• Wiring Diagram for CN5 (Station No. Command Method)

Parameter 15 set value = 0

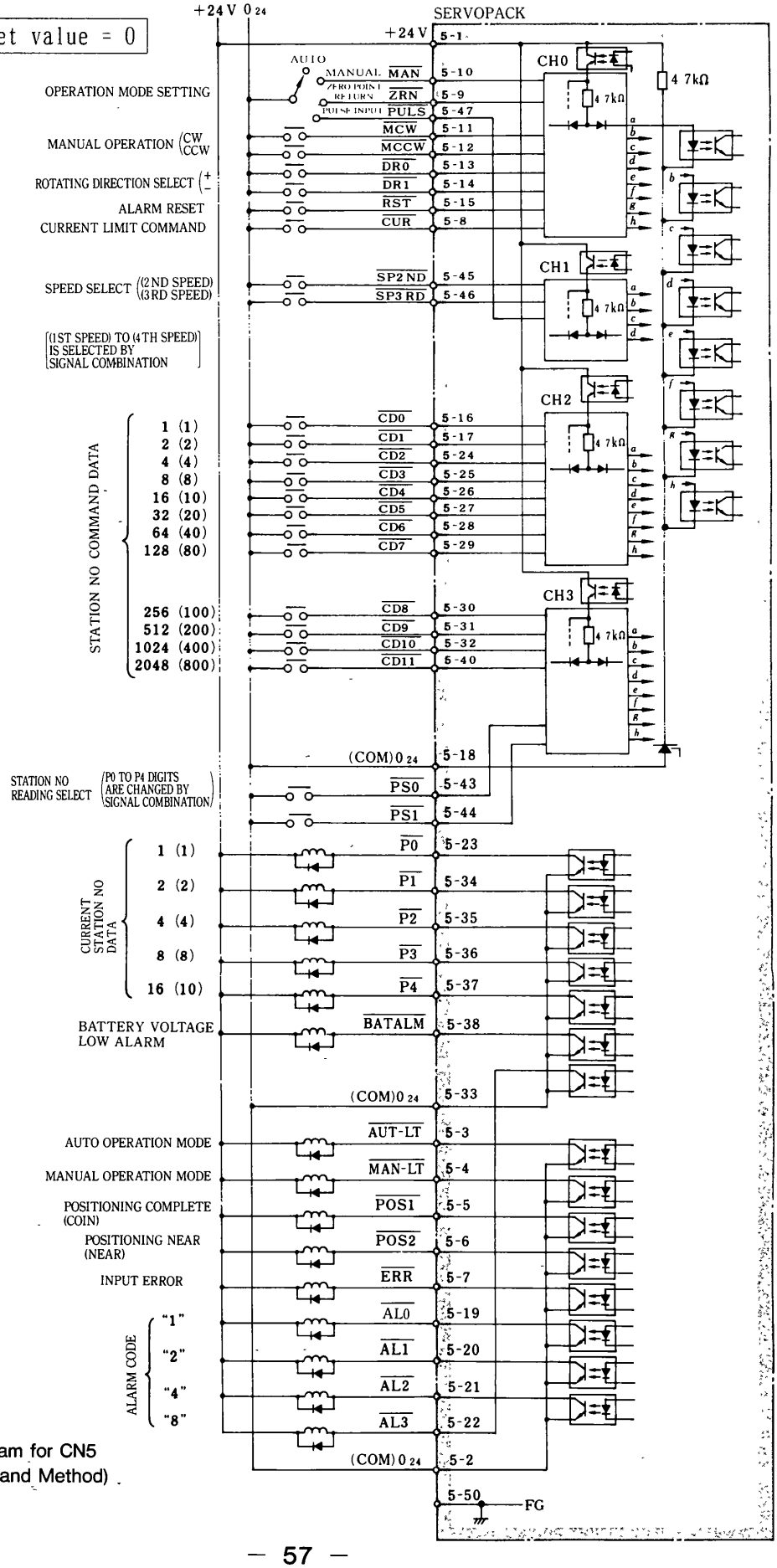


Fig. 5.14 Wiring Diagram for CN5 (Station No. Command Method)

• Wiring Diagram for CN5 (DG-SW Command Method)

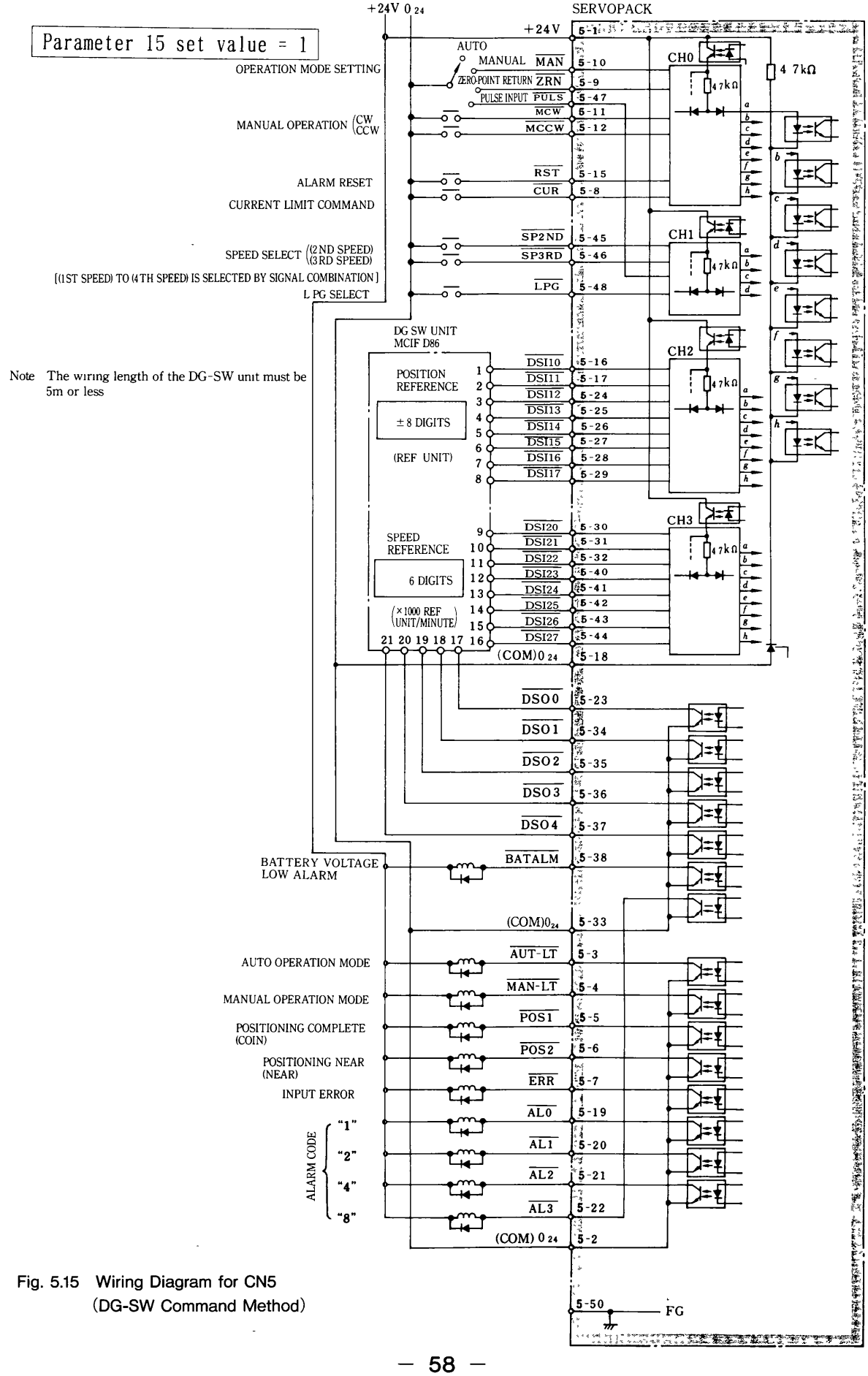


Fig. 5.15 Wiring Diagram for CN5 (DG-SW Command Method)

• Wiring Diagram for CN5 (Command Table Method)

Parameter 15 set value = 4

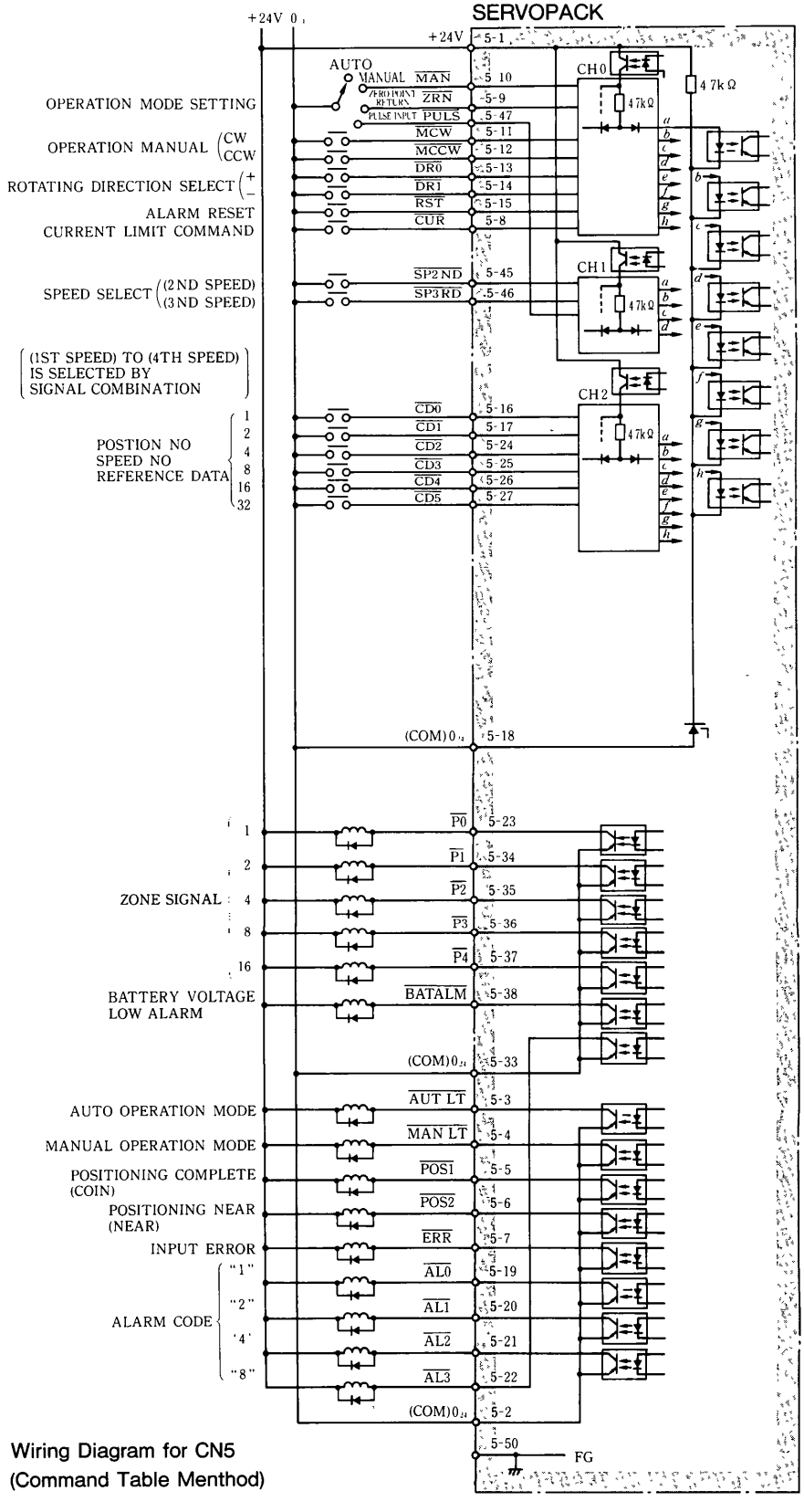


Fig. 5.16 Wiring Diagram for CN5 (Command Table Menthod)

5.6.3 Description and Usage of I/O Signals of Connector CN5

(1) Common I/O signals: Can be used regardless of position reference method (set by parameter 15), including serial command method.

• Output Signals

Signal Name	Pin No.	Name		Effective logic	Function
$\overline{AL0}$	19	Servo Alarm Code Output* (1, 2, 4, 8)			Outputs the contents in binary when an alarm occurs (ALM signal = H level) or an error occurs ($\overline{ERR}$ signal = L level). (Refer to Par. 6.4.2 (9).)
$\overline{AL1}$	20				
$\overline{AL2}$	21				
$\overline{AL3}$	22				
$\overline{ERR}$	7	Error Output			Outputs if contact reference data error or malfunction during motor applied with current. Does not operate when $\overline{ERR}$ signal is operating (L level).
$\overline{POS1}$	5	Positioning Complete Output (COIN)			Outputs with | current position − aimed position | ≦ parameter 6 set value. (Refer to Par. 8.2, "Parameter 6".)
$\overline{POS2}$	6	Positioning Near Output (NEAR)			Outputs with | current position − aimed position | ≦ parameter 45 set value. (Refer to Par. 8.2, "Parameter 45".)
$\overline{AUT\text{-}LT}$	3	Operation Mode Display Output	Auto		Outputs when "auto operation mode" is set during servo ON Status.
$\overline{MAN\text{-}LT}$	4		Manual		Outputs when "manual operation mode" is set during servo ON Status.
$\overline{BATALM}$	38	Battery Voltage Low Alarm			Detects and outputs when battery voltage provided on the panel is low (only at power supply turned ON).

Signal Name	$\overline{AL0}$	$\overline{AL1}$	$\overline{AL2}$	$\overline{AL3}$
Binary	1	2	4	8

* In the station No. command method (parameter 15 set value = 0), by setting parameter 20 b6=1 and parameter 66 b4=1, current data (station No.) output signals (P5 to P8) are enabled.

• Input Signals

Signal Name	Pin No.	Name		Effective Logic	Function
$\overline{ZRN}$	9	Operation Mode Setting Input	Zero-Point Return (Homing)	Operation mode is determined by combination of three types of signals H or L level setting described on the left.	$\overline{ZRN}$ / $\overline{MAN}$ / $\overline{PULS}$ / Operation Mode H / H / H : Auto H / L / H : Manual L / H / H : Zero-point return (homing) H / H / L : Pulse
$\overline{MAN}$	10		Auto/ Manual		
$\overline{PULS}$	47		Pulse Operation		
$\overline{MCW}$	11	Manual Operation Command	Motor Reverse Direction	⌐	Signal becomes effective in manual operation mode setting. Operation can be performed only while this signal is turned ON. Motor reverse direction command
$\overline{MCCW}$	12		Motor Forward Direction		Motor forward direction command
$\overline{RST}$	15	Alarm Reset		⌐	Resets alarm status. Check the alarm contents before turning on this signal.
$\overline{SP2ND}$	45	Speed Select Signal	2nd Speed	Selects parameter setting (1st speed) to (4th speed) reference speed.	$\overline{SP2ND}$ / $\overline{SP3RD}$ / Auto/Manual Operation Mode: Parameter No. (Contents) / Pulse Operation Mode: Input pulse maltiplication H / H / 4 (1st speed) / × 1 L / H / 31 (2nd speed) / × 10 H / L / 32 (3rd speed) / ×100 L / L / 33 (4th speed) / × 1
$\overline{SP3RD}$	46		3rd Speed		
$\overline{CUR}$	8	Current Limit Command		⌐	Motor current is limited with current value set by parameter by turning ON this signal.
$\overline{LPG}$	48	Line PG Select Input		⌐	Signal used for line PG. Feedback system is switched to line PG by turning ON this signal.

5

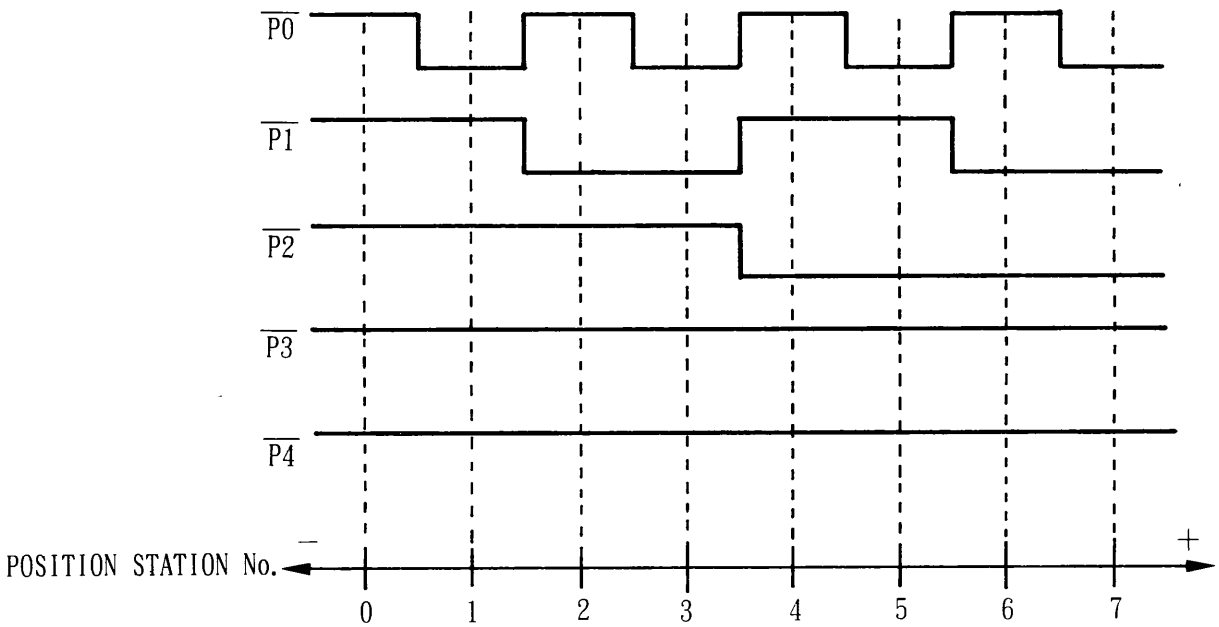
(2) Reference data signal for Station No. reference method
(Parameter 15 Set Value = 0)

Signal Name	Pin No.	Name	Effective Logic	Function
$\overline{DRO}$	13	Rotating Direction Select Input +	Rotating direction is set by signal combination.	$\overline{DRO}$ / $\overline{DR1}$: H H — Absolute Mode: Short-cut direction; Incremental Mode: (Error) L H — Absolute Mode: Station No. increase direction; Incremental Mode: Station No. increase direction H L — Absolute Mode: Station No. decrease direction; Incremental Mode: Station No. decrease direction L L — Absolute Mode: (Error); Incremental Mode: (Error) Absolute/incremental modes are set by parameter 14 b3.
$\overline{DR1}$	14	−		
$\overline{CD0}$	16	Station No. Reference Data	⌐	BCD setting (0 to 999): 1, 2, 4, 8, 10, 20, 40, 80, 100, 200, 400, 800 Binary setting (0 to 4095): 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048 BCD/binary are selected by parameter setting (14 b4).
$\overline{CD1}$	17			
$\overline{CD2}$	24			
$\overline{CD3}$	25			
$\overline{CD4}$	26			
$\overline{CD5}$	27			
$\overline{CD6}$	28			
$\overline{CD7}$	29			
$\overline{CD8}$	30			
$\overline{CD9}$	31			
$\overline{CD10}$	32			
$\overline{CD11}$	40			
$\overline{PS0}$	43	Station No. Read-out Select Input	Reads out current station No. data output ($\overline{P0}$ to $\overline{P4}$) by signal combination.	$\overline{PS0}$ / $\overline{PS1}$: H H — H L — L H — L L
$\overline{PS1}$	44			
$\overline{P0}$	23	Current Station No. Data Output	⌐	(BCD) (BINARY): 1 1 — 1 1 — 10 16 — 100 256 2 2 — 2 2 — 20 32 — 200 512 4 4 — 4 4 — 40 64 — 400 1024 8 8 — 8 8 — 80 128 — 800 2048 10 16 — Parity — Parity — Parity
$\overline{P1}$	34			
$\overline{P2}$	35			
$\overline{P3}$	36			
$\overline{P4}$	37			

Notes: 1. Parity outputs so that number of low level of $\overline{P0}$ to $\overline{P4}$ becomes odd number.

2. Current station No. data output is a coded output as in the following example.

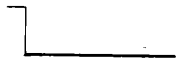
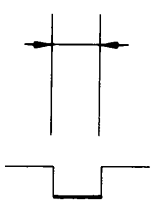
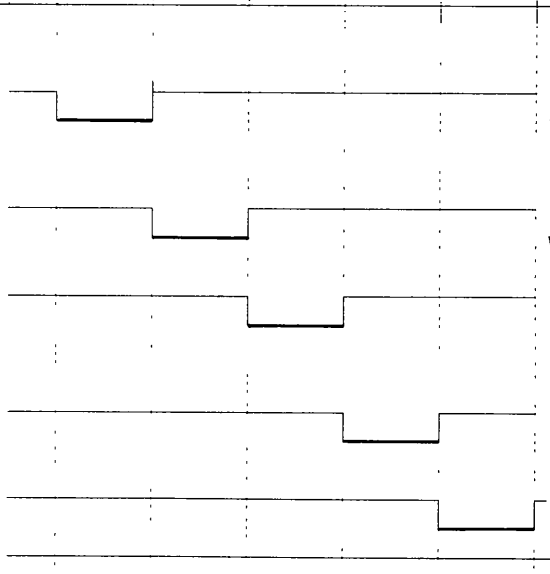
when : $\overline{PS0}$ = H, $\overline{PS1}$ = H, parameter 14 b4 = 0



3. If motor stops at a position between two stations, the nearer station No. is output.

4. During motor rotation, current station No. data output is unstable.

(3) Reference data signal for DG-SW reference method
(Parameter 15 Set Value = 1)

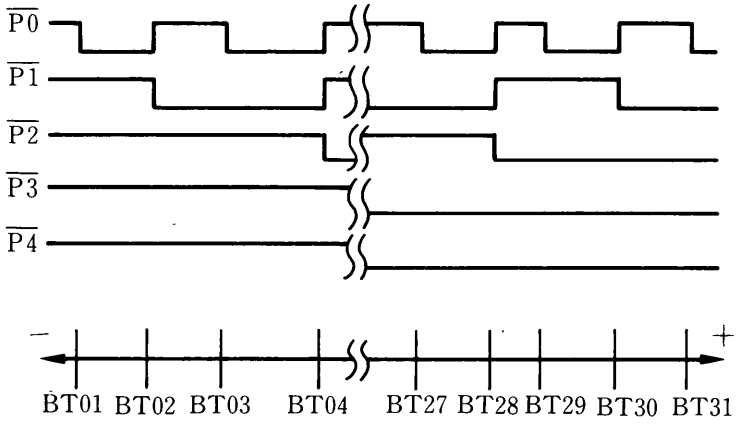
Signal Name	Pin No.	Name	Effective Logic	Function
$\overline{DSI10}$	16	Position Ref. Data Input		1 2 4 8 : 10^0 10^2 10^4 10^6 digit; + / − ; BCD Selected by data strobe output described below is input by 2 digits.
$\overline{DSI11}$	17			
$\overline{DSI12}$	24			
$\overline{DSI13}$	25			
$\overline{DSI14}$	26			1 2 4 8 : 10^1 10^3 10^5 10^7 digit
$\overline{DSI15}$	27			
$\overline{DSI16}$	28			
$\overline{DSI17}$	29			
$\overline{DSI20}$	30	Speed Ref. Data Input		1 2 4 8 : 10^0 10^2 10^4 digit
$\overline{DSI21}$	31			
$\overline{DSI22}$	32			
$\overline{DSI23}$	40			
$\overline{DSI24}$	41			1 2 4 8 : 10^1 10^3 10^5 digit
$\overline{DSI25}$	42			
$\overline{DSI26}$	43			
$\overline{DSI27}$	44			
$\overline{DSO0}$	23	Data Strobe Output	Read-in time for one digit can be set by parameter 77. (Normally, it is set to 24ms.) 24ms to 2000ms 	 Data strobe is output in order by any pulse width. It takes 5 times of pulse width to read-in all digits.
$\overline{DSO1}$	34			
$\overline{DSO2}$	35			
$\overline{DSO3}$	36			
$\overline{DSO4}$	37			

(4) Reference data signal for command table method
(Parameter 15 set Value = 4)

Signal Name	Pin No.	Name	Effective Logic		Function
$\overline{CD0}$	16	Position No., Speed No., Reference Data Input		1	Specifies position No. and speed No. in $\overline{CD0}$ to $\overline{CD5}$ codes. Specifies 64 when all $\overline{CD0}$ to $\overline{CD5}$ codes are OFF(H). Set parameter 14 b4=0 since $\overline{CD0}$ to $\overline{CD5}$ are effective only in binary setting.
$\overline{CD1}$	17			2	
$\overline{CD2}$	24			4	
$\overline{CD3}$	25			8	
$\overline{CD4}$	26			16	
$\overline{CD5}$	27			32	
$\overline{P0}$	23	Zone Signal Output		1	Output only when parameter 20 b5=1 and parameter 65 b0=1 are set.
$\overline{P1}$	34			2	
$\overline{P2}$	35			4	
$\overline{P3}$	36			8	
$\overline{P4}$	37			16	

Notes

1. Zone signals are coded output as shown below. (It is safe to read in the data during stop because of coded output.)



2. Boundary positions of BT1 to BT31 are set by serial command. Positions must be arranged in the order as shown above.

3. It takes 40ms maximum from boundary position passing to zone signal change.

4. Even if the number of boundary positions to be set is less than 31, keep the order from BT1 to BT31. (Set so as to be BTn value $\leqq$ BT_{n+1} value.)

5.7 POWER SUPPLY CONNECTION

5.7.1 Power Supply ON/OFF

For main circuit power supply (R, S, T) or control power supply (r, t) to turn ON in sequence, they are turned ON simultaneously or the control power supply is turned ON before the main circuit power supply. (See Figs. 5.17 and 5.18.)

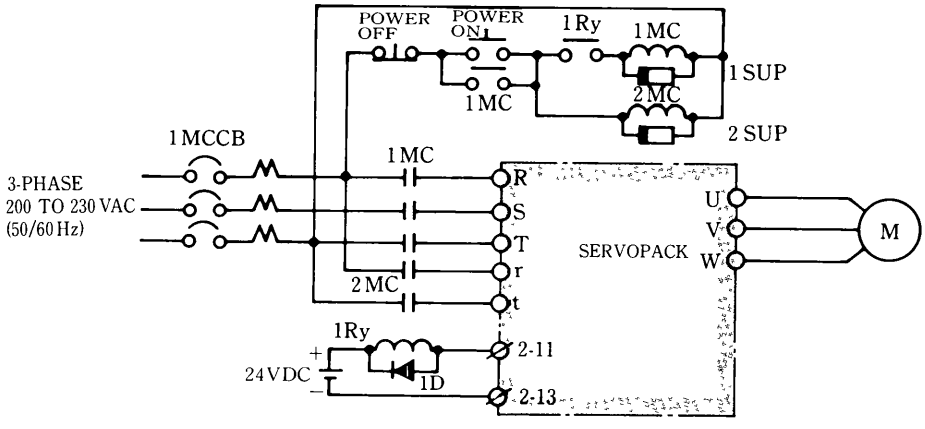


Fig. 5.17 Typical Connection when Both Control Power Supply and Main Power Supply are Turned ON/OFF Simultaneously

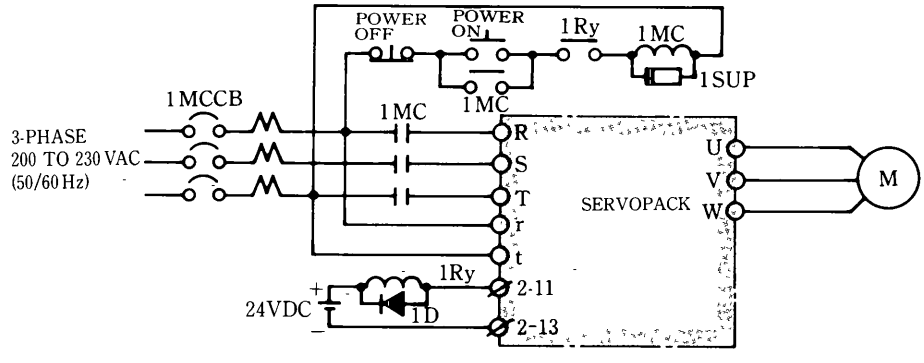


Fig. 5.18 Typical Connection when only Main Circuit Power Supply is Turned ON/OFF

Note: 1SUP, 2SUP: Surge suppressor
CR50500BA (made by OKAYA ELECTRIC INDUSTRIES Co., Ltd.) or equivalent
1D: Flywheel diode (to prevent Ry spikes)

For power supply to turn OFF in sequence, both power supplies are turned OFF simultaneously (including momentary power loss) (Fig. 5. 17) or the main circuit power supply is turned OFF before the control power supply (Fig. 5. 18).

(Precautions for Figs. 5. 17 and 5. 18)

- Main circuit power supply must be turned OFF by SERVO ALARM signal.
  (If the control supply is also turned OFF, LED which indicates the servo alarms also goes out.)
- In power supply ON-OFF sequence in Fig. 5. 17, it takes approx. 1 second at maximum to establish a normal signal in the control circuit (1Ry is turned on).

Note : Because of initializing the Servopack, SERVO ALARM signal is output for approx. 1 second at maximum (typical 200 to 300ms) when the control power supply is turned ON.

Therefore, hold POWER ON signal for more than 1 second.

However, in the sequence in Fig. 5. 18, it is not necessary since the control power supply is always turned ON.

- Since Servopack is of capacitor input type, large charging current (charging time is 0. 5 second) is applied when the main circuit power supply is turned ON. Therefore, frequent switching of power supply will result in deterioration of the main circuit elements which may cause unexpected trouble.
  (Motor operation start/stop must be performed by turning operation signal ON-OFF. Do not use the power supply ON-OFF.)
- Turn ON or OFF Servopack power supply in SERVO OFF state to prevent trouble at transition.

5.7.2 Power Supply Line Protection

Circuit breakers (MCCB) or fuses must be used to protect the power-supply lines to the SERVOPACK. Select the breakers or fuses based on the number of SERVOPACKs and their ratings. (Refer to Table 5.13)

Do not use fast-blow fuses because the in-rush current will destroy them.

Table 5.13 Power Supply Capacity and MCCB or Fuse Capacity

Servopack Type CACR-	Power Supply *1 Capacity per Servopack (kVA)	Power Supply *2 Capacity per MCCB or Fuse (A)
HR03UB	0.65	5
HR05UB	1.1	5
HR10UB	2.1	8
HR15UB	3.1	10
HR20UB	4.1	12
HR30UB	6.0	18
HR44UB	8.0	24

*1 : Values at rated load

*2 : Breaking characteristic (25℃) : 200% 2s or more, 700% 0.01s or more

Note : Use a high-speed type of earth leakage circuit breaker. (Time-delay type is not adjustable.)

5.8 WIRE SIZES

The wire sizes and types are shown in Table 5.13.

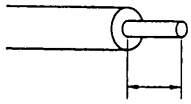


Table 5.13 Wire Size

Circuit	Model CACR-HR	Terminal Symbol	Torque † Values N•m	75℃ Copper Wire Range AWG	75℃ Copper Wire Range mm²	Wire Type
On-line	03UB	R, S, T (Y3, Y4, Y5)	1.2	14-10	2-5.5	Power Cable: 600V vinyl sheathed lead or equivalent
		U, V, W	1.2	14-10	2-5.5	
		r, t	1.2	14-10	2-5.5	
		⏚	1.2	12-10	3.5-5.5	
	05UB	R, S, T (Y3, Y4, Y5)	1.2	14-10	2-5.5	
		U, V, W	1.2	14-10	2-5.5	
		r, t	1.2	14-10	2-5.5	
		⏚	1.2	12-10	3.5-5.5	
	10UB	R, S, T (Y3, Y4, Y5)	1.2	14-10	2-5.5	
		U, V, W	1.2	14-10	2-5.5	
		r, t	1.2	14-10	2-5.5	
		⏚	1.2	12-10	3.5-5.5	
	15UB	R, S, T (Y3, Y4, Y5)	1.2	14-10	2-5.5	
		U, V, W	1.2	14-10	2-5.5	
		r, t	1.2	14-10	2-5.5	
		⏚	1.2	12-10	3.5-5.5	
	20UB	R, S, T (Y3, Y4, Y5)	1.2	14-10	2-5.5	
		U, V, W	1.2	10	5.5	
		r, t	1.2	14-10	2-5.5	
		⏚	1.2	12-10	3.5-5.5	
	30UB	R, S, T (Y3, Y4, Y5)	1.2	12-10	3.5-5.5	
		U, V, W	1.2	10	5.5	
		r, t	1.2	14-10	2-5.5	
		⏚	1.2	10	5.5	
	44UB	R, S, T (Y3, Y4, Y5)	1.2	8	8	
		U, V, W	1.2	8	8	
		r, t	1.2	14-10	2-5.5	
		⏚	1.2	10	5.5	
Off-line	Common to All models					*Wire with Class 1 Wiring

* Twisted pair cable or twisted pair totally shielded cable
Core cable 0.2mm or more, plated soft steel twisted cable
Finished dimensions : CN2 16DIA or less
CN3 11DIA or less

† 1.80 N•m max

IMPORTANT

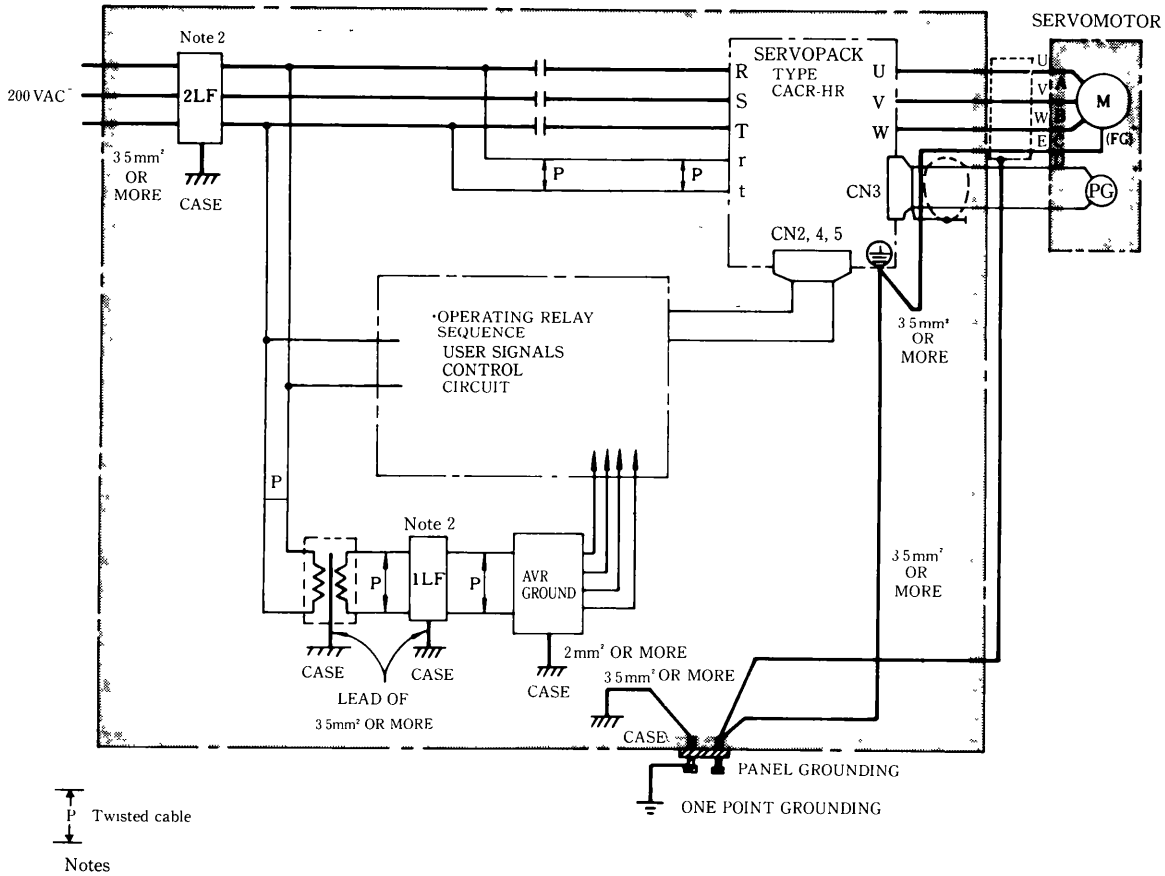
Lead size should be determined considering voltage drop of leads.

5.9 NOISE CONTROL

Servopack uses power transistors in the main circuit. When these transistors are switched, the effect of di/dt or dv/dt (switching noise) may sometimes occur depending on the wiring or grounding method.

The Servopack incorporates CPU. This requires wiring and treatment to prevent noise interference. The recommended wiring and grounding for reducing switching noise are shown in Fig. 5.19

(1) Grounding method



Notes
1 Use wires of 3.5mm² or more for grounding to the case (preferably flat-woven copper wire)
2 Connect line filters observing the precautions as shown in (2) Noise filter installation

Fig. 5.19 Grounding Method

• Motor frame grounding

When the motor is at the machine side and grounded through the frame, Cf dv/dt current flows from the PWM power through the stray capacity of the motor. To prevent this effect of current, motor ground terminal Ⓓ (motor frame) should be connected to terminal ⏚ of Servopack.
(Terminal ⏚ of Servopack should be directly grounded.)

• Metallic Conduit Grounding

When motor wiring is in a metallic conduit, ground the conduit and the terminal box. Perform the following grounding procedures at one point.

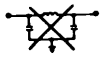
(2) Noise filter installation

When noise filters are installed to prevent noise from the power line, the block type must be used. The recommended noise filter is shown in Table 5.17. The power supply to peripherals also needs noise filters.

Note

If the noise filter connection is wrong, the effect decreases greatly. Observing the precautions, carefully connect them as shown in Figs. 5.20 to 5.23.

Table 5.17 Recommended Noise Filter

SERVOPACK Type CACR-	Applicable Noise Filter	Recommended Noise Filter	
		Type	Specifications
HR03UB HR05UB	(CORRECT) 	LF-305	Three-phase 200VAC class, 5A
HR10UB HR15UB		LF-315	Three-phase 200VAC class, 15A
HR20UB	(WRONG)	LF-320	Three-phase 200VAC class, 20A
HR30UB		LF-330	Three-phase 200VAC class, 30A
HR44UB		LF-340	Three-phase 200VAC class, 40A

Note: Noise filter made by Tokin Corp.

5.9 NOISE CONTROL (Cont'd)

(a) Separate the input leads from the output. Do not bundle or run them in the same duct.

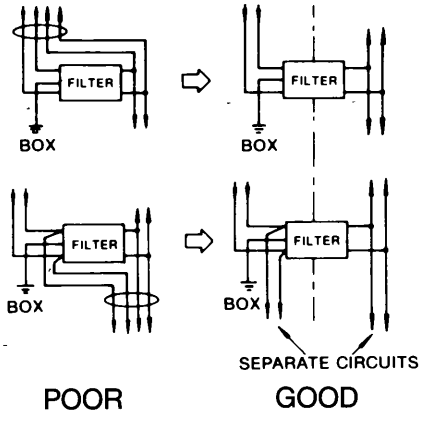


Fig. 5.20

(b) Do not bundle the ground lead with the filter output line or other signal lines or run them in the same duct.

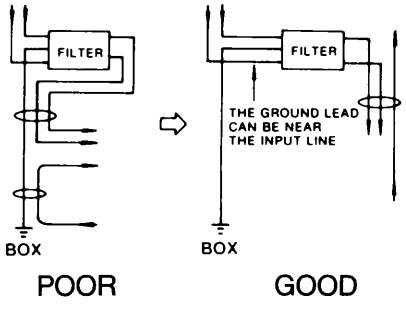


Fig. 5.21

(c) Connect the ground lead singly to the box or the ground panel.

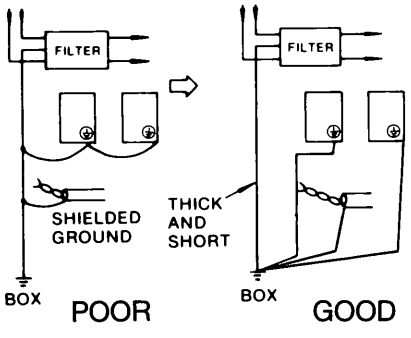


Fig. 5.22

(d) The filter on the control panel is required to ground to the equipment ground terminal.

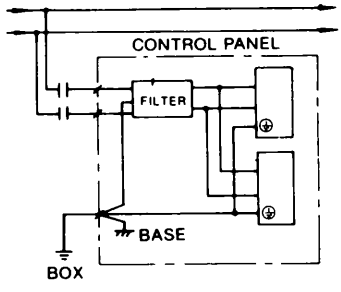


Fig. 5.23

(3) Serial communication line noise preventive action

When personal computers, etc. are used as master controllers, insert troidal core (ESD-RB series by Tokin Corp. or equivalent) in the input section as a noise preventive action.

Take some noise preventive action (such as insertion of a line filter) in the power supply lines.

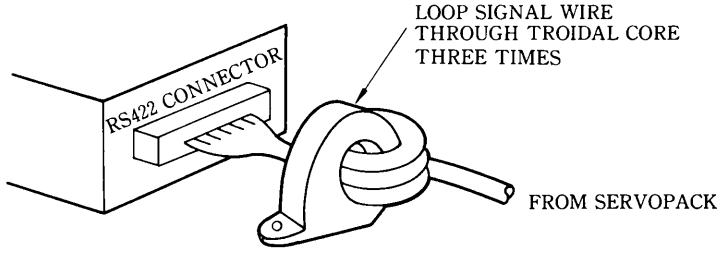


Fig. 5.24

6 I/O SIGNAL OPERATION AND FUNCTIONS

6.1 OPERATION AND FUNCTIONS OF CN2 INPUT SIGNAL

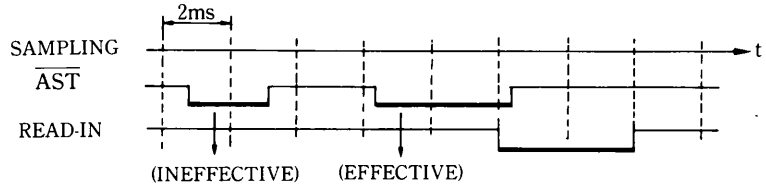
6.1.1 Signal Timing

• $\overline{\text{SVON}}$, $\overline{\text{AST}}$, STOP, N-OT, P-OG, DEC, $\overline{\text{PCON}}$

These signals are sampled every 2ms and read-in whenever the same levels are continued more than two times. (2 to 4ms filter)

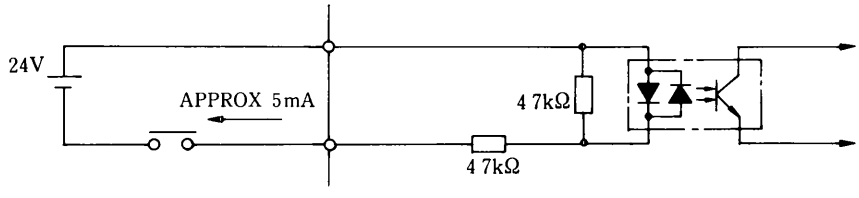
It is necessary to hold more than 5ms to be effective.

Example of AST Signal



• Since STP signal has a small filter, the above example is not applied.

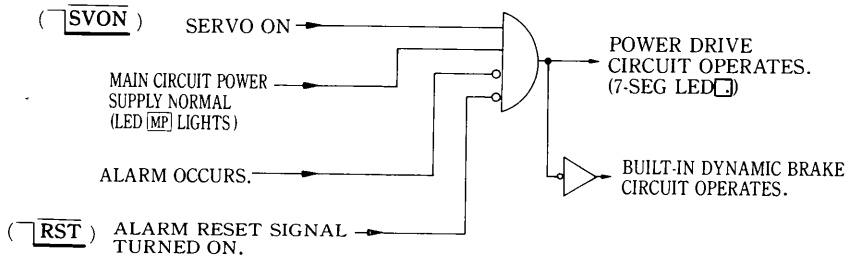
6.1.2 Input Circuit (Refer to Fig. 5.7 for Connection.)



6.1.3 Signal Operation and Functions

(1) Servo ON [$\overline{\text{SVON}}$]

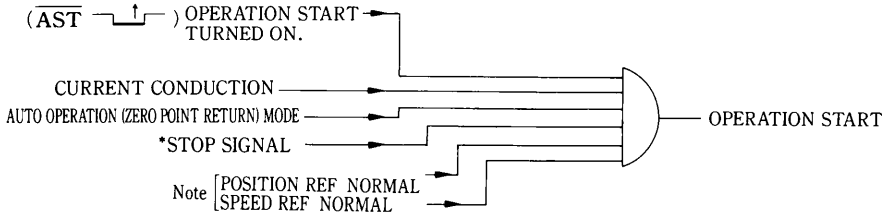
By turning ON this signal, Servopack main circuit power drive circuit operates according to the following conditions and the motor is applied with current.



(2) Operation start [$\overline{\text{AST}}$]

① Operation start signal in automatic operation mode or zero-point return (homing) mode. 5ms or more pulse width required.

② $\overline{\text{AST}}$ signal becomes effective when the following conditions are satisfied and operation is started by signal rising edge.



Notes:

- Position reference not normal: when reference data exceed software overtravel value (refer to Par. 8.3 "Parameters 40, 41").
- Speed reference not normal : when data exceed speed limit value (refer to Par. 8.3 "Parameter 46").

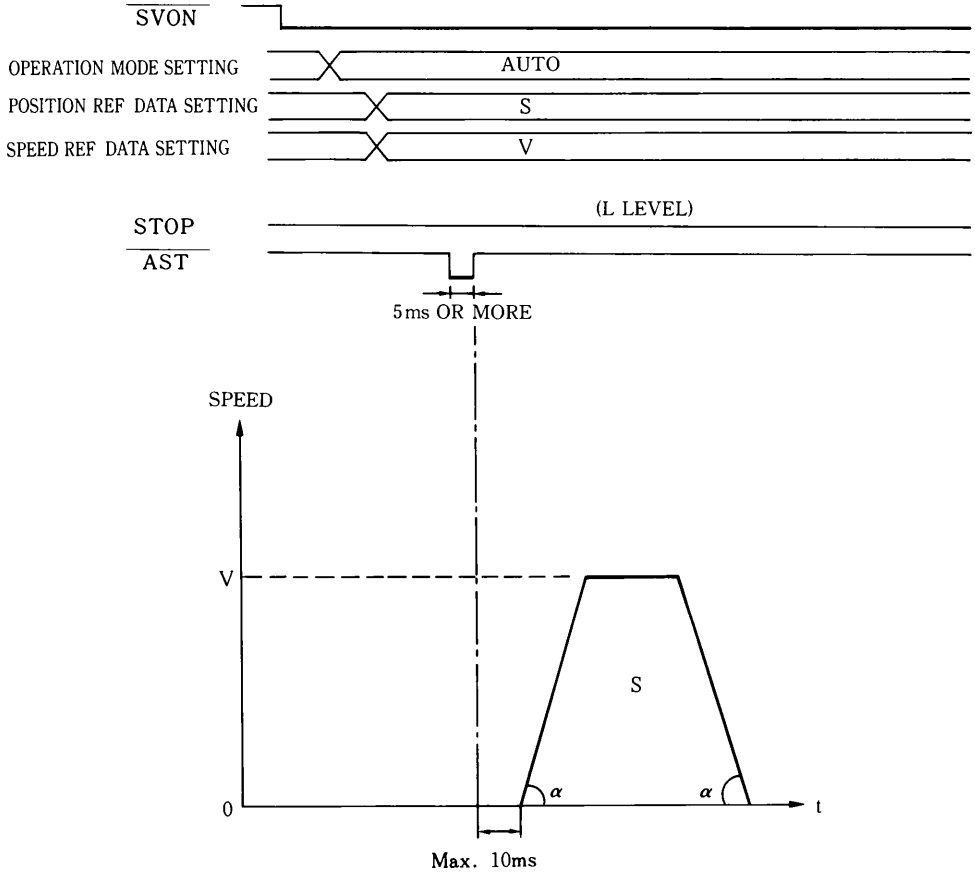
* The STOP signal is active when contact is open.

In the above cases, an error occurs by turning $\overline{\text{AST}}$ signal ON and operation does not start. Instead, ERR signal (refer to Par. 6.3.2 (3)) is output.

③ When $\overline{\text{AST}}$ signal is not accepted (disregarded):

- Motor is moving.
- Motor is not under current conduction.
- Automatic operation mode or zero-point return (homing) mode is not selected.

④ Timing chart



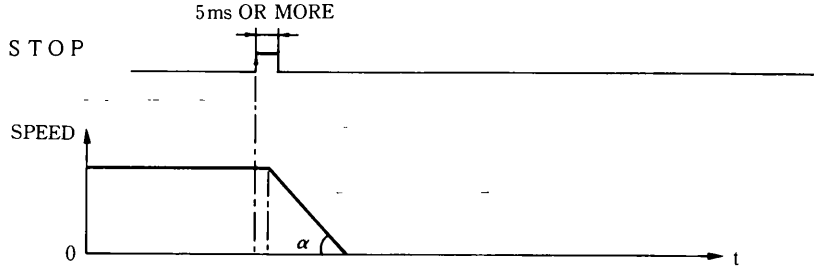
(α is accel/decel rate and set by parameter)

6.1.3 Signal Operation and Functions (Cont'd)

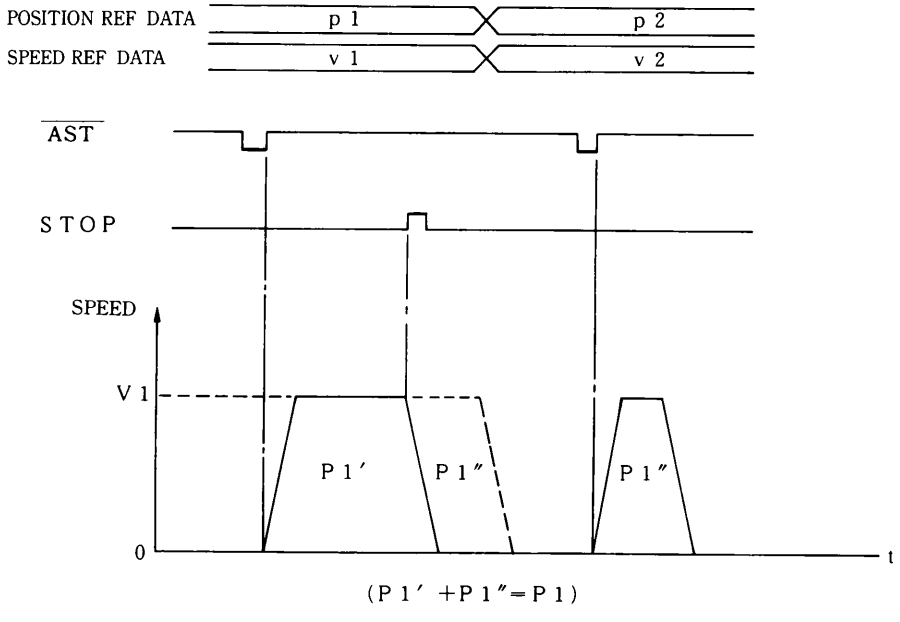
(3) Temporary stop [STOP]

① Temporary stop reference in automatic operation mode or zero-point return (homing) mode. 5ms more than pulse width is required.

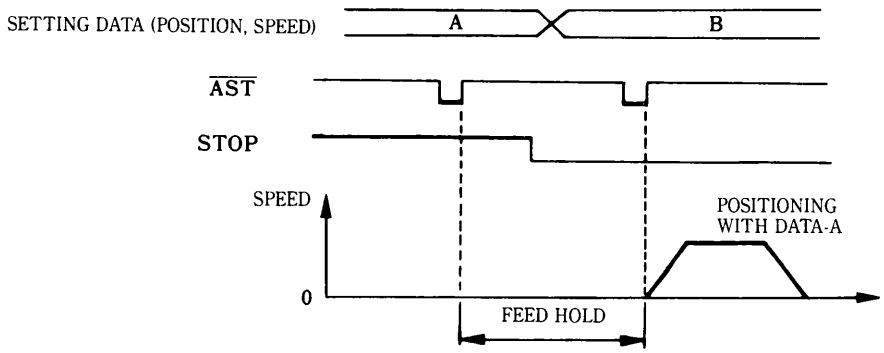
② If STOP signal is turned on during operation, it is detected by the signal rising edge and deceleration to a stop is performed at parameter set speed.



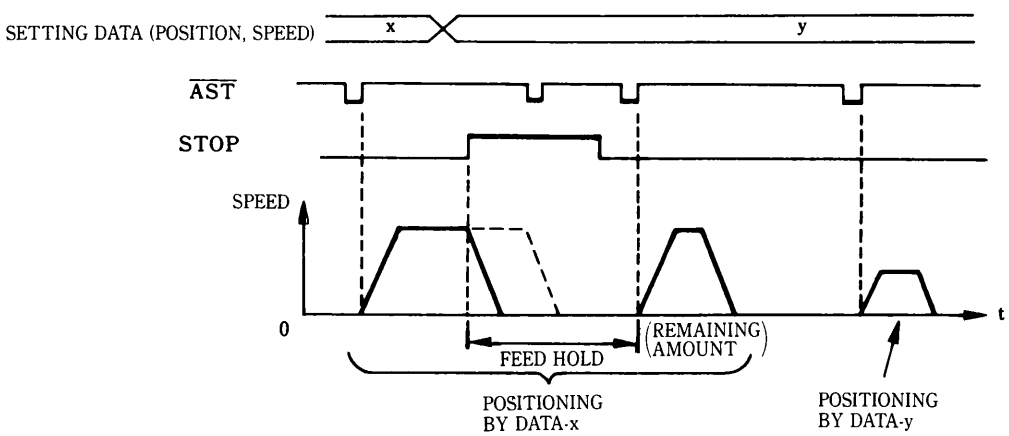
③ STOP signal contains feed hold function. That is, when position reference data are not discharged completely and operation stops after STOP signal is turned on, if $\overline{AST}$ signal is turned on, aimed position and feeding speed will be processed with the former data. (Remaining positioning)



④ Feed hold functions when $\overline{\text{AST}}$ signal is turned ON with STOP signal turned ON.



⑤ Typical operation with STOP signal



⑥ Feed hold release

- After $\overline{\text{AST}}$ signal is turned ON when STOP signal is OFF.
- Operation mode is switched.
- Baseblocking (current is not applied to motor.)

⑦ When STOP signal input remains open, stop status continues. Therefore, when STOP signal is not used, set parameter 19 b1 = 1.

6.1.3 Signal Operation and Functions (Cont'd)

(4) Overtravel LS (P-OT, N-OT)

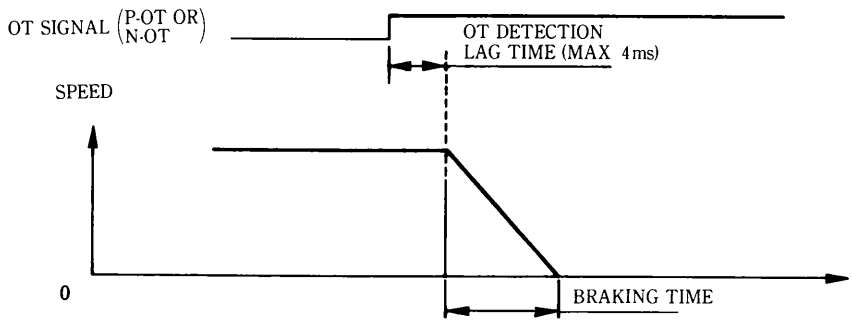
① When P or N-OT signal operates, speed reference in the moving direction is forced to be 0. (Motor stops at maximum deceleration rate during operation.)

② Relation between reference direction, motor rotating direction and P-OT or N-OT signal.

Parameter 14b0	Reference Direction (Ref Data Polarity)	Motor Rotating Direction	Effective OT Signal
0 (Standard)	+	Forward(CCW)	P-OT
	−	Reverse(CW)	N-OT
1 (Reverse Connection)	+	Reverse(CW)	P-OT
	−	Forward(CCW)	N-OT

③ When P-OT and N-OT signal are not used, set parameter 19 b0 = 1.

④ After P-OT or N-OT signal is detected, there is a 4ms lag time at maximum until braking is actually applied. Additionally, there is a braking time until stop. When LS is set, these points must be considered.



(5) LS related to zero-point return (homing) [DEC, STP]

Refer to the zero-point return (homing) mode described in Par. 6.2.3 (1)(d).

(6) Proportional operation reference [$\overline{\text{PCON}}$]

Speed loop control mode is changed from PI operation to P operation by turning ON this signal, and servo rigidity is reduced.

6.2 OPERATION AND FUNCTIONS OF CN5 INPUT SIGNAL

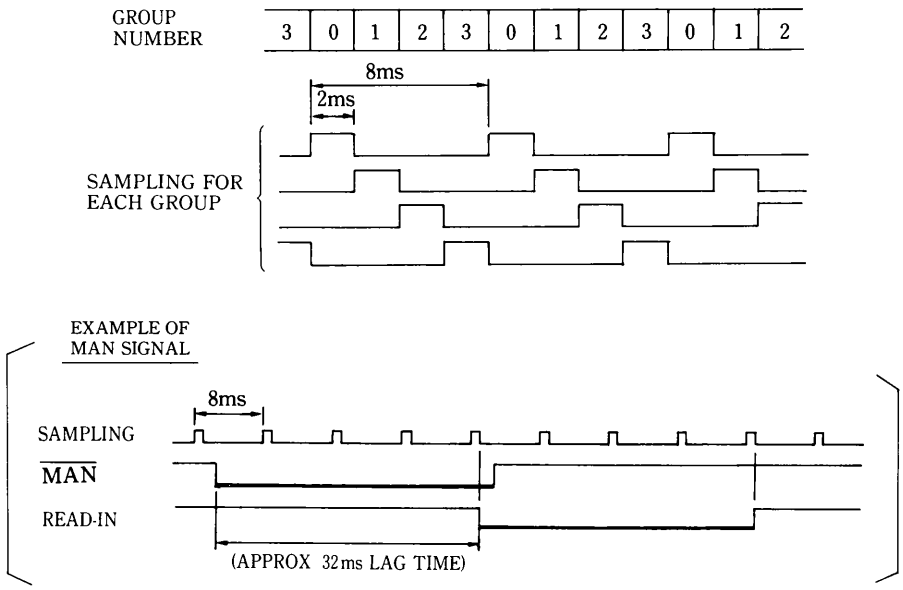
6.2.1 Signal Timing

Input signals are divided into four groups (CH0 to CH3: refer to Figs. 5.14, 5.15 and 5.16).

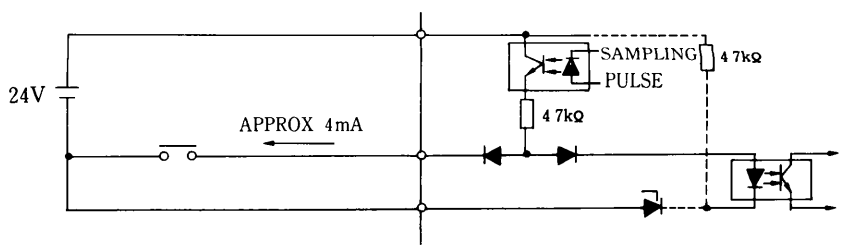
Each group is sampled every 8ms with 2ms width pulse.

When the same level continues three times or more, each signal is read-in (24 to 32ms filter).

Signal must be hold more than 30ms to be effective.



6.2.2 Input Circuit (Refer to Figs. 5.14, 5.15 and 5.16 for Typical Connection.)



6.2.3 Signal Operation and Functions

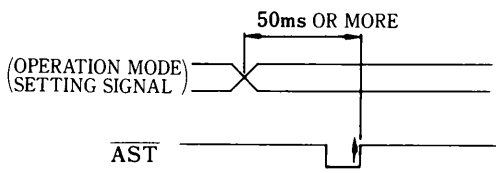
(1) Operation mode setting (MAN, ZRN, PULS)

Automatic, manual, external pulse train or zero-point return (homing) operation mode is selected by operation mode signal setting, as shown below:

Operation Mode	Operation Mode Setting Signal			Description
	MAN	PULS	ZRN	
Automatic	H	H	H	Sets position data and performs positioning by turning on AST signal.
Manual	L	H	H	Performs constant speed operation by manual signal (MCW, MCCW).
External pulse train	H	L	H	Performs positioning by pulse train reference.
Zero-point return(homing)	H	H	L	Zero-point return method is selected by parameter setting.
—	H	L	L	Setting status described on the left is considered as an error and ERR signal is output. Operation cannot be performed.
	L	H	L	
	L	L	H	
	L	L	L	

Notes:

1. If operation mode is switched during motor rotating, the motor will stop. (In this case, there is no feed hold)
2. 50ms or more is needed for timing with AST signal.

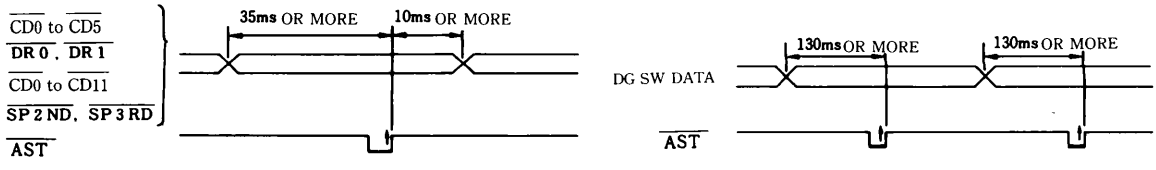


(a) Automatic operation mode

Position Reference Method	Parameter 15 Set Value	Position Data	Reference Direction	Operation
Station No. Reference Method	0	Station No. Reference contact data $\overline{CD0}$ to $\overline{CD11}$.	By rotating direction selection signal $\overline{DR0}$ or $\overline{DR1}$.	By turning ON the $\overline{AST}$ signal, the axis is positioned at station No. set at constant data. (Absolute or incremental reference)
DG-SW Reference Method	1	DG-SW Reference date value	DG-SW reference data polarity (+/ −)	By turning ON the $\overline{AST}$ signal, the axis is moved to the position set by DG-SW reference data. (Absolute or incremental reference)
		$\overline{DSI10}$ to $\overline{DSI17}$ $\overline{DS00}$ to $\overline{DS04}$		
Command Table Method	4	Position No., speed No. selecting signals $\overline{CD0}$ to $\overline{CD5}$		By turning ON the $\overline{AST}$ signal, positioning is performed at the position specified by position No. selection signals.

Notes:
1. There are four speed setting methods by parameter setting.
   ① (1st speed) to (4th speed) by selected $\overline{SP2ND}$ and $\overline{SP3RD}$ (speed setting signal)
   ② DG-SW
   ③ serial command
   ④ speed table

2. Timing with $\overline{AST}$ signal



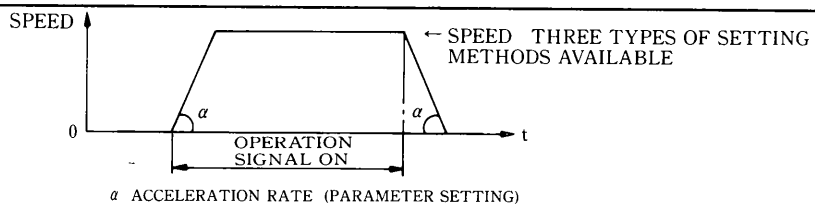
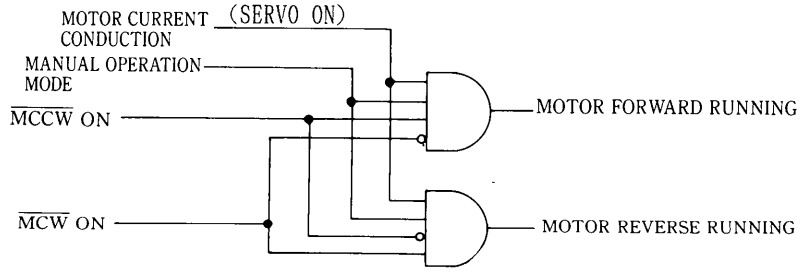
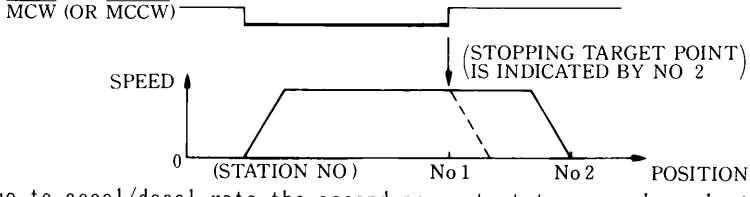
Since DG-SW data are strobed for five times by 2 digits, it takes more than 120ms* for complete input of all digits. Refer to Par. 5.6.3 (3).

* For parameter 65 setting "b2 = 0".

6.2.3 Signal Operation and Functions (Cont'd)

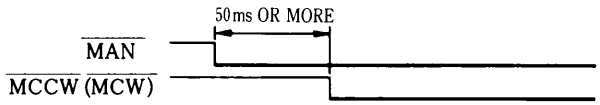
(b) Manual operation mode

Constant start operation is performed only when manual operation signal ($\overline{MCW}$ or $\overline{MCCW}$) is turned ON. Operation method is set on parameter 15.
(Position reference method: Station No., DG-SW or command table)

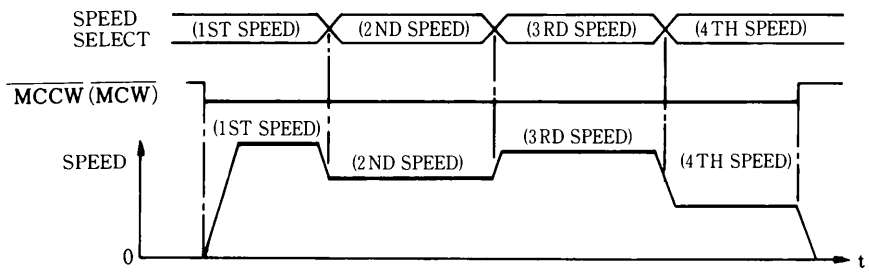
Items		Contents
Accel/Decel speed		
speed		
Conditions		
Operation	Station No. Ref. Method (Parameter 15) = 0	Performs positioning at the nearest station in the operating direction after operation signal is turned OFF.  Due to accel/decel rate, the second, nearest station may be selected.
	DG-SW Ref. Method (Parameter 15) = 1	Stops at a deceleration rate set to parameter after operation signal is turned OFF.
	Command Table Method (Parameter 15) = 4	

Notes:

1. Timing with operation setting signal



2. When speed select signal(SP2ND, SP3RD) is used and speed is changed during operation, corresponding parameter speed is set.

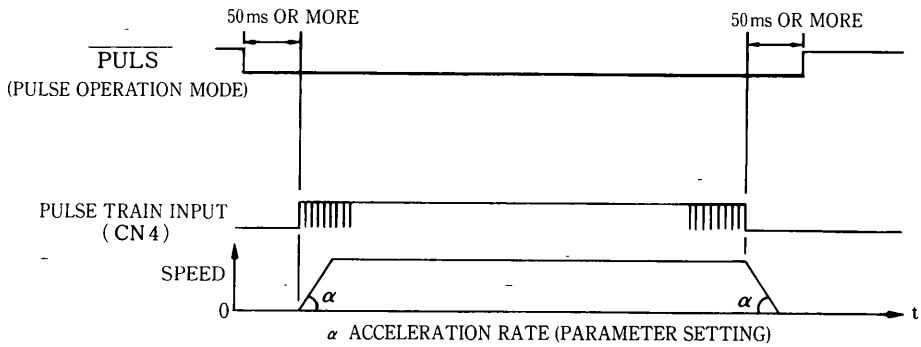


3. In DG-SW speed reference, speed varies if the setting is changed while MCW (MCCW) is turned ON since setting data are read-in every 120 ms *.
   However, do not change DG-SW setting during operation, incorrect data may be read-in.
   * Parameter 65 b2 = 0

6.2.3 Signal Operation and Functions (Cont'd)

(c) Pulse train operation mode

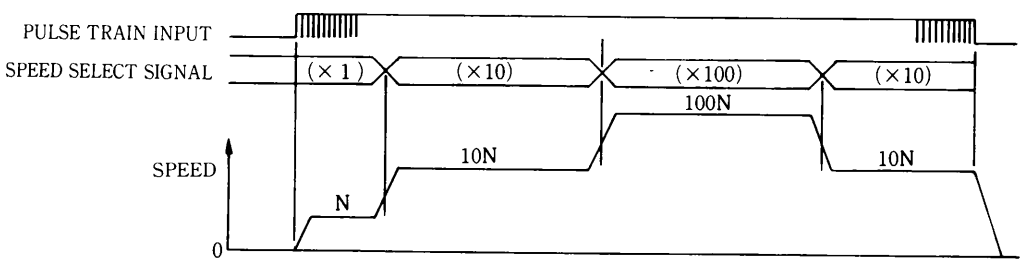
In this mode, positioning by external reference pulse train is performed.



Notes:

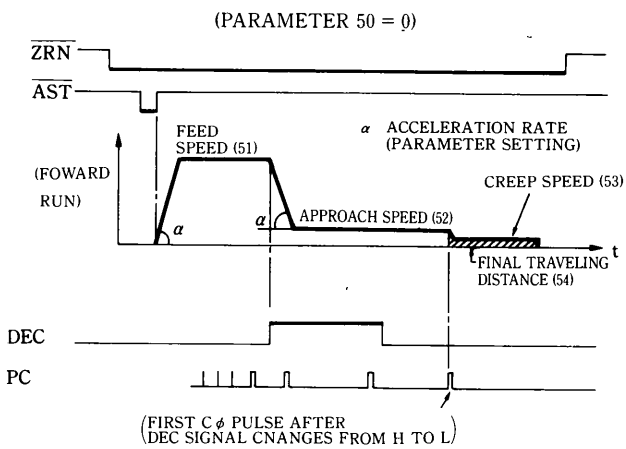
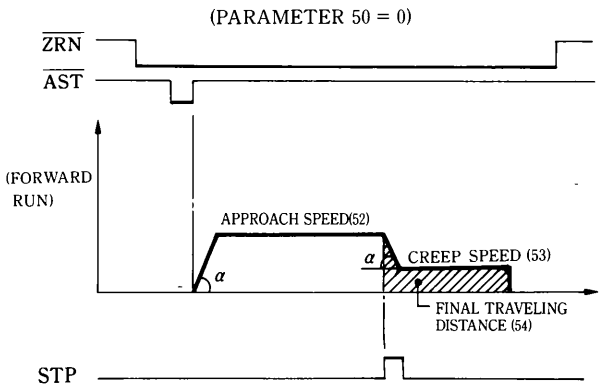
1. One-pulse input moves one reference unit.
2. Frequency→reference speed [f (pps) → f×60(reference unit) /min.]
   Number of pulses → Positioning value [P(pulse) → P(reference unit)]
3. For pulse train signal form to be input to CN4, refer to Par. 8.2 "Parameter 19 b3".
4. Speed select signals ($\overline{SP2ND}$, $\overline{SP3RD}$) at pulse operation mode determines input pulse multiplier.

$\overline{SP2ND}$	$\overline{SP3RD}$	Pulse Multiplier
H	H	× 1
L	H	× 10
H	L	×100
L	L	× 1



(d) Zero-point return (homing) mode (positioning using LS)

When zero-point return mode is used, set parameter 18 b4 = 1.

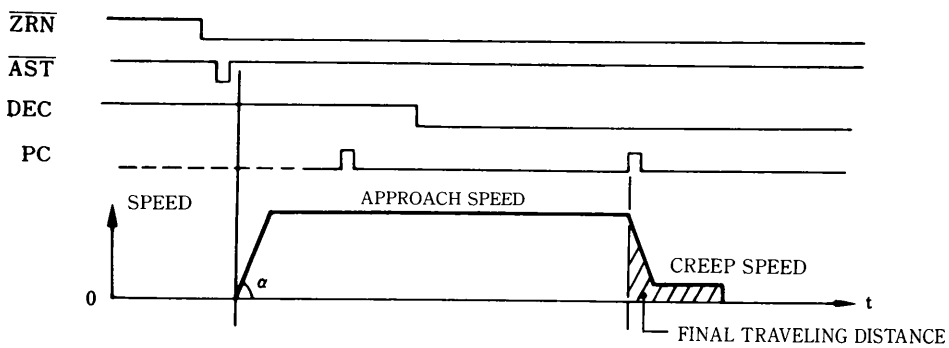
	Zero-point Return (Homing) Method	Operation Pattern
Mode I (Parameter 49 = 0)	3-step deceleration method using DEC signal (deceleration LS) and PG Cϕ pulse signal,	
Mode II (Parameter 49 = 1)	2-step deceleration method using STP signal (stop LS)	

6.2.3 Signal Operation and Functions (Cont'd)

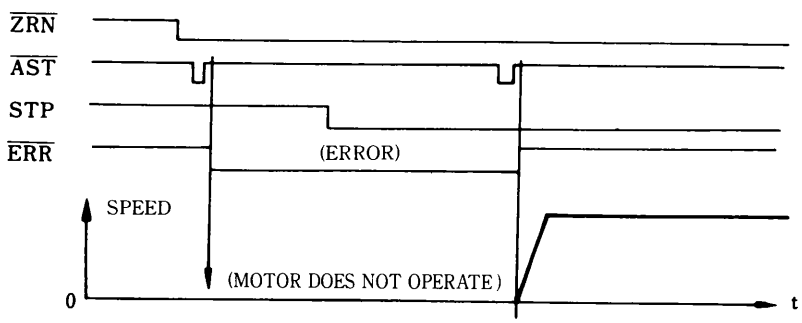
Note 1: Related parameters: Parameters described below become effective when parameter 18 b4 = 1, ineffective when b4 = 0.

Parameter No.	Name	Setting Range	Unit
50	Zero-speed return (homing) direction	0:FWD, 1: REV direction	
51	Zero-speed return feed speed	0 to 240000	×1000 • reference unit/min.
52	Zero-point return approach speed	0 to 240000	
53	Zero-point return creep speed	0 to 240000	
54	Zero-point return final traveling distance	FWD: 0 to +99999999	Reference unit
		REV: -99999999 to 0	

Note 2: When DEC signal is at H level in mode I and $\overline{AST}$ signal is activated, operation is started at approach speed (parameter 52) from the beginning, regardless of zero-point return feed speed (parameter 51)



Note 3: When STP signal is at H level in mode II and $\overline{AST}$ signal is activated, an error occurs ($\overline{ERR}$ signal is output.)



(2) Speed selection [$\overline{SP2ND}$, $\overline{SP3RD}$]

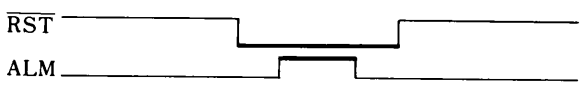
- In automatic or manual operation mode, reference speed can be selected from (1st speed) to (4th speed) by combination of speed selection signals and speed reference selection (Refer to Par. 8.2 "Parameter 18 b2, b3").

Speed Select Signal		Parameter		
$\overline{SP2ND}$	$\overline{SP3RD}$	No.	Name	Setting Range/Unit
H	H	4	1st feed speed	1 to 240000 (×1000 • reference unit/min.)
L	H	31	2nd feed speed	
H	L	32	3rd feed speed	
L	L	33	4th feed speed	

- In pulse operation mode, $\overline{SP2ND}$ and $\overline{SP3RD}$ are used to select input pulse multiplier. (Refer to 6.2.3(1) (c) Note 4.)

(3) Alarm reset [$\overline{RST}$]

- Signal to reset servo alarm status. This becomes effective with pulse width of 30ms or more.
- Refer to Par. 6.1.3 (3) for the operation of $\overline{RST}$ signal.
- If $\overline{RST}$ signal is activated at normal operation (not in servo alarm status), alarm output signal ALM becomes H.



6.2.3 Signal Operation and Functions (Cont'd)

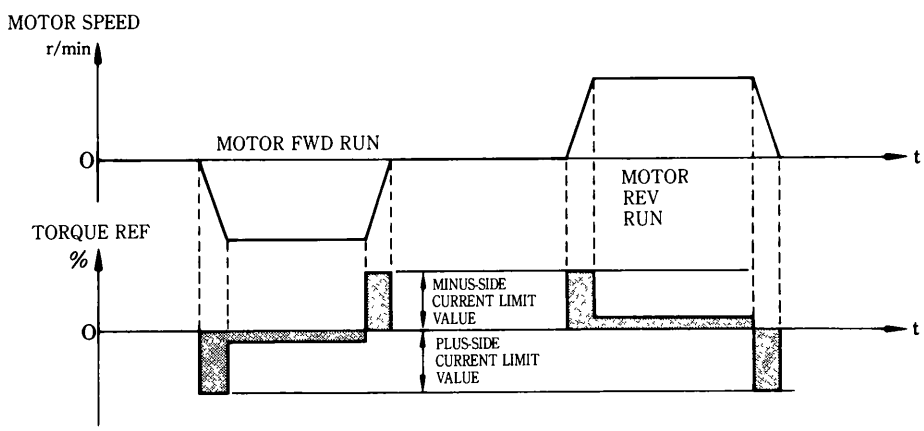
(4) Current limit command [$\overline{CUR}$]

- By setting parameter 17 b0 = 1, plus or minus side current limit value set by parameter becomes effective when $\overline{CUR}$ signal is turned ON.
- Relation between current limit parameter and $\overline{CUR}$ signal is shown in the table below:

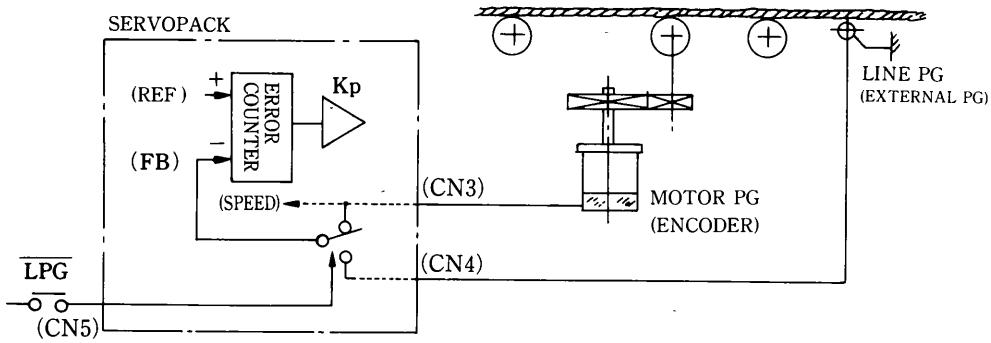
Parameter		Parameter 17	Parameter 17 bo = 1		
Name	No.	bo = 0	$\overline{CUR}$ signal = H	$\overline{CUR}$ signal = L	
		(Current Limit Value)		(Plus limit value)	(Minus limit value)
(Motor special current limit value)	(7)	○	○	○	○
Current limit value	34	×	○	○	○
Plus limit value	35	×	×	○	×
Minus limit value	36	×	×	×	○

Notes:

1. Parameters with ○ are effective. When more than one parameter has ○, the smaller set value becomes effective.
2. Parameter 34 "current limit value" is effective for both plus and minus.
3. Limit value of parameters 35 and 36 are explained below:



(5) Line PG (External PG) switching [$\overline{\text{LPG}}$]

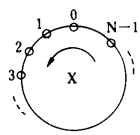
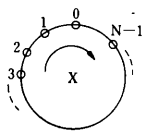


- When $\overline{\text{LPG}}$ signal is turned ON, position feedback signal is switched from motor PG to line PG and position fully closed loop by line PG is formed.
- Line PG output pulse corresponds to reference data one-by-one. That is, one pulse from line PG is read-in as one reference unit move.
- When line PG is used, zero-point return (homing) cannot be performed. Entering zero-point return mode causes an error.

(6) Input signal used in station No. reference method

(a) Rotating direction selection [$\overline{\text{DRO}}$, $\overline{\text{DRI}}$]

By combining $\overline{\text{DRO}}$ and $\overline{\text{DRI}}$ signals, the rotating direction at the motor shaft (viewed from the load side) in automatic operation mode is selected as shown below:

Signal / Parameter 14-b3	$\overline{\text{DRO}}$	H	L	H	L
	$\overline{\text{DRI}}$	H	H	L	L
0	Absolute mode	Short-cut direction	Station No. increasing direction (Example) 	Station No. decreasing direction (Example) 	(This setting causes an error.)
1	Incremental mode	(This setting causes an error.)			

6.2.3 Signal Operation and Functions (Cont'd)

(b) Station No. reference data [$\overline{CD0}$ to $\overline{CD11}$]

Contact data input signal to specify the positioning station No.

By parameter (14 b4) setting, BCD or binary code is selected.

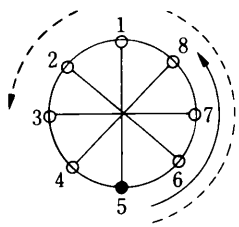
- Absolute mode: Move to data ($\overline{CD0}$ to $\overline{CD11}$) station No. position. (Parameter 14 b4 = 0)
- Incremental mode: Data ($\overline{CD0}$ to $\overline{CD11}$) indicates station No. to move to. (Parameter 14 b4 = 1)

(Example)

When data ($\overline{CD0}$ to $\overline{CD11}$) value is "3" with current station No. ⑤, ($\overline{DR0}$ = L, DR1 = H) is input after start command is turned ON.

<Absolute mode> : Move to station No. ③ position. (-------->)

<Incremental mode> : Move to station No. ⑧ position. (——→)



- Station No. reference data codes

Parameter 14-b4	Data Code	$\overline{CD0}$	$\overline{CD1}$	$\overline{CD2}$	$\overline{CD3}$	$\overline{CD4}$	$\overline{CD5}$	$\overline{CD6}$	$\overline{CD7}$	$\overline{CD8}$	$\overline{CD9}$	$\overline{CD10}$	$\overline{CD11}$
1	BCD (0 to 999)	1	2	4	8	10	20	40	80	100	200	400	800
0	Binary (0 to 4095)	1	2	4	8	16	32	64	128	256	512	1024	2048

(c) Station No. read-out selection [$\overline{PS0}$, $\overline{PS1}$]

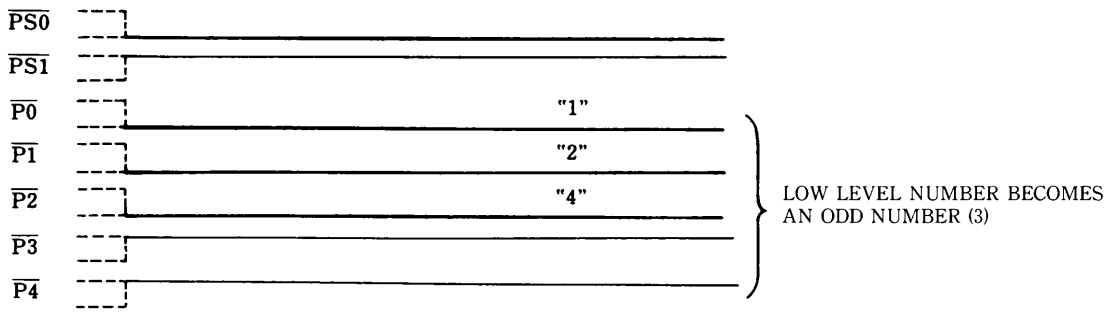
Current station No. value is read-out by current data (station No.) output signal ($\overline{P0}$ to $\overline{P4}$) $\overline{P0}$ to $\overline{P4}$ have only 5 bits. Therefore, by selecting PS0 and PS1, data must be read-out successively.

Output signals ($\overline{P0}$ to $\overline{P4}$) change the codes as shown in the table below by combining $\overline{PS0}$ or $\overline{PS1}$ H and L.

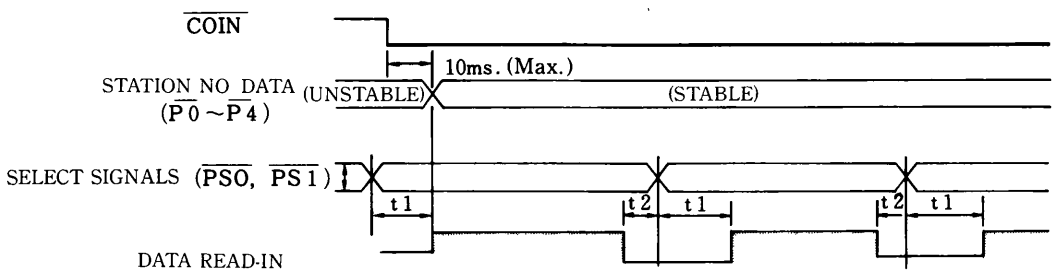
Input Signal / Output Signal		$\overline{PS0}$	H	L	H	L
		$\overline{PS1}$	H	H	L	L
BCD setting parameter 14 b4 = 1		$\overline{P0}$	1	1	10	100
		$\overline{P1}$	2	2	20	200
		$\overline{P2}$	4	4	40	400
		$\overline{P3}$	8	8	80	800
		$\overline{P4}$	10	Odd parity	Odd parity	Odd parity
Binary parameter 14 b4 = 0		$\overline{P0}$	1	1	16	256
		$\overline{P1}$	2	2	32	512
		$\overline{P2}$	4	4	64	1024
		$\overline{P3}$	8	8	128	2048
		$\overline{P4}$	16	Odd parity	Odd parity	Odd parity

Notes:

1. In a case other than $\overline{PS0}$ = $\overline{PS1}$ = H, $\overline{P4}$ becomes parity bit.
   For example, in BCD setting, when $\overline{PS0}$ = L and $\overline{PS1}$ = H, and ($\overline{P0}$ to $\overline{P3}$) is 7, data are output as P4 = H so that the figure below becomes an odd number (3) completely at low level with $\overline{P0}$ = L, $\overline{P1}$ = L, $\overline{P2}$ = L and $\overline{P3}$ = H.



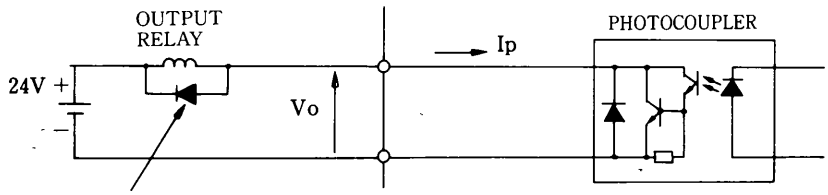
2. Timing with which current value data (station No.) is read-out several times must be as follows.



t 1 ≧ 40ms, t 2 ≧ 10ms

6.3 OPERATION AND FUNCTIONS OF CN2/CN5 OUTPUT SIGNAL

6.3.1 Output Circuit (Refer to Figs. 5.7, 5.14 and 5.15.)



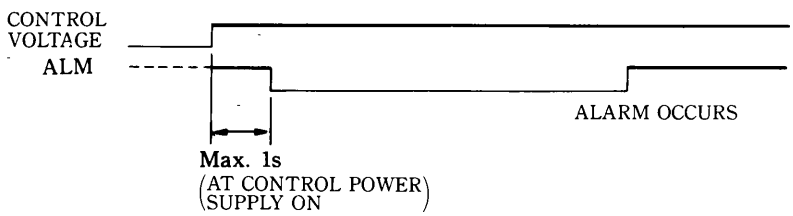
FLYWHEEL DIODE (MAKE SURE OF THE POLARITY)

- Applied voltage: $V_o \leqq 30V$
- Applied current: $I_p \leqq 50mA$
- Flywheel diode: Use diode having repetitive peak reverse voltage 5 times more than the voltage.

6.3.2 Signal Operation and Functions

(1) Alarm [ALM]

- When fault detection function (see Table 4.1) operates, the power drive circuit in the Servopack is turned OFF and alarm signal is output. Then the alarm contents are displayed to a 7-segment LED.
- Alarm signal timing

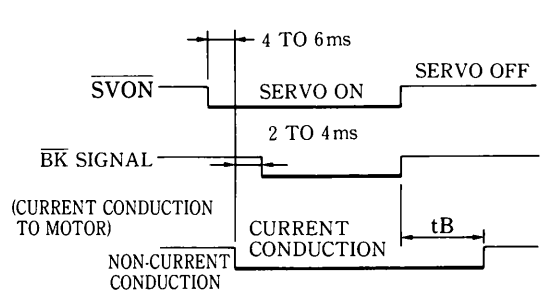
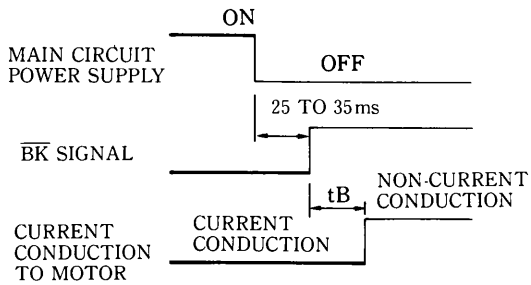


(2) Brake release signal (BK)

Brake release signal BK is an output signal to interlock the timing between current conduction or motor speed and brake release.

By setting parameter 19 b2 = 1, the brake release signal becomes effective. In this case, interlocking constant set by parameter 43 or 44 becomes effective.

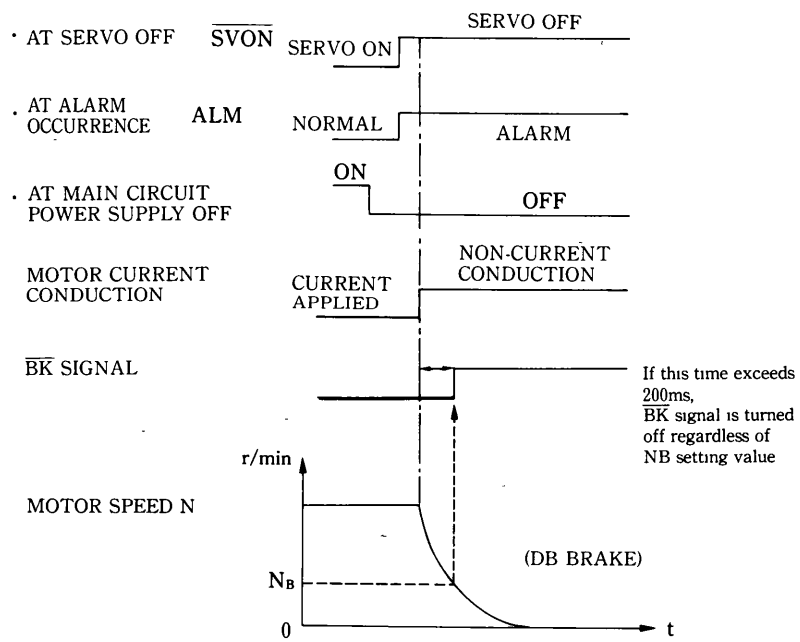
At Motor Stop

Timing with SERVO ON Signal	Timing with Main Circuit Power Supply
	

tB: Brake time (set by parameter 43: 8 to 100ms)

Motor Rotating

TIMING AT SERVO OFF, MAIN CIRCUIT POWER SUPPLY OFF OR ALARM OCCURRENCE



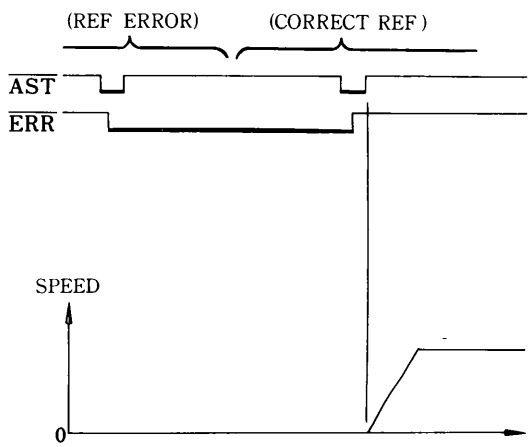
When motor speed N is lower than N_B, BK signal is output at the same time as motor non-current condition.

NB: SPEED at which BK signal is turned OFF (set by parameter 44: 1 to 10000 r/min).

6.3.2 Signal Operation and Functions (Cont'd)

(3) Reference Error ($\overline{ERR}$)

Outputs when reference data by contact signal is incorrect or operation is abnormal under motor current conduction. At this time, the motor cannot be driven.

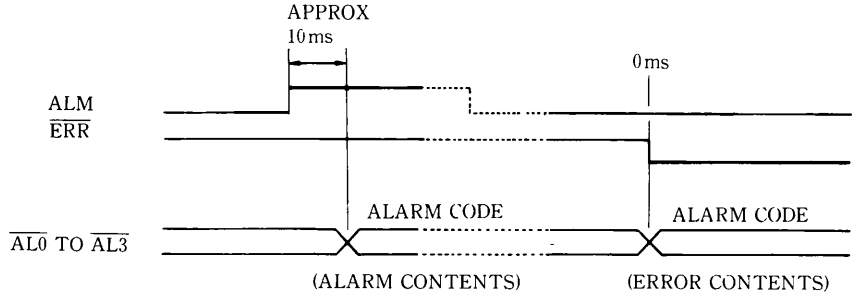
<table>
<tr><th colspan="3">Error Contents</th><th colspan="2">$\overline{ERR}$ Output Timing</th></tr>
<tr><td rowspan="4">Reference Error</td><td rowspan="2">At station No. Reference</td><td>Commands A to F at BCD setting</td><td colspan="2" rowspan="2">$\overline{ERR}$ is released by correcting reference or switching operation mode once.

</td></tr>
<tr><td>Commands station 0 at setting "station No. 0 not provided" in absolute reference mode.</td></tr>
<tr><td rowspan="2">At DG-SW reference</td><td>Commands position data exceeding software over-travel set value.</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Commands data exceeding speed limit value.</td></tr>
<tr><td rowspan="6">Operation Error, etc.</td><td>At station No. Reference</td><td>Operation mode improper setting (refer to Par. 6. 2. 3 (1).)</td><td rowspan="6">$\overline{ERR}$ signal is output in the conditions as described on the left. Recovery from error immediately releases $\overline{ERR}$.</td><td>$\overline{ERR}$ is not output at baseblock.</td></tr>
<tr><td rowspan="5">At DG-SW Reference</td><td>Operation mode improper setting</td><td rowspan="5">At baseblock, $\overline{ERR}$ is output only when:
• out of software overtravel range
• external overtravel is detected</td></tr>
<tr><td>$\overline{LPG}$ signal is turned on in pulse operation mode.</td></tr>
<tr><td>Software over-travel is applied during operation in pulse or manual operation mode.</td></tr>
<tr><td>External over-travel (P-OT, N-OT) is applied.</td></tr>
</table>

(4) Alarm code ($\overline{AL0}$ to $\overline{AL3}$)

- When an alarm occurs (ALM signal = H) or an error occurs ($\overline{ERR}$ signal = L), the contents are output in 4-bit code.

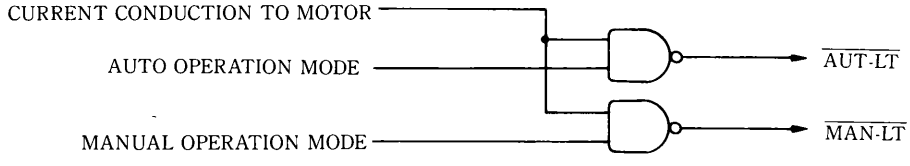
For details of alarm or error contents and corresponding alarm code signals, refer to (9) "Servopack status output signal".

- Output timing



(5) Operation mode display ($\overline{AUT-LT}$, $\overline{MAN-LT}$)

Output conditions of each signal are as follows:



(6) Battery voltage low-level detection ($\overline{BATALM}$)

If Servopack built-in battery (nominal voltage 3.6V) voltage become less than 3.3V (detected range 3.0 to 3.3V), it is detected when the control power supply is turned ON and $\overline{BATALM}$ signal is output. At this time, a 7-SEG LED blinks [d.].

(7) Positioning complete, positioning near ($\overline{COIN}$ ($\overline{NEAR}$))

$\overline{COIN}$ ($\overline{NEAR}$) signal is output with the conditions according to positioning complete (near) width set by parameter and operation mode.

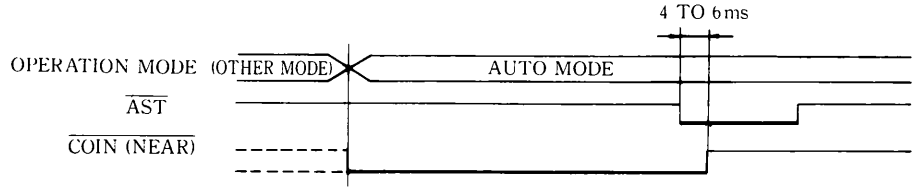
Output Signal	Parameter (Refer to Par. 8.2.)			
	Name	Parameter No.	Setting Range	Unit
$\overline{COIN}$	Positioning complete width	6	1 to 250	Reference unit
$\overline{NEAR}$	Positioning near width	45	0 to 3000	

$\overline{COIN}$ ($\overline{NEAR}$) signal is always output during baseblock.

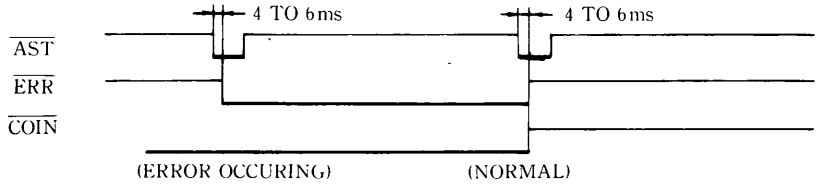
6.3.2 Signal Operation and Functions (Cont'd)

(a) Output specifications in automatic operation mode

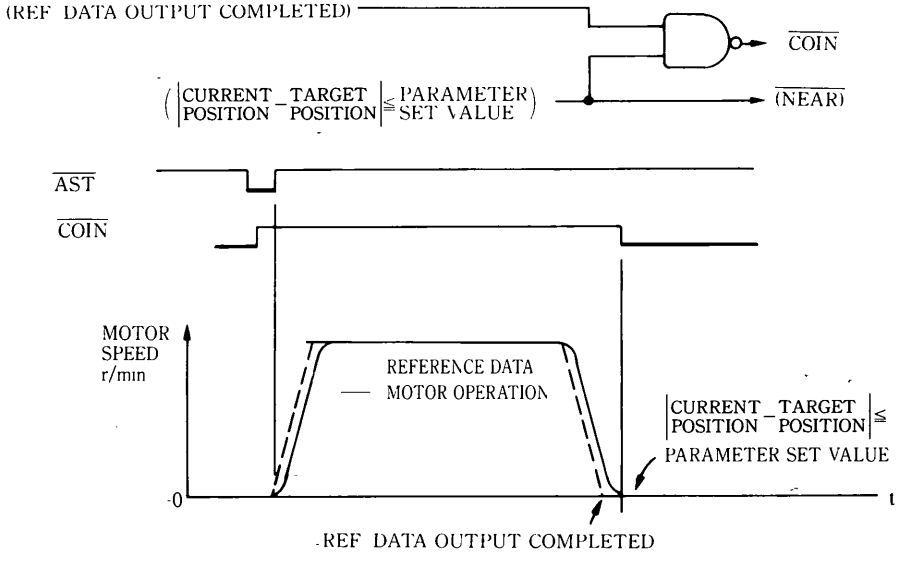
① At mode switching and relation with $\overline{AST}$ signal



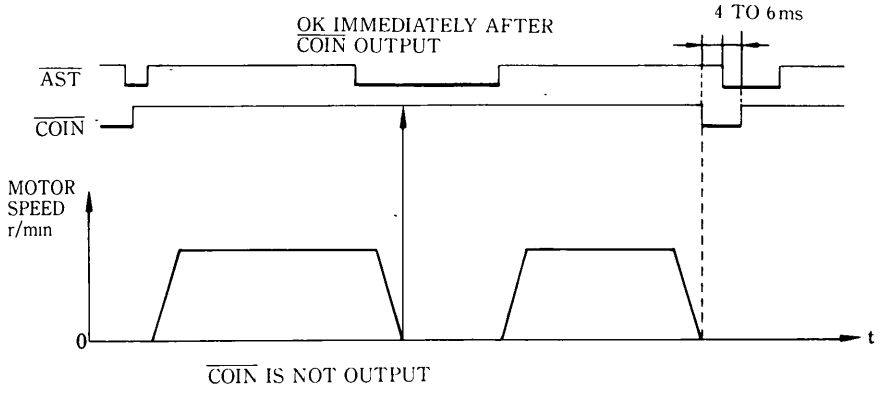
② $\overline{COIN}$ signal becomes as shown below if and error occurs when $\overline{AST}$ signal is turned ON.



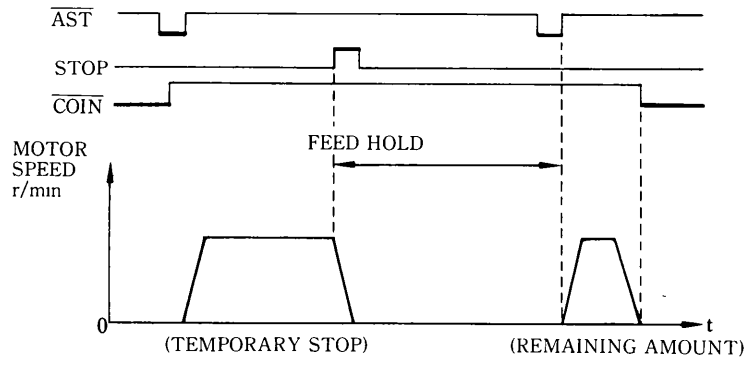
③ Conditions where $\overline{COIN}$ ($\overline{NEAR}$) signal is output during automatic operation

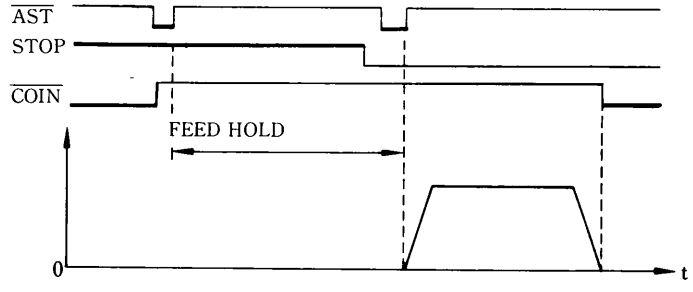


④ When $\overline{AST}$ signal is turned ON during automatic operation



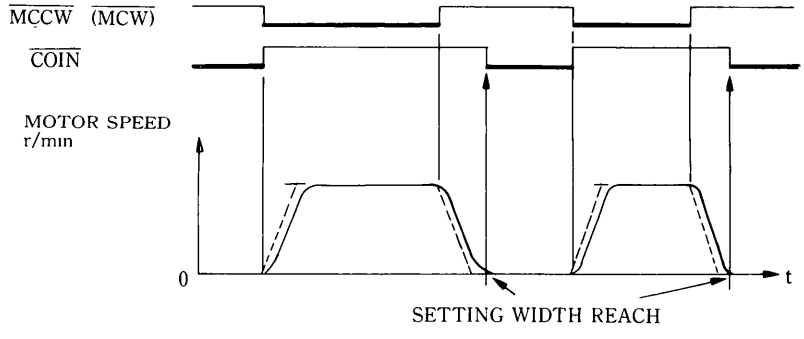
⑤ $\overline{\text{COIN}}$ signal is not output in feed hold status.





(b) Output specifications in manual operation mode

In manual operation mode, $\overline{\text{COIN}}$ is output during stop. When operation signal ($\overline{\text{MCW}}$, $\overline{\text{MCCW}}$) is turned ON, $\overline{\text{COIN}}$ becomes high.



(8) Station No. Output ($\overline{\text{P0}}$ to $\overline{\text{P4}}$)

(a) Station No. reference method (parameter 15 set value = 0)

- Positioning station No. is indicated in BCD or binary code(5 bits). (BCD/binary setting depends on parameter 14 b4.)
- By combining H and L levels of read-out input signal ($\overline{\text{PS0}}$, $\overline{\text{PS1}}$), the code contents of $\overline{\text{P0}}$ to $\overline{\text{P4}}$ changes. Refer to Par. 6.2.3 (6) (c).

(b) Command table method (parameter 15 set value = 4)

- By setting parameter 20 b5 = 1 and parameter 65 b0 = 1, $\overline{\text{P0}}$ to $\overline{\text{P4}}$ become zone signals.

6.3.2 Signal Operation and Functions (Cont'd)

(9) Servopack status output signals

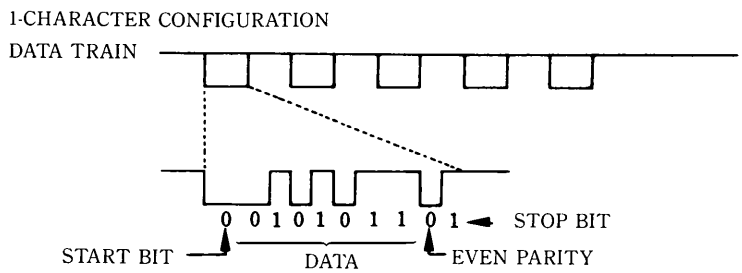
SERVOPACK Status				Status Output Signal					
	7SEG. LED	Contents		ALM	$\overline{ERR}$	Alarm Code			
						$\overline{AL3}$	$\overline{AL2}$	$\overline{AL1}$	$\overline{AL0}$
Status	•	Motor current Conduction	Ref. Operation: Normal	0	1	1	1	1	1
			Ref. Operation: Mode Error	0	0	0	1	0	1
			Ref. Operation: Position Error	0	0	0	1	0	0
			Ref. Operation: Speed Error	0	0	0	0	1	1
	-	Base-blocking		0	1	1	1	1	1
	P	P-Side Overtravel		0	0	1	1	0	1
		P-Side Software Overtravel		0	0	1	0	1	1
	n.	N-Side Overtravel		0	0	1	1	0	0
		N-Side Software Overtravel		0	0	1	0	1	0
	d	Battery Voltage Low		-	-	-	-	-	-
Alarm	0	Abso Error		1	1	0	1	1	1
	1	Overcurrent		1	1	1	1	1	0
	2	FAN stop		1	1	1	1	0	1
	3	Regenerative Error		1	1	1	1	0	0
	4.	Overvoltage		1	1	1	0	1	1
	5.	Overspeed		1	1	1	0	1	0
	6	Undervoltage		1	1	1	0	0	1
	7.	Overload		1	1	1	0	0	0
	8	Position Error		1	1	0	1	1	1
	A	Heat Sink Overheat		1	1	0	1	0	1
	C.	PG Disconnection		1	1	0	0	1	1
	F	Open Phase		1	1	0	0	0	0
	H.	Hardware Error		1	1	1	1	1	1
	J	Overflow		1	1	1	1	0	0
	L	Overrun		1	1	0	0	1	1
	y	Parameter Error		1	1	0	0	0	1
		CPU Error		1	1	1	1	1	1

Notes:
1. At battery voltage low-level detection, LED indicator [d.] blinks.
2. At CPU error, LED indicator is uncertain.
3. Status output signal
   0: Relay ON, 1: Relay OFF, -: Not defined

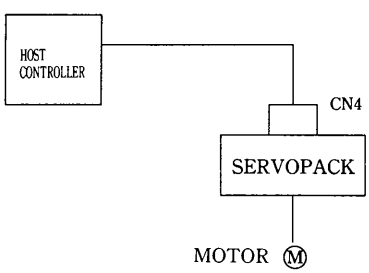
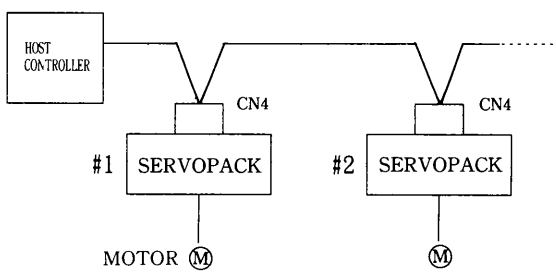
7 SERIAL COMMUNICATION

7.1 SPECIFICATIONS

Items	Specifications
Standard in complying with	RS422
Communication method	Asynchronous (ASYNC)
Baud rate	9600, 4800, 2400, 1200, Baud, selected at initial setting (9600 Baud prior to shipping)
Start bit	1 bit
Data	7 bits
Parity	1 bit even
Stop bit	1 bit
Start/stop	XON/XOFF control



7.2 CONTROL CONFIGURATION

	1-axis Control	Multi-axis Control
Outline		
Initial Setting	• Baud rate (not required for 9600 Baud)	• Address (For how to use axis address, refer to Par. 7.3.2.) • Baud rate

(UP TO 16 AXES AVAILABLE)

Note: For initial setting method, refer to Par. 11.2.1 (1).

7.3 COMMAND TRANSMISSION (MASTER CONTROLLER → SERVOPACK)

7.3.1 Transmission Method

	One-axis Control	Multi-axis Control
Command	COMMAND CHARACTER LINE [CR]	• When axis is specified: AXIS NO. [COMMAND CHARACTER LINE] [CR] • When all axes are specified: [COMMAND CHARACTER LINE] [CR] (Command becomes effective for all axes.)
Example	• SVON [CR] • SPD12345 [CR] • MOV1234 [CR] • ST [CR]	• 1SVON [CR] • 2SVON [CR] • 1SPD123 [CR] • 2SPD456 [CR] • 1MOV123 [CR] • 2MOV456 [CR] • ST [CR]

7.3.2 How to Use Axis Address

(1) How to set axis address and axis designation

Control Configuration	Axis Address Setting		Axis Designation Method				
	10-digit	1-digit	Not designated	Axis No. = m	Axis No. = om	Axis No. = no	Axis No. = nm
One-axis control	Not required	0	Possible	Not used	Not used	Not used	Not used
Multi-axis control;2 to 9 axes group designation not provided	Not required	M	Possible	Possible	Not used	Not used	Not used
Multi-axis control;2 to 9 axes group designation provided	N	M	Possible	Prohibited	Possible	Possible	Possible
Multi-axis control;10 to 16 axes	N	M	Possible	Prohibited	Possible	Possible	Possible

Note: M, N, m or n is a number from 1 to 9.

(2) Axis designation function (M, N, m or n is a number from 1 to 9.)

(a) One-axis control

Axis Designation	Axis with Effective Command	Use of Command to Require Response	Response for Command (ERR □□□, OK*)
Not provided	——	Possible	Provided

* Response OK to command is given only when parameter 72 b4=1 is set.

(b) Multi-axis (2 to 9 axes) control without group designation

Axsis Designation	Axis with Effective Command	Use of Command to Require Response	Response for Command (ERR □□□, OK*)
Not provided	All axes	Not possible	Not Provided
Axis No. = m	Axis with axis address m	Possible	Provided

* Response OK to command is given only when parameter 72 b4=1 is set.

(c) Multi-axis (2 to 9 axes) control with group designation and multi-axis control for 10 axes or more (up to 16 axes)

Axis Designation	Axis with Effective Command	Use of Command to Require Response	Response for Command (ERR □□□ , OK*)
Not provided	All axes	Not possible	Not provided
Axis No. = om	Axes with M = m (group)	Not possible	Not provided
Axis No. = no	Axes with N = n (group)	Not possible	Not provided
Axis No. = nm	Axes with N = n and M = m (group)	Possible	provided

* Response OK to command is given only when parameter 72 b4 = 1 is set.

(3) Precautions on multi-axis control

If no axis is designated on serial command. a command is effective for all axes. Do not forget to designate axis number when one axis operation is required. (Pay attention especially to RES or ST command.)

7.4 TRANSMISSION DATA (SERVOPACK → HOST CONTROLLER)

(1) Data

DATA CHARACTER LINE | CR | LF

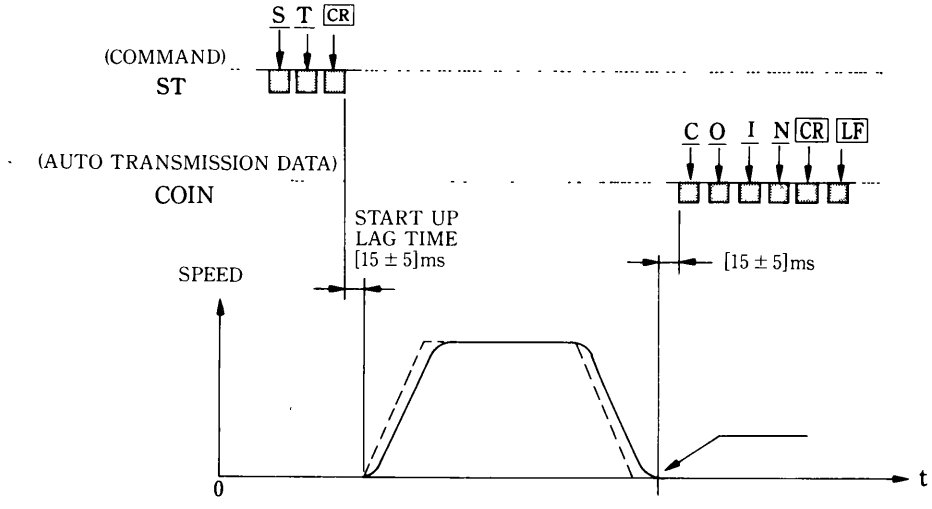
(2) Example

- ALM␣␣. RUN␣␣ CR LF
- PUN =+1 2 3 4 5 6 7 8 CR
- COIN CR LF

Monitor data

……Automatic transmission data (One-axis control only)

7.5 SERIAL COMMUNICATION AND TYPICAL SERVOPACK RESPONSE



7.6 SERIAL COMMUNICATION CONTROL CODE

Control Code	Contents
Ctrl-S	Stops transmission. (X-OFF)
Ctrl-Q	Restart transmission. (X-ON)
Ctrl-C	Monitor data transmission from Servopack is canceled. (For restart, send monitor command to Servopack again.)
Ctrl-E	Switches echo-back "provided/not provided" from Servopack for command. (At initialization, echo-back is set to "not provided.") Example ◎ (INITIAL) ① (COMMAND) MON1 ② (MONITOR DATA) PUN = +123 ③ Ctrl-E ④ (COMMAND) MON3 ⑤ (ECHO BACK) MON3 ⑥ (MONITOR DATA) NFB = 0 ⑦ Ctrl-E ⑧ (COMMAND) MON4 ⑨ (MONITOR DATA) NREF = 0 Note: Echo-back functions only for one-axis control. Echo-back is not provided for multi-axis control.

7.7 AUTOMATIC TRANSMISSION DATA FROM SERVOPACK

- Monitor data are sent automatically from Servopack only in one-axis control. (Transmission is completed at one time.)

Transmission Conditions		Data Display
At Positioning Completion		COIN
At Positioning Near		NEAR
At Alarm Occurrence		ALM n. nnnnn ↑ ↑ Alarm code Alarm abbreviation
At Parity Error		ERR PE
At Command Error	Command Error (Undefined command is sent.)	ERR SN
	No. (pp) Error (ALMp, MONp, PRMpp, etc.)	ERR PN
	Data (n·····n) Error (Exceeding specified digits)	ERR OV

- In multi-axis control, ERR SN(PN, OV) data are automatically sent only when axis designation command (1MON1, 2MON1, etc.) error occurs. (Automatic transmission is not performed.)

• Communication Error Cause

× : No error occurs　　○ : Only ERR OV occurs at excessive number of digits.

	Command	ERR PN	ERR OV	ERR SN
Operation	SVON	×	×	$\overline{\text{RST}}$ ON, OL status
	SVOFF	×	×	
	ARES	×	×	
	ZEROSET (±) nnnnnnnn	×	○	
	RES	×	×	
Move command	POS (±) nnnnnnnn	×	software overtravel exceeded	*
	POSI (±) nnnnnnnn	×	software overtravel exceeded	*
	JOG (±) nnnnnn	×	speed limit exceeded	*
	MOV (±) nnnnnnnn	×	○	
	MOVI (±) nnnnnnnn	×	○	
	SPD nnnnnn	×	speed limit exceeded	
	ST	×	×	*
	JOGP	×	speed limit exceeded	*
	JOGN	×	speed limit exceeded	*
	ZRN	×	speed limit exceeded	*
	PCON	×	×	
	PCOFF	×	×	
	SKIP	×	×	
	HOLD	×	×	
	PON	×	×	Motor not under current conduction
	POFF	×	×	Not in pulse mode
	SET (±) nnnnnnnn	×	○	
Parameter	PRM	×	×	
	PRMpp	Other than 0 to 99	×	
	PRMpp= (±) nnnnnnnn	Other than 0 to 99	Exceeding number of bytes determined per parameter No.	
Monitor	MU=n	×	Other than 1 or 2	
	MONp	Other than 1 to 6	×	
	INp	Other than 1 to 8	×	
	OUTp	Other than 1 to 3	×	
	ALM (p)	Other than 0 to 9	×	

* Refer to the next page.

Cause of ERR SN marked with *

Cause / Move Command	Motor is not under current conduction	Currently moving	Command exceeds software overtravel	OT condition in the commanded direction	STOP signal is turned OFF (STOP is active).	Speed limit is exceeded.
POS	○	○	×	○	×	○
POSI	○	○	×	○	×	○
JOG	○	○	○	○	×	×
ST	○	○	○	○	○	○
JOGP	○	○	○	○	×	×
JOGN	○	○	○	○	×	×
ZRN *	○	○	○	○	○	×

○ : An error occurs.

× : An error does not occur.

* ERR SN is displayed when ZRN is commanded and STOP signal is activated in the zero-point return (homing) mode Ⅱ (PRM49=1).

7.8 SERIAL COMMAND

7.8.1 Serial Command List

	Command	Contents
Operation	SVON	Performs current conduction to motor
	SVOFF	Stops current conduction to motor
	ARES	Resets alarm
	ZEROSET (±) nnnnnnnn	Re-writes machine zero-point so that current position will be (±) nnnnnnnn
	RES	Performs the same operation as control power supply OFF/ON
Moving Command	POS (±) nnnnnnnn	Performs positioning at linear accel/decel speed in (±) nnnnnnnn (Absolute value)
	POSI (±) nnnnnnnn	Performs positioning at linear accel/decel speed in (±) nnnnnnnn (Incremental value)
	JOG (±) nnnnnn	Performs constant speed operation at (±) nnnnnnnn speed
	MOV (±) nnnnnnnn	Sets position reference (Absolute value)
	MOVI (±) nnnnnnnn	Sets position reference (Incremental value)
	SPD nnnnnn	Sets speed reference.
	ST	Starts automatic operation
	JOGP	Starts manual operation plus direction
	JOGN	Starts manual operation· minus direction
	ZRN	Starts zero-point return (homing)
	PCON	Performs P (proportional) operation in speed loop
	PCOFF	Releases P operation of speed loop.
	SKIP	Decelerates and stops
	HOLD	Feed hold (remaining amount is held.)
	PON	Enters pulse operation mode.
	POFF	Clears pulse operation mode
	SET (±) nnnnnnnn	Re-writes current position to (±) nnnnnnnn.
Parameter	PRM	Sends all parameters (Unused parameters are not sent)
	PRMpp	Sends parameters with pp (parameter number).
	PRMpp= (±) nnnnnnnn	Re-writes parameters with pp (parameter number) to (±) nnnnnnnn.
Monitor	MU=n	Selects monitor signal n=1: torque reference, n=2· speed reference
	MONp	Sends monitor data.
	INp	Sends input signal status.
	OUTp	Sends output signal status
	ALM (p)	Sends alarm code. p not provided: current alarm, p = 1 to 9: alarm which occurred p times before
Command Table Setup	PT/VT/BT	Sends all command table positions/speeds/ boundary positions.
	PTpp/VTpp/BTpp	Sends position/speed/boundary position number pp
	PTpp= (±) nnnnnnnn VTpp= (±) nnnnnnnn BTpp= (±) nnnnnnnn	Re-writes position /speed/boundary position number pp.

7.8.2 Command Functions

(1) Parameter operation commands

Monitor or re-write parameter contents.

(Since parameters are stored in E²PROM, the contents are not erased even if the control power supply is turned OFF.)

For details, refer to Par. 8.1 "PARAMETER LIST".

Command	Function/Contents
PRM	All parameters are sent from Servopack by this command. Unused parameters are not sent.) Used for parameter contents check. (Example) COMMAND [PRM] → PRM1 =××……× PRM2 =××……× …… PRM49=××……× …… …… (Sent from Servopack.)
PRMpp (pp: parameter number)	Contents of parameters with pp are sent from Servopack. Used for specified parameter contents check. (Example) COMMAND [PRM30] → PRM30 =××……× (Sent from Servopack.)
PRMpp = ± n…n within 8 digits pp: parameter number, n: 0 to 9	Re-writes parameter with parameter No. pp to (±n……n). You can omit the +. For off-line parameters (refer to the note below), execute command [RES] after this command. Unless [RES] command is executed, the parameter contents will not be re-written. (Example) COMMAND • [PRM10 = 123] • [PRM12 = -456] • [PRM20 = 789] • [RES] ← For off-line parameters, execute [RES] command without fail.

(Cont'd)

(Cont'd)

Command	Function/Contents
TRMpp = ± n···n (within 8 digits) (pp : Parameter No. n : 0 to 9)	For applications where the online parameter (refer to the note below) is re-written frequently during operation, use this command instead of PRMpp = ± n·····n . Functions are the same. (Number of write-in times is limited on E^2 PROM physical characteristic). Contents set by this command are returned to the contents set by PRMpp = ± n·····n command at the beginning by turning ON/OFF the control power supply or executing RES command.

Note: Examples of Parameter Contents Renewal Command

Online Parameter*1	Offline Parameter*2
PRM1 = 50 PRM2 = 100 PRM5 = 30	PRM17 = 11111 PRM18 = 10100 PRM19 = 11111 RES

*1 Online parameter: Parameter is renewed only by parameter write-in command.

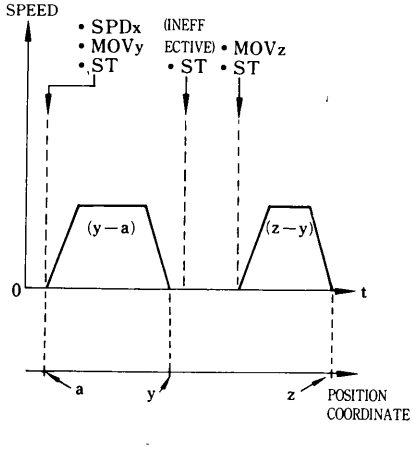
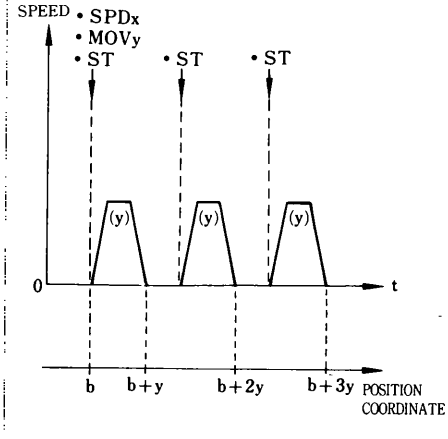
*2 Offline parameter: Parameter is renewed after RES command is sent after command.

(2) Basic operation command

Command	Function/Contents
RES	Provides initial reset ; the same conditions as when control power supply is switched from OFF to ON, or to the Servopack control section.
ARES	When Servopack detects an alarm, the alarm is reset by this command. The same operation as alarm reset signal RST.
ZEROSET ± n···n 8 digits (+ can be omitted.)	[± n·····n] is a position with reference of machine zero point (home position). (Unit: reference unit) • ZEROSET ± n·····n • RES By execution of the above commands, current position is set to [± n···n]. Note: Current position is a value indicated by monitor data <PUN = ±××·····×> (refer to (4) "Monitor Command").
SVON SVOFF	Servopack main circuit power drive circuit operates by SVON command and the motor becomes in current conduction. The current conduction to motor is released by SVOFF command. (These two commands perform the same operation as SERVO ON signal $\overline{SVON}$. SVON ▼ SVOFF ▼ MOTOR STATUS: NON CURRENT CONDUCTION | CURRENT CONDUCTION | NON CURRENT CONDUCTION

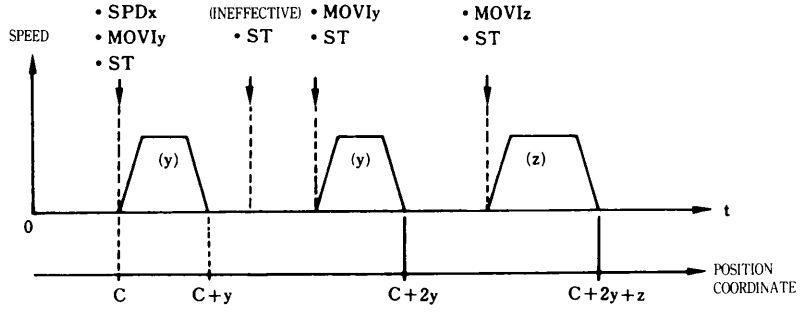
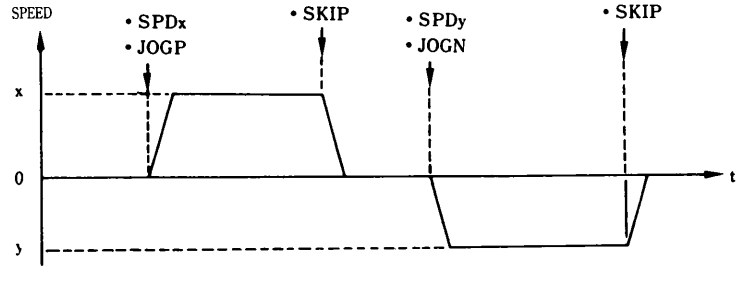
7.8.2 Command Functions (Cont'd)

(3) Move command

<table>
<tr><th>Command</th><th>Function/Contents</th></tr>
<tr><td>SPD n···n
Max. 6-digit</td><td>Setting command for speed reference. (nn·····n) unit is [×1000 reference unit/min]. Speed reference value is the set value of parameter 4 when the power supply is turned ON or RES command is executed.
Example
Reference unit = 0.01mm: When 15m/min;
$\frac{15000\text{mm}/\text{min}}{0.01\text{mm}}$ = 1500000 reference units/min.
= 1500 [×1000 reference units/min]
∴ SPD 1500</td></tr>
<tr><td>MOV ± n···n
Max. 8-digit
(+ can be omitted)</td><td>Setting command for position reference. (±n ·····n) unit is [reference unit].
(+ n·····n) : Motor FWD run, (− n·····n) : Motor REV run
Position reference value becomes 0 when the power supply is turned ON and RES command is executed.
Operation differs depending on parameter 14 b3 [position reference mode] setting.
<table>
<tr><th colspan="2">Parameter</th><th rowspan="2">Position Reference Mode</th></tr>
<tr><th>No.</th><th>Set Value</th></tr>
<tr><td rowspan="2">14 b3</td><td>0</td><td>Absolute value</td></tr>
<tr><td>1</td><td>Incremental value</td></tr>
</table>
<table>
<tr><th>Absolute Mode</th><th>Incremental Mode</th></tr>
<tr><td>(Data are in absolute value.)</td><td>(Data are in incremental value.)</td></tr>
<tr><td>
</td><td>
</td></tr>
</table></td></tr>
</table>

(Cont'd)

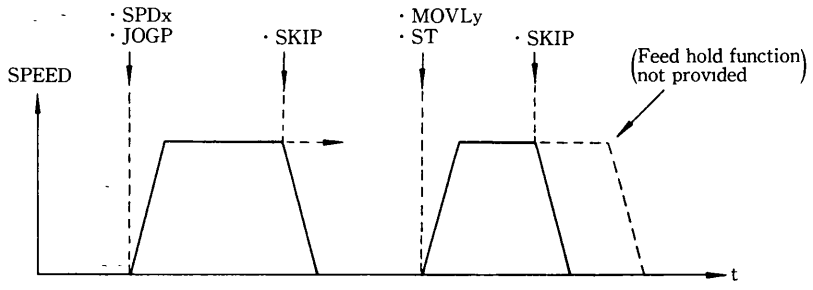
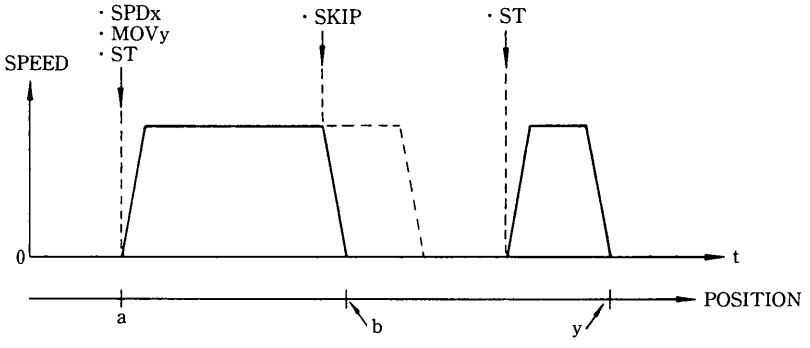
(Cont'd)

Command	Function/Contents
MOVI± n·····n Max. 8-digit (+ can be omitted)	Position reference setting command which is effective when position reference mode is absolute mode (14 b3 = 0). Data are in incremental value.  Note: Do not use this command for incremental mode (parameter 14 b3 = 1). Does not operate normally.
ST	Command to start automatic operation after speed or position data setting command. ST command is disregarded during positioning. (Example) ① SPD n···n ····· Speed data setting MOV ± n···n ····· Position data setting ST ····· Automatic operation start ② MOV ± n···n ┐ Operates at speed which was ST ┘ set before. ③ RES ┐ In this case, returns to zero point (home ST ┘ position) at speed set in parameter 4. Notes: 1. When ST command is sent for special axis operation check after parameter change for special axis in case of multi-axis configuration, be sure to designate the axis. If ST command is sent without axis designation after RES command is sent to all axes or the control power supply is turned OFF and then ON, all axes will operate as described in (Example) ③. 2. If STOP signal input (CN2-15) remains open, ERR SN (command error) occurs even if ST command is sent at move command execution. When STOP signal is not used, set parameter 19 b1=1.
JOGP JOGN	Manual jog operation start command. The speed is set by command SPD : JOGP : Motor FWD run , JOGN : Motor REV run. SKIP command is used for stop. 

(Cont'd)

7.8.2 Command Functions (Cont'd)

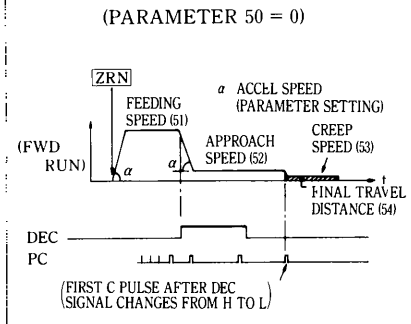
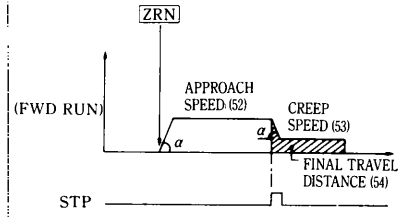
(Cont'd)

Command	Function/Contents
SKIP	Command to stop operation after deceleration set by a parameter. (Example 1)  (Example 2) When SKIP command is input during positioning by MOV command in absolute mode, the remaining positioning is executed only by ST command after stopping. 

(Cont'd)

(Cont'd)

Command	Function/Contents
ZRN	Command to start zero-point return (homing) operation as shown below:

Zero-point Return Method	Operation Pattern
Mode I (Parameter 49=0): 3-step deceleration method using DEC signal (decel LS), Cϕ pulse signal (in Servopack)	
Mode II (Parameter 49=1): 2-step deceleration method using STP signal (decel LS)	

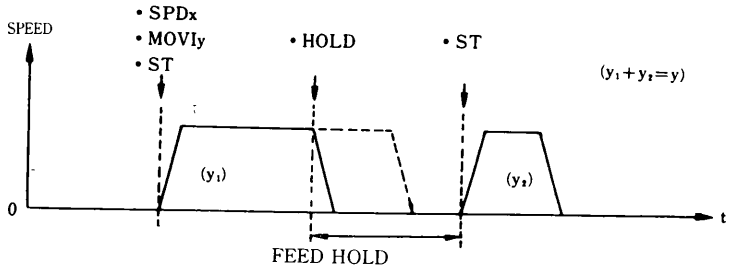
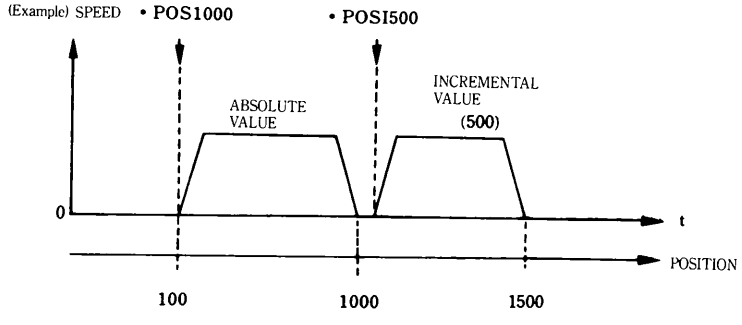
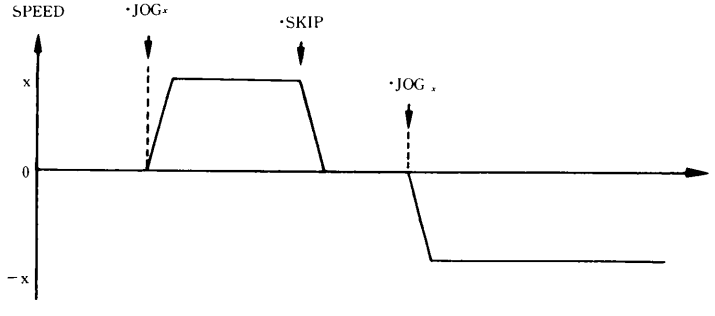
Note 1: Related parameters

Parameters shown below are effective when parameter 18 b4 = 1.
Does not operate when b4 = 0.

Parameter No.	Name	Unit	
50	Zero-point return direction	0: FWD direction 1: REV direction	
51	Zero-point return feeding speed	0 to 240000	×1000 reference unit/min
52	Zero-point return approach speed	0 to 240000	
53	Zero-point return creep speed	0 to 240000	
54	Zero-point return final traveling distance	FWD:0 to +99999999 REV:0 to -99999999	Reference unit

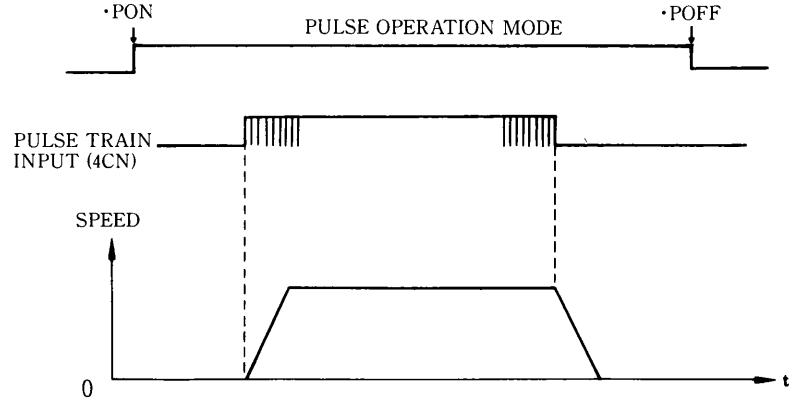
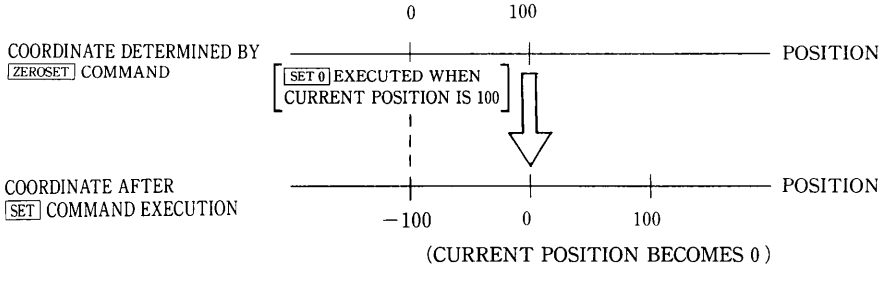
(Cont'd)

(3) Move command (Cont'd)

Command	Function/Contents
HOLD	(1) When this command is sent during positioning by [ST] command, operation stops at a specified deceleration speed. However, the remaining amount is held. (Feed hold function)  (2) When [HOLD] command is sent during manual operation ([JOGP], [JOGN], [JOG ±n·····n] command) or during operation by [POS], [POSI] command, the same operation is performed as [SKIP] command.
POS (±) n···n Max. 8-digit POSI (±) n···n Max. 8-digit	Command to perform positioning by linear accel/decel. Data (±) n·····n moves to position [(±) n·····n] in absolute value for POS; moves by distance [(±) n·····n] in incremental value for POSI. [Speed is a set value of parameter (4).] 
JOG (±) n···n Max. 6-digit	Command to perform manual jog operation at speed [(±) n·····n] 

(Cont'd)

(Cont'd)

Command	Function/Contents
PON POFF	Command to turn ON/OFF pulse operation mode (positioning operation by external pulse train command). PON enters pulse operation mode and POFF releases it. 
PCON PCOFF	Command to change Servopack speed loop control mode from PI (proportion - integer) operation to P (proportion) operation. PCON enters P operation and PCOFF returns to PI operation.
SET (±) n···n Max. 8-digit	Command to re-write the current position to [(±) n·····n]. After execution of this command, a new coordinate becomes effective. (Example)  Note: Coordinate which has been changed by SET command is returned to the former by RES command or turning ON/OFF the control power supply.

(Cont'd)

(3) Move command (Cont'd)

Command	Function/Contents
PT	All position tables are sent from the Servopack by this command. (Example) Command [PT] → PT01=±n...n PT02=±n...n ..... PT64=±n...n (Sent from Servopack)
PTpp (pp: Position No. pp=1 to 64)	Position No. pp reference position is sent from the Servopack. (Example) Command [PT25] → PT25 = +00050000 (Sent from Servopack)
PTpp = ±n...n (Max. 8 digits) pp : Position No. ±n..: Reference position pp = 1 to 64	A command to change position No. pp reference position to (±n...n). + can be omitted. Becomes effective by execution of [RES] command or ON/OFF of control power supply. (Example) Command • [PT25=50050] • [RES] • Reference position (±nn...n) unit is [reference unit]. Note: Data cannot be changed frequently because of characteristics of E²PROM.
VT	All speed tables are sent from Servopack by this command. (Example) Command [VT] → VT01=n...n VT02=n...n ..... VT64=n...n (Sent from Servopack)
VTpp (pp: Speed No. pp=1 to 64)	Speed No. pp reference speed is sent from the Servopack. (Example) Command [VT25] → VT25 = 001200 (Sent from Servopack)
VTpp = n...n (Max. 6 digits) pp : Speed No. n.. : Reference speed pp = 1 to 64	A command to change speed No. pp reference speed to (n...n). Becomes effective by execution of [RES] command or ON/OFF of control power supply. (Example) Command • [VT25=1250] • [RES] • Reference speed (n...n) unit is [×1000 reference unit/minute]. Example When reference unit = 0.01mm and at 15m/min; $\frac{15000\text{mm/min.}}{0.01\text{mm}}$ = 1500000 reference unit/min. = 1500 [×1000 reference unit/min.] Therefore, [VT25 = 1500] is obtained. Note: Data cannot be changed frequently because of characteristics of E²PROM.

(Cont'd)

(Cont'd)

Command	Function/Contents
BT	All boundary tables for zone signals are sent from the Servopack by this command. (Example) Command [BT] BT01=±n...n BT02=±n...n ..... BT31=±n...n (Sent from Servopack)
BTpp (pp: Boundary No. pp=1 to 31)	Boundary No. pp boundary position is sent from the Servopack. (Example) Command [BT25] → BT25 = +00050000 (Sent from Servopack)
BTpp = ±n...n (Max. 8 digits) pp :Boundary No. ±n..:Boundary position pp = 1 to 31	A command to change boundary No. pp boundary position to (±n...n). + can be omitted. Becomes effective by execution of [RES] command or ON/OFF of control power supply. (Example) Command • [BT25=50050] • [RES] • Boundary position unit is [reference unit]. • For boundary position, write in the data so as to be BT01≦BT02≦BT03≦..≦BT31 Example When only BT01 to BT10 are used, set as follows: [BT11= + 99999999] ⋮ [BT31= + 99999999] Note: Data cannot be changed frequently because of characteristics of E^2PROM.

(4) Monitor commands

By executing monitor commands, monitor data are sent continuously and repeatedly from the Servopack* (excluding ALM and ALMp commands). Data are indicated by [CHARACTER STRING] [CR] without [LF]. By sending some characters to the Servopack, monitor data transmission is stopped after sending [LF].

* When parameter 72 b5 = 1 is set, data are sent from the Servopack only one time.

(a) MON commands

Command	Data Sent from SERVOPACK		(Unit) Others
	Name	Display	
MON1	Current Position	PUN = ± n···n (8 digits)	(Reference unit)
MON2	Position following error	PER = ± n···n (8 digits)	×4 multiplier of encoder pulse
MON3	Current speed (motor speed)	NFB = ± n···n (5 digits)	(r/min)
MON4	Reference speed	NREF = ± n···n (6 digits)	(×1000) reference unit/min
MON5	Torque reference	TREF = ± n n n (3 digits)	(%)
MON6	SERVOPACK status	STS = n n n (PRDY) (SLIM) (TLIM)	

Status		n Value	
PRDY	Main circuit DC power supply	Normal	1
		Low	0
SLIM	Speed limit function	Speed limiting (active)	1
		Inactive	0
TLIM	Current limit function	Current limiting (active)	1
		Inactive	0

(b) Input signal status

Command	Data Sent from SERVOPACK			Remarks
	Contents		Display	
IN1	Connector CN2 input		INp = n_7 n_6 n_5 n_4 n_3 n_2 n_1 n_0 (p corresponds to command number.) n_0 to n_7 is " 0 " or " 1 "	Refer to the Note described below:
IN2	Connector CN5 input			
IN3				
IN4				
IN5				
IN6	Input pulse signal			
IN7	DG-SW setting	Position reference	DS1 = ±nnnnnnnn	Data are in decimal.
IN8		Speed reference	DS2 = ±nnnnnnnn	

Note: INp = n_7 n_6 n_5 n_1 n_3 n_2 n_1 n_0

Monitor data indicate input signal status.
- Contact <closed: 0, open: 1>
- Pulse <H level: 1, L level: 0>

The following table shows each data digit and corresponding connector pin number and signal name.

		n_7	n_6	n_5	n_4	n_3	n_2	n_1	n_0
IN1	CN2 PIN NO.	1	15	16	17	18	8	9	10
		STP	STOP	$\overline{\text{AST}}$	DEC	$\overline{\text{PCON}}$	$\overline{\text{SVON}}$	N-OT	P-OT
IN2	CN5 PIN NO.	15	14	13	12	11	10	9	8
		$\overline{\text{RST}}$	$\overline{\text{DRI}}$	$\overline{\text{DRO}}$	$\overline{\text{MCCW}}$	$\overline{\text{MCW}}$	$\overline{\text{MAN}}$	$\overline{\text{ZRN}}$	$\overline{\text{CUR}}$
IN3		29	28	27	26	25	24	17	16
IN4		44	43	42	41	40	32	31	30
IN5					49	48	47	46	45
						$\overline{\text{LPG}}$	$\overline{\text{PULS}}$	$\overline{\text{SP3RD}}$	$\overline{\text{SP2ND}}$
IN6	INPUT PULSE				PG PULSE			REF. PULSE	
					PA	PB	PC	CA	CB

(4) Monitor commands (Cont'd)

(c) Output signal status

Command	Data Sent from SERVOPACK		Remarks
	Contents	Display	
OUT1	Connector CN2 output	OUT1 = n_1 n_0	Refer to the Note below:
OUT2	Connector CN5 output	OUT2 = n_7 n_6 n_5 n_4 n_3 n_2 n_1 n_0	
OUT3		OUT3 = n_7 n_6 n_5 n_4 n_3 n_2 n_1 n_0	

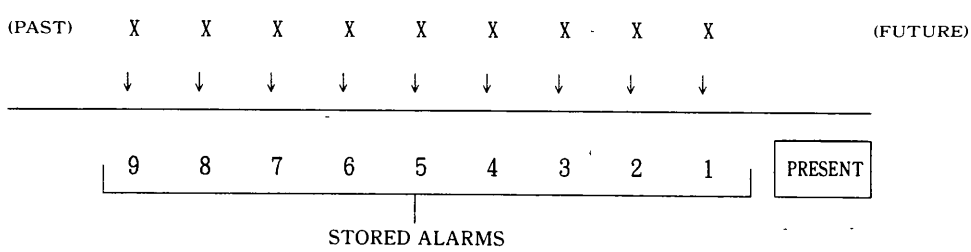
Note: OUTp = n_7 n_6 n_5 n_4 n_3 n_2 n_1 n_0

Monitor data indicate output signal status.
0 when output relay is ON, 1 when OFF.
The following table shows each data digit and corresponding connector pin number and signal name.

		n_7	n_6	n_5	n_4	n_3	n_2	n_1	n_0
OUT1	CN2 PIN NO.							12	11
								$\overline{BK}$	ALM
OUT2	CN5 PIN NO.	21	20	19	7	6	5	4	3
		$\overline{AL2}$	$\overline{AL1}$	$\overline{AL0}$	$\overline{ERR}$	$\overline{POS2}$	$\overline{POS1}$	$\overline{MAN\text{-}LT}$	$\overline{AUT\text{-}LT}$
OUT3		39	38	37	36	35	34	23	22
				$\overline{DSO4}$	$\overline{DSO3}$	$\overline{DSO2}$	$\overline{DSO1}$	$\overline{DSO0}$	$\overline{AL3}$

(d) ALM (ALMp) command

For command ALM (ALMp), data are sent only once from the Servopack.

<table>
<tr><th rowspan="2">Command</th><th colspan="2">Data Sent from SERVOPACK</th></tr>
<tr><th colspan="2">SERVOPACK Status</th><th>Data Display</th></tr>
<tr><td rowspan="7">ALM</td><td rowspan="6">Operation Status</td><td>Motor non-current conduction (baseblock status)</td><td>ALM␣␣—. BB␣␣␣</td></tr>
<tr><td>Motor current conduction</td><td>ALM␣␣␣. ␣␣␣␣␣</td></tr>
<tr><td>Feedholding</td><td>ALM␣␣␣. HOLD␣</td></tr>
<tr><td>Motor running</td><td>ALM␣␣␣. RUN ␣␣</td></tr>
<tr><td>Positioning-completed</td><td>ALM␣␣␣. COIN␣</td></tr>
<tr><td>Positioning near</td><td>ALM␣␣␣. NEAR␣</td></tr>
<tr><td colspan="2">At alarm occurrence</td><td>ALM n. nnnnn
Alarm abbreviation
Alarm Code
(For alarm code and abbreviation refer to (e) "Status and automatic transmission data")</td></tr>
<tr><td rowspan="2">ALMp
(p = 1 to 9)</td><td colspan="2">Alarm which occurred p times before</td><td>ALMp = n. nnnnn
Alarm abbreviation
Alarm code</td></tr>
<tr><td colspan="3">SERVOPACK stores up to nine alarms which have occurred. By commands ALM1 to ALM9, the past alarm contents can be given. For example, ALM3 is a command to give the contents of the alarm which occurred three times before.

</td></tr>
</table>

(4) Monitor commands (Cont'd)

(e) Servopack Status and automatic transmission data

SERVOPACK Status				Automatic Transmission Data		Note
	7SEG. LED	Contents		Alarm	Error	
Status	.	Motor Current Conduction	Ref. Operation: Normal	—	—	
			Command	—	ERR SN	
			No. Error	—	ERR PN	
			Data Error	—	ERR OV	1
	-.	Baseblocking		—	—	
	P.	P-Side Overtravel		ALM P. P-OT	—	
		P-Side Software Overtravel		ALM P. P-LS	—	1
	n.	N-Side Overtravel		ALM N. N-OT	—	
		N-Side Software Overtravel		ALM N. N-LS	—	1
	d.	Battery Voltage Low		ALM D. BAT	—	2
Alarm	0.	Abso Error		ALM 0. ABS	—	
	1.	Overcurrent		ALM 1. OC	—	
	2.	FAN stop		ALM 2. FAN	—	
	3.	Regenerative Error		ALM 3. RG	—	
	4.	Overvoltage		ALM 4. OV	—	
	5.	Overspeed		ALM 5. OS	—	
	6	Undervoltage		ALM 6. UV	—	
	7.	Overload		ALM 7. OL	—	
	8.	Position Error		ALM 8. POS	—	
	A.	Heat Sink Overheat		ALM A. OH	—	
	C.	PG Disconnection		ALM C. PG	—	
	F	Open Phase		ALM F. O-PH	—	
	H.	Hardware Error		ALM H. HARD	—	
	J.	Overflow		ALM J. OF	—	
	L.	Overrun		ALM L. RWY	—	
	Y	Parameter Error		ALM Y. PRMpp	—	3
	(Un-defined)	CPU Error			—	4

Notes:
1. When a position reference which is out of P or N side software overtravel range is input, a data fault error (ERR OV) occurs.
   When the current position is out of P or N side software overtravel range, (ALM P. P-LS or ALM N. N-LS) occurs.
2. Battery voltage low-level detection LED indicator [d.] blinks.
3. pp indicates a parameter number.
4. In case of CPU error, LED indication is uncertain.

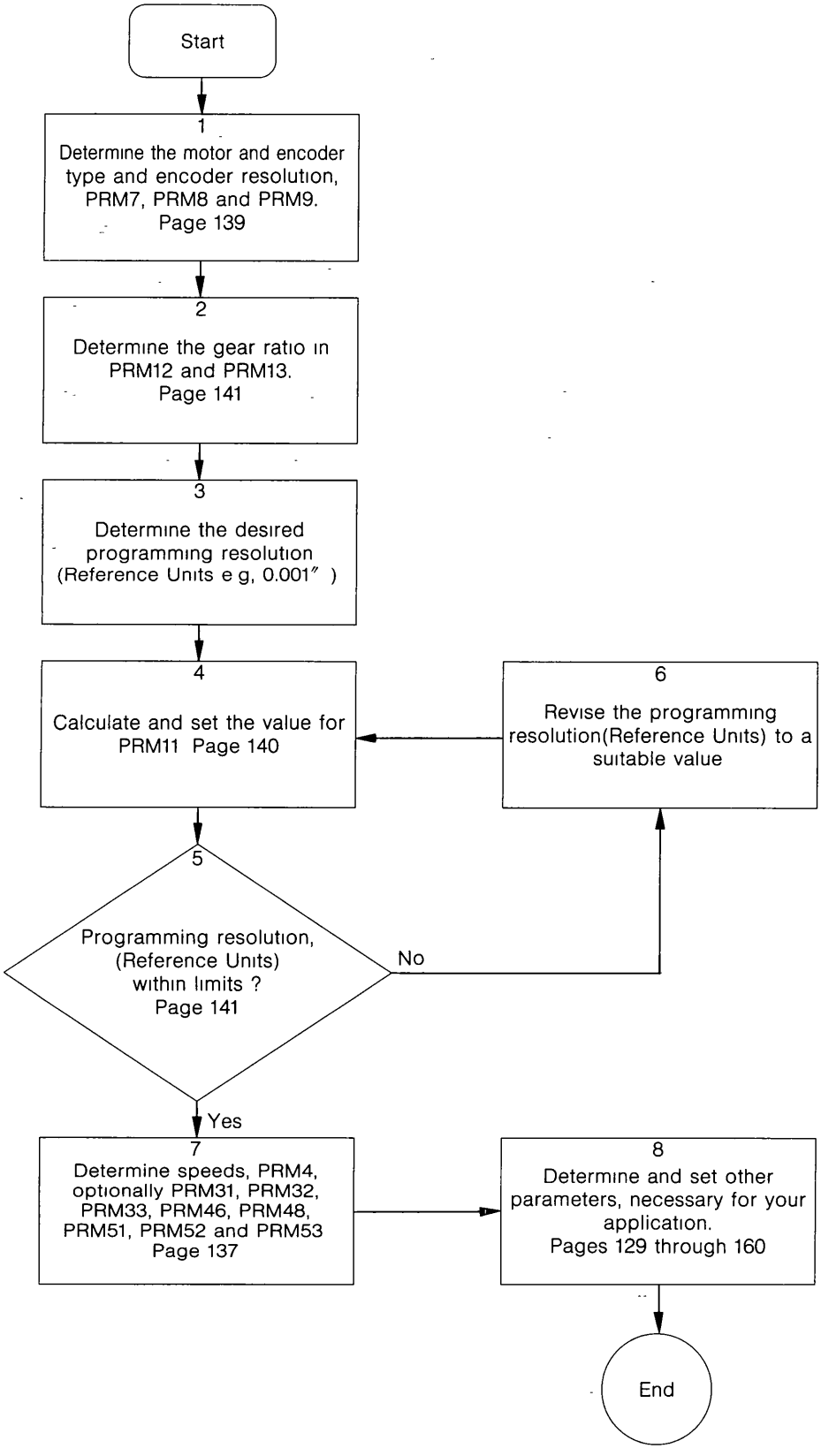
8 PARAMETERS

Servopack type CACR-HR sets gain, internal constants, and function selection by parameters (serial communication).

- Parameter setter: Personal computer and terminal emulator software
- Serial communication specifications: See section 7.

(Data can be set in Servopack setting and displaying section. Refer to Par. 9.1.2.)

8.1 GENERAL PROCEDURE FOR DEFINING PARAMETERS



The flow chart on the previous page shows the steps necessary to determine parameters for HR-Servo applications.

◆ Step 1

Determine the motor type and motor-parameter number (PRM7) from the table on page 139. If the motor is equipped with an incremental encoder set parameter PRM9 to 1. Set this parameter to 0, in case of a motor with absolute encoder. Parameter PRM8 holds the encoder resolution. The standard absolute encoder has 8,192 lines per revolution, providing 32,768 (8,192×4) pulses per motor revolution (PRM8 = 32,768).

◆ Step 2

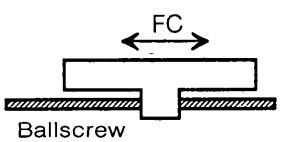
Parameters PRM12 and PRM13 define the gear ratio as a ratio of 2 integer numbers. Set parameter PRM12 to the motor speed, and set parameter PRM13 to the gearbox-output speed.

◆ Step 3

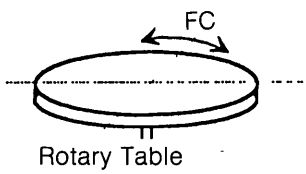
Determine the desired programming resolution, also referred to as Reference Unit. Typical values are 0.001", 0.001 mm, 0.01 degrees. This is minimum position increment that can be programmed and is different from the encoder resolution. The programming resolution is determined by parameters, the encoder resolution is determined by the number of encoder pulses and the machine configuration (gear ratio, screw pitch, etc.).

◆ Step 4

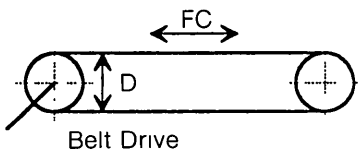
Determine the amount of linear or rotary motion for one revolution of the gearbox-output shaft (one motor revolution, in case of direct drive); also referred to as Feed Constant (FC) in this document. The illustration below shows three common application examples.



FC=Lead of Screw



FC=One Rotation
(360 Degrees, 1 Rev , etc)



FC=πD

There are no restrictions for choosing the units of FC (inches, mm, degrees, furlongs, or anything else). Divide the value of FC by the programming resolution determined in step 3. Omit any remaining digits after the decimal point. The result is the value for parameter PRM11.

PRM11=FC/Reference Unit.

◆ Step 5

There is a restriction for the HR-Servo as far as the number of encoder pulses per Reference Unit is concerned. The number of encoder pulses per Reference Unit has to be equal to or larger than 0.01 pulses, and equal to or smaller than 100 pulses. This may be quickly checked, evaluating the formula below.

$$0.01 \leqq \frac{\text{PRM8} \times \text{PRM12}}{\text{PRM11} \times \text{PRM13}} \leqq 100$$

If the calculated value is smaller than one, the programming resolution is smaller than the encoder resolution. This means that the positioning accuracy is not as good as the programming resolution (less than one encoder pulse per Reference Unit).

◆ Step 6

If the result of the calculation in step 5 is outside the limits, revise the selected programming resolution (Reference Unit) and go back to step 4.

◆ Step 7

Determine the feed speed expressed in terms of Reference Units per minute. Set parameter PRM4 to the speed in Reference Units per minute divided by 1,000.

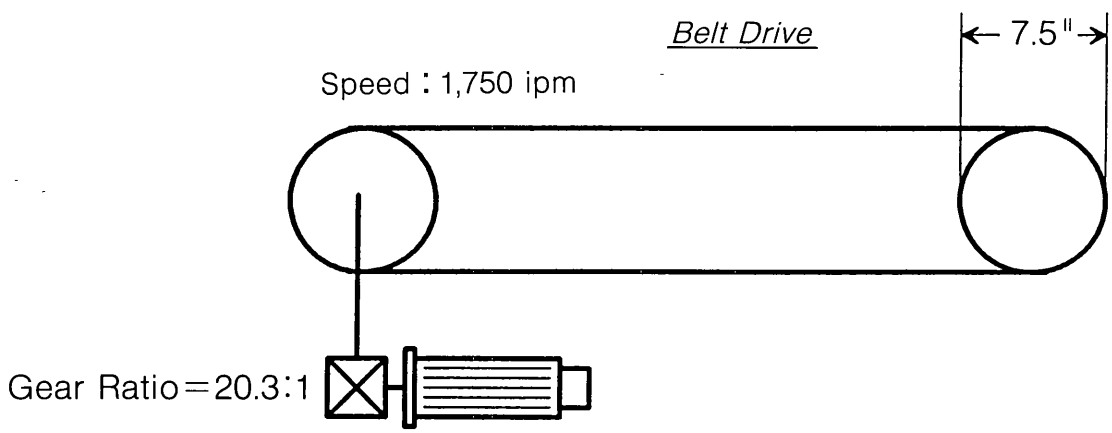
PRM4=Speed [Reference Unit per minute] /1,000

The other parameters related to speed, PRM31, PRM32, PRM33, PRM46, PRM48, PRM51, PRM52 and PRM53 are optional. They have to set only, if the associated optional functions are enabled. The procedure for setting the optional, speed related parameters is the same as the procedure for parameter PRM4.

◆ Step 8

Set all other parameters required for your application. Refer to pages 129 through 160 for details.

Example:



Motor part number: USAGED-13L22K (incremental encoder, 8,192 lines per rev.)

◆ Step 1

Motor and encoder parameters

A. Motor type:	PRM7=54
B. Encoder type:	PRM9=1
C. Encoder pulses per revolution:	PRM8=32,768

◆ Step 2

Parameters for the gear reduction

A. Motor speed: PRM12=203

B. Gearbox-output speed: PRM13=10

All parameters have to be integers ("whole numbers"). Only the ratio of parameters PRM12 and PRM13 is used for "internal" calculations.

◆ Step 3

Programming resolution (Reference Unit): 0.01"(preliminary value)

◆ Step 4

Amount of linear motion for one revolution of the gearbox-output shaft, Feed Constant (FC)

A. FC=π ×D=3.14159×7.5inches=23.562inches

B. PRM11=FC/Reference Unit=23.562/0.01=2356

◆ Step 5

Programming resolution (Reference Unit) within limits?

A. PRM8×PRM12/(PRM11×PRM13)=32,768×203/(2356×10)=282

B. This value is outside the limits

C. Next step is step 6

◆ Step 6

Revised programming resolution (Reference Unit): 0.001"

◆ Step 4

Amount of linear motion for one revolution of the gearbox-output shaft, Feed Constant (FC)

A. FC=π ×D=3.14159×7.5inches=23.562inches

B. PRM11=FC/Reference Unit=23.562/0.001=23,562

◆ Step 5

Programming resolution (Reference Unit) within limits?

A. PRM8×PRM12/(PRM11×PRM13)=32,768×203/(23,562×10)=28

B. This value is within the limits

C. Next step is step 7

◆ Step 7

Feed speed parameter value

A. 1,750ipm=1,750,000 Reference Units per minute (programming resolution=0.001")

B. PRM4=Speed [Reference Unit per minute] /1000=1,750,000/1,000=1,750

◆ Step 8

Other parameters, pages129 through 160.

◆ Results

PRM4 =1,750
PRM7 =54
PRM8 =32,768
PRM9 =1
PRM11 =23,562
PRM12 =203
PRM13 =10

8.2 PARAMETER LIST

Changing Process: ON (on-line parameters), OFF (off-line parameters: effective with command <RES> or by turning the power OFF and then ON once.)

●: Typical parameters which require setting in each position reference method standard way of use

▲: Parameter to be set in each position reference method if necessary

[ ]: Normally not used.

No.	Name	Range	Unit <→Related Parameter No.>	Change		Preset at the Factory	Position Reference Method			
				ON	OFF		Station No.	DG-SW	Serial command	Command table
1	Position loop gain· Kp	0 to 200	S^{-1}	○		30	●	●	●	●
2	Speed loop gain· Kv	1 to 200		○		15	●	●	●	●
3	Integral time constant : Ti	1 to 255	×2(ms)	○		10	●	●	●	●
4	1st feeding speed	1 to 240000	(×1000) reference unit/min	○		60	●	●	●	●
5	Linear accel/ decel time 1	8 to 60000	ms	○		100	●	●	●	●
6	Positioning complete range	1 to 250	Reference unit	○		1	●	●	●	●
7	Motor selection	0 to 79			○	(Note)	●	●	●	●
8	Encoder pulse	4096 to 32768	Pulse (×4)		○	32768	●	●	●	●
9	Encoder selection	0: absolute 1. incremental			○	0	●	●	●	●
10	Absolute encoder allowable error amount	0 to 99999999	Pulse		○	32768	●	●	●	●
11	Reference unit/machine one rotation	1 to 1500000	Reference unit		○	32768	●	●	●	●
12	Gear ratio setting (motor side speed)	1 to 10000000	Rotation		○	1	●	●	●	●
13	Gear ratio setting (machine side speed)	1 to 10000000	Rotation		○	1	●	●	●	●
14	Mode setting	0 to 11111	Bit (5-bit)			00000				
	b0: Motor rotating direction (REV run connection)	0: FWD run 1: REV run				0	▲	▲	▲	▲
	b1: Finite positioning/ infinite positioning mode setting	0: Finite positioning 1: Infinite positioning			○	0	●	●	●	●
	b2: Linear/rotation type mode setting	0: Linear type 1: Rotation type				0	●	●	●	●
	b3: Position reference mode	0: Absolute 1. Incremental				0	●	●	●	●
	b4: Position data code	0: Binary 1: BCD				0	●	●		●
15	Position reference method	0: Station No. (contact)	<→16. 20/b2>		○	2	●	●	●	●
		1: DG-SW	<→20/b1>							
		2: Serial command								
		4· Command table								

(Cont'd)

8.2 PARAMETER LIST (Cont'd)

No	Name	Range	Unit <→Related Parameter No >	Change ON	Change OFF	Preset at the Factory	Position Reference Method: Station No	DG-SW	Serial command	Command table
16	Station No	1 to 4096	<→20/b2>		○	1	●			
17	Function selection 1	0 to 11111	Bit (5-bit)			00000				
	b0: Current limit	1: Set	<→34 to 36>			0		▲	▲	
	b1: Feed forward	1: Provided	<→37>			0		▲	▲	
	b2: 2-step accel/decel	1: 2-step (0: 1-step)	<→38, 39>		○	0	▲	▲	▲	▲
	b3: Speed limit	1: Set	<→46>			0		▲		
	b4: Accel/decel type designation	1: Set	<→68 to 71, 47, 48>			0		▲	▲	
18	Function selection 2	0 to 11111	Bit (5-bit)			00000				
	b0: Software overtravel (Position reference fault detection)	1: Set	<→40, 41>			0		▲	▲	
	b1: Backlash compensation	1: Provided	<→42>			0	▲	▲	▲	▲
	b2: Speed reference (automatic mode)	1: Set	<→61>		○	0		▲		▲
	b3: Speed reference (manual mode)	1: Set	<→62>			0		▲		
	b4: Zero-point return	1: Used	<→49 to 54>			0		▲	▲	
19	Function selection 3	0 to 11111111	Bit (8-bit)			000000				
	b0: OT signal	1: Mask	<→19/b6>			0	▲	▲	▲	▲
	b1: STOP signal	1: Mask	<→72/b1>			0	▲	▲	▲	▲
	b2: Brake release signal	1: Used	<→43, 44>			0	▲	▲	▲	▲
	b3: Pulse input (reference)	1: Used	<→63>			0		▲	▲	
	b4: Pulse output (without FB zero point)	1: Used	<→64>		○	0		▲	▲	
	b5: Positioning (station) near signal	1: Used	<→45>			0	▲	▲	▲	▲
	b6: OT signal switching	0: Standard 1: Inversion				0		▲	▲	
	b7: Torque filter time constant change	0: Not change 1: Change	<→90>			0	▲	▲	▲	▲

(Cont'd)

(Cont'd)

No.	Name	Range	Unit <→Related Parameter No >	Change ON	Change OFF	Preset at the Factory	Position Reference Method: Station No.	DG-SW	Serial command	Command table
20	Function selection 4	0 to 1111111	Bit (7-bit)			0000000				
	b0	0				0				
	b1. External position indicator	1. Used 0 Not used	<→67>			0		●		
	b2· Station No 0	0· Provided 1. Not provided			○	0	●			
	b3: Simplified S-curve accel/decel	1· Used 0 Not used	<→76>			0	▲	▲	▲	▲
	b4: Function 7 setting	0: Not set 1: Set	<→72>			0	▲	▲	▲	▲
	b5: Function 5 setting	0: Not set 1: Set	<→65>			0	▲	▲	▲	▲
	b6: Function 6 setting	0: Not set 1: Set	<→66>			0	▲		▲	
21 to 30	For future use					0				
31	2nd feed speed	1 to 240000	(×1000) · reference unit/min	○		1	▲	▲		
32	3rd feed speed	1 to 240000	(×1000) · reference unit/min	○		1	▲	▲		
33	4th feed speed	1 to 240000	(×1000) · reference unit/min	○		1	▲	▲		
34	Current limit value	0 to 400	%	○		400		▲	▲	
35	Plus side current limit value (current limiting)	0 to 400	%	○		400		▲	▲	
36	Minus side current limit value (current limiting)	0 to 400	%	○		400		▲	▲	
37	Feedforward compensation value	0 to 200	%	○		0		▲	▲	
38	Linear accel/decel time 2	8 to 60000	ms	○		100		▲	▲	
39	Linear accel/decel accel switching speed	0 to 240000	(×1000) · reference unit/min	○		240000		▲	▲	
40	Plus side software overtravel (plus side position reference fault detection value)	±99999999	Reference unit	○		+99999999			▲	
41	Minus side software overtravel (minus side position reference fault detection value)	±99999999	Reference unit	○		-99999999			▲	
42	Backlash compensated amount	0 to ±30000	Pulse	○		0	▲	▲	▲	▲

(Cont'd)

8.2 PARAMETER LIST (Cont'd)

No.	Name	Range	Unit <→Related Parameter No >	Change		Preset at the Factory	Position Reference Method			
				ON	OFF		Station No	DG-SW	Serial command	Command table
43	Braking time	8 to 1000	ms	○		8	▲	▲	▲	▲
44	Brake ON. motor speed	1 to 10000	r/min	○		1	▲	▲	▲	▲
45	Positioning near range (station near range)	0 to 30000	Reference unit	○		1	▲	▲	▲	▲
46	Speed limit value	1 to 240000	(×1000) • reference unit/min	○		240000		▲		
47	Exponential accel/decel time constant	8 to 1000	ms	○		100		▲	▲	
48	Exponential accel/decel bias speed	0 to 240000	(×1000) • reference unit/min	○		0		▲	▲	
49	Zero-point return (homing) mode	0. DEC+C, 1:STP		○		1		▲	▲	
50	Zero-point return direction	0: Plus direction 1: Minus direction		○		0		▲	▲	
51	Zero-point return feed speed	0 to 240000	(×1000) • reference unit/min	○		1		▲	▲	
52	Zero-point return approach speed	0 to 240000	(×1000) • reference unit/min	○		1		▲	▲	
53	Zero-point return creep speed	0 to 240000	(×1000) • reference unit/min	○		1		▲	▲	
54	Zero-point return final travel distance	1 to ±99999999	Reference unit	○		1		▲	▲	
55 to 60	For future use					0				
61	Feed speed setting method (automatic mode)	0: Select by parameter at contacts 1: Digital switch 2: Serial command 4: Speed table			○	2		▲		
62	Feed speed setting method (manual mode)	0: Select by parameter at contacts 1: Digital switch 2: Serial command 4: Speed table			○	2		▲		

(Cont'd)

(Cont'd)

No.	Name	Range	Unit <→Related Parameter No.>	Change ON	Change OFF	Preset at the Factory	Position Reference Method: Station No	DG-SW	Serial command	Command table
63	Pulse signal status	0: 90° phase difference 2-phase pulse ×4 1: 90° phase difference 2-phase pulse ×2 2: 90° phase difference 2-phase pulse ×1 3: Sign + pulse train 4: CCW pulse + CW pulse			○	0		▲	▲	
64	Output pulse dividing ratio	2 to 64	1/2		○	2		▲		
65	Function selection 5	0 to 1111111	Bit (7-bit)			0000000				
	b0: Zone signal	1: Used 0: Not used				0				▲
	b1: Station near signal	1: Used 0: Not used	<→19/b5, 45>		○	0	▲			
	b2: DG-SW read-in time change	1: Change 0: Not change	<→77>			0		▲		
	b3: DG-SW digit number shift	1: Used 0: Not used	<→67>			0		▲		
	b4:	0				0				
	b5:	0				0				
	b6: Positioning completion signal	1: Changed 0: Not changed				0	▲	▲	▲	▲
66	Function selection 6	0 to 11111111	Bit (8-bit)			00000000				
	b0:	0				0				
	b1:	0				0				
	b2:	0				0				
	b3:	0				0				
	b4: Extension of station No. output	1: Used 0: Not used			○	0	▲			
	b5:	0				0				
	b6:	0				0				
	b7: Servopack response axis address	1: Provided 0: Not provided				0			▲	
67	Decimal point position and digit number shift	0 to 7			○	0		●		
68	Accel/decel type setting (automatic mode)	0: Linear, simplified S curve 1: Exponent		○		0		▲	▲	
69	Accel/decel type setting (manual mode)	0: Linear, simplified S curve 1: Exponent		○		0		▲		
70	Accel/decel type setting (pulse mode)	0: Linear, simplified S curve 1: Exponent		○		0		▲	▲	
71	Accel/decel type setting (zero-point return mode)	0: Linear, simplified S curve 1: Exponent		○		0		▲	▲	

(Cont'd)

8.2 PARAMETER LIST (Cont'd)

No.	Name	Range	Unit <→Related Parameter No >	Change ON	Change OFF	Preset at the Factory	Position Reference Method: Station No.	DG-SW	Serial command	Command table
72	Function selection 7	0 to 111111	Bit (6-bit)			000000				
	b0: Overrun detection alarm check	0: Check 1: Not check				0				
	b1: Remaining data after STOP signal	0: Appear 1: Disappear			○	0	▲	▲	▲	▲
	b2: FB after positioning stop	0: By contact 1: Motor PG				0		▲	▲	
	b3: Echo back at initialization	0: Not provided 1: Provided				0			▲	
	b4: OK response for serial command	0: No response 1: Response				0			▲	
	b5: Monitor Data Transmission Specification Change	0: Repeatedly 1: Only once				0			▲	
73 to 75	For future use					0				
76	Simplified S-curve accel /decel time	0 to 124	(+2)ms		○	0	▲	▲	▲	▲
77	DG-SW read-in scanning time	24 to 2000	ms		○	24		▲		
78 to 89	For future use					0				
90	Torque reference filter Time constant	0 to 100	(×32.5)μs		○	15	▲	▲	▲	▲
91 to 99	For future use					0				

Note Refer to Table 8 1 for parameter No. 7 (motor selection) preset at the factory

Servopack parameter No. 7 setting prior to shipping is as shown below. Change the set value to [motor code] suitable for motor to be used.

Table 8.1 Parameter No. 7 (Motor Selection) Setting prior to Shipping

SERVOPACK Type	Parameter No 7 Value Set Prior to Shipping	Applicable SERVOMOTOR Type -	Motor Code
HR03UB	11	USAMED-03L □ 1	1
HR05UB	12	USAFED-05L □ 1	12
		USAGED-05L □ 1	52
HR10UB	13	USAMED-06L □ 1	2
		USAMED-09L □ 2	3
		USAFED-09L □ 1	13
		USAGED-09L □ 1	53
HR15UB	14	USAMED-12L □ 2	4
		USAFED-13L □ 2	14
		USAGED-13L □ 2	54
HR20UB	15	USAMED-20L □ 2	5
		USAFED-20L □ 2	15
		USAGED-20L □ 2	55
HR30UB	16	USAMED-30L □ 2	6
		USAFED-30L □ 2	16
		USAGED-30L □ 2	56
HR44UB	17	USAMED-44L □ 2	7
		USAFED-44L □ 2	17
		USAGED-44L □ 2	57

8.3 PARAMETER FUNCTION DETAILS

No.	Name	Contents
1	Position Loop Gain (Abbreviation: Kp)	Position loop gain set value. Unit: [S $^{-1}$] , setting range: (0 to 200)
2	Speed Loop Gain (Abbreviation: Kv)	• Kv : Speed loop gain set value. Unit: [×2.5Hz] , setting range: (1 to 200) (for equivalent inertia)
3	Integral Time Constant (Abbreviation: Ti)	• Ti: Speed loop integral time constant set value. Unit: [×2ms] , setting range: (1 to 255)
	Notes: 1. Relation between speed loop gain Kv and integral time constant Ti is defined by the following value in proportion to current reference, assuming speed deviation is εv: $$Kv\left(\varepsilon v + \int \frac{\varepsilon v}{Ti} dt\right)$$ 2. Speed loop gain Kv cannot obtain a high value when machine system rigidity is low. (Oscillation occurs by forcing the value to increase.) 3. Excessively small integral time constant Ti causes oscillation. Do not use it by making it extremely smaller than factory set value 10 (20ms).	

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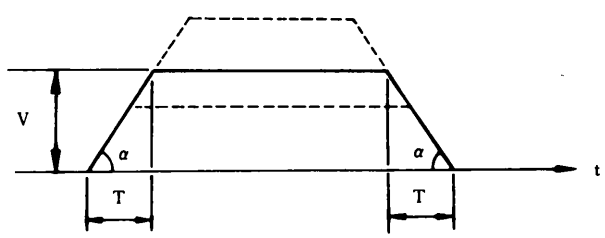
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No.	Name	Contents
4	(1st) Feeding Speed	Acceleration speed value set value for reference speed and linear accel/decel. Unit : (× 1000 reference unit/min), setting range: (1 to 240000). (Example) For reference unit 0.01mm, feeding speed set value of 150m/min is as follows: $\frac{(150\times10^3)}{0.01}$ = 15000000reference unit/min = 15000 ×1000 unit/min = 15000 (1) For reference speed, this parameter set value is selected when speed select signals (CN5) both SP2ND and SP3RD are at H level. < Speed selected by this parameter at contact >

Parameter			Speed Select Signanl	
No	Name	Setting Range/Unit	$\overline{SP2ND}$	$\overline{SP3RD}$
4	(1st) Feeding Speed	1 to 240000 (×1000 reference unit/min)	H	H
31	(2nd) Feeding Speed		L	H
32	(3rd) Feeding Speed		H	L
33	(4th) Feeding Speed		L	L

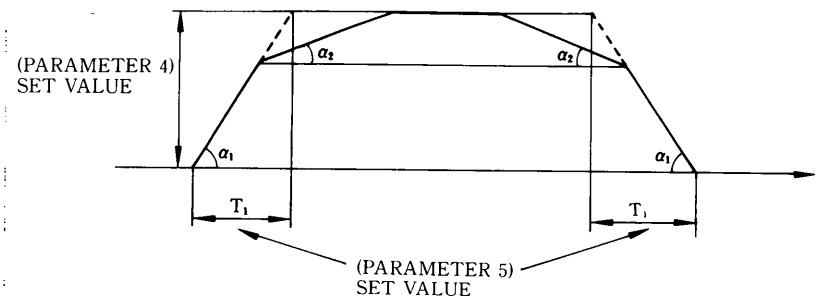
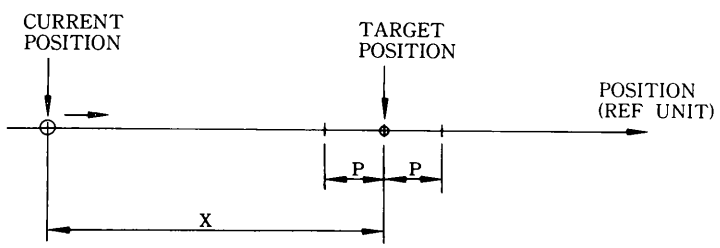
(2) Accel/decel speed set value (1-, 2-step linear accel/decel, simplified S-curve accel/decel)

Parameter No.	4	5
Set Value	V	T



Accel speed α is determined by V/T and becomes constant if feed speed changes. (Accel speed constant control)

(Cont'd)

No.	Name	Contents
5	Linear Accel/Decel Time 1	For linear accel/decel speed control, accel/decel speed is set with parameter 4. Unit: (ms), setting range: (8 to 60000) ① For 1-step accel/decel, refer to the description of parameter 4. ② For 2-step accel/decel, (refer to the description of parameter 17 b2), the first-step accel/decel speed is set. ③ For simplified S-curve accel/decel (refer to the description of parameter 76), the second-step accel/decel speed is set.  α1: 1st-step accel/decel speed (by V1/T1) α2: 2nd-step accel/decel speed (Refer to the description of parameter 17.)
6	Positioning Complete Range (Abbreviation: COIN Width)	If distance difference (in reference units) between current position and target position provided by reference data becomes lower than the value set by parameter 6, $\overline{\text{COIN}}$ signal is output. (In serial communication, [COIN] is automatically sent.) Setting range: 1 to 250 (reference unit).  P: Positioning complete range x: | Current position - target position | $\overline{\text{COIN}}$ signal is output when x ≦ p.

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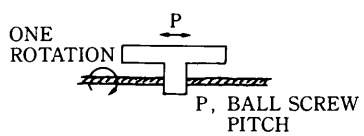
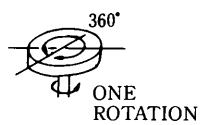
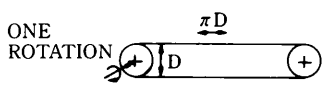
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<table>
<tr><th>No.</th><th>Name</th><th colspan="2">Contents</th></tr>
<tr><td>7</td><td>Motor Selection Code</td><td colspan="2">In Servopack type CACR-HR, each constant required for control with matching motors is determined by the code set in parameter 7 for perfect matching of Servopack and motors.

Since a code number is provided for each motor type, check matching motor type and set the code number.

<table>
<tr><th colspan="2">M Series</th><th colspan="2">F Series</th><th colspan="2">G Series</th></tr>
<tr><th>Motor Type USAMED-</th><th>Code No.</th><th>Motor Type USAFED-</th><th>Code No.</th><th>Motor Type USAGED-</th><th>Code No.</th></tr>
<tr><td>—</td><td>0</td><td></td><td></td><td></td><td></td></tr>
<tr><td>03L ⬚ 1</td><td>1</td><td></td><td></td><td></td><td></td></tr>
<tr><td>06L ⬚ 1</td><td>2</td><td>05L ⬚ 1</td><td>12</td><td>05L ⬚ 1</td><td>52</td></tr>
<tr><td>09L ⬚ 2</td><td>3</td><td>09L ⬚ 1</td><td>13</td><td>09L ⬚ 1</td><td>53</td></tr>
<tr><td>12L ⬚ 2</td><td>4</td><td>13L ⬚ 2</td><td>14</td><td>13L ⬚ 2</td><td>54</td></tr>
<tr><td>20L ⬚ 2</td><td>5</td><td>20L ⬚ 2</td><td>15</td><td>20L ⬚ 2</td><td>55</td></tr>
<tr><td>30L ⬚ 2</td><td>6</td><td>30L ⬚ 2</td><td>16</td><td>30L ⬚ 2</td><td>56</td></tr>
<tr><td>44L ⬚ 2</td><td>7</td><td>44L ⬚ 2</td><td>17</td><td>44L ⬚ 2</td><td>57</td></tr>
</table>
</td></tr>
<tr><td>8</td><td>Encoder Pulse</td><td colspan="2">Encoder pulse resolution mounted at motor shaft opposite load side is set. Prior to shipping, value [32768] (8192 ×4) is set.</td></tr>
<tr><td>9</td><td>Encoder Selection</td><td colspan="2">Identification code of encoder to be used is set. Factory setting is [0] .
Absolute encoder identification code: 0
Incremental encoder identification code: 1</td></tr>
<tr><td>10</td><td>Absolute Encoder Allowable Error Amount</td><td>Effective with parameter 9=0</td><td>Absolute encoder absolute value data are checked when Servopack power supply is turned on. At this time, if an error amount (difference of position compared to position before provious power-down) exceeds parameter 10 set value, an alarm (ABSO error) occurs.
Set value prior to shipping is [32768] .</td></tr>
</table>

(Cont'd)

<table>
<tr><th>No.</th><th>Name</th><th>Contents</th></tr>
<tr><td>11</td><td>Load Moving Amount at Load Side One Rotation (Reference unit)</td><td>
(1) Reference unit is the minimum unit of position data to move the load.
(Example: 0.01mm, 1 μm, 0.1° or 0.01 inch)
For example, when reference unit is 1 μm, and position data value is 50000, actual moving amount will be:
50000 × 0.1 = 5000 μm = 5mm.
• Determine reference unit, considering machine specifications, positioning accuracy, etc.
• Position data unit for DG-SW, serial communication, etc. is the reference unit.
• Speed data unit in DG-SW, serial communication or parameter setting is [×1000 reference unit/min].
(2) (Parameter 11) set value
= Moving amount per load side rotation / Reference unit
The table below shows typical load moving amount rotation:
<table>
<tr><th>Load Moving Amount per Load Shaft Rotation</th><th colspan="2">Typical Load Cofiguration</th></tr>
<tr><td>P</td><td>Ball Screw</td><td>
</td></tr>
<tr><td>360°</td><td>Round Table</td><td>
</td></tr>
<tr><td>πD</td><td>Belt</td><td>
</td></tr>
</table>
Parameter 11 setting range: 1 to 1500000
(Example) When load moving mount per load shaft rotation is 12mm and reference unit is 0.01mm, the following value is set:
(Parameter 11) = 12 / 0.01 = 1200
</td></tr>
</table>

(Cont'd)

(Cont'd)

No.	Name	Contents
12	Gear Ratio Setting m (Motor Shaft Rotation Speed)	(1) Assuming load shaft rotates ℓ times when motor shaft rotates m times according to applicable machine specifications by parameter to set gear ratio, the following values are set: • (Parameter 12) = m • (Parameter 13) = ℓ (2) Parameter 12 or 13 unit is (rotation) and the setting range is 1 to 10000000. (3) By parameters 8 and 11 to 13, reference data and encoder pulse conversion can be possible. $\frac{B}{A} = \frac{(\text{PARAMETER 8}) \times (\text{PARAMETER 12})}{(\text{PARAMETER 11}) \times (\text{PARAMETER 13})}$ However, the above indicates the number of encoder pulses per reference unit, having limiting conditions as follows: $0.01 \leqq \frac{B}{A} \leqq 100$ (You must reconsider the machine specifications to omit this condition.) (4) Precautions when $\frac{B}{A} < 1$ Since the reference unit becomes smaller than the encoder pulse resolution, positioning accuracy becomes lower as $\frac{B}{A}$ value becomes smaller.
13	Gear Ratio Setting ℓ (Load Shaft Rotation Speed)	
14	Mode Setting	By setting b4, b3, b2, b1 or b0 to "0" or "1", mode is set (b0 is LSB).
	b0 Motor Rotating Direction Setting	Used when motor rotating direction for reference direction (±) is changed.

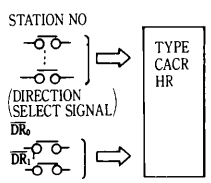
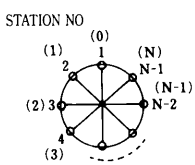
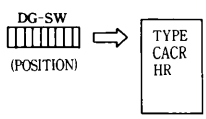
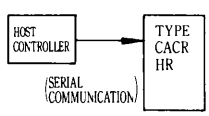
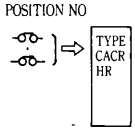
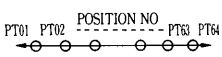
Set Value	Reference Direction	Motor Shaft Rotating Direction
0	+	Forward direction
	−	Reverse direction
1	+	Reverse direction
	−	Forward direction

(Cont'd)

<table>
<tr><th>No.</th><th>Name</th><th>Contents</th></tr>
<tr><td>14</td><td>b1
Finite Positioning/ Infinite Positioning Mode Setting</td><td>Set according to machine specification.
<table>
<tr><td>Finite Positioning Mode (Set Value = 0)</td><td>Used for configuration with a moving limit. (Software overtravel function provided.)</td></tr>
<tr><td>Infinite Positioning Mode (Set Value = 1)</td><td>Used for configuration without moving limit (such as round table or press feeder one direction feeding). (Position reference fault detection provided.)</td></tr>
</table></td></tr>
<tr><td></td><td>b2
Linear Type/Rotation Type Mode Setting</td><td>Set according to the machine specifications (Load is of linear type or rotating type). Positioning range is as shown below by mode.
<table>
<tr><td>Linear (b2=0)</td><td>−99999999 ～ +99999999</td></tr>
<tr><td>Rotation (b2=1)</td><td>Positioning range is 0 to [parameter (11) set value - 1] regardless of rotating amount. (Range for one rotation)</td></tr>
</table></td></tr>
<tr><td></td><td>b3
Position Reference Mode</td><td>Determines whether position data is of absolute value or incremental value. When reference data value is x, the aimed position after start command ($\overline{AST}$ signal or serial command [ST]) will be as shown below:
<table>
<tr><th rowspan="2">Position Reference Mode</th><th colspan="4">Position Reference Method (by Parameter 15 Setting)</th></tr>
<tr><th>Station No.</th><th>DG-SW</th><th>Serial Communication
MOV x</th><th>Serial Communication
MOVI x</th><th>Command table</th></tr>
<tr><td>Absolute value (b3 = 0)</td><td>x = Target station No</td><td>Absolute value</td><td>Absolute value</td><td>Incremental value</td><td>Absolute value</td></tr>
<tr><td>Incremental value (b3 = 1)</td><td>x = Number of stations to be moved</td><td>Incremental value</td><td>Incremental value</td><td>(Do not use)</td><td>(Do not use)</td></tr>
</table></td></tr>
</table>

(Cont'd)

(Cont'd)

<table>
<tr><th>No.</th><th>Name</th><th>Contents</th></tr>
<tr><td>14</td><td>b4 Position Reference Code</td><td>Position data code (BCD or binary) is selected.
(1) Station No. reference method
<table>
<tr><td>Input Signal</td><td>$\overline{CD0}$</td><td>$\overline{CD1}$</td><td>$\overline{CD2}$</td><td>$\overline{CD3}$</td><td>$\overline{CD4}$</td><td>$\overline{CD5}$</td><td>$\overline{CD6}$</td><td>$\overline{CD7}$</td><td>$\overline{CD8}$</td><td>$\overline{CD9}$</td><td>$\overline{CD10}$</td><td>$\overline{CD11}$</td></tr>
<tr><td>B C D (b4=1)</td><td>1</td><td>2</td><td>4</td><td>8</td><td>10</td><td>20</td><td>40</td><td>80</td><td>100</td><td>200</td><td>400</td><td>800</td></tr>
<tr><td>Binary (b4=0)</td><td>1</td><td>2</td><td>4</td><td>8</td><td>16</td><td>32</td><td>64</td><td>128</td><td>256</td><td>512</td><td>1024</td><td>2048</td></tr>
</table>
(2) Set BCD (b4 = 1) for DG-SW reference method
(3) Set binary setting (b4 = 0) for command table method.</td></tr>
<tr><td>15</td><td>Position Reference Method</td><td>Applicable position data reference method is set.
<table>
<tr><th>Set Value</th><th>Position Data Reference Mehtod</th></tr>
<tr><td>0</td><td>Station No.</td></tr>
<tr><td>1</td><td>DG-SW</td></tr>
<tr><td>2</td><td>Serial Communication</td></tr>
<tr><td>4</td><td>Command Table</td></tr>
</table>
<table>
<tr><th></th><th>Reference Method and Outline</th><th>Reference Input</th><th>Remarks</th></tr>
<tr><td>Station No.</td><td>Positioning to a station No. provided by parallel contact data (12-bit). Rotating direction is determined by direction select signal.</td><td>
</td><td>
</td></tr>
<tr><td>DG-SW</td><td>Position reference by DG-SW (up to 8 digits) setting data.</td><td>
</td><td></td></tr>
<tr><td>Serial Communication</td><td>Position reference command. Data are set by MOV or MOVI.</td><td>
</td><td></td></tr>
<tr><td>Command Table</td><td>Positioning at position No. specified by parallel contact data (6-bit).</td><td>
</td><td>
</td></tr>
</table></td></tr>
</table>

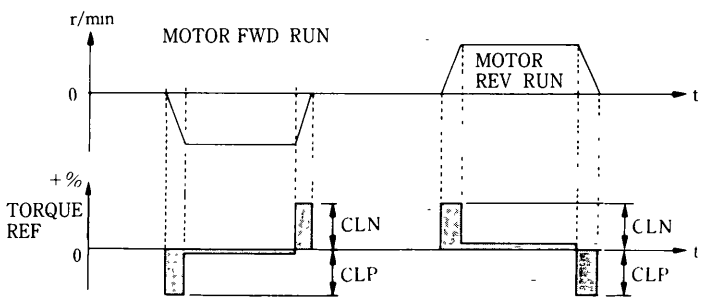
(Cont'd)

<table>
<tr><th>No.</th><th colspan="2">Name</th><th>Contents</th></tr>
<tr><td>16</td><td colspan="2">Number of Stations</td><td>Parameter to set the number of stations when the station No. reference method is selected.
Setting range: 1 to 4096.

By setting the number of stations N, N stations divided equally on the load shaft circumference are determined.

Whether the station No. is taken from 0 or 1 is set by parameter 20 b2.</td></tr>
<tr><td>17</td><td colspan="2">Function Selection 1</td><td>By setting (b4, b3, b2, b1, b0) to "0" or "1", each function can be selected.</td></tr>
<tr><td></td><td>b0</td><td>Current Limit</td><td>b0 = 1 when current limit value setting parameter 34, 35 or 36 function is to be effective.
b0 = 0 when ineffective.

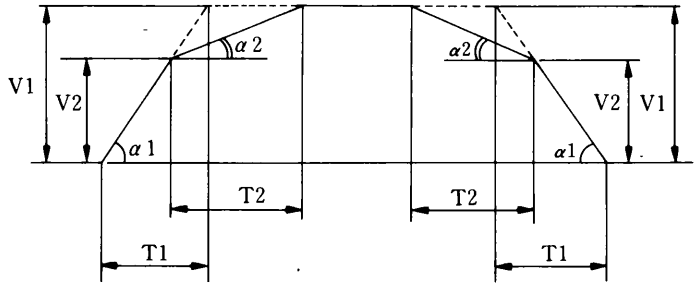
The table below shows effective current limit values marked with ○ when b0 = 1.

<table>
<tr><th colspan="2">Parameter</th><th rowspan="2">$\overline{\text{CUR}}$ Signal Not Turned ON ($\overline{\text{CUR}}$-H)</th><th colspan="2">$\overline{\text{CUR}}$ Signal ON ($\overline{\text{CUR}}$-L)</th></tr>
<tr><th>No.</th><th>Name</th><th>+Side Limit Value (CLP)</th><th>−Side Limit Value (CLN)</th></tr>
<tr><td>34</td><td>Current Limit Value</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>35</td><td>Plus Side Current Limit Value</td><td>×</td><td>○</td><td>×</td></tr>
<tr><td>36</td><td>Minus Side Current Limit Value</td><td>×</td><td>×</td><td>○</td></tr>
</table>
(The figures below show observed waveform in monitor output.)


Note: Motor's maximum current limit value is effective when parameter set value is larger than motor's maximum current limit value.
Motor's maximum current limit value is determined by parameter 7 motor code.</td></tr>
<tr><td></td><td>b1</td><td>Feed forward Compensation</td><td>• By setting b1 = 1, feedforward compensation functions and compensated amount (0 to 100%) set in parameter 37 becomes effective.
• When b1 = 0, the feedforward compensation is ineffective. (Parameter 37 set value is ineffective.)</td></tr>
</table>

(Cont'd)

(Cont'd)

<table>
<tr><th>No.</th><th colspan="2">Name</th><th>Contents</th></tr>
<tr><td>17</td><td>b2</td><td>2-step Accel/Decel</td><td>1-step or 2-step accel/decel is selected.
<table>
<tr><th rowspan="2">b2 Set Value</th><th rowspan="2">Accel/ Decel Type</th><th colspan="4">Accel/Decel Setting Parameters</th></tr>
<tr><th>4</th><th>5</th><th>38</th><th>39</th></tr>
<tr><td>0</td><td>1-step</td><td>V</td><td>T</td><td>—</td><td>—</td></tr>
<tr><td>1</td><td>2-step</td><td>V1</td><td>T1</td><td>V2</td><td>T2</td></tr>
</table>
• 2-step accel/decel type speed setting


Accel/decel speed α1 or α2 is determined by V1/T1 or (V1-V2)/T2. It is constant even if feeding speed changes.</td></tr>
<tr><td></td><td>b3</td><td>Speed Limit</td><td>By setting b3 = 1, parameter 46 speed limit value becomes effective.
<table>
<tr><th>b3 Set Value</th><th>Speed Limit Value</th></tr>
<tr><td>0</td><td>Max. r/min in motor specifications. (Determined by parameter 7.)
<table>
<tr><td>M Series 2000r/min *1</td></tr>
<tr><td>F Series 2500r/min</td></tr>
<tr><td>G Series 3000r/min</td></tr>
</table>
*1 1500r/min for type USAMED-44L □ 2</td></tr>
<tr><td>1</td><td>Smaller value (parameter 46 set value or the above motor max. speed)</td></tr>
</table></td></tr>
</table>

(Cont'd)

<table>
<tr><th>No.</th><th>Name</th><th>Contents</th></tr>
<tr><td>17</td><td>b4 Accel/Decel Type Setting</td><td>Accel/decel type (linear or exponent) is specified by b4 setting.

< Setting Method >

<table>
<tr><th>b4 Set Value</th><th>Accel/decel Type</th></tr>
<tr><td>0</td><td>1-step or 2-step linear accel/decel and simplified S-curve accel/decel. (Always linear type regardless of operation mode.)</td></tr>
<tr><td>1</td><td>Set the following parameters according to the accel/decel type in each operation mode:
<table>
<tr><th>Parameter No.</th><th>Operation Mode</th><th>Linear Accel /Decel or Simplified S-Curve Accel/Decel</th><th>Exponential Accel/Decel</th></tr>
<tr><td>68</td><td>Automatic</td><td>1</td><td>0</td></tr>
<tr><td>69</td><td>Manual</td><td>1</td><td>0</td></tr>
<tr><td>70</td><td>Pulse command</td><td>1</td><td>0</td></tr>
<tr><td>71</td><td>Zero-point return (homing)</td><td>1</td><td>0</td></tr>
</table>
Note: Refer to parameters 47 and 48 for exponential accel/decel setting.</td></tr>
</table>
</td></tr>
</table>

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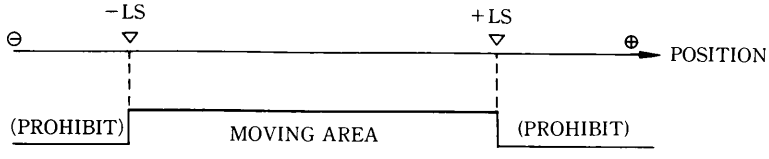
No.	Name	Contents
18	Function Selection 2	By setting (b4, b3, b2, b1, b0) to "0" or "1", each function can be selected.
	b0 Software overtravel (Position Reference Fault Detection)	(1) Software overtravel function is effective in finite positioning mode while position reference fault detection function is effective in infinite positioning mode.

Parameter No.	Set Value	Remarks	Effective Function
14	b1 = 0	Finite positioning mode	Software overtravel
	b1 = 1	Infinite positioning mode	Position reference fault detection

(2)

b0 Set Value	Software Overtravel Set Position	
	Plus Side (+LS)	Minus Side (-LS)
0	+99999999	-99999999
1	(Parameter 40) set value	(Parameter 41) set value

Note: When incremental encoder is used (Parameter 9 = 1), software overtravel becomes effective after zero-point return (homing).



(3)

b0 Set Value	Position Reference Range (Limit Value)	
	Plus Side	Minus Side
0	+99999999	−99999999
1	[Parameter 40] set value	[Parameter 41] set value

(4) Finite positioning mode
By software overtravel detection, operation is prohibited and
- Error signal $\overline{ERR}$ is output.
- [ERR OV] is automatically sent from Servopack in serial communication. (For only one-axis)

Detecting operation differs as follows depending on operation mode.

Operation Mode	Detecting Operation
Automatic	When position data exceed software overtravel set value, detection is performed at turning on start signal $\overline{AST}$ or command [ST].
Manual	When software overtravel set position is passed during operation, the operation stops at the position at a specified deceleration.
Pulse	
Non-current conduction	Detects when present position is out of software overtravel set position.

(5) Infinite positioning mode
When position reference value is out of the following range in the automatic operation mode, position reference fault error (alarm code output $\overline{AL0}$ = 0, $\overline{AL1}$ = 0, $\overline{AL2}$ = 1, $\overline{AL3}$ = 0) occurs.
[Parameter 41] set value ≦ position reference value ≦ [Parameter 40] set value
(Example) Parameter 14 b1 = 1: Infinite positioning mode
b3 = 1: Incremental reference
Parameter 15 = 1 : DG-SW reference method
Parameter 18 b0 = 1: Parameters 40 and 41 are effective.
Parameter 40 = 5000
Parameter 41 = 0

When the parameters are set as shown above, by setting the digital switch to the following values and inputting the start signal:
Set value
+48000 : Move to the plus side by 48000
+52000 } : Does not start because of position reference fault.
- 2000

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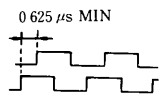
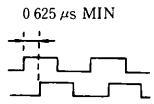
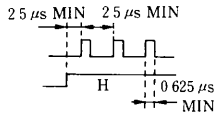
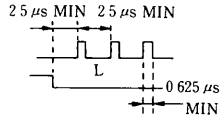
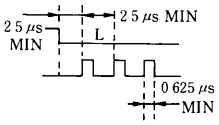
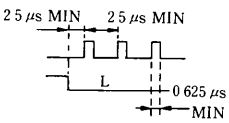
<table>
<tr><th>No.</th><th>Name</th><th>Contents</th></tr>
<tr><td>18</td><td>b1</td><td>Backlash Compensation</td><td>Sets whether backlash compensation function is provided or not
<table>
<tr><th>b1 Set Value</th><th>Backlash Compensation</th></tr>
<tr><td>0</td><td>Not provided</td></tr>
<tr><td>1</td><td>Compensated amount is (parameter 42) set value</td></tr>
</table></td></tr>
<tr><td></td><td>b2</td><td>Speed Reference in Auto Operation Mode</td><td>Selects speed reference setter in automatic operation mode.
<table>
<tr><th rowspan="2">b2 Set Value</th><th colspan="4">Parameter 15 Setting (Position Reference Method)</th></tr>
<tr><th>0</th><th>1</th><th>2</th><th>4</th></tr>
<tr><td></td><td>Station No.</td><td>DG-SW</td><td>Serial Communication</td><td>Command table</td></tr>
<tr><td>0</td><td>Selected by parameter at contact.</td><td>DG-SW</td><td>Serial command (SPD×××)</td><td>Speed table</td></tr>
<tr><td>1</td><td colspan="4">Speed reference setter can be selected regardless of position reference method.
<table>
<tr><th>Parameter No</th><th>Set Value</th><th>Speed Reference Setter</th></tr>
<tr><td rowspan="4">61</td><td>0</td><td>Selected by parameter at contact</td></tr>
<tr><td>1</td><td>DG-SW</td></tr>
<tr><td>2</td><td>Serial command</td></tr>
<tr><td>4</td><td>Speed table</td></tr>
</table></td></tr>
</table>
Note. "Selected by parameter at contact" means to select parameter setting (1st speed) to (4th speed) by speed select signals $\overline{SP2ND}$ and $\overline{SP3RD}$. Refer to the description of parameter 4.</td></tr>
</table>

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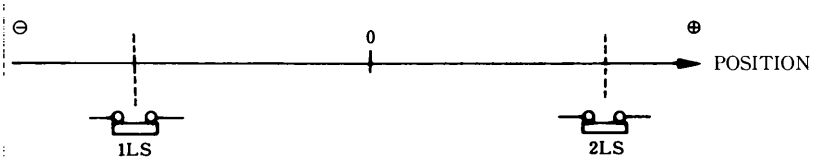
<table>
<tr><th>No.</th><th>Name</th><th>Contents</th></tr>
<tr><td>18</td><td>b3 Speed Reference in Manual Operation Mode</td><td>Selects speed reference setter in manual operation mode.
<table>
<tr><th rowspan="2">b3 Set Value</th><th colspan="4">Parameter 15 setting (Position Reference Method)</th></tr>
<tr><th>0</th><th>1</th><th>2</th><th>4</th></tr>
<tr><td></td><td>Station No</td><td>DG-SW</td><td>Serial Communication</td><td>Command table</td></tr>
<tr><td>0</td><td>Selected by parameter at contact.</td><td>DG-SW</td><td>Serial command (SPD×××)</td><td>Speed table</td></tr>
<tr><td>1</td><td colspan="4">Speed reference setter can be selected regardless of position reference method.
<table>
<tr><th>Parameter No</th><th>Set Value</th><th>Speed Reference Setter</th></tr>
<tr><td rowspan="4">62</td><td>0</td><td>Selected by parameter at contact</td></tr>
<tr><td>1</td><td>DG-SW</td></tr>
<tr><td>2</td><td>Serial command</td></tr>
<tr><td>4</td><td>Speed table</td></tr>
</table></td></tr>
</table>
Note: "Selected by parameter at contact" means to select parameter setting (1st speed) to (4th speed) by speed select signals $\overline{SP2ND}$ and $\overline{SP3RD}$. Refer to the description of parameter 4</td></tr>
<tr><td></td><td>b4 Zero-point Return (Homing)</td><td>Set b4 = 1 so that parameters 49 to 54 required for operation in zero-point return mode (refer to Par. 6.2.3 (1) (d)) will be effective.
<table>
<tr><th>b4 Set Value</th><th>Operation in Zero-point Return Mode</th></tr>
<tr><td>0</td><td>Not : Parameters 49 to 54 setting are ineffective</td></tr>
<tr><td>1</td><td>Perform : Parameters 49 to 54 setting are effective</td></tr>
</table></td></tr>
<tr><td>19</td><td colspan="2">Function Selection 3</td><td>By setting (b7, b6, b4, b3, b2, b1, b0) to "0" or "1", each function can be selected</td></tr>
<tr><td></td><td>b0</td><td>OT Signal</td><td>Enables or disables overtravel LS input signal P-OT or N-OT.
<table>
<tr><th>b0 Set Value</th><th>P-OT or N-OT Signal</th></tr>
<tr><td>0</td><td>Used (Closed input at normal operation)</td></tr>
<tr><td>1</td><td>Not used (Input can be opened.)</td></tr>
</table></td></tr>
</table>

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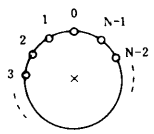
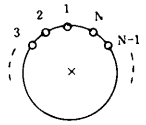
<table>
<tr><th>No.</th><th>Name</th><th>Contents</th></tr>
<tr><td>19</td><td>b1</td><td>STOP Signal</td><td>Enables or disables STOP signal operation. To perform automatic operation in serial communication, set b1 = 1. If STOP signal input (2CN-15) remains open, [ST] command becomes [ERR SN]
<table>
<tr><th>b1 Set Value</th><th>STOP Signal</th></tr>
<tr><td>0</td><td>Used (Closed input at operation.)</td></tr>
<tr><td>1</td><td>Not used (Input can be opened.)</td></tr>
</table></td></tr>
<tr><td></td><td>b2</td><td>Brake Release Signal</td><td>Set b2 = 1 so that parameter 43 and 44 required for brake release signal output $\overline{BK}$ (refer to Par. 6.3.2 (2)) operation will be effective.
<table>
<tr><th>b2 Set Value</th><th>$\overline{BK}$ Signal</th></tr>
<tr><td>0</td><td>Not used (Parameters 43, and 44 setting are ineffective)</td></tr>
<tr><td>1</td><td>Used (Parameters 43, and 44 setting are effective)</td></tr>
</table></td></tr>
<tr><td></td><td>b3</td><td>Pulse Reference Input</td><td>Set together with parameter 63 according to input pulse signal form in pulse train operation mode.
<table>
<tr><th colspan="2" rowspan="2">Signal Form</th><th colspan="2">Parameter No.</th><th rowspan="2">Signal Name</th><th colspan="2">Pulse Waveform</th></tr>
<tr><th>63</th><th>19 b3</th><th>Plus Side Reference</th><th>Minus Side Reference</th></tr>
<tr><td rowspan="3">90° phase difference 2-phase pulse train</td><td>×4</td><td>0</td><td rowspan="3">0</td><td rowspan="3">CA
CB</td><td rowspan="3"></td><td rowspan="3"></td></tr>
<tr><td>×2</td><td>1</td></tr>
<tr><td>×1</td><td>2</td></tr>
<tr><td colspan="2">Sign + pulse train</td><td>3</td><td rowspan="2">1</td><td>CA
CB</td><td></td><td></td></tr>
<tr><td colspan="2">CCW + CW pulse train</td><td>4</td><td>CA
CB</td><td></td><td></td></tr>
</table></td></tr>
</table>

(Cont'd)

(Cont'd)

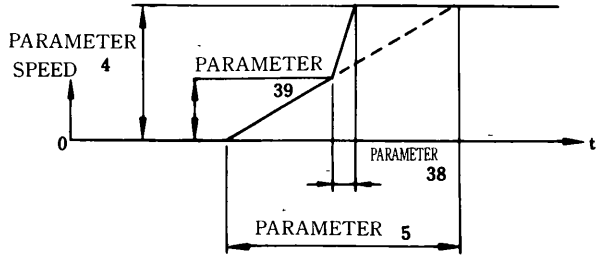
<table>
<tr><th>No.</th><th>Name</th><th>Contents</th></tr>
<tr><td>19</td><td>b4 Pulse Output</td><td>PG dividing output signal (FA, FB) dividing ratio.
(Refer to Fig. 5.12.)
<table><tr><th>b4 Set Value</th><th>Parameter 64</th><th>Dividing Ratio</th></tr><tr><td>0</td><td>—</td><td>1</td></tr><tr><td>1</td><td>N(N=2 to 64)</td><td>2/N</td></tr></table></td></tr>
<tr><td></td><td>b5 Positioning Near Signal and Station Near Signal</td><td>For station near signal, refer to the description of parameter 65 b1. Set b5 = 1 so that (parameter 45) required for positioning near signal NEAR operation will be effective.
<table><tr><th>b5 Set Value</th><th>Positioning Near Signal</th></tr><tr><td>0</td><td>Does not operate.
(Parameter 45 setting is ineffective.)</td></tr><tr><td>1</td><td>When distance difference (reference unit) between current position and aimed position is less than the value set by parameter 45, $\overline{\text{NEAR}}$ signal is output. (In serial communication, NEAR is automatically sent.)</td></tr></table></td></tr>
<tr><td></td><td>b6 OT Signal Switching</td><td>Function can be inverted without switching P-OT and N-OT signals.

<table><tr><th>b6 Set Value</th><th>1LS</th><th>2LS</th><th></th></tr><tr><td>0</td><td>N-OT</td><td>P-OT</td><td>(Standard)</td></tr><tr><td>1</td><td>P-OT</td><td>N-OT</td><td></td></tr></table>P-OT: Stops + direction reference
N-OT: Stops — direction reference</td></tr>
<tr><td></td><td>b7 Torque Reference Filter Time Constant Change</td><td>b7 = 1 when the function of parameter 90 which sets torque reference filter time constant to prevent shaft oscillation is to be effective; b7 = 0 when ineffective.
<table><tr><th>b7 Set Value</th><th>Torque Reference Filter Time Constant</th></tr><tr><td>0</td><td>0.45ms</td></tr><tr><td>1</td><td>Value set by parameter 90</td></tr></table></td></tr>
</table>

(Cont'd)

<table>
<tr><th>No.</th><th>Name</th><th>Contents</th></tr>
<tr><td>20</td><td>Function Selection 4</td><td>By setting (b6, b5, b4, b3, b2, b1, b0) to "0" or "1", each function can be selected</td></tr>
<tr><td></td><td>b0 —</td><td>(Always set to 0)</td></tr>
<tr><td></td><td>b1 External Position Indicator</td><td>When used by connecting to external position indicator (MCIF-L8 type), set to b1 = 1
Decimal position of the external position indicator is selected by parameter 67.</td></tr>
<tr><td></td><td>b2 Station No 0</td><td>In the station No reference method (parameter 15 setting = 0), the number of stations N is set by parameter 16 and how to take the station No. is set by b2.
<table>
<tr><th>b2 Set Value</th><th>0</th><th>1</th></tr>
<tr><td>How to Take Station No.</td><td>Station No 0 Provided
</td><td>Station No 0 Not Provided
</td></tr>
</table></td></tr>
<tr><td></td><td>b3 Simplified S-curve Accel/Decel</td><td>Selects whether simplified S-curve accel/decel is used or not
<table>
<tr><th>b3 Set Value</th><th>Simplified S-curve Accel/Decel</th></tr>
<tr><td>0</td><td>Not used· Parameter 76 setting ineffective</td></tr>
<tr><td>1</td><td>Used Parameter 76 setting effective</td></tr>
</table></td></tr>
<tr><td></td><td>b4 Function Selection 7 Setting (Related to Parameter 72)</td><td>Set to 1 when parameter 72 function is to be effective. (Normally set to 0.)
<table>
<tr><th>b4 Set Value</th><th>Parameter 72 Setting Contents</th></tr>
<tr><td>1</td><td>Effective</td></tr>
<tr><td>0</td><td>Same function as parameter 72 b0 = 0, b1 = 0, b2 = 0, b3 = 0, b4 = 0 or b5 = 0 setting</td></tr>
</table></td></tr>
<tr><td></td><td>b5 Function Selection 5 Setting (Related to Parameter 65)</td><td>Set to 1 when parameter 65 function is to be effective (Normally set to 0.)
<table>
<tr><th>b5 Set Value</th><th>Parameter 65 Setting Contents</th></tr>
<tr><td>1</td><td>Effective</td></tr>
<tr><td>0</td><td>Same function as parameter 65 b0 = 0, b1 = 0, b2 = 0, b3 = 0, b4 = 0, b5 = 0 or b6 = 0 setting.</td></tr>
</table></td></tr>
<tr><td></td><td>b6 Function Selection 6 Setting (Related to Parameter 66)</td><td>Set to 1 when parameter 66 function is to be effective. (Normally set to 0.)
<table>
<tr><th>b5 Set Value</th><th>Parameter 66 Setting Contents</th></tr>
<tr><td>1</td><td>Effective</td></tr>
<tr><td>0</td><td>Same function as parameter 66 b0 = 0, b1 = 0, b2 = 0, b3 = 0, b4 = 0, b5 = 0, b6 = 0 or b7 = 0 setting.</td></tr>
</table></td></tr>
</table>

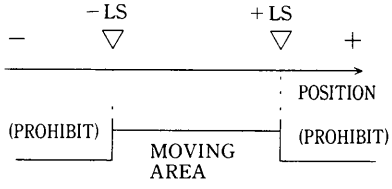
(Cont'd)

(Cont'd)

<table>
<tr><th>No.</th><th>Name</th><th colspan="4">Contents</th></tr>
<tr><td>31</td><td>2nd Feeding Speed</td><td rowspan="3">Effective in mode selected by parameter at contact</td><td colspan="3">Speed reference value selected by speed select signal SP2ND or SP3RD. (selected by parameter at contact.)
<table><tr><td></td><td>4 (1st Feeding Speed)</td><td>31</td><td>32</td><td>33</td></tr><tr><td>SP2ND</td><td>H</td><td>L</td><td>H</td><td>L</td></tr><tr><td>SP3RD</td><td>H</td><td>H</td><td>L</td><td>L</td></tr></table>Setting range: 1 to 240000
Unit: ×1000 reference units/min</td></tr>
<tr><td>32</td><td>3rd Feeding Speed</td><td colspan="3"></td></tr>
<tr><td>33</td><td>4th Feeding Speed</td><td colspan="3"></td></tr>
<tr><td>34</td><td>Current Limit Value</td><td rowspan="3">Effective by parameter 17 b0 = 1</td><td colspan="2">Current limit value in plus/minus direction. Current limit works regardless of current limit signal CUR.</td><td rowspan="3">Setting range: 0 to 400
Unit: %
(The smaller value between parameter set value and motor maximum current limit value becomes effective.)</td></tr>
<tr><td>35</td><td>Plus Side Current Limit Value</td><td rowspan="2">Effective by turning ON CUR signal</td><td>Limit plus side current (activation current at motor FWD run)</td></tr>
<tr><td>36</td><td>Minus Side Current Limit Value</td><td>Limit minus side current (activation current at motor REV run)</td></tr>
<tr><td>37</td><td>Feedforward Compensation Amount</td><td colspan="4">Feedforward compensation amount becomes effective by parameter 17 b1 = 1.
Setting range: 0 to 200, unit: %</td></tr>
<tr><td>38</td><td>Linear Accel/Decel Time 2</td><td colspan="4">Parameter to determine accel/decel speed at the second step in 2-step linear accel/decel type.
In 2-step linear accel/decel, linear accel/decel type is selected by parameter 17 b4 and becomes effective by parameter 17 b2 = 1 setting.</td></tr>
<tr><td>39</td><td>2-step Linear Accel/Decel Accel Speed Switching Speed</td><td colspan="4">

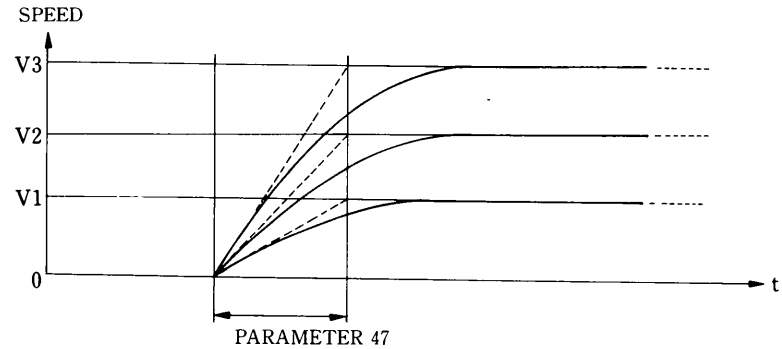
<table><tr><th>Parameter</th><th>Range</th><th>Unit</th></tr><tr><td>38</td><td>8 to 60000</td><td>ms</td></tr><tr><td>39</td><td>0 to 240000</td><td>×1000 reference units/min</td></tr></table></td></tr>
</table>

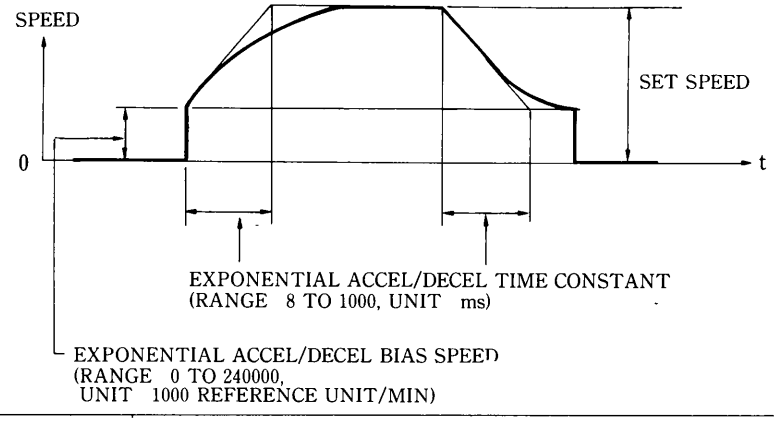
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No.	Name	Contents	
40	Plus Side Software Overtravel (Plus Side Position Reference Fault Detection Value)	(1) Parameter 14 b1 = 0 (finite positioning mode) Effective by parameter 18 b0 = 1 setting. 	(1) Parameter 14 b1 = 0 (finite positioning mode) Prohibits moving in + direction by set value. (2) Parameter 14 b1 = 1 (infinite positioning mode) A position reference value exceeding the set value results in a position reference fault error.
41	Minus Side Software Overtravel (Minus Side Position Reference Fault Detection Value)	Range: ±99999999 Unit : Reference unit Note : When incremental encoder is used (Parameter 9=1), software overtravel becomes effective after zero-point return (homing). (2) Parameter 14 b1 = 1 (infinite positioning mode) Effective by parameter 18 b0 = 1 setting. When the position reference value is out of the following range in the automatic operation, a position reference fault error occurs. [Parameter 41] set value ≦ position reference value ≦ [Parameter 40] set value	(1) Parameter 14 b1 = 0 (finite positioning mode) Prohibits moving in − direction by set value. (2) Parameter 14 b1 = 1 (infinite positioning mode) A position reference value exceeding the set value results in a position reference fault error.
42	Backlash Compensation Amount	Effective by parameter 18 b2 = 1 setting. Setting range: 1 to ±30000 Unit: Pulse (feedback pulse from encoder) [Relation between reference unit and pulse is indicated by B/A (refer to parameter 13.)]	
43	Brake Time	Effective by parameter 19 b2 = 1.	Setting range: 8 to 1000 Unit: ms
44	Brake ON Motor Speed	Refer to par. 6.3.2 (2) for operation.	Setting range: 1 to 10000 Unit: r/min (motor speed)
45	Positioning Near Range and Station Near Range	Effective by parameter 19 b5 = 1. Setting range: 0 to 30000 Unit: Reference unit (Station near range when parameter 20 b5 = 1 or parameter 65 b1 = 1)	
46	Speed Limit Value	Effective by parameter 17 b3 = 1. Set value becomes load maximum speed. Set value: 1 to 240000 Unit: ×1000 reference unit/min	

(Cont'd)

(Cont'd)

<table>
<tr><th>No.</th><th>Name</th><th>Contents</th></tr>
<tr><td>47</td><td>Exponential Accel/Decel Time Constant</td><td>Accel/decel speed varies depending on set speed


Exponential accel/decel becomes effective in a specified operation mode when exponential accel/decel type is set by parameter 17 b4 = 1 and parameters 68 to 71.

</td></tr>
<tr><td>48</td><td>Exponential Accel/Decel Bias Speed</td><td></td></tr>
<tr><td>49</td><td>Zero-point Return (Homing) Mode</td><td rowspan="5">Effective by parameter 18 14b = 1</td><td>0 Zero-point return mode I (Decel LS and Cϕ pulse used)
1 Zero-point return mode II (STP signal used)</td></tr>
<tr><td>50</td><td>Zero-point Return Direction</td><td>0 Zero-point return toward plus direction
1 Zero-point return toward minus direction</td></tr>
<tr><td>51</td><td>Zero-point Return Feeding Speed</td><td rowspan="3">Setting range: 0 to 240000
Unit: ×1000 reference unit/min</td></tr>
<tr><td>52</td><td>Zero-point Return Approach Speed</td></tr>
<tr><td>53</td><td>Zero-point Return Creep Speed</td></tr>
<tr><td>54</td><td>Zero-point Return Final Traveling Distance</td><td></td><td><table><tr><th>Setting Range</th><th>Unit</th></tr><tr><td>Plus direction: 0 to 99999999</td><td rowspan="2">Reference unit</td></tr><tr><td>Minus direction: -99999999 to 0</td></tr></table></td></tr>
</table>

(Cont'd)

8.3 PARAMETER FUNCTION DETAILS (Cont'd)

No.	Name	Conditioning Parameter No.	Conditioning Parameter Set Value	Contents
61	Feed Speed-Setting Method in Auto Operation Mode	18 b2	1	0: Selected by parameter at contact 1: DG-SW 2: Serial command 4: Speed table
62	Feed Speed Setting Method in Manual Operation Mode	18 b3	1	0: Selected by parameter at contact 1: DG-SW 2: Serial command 4: Speed table
63	Pulse-Signal Form	19 b3	1	0: 90° phase difference 2-phase pulse ×4 1: 90° phase difference 2-phase pulse ×2 2: 90° phase difference 2-phase pulse ×1 3: Sign + pulse train 4: CCW + CW pulse train
64	Output Pulse Dividing Ratio	19 b4	1	Dividing ratio is 2/N when parameter set value is N (2 to 64)
65	Function Selection 5	20 b5	1	By setting (b3, b2, b1, b0) to "0" or "1", each function can be selected.
	b0 Zone Signal			Set b0 = 1 when outputs of $\overline{P0}$ to $\overline{P4}$ are used as zone signals.

b0 Set Value	Zone Signal
0	Not Used
1	Used

	b1 Station Near Signal	Set to b1 = 1 so that $\overline{NEAR}$ signal can function as station near signal. ($\overline{NEAR}$ signal does not operate unless setting to parameter 19 b5 = 1.)

b1 Set Value	$\overline{NEAR}$ Signal
0	Operates as positioning near signal.
1	In the station No. reference method (parameter 15 setting = 0), if distance difference (reference unit) between the current position and the nearest station position to the current position becomes less than the value set by parameter 45, $\overline{NEAR}$ signal is output. (In serial communication, [$\overline{NEAR}$] is automatically sent.) Note: In this case, NEAR signal output lag time is up to 40ms.

(Parameter setting becomes effective by conditioning parameter setting.) (Cont'd)

(Cont'd)

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Name</th><th colspan="2">Conditioning Parameter</th><th rowspan="2">Contents</th></tr>
<tr><th>No.</th><th>Set Value</th></tr>
<tr><td>65</td><td>b2 DG-SW Read-in Time Change</td><td>20 b5</td><td>1</td><td>Set to b2 = 1 when DG-SW read-in time (data strobe output pulse width) is required to change in DG-SW reference method (parameter 15 setting = 1).
<table><tr><th>b2 Set Value</th><th>DG-SW Read-in Time (Data Strobe Output Pulse Width)</th></tr><tr><td>0</td><td>24ms</td></tr><tr><td>1</td><td>Parameter 77 set value</td></tr></table>When YASKAWA digital unit is used, it is not necessary to change DG-SW read-in time</td></tr>
<tr><td></td><td>b3 DG-SW Shift Digit Number</td><td></td><td></td><td>Set to b3 = 1 when position or speed input is multiplied by 10, 100, etc. in DG-SW reference method (parameter 15 setting = 1)
Number of digits to be shifted is set by parameter 67.</td></tr>
<tr><td></td><td>b4</td><td></td><td></td><td>(Normally set to 0)</td></tr>
<tr><td></td><td>b5</td><td></td><td></td><td>(Normally set to 0.)</td></tr>
<tr><td></td><td>b6 Position Completion Signal Change</td><td></td><td></td><td>Set to b6 = 1 to change the specifications of positioning completion signal (<u>COIN</u>, CN5-5).
<table><tr><th>b6 Set Value</th><th>Specifications of Positioning Completion Signal (<u>COIN</u> Signal)</th></tr><tr><td>0</td><td>ON when reference is not being discharged and position error is smaller than parameter 6. OFF while start command input signal (<u>AST</u>) is ON and until zero-point return is completed in the zero-point return (homing) mode. (Normal specifications)</td></tr><tr><td>1</td><td>OFF when power supply is turned ON.
ON when operation is started in automatic operation mode and positioning is completed normally (reference discharge is completed and position error becomes smaller than parameter 6 set value.)
Also OFF in the following cases:
• Starting again in automatic operation mode
• In baseblock status
• Changing mode
• At overtravel
• While start command input signal is ON</td></tr></table></td></tr>
</table>

(Cont'd)

No.	Name		Conditioning Parameter No	Conditioning Parameter Set Value	Contents
66	Function Selection 6		20 b6	1	By setting (b7, b6, b5, b4, b3, b2, b1, b0) to "0" or "1", each function can be selected.
	b0				(Normally set to 0)
	b1				
	b2				
	b3				
	b4	Station No. Output Extension			Set to b4 = 1 when alarm code outputs ($\overline{ALO}$ to $\overline{AL3}$) are used as station No outputs ($\overline{P5}$ to $\overline{P8}$). b4 Set Value: 0 — Alarm code output ($\overline{ALO}$ to $\overline{AL3}$); 1 — Station No output ($\overline{P5}$ to $\overline{P8}$) (CN5-19, 20, 21, 22 output at parameter 15 = 0)
	b5				(Normally set to 0)
	b6				
	b7	Servopack Response Axis Address			Set to b7 = 1 when axis address is provided for Servopack response. However, axis address can be provided only in multi-axis control (Example) Command [3PRM30] → 3PRM30 = ××... × (Sent from Servopack) Command [5ALM] → 5ALM .COIN (Sent from Servopack)
67	External Position Indicator Decimal Point Position and DG-SW Shift Digit Number		20 b1	1	When external position indicator is used (set to parameter 20 b1 = 1), decimal point which is indicated by value set by parameter 67 lights. 7 6 5 4 3 2 1 0 + − 8.8.8.8.8.8.8.8. External position indicator (Unit Reference unit) When setting to parameter 65 b3 = 1, DG-SW position or speed input is shifted to the left by the number of digits of the value set in parameter 67. (Digital switch reference) $\times 10^{(\text{PARAMETER 67 SET VALUE})}$ Example. When parameter 67 = 2 and DG-SW reference = 123; $123 \times 10^2 = 12300$ is referenced
68	Accel/Decel Type Setting	Automatic Operation Mode	17 b4	1	0 — Linear or simplified S-curve accel/decel 1 — Exponent
69		Manual Operation Mode			0 — Linear or simplified S-curve accel/decel 1 — Exponent
70		Pulse Operation Mode			0 — Linear or simplified S-curve accel/decel 1 — Exponent
71		Zero-Point Return (Homing) Operation Mode			0 — Linear or simplified S-curve accel/decel 1 — Exponent

(Parameter setting becomes effective by conditioning parameter setting.)

(Cont'd)

(Cont'd)

<table>
<tr><th>No.</th><th>Name</th><th>Conditioning Parameter
No.</th><th>Conditioning Parameter
Set Value</th><th>Contents</th></tr>
<tr><td>72</td><td>Function Selection 6</td><td>20</td><td>b4
1</td><td>By setting (b0, b1, b2, b3, b4) to "0" or "1", the following function can be selected:

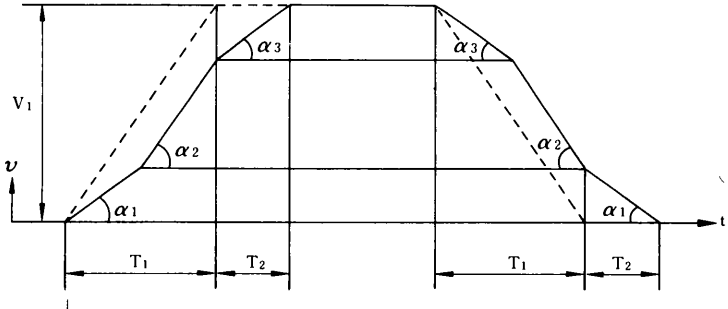
b0: Overrun Alarm Process — Set value 0: Set; Set value 1: Not set
b1: Remaining Data Process after STOP signal is input — Set value 0: Hold (Feedhold); Set value 1: Abandon (No feedhold)
b2: PG (L-PG/M-PG) Selecting Method at Positioning Completion when Line PG Used — Set value 0: Selected by $\overline{\text{L-PG}}$ signal; Set value 1: Motor PG selected by force
b3: Echo-back at Initialization — Set value 0: Not set; Set value 1: set
b4: OK Response for Command — Set value 0: Not set; Set value 1: set
b5: Monitor Data Transmission Specification Change — Set value 0: Monitor data are sent repeatedly from Servopack.; Set value 1: Monitor data are sent only once from Servopack.</td></tr>
<tr><td>76</td><td>Simplified S-curve Accel/ Decel Time</td><td>20</td><td>b3
1</td><td>Set accel/decel speed in simplified S-curve accel/decel control together with parameter 4.

Unit: ms
Setting range: 0 to 124

1st or 3rd step accel/decel speed is set by this parameter.

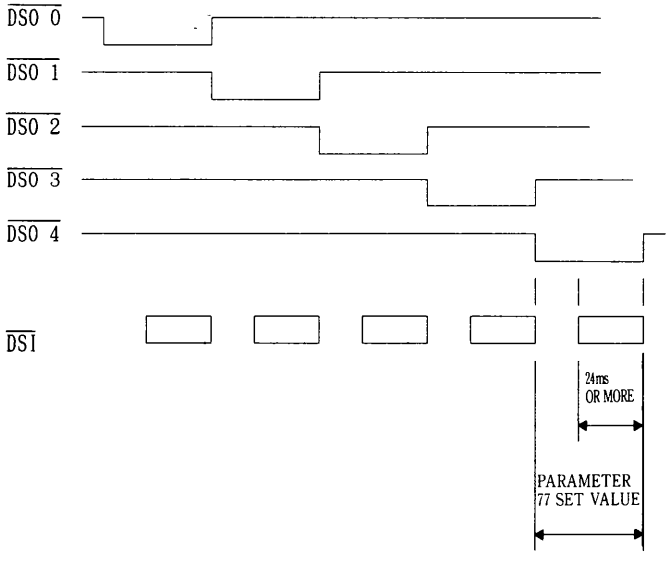
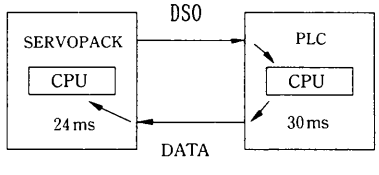
Positioning time is extended by (parameter 76 value + 2) (ms).

Simplified S-curve accel/decel becomes effective by 20 b3 = 1 setting when linear accel/decel type is selected by parameter 17 b4.



V_1 : Parameter 4 set value
T_1 : parameter 5 set value
T_2 : parameter 76 set value + 2 (ms)
α_1: 1st-step accel/decel speed($\alpha_2/2$)
α_2: 2nd-step accel/decel speed(V_1/T_1)
α_3: 3rd-step accel/decel speed (Same as α_1)</td></tr>
</table>

(Parameter setting becomes effective by conditioning parameter setting.) (Cont'd)

No.	Name	Conditioning Parameter No.	Conditioning Parameter Set Value	Contents
77	DG-SW Read-in Scanning Time	65 b2	1	When position or speed reference is provided other than in exclusive-use digital switch unit in DG-SW reference method (set to parameter 15 = 1), DG-SW read-in scanning time (data strobe output pulse width) is set. Setting range: 24 to 2000 (ms) More than 24ms is needed for Servopack to read the data. Therefore, set a value added with 24ms to a time required to send the data at reference setter (sequencer) side. (Refer to Par. 5.6.3 (3).)  Example  (Parameter 77 set value) = 30ms + 24ms = 54ms or more
90	Torque Reference Filter Time Constant	19 b7	1	Set torque reference filter time constant. Used to prevent oscillation. Setting range: 0 to 100 [×32.5 (μs)]

(Parameter setting becomes effective by conditioning parameter setting.)

9 DISPLAY/SETTING/MONITOR FUNCTIONS

9.1 DISPLAY AND SETTING FUNCTIONS

9.1.1 Display

Status of drive is displayed by LED indicators or 7-segment indicators. Fault contents are displayed in the data display section.

Table 9.1 LED Indicators

Display Specifications	HR □□□ UB	Conditions at Lighting
Power Supply Display	MP (green)	Servopack DC main circuit voltage normal
	P (green)	Servopack control power supply (+5V) normal
Alarm Display	ALM (red)	At alarm occurrence

Table 9.2 7-segment LED (Red) Display Specifications and Fault Contents Display Specifications

Fault Contents Display in Data Display Section	7-segment LED Display	Display Contents	
.???? *1	.	Baseblock is released. (Indicates current conduction to motor.)	
-.bb	-	Baseblocking (Stops current conduction.)	
P.P-OT	P.	P-side overtravel	
n.n-OT	n.	N-side overtravel	
P.P-LS	P	P-side software overtravel	
n.n-LS	n	N-side software overtravel	
d.bAt	d. Blinks	Battery voltage low-level detection	
0.Abs	0.	ABSO error	• Servopack power circuit is base-blocked. • Self-holding until resetting • Servo alarm output
1.OC	1.	Overcurrent	
2.FAn	2.	FAN stop	
3.rG	3.	Regenerative error	
4.OU	4.	Overvoltage	
5.OS	5.	Overspeed	
6.UU	6.	Undervoltage	
7.OL	7.	Overload	
8.POS	8.	Position error	
A.OH	A.	Heat sink overheat	
C.PG	C.	PG disconnection	
F.O-PH	F.	Open phase	
H.HArd	H.	Hardware error	
J.OF	J.	Overflow	
L.ruN	L.	Overrun	
N.Pr ??*2	N.	Parameter error	

*1 .???? varies as follows depending on the status:
At positioning completion: COIn,
At positioning near: nEAr,
At positioning: rUn,
At feedholding: HOLd

*2 ?? indicates parameter No.

9.1.2 Display and Setting Functions

The setting of parameter etc. can be performed using parameter display/setting functions built into Servopack.

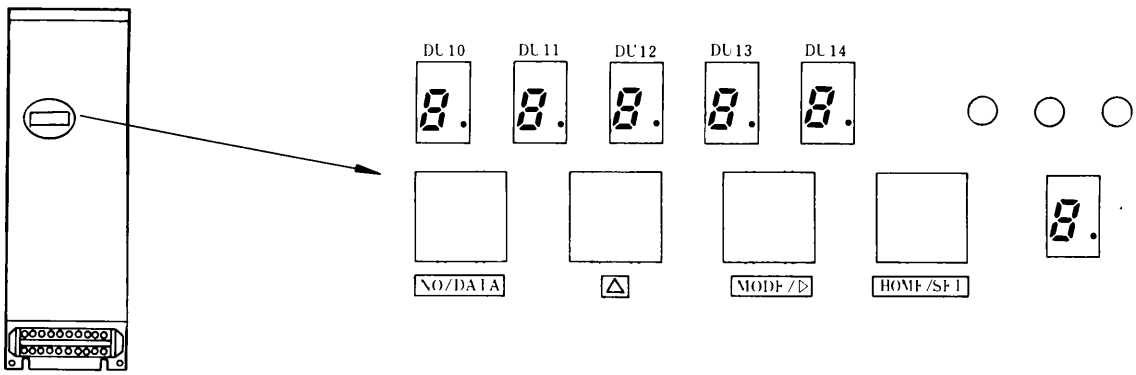


Fig. 9 1 Setting/Display Section

Table 9.4 Setting/Display Setting Mode Selection

No.	Switch Depressed	Display	Contents
0	Initial Status	-.bb	Alarm/status display
1	NO/DATA	AL-00	Alarm record display (See Table 9.5.)
2	MODE/▷	Cn-01	Parameter display/setting (See Table 9.6.)
3	MODE/▷	OS-00	Machine zero-point setting (See Table 9.7.)
4	MODE/▷	SS-00	Serial communication setting (See Table 9.8.)
5	MODE/▷	Un-01	Monitor data display (See Table 9.9.)
6	MODE/▷	In-01	Input signal status display (See Table 9.10.)
7	MODE/▷	On-01	Output signal status display (See Table 9.11.)
8	MODE/▷	AL-00	Alarm record display (Return to No.1)

Depressing HOME/SET in the above 1 to 8, returns to initial status (alarm/status display).

Depressing HOME/SET in the above 0 status, resets an alarm when it occurs (same as serial command ARES) or performs Servopack initial reset when an alarm does not occur (same as serial command RES).

Table 9.5 Alarm Record Display Mode

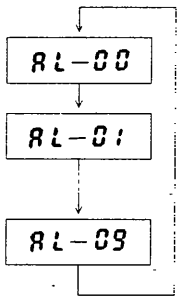
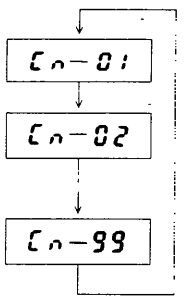
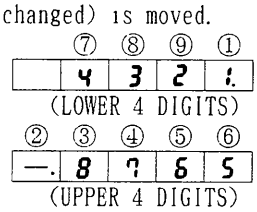
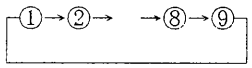
△	NO/DATA	MODE/▷	HOME/SET
• Alarm No. display  	Exchange alarm No. with alarm content display. For alarm content display, refer to Table 9.2.	• Alarm No. display Parameter display/setting mode is entered.	• Alarm No. display Alarm/status (initial status) is displayed.

Table 9.6 Parameter Display/Setting Mode

△	NO/DATA	MODE/▷	HOME/SET
• Parameter No. display  • Parameter data display Change the value which is blinking.	Exchange parameter No. with parameter data display.	• When parameter No. is displayed. Machine zero-point setting mode is entered. • When parameter data is displayed. Blinking digit (to be changed) is moved.  In the above figure, the blinking digit changes as shown below:  	• When parameter No. is displayed. Alarm/status (initial status) is displayed. • When parameter data is displayed. Displayed data are set. (Reset is required for off-line parameters.)

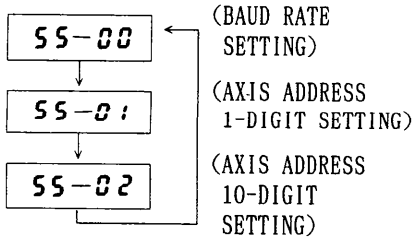
Note: For parameters, refer to Par. 8 "PARAMETER".

Table 9.7 Machine Zero-point Setting Mode

△	NO/DATA	MODE/▷	HOME/SET
• Zero-point No. display Ineffective	Exchange zero-point No. display (only 05 - 00) and zero-point data display.	• When zero-point No. is displayed. Serial communication setting mode is entered.	• When zero-point No. is displayed. Alarm/status (initial status) is displayed.
• Zero-point data display Change the value which is blinking.		• When zero-point data is displayed. Blinking digit (to be changed) is moved. ⑦ ⑧ ⑨ ① 4 3 2 1. (LOWER 4 DIGITS) ② ③ ④ ⑤ ⑥ −. 8 7 6 5 (UPPER 4 DIGITS) In the above figure, the blinking digit changes as shown below: ①→②→···→⑧→⑨	• When zero-point data is displayed. Motor current position is set to displayed machine position.* (Reset is required after the setting.)

* Same as serial command ZEROSET ±nnnnnnnn.

Table 9.8 Serial Communication Setting Mode

△	NO/DATA	MODE/▷	HOME/SET
• Set No. display  • Set data display Change set data as follows: In baud rate setting 9600→4800→2400→1200 In axis address setting 0→1→2→3→4→5→6→7→8→9	Exchange set No. display with set data display	• When set No. is displayed. Monitor data display mode is entered.	• When set No. is displayed. Alarm/status (initial status) is displayed. • When set data is displayed. Displayed data are set. (Reset is required after the setting.)

Note: For how to use axis address (setting range), refer to Par. 7.3.2.

Table 9.9 Monitor Data Display Mode

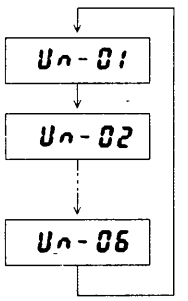
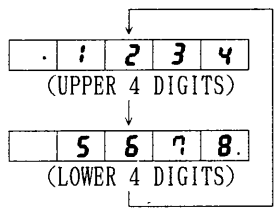
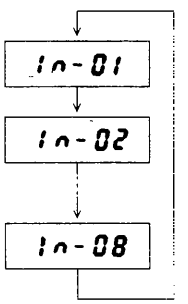
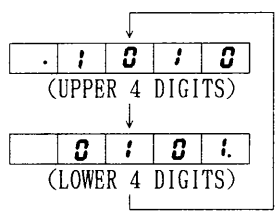
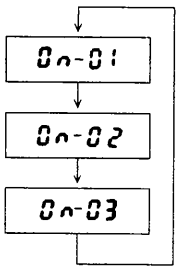
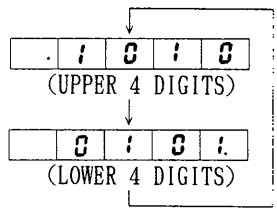
△	NO/DATA	MODE/▷	HOME/SET
• Monitor data No. display.  Monitor data Nos. are the same as serial communication monitor commands MON1 to MON6.	Exchange monitor data No. with monitor data display.	• When monitor No. is displayed. Input signal status display mode is entered. • When monitor data is displayed. Exchange monitor data upper 4 digits with lower 4 digits  	• When monitor No. is displayed. Alarm/status (initial status) is displayed.

Table 9.10 Input Signal Status Display Mode

△	NO/DATA	MODE/▷	HOME/SET
• Input signal No. display.  Input signal Nos. are the same as serial communication monitor commands IN1 to IN8.	Exchange input signal with input data display	• When input signal No. is displayed. Output signal status display mode is entered. • When input signal data is displayed. Exchange input signal data upper 4 digits with lower 4 digits.  	• When input signal No. is displayed. Alarm/status (initial status) is displayed.

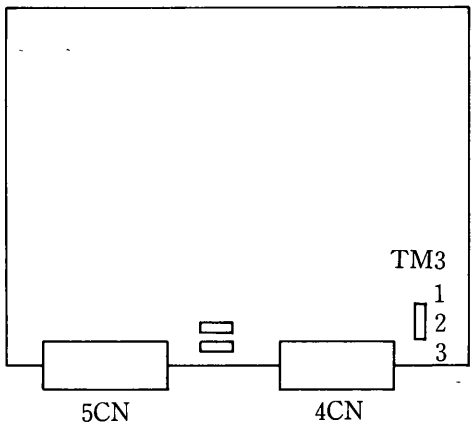
Note: For serial commands, refer to Par. 7.8 "SERIAL COMMANDS".

Table 9.11 Output Signal Status Display Mode

△	NO/DATA	MODE/▷	HOME/SET
• Output signal No. display  (OUTPUT SIGNAL 1) (OUTPUT SIGNAL 2) (OUTPUT SIGNAL 3) Output signal Nos. are the same as serial communication monitor commands OUT1 to OUT3.	Exchange output signal with output data display.	• When output signal No. is displayed. Alarm record display mode is entered. • When output signal data is displayed. Exchange output signal data upper 4 digits with lower 4 digits.  	• When output signal No. is displayed. Alarm/status (initial status) is displayed.

Note: For serial commands, refer to Par. 7.8 "SERIAL COMMANDS".

9.2 MONITOR FUNCTION



Pin No.	Signal Name	Name	Output Voltage
TM3-1	V_{TG}	Motor speed	$\mp 2.0 \times \frac{P^*}{8192}$ V/±1000r/min
TM3-2	T_{MON}	Torque or speed reference	Torque reference: ∓3.0V/±100% Speed reference : ±2.0V/±1000r/min
TM3-3	GND	0V for signal	0V

* P value is number of encoder pulses per revolution (P/R) to be used.

Notes:

1. Torque reference or speed reference selection is performed by serial command. Torque reference is selected when power supply is turned ON.

Command	T_{MON} Output
MU = 1	Torque reference
MU = 2	Speed reference

2. Accuracy; ±10%
3. 8-bit D/A converter is used. Output may have 1-bit ripple.

10 PERIPHERAL DEVICES

10.1 COMBINATION OF PERIPHERAL DEVICES

Table 10.1 Combination of SERVOPACK, SERVOMOTOR M Series and Peripheral Devices

SERVOPACK Type CACR-	AC SERVOMOTOR Type USAMED-	Power Capacity per SERVOPACK*1 kVA	Current Capacity Per MCCB of Fuse A	Applicable Noise Filter	Recommended Noise Filler*2		Power ON/OFF Switch
					Type	200VAC Class	
HR03UB	03L □ 1	0.65	5	Good / Poor	LF-305	5A	Contactor 30A or above
HR10UB	06L □ 1	1.5	8		LF-310	10A	
	09L □ 2	2.1	8		LF-315	15A	
HR15UB	12L □ 2	3.1	10				
HR20UB	20L □ 2	4.1	12		LF-320	20A	Contactor 35A or above
HR30UB	30L □ 2	6.0	18		LF-330	30A	
HR44UB	44L □ 2	8.0	24		LF-340	40A	

*1 Values at rated load
*2 Made by Tokin Corp.

Table 10.2 Combination of SERVOPACK, SERVOMOTOR F Series and Peripheral Devices

SERVOPACK Type CACR-	AC SERVOMOTOR Type USAFED-	Power Capacity per SERVOPACK kVA	Current Capacity per MCCB of Fuse A	Applicable Noise Filter	Recommended Noise Filter		Power ON/OFF Switch
					Type	200VAC class	
HR05UB	05L □ 1	1.1	5	Good	LF-305	5A	Contactor 30A or above
HR10UB	09L □ 1	2.1	8		LF-315	15A	
HR15UB	13L □ 2	3.1	10				
HR20UB	20L □ 2	4.1	12	Poor	LF-320	20A	Contactor 35A or above
HR30UB	30L □ 2	6.0	18		LF-330	30A	
HR44UB	44L □ 2	8.0	24		LF-340	40A	

Table 10.3 Combination of SERVOPACK, SERVOMOTOR G Series and Peripheral Devices

SERVOPACK Type CACR-	AC SERVOMOTOR Type USAFED-	Power Capacity per SERVOPACK kVA	Current Capacity per MCCB of Fuse A	Applicable Noise Filter	Recommended Noise Filter		Power ON/OFF Switch
					Type	200VAC class	
HR05UB	05L □ 1	1.1	5	Good	LF-305	5A	Contactor 30A or above
HR10UB	09L □ 1	2.1	8		LF-315	15A	
HR15UB	13L □ 2	3.1	10				
HR20UB	20L □ 2	4.1	12	Poor	LF-320	20A	Contactor 35A or above
HR30UB	30L □ 2	6.0	18		LF-330	30A	
HR44UB	44L □ 2	8.0	24		LF-340	40A	

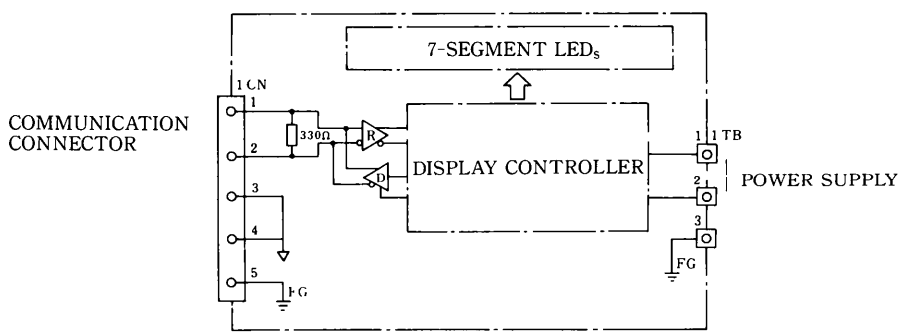
10.2 EXTERNAL POSITION INDICATOR (TYPE MCIF-L8□)

(1) Specifications

Item \ Type	MCIF-L8	MCIF-L8-24*	MCIF-L8-A1 *
Power supply	5VDC, 1A	24VDC, 0.5A	100VAC, 0.2A
Power supply variation range	4.75 to 5.25V	18 to 27VDC	85 to 120VAC
Operating temperature	0 to +55℃		
Storage temperature	-20 to +80℃		
Operating/storage humidity	90% or less		
Vibration or shock resistance	Vibration resistance:4.9m/s^2(0.5G)(10 to 55Hz) Shock resistance:19.6m/s^2(2G)		
Number of display digits	− sign indication and 8-digit number		
Connecting method	Serial communication, connected to connector CN4, of CACR-HR.		

Note: Types marked with * are manufactured on order.

(2) Circuit block diagram



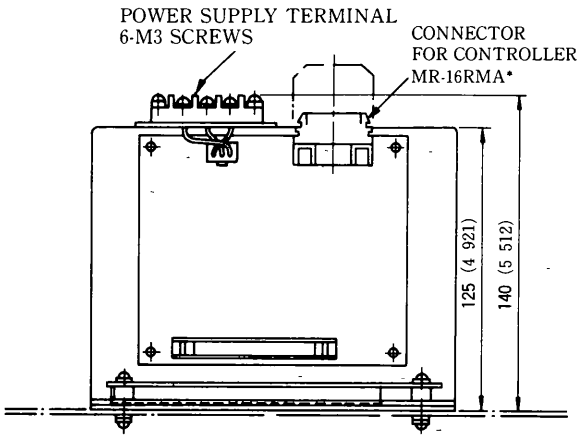
Note: Do not connect anything to 1CN pin 7 or 8 since they are for test.
Other pins are not used.

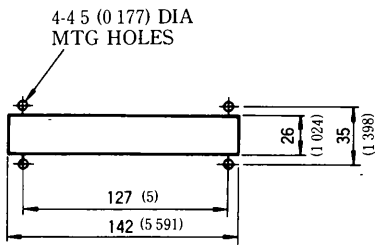
Power Supply and Connection

Type \ ITB	1	2	3
MC1F-L8	+5V	0	FG
MC1F-L8 24	+24V	0	FG
MC1F-L8-A1	AC100V	(AC100V)	FG

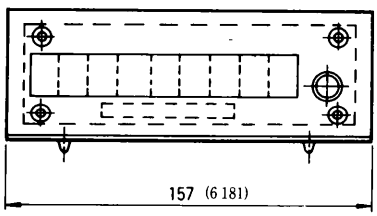
(3) Dimensions in mm (inches)

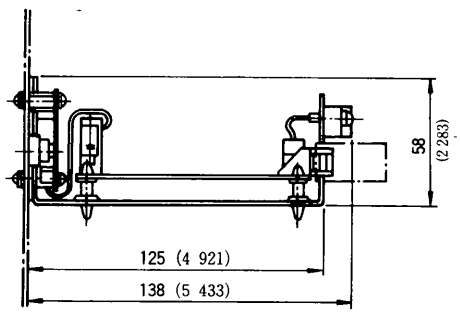
Type MCIF-L8





Mounting Dimensions





Surface processing
Electrodeposition coating, N1 5 in Munsell notation (black)
Mass 0 6kg (1 3lb)

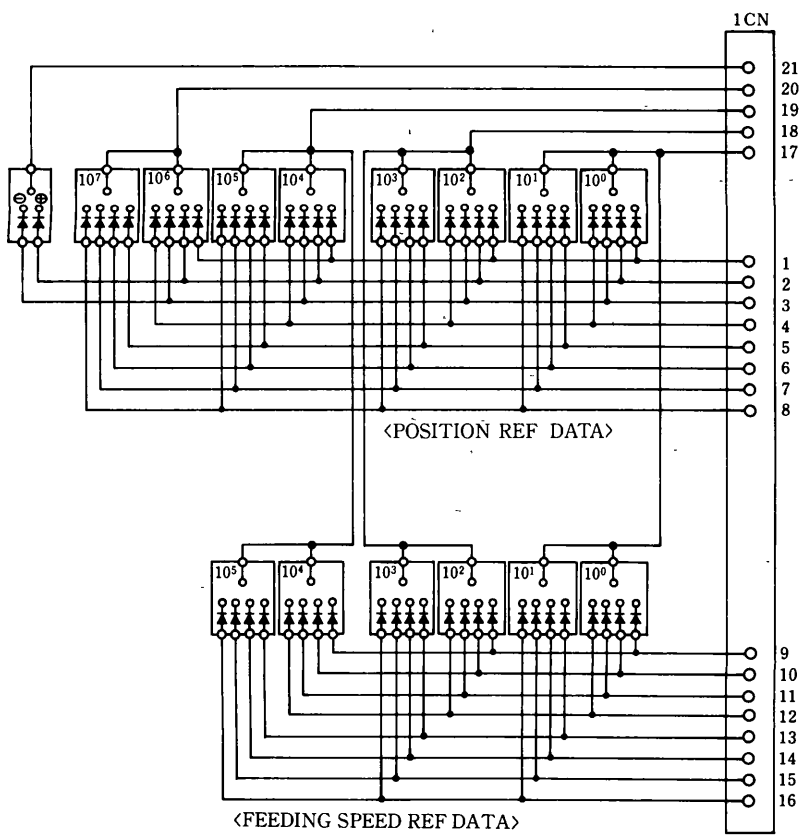
*Applicable receptacle
soldred type MR-16F
caulking type MRP-16F01
case MR-16L

10.3 DIGITAL SWITCH UNIT (TYPE MCIF-D□□)

(1) Specifications

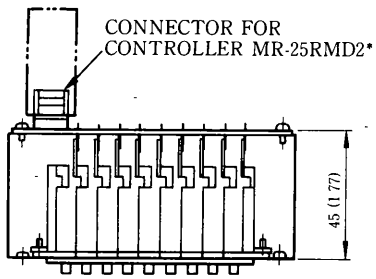
Item \ Type	MCIF-D86	MCIF-D66	MCIF-D44	MCIF-D80	MCIF-D60	MCIF-D40
Data contents	2-step(position/speed reference data)			1-step(only position reference data)*		
Position reference data	BCD 8-digit	BCD 6-digit	BCD 4-digit	BCD 8-digit	BCD 6-digit	BCD 4-digit
Speed reference data	BCD 6-digit	BCD 6-digit	BCD 4-digit	None		
Operating temperature	0 to +55℃					
Storage temperature	-20 to +80℃					
Vibration or shock resistance	Vibration resistance: 4.9m/s^2(0.5G)(10 to 55Hz) Shock resistance: 19.6m/s^2(2G)					
Connecting method	Connect CN5 to CACR-HR.					

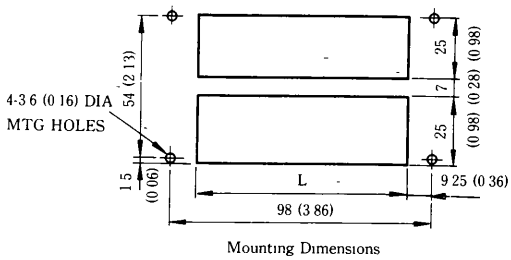
(2) Circuit Diagram



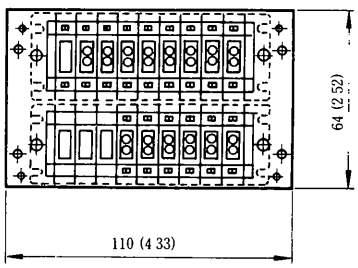
(3) Dimensions in mm (inches)

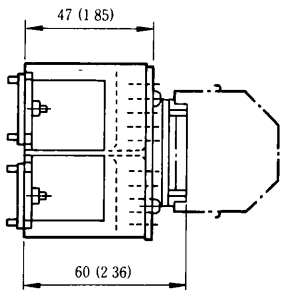
Type MCIF-D44, -D66, -D86





Mounting Dimensions

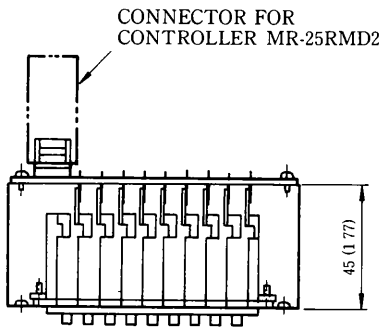


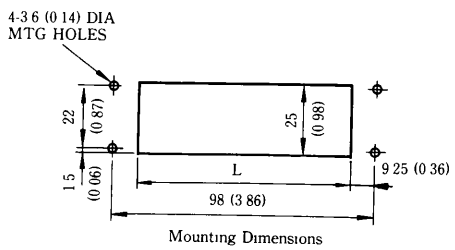


Number of Digits		Type	L mm(in)
Position	Speed		
4	4	MCIF-D44	47 5(1 87)
6	6	MCIF-D66	63 5(2 5)
8	6	MCIF-D86	79 5(3 13)

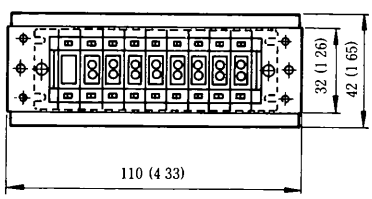
Surface treatment
Electrodeposition N1 5 in Munsell notation (black)
Approx Mass 0 3kg (0 7lb)

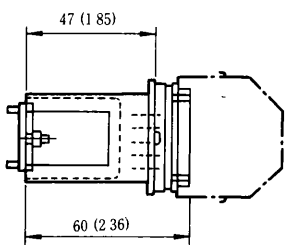
Type MCIF-D40, -D60, -D80





Mounting Dimensions





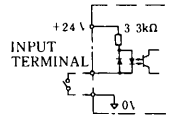
Number of Digits	Type	L mm(in)
4	MCIF-D40	47 5(1 87)
6	MCIF-D60	63 5(2 5)
8	MCIF-D80	79 5(3 13)

Surface treatment
Electrodeposition N1 5 in Munsell notation (black)
Approx Mass 0 2kg (0 4lb)

*Applicable receptacle
soldered type MR-25F
caulking type MRP-25F01
case MR-25L

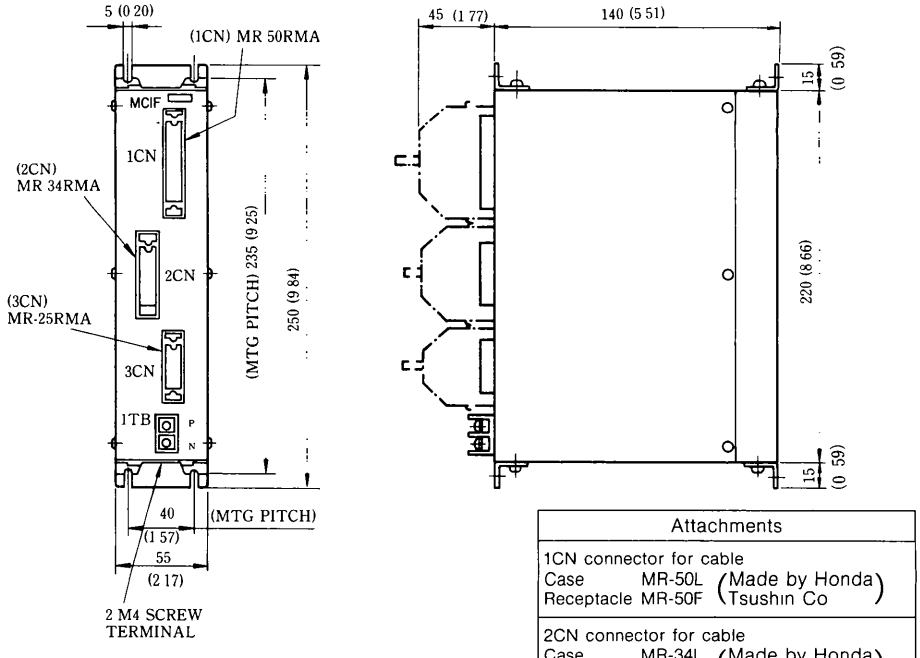
10.4 CONTACT INPUT UNIT (TYPE MCIF-R86)

(1) Specifications

Item \ Type	MCIF-R86
Data contents	Position reference (sign signal and 8-digit BCD signal) Speed reference (6-digit BCD signal)
Operating temperature	0 to +55℃
Storage temperature	-20 to +80℃
Operating/storage humidity	99% or less
Vibration or shock resistance	Vibration resistance: 4.9m/s^2(0.5G)(10 to 55Hz) Shock resistance: 19.6m/s^2(2G)
Input conditions	• Power supply 24VDC, photocoupler input (drive current 7mA) • Dry contact and transistor open collector input • Position data: 1CN connector • Speed data: 2CN connector 
Connecting method	Connect 3CN to CACR-HR CN5

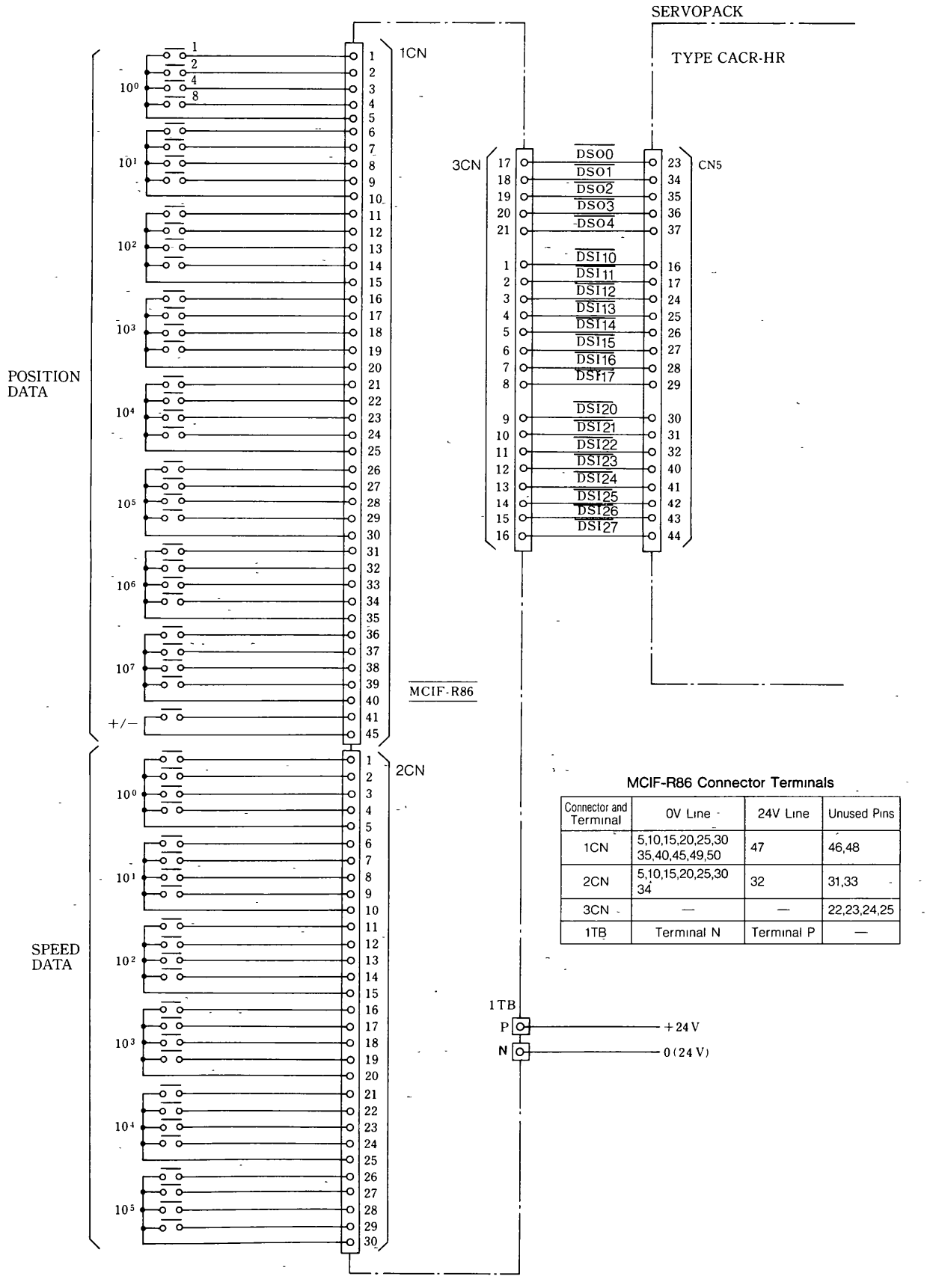
(2) Dimensions in mm (inches)

Type MCIF-R86



Attachments
1CN connector for cable Case MR-50L (Made by Honda) Receptacle MR-50F (Tsushin Co)
2CN connector for cable Case MR-34L (Made by Honda) Receptacle MR-34F (Tsushin Co)
3CN connector for cable Case MR-25L (Made by Honda) Receptacle MR-25F (Tsushin Co)

(3) Circuit block diagram



MCIF-R86 Connector Terminals

Connector and Terminal	0V Line	24V Line	Unused Pins
1CN	5,10,15,20,25,30 35,40,45,49,50	47	46,48
2CN	5,10,15,20,25,30 34	32	31,33
3CN	—	—	22,23,24,25
1TB	Terminal N	Terminal P	—

10.5 MANUAL PULSE GENERATOR (TYPE PREH-2C3T/100-M1)

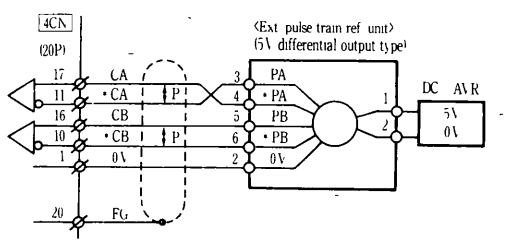
(1) Specifications

Item \ Type	PREH-2C3T/100-M1
Power supply	5VDC ±10%, 150mA
Output waveform, output type	Rectangular wave, line driver output
Number of output pulses, output signal	100 pulses/rev. 90° phase difference 2 signals (phases A and B)
Operating temperature	0 to +50℃
Storage temperature	-30 to +70℃
Operating/storage humidity	20 to 80% RH
Vibration or shock resistance	Vibration resistance: 4.9m/s²(0.5G)(10 to 55Hz) Shock resistance: 19.6m/s²(2G)
Connecting method	Connect to CACR-HR CN4

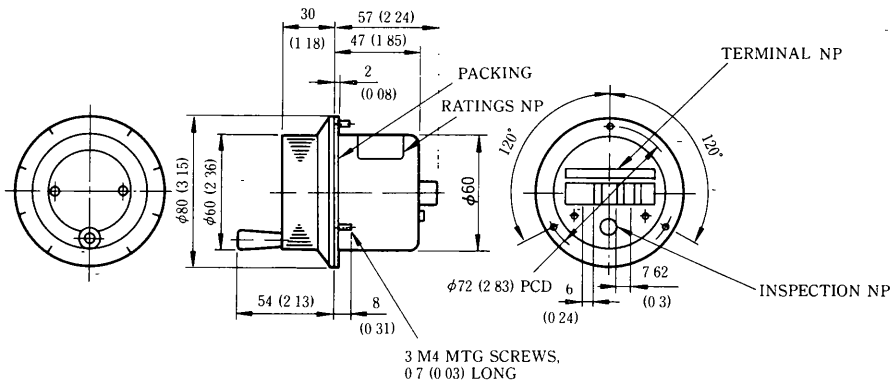
(2) Output terminal Arrangement

Symbol	Function
1	+V (DC5V)
2	V (OV)
3	SIG. A
4	SIG. $\overline{A}$
5	SIG. B
6	SIG. $\overline{B}$

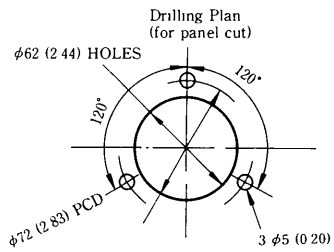
Note: When connecting to Servopack, reverse SIG.A and SIG. $\overline{A}$ on Par 5.1, as follows:



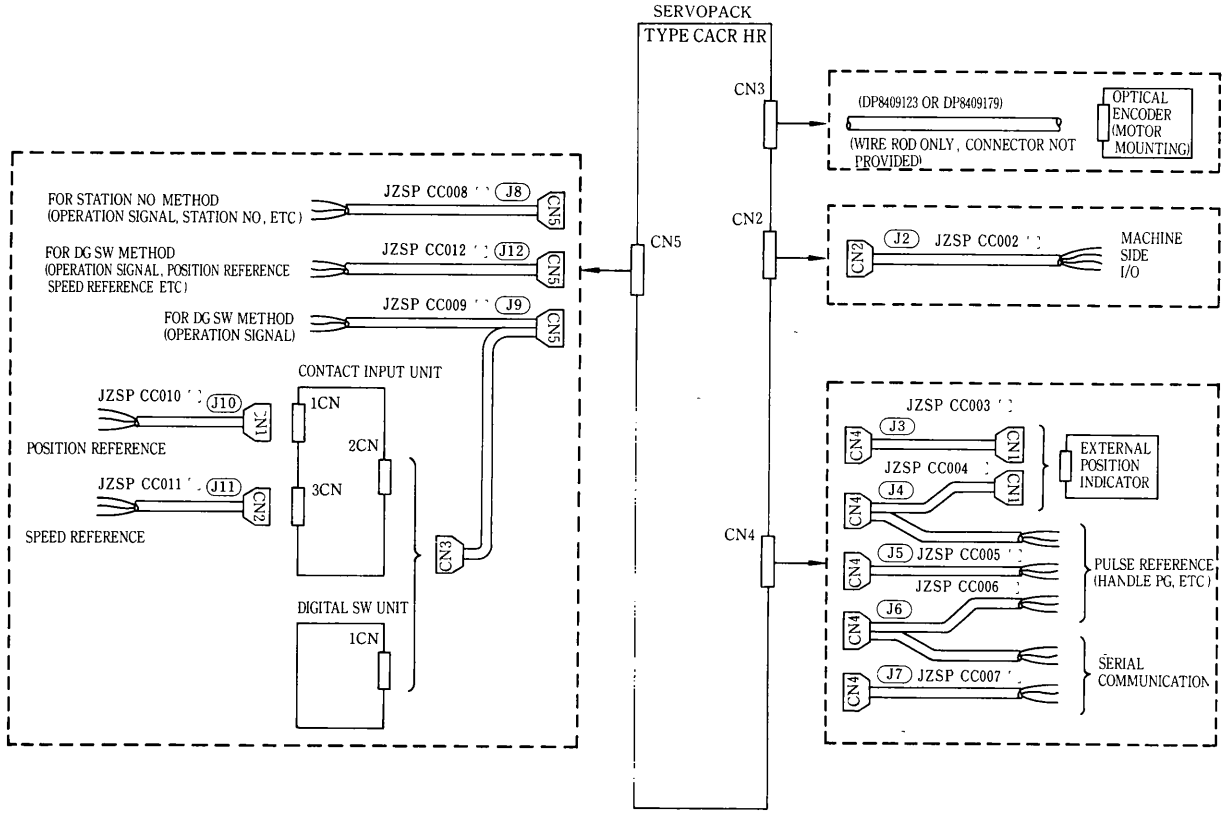
(3) Dimensions in mm (inches)



Note Receiver IC is AM26LS32C, SN7517S or equivalent



10.6 CONNECTING CABLE



Note Cable length 1,3 or 5 meters (39 37, 118 11 or 196 85 inches)
For CN4 or CN5, select one cable suitable for the system

10.7 PARAMETER SETTER (PF803)

10.7.1 Specifications

(1) Display

Display element	TN type LCD
Display screen	20 columns × 4 lines
Display character composition	5 × 7 dots matrix
Display character size	4.75 × 2.95 mm/character (0.19 × 0.12 in./character)
Display character type	Alphabets (capital, small), numeric, symbols (Total 195 types)
Cursor display method	Blinked block
Status display	4 LED lamps • Alphabet small letters mode: red • On-line mode: orange • Edit mode. green • Transmission mode: yellow
Backup battery check display	1 red LED lamp

(2) Control

CPU	8-bit CMOS micro-processor (Basic clock: 7.37MHz)
Buffer memory	2000 bytes for terminal. 100000 bytes for file data
Built-in backup battery	1 NiCd battery (3.6V, 40mAH, rechargeable) Exclusive-use for buffer memory backup
Buzzer	1 piezoelectric buzzer

(3) Keyboard

Key top	Membrane shielded type
Switch for keys	Switch with click feedback
Data input keys	44 keys
Shift key	1 key for key top lower data input
Capital key	1 key for switching alphabet capital/small
Window key	1 key for window up/down
Battery check key	1 key for check voltage of battery exclusive use for buffer memory backup
Reset key	1 key
Key input code type	JIS code mode : 192 types ASCII code mode: 128 types
Function keys	For 5 keys Max. 64-code train registration possible per key

(4) Interface

Using codes	JIS 7-bit, 8-bit or ASCII code
Character composition	Asynchronous type 9, 10, 11 or 12 bits
Parity	Even, odd, mark, space, or no-parity
Data type	Bit serial
Data communication speed	110, 150, 300, 600, 1200, 2400, 4800, 9600 or 19200 bps
Data signal type	• Host system port : RS-232C (in accordance with EIA-232D /JIS C6361)

(5) Power Supply

Using battery	Exclusive-use nickel-cadmium set battery (Type: FA4/700AAF) Nominal capacity: 700mAH
Power supply switch	1
Recharging jack	1
Consumed power	At normal operation: • Local mode At standby: 115mW At data processing: 300mW • Online mode At data processing: 580mW

(6) External Dimensions and Mass

Main body	205D × 110W ×35H mm (8.07D × 4.33W ×1.38H inches) Mass: 580 g (1.28lb)
Interface cable, connector	Shielded cable, Host system side connector: D-sub(25pins) Removable from the main body Standard 2m (78.74in.) long (type PEC803-02)

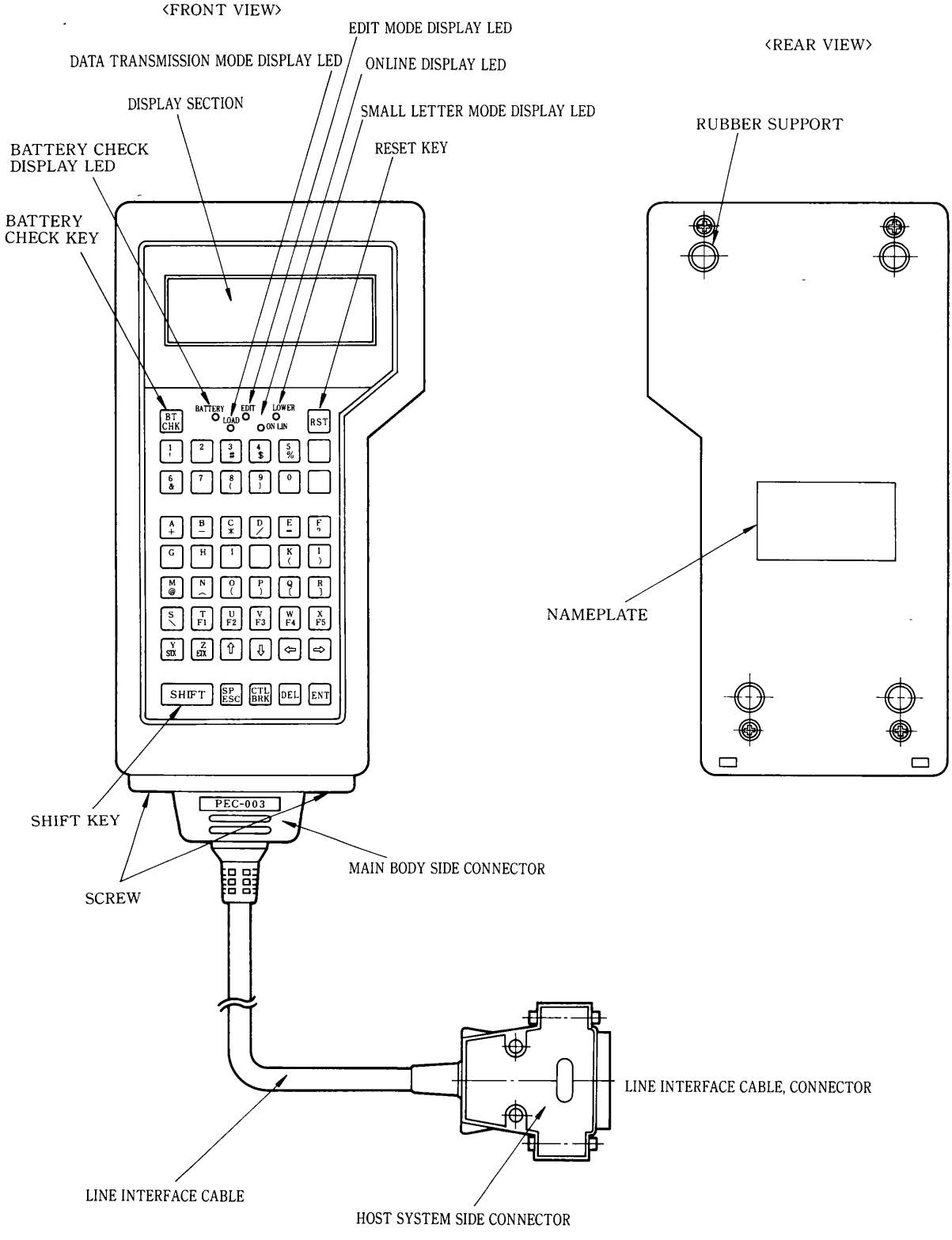
(7) Operational Environment

Environment	Shockproof, dustproof and noise resistant specifications in standard interface cable (PEC803-02 type)
Ambient temperature	At operation: 0 to +45℃ At storage : -10 to +60℃
Humidity	5 to 90% RH

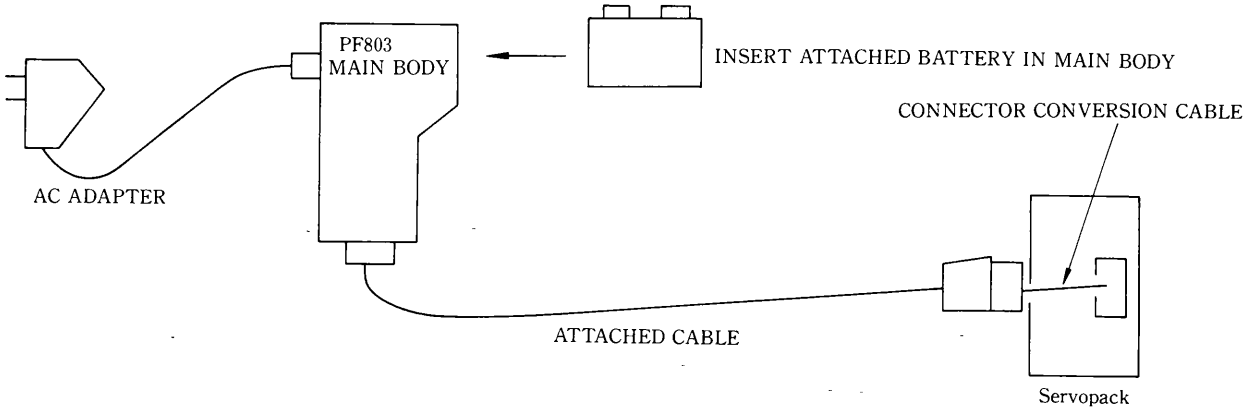
(8) AC Adapter (Type PAC803-A)

Output	7.5VDC±1V, 2.25W
Power supply	100±10VAC (50/60Hz)
External dimensions, mass	• Main body: 60D × 50W × 40H mm (2.36D × 1.97W × 1.57H inches) 210g (0.46lb) • DC output cable: 1.9m (74.8 in.)
Operating temperature	+10 to +40℃
Applicable type	PF803-AS type, operation possible during recharging

10.7.2 External View



10.7.3 How to Use



Power Supply:

- Can be used with AC adapter connected.
- Can be recharged fully for 48 hours and used for 10 hours without AC adapter.
- If not used for 40 days or more, charge it, for at times setup information or files may disappear.

Key Operation:

- Do not depress [SHIFT] simultaneously with other keys. Depress [SHIFT] key and release it before depressing another key.
  (Depressing [SHIFT] key changes the cursor from ▨ to ▨ .)
- After depressing [CTL BRK] key (control key), release it, depress another key.
- When used connecting with SERVOPACK, if wrong key input is made, [DEL] and [⇦] key cannot be used.
  In this case, input any character to cause an error by [ENT] and start key input again from the beginning.

Setup (For the first use, perform the following setup.)

< Operation >

1.

```
MENU
F1=TELCOM       F2=TEXT
F3=SET UP       F4=TEST
```

<Display 1>

2. SHIFT + V F3

3.

```
SETUP-MODE
F1=COM          F2=DISPLAY
F3=KEY          F4=RS232C
F5=MENU
```

4. Set the setup data as the following procedure.

① SHIFT + T F1

```
COMMUNICATION       SPEED
9600 bps
CODE   PARITY       STOP
ASCII  Even         1Bit
```

ENT

```
XON/XOFF        LOCAL  ECHO
Enable          Disable
DELIMITER       CHARACTER
Cr.Lf
```

ENT

② SHIFT + U F2

```
SET H-TAB           STOP
1
CR OPERATION
Cr
```

ENT

```
MEMORY     RETENTION
Yes
```

ENT

<Description>

Displayed when turning the power on.

Select SET UP.

Displayed setup-mode.
Set by using the following keys.

⇨ : selects an item to be set.

⇩ : sets data. See next page.

ENT : ends the setting.

COM is selected.

- Data to be set

COMMUNICATION	9600 bps
SPEED	
CODE	ASCII
PARITY	Even
STOP	1Bit
XON/XOFF	Enable
LOCAL ECHO	Disable
DELIMITER	
CHARACTER	Cr.Lf

DISPLAY is selected.

- Data to be set

SET-H-TAB STOP	1
CR OPERATION	Cr
MEMORY RETENTION	Yes

10

③ SHIFT + V F3

KEY is selected.

```
KEY  CLICK
Yes
AUTO  REPEAT
Yes
```

• Data to be set

KEY CLICK	Yes
AUTO REPEAT	Yes

ENT

④ SHIFT + W F4

RS-232C is selected.

```
Control  RS-232C  Input Signals
CS DSR CD
No  No  No
```

• Data to be set

CS	No
DSR	No
CD	No

ENT

⑤ SHIFT + X F5

Returns to MENU.

```
MENU
F1=TELCOM       F2=TEXT
F3=SET UP       F4=TEST
```

<Display 1>

Using method when connecting with Servopack (Turn ON the Servopack control power supply.)

< Operation >

<Description>

```
MENU
F1=TELCOM       F2=TEXT
F3=SET UP       F4=TEST
```

<Display 1>

1. SHIFT + T F1

Select TELCOM.

```
TELCOM-MODE
F1=TERM         F2=UPLOAD
F3=DOWNLOAD
F5=MENU
```

<Display 4>

2. SHIFT + T F1

Select TERM.

3. CTL BRK + E -

Perform echo-back.

4. Check that characters are displayed by key input.

NOTE If strange characters are displayed, clear the screen by depressing CTL BRK and L) keys.

5. Set the parameter.
(ex)
• Enter 20 to parameter No. 1.
[P)] [R)] [M @] [1 !] [SHIFT] [-] [2] [0 _] [ENT]
• Enter 11110 to parameter No. 14.
[P)] [R)] [M @] [1 !] [4 $] [SHIFT] [-] [1 !] [1 !] [1 !] [1 !] [0 _] [ENT]
(b4) (b3) (b2) (b1) (b0)

6. [R)] [E =] [S \] [ENT]

7. After approx. 3 seconds:
[CTL BRK] [E =] [P)] [R)] [M @] [ENT]

8. Check by all parameter display
(Do not use it after PRM 21).

When setting is completed, send reset command.

NOTE
1. Parameter is not displayed.
2. The amount of over-operation can be checked by using [⇧] [⇩] key.

9. [SHIFT] + [X F5]

```
TELCOM-MODE
F1=TERM          F2=UPLOAD
F3=DOWNLOAD
F5=MENU
```

< Display 4 >

Return to <Display 4>.

10. When entering parameter to PF803 file.

① [SHIFT] + [V F3]

```
File  Name?      *DNLOAD*
Free  Memory
      Byte
```

REMAINING MEMORY
< Display 5 >

Select DOWNLOAD.

CURRENT NUMBER OF FILES

② "File Name" + [ENT]
(8 max.)

Input file name (within 8 characters) and depress [ENT] key.

NOTE Wrong key input is cleared by [DEL] key.

③ [P)] [R)] [M @] [ENT]

④ Ends when decreasing remaining memory value stops.

(No display provided.)

11. Send parameter entered in PF803 file to Servopack.

① SHIFT + U F2

File Name?	*UPLOAD*
Select File	

< Display 6 >

Completes when the cursor comes under File Name? after buzzer rings.

② SHIFT + X F5

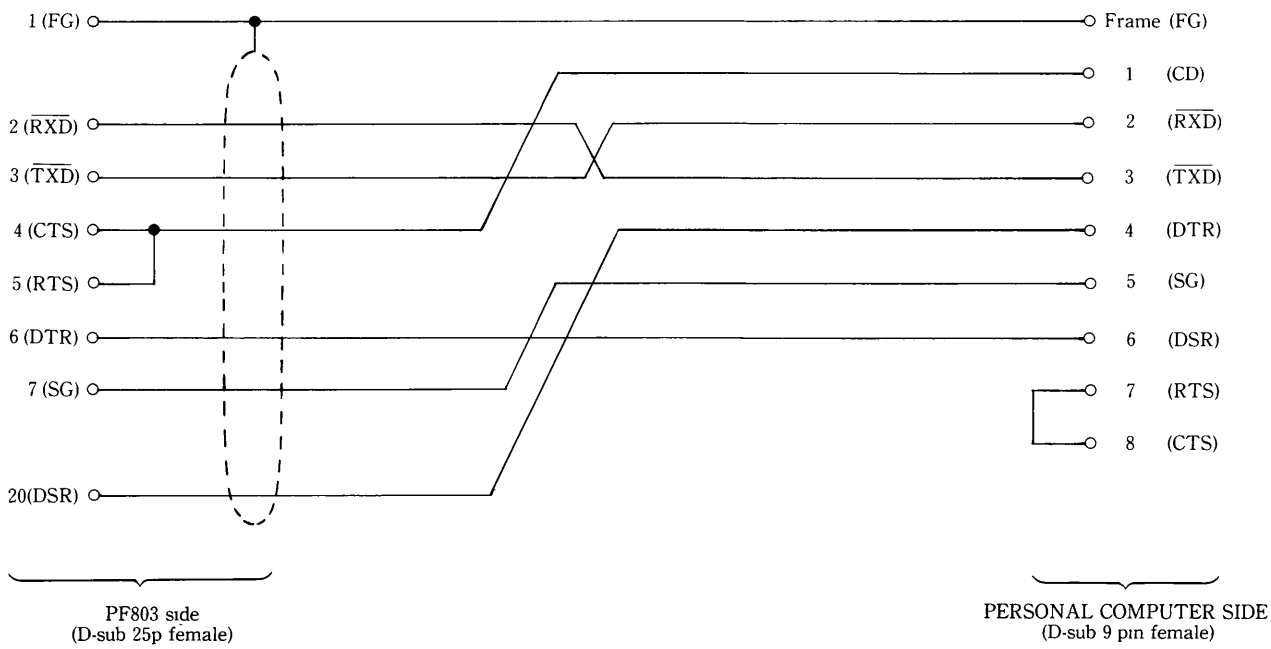
Select UPLOAD.
Use following keys.
→ : enters to file name mode.
↑ ↓ : selects the file.
ENT : sends the data.

Returns to <Display 4>.

Personal computer
File exchanging method with IBM* PC-AT* or 100% compatible (PC-DOS* used)

* These brand and product names are trademarks or registered trademarks of International Business Machines Corporation

• Connection with a personal computer, use the connector conversion cable shown below.



• Personal computer setting : Set COM1 by MODE command as follows.

MODE COM1:BAUD=12, PARITY=E, DATA=7, STOP=1 ↵
or MODE COM1:12, E, 7, 1 ↵

(baud rate=1200 baud, even parity, character=7 bit, stop bit=1 bit)

• Parameter Setter Setting

< Operation >

1.

```
MENU
F1=TELCOM        F2=TEXT
F3=SET UP        F4=TEST
```

<Display 1>

2. [SHIFT] + [V F3]

3.

```
SETUP-MODE
F1=COM           F2=DISPLAY
F3=KEY           F4=RS232C
F5=MENU
```

4. Set the setup data as the following procedure.

① [SHIFT] + [T F1]

```
COMMUNICATION        SPEED
1200 bps
CODE   PARITY        STOP
ASCII  Even          1Bit
```

[ENT]

```
XON/XOFF        LOCAL ECHO
Disable         Disable
DELIMITER       CHARACTER
Cr.Lf
```

[ENT]

② [SHIFT] + [U F2]

```
SET H-TAB            STOP
1
CR OPERATION
Cr
```

[ENT]

```
MEMORY       RETENTION
Yes
```

[ENT]

③ [SHIFT] + [V F3]

```
KEY  CLICK
Yes
AUTO  REPEAT
Yes
```

[ENT]

<Description>

Displayed when turning the power on.

Select SET UP.

Displayed setup-mode.

Set by using the following keys.

[⇨] : selects an item to be set.

[⇩] : sets data. See below.

[ENT] : ends the setting.

COM is selected.

• Data to be set

COMMUNICATION	1200 bps
SPEED	
CODE	ASCII
PARITY	Even
STOP	1Bit
XON/XOFF	Disable
LOCAL ECHO	Disable
DELIMITER	
CHARACTER	Cr.Lf

DISPLAY is selected.

• Data to be set

SET-H-TAB STOP	1
CR OPERATION	Cr
MEMORY RETENTION	Yes

KEY is selected.

• Data to be set

KEY CLICK	Yes
AUTO REPEAT	Yes

10

④ SHIFT + W F4

```
Control  RS-232C  Input Signals
CS DSR CD
Yes  Yes  No
```

ENT

⑤ SHIFT + X F5

```
MENU
F1=TELCOM      F2=TEXT
F3=SET UP      F4=TEST
```

<Display 1>

RS-232C is selected.

- Data to be set

CS	Yes
DSR	Yes
CD	No

Returns to MENU.

- PF803 ⟶ Personal computer

① Personal computer side : COPY/A COM1 [personal computer side filename] ↵

② PF803 side : Same as sending to Servopack. (Display 6)
After sending, sent CTL BRK and Z EIX in TERM mode.

- Personal computer ⟶ PF803

① PF803 side : Same as receiving from Servopack.
But, do not send P R M @ ENT .

② Personal computer side : COPY/A [personal computer side filename] COM1 ↵

③ PF803 side : After receiving, SHIFT X F5 .

Perform setup (See pages 186 and 187) again after file exchanging with personal computers.

NOTE

11 DIMENSIONS

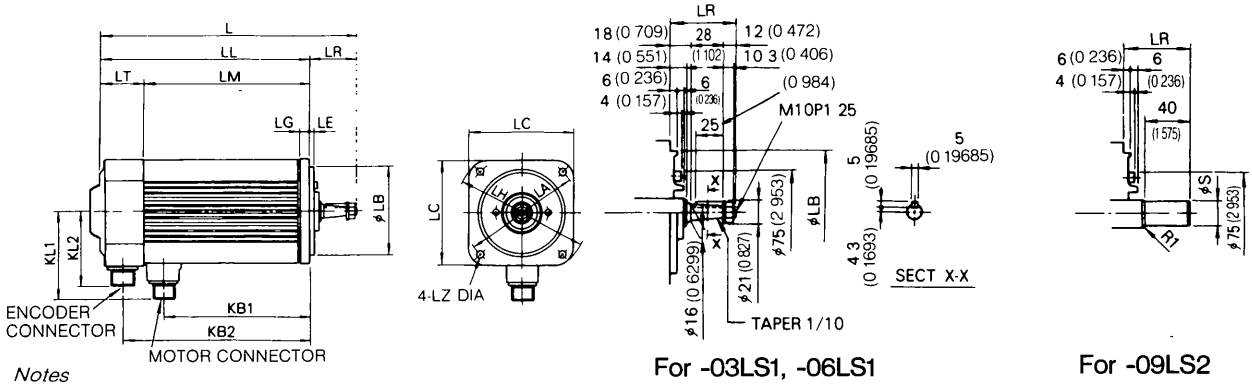
11.1 AC SERVOMOTOR WITH ABSOLUTE ENCODER

(1) M Series

Dimensions in mm (inches)

· Standard Type

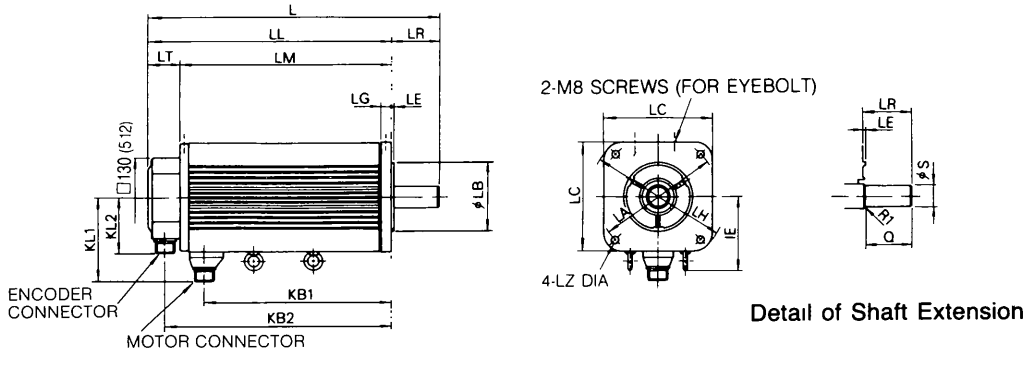
Drawing 1 USAMED-03LS1, -06LS1 (Taper Shaft), -09LS2 (Straight Shaft)



Notes

1 *Plug and clamp are not attached for receptacle connection*
2 *Key and keyway comply with JIS B 1301-1976 (Parallel key, keyway common class)*
3 *Motor should be mounted with connectors down*

Drawing 2 USAMED-12LS2 to -44LS2 (Straight Shaft)



Notes

1 *Plug and clamp are not attached for receptacle connection*
2 *Motor should be mounted with connectors down*

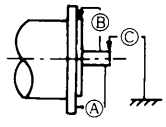
AC SERVOMOTOR Type USAMED-	Dwg No	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface							Shaft Extension		Approx Mass kg (lb)
												LA	LB	LC	LE	LG	LH	LZ	S	Q	
03LS1 *	1	277 (10 91)	219 (8 63)	150 (5 91)	58 (2 28)	69 (2 72)	127 (5 0)	177 (6 97)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 $^{0}_{-0\,035}$ (4 3307 $^{0}_{-0\,0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	—	—	9 (19 8)
06LS1 *		334 (13 15)	276 (10 87)	207 (8 15)	58 (2 28)	69 (2 72)	184 (7 24)	234 (9 21)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 $^{0}_{-0\,035}$ (4 3307 $^{0}_{-0\,0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	—	—	14 (30 9)
09LS2 *		403 (15 87)	345 (13 59)	276 (10 87)	58 (2 28)	69 (2 72)	253 (9 96)	303 (11 93)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 $^{0}_{-0\,035}$ (4 3307 $^{0}_{-0\,0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	22 $^{0}_{-0\,013}$ (0 8661 $^{0}_{-0\,0005}$)	40 (1 575)	20 (44 1)
12LS2 *	2	344 (13 54)	265 (10 43)	211 (8 30)	79 (3 11)	54 (2 13)	171 (6 73)	237 (9 33)	—	139 (5 47)	92 (3 62)	200 (7 87)	114 3 $^{0}_{-0\,025}$ (4 5 $^{0}_{-0\,001}$)	180 (7 08)	3 2 (0 13)	18 (0 71)	230 (9 1)	13 5 (0 53)	35 $^{+0\,01}_{0}$ (1 3779 $^{+0\,0004}_{0}$)	76 (2 992)	22 (48 5)
20LS2		401 (15 79)	322 (12 68)	268 (10 55)	79 (3 11)	54 (2 13)	229 (9 01)	294 (11 57)	123 (4 84)	139 (5 47)	92 (3 62)	200 (7 87)	114 3 $^{0}_{-0\,025}$ (4 5 $^{0}_{-0\,001}$)	180 (7 08)	3 2 (0 13)	18 (0 71)	230 (9 1)	13 5 (0 53)	35 $^{+0\,01}_{0}$ (1 3779 $^{+0\,0004}_{0}$)	76 (2 992)	29 (63 9)
30LS2		486 (19 13)	407 (16 02)	353 (13 90)	79 (3 11)	54 (2 13)	314 (12 36)	379 (14 92)	123 (4 84)	139 (5 47)	92 (3 62)	200 (7 87)	114 3 $^{0}_{-0\,025}$ (4 5 $^{0}_{-0\,001}$)	180 (7 08)	3 2 (0 13)	18 (0 71)	230 (9 1)	13 5 (0 53)	35 $^{+0\,01}_{0}$ (1 3779 $^{+0\,0004}_{0}$)	76 (2 992)	41 (90 4)
44LS2		688 (27 09)	578 (22 76)	524 (20 63)	110 (4 33)	54 (2 13)	476 (18 74)	550 (21 65)	123 (4 84)	149 (5 87)	92 (3 62)	200 (7 87)	114 3 $^{0}_{-0\,025}$ (4 5 $^{0}_{-0\,001}$)	180 (7 08)	3 2 (0 13)	18 (0 71)	230 (9 1)	13 5 (0 53)	42 $^{0}_{-0\,016}$ (1 6535 $^{0}_{-0\,0006}$)	110 (4 33)	66 (145 5)

** Not provided with an eyebolt*

CONNECTOR TYPES

AC SERVOMOTOR Type USAMED-	Motor Connector Types				Absolute Encoder Connector Types			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
03LS1 06LS1 09LS2	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A	97F3102E 20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
12LS2 20LS2 30LS2	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057 -12A				
44LS2	MS3102 A32-17P	MS3108 B32-17S	MS3106 B32-17S	MS3057 -20A				

MECHANICAL SPECIFICATIONS

Accuracy (T. I. R)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0 04 (0 0016)	
Flange diameter concentric to shaft Ⓑ	0 04 (0 0016)	
Shaft run out Ⓒ	0 02 (0 0008) 0 04† (0 0016†)	

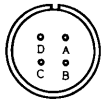
Servomotors with a brake or a modified shaft extension are also available

** T I R (Total Indicator Reading)*

† Accuracy for motor type USAMED-44LS2

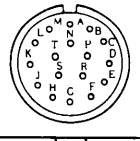
CONNECTOR SPECIFICATIONS

Motor Receptacle



A	Phase U
B	Phase V
C	Phase W
D	Frame ground

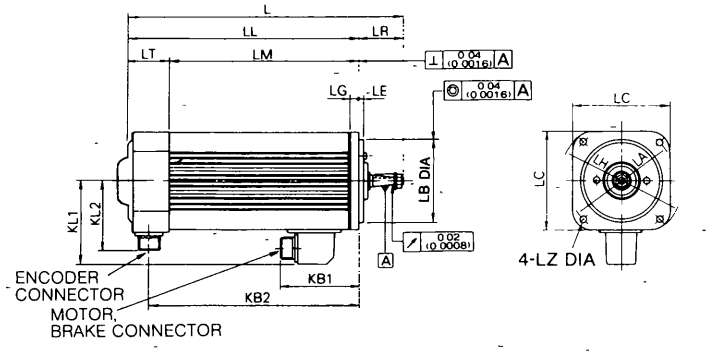
Absolute Encoder Receptacle

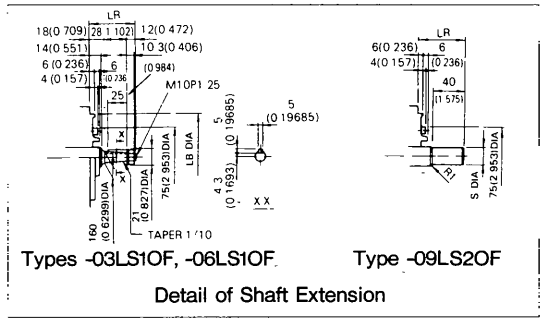


A	Channel A output	K	—
B	Channel $\overline{A}$ output	L	—
C	Channel B output	M	—
D	Channel $\overline{B}$ output	N	—
E	Channel C output	P	—
F	Channel $\overline{C}$ output	R	For reset
G	0 V	S	0V (battery)
H	+5VDC	T	3 6V (battery)
J	Frame ground	—	—

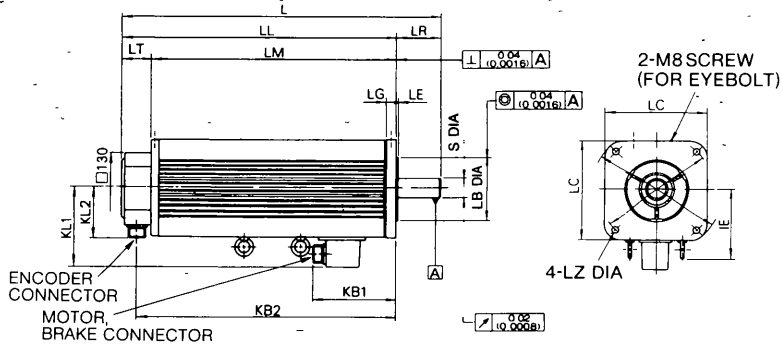
• With Brake

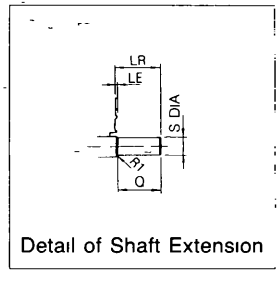
(a) Types USAMED-03LS1OF, -06LS1OF (Taper Shaft), -09LS2OF (Straight Shaft)





(b) Types USAMED-12LS2OF, -20LS2OF, -30LS2OF (Straight Shaft)





AC SERVOMOTOR Type USAMED-	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface LA	LB	LC	LE	LG	LH	LZ	Shaft Extension S	Q	Approx Mass kg (lb)	Brake Braking Torque N·m(kg·m)	Brake Inertia $(\frac{GD^2}{4})$ kg·m²
03LS1OF*	334 (13 15)	276 (10 87)	207 (8 15)	58 (2 28)	69 (2 72)	128 (5 04)	234 (9 21)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0.025}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	–	–	11 5(25 4)	5 88 (0 6)	0 85×10⁻⁴
06LS1OF*	380 (14 96)	322 (12 68)	253 (9 97)	58 (2 28)	69 (2 72)	118 (4 65)	280 (11 02)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0.035}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	–	–	15(33 1)		
09LS2OF*	450 (17 72)	392 (15 43)	323 (12 73)	58 (2 28)	69 (2 72)	118 (4 65)	350 (13 78)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0.035}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	22 $^{0}_{-0.013}$ (0 8661 $^{0}_{-0.0005}$)	40 (1 575)	23(50 7)	8 83 (0 9)	0 9×10⁻⁴
12LS2OF	422 (16 61)	343 (13 50)	289 (11 38)	79 (3 11)	54 (2 13)	164 (6 46)	315 (12 4)	123 (4 84)	143 (5 63)	92 (3 62)	200 (7 87)	114 3 (4 5 $^{0}_{-0.001}$)	180 (7 08)	3 2 (0 13)	18 (0 71)	230 (9 1)	13 5 (0 53)	35 $^{+0.01}_{0}$ (1 3779 $^{+0.0004}_{0}$)	76 (2 992)	30(66 2)	35 3 (3 6)	6 25×10⁻⁴
20LS2OF	486 (19 13)	407 (16 02)	354 (13 94)	79 (3 11)	54 (2 13)	164 (6 46)	379 (14 92)	123 (4 84)	143 (5 63)	92 (3 62)	200 (7 87)	114 3 (4 5 $^{0}_{-0.001}$)	180 (7 08)	3 2 (0 13)	18 (0 71)	230 (9 1)	13 5 (0 53)	35 $^{+0.01}_{0}$ (1 3779 $^{+0.0004}_{0}$)	76 (2 992)	37(81 6)		
30LS2OF	567 (22 32)	488 (19 21)	435 (17 13)	79 (3 11)	54 (2 13)	164 (6 46)	460 (18 11)	123 (4 84)	143 (5 63)	92 (3 62)	200 (7 87)	114 3 (4 5 $^{0}_{-0.001}$)	180 (7 08)	3 2 (0 13)	18 (0 71)	230 (9 1)	13 5 (0 53)	35 $^{+0.01}_{0}$ (1 3779 $^{+0.0004}_{0}$)	76 (2 992)	49(108)		

* *Not provided with an eyebolt*

† *TIR Total Indicator Reading*

Notes 1 Absolute encoder 8192 pulses/rev is used as a detector

2 Vibration 15 μm or below

3 Plug and clamp are not attached for receptacle connection

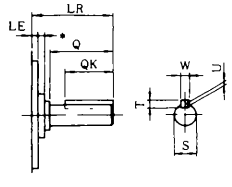
4 Connector specifications Refer to Par 3 3

5 It is recommended that the motor be mounted with its connector placed down

6 Power supply for brake is 24VDC

• Shaft Extension of Straight Shaft with Keyway

Both Servomotors with brake and without brake have the same dimensions except for shaft extension Shaft extensions are shown below



**6mm (0 236in) for USAMED-03LS2 to 09LS2*

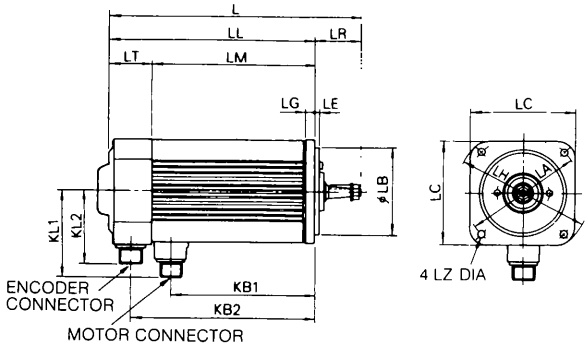
Motor type Without Brake	Motor type With Brake	LR	LE	Dimensions of Shaft Extension S	Q	QK	T	U	W
*USAMED-03LS2K	*USAMED-03LS2KF	58 (2 28)	6 (0 24)	19 (0 7480 $^{0}_{-0.013}$ $^{0}_{-0.0005}$)	40 (1 57)	25 (0 98)	5 (0 1968)	3 (0 1181)	5 (0 1968)
*USAMED-06LS2K	*USAMED-06LS2KF	58 (2 28)	6 (0 24)	19 (0 7480 $^{0}_{-0.013}$ $^{0}_{-0.0005}$)	40 (1 57)	25 (0 98)	5 (0 1968)	3 (0 1181)	5 (0 1968)
*USAMED-09LS2K	*USAMED-09LS2KF	58 (2 28)	6 (0 24)	22 $^{0}_{-0.013}$ (0 8661 $^{0}_{-0.0005}$)	40 (1 57)	25 (0 98)	6 (0 2362)	3 5 (0 1378)	6 (0 2362)
USAMED-12LS2K	USAMED-12LS2KF	79 (3 11)	3 2 (0 13)	35 $^{+0.01}_{0}$ (1 3779 $^{+0.0004}_{0}$)	76 (2 99)	60 (2 36)	8 (0 3149)	5 (0 1968)	10 (0 3937)
USAMED-20LS2K	USAMED-20LS2KF	79 (3 11)	3 2 (0 13)	35 $^{+0.01}_{0}$ (1 3779 $^{+0.0004}_{0}$)	76 (2 99)	60 (2 36)	8 (0 3149)	5 (0 1968)	10 (0 3937)
USAMED-30LS2K	USAMED-30LS2KF	79 (3 11)	3 2 (0 13)	35 (1 3779 $^{+0.01}_{0}$ $^{+0.0004}_{0}$)	76 (2 99)	60 (2 36)	8 (0 3149)	5 (0 1968)	10 (0 3937)
USAMED-44LS2K	–	110 (4 33)	3 2 (0 13)	42 (1 6535 $^{0}_{-0.016}$ $^{0}_{-0.0006}$)	110 (4 33)	90 (3 54)	8 (0 3149)	5 (0 1968)	12 (0 4724)

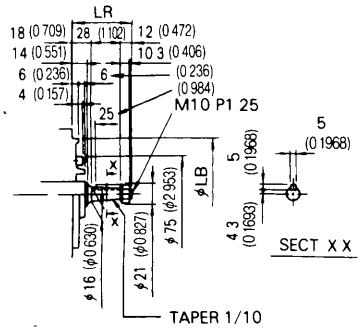
(2) F Series

Dimensions in mm (inches)

· Standard Type

Drawing 1 USAFED-05LS1, -09LS1 (Taper Shaft), -13LS2 (Straight Shaft)





For -05LS1, -09LS1 For -13LS2

Detail of Shaft Extension

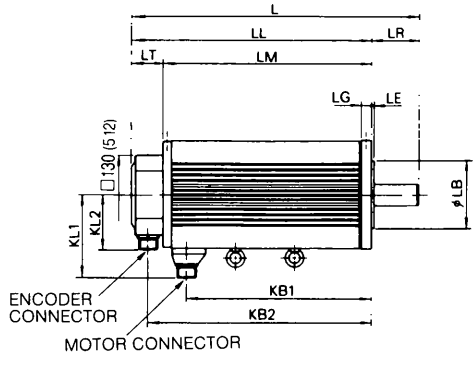
Notes

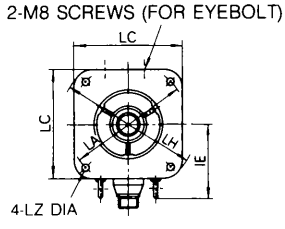
1 Plug and clamp are not attached for receptacle connection

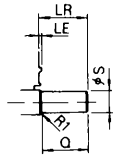
2 Key and keyway comply with JIS B 1301-1976 (Parallel key, keyway common class)

3 Motor should be mounted with connectors down

Drawing 2 USAFED-20LS2 to -44LS2 (Straight Shaft)







Detail of Shaft Extension

Notes

1 Plug and clamp are not attached for receptacle connection

2 Motor should be mounted with connectors down

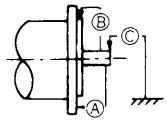
AC SERVOMOTOR Type USAFED-	Dwg No	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface							Shaft Extension		Approx Mass kg (lb)
												LA	LB	LC	LE	LG	LH	LZ	S	Q	
05LS1*	1	277 (10 90)	219 (8 62)	150 (5 91)	58 (2 28)	69 (2 72)	127 (5 0)	177 (6 97)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0.035}$ $^{0}_{-0.0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	—	—	9 (19 9)
09LS1*		334 (13 14)	276 (10 86)	207 (8 16)	58 (2 28)	69 (2 72)	184 (7 24)	234 (9 21)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0.035}$ $^{0}_{-0.0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	—	—	14 (30 9)
13LS2*		403 (15 87)	345 (13 59)	276 (10 87)	58 (2 28)	69 (2 72)	253 (9 96)	303 (11 93)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0.035}$ $^{0}_{-0.0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	22 (0 8661 $^{0}_{-0.013}$ $^{0}_{-0.0005}$)	40 (1 57)	20 (44 1)
20LS2*	2	344 (13 54)	265 (10 43)	211 (8 3)	79 (3 11)	54 (2 13)	172 (6 77)	237 (9 33)	—	139 (5 47)	92 (3 62)	200 (7 88)	114 3 (4 5 $^{0}_{-0.025}$ $^{0}_{-0.001}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 (1 3379 $^{-0.01}_{0}$ $^{0}_{-0.0004}$)	76 (2 99)	22 (48 5)
30LS2		401 (15 79)	322 (12 68)	268 (10 55)	79 (3 11)	54 (2 13)	229 (9 02)	294 (11 57)	123 (4 85)	139 (5 47)	92 (3 62)	200 (7 88)	114 3 (4 5 $^{0}_{-0.025}$ $^{0}_{-0.001}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 (1 3379 $^{-0.01}_{0}$ $^{0}_{-0.0004}$)	76 (2 99)	29 (63 9)
44LS2		486 (19 14)	407 (16 02)	353 (13 90)	79 (3 11)	54 (2 13)	314 (12 36)	379 (14 92)	123 (4 85)	139 (5 47)	92 (3 62)	200 (7 88)	114 3 (4 5 $^{0}_{-0.025}$ $^{0}_{-0.001}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 (1 3379 $^{-0.01}_{0}$ $^{0}_{-0.0004}$)	76 (2 99)	41 (90 4)

** Not provided with an eyebolt*

CONNECTOR TYPES

AC SERVOMOTOR Type USAFED-	Motor Connector Types				Absolute Encoder Connector Types			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
05LS1 09LS1 13LS2	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A	97F3102E 20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
20LS2 30LS2 44LS2	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057 -12A				

MECHANICAL SPECIFICATIONS

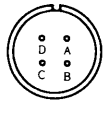
Accuracy (T I R)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0 04 (0 0016)	
Flange diameter concentric to shaft Ⓑ	0 04 (0 0016)	
Shaft run out Ⓒ	0 02 (0 0008)	

** T I R (Total Indicator Reading)*

Servomotors with a brake or a modified shaft extension are also available

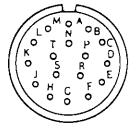
CONNECTOR SPECIFICATIONS

Motor Receptacle



A	Phase U
B	Phase V
C	Phase W
D	Frame ground

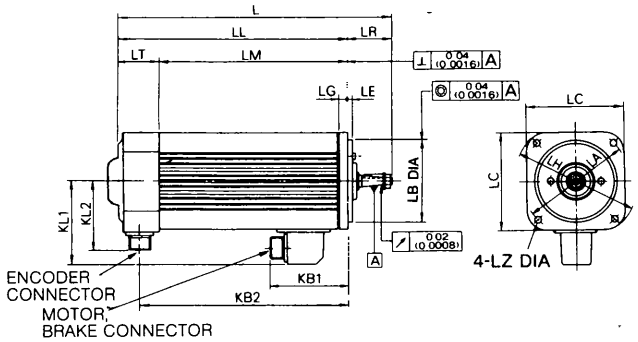
Absolute Encoder Receptacle

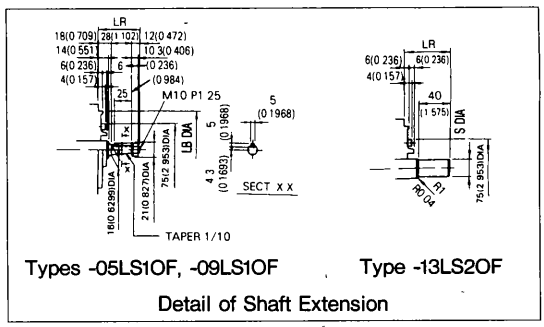


A	Channel A output	K	—
B	Channel $\overline{A}$ output	L	—
C	Channel B output	M	—
D	Channel $\overline{B}$ output	N	—
E	Channel C output	P	—
F	Channel $\overline{C}$ output	R	For reset
G	0 V	S	0V (battery)
H	+ 5VDC	T	3 6V (battery)
J	Frame ground	—	—

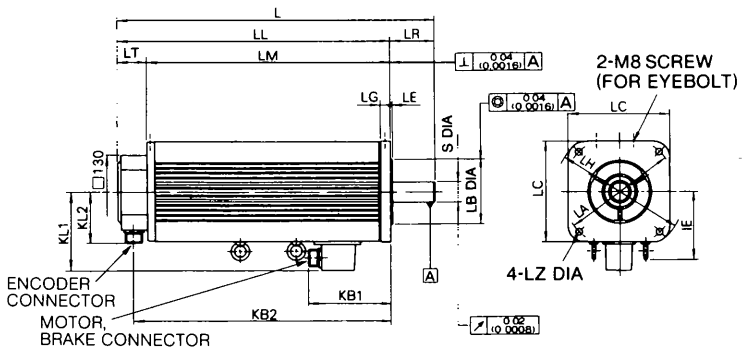
• With Brake

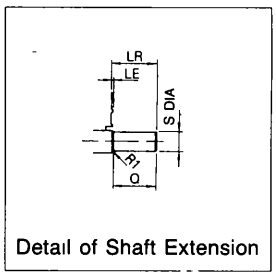
(a) Types USAFED-05LS1OF, -09LS1OF (Taper Shaft), -13LS2OF (Straight Shaft)





(b) Types USAFED-20LS2OF, -30LS2OF, -44LS2OF (Straight Shaft)





AC SERVOMOTOR Type USAFED-	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface							Shaft Extension		Approx Mass kg (lb)	Brake	
											LA	LB	LC	LE	LG	LH	LZ	S	Q		Braking Torque N·m(kg·m)	Inertia ($GD^2/4$) kg·m²
05LS1OF*	334 (13 15)	276 (10 87)	207 (8 15)	58 (2 28)	69 (2 72)	128 (5 04)	234 (9 21)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 (4 3307)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	–	–	12(26 5)	5 88 (0 6)	0 85×10⁻⁴
09LS1OF*	380 (14 96)	322 (12 68)	253 (9 97)	58 (2 28)	69 (2 72)	118 (4 65)	280 (11 02)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 (4 3307)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	–	–	16(35 3)		
13LS2OF*	450 (17 72)	392 (15 43)	323 (12 73)	58 (2 28)	69 (2 72)	118 (4 65)	350 (13 78)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 (4 3307)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	22 (0 8661)	40 (1 57)	23(50 7)	8 83 (0 9)	0 9×10⁻⁴
20LS2OF	422 (16 61)	343 (13 50)	289 (11 38)	79 (3 11)	54 (2 13)	164 (6 46)	315 (12 4)	123 (4 85)	143 (5 63)	92 (3 62)	200 (7 88)	114 3 (4 5)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 (1 3779)	76 (2 99)	30(66 2)	35 3 (3 6)	6 25×10⁻⁴
30LS2OF	486 (19 13)	407 (16 02)	353 (13 90)	79 (3 11)	54 (2 13)	164 (6 46)	379 (14 92)	123 (4 85)	143 (5 63)	92 (3 62)	200 (7 88)	114 3 (4 5)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 (1 3779)	76 (2 99)	37(81 6)		
44LS2OF	567 (22 32)	488 (19 21)	434 (17 09)	79 (3 11)	54 (2 13)	164 (6 46)	460 (18 11)	123 (4 85)	143 (5 63)	92 (3 62)	200 (7 88)	114 3 (4 5)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 (1 3779)	76 (2 99)	49(108)		

* *Not provided with an eyebolt*

† *TIR Total Indicator Reading*

Notes 1 Absolute encoder 8192 pulses/rev is used as a detector

2 Vibration 15μm or below

3 Plug and clamp are not attached for receptacle connection

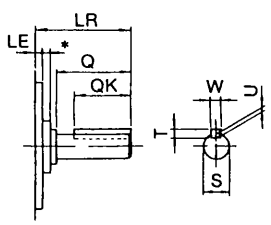
4 Connector specifications Refer to Par 3 3

5 It is recommended that the motor be mounted with its connector placed down

6 Power supply for brake is 24VDC

• Shaft Extension of Straight Shaft with Keyway

Both Servomotors with brake and without brake have the same dimensions except for shaft extension Shaft extensions are shown below



Motor Type		LR	LE	Dimensions of Shaft Extension					
Without Brake	With Brake			S	Q	QK	T	U	W
*USAFED-05LS2K	*USAFED-05LS2KF	58 (2 28)	6 (0 24)	19 (0 7480)	40 (1 57)	25 (0 98)	5 (0 1968)	3 (0 1181)	5 (0 1968)
*USAFED-09LS2K	*USAFED-09LS2KF	58 (2 28)	6 (0 24)	19 (0 7480)	40 (1 57)	25 (0 98)	5 (0 1968)	3 (0 1181)	5 (0 1968)
*USAFED-13LS2K	*USAFED-13LS2KF	58 (2 28)	6 (0 24)	22 (0 8661)	40 (1 57)	25 (0 98)	6 (0 2362)	3 5 (0 1378)	6 (0 2362)
USAFED-20LS2K	USAFED-20LS2KF	79 (3 11)	3 2 (0 13)	35 (1 3379)	76 (2 99)	60 (2 36)	8 (0 3149)	5 (0 1968)	10 (0 3937)
USAFED-30LS2K	USAFED-30LS2KF	79 (3 11)	3 2 (0 13)	35 (1 3379)	76 (2 99)	60 (2 36)	8 (0 3149)	5 (0 1968)	10 (0 3937)
USAFED-44LS2K	USAFED-44LS2KF	79 (3 11)	3 2 (0 13)	35 (1 3379)	76 (2 99)	60 (2 36)	8 (0 3149)	5 (0 1968)	10 (0 3937)

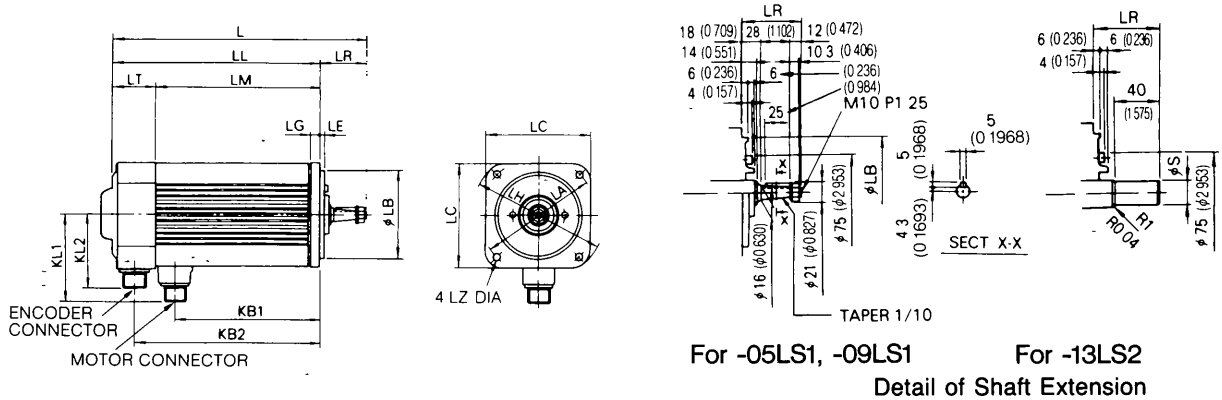
* *6mm (in) for USAFED-05LS2 to 13LS2*

(3) G Series

· Standard Type

Dimensions in mm (inches)

Drawing 1 USAGED-05LS1, -09LS1 (Taper Shaft), -13LS2 (Straight Shaft)



For -05LS1, -09LS1 For -13LS2

Detail of Shaft Extension

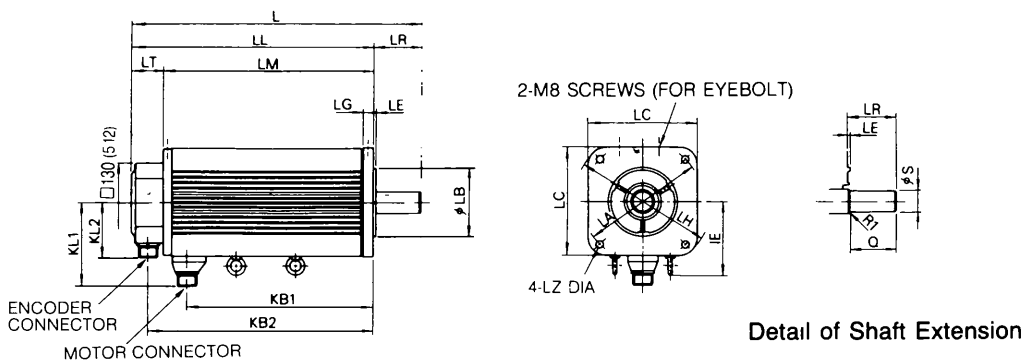
Notes .

1 Plug and clamp are not attached for receptacle connection

2 Key and keyway comply with JIS B 1301-1976 (Parallel key, keyway common class)

3 Motor should be mounted with connectors down

Drawing 2 USAGED-20LS2 to -44LS2 (Straight Shaft)



Detail of Shaft Extension

Notes

1 Plug and clamp are not attached for receptacle connection

2 Motor should be mounted with connectors down

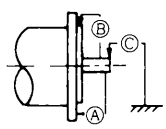
AC SERVOMOTOR Type USAGED-	Dwg No	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface							Shaft Extension		Approx Mass kg (lb)
												LA	LB	LC	LE	LG	LH	LZ	S	Q	
05LS1*	1	277 (10 90)	219 (8 62)	150 (5 91)	58 (2 28)	69 (2 72)	127 (5 0)	177 (6 97)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 (4 3307)	$^{0}_{-0.035}$ $^{0}_{-0.0014}$	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)			9 (19 9)
09LS1*		334 (13 14)	276 (10 86)	207 (8 16)	58 (2 28)	69 (2 72)	184 (7 24)	234 (9 21)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 (4 3307)	$^{0}_{-0.035}$ $^{0}_{-0.0014}$	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)			14 (30 9)
13LS2*		403 (15 87)	345 (13 59)	276 (10 87)	58 (2 28)	69 (2 72)	253 (9 96)	303 (11 93)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 (4 3307)	$^{0}_{-0.035}$ $^{0}_{-0.0014}$	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	22 (0 8661)	$^{0.013}_{0}$ $^{0}_{0.0005}$	40 (1 57)	20 (44 1)
20LS2*	2	344 (13 54)	265 (10 43)	211 (8 3)	79 (3 11)	54 (2 13)	172 (6 77)	237 (9 33)	—	139 (5 47)	92 (3 62)	200 (7 88)	114 3 (4 5	$^{0}_{-0.025}$ $^{0}_{-0.001}$	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 (1 3379)	$^{0.01}_{0}$ $^{0}_{0.0004}$	76 (2 99)	22 (48 5)
30LS2		401 (15 79)	322 (12 68)	268 (10 55)	79 (3 11)	54 (2 13)	229 (9 02)	294 (11 57)	123 (4 85)	139 (5 47)	92 (3 62)	200 (7 88)	114 3 (4 5	$^{0}_{-0.025}$ $^{0}_{-0.001}$	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 (1 3379)	$^{0.01}_{0}$ $^{0}_{0.0004}$	76 (2 99)	29 (63 9)
44LS2		486 (19 14)	407 (16 02)	353 (13 90)	79 (3 11)	54 (2 13)	314 (12 36)	379 (14 92)	123 (4 85)	139 (5 47)	92 (3 62)	200 (7 88)	114 3 (4 5	$^{0}_{-0.025}$ $^{0}_{-0.001}$	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 (1 3379)	$^{0.01}_{0}$ $^{0}_{0.0004}$	76 (2 99)	41 (90 4)

Not provided with an eyebolt

CONNECTOR TYPES

AC SERVOMOTOR Type USAGED-	Motor Connector Types				Absolute Encoder Connector Types			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
05LS1 09LS1 13LS2	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A	97F3102E 20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
20LS2 30LS2 44LS2	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057 -12A				

MECHANICAL SPECIFICATIONS

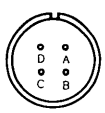
Accuracy (T I R)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0 04 (0 0016)	
Flange diameter concentric to shaft Ⓑ	0 04 (0 0016)	
Shaft run out Ⓒ	0 02 (0 0008)	

T I R (Total Indicator Reading)

Servomotors with a brake or a modified shaft extension are also available

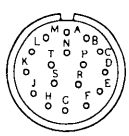
CONNECTOR SPECIFICATIONS

Motor Receptacle



A	Phase U
B	Phase V
C	Phase W
D	Frame ground

Absolute Encoder Receptacle

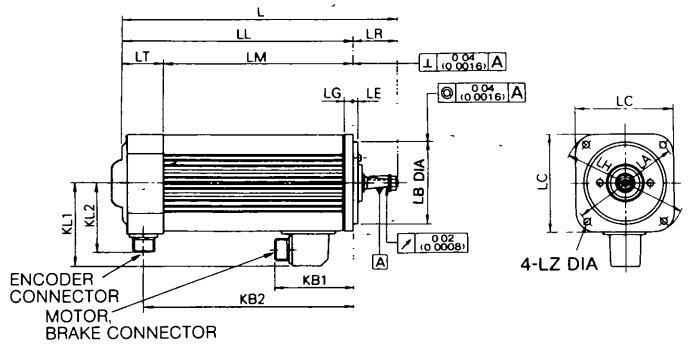


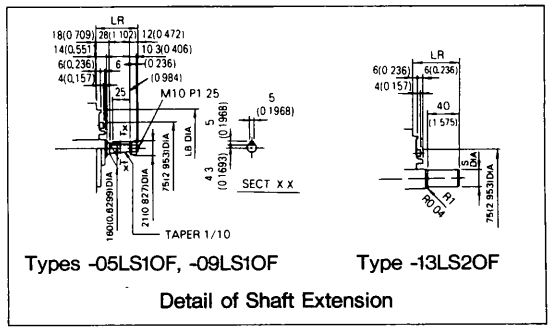
A	Channel A output	K	—
B	Channel $\overline{A}$ output	L	—
C	Channel B output	M	—
D	Channel $\overline{B}$ output	N	—
E	Channel C output	P	—
F	Channel $\overline{C}$ output	R	For reset
G	0V	S	0V (battery)
H	+5VDC	T	3 6V (battery)
J	Frame ground	—	—

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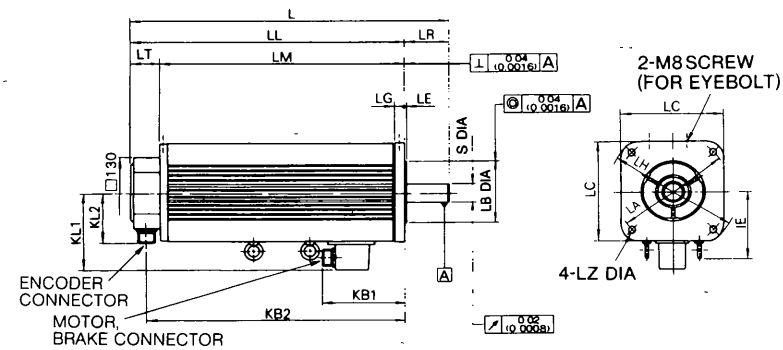
• With Brake

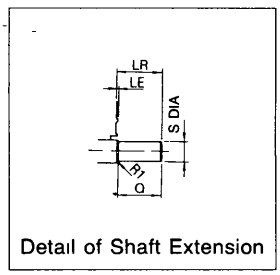
(a) Types USAGED-05LS1OF, -09LS1OF (Taper Shaft), -13LS2OF (Straight Shaft)





(b) Types USAGED-20LS2OF, -30LS2OF, -44LS2OF (Straight Shaft)





AC SERVOMOTOR Type USAGED-	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface LA	LB	LC	LE	LG	LH	LZ	Shaft Extension S	Q	Approx Mass kg (lb)	Brake Braking Torque N·m(kg·m)	Brake Inertia $(GD^2/4)$ kg·m²
05LS1OF*	334 (13 15)	276 (10 87)	207 (8 15)	58 (2 28)	69 (2 72)	128 (5 04)	234 (9 21)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 $^{0}_{-0.035}$ (4 3307 $^{0}_{-0.0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	–	–	12(26 5)	5 88 (0 6)	0 85×10⁻⁴
09LS1OF*	380 (14 96)	322 (12 68)	253 (9 97)	58 (2 28)	69 (2 72)	118 (4 65)	280 (11 02)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 $^{0}_{-0.035}$ (4 3307 $^{0}_{-0.0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	–	–	16(35 3)		
13LS2OF*	450 (17 72)	392 (15 43)	323 (12 73)	58 (2 28)	69 (2 72)	118 (4 65)	350 (13 78)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 $^{0}_{-0.035}$ (4 3307 $^{0}_{-0.0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	22 $^{0}_{-0.013}$ (0 8661 $^{0}_{-0.0005}$)	40 (1 57)	23(50 7)	8 83 (0 9)	0 9×10⁻⁴
20LS2OF	422 (16 61)	343 (13 50)	289 (11 38)	79 (3 11)	54 (2 13)	164 (6 46)	315 (12 4)	123 (4 85)	143 (5 63)	92 (3 62)	200 (7 88)	114 3 $^{0}_{-0.025}$ (4 5 $^{0}_{-0.001}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 6)	13 5 (0 53)	35 $^{+0.01}_{0}$ (1 3779 $^{+0.0004}_{0}$)	76 (2 99)	30(66 2)	35 3 (3 6)	6 25×10⁻⁴
30LS2OF	486 (19 13)	407 (16 02)	353 (13 90)	79 (3 11)	54 (2 13)	164 (6 46)	379 (14 92)	123 (4 85)	143 (5 63)	92 (3 62)	200 (7 88)	114 3 $^{0}_{-0.025}$ (4 5 $^{0}_{-0.001}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 6)	13 5 (0 53)	35 $^{+0.01}_{0}$ (1 3779 $^{+0.0004}_{0}$)	76 (2 99)	37(81 6)		
44LS2OF	567 (22 32)	488 (19 21)	434 (17 09)	79 (3 11)	54 (2 13)	164 (6 46)	460 (18 11)	123 (4 85)	143 (5 63)	92 (3 62)	200 (7 88)	114 3 $^{0}_{-0.025}$ (4 5 $^{0}_{-0.001}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 6)	13 5 (0 53)	35 $^{+0.01}_{0}$ (1 3779 $^{+0.0004}_{0}$)	76 (2 99)	49(108)		

* *Not provided with an eyebolt*

† *TIR Total Indicator Reading*

Notes 1 Absolute encoder 8192 pulses/rev is used as a detector

2 Vibration 15μm or below

3 Plug and clamp are not attached for receptacle connection

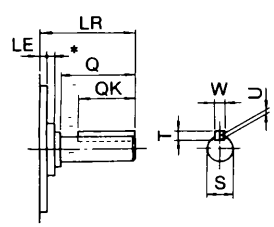
4 Connector specifications Refer to Par 3 3

5 It is recommended that the motor be mounted with its connector placed down

6 Power supply for brake is 24VDC

• Shaft Extension of Straight Shaft with Keyway

Both Servomotors with brake and without brake have the same dimensions except for shaft extension Shaft extensions are shown below



Motor Type		LR	LE	Dimensions of Shaft Extension					
Without Brake	With Brake			S	Q	QK	T	U	W
*USAGED-05LS2K	*USAGED-05LS2KF	58 (2 28)	6 (0 24)	19 (0 7480 $^{0}_{-0.013}$ $^{0}_{-0.0005}$)	40 (1 57)	25 (0 98)	5 (0 1968)	3 (0 1181)	5 (0 1968)
*USAGED-09LS2K	*USAGED-09LS2KF	58 (2 28)	6 (0 24)	19 (0 7480 $^{0}_{-0.013}$ $^{0}_{-0.0005}$)	40 (1 57)	25 (0 98)	5 (0 1968)	3 (0 1181)	5 (0 1968)
*USAGED-13LS2K	*USAGED-13LS2KF	58 (2 28)	6 (0 24)	22 (0 8661 $^{0}_{-0.013}$ $^{0}_{-0.0005}$)	40 (1 57)	25 (0 98)	6 (0 2362)	3 5 (0 1378)	6 (0 2362)
USAGED-20LS2K	USAGED-20LS2KF	79 (3 11)	3 2 (0 13)	35 (1 3779 $^{+0.01}_{0}$ $^{+0.0004}_{0}$)	76 (2 99)	60 (2 36)	8 (0 3149)	5 (0 1968)	10 (0 3937)
USAGED-30LS2K	USAGED-30LS2KF	79 (3 11)	3 2 (0 13)	35 (1 3779 $^{+0.01}_{0}$ $^{+0.0004}_{0}$)	76 (2 99)	60 (2 36)	8 (0 3149)	5 (0 1968)	10 (0 3937)
USAGED-44LS2K	USAGED-44LS2KF	79 (3 11)	3 2 (0 13)	35 (1 3779 $^{+0.01}_{0}$ $^{+0.0004}_{0}$)	76 (2 99)	60 (2 36)	8 (0 3149)	5 (0 1968)	10 (0 3937)

* *6mm for USAGED-05LS2 to 13LS2*

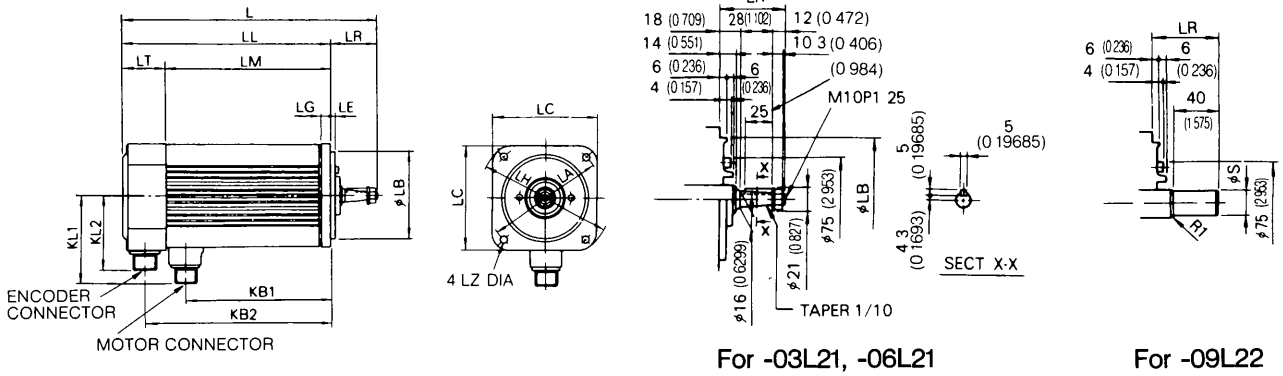
11.2 AC SERVOMOTOR WITH INCREMENTAL ENCODER

(1) M Series

· Standard Type

Dimensions in mm (inches)

Drawing 1 USAMED-03L21, -06L21 (Taper Shaft), -09L22 (Straight Shaft)



For -03L21, -06L21

For -09L22

Detail of Shaft Extension

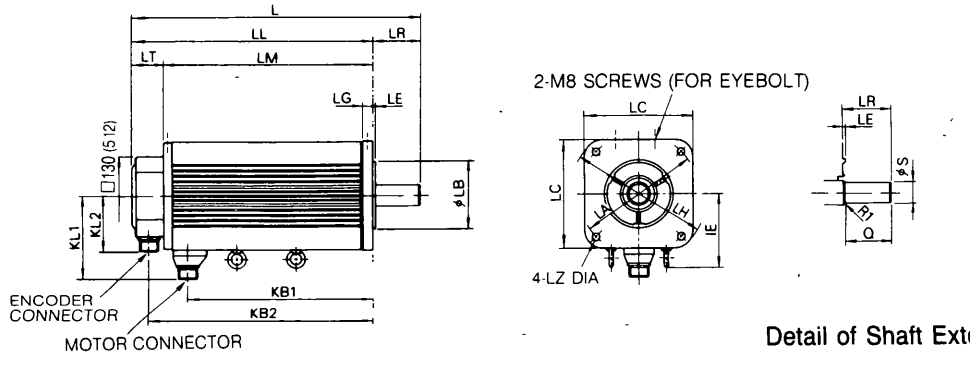
Notes

1 Plug and clamp are not attached for receptacle connection

2 Key and keyway comply with JIS B 1301-1976 (Parallel key, keyway common class)

3 Motor should be mounted with connectors down

Drawing 2 USAMED-12L22 to -44L22 (Straight Shaft)



Detail of Shaft Extension

Notes

1 Plug and clamp are not attached for receptacle connection

2 Motor should be mounted with connectors down

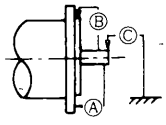
AC SERVOMOTOR Type USAMED-	Dwg No	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface							Shaft Extension		Approx Mass kg (lb)
												LA	LB	LC	LE	LG	LH	LZ	S	Q	
03L21*	1	263 (10 34)	205 (8 06)	150 (5 9)	58 (2 28)	55 (2 16)	127 (5 0)	177 (6 97)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0035}$ $^{0}_{-0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	—	—	8 5 (18 7)
06L21*		320 (12 59)	262 (10 31)	207 (8 15)	58 (2 28)	55 (2 16)	184 (7 24)	234 (9 21)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0035}$ $^{0}_{-0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	—	—	13 (28 7)
09L22*		389 (15 31)	331 (13 03)	276 (10 87)	58 (2 28)	55 (2 16)	253 (9 96)	303 (11 93)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0035}$ $^{0}_{-0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	22 (0 8661 $^{-0.013}_{-0.019}$)	40 (1 575)	20 (44 1)
12L22*	2	344 (13 54)	265 (10 43)	211 (8 30)	79 (3 11)	54 (2 13)	172 (6 77)	237 (9 33)	—	139 (5 47)	92 (3 62)	200 (7 87)	114 3 (4 5 $^{0}_{-0025}$ $^{0}_{-0001}$)	180 (7 08)	3 2 (0 13)	18 (0 71)	230 (9 1)	13 5 (0 53)	35 (1 3779 $^{-0.01}_{-0.0004}$)	76 (2 992)	22 (48 5)
20L22		401 (15 79)	322 (12 68)	268 (10 55)	79 (3 11)	54 (2 13)	229 (9 01)	294 (11 57)	123 (4 84)	139 (5 47)	92 (3 62)	200 (7 87)	114 3 (4 5 $^{0}_{-0025}$ $^{0}_{-0001}$)	180 (7 08)	3 2 (0 13)	18 (0 71)	230 (9 1)	13 5 (0 53)	35 (1 3779 $^{-0.01}_{-0.0004}$)	76 (2 992)	29 (63 9)
30L22		486 (19 13)	407 (16 02)	353 (13 90)	79 (3 11)	54 (2 13)	314 (12 36)	379 (14 92)	123 (4 84)	139 (5 47)	92 (3 62)	200 (7 87)	114 3 (4 5 $^{0}_{-0025}$ $^{0}_{-0001}$)	180 (7 08)	3 2 (0 13)	18 (0 71)	230 (9 1)	13 5 (0 53)	35 (1 3779 $^{-0.01}_{-0.0004}$)	76 (2 992)	41 (90 4)
44L22		688 (27 09)	578 (22 76)	524 (20 63)	110 (4 33)	54 (2 13)	476 (18 74)	550 (21 65)	123 (4 84)	149 (5 87)	92 (3 62)	200 (7 87)	114 3 (4 5 $^{0}_{-0025}$ $^{0}_{-0001}$)	180 (7 08)	3 2 (0 13)	18 (0 71)	230 (9 1)	13 5 (0 53)	42 (1 6535 $^{-0.016}_{-0.0006}$)	110 (4 33)	66 (145 5)

* *Not provided with an eyebolt*

CONNECTOR TYPES

AC SERVOMOTOR Type USAMED-	Motor Connector Types				Incremental Encoder Connector Types			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
03L21 06L21 09L22	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A	97F3102E 20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
12L22 20L22 30L22	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057 -12A				
44L22	MS3102 A32-17P	MS3108 B32-17S	MS3106 B32-17S	MS3057 -20A				

MECHANICAL SPECIFICATIONS

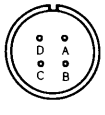
Accuracy (T. I R)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0 04 (0 0016)	
Flange diameter concentric to shaft Ⓑ	0 04 (0 0016)	
Shaft run out Ⓒ	0 02 (0 0008) 0 04† (0 0016†)	

* *T I R (Total Indicator Reading)*
† *Accuracy for motor type USAMED-44L22*

Servomotors with a brake or a modified shaft extension are also available For detailed information, refer to related Bulletins (TSE-S800-11 1)

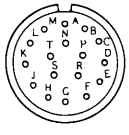
CONNECTOR SPECIFICATIONS

Motor Receptacle



A	Phase U
B	Phase V
C	Phase W
D	Frame ground

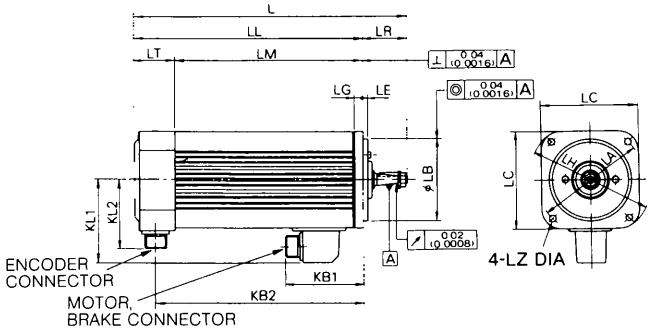
Incremental Encoder Receptacle

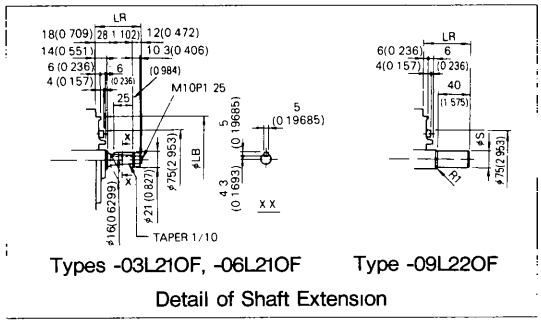


A	Channel A output	K	—
B	Channel $\overline{A}$ output	L	—
C	Channel B output	M	—
D	Channel $\overline{B}$ output	N	—
E	Channel C output	P	—
F	Channel $\overline{C}$ output	R	—
G	0V	S	—
H	+5VDC	T	—
J	Frame ground	—	—

• With Brake

(a) Types USAMED-03L21OF, -06L21OF (Taper Shaft), -09L22OF (Straight Shaft)

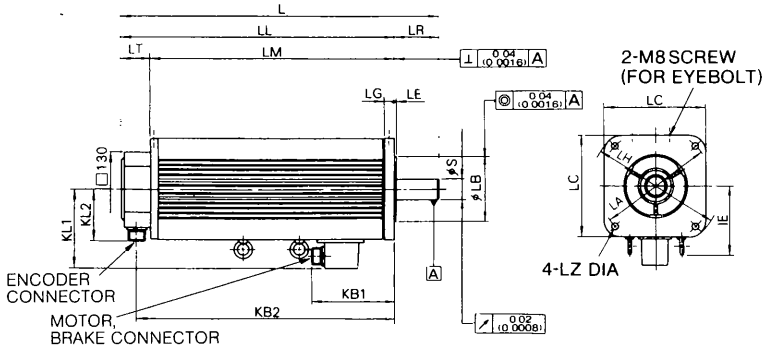


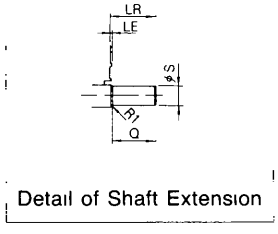


Types -03L21OF, -06L21OF Type -09L22OF

Detail of Shaft Extension

(b) Types USAMED-12L22OF, -20L22OF, -30L22OF (Straight Shaft)





Detail of Shaft Extension

AC SERVOMOTOR Type USAMED-	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface LA	LB	LC	LE	LG	LH	LZ	Shaft Extension S	Q	Approx Mass kg (lb)	Brake Braking Torque N·m(kg·m)	Brake Inertia (GD²/4) kg·m²
03L21OF*	320 (12 60)	262 (10 31)	207 (8 15)	58 (2 28)	55 (2 16)	128 (5 04)	234 (9 21)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 (4 3307 $^{-0.035}_{-0.014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	–	–	11 5(25 4)	5 88 (0 6)	0 85X10⁻⁴
06L21OF*	366 (14 41)	308 (12 13)	253 (9 97)	58 (2 28)	55 (2 16)	118 (4 65)	280 (11 02)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 (4 3307 $^{-0.035}_{-0.014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	–	–	15(33 1)		
09L22OF*	436 (17 17)	378 (14 89)	323 (12 73)	58 (2 28)	55 (2 16)	118 (4 65)	350 (13 78)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 (4 3307 $^{-0.035}_{-0.014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	22 (0 8661 $^{-0.013}_{-0.033}$)	40 (1575)	23(50 7)	8 83 (0 9)	0 9X10⁻⁴
12L22OF	422 (16 61)	343 (13 50)	289 (11 38)	79 (3 11)	54 (2 13)	164 (6 46)	315 (12 4)	–	143 (5 63)	92 (3 62)	200 (7 87)	114 3 (4 5 $^{-0.025}_{-0.001}$)	180 (7 08)	3 2 (0 13)	18 (0 71)	230 (9 1)	13 5 (0 53)	35 (1 3779 $^{+0.01}_{0}$)	76 (2 992)	30(66 2)	35 3 (3 6)	6 25X10⁻⁴
20L22OF	486 (19 13)	407 (16 02)	353 (13 90)	79 (3 11)	54 (2 13)	164 (6 46)	379 (14 92)	123 (4 84)	143 (5 63)	92 (3 62)	200 (7 87)	114 3 (4 5 $^{-0.025}_{-0.001}$)	180 (7 08)	3 2 (0 13)	18 (0 71)	230 (9 1)	13 5 (0 53)	35 (1 3779 $^{+0.01}_{0}$)	76 (2 992)	37(81 6)		
30L22OF	567 (22 32)	488 (19 21)	434 (17 09)	79 (3 11)	54 (2 13)	164 (6 46)	460 (18 11)	123 (4 84)	143 (5 63)	92 (3 62)	200 (7 87)	114 3 (4 5 $^{-0.025}_{-0.001}$)	180 (7 08)	3 2 (0 13)	18 (0 71)	230 (9 1)	13 5 (0 53)	35 (1 3779 $^{+0.01}_{0}$)	76 (2 992)	49(108)		

* *Not provided with an eyebolt*

† *TIR Total Indicator Reading*

Notes 1 Optical encoder 8192 pulses/rev is used as a detector

2 Vibration 15 μm or below

3 Plug and clamp are not attached for receptacle connection

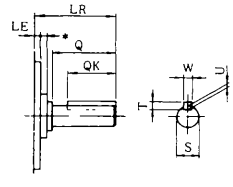
4 Connector specifications Refer to Par 3 3

5 It is recommended that the motor be mounted with its connector placed down

6 Power supply for brake is 24VDC

• Shaft Extension of Straight Shaft with Keyway

Both Servomotors with brake and without brake have the same dimensions except for shaft extension Shaft extensions are shown below



Motor type		LR	LE	Dimensions of Shaft Extension					
Without Brake	With Brake			S	Q	QK	T	U	W
*USAMED-03L22K	*USAMED-03L22KF	58 (2 28)	6 (0 24)	19 (0 7480 $^{0}_{-0.0005}$)	40 (1 57)	25 (0 98)	5 (0 1968)	3 (0 1181)	5 (0 1968)
*USAMED-06L22K	*USAMED-06L22KF	58 (2 28)	6 (0 24)	19 (0 7480 $^{0}_{-0.0005}$)	40 (1 57)	25 (0 98)	5 (0 1968)	3 (0 1181)	5 (0 1968)
*USAMED-09L22K	*USAMED-09L22KF	58 (2 28)	6 (0 24)	22 (0 8661 $^{0}_{-0.0005}$)	40 (1 57)	25 (0 98)	6 (0 2362)	3 5 (0 1378)	6 (0 2362)
USAMED-12L22K	USAMED-12L22KF	79 (3 11)	3 2 (0 13)	35 (1 3379 $^{0}_{-0.0004}$)	76 (2 99)	60 (2 36)	8 (0 3149)	5 (0 1968)	10 (0 3937)
USAMED-20L22K	USAMED-20L22KF	79 (3 11)	3 2 (0 13)	35 (1 3379 $^{0}_{-0.0004}$)	76 (2 99)	60 (2 36)	8 (0 3149)	5 (0 1968)	10 (0 3937)
USAMED-30L22K	USAMED-30L22KF	79 (3 11)	3 2 (0 13)	35 (1 3379 $^{0}_{-0.0004}$)	76 (2 99)	60 (2 36)	8 (0 3149)	5 (0 1968)	10 (0 3937)
USAMED-44L22K	–	110 (4 33)	3 2 (0 13)	42 (1 6535 $^{0}_{-0.0006}$)	110 (4 33)	90 (3 54)	8 (0 3149)	5 (0 1968)	12 (0 4724)

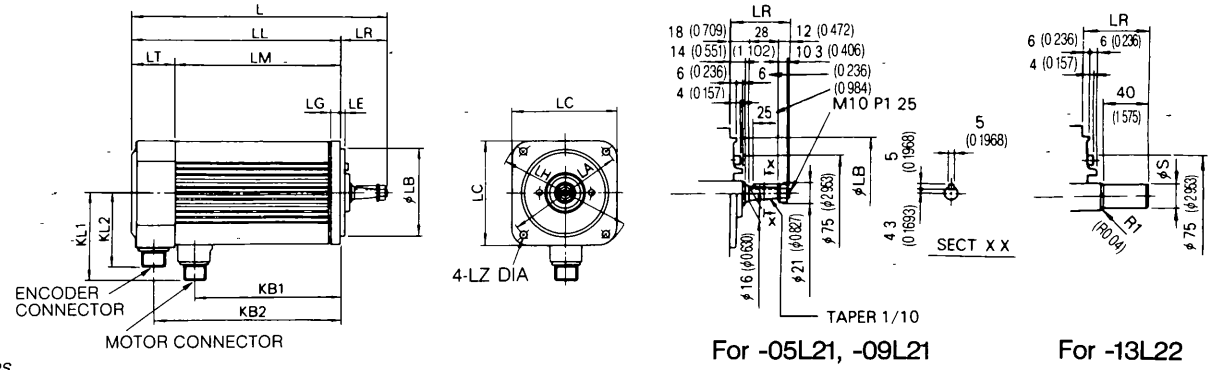
**6mm (0 236in) for USAMED-03L22 to 09L22*

(2) F Series

Dimensions in mm (inches)

· Standard Type

Drawing 1 USAFED-05L21, -09L21 (Taper Shaft), -13L22 (Straight Shaft)



For -05L21, -09L21 For -13L22

Detail of Shaft Extension

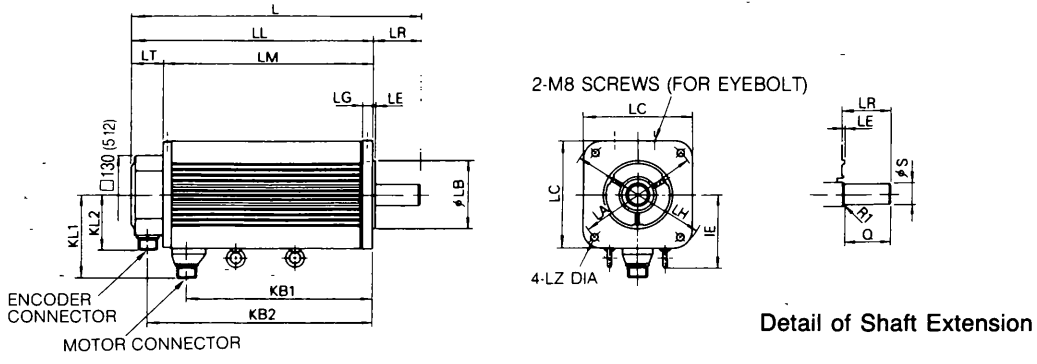
Notes

1 Plug and clamp are not attached for receptacle connection

2 Key and keyway comply with JIS B 1301-1976 (Parallel key, keyway common class)

3 Motor should be mounted with connectors down

Drawing 2 USAFED-20L22 to -44L22 (Straight Shaft)



Detail of Shaft Extension

Notes :

1 Plug and clamp are not attached for receptacle connection

2 Motor should be mounted with connectors down

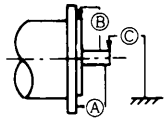
AC SERVOMOTOR Type USAFED-	Dwg No	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface							Shaft Extension		Approx Mass kg (lb)
												LA	LB	LC	LE	LG	LH	LZ	S	Q	
05L21*	1	263 (10 35)	205 (8 07)	150 (5 91)	58 (2 28)	55 (2 16)	127 (5 0)	177 (6 97)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0.0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	—	—	8 5 (18 7)
09L21*		320 (12 6)	262 (10 32)	207 (8 16)	58 (2 28)	55 (2 16)	184 (7 24)	234 (9 21)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0.0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	—	—	13 (28 7)
13L22*		389 (15 31)	331 (13 03)	276 (10 87)	58 (2 28)	55 (2 16)	253 (9 96)	303 (11 93)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0.0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	22 0 8661 $^{0}_{-0.0005}$	40 (1 57)	20 (44 1)
20L22*	2	344 (13 54)	265 (10 43)	211 (8 3)	79 (3 11)	54 (2 13)	172 (6 77)	237 (9 33)	—	139 (5 47)	92 (3 62)	200 (7 87)	114 3 (4 5 $^{0}_{-0.001}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 (1 3779 $^{+0.001}_{0}$ $^{0}_{-0.0004}$)	76 (2 99)	22 (48 5)
30L22		401 (15 79)	322 (12 68)	268 (10 55)	79 (3 11)	54 (2 13)	229 (9 02)	294 (11 57)	123 (4 85)	139 (5 47)	92 (3 62)	200 (7 87)	114 3 (4 5 $^{0}_{-0.001}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 (1 3779 $^{+0.001}_{0}$ $^{0}_{-0.0004}$)	76 (2 99)	29 (63 9)
44L22		486 (19 14)	407 (16 02)	353 (13 90)	79 (3 11)	54 (2 13)	314 (12 36)	379 (14 92)	123 (4 85)	139 (5 47)	92 (3 62)	200 (7 87)	114 3 (4 5 $^{0}_{-0.001}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 (1 3779 $^{+0.001}_{0}$ $^{0}_{-0.0004}$)	76 (2 99)	41 (90 4)

** Not provided with an eyebolt*

CONNECTOR TYPES

AC SERVOMOTOR Type USAFED-	Motor Connector Types				Incremental Encoder Connector Types			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
05L21 09L21 13L22	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A	97F3102E 20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
20L22 30L22 44L22	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057 -12A				

MECHANICAL SPECIFICATIONS

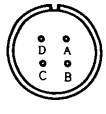
Accuracy (T. I. R)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0 04 (0 0016)	
Flange diameter concentric to shaft Ⓑ	0 04 (0 0016)	
Shaft run out Ⓒ	0 02 (0 0008)	

** T I R (Total Indicator Reading)*

Servomotors with a brake or a modified shaft extension are also available For detailed information, refer to related Bulletins (TSE-S800-11 1)

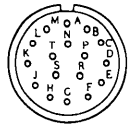
CONNECTOR SPECIFICATIONS

Motor Receptacle



A	Phase U
B	Phase V
C	Phase W
D	Frame ground

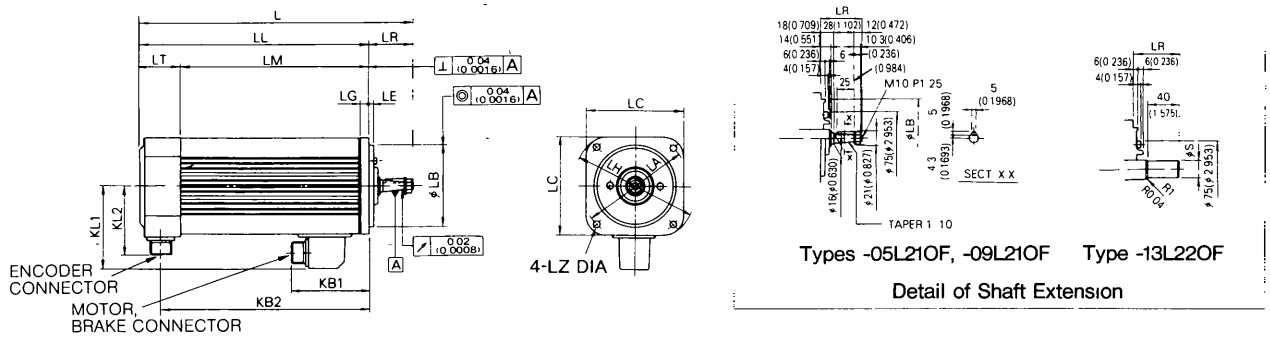
Incremental Encoder Receptacle



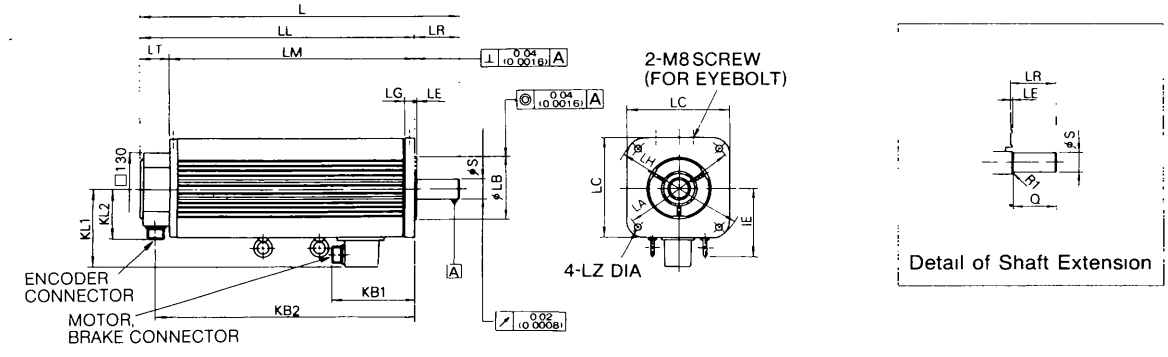
A	Channel A output	K	—
B	Channel $\overline{A}$ output	L	—
C	Channel B output	M	—
D	Channel $\overline{B}$ output	N	—
E	Channel C output	P	—
F	Channel $\overline{C}$ output	R	—
G	0V	S	—
H	+5VDC	T	—
J	Frame ground	—	—

• With Brake

(a) Types USAFED-05L21OF, -09L21OF (Taper Shaft), -13L22OF (Straight Shaft)



(b) Types USAFED-20L22OF, -30L22OF, -44L22OF (Straight Shaft)



AC SERVOMOTOR Type USAFED-	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface LA	LB	LC	LE	LG	LH	LZ	Shaft Extension S	Q	Approx Mass kg (lb)	Brake Braking Torque N·m(kg·m)	Brake Inertia (GD²/4) kg·m²
05L21OF*	320 (12 60)	262 (10 31)	207 (8 15)	58 (2 28)	55 (2 16)	128 (5 04)	234 (9 21)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0.014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	–	–	11 5(25 4)	5 88 (0 6)	0 85×10⁻⁴
09L21OF*	366 (14 41)	308 (12 13)	253 (9 97)	58 (2 28)	55 (2 16)	118 (4 65)	280 (11 02)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0.014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	–	–	15(33 1)		
13L22OF*	436 (17 17)	378 (14 89)	323 (12 73)	58 (2 28)	55 (2 16)	118 (4 65)	350 (13 78)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0.014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	22 (0 8661 $^{+0.013}_{-0.005}$)	40 (1 57)	23(50 7)	8 83 (0 9)	0 9×10⁻⁴
20L22OF	422 (16 61)	343 (13 50)	289 (11 38)	79 (3 11)	54 (2 13)	164 (6 46)	315 (12 4)	123 (4 85)	143 (5 63)	92 (3 62)	200 (7 88)	114 3 (4 5 $^{0}_{-0.011}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 (1 3379 $^{+0.018}_{+0.005}$)	76 (2 99)	30(66 2)	35 3 (3 6)	6 25×10⁻⁴
30L22OF	486 (19 13)	407 (16 02)	353 (13 90)	79 (3 11)	54 (2 13)	164 (6 46)	379 (14 92)	123 (4 85)	143 (5 63)	92 (3 62)	200 (7 88)	114 3 (4 5 $^{0}_{-0.011}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 (1 3379 $^{+0.018}_{+0.005}$)	76 (2 99)	37(81 6)		
44L22OF	567 (22 32)	488 (19 21)	434 (17 09)	79 (3 11)	54 (2 13)	164 (6 46)	460 (18 11)	123 (4 85)	143 (5 63)	92 (3 62)	200 (7 88)	114 3 (4 5 $^{0}_{-0.011}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 (1 3379 $^{+0.018}_{+0.005}$)	76 (2 99)	49(108 1)		

** Not provided with an eyebolt*

† TIR Total Indicator Reading

Notes 1 Optical encoder 8192 pulses/rev is used as a detector

2 Vibration 15μm or below

3 Plug and clamp are not attached for receptacle connection

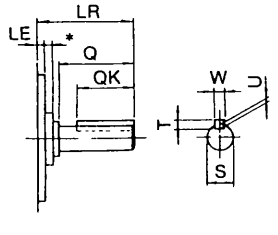
4 Connector specifications Refer to Par 3 3

5 It is recommended that the motor be mounted with its connector placed down

6 Power supply for brake is 24VDC

• Shaft Extension of Straight Shaft with Keyway

Both Servomors with brake and without brake have the same dimensions except for shaft extension Shaft extensions are shown below



Motor Type		LR	LE	Dimensions of Shaft Extension					
Without Brake	With Brake			S	Q	QK	T	U	W
*USAFED-05L22K	*USAFED-05L22KF	58 (2 28)	6 (0 24)	19 (0 7480 $^{0}_{-0.005}$)	40 (1 57)	25 (0 98)	5 (0 1968)	3 (0 1181)	5 (0 1968)
*USAFED-09L22K	*USAFED-09L22KF	58 (2 28)	6 (0 24)	19 (0 7480 $^{0}_{-0.005}$)	40 (1 57)	25 (0 98)	5 (0 1968)	3 (0 1181)	5 (0 1968)
*USAFED-13L22K	*USAFED-13L22KF	58 (2 28)	6 (0 24)	22 (0 8661 $^{0}_{-0.005}$)	40 (1 57)	25 (0 98)	6 (0 2362)	3 5 (0 1378)	6 (0 2362)
USAFED-20L22K	USAFED-20L22KF	79 (3 11)	3 2 (0 13)	35 (1 3379 $^{+0.018}_{+0.005}$)	76 (2 99)	60 (2 36)	8 (2 2835)	5 (0 1968)	10 (0 3937)
USAFED-30L22K	USAFED-30L22KF	79 (3 11)	3 2 (0 13)	35 (1 3379 $^{+0.018}_{+0.005}$)	76 (2 99)	60 (2 36)	8 (2 2835)	5 (0 1968)	10 (0 3937)
USAFED-44L22K	USAFED-44L22KF	79 (3 11)	3 2 (0 13)	35 (1 3379 $^{+0.018}_{+0.005}$)	76 (2 99)	60 (2 36)	8 (2 2835)	5 (0 1968)	10 (0 3937)

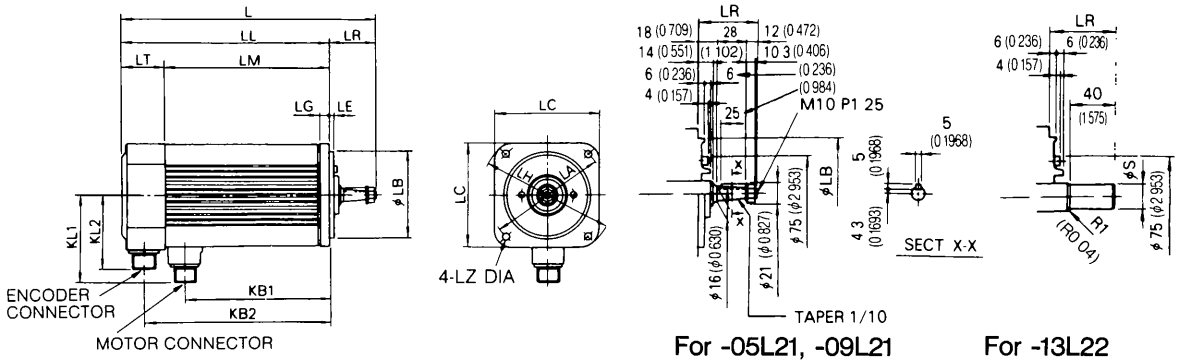
** 6mm (in) for USAFED-05L22 to 13L22*

(3) G Series

Dimensions in mm (inches)

- Standard Type

Drawing 1 USAGED-05L21, -09L21 (Taper Shaft), -13L22 (Straight Shaft)



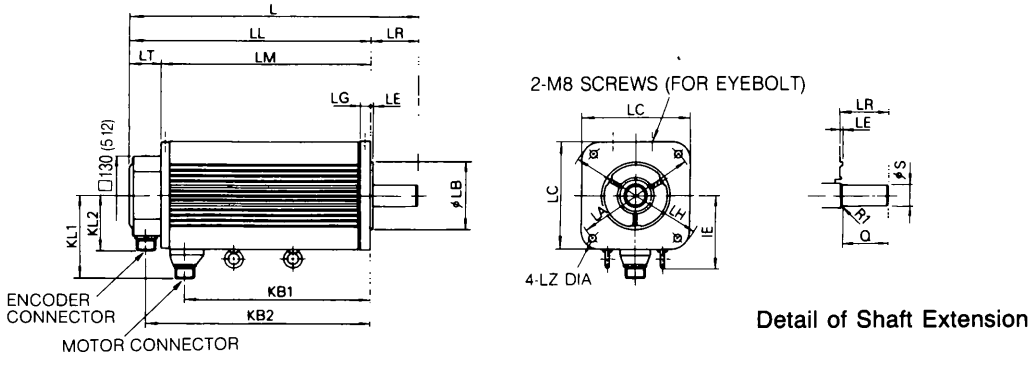
For -05L21, -09L21 For -13L22

Detail of Shaft Extension

Notes

1 *Plug and clamp are not attached for receptacle connection*
2 *Key and keyway comply with JIS B 1301-1976 (Parallel key, keyway common class)*
3 *Motor should be mounted with connectors down*

Drawing 2 USAGED-20L22 to -44L22 (Straight Shaft)



Detail of Shaft Extension

Notes

1 *Plug and clamp are not attached for receptacle connection*
2 *Motor should be mounted with connectors down*

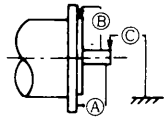
AC SERVOMOTOR Type USAGED-	Dwg No	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface							Shaft Extension		Approx Mass kg (lb)
												LA	LB	LC	LE	LG	LH	LZ	S	Q	
05L21*	1	263 (10 35)	205 (8 07)	150 (5 91)	58 (2 28)	55 (2 16)	127 (5 0)	177 (6 97)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0\,0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	—	—	8 5 (18 7)
09L21*		320 (12 6)	262 (10 32)	207 (8 16)	58 (2 28)	55 (2 16)	184 (7 24)	234 (9 21)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0\,0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	—	—	13 (28 7)
13L22*		389 (15 31)	331 (13 03)	276 (10 87)	58 (2 28)	55 (2 16)	253 (9 96)	303 (11 93)	—	109 (4 29)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0\,0014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	22 ($^{0}_{-0\,0005}$)	40 (1 57)	20 (44 1)
20L22*	2	344 (13 54)	265 (10 43)	211 (8 3)	79 (3 11)	54 (2 13)	172 (6 77)	237 (9 33)	—	139 (5 47)	92 (3 62)	200 (7 87)	114 3 ($^{0}_{-0\,001}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 ($^{0}_{-0\,0004}$)	76 (2 99)	22 (48 5)
30L22		401 (15 79)	322 (12 68)	268 (10 55)	79 (3 11)	54 (2 13)	229 (9 02)	294 (11 57)	123 (4 85)	139 (5 47)	92 (3 62)	200 (7 87)	114 3 ($^{0}_{-0\,001}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 ($^{0}_{-0\,0004}$)	76 (2 99)	29 (63 9)
44L22		486 (19 14)	407 (16 02)	353 (13 90)	79 (3 11)	54 (2 13)	314 (12 36)	379 (14 92)	123 (4 85)	139 (5 47)	92 (3 62)	200 (7 87)	114 3 ($^{0}_{-0\,001}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 06)	13 5 (0 53)	35 ($^{0}_{-0\,0004}$)	76 (2 99)	41 (90 4)

** Not provided with an eyebolt*

CONNECTOR TYPES

AC SERVOMOTOR Type USAGED-	Motor Connector Types				Incremental Encoder Connector Types			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
05L21 09L21 13L22	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A	97F3102E 20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
20L22 30L22 44L22	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057 -12A				

MECHANICAL SPECIFICATIONS

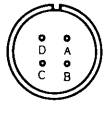
Accuracy (T. I. R)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0 04 (0 0016)	
Flange diameter concentric to shaft Ⓑ	0 04 (0 0016)	
Shaft run out Ⓒ	0 02 (0 0008)	

** T I R (Total Indicator Reading)*

Servomotors with a brake or a modified shaft extension are also available For detailed information, refer to related Bulletins (TSE-S800-11 1)

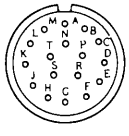
CONNECTOR SPECIFICATIONS

Motor Receptacle



A	Phase U
B	Phase V
C	Phase W
D	Frame ground

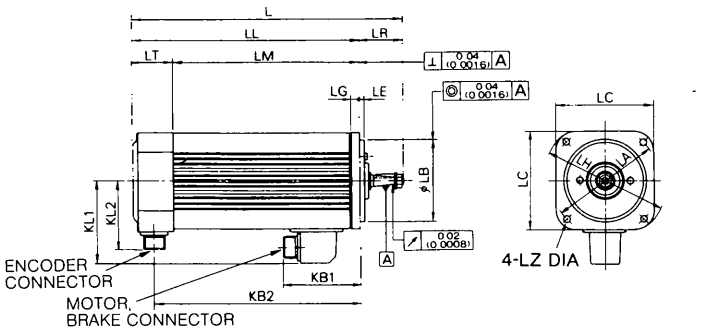
Incremental Encoder Receptacle

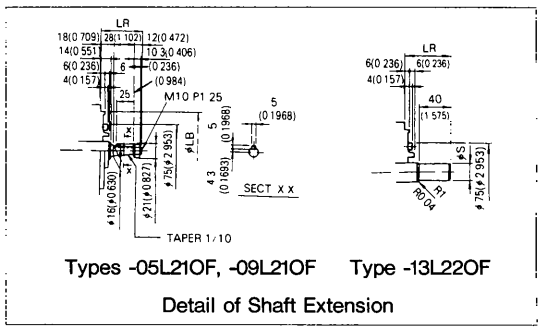


A	Channel A output	K	—
B	Channel $\overline{A}$ output	L	—
C	Channel B output	M	—
D	Channel $\overline{B}$ output	N	—
E	Channel C output	P	—
F	Channel $\overline{C}$ output	R	—
G	0V	S	—
H	+5VDC	T	—
J	Frame ground	—	—

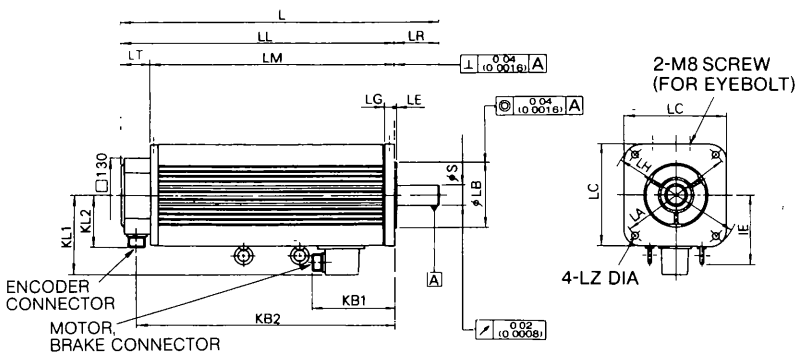
• With Brake

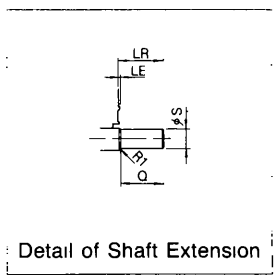
(a) Types USAGED-05L21OF, -09L21OF (Taper Shaft), -13L22OF (Straight Shaft)





(b) Types USAGED-20L22OF, -30L22OF, -44L22OF (Straight Shaft)





AC SERVOMOTOR Type USAGED-	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface							Shaft Extension		Approx Mass kg (lb)	Brake	
											LA	LB	LC	LE	LG	LH	LZ	S	Q		Braking Torque N·m(kg·m)	Inertia (GD²/4) kg·m²
05L21OF*	320 (12 60)	262 (10 31)	207 (8 15)	58 (2 28)	55 (2 16)	128 (5 04)	234 (9 21)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0.014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	–	–	11 5(25 4)	5 88 (0 6)	0 85X10⁻⁴
09L21OF*	366 (14 41)	308 (12 13)	253 (9 97)	58 (2 28)	55 (2 16)	118 (4 65)	280 (11 02)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0.014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	–	–	15(33 1)		
13L22OF*	436 (17 17)	378 (14 89)	323 (12 73)	58 (2 28)	55 (2 16)	118 (4 65)	350 (13 78)	–	113 (4 45)	92 (3 62)	145 (5 71)	110 (4 3307 $^{0}_{-0.014}$)	130 (5 12)	6 (0 24)	12 (0 47)	165 (6 5)	9 (0 35)	22 ($^{0}_{-0.013}$ $^{0}_{-0.028}$)	40 (1 57)	23(50 7)	8 83 (0 9)	0 9X10⁻⁴
20L22OF	422 (16 61)	343 (13 50)	289 (11 38)	79 (3 11)	54 (2 13)	164 (6 46)	315 (12 4)	123 (4 85)	143 (5 63)	92 (3 62)	200 (7 88)	114 3 ($^{0}_{-0.025}$ $^{0}_{-0.061}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 6)	13 5 (0 53)	35 ($^{+0.01}_{0}$ $^{+0.025}_{+0.009}$)	76 (2 99)	30(66 2)	35 3 (3 6)	6 25X10⁻⁴
30L22OF	486 (19 13)	407 (16 02)	353 (13 90)	79 (3 11)	54 (2 13)	164 (6 46)	379 (14 92)	123 (4 85)	143 (5 63)	92 (3 62)	200 (7 88)	114 3 ($^{0}_{-0.025}$ $^{0}_{-0.061}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 6)	13 5 (0 53)	35 ($^{+0.01}_{0}$ $^{+0.025}_{+0.009}$)	76 (2 99)	37(81 6)		
44L22OF	567 (22 32)	488 (19 21)	434 (17 09)	79 (3 11)	54 (2 13)	164 (6 46)	460 (18 11)	123 (4 85)	143 (5 63)	92 (3 62)	200 (7 88)	114 3 ($^{0}_{-0.025}$ $^{0}_{-0.061}$)	180 (7 09)	3 2 (0 13)	18 (0 71)	230 (9 6)	13 5 (0 53)	35 ($^{+0.01}_{0}$ $^{+0.025}_{+0.009}$)	76 (2 99)	49(108 1)		

**Not provided with an eyebolt*

† TIR Total Indicator Reading

Notes 1 Optical encoder 8192 pulses/rev is used as a detector

2 Vibration 15μm or below

3 Plug and clamp are not attached for receptacle connection

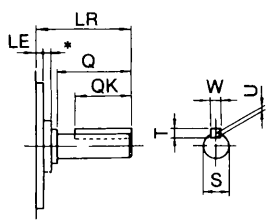
4 Connector specifications Refer to Par 3 3

5 It is recommended that the motor be mounted with its connector placed down

6 Power supply for brake is 24VDC

• Shaft Extension of Straight Shaft with Keyway

Both Servomotors with brake and without brake have the same dimensions except for shaft extension Shaft extensions are shown below



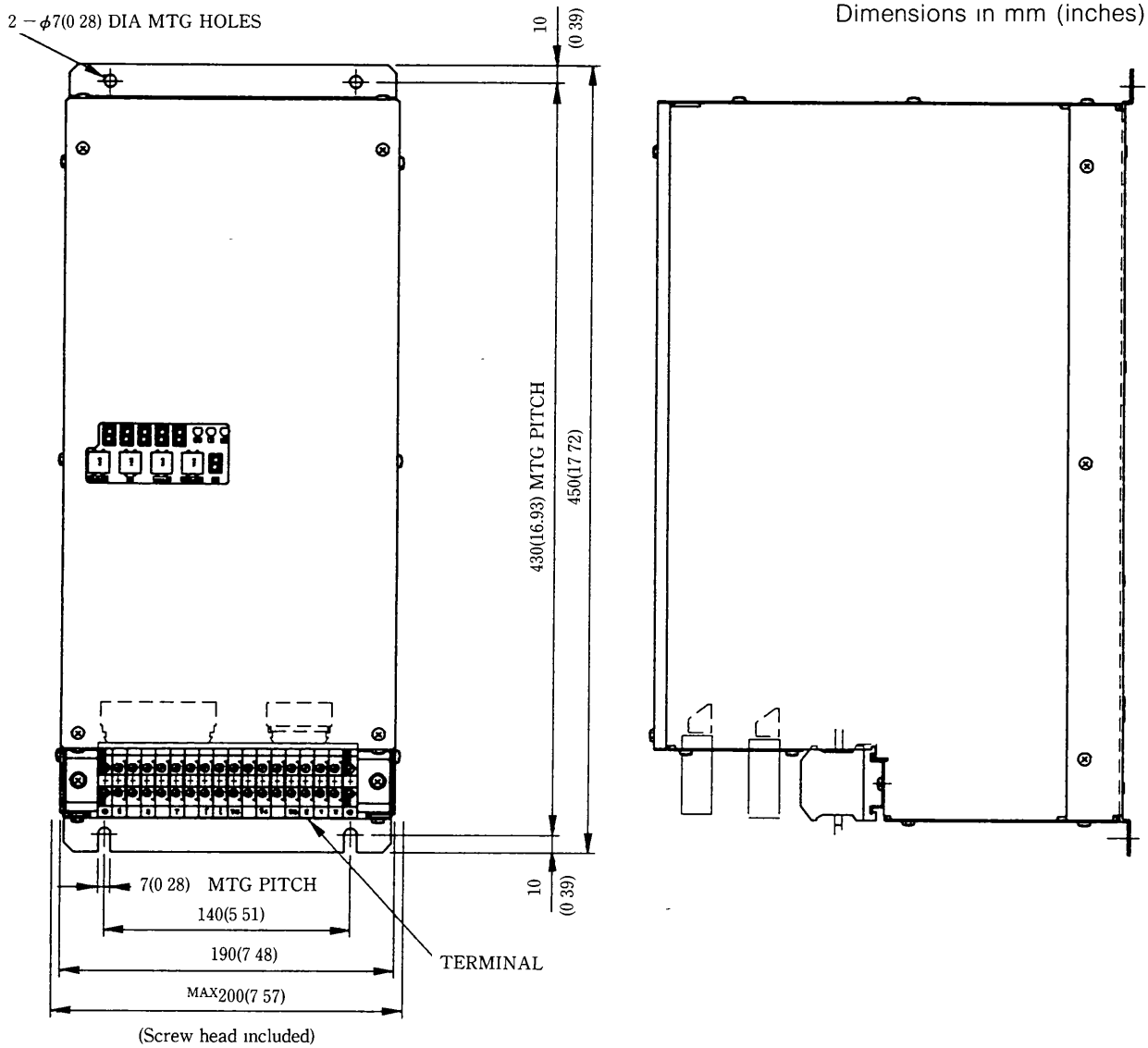
Motor Type		LR	LE	Dimensions of Shaft Extension					
Without Brake	With Brake			S	Q	QK	T	U	W
*USAGED-05L22K	*USAGED-05L22KF	58 (2 28)	6 (0 24)	19 (0 7480 $^{0}_{-0.013}$ $^{0}_{-0.028}$)	40 (1 57)	25 (0 98)	5 (0 1968)	3 (0 1181)	5 (0 1968)
*USAGED-09L22K	*USAGED-09L22KF	58 (2 28)	6 (0 24)	19 (0 7480 $^{0}_{-0.013}$ $^{0}_{-0.028}$)	40 (1 57)	25 (0 98)	5 (0 1968)	3 (0 1181)	5 (0 1968)
*USAGED-13L22K	*USAGED-13L22KF	58 (2 28)	6 (0 24)	22 (0 8661 $^{0}_{-0.013}$ $^{0}_{-0.028}$)	40 (1 57)	25 (0 98)	6 (0 2362)	3 5 (0 1378)	6 (0 2362)
USAGED-20L22K	USAGED-20L22KF	79 (3 11)	3 2 (0 13)	35 (1 3379 $^{+0.01}_{0}$ $^{+0.025}_{+0.009}$)	76 (2 99)	60 (2 36)	8 (2 2835)	5 (0 1968)	10 (0 3937)
USAGED-30L22K	USAGED-30L22KF	79 (3 11)	3 2 (0 13)	35 (1 3379 $^{+0.01}_{0}$ $^{+0.025}_{+0.009}$)	76 (2 99)	60 (2 36)	8 (2 2835)	5 (0 1968)	10 (0 3937)
USAGED-44L22K	USAGED-44L22KF	79 (3 11)	3 2 (0 13)	35 (1 3379 $^{+0.01}_{0}$ $^{+0.025}_{+0.009}$)	76 (2 99)	60 (2 36)	8 (2 2835)	5 (0 1968)	10 (0 3937)

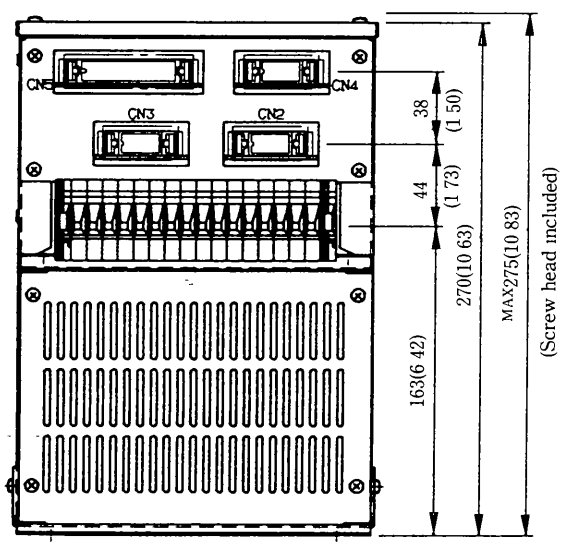
** 6mm (in) for USAGED-05L22 to 13L22*

11.3 SERVOPACK

CACR-HR03UB to - HR10UB

Dimensions in mm (inches)



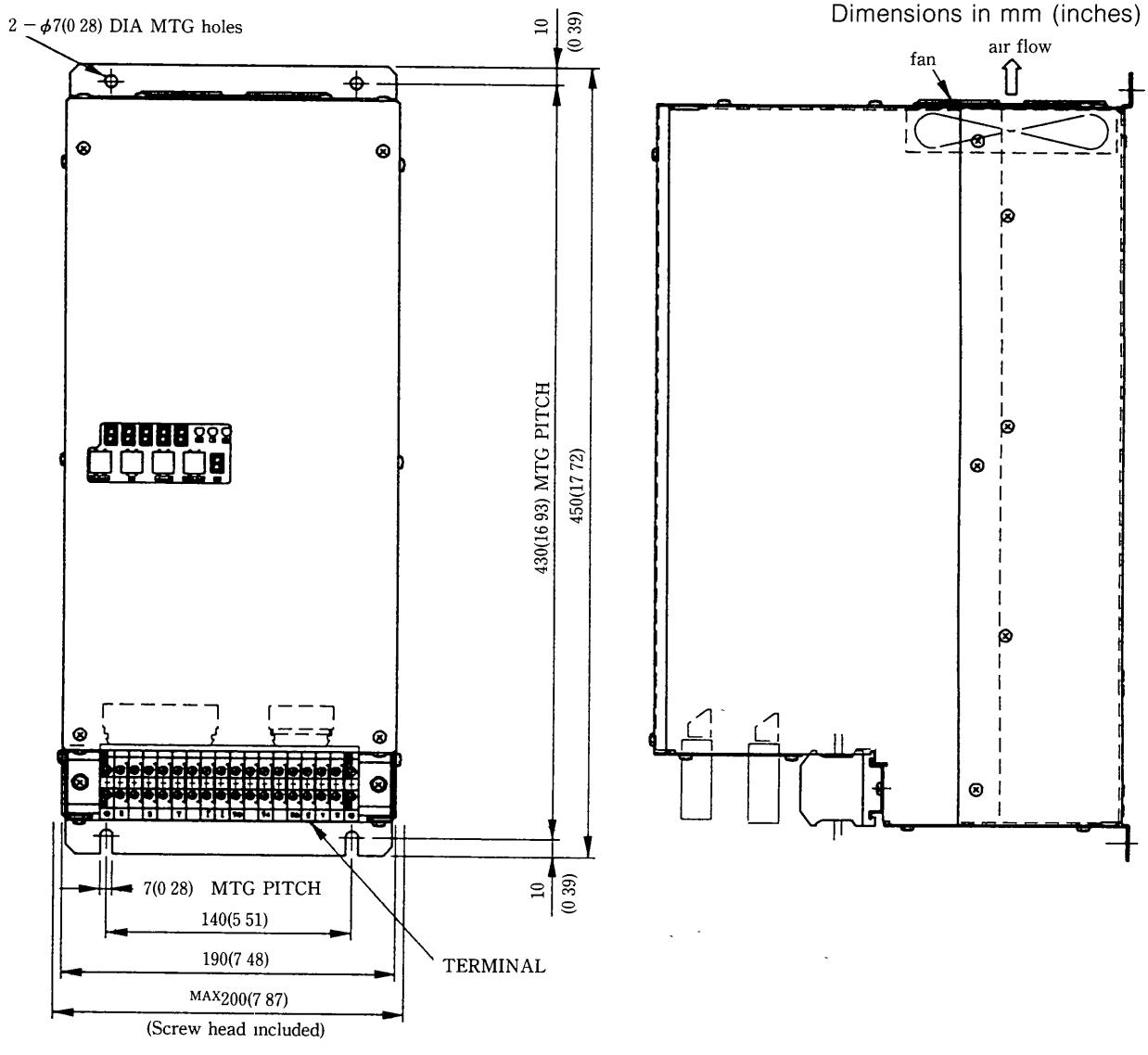


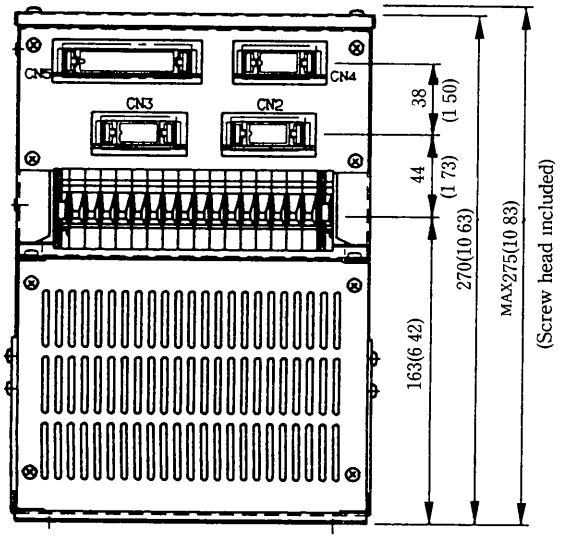
Item	Connector Type	Accessory	
CN2	MR-20RFA	case housing	MR-20L MR-20M
CN3	MR-20RMA	case housing	MR-20L MR-20F
CN4	MR-20RMA	case housing	MR-20L MR-20F
CN5	MR-50RMA	case housing	MR-50L MR-50F

Made by HONDA TSUSHIN Co

CACR-HR15UB to - HR44UB

Dimensions in mm (inches)





Item	Connector Type	Accessory	
CN2	MR-20RFA	case housing	MR-20L MR-20M
CN3	MR-20RMA	case housing	MR-20L MR-20F
CN4	MR-20RMA	case housing	MR-20L MR-20F
CN5	MR-50RMA	case housing	MR-50L MR-50F

Made by HONDA TSUSHIN Co.

12 APPENDIX PARAMETER SETTING

AC Servopack type CACR-HR is a position control provided with all constant setting and function selections using parameters. It is necessary to set the parameters before use.

For details of each parameter content, refer to the Section 8 in this manual. This section briefly describes parameter settings in checking method.

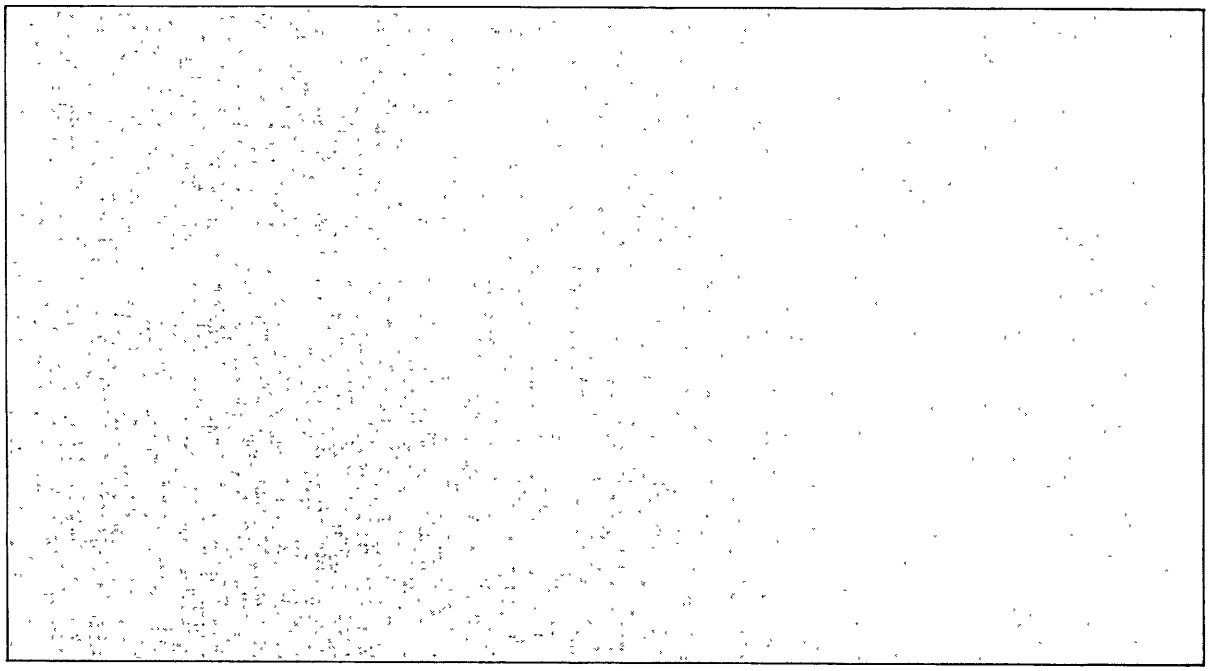
When it is required for YASKAWA to set parameters before delivery, fill out your machine configuration and specifications (sections ☐) and the required items in Par. 12.7 and contact your YASKAWA representative.

12.1 APPLICATIONS

12.2 ORDER ELECTRICAL DEVICES

Name	Type/Specifications	Q'ty
AC Servomotor	with encoder pulses/rev	
AC Servopack		
External Position Indicator	MCIF-L8 (Sigh + 8-digit)	
DG-SW (1 Set)	MCIF-D80 (Only position reference data)	
DG-SW (2 Set)	MCIF-D86 (Position and speed reference)	
Parameter Setter	PF803-ASY	

12.3 MACHINE CONFIGURATION

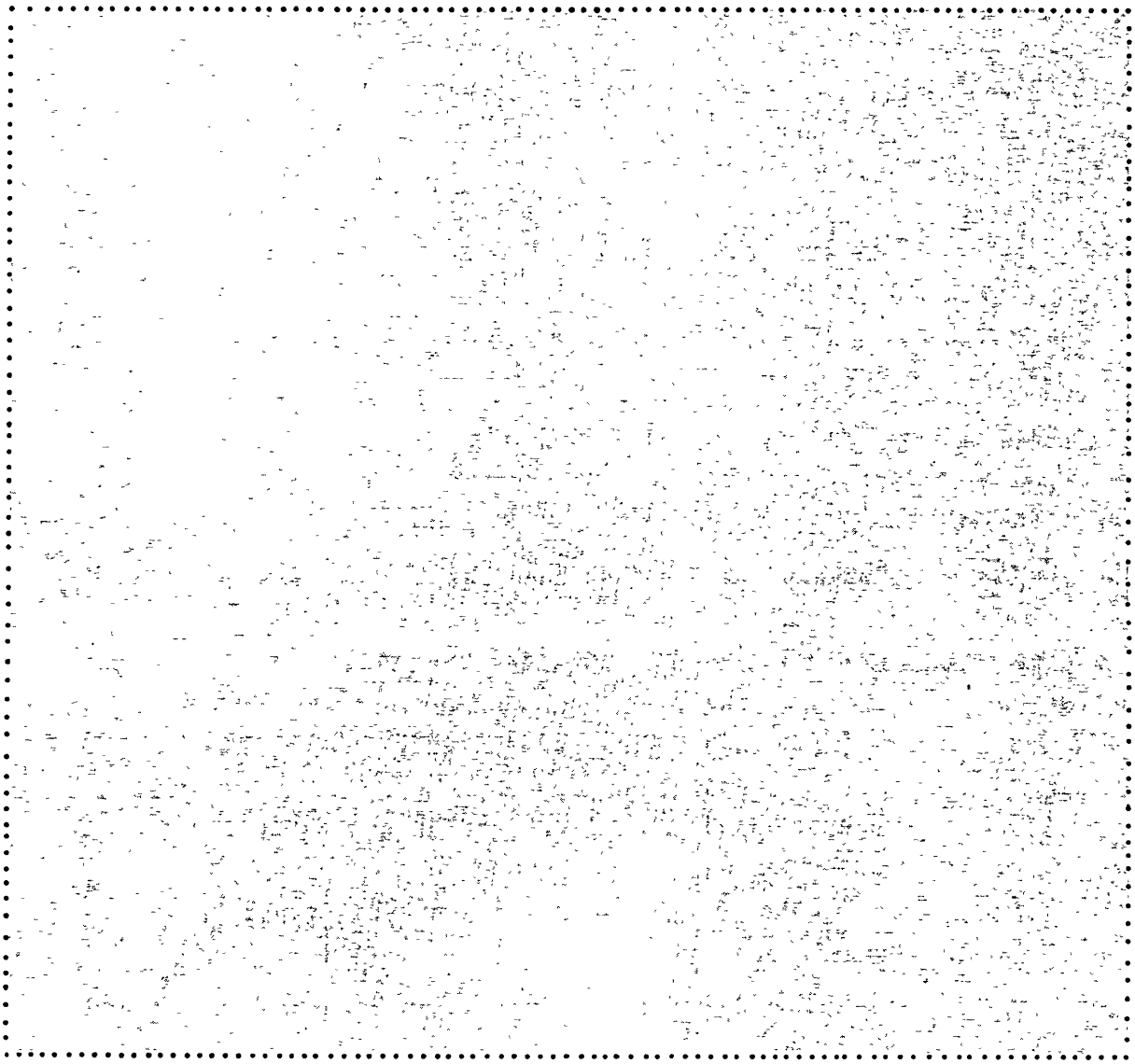


12.4 SPECIFICATIONS

Machine Specifications		SERVOMOTOR Specifications		SERVOPACK Specification
Using Axis	Horizontal Vertical	Rated Output	kW	Input Power Supply
Max. Speed of Movable Section		Rated Speed	r/min	Continuous Output Current
Total Deceleration Rate		Max. Speed	r/min	Max. Output Current
Load Moving Amount per Load Shaft Rotation		Used Speed	r/min	
Load Torque *	N • m	Rated Torque	N • m (ℓb • in)	
Load Inertia J_L*	kg • m² (ℓb • in • s²)	Rated Current	Arms	
Reference Unit(min.)		Rotor Inertia J_M	kg • m² (ℓb • in • s²)	

* Motor shaft conversion

12.5 SPEED DIAGRAM



12.6 PARAMETER SETTING TABLE

No	Name	Setting Range	Unit	Set Value
1	Position Loop Gain	0 to 200	S^{-1}	
2	Speed Loop Gain	1 to 200	$\times 5J_M/(J_M+J_L)$Hz	
3	Integral Time Constant	1 to 255	×2ms	10
4	1st Feeding Speed (V_1)	1 to 240000	(×1000) reference unit	
5	Linear Accel/Decel Time(t_1)	8 to 60000	ms	
6	Positioning Complete Range	1 to 250	Reference unit/min	
7	Motor Selection Code	0 to 79		
8	Number of Encoder Pulses	4096 to 32768	Pulses/rev (at×4)	
9	Encoder Selection Code	0: absolute, 1: incremental		
10	ABSO Error Detection Range	0 to 99999999	Pulse (at×4)	
11	Load Moving Amount per Load Shaft Rotation	1 to 15000000	Reference unit	
12	Gear Ratio Setting — Motor Shaft Speed	1 to 10000000	Rotation	
13	Gear Ratio Setting — Load Shaft Speed			
14	Mode Setting	0 to 11111		
	b0: Motor rotating direction (+at reference)	0: FWD run, 1: REV run (CCW) (CW)		
	b1: Finite/infinite positioning mode	0: finite, 1: infinite		
	b2: Linear/rotating motion	0: linear , 1: rotation		
	b3: Position reference mode	0: absolute , 1: incremental		
	b4: Position data code	0: binary , 1: BCD		
15	Position Reference Input Method	0: station No., 1: DG-SW, 2: serial communication 4: command table		
16	Number of Stations	1 to 4096		
17	Function Selection 1	0 to 11111		0
	b0: Current limit	0: motor fixed value, 1: set		
	b1: Feed forward compensation	0: ineffective, 1: effective		0
	b2: Linear accel/decel 1-step/2-step	0: 1-step , 1: 2-step		
	b3: Speed limit	0: motor max. speed, 1: set		
	b4: Accel/decel type setting	0: linear (1-or 2-step), 1: selected in operation mode		
18	Function Selection 2	0 to 11111		
	b0: Software overtravel (position reference fault detection)	0: ±99999999, 1: set		
	b1: Backlash compensation	0: not provided, 1:set		
	b2 / b3: Speed reference input method — Automatic mode / Manual mode	0: fixed by position reference method, 1: set		
	b4: Zero-point return (homing) mode	0: not used, 1: used		

(Cont'd)

12.6 PARAMETER SETTING TABLE (Cont'd)

No	Name		Setting Range	Unit	Set Value
19	Function Selection 3		0 to 11111111		
	b0: OT signal		0: used, 1: not used		
	b1: STOP signal		0: used, 1: not used		
	b2: Holding brake release signal		0: not used, 1: used		
	b3: Pulse status in pulse mode		0: Aϕ+Bϕ×4(fixed), 1: select		
	b4: Pulse output division rate		0: fixed dividing ratio 1:1 1: set dividing ratio		
	b5: Positioning (station) near signal		0: not used, 1: used		
	b6: OT signal switching		0: P-OT, N-OT operation in plus/minus direction, 1: N-OT, P-OT operation in plus/minus direction		
	b7: Torque reference filter time constant change		0: no change, 1: change		
20	Function Selection 4		0 to 1111111		0
	b0:		0		0
	b1: External position indicator		0: not used, 1: used		
	b2: Station No. (0)		0: provided, 1: not provided		
	b3: Simplified S-curve Accel/Decel		0: not used, 1: used		
	b4: Pi72 function setting		0: not provided, 1: provided		
	b5: Pi65 function setting		0: not provided, 1: provided		
	b6: Pi66 function setting		0: not provided, 1: provided		
31	Feeding Speed	2nd speed	1 to 240000	(×1000) reference unit/min	
32		3rd speed			
33		4th speed			
34	Current Limit Value	Plus/minus side	0 to 400	%	
35		Plus side			
36		Minus side			
37	Forward Feed Compensation Value		0 to 200	%	0
38	Linear 2-step Accel/Decel	Time (t_5)	8 to 60000	ms	
39		Switching speed (V_5)	0 to 240000	(×1000)reference unit /min	
40	Software over-travel (position reference fault detection value)	Plus side	±99999999	Reference unit	
41		Minus side			
42	Backlash Compensation		0 to ±30000	Pulse	
43	Braking Time		8 to 1000	ms	
44	Brake ON Motor Speed		1 to 10000	r/min	
45	Positioning (station) Near Range		0 to 30000	Reference unit	
46	Speed Limit Value		1 to 240000	(×1000)reference unit/min	
47	Exponential Accel/Decel	Time constant (t_6)	8 to 1000	ms	
48		Bias speed (V_6)	0 to 240000	(×1000)reference unit/min	

(Cont'd)

(Cont'd)

No	Name		Setting Range	Unit	Set Value
49	Zero-point Return (Homing)	Method	0 mode Ⅰ, 1· mode Ⅱ		
50		Direction	0. plus direction. 1. minus direction		
51		Feeding speed	0 to 240000	(×1000) reference unit/min	
52		Approach speed			
53		Creep speed			
54		Final traveling distance	1 to ±99999999	Reference unit	
61	Speed Reference Input Method	Automatic mode	0: internal speed selection at contact. 1 DG-SW 2. serial command. 4 speed table		
62		Manual mode			
63	Pulse Signal Status (with Pulse Mode)		0· Aϕ + Bϕ×4. 1.Aϕ + Bϕ×2. 2 Aϕ + Bϕ×1. 3 sign + pulse train. 4: CCW pulse + CW pulse		
64	Output Pulse Dividing Ratio		2 to 60	2/N	
65	Function Selection 5		0 to 1111111		
	b0: Zone signal		0 not used. 1. used		
	b1: Station near signal		0. not used. 1· used		
	b2· DG-SW read-in time change		0· not change. 1 change		
	b3 DG-SW digit number shift		0 no shift. 1. shift		
	b4·		0		
	b5:		0		
	b6: Position completion signal change		0. not change 1 change		
66	Function Selection 6		0 to 11111111		
	b0		0		
	b1.		0		
	b2		0		
	b3:		0		
	b4· Station No. output extension		0· not extend 1 extend		
	b5		0		
	b6:		0		
	b7. Servopack axis address		0· not provided 1·provided		
67	External Position Indicator Decimal Point Position and Digit Number to Shift DG-SW Digit		0 to 7		
68	Accel/Decel Type Selection	Automatic mode	0: linear or simplified S-curve. 1: exponent		
69		Manual mode			
70		Pulse mode			
71		Zero-point return mode (Homing)			
72	Function Selection 7		0 to 11111		
	b0. Overrun detection alarm		0: detect. 1 not detect		
	b1. Remaining data after STOP signal		0: hold. 1: abandon		
	b2· PG selection when using line PG		0: by L-PG signal. 1· Forcing motor PG		
	b3· Echo-back at initialization		0: not echo back 1: echo back		
	b4· OK response for command		0. no response. 1: response		
	b5 Monitor data transmission spec change		0: sent repeatedly 1. sent only once		
76	Simplified S-curve Accel/Decel Time		0 to 124	(+2)ms	
77	DG-SW Read-in Scanning Time		24 to 2000	ms	
90	Torque Reference Filter Time Constant		0 to 100	(×32.5)μs	

Parameters 21 to 30, 55 to 60, 66, 73 to 75, 78 to 89, 91 to 99 are for future use and all are set to "0".

12.7 PARAMETER CHECK LIST

12.7.1 Parameters Related to Motor Used

Motor Type: _____ (Pr7 = Codes as shown in the following table)

M Series		F Series		G Series	
Motor Type USAMED-	Code	Motor Type USAFED-	Code	Motor Type USAGED-	Code
	0				
03L ⬚ 1	1				
06L ⬚ 1	2	05L ⬚ 1	12	05L ⬚ 1	52
09L ⬚ 2	3	09L ⬚ 1	13	09L ⬚ 1	53
12L ⬚ 2	4	13L ⬚ 2	14	13L ⬚ 2	54
20L ⬚ 2	5	20L ⬚ 2	15	20L ⬚ 2	55
30L ⬚ 2	6	30L ⬚ 2	16	30L ⬚ 2	56
44L ⬚ 2	7	44L ⬚ 2	17	44L ⬚ 2	57

Encoder type

- Method: ☐ Absolute encoder (Pr9 = 0)
  ☐ Incremental encoder (Pr9 = 1)
- Number of pulses: ☐ 1024 pulses/rev (Pr8 = 4096)
  ☐ 2048 pulses/rev (Pr8 = 8192)
  ☐ 8192 pulses/rev (Pr8 = 32768)

12.7.2 Parameters Related to Machine Specifications

① ☐ Linear motion (Pr14b2=0) ② ☐ Finite positioning (Pr14b1=0)
☐ Rotating motion (Pr14b2=1) ☐ Infinite positioning (Pr14b1=0)

③ Total reduction ratio _____ (=Pr13/Pr12)

④ Motor rotating direction when load moves in plus direction (viewed from load side)
☐ CCW (Pr14b0=0)
☐ CW (Pr14b0=1)

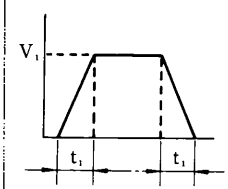
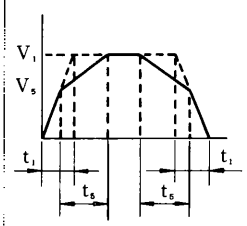
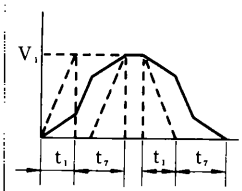
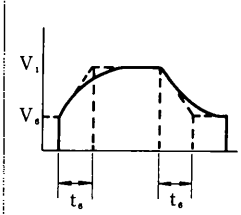
⑤ Reference unit(minimum) A = _____(mm): position resolution

⑥ Load moving amount-per load shaft rotation P= _____ (mm)(Pr11=P/A)
(Note) Limiting conditions: $0.01 \leqq (Pr8 \times Pr12)/(Pr11 \times Pr13) \leqq 100$

12.7.2 Parameters Related to Machine Specifications (Cont'd)

⑦ Accel/Decel type

	☐ All-mode Linear 1-step Accel/Decel Speed	☐ All-mode Linear 2-step Accel/Decel Speed	☐ All-mode Simplified S-curve Accel/Decel Speed	☐ Set in each Mode (Pr17b4=1)			
				Linear 1-step	Linear 2-step	Simplified S-curve	Exponential Accel/Decel Speed
☐ Automatic Mode				☐ Pr17b2=0 Pr68=0	☐ Pr17b2=1 Pr68=0	☐ Pr20b3=1 Pr68=0	☐ Pr68=1 (Pr17b2, Pr20b3 Setting are not required.)
☐ Manual Mode	Pr17b2=0 Pr17b4=0	Pr17b2=1 Pr17b4=0	Pr17b4=0 Pr20b3=1	☐ Pr17b2=0 Pr69=0	☐ Pr17b2=1 Pr69=0	☐ Pr20b3=1 Pr69=0	☐ Pr69=1 (Pr17b2, Pr20b3 Setting are not required.)
☐ Pulse Mode	(Pr68 to Pr71 Settings are not required.)	(Pr68 to Pr71 Settings are not required.)	(Pr68 to Pr71 Settings are not required.)	☐ Pr17b2=0 Pr70=0	☐ Pr17b2=1 Pr70=0	☐ Pr20b3=1 Pr70=0	☐ Pr70=1 (Pr17b2, Pr20b3 Setting are not required.)
☐ Zero-point Return Mode				☐ Pr17b2=0 Pr71=0	☐ Pr17b2=1 Pr71=0	☐ Pr20b3=1 Pr71=0	☐ Pr71=1 (Pr17b2, Pr20b3 Setting are not required.)

	Pr				
V1(mm/min)	4				
V5(mm/min)	39	——		——	——
V6(mm/min)	48	——	——	——	
t1(ms)	5				——
t5(ms)	38	——		——	——
t6(ms)	47	——	——	——	
t7(ms)	76	——	——		——

(Pr4, 39, 47) = (Speed)/(1000 • A)

12.7.3 Parameters Related to Position Reference Method

① Reference input method

[ ] = Setting not required

	☐ Station No. Input	☐ DG-SW Input	☐ Serial Communication Input	☐ Command Table No. Input
Pr15	0	1	2	4
Pr16	Number of Stations___			
Pr14b4	Position Data ☐ Binary(= 0) ☐ BCD (= 1)	1		0
Pr20 b1		Position Display ☐ Not used (= 0) ☐ Used (= 1)		
Pr20 b2	Station No. "0" ☐ Provided (= 0) ☐ Not provided(= 1)			
Pr65b0				Zone Signal ☐ Not used (= 0) ☐ Used (= 1)
Pr67		Position Display Decimal Point Position		

② Reference mode ☐ Absolute value (Pr14b3=0)
☐ Incremental value (Pr14b3=1)

12.7.4 Speed Reference Method

① Reference input method

[ ] = Setting not required

Speed Reference \ Position Reference		☐ Station No. Input			☐ DG-SW Input			☐ Serial Communication Input			☐ Command Table No. Input		
		Pr18	Pr61	Pr62	Pr18	Pr61	Pr62	Pr18	Pr61	Pr62	Pr18	Pr61	Pr62
Automatic Mode	☐ Contact*	b2=0			b2=1	0		b2=1	0		b2=1	0	
	☐ DG-SW	Cannot be used			b2=0			b2=1	1		Cannot be used		
	☐ Serial Command	b2=1	2		b2=1	2		b2=0			b2=1	2	
	☐ Command Table	Cannot be used			Cannot be used			b2=1	4		b2=0		
Manual Mode	☐ Contact*	b3=0			b3=1		0	b3=1		0	b3=1		0
	☐ DG-SW	Cannot be used			b3=0			b3=1		1	Cannot be used		
	☐ Serial Command	b3=1		2	b3=1		2	b3=0			b3=1		2
	☐ Command Table	Cannot be used			Cannot be used			b3=0		4	b3=0		

* Select from internal speed by contact (only speed to be used is set.)

1st speed: V1= _____ mm/min (in/min) (Pr4)
2nd speed: V2= _____ mm/min (in/min) (Pr31)
3rd speed: V3= _____ mm/min (in/min) (Pr32)
4th speed: V4= _____ mm/min (in/min) (Pr33)

Pr4, Pr31 to 33 = (Speed)/(1000 • A)
A: Reference unit

12.7.5 Parameters Related to Position Control

① Speed loop gain

Motor inertia J_M = _____

Load inertia J_L = _____ } (Motor shaft conversion value)

Pr2 = 20 × $(J_L + J_M)/J_M$

Note: When mechanical system regidity is low and oscillation occurs, lower the above value.

② Positioning complete range

C = _____ mm (inch) (Pr6 = C/A)

③ Positioning near range

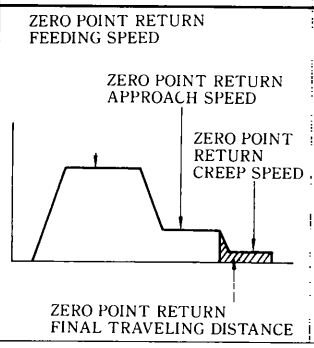
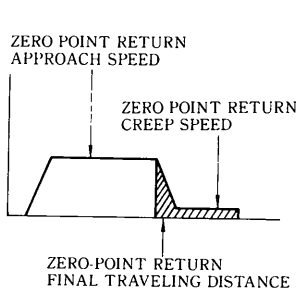
☐ Not used (Pr19b5=0, Pr45 setting not required)

☐ Used (Pr19b5=1)

└→ Positioning near range N = _____ mm (inch)
(Pr45 = N/A)

12.7.6 Selection Function

① Zero-point return (homing) mode: ☐ Not used
(Pr18b4=0, Pr49 to 54 setting not required)
☐ Used (Pr18b4=1)

	Pr	☐ Mode I (Decel LS + Cϕ pulse) Pr49 = 0	☐ Mode II (STP signal) Pr49 = 1
Operation Pattern			
Zero-point Return Feeding Speed	50	☐ Motor FWD direction(=0)	☐ Motor REV direction(=1)
Feeding Speed*1 mm/min (inch/min)	51		Setting not required
Approach Speed*1 mm/min (inch/min)	52		
Creep Speed*1 mm/min (inch/min)	53		
Final Traveling Distance*1 mm (inch)	54		

*1 Pr51 to Pr53 = (Speed)/(1000 · A)

*2 Pr54 = (Distance)/A

② Pulse mode ☐ Not used (Pr19b3, Pr63 setting not required)
☐ Used (Pr19b3=1)

└→Signal form
☐ 90 ° phase difference 2-phase pulse ×4 (Pr63=0)
☐ 90 ° phase difference 2-phase pulse ×2 (Pr63=1)
☐ 90 ° phase difference 2-phase pulse ×1 (Pr63=2)
☐ Sign + pulse train (Pr63=3)
☐ CW + CCW pulse train (Pr63=4)

③ Current limit ☐ Not used (Pr17b0=0, Pr34 to 36 setting not required)
☐ Used (Pr17b0=1)

☐ Plus/minus sides current limit value _____%(=Pr34)
☐ Plus side current limit value _____%(=Pr35)
☐ Minus side current limit value _____%(=Pr36)

④ Speed limit ☐ Not used (Pr17b3=0, Pr46 setting not required)
☐ Used (Pr17b3=1)

└→ Speed limit value _____ mm/min (inch/min)

Pr46 = (Speed)/(1000 • A)

⑤ Software overtravel
☐ Fixed (Pr18b0=0, Pr40, 41 setting not required)
☐ Parameter setting (Pr18b0=1)

→ Plus side software overtravel Ip =_____ mm(inch) (Pr40)
→ Minus side software overtravel In =_____ mm(inch) (Pr41)

Note : When incremental encoder is used (Parameter 9 = 1), software overtravel becomes effective after zero-point return (homing).

⑥ OT signal ☐ Not used (Pr19b0=1)
☐ Used (Pr19b0=0)

⑦ STOP signal ☐ Not used (Pr19b1=1, Pr20b4, Pr72b1 setting not required)
☐ Used (Pr19b1=0)

→ Remaining data processed after STOP signal
☐ Leave (Pr20b4=0 or Pr20b4=1, Pr72b1=0)
☐ Abandon (Pr20b4=1, Pr72b1=1)

⑧ Holding brake release signal
☐ Not used (Pr19b2=0, Pr43 and Pr44 setting not required)
☐ Used (Pr19b2=1)

→ Braking time _____ ms (=Pr43)
→ Brake ON motor speed _____ r/min(=Pr44)

12.7.6 Selection Function (Cont'd)

⑨ Backlash compensation

☐ Not used (Pr18b1=0, Pr42 setting not required)

☐ Used (Pr18b1=1)

└→ Compensation value δ = _____ mm(inch) (Pr42)

Pr42 = (δ × 32768 × Pr12)/(A × Pr11 × Pr13)

⑩ Pulse output ☐ Not used (Pr19b4=0, Pr64 setting not required)

☐ Used (Pr19b4=1)

└→ Dividing ratio (2/N) N = _____ (Pr64 = N)

⑪ Line PG ☐ Not used (Pr20b4, Pr72b2 setting not required)

☐ Used ⟶ PG selection after positioning complete

☐ By L-PG signal

(Pr20b4=0 or Pr20b4=1, Pr72b2=0)

☐ Motor PG by force (Pr20b4=1, Pr72b2=1)

NOTE

NOTE

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