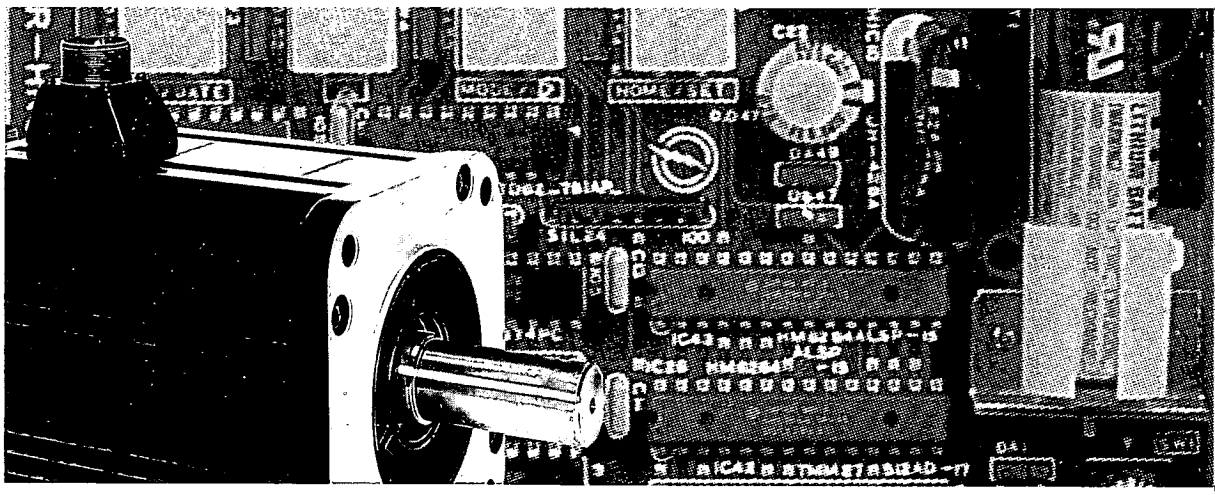
AC SERVO DRIVES HR SERIES
DESCRIPTIVE MANUAL

FOR MULTI-FUNCTIONS/POSITIONING CONTROL

SERVOMOTOR	M,F,G,D,S,R,P SERIES
SERVOPACK	CACR-HR□□BAB(RACK-MOUNTED TYPE)
	CACR-HR□□BB (BASE-MOUNTED TYPE)



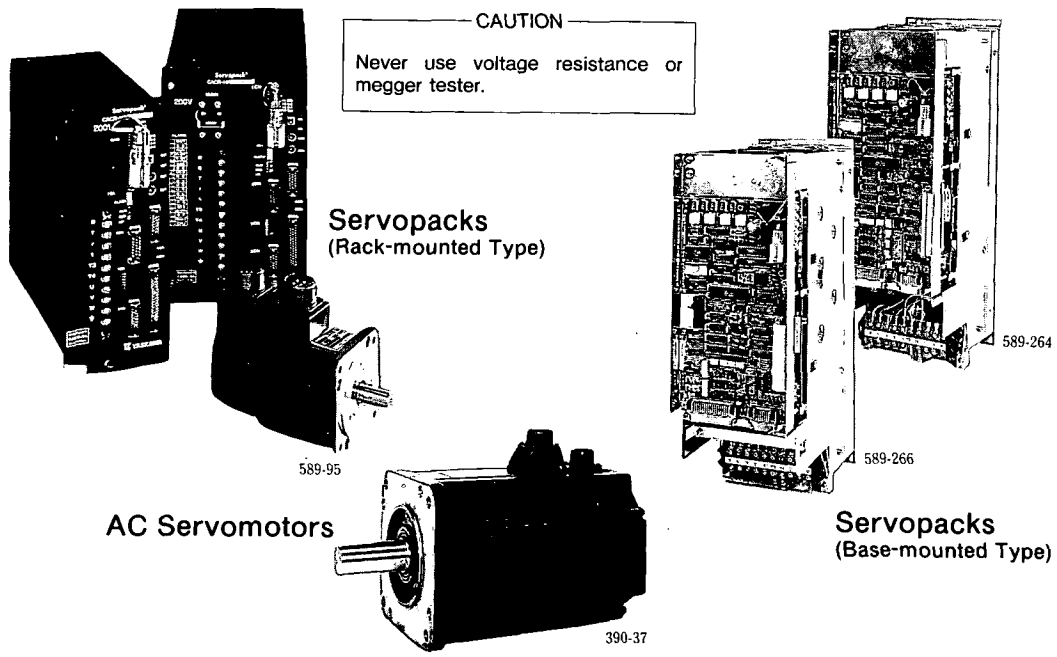
YASKAWA

TSE-S800-6H

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.



General Precautions

- Some drawings in this manual are shown with the protective cover or shields removed, in order to describe the detail with more clarity. Make sure all covers and shields are replaced before operating this product.
- Some drawings in this manual are shown as typical example and may differ from the shipped product.
- This manual may be modified when necessary because of improvement of the product, modification, or changes in specifications.
  Such modification is made as a revision by renewing the manual No.
- To order a copy of this manual, if your copy has been damaged or lost, contact your YASKAWA representative listed on the last page stating the manual No. on the front cover.
- YASKAWA is not responsible for accidents or damages due to any modification of the product made by the user since that will void our guarantee.

NOTES FOR SAFE OPERATION

Read this manual thoroughly before installation, operation, maintenance or inspection of the AC Servo Drives. In this manual, the NOTES FOR SAFE OPERATION are classified as "WARNING" or "CAUTION."

⚠ WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious personal injury.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate personal injury and/or damage to the equipment.

In some instances, items described in ⚠ CAUTION may also result in a serious accident. In either case, follow these important items.

⚠ WARNING

(WIRING)

- **Grounding must be in accordance with the national code and consistent with sound local practices.**
  Failure to observe this warning may lead to electric shock or fire.

(OPERATION)

- **Never touch any rotating motor parts during operation.**
  Failure to observe this warning may result in personal injury.

(INSPECTION AND MAINTENANCE)

- **Never open the panel cover while power is ON, and never turn ON power when the panel cover is open.**
  Otherwise, electric shock may result.
- **After turning OFF power, wait at least five minutes before servicing the product.**
  Otherwise, residual electric charges may result in electric shock.

⚠ CAUTION

(RECEIVING)

- Use the specified combination of SERVOMOTOR and SERVOPACK.
  Failure to observe this caution may lead to fire or failure.

(INSTALLATION)

- Never use the equipment where it may be exposed to splashes of water, corrosive or flammable gases, or near flammable materials.
  Failure to observe this caution may lead to electric shock or fire.

(WIRING)

- Do not connect three-phase power supply to output terminals Ⓤ Ⓥ and Ⓦ.
  Failure to observe this caution may lead to personal injury or fire.
- Securely tighten screws on the power supply and motor output terminals.
  Failure to observe this caution can result in a fire.

(OPERATION)

- To avoid inadvertent accidents, run the SERVOMOTOR only in test run (without load).
  Failure to observe this caution may result in personal injury.
- Before starting operation with a load connected, make sure emergency-stop procedures are in place.
  Failure to observe this caution may result in personal injury.
- During operation, do not touch the heat sink, regenerative resistance, SERVOMOTOR and other peripheral devices.
  Failure to observe this caution may result in burns.
- When Servo Alarm goes off, determine cause and confirm safety before resetting alarm and resuming operation.
  Failure to observe this caution may result in personal injury.

(INSPECTION AND MAINTENANCE)

- Do not disassemble the SERVOMOTOR.
  Failure to observe this caution may result in electric shock or personal injury.
- Never change wiring while power is ON.
  Failure to observe this caution may result in electric shock or personal injury.

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1 OUTLINE

Servopack types CACR-HR □□□ BAB and -HR □□□ BB are 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 types CACR-HR □□□ BAB and -HR□□□BB and to realize their 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 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.

Software Revised Version

Some functions of the CACR-HR type have been added with the revised software. Concerning the additional functions in Table 1.3, check the software version before use.

Table 1.3 Software Version Adjustable for Additional Functions

Function	Software Version	
	HR□□BAB	HR□□BB
Command table method and zone signal	3 and upper	HRG006 and upper
Positioning completion signal change		
Positioning command error detection		
Extension of station No. output	4 and upper	HRG008 and upper
Addition of Servopack response axis addresses		

Software Version Indication Position

Figs. 1.1 and 1.2 show the software version indications.

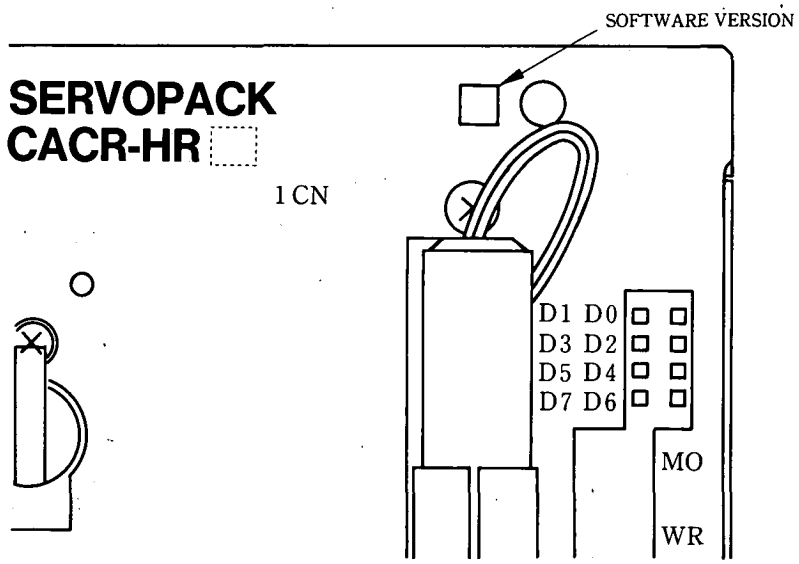


Fig. 1.1 Software Version Indication of HR □□ BAB

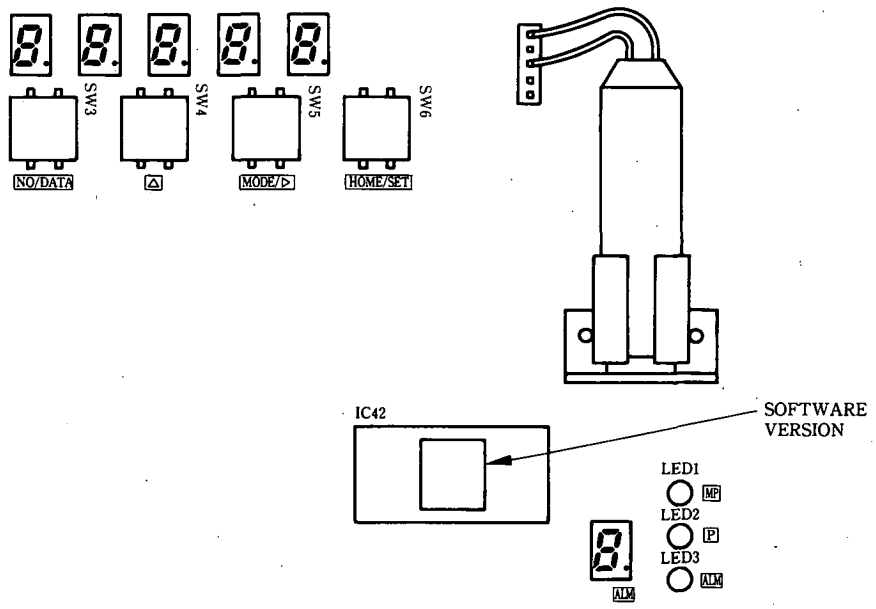
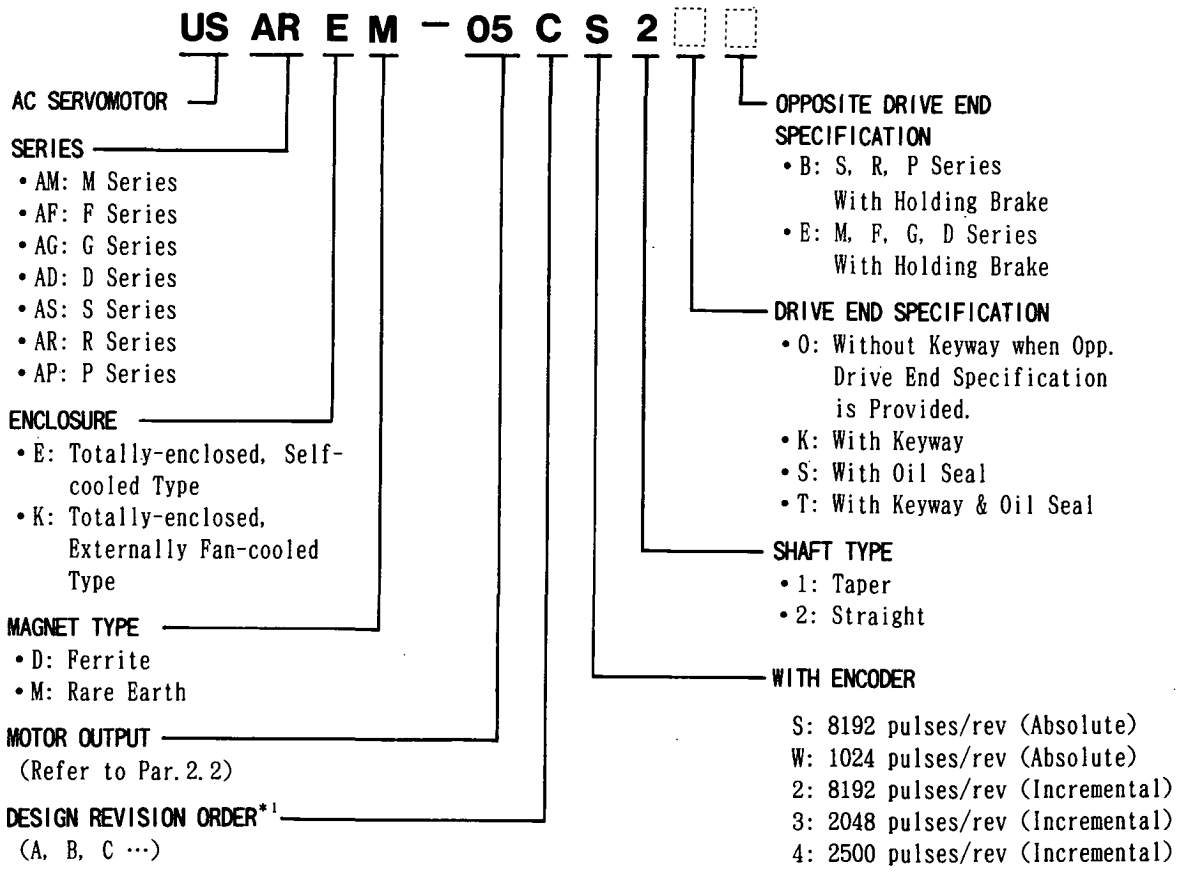


Fig. 1.2 Software Version Indication of HR □□ BB

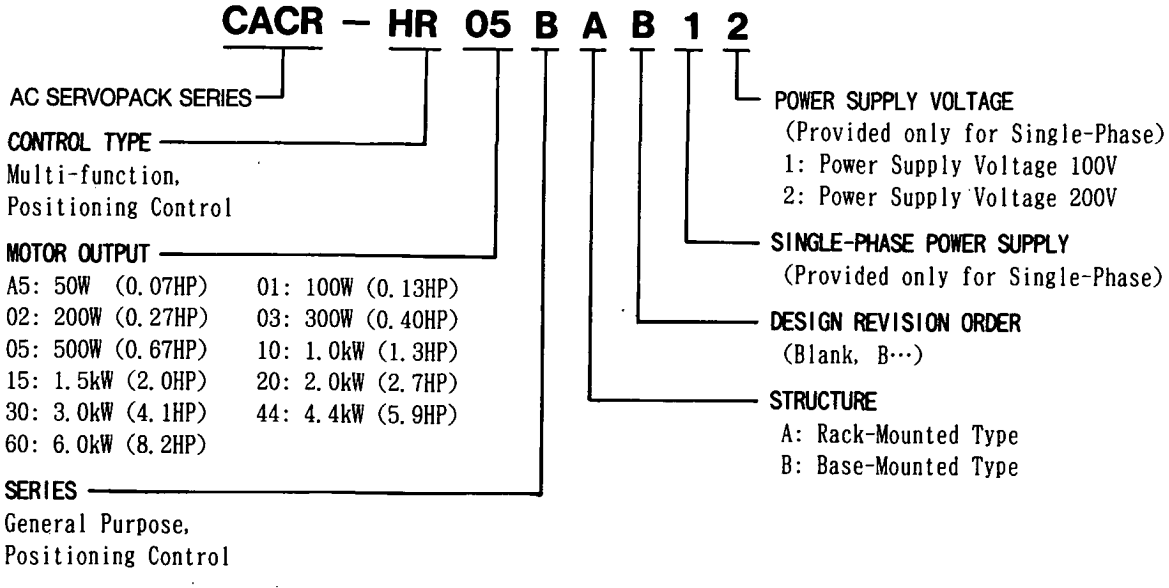
2 TYPE DESIGNATION AND CONFIGURATION

2.1 TYPE DESIGNATION

(1) Servomotor



(2) Servopack



*1

Encoder Specification	Series	Type
Absolute 8192P/R	M	USAMED-03BS to -60BS
	F	USAFED-02CS to -44CS
	G	USAGED-02AS to -44AS
	D	USADED-05ES to -37ES
	S	USASEM-02AS to -30AS
	R	USAREM-A5CS(200V) to -07CS USAREM-A5DS(100V) to -05DS
Absolute 1024P/R	M	USAMED-03BW to -60BW
	F	USAFED-02CW to -44CW
	G	USAGED-02AW to -44AW
	D	USADED-05EW to -37EW
	S	USASEM-02AW to -30AW
	P	USAPEM-01CW to -07CW

Encoder Specification	Series	Type
Incremental 2048P/R	M	USAMED-03C3 -06C3 -09B3 to -60B3
	F	USAFED-02D3 to -09D3 -13C3 to -44C3
	G	USAGED-02C3 to -09C3 -13A3 to -44A3
	D	USADED-05E3 to -37E3
	S	USASEM-02A3 to -30A3
Incremental 8192P/R	M	USAMED-03B2 to -60B2
	F	USAFED-02D2 -03D2 -05C2 to -44C2
	G	USAGED-02C2 -03C2 -05A2 to -44A2
	D	USADED-05E2 to -37E2
Incremental 2500P/R	S	USASEM-02A4 to -30A4

2.2 COMBINATION OF AC SERVOPACK AND SERVOMOTOR

Table 2.1 Rack-mounted Type Servopack (200 VAC)

Configuration, Main Circuit Voltage			Rack-mounted Type, Single-phase 200VAC						Rack-mounted Type, 3-phase 200VAC		
Type CACR-HR			A5BAB12	01BAB12	02BAB12	03BAB12		05BAB12	10BAB		15BAB
M Series	Applicable Servomotor	Type USAMED-	—	—	—	03 □□□ 1		—	06 □□□ 1	09B □ 1	12B □ 1
		Output kW / HP	—	—	—	0.3 / 0.4		—	0.6 / 0.8	0.9 / 1.2	1.2 / 1.6
		Speed r/min	—	—	—	Rating 1000/Max. 2000		—	Rating 1000/Max. 2000		
	Continuous Output Current Arms		—	—	—	3.0		—	5.8	7.6	11.7
	Max Output Current Arms		—	—	—	7.3		—	13.9	16.6	28.0
	Allowable Load Inertia $J_L(=GD^2_L/4)$	kg・cm² / lb・in・S²×10⁻³	—	—	—	67.5 / 60		—	121.5 / 107.5	183.5 / 162.5	290 / 256
F Series	Applicable Servomotor	Type USAFED-	—	—	—	02 □□□ 1	03 □□□ 1	05 □□□ 1	09 □□□ 1		13C □ 2
		Output kW / HP	—	—	—	0.15 / 0.2	0.3 / 0.4	0.45 / 0.6	0.85 / 1.1		1.3 / 1.7
		Speed r/min	—	—	—	Rating 1500/Max. 2500			Rating 1500/Max. 2500		
	Continuous Output Current Arms		—	—	—	3.0	3.0	3.8	6.2		9.7
	Max Output Current Arms		—	—	—	8.5	8.5	11.0	17.0		27.6
	Allowable $J_L(=GD^2_L/4)$	kg・cm² / lb・in・S²×10⁻³	—	—	—	6.5 / 5.75	10.3 / 9	67.5 / 60	121.5 / 107.5		183.5 / 162.5
G Series	Applicable Servomotor	Type USAGED-	—	—	—	02 □□□ 1	03 □□□ 1	05 □□□ 1	09 □□□ 1		13A □ 2
		Output kW / HP	—	—	—	0.15 / 0.2	0.3 / 0.4	0.45 / 0.6	0.85 / 1.1		1.3 / 1.7
		Speed r/min	—	—	—	Rating 1500/Max. 3000			Rating 1500/Max. 3000		
	Continuous Output Current Arms		—	—	—	3.0	3.0	3.8	7.6		11.7
	Max Output Current Arms		—	—	—	8.5	8.5	11.0	17.0		28.0
	Allowable Load Inertia $J_L(=GD^2_L/4)$	kg・cm² / lb・in・S²×10⁻³	—	—	—	6.5 / 5.75	10.3 / 9	67.5 / 60	121.5 / 107.5		183.5 / 162.5
D Series	Applicable Servomotor	Type USADED-	—	—	—	—		05E □	—		10E □
		Output kW / HP	—	—	—	—		0.5 / 0.67	—		1.0 / 1.3
		Speed r/min	—	—	—	—		Rating2000 Max. 2500	—		Rating2000 Max. 2500
	Continuous Output Current Arms		—	—	—	—		3.5	—		7.9
	Max Output Current Arms		—	—	—	—		10.6	—		25.2
	Allowable Load Inertia $J_L(=GD^2_L/4)$	kg・cm² / lb・in・S²×10⁻³	—	—	—	—		105 / 91	—		160 / 143
S Series	Applicable Servomotor	Type USASEM-	—	—	02A □ 2	03A □ 2		05A □ 2	08A □ 2		15A □ 2
		Output kW / HP	—	—	0.154 / 0.2	0.308 / 0.4		0.462 / 0.6	0.771 / 1.0		1.54 / 2.1
		Speed r/min	—	—	Rating 3000/Max. 4000				Rating 3000/Max. 4000		
	Continuous Output Current Arms		—	—	2.1	3.0		4.2	5.3		10.4
	Max Output Current Arms		—	—	6.0	8.5		11.0	15.6		28.0
	Allowable Load Inertia $J_L(=GD^2_L/4)$	kg・cm² / lb・in・S²×10⁻³	—	—	0.65 / 0.55	2.55 / 2.25		3.75 / 3.35	14.25 / 12.65		16.5 / 14.4

Table 2.1 Rack-mounted Type Servopack (200VAC) (Cont'd)

Configuration, Main Circuit Voltage			Rack-mounted Type, Single-phase 200VAC					Rack-mounted Type, 3-phase 200VAC	
Type CACR-HR			A5BAB12	01BAB12	02BAB12	03BAB12	05BAB12	10BAB	15BAB
R Series	Applicable Servomotor	Type USAREM-	A5CS	01CS	02CS	03CS	05CS	07CS	—
		Output W HP	50 0.07	100 0.13	200 0.27	300 0.40	500 0.67	700 0.94	—
		Speed r/min	Rating 3000/Max. 4500					Rating 3000/Max. 4500	—
	Continuous Output Current Arms		0.71	1.0	2.0	2.7	3.6	5.7	—
	Max Output Current Arms		2.1	2.8	5.7	7.8	10.6	16.3	—
	Allowable Load Inertia $J_L(=GD^2_L/4)$	kg·cm² oz·in·S²×10⁻³	0.775 10.8	1.25 17.8	5.075 71.8	7.65 109	27.2 386	37.2 528	—
P Series	Applicable Servomotor	Type USAPEM-	—	01CW	02CW	03CW	05CW	07CW	—
		Output W HP	—	100 0.13	200 0.27	300 0.40	500 0.67	700 0.94	—
		Speed r/min	—	Rating 3000/Max. 4500				Rating 3000/Max. 4500	—
	Continuous Output Current Arms		—	1.0	2.0	2.7	3.6	5.7	—
	Max Output Current Arms		—	2.8	5.7	7.8	10.6	16.3	—
	Allowable Load Inertia $J_L(=GD^2_L/4)$	kg·cm² oz·in·S²×10⁻³	—	1.95 27.75	3.2 45.15	4.9 69.5	23.9 339	32.85 465	—

Table 2.2 Rack-mounted Type Servopack (Single-phase 100VAC)

Configuration, Main Circuit Voltage			Rack-mounted Type, Single-phase 100VAC				
Type CACR-HR			A5BAB11	01BAB11	02BAB11	03BAB11	05BAB11
R Series	Applicable Servomotor	Type USAREM-	A5DS	01DS	02DS	03DS	05DS
		Output W HP	50 0.07	100 0.13	200 0.27	300 0.40	500 0.67
		Speed r/min	Rating 3000/Max. 4000				
	Continuous Output Current Arms		1.2	1.7	2.9	3.6	5.5
	Max Output Current Arms		3.6	5.0	8.5	10.6	16.3
	Allowable Load Inertia $J_L(=GD^2_L/4)$	kg·cm² oz·in·S²×10⁻³	0.775 10.8	1.25 17.8	5.075 71.8	7.65 109	27.2 386

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

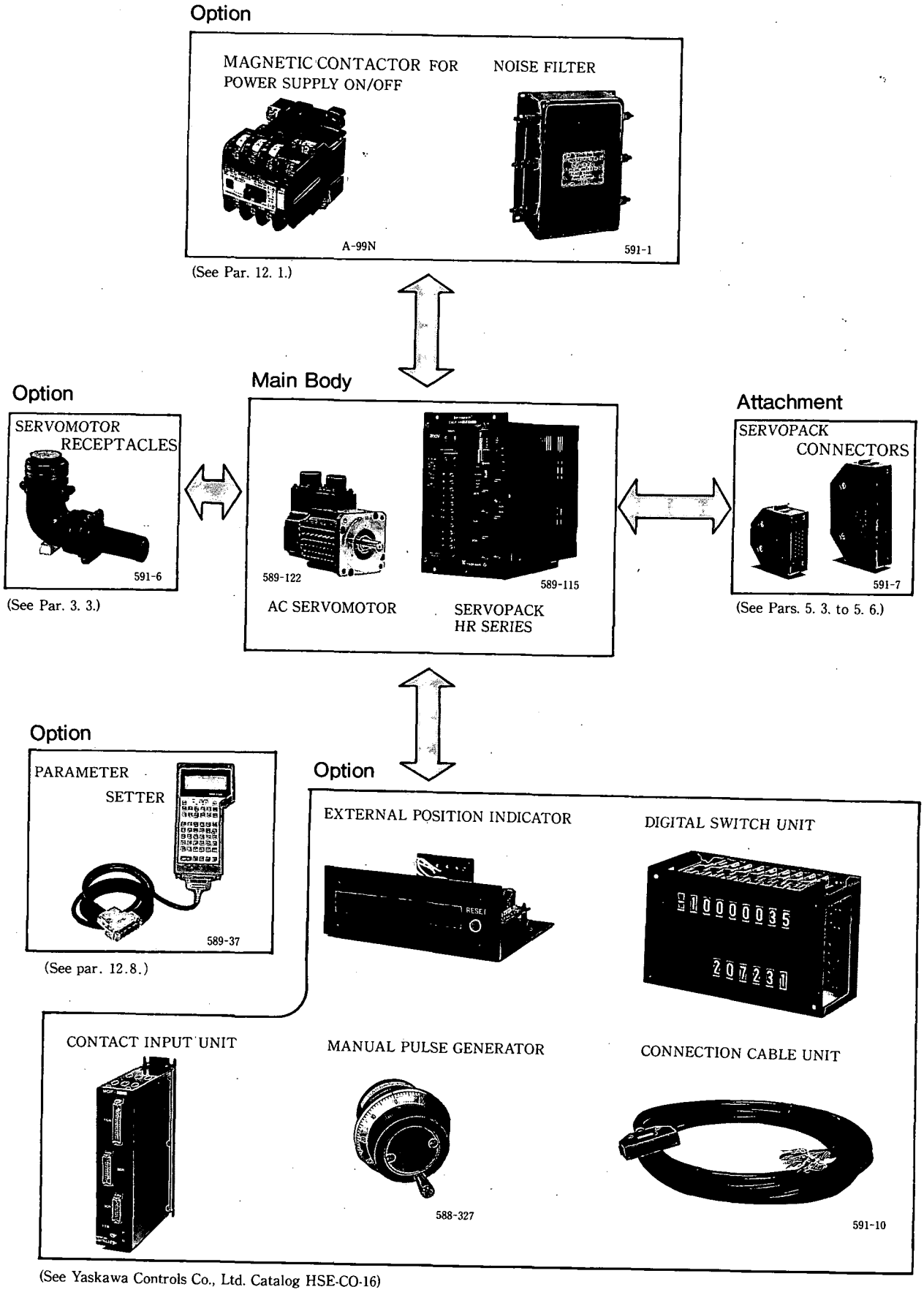
Servomotor \ No. of Pulses	Incremental Encoder			Absolute Encoder	
	2048	2500	8192	1024	8192
M Series	○	—	◎	○	◎
F Series	○	—	◎	○	◎
G Series	○	—	◎	○	◎
D Series	◎	—	○	◎	○
S Series	◎	○	—	○	◎
R Series	—	—	—	—	◎
P Series	—	—	—	◎	—

◎ Standard
○ Semi-standard

Table 2.3 Base-mounted Type Servopack (3-phase 200 VAC)

Configuration, Main Circuit Voltage			Base-mounted Type, 3-phase 200VAC							
Type CACR-HR			03BB	05BB	10BB		15BB	20BB	30BB	44BB	60BB
M Series	Applicable Servomotor	Type USAMED-	03B □□□ 1	—	06B □□□ 1	09B □□ 2	12B □□ 2	20B □□ 2	30B □□ 2	44B □□ 2	USAMKD -60B □□ 2
		Output kW	0.3	—	0.6	0.9	1.2	2.0	3.0	4.4	6.0
		Output HP	0.4		0.8	1.2	1.6	2.7	4.0	5.9	8.0
		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	45.0
	Max Output Current Arms		7.3	—	13.9	16.6	28.0	42.0	56.5	70.0	80.6
	Allowable Load Inertia $J_L(=GD^2_L/4)$	kg·cm²	67.5	—	121.5	183.5	290	550	715	1200	1200
		lb·in·S²×10⁻³	60		107.5	162.5	256	486	633.5	1063	1063
F Series	Applicable Servomotor	Type USAFED-	02 □□□ 1	03 □□□ 1	05 □□□ 1	09 □□□ 1	13C □□ 2	20C □□ 2	30C □□ 2	44C □□ 2	—
		Output kW	0.15	0.3	0.45	0.85	1.3	1.8	2.9	4.4	—
		Output HP	0.2	0.4	0.6	1.1	1.7	2.4	3.9	5.9	
		Speed r/min	Rating 1500/Max. 2500								—
	Continuous Output Current Arms		3.0	3.0	3.8	6.2	9.7	15.0	20.0	30.0	—
	Max Output Current Arms		8.5	8.5	11.0	17.0	27.6	42.0	56.5	77.0	—
	Allowable Load Inertia $J_L(=GD^2_L/4)$	kg·cm²	6.5	10.3	67.5	121.5	183.5	290	550	715	—
		lb·in·S²×10⁻³	5.75	9	60	107.5	162.5	256	486	633.5	
G Series	Applicable Servomotor	Type USAGED-	02 □□□ 1	03 □□□ 1	05 □□□ 1	09 □□□ 1	13A □□ 2	20A □□ 2	30A □□ 2	44A □□ 2	—
		Output kW	0.15	0.3	0.45	0.85	1.3	1.8	2.9	4.4	—
		Output HP	0.2	0.4	0.6	1.1	1.7	2.4	3.9	5.9	
		Speed r/min	Rating 1500/Max. 3000								—
	Continuous Output Current Arms		3.0	3.0	3.8	7.6	11.7	19.0	26.0	33.0	—
	Max Output Current Arms		8.5	8.5	11.0	17.0	28.0	42.0	56.5	70.0	—
	Allowable Load Inertia $J_L(=GD^2_L/4)$	kg·cm²	6.5	10.3	67.5	121.5	183.5	290	550	715	—
		lb·in·S²×10⁻³	5.75	9	60	107.5	162.5	256	486	633.5	
D Series	Applicable Servomotor	Type USADED-	—		05E □□	—	10E □□	15E □□	22E □□	37E □□	—
		Output kW	—		0.5	—	1.0	1.5	2.2	3.7	—
		Output HP			0.67		1.3	2.0	2.9	5.0	
		Speed r/min	—		Rating2000 Max. 2500	—	Rating 2000/Max. 2500				—
	Continuous Output Current Arms		—		3.5	—	7.9	12.6	16.6	23.3	—
	Max Output Current Arms		—		10.6	—	25.2	40.6	54.0	76.7	—
	Allowable Load Inertia $J_L(=GD^2_L/4)$	kg·cm²	—		105	—	160	310	415	740	—
		lb·in·S²×10⁻³			91		143	274.5	367.5	655	
S Series	Applicable Servomotor	Type USASEM-	02A □□ 2	03A □□ 2	05A □□ 2	08A □□ 2	15A □□ 2	—	30A □□ 2	—	—
		Output kW	0.154	0.308	0.462	0.771	1.54	—	3.08	—	—
		Output HP	0.2	0.4	0.6	1.0	2.1		4.1		
		Speed r/min	Rating 3000/Max. 4000					—	Rating3000 Max. 4000	—	—
	Continuous Output Current Arms		2.1	3.0	4.2	5.3	10.4	—	19.9	—	—
	Max Output Current Arms		6.0	8.5	11.0	15.6	28.0	—	56.5	—	—
	Allowable Load Inertia $J_L(=GD^2_L/4)$	kg·cm²	0.65	2.55	3.75	14.25	16.5	—	28.7	—	—
		OZ·in·S²×10⁻³	0.55	2.25	3.35	12.65	14.4		25.45		

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 for 03 to 44 and externally fan-cooled for 60; IP65 (exclusive of 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
  - USAM□D - □□□ BS □ : With absolute encoder (8192 pulses/rev)
  - USAM□D - □□□ B2 □ : With incremental encoder (8192 pulses/rev)
- Semi-Standard
  - USAM□D - □□□ BW □ : With absolute encoder (1024 pulses/rev)
  - USAM□D - □□□ B3 □ : With incremental encoder (2048 pulses/rev) (09 to 60)
  - USAMED - □□□ C3 □ : With incremental encoder (2048 pulses/rev) (03, 06)

Table 3.1 Ratings and Specifications of M Series AC Servomotors

Item \ Motor Type USAMED-		03 □□□ 1	06 □□□ 1	09B □ 2	12B □ 2	20B □ 2	30B □ 2	44B □ 2	USAMKD-60B □ 2
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)	6.0 (8.0)
Rated Torque*	N·m (lb·in)	2.84 (25)	5.68 (50)	8.62 (76)	11.5 (102)	19.1 (169)	28.4 (252)	41.9 (372)	57.2 (507)
Continuous Max. Torque*	N·m (lb·in)	2.94 (26)	5.88 (52)	8.82 (78)	11.8 (104)	21.6 (191)	32.3 (286)	46.1 (408)	62.9 (557)
Instantaneous Peak Torque*	N·m (lb·in)	7.17 (63)	14.1 (125)	19.3 (171)	28.0 (248)	44.0 (390)	63.7 (564)	91.1 (807)	106 (938)
Rated Current*	A	3.0	5.8	7.6	11.7	18.8	26	33	45
Rated Speed*	r/min	1000							
Instantaneous Max. Speed*	r/min	2000						1500	
Torque Constant	N·m/A (lb·in/A)	1.01 (8.9)	1.04 (9.2)	1.21 (10.7)	1.02 (9.0)	1.07 (9.5)	1.16 (10.2)	1.33 (11.8)	1.33 (11.8)
Moment of Inertia $J_M(=GD^2_M/4)$	$Kg·m^2×10^{-4}$ ($lb·in·s^2×10^{-3}$)	13.5 (12.0)	24.3 (21.5)	36.7 (32.5)	58 (51.2)	110 (97.2)	143 (126.7)	240 (212.6)	240 (212.6)
Power Rate*	kW/s	6.0	13.3	20.3	22.7	33.2	57.0	74.0	138
Inertia Time Constant	ms	12.8	6.3	4.4	6.0	5.2	3.5	3.6	3.6
Inductive Time Constant	ms	2.7	5.1	6.5	10.4	12.9	15.3	16.2	16.2

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

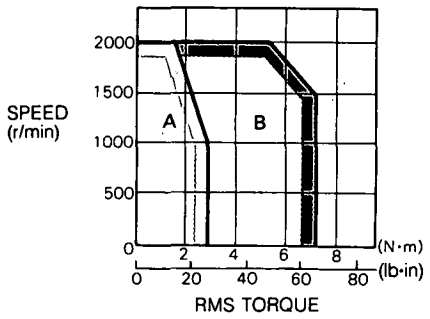
(3) Speed-torque characteristics

Typical at 20°C (Armature Winding Temp.)

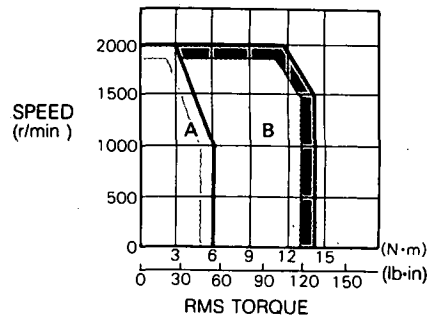
A : Continuous Duty Zone

B : Intermittent Duty Zone

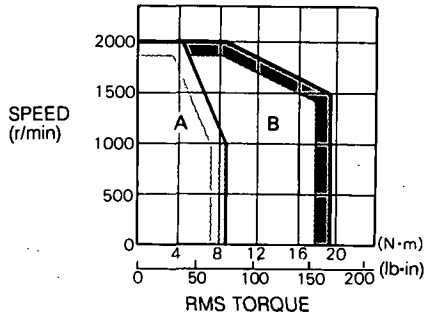
USAMED-03□



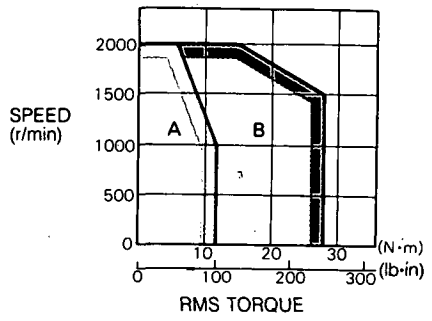
USAMED-06□



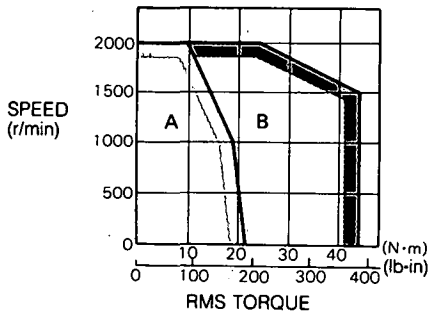
USAMED-09B



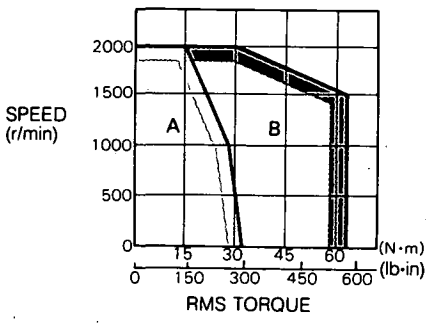
USAMED-12B



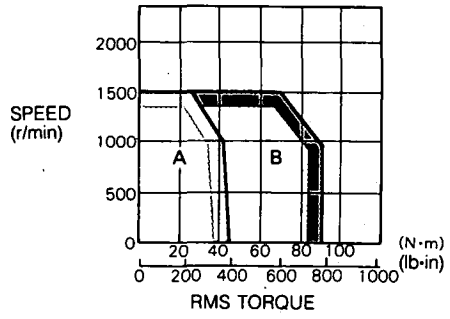
USAMED-20B



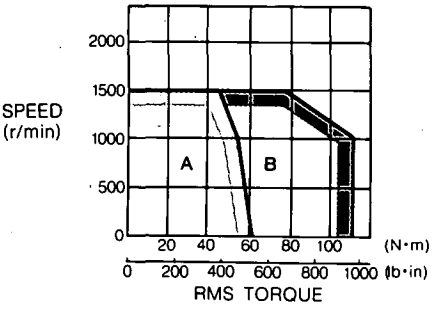
USAMED-30B



USAMED-44B



USAMKD-60B



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; IP65 (exclusive of 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- □□□ CS □ : With absolute encoder (8192 pulses/rev)
  - USAFED- □□□ C2 □ : With incremental encoder (8192 pulses/rev) (05 to 44)
  - USAFED- □□□ D2 □ : With incremental encoder (8192 pulses/rev) (02, 03)
- Semi-Standard
  - USAFED- □□□ CW □ : With absolute encoder (1024 pulses/rev)
  - USAFED- □□□ C3 □ : With incremental encoder (2048 pulses/rev) (13 to 44)
  - USAFED- □□□ D3 □ : With incremental encoder (2048 pulses/rev) (02 to 09)

Table 3.2 Ratings and Specifications of F Series AC Servomotors

Item \ Motor Type USAFED-		02 □□1	03 □□1	05 □□1	09 □□1	13C □2	20C □2	30C □2	44C □2
Rated Output*	kW (HP)	0.15 (0.2)	0.3 (0.4)	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)	0.98 (8.7)	1.96 (17)	2.84 (25)	5.39 (48)	8.34 (74)	11.5 (102)	18.6 (165)	28.4 (252)
Continuous Max. Torque*	N·m (lb·in)	1.08 (10)	2.16 (19)	2.94 (26)	5.88 (52)	8.83 (78)	11.8 (104)	22.6 (200)	37.3 (330)
Instantaneous Peak Torque*	N·m (lb·in)	2.91 (26)	5.82 (52)	8.92 (79)	15.2 (135)	24.7 (219)	34.0 (301)	54.1 (479)	76.2 (675)
Rated Current*	A	3.0	3.0	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)	0.36 (3.2)	0.72 (6.3)	0.8 (7.1)	0.92 (8.2)	0.92 (8.2)	0.82 (7.3)	0.98 (8.7)	1.02 (9.0)
Moment of Inertia $J_M(=GD^2_M/4)$	$Kg·m^2×10^{-4}$ ($lb·in·S^2×10^{-3}$)	1.30 (1.2)	2.06 (1.8)	13.5 (12.0)	24.3 (21.5)	36.7 (32.5)	58 (51.2)	110 (97.2)	143 (126.7)
Power Rate*	kW/s	7.4	18.3	6.0	12	18.9	22.7	31.5	57.0
Inertia Time Constant	ms	3.9	2.5	10.9	6.0	4.4	5.9	5.2	3.7
Inductive Time Constant	ms	3.4	4.3	3.2	5.2	6.1	10.4	13.0	15.2

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

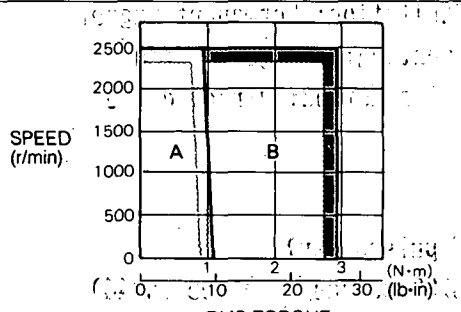
(3) Speed-torque characteristics

Typical at 20°C (Armature Winding Temp.)

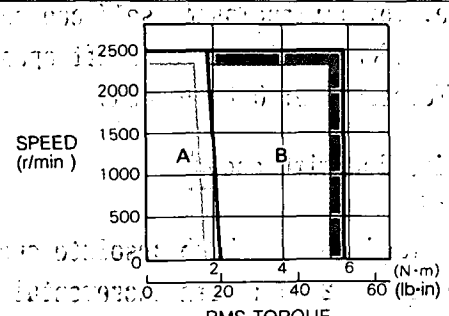
A : Continuous Duty Zone

B : Intermittent Duty Zone

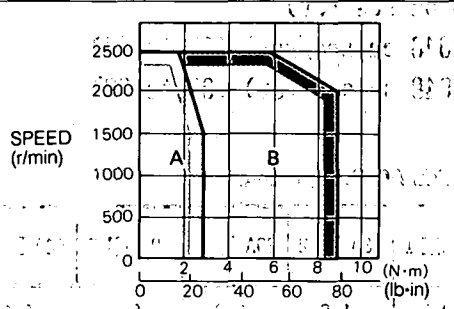
USAFED-02□



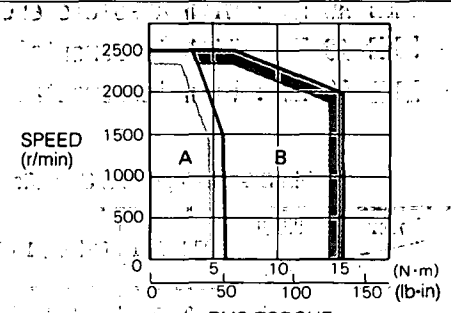
USAFED-03□



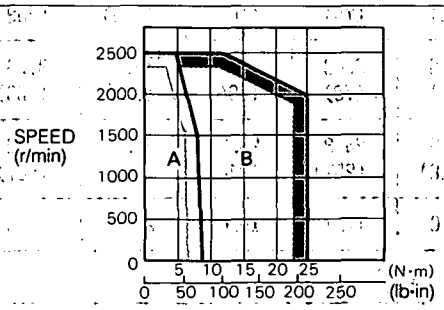
USAFED-05□



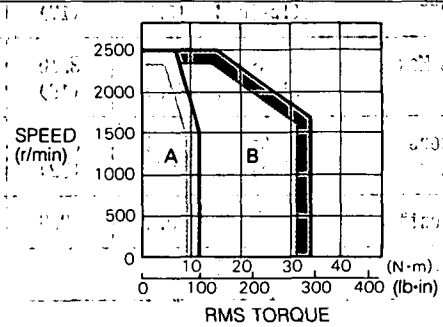
USAFED-09□



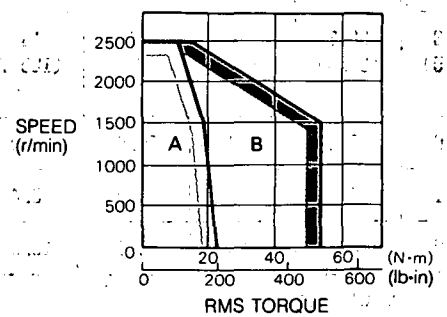
USAFED-13C



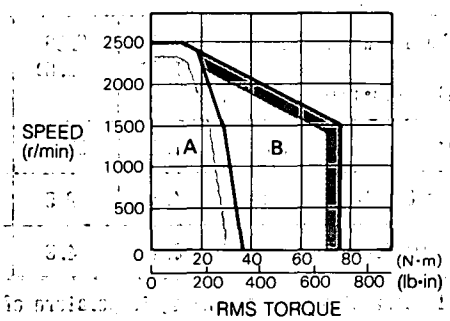
USAFED-20C



USAFED-30C



USAFED-44C



3.1.3 G Series

(1) Ratings

Time Rating: Continuous
Insulation: Class F
Isoiation Voltage: 1500 VAC, one minute
Insulation Resistance: 500 VDC, 10MΩ or more
Enclosure: Totally-enclosed, self-cooled; IP65 (exclusive of shaft opening)
Ambient Temperature: 0 to + 40°C
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-□□A S □ With absolute encoder (8192 pulses/rev)
USAGED-□□A 2 □ With incremental encoder (8192 pulses/rev) (05 to 44)
USAGED-□□C 2 □ With incremental encoder (8192 pulses/rev) (02, 03)

. Semi-Standard

USAGED-□□AW□ : With absolute encoder (1024 pulses/rev)
USAGED-□□A 3 □ With incremental encoder (2048 pulses/rev) (13 to 44)
USAGED- □□ C3 □ : With incremental encoder (2048 pulses/rev) (02 to 09)

Table 3.3 Ratings and Specifications of G Series AC Servomotors

Item \ Motor Type USAGED-		02□□1	03□□1	05□□1	09□□1	13A□2	20A□2	30A□2	44A□2
Rated Output*	kW (HP)	0.15 (0.2)	0.3 (0.4)	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)	0.98 (8.7)	1.96 (17)	2.84 (25)	5.39 (48)	8.34 (74)	11.5 (102)	18.6 (165)	28.4 (252)
Continuous Max. Torque*	N·m (lb·in)	1.08 (10)	2.16 (19)	2.94 (26)	5.88 (52)	8.83 (78)	11.8 (104)	22.6 (200)	37.3 (330)
Instantaneous Peak Torque'	N·m (lb·in)	2.91 (26)	5.83 (52)	8.92 (79)	13.3 (118)	23.3 (207)	28.0 (248)	45.1 (400)	66.2 (587)
Rated Current*	A	3.0	3.0	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)	0.36 (3.2)	0.72 (6.3)	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 $J_M(=GD^2_M/4)$	kg·m²×10⁻⁴ (lb·in·s²×10⁻³)	1.3 (1.2)	2.06 (1.8)	13.5 (12.0)	24.3 (21.5)	36.7 (32.5)	57.9 (51.2)	110 (97.2)	143 (126.7)
Power Rate'	kW/s	7.4	18.3	6.0	12.0	18.9	22.7	36.5	57.0
Inertia Time Constant	ms	4.5	2.5	10.9	6.1	4.3	5.8	5.2	3.4
Inductive Time Constant	ms	3.4	4.3	3.2	5.2	6.7	10.4	13.2	15.9

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

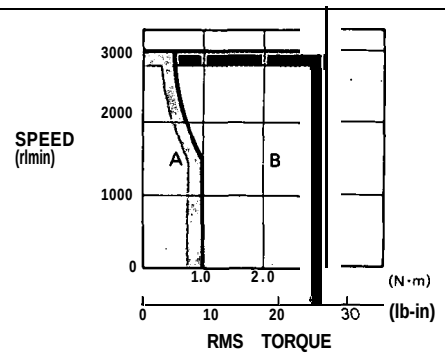
(3) Speed-torque characteristics

Typical at 20°C (Armature Winding Temp.)

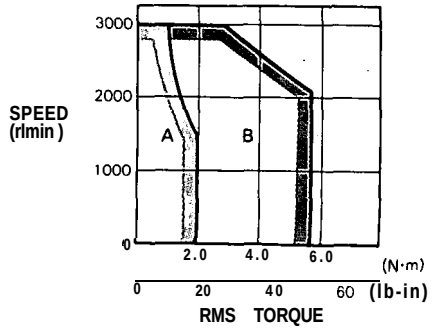
: Continuous Duty Zone

: Intermittent Duty Zone

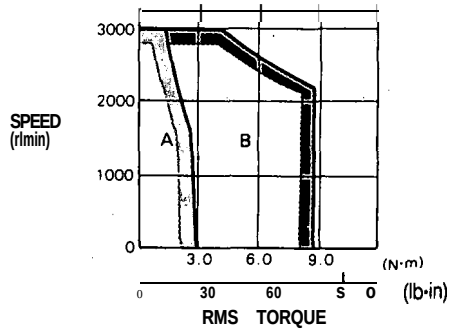
USAG ED-02



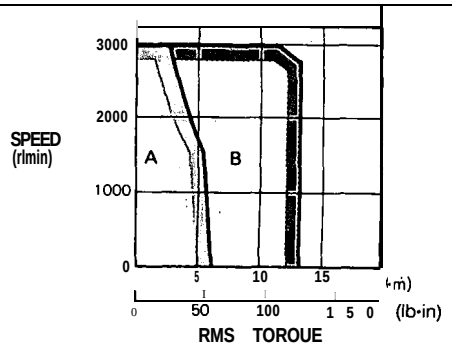
USAGED-03



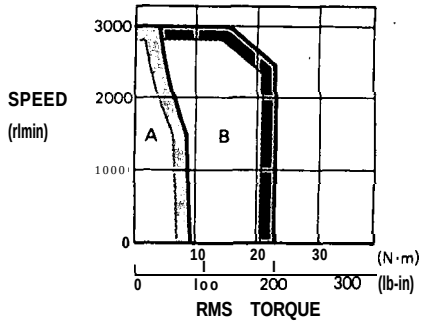
USAGED-05



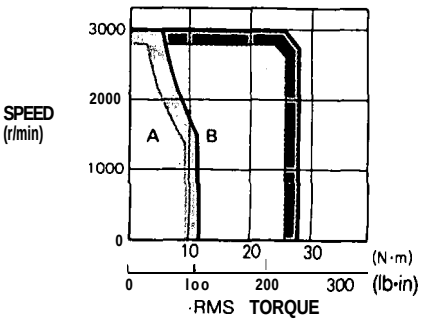
USAGED-09



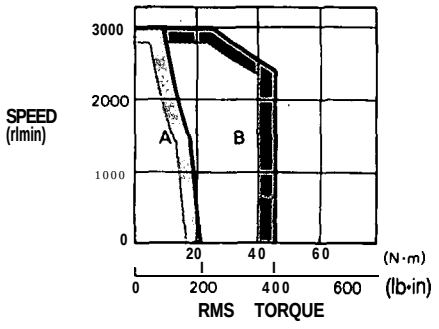
USAGED-13A



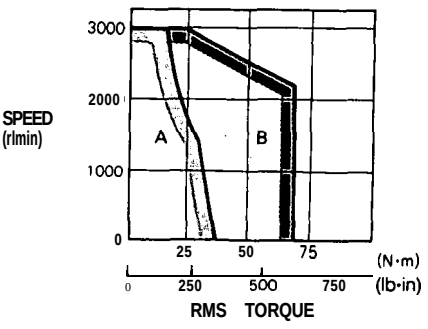
USAGED-20A



USAGED-30A



USAGED-44A



3.1.4 D 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;
IP65 (exclusive of 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
Holding Brake Provided

(2) Combination with encoder

- Standard
  USADED- □□ EW : With absolute encoder (1024 pulses/rev)
  USADED- □□ E3 : With incremental encoder (2048 pulses/rev)
- Semi-Standard
  USADED- □□ ES : With absolute encoder (8192 pulses/rev)
  USADED- □□ E2 : With incremental encoder (8192 pulses/rev)

Table 3.4 Ratings and Specifications of D Series AC Servomotors

Item \ Motor Type USADED-		05E □	10E □	15E □	22E □	37E □
Rated Output*	kW (HP)	0.5 (0.67)	1.0 (1.3)	1.5 (2.0)	2.2 (2.9)	3.7 (5.0)
Rated Torque*	N•m (lb•in)	2.35 (21)	4.81 (43)	7.16 (63)	10.5 (93)	17.7 (156)
Continuous Max. Torque*	N•m (lb•in)	3.43 (30)	6.37 (56)	8.83 (78)	13.7 (122)	21.6 (191)
Instantaneous Peak Torque*	N•m (lb•in)	8.24 (73)	16.9 (149)	25.1 (222)	36.8 (326)	61.8 (547)
Rated Current*	A	3.5	7.9	12.6	16.6	23.3
Rated Speed*	r/min	2000				
Instantaneous Peak Speed*	r/min	2500				
Torque Constant	N•m/A (lb•in/A)	0.83 (7.38)	0.69 (6.07)	0.64 (5.64)	0.71 (6.25)	0.82 (7.29)
Moment of Motor Inertia $J_M(=GD^2_M/4)$	$kg•m^2×10^{-4}$ $(lb•in•s^2×10^{-3})$	21, 13† (18.2, 11.3†)	32, 24† (28.6, 21.5†)	62, 59† (54.7, 52.1†)	83, 80† (73.8, 71.1†)	148, 145† (131, 128†)
Power Rate*	kW/s	2.7 4.4†	7.3 9.7†	8.2 8.6†	13 14†	21 22†
Inertia Time Constant	ms	18 11†	7.8 5.9†	7.1 6.8†	6.2 6.0†	4.3 4.2†
Inductive Time Constant	ms	4.4	6.9	9.4	11	15

* Typical value at armature winding temperature of 20℃, in combination with Servopack.
† Values show those of D series without holding brake.

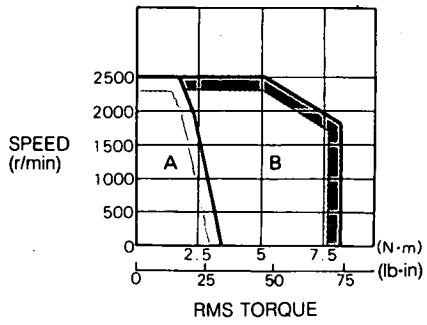
(3) Speed-torque characteristics

Typical at 20°C (Armature Winding Temp.)

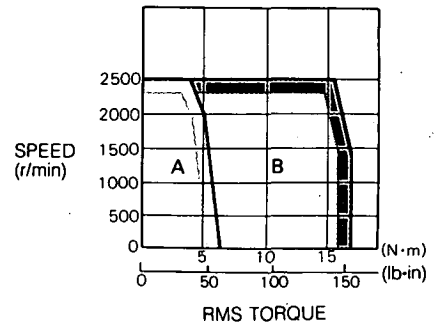
A : Continuous Duty Zone

B : Intermittent Duty Zone

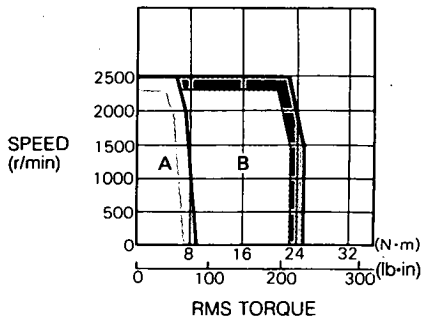
USADED-05E



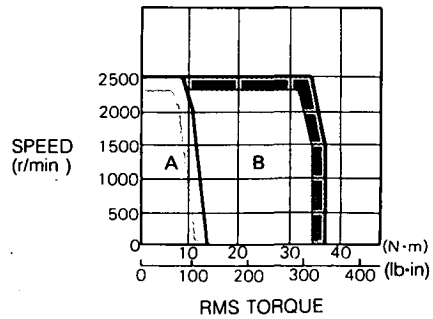
USADED-10E



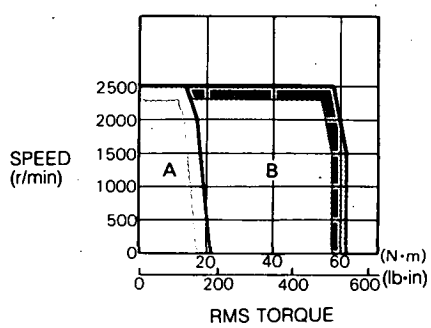
USADED-15E



USADED-22E



USADED-37E



3.1.5 S Series

(1) Ratings

Time Rating: Continuous
Insulation: Class B (Types USASEM-02A □ 2,
-03A □ 2, -05A □ 2)
Class F (Types USASEM-08A □1,
-15A □ 1, -30A □ 1)
Isolation Voltage: 1500 VAC, one minute
Insulation Resistance: 500 VDC, 10MΩ or more
Enclosure: Totally-enclosed, self-cooled;
IP44 (exclusive of shaft opening)
Ambient Temperature: 0 to + 40℃
Ambient Humidity: 20% to 80%
(non-condensing)
Vibration: 15 μm or below
Finish in Munsell Notation: N1.5
Excitation: Permanent magnet
Mounting: Flange mounted
Drive Method: Direct drive

(2) Combination with encoder

- Standard
  USASEM- □□ AS : With absolute encoder (8192 pulses/rev)
  USASEM- □□ A3 : With incremental encoder (2048 pulses/rev)
- Semi-Standard
  USASEM- □□ AW : With absolute encoder (1024 pulses/rev)
  USASEM- □□ A4 : With incremental encoder (2500 pulses/rev)

Table 3.5 Ratings and Specifications of S Series AC Servomotors

Item \ Motor Type USASEM-		02A □ 2	03A □ 2	05A □ 2	08A □ 1	15A □ 1	30A □ 1
Rated Output*	W (HP)	154 (0.2)	308 (0.4)	462 (0.6)	771 (1.0)	1540 (2.1)	3080 (4.1)
Rated Torque*	N•m (lb•in)	0.49 (4.3)	0.98 (8.7)	1.47 (13)	2.45 (22)	4.90 (43)	9.81 (87)
Continuous Max. Torque*	N•m (lb•in)	0.57 (5.0)	1.18 (10)	1.67 (15)	3.33 (30)	6.18 (55)	12.2 (108)
Instantaneous Peak Torque*	N•m (lb•in)	1.47 (13)	2.94 (26)	4.02 (36)	7.35 (65)	13.7 (122)	29.0 (257)
Rated Current*	A	2.1	3.0	4.2	5.3	10.4	19.9
Rated Speed*	r/min	3000					
Instantaneous Max Speed*	r/min	4000					
Torque Constant	N•m/A (lb•in/A)	0.25 (2.19)	0.35 (3.10)	0.37 (3.25)	0.51 (4.49)	0.50 (4.43)	0.53 (4.64)
Moment of Motor Inertia $J_M(=GD^2_M/4)$	kg•m²×10⁻⁴ (lb•in•S²×10⁻³)	0.13 (0.11)	0.51 (0.45)	0.75 (0.67)	2.85 (2.53)	3.25 (2.88)	5.74 (5.09)
Power Rate*	kW/s	18.5	18.9	28.9	21	74	167
Inertia Time Constant	ms	1.8	2.2	1.8	1.9	0.7	0.4
Inductive Time Constant	ms	1.5	2.7	3.1	6.2	13	26

* Typical value at armature winding temperature of 100℃, in combination with Servopack.
Other values at 20℃.

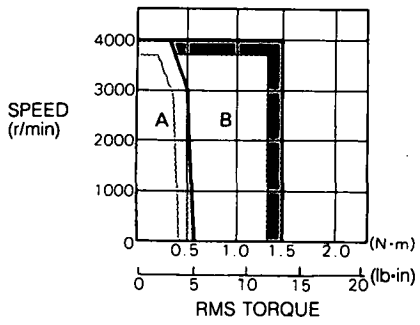
(3) Speed-torque characteristics

Typical at 100°C (Armature Winding Temp.)

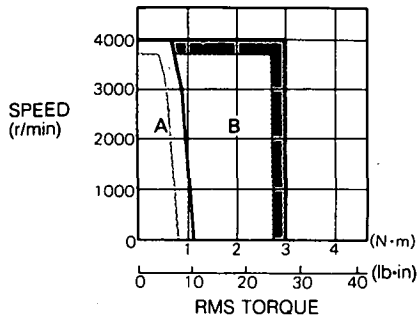
A : Continuous Duty Zone

B : Intermittent Duty Zone

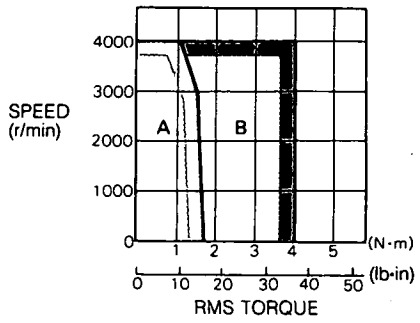
USASEM-02A



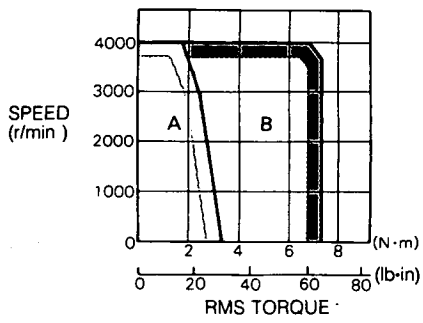
USASEM-03A



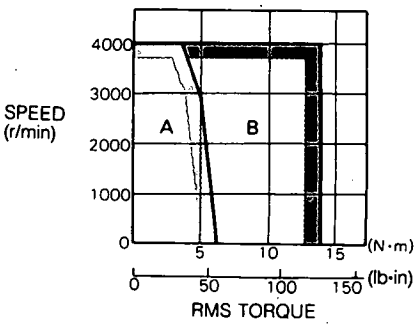
USASEM-05A



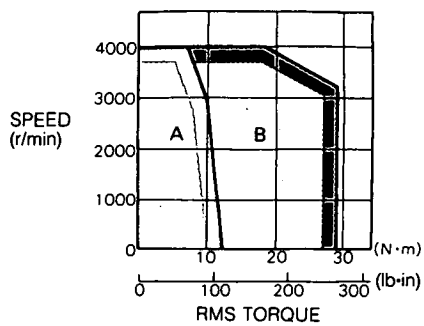
USASEM-08A



USASEM-15A



USASEM-30A



3.1.6 R Series (For 200V)

(1) Ratings

Time Rating: Continuous
Insulation: Class B
Isolation Voltage: 1000 VAC, one minute
Insulation Resistance: 500 VDC, 10MΩ or more
Enclosure: Totally-enclosed, self-cooled;
IP44 (exclusive of shaft opening)
Ambient Temperature: 0 to +40℃
Storage Temperature: −20 to +60℃
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
USAREM- ☐☐☐ CS2 : With absolute encoder (8192 pulses/rev)

Table 3.6 Ratings and Specifications of R Series AC Servomotors (For 200V)

Item \ Motor Type USAREM-		A5C ☐ 2	01C ☐ 2	02C ☐ 2	03C ☐ 2	05C ☐ 2	07C ☐ 2
Rated Output*	W (HP)	50 (0.07)	100 (0.13)	200 (0.27)	300 (0.40)	500 (0.67)	700 (0.93)
Rated Torque*	N•m (oz•in)	0.159 (22.5)	0.318 (45)	0.637 (90)	0.955 (135)	1.59 (225)	2.22 (316)
Continuous Max. Torque*	N•m (oz•in)	0.19 (26.9)	0.382 (54.2)	0.765 (108.3)	1.15 (162.5)	1.90 (269.4)	2.67 (378)
Peak Torque*	N•m (oz•in)	0.476 (67.5)	0.955 (135)	1.91 (270)	2.86 (405)	4.76 (675)	6.68 (948)
Rated Current*	A	0.71	1.0	2.0	2.7	3.6	5.7
Rated Speed*	r/min	3000					
Max. Speed*	r/min	4500					
Torque Constant	N•m/A (oz•in/A)	0.235 (33.3)	0.353 (50.0)	0.346 (49.0)	0.378 (53.6)	0.466 (66.0)	0.426 (60.4)
Moment of Motor Inertia $J_M(=GD^2_M/4)$	kg•cm² (oz•in•s²×10⁻³)	0.076 (1.08)	0.125 (1.78)	0.507 (7.18)	0.766 (10.9)	2.72 (38.6)	3.72 (52.8)
Power Rate*	kW/s	3.30	8.09	8.01	11.9	9.26	13.3
Inertia Time Constant	ms	4.4	3.4	2.9	2.6	2.8	2.5
Inductive Time Constant	ms	1.3	1.6	4.1	4.5	9.4	10.0

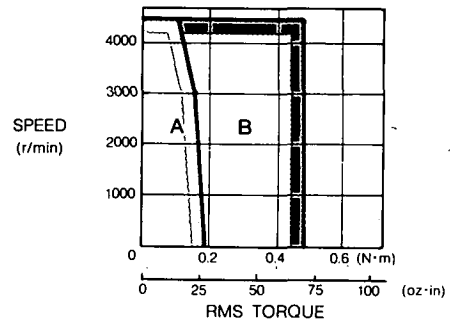
* Typical value at armature winding temperature of 75℃, in combination with Servopack. Other values at 20℃.

(3) Speed-torque characteristics

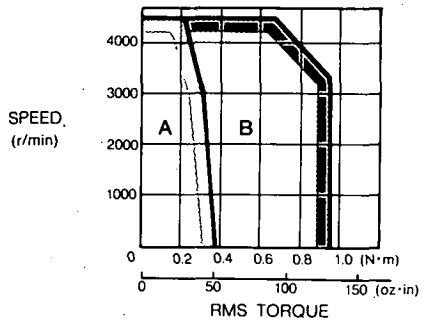
Typical at 20°C (Armature Winding Temp.)
[A]: Continuous Duty Zone
[B]: Intermittent Duty Zone

Note : Values in the intermittent duty zone are typical values when Servopack power supply voltage is 200 VAC. When it is less than 200 VAC, output characteristics may be reduced even if the values are within in the allowable variation range.

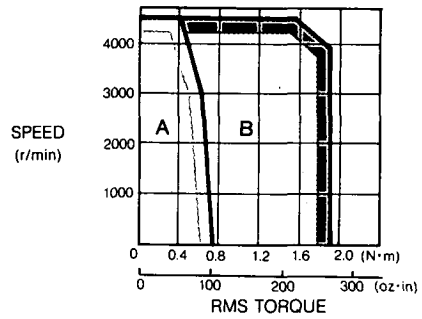
USAREM-A5C



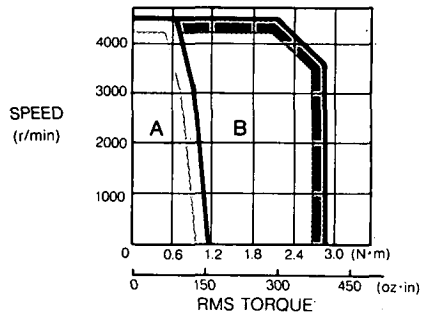
USAREM-01C



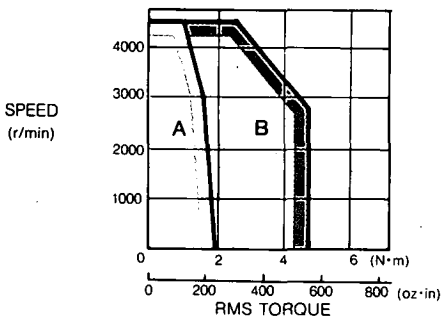
USAREM-02C



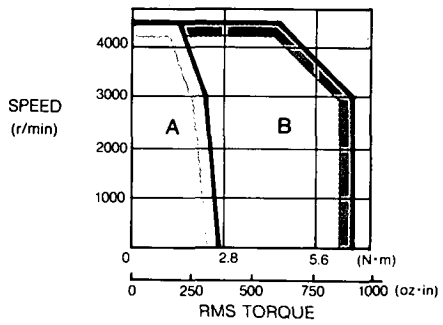
USAREM-03C



USAREM-05C



USAREM-07C



3.1.7 R Series (For 100V)

(1) Ratings

Time Rating: Continuous
Insulation: Class B
Isolation Voltage: 1000 VAC, one minute
Insulation Resistance: 500 VDC, 10MΩ or more
Enclosure: Totally-enclosed, self-cooled;
IP44 (exclusive of shaft opening)
Ambient Temperature: 0 to + 40℃
Storage Temperature: −20 to + 60℃
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

USAREM- ☐☐ DS2 : With absolute encoder (8192 pulses/rev)

Table 3.7 Ratings and Specifications of R Series AC Servomotors (For 100 V)

Item \ Motor Type USAREM-		A5D ☐ 2	01D ☐ 2	02D ☐ 2	03D ☐ 2	05D ☐ 2
Rated Output*	W (HP)	50 (0.07)	100 (0.13)	200 (0.27)	300 (0.40)	500 (0.67)
Rated Torque*	N·m (oz·in)	0.159 (22.5)	0.318 (45)	0.637 (90)	0.955 (135)	1.59 (225)
Continuous Max. Torque*	N·m (oz·in)	0.19 (26.9)	0.382 (54.2)	0.765 (108.3)	1.15 (162.5)	1.90 (269.4)
Peak Torque*	N·m (oz·in)	0.476 (67.5)	0.955 (135)	1.91 (270)	2.86 (405)	4.76 (675)
Rated Current*	A	1.2	1.7	2.9	3.6	5.5
Rated Speed*	r/min	3000				
Max. Speed*	r/min	4000				
Torque Constant	N·m/A (oz·in/A)	0.136 (19.3)	0.198 (28.1)	0.235 (33.3)	0.284 (40.3)	0.308 (43.6)
Moment of Motor Inertia J_M ($=GD^2_M/4$)	kg·cm² (oz·in·s²×10⁻³)	0.076 (1.08)	0.125 (1.78)	0.507 (7.18)	0.766 (10.9)	2.72 (38.6)
Power Rate*	kW/s	3.30	8.09	8.01	11.9	9.26
Inertia Time Constant	ms	4.2	3.2	3.0	2.5	2.7
Inductive Time Constant	ms	1.4	1.7	4.0	4.6	9.6

* Typical value at armature winding temperature of 75℃, in combination with Servopack.
Other values at 20℃

(3) Speed-torque characteristics

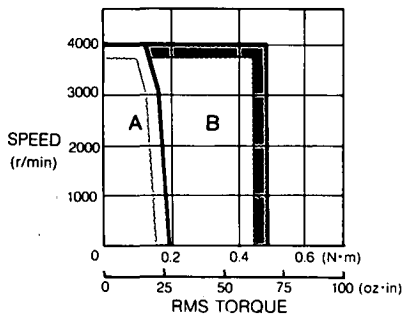
Typical at 20°C (Armature Winding Temp.)

A: Continuous Duty Zone

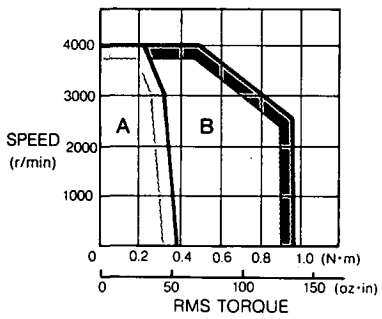
B: Intermittent Duty Zone

Note: Values in the intermittent duty zone are typical values when Servopack power supply voltage is 100 VAC. When it is less than 100 VAC, output characteristics may be reduced even if the values are within in the allowable variation range.

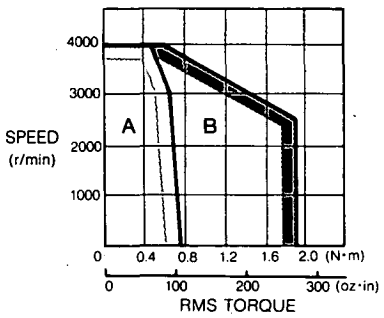
USAREM-A5D



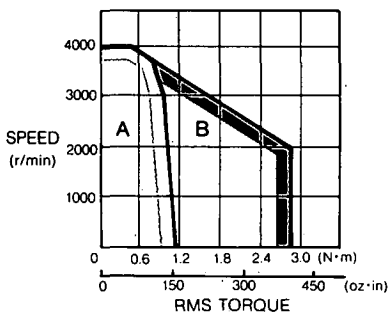
USAREM-01D



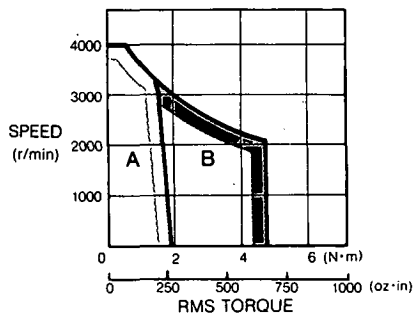
USAREM-02D



USAREM-03D



USAREM-05D



3.1.8 P Series

(1) Ratings

Time Rating: Continuous
Insulation: Class B
Isolation Voltage: 1000 VAC, one minute
Insulation Resistance: 500 VDC, 10MΩ or more
Enclosure: Totally-enclosed, self-cooled;
IP55 (exclusive of shaft opening)
Ambient Temperature: 0 to + 40℃
Storage Temperature: −20 to + 60℃
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

USAPEM- ☐☐☐ CW2 : With absolute encoder (1024 pulses/rev)

Table 3.8 Ratings and Specifications of P Series AC Servomotors

Item \ Motor Type USAPEM-		01C ☐ 2	02C ☐ 2	03C ☐ 2	05C ☐ 2	07C ☐ 2
Rated Output*	W (HP)	100 (0.13)	200 (0.27)	300 (0.40)	500 (0.67)	750 (1.0)
Rated Torque*	N·m (oz·in)	0.32 (45)	0.64 (90)	0.95 (135)	1.59 (225)	2.39 (339)
Continuous Max. Torque*	N·m (oz·in)	0.32 (45)	0.64 (90)	0.95 (135)	1.59 (225)	2.39 (339)
Peak Torque*	N·m (oz·in)	0.96 (136)	1.91 (270)	2.86 (405)	4.76 (675)	7.06 (1000)
Rated Current*	Arms	1.0	2.0	2.7	3.3	5.7
Rated Speed*	r/min	3000				
Max. Speed*	r/min	4500				
Torque Constant	N·m/A (oz·in/A)	0.35 (49.6)	0.34 (47.8)	0.37 (52.8)	0.51 (72.5)	0.44 (62.6)
Moment of Motor Inertia J_M ($=GD^2_M/4$)	kg·cm² (oz·in·s²×10⁻³)	0.39 (5.55)	0.64 (9.03)	0.98 (13.9)	4.78 (67.8)	6.57 (93.0)
Power Rate*	kW/s	2.59	6.37	9.30	5.27	8.71
Inertia Time Constant	ms	5.3	2.8	2.2	4.9	3.3
Inductive Time Constant	ms	4.7	5.8	6.4	10.0	14.0

* Typical value at armature winding temperature of 75℃, in combination with Sevopack. Other values at 20℃.

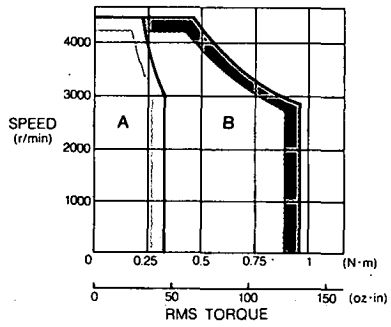
(3) Speed-torque characteristics

Typical at 20°C (Armature Winding Temp.)
[A]: Continuous Duty Zone
[B]: Intermittent Duty Zone

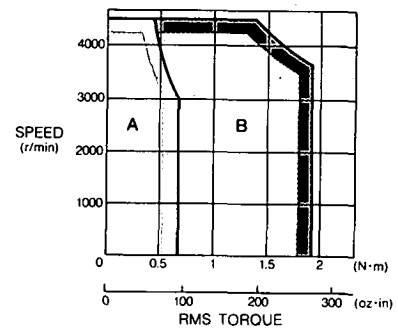
Note: Values in the intermittent duty zone are typical values when Servopack power supply voltage is 200 VAC. When it is less than 200 VAC, output characteristics may be reduced even if the values are with in the allowable variation range.

3

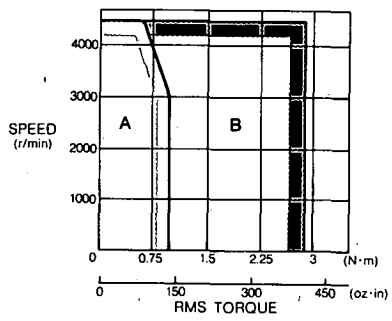
Type USAPEM-01C



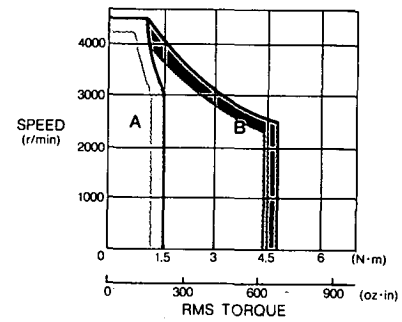
Type USAPEM-02C



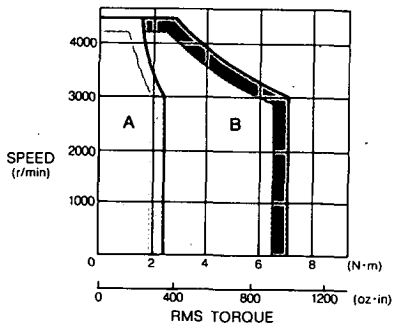
Type USAPEM-03C



Type USAPEM-05C



Type USAPEM-07C



3.2 MECHANICAL CHARACTERISTICS

3.2.1 Mechanical Strength

AC servomotors withstand to 300% (350% only for D series) of the rated torque at output shaft.

3.2.2 Allowable Radial Load and Thrust Load

Table 3.9 shows allowable loads according to AC servomotor types.

Table 3.9 Allowable Radial Load and Thrust Load

• M Series

Motor Type USAM □ D-	Allowable Radial Load* N(lb)	Allowable Thrust Load N(lb)
03□□1	490(110)	98(22) †
06□□1		
09B □ 2	686(154)	343(77)
12B □ 2	1470(330)	490(110)
20B □ 2		
30B □ 2		
44B □ 2	1764(397)	588(132)
60B □ 2		

• F Series

Motor Type USAFED-	Allowable Radial Load* N(lb)	Allowable Thrust Load N(lb)
02□□1	147(33)	49(11) †
03□□1		
05□□1	490(110)	98(22) †
09□□1	686(154)	343(77)
13C □ 2		
20C □ 2		
30C □ 2	1470(331)	490(110)
44C □ 2		

• G Series

Motor Type USAGED-	Allowable Radial Load* N(lb)	Allowable Thrust Load N(lb)
02□□1	147(33)	49(11) †
03□□1		
05□□1	490(110)	98(22) †
09□□1	686(154)	343(77)
13A □ 2		
20A □ 2		
30A □ 2	1470(331)	490(110)
44A □ 2		

• D Series

Motor Type USADED-	Allowable Radial Load* N(lb)	Allowable Thrust Load N(lb)
05E □	686(154)	343(77)
10E □		
15E □	1176(265)	490(110)
22E □		
37E □		

• S Series

Motor Type USASEM-	Allowable Radial Load* N(lb)	Allowable Thrust Load N(lb)
02A □	78.4(18)	39.2(9)
03A □	245(55)	98(22)
05A □		
08A □	392(88)	147(33)
15A □	490(110)	
30A □	686(154)	196(44)

• R Series

Motor Type USAREM-	Allowable Radial Load* N(lb)	Allowable Thrust Load N(lb)
A5 □□2	78.4(18)	39.2(9)
01 □□2		
02 □□2	245(55)	98(22)
03 □□2		
05 □□2	392(88)	147(33)
07 □□2		

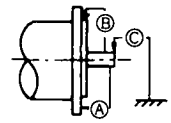
• P Series

Motor Type USAPEM-	Allowable Radial Load* N(lb)	Allowable Thrust Load N(lb)
01C □ 2	88.2(20)	39.2(9)
02C □ 2	147(33)	58.8(13)
03C □ 2	196(44)	
05C □ 2	343(77)	98(22)
07C □ 2	441(99)	127.4(29)

* 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 3.10 Mechanical Specifications in mm

Accuracy(T. I. R.)*1		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0.04 (0.06)*2	
Flange diameter concentric to shaft Ⓑ	0.04	
Shaft run out Ⓒ	0.02 (0.04)*3	

*1 T. I. R. (Total Indicator Reading)
*2 Accuracy for motor types USADED-15E, -22E, and -37E.
*3 Accuracy for motor types USAMED-44B □ 2 and USAMKD-60B □ 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 Shock Resistance

When mounted horizontally and exposed to vertical shock impulses, the motor can withstand up to two incidents with shock acceleration of 490 m/s²(50G) (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 15 μm or below (Fig. 3. 14).

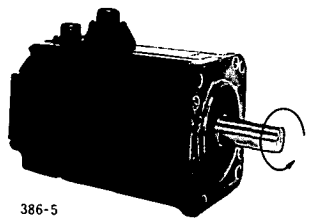


Fig. 3.11 Forward Rotation Direction

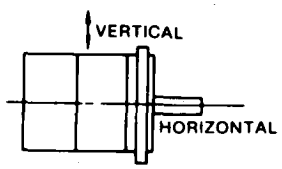


Fig. 3.12 Impact Resistance

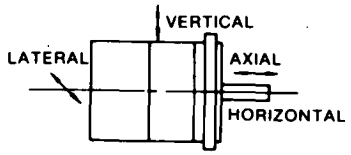


Fig. 3.13 Vibration Resistance

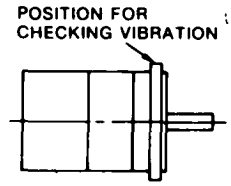


Fig. 3.14 Vibration Checking

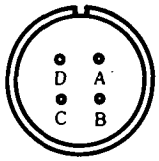
3.3 RECEPTACLES

3.3.1 *Connector Specifications*

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

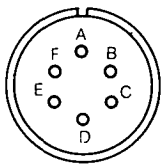
(a) Motor receptacle

• M, F, G, R series



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

Fan terminal
connector specifications
Type USAMKD-60B□2

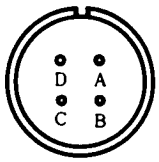


A, B	Fan motor
C	—
D, E	Alarm terminal
F	—

• S series
Type USASEM-02

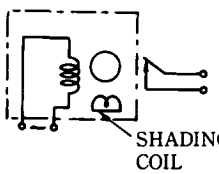
Color of Lead	Applicable
Red	Phase U
White	Phase V
Blue	Phase W
Green	Frame Ground

Type USASEM-03A to 30A



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

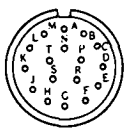
Fan motor connection



Power supply:single-phase
200/200/220V, 50/60/60Hz
Alarm contact :
OFF at fan rotation normal
ON at 1800±200r/min or less
ON for 3 seconds after starting
Contact capacity :
Resistance load max 110V 0.3A

(b) Detector receptacle

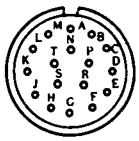
• Incremental encoder



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	-	—

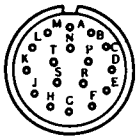
• Absolute encoder

(8192P/R)



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)

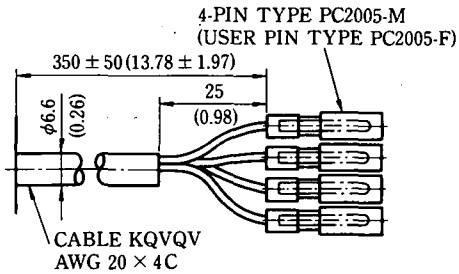
(1024P/R)



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

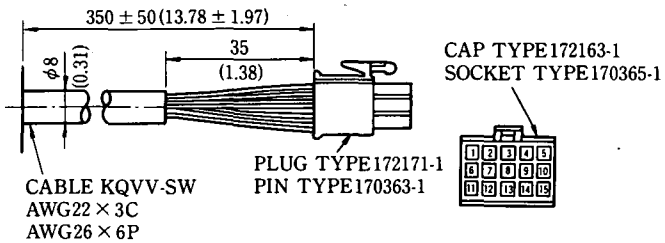
(2) Without brake (P series)

(a) Motor side



Phase U	Red
Phase V	White
Phase W	Blue
Frame Ground	Green

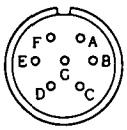
(b) Detector side (absolute encoder)



1	Channel A output	Blue	9	Frame ground	Green/Yellow
2	Channel $\overline{A}$ output	White/Blue	10	Channel S output	Purple
3	Channel B output	Yellow	11	Channel $\overline{S}$ output	White/Purple
4	Channel $\overline{B}$ output	White/Yellow	12	Capacitor reset	Grey
5	Channel Z output	Green	13	Reset	White/Grey
6	Channel $\overline{Z}$ output	White/Green	14	0V(battery)	White/Orange
7	0V	Black	15	3.6V(battery)	Orange
8	5VDC	Red	–	–	–

(3)With brake

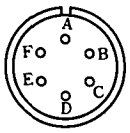
• M, F (except models 02 and 03), G, D Series



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

Notes:
1. D series is provided with brake as standard.
2. For D series motor without brake, pins E and F are not used.

• F Series (models 02 and 03)



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

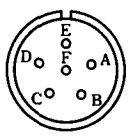
• S, R Series

USASEM-02A

Color of Lead	Applicable
Red	Phase U
White	Phase V
Blue	Phase W
Black	Brake
Black	Brake
Green	Frame Ground

USASEM -08A to -30A

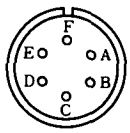
USAREM -05C, -05D, -07C



A	Phase U
B	Phase V
C	Phase W
D, E	Brake terminal
F	Frame Ground

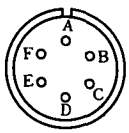
USASEM -03A, -05A

USAREM -02C, -02D, -03C, -03D



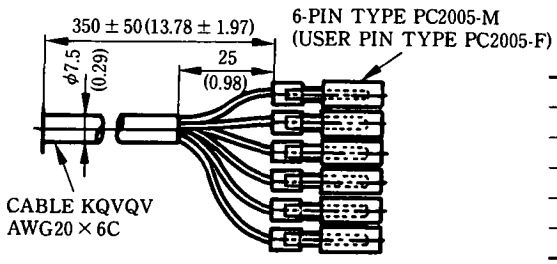
A	Phase U
B	Phase V
C	Phase W
D, E	Brake terminal
F	Frame Ground

USAREM -A5C, -A5D, -01C, -01D



A	Phase U
B	Phase V
C	Phase W
D, E	Brake terminal
F	Frame Ground

• P Series



Phase U	Red
Phase V	White
Phase W	Blue
Frame Ground	Green
Brake terminal	Black
Brake terminal	Black

NOTE

3.3.2 List of Standard Combination

Table 3.11 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
03 □□□ 1	MS3102A 18-10P	MS3108B 18-10S	MS3106B 18-10S	MS3057 -10A	MS3102A 20-29P	MS3108B 20-29S	MS3106B 20-29S	MS3057 -12A
06 □□□ 1								
09B □ 2								
12B □ 2	MS3102A 22-22P	MS3108B 22-22S	MS3106B 22-22S	MS3057 -12A				
20B □ 2								
30B □ 2								
44B □ 2	MS3102A 32-17P	MS3108B 32-17S	MS3106B 32-17S	MS3057 -20A				
USAMKD-60B □ 2*								

Table 3.12 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
02 □□□ 1	MS3102A 14S-2P	MS3108B 14S-2S	MS3106B 14S-2S	MS3057 -6A	MS3102A 14S-29P	MS3108B 20-29S	MS3106B 20-29S	MS3057 -12A
03 □□□ 1								
05 □□□ 1	MS3102A 18-10P	MS3108B 18-10S	MS3106B 18-10S	MS3057 -10A	MS3102A 20-29P			
09 □□□ 1								
13C □ 2								
20C □ 2	MS3102A 22-22P	MS3108B 22-22S	MS3106B 22-22S	MS3057 -12A	MS3102A 20-29P			
30C □ 2								
44C □ 2								

Table 3.13 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
02 □□□ 1	MS3102A 14S-2P	MS3108A 14S-2S	MS3106B 14S-2S	MS3057 -6A	MS3102A 20-29P	MS3108B 20-29P	MS3106B 20-29S	MS3057 -12A
03 □□□ 1								
05 □□□ 1	MS3102A 18-10P	MS3108B 18-10S	MS3106B 18-10S	MS3057 -10A				
09 □□□ 1								
13A □ 2								
20A □ 2	MS3102A 22-22P	MS3108B 22-22S	MS3106B 22-22S	MS3057 -12A				
30A □ 2								
44A □ 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
	–	–	–	–

* Cooling fan required:
Receptacle type
MS3102A14S-6B
Plug type
MS3108B14S-6S
Cable clamp type
MS3057-6A

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

	Holding Brake			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp
	MS3102A 14S-6P	MS3108B 14S-6S	MS3106B 14S-6S	MS3057 -6A
	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 14S-6P	MS3108B 14S-6S	MS3106B 14S-6S	MS3057 -6A
	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.

Table 3.14 D Series: Characteristics of AC Servomotor, Detector, and Holding Brake for Standard Combination

AC Servomotor Type USADED-	Holding Brake				Detector			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
05E □	MS3102A 20-15P	MS3108B 20-15S	MS3106B 20-15S	MS3057 -12A	MS3102A 20-29P	MS3108B 20-29S	MS3106B 20-29S	MS3057 -12A
10E □								
15E □	MS3102A 24-10P	MS3108B 24-10S	MS3106B 24-10S	MS3057 -16A				
22E □								
37E □								

Table 3.15 S Series: Characteristics of AC Servomotor, Detector and Holding Brake (Option) for Standard Combination

AC Servomotor Type USASEM-	AC Servomotor				Detector			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
02A □	Since lead outlet method differs. refer to the data separately.							
03A □	MS3102A 18-10P	MS3108B 18-10S	MS3106B 18-10S	MS3057 -10A	MS3102A 20-29P	MS3108B 20-29S	MS3106B 20-29S	MS3057 -12A
05A □								
08A □	MS3102A 20-4P	MS3108B 20-4S	MS3106B 20-4S	MS3057 -12A				
15A □								
30A □								

Note: There connectors made by DAI-ICHI DENSHI KOGYO CO.. LTD.

Table 3.16 R Series: Characteristics of AC Servomotor, Detector, and Holding Brake (Option) for Standard Combination

AC Servomotor Type USAREM-	AC Servomotor			Detector			Holding Brake		
	Receptacle Type	L-type Plug	Cable Clamp	Receptacle Type	L-type Plug	Cable Clamp	Receptacle Type	L-type Plug	Cable Clamp
A5C □ 2	MS3101A 14S-2P	MS3106B* 14S-2S	MS3057 -6A	MS3101A 20-29A	MS3106B 20-29S*	MS3057 -12A	MS3101A 14S-6P	MS3106B 14S-6S*	MS3057 -6A
01C □ 2									
02C □ 2	MS3102A 18-10P	MS3108B 18-10S	MS3057 -10A	MS3102A 20-29P	MS3108B 20-29S		MS3102A 18-12P	MS3108B 18-12S	MS3057 -10A
03C □ 2									
05C □ 2	MS3102A 20-4P	MS3108B 20-4S	MS3057 -12A				MS3102A 20-17P	MS3108B 20-17S	MS3057 -12A
07C □ 2									
A5D □ 2	MS3101A 14S-2P	MS3106B 14S-2S*	MS3057 -6A	MS3101A 20-29A	MS3106B 20-29S*	ME3057 -12A	MS3101A 14S-6P	MS3106B 14S-6S*	MS3057 -6A
01D □ 2									
02D □ 2	MS3102A 18-10P	MS3108B 18-10S	MS3057 -10A	MS3102A 20-29P	MS3108B 20-29S		MS3102A 18-12P	MS3108B 18-12S	MS3057 -10A
03D □ 2									
05D □ 2	MS3102A 20-4P	MS3108B 20-4S	MS3057 -12A				MS3102A 20-17P	MS3108B 20-17S	MS3057 -12A

* Straight Plug
Note: These connectors are made by DAI-ICHI DENSHI KOGYO Co.. Ltd.

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

	Holding Brake			
	Receptacle	L-type Plug	Straight plug	Cable Clamp
	MS3102A 18-12P	MS3108B 18-12S	—	MS3057 -10A
	MS3102A 20-17P	MS3108B 20-17S	—	MS3057 -12A

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

Table 3.17 P Series:Characteristics of AC Servomotor, Detector, and Holding Brake for Standard Combination

AC Servomotor Type USAPEM-	AC Servomotor	Detector		Holding Brake
	Pin Terminal	Connector (MATE-N-LOCK Conversal)		Pin Terminal
		Plug	Pin	
01C □ 2	PC2005-M	172171-1	170363-1	PC2005-M
02C □ 2	PC2005-M	172171-1	170363-1	PC2005-M
03C □ 2	PC2005-M	172171-1	170363-1	PC2005-M
05C □ 2	PC2005-M	172171-1	170363-1	PC2005-M
07C □ 2	PC2005-M	172171-1	170363-1	PC2005-M

Note: The type of connectors prepared by users are shown in the table below.

AC Servomotor	user pin terminal (common for types with brake and without brake) PC 2005F appropriate tool NA-3 head N3-5 manual tool NH-5	NICHIFU TERMINAL INDUSTRIAL CO., LTD.
Detector	user cap 172163-1 socket 170365-1 manual tool 724649-1	AMP (Japan) 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□□				A5BAB12	01BAB12	02BAB12	03BAB12	05BAB12	10BAB	15BAB
Max. Applicable Motor Capacity kW (HP)				0.05 (0.07)	0.1 (0.13)	0.2 (0.27)	0.3 (0.40)	0.5 (0.67)	1.0 (1.3)	1.5 (2.0)
Basic Specifications	Input Power Supply	Main	No. of Phases	Single-phase AC					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.)			Rack-mounted A5 to 05: 100W × 250H × 250D (3.94W × 9.84H × 9.84D) 10 and 15: 150W × 250H × 250D (5.91W × 9.84H × 9.84D)						
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			A5, 01: not provided, 02 to 15: 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, MCCB, PG, UV, CPU, ABS, POS, O-PH, RWY, RG, HARD, OF, PRM (See Table 4.2)						
	Display			Main circuit power supply: yellow LED, control power supply: green LED, alarm: red LED Alarm contents: 7-segment						
	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) (By personal computer)						
Absolute Encoder Battery				Provided on the Servopack panel						
Applicable Inertia J_L				5 times or less of rotor inertia J_M (motor GD^2) for M, F, G, D, S or P series: 10 times or less for R series						

	A5BAB11	01BAB11	02BAB11	03BAB11	05BAB11	03BB	05BB	10BB	15BB	20BB	30BB	44BB	60BB
	0.05 (0.07)	0.1 (0.13)	0.2 (0.27)	0.3 (0.40)	0.5 (0.67)	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)	6.0 (8.2)
	Single-phase AC					3-phase AC							
	100 to 115V +10 to -15% 50/60Hz					200 to 230V +10 to -15% 50/60Hz							
	Single-phase 100 to 115VAC +10 to -15% 50/60Hz					Single-phase 200 to 230VAC +10 to -15% 50/60Hz							
	Full-wave rectifying, transistorized PWM control, sine-wave drives												
	Absolute encoder (8192 or 1024pulses/rev), incremental encoder (8192, 2500, or 2048pulses/rev)												
	0 to +55℃												
	-20 to +85℃												
	90% or less (non-condensing)												
	4.9m/s²(0.5G)/19.6m/s²(2G)												
	Rack-mounted A5 to 03: 100W × 250H × 250D (3.94W × 9.84H × 9.84D) 05: 150W × 250H × 250D (5.91W × 9.84H × 9.84D)					Base-mounted 03 to 15 : 150W × 350H × 220D (5.91W × 13.78H × 8.66D) 20 and 30: 150W × 450H × 220D (5.91W × 17.72H × 8.66D) 44: 150W × 450H × 300D (5.91W × 17.72H × 11.81D) 60: 180W × 450H × 325D (7.09W × 17.72H × 12.80D)							
	Constant point positioning by station No. command (contact data)												
	Position command: BCD (up to 3-digit 000 to 999) or BIN (up to 12-bit 0 to 4095)												
	Both absolute and incremental commands available												
	Positioning by DG-SW command data												
	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												
	Both absolute and incremental commands available												
	Positioning by serial communication												
	RS422, asynchronous, communication speed 9.6/4.8/2.4/1.2 kBaud												
	Both absolute and incremental commands available												
	Positioning by position No. and speed No. command (contact data)												
	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)												
	Only absolute value command available												
	Positioning by pulse train (line PG or pulse train 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)												
	Only incremental command available												
	Operated at main power OFF, servo alarm, servo OFF												
	Output signal for turning brake power supply ON/OFF (brake timing is set by parameter.)												
	A5: not provided	01 to 05: built-in (regenerating resistor included)				Built-in (regenerating resistor included). Note that regenerating resistor provided separately for 60BB.							
	By soft limit and hard LS: internal command stop at operation												
	Current limit value switching by constant input Current limit value: Common in FWD/REV, FWD only, REV only (parameter setting)												
	OV, OC, OL, OS, MCCB, PG, UV, CPU, ABS, POS, RWY, RG, HARD, OF, PRM (See Table 4.2)					OV, OC, OL, OS, MCCB, PG, UV, CPU, ABS, POS, O-PH, RWY, PG, HARD, OF, PRM, OH (See Table 4.2)							
	Main circuit power supply: yellow LED, control power supply: green LED, alarm: red LED Alarm contents: 7-segment					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							
	Serial communication (position, speed, torque, etc.) Speed command, torque command or speed output in analog value												
	Linear accel/decel, exponential accel/decel, A/B function, pulse multiplication, soft OT, backlash compensation, COIN NEAR, motor・line PG switching (incremental operation), etc.												
	Serial 1 port and digital 24V system× 20 (Max.)												
	Serial 1 port and digital 24V system× 18 (Max.), 5V system 2 circuits (PG output)												
	Serial communication (RS422, asynchronous, communication speed (9.6/4.8/2.4/1.2 kBaud) (By personal computer)					Serial communication (RS422, asynchronous, communication speed 9.6/4.8/2.4/1.2 kBaud) or selection by AC Servopack switch							
	Provided on the Servopack panel					Provided on Servopack board							
	5 times or less of rotor inertia J_M (motor GD²) for M, F, G, D, S or P series; 10 times or less for R series												

4.2 INTERNAL BLOCK DIAGRAM

• Servopack Type CACR-HRA5BAB□□ to -05BAB□□

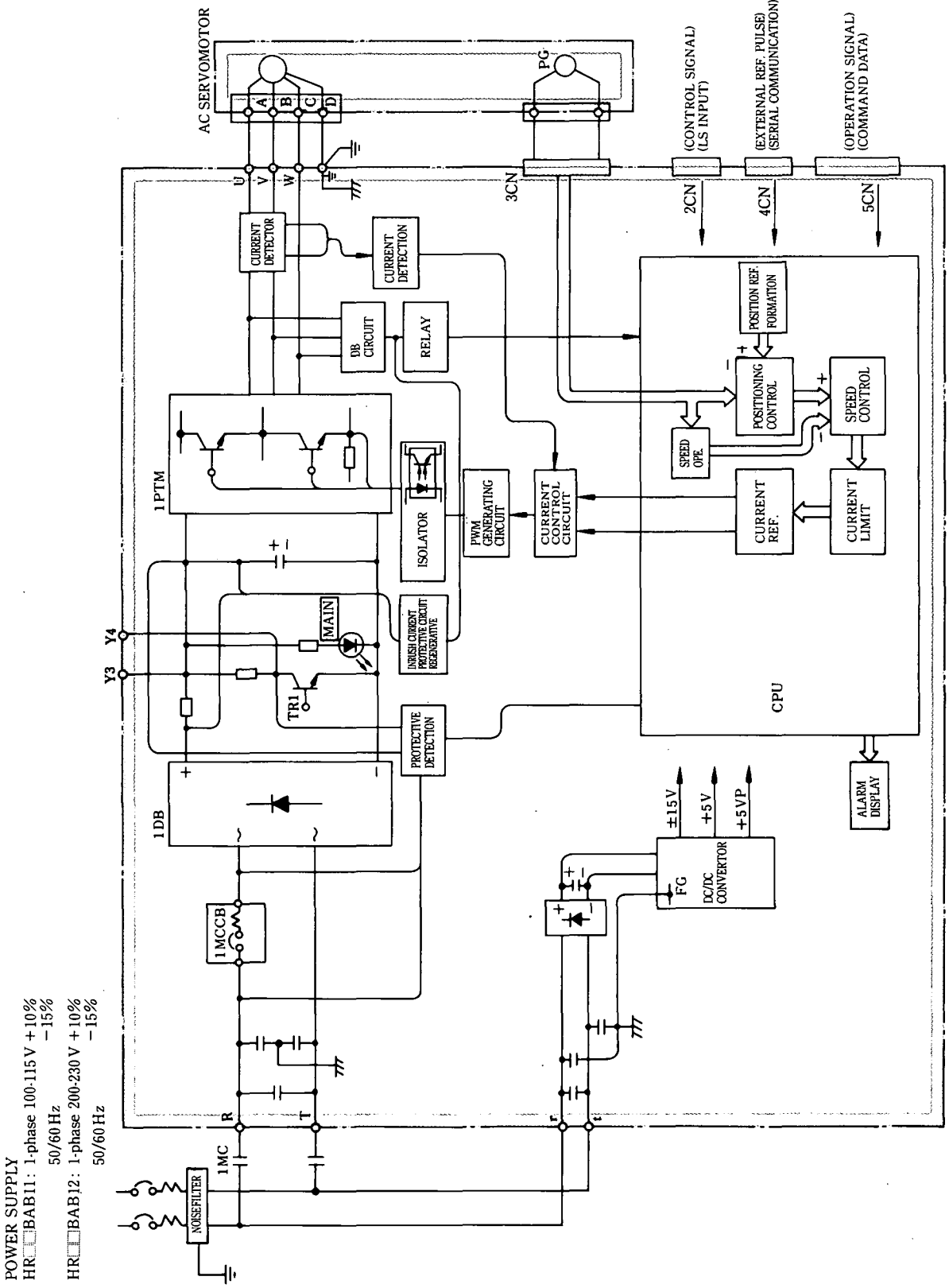


Fig. 4.1 Internal Block Diagram of Servopack Type CACR-HRA5BAB□□ to -05BAB□□
(Regenerative transistor TR1 not provided for A5BAB11, A5BAB12 or 01BAB12)

• Servopack Type CACR-HR10BAB, -15BAB

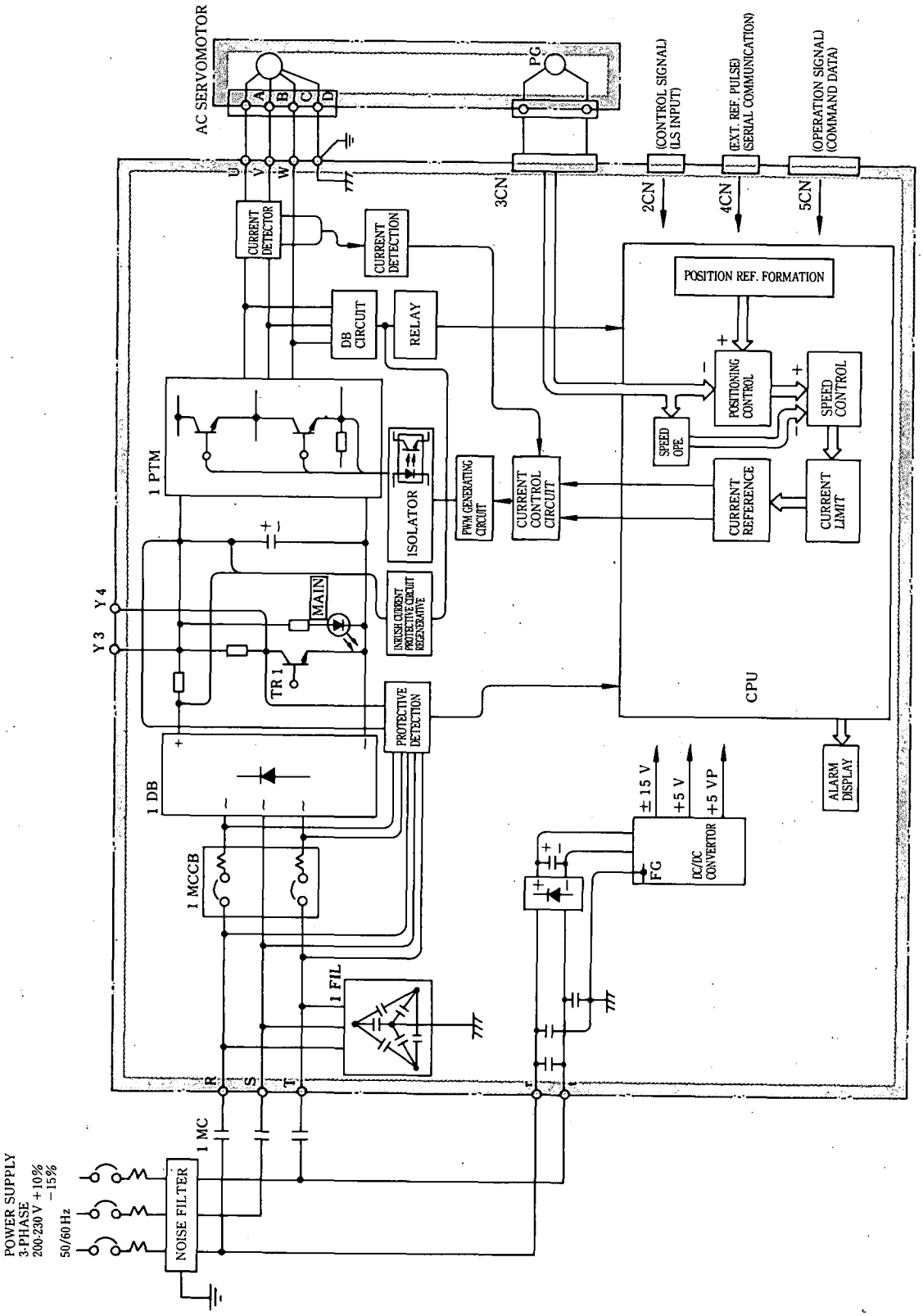


Fig. 4.2 Internal Block Diagram Servopack Type CACR-HR10BAB, -15BAB

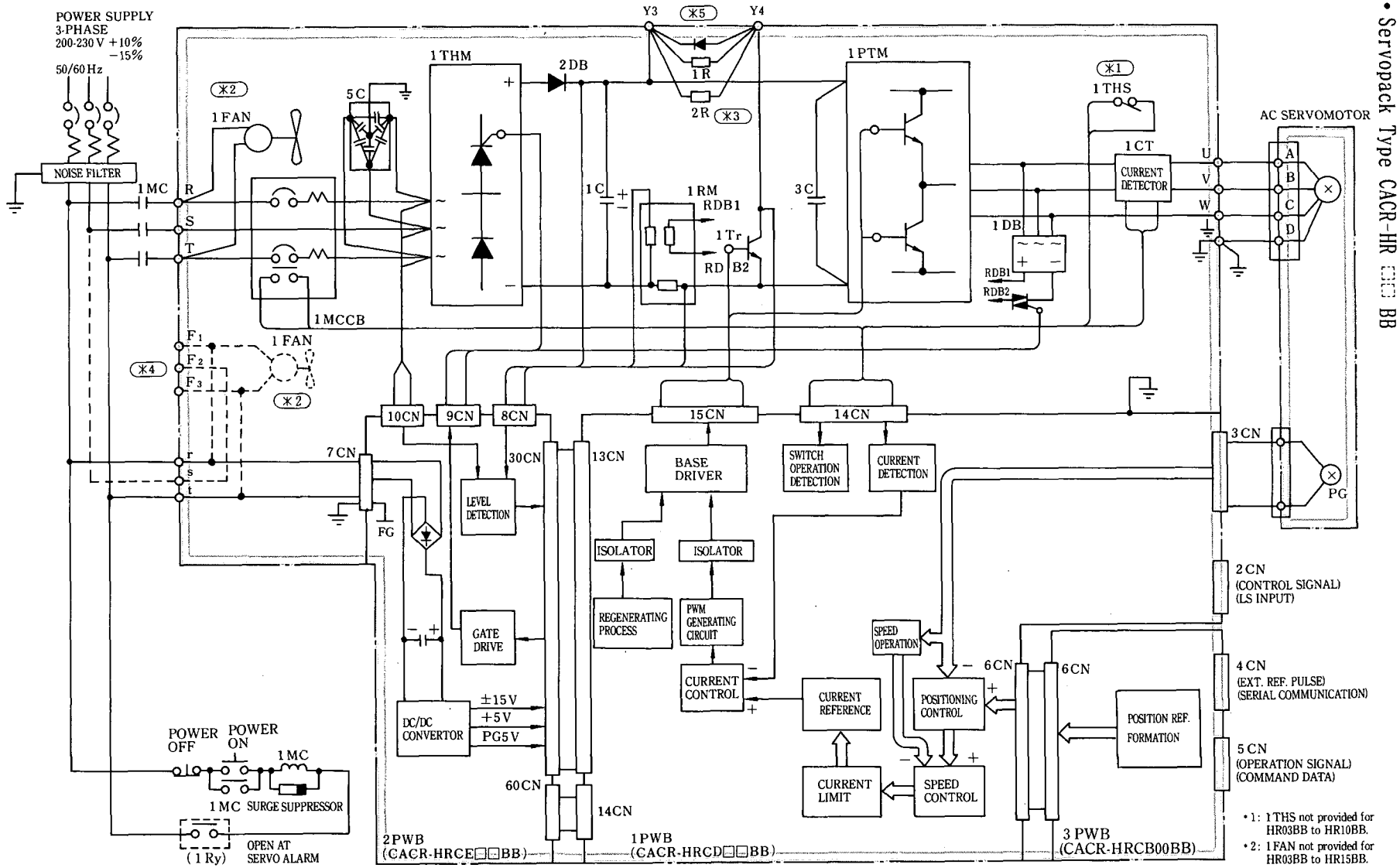


Fig. 4.3 Internal Block Diagram Servopack Type CACR-HR03BB to HR60BB

• 1: 1THS not provided for HR03BB to HR10BB.
• 2: 1FAN not provided for HR03BB to HR15BB.
1FAN provided for control power supply of type HR60BB
• 3: 2R not provided for HR03BB to HR15BB.
• 4: Added only for HR60BB.
(for connection of motor cooling fan)
• 5: 1R and 2R not provided for HR60BB.
External resistor is connected between Y3 and Y4.

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 Trouble Detecting Functions

Fault	Detection
Overcurrent (OC)	Overcurrent flow in the main circuit (at 1.2 times or more of inst. max. current)
Circuit Protector Trip (MCCB)	Circuit protector tripped
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 85℃ min.) (only for type HR [ ] BB)
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)	
Abso 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.

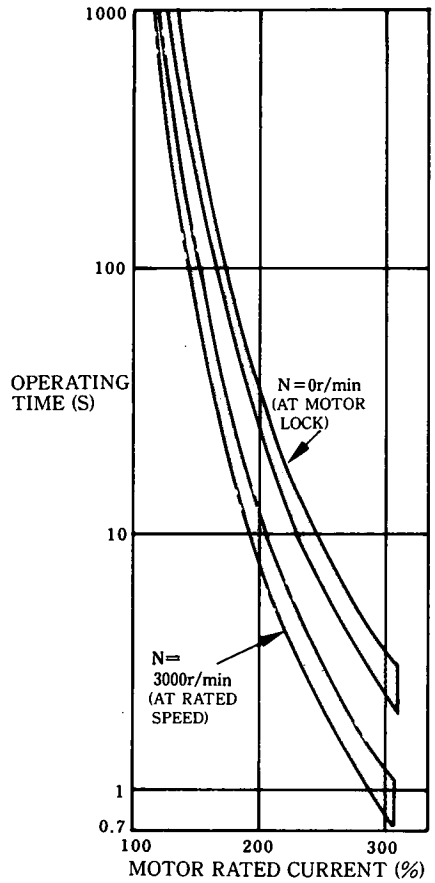


Fig. 4.4 Overload Characterisitics

(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.

CAUTION

When an alarm signal cuts off only the main circuit, turn off servo ON $\overline{(SVON)}$ signal before supplying power to the main circuit to resume the operation.

(6) Resetting servo alarm

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

If [?.] 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, D, S, P series) or ten times (R series) the inertia of the applicable AC servomoter. 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 values 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 sxceeds $\frac{60}{m+1}$ 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 200 V* by using a power transformer. Table 5.13 shows the transformer selection. Connection should be made so that the power is supplied and cut at the primary side of the transformer.

* 100V for Servopack type HR □□□ BAB11.

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
HRA5BAB12	0.7	20	–	30	50
HR01BAB12	1.0	25	–		55
HR02BAB12	2.0	30	6		66
HR03BAB12	2.7	35	6		71
HR05BAB12	3.6	55	6		91
HR10BAB	7.6	70	20		120
HR15BAB	11.7	80	20		130
HR03BB	3.0	20	10	60	90
HR05BB	4.2	40	10		110
HR10BB	7.6	70	20		150
HR15BB	11.7	80	20		160
HR20BB	18.8	100	40		200
HR30BB	26.0	160	80		300
HR44BB	33.0	210	100		370
HR60BB	45.0	300	120		480
HRA5BAB11	1.2	20	–	30	50
HR01BAB11	1.7	25	6		61
HR02BAB11	2.9	40	6		76
HR03BAB11	3.6	50	6		86
HR05BAB11	5.5	45	15		90

* 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

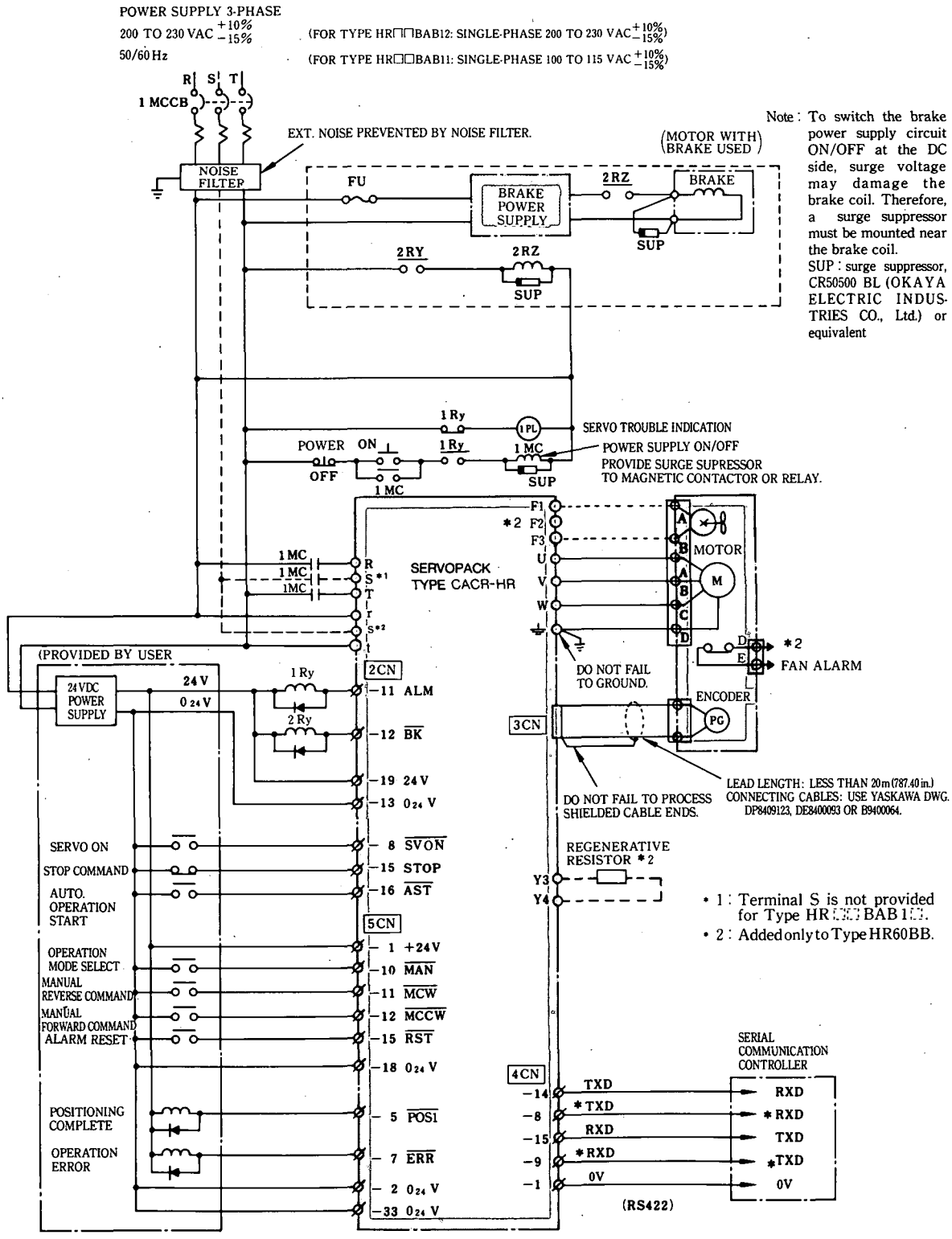
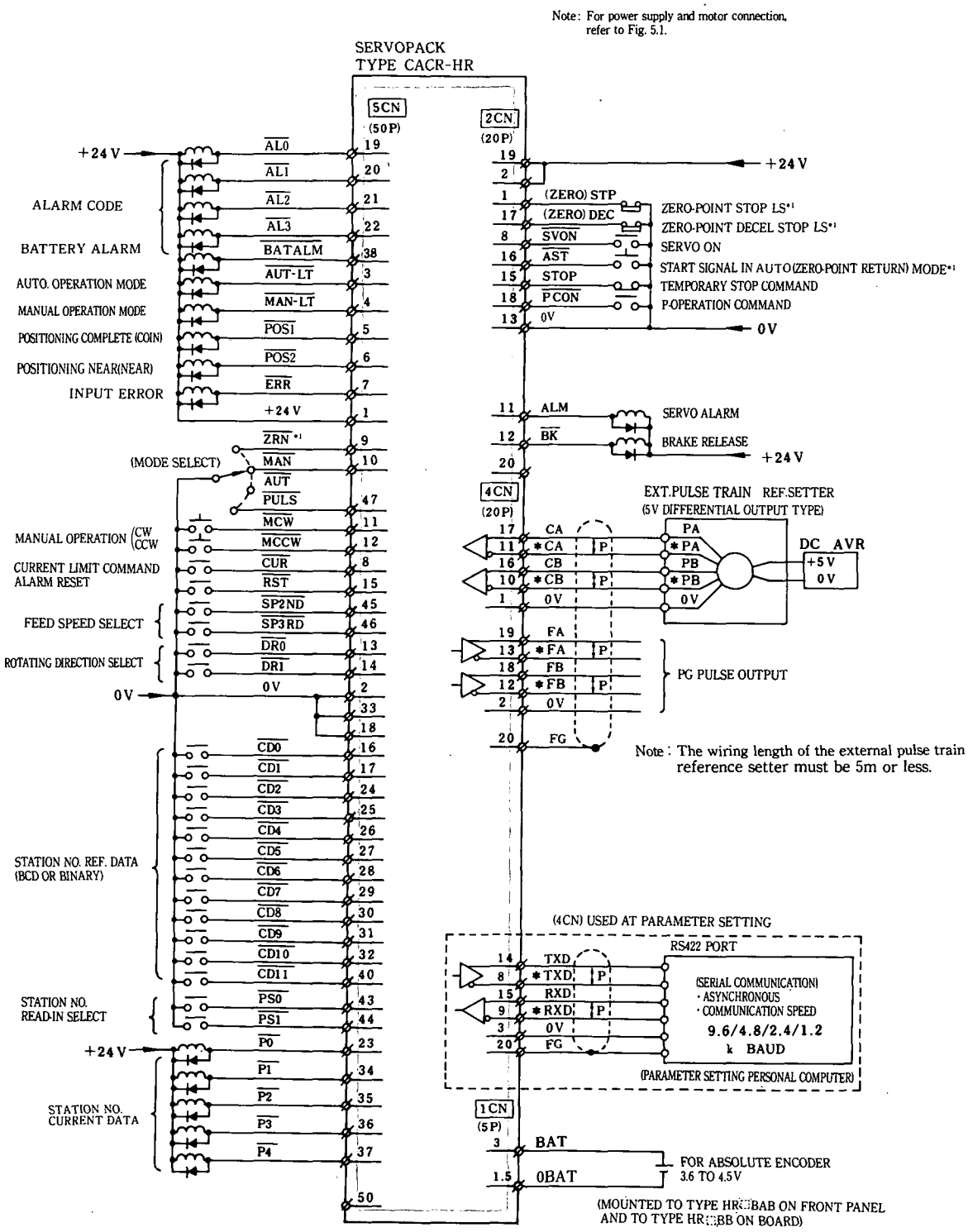


Fig. 5.1 Basic Connection

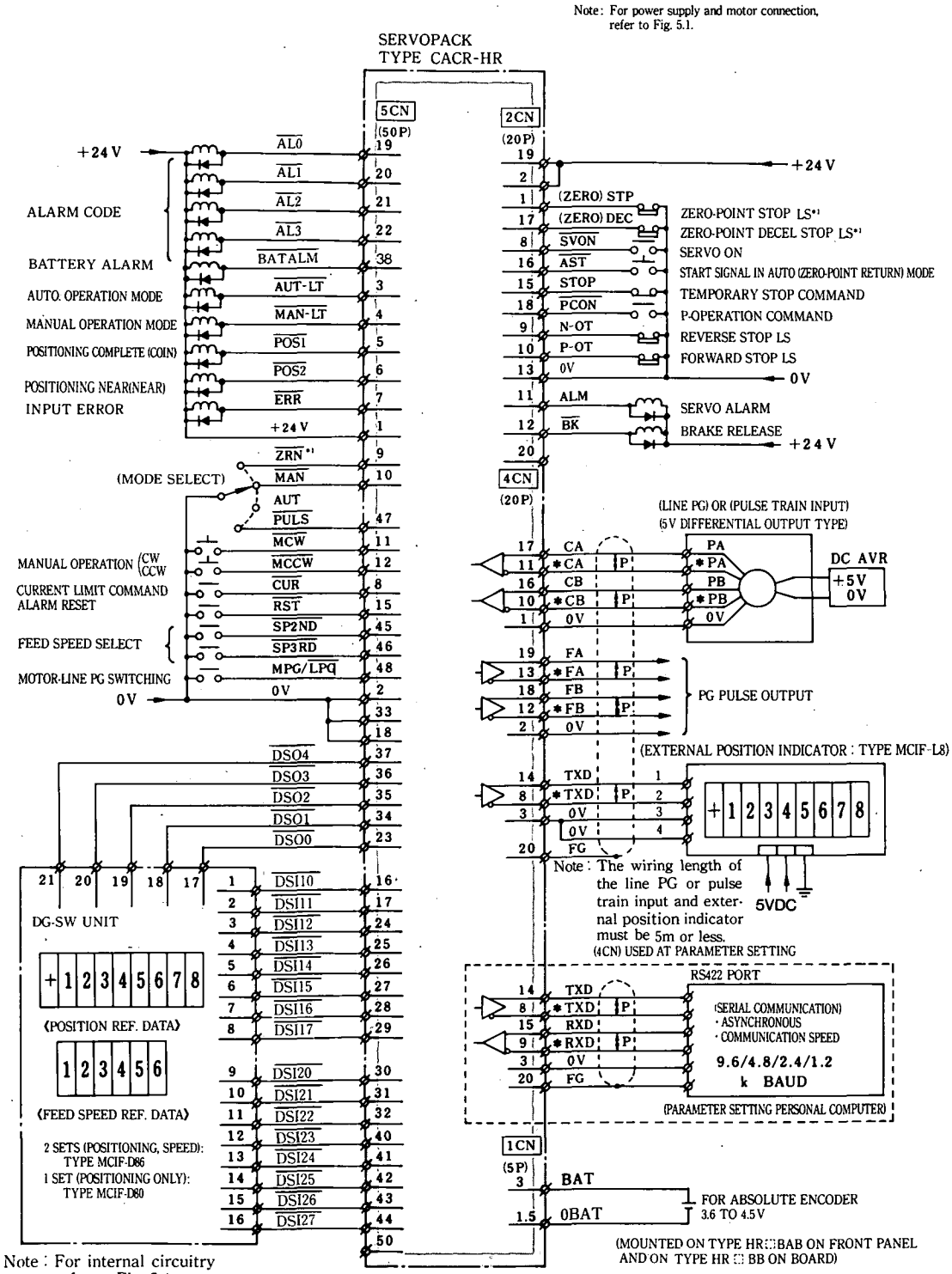
5.1.2 Typical Connection at Positioning by Station No.



*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



Note: For internal circuitry refer to Fig. 5.4. Additionally, the wiring length of the DG-SW unit must be 5m or less.

*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

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

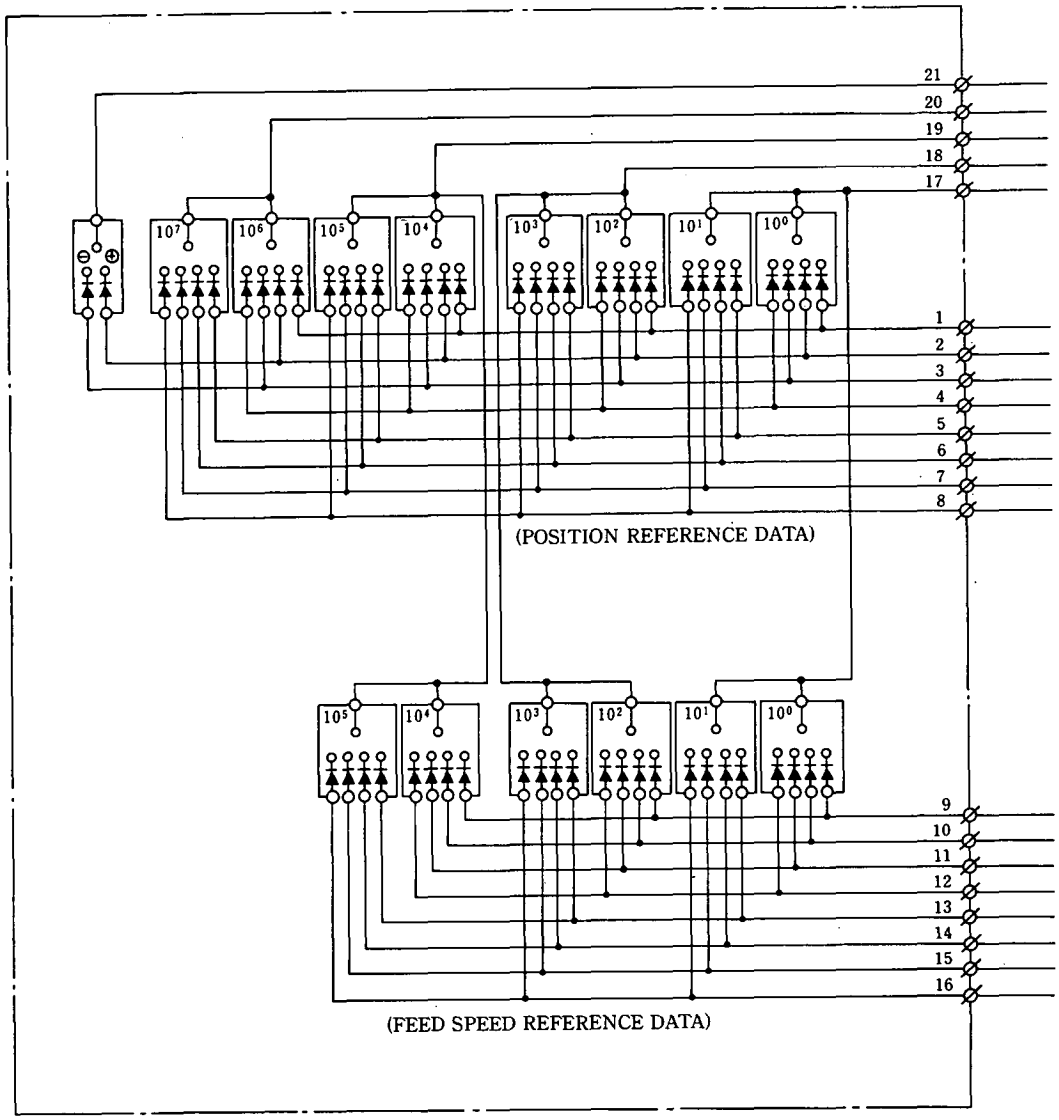
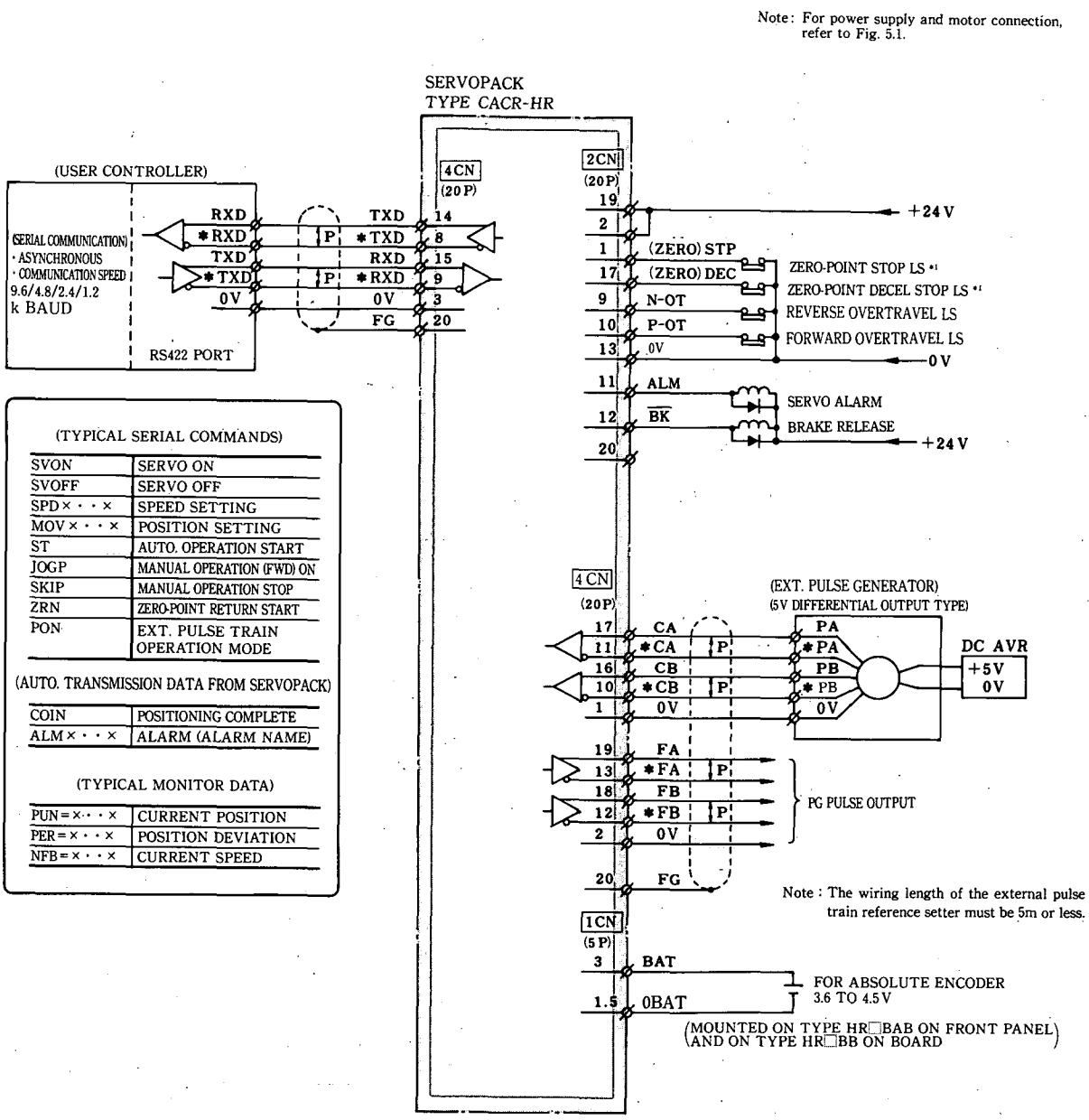


Fig. 5.4 Details in DG-SW Unit

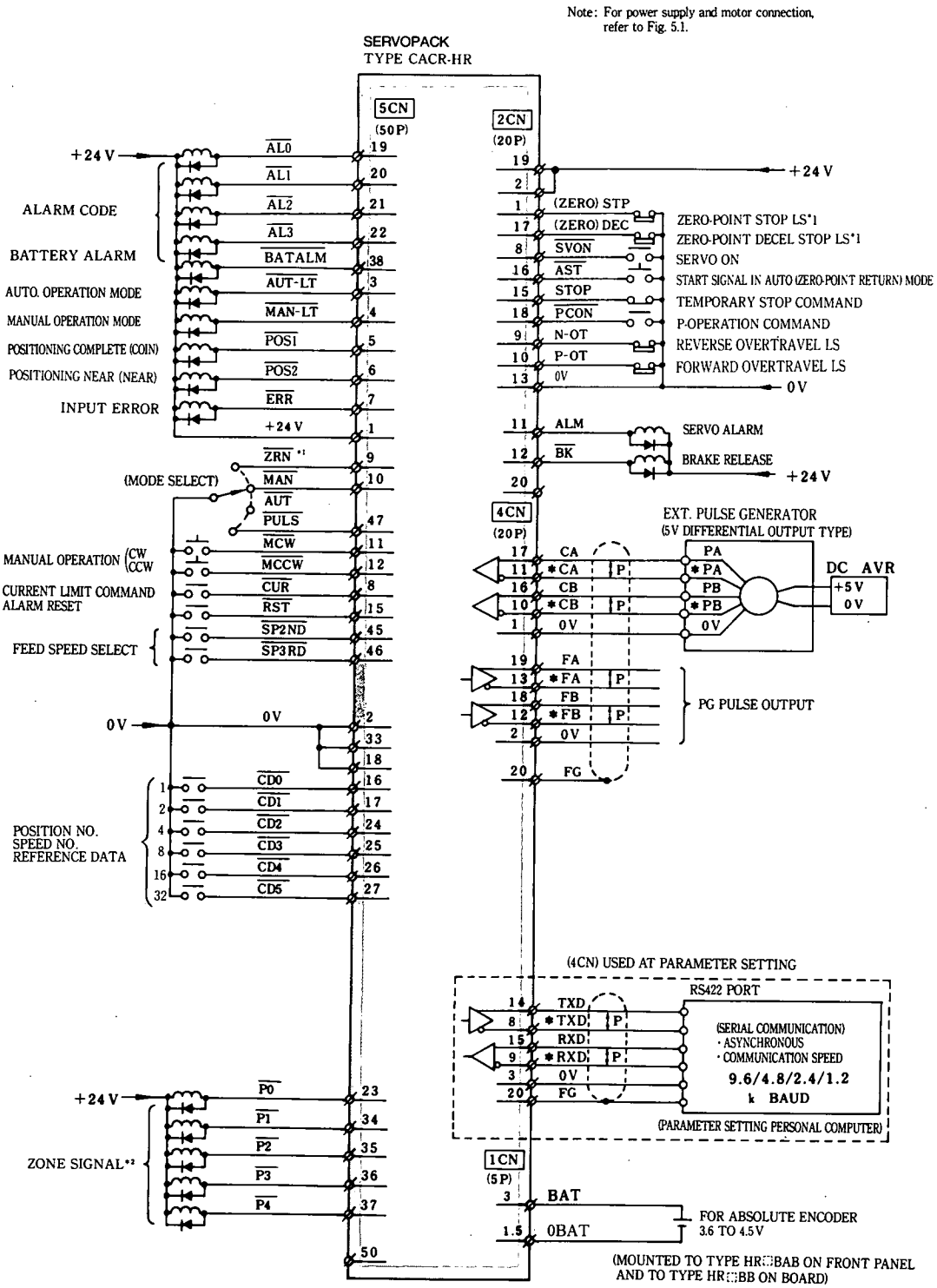
5.1.4 Typical Connection at Positioning by Serial Communication



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

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
*1 Ⓡ Ⓢ Ⓣ	Main curcuit power supply input terminal	*2 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
*3 ⓡ ⓣ	Control power supply input terminal	*4 Single-phase 200 to 230VAC $^{+10\%}_{-15\%}$, 50/60Hz
⏚	Grounding terminal	Connected with motor terminal D to ground.
Ⓨ3 Ⓨ4	Regenerative resistor connecting terminal	*5 Regenerative resistor connecting terminal (Normally, no connection is necessary)
*6 Ⓕ1 Ⓕ2 Ⓕ3	Motor cooling fan connecting terminal	Conection needed only when Type USAMKD-60B is used.

*1 : Ⓡ, Ⓣ for Type HR □□□ BAB1□
*2 : Single-phase 100 to 115VAC $^{+10\%}_{-15\%}$, 50/60Hz for Type HR □□□ BAB11.
Single-phase 200 to 230VAC $^{+10\%}_{-15\%}$, 50/60Hz for Type HR □□□ BAB12.
*3 : ⓡ, Ⓢ, ⓣ only for Type HR60BB
*4 : Single-phase 100 to 115VAC $^{+10\%}_{-15\%}$, 50/60Hz for Type HR □□□ BAB11.
*5 : External resistor must be connected for Type HR60BB.
*6 : Provided only for Type HR60BB.

5.3 CONNECTOR TERMINAL (2CN) FOR I/O SIGNAL

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 2CN Layout and Connection

Table 5.3 shows the terminal layout of connector 2CN and Fig. 5.7 shows the wiring diagram for 2CN.

Table 5.3 Connector 2CN 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		Servo Alarm Output	Brake Release Command Output	0V for ALM. BK Signal
	Reverse Side	Forward Side			

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)

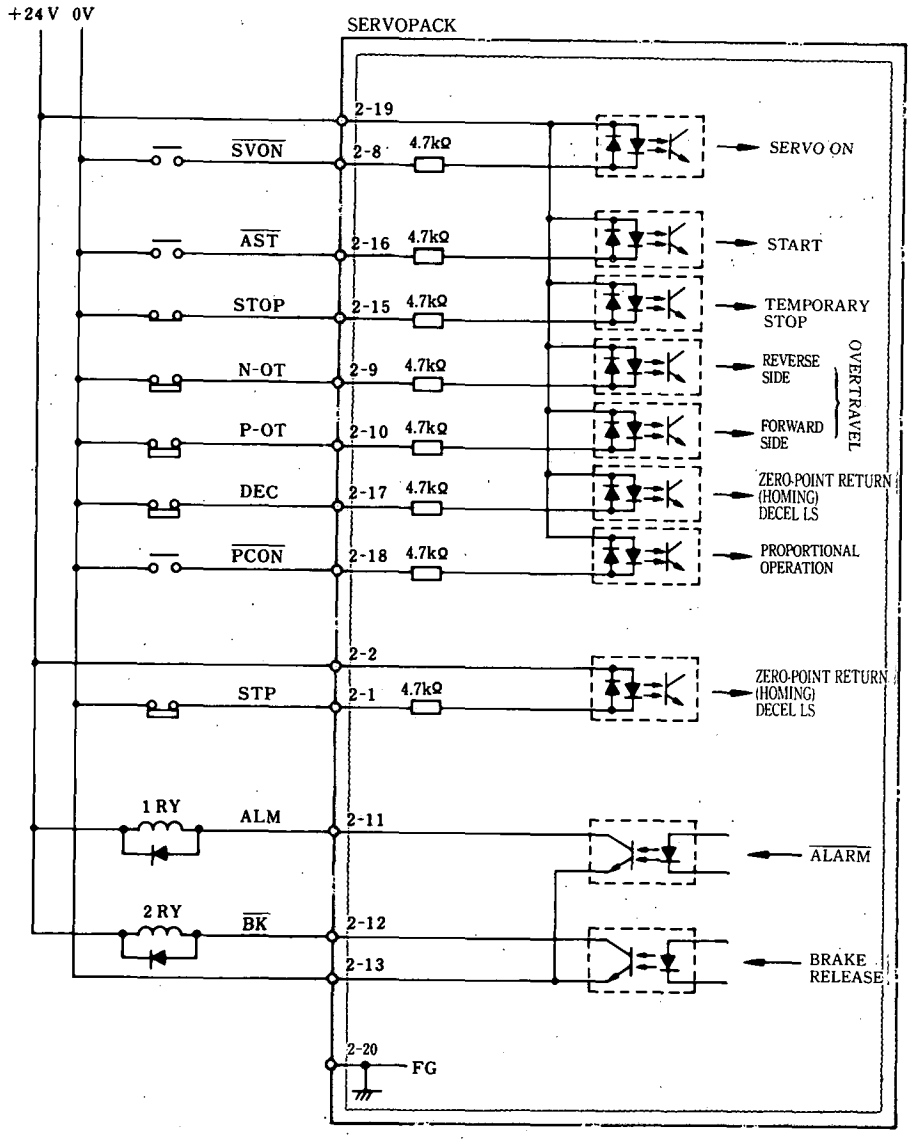
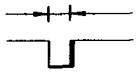
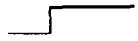
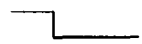
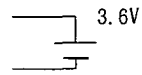


Fig. 5.7 Wiring Diagram for 2CN

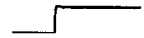
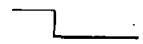
5.3.3 Description and Usage of I/O Signals of Connector 2CN

(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 for HR□□BAB on the panel and for HR□□□BB 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 (3CN) FOR ENCODER

5.4.1 Applicable Receptacle and Cable Specifications

5

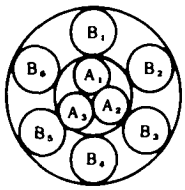
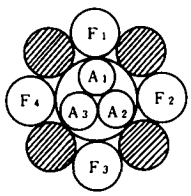
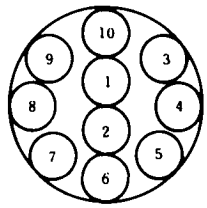
Table 5.4 Applicable Receptacle and Cable Specifications

Specifications of Connector Used in Servopack	Applicable Receptacle Type				Connecting Cable Specifications
	Soldered Type	Caulking Type	Case	Maker	
MR-20RMA 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.)			
	A1 Red A2 Black A3 Green/yellow B1 Blue-white/blue B2 Yellow-white/yellow B3 Green-white/green B4 Orange-white/orange B5 Purple-white/purple B6 Gray-white/gray } Twisted cable	A1 Red A2 Black A3 Green/yellow F1 Blue-white/blue F2 Yellow-white/yellow F3 Pale green-white/pale green F4 Orange-white/orange } Twisted cable	1 Blue-white 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 } Twisted cable
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 3CN Layout and Connection

The terminal layout for the Servopack connector (3CN) 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 3CN 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.

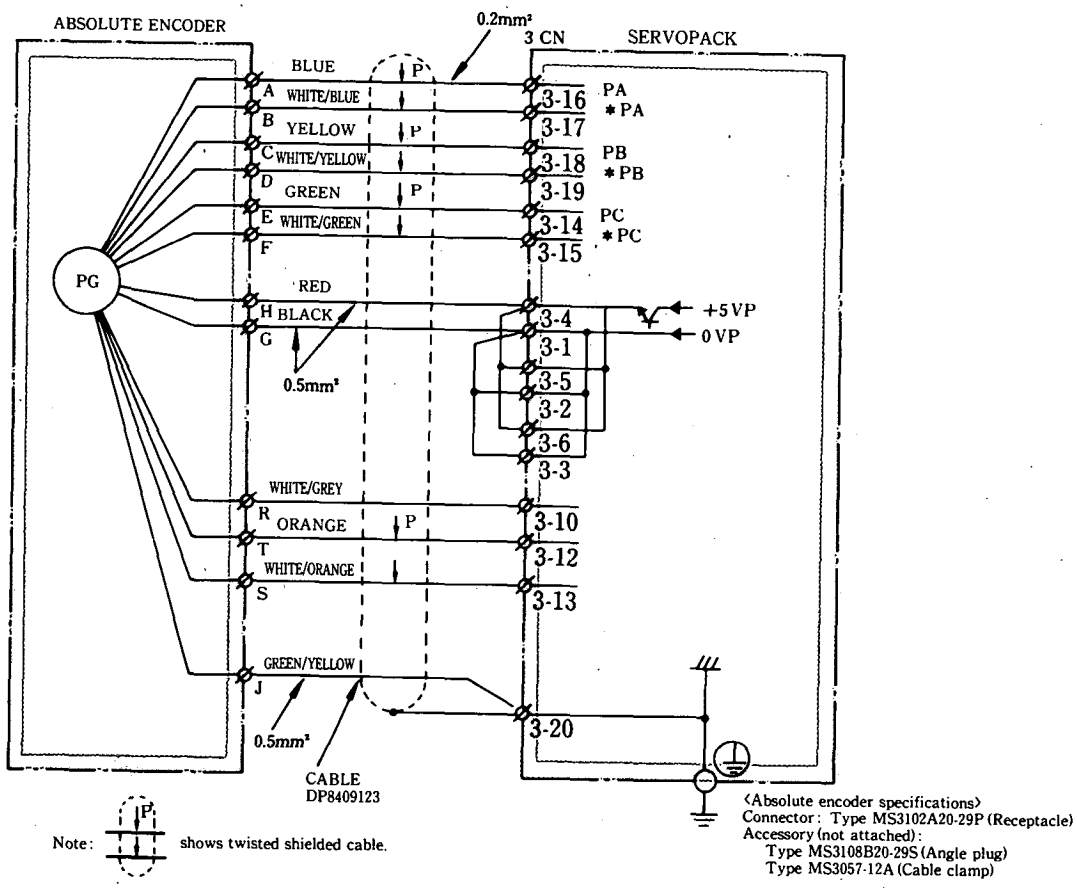


Fig. 5.8 Connection between 3CN and Absolute Encoder
(When soldered type cable DP8409123 is used)

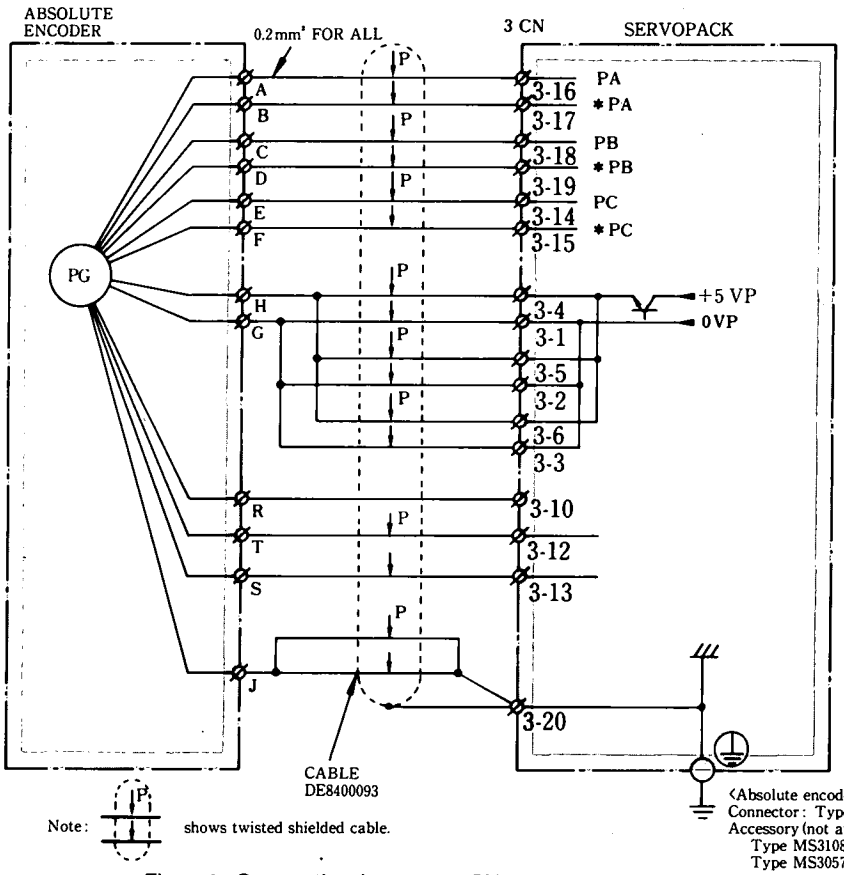


Fig. 5.9 Connection between 3CN and Absolute Encoder
(When caulking type cable DE8400093 is used)

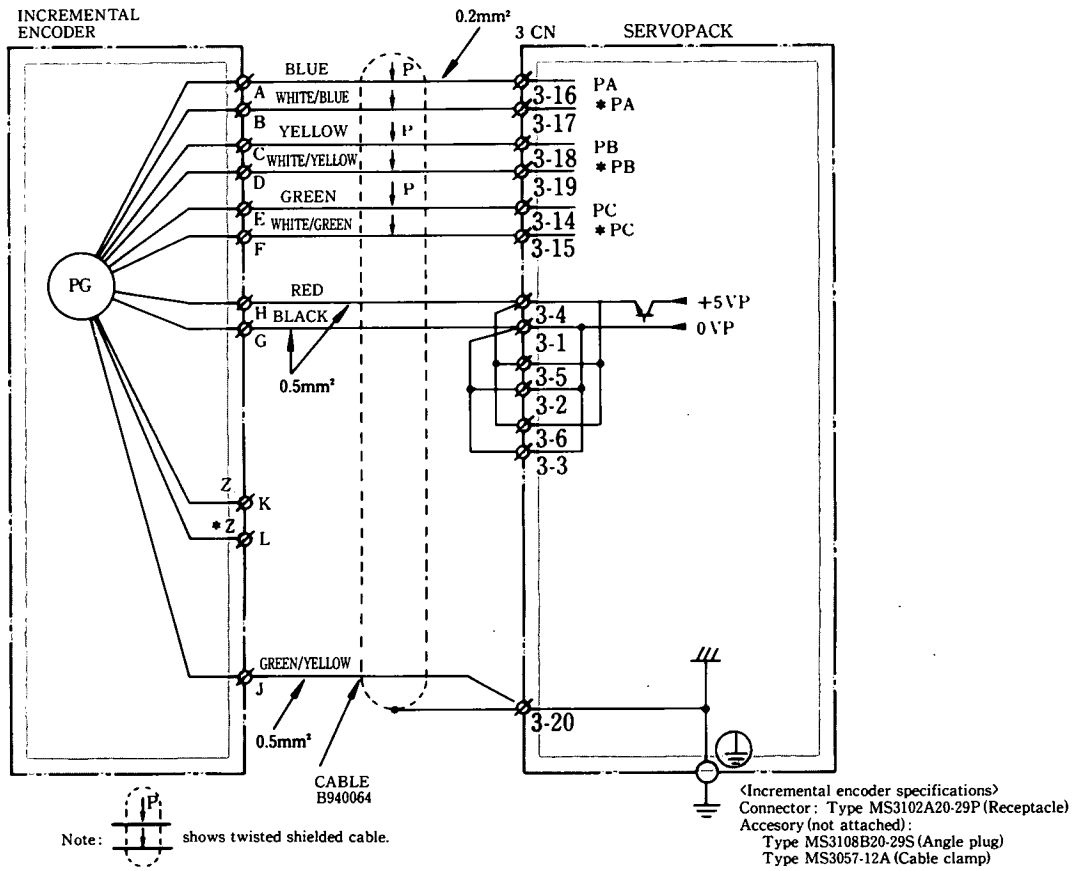


Fig. 5.10 Connection between 3CN and Incremental Encoder
(When soldered type cable B9400064 is used)

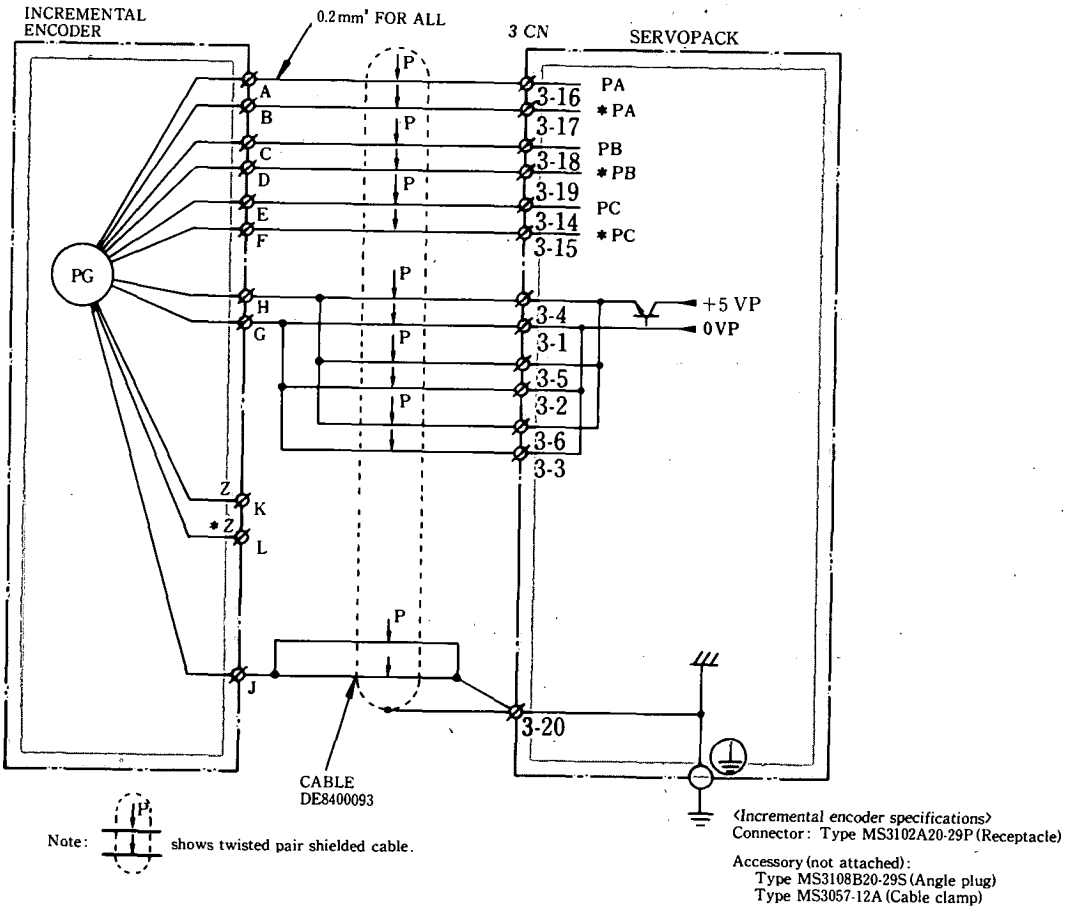


Fig 5.11 Connection between 3CN and Incremental Encoder
(When caulking type cable DE8400093 is used)

5.5 CONNECTOR TERMINAL (4CN) FOR I/O SIGNAL

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 4CN Layout and Connection

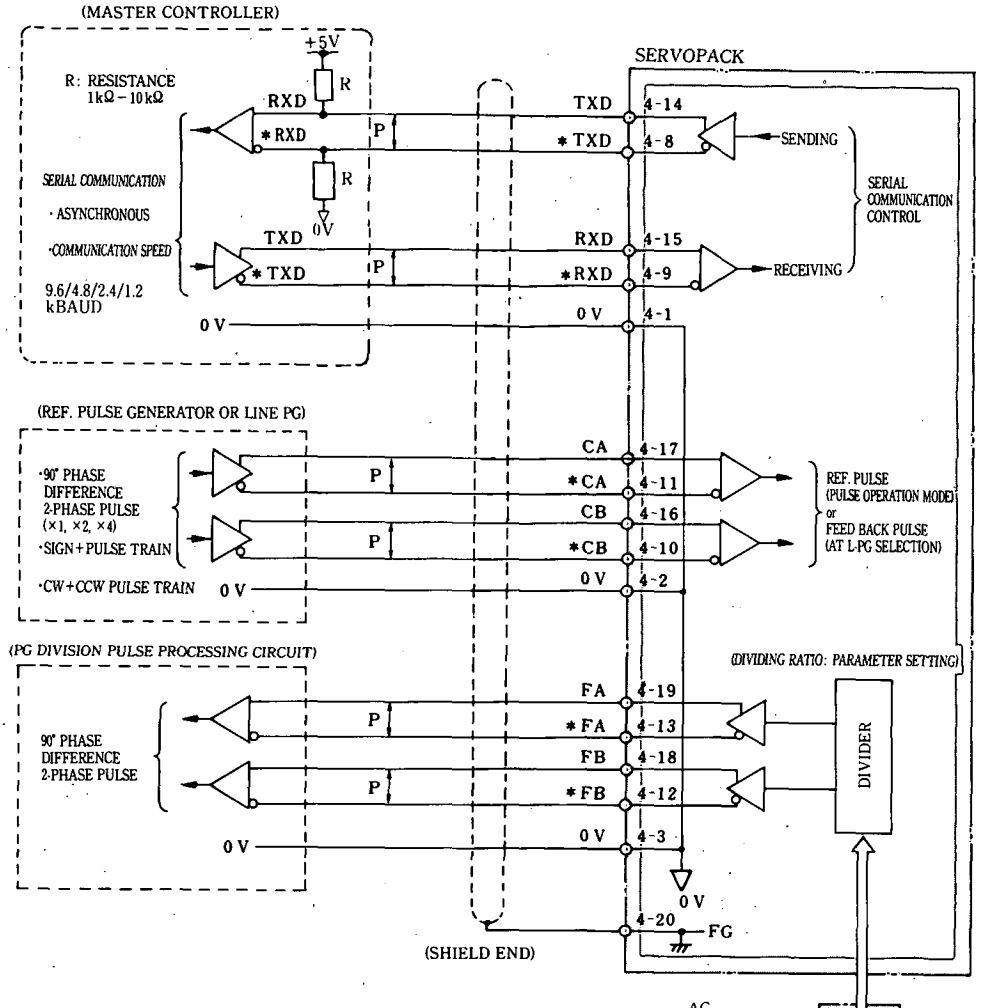
Table 5.8 shows the terminal layout of connector 4CN and Fig. 5.12 shows the wiring diagram for 4CN.

Table 5.8 Connector 4CN 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)	—	—

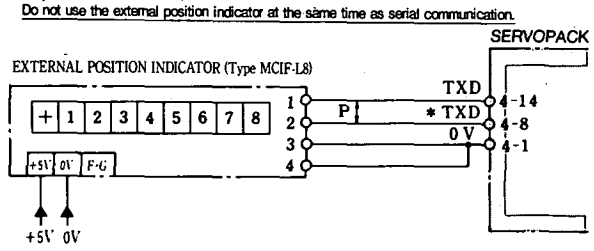
8	9	10	11	12	13
*TXD	*RXD	*CB	*CA	*FB	*FA
For serial communication (RS 422)		Line receiver negative side input for pulse train command		PG division output line driver negative side output	
Line driver negative side output	Line receiver negative side input	$\overline{B\phi}$ Input	$\overline{A\phi}$ Input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

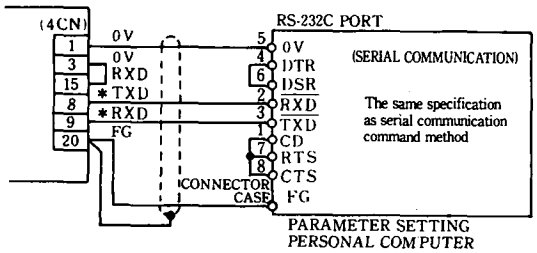


When external position indicator (Type MCIF-L8) is used, connect to TXD (• TXD) signal.

Do not use the external position indicator at the same time as serial communication.



When RS-232 port such as personal computer is used, connect as follows:



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.

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

Fig. 5.12 Wiring Diagram for 4CN

5.5.3 Description and Usage of I/O Signals of Connector 4CN

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.

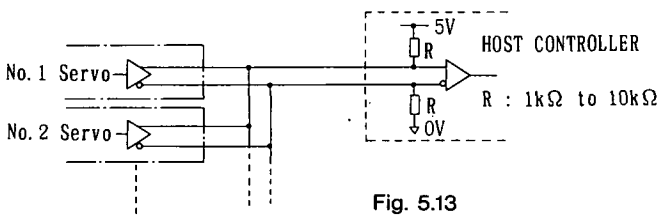


Fig. 5.13

When CACR-HR□□BB is used on one axis and shorting pins SEL-1 and SEL-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 SEL-1 and SEL-2 to 1-2 side and connect pull-up and pull-down resistors in the host controller side.

5.6 CONNECTOR TERMINAL (5CN) FOR I/O SIGNAL

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 5CN Layout and Connection

The layout for the Servopack connector (5CN) 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 5CN.

Table 5.10 Connector 5CN 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		Positioning complete output (COIN)	Positioning near output (NEAR)	Command error output	Current limit command input	Operation mode setting input		Manual operation command input		Rotating direction select input		Alarm reset input	Reference data input		0V pin for I/O 24V
		Auto mode	Manual mode					Zero-point return (homing) mode	Manual mode	CW operation	CCW operation	• No. increase direction • No. decrease direction • Short-cut direction			1 (1)	2 (2)	

19	20	21	22	23	24	25	26	27	28	29	30	31	32
$\overline{\text{AL0}}$	$\overline{\text{AL1}}$	$\overline{\text{AL2}}$	$\overline{\text{AL3}}$	$\overline{\text{P0}}$	$\overline{\text{CD2}}$	$\overline{\text{CD3}}$	$\overline{\text{CD4}}$	$\overline{\text{CD5}}$	$\overline{\text{CD6}}$	$\overline{\text{CD7}}$	$\overline{\text{CD8}}$	$\overline{\text{CD9}}$	$\overline{\text{CD10}}$
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				Battery voltage low alarm output		Ref. data input			Station No. reading select input (P0 to P4 output control)		Speed select code input		Pulse operation mode selection input			Frame ground
	2	4	8	16			2048 (800)					(1st speed) to (4th speed)					

Table 5.11 Connector 5CN 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
	$\overline{\text{AL0}}$	$\overline{\text{AL1}}$	$\overline{\text{AL2}}$	$\overline{\text{AL3}}$	$\overline{\text{DSO0}}$	$\overline{\text{DSI12}}$	$\overline{\text{DSI13}}$	$\overline{\text{DSI14}}$	$\overline{\text{DSI15}}$	$\overline{\text{DSI16}}$	$\overline{\text{DSI17}}$	$\overline{\text{DSI20}}$	$\overline{\text{DSI21}}$	$\overline{\text{DSI22}}$
	Alarm code output (Binary)				Data strobe output	Position ref. data input						Speed ref. data input		
	"1"	"2"	"4"	"8"	1 (LSD)*	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	$\overline{\text{DSO1}}$	$\overline{\text{DSO2}}$	$\overline{\text{DSO3}}$	$\overline{\text{DSO4}}$	$\overline{\text{BATALM}}$		$\overline{\text{DSI23}}$	$\overline{\text{DSI24}}$	$\overline{\text{DSI25}}$	$\overline{\text{DSI26}}$	$\overline{\text{DSI27}}$	$\overline{\text{SP2ND}}$	$\overline{\text{SP3RD}}$	$\overline{\text{PULS}}$	$\overline{\text{LPG}}$		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 5CN 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
$\overline{\text{AL0}}$	$\overline{\text{AL1}}$	$\overline{\text{AL2}}$	$\overline{\text{AL3}}$	$\overline{\text{P0}}$	$\overline{\text{CD2}}$	$\overline{\text{CD3}}$	$\overline{\text{CD4}}$	$\overline{\text{CD5}}$					
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	4	8	16								(1st speed) to (4th speed)					

• Wiring Diagram for 5CN (Station No. Command Method)

Parameter 15 set value = 0

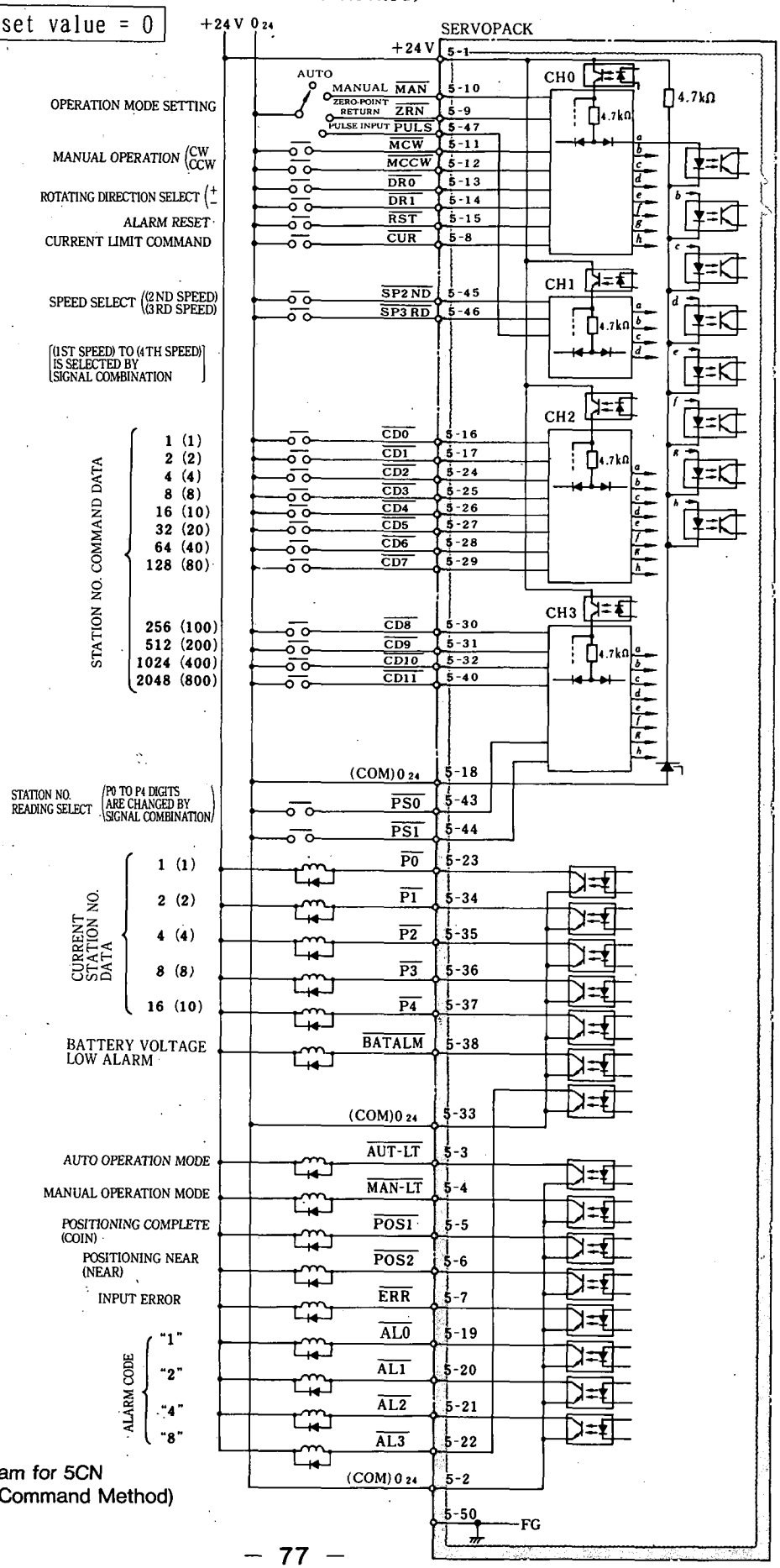
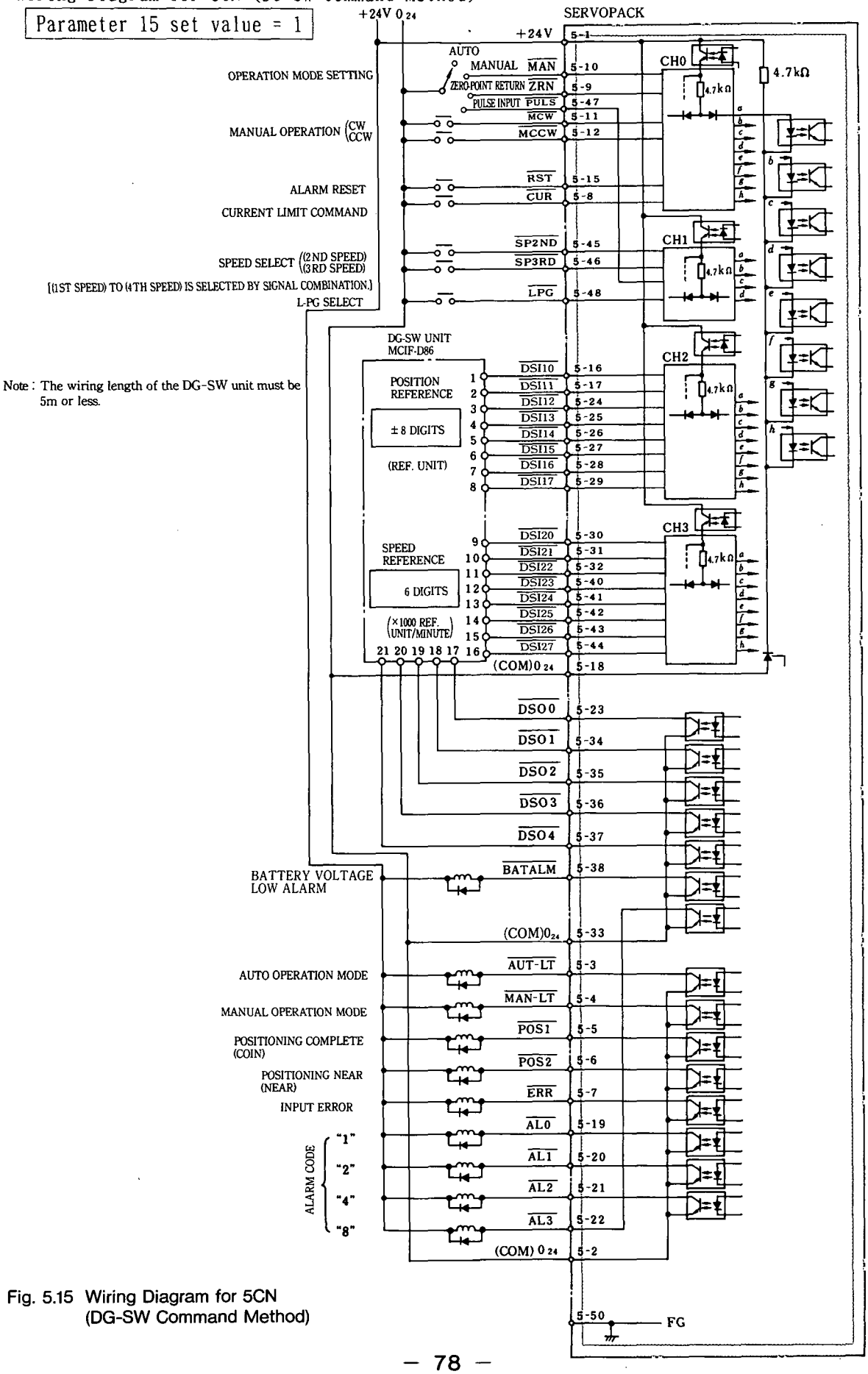


Fig. 5.14 Wiring Diagram for 5CN (Station No. Command Method)

• Wiring Diagram for 5CN (DG-SW Command Method)

Parameter 15 set value = 1



Note : The wiring length of the DG-SW unit must be 5m or less.

Fig. 5.15 Wiring Diagram for 5CN (DG-SW Command Method)

• Wiring Diagram for 5CN (Command Table Method)

Parameter 15 set value = 4

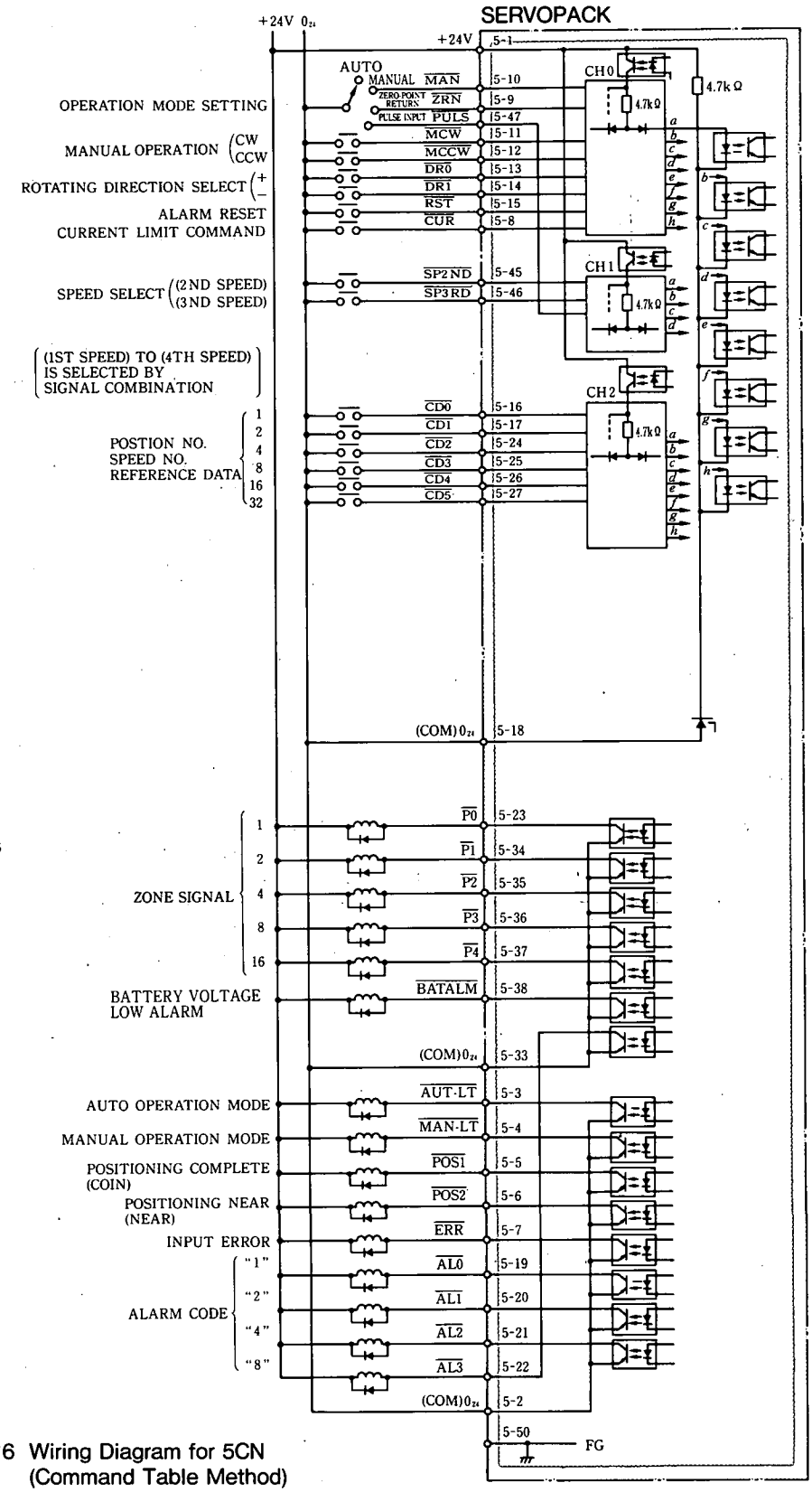
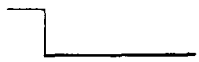


Fig. 5.16 Wiring Diagram for 5CN (Command Table Method)

5.6.3 Description and Usage of I/O Signals of Connector 5CN

(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. 6.3.2 (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".)
$\overline{AUT-LT}$	3	Operation Mode Display Output — Auto		Outputs when "auto operation mode" is set during servo ON status.
$\overline{MAN-LT}$	4	Operation Mode Display Output — 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 board 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

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

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

Signal Name	Pin No.	Name		Effective Logic	Function
$\overline{DR0}$	13	Rotating Direction Select Input	+	Rotating direction is set by signal combination.	
$\overline{DR1}$	14		−		

$\overline{DR0}$	$\overline{DR1}$	Absolute Mode	Incremental Mode
H	H	Short-cut direction	(Error)
L	H	Station No. increase direction	Station No. increase direction
H	L	Station No. decrease direction	Station No. decrease direction
L	L	(Error)	(Error)

Absolute/incremental modes are set by parameter 14 b3.

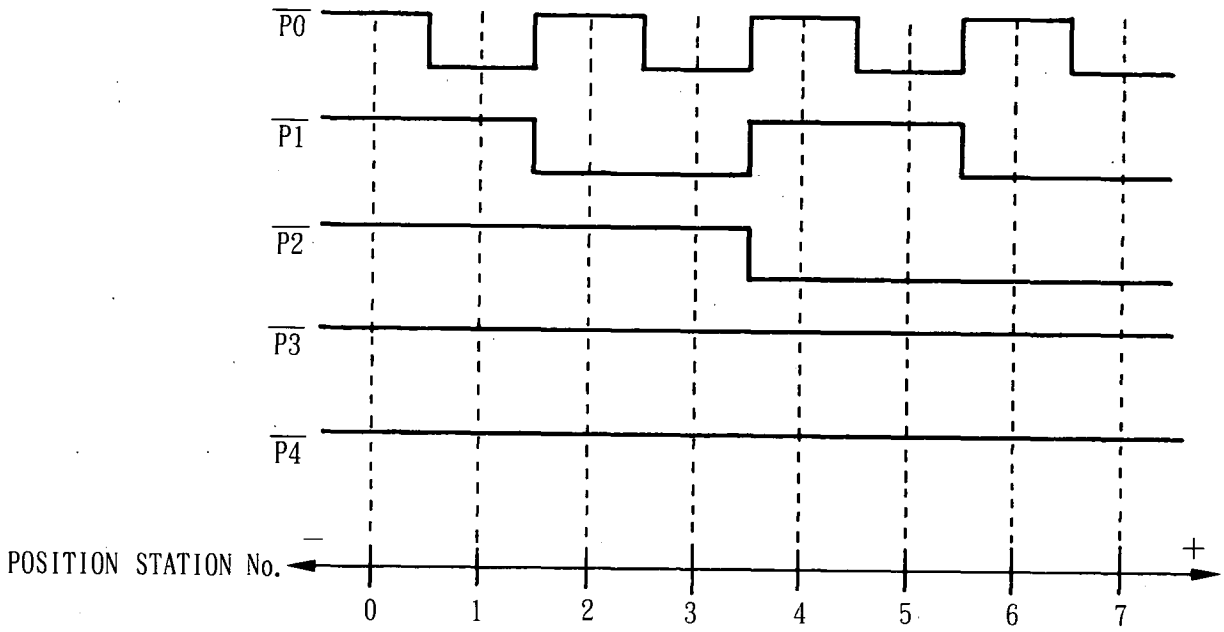
$\overline{CD0}$	16	Station No. Reference Data		BCD setting (0 to 999)	1	Binary setting (0 to 4095)	1	BCD/binary are selected by parameter setting (14 b4).
$\overline{CD1}$	17				2		2	
$\overline{CD2}$	24				4		4	
$\overline{CD3}$	25				8		8	
$\overline{CD4}$	26				10		16	
$\overline{CD5}$	27				20		32	
$\overline{CD6}$	28				40		64	
$\overline{CD7}$	29				80		128	
$\overline{CD8}$	30				100		256	
$\overline{CD9}$	31				200		512	
$\overline{CD10}$	32				400		1024	
$\overline{CD11}$	40				800		2048	

$\overline{PS0}$	43	Station No. Read-out Select Input		Reads out current station No. data output ($\overline{P0}$ to $\overline{P4}$) by signal combination.	H		L		H		L	
$\overline{PS1}$	44				H		H		L		L	
$\overline{P0}$	23	Current Station No. Data Output			(BCD) 1	(BINARY) 1	(BCD) 1	(BINARY) 1	(BCD) 10	(BINARY) 16	(BCD) 100	(BINARY) 256
$\overline{P1}$	34				2	2	2	2	20	32	200	512
$\overline{P2}$	35				4	4	4	4	40	64	400	1024
$\overline{P3}$	36				8	8	8	8	80	128	800	2048
$\overline{P4}$	37				10	16	Parity		Parity		Parity	

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.

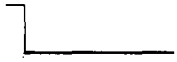
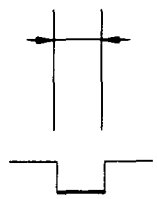
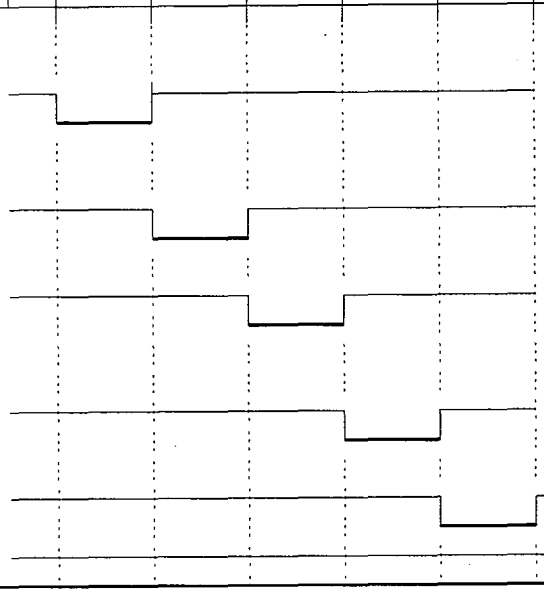
when : $\overline{PS0}$ = H, $\overline{PS1}$ = H, parameter 14 b4 = 0



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)

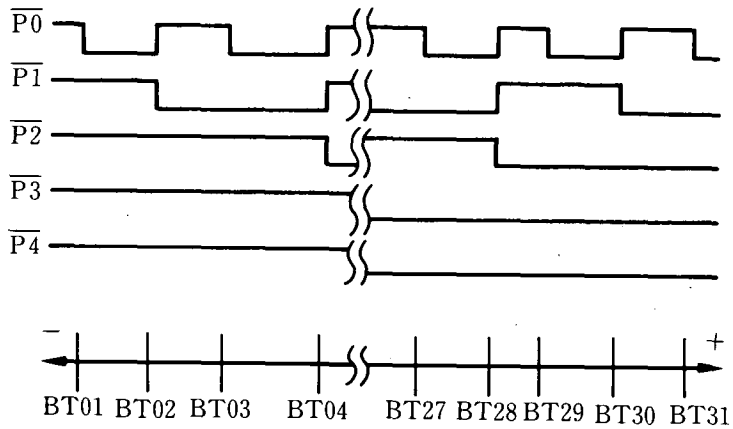
Signal Name	Pin No.	Name	Effective Logic	Function
$\overline{DSI10}$	16	Position Ref. Data Input		1: 10^0 digit; 2: 10^2 digit; 4: 10^4 digit; 8: 10^6 digit; + / − selected by data strobe output described below is input by 2 digits.
$\overline{DSI11}$	17			
$\overline{DSI12}$	24			
$\overline{DSI13}$	25			
$\overline{DSI14}$	26			1: 10^1 digit; 2: 10^3 digit; 4: 10^5 digit; 8: 10^7 digit
$\overline{DSI15}$	27			
$\overline{DSI16}$	28			
$\overline{DSI17}$	29			
$\overline{DSI20}$	30	Speed Ref. Data Input		1: 10^0 digit; 2: 10^2 digit; 4: 10^4 digit; 8
$\overline{DSI21}$	31			
$\overline{DSI22}$	32			
$\overline{DSI23}$	40			
$\overline{DSI24}$	41			1: 10^1 digit; 2: 10^3 digit; 4: 10^5 digit; 8
$\overline{DSI25}$	42			
$\overline{DSI26}$	43			
$\overline{DSI27}$	44			
$\overline{DS00}$	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.
$\overline{DS01}$	34			
$\overline{DS02}$	35			
$\overline{DS03}$	36			
$\overline{DS04}$	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.)



Motor Position

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) *1 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.)

*1 (R, T) for Servopack Type HR □□□ BAB1 □ .

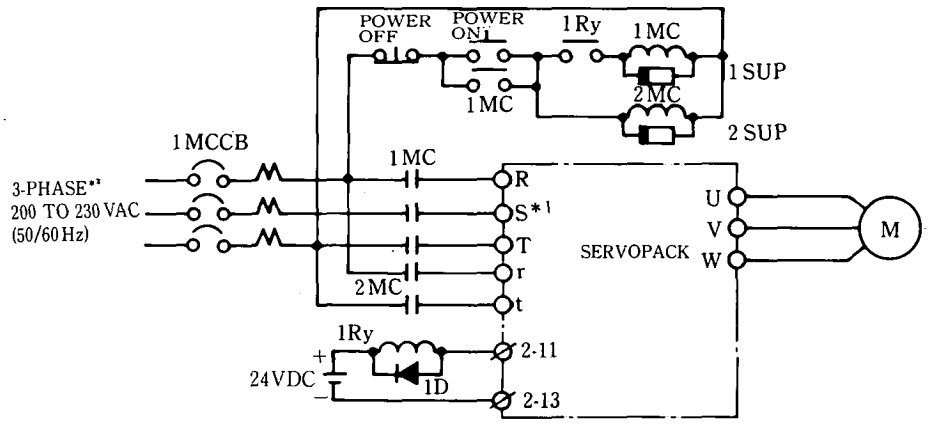


Fig. 5.17 Typical Connection when Both Control Power Supply and Main Power Supply are Turned ON/OFF Simultaneously

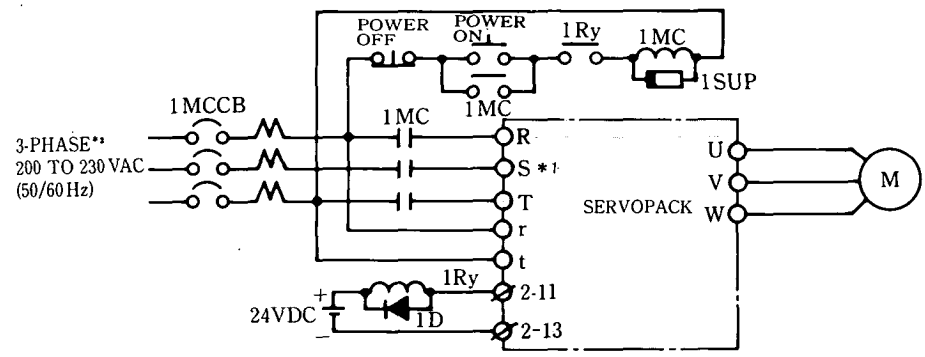


Fig. 5.18 Typical Connection when only Main Circuit Power Supply is Turned ON/OFF

*2 HR □ BAB12 —— Single-phase 200 to 230VAC (50/60Hz)
HR □ BAB11 —— Single-phase 100 to 115VAC (50/60Hz)

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

Servopack is of line operated type using commercial power supply (200V) *.

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.

* : 100V for Servopack Type HR ☐☐ BAB11.

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)
HRA5BAB12	0.3	5
HR01BAB12	0.5	5
HR02BAB12	0.75	5
HR03BAB12	1.0	7
HR05BAB12	1.4	11
HR10BAB	2.1	8
HR15BAB	3.1	10
HR03BB	0.65	5
HR05BB	1.1	5
HR10BB	2.1	8
HR15BB	3.1	10
HR20BB	4.1	12
HR30BB	6.0	18
HR44BB	8.0	24
HR60BB	11	32
HRA5BAB11	0.3	5
HR01BAB11	0.5	5
HR02BAB11	0.75	8
HR03BAB11	1.0	11
HR05BAB11	1.4	15

*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 RATED CURRENT AND TYPICAL APPLICABLE CABLE SIZE

Tables 5.14 and 5.15 show Servopack external terminal rated current and typical applicable cable size for rated current. Applicable cables and sizes are selected according to current capacity. The values shown in Table 5.15 are obtained under conditions where rated current is applied at ambient temperature of 40℃ and in three lead wires. Table 5.16 shows the types of applicable cables.

Table 5.14 Servopack External Terminal Rated Current (A: rms)

External Terminal Name		Terminal Symbol	Type CACR-						
			HRA5BAB12	HR01BAB12	HR02BAB12	HR03BAB12	HR05BAB12	HR10BAB	HR15BAB
On-line	Main circuit power supply input terminal	R, T*	1.3	2.5	4.4	6.5	10.4	8	10
	Motor connection terminal	U, V, W	0.7	1.0	2.0	2.7	3.6	7.6	11.7
	Control power supply input terminal	r, t	0.5						
Off-line	Control I/O signal connectors	2CN, 4CN, 5CN	100mA DC Max.						
	PG signal connector	3CN	100mA DC Max. 500mA for power supply line						
	Grounding terminal	FG	–						

* R, S, T for Servopack HR10BAB and HR15BAB.

External Terminal Name		Terminal Symbol	Type CACR-						
			HR03BB	HR05BB	HR10BB	HR15BB	HR20BB	HR30BB	HR44BB	HR60BB
On-line	Main circuit power supply input terminal	R, S, T	2	5	8	10	12	18	24	32
	Motor connection terminal	U, V, W	3.0	4.2	7.6	11.7	18.8	26.0	33.0	45
	Control power supply input terminal	r, t	0.5							
Off-line	Control I/O signal connectors	2CN, 4CN, 5CN	100mA DC Max.							
	PG signal connector	3CN	100mA DC Max. 500mA for power supply line							
	Grounding terminal	FG	–							

External Terminal Name		Terminal Symbol	Type CACR-				
			HRA5BAB11	HR01BAB11	HR02BAB11	HR03BAB11	HR05BAB11
On-line	Main circuit power supply input terminal	R, T	2.6	4.5	8.0	11.0	15.0
	Motor connection terminal	U, V, W	1.2	1.7	2.9	3.6	5.5
	Control power supply input terminal	r, t	0.5				
Off-line	Control I/O signal connectors	2CN, 4CN, 5CN	100mA DC Max.				
	PG signal connector	3CN	100mA DC Max. 500mA for power supply line				
	Grounding terminal	FG	–				

Table 5.15 Typical Applicable Cable Size (mm^2)

External Terminal Name		Terminal Symbol	Type CACR-						
			HRA5BAB12	HR01BAB12	HR02BAB12	HR03BAB12	HR05BAB12	HR10BAB	HR15BAB
On-line	Main circuit power supply input terminal	R, T*	1.25			2.0			3.5
	Motor connection terminal	U.V.W	1.25					3.5	
	Control power supply input terminal	r, t	1.25						
Off-line	Control I/O signal connectors	2CN, 4CN, 5CN	Twisted pair cable or twisted pair totally shielded cable Core cable 0.2mm or more, plated soft steel twisted cable Finished dimensions : 5CN ϕ16 or less 2CN, 3CN, 4CN ϕ11 or less						
	PG signal connector	3CN							
	Grounding terminal	FG	1.25					2.0	

External Terminal Name		Terminal Symbol	Type CACR-							
			HR03BB	HR05BB	HR10BB	HR15BB	HR20BB	HR30BB	HR44BB	HR60BB
On-line	Main circuit power supply input terminal	R, S, T	1.25		2.0	3.5		5.5		8.0
	Motor connection terminal	U.V.W	1.25		3.5			5.5		8.0
	Control power supply input terminal	r, t	1.25							
Off-line	Control I/O signal connectors	2CN, 4CN, 5CN	Twisted pair cable or twisted pair totally shielded cable Core cable 0.2mm or more, plated soft steel twisted cable Finished dimensions : 5CN ϕ16 or less 2CN, 3CN, 4CN ϕ11 or less							
	PG signal connector	3CN								
	Grounding terminal	FG	2.0							

External Terminal Name		Terminal Symbol	Type CACR-				
			HRA5BAB11	HR01BAB11	HR02BAB11	HR03BAB11	HR05BAB11
On-line	Main circuit power supply input terminal	R, T	1.25		2.0		
	Motor connection terminal	U.V.W	1.25				2.0
	Control power supply input terminal	r, t	1.25				
Off-line	Control I/O signal connectors	2CN, 4CN, 5CN	Twisted pair cable or twisted pair totally shielded cable Core cable 0.2mm or more, plated soft steel twisted cable Finished dimensions : 5CN ϕ16 or less 2CN, 3CN, 4CN ϕ11 or less				
	PG signal connector	3CN					
	Grounding terminal	FG	1.25				

*: R.S.T for Srvopack Type HAR10BAB, HAR15BAB.

Notes: 1. All sizes are for HIV [ ] or more.

2. Applicable cable size selecting conditions :
Rated current is applied at ambient temperature of 40℃ and in three lead wires.

Table 5.16 Applicable Cable

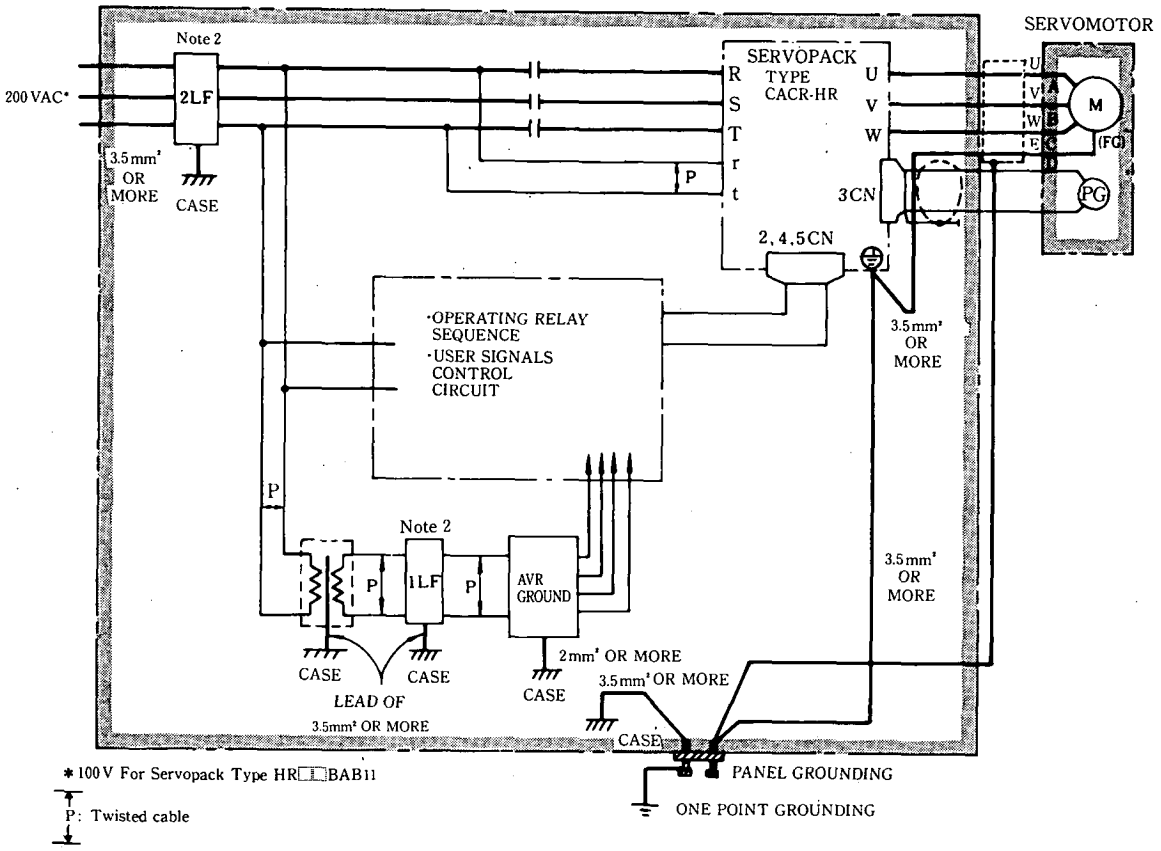
Cable Type		Conduit Allowable Temperature (°C)
Symbol	Name	
PVC	General vinyl cable	——
IV	600V vinyl cable	60
HIV	Special heat-resistant vinyl cable	75

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 are for reducing switching noise 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

5.9 NOISE CONTROL (Cont'd)

• 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.

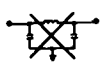
(2) Noise filter installation

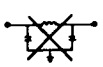
When noise filters are installed to prevent noise from the power line, the block type must be used. The recommended noise filter is shown in Table 5.17. The power supply to peripherals also needs noise filters.

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
HRA5BAB12 HR01BAB12 HR02BAB12	(CORRECT)  (WRONG) 	LF-205A	Single-phase 200VAC class, 5A
HR03BAB12		LF-210	Single-phase 200VAC class, 10A
HR05BAB12		LF-215	Single-phase 200VAC class, 15A
HR10BAB HR15BAB		LF-315	Three-phase 200VAC class, 15A
HR03BB HR05BB		LF-305	Three-phase 200VAC class, 5A
HR10BB HR15BB		LF-315	Three-phase 200VAC class, 15A
HR20BB		LF-320	Three-phase 200VAC class, 20A
HR30BB		LF-330	Three-phase 200VAC class, 30A

Servopack Type CACR-	Applicable Noise Filter	Recommended Noise Filter	
		Type	Specifications
HR44BB HR60BB	(CORRECT)  (WRONG) 	LF-340	Three-phase 200VAC class, 40A
HRA5BAB11		LF-350	Three-phase 200VAC class, 50A
HR01BAB11		LF-205A	Single-phase 200VAC class, 5A
HR02BAB11		LF-210	Single-phase 200VAC class, 10A
HR03BAB11		LF-215	Single-phase 200VAC class, 15A
HR05BAB11		LF-220	Single-phase 200VAC class, 20A

Note: Noise filter made by Tokin Corp.

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

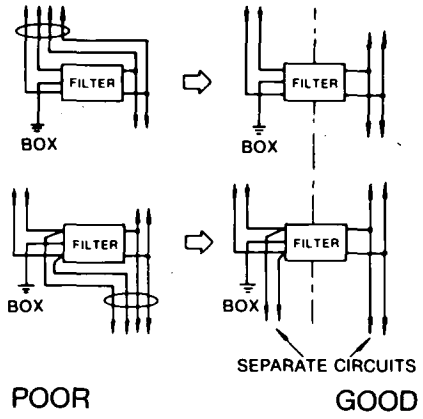


Fig. 5.20

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

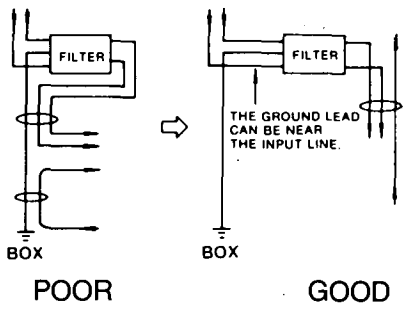


Fig. 5.21

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

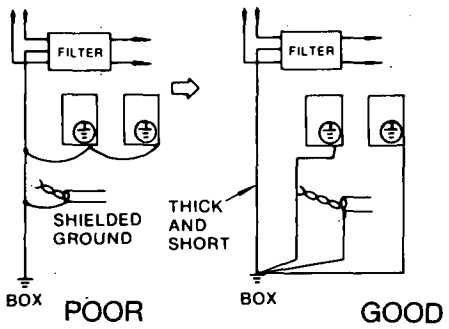


Fig. 5.22

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

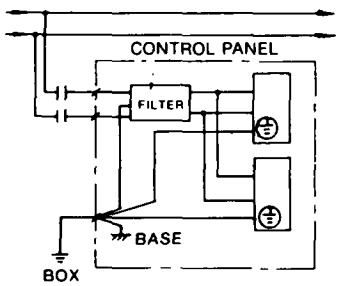


Fig. 5.23

5.9 NOISE CONTROL (Cont'd)

(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.

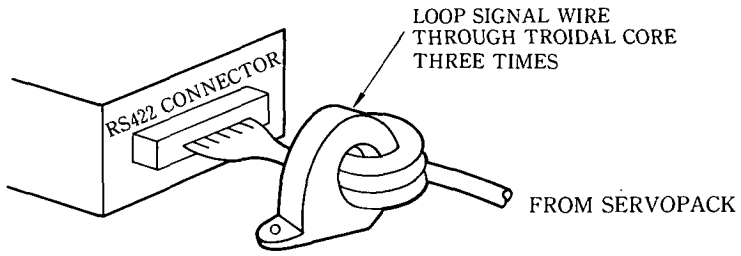


Fig. 5.24

6 I/O SIGNAL OPERATION AND FUNCTIONS

6.1 OPERATION AND FUNCTIONS OF 2CN INPUT SIGNAL

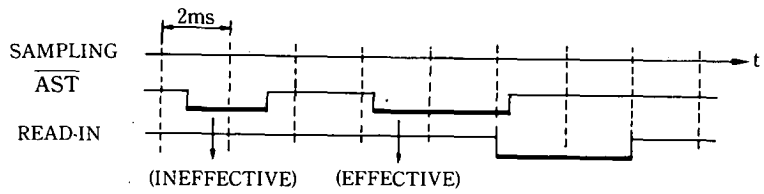
6.1.1 Signal Timing

• $\overline{\text{SVON}}$, $\overline{\text{AST}}$, STOP, N-OT, P-OT, 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)

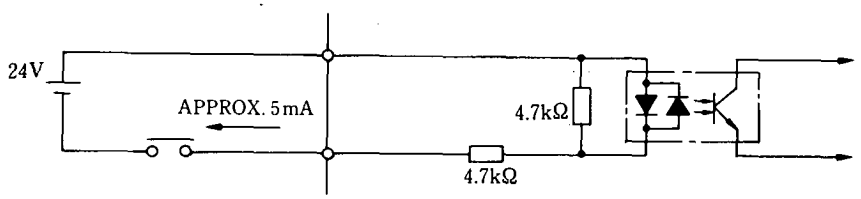
It is necessary to hold more than 5ms to be effective.

Example of $\overline{\text{AST}}$ Signal



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

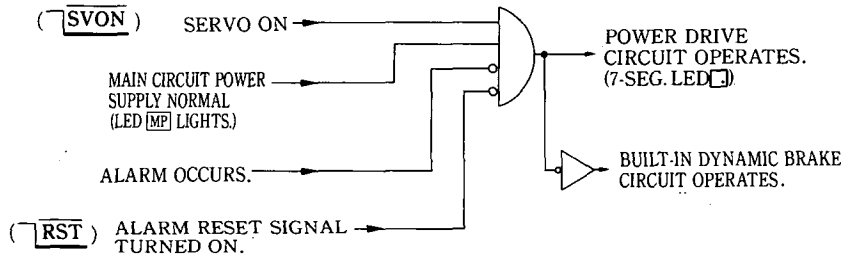
6.1.2 Input Circuit (Refer to Fig. 5.7 for Connection.)



6.1.3 Signal Operation and Functions

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

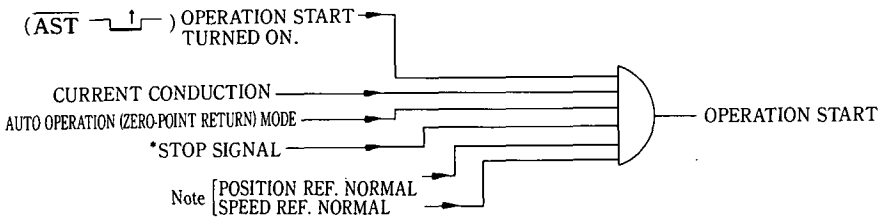
By turning on this signal, Servopack main circuit power drive circuit operates according to the following conditions and the motor is applied with current.



(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").

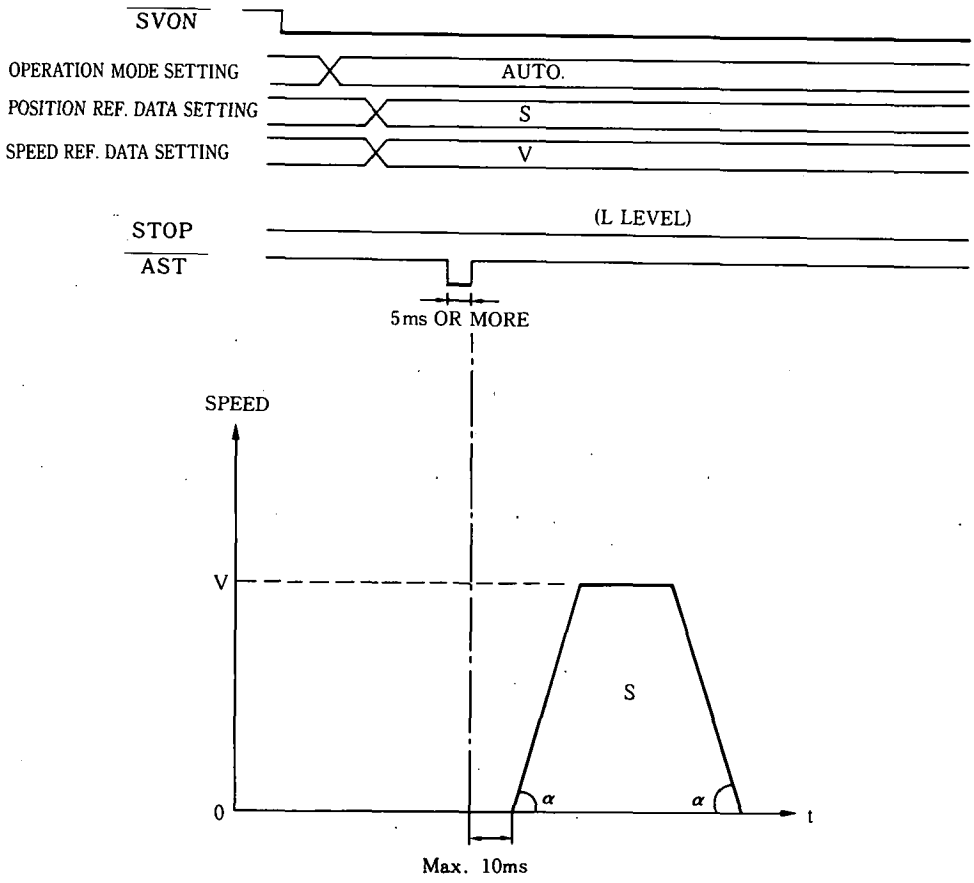
* The STOP signal is active when contact is open.

In the above cases, an error occurs by turning $\overline{\text{AST}}$ signal on and operation does not start. Instead, $\overline{\text{ERR}}$ 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



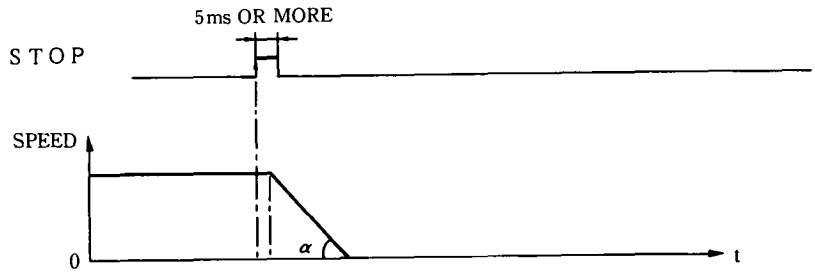
(α is accel/decel rate and set by parameter.)

6.1.3 Signal Operation and Functions (Cont'd)

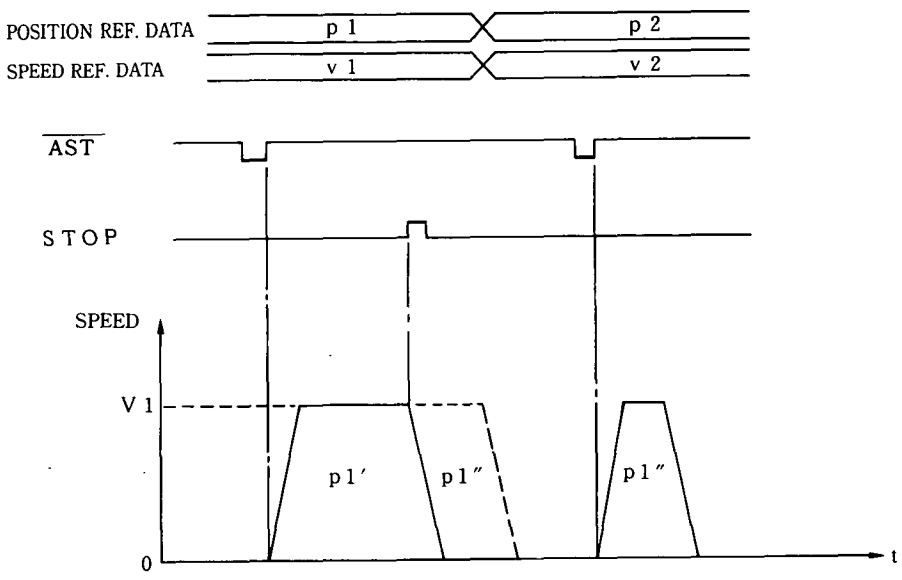
(3) Temporary stop [STOP]

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.

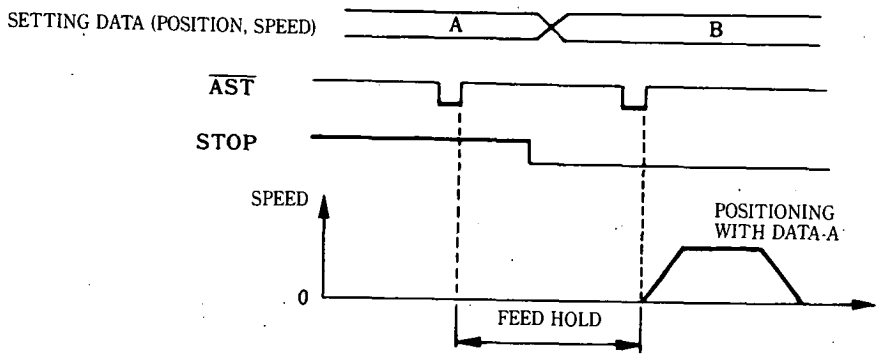


③ STOP signal contains feed hold function. That is, when position reference data are not discharged completely and operation stops after STOP signal is turned on, if $\overline{AST}$ signal is turned on, aimed position and feeding speed will be processed with the former data. (Remaining positioning)

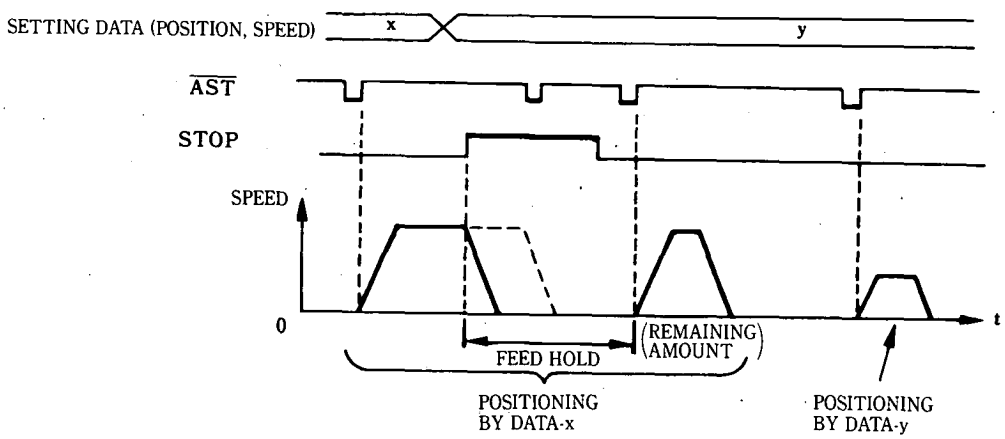


(p1'+p1"=p1)

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



⑤ Typical operation with STOP signal



⑥ Feed hold release

- After $\overline{AST}$ 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)

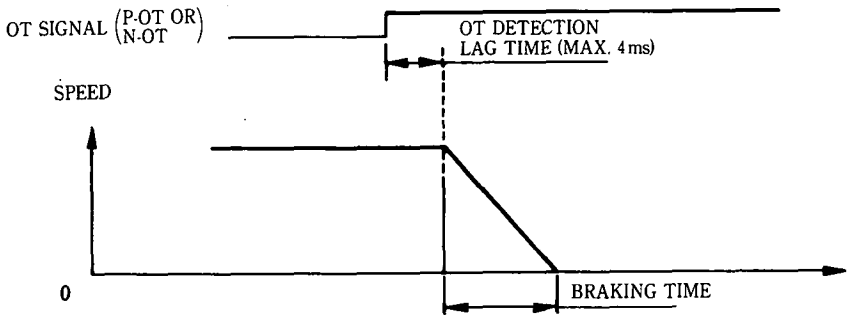
① When P or N-OT signal operates, speed reference in the moving direction is forced to be 0. (Motor stops at maximum deceleration rate during operation.)

② Relation between reference direction, motor rotating direction and P-ON 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-ON 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 5CN INPUT SIGNAL

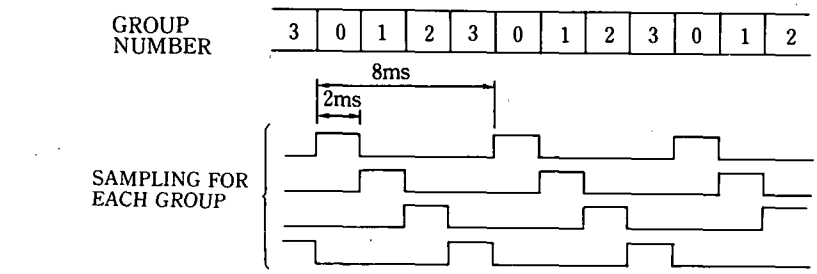
6.2.1 Signal Timing

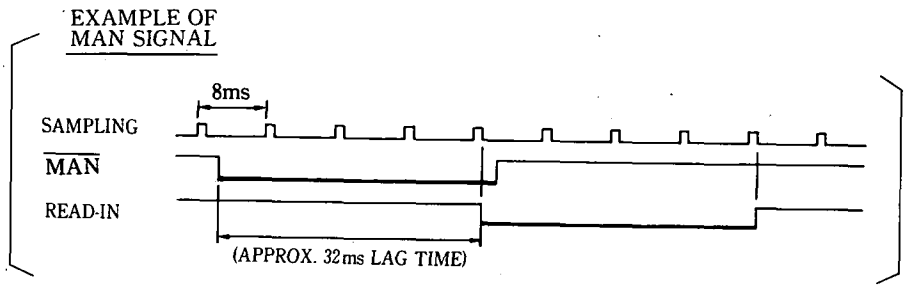
Input signals are divided into four groups (CH0 to CH3: refer to Figs. 5.14, 5.15 and 5.16).

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

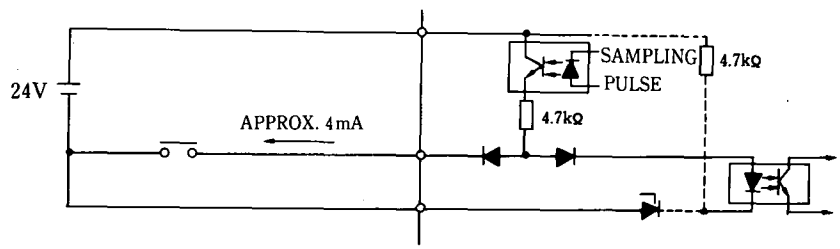
When the same level continues three times or more, each signal is read-in (24 to 32ms filter).

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

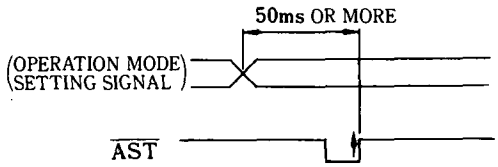
(1) Operation mode setting [$\overline{MAN}$, $\overline{ZRN}$, $\overline{PULS}$]

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
	$\overline{MAN}$	$\overline{PULS}$	$\overline{ZRN}$	
Automatic	H	H	H	Sets position data and performs positioning by turning on $\overline{AST}$ signal.
Manual	L	H	H	Performs constant speed operation by manual signal ($\overline{MCW}$, $\overline{MCCW}$).
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	

Note:

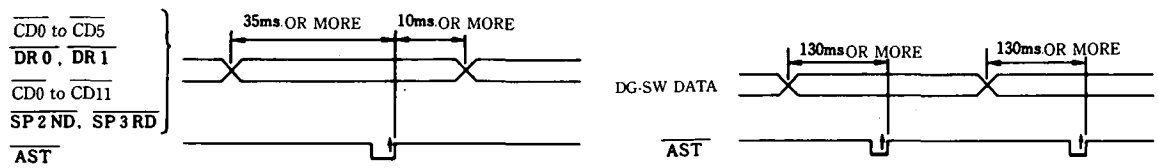
1. If operation mode is switched during motor rotating, the motor will stop. (In this case, there is no feed hold)
2. 50ms or more is needed for timing with $\overline{AST}$ signal.



(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 $\overline{AST}$ signal, the axis is positioned at station No. set at constant data. (Absolute value or incremental reference)
DG-SW Reference Method	1	DG-SW Reference date value	DG-SW reference data polarity (+/ −)	By turning on $\overline{AST}$ 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. selection 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



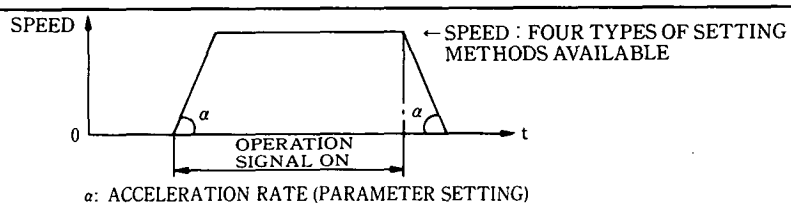
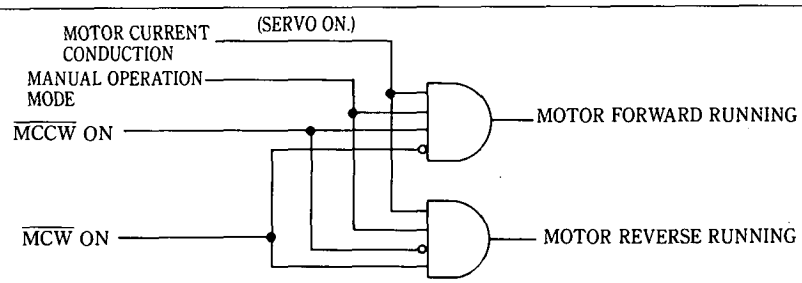
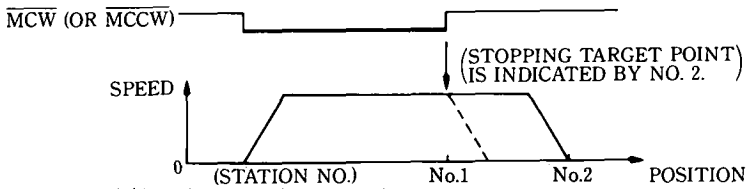
Since DG-SW data are strobed for five times by 2 digits, it takes more than 120ms* for complete input of all digits. Refer to Par. 5.6.3 (3).

* For parameter 65 setting "b2 = 0".

6.2.3 Signal Operation and Functions (Cont'd)

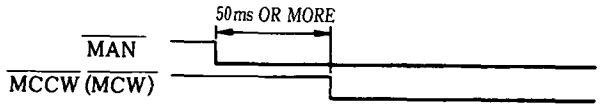
(b) Manual operation mode

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.
(Positon reference method: Station No., DG-SW or command table)

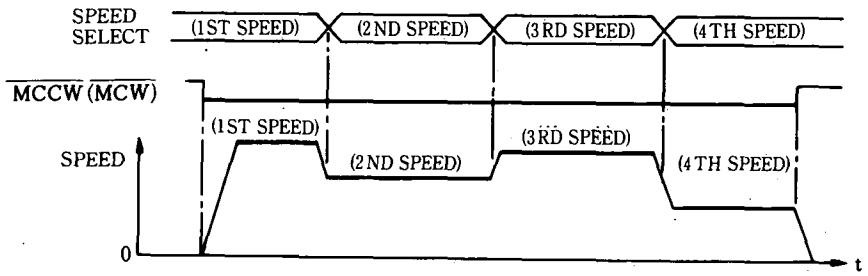
Items		Contents
Accel/Decel speed		 α: ACCELERATION RATE (PARAMETER SETTING)
speed		
Conditions		
Operation	Station No. Ref. Method (Parameter 15) = 0	Performs positioning at the nearest station in the operating direction after operation signal is turned OFF.  Due to accel/decel rate, the second, nearest 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.

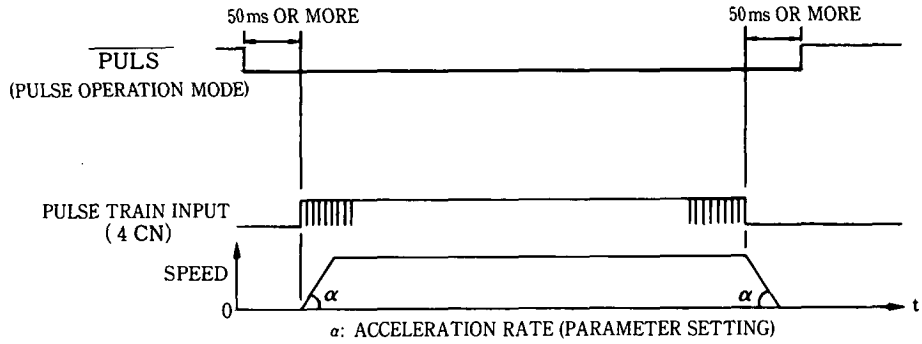


3. In DG-SW speed reference, speed varies if the setting is changed while MCW (MCCW) is turned on since setting data are read-in every 120ms*.
   However, do not change DG-SW setting during operation, incorrect data may be read-in.
   * Parameter 65 b2 = 0

6.2.3 Signal Operation and Functions (Cont'd)

(c) Pulse train operation mode

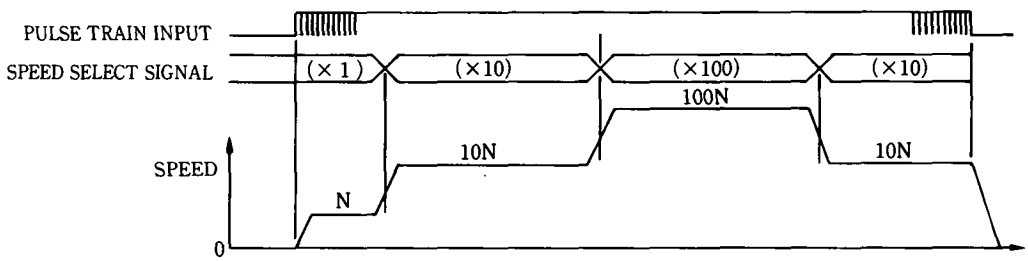
In this mode, positioning by external reference pulse train is performed.



Notes:

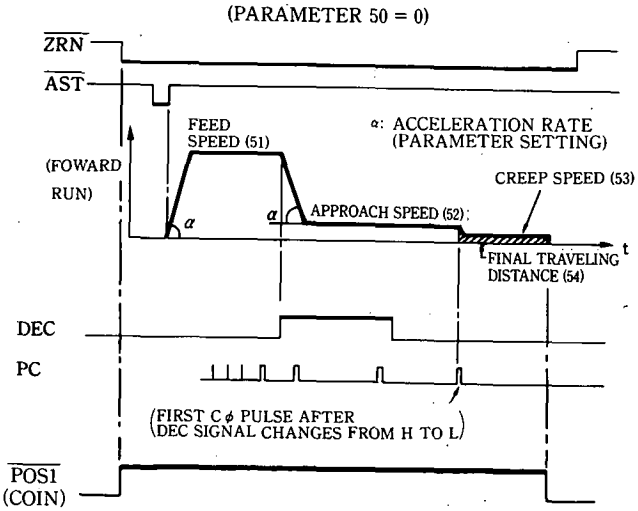
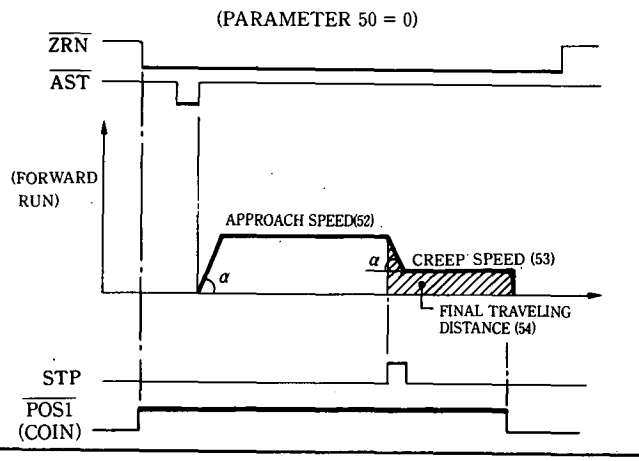
1. One-pulse input moves one reference unit.
2. Frequency→reference speed [f (pps) → f×60(reference unit) /min.]
   Number of pulses → Positioning value [P(pulse) → P(reference unit)]
3. For pulse train signal form to be input to 4CN, refer to Par. 8.2 "Parameter 19 b3".
4. Speed select signals ($\overline{SP2ND}$,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

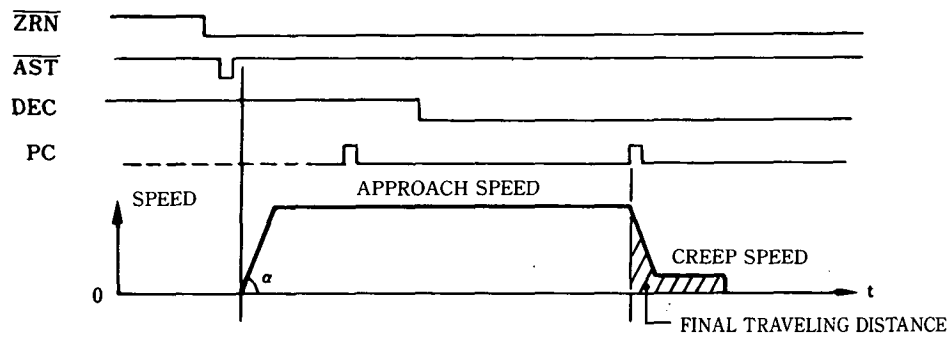
	Zero-point Return (Homing) Method	Operation Pattern
Mode I (Parameter 49 = 0)	3-step deceleration method using DEC signal (deceleration LS) and PG Cϕ pulse signal	
Mode II (Parameter 49 = 1)	2-step deceleration method using STP signal (stop LS)	

6

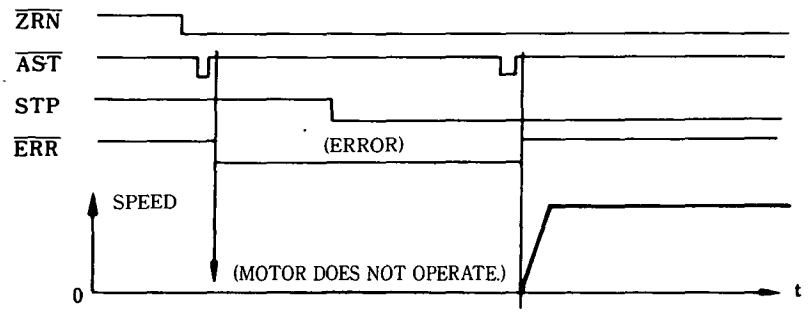
Note 1: Related parameters: Parameters described below become effective when parameter 18 b4 = 1, ineffective when b4 = 0.

Parameter No.	Name	Setting Range	Unit
50	Zero-point return (homing) direction	0:FWD, 1: REV direction	
51	Zero-point 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 [$\overline{\text{SP2ND}}$, $\overline{\text{SP3RD}}$]

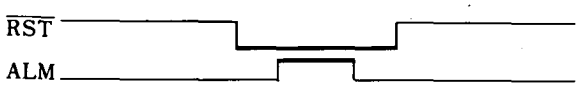
- In automatic or manual operation mode, reference speed can be selected from (1st speed) to (4th speed) by combination of speed selection signals and speed reference selection (Refer to Par. 8.2 "Parameter 18 b2, b3").

Speed Select Signal		Parameter		
$\overline{\text{SP2ND}}$	$\overline{\text{SP3RD}}$	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, $\overline{\text{SP2ND}}$ and $\overline{\text{SP3RD}}$ are used to select input pulse multiplier. (Refer to 6.2.3(1) (c) Note 4.)

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

- 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 $\overline{\text{RST}}$ signal.
- If $\overline{\text{RST}}$ 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)

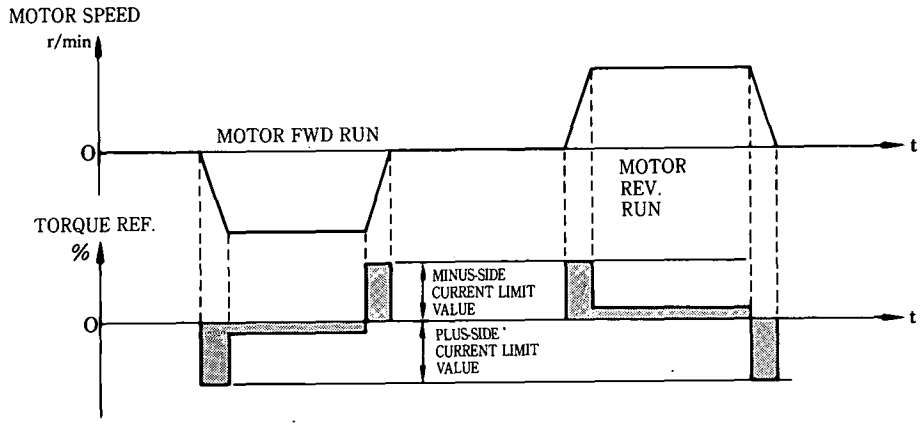
(4) Current limit command [$\overline{CUR}$]

- 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:

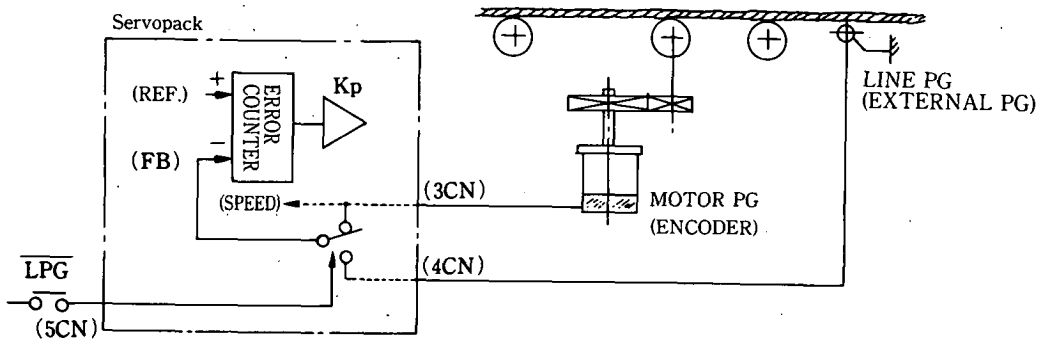
Parameter		Parameter 17	Parameter 17 b0 = 1		
Name	No.	b0 = 0	CUR signal = H	$\overline{CUR}$ signal = L	
		(Current Limit Value)		(Plus limit value)	(Minus limit value)
(Motor special current limit value)	(7)	○	○	○	○
Current limit value	34	×	○	○	○
Plus limit value	35	×	×	○	×
Minus limit value	36	×	×	×	○

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 [$\overline{\text{LPG}}$]

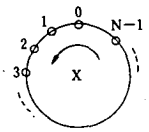
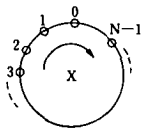


- When $\overline{\text{LPG}}$ signal is turned on, position feedback signal is switched from motor PG to line PG and position fully closed loop by line PG is formed.
- Line PG output pulse corresponds to reference data one-by-one. That is, one pulse from line PG is read-in as one reference unit move.
- 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.

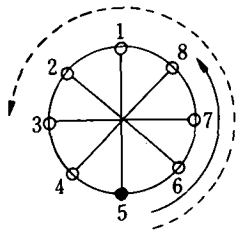
- Absolute mode: Move to data ($\overline{CD0}$ to $\overline{CD11}$) station No. position. (Parameter 14 b4 = 0)
- Incremental mode: Data ($\overline{CD0}$ to $\overline{CD11}$) indicates station No. to move to. (Parameter 14 b4 = 1)

(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 ($\overline{PS0}$, $\overline{PS1}$)

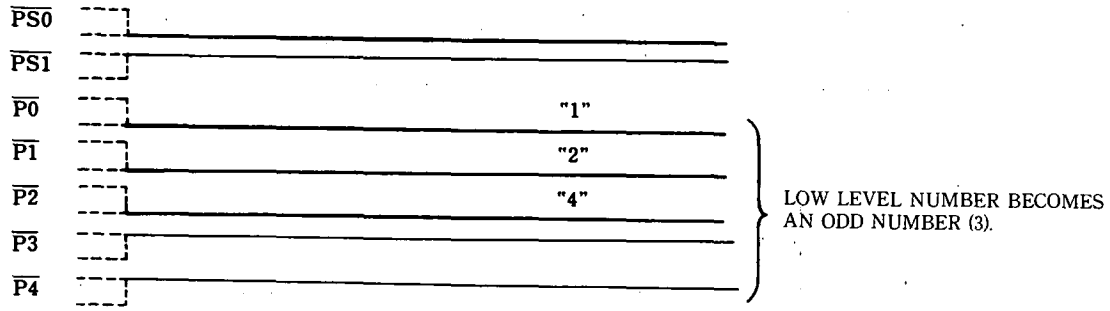
Current station No. value is read-out by current data (station No.) output signal ($\overline{P0}$ to $\overline{P4}$) $\overline{P0}$ to $\overline{P4}$ have only 5 bits. Therefore, by selecting PS0 and PS1, data must be read-out successively.

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.

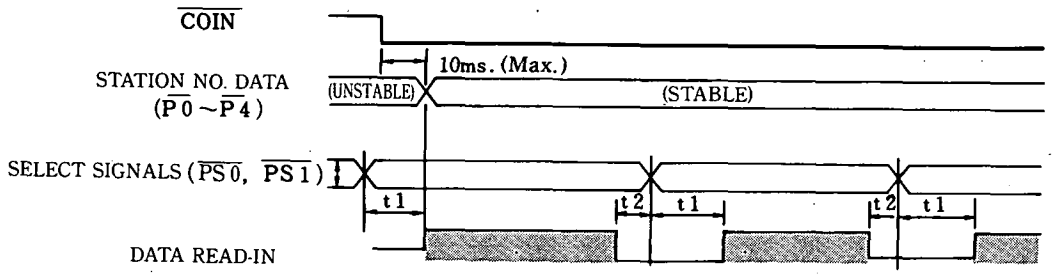
Input Signal / Output Signal		$\overline{PS0}$	H	L	H	L
		$\overline{PS1}$	H	H	L	L
BCD setting parameter 14 b4 = 1		$\overline{P0}$	1	1	10	100
		$\overline{P1}$	2	2	20	200
		$\overline{P2}$	4	4	40	400
		$\overline{P3}$	8	8	80	800
		$\overline{P4}$	10	Odd parity	Odd parity	Odd parity
Binary parameter 14 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.



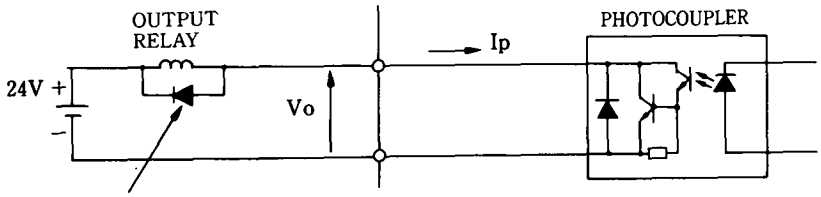
2. Timing with which current value data (station No.) is read-out several times must be as follows.



t1 ≧ 40ms, t2 ≧ 10ms

6.3 OPERATION AND FUNCTIONS OF 2CN/5CN OUTPUT SIGNAL

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



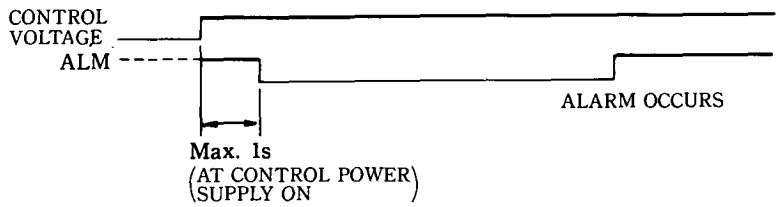
FLYWHEEL DIODE (MAKE SURE OF THE POLARITY.)

- 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

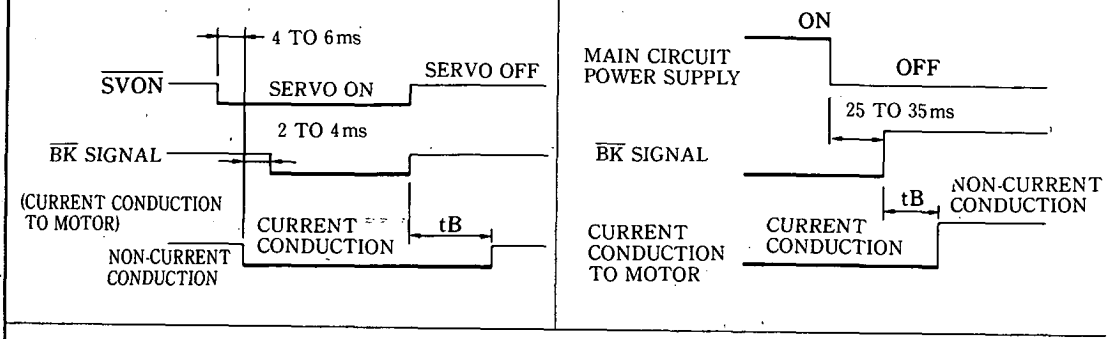


(2) Brake release signal [$\overline{BK}$]

Brake release signal $\overline{BK}$ 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.

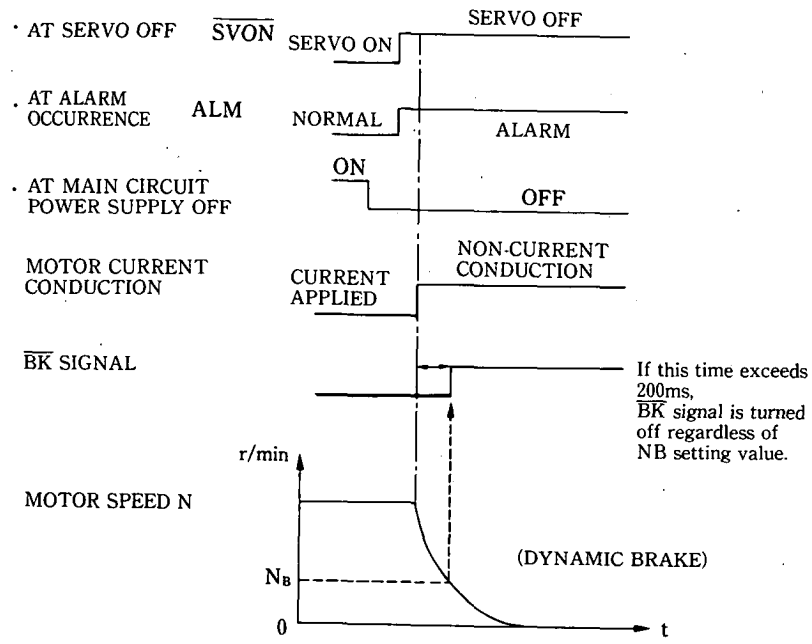
At Motor Stop



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

Motor Rotating

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



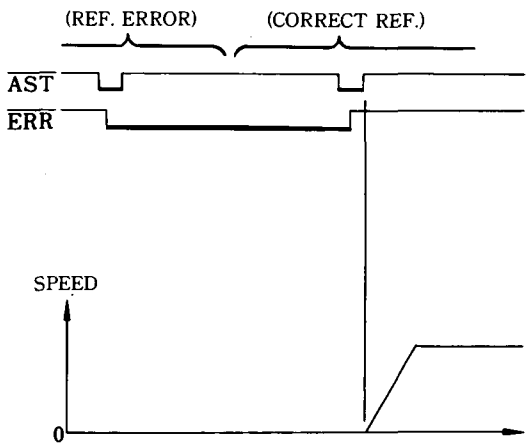
When motor speed N is lower than N_B $\overline{BK}$ signal is output at the same time as motor non-current condition.

NB: SPEED at which $\overline{BK}$ 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 [$\overline{\text{ERR}}$]

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

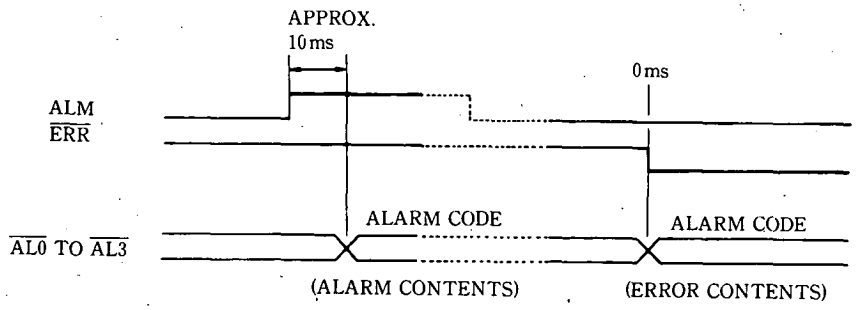
<table>
<tr><th colspan="3">Error Contents</th><th colspan="2">$\overline{\text{ERR}}$ Output Timing</th></tr>
<tr><td rowspan="4">Reference Error</td><td rowspan="2">At station No. Reference</td><td>Commands A to F at BCD setting</td><td colspan="2" rowspan="3">$\overline{\text{ERR}}$ is released by correcting reference or switching operation mode once.
 
</td></tr>
<tr><td>Commands station 0 at setting "station No. 0 not provided" in absolute refernce mode.</td></tr>
<tr><td rowspan="2">At DG-SW reference</td><td>Commands position data exceeding software over-travel set value.</td></tr>
<tr><td>Commands data exceeding speed limit value.</td><td colspan="2"></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">$\overline{\text{ERR}}$ signal is output in the conditions as described on the left. Recovery from error immediately releases $\overline{\text{ERR}}$.</td><td>$\overline{\text{ERR}}$ 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, $\overline{\text{ERR}}$ is output only when:
• out of software overtravel range
• external over-travel is detected</td></tr>
<tr><td>$\overline{\text{LPG}}$ 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>
<tr><td></td></tr>
</table>

(4) Alarm code [$\overline{ALO}$ 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.

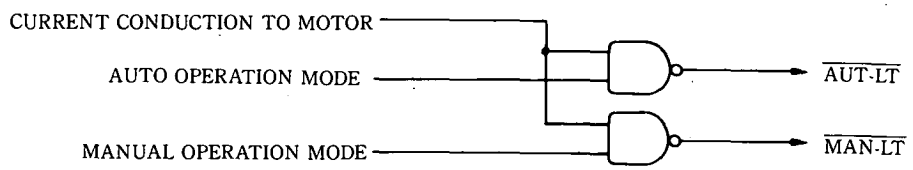
For details of alarm or error contents and corresponding alarm code signals, refer to (9) "Servopack status output signal".

- Output timing



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

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 becomes 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.

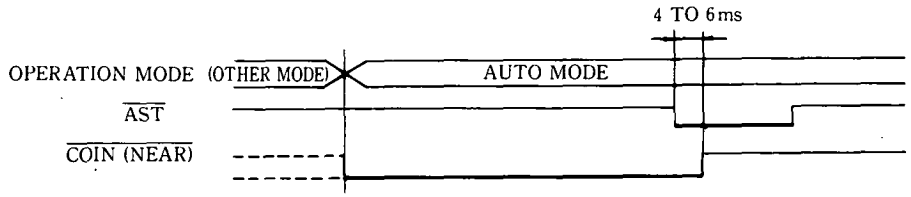
Output Signal	Parameter (Refer to Par. 8.2.)			
	Name	Parameter No.	Setting Range	Unit
$\overline{COIN}$	Positioning complete width	6	1 to 250	Reference unit
$\overline{NEAR}$	Positioning near width	45	0 to 3000	

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

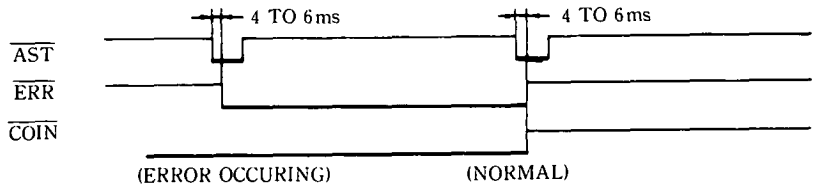
6.3.2 Signal Operation and Functions (Cont'd)

(a) Output specifications in automatic operation mode

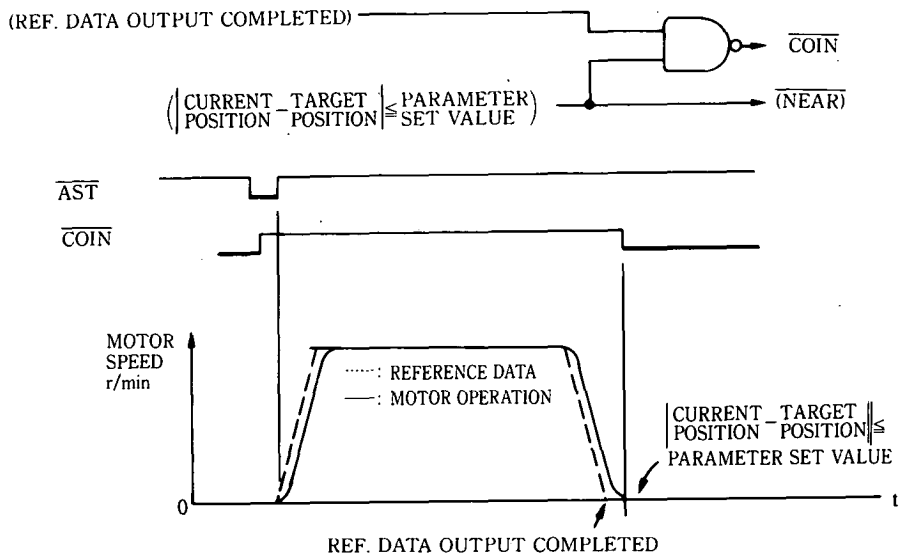
① At mode switching and relation with $\overline{\text{AST}}$ signal



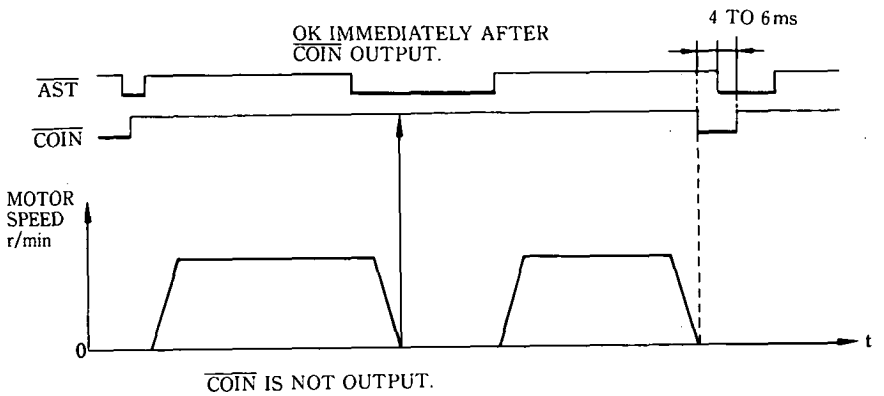
② $\overline{\text{COIN}}$ signal becomes as shown below if and error occurs when $\overline{\text{AST}}$ signal is turned on.



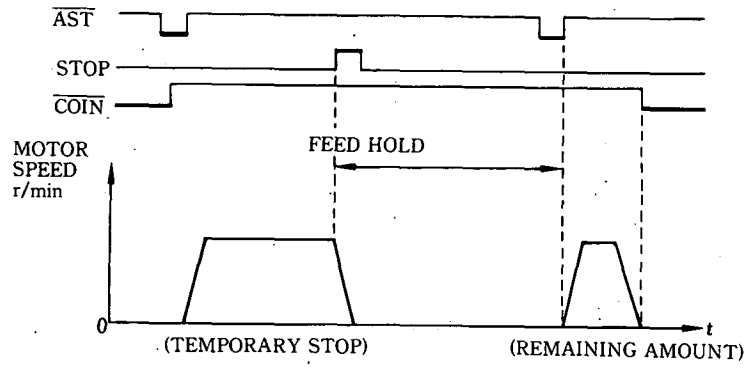
③ Conditions where $\overline{\text{COIN}}$ ($\overline{\text{NEAR}}$) signal is output during automatic operation

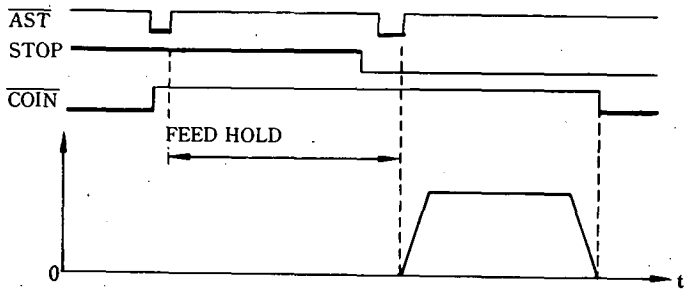


④ When $\overline{\text{AST}}$ signal is turned on during automatic operation



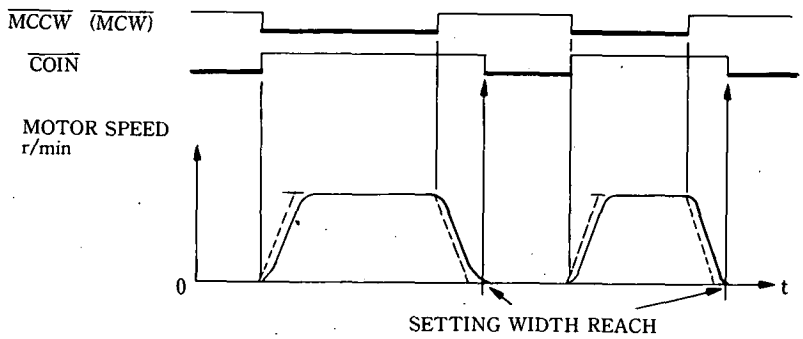
⑤ $\overline{\text{COIN}}$ signal is not output in feed hold status.





(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

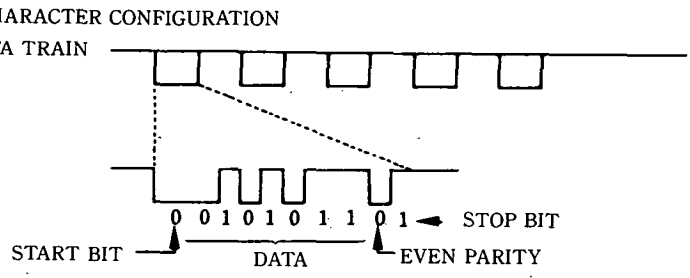
Servopack Status					Status Output Signal					
7SEG. LED		Contents			ALM	$\overline{ERR}$	Alarm Code			
							$\overline{AL3}$	$\overline{AL2}$	$\overline{AL1}$	$\overline{AL0}$
Status	•	Motor current Conduction	Ref. Operation	Normal	0	1	1	1	1	1
				Mode Error	0	0	0	1	0	1
				Position Error	0	0	0	1	0	0
				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.	MCB Trip			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.	Main Circuit Power Supply Error			1	1	1	0	0	1
	7.	Overload			1	1	1	0	0	0
	8.	Position Error			1	1	0	1	1	1
	9.	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
	U.	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

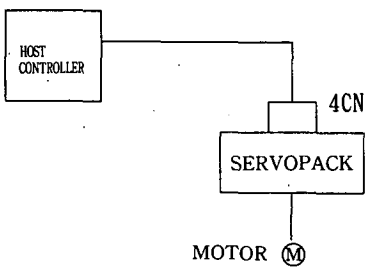
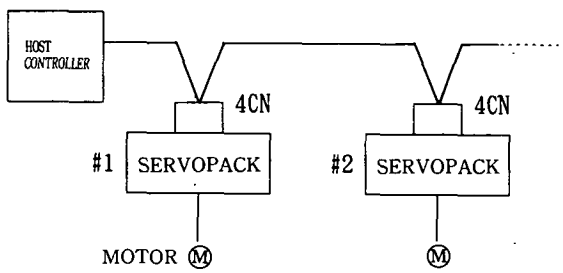
7 SERIAL COMMUNICATION

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-bit ASCII code (JIS X 0201, former C6220)
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

<table>
<tr><th></th><th>One-axis Control</th><th>Multi-axis Control</th></tr>
<tr><td>Command</td><td>COMMAND CHARACTER LINE | CR</td><td>• 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.)</td></tr>
<tr><td>Example</td><td>• SVON CR
• SPD12345 CR
• MOV1234 CR
• ST CR</td><td>• 1SVON CR
• 2SVON CR
• 1SPD123 CR
• 2SPD456 CR
• 1MOV123 CR
• 2MOV456 CR
• ST CR</td></tr>
</table>

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. = 0m	Axis No. = n0	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	Pro-hibited	Possible	Possible	Possible
Multi-axis control;10 to 16 axes	N	M	Possible	Pro-hibited	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. = 0m	Axes with M = m (group)	Not possible	Not provided
Axis No. = n0	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]

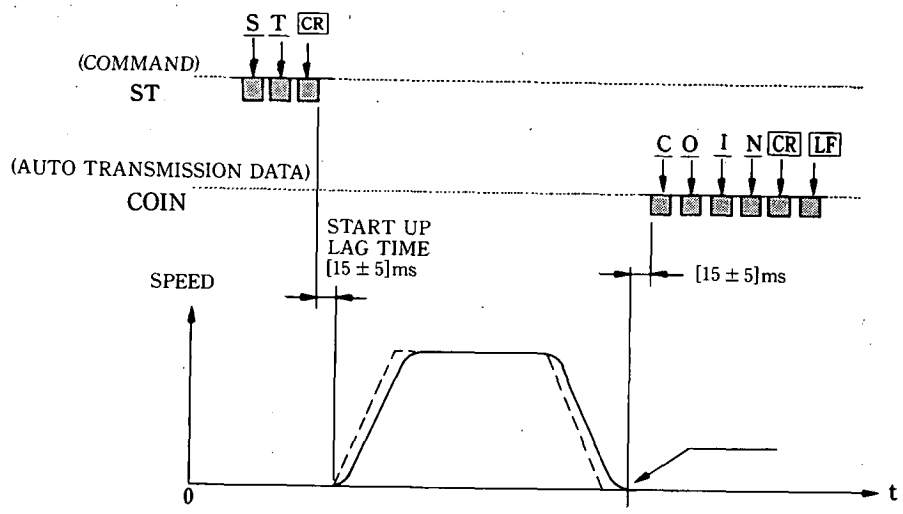
(2) Example

- 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
DC3(Ctrl-S, 13H)	Stops transmission. (X-OFF)
DC1(Ctrl-Q, 11H)	Restart transmission. (X-ON)
ETX(Ctrl-C, 03H)	Monitor data transmission from Servopack is canceled. (For restart, send monitor command to Servopack again.)
ENQ(Ctrl-E, 05H)	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. (p.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	×	×	$\overline{RST}$ 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 OFF.)	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 STP signal is OFF 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. (For parameter 21 and beyond, 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. [ZEROSET ± n···n] command cannot be effective unless [RES] command is executed successively.
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

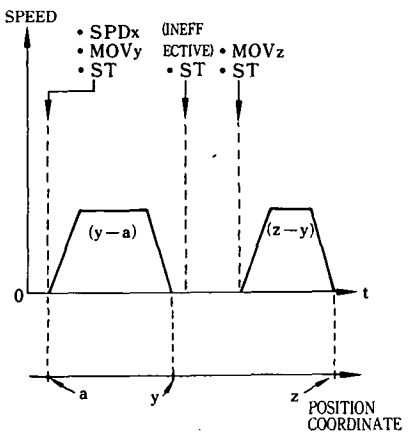
7.8.2 Command Functions (Cont'd)

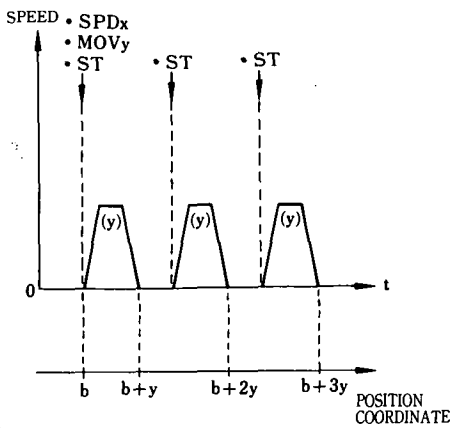
(3) Move command

Command	Function/Contents
SPD n···n Max. 6-digit	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
MOV ± n···n Max. 8-digit (+ can be omitted)	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.

Parameter		Position Reference Mode
No.	Set Value	
14 b3	0	Absolute value
	1	Incremental value

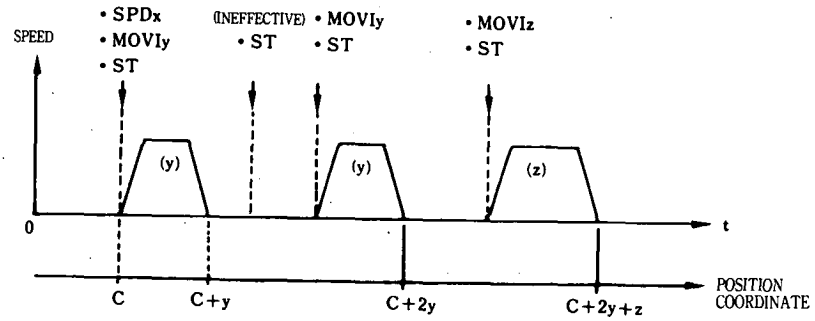
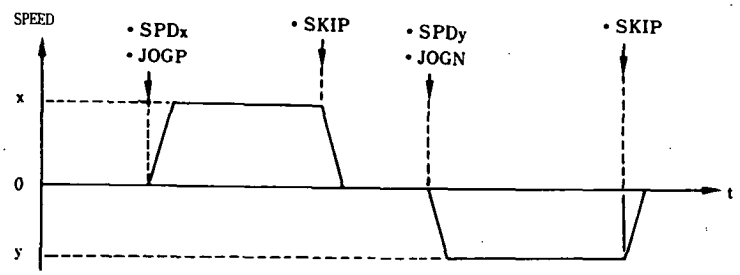
Absolute Mode	Incremental Mode
(Data are in absolute value.)	(Data are in incremental value.)





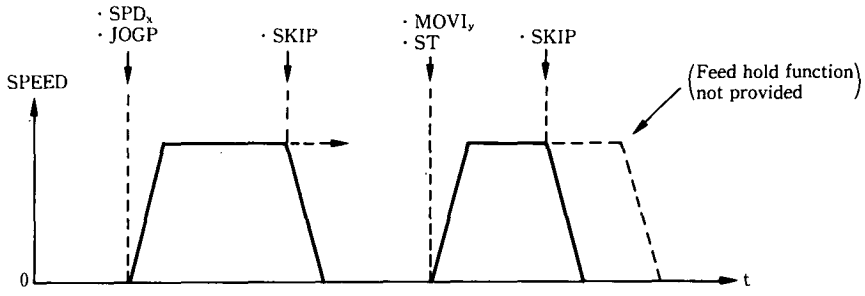
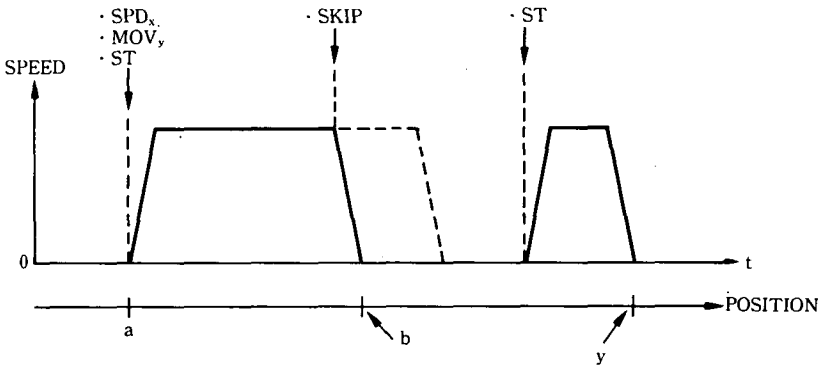
(Cont'd)

(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, ST ┐ Operates at speed which was set before. ③ RES, ST ┐ In this case, returns to zero point (home 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 (2CN-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)

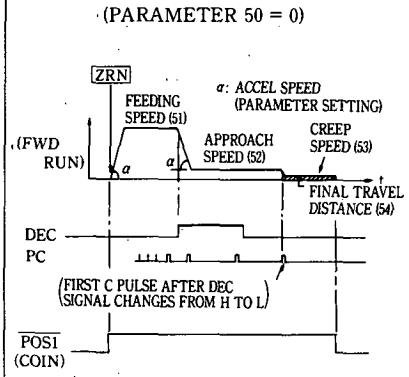
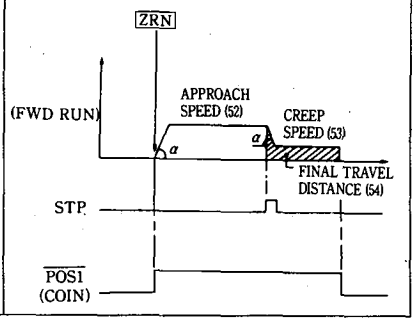
(3) Move command (Cont'd)

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)	

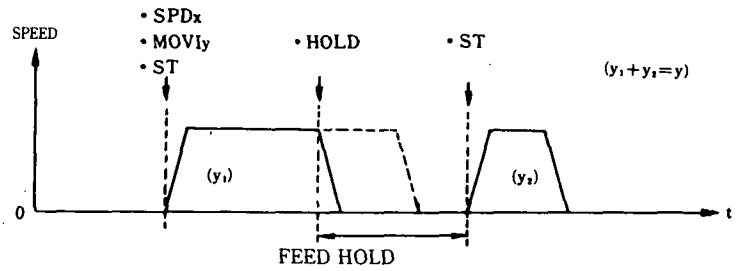
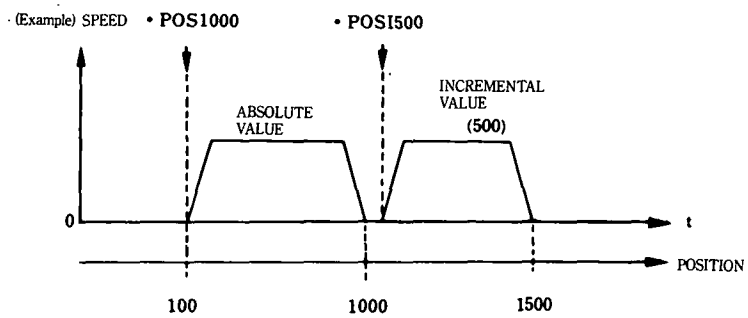
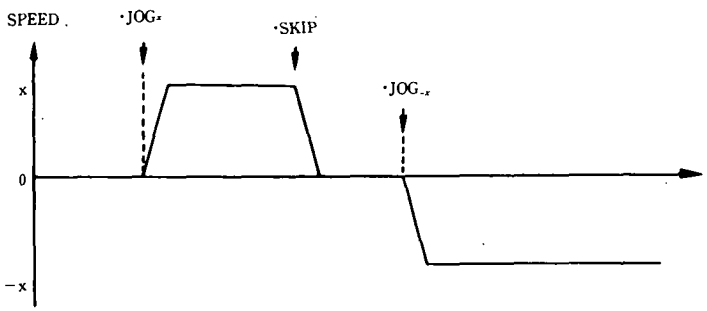
Note 1: Related parameters

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 POS1. [Speed is a set value of parameter (4).] 
JOG (±) n···n Max. 6-digit	Command to perform manual jog operation at speed [(±) n·····n] 

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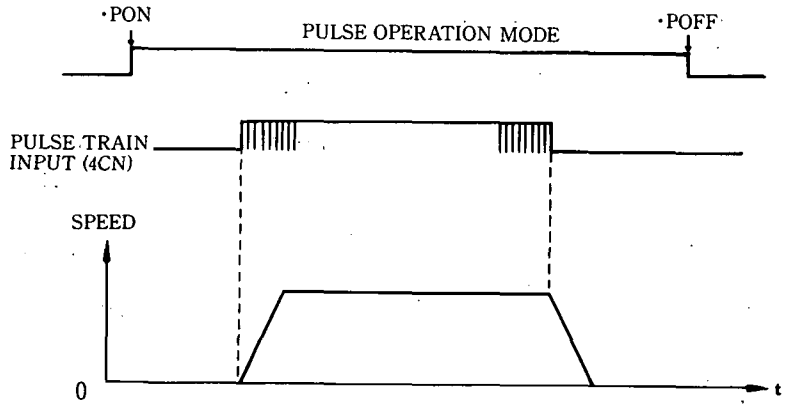
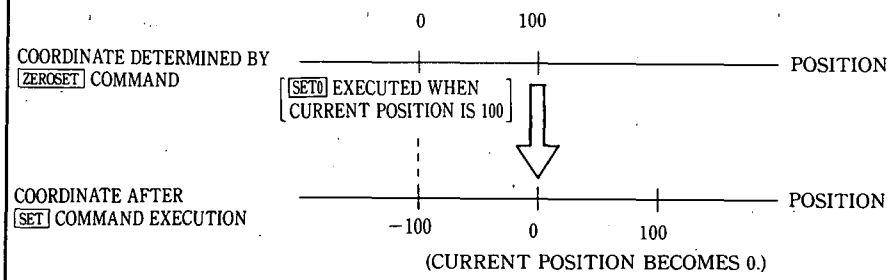
Command	Function/Contents
PON POFF	Command to turn on/off pulse operation mode (positioning operation by external pulse train command). PON enters pulse operation mode and POFF releases it. 
PCON PCOFF	Command to change Servopack speed loop control mode from PI (proportion - integer) operation to P (proportion) 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)

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(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; 15000mm/min. / 0.01mm = 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 2CN 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 5CN 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_4 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	2CN 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	5CN PIN NO.	15	14	13	12	11	10	9	8
		$\overline{\text{RST}}$	$\overline{\text{DR1}}$	$\overline{\text{DR0}}$	$\overline{\text{MCCW}}$	$\overline{\text{MCW}}$	$\overline{\text{MAN}}$	$\overline{\text{ZRN}}$	$\overline{\text{CUR}}$
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 2CN output	OUT1 = n_1 n_0	Refer to the Note below:
OUT2	Connector 5CN 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	

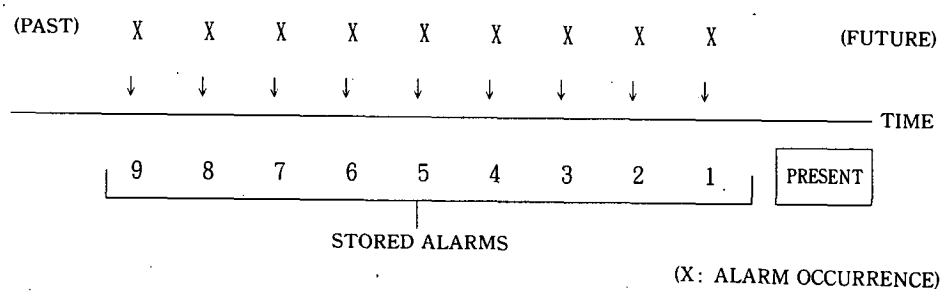
Note: OUTp = n_7 n_6 n_5 n_4 n_3 n_2 n_1 n_0

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	2CN PIN NO.							12	11
								$\overline{BK}$	ALM
OUT2	5CN 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
				$\overline{DS04}$	$\overline{DS03}$	$\overline{DS02}$	$\overline{DS01}$	$\overline{DS00}$	$\overline{AL3}$

(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>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="4">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.
 

(X: ALARM OCCURRENCE)</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	MCB trip			ALM 2. MCB	—	
	3	Regenerative Error			ALM 3. RG	—	
	4	Overvoltage			ALM 4. OV	—	
	5	Overspeed			ALM 5. OS	—	
	6	Main Circuit Power Supply Error			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

Note:
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. (00 means Position / Speed / Boundary table error.)
   For answer to ALMp command, ?? is not output.
   Answer data are "ALM Y. PRM".
4. In case of CPU error, LED indication is uncertain.

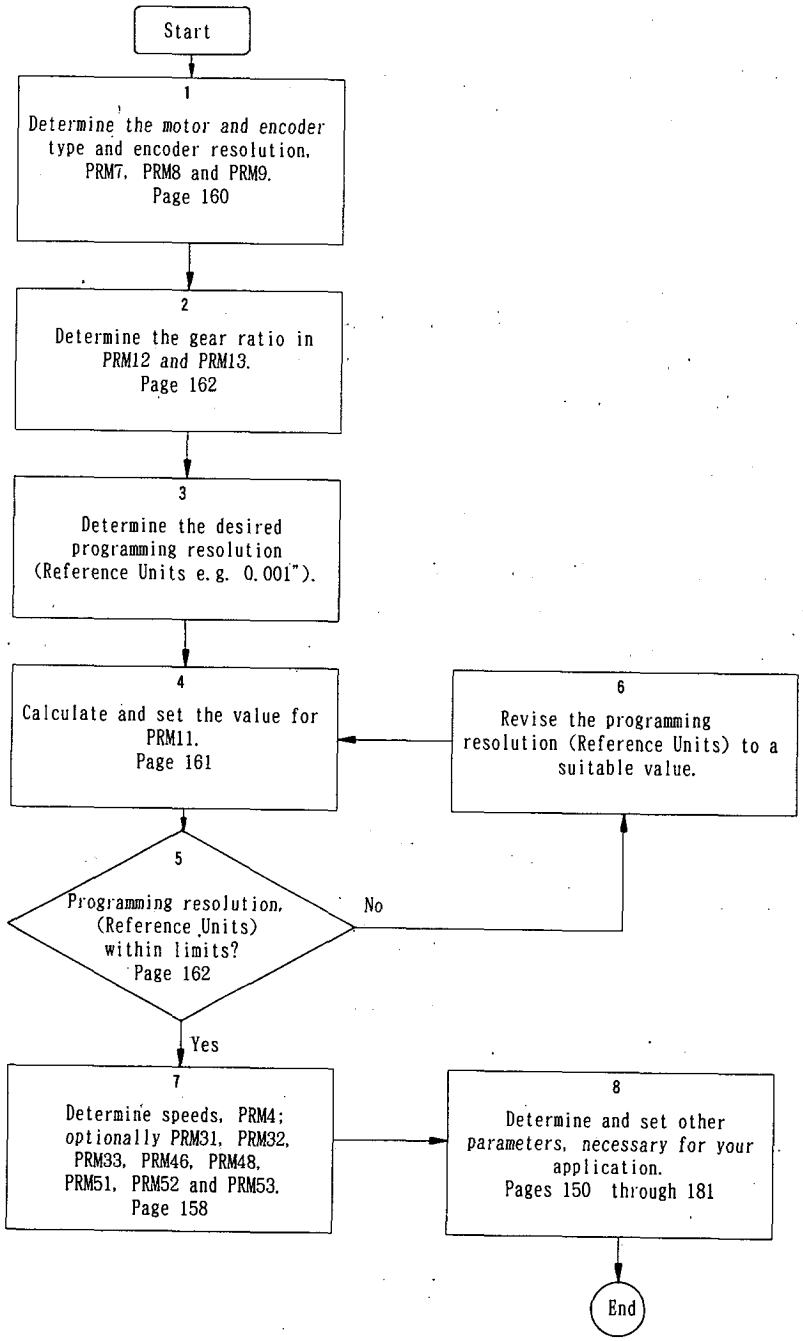
8 PARAMETERS

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.

(For type CACR-HR □□□ BB, data can be set in Servopack setting and displaying section. Refer to Par. 9.1.3)

8.1 GENERAL PROCEDURE FOR DEFINING PARAMETERS



8.1 GENERAL PROCEDURE FOR DEFINING PARAMETERS (Cont'd)

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 160. 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

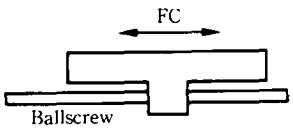
Parameters PRM12 and PRM13 define the gear ratio as a ratio of 2 integer numbers. Set parameter PRM12 to the motor speed, and set parameter PRM13 to the gearbox-output speed.

◆ Step 3

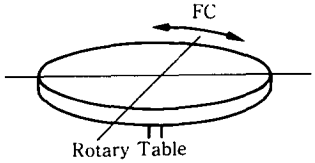
Determine the desired programming resolution, also referred to as Reference Unit. Typical values are 0.001", 0.001mm, 0.01 degrees. This is minimum position increment that can be programmed and is different from the encoder resolution. The programming resolution is determined by parameters, the encoder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

◆ Step 4

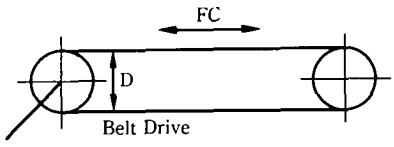
Determine the amount of linear or rotary motion for one revolution of the gearbox-output shaft (one motor revolution, in case of direct drive); also referred to as Feed Constant (FC) in this document. The illustration below shows three common application examples.



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.

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

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.

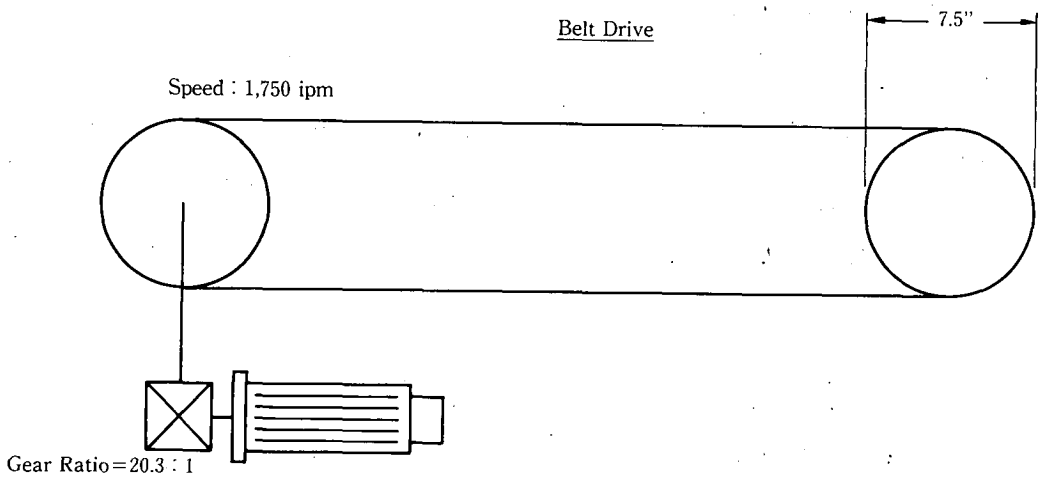
PRM4 = Speed 〔 Reference Unit per minute 〕 /1,000

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 150 through 181 for details.

Example:



Motor part number: USAGED-13A22K (incremental encoder, 8,192 lines per rev.)

8.1 GENERAL PROCEDURE FOR DEFINING PARAMETERS (Cont'd)

◆ 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 = $\pi \times D$ = 3.14159×7.5 inches = 23.562 inches
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 = $\pi \times D$ = 3.14159×7.5 inches = 23.562 inches
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, pages 150 through 181

◆ 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.

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
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> <→20/b1>		○	2	●	●	●	●
		1: DG-SW								
		2: Serial command								
		4: Command table								

(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
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)

8

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
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)

(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	0 to ±99999999	Reference unit	○		0		▲	▲	
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)

8

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
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)

(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
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

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
HRA5BAB12	32	USAREM-A5C □ 2	32
HR01BAB12	33	USAREM-01C □ 2	33
		USAPEM-01C □ 2	73
HR02BAB12	34	USASEM-02A □	20
		USAREM-02C □ 2	34
		USAPEM-02C □ 2	74
HR03BAB12	1	USAMED-03□□ 1	1
		USAFED-02□□ 1	10
		USAFED-03□□ 1	11
		USAGED-02□□ 1	50
		USAGED-03□□ 1	51
		USASEM-03A □	21
		USAREM-03C □ 2	35
		USAPEM-03C □ 2	75
HR05BAB12	36	USAFED-05□□ 1	12
		USAGED-05□□ 1	52
		USADED-05E □	42
		USASEM-05A □	22
		USAREM-05C □ 2	36
		USAPEM-05C □ 2	76
HR10BAB	2	USAMED-06□□ 1	2
		USAMED-09B □ 2	3
		USAFED-09□□ 1	13
		USAGED-09□□ 1	53
		USASEM-08A □	23
		USAREM-07C □ 2	37
		USAPEM-07C □ 2	77
HR15BAB	43	USAMED-12B □ 2	4
		USAFED-13C □ 2	14
		USAGED-13A □ 2	54
		USADED-10E □	43
		USASEM-15A □	24
HRA5BAB11	62	USAREM-A5D □ 2	62
HR01BAB11	63	USAREM-01D □ 2	63
HR02BAB11	64	USAREM-02D □ 2	64
HR03BAB11	65	USAREM-03D □ 2	65
HR05BAB11	66	USAREM-05D □ 2	66

Servopack Type	Parameter No. 7 Value Set Prior to Shipping	Applicable Servomotor Type - □	Motor Code
HR03BB	11	USAMED-03□□ 1	1
		USAFED-02□□ 1	10
		USAFED-03□□ 1	11
		USAGED-02□□ 1	50
		USAGED-03□□ 1	51
		USASEM-02A □	20
		USASEM-03A □	21
HR05BB	12	USAFED-05□□ 1	12
		USAGED-05□□ 1	52
		USADED-05E □	42
		USASEM-05A □	22
HR10BB	13	USAMED-06□□ 1	2
		USAMED-09B □ 2	3
		USAFED-09□□ 1	13
		USAGED-09□□ 1	53
		USASEM-08A □	23
HR15BB	14	USAMED-12B □ 2	4
		USAFED-13C □ 2	14
		USAGED-13A □ 2	54
		USADED-10E □	43
		USASEM-15A □	24
HR20BB	15	USAMED-20B □ 2	5
		USAFED-20C □ 2	15
		USAGED-20A □ 2	55
		USADED-15E □	44
HR30BB	16	USAMED-30B □ 2	6
		USAFED-30C □ 2	16
		USAGED-30A □ 2	56
		USADED-22E □	45
		USASEM-30A □	26
HR44BB	17	USAMED-44B □ 2	7
		USAFED-44C □ 2	17
		USAGED-44A □ 2	57
		USADED-37E □	46
HR60BB	8	USAMKD-60B □ 2	8

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) prior to shipping.	

(Cont'd)

<table>
<tr><th>No.</th><th>Name</th><th>Contents</th></tr>
<tr><td>4</td><td>(1st) Feeding Speed</td><td>
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

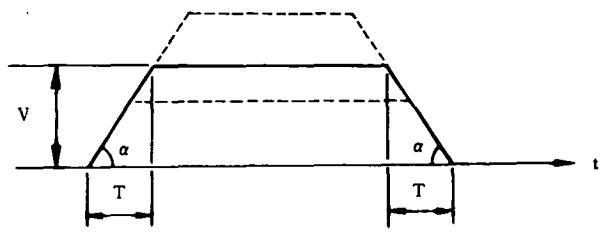
(1) For reference speed, this parameter set value is selected when speed select signals (5CN) both SP2ND and SP3RD are at H level.

< Speed selected by this parameter at contact >
<table>
<tr><th colspan="3">Parameter</th><th colspan="2">Speed Select Signanl</th></tr>
<tr><th>No</th><th>Name</th><th>Setting Range/Unit</th><th>$\overline{\text{SP2ND}}$</th><th>$\overline{\text{SP3RD}}$</th></tr>
<tr><td>4</td><td>(1st) Feeding Speed</td><td rowspan="4">1 to 240000

(×1000 reference unit/min)</td><td>H</td><td>H</td></tr>
<tr><td>31</td><td>(2nd) Feeding Speed</td><td>L</td><td>H</td></tr>
<tr><td>32</td><td>(3rd) Feeding Speed</td><td>H</td><td>L</td></tr>
<tr><td>33</td><td>(4th) Feeding Speed</td><td>L</td><td>L</td></tr>
</table>

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

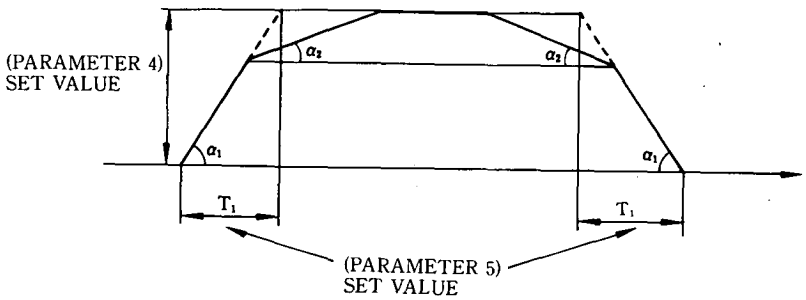
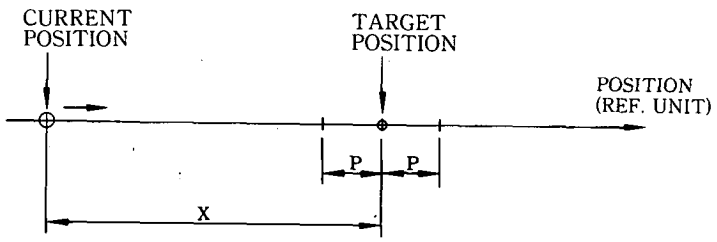
<table>
<tr><td>Parameter No.</td><td>4</td><td>5</td></tr>
<tr><td>Set Value</td><td>V</td><td>T</td></tr>
</table>



Accel speed α is determined by V/T and becomes constant if feeding speed changes. (Accel speed constant control)
</td></tr>
</table>

(Cont'd)

(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 $\leqq$ p.

(Cont'd)

8

No.	Name	Contents
7	Motor Selection Code	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.

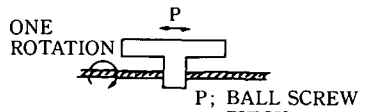
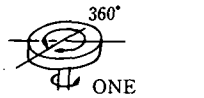
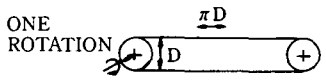
M Series		F Series		G Series		D Series		S Series		R Series (200V)		R Series (100V)		P Series	
Motor Type USAMED-	Code No.	Motor Type USAFED-	Code No.	Motor Type USAGED-	Code No.	Motor Type USADED-	Code No.	Motor Type USASEM-	Code No.	Motor Type USAREM-	Code No.	Motor Type USAREM-	Code No.	Motor Type USAPEM-	Code No.
—	0	02□□ 1	10	02□□ 1	50	—	40	02A □	20	—	30	—	60	—	70
03□□ 1	1	03□□ 1	11	03□□ 1	51	—	41	03A □	21	—	31	—	61	—	71
06□□ 1	2	05□□ 1	12	05□□ 1	52	05E □	42	05A □	22	A5C □ 2	32	A5D □ 2	62	—	72
09B □ 2	3	09□□ 1	13	09□□ 1	53	10E □	43	08A □	23	01C □ 2	33	01D □ 2	63	01C □ 2	73
12B □ 2	4	13C □ 2	14	13A □ 2	54	15E □	44	15A □	24	02C □ 2	34	02D □ 2	64	02C □ 2	74
20B □ 2	5	20C □ 2	15	20A □ 2	55	22E □	45	—	25	03C □ 2	35	03D □ 2	65	03C □ 2	75
30B □ 2	6	30C □ 2	16	30A □ 2	56	37E □	46	30A □	26	05C □ 2	36	05D □ 2	66	05C □ 2	76
44B □ 2	7	44C □ 2	17	44A □ 2	57	—	47	—	27	07C □ 2	37	—	67	07C □ 2	77
USAMKD-60B □ 2	8	—	18	—	58	—	48	—	28	—	38	—	68	—	78
—	9	—	19	—	59	—	49	—	29	—	39	—	69	—	79

8	Encoder Pulse		Encoder pulse resolution mounted at motor shaft opposite load side is set. Prior to shipping, value [32768] (8192 ×4) is set.
9	Encoder Selection		Identification code of encoder to be used is set. Factory setting is [0]. Absolute encoder identification code: 0 Incremental encoder identification code: 1
10	Absolute Encoder Allowable Error Amount	Effective with parameter 9=0	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 previous power-down) exceeds parameter 10 set value, an alarm (ABS0 error) occurs. Set value prior to shipping is [32768].

(Cont'd)

(Cont'd)

No.	Name	Contents
11	Load Moving Amount at Load Side One Rotation (Reference unit)	(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 $\times$0.1 = 5000 μm = 5mm. • Determine reference unit, considering machine specifications, positioning accuracy, etc. • Position data unit for DG-SW, serial communication, etc. is the reference unit. • Speed data unit in DG-SW, serial communication or parameter setting is [$\times$1000 reference unit/min]. (2) (Parameter 11) set value $= \frac{\text{Moving amount per load side rotation}}{\text{Reference unit}}$ The table below shows typical load moving amount rotation:

Load Moving Amount per Load Shaft Rotation	Typical Load Cofiguration	
P	Ball Screw	
360°	Round Table	
πD	Belt	

Parameter 11 setting range: 1 to 1500000

(Exmaple) When load moving mount per load shaft rotation is 12mm and reference unit is 0.01mm, the following value is set:

(Parameter 11) = $\frac{12}{0.01}$ = 1200

(Cont'd)

<table>
<tr><th>No.</th><th>Name</th><th>Contents</th></tr>
<tr><td>12</td><td>Gear Ratio Setting m
(Motor Shaft Rotation Speed)</td><td rowspan="2">(1) Assuming load shaft ratates 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.</td></tr>
<tr><td>13</td><td>Gear Ratio Setting ℓ
(Load Shaft Rotation Speed)</td></tr>
<tr><td>14</td><td colspan="2">Mode Setting</td><td>By setting b4, b3, b2, b1 or b0 to "0" or "1", mode is set (b0 is LSB).</td></tr>
<tr><td></td><td>b0</td><td>Motor Rotating Direction Setting</td><td>Used when motor rotating direction for reference direction (±) is changed.
<table>
<tr><th>Set Value</th><th>Reference Direction</th><th>Motor Shaft Rotating Direction</th></tr>
<tr><td rowspan="2">0</td><td>+</td><td>Forward direction</td></tr>
<tr><td>−</td><td>Reverse direction</td></tr>
<tr><td rowspan="2">1</td><td>+</td><td>Reverse direction</td></tr>
<tr><td>−</td><td>Forward direction</td></tr>
</table></td></tr>
</table>

(Cont'd)

(Cont'd)

<table>
<tr><th>No.</th><th colspan="2">Name</th><th>Contents</th></tr>
<tr><td rowspan="3">14</td><td>b1</td><td>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>b2</td><td>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>b3</td><td>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 colspan="2">Serial Communication</th><th>Command table</th></tr>
<tr><th></th><th></th><th></th><th>MOV x</th><th>MOVI x</th><th></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)

8

No.	Name	Contents
14	b4 Position Reference Code	Position data code (BCD or binary) is selected. (1) Station No. reference method

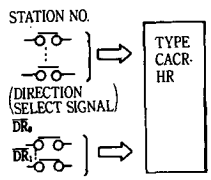
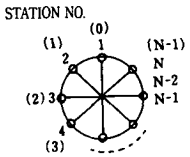
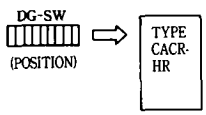
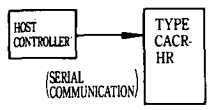
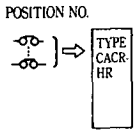
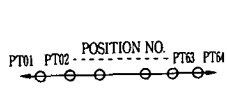
Input Signal	$\overline{CD0}$	$\overline{CD1}$	$\overline{CD2}$	$\overline{CD3}$	$\overline{CD4}$	$\overline{CD5}$	$\overline{CD6}$	$\overline{CD7}$	$\overline{CD8}$	$\overline{CD9}$	$\overline{CD10}$	$\overline{CD11}$
B C D (b4=1)	1	2	4	8	10	20	40	80	100	200	400	800
Binary (b4=0)	1	2	4	8	16	32	64	128	256	512	1024	2048

(2) Set BCD (b4 = 1) for DG-SW reference method
(3) Set binary setting (b4 = 0) for command table method.

15 Position Reference Method

Applicable position data reference method is set.

Set Value	Position Data Reference Method
0	Station No.
1	DG-SW
2	Serial Communication
4	Command Table

	Reference Method and Outline	Reference Input	Remarks
Station No.	Positioning to a station No. provided by parallel contact data (12-bit). Rotating direction is determined by direction select signal.		
DG-SW	Position reference by DG-SW (up to 8 digits) setting data.		
Serial Communi-cation	Position reference command. Data are set by MOV or MOVI.		
Command Table	Positioning at position No. specified by parallel contact data (6-bit).		

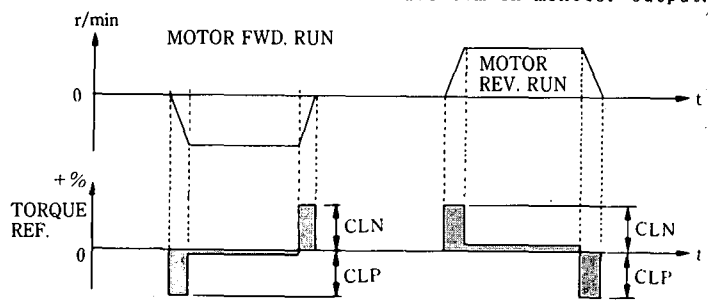
(Cont'd)

(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.

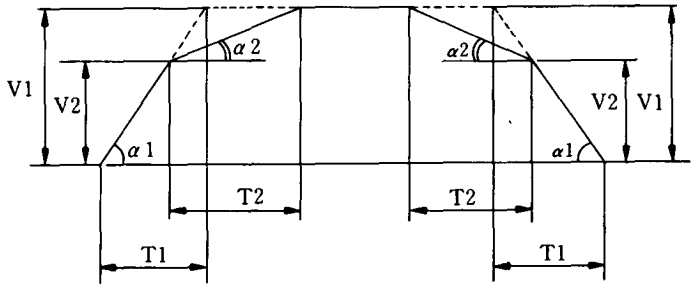
Whether the station No. is taken from 0 or 1 is set by parameter 20 b2.</td></tr>
<tr><td>17</td><td colspan="2">Function Selection 1</td><td>By setting (b4, b3, b2, b1, b0) to "0" or "1", each function can be selected.</td></tr>
<tr><td></td><td>b0</td><td>Current Limit</td><td>b0 = 1 when current limit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

8

<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>
<tr><td>D Series 2500r/min</td></tr>
<tr><td>Ṡ Series 4000r/min</td></tr>
<tr><td>R Series 4500r/min *2</td></tr>
<tr><td>P Series 4500r/min</td></tr>
</table>
*1 1500r/min for types USAMED 44B ☐ 2 and USAMKD-60B ☐ 2.
*2 4000r/min for 100V (USAREM- ☐☐D ☐ 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)

(Cont'd)

No.	Name	Contents
17	b4 Accel/Decel Type Setting	Accel/decel type (linear or exponent) is specified by b4 setting.

< Setting Method >

b4 Set Value	Accel/decel Type
0	1-step or 2-step linear accel/decel and simplified S-curve accel/decel. (Always linear type regardless of operation mode.)
1	Set the following parameters according to the accel/decel type in each operation mode:

Parameter No.	Operation Mode	Linear Accel /Decel or Simplified S-Curve Accel/Decel	Exponential Accel/Decel
68	Automatic	1	0
69	Manual	1	0
70	Pulse command	1	0
71	Zero-point return (homing)	1	0

Note: Refer to parameters 47 and 48 for exponential accel/decel setting.

(Cont'd)

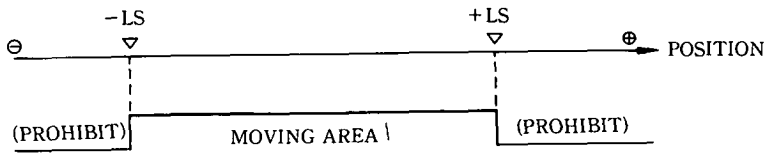
No.	Name	Contents
18	Function Selection 2	By setting (b4, b3, b2, b1, b0) to "0" or "1", each function can be selected.
	b0 Software overtravel (Position Reference Fault Detection)	(1) Software overtravel function is effective in finite positioning mode while position reference fault detection function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

(Cont'd)

(Cont'd)

<table>
<tr><th>No.</th><th colspan="2">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 $\overline{\text{SP2ND}}$ and $\overline{\text{SP3RD}}$. Refer to the description of parameter 4.</td></tr>
</table>

(Cont'd)

<table>
<tr><th>No.</th><th colspan="2">Name</th><th>Contents</th></tr>
<tr><td>18</td><td>b3</td><td>Speed Reference in Manual Operation Mode</td><td>Selects speed reference setter in manual operation mode.
<table>
<tr><td rowspan="2">b3 Set Value</td><td colspan="4">Parameter 15 setting (Position Reference Method)</td></tr>
<tr><td>0</td><td>1</td><td>2</td><td>4</td></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 $\overline{\text{SP2ND}}$ and $\overline{\text{SP3RD}}$. Refer to the description of parameter 4.</td></tr>
<tr><td></td><td>b4</td><td>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 signals P-OT and N-OT.
<table>
<tr><th>b0 Set Value</th><th>P-OT and N-OT Signals</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>

(Cont'd)

(Cont'd)

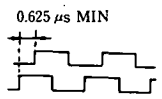
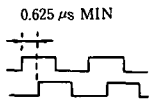
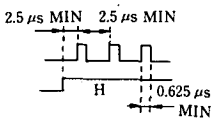
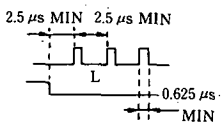
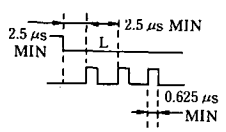
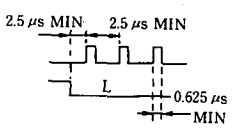
No.		Name	Contents
19	b1	STOP Signal	Enables or disables STOP signal operation. To perform automatic operation in serial communication, set b1 = 1. If STOP signal input (2CN-15) remains open, [ST] command becomes [ERR SN]

b1 Set Value	STOP Signal
0	Used (Closed input at operation.)
1	Not used (Input can be opened.)

	b2	Brake Release Signal	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.

b2 Set Value	$\overline{BK}$ Signal
0	Not used (Parameters 43, and 44 setting are ineffective)
1	Used (Parameters 43, and 44 setting are effective)

	b3	Pulse Reference Input	Set together with parameter 63 according to input pulse signal form in pulse train operation mode.

Signal Form		Parameter No. 63	Parameter No. 19 b3	Signal Name	Pulse Waveform: Plus Side Reference	Pulse Waveform: Minus Side Reference
90° phase difference 2-phase pulse train	×4	0	0	CA, CB		
	×2	1	1			
	×1	2				
Sign + pulse train		3		CA, CB		
CCW + CW pulse train		4		CA, CB		

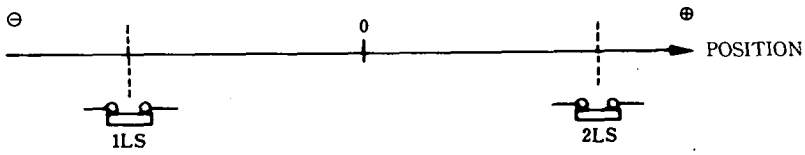
(Cont'd)

8

<table>
<tr><th>No.</th><th colspan="2">Name</th><th>Contents</th></tr>
<tr><td rowspan="4">19</td><td>b4</td><td>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>b5</td><td>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 $\overline{\text{NEAR}}$ 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>b6</td><td>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></tr><tr><td>0</td><td>N-OT</td><td>P-OT</td></tr><tr><td>1</td><td>P-OT</td><td>N-OT</td></tr></table> (Standard)

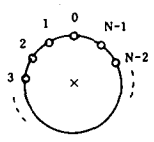
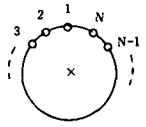
P-OT: Stops + direction reference
N-OT: Stops — direction reference</td></tr>
<tr><td>b7</td><td>Torque Reference Filter Time Constant Change</td><td>b7 = 1 when the function of parameter 90 which sets torque reference filter time constant to prevent shaft oscillation is to be effective; b7 = 0 when 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)

(Cont'd)

No.	Name	Contents
20	Function Selection 4	By setting (b6, b5, b4, b3, b2, b1, b0) to "0" or "1", each function can be selected.
	b0 —	(Always set to 0.)
	b1 External Position Indicator	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.
	b2 Station No. 0	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.

b2 Set Value	0	1
How to Take Station No.	Station No. 0 Provided	Station No. 0 Not Provided
		

b3	Simplified S-curve Accel/Decel	Selects whether simplified S-curve accel/decel is used or not.

b3 Set Value	Simplified S-curve Accel/Decel
0	Not used: Parameter 76 setting ineffective
1	Used : Parameter 76 setting effective

b4	Function Selection 7 Setting (Related to Parameter 72)	Set to 1 when parameter 72 function is to be effective. (Normally set to 0.)

b4 Set Value	Parameter 72 Setting Contents
1	Effective
0	Same function as parameter 72 b0 = 0, b1 = 0, b2 = 0, b3 = 0, b4 = 0 or b5 = 0 setting.

b5	Function Selection 5 Setting (Related to Parameter 65)	Set to 1 when parameter 65 function is to be effective. (Normally set to 0.)

b5 Set Value	Parameter 65 Setting Contents
1	Effective
0	Same function as parameter 65 b0 = 0, b1 = 0, b2 = 0, b3 = 0, b4 = 0, b5 = 0 or b6 = 0 setting.

b6	Function Selection 6 Setting (Related to Parameter 66)	Set to 1 when parameter 66 function is to be effective. (Normally set to 0.)

b5 Set Value	Parameter 66 Setting Contents
1	Effective
0	Same function as parameter 66 b0 = 0, b1 = 0, b2 = 0, b3 = 0, b4 = 0, b5 = 0, b6 = 0 or b7 = 0 setting.

(Cont'd)

8.3 PARAMETER FUNCTION DETAILS (Cont'd)

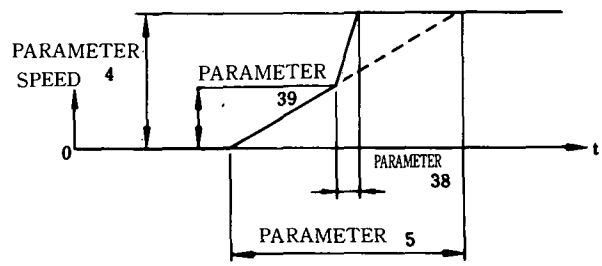
<table>
<tr><th>No.</th><th>Name</th><th colspan="4">Contents</th></tr>
<tr><td>31</td><td>2nd Feeding Speed</td><td rowspan="3">Effective in mode selected by parameter at contact</td><td colspan="3">Speed reference value selected by speed select signal SP2ND or SP3RD. (selected by parameter at contact.)

<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.

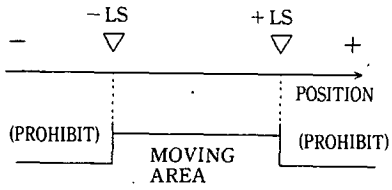
Setting range: 0 to 100, unit: %</td></tr>
<tr><td>38</td><td>Linear Accel/Decel Time 2</td><td colspan="4">Parameter to determine accel/decel speed at the second step in 2-step linear accel/decel type.

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>

(Cont'd)

(Cont'd)

<table>
<tr><th>No.</th><th>Name</th><th colspan="2">Contents</th></tr>
<tr><td>40</td><td>Plus Side Software Overtravel
(Plus Side Position Reference Fault Detection Value)</td><td rowspan="2">(1) Parameter 14 b1 = 0
(finite positioning mode)
Effective by parameter 18 b0 = 1 setting.
 

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</td><td>(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.</td></tr>
<tr><td>41</td><td>Minus Side Software Overtravel
(Minus Side Position Reference Fault Detection Value)</td><td>(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.</td></tr>
<tr><td>42</td><td>Backlash Compensation Amount</td><td colspan="2">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.)〕</td></tr>
<tr><td>43</td><td>Brake Time</td><td rowspan="2">Effective by parameter 19 b2 = 1.
Refer to par. 6.3.2 (2) for operation.</td><td>Setting range: 8 to 1000
Unit: ms</td></tr>
<tr><td>44</td><td>Brake ON Motor Speed</td><td>Setting range: 1 to 10000
Unit: r/min (motor speed)</td></tr>
<tr><td>45</td><td>Positioning Near Range and Station Near Range</td><td colspan="2">Effective by parameter 19 b5 = 1.

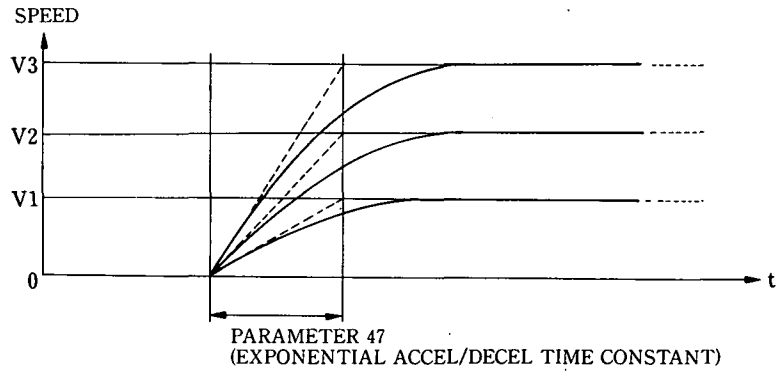
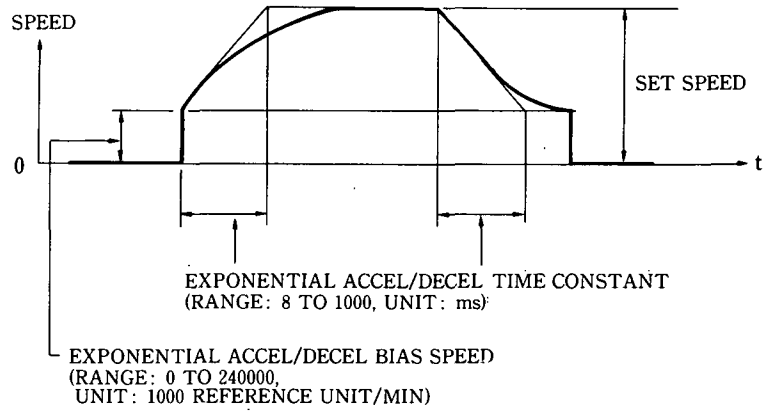
Setting range: 0 to 30000
Unit: Reference unit

(Station near range when parameter 20 b5 = 1 or parameter 65 b1 = 1)</td></tr>
<tr><td>46</td><td>Speed Limit Value</td><td colspan="2">Effective by parameter 17 b3 = 1. Set value becomes load maximum speed.

Set value: 1 to 240000
Unit: ×1000 reference unit/min</td></tr>
</table>

(Cont'd)

8.3 PARAMETER FUNCTION DETAILS (Cont'd)

<table>
<tr><th>No.</th><th>Name</th><th colspan="3">Contents</th></tr>
<tr><td>47</td><td>Exponential Accel/Decel Time Constant</td><td colspan="3">Accel/decel speed varies depending on set speed.
 
</td></tr>
<tr><td>48</td><td>Exponential Accel/Decel Bias Speed</td><td colspan="3">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>49</td><td>Zero-point Return (Homing) Mode</td><td rowspan="6">Effective by parameter 18 14b = 1</td><td>0</td><td>Zero-point return mode I
(Decel LS and Cϕ pulse used)</td></tr>
<tr><td></td><td>1</td><td>Zero-point return mode II (STP signal used)</td></tr>
<tr><td>50</td><td>Zero-point Return Direction</td><td>0</td><td>Zero-point return toward plus direction</td></tr>
<tr><td></td><td>1</td><td>Zero-point return toward minus direction</td></tr>
<tr><td>51</td><td>Zero-point Return Feeding Speed</td><td colspan="2" 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 colspan="2"><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)

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.
	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.)

b0 Set Value	Zone Signal
0	Not Used
1	Used

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, 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)

<table>
<tr><th rowspan="2">No.</th><th colspan="2" 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</td><td>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</td><td>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></td><td>(Normally set to 0.)</td></tr>
<tr><td></td><td>b5</td><td></td><td></td><td></td><td>(Normally set to 0.)</td></tr>
<tr><td></td><td>b6</td><td>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>, 5CN-5).
<table><tr><th>b6 Set Value</th><th>Specifications of <u>Positioning</u> 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)

(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 $\overline{P8}$) (5CN-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) ×10 (PARAMETER 67 SET VALUE) Example: When parameter 67 = 2 and DG-SW reference = 123; 123×10² = 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)

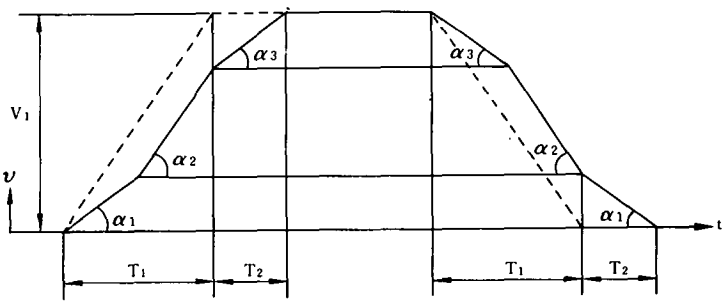
<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Name</th><th colspan="2">Conditioning Parameter</th><th rowspan="2">Contents</th></tr>
<tr><th>No.</th><th>Set Value</th></tr>
<tr><td>72</td><td>Function Selection 6</td><td colspan="3">By setting (b0, b1, b2, b3, b4, b5) to "0" or "1", the following function can be selected:
<table>
<tr><th colspan="2" rowspan="2">20 b4 | 1</th><th colspan="2">Set Value and Function Provided/Not Provided</th></tr>
<tr><th>0</th><th>1</th></tr>
<tr><td>b0</td><td>Overrun Alarm Process</td><td>Set</td><td>Not set</td></tr>
<tr><td>b1</td><td>Remaining Data Process after STOP signal is input</td><td>Hold (Feedhold)</td><td>Abandon (No feedhold)</td></tr>
<tr><td>b2</td><td>PG (L-PG/M-PG) Selecting Method at Positioning Completion when Line PG Used</td><td>Selected by $\overline{\text{L-PG}}$ signal</td><td>Motor PG selected by force</td></tr>
<tr><td>b3</td><td>Echo-back at Initialization</td><td>Not set</td><td>set</td></tr>
<tr><td>b4</td><td>OK Response for Command</td><td>Not set</td><td>set</td></tr>
<tr><td>b5</td><td>Monitor Data Transmission Specification Change</td><td>Monitor data are sent repeatedly from Servo-pack.</td><td>Monitor data are sent only once from Servopack.</td></tr>
</table></td></tr>
<tr><td>76</td><td>Simplified S-curve Accel/ Decel Time</td><td>20 b3</td><td>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).

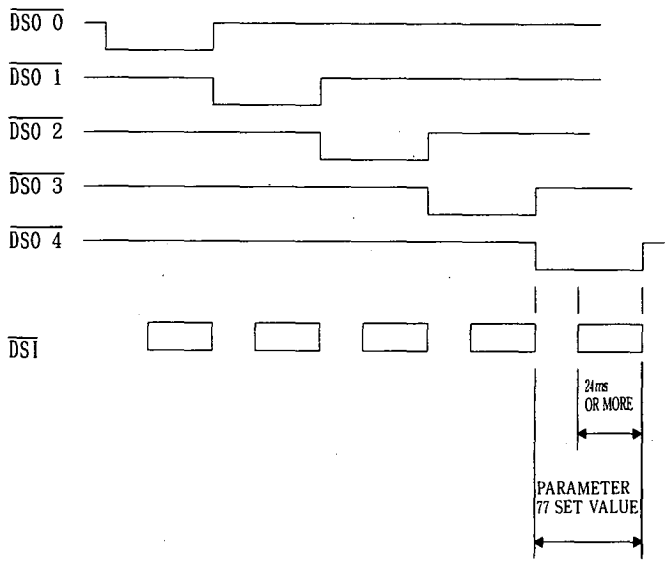
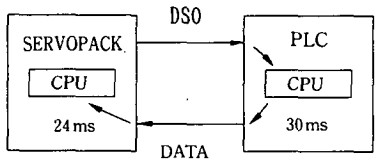
Simplified S-curve accel/decel becomes effective by 20 b3 = 1 setting when linear accel/decel type is selected by parameter 17 b4.

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)

(Cont'd)

No.	Name	Conditioning Parameter		Contents
		No.	Set Value	
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 indicator. For Servopack type HR □□□ BB, fault contents are displayed in the data display section.

Table 9.1 LED Indicators

Display Specifications	HR □□□ BAB	HR □□□ BB	Conditions at Lighting
Power Supply Display	MAIN (red)	—	Voltage remaining in Servopack DC main circuit (fail-safe lamp)
	MP (yellow)	MP (green)	Servopack DC main circuit voltage normal
	RUN (green)	P (green)	Servopack control power supply (+5V) normal
Alarm Display	ALARM (red)	ALM (red)	At alarm occurrence

Table 9.2 7-segment LED (Red) Display Specifications and Fault Contents Display Specifications of Servopack Type HR□BB

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.nCb	2.	Circuit protector trip	
3.rG	3.	Regenerative error	
4.OU	4.	Overvoltage	
5.OS	5.	Overspeed	
6.UU	6.	Main circuit power supply error	
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.rUY	L.	Overrun	
Y.Pr ??*2	Y.	Parameter error	

*1 ???? varies as follows depending on the status:
At positioning completion: COin.
At positioning near: nEAr.
At positioning: rUn.
At feed holding: HOLd
*2 ?? indicates parameter No. (00 means Position / Speed / Boundary table error.)
(In alarm record display mode, ?? is not indicated.)

9.1.2 Display and Setting Functions for Servopack Type CACR-HR□□BAB□□

(1) I/O signal check

I/O signals can be checked by LED block on the panel. Table 9.3 shows the signals indicated by LED blocks according to SW setting. The table below shows I/O signal status:

	At LED Lighting	At LED Extinguishing
Contact Input	Open	Close
Pulse Input	H level	L level
Output Signal	Output relay OFF	Output relay ON

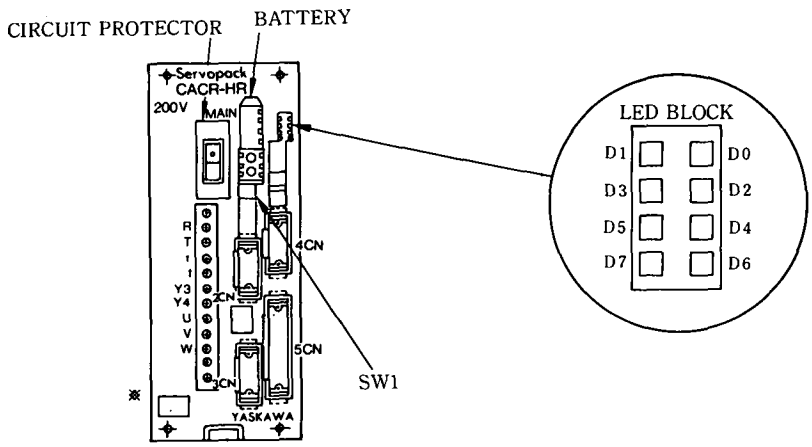


Table 9.3 Connector Pin Nos. and Names of Signals Indicated by LED Blocks

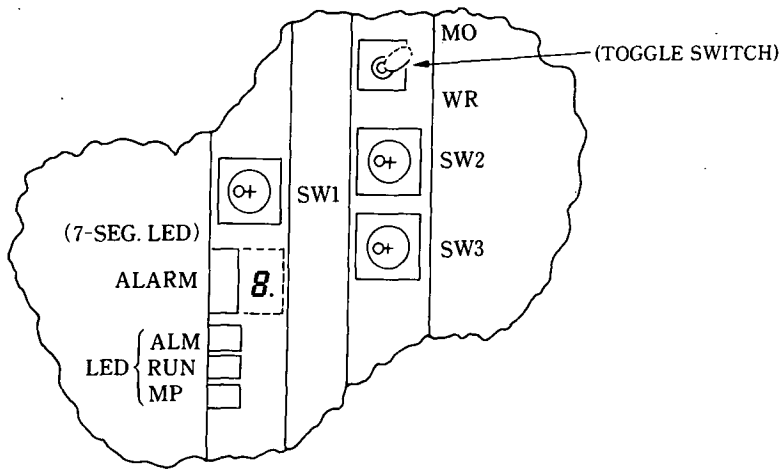
SW1		D7	D6	D5	D4	D3	D2	D1	D0
0	Signal Name and 2CN Pin No.	1	15	16	17	18	8	9	10
		STP	STOP	$\overline{\text{AST}}$	DEC	$\overline{\text{PCON}}$	$\overline{\text{SVON}}$	N-OT	P-OT
1	Signal Name and 5CN Pin No.	15	14	13	12	11	10	9	8
		$\overline{\text{RST}}$	$\overline{\text{DR1}}$	$\overline{\text{DR0}}$	$\overline{\text{MCCW}}$	$\overline{\text{MCW}}$	$\overline{\text{MAN}}$	$\overline{\text{ZRN}}$	$\overline{\text{CUR}}$
2		29	28	27	26	25	24	17	16
3		44	43	42	41	40	32	31	30
4					49	48	47	46	45
						$\overline{\text{LPG}}$	$\overline{\text{PULS}}$	$\overline{\text{SP3RD}}$	$\overline{\text{SP2ND}}$
5	Signal Name and Input Pulse				PG Pulse			Reference Pulse	
					PA	PB	PC	CA	CB
6	Signal Name and 2CN Pin No.							12	11
								$\overline{\text{BK}}$	ALM
7	Signal Name and 5CN Pin No.	21	20	19	7	6	5	4	3
		$\overline{\text{AL2}}$	$\overline{\text{AL1}}$	$\overline{\text{AL0}}$	$\overline{\text{ERR}}$	$\overline{\text{POS2}}$	$\overline{\text{POS1}}$	$\overline{\text{MAN-LT}}$	$\overline{\text{AUT-LT}}$
8		39	38	37	36	35	34	23	22
			$\overline{\text{BATALM}}$	$\overline{\text{DS04}}$	$\overline{\text{DS03}}$	$\overline{\text{DS02}}$	$\overline{\text{DS01}}$	$\overline{\text{DS00}}$	$\overline{\text{AL3}}$

(2) Baud rate and axis address setting (initial setting)

Baud rate and axis address do not have to be set for any reason other than setting change once set at test run.

Operation section (Servopack panel face)

SW1 to SW3 are digital switches (rotated by a small-size screwdriver).



<table>
<tr><th>Procedures</th><th>Operation Method</th><th>(7-SEG. LED)
ALARM Lightig</th></tr>
<tr><td>①</td><td>Turn on only Servopak control power supply.
(LED [RUN] lights.)</td><td>[—.]</td></tr>
<tr><td>②</td><td>Set toggle switch (MO-neutral-WR) in neutral status.</td><td rowspan="2">[—] blinks.</td></tr>
<tr><td>③</td><td>Set SW1 to SW3 as shown below:
<table>
<tr><th>SW1</th><th>SW2</th><th>SW3</th></tr>
<tr><td>6</td><td>0</td><td>0</td></tr>
</table></td></tr>
<tr><td>④</td><td>Lower toggle switch to WR side. (Return to neutral.)</td><td rowspan="2">[S.] blinks.</td></tr>
<tr><td>⑤</td><td>(1) Baud rate setting
<table>
<tr><td>Baud Rate</td><td>9600</td><td>4800</td><td>2400</td><td>1200</td></tr>
<tr><td>SW2 Set Value</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
</table>
(2) Axis address setting (Refer to Par. 7.3 for how to use axis address.)
<table>
<tr><th>Control Configuration</th><th>SW3 Set Value (Axis address 10-digit setting)</th><th>SW1 Set Value (Axis address 1-digit setting)</th></tr>
<tr><td>1-axis control</td><td>Setting not needed.</td><td>0</td></tr>
<tr><td>Multi-axis control (2 to 9 axes) group designation not performed</td><td>Setting not needed.</td><td>Any number of 1 to 9</td></tr>
<tr><td>Multi-axis control (2 to 9 axes) group designation performed</td><td>Any number of 1 to 9</td><td>Any number of 1 to 9</td></tr>
<tr><td>Multi-axis control (10 to 16 axes)</td><td>Any number of 1 to 9</td><td>Any number of 1 to 9</td></tr>
</table></td></tr>
<tr><td>⑥</td><td>Lower toggle switch to WR side. (Return to neutral.)</td><td>[—] blinks.</td></tr>
<tr><td>⑦</td><td>Set SW1 to SW3 as follows and keep toggle switch in MO.
<table>
<tr><th>SW1</th><th>SW2</th><th>SW3</th></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
</table></td><td>[—.]</td></tr>
<tr><td>⑧</td><td>Turn off Servopack control power supply.</td><td>(Extinguished)</td></tr>
<tr><td>⑨</td><td>Turn on only Servopack control power supply again.</td><td>[—.]</td></tr>
</table>

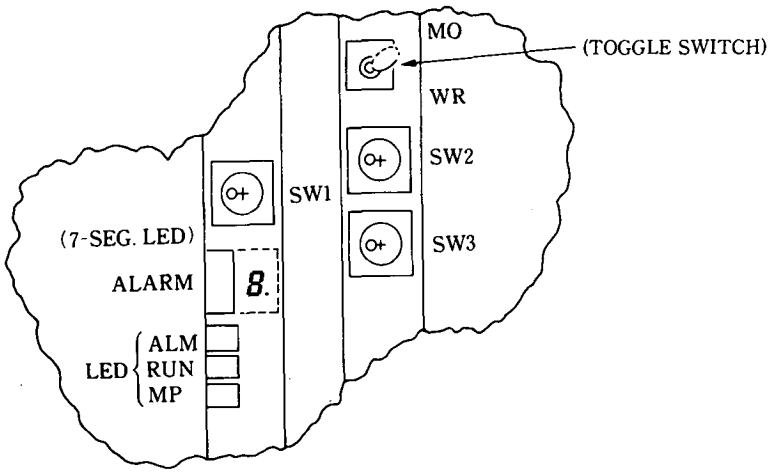
Baud rate and axis address setting are now completed.

(3) Machine zero-point setting

For type HR □□□ BAB, machine zero-point can be set by switches on the panel in addition to serial communication.

Operation section (Servopack panel face)

SW1 to SW3 are digital switches (rotated by a small-size screwdriver.)



Setting is performed for the following procedures after moving to machine zero-point in manual operation mode.

<table>
<tr><th>Procedures</th><th>Operation Method</th><th>(7-SEG. LED)
ALARM Lighting</th></tr>
<tr><td>①</td><td>Set toggle switch (MO-neutral-WR) in neutral status.</td><td rowspan="2">— blinks.</td></tr>
<tr><td>②</td><td>Set SW1 to SW3 as shown below:
<table><tr><th>SW1</th><th>SW2</th><th>SW3</th></tr><tr><td>7</td><td>0</td><td>0</td></tr></table></td></tr>
<tr><td>③</td><td>Lower toggle switch to WR side. (Return to neutral.)</td><td rowspan="2">0. blinks.</td></tr>
<tr><td>④</td><td>Set SW1 to SW3 as shown below:
<table><tr><th>SW1</th><th>SW2</th><th>SW3</th></tr><tr><td>7</td><td>7</td><td>7</td></tr></table></td></tr>
<tr><td>⑤</td><td>Lower toggle switch to WR side. (Return to neutral.)</td><td>— blinks.</td></tr>
<tr><td>⑥</td><td>Set SW1 to SW3 as follows and keep toggle switch in MO.
<table><tr><th>SW1</th><th>SW2</th><th>SW3</th></tr><tr><td>0</td><td>0</td><td>0</td></tr></table></td><td>—.</td></tr>
<tr><td>⑦</td><td>Turn off Servopack control power supply.</td><td>(Extinguished)</td></tr>
<tr><td>⑧</td><td>Turn on only Servopack control power supply again.</td><td>—.</td></tr>
</table>

Machine zero-point setting is now cmpleted. (These procedures correspond to serial command "ZEROSET 0".)

9.1.3 Display and Setting Functions for Servopack Type CACR-HR□□BB

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

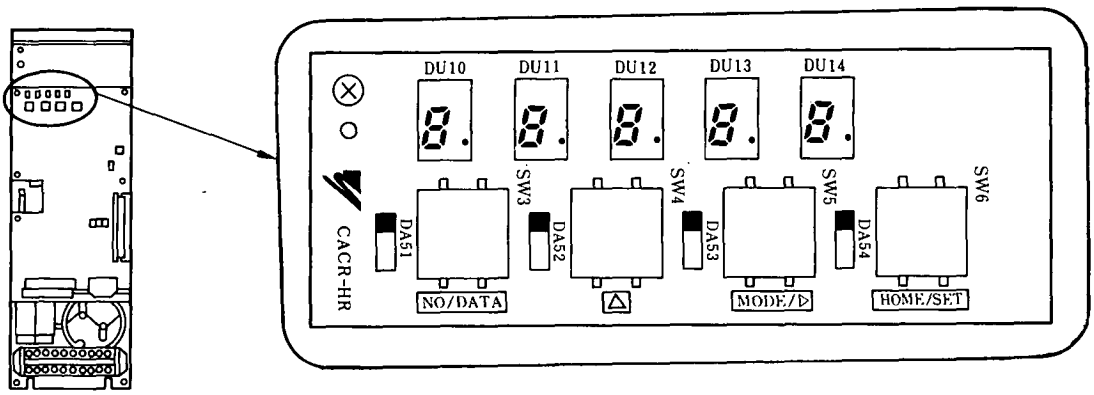


Fig. 9.1 Setting/Display Section

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/▷	0S-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

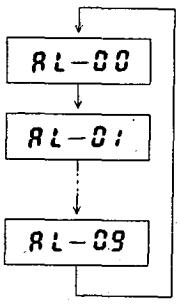
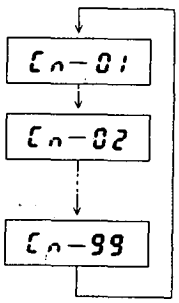
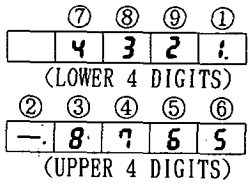
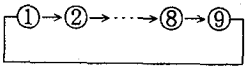
△	NO/DATA	MODE/▷	HOME/SET
• Alarm No. display  1. (MOST RECENT ALARM) 2. (ALARM 1 TIME BEFORE) 3. (ALARM 9 TIMES BEFORE)	Exchange alarm No. with alarm content display. For alarm content display, refer to Table 9.2.	• Alarm No. display Parameter display/setting mode is entered.	• Alarm No. display Alarm/status (initial status) is displayed.

Table 9.6 Parameter Display/Setting Mode

△	NO/DATA	MODE/▷	HOME/SET
• Parameter No. display  (PARAMETER No. 1) (PARAMETER No. 2) (PARAMETER No. 99) • 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 offline 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 : (LOWER 4 DIGITS) ② ③ ④ ⑤ ⑥ -. 8 ? 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 55-00 (BAUD RATE SETTING) 55-01 (AXIS ADDRESS 1-DIGIT SETTING) 55-02 (AXIS ADDRESS 10-DIGIT SETTING) • 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

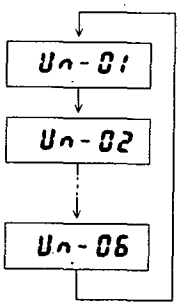
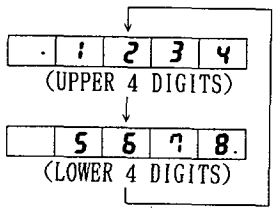
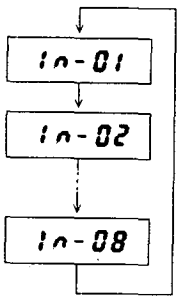
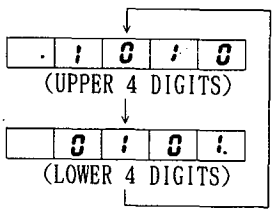
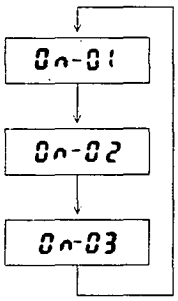
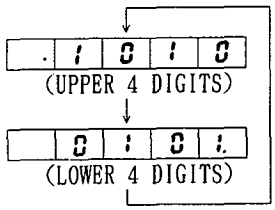
△	NO/DATA	MODE/▷	HOME/SET
• Monitor data No. display.  (MONITOR DATA 1) (MONITOR DATA 2) (MONITOR DATA 6) Monitor data Nos. are the same as serial communication monitor commands MON1 to MON6.	Exchange monitor data No. with monitor data display.	• When monitor No. is displayed. Input signal status display 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 1) (INPUT SIGNAL 2) (INPUT SIGNAL 8) 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."

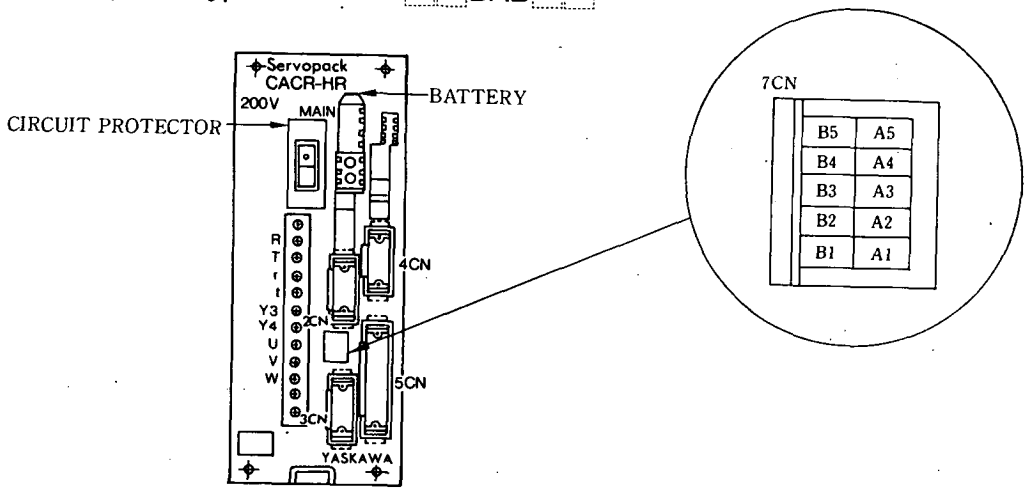
Table 9.11 Output Signal Status Display Mode

△	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 (intial status) is displayed.

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

9.2 MONITOR FUNCTION

9.2.1 Servopack Type CACR-HR□□BAB□□



Pin No.	Signal Name	Name		Output Voltage				
B5	V_{TG}	Motor speed		∓2.0V/ ±1000r/min				
A5	T_{MON}	Torque or speed reference		Torque reference: ∓3.0V/ ±100% Speed reference : ±2.0V/ ±1000r/min				
B4	IU	Phase U	Current monitor	Type	HR□□BAB11 (100V)	A5	01	02, 03, 05	—
A4	IV	Phase V			HR□□BAB12 HR□□BAB (200V)	A5, 01	02	03, 05	10, 15
				Output Voltage (V/A)		0.8	0.4	0.2	0.1
B1	SG	GND		0V					
B3	PA	Phase A		(Encoder phase A signal)					
A3	PB	Phase B		(Encoder phase B signal)					
A2	PC	Phase C for incremental encoder Phase Z for absolute encoder		(Phase C signal of incremental encoder, Phase Z signal of absolute encoder)					

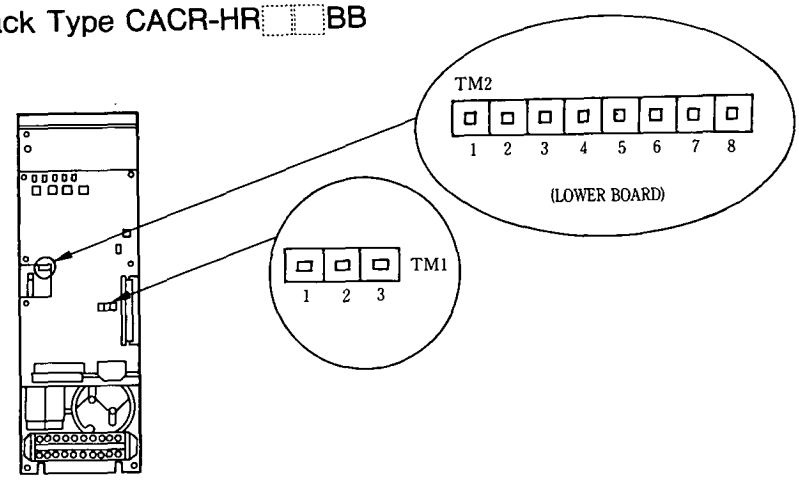
Notes:

1. Check terminals can be observed by oscilloscope.
   If the pin is inserted 7mm or more, it may be shorted the other signal.
   Insert to the short-side pin of connector type PS-10PE-D4R1-A1(made by Japan Aviation Electronics Industry, Ltd.).
2. At observation, do not contact adjacent check terminals.
3. 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

4. Accuracy: ±10%
5. 8-bit D/A converter is used. Ripple for 1-bit generates at output.

9.2.2 Servopack Type CACR-HR☐☐BB



Pin No.	Signal Name	Name	Output Voltage
TM1-1	V_{TG}	Motor speed	$\mp 2.0 \times \frac{P^*}{8192}$ V/±1000r/min
TM1-2	T_{MON}	Torque or speed reference	Torque reference: ∓3.0V/±100% Speed reference : ±2.0V/±1000r/min
TM1-3	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.

Pin No.	Signal Name	Name		Output Voltage								
TM2-1 to TM2-3	—	—		Check terminals used only for shipping (Do not observe.)								
TM2-4	UREF	Phase U	Current reference monitor	Monitor of current reference								
TM2-5	VREF	Phase V										
TM2-6	IU	Phase U	Current Monitor	Type	03	05	10	15	20	30	44	60
TM2-7	IV	Phase V		Output Voltage (V/A)	0.4	0.24	0.16	0.08		0.04		
TM2-8	SG	0V for signal										

Notes:

1. Check terminals can be observed by oscilloscope.
2. At observation, do not contact adjacent check terminals.

10 INSTALLATION AND WIRING

10.1 RECEIVING

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

- Its nameplate ratings meet your requirements.
- It has sustained no damage while in transit.
- The output shaft should be hand-rotated freely. However, the brake-mounted motor does not rotate as it is shipped with the shaft locked.
- Fastening bolts and screws are not loose.

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

10.2 INSTALLATION

10.2.1 Servomotor

AC Servomotor can be installed either horizontally or vertically.

(1) Before mounting

Wash out anticorrosive paint on shaft extension and flange surface with thinner before connecting the motor to the driven machine. See Fig. 10.1.

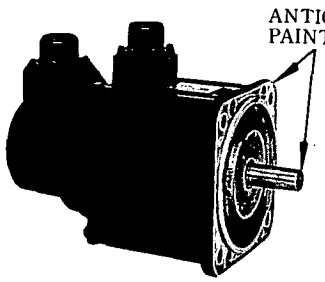


Fig. 10.1 Anticorrosive Paint to be Removed

(2) Location

Use the motor under the following conditions.

- Indoors
- Free from corrosive and/or explosive gases or liquids
- Ambient temperature: 0 to +40℃
- Clean and dry
- Accessible for inspection and cleaning

If the AC servomotor is subject to excessive water or oil droplets, protect the motor with a cover. The motor can withstand a small amount of splashed water or oil.

(3) Environmental conditions

Ambient temperature: 0 to +40℃

Storage temperature: −20 to +60℃

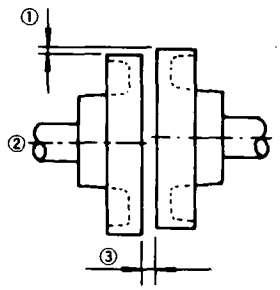
Humidity: 20% to 80% RH (non-condensing)

(4) Load coupling

True alignment of motor and driven machine is essential to prevent vibration, reduced bearing and coupling life, or shaft and bearing failures.

Use flexible coupling with direct drive. The alignment should be made in accordance with Fig. 10.2.

When mounting coupling, ease the impact on the shaft and avoid the excessive force on the bearing.



① Measure the gap between the straightedge and coupling halves at four equidistant points of the coupling. The each reading should not exceed 0.03 mm (0.0012 in.).

② Align the shafts.

③ Measure the gap between the coupling faces at four equidistant points around the coupling rim with thickness gage. The maximum variation between any two readings should not exceed 0.03 mm (0.0012 in.)

Fig. 10.2 Alignment of Coupling

(5) Allowable bearing load

Avoid both excessive thrust and radial loads to the motor shaft. If unavoidable, never exceed the values in Table 3.9.

When mounting the gear, coupling and pulley, ease the impact on the shaft and avoid excessive force on the bearing. [98m/s²(10G)max]

10.2.2 Servopack

(1) Installation

The Servopack type CACR-HR ☐☐☐ BAB ☐☐☐ is rack-mounted type, and type CACR-HR ☐☐☐ BB is base-mounted type.

(2) Location

- When installed in a panel:
  Keep the temperature around Servopack at 55℃ or below.
- When installed near a heat source:
  Keep the temperature around Servopack below 55℃.
- If subjected to vibration:
  Mount the unit on shock absorbing material.
- If corrosive gases are present:
  Avoid locations where corrosive gases exist as it may cause extensive damage over long use. Especially vulnerable are switching operation of contactors and relays.
- Unfavorable atmospheric conditions:
  Select a location with minimum exposure to oil, water, hot air, high humidity, excessive dust or metallic particles.

(3) Mounting Direction

ⓐ Type HR ☐☐☐ BAB ☐☐☐

Mount the Servopack unit vertically on the wall with main terminals being at the bottom to take advantage of natural air convection (Fig. 10.3). Install it with setscrews tightened at four mounting holes in the unit base.

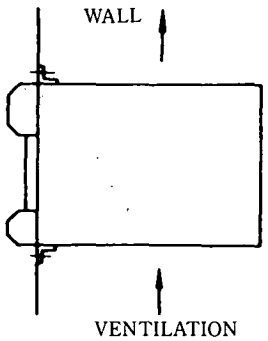


Fig. 10.3 Mounting Direction

ⓑ Type HR ☐☐☐ BB

Mount the unit vertically on the wall using the mounting holes (4) on the base plate, with main terminals at the bottom (Fig. 10.4).

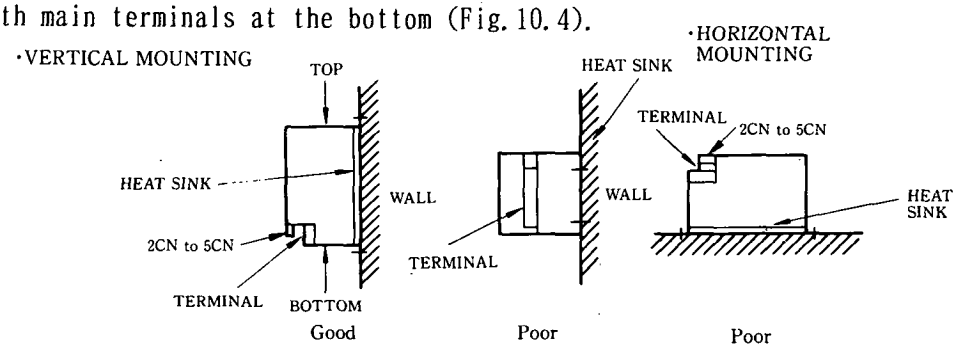


Fig. 10.4 Mounting Direction of Servopack

10.3 WIRING PRECAUTIONS

The following precautions should be taken for wiring.

(1) For signal lines and PG feedback lines, use twisted cables or multi-core shielded twisted-pair cables (Yaskawa Drawing No. DP8409123, DE8400093 or B9400064). (See Table 5.5.)

Cable length is a maximum of 5 m for reference input lines (DG-SW unit, reference pulse generator, display unit) and a maximum of 20 m for PG feedback lines. Use the shortest possible length. Contact your YASKAWA representative for longer PG feedback lines.

(2) For ground line, cable should be as heavy as possible to provide class 3 ground (ground resistance 100Ω or less). Make sure to ground at a central point. If the motor and machine are insulated, ground the motor.

(3) To prevent malfunction due to noise, take the following precautions:

- Place the noise filter, Servopack and I/O reference as near as possible to each other.
- Make sure to mount a surge absorbing circuit with relays, electromagnetic contacts, and solenoids.
- Run the power line and signal line, holding the distance to 30 cm or more; do not run them in the same duct or in a bundle.
- When the same power source is used for Servopack, as for an electric welder or electrical discharge machine or when a high-frequency noise source is present in the vicinity, use filters in the power and input circuits.
- The Servopack uses a PWM amplifier, and spurious noise may be present in the signal line.

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

Servopack may interfere with radio reception. If the controller interferes with radio reception, connect a noise filter to the power supply.

(5) The signal line uses cables whose core is extremely fine (0.2 to 0.3 mm^2). Avoid using excessive force which may damage these cables.

11 TEST RUN, MAINTENANCE, AND INSPECTION

SAFETY PRECAUTIONS

- Power supply must be in conformance with the product ratings.
  For HR□□BAB□□ type, check [200V] or [100V] described on the panel surface and use 200 to 230VAC (+10%, -15%) 50/60Hz or 100 to 115VAC (+10%, -15%) 50/60Hz.
  For HR□□BB type, be sure to use 200 to 230VAC (+10%, -15%) 50/60Hz.
  Power supplies other than described above may cause a fault.
- Do not touch the current-conducting sections of the SERVOPACK without taking proper safety precautions. A high voltage (250 to 300 VDC) is applied, and contact is dangerous.
- Operate only when the terminal cover is set. Personnel may receive an electric shock if the cover is not set.
- The main circuit should not be touched for five or six minutes after switching off power. It is dangerous until the main circuit voltage lowers to approximately 20 V or less.
- Check safety procedures carefully before switching on and off power during maintenance work.
- This unit should never be used in a place which is exposed to corrosive liquids or gases such as acids and alkalis, as well as inflammable and explosive gases.
- Check to be sure that the SERVOPACK is grounded under class 3 grounding. (ground resistance 100Ω or less)
- The motor should be operated at an ambient temperature between 0 and 40℃ with relative humidity of 20 to 80%. For the SERVOPACK between 0 and 55℃ with 90% or below.
- Protect the AC servomotor against all moisture. Water may cause a short circuit or electric shock accident.
- Never use voltage resistance or insulation resistance test.

11.1 CHECK ITEMS BEFORE TEST RUN

11.1.1 Servomotor

Before test run, check the following.

- Connection to machines or devices, wiring, fuse connection, and grounding are correct.
- Bolts and nuts are not loose.
- For motors with oil seals, the seals are not damaged and are properly lubricated.

11.1.2 Servopack

- Connection and wiring leads are firmly connected to terminals or inserted into the connectors.
- The power supply is turned off if servo alarm occurs.
- Voltage supplied to Servopack is adjustable for the product ratings.

11.2 TEST RUN PROCEDURES

> During test run, loads should not be applied to the servomotor. If it is necessary to start with the motor connected to the machine, confirm that the system is ready for emergency stop at any time.

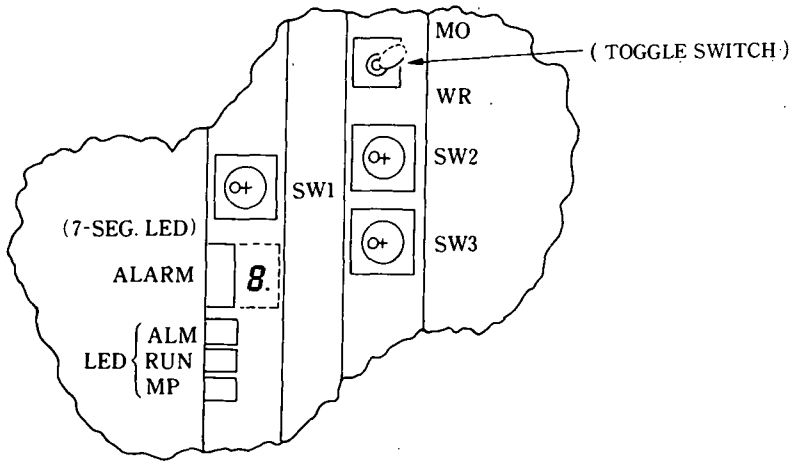
11.2.1 Test-run Preparations

(1) Servopack Initial Setting (Baud Rate, Axis Address Setting)

(a) Servopack Type HR ☐☐ BAB ☐☐

> Baud rate or axis address does not have to be set for any reason other than setting change once set at test run.

Operation section (Servopack panel face)
SW1 to SW3 are digital switches (rotated by a small-size screwdriver).



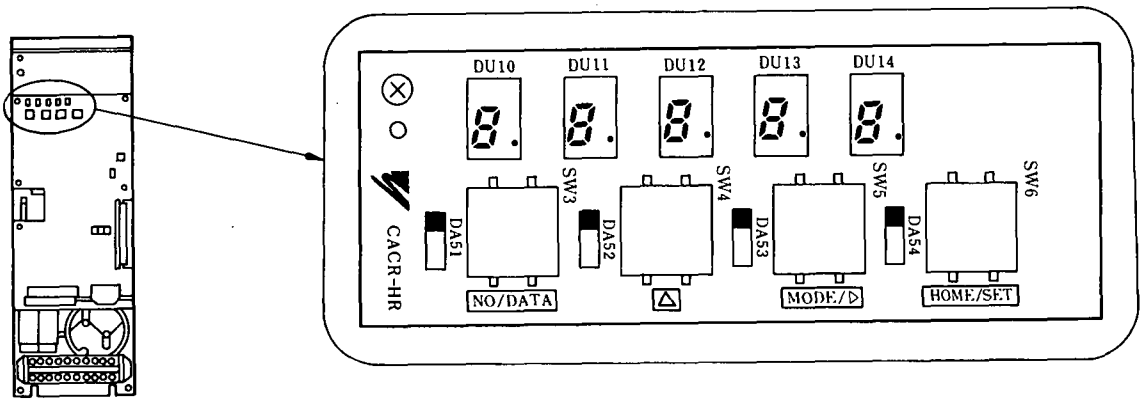
<table>
<tr><th>Procedures</th><th>Operation Method</th><th>(7-SEG. LED)
ALARM Lighting</th></tr>
<tr><td>①</td><td>Turn on only Servopack control power supply.
(LED [RUN] Lights.)</td><td>[—.]</td></tr>
<tr><td>②</td><td>Set toggle switch (MO-neutral WR) in neutral status.</td><td rowspan="2">[—] blinks.</td></tr>
<tr><td>③</td><td>Set SW1 to SW3 as shown below:
<table><tr><th>SW1</th><th>SW2</th><th>SW3</th></tr><tr><td>6</td><td>0</td><td>0</td></tr></table></td></tr>
<tr><td>④</td><td>Lower toggle switch to WR side. (Return to neutral.)</td><td rowspan="2">[5.] blinks.</td></tr>
<tr><td>⑤</td><td>(1) Baud rate setting
<table><tr><td>Baud Rate</td><td>9600</td><td>4800</td><td>2400</td><td>1200</td></tr><tr><td>SW2 Set Value</td><td>0</td><td>1</td><td>2</td><td>3</td></tr></table>(2) Axis address setting(Refer to Par. 7.3 for how to use axis address.)
<table><tr><th>Control Configuration</th><th>SW3 Set Value (Axis address 10-digit setting)</th><th>SW1 Set Value (Axis address 1-digit setting)</th></tr><tr><td>1-axis control</td><td>Setting not needed.</td><td>0</td></tr><tr><td>Multi-axis control (2 to 9 axes) group designation not performed</td><td>Setting not needed.</td><td>Any number of 1 to 9</td></tr><tr><td>Multi-axis control (2 to 9 axes) group designation performed</td><td>Any number of 1 to 9</td><td>Any number of 1 to 9</td></tr><tr><td>Multi-axis control (10 to 16 axes)</td><td>Any number of 1 to 9</td><td>Any number of 1 to 9</td></tr></table></td></tr>
<tr><td>⑥</td><td>Lower toggle switch to WR side. (Return to neutral.)</td><td>[—] blinks.</td></tr>
<tr><td>⑦</td><td>Set SW1 to SW3 as follows and keep toggle switch in MO.
<table><tr><th>SW1</th><th>SW2</th><th>SW3</th></tr><tr><td>0</td><td>0</td><td>0</td></tr></table></td><td>[—.]</td></tr>
<tr><td>⑧</td><td>Turn off Servopack control power supply.</td><td>(Extinguished)</td></tr>
<tr><td>⑨</td><td>Turn on only Servopack control power supply again.</td><td>[—.]</td></tr>
</table>

Baud rate and axis address setting are now completed.

(b) Servopack Type HR □□□ BB

Baud rate or axis address does not have to be set for any reason other than setting change once set at test run.

Operation section (Setting and display parts)



First, set jumpers [SEL1] and [SEL2] to cover pins 2 and 3 for single-axis control or 1 and 2 for multi-axis control.

Procedures	Operation Method	Display
①	Turn on only Servopack control power supply. (LED [P] lights.)	– bb
②	Depress SW3 [NO/DATA].	AL–00
③	Depress SW5 [MODE/ ▷] three times until the display shown on the right is obtained.	55–00
④	Depress SW3 [NO/DATA].	9600
⑤	Baud rate setting By depressing [△], display changes as 9600→4800→2400→1200→9600 (cyclic). Depress SW4 [△] until desired value is displayed.	–
⑥	Depress SW6 [HOME/SET]. (Baud rate setting completed.)	–
⑦	Depress SW3 [NO/DATA].	55–00
⑧	Depress SW4 [△].	55–01
⑨	Depress SW3 [NO/DATA].	0
⑩	Axis address (1-digit) setting By depressing SW4 [△], the display changes from 0 to 9 (cyclic). • 0 is displayed for single-axis control. • Desired value from 1 to 9 is displayed to multi-axis control.	–
⑪	Depress SW6 [HOME/SET]. (Axis address 1-digit setting completed)	–
⑫	Depress SW3 [NO/DATA].	55–01

The procedures from ⑬ to ⑲ are not necessary for single-axis control and control of 9 axes or less without group designation.
Refer to Par. 7.3 for group designation.

Procedures	Operation Method	Display
⑬	Depress SW4 [△] .	55-02
⑭	Depress SW6 [HOME/SET] .	0
⑮	Axis address (10-digit) setting By depressing SW4 [△] , the display changes form 0 to 9 (cyclic). Desired value from 1 to 9 is displayed.	—
⑯	Depress SW6 [HOME/SET] .	—.
⑰	Depress SW3 [NO/DATA] .	55-02
⑱	Depress SW6 [HOME/SET] .	—. bb
⑲	Depress SW6 [HOME/SET] . (Opearation is reset. This procedure makes the above setting effective.)	

Servopack initial setting is now completed.
Note: Refer to Par. 7.3 for how to use axis address.

(2) Parameter Setting
(By serial communication, parameter operation commands are sent from the master controller. For Servopack Type HR □□ BB, setting can be performed by using Servopack setting/display section. Refer to Par. 9.1.3.)

① All parameters required are written-in by using command [PRMpp = ±n ··· n] .

② Send command [RES] after completing parameter writing-in.

③ Parameter contents check
Check that the parameter contents are set in accordance with the specifications by using command [PRM] or [PRMpp] .
Especially, check motor selection parameter, encoder pulse parameter, or encoder selection parameter (parameter Nos. 7 to 9) set value. Set a code or value (see the tables below) optimum for the matching motor type and encoder type.

M Series		F Series		G Series		D Series		S Series		R Series (200V)		R Series (100V)		P Series	
Type USAMED	Code No.	Type USAFED	Code No.	Type USAGED	Code No.	Type USADED	Code No.	Type USASEM	Code No.	Type USAREM	Code No.	Type USAREM	Code No.	Type USAPEM	Code No.
—	0	02□□ 1	10	02□□ 1	50	—	40	02A □	20	—	30	—	60	—	70
03□□ 1	1	03□□ 1	11	03□□ 1	51	—	41	03A □	21	—	31	—	61	—	71
06□□ 1	2	05□□ 1	12	05□□ 1	52	05E □	42	05A □	22	A5C □ 2	32	A5D □ 2	62	—	72
09B □ 2	3	09□□ 1	13	09□□ 1	53	10E □	43	08A □	23	01C □ 2	33	01D □ 2	63	01C □ 2	73
12B □ 2	4	13C □ 2	14	13A □ 2	54	15E □	44	15A □	24	02C □ 2	34	02D □ 2	64	02C □ 2	74
20B □ 2	5	20C □ 2	15	20A □ 2	55	22E □	45	—	25	03C □ 2	35	03D □ 2	65	03C □ 2	75
30B □ 2	6	30C □ 2	16	30A □ 2	56	37E □	46	30A □	26	05C □ 2	36	05D □ 2	66	05C □ 2	76
44B □ 2	7	44C □ 2	17	44A □ 2	57	—	47	—	27	07C □ 2	37	—	67	07C □ 2	77
USAMKD-60B □ 2	8	—	18	—	58	—	48	—	28	—	38	—	68	—	78
—	9	—	19	—	59	—	49	—	29	—	39	—	69	—	79

Encoder Type	Encoder Pulse (Paramenter 8)	Encoder Selection (Parameter 9)
Absolute Encoder 8192 pulses/rev	32768	0
Absolute Encoder 1024 pulses/rev	4096	0
Incremental Encoder 8192 pulses/rev	32768	1
Incremental Encoder 2048 pulses/rev	8192	1
Incremental Encoder 2500 pulses/rev	10000	1

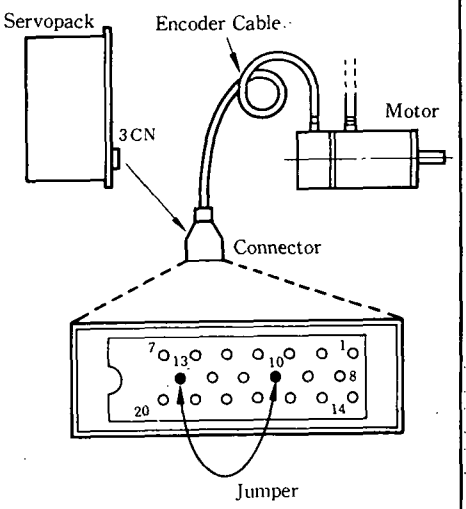
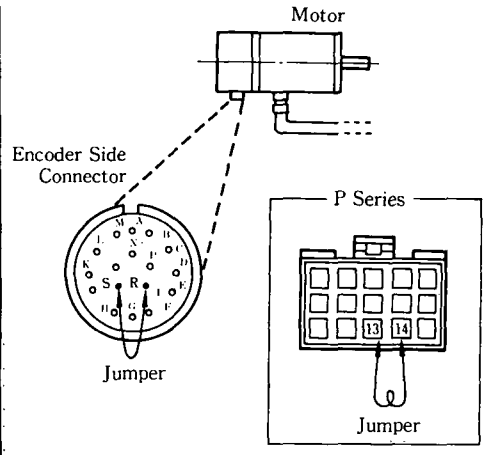
(3) Absolute Encoder Setup

The absolute encoder set-up procedure has to be performed before test-run, and when the Servopack is disconnected from the motor for an extended period of time. (The encoder data is maintained by battery back-up. The battery is in the Servopack.)

① For 1024pulses/rev, turn on the control power supply with normal wiring for 3 min or more.

② Turn off Servopack control power supply.

③ Absolute encoder setup.

At Servopack	At Encoder
(1) Remove encoder cables from 3CN. (2) Short encoder cable pins ⑩–⑬.	(1) Remove cables from encoder connector. (2) Short connector pins Ⓡ-Ⓢ at encoder side. (For P series, short ⑬–⑭.)
	
(3) Wait for 1 to 2 seconds for 1024 pulses/rev or 2 minutes or more for 8192 pulses/rev before removing the jumper. Never turn on Servopack control power while shorting. (4) Remove jumper and insert connectors in their original position.	

④ Turn on the Servopack control power supply with absolute encoder connected to the Servopack. At this time, when 7-SEG. LED display is [–], setup is completed.

⑤ If ABSO error alarm ([C.], serial communication ALM 0. ABS), perform the following steps:

Process at ABSO Error Occurrence

Temporary machine zero-point is set in serial communication.

⑥ Send command [ZEROSET 0] .

⑦ Send command [RES] .

} Can be performed in Servopack operation section. (Refer to Par. 11.2.2 (3) "Note".

- Setup is completed unless an alarm occurs.
- If an alarm occurs again repeat the above steps from starting at ①. If this is unsuccessful, there may be a problem related to the encoder or encoder connection.

(4) Input Signal Check

Check input signals are input normally to Servopack by using monitor commands IN1 to IN6. (Refer to Par. 7.8.2 (4) (b).)

Check can be performed by Servopack LED display. (Refer to Table 9.3 or 9.4 for Servopack Type HR □□□ BAB □□□ or HR □□□ BB.)

11.2.2 Operation Check

(1) Main Circuit Power Supply ON

① When the main circuit power supply ON circuit is composed according to Fig. 5.16, the power supply is turned on by depressing the power supply push-button switch.

② When the main power is applied normally, in Type HR □□□ BAB □□□, LED MAIN (above the circuit breaker) and MP light; in Type HR □□□ BB, LED MP (green) lights.

(2) Motor Operation Check

① Servopack power circuit operates by sending serial command SVON to enable the Servopack. (7-SEG. LED ALARM * indicator changes from – to □.)

* ALM for Type HR □□□ BB

② Rotate the motor at a low speed by using command JOG(±)n…n and check that operation is normal.

(3) Machine Zero-point Setting (When using Absolute Encoder)

(a) DG-SW, serial communication command, or command table method

① Move to machine zero-point by manual operation command.

② Command ZEROSET(±)n…n ((±)n…n: Machine zero-point)

③ Then send RES.

The machine zero-point setting is now completed.

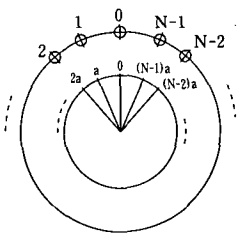
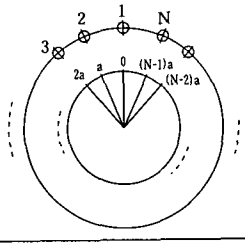
(b) Station No. reference method

① Move to the reference station No. (see below) position.

Reference Station No.	Parameter 20 b2 Setting
0	0 (Station No. 0 provided)
1	1 (Station No. 0 not provided)

② Send command [ZEROSET 0], then send [RES].

③ Station No. is set as follows :

Station No. 0 Provided	Station No. 0 not Provided
	

$$a = \frac{\text{(Parameter 11 set value)}}{N}$$

N indicates the number of stations (parameter 16 set value) and the values in the inner circle indicate current values.

Notes :

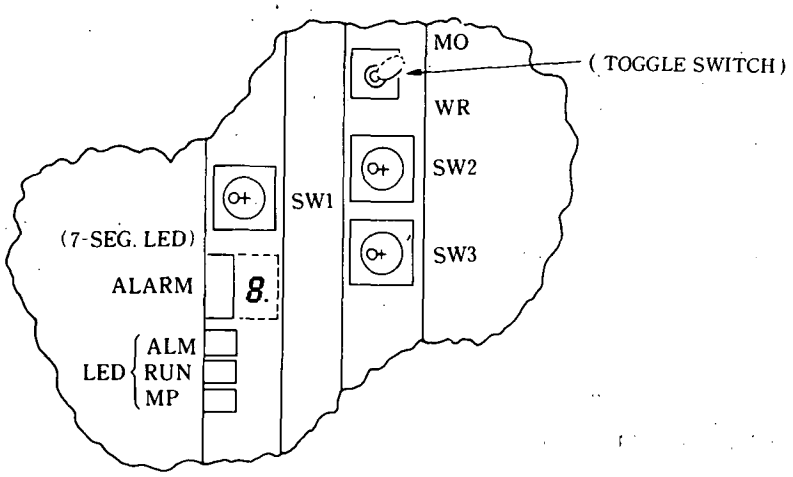
1. Current position is [PUN=×××] value indicated by [MON1].
2. Reference equivalent to serial command [ZEROSET 0] can be performed from the Servopack's operation panel. (Refer to the next pages.)

(4) Machine Zero-point Setting (When Using Incremental Encoder)

① Set parameter 54 (Zero-point return final traveling distance) to 0, for zero-point return.
② Set the distance between zero-point return complete position and machine zero-point or reference station number at parameter 54.
③ Move the machine to internal zero-point return LS (DEC or STP) by manual operation command ; send control power ON/OFF or RES command.
④ Perform zero-point return.
Recheck that zero-point return complete position is the same as the machine zero-point or the reference station number.
In case of divergence, reset parameter 54 and repeat steps ③ and ④.

Note : Confirm that zero-point return LS (DEC or STP) is on the zero-point return direction, (parameter 50) before carrying out zero-point return.
When using an incremental encoder, software LS cannot be operated until zero-point return completion.

• Servopack Type HR □□□ BAB □□□
Operation section (Servopack panel face)
SW1 to SW3 are digital switches (rotated by a small-size screwdriver.)

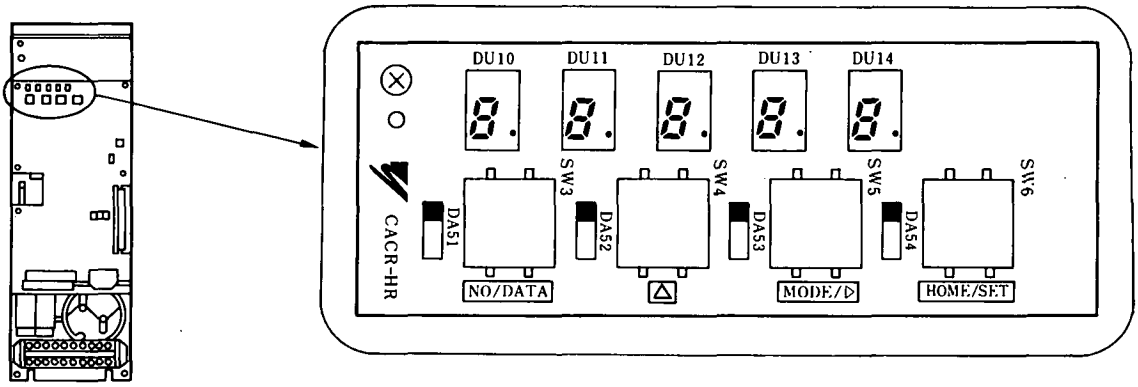


Setting is performed for the following procedures after moving to the machine zero-point in manual operation mode.

Procedures	Operation Method	(7-SEB. LED) ALARM Lighting
①	Set toggle switch (MO-neutral-WR) in neutral status.	— blinkS.
②	Set SW1 to SW3 as shown below: SW1: 7, SW2: 0, SW3: 0	
③	Lower toggle switch to WR side. (Return to neutral.)	8. blinks.
④	Set SW1 to SW3 as shown below: SW1: 7, SW2: 7, SW3: 7	
⑤	Lower toggle switch to WR side. (Return to neutral.)	— blinks.
⑥	Set SW1 to SW3 as follows and keep toggle switch in MO. SW1: 0, SW2: 0, SW3: 0	—.
⑦	Turn off Servopack control power supply.	(Extinguished)
⑧	Turn on only Servopack control power supply again.	—.

Machine zero-point setting is now completed.

• Servopack Type HR □□□ BB □□□
Operation section (on Servopack PC board)



Setting is performed for the following procedures after moving to the machine zero-point in manual operation mode.

Procedures	Operation Method	Display
①	Depress SW3 [NO DATA] .	AL-00
②	Depress SW5 [MODE/ ▷] twice until the display shown on the right is obtained.	05-00
③	Depress SW3 [NO/DATA] .	0000
④	Depress SW6 [HOME/SET] . (Set current position to machine zero-point)	—
⑤	Depress SW3 [NO/DATA] .	05-00
⑥	Depress SW6 [HOME/SET] . (Baud rate setting completed.)	-.bb
⑦	Depress SW6 [HOME/SET] . (Operation is reset. This procedure makes the above setting effective.)	-.

Machine zero-point setting is now completed.

11.3 SERVO PERFORMANCE ADJUSTMENT

11.3.1 Parameter Setting

(1) Position Loop Gain Kp is stored in parameter 1. (30 is set prior to shipping).

(2) Speed Loop Gain Kv is stored in parameter 2.

The cutoff frequency fc based on the reflected load inertia can be calculated as follows. A factor of 2.5 applies to the value in parameter.

Parameter 2 set value × 2.5 (Hz)

Inertia variation for the same parameter value changes the cutoff frequency fc.

(J_M: Motor inertia, J_L: Reflected load inertia
$J_L/J_M = x$)

Cutoff frequency fc = parameter 2 × $\frac{5}{x+1}$ (Hz)

① Parameter

Set value is 20 (x +1)

(fc = 100Hz for equivalent inertia)

② When mechanical system rigidity is low, it may be impossible to obtain the above value. Therefore, set 20 (x +15) at the beginning.

Then start increasing this number to the calculated optimum or up to system instability.

[Factory default is 15 with x=0 (no load).]

(3) Integral time constant Ti is stored in parameter 3.

Default value is 10 (20ms). (Keep the default value.)

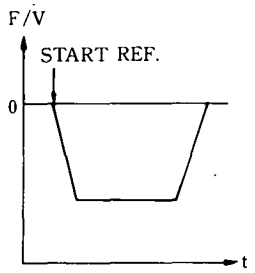
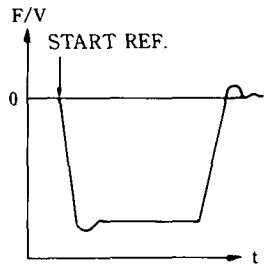
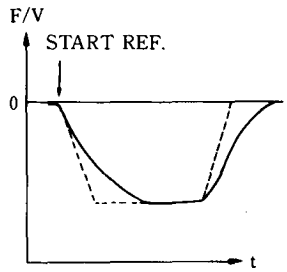
11.3.2 Adjusting Method—Kp, Kv' Optimum Setting

• Servopack Type HR □□□ BAB □□□

Check terminal to monitor analog speed output V_{TG} .*1

• Servopack Type HR □□□ BB

Check terminal to monitor analog speed output TM1-1 .*2

Speed Monitor Waveform	Adjusting Method	Remarks
	Optimum setting status with good response follow-up performance without overshooting or oscillation.	Because of mechanical system rigidity, the waveform shown to the left may not be obtained.
	If overshooting or oscillation occurs; • Decrease Kp set value gradually. or • Increase Kv' set value gradually. • If overshooting or oscillation go worse when increasing Kv' set value, Decrease Kv' set value gradually.	When considerable Kp value is required and overshooting must be avoided, increase accel/decel time (parameter 5) value.
	For poor response follow-up performance: ①Increase Kp set value gradually. ②When Kp cannot be increased because of vibration, etc., increase Kv' set value gradually.	When Kv' set value increase causes vibration by ②, it indicates that follow-up performance (including that of the mechanical system) reaches the limit.

*1 Refer to Par. 9.2.1
*2 Refer to Par. 9.2.2

11.4 INSPECTION AND MAINTENANCE

11.4.1 AC Servomotor

The AC Servomotor has no wearing parts (e.g. brushes), so simple daily inspection is sufficient. The inspection schedule for the motor is shown in Table 11.1.

Do not disassemble the motor. If disassembly is necessary, contact your Yaskawa representative.

Table 11.1 Inspection Schedule for Motors

Inspection Item	Frequency	Inspection Operation	
Vibration	Daily	Feel manually	If abnormal vibration or noise is found, contact your Yaskawa representative.
Noise		Aurally	
Exterior and Cleaning	As required	Clean with dry cloth or compressed air.	
Insulation Resistance	Yearly	Make sure that it is more than 10MΩ by measuring with a 500V megger after disconnecting the motor from Servopack.	
Oil Seal	Every 5000 hours	Replace oil seal.	
Overhaul	Every 20,000 hours or every 5-year	If worn or damaged, replace after disconnecting the motor from the driven machine.	

11.4.2 Servopack

Servopack does not require any daily maintenance. However, it is advisable to perform maintenance as shown in Table 11.2 at least once a year.

Table 11.2 Inspection Schedule for Servopack

Inspection Item	Frequency	Operation	Corrective Action
Cleaning of Servopack and board	Every 1 year	Visually check for dust or oil on parts.	Clean with dry cloth or compressed air.
Loose screws		Check for loose screws of terminals and connectors of 2CN to 5CN of Servopack.	Retighten.
Deterioration of Servopack and/or parts on the board		Visually check for discoloration, breakage or disconnection resulting from heat, bumping, etc.	Contact your YASKAWA representative.
Cooling fan		Check that the fan rotates normally.	

• Parts Replacement Schedule

The parts shown in Table 11.3 should be replaced periodically since they may become worn mechanically/physically or deteriorate with age.

Table 11.3 Parts Replacement Schedule

Parts Name	Interval	Remarks
Smoothing capacitor	7 to 8 years	Replace with new one. (Decided after inspection)
Circuit protector or relays	Variable	Upon inspection, decide whether they should be replaced.
Aluminum electrolytic capacitors on PC board	10 years	Replace with new board. (Decided after inspection)

Note: Optimum operating environment is as follows:
Ambient temperature: 30℃ on average
Load factor: 80% or less
Operating rate: 20 hours or less per day

11.4.3 Battery Replacement

Replace the Servopack batteries (ER6VC3 provided with connector: made by Toshiba Battery Co., Ltd.) as follows. (Service life is about 10 years.)

① Remove the screws mounted on the panel and remove the battery holder (only for Servopack Type HR □□□ BAB □□□).
② Pull out the battery connector from the connector on the board.
③ Insert a new battery connector correctly.
④ Remount the battery holder (only for Servopack Type HR □□□ BAB □□□).
⑤ Insert a new battery in the battery holder.

11.5 TROUBLESHOOTING GUIDE

11.5.1 AC Servomotor

If mulfunctions occur during operation, provide appropriate corrective actions according to Table 11.4. If any malfunction cannot be corrected, contact your Yaskawa representative.

> WARNING
> Actions in ▨ should be implemented after turning off the power.

Table 11.4 Troubleshooting Guide for AC Servomotor

Trouble	Cause	Corrective Action
Motor does not start.*	Loose connection	Tighten connection
	Wrong wiring	Correct.
	Overload.	Reduce load or use a larger motor.
Unstable operation	Wrong wiring	Inspect and correct wiring across motor terminals U, V, and W, and PG.
Motor overheats.	Excessive ambient temperature.	Reduce below 40 ℃
	Motor dirty	Clean motor surface.
	Overload	Reduce load or use a larger motor.
Unusual noise	Motor loosely mounted	Tighten foundation bolts.
	Motor misaligned	Realign.
	Coupling out of balance	Balance coupling.
	Noisy bearing	Check alignment, loading of bearing, lubrication. Contact your YASKAWA representative if it cannot be corrected.
	Vibration of driven machine	Contact the machine manufacturer.

* When the motor won't start, check if speed command has returned to zero.
(Example) Speed command is from speed table but data are not set in the table.

11.5.2 Servopack

Table 11.5 Typical Troubleshooting by 7-segment LED Indications

	Status when an error occurs		Cause	Corrective Action
0. ABSO ERROR	Occurs when control power is applied.	I	SERVOPACK or absolute encoder mulfunction	Cycle the control power supply.
		II	Using an incremental encoder	Change parameter 9 to 1.
			Motor shaft rotates more than parameter 10 set value during control power loss.	Turn on $\overline{RST}$ signal. (Or send command [ARES] .) ↓ Set machine zero point.
		III	SERVOPACK loss of home position	Send command [ZEROSET 0] . ↓ Set machine zero point.
		IV	Absolute encoder data fault	① Perform absolute encoder setup. ② Send command [ZEROSET 0] . ↓ Set machine zero point.
		When occurs frequently	• Absolute encoder improper wiring • Connector contact fault	Correct wiring.
			Absolute encoder fault	Replace motor.
			SERVOPACK fault	Replace SERVOPACK.
1. OVER-CURRENT	Occurs when control power is applied.		SERVOPACK malfunction or fault	Cycle the control power supply. ↓ When occurs again, replace SERVOPACK.
	Occurs when main power is applied.		SERVOPACK malfunction or fault	Cycle the control power supply. ↓ When occurs again, replace SERVOPACK.
	Occurs when servo on.		Motor improper wiring	Correct wirirng. ↓ When occurs again, replace SERVOPACK.
			Motor grounding	Replace motor.
			SERVOPACK fault	Replace SERVOPACK.
	Occurs when motor is running.		SERVOPACK malfunction or fault	Cycle the control power supply. ↓ When occurs again, replace SERVOPACK.
			Improper motor code setting	Change parameter 7 to suitable value for the motor.

(Cont'd)

(Cont'd)

	Status when an error occurs	Cause	Corrective Action
2. CIRCUIT PROTECTOR TRIP	In case SERVOPACK MCCB is not tripped	SERVOPACK malfunction or fault	Cycle the control power supply. ↓ When occurs again, replace SERVOPACK.
	In case SERVOPACK MCCB is tripped		
	Occurs when control power is applied.	SERVOPACK MCCB is manually turned off. (type HR □□□ BB)	Turn on MCCB and cycle the control power.
	Occurs when main power is applied.	SERVOPACK MCCB is manually turned off. (type HR □□□ BAB)	Turn on MCCB and cycle the control power.
		SERVOPACK main circuit fault	Replace SERVOPACK.
	Occurs when servo on.	Motor improper wiring	Correct wiring. ↓ When occurs again, replace SERVOPACK.
		Motor grounding	Replace motor.
		SERVOPACK fault	Replace SERVOPACK.
3. REGENERATIVE ERROR	Occurs when control power is applied.	SERVOPACK malfunction or fault	Cycle the control power supply. ↓ When occurs again, replace SERVOPACK.
	Occurs in apporox. 0.5 to 1 second after main power is applied.	SERVOPACK fault	Replace SERVOPACK.
4. OVER-VOLTAGE	Occurs when control power is applied.	SERVOPACK malfunction or fault	Cycle the control power supply. ↓ When occurs again, replace SERVOPACK.
	Occurs when main power is applied.	SERVOPACK malfunction or fault	Cycle the control power supply. ↓ When occurs again, replace SERVOPACK.
	Occurs during deceleration	Excessive load inertia	Check application and motor sizing. (Reduce deceleration)
		SERVOPACK fault	Replace SERVOPACK.
5. OVERSPEED	Occurs when motor running.	Improper gain setting (Kp, Kv, acceleration)	Set gains as described in parameter 1, 2, 4.
		Falling load on vertical axis	Use holding brake.
		SERVOPACK fault	Replace SERVOPACK.
6. UNDER-VOLTAGE	Occurs when control power is applied.	SERVOPACK malfunction or fault	Cycle the control power supply. ↓ When occurs again, replace SERVOPACK.
	Occurs when main power is applied.		

(Cont'd)

(Cont'd)

	Status when an error occurs	Cause	Corrective Action
7. OVERLOAD	Occurs when control power is applied.	SERVOPACK malfunction or fault	Cycle the control power supply. ↓ When occurs again, replace SERVOPACK.
	Occurs during operation. (Operation restarts when control power supply is turned off and then on.)	Improper motor code setting	Change parameter 7 to suitable value for the motor.
		Operation is performed at 105 to 130% or more of rated load.	• Check load (overload). • Verify motor sizing and application data.
	• Motor rotates but no torque is obtained.	Improper motor code setting	Change parameter 7 to suitable value for the motor.
	• Motor does not rotate.	Improper motor wiring or single-phase connection	Correct wiring.
		Improper encoder pulse/rev setting	Change parameter 8 to suitable value for the encoder.
8. POSITION ERROR	Occurs when control power is turned on.	Using an incremental encoder	Change parameter 9 to 1.
		Improper encoder pulse/rev setting	Change parameter 8 to suitable value for the encoder.
		Improper encoder wiring	Correct wiring.
		Absolute encoder mulfunction	Set up absolute encoder.
		SERVOPACK mulfunction or fault	Cycle the control power supply. ↓ When occurs again, replace SERVOPACK.
	Occurs during operation.	Improper encoder pulse/rev setting	Change parameter 8 to suitable value for the encoder.
		Improper encoder wiring	Correct wiring.
		Noise to encoder wiring	Perform noise treatment.
A. HEAT SINK OVERHEAT	• Occurs during operation. • Occurs when control power is turned OFF and then ON again. • Operation restarts after reset and after a while.	Fan does not rotate.	Check fan applied SERVOPACK type HR20, 30, 44BB.
		SERVOPACK ambient temparature exceeds 55℃.	Lower SERVOPACK ambient temperature to 55℃ or less.

(Cont'd)

(Cont'd)

	Status when an error occurs		Cause	Corrective Action
[C.] PG DIS-CONNECTION	Occurs when control power is applied.		Improper encoder wiring	Correct wiring.
			Alarm of 12bit absolute encoder occured	Perform absolute encoder setup.
			Mulfunction of absolute encoder	Perform absolute encoder setup.
			SERVOPACK fault	Replace SERVOPACK.
			Encoder fault	Replace motor.
[F.] OPEN PHASE DETECTION	Occurs when control power is applied.		SERVOPACK mulfunction or fault	Cycle the control power supply. ↓ When occurs again, replace SERVOPACK.
	Occurs when main power is applied.		3-phase power supply improper connection	Check connection.
			Improper motor code setting (type HR [][][] BAB1 [] only)	Change parameter 7 to suitable value for the motor.
			SERVOPACK mulfuction or fault	Cycle the control power supply. ↓ When occurs again, replace SERVOPACK.
[H.] HARD ERROR	Occurs when control power is applied.		SERVOPACK mulfunction or fault	Cycle the control power supply. ↓ When occurs again, replace SERVOPACK.
	Occurs when main power is applied.			
	Occurs during operation.			
[J.] OVERFLOW	Occurs when control power is applied.		SERVOPACK mulfunction or fault	Cycle the control power supply. ↓ When occurs again, replace SERVOPACK.
	Occurs during motor running.	Occurs during accel./decel.	Excessive acceleration	Change parameter set value.
			Excessive feed speed	Change parameter or reference speed.
			Excessive load	Check load (torque, inertia) and application data.
		Vibration, etc. occurs.	Speed loop gain is low.	Set slightly larger parameter 2 set value.
		Motor does not operate on command.	Improper motor wiring	Correct wiring.
			Encoder mulfunction or fault	When absolute encoder is used, perform absolute encoder setup. ↓ When occurs again or incremental encoder is used, replace motor.

(Cont'd)

(Cont'd)

	Status when an error occurs	Cause	Corrective Action
L. OVERRUN	Occurs when control power is applied.	Absolute encoder is used.	Change parameter 9 to 0.
		Improper incremental encoder wiring.	Correct wiring.
		SERVOPACK mulfunction or fault	Cycle the control power supply. ↓ When occurs again, replace SERVOPACK.
	Occurs at starting after operating for a while.	Improper motor code setting	Change parameter 7 to suitable value for the motor.
		Improper encoder pulse/rev setting	Change parameter 8 to suitable value for the encoder.
		Improper motor wiring	Correct wiring.
		Improper encoder wiring	Correct wiring.
4. PARAMETER ERROR	Occurs when control power is applied.	Parameter data fault (When error parameter No.≠00)	Verify parameter value and rewrite it.
		Table (Position/Speed/Boundary data fault) (When error parameter No.=00)	Check table value and rewrite it.
		SERVOPACK fault	Replace SERVOPACK.
d. (Blinks) BATTERY VOLTAGE LOW	Occurs when control power is applied.	Battery is not connected	Check battery connection.
		Battery connector contact fault	
		Battery voltage reduction	Replace battery. (If battery runs down in short time, check encoder connection or set up absolute encoder.)
		SERVOPACK fault	Replace SERVOPACK.

12 PERIPHERAL DEVICES

12.1 COMBINATION OF PERIPHERAL DEVICES

Table 12.1 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 Filter*2		Power ON/OFF Magnetic Contactor
					Type	200VAC Class	
HR03BAB12	03[ ][ ] 1	1.0	7	Good Poor	LF-215	15A	YASKAWA Type HI-15E$_2$ (30A) or equivalent
HR10BAB	06[ ][ ] 1 09B [ ] 2	2.1	8		LF-315	15A	
HR15BAB	12B [ ] 2	3.1	10				
HR03BB	03[ ][ ] 1	0.65	5		LF-305	5A	
HR10BB	06[ ][ ] 1	1.5	8		LF-310	10A	
	09B [ ] 2	2.1	8		LF-315	15A	
HR15BB	12B [ ] 2	3.1	10				
HR20BB	20B [ ] 2	4.1	12		LF-320	20A	YASKAWA Type HI-18E (35A) or equivalent
HR30BB	30B [ ] 2	6.0	18		LF-330	30A	
HR44BB	44B [ ] 2	8.0	24		LF-340	40A	
HR60BB	(USAMKD-) 60B [ ] 2	11	32		LF-350	50A	YASKAWA Type HI-25E (50A) or equivalent

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

Table 12.2 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 Magnetic Contactor
					Type	200VAC class	
HR03BAB12	02[ ][ ] 1	1.0	7	Good / Poor	LF-210	10A	YASKAWA Type HI-15E$_2$ (30A) or equivalent
	03[ ][ ] 1						
HR05BAB12	05[ ][ ] 1	1.4	11		LF-215	15A	
HR10BAB	09[ ][ ] 1	2.1	8		LF-315	15A	
HR15BAB	13C [ ] 2	3.1	10				
HR03BB	02[ ][ ] 1	0.65	5		LF-305	5A	YASKAWA Type HI-18E (35A) or equivalent
	03[ ][ ] 1						
HR05BB	05[ ][ ] 1	1.1	5		LF-305	5A	
HR10BB	09[ ][ ] 1	2.1	8		LF-315	15A	
HR15BB	13C [ ] 2	3.1	10				
HR20BB	20C [ ] 2	4.1	12		LF-320	20A	
HR30BB	30C [ ] 2	6.0	18		LF-330	30A	
HR44BB	44C [ ] 2	8.0	24		LF-340	40A	

Table 12.3 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 Magnetic Contactor
					Type	200VAC class	
HR03BAB12	02[ ][ ] 1	1.0	7	Good / Poor	LF-210	10A	YASKAWA Type HI-15E$_2$ (30A) or equivalent
	03[ ][ ] 1						
HR05BAB12	05[ ][ ] 1	1.4	11		LF-215	15A	
HR10BAB	09[ ][ ] 1	2.1	8		LF-315	15A	
HR15BAB	13A [ ] 2	3.1	10				
HR03BB	02[ ][ ] 2	0.65	5		LF-305	5A	
	03[ ][ ] 1						
HR05BB	05[ ][ ] 1	1.1	5		LF-305	5A	YASKAWA Type HI-18E (35A) or equivalent
HR10BB	09[ ][ ] 1	2.1	8		LF-315	15A	
HR15BB	13A [ ] 2	3.1	10				
HR20BB	20A [ ] 2	4.1	12		LF-320	20A	
HR30BB	30A [ ] 2	6.0	18		LF-330	30A	
HR44BB	44A [ ] 2	8.0	24		LF-340	40A	

Table 12.4 Combination of Servopack, Servomotor D Series and Peripheral Devices

Servopack Type CACR-	AC Servomotor Type USADED-	Power Capacity per Servopack kVA	Current Capacity per MCCB of Fuse A	Applicable Noise Filter	Recommended Noise Filter		Power ON/OFF Magnetic Contactor
					Type	200VAC class	
HR05BAB12	05E ⬚	1.4	11	Good / Poor	LF-215	15A	YASKAWA Type HI-15E$_2$ (30A) or equivalent
HR15BAB	10E ⬚	3.1	10		LF-315	15A	
HR05BB	05E ⬚	1.5	8		LF-310	10A	
HR15BB	10E ⬚	3.1	10		LF-315	15A	
HR20BB	15E ⬚	4.1	12		LF-320	20A	YASKAWA Type HI-18 (35A) or equivalent
HR30BB	22E ⬚	6.0	18		LF-330	30A	
HR44BB	37E ⬚	8.0	24		LF-340	40A	

Table 12.5 Combination of Servopack, Servomotor S Series and Peripheral Devices

Servopack Type CACR-	AC Servomotor Type USASED-	Power Capacity per Servopack kVA	Current Capacity per MCCB of Fuse A	Applicable Noise Filter	Recommended Noise Filter		Power ON/OFF Magnetic Contactor
					Type	200VAC class	
HR02BAB12	02A ⬚	0.75	5	Good / Poor	LF-205A	5A	YASKAWA Type HI-15E$_2$ (30A) or equivalent
HR03BAB12	03A ⬚	1.0	7		LF-210	10A	
HR05BAB12	05A ⬚	1.4	11		LF-215	15A	
HR10BAB	08A ⬚	2.1	8		LF-315	15A	
HR15BAB	15A ⬚	3.1	10				
HR03BB	02A ⬚	0.65	5		LF-305	5A	
	03A ⬚						
HR05BB	05A ⬚	1.1	5				
HR10BB	08A ⬚	2.1	8		LF-315	15A	
HR15BB	15A ⬚	3.1	10				
HR30BB	30A ⬚	6.0	18		LF-330	30A	YASKAWA Type HI-18E (35A) or equivalent

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Table 12.6 Combination of Servopack, Servomotor R Series and Peripheral Devices

Servopack Type CACR-	AC Servomotor Type USARED-	Power Capacity per Servopack kVA	Current Capacity per MCCB of Fuse A	Applicable Noise Filter	Recommended Noise Filter		Power ON/OFF Magnetic Contactor
					Type	200VAC class	
HRA5BAB12	A5C ⬚ 2	0.3	5	Good ⊤ Poor ⊠	LF-205A	5A	YASKAWA Type HI-15E$_2$ (30A) or equivalent
HR01BAB12	01C ⬚ 2	0.5					
HR02BAB12	03C ⬚ 2	0.75					
HR03BAB12	03C ⬚ 2	1.0	7		LF-210	10A	
HR05BAB12	05C ⬚ 2	1.4	11		LF-215	15A	
HR10BAB	07C ⬚ 2	2.1	8		LF-315	10A	
HRA5BAB11	A5D ⬚ 2	0.3	5		LF-205A	5A	
HR01BAB11	01D ⬚ 2	0.5					
HR02BAB11	02D ⬚ 2	0.75	8		LF-210	10A	
HR03BAB11	03D ⬚ 2	1.0	11		LF-215	15A	
HR05BAB11	05D ⬚ 2	1.4	15		LF-220	20A	

Table 12.7 Combination of Servopack, Servomotor P Series and Peripheral Devices

Servopack Type CACR-	AC Servomotor Type USAPEN-	Power Capacity per Servopack kVA	Current Capacity per MCCB of Fuse A	Applicable Noise Filter	Recommended Noise Filter		Power ON/OFF Magnetic Contactor
					Type	200VAC class	
HR01BAB12	USAPEM-01C ⬚ 2	0.5	5	Good ⊤ Poor ⊠	LF-205A	5A	YASKAWA Type HI-15E$_2$ (30A) or equivalent
HR02BAB12	USAPEM-02C ⬚ 2	0.75					
HR03BAB12	USAPEM-03C ⬚ 2	1.0	7		LF-210	10A	
HR05BAB12	USAPEM-05C ⬚ 2	1.4	11		LS-215	15A	
HR10BAB	USAPEM-10C ⬚ 2	2.1	8		LF-315	10A	

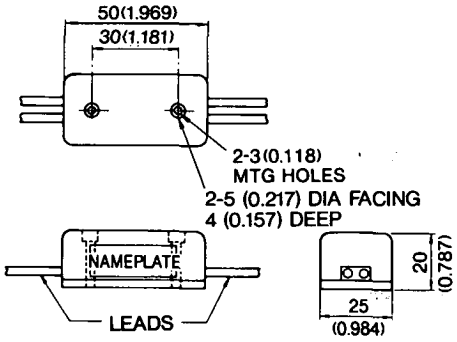
12.2 BRAKE POWER SUPPLY

There are two types of brake power supplies for M, F, G and D series and for S, R and P series. Select one suitable for the applicable motor.

(a) Power supply unit for S, P, R series (made by YASKAWA CONTROL CO., LTD.)

- Input 100VAC, output 90VDC, Max. 1.0ADC (B9400876-2) type LPDE-1H01
- Input 200VAC, output 90VDC, Max. 1.0ADC (B9400876-1) type LPSE-2H01

Dimensions in mm (inches)

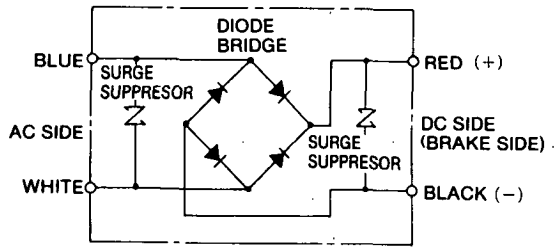


- Lead Length: 500mm for each (19.69inches.)
- Lead Color Distinction

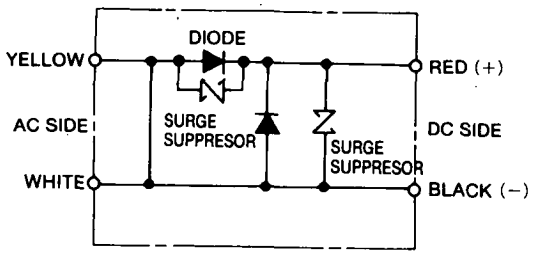
AC Input Side		Brake Side
100V	200V	
Blue White	Yellow White	Red Black

- Max Ambient Temperature 60° C

100VAC: Internal Circuit



200VAC: Internal Circuit

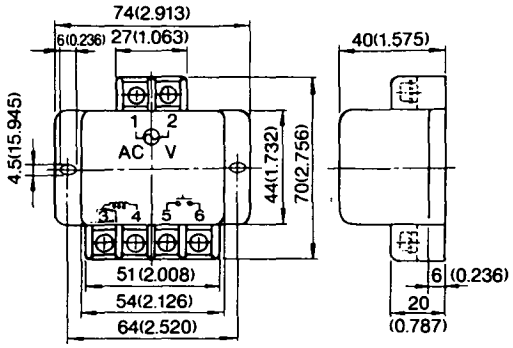


Notes: 1. Do not short-circuit between output leads.
2. Insert a fuse in the input or output side to protect the power supply.
3. Brake power supply circuit can be opened/closed either at AC or DC side. Normally, it is safer to open/close at AC side. (However, brake time becomes longer.) To open/close at DC side, brake coil may be damaged by surge voltage. Be sure to use a surge suppressor [CR50500BL(made by Okaya Electric Industries Co., Ltd.) or equivalent] near brake coil.

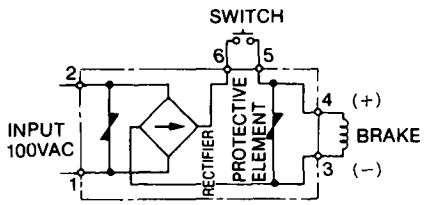
(b) Power supply unit for M, F, G, D series (made by Ogura Clutch Co., Ltd.)

- Input 100VAC, output 90VDC, Max. 1.0A (type OPR 109F)
- Input 200VAC, output 90VDC, Max. 1.0A (type OPR 109A)

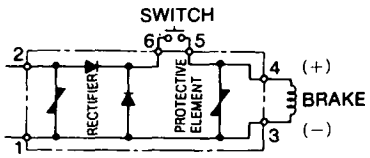
Dimensions in mm (inches)



Type OPR109F Circuit Diagram

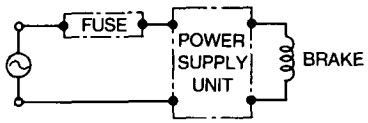


Type OPR109A Circuit Diagram



Recommended fuse : type MF60 NR2 (made by TOYO FUSE CO., LTD.)

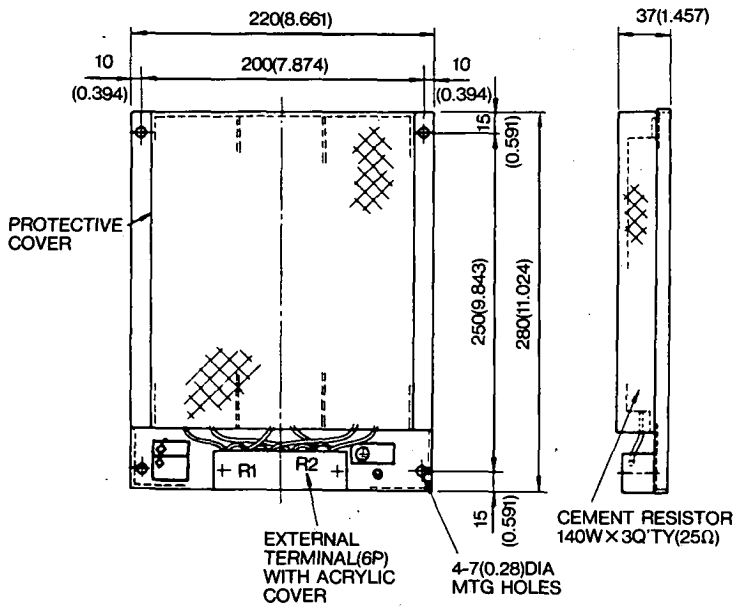
Circuit Diagram



Notes : 1. Do not short-circuit between output terminal Nos. 3 and 4.
2. The rated current of the contact used for Nos. 5 and 6 is 5 to 10 times the rated current of the brake used. Contacts for DC power must be used.
3. Insert a fuse in the input side to protect the power supply.
4. Brake power supply circuit can be opened/closed either at AC or DC side. Normally, it is safer to open/close at AC side. (However, brake time becomes longer.) To open/close at DC side, brake coil may be damaged by surge voltage. Be sure to use a surge suppressor (CR50500BL(made by Okaya Electric Industries Co., Ltd.) or equivalent) near brake coil.

12.3 BRAKING RESISTOR UNIT (TYPE JUSP-RA03)

For Sarvopack Type CACR-HR60BB



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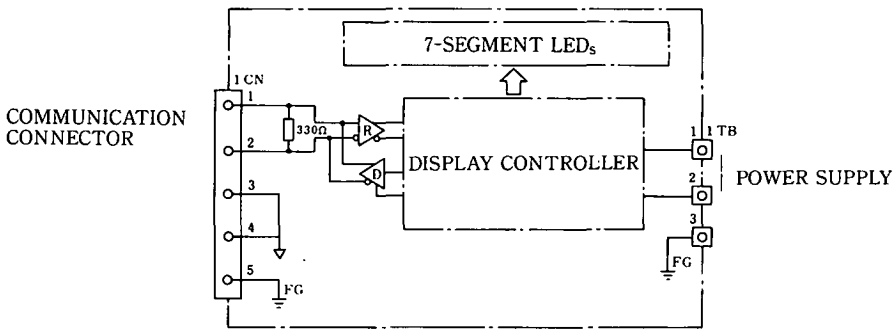
12.4 EXTERNAL POSITION INDICATOR (TYPE MCIF-L8□)

(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/s²(0.5G)(10 to 55Hz) Shock resistance: 19.6m/s²(2G)		
Number of display digits	- sign indication and 8-digit number		
Connecting method	Serial communication, connected to connector 4CN of CACR-HR.		

Note: Types marked with * are manufactured on order.

(2) Circuit block diagram



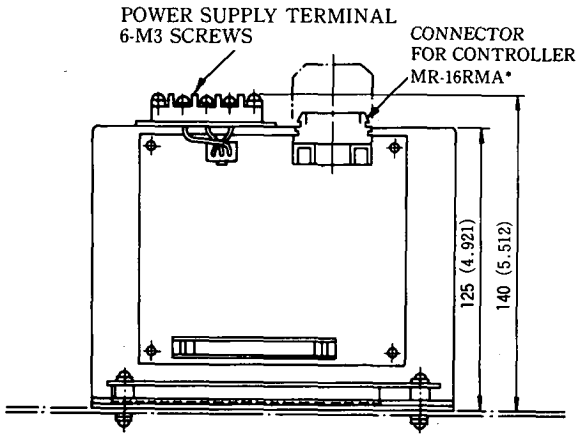
Note: Do not connect anything to 1CN pin 7 or 8 since they are for test.
Other pins are not used.

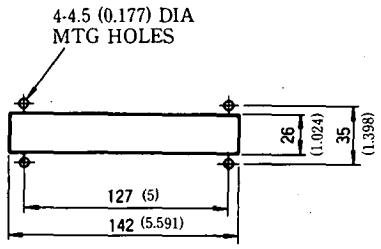
Power Supply and Connection

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

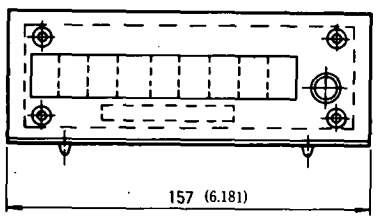
(3) Dimensions in mm (inches)

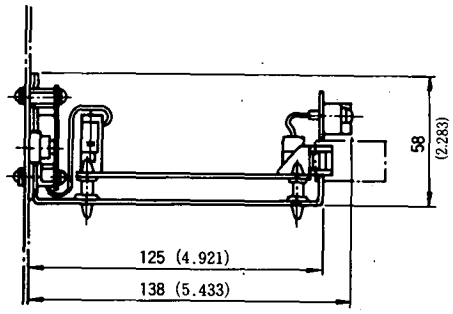
Type MCIF-L8





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

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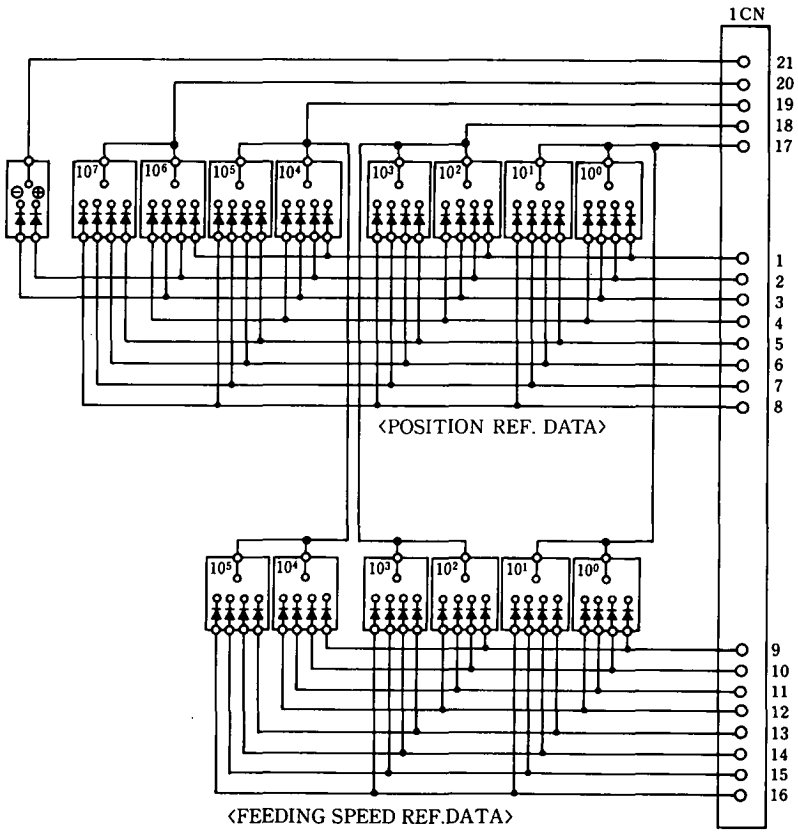
12.5 DIGITAL SWITCH UNIT (TYPE MCIF-D□□)

(1) Specifications

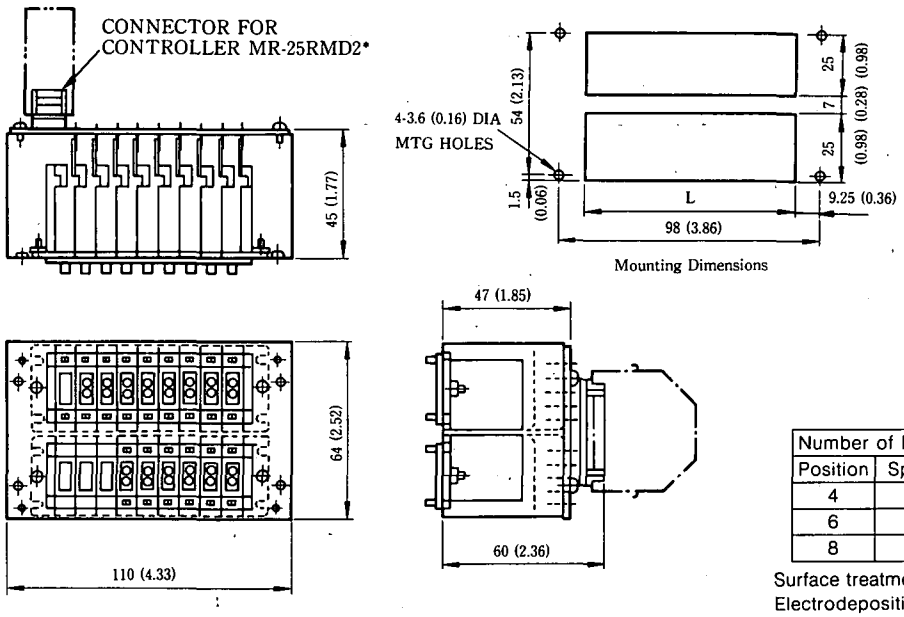
Item \ Type	MCIF-D86	MCIF-D66	MCIF-D44	MCIF-D80	MCIF-D60	MCIF-D40
Data contents	2-step(position/speed reference data)			1-step(only position reference data)*		
Position reference data	BCD 8-digit	BCD 6-digit	BCD 4-digit	BCD 8-digit	BCD 6-digit	BCD 4-digit
Speed reference data	BCD 6-digit	BCD 6-digit	BCD 4-digit	None		
Operating temperature	0 to +55℃					
Storage temperature	-20 to +80℃					
Vibration or shock resistance	Vibration resistance: 4.9m/s²(0.5G)(10 to 55Hz) Shock resistance: 19.6m/s²(2G)					
Connecting method	Connect 5CN to CACR-HR.					

(2) Circuit Diagram



(3) Dimensions in mm (inches)

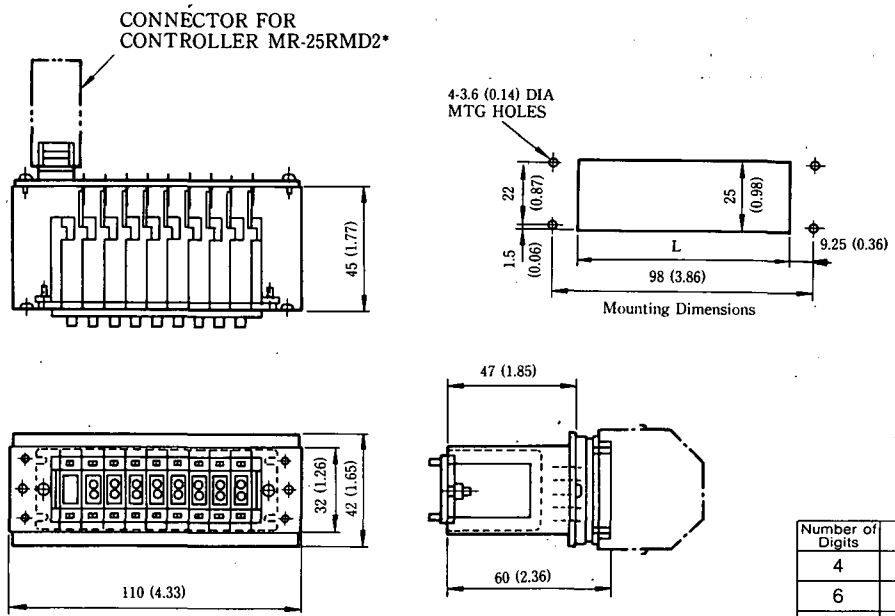
Type MCIF-D44, -D66, -D86



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



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

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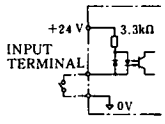
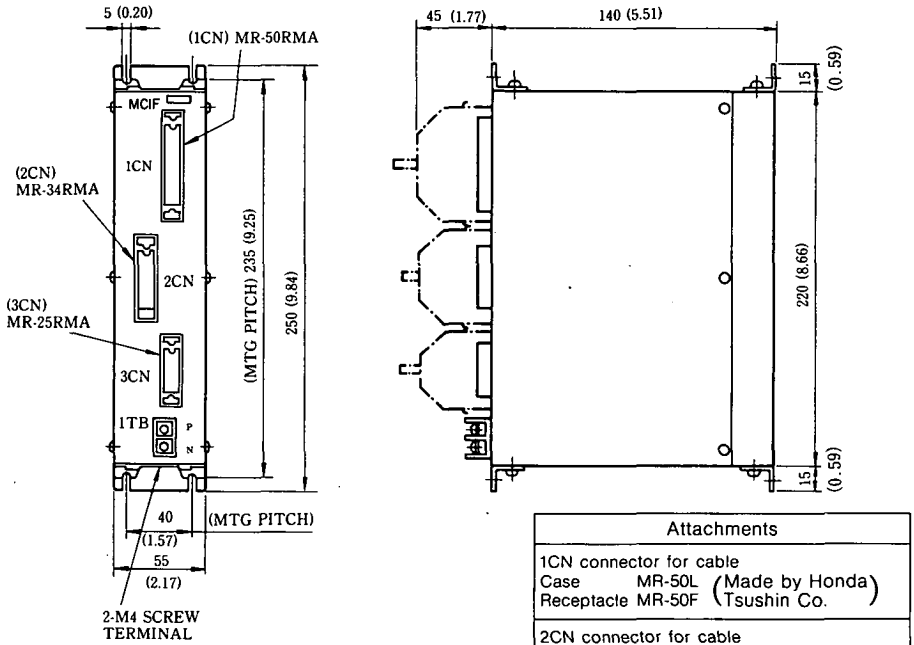
12.6 CONTACT INPUT UNIT (TYPE MCIF-R86)

(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/s²(0.5G)(10 to 55Hz) Shock resistance: 19.6m/s²(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 5CN

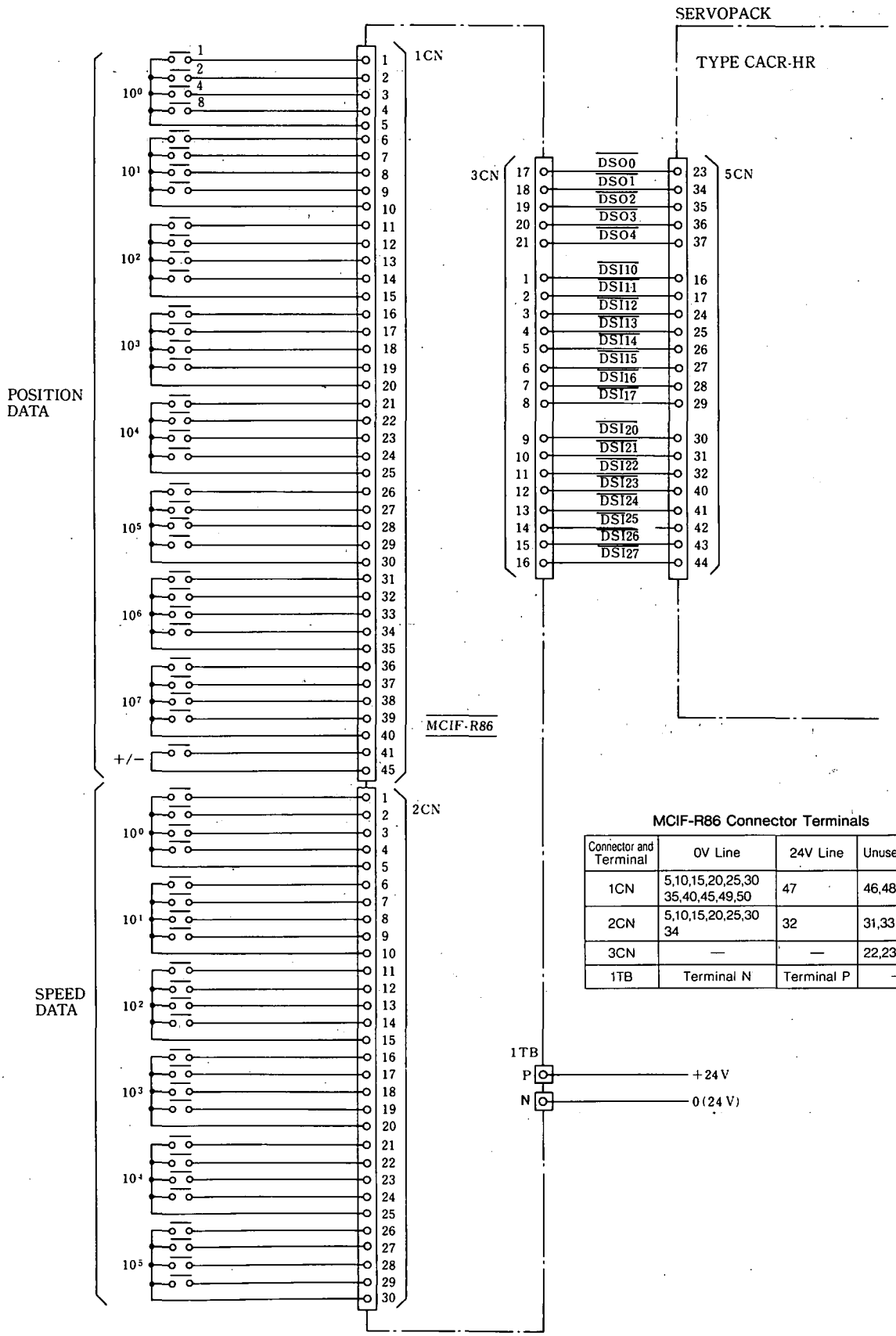
(2) Dimensions in mm (inches)

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	—

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

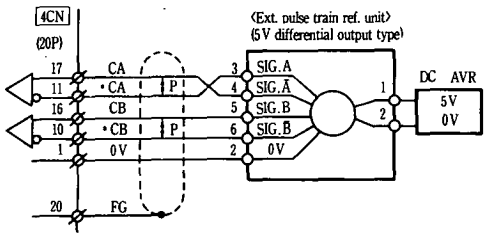
(1) Specifications

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 CACR-HR 4CN

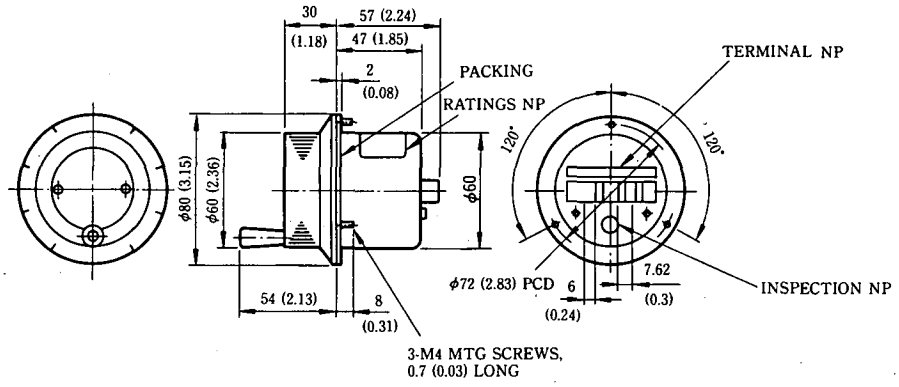
(2) Output terminal Arrangement

Symbol	Function
1	+V (DC5V)
2	V (0V)
3	SIG. A
4	SIG. $\overline{A}$
5	SIG. B
6	SIG. $\overline{B}$

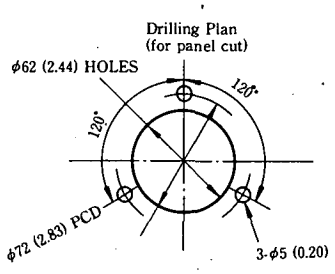
Note: When connecting to Servopack, reverse SIG.A and SIG. $\overline{A}$ on Par 5.1, as follows:



(3) Dimensions in mm (inches)



Note: Receiver IC is AM26LS32C, SN75175 or equivalent.



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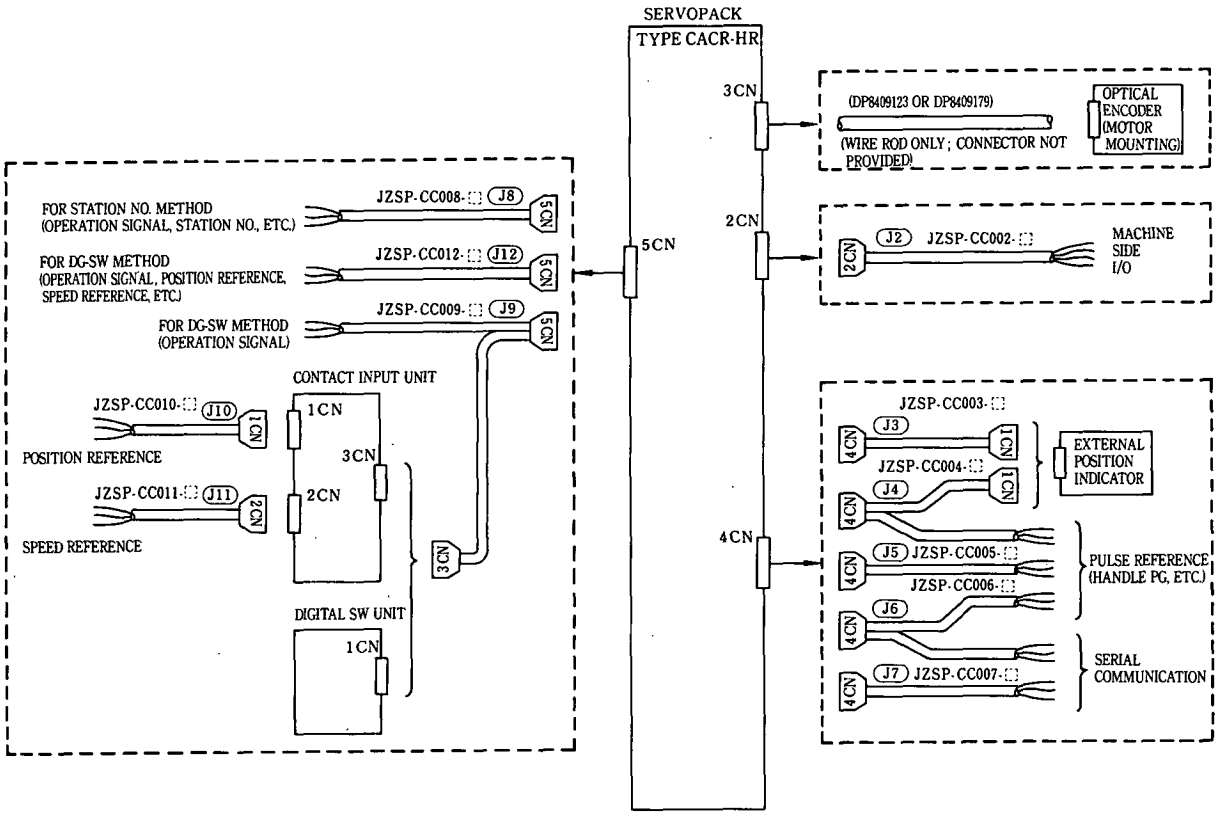
12.8 CONNECTING CABLE



Note: Cable length: 1,3 or 5 meters (39.37, 118.11 or 196.85 inches)
For 4CN or 5CN, select one cable suitable for the system.

12.9 PARAMETER SETTER (PF803)

12.9.1 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)

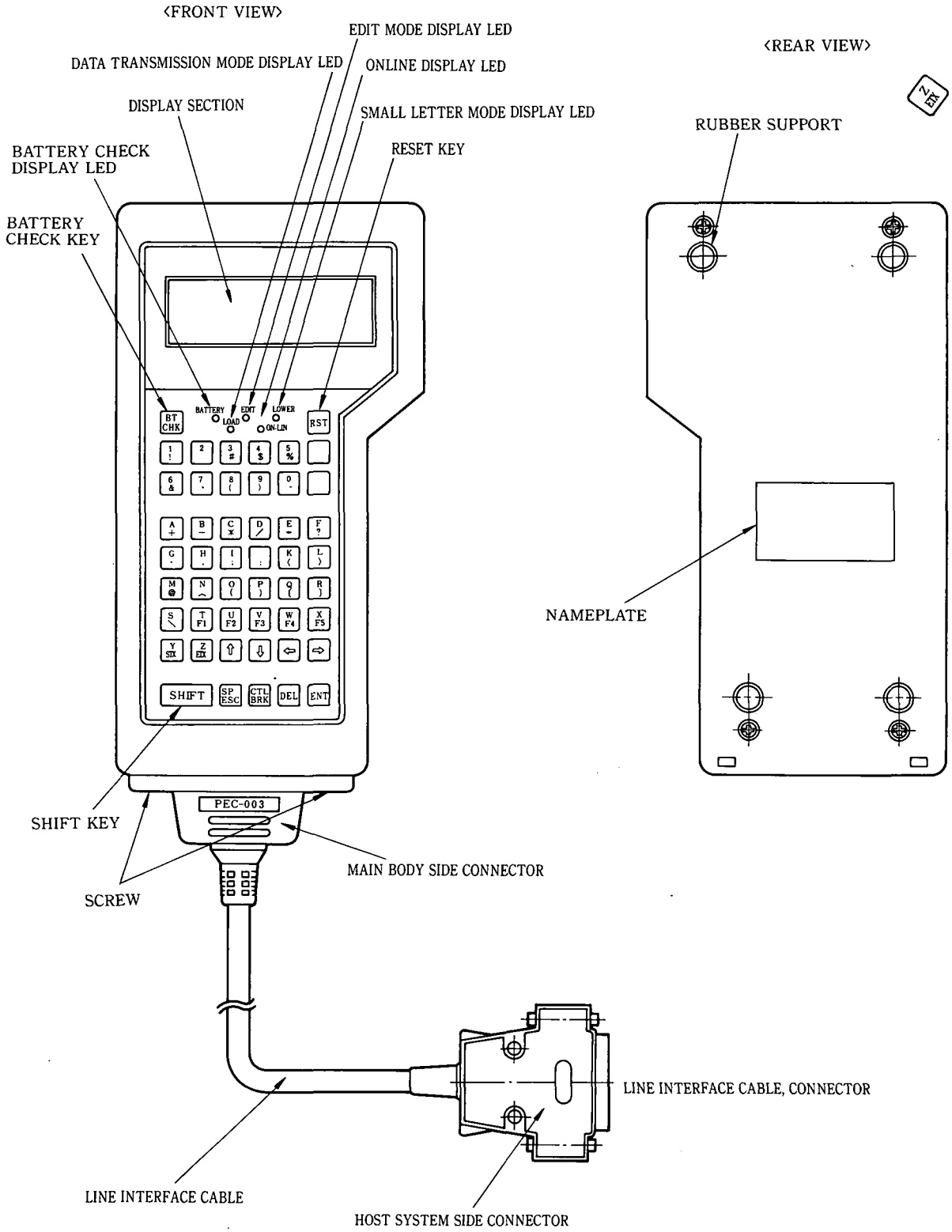
(7) Operational Environment

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

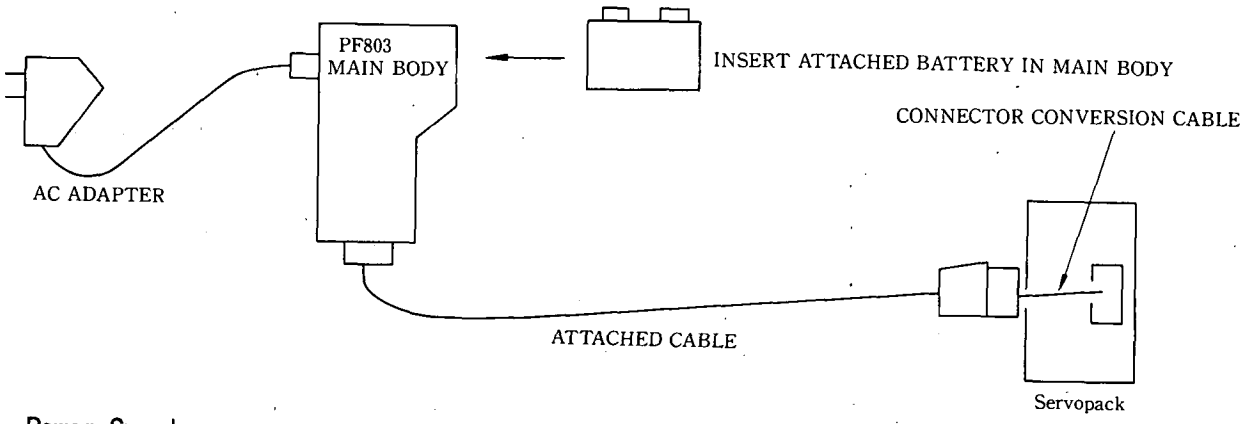
(8) AC Adapter (Type PAC803-A)

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

12.9.2 External View



12.9.3 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 SPEED	9600 bps
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

③ SHIFT + V F3

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

ENT

KEY is selected.

• Data to be set

KEY CLICK	Yes
AUTO REPEAT	Yes

④ SHIFT + W F4

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

ENT

RS-232C is selected.

• Data to be set

CS	No
DSR	No
CD	No

⑤ SHIFT + X F5

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

<Display 1>

Returns to MENU.

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.

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

4. Check that characters are displayed by key input.

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5. Set the parameter and the table.
(ex)
• Enter 20 to parameter No. 1.
[P)] [R)] [M @] [1 !] [SHIFT] [E =] [2 "] [0 _] [ENT]
• Enter 11110 to parameter No. 14.
[P)] [R)] [M @] [1 !] [4 $] [SHIFT] [E =] [1 !] [1 !] [1 !] [1 !] [0 _] [ENT]
(b4) (b3) (b2) (b1) (b0)
• Enter -123 to position table No. 1.
[P)] [T F1] [1 !] [SHIFT] [E =] [SHIFT] [B _] [1 !] [2 "] [3 #] [ENT]
• Enter 1000 to speed table No. 25.
[V F3] [T F1] [2 "] [5 %] [SHIFT] [E =] [1 !] [0 _] [0 _] [0 _] [ENT]
• Enter 98765 to block table No. 31.
[B _] [T F1] [3 #] [1 !] [SHIFT] [E =] [9 >] [8 (] [7 '] [6 &] [5 %] [ENT]

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

When setting is completed, send reset command.

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

8. Check by all parameter display.
[P)] [T F1] [ENT]
Check by all position table display.
[V F3] [T F1] [ENT]
Check by all speed table display.
[B _] [T F1] [ENT]
Check by all block table display.

NOTE
1. Unused parameters No. 21 and above are 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. <u>When entering parameter and table to PF803 file.</u>

① [SHIFT] + [V F3]

Select DOWNLOAD.

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

CURRENT NUMBER OF FILES

REMAINING MEMORY

< Display 5 >

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] (for parameter)
[P)] [T F1] [ENT] (for position table)
[V F3] [T F1] [ENT] (for speed table)
[B –] [T F1] [ENT] (for block table)

(No display provided.)

④ Ends when decreasing remaining memory value stops.

11. Send parameter and table entered in PF803 file to Servopack.

① [SHIFT] + [U F2]

File	Name?	*UPLOAD*
Select	File	

< Display 6 >

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

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

② [SHIFT] + [X F5]

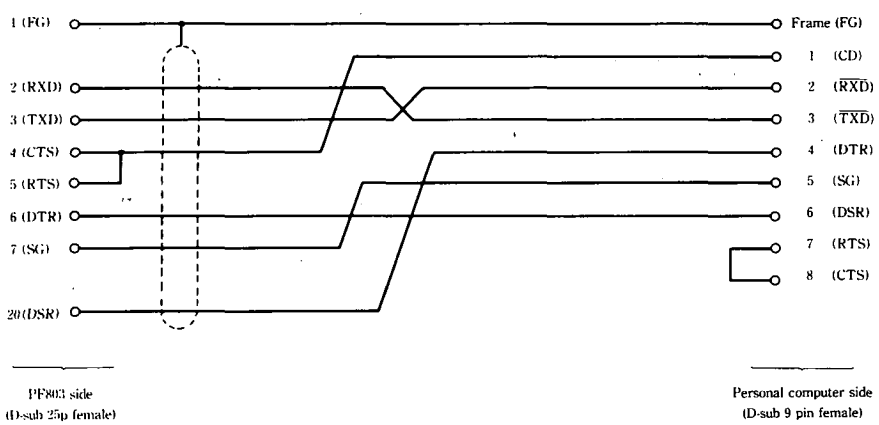
Returns to <Display 4>.

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.



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• 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>

<Description>

Displayed when turning the power on.

2. [SHIFT] + [V F3]

Select SET UP.

3.
```
SETUP-MODE
F1=COM          F2=DISPLAY
F3=KEY          F4=RS232C
F5=MENU
```
Displayed setup-mode.
Set by using the following keys.

[⇨] : selects an item to be set.

[⇩] : sets data. See below.

[ENT] : ends the setting.

4. Set the setup data as the following procedure.

① [SHIFT] + [T F1]

```
COMMUNICATION     SPEED
1200 bps
CODE PARITY       STOP
ASCII Even        1Bit
```
COM is selected.

• Data to be set

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

[ENT]

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

[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

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>

• 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

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, send CTL BRK and Z ETX 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 240 and 241) again after file exchanging with personal computers.

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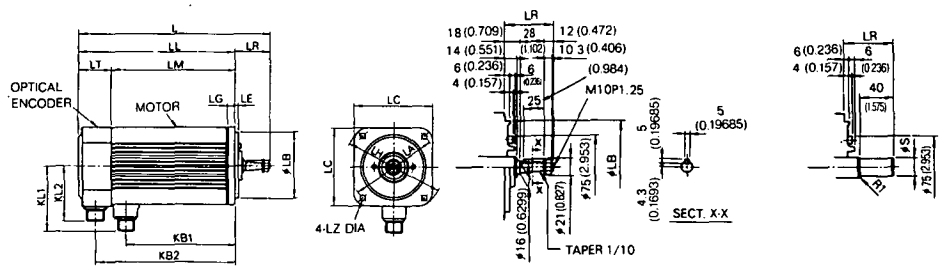
13 DIMENSIONS

13.1 AC SERVOMOTOR WITH ABSOLUTE ENCODER

(1) M Series

Dimensions in mm (inches)

Drawing 1 USAMED-03B□1, -06B□1 (Taper Shaft), -09B□2 (Straight Shaft)



For -03B□1, -06B□1

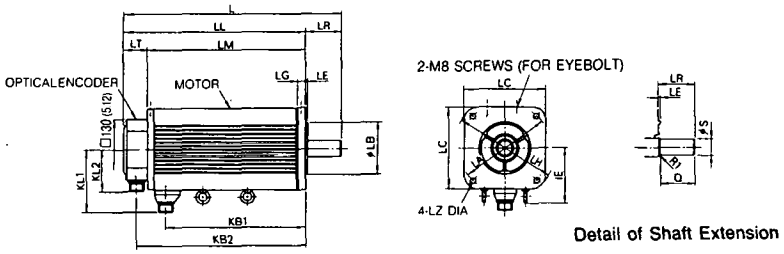
For -09B□2

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.*
4. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : S (8192 P/R)
   Semi-standard : W (1024 P/R)

Drawing 2 USAMED-12B□2 to -44B□2 (Straight Shaft)

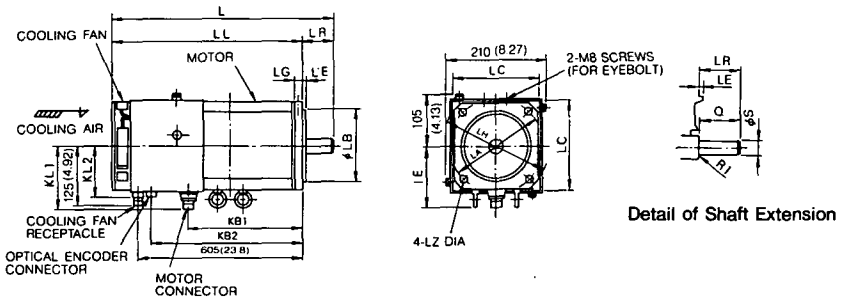


Detail of Shaft Extension

Notes :

1. *Plug and clamp are not attached for receptacle connection.*
2. *Motor should be mounted with connectors down.*
3. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : S (8192 P/R)
   Semi-standard : W (1024 P/R)

Drawing 3 USAMKD-60B□2 (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.*
3. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : S (8192 P/R)
   Semi-standard : W (1024 P/R)

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	
03B□1†	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)
06B□1†		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)
09B□2†		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)
12B□2†	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 $^{0}_{-0.01}$ (1.3779 $^{0}_{-0.0004}$)	76 (2.992)	22 (48.5)
20B□2		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 $^{0}_{-0.01}$ (1.3779 $^{0}_{-0.0004}$)	76 (2.992)	29 (63.9)
30B□2		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 $^{0}_{-0.01}$ (1.3779 $^{0}_{-0.0004}$)	76 (2.992)	41 (90.4)
44B□2		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)
60B□2	3	800 (31.50)	690 (27.17)	—	110 (4.33)	—	476 (18.74)	583 (22.95)	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)	71 (156.5)

** For servomotor of 6kW, "K" is used instead of "E", because of externally fan-cooled type.*
† Not provided with an eyebolt.

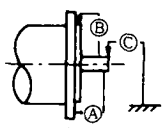
CONNECTOR TYPES

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
03B□1 06B□1 09B□2	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A	MS3102 A20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
12B□2 20B□2 30B□2	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057 -12A				
44B□2 USAMKD-60B□2*	MS3102 A32-17P	MS3108 B32-17S	MS3106 B32-17S	MS3057 -20A				

** Cooling fan receptacle : MS 3102 A 14 S-6P*
Cooling fan plug : MS 3108 B 14 S-6S
Cooling fan clamp : MS 3057-6 A

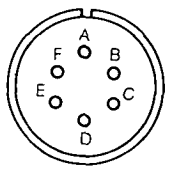
Servomotors with a brake are also available.

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 types USAMED-44BS2, USAMKD-60BS2.

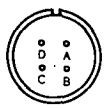
FAN TERMINAL CONNECTION
(For only 60BS2)



A	Fan motor
B	Fan motor
C	—
D	Alarm terminal
E	Alarm terminal
F	—

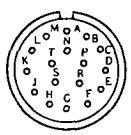
CONNECTOR SPECIFICATIONS

Motor Receptacle

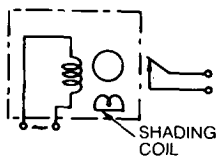


A	Phase U
B	Phase V
C	Phase W
D	Ground

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	—	—



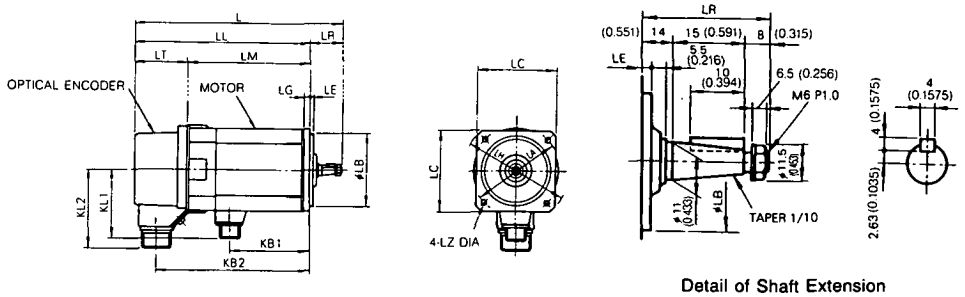
Alarm Contact :
OFF at normal fan rotation
ON at 1800±200 r/min or less
(ON during 3 seconds at start-up)
Contact Capacity :
Max. resistive load 110V, 0.3A

13

(2) F Series

Dimensions in mm (inches)

Drawing 1 USAFED-02C□1, -03C□1 (Taper Shaft)

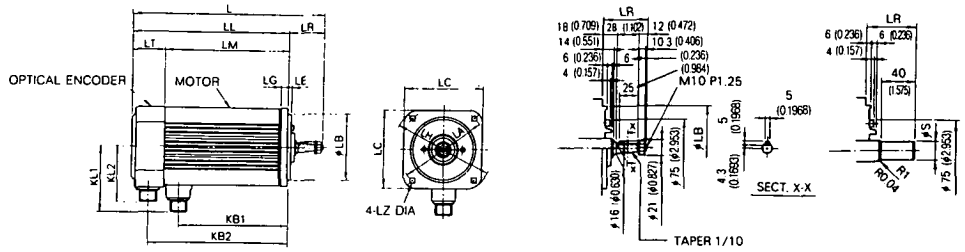


Detail of Shaft Extension

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.*
4. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : S (8192 P/R)
   Semi-standard : W (1024 P/R)

Drawing 2 USAFED-05C□1, -09C□1 (Taper Shaft), -13C□2 (Straight Shaft)



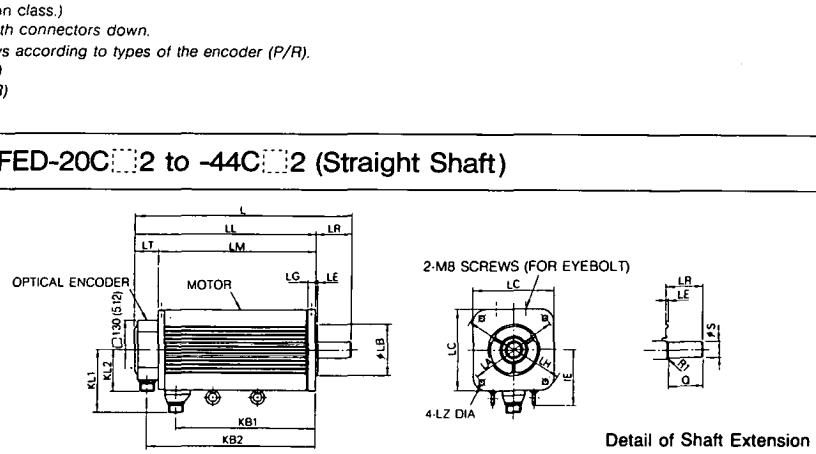
For -05CS1, -09CS1 For -13CS2

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.*
4. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : S (8192 P/R)
   Semi-standard : W (1024 P/R)

Drawing 3 USAFED-20C□2 to -44C□2 (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.*
3. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : S (8192 P/R)
   Semi-standard : W (1024 P/R)

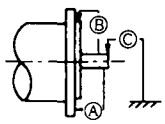
AC Servomotor Type USAFED-	Dwg. No.	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface							Shaft Extension		Approx Mass kg (lb)
												LA	LB	LC	LE	LG	LH	LZ	S	Q	
02C□1*	1	234 (9.21)	197 (7.75)	137 (5.39)	37 (1.46)	60 (2.36)	90 (3.54)	172 (6.77)	—	76 (2.99)	87 (3.43)	100 (3.94)	80 $^{0}_{-0.030}$ (3.1496 $^{0}_{-0.0012}$)	90 (3.54)	4 (0.157)	7 (0.276)	120 (4.72)	6.6 (0.26)	—	—	5 (11.0)
03C□1*		280 (11.02)	243 (9.56)	183 (7.2)	37 (1.46)	60 (2.36)	136 (5.35)	218 (8.58)	—	76 (2.99)	87 (3.43)	100 (3.94)	80 $^{0}_{-0.030}$ (3.1496 $^{0}_{-0.0012}$)	90 (3.54)	4 (0.157)	7 (0.276)	120 (4.72)	6.6 (0.26)	—	—	7 (15.5)
05C□1*	2	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 $^{0}_{-0.035}$ (4.3307 $^{0}_{-0.0014}$)	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	—	—	9 (19.9)
09C□1*		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 $^{0}_{-0.035}$ (4.3307 $^{0}_{-0.0014}$)	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	—	—	14 (30.9)
13C□2*		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 (1.57)	20 (44.1)
20C□2*	3	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 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.001}$)	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 $^{-0.01}_{0}$ (1.3379 $^{-0.0004}_{0}$)	76 (2.99)	22 (48.5)
30C□2		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 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.001}$)	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 $^{-0.01}_{0}$ (1.3379 $^{-0.0004}_{0}$)	76 (2.99)	29 (63.9)
44C□2		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 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.001}$)	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 $^{-0.01}_{0}$ (1.3379 $^{-0.0004}_{0}$)	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
02C□1 03C□1	MS3102 A14S-2P	MS3108 B14S-2S	MS3106 B14S-2S	MS3057 -6A	MS3102 A20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
05C□1 09C□1 13C□2	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A				
20C□2 30C□2 44C□2	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057 -12A				

MECHANICAL SPECIFICATIONS

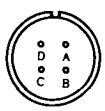
Accuracy (T. I. R)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0.04 (0.0016)	
Flange diameter concentric to shaft Ⓑ	0.04 (0.0016)	
Shaft run out Ⓒ	0.02 (0.0008)	

** T. I. R. (Total Indicator Reading)*

Servomotors with a brake are also available.

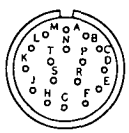
CONNECTOR SPECIFICATIONS

Motor Receptacle



A	Phase U
B	Phase V
C	Phase W
D	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	—	—

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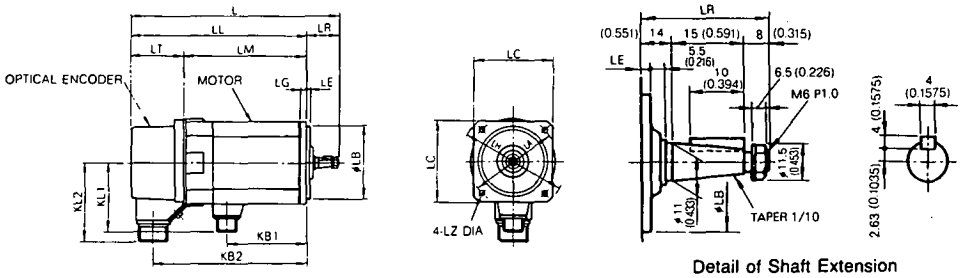
(3) G Series

Dimensions in mm (inches)

Drawing 1 USAGED-02A□1, -03A□1 (Taper Shaft)

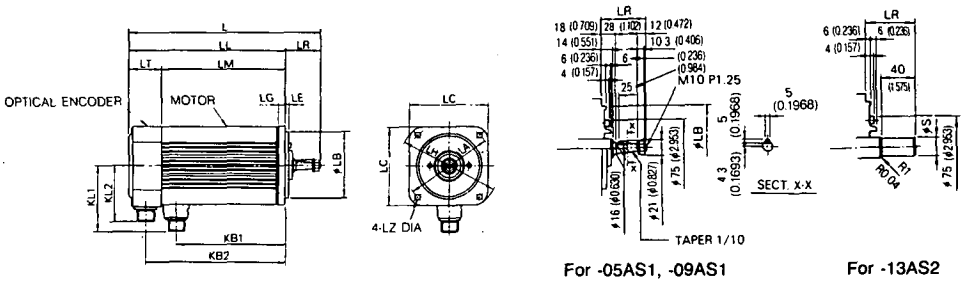


Detail of Shaft Extension

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.*
4. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : S (8192 P/R)
   Semi-standard : W (1024 P/R)

Drawing 2 USAGED-05A□1, -09A□1 (Taper Shaft), -13A□2 (Straight Shaft)



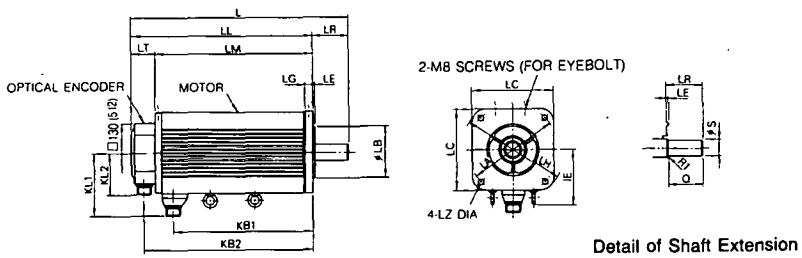
For -05AS1, -09AS1 For -13AS2

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.*
4. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : S (8192 P/R)
   Semi-standard : W (1024 P/R)

Drawing 3 USAGED-20A□2 to -44A□2 (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.*
3. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : S (8192 P/R)
   Semi-standard : W (1024 P/R)

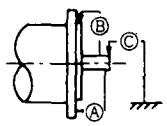
AC Servomotor Type USAGED-	Dwg. No.	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface							Shaft Extension		Approx Mass kg (lb)
												LA	LB	LC	LE	LG	LH	LZ	S	Q	
02A□1*	1	234 (9.21)	197 (7.75)	137 (5.39)	37 (1.46)	60 (2.36)	90 (3.54)	172 (6.77)	—	76 (2.99)	87 (3.43)	100 (3.94)	80 $^{0}_{-0.030}$ (3.1496 $^{0}_{-0.0012}$)	90 (3.54)	4 (0.157)	7 (0.276)	120 (4.72)	6.6 (0.26)	—	—	5 (11.0)
03A□1*		280 (11.02)	243 (9.56)	183 (7.2)	37 (1.46)	60 (2.36)	136 (5.35)	218 (8.58)	—	76 (2.99)	87 (3.43)	100 (3.94)	80 $^{0}_{-0.030}$ (3.1496 $^{0}_{-0.0012}$)	90 (3.54)	4 (0.157)	7 (0.276)	120 (4.72)	6.6 (0.26)	—	—	7 (15.5)
05A□1*	2	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 $^{0}_{-0.035}$ (4.3307 $^{0}_{-0.0014}$)	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	—	—	9 (19.9)
09A□1*		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 $^{0}_{-0.035}$ (4.3307 $^{0}_{-0.0014}$)	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	—	—	14 (30.9)
13A□2*		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 (1.57)	20 (44.1)
20A□2*	3	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 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.001}$)	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 $^{+0.01}_{0}$ (1.3379 $^{+0.0004}_{0}$)	76 (2.99)	22 (48.5)
30A□2		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 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.001}$)	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 $^{+0.01}_{0}$ (1.3379 $^{+0.0004}_{0}$)	76 (2.99)	29 (63.9)
44A□2		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 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.001}$)	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 $^{+0.01}_{0}$ (1.3379 $^{+0.0004}_{0}$)	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
02A□1 03A□1	MS3102 A14S-2P	MS3108 A14S-2S	MS3106 B14S-2S	MS3057 -6A	MS3102 A20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
05A□1 09A□1 13A□2	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A				
20A□2 30A□2 44A□2	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057 -12A				

MECHANICAL SPECIFICATIONS

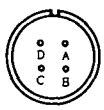
Accuracy (T. I. R)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0.04 (0.0016)	
Flange diameter concentric to shaft Ⓑ	0.04 (0.0016)	
Shaft run out Ⓒ	0.02 (0.0008)	

*T. I. R. (Total Indicator Reading)

Servomotors with a brake are also available.

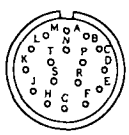
CONNECTOR SPECIFICATIONS

Motor Receptacle



A	Phase U
B	Phase V
C	Phase W
D	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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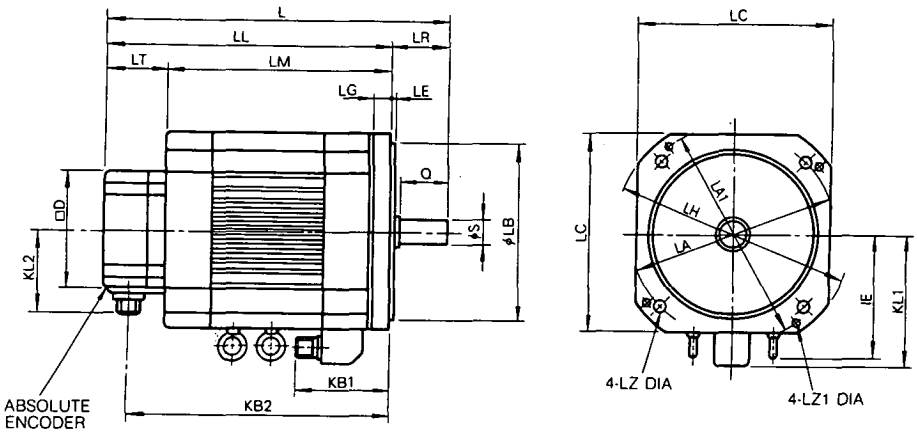
Dimensions in mm (inches)

Drawing 1 USADED-05E□2 to -37E□2



Notes :

1. *Absolute encoder is used as a detector.*
2. *Plug and clamp are not attached for receptacle connection.*
3. *Motor should be mounted with connectors down.*
4. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : W (1024 P/R)
   Semi-standard : S (8192 P/R)

Straight Shaft/With Key

Detail of Shaft Extension

Note: Key and keyway comply with JIS B 1301-1976 (parallel key, keyway: common class).

AC Servomotor Type USADED-	Shaft Extension					
	S	Q	QK	T	U	W
05E□2K□	22 $^{0}_{-0.013}$ (0.8661 $^{0}_{-0.0005}$)	50 (1.97)	45 (1.77)	6 (0.236)	3.5 (0.138)	6 (0.2362)
10E□2K□	22 $^{0}_{-0.013}$ (0.8661 $^{0}_{-0.0005}$)	50 (1.97)	45 (1.77)	6 (0.236)	3.5 (0.138)	6 (0.2362)
15E□2K□	28 $^{0}_{-0.013}$ (1.1024 $^{0}_{-0.0005}$)	50 (1.97)	45 (1.77)	7 (0.275)	4 (0.157)	8 (0.3149)
22E□2K□	28 $^{0}_{-0.013}$ (1.1024 $^{0}_{-0.0005}$)	50 (1.97)	45 (1.77)	7 (0.275)	4 (0.157)	8 (0.3149)
37E□2K□	32 $^{0}_{-0.016}$ (1.2598 $^{0}_{-0.0006}$)	60 (2.36)	50 (1.97)	8 (0.315)	5 (0.197)	10 (0.3937)

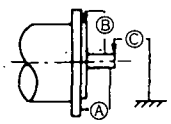
AC Servomotor Type USADED-	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	D	Flange Surface								Shaft Extension		Approx Mass kg (lb)
												LA	LA1	LB	LC	LE	LG	LH	LZ	LZ1	S	Q	
05E□20E*	237 (9.33)	182 (7.17)	137 (5.39)	55 (2.16)	45 (1.77)	82 (3.23)	158 (6.22)	—	143 (5.63)	92 (3.62)	130 (5.12)	200 (7.87)	—	114.3 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.001}$)	180 (7.09)	3.2 (0.126)	12 (0.472)	230 (9.06)	13.5 (0.53)	—	22 $^{0}_{-0.013}$ (0.8661 $^{0}_{-0.0005}$)	50 (1.97)	17 (16) [37.5 (35.3)]
10E□20E*	257 (10.12)	202 (7.96)	157 (6.18)	55 (2.16)	45 (1.77)	82 (3.23)	178 (7.0)	—	143 (5.63)	92 (3.62)	130 (5.12)	200 (7.87)	—	114.3 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.001}$)	180 (7.09)	3.2 (0.126)	12 (0.472)	230 (9.06)	13.5 (0.53)	—	22 $^{0}_{-0.013}$ (0.8661 $^{0}_{-0.0005}$)	50 (1.97)	19 (18) [41.9 (39.7)]
15E□20E	272 (10.71)	217 (8.47)	170 (6.69)	55 (2.16)	47 (1.85)	100 (3.94)	193 (7.60)	142 (5.59)	162 (6.38)	92 (3.62)	130 (5.12)	235 (9.25)	250 (9.84)	200 $^{0}_{-0.046}$ (7.874 $^{0}_{-0.0018}$)	220 (8.66)	4 (0.157)	16 (0.63)	270 (10.63)	13.5 (0.53)	M8	28 $^{0}_{-0.013}$ (1.1024 $^{0}_{-0.0005}$)	50 (1.97)	30 (27) [66.2 (59.5)]
22E□20E	287 (11.30)	232 (9.06)	185 (7.28)	55 (2.16)	47 (1.85)	100 (3.94)	208 (8.19)	142 (5.59)	162 (6.38)	92 (3.62)	130 (5.12)	235 (9.25)	250 (9.84)	200 $^{0}_{-0.046}$ (7.874 $^{0}_{-0.0018}$)	220 (8.66)	4 (0.157)	16 (0.63)	270 (10.63)	13.5 (0.53)	M8	28 $^{0}_{-0.013}$ (1.1024 $^{0}_{-0.0005}$)	50 (1.97)	32 (29) [70.6 (63.9)]
37E□20E	347 (13.66)	282 (11.02)	235 (9.25)	65 (2.56)	47 (1.85)	100 (3.94)	251 (9.88)	142 (5.59)	162 (6.38)	92 (3.62)	130 (5.12)	235 (9.25)	250 (9.84)	200 $^{0}_{-0.046}$ (7.874 $^{0}_{-0.0018}$)	220 (8.66)	4 (0.157)	16 (0.63)	270 (10.63)	13.5 (0.53)	M8	32 $^{0}_{-0.016}$ (1.2598 $^{0}_{-0.0006}$)	60 (2.36)	39 (36) [86 (79.4)]

** Not provided with an eyebolt.*
Note : Dimensions above are applied for servomotor w/wo holding brake as well.
Approx mass in ( ) is for servomotor without holding brake.

CONNECTOR TYPES

AC Servomotor Type USADED-	Motor Connector Types				Absolute Encoder Connector Types			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
05E□2□□ 10E□2□□	MS3102 A20-15P	MS3108 B20-15S	MS3106 B20-15S	MS3057 -12A	MS3102 A20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
15E□2□□ 22E□2□□ 37E□2□□	MS3102 A24-10P	MS3108 B24-10S	MS3106 B24-10S	MS3057 -16A				

MECHANICAL SPECIFICATIONS

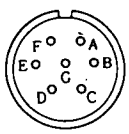
Accuracy (T. I. R)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0.04 (0.0016) 0.06† (0.0026†)	
Flange diameter concentric to shaft Ⓑ	0.04 (0.0016)	
Shaft run out Ⓒ	0.02 (0.0008)	

** T. I. R. (Total Indicator Reading)*
† Accuracy for motor types USADED-15EW, -22EW, and -37EW.

Servomotors with a brake are also available.

CONNECTOR SPECIFICATIONS

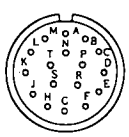
Motor Receptacle



A	Phase U	E	Brake term.
B	Phase V	F	Brake term.
C	Phase W	G	—
D	Ground		

When not provided with holding brake, E and F are not used.

Absolute Encoder Receptacle



A	Channel A output	K	Channel S output
B	Channel $\overline{A}$ output	L	Channel S output
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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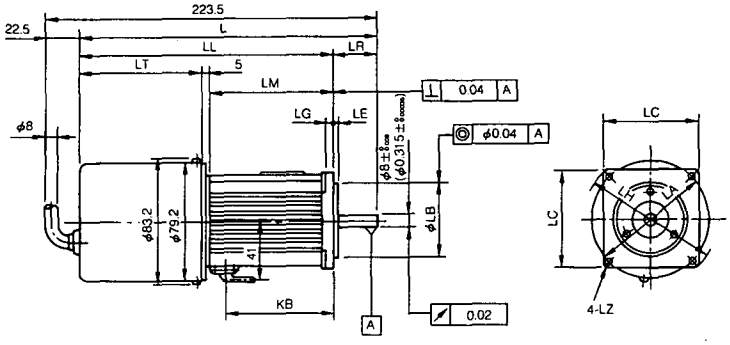
(5) S series

Dimensions in mm (inches)

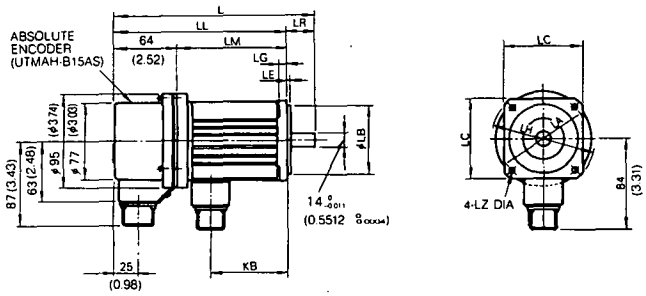
Drawing 1 USASEM-02A□2



Notes:

1. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : S (8192 P/R)
   Semi-standard : W (1024 P/R)
2. *Vibration class : V15*
3. *Plug and clamp are not attached for receptacle connection.*
4. *Motor should be mounted with connectors down.*

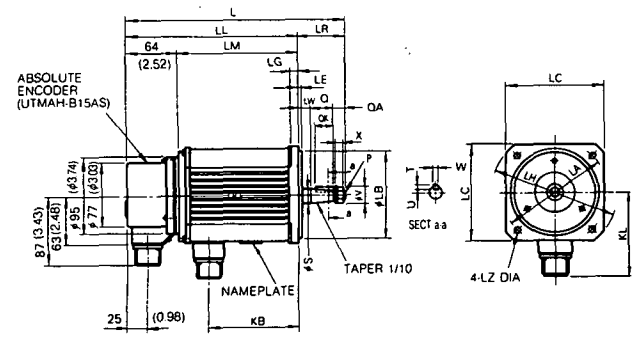
Drawing 2 USASEM-03A□2, -05A□2 (Straight Shaft)



Notes :

1. *Plug and clamp are not attached for receptacle connection.*
2. *Motor should be mounted with connectors down.*
3. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : S (8192 P/R)
   Semi-standard : W (1024 P/R)

Drawing 3 USASEM-08A□1, -15A□1, -30A□1 (Taper 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 : precise class.)
3. *Motor should be mounted with connectors down.*
4. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : S (8192 P/R)
   Semi-standard : W (1024 P/R)

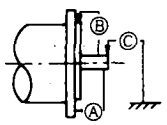
AC Servomotor Type USASEM-	Dwg. No.	L	LL	LM	LR	KB	KL	Flange Surface							Approx Mass kg (lb)
								LA	LB	LC	LE	LG	LH	LZ	
02A□2	1	201 (7.91)	171 (6.73)	83 (3.27)	30 (1.18)	72.5 (2.85)	–	80 (3.15)	$50\ ^{0}_{-0.025}$ ($1.9685\ ^{0}_{-0.00098}$)	65 (2.56)	3 (0.118)	6 (0.2362)	90 (3.54)	5 (0.1968)	2.0 (4.4)
03A□2	2	208 (8.19)	178 (7.01)	114 (4.49)	30 (1.18)	79 (3.11)	–	90 (3.54)	$70\ ^{0}_{-0.030}$ ($2.7559\ ^{0}_{-0.0012}$)	80 (3.15)	3 (0.118)	8 (0.31)	105 (4.13)	6 (0.236)	3.2 (7.1)
05A□2	2	230 (9.01)	200 (7.83)	136 (5.31)	30 (1.18)	101 (3.98)	–	90 (3.54)	$70\ ^{0}_{-0.030}$ ($2.7559\ ^{0}_{-0.0012}$)	80 (3.15)	3 (0.118)	8 (0.31)	105 (4.13)	6 (0.236)	3.8 (8.4)
08A□1	3	270.5 (10.65)	212.5 (8.37)	149 (5.87)	58 (2.28)	115 (4.53)	102 (4.02)	130 (5.12)	$110\ ^{0}_{-0.035}$ ($4.3307\ ^{0}_{-0.0014}$)	120 (4.72)	3 (0.118)	10 (0.39)	155 (6.1)	9 (0.35)	6.3 (13.9)
15A□1	3	325.5 (12.81)	267.5 (10.53)	204 (8.03)	58 (2.28)	166.5 (6.56)	109 (4.29)	145 (5.71)	$110\ ^{0}_{-0.035}$ ($4.3307\ ^{0}_{-0.0014}$)	130 (5.12)	6 (0.24)	12 (0.47)	9 (6.5)	9 (0.35)	11.5 (25.4)
30A□1	3	374 (14.72)	304 (11.96)	240 (9.44)	70 (2.76)	206 (8.11)	135 (5.31)	200 (7.87)	$114.3\ ^{0}_{-0.040}$ ($4.5\ ^{0}_{-0.0016}$)	180 (7.09)	6 (0.24)	18 (0.71)	230 (9.1)	13.5 (0.53)	24.5 (54)

AC Servomotor Type USASEM-	Dwg. No.	Shaft Extension										
		LW	Q	QK	QA	X	S	V	P	U	W	T
08A□1	3	18 (0.71)	28 (1.1)	25 (0.98)	12 (0.47)	10.3 (0.41)	16 (0.63)	21 (0.83)	M10 (P1.25)	$4.3\ ^{0}_{-0.01}$ ($0.169\ ^{0}_{-0.004}$)	5 (0.1968)	5 (0.1968)
15A□1	3	18 (0.71)	28 (1.1)	25 (0.98)	12 (0.47)	10.3 (0.41)	19 (0.75)	21 (0.83)	M10 (P1.25)	$5.8\ ^{0}_{-0.01}$ ($0.228\ ^{0}_{-0.004}$)	5 (0.1968)	5 (0.1968)
30A□1	3	20 (0.79)	36 (1.42)	32 (1.26)	14 (0.55)	12.5 (0.49)	22 (0.87)	24 (0.94)	M12 (P1.25)	$6.6\ ^{0}_{-0.01}$ ($0.26\ ^{0}_{-0.004}$)	6 (0.2362)	6 (0.2362)

CONNECTOR TYPES

AC Servomotor Type USASEM-	Motor Connector Types				Absolute Encoder Connector Types			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
03A□2 05A□2	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A	MS3102 A20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
08A□1 15A□1 30A□1	MS3102 A20-4P	MS3108 B20-4S	MS3106 B20-4S	MS3057 -12A				

MECHANICAL SPECIFICATIONS

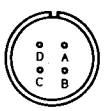
Accuracy (T. I. R)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0.04 (0.0016)	
Flange diameter concentric to shaft Ⓑ	0.04 (0.0016)	
Shaft run out Ⓒ	0.02 (0.0008)	

* *T. I. R. (Total Indicator Reading)*

Servomotors with a brake are also available.

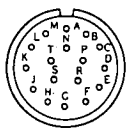
CONNECTOR SPECIFICATIONS

Motor Receptacle



A	Phase U
B	Phase V
C	Phase W
D	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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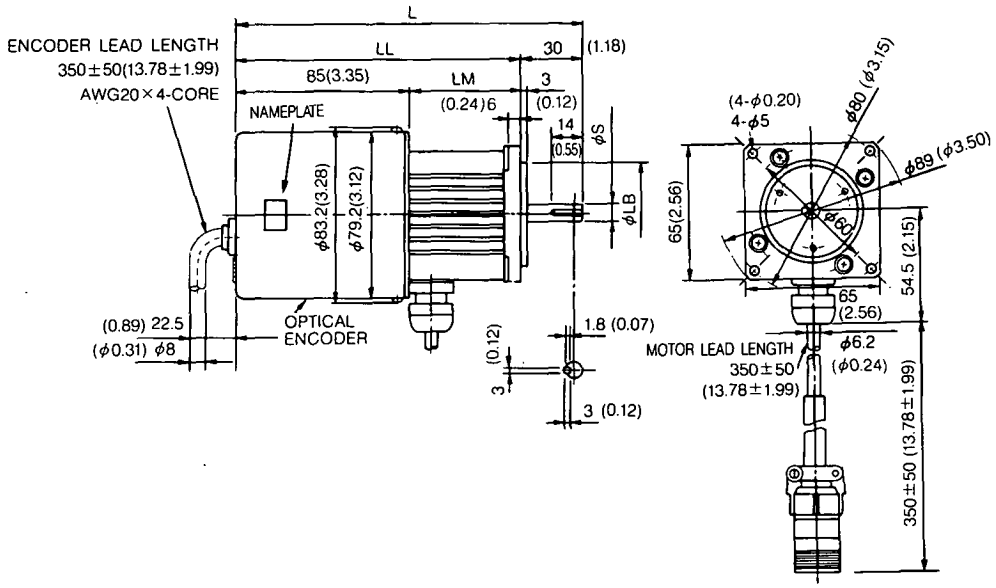
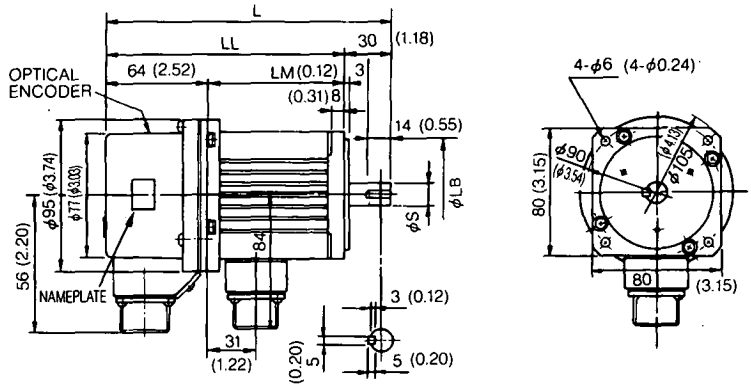
(6) R Series

Dimensions in mm (inches)

USAREM-A5CS2K 50W, -01CS2K 100W·····(200V)
USAREM-A5DS2K 50W, -01DS2K 100W·····(100V)



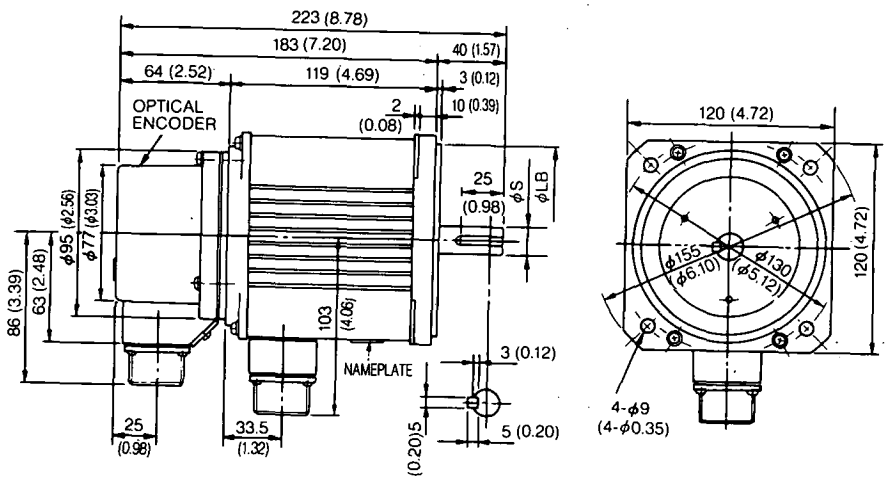
USAREM-02CS2K 200W, -03CS2K 300W·····(200V)
USAREM-02DS2K 200W, -03DS2K 300W·····(100V)



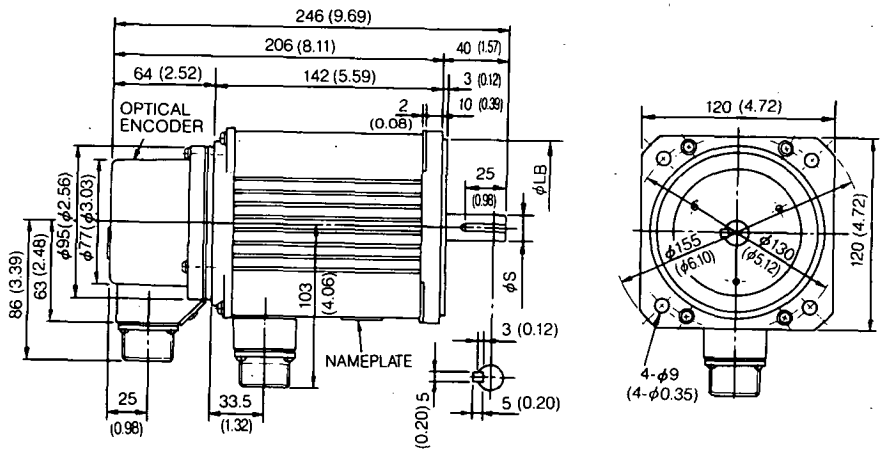
Drawing No.	Servomotor Type USAREM-	L	LL	LM	S	LB	Approx. Mass kg	(lb)
1	A5 C/D S2K	169 (6.66)	139 (5.48)	54 (2.13)	$8\ ^{0}_{-0.009}$	$50\ ^{0}_{-0.025}$	1.5	(3.3)
	01 C/D S2K	186.5 (7.34)	156.5 (6.16)	71.5 (2.81)	$(0.315\ ^{0}_{-0.00036})$	$(1.9685\ ^{0}_{-0.00098})$	1.8	(4.0)
2	02 C/D S2K	181.5 (7.15)	151.5 (5.96)	87.5 (3.44)	$14\ ^{0}_{-0.011}$	$70\ ^{0}_{-0.030}$	2.5	(5.5)
	03 C/D S2K	205.5 (8.09)	175.5 (6.91)	111.5 (4.39)	$(0.551\ ^{0}_{-0.00043})$	$(2.756\ ^{0}_{-0.0012})$	3.1	(6.9)
3	05 C/D S2K	See Drawing 3.			$16\ ^{0}_{-0.011}$	$110\ ^{0}_{-0.035}$	4.9	(10.8)
4	07 C/D S2K	See Drawing 4.			$(0.631\ ^{0}_{-0.00043})$	$(4.331\ ^{0}_{-0.00014})$	7.5	(16.5)

Dimensions in mm (inches)

USAREM-05CS2K 500W·····(200V)
USAREM-05DS2K 500W·····(100V)



USAREM-07CS2K 700W·····(200V)



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(6) R Series (Cont'd)

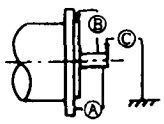
CONNECTOR TYPES

Servomotor Type USAREM-	Encoder Side			Motor Side		
	Receptacle Type	Plug* Type	Cable Clamp Type	Receptacle Type	Plug* Type	Cable Clamp Type
A5□† S2K 01□ S2K	MS3101A20 -29P	MS3106B20 -29S	MS3057 -12A	MS3101A 14S-2P	MS3106B 14-2S	MS3057 -6A
02□ S2K 03□ S2K	MS3102A20 -29P	MS3108B20 -29S		MS3102A 18-10P	MS3108B 18-10S	MS3057 -10A
05□ S2K 07□ S2K				MS3102A 20-4P	MS3108B 20-4S	MS3057 -12A

*Provided by customer
†□ in type designation is C (200V class) or D (100V class).

Note:
1. With motor connection shown above, by plus reference voltage, the motor rotates counterclockwise (when viewed from the drive end).
2. Dimensions of the keyway are based on JIS B 1301 "Sunk keys and their corresponding key ways (close keys)." Parallel key has been attached. Tolerance of keyway is precision class.

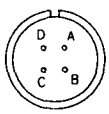
MECHANICAL SPECIFICATIONS

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)

CONNECTOR SPECIFICATIONS

Motor Receptacle



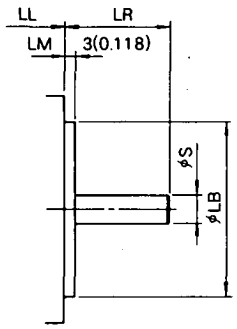
A	Phase U
B	Phase V
C	Phase W
D	Frame ground

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	—	—	—

Straight Shaft

Servomotor proper is the same dimensions as standard servomotor. Details of shaft extension are shown below:



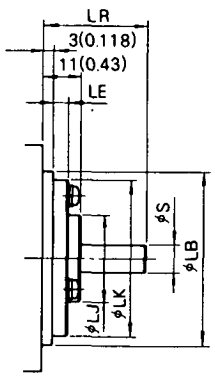
Detail of Shaft Extension

Dimensions in mm (inches)

Without Brake Type USAREM-	With Brake Type USAREM-	LR	S	LB
A5 ⬚ S2	A5 ⬚ S2B	30 (1.18)	$8\ {}^{0}_{-0.009}$ ($0.31\ {}^{0}_{-0.00035}$)	$50\ {}^{0}_{-0.025}$ ($1.97\ {}^{0}_{-0.00098}$)
01 ⬚ S2	01 ⬚ S2B			
02 ⬚ S2	02 ⬚ S2B		$14\ {}^{0}_{-0.011}$ ($0.551\ {}^{0}_{-0.00043}$)	$70\ {}^{0}_{-0.030}$ ($2.756\ {}^{0}_{-0.0012}$)
03 ⬚ S2	03 ⬚ S2B			
05 ⬚ S2	05 ⬚ S2B	40 (1.57)	$16\ {}^{0}_{-0.011}$ ($0.6299\ {}^{0}_{-0.00043}$)	$110\ {}^{0}_{-0.035}$ ($4.331\ {}^{0}_{-0.00014}$)
07CS2	07CS2B			

Straight Shaft with Oilseal

Servomotor proper is the same dimensions as standard servomotor. Details of shaft extension are shown below.



Detail of Shaft Extension

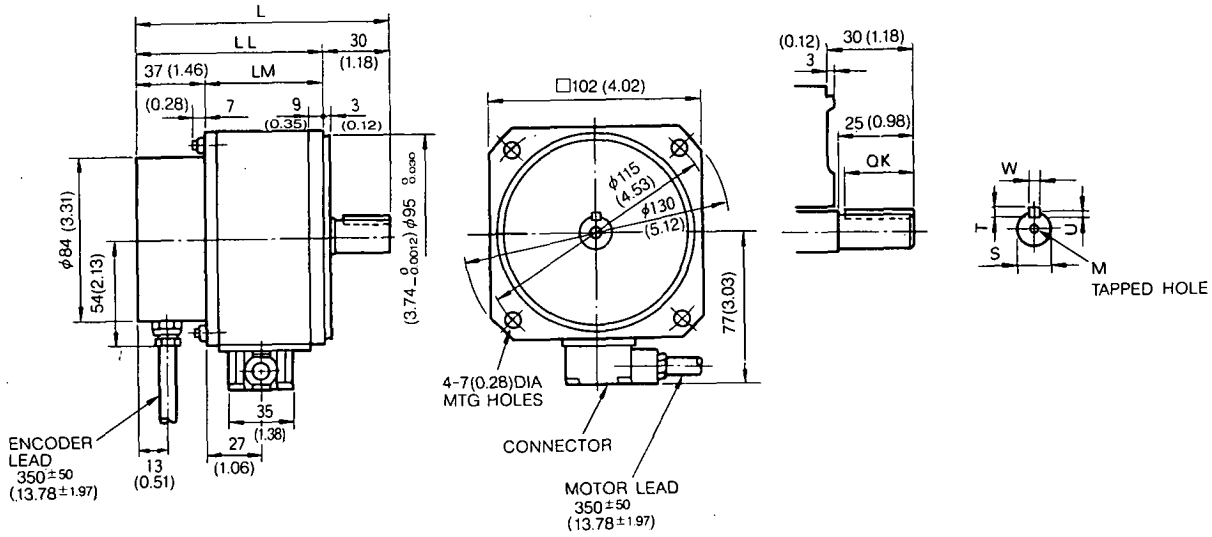
Dimensions in mm (inches)

Without Brake Type USAREM-	With Brake Type USAREM-	LR	LE	LJ	LK	S	LB	Oilseal
A5 ⬚ S2S	A5 ⬚ S2SB	30 (1.18)	4.5 (0.18)	25 (0.98)	45 (1.77)	$8\ {}^{0}_{-0.009}$ ($0.31\ {}^{0}_{-0.00035}$)	$50\ {}^{0}_{-0.025}$ ($1.97\ {}^{0}_{-0.00098}$)	SB08187
01 ⬚ S2S	01 ⬚ S2SB							
02 ⬚ S2S	02 ⬚ S2SB			36 (1.42)	60 (2.36)	$14\ {}^{0}_{-0.011}$ ($0.551\ {}^{0}_{-0.00043}$)	$70\ {}^{0}_{-0.030}$ ($2.756\ {}^{0}_{-0.0012}$)	SB14287
03 ⬚ S2S	03 ⬚ S2SB							
05 ⬚ S2S	05 ⬚ S2SB	40 (1.57)	2.5 (0.10)	50 (1.97)	73 (2.87)	$16\ {}^{0}_{-0.011}$ ($0.6299\ {}^{0}_{-0.00043}$)	$110\ {}^{0}_{-0.030}$ ($4.331\ {}^{0}_{-0.00014}$)	SB16307
07CS2S	07CS2SB							

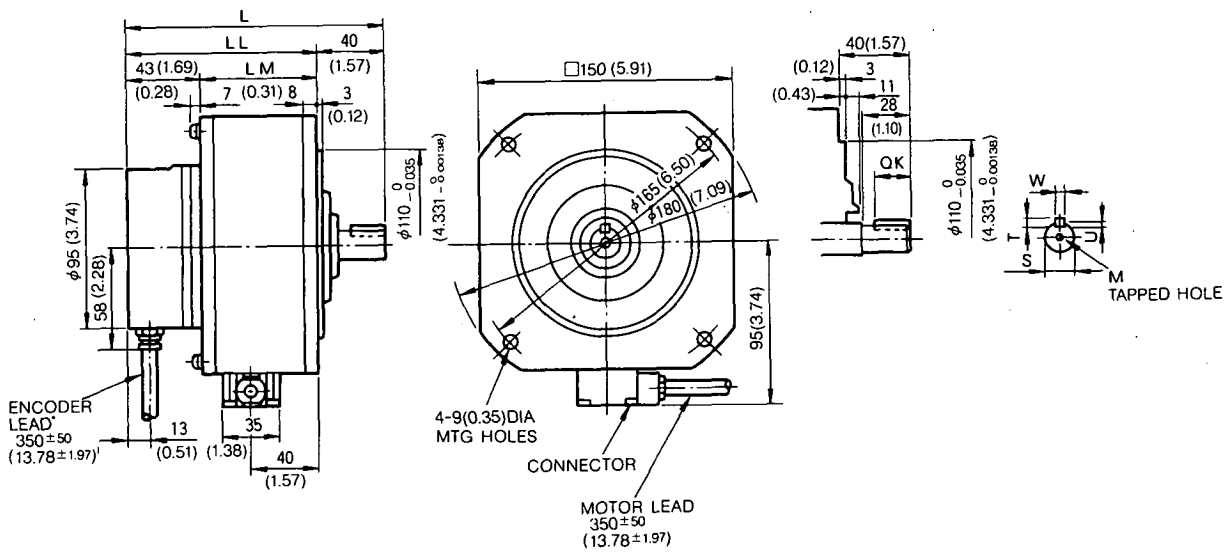
Straight Shaft with Keyway and Oilseal

Servomotor proper and shaft extension are same dimensions as standard Servomotor. Oilseal is same dimensions as shown above.

Drawing 1 USAPEM-01CW2K, -02CW2K, -03CW2K (Straight Shaft, With Key)

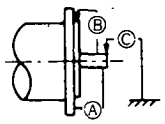


Drawing 2 USAPEM-05CW2K, -07CW2K (Straight Shaft, With Key)



AC Servomotor Type USAPEM-	Dwg. No.	L	LL	LM	Shaft Extension						Approx. kg	Mass (lb)
					S	QK	U	W	T	M		
01CW2K	1	133 (5.24)	103 (4.06)	52 (2.05)	11 $^{0}_{-0.011}$ (0.433 $^{0}_{-0.00043}$)	18 (0.71)	2.5 (0.10)	4 (0.157)	4 (0.157)	M3, Deep 6 (0.24)	1.7	(3.7)
02CW2K	1	136 (5.35)	106 (4.17)	55 (2.17)	14 $^{0}_{-0.011}$ (0.551 $^{0}_{-0.00043}$)	18 (0.71)	3 (0.12)	5 (0.197)	5 (0.197)	M4, Deep 10 (0.39)	2.0	(4.4)
03CW2K	1	140 (5.51)	110 (4.33)	59 (2.32)	14 $^{0}_{-0.011}$ (0.551 $^{0}_{-0.00043}$)	18 (0.71)	3 (0.12)	5 (0.197)	5 (0.197)	M4, Deep 10 (0.39)	2.3	(5.1)
05CW2K	2	160 (6.30)	120 (4.72)	69 (2.72)	16 $^{0}_{-0.011}$ (0.630 $^{0}_{-0.00043}$)	20 (0.79)	3 (0.12)	5 (0.197)	5 (0.197)	M4, Deep 10 (0.39)	4.6	(10.1)
07CW2K	2	160 (6.30)	120 (4.72)	69 (2.72)	16 $^{0}_{-0.011}$ (0.630 $^{0}_{-0.00043}$)	20 (0.79)	3 (0.12)	5 (0.197)	5 (0.197)	M4, Deep 10 (0.39)	5	(11.0)

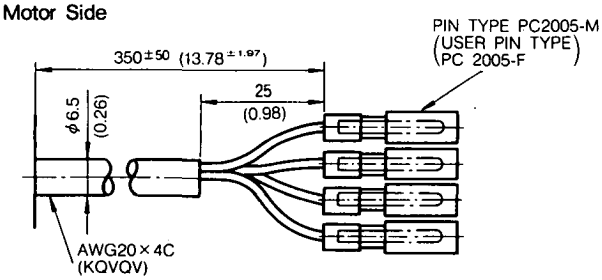
MECHANICAL SPECIFICATIONS

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)	

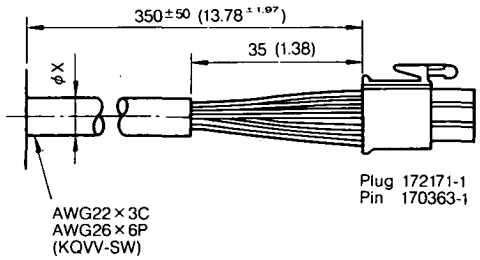
** T. I. R. (Total Indicator Reading)*

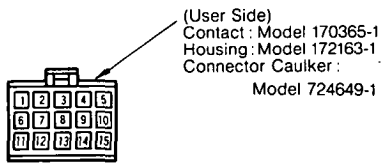
CONNECTOR SPECIFICATIONS

• Motor Side



• Encoder Side





1	Channel A output	Blue
2	Channel $\overline{A}$ output	White/Blue
3	Channel B output	Yellow
4	Channel $\overline{B}$ output	White/Yellow
5	Channel C output	Green
6	Channel $\overline{C}$ output	White/Green
7	0V (Power Supply)	Black
8	+5V (Power Supply)	Red
9	FG frame ground	Green/Yellow
10	Channel S output	Purple
11	Channel $\overline{S}$ output	White/Purple
12	Capacitor reset	Gray
13	Reset	White/Gray
14	0V (Battery)	White/Orange
15	3.6V (Battery)	Orange

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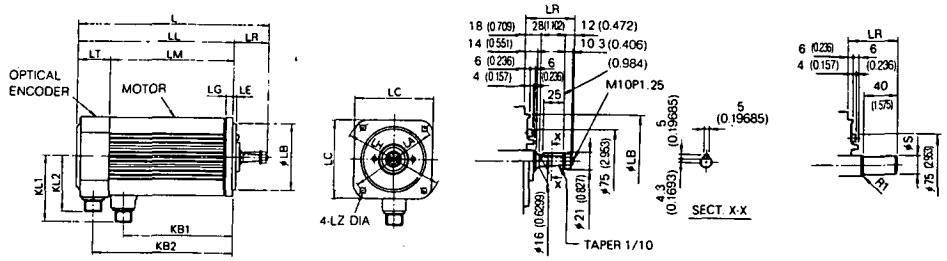
13.2 AC SERVOMOTOR WITH INCREMENTAL ENCODER

(1) M Series

Dimensions in mm (inches)

Drawing 1 USAMED-03□□1, -06□□1 (Taper Shaft), -09B□2 (Straight Shaft)



For -03B21, -06B21

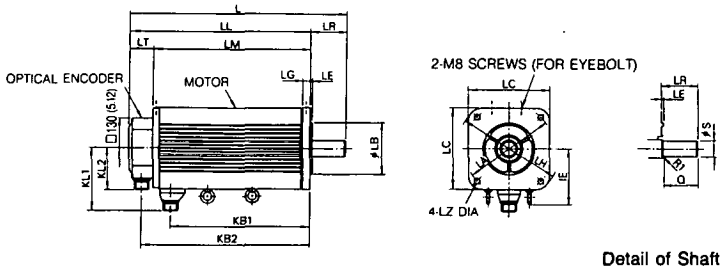
For -09B22

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.*
4. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : 2 (8192 P/R)
   Semi-standard : 3 (2048 P/R)

Drawing 2 USAMED-12B□2 to -44B□2 (Straight Shaft)

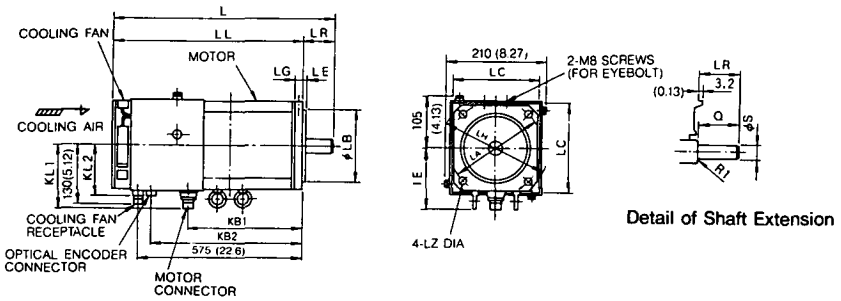


Detail of Shaft Extension

Notes :

1. *Plug and clamp are not attached for receptacle connection.*
2. *Motor should be mounted with connectors down.*
3. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : 2 (8192 P/R)
   Semi-standard : 3 (2048 P/R)

Drawing 3 USAMKD-60B□2 (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.*
3. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : 2 (8192 P/R)
   Semi-standard : 3 (2048 P/R)

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	
03□□1†	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 $^{0}_{-0.035}$ (4.3307 $^{0}_{-0.0014}$)	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	—	—	8.5 (18.7)
06□□1†		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 $^{0}_{-0.035}$ (4.3307 $^{0}_{-0.0014}$)	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	—	—	13 (28.7)
09B□2†		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 $^{0}_{-0.035}$ (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)
12B□2†	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 $^{0}_{-0.025}$ (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 $^{0}_{-0.0004}$)	76 (2.992)	22 (48.5)
20B□2		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 $^{0}_{-0.0004}$)	76 (2.992)	29 (63.9)
30B□2		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 $^{0}_{-0.0004}$)	76 (2.992)	41 (90.4)
44B□2		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)
60B□2		775 (30.51)	665 (26.18)	—	110 (4.33)	—	476 (18.74)	550 (21.65)	123 (4.84)	149 (5.87)	100 (3.94)	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)	71 (156.9)

*For servomotor of 6kW, "K" is used instead of "E", because of externally fan-cooled type.
† Not provided with an eyebolt.

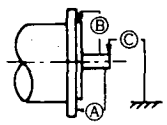
CONNECTOR TYPES

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
03□□1 06□□1 09B□2	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A	MS3102 A20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
12B□2 20B□2 30B□2	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057 -12A				
44B□2	MS3102 A32-17P	MS3108 B32-17S	MS3106 B32-17S	MS3057 -20A				
USAMKD-60B□2*								

*Cooling fan receptacle : MS3102A14S-6P
Cooling fan plug : MS3108B14S-6P
Cooling fan cable clamp : MS3057-6A

Servomotors with a brake are also available. For detailed information, refer to related Bulletins (TSE-S800-11.1).

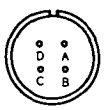
MECHANICAL SPECIFICATIONS

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 types USAMED-44B22, USAMKD-60B22.

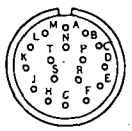
CONNECTOR SPECIFICATIONS

Motor Receptacle



A	Phase U
B	Phase V
C	Phase W
D	Ground

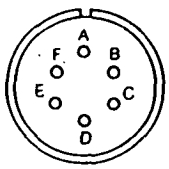
Incremental Encoder Receptacle



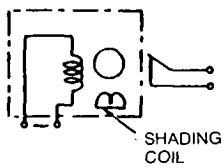
A	Channel A output	K	—
B	Channel $\overline{A}$ output	L	—
C	Channel B output	M	—
D	Channel $\overline{B}$ output	N	—
E	Channel C output	P	—
F	Channel $\overline{C}$ output	R	—
G	0V	S	—
H	+5VDC	T	—
J	Frame ground	—	—

FAN TERMINAL CONNECTION

(For only 60B22)



A	Fan motor
B	Fan motor
C	—
D	Alarm terminal
E	Alarm terminal
F	—



Alarm Contact :

OFF at normal fan rotation
ON at 1800±200 r/min or less
(ON during 3 seconds at start-up)

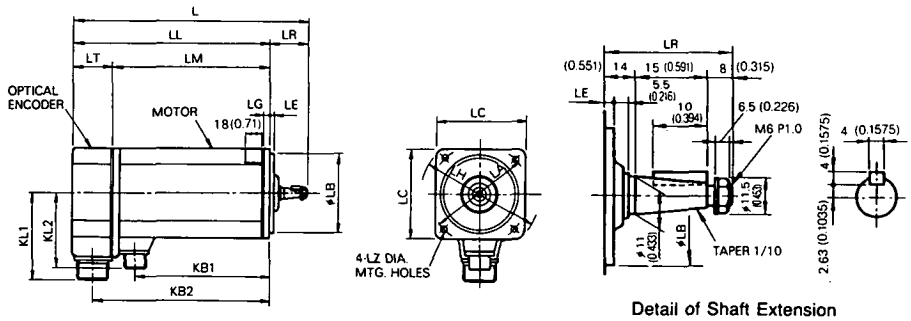
Contact Capacity :

Max. resistive load 110V, 0.3A

(2) F Series

Dimensions in mm (inches)

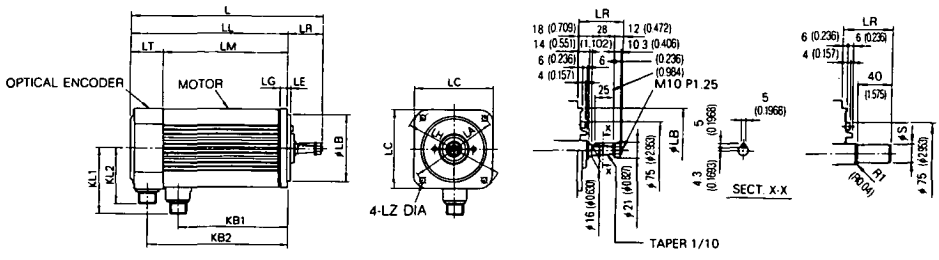
Drawing 1 USAFED-02□□1, -03□□1 (Taper Shaft)



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.*
4. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : 2 (8192 P/R)
   Semi-standard : 3 (2048 P/R)

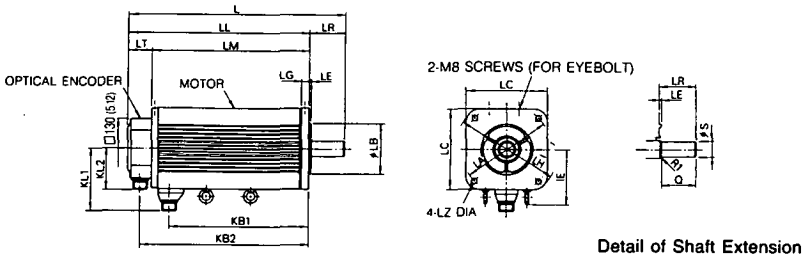
Drawing 2 USAFED-05□□1, -09□□1 (Taper Shaft), -13C□2 (Straight Shaft)



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.*
4. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : 2 (8192 P/R)
   Semi-standard : 3 (2048 P/R)

Drawing 3 USAFED-20C□2 to -44C□2 (Straight Shaft)



Notes :

1. *Plug and clamp are not attached for receptacle connection.*
2. *Motor should be mounted with connectors down.*
3. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : 2 (8192 P/R)
   Semi-standard : 3 (2048 P/R)

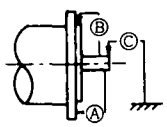
AC Servomotor Type USAFED-	Dwg. No.	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface							Shaft Extension		Approx Mass kg (lb)
												LA	LB	LC	LE	LG	LH	LZ	S	Q	
02□□1*	1	190 (7.48)	153 (6.02)	113 (4.45)	37 (1.46)	40 (1.57)	90 (3.54)	132 (5.19)	—	76 (2.99)	87 (3.43)	100 (3.94)	80 $^{0}_{-0.030}$ ($3.1496 $^{0}_{-0.0012}$)	90 (3.54)	4 (0.157)	7 (0.276)	120 (4.72)	6.6 (0.26)	—	—	4 (8.8)
03□□1*		236 (9.29)	199 (7.83)	159 (6.26)	37 (1.46)	40 (1.57)	136 (5.35)	178 (7.0)	—	76 (2.99)	87 (3.43)	100 (3.94)	80 $^{0}_{-0.030}$ ($3.1496 $^{0}_{-0.0012}$)	90 (3.54)	4 (0.157)	7 (0.276)	120 (4.72)	6.6 (0.26)	—	—	6 (13.2)
05□□1*	2	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 $^{0}_{-0.035}$ ($4.3307 $^{0}_{-0.0014}$)	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	—	—	8.5 (18.7)
09□□1*		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 $^{0}_{-0.035}$ ($4.3307 $^{0}_{-0.0014}$)	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	—	—	13 (28.7)
13C□2*		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 $^{0}_{-0.035}$ ($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)	20 (44.1)
20C□2*	3	344 (13.54)	265 (10.43)	211 (8.3)	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 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 $^{+0.01}_{0}$ 1.3779 $^{+0.0004}_{0}$	76 (2.99)	22 (48.5)
30C□2		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 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.001}$)	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 $^{+0.01}_{0}$ 1.3779 $^{+0.0004}_{0}$	76 (2.99)	29 (63.9)
44C□2		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 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.001}$)	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 $^{+0.01}_{0}$ 1.3779 $^{+0.0004}_{0}$	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
02□□1 03□□1	MS3102 A14S-2P	MS3108 B14S-2S	MS3106 B14S-2S	MS3057 -6A	MS3102 A20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
05□□1 09□□1 13C□2	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A				
20C□2 30C□2 44C□2	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057 -12A				

MECHANICAL SPECIFICATIONS

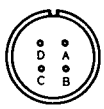
Accuracy (T. I. R)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0.04 (0.0016)	
Flange diameter concentric to shaft Ⓑ	0.04 (0.0016)	
Shaft run out Ⓒ	0.02 (0.0008)	

** T. I. R. (Total Indicator Reading)*

Servomotors with a brake are also available. For detailed information, refer to related Bulletins (TSE-S800-11.1).

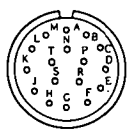
CONNECTOR SPECIFICATIONS

Motor Receptacle



A	Phase U
B	Phase V
C	Phase W
D	Ground

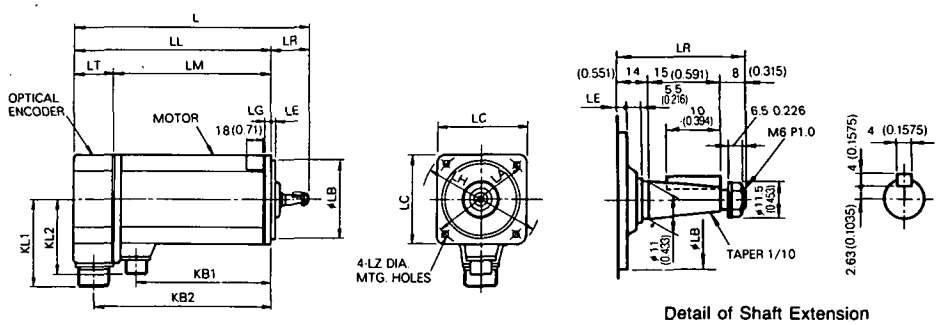
Incremental Encoder Receptacle



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	—	—

13

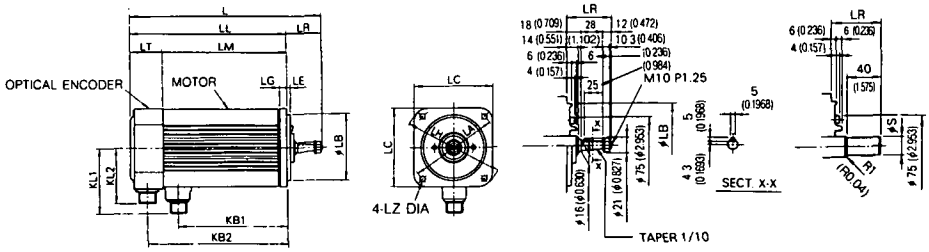
Drawing 1 USAGED-02□□1, -03□□1 (Taper Shaft)



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.*
4. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : 2 (8192 P/R)
   Semi-standard : 3 (2048 P/R)

Drawing 2 USAGED-05□□1, -09□□1 (Taper Shaft), -13A□2 (Straight Shaft)

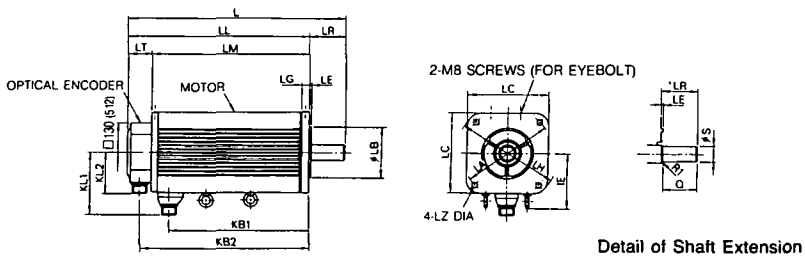


For -05A21, -09A21 For -13A22

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.*
4. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : 2 (8192 P/R)
   Semi-standard : 3 (2048 P/R)

Drawing 3 USAGED-20A□2 to -44A□2 (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.*
3. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : 2 (8192 P/R)
   Semi-standard : 3 (2048 P/R)

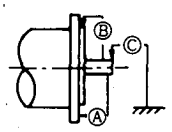
AC Servomotor Type USAGED-	Dwg. No.	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface							Shaft Extension		Approx Mass kg (lb)
												LA	LB	LC	LE	LG	LH	LZ	S	Q	
02□□1*	1	190 (7.48)	153 (6.02)	113 (4.45)	37 (1.46)	40 (1.57)	90 (3.54)	132 (5.19)	—	76 (2.99)	87 (3.43)	100 (3.94)	80 $^{0}_{-0.030}$ (3.1496 $^{0}_{-0.0012}$)	90 (3.54)	4 (0.157)	7 (0.276)	120 (4.72)	6.6 (0.26)	—	—	4 (8.8)
03□□1*		236 (9.29)	199 (7.83)	159 (6.26)	37 (1.46)	40 (1.57)	136 (5.35)	178 (7.0)	—	76 (2.99)	87 (3.43)	100 (3.94)	80 $^{0}_{-0.030}$ (3.1496 $^{0}_{-0.0012}$)	90 (3.54)	4 (0.157)	7 (0.276)	120 (4.72)	6.6 (0.26)	—	—	6 (13.2)
05□□1*	2	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 $^{0}_{-0.035}$ (4.3307 $^{0}_{-0.0014}$)	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	—	—	8.5 (18.7)
09□□1*		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 $^{0}_{-0.035}$ (4.3307 $^{0}_{-0.0014}$)	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	—	—	13 (28.7)
13A□2*		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 $^{0}_{-0.035}$ (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)	20 (44.1)
20A□2*	3	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 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.001}$)	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 $^{+0.01}_{0}$ (1.3779 $^{+0.0004}_{0}$)	76 (2.99)	22 (48.5)
30A□2		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 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.001}$)	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 $^{+0.01}_{0}$ (1.3779 $^{+0.0004}_{0}$)	76 (2.99)	29 (63.9)
44A□2		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 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.001}$)	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 $^{+0.01}_{0}$ (1.3779 $^{+0.0004}_{0}$)	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
02□□1 03□□1	MS3102 A14S-2P	MS3108 B14S-2S	MS3106 B14S-2S	MS3057 -6A	MS3102 A20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
05□□1 09□□1 13A□2	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A				
20A□2 30A□2 44A□2	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057 -12A				

MECHANICAL SPECIFICATIONS

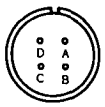
Accuracy (T. I. R)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0.04 (0.0016)	
Flange diameter concentric to shaft Ⓑ	0.04 (0.0016)	
Shaft run out Ⓒ	0.02 (0.0008)	

** T. I. R. (Total Indicator Reading)*

Servomotors with a brake are also available. For detailed information, refer to related Bulletins (TSE-S800-11.1).

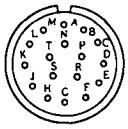
CONNECTOR SPECIFICATIONS

Motor Receptacle



A	Phase U
B	Phase V
C	Phase W
D	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	—	—

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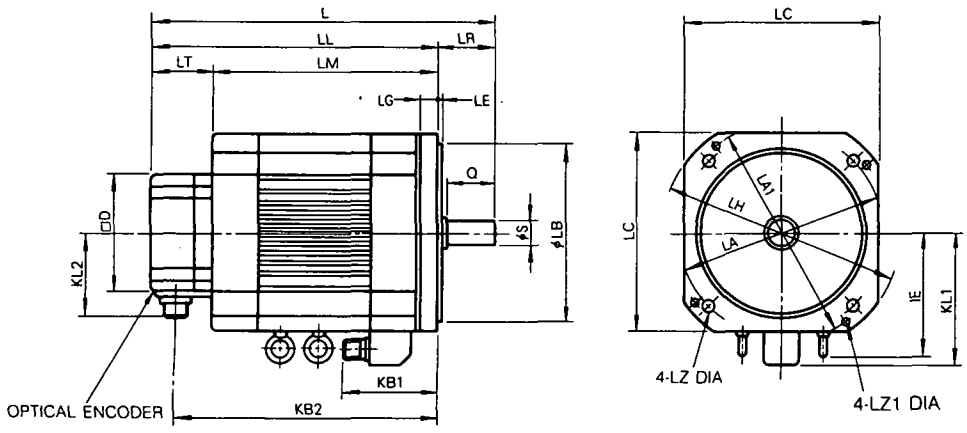
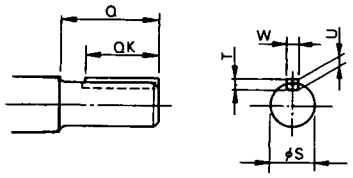
Drawing 1 USADED-05E□2, -37E□2



Notes :

1. *Plug and clamp are not attached for receptacle connection.*
2. *Motor should be mounted with connectors down.*
3. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : 3 (2048 P/R)
   Semi-standard : 2 (8192 P/R)

Straight Shaft/With Key



Detail of Shaft Extension

Note: Key and keyway comply with JIS B 1301-1976 (parallel key, keyway: common class).

AC Servomotor Type USADED-	Shaft Extension					
	S	Q	QK	T	U	W
05E□2K□	22 $^{0}_{-0.013}$ (0.8661 $^{0}_{-0.0005}$)	50 (1.97)	46 (1.77)	6 (0.236)	3.5 (0.138)	6 (0.2362)
10E□2K□	22 $^{0}_{-0.013}$ (0.8661 $^{0}_{-0.0005}$)	50 (1.97)	45 (1.77)	6 (0.236)	3.5 (0.138)	6 (0.2362)
15E□2K□	28 $^{0}_{-0.013}$ (1.1024 $^{0}_{-0.0005}$)	50 (1.97)	45 (1.77)	7 (0.275)	4 (0.157)	8 (0.3149)
22E□2K□	28 $^{0}_{-0.013}$ (1.1024 $^{0}_{-0.0005}$)	50 (1.97)	45 (1.77)	7 (0.275)	4 (0.157)	8 (0.3149)
37E□2K□	32 $^{0}_{-0.016}$ (1.2598 $^{0}_{-0.0006}$)	60 (2.36)	50 (1.97)	8 (0.315)	5 (0.197)	10 (0.3937)

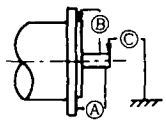
AC Servomotor Type USADED-	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	D	Flange Surface								Shaft Extension		Approx Mass kg (lb)
												LA	LA1	LB	LC	LE	LG	LH	LZ	LZ1	S	Q	
05E□2OE*	237 (9.33)	182 (7.17)	137 (5.39)	55 (2.16)	45 (1.77)	82 (3.23)	158 (6.22)	—	143 (5.63)	92 (3.62)	130 (5.12)	200 (7.87)	—	114.3 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.001}$)	180 (7.09)	3.2 (0.126)	12 (0.472)	230 (9.06)	13.5 (0.53)	—	22 $^{0}_{-0.013}$ (0.8661 $^{0}_{-0.0005}$)	50 (1.97)	17 (16) [37.5 (35.3)]
10E□2OE*	257 (10.12)	202 (7.96)	157 (6.18)	55 (2.16)	45 (1.77)	82 (3.23)	178 (7.0)	—	143 (5.63)	92 (3.62)	130 (5.12)	200 (7.87)	—	114.3 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.001}$)	180 (7.09)	3.2 (0.126)	12 (0.472)	230 (9.06)	13.5 (0.53)	—	22 $^{0}_{-0.013}$ (0.8661 $^{0}_{-0.0005}$)	50 (1.97)	19 (18) [41.9 (39.7)]
15E□2OE	272 (10.71)	217 (8.47)	170 (6.69)	55 (2.16)	47 (1.85)	100 (3.94)	193 (7.60)	142 (5.59)	162 (6.38)	92 (3.62)	130 (5.12)	235 (9.25)	250 (9.84)	200 $^{0}_{-0.046}$ (7.874 $^{0}_{-0.0018}$)	220 (8.66)	4 (0.157)	16 (0.63)	270 (10.63)	13.5 (0.53)	M8	28 $^{0}_{-0.013}$ (1.1024 $^{0}_{-0.0005}$)	50 (1.97)	30 (27) [66.2 (59.5)]
22E□2OE	287 (11.30)	232 (9.06)	185 (7.28)	55 (2.16)	47 (1.85)	100 (3.94)	208 (8.19)	142 (5.59)	162 (6.38)	92 (3.62)	130 (5.12)	235 (9.25)	250 (9.84)	200 $^{0}_{-0.046}$ (7.874 $^{0}_{-0.0018}$)	220 (8.66)	4 (0.157)	16 (0.63)	270 (10.63)	13.5 (0.53)	M8	28 $^{0}_{-0.013}$ (1.1024 $^{0}_{-0.0005}$)	50 (1.97)	32 (29) [70.6 (63.9)]
37E□2OE	347 (13.66)	282 (11.02)	235 (9.25)	65 (2.56)	47 (1.85)	100 (3.94)	258 (10.16)	142 (5.59)	162 (6.38)	92 (3.62)	130 (5.12)	235 (9.25)	250 (9.84)	200 $^{0}_{-0.046}$ (7.874 $^{0}_{-0.0018}$)	220 (8.66)	4 (0.157)	16 (0.63)	270 (10.63)	13.5 (0.53)	M8	32 $^{0}_{-0.016}$ (1.2598 $^{0}_{-0.0006}$)	60 (2.36)	39 (36) [86 (79.4)]

** Not provided with an eyebolt.*
Note : Dimensions above are applied for servomotor w/wo holding brake as well.
Approx mass in ( ) is for servomotor without holding brake.

CONNECTOR TYPES

AC Servomotor Type USADED-	Motor Connector Types				Incremental Encoder Connector Types			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
05E□2□ 10E□2□	MS3102 A20-15P	MS3108 B20-15S	MS3106 B20-15S	MS3057 -12A	MS3102 A20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
15E□2□ 22E□2□ 37E□2□	MS3102 A24-10P	MS3108 B24-10S	MS3106 B24-10S	MS3057 -16A				

MECHANICAL SPECIFICATIONS

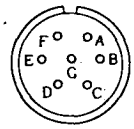
Accuracy (T. I. R)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0.04 (0.0016) 0.06† (0.0024†)	
Flange diameter concentric to shaft Ⓑ	0.04 (0.0016)	
Shaft run out Ⓒ	0.02 (0.0008)	

** T. I. R. (Total Indicator Reading)*
† Accuracy for motor types USADED-15E3, -22E3, and -37E3.

Servomotors with a brake are also available. For detailed information, refer to related Bulletins (TSE-S800-11.1).

CONNECTOR SPECIFICATIONS

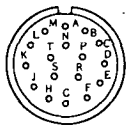
Motor Receptacle



A	Phase U	E	Brake term.
B	Phase V	F	Brake term.
C	Phase W	G	—
D	Ground		

When not provided with holding brake, E and F are not used.

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	—	—

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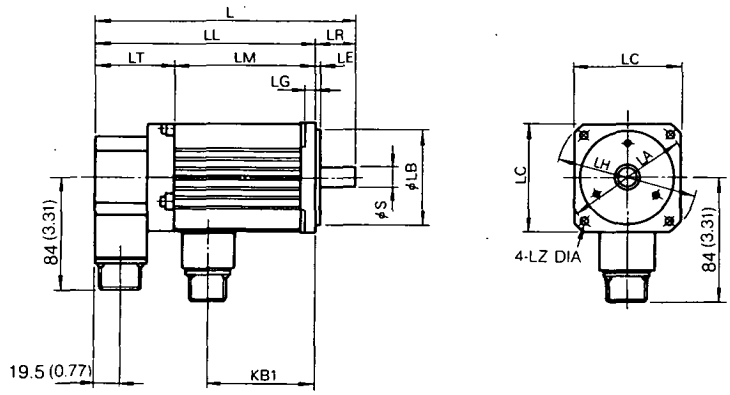
(5) S Series

Dimensions in mm (inches)

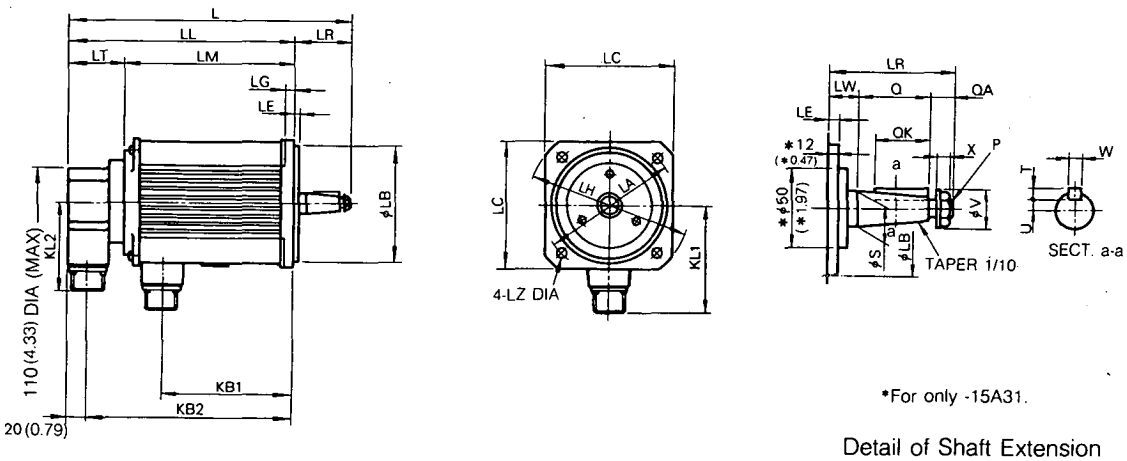
Drawing 1 USASEM-02A□2, -03A□2, -05A□2 (Straight Shaft)



Notes :

1. *Type USASEM-02A32 terminates in bare wires with a waterproof gland (seal) fitting. Therefore, the MS-connector part differs from the figure above. For details, contact your YASKAWA representative.*
2. *Plug and clamp are not attached for receptacle connection.*
3. *Motor should be mounted with connectors down.*
4. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : 3 (2048 P/R)
   Semi-standard : 4 (2500 P/R)

Drawing 2 USASEM-08A□1, -15A□1, -30A□1 (Taper Shaft)



*For only -15A31.

Detail of Shaft Extension

Notes :

1. *Hexagon socket head bolts should be used to mount the motor.*
2. *Plug and clamp are not attached for receptacle connection.*
3. *Key and keyway comply with JIS B 1301-1976. (Parallel key : precise class.)*
4. *Motor should be mounted with connectors down.*
5. *□ in the models are as follows according to types of the encoder (P/R).*
   Standard : 3 (2048 P/R)
   Semi-standard : 4 (2500 P/R)

Drawing 1

AC Servomotor Type USASEM-	L	LL	LM	LT	LR	KB1	Flange Surface and Shaft Extension								Approx Mass kg (lb)
							LA	LB	LC	LE	LG	LH	LZ	S	
02A□2	164.5 (6.48)	134.5 (5.30)	95 (3.74)	39.5 (1.56)	30 (1.18)	76 (2.99)	80 (3.15)	50 $^{0}_{-0.025}$ (1.9685 $^{0}_{-.001}$)	65 (2.559)	3 (0.118)	6 (0.24)	89 (3.50)	5 (0.197)	8 $^{0}_{-0.009}$ (0.315 $^{0}_{-0.0003}$)	1.4 (3.1)
03A□2	179 (7.05)	149 (5.87)	110 (4.33)	39 (1.54)	30 (1.18)	78 (3.07)	90 (3.54)	70 $^{0}_{-0.030}$ (2.7559 $^{0}_{-0.0012}$)	80 (3.15)	3 (0.118)	8 (0.31)	105 (4.13)	6 (0.236)	14 $^{0}_{-0.011}$ (0.5512 $^{0}_{-0.0004}$)	2.6 (5.7)
05A□2	201 (7.91)	171 (6.73)	132 (5.20)	39 (1.54)	30 (1.18)	100 (3.94)	90 (3.54)	70 $^{0}_{-0.030}$ (2.7559 $^{0}_{-0.0012}$)	80 (3.15)	3 (0.118)	8 (0.31)	105 (4.13)	6 (0.236)	14 $^{0}_{-0.011}$ (0.5512 $^{0}_{-0.0004}$)	3.3 (7.3)

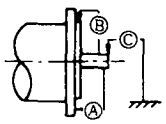
Drawing 2

AC Servomotor Type USASEM-	L	LL	LM	LT	LR	KB1	KB2	KL1	KL2	Flange Surface								Shaft Extension									Approx Mass kg (lb)
										LA	LB	LC	LE	LG	LH	LZ	LW	Q	QK	QA	X	S	V	P	U	W	T	
08A□1	257 (10.12)	199 (7.84)	148.5 (5.85)	50.5 (1.99)	58 (2.28)	115 (4.53)	188 (7.4)	102 (4.02)	86 (3.39)	130 (5.12)	110 $^{0}_{-0.035}$ (4.3307 $^{0}_{-0.0014}$)	120 (4.72)	3 (0.12)	10 (0.4)	155 (6.1)	9 (0.35)	18 (0.71)	28 (1.1)	25 (0.98)	12 (0.47)	10.3 (0.41)	16 (0.63)	21 (0.83)	M10 (P1.25)	4.3 $^{0}_{-0.1}$ (0.169 $^{0}_{-0.004}$)	5 (0.1968)	5 (0.1968)	6 (13.2)
15A□1	325.5 (12.81)	267.5 (10.53)	203.5 (8.02)	56 (2.2)	58 (2.28)	166.5 (6.56)	239.5 (9.43)	109 (4.29)	87 (3.43)	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)	18 (0.71)	28 (1.1)	25 (0.98)	12 (0.47)	10.3 (0.41)	19 (0.75)	21 (0.83)	M10 (P1.25)	5.8 $^{0}_{-0.1}$ (0.228 $^{0}_{-0.004}$)	5 (0.1968)	5 (0.1968)	11 (24.3)
30A□1	374 (14.72)	304 (11.97)	240 (9.45)	56 (2.2)	70 (2.76)	206 (8.11)	276 (10.87)	135 (5.32)	87 (3.43)	200 (7.87)	114.3 $^{0}_{-0.040}$ (4.3 $^{0}_{-0.0016}$)	180 (7.09)	6 (0.24)	18 (0.71)	230 (9.1)	13.5 (0.53)	20 (0.79)	36 (1.42)	32 (1.26)	14 (0.55)	12.5 (0.49)	22 (0.87)	24 (0.94)	M12 (P1.25)	6.6 $^{0}_{-0.1}$ (0.26 $^{0}_{-0.004}$)	6 (0.2362)	6 (0.2362)	24 (52.9)

CONNECTOR TYPES

AC Servomotor Type USASEM-	Motor Connector Types				Incremental Encoder Connector Types			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
03A□2 05A□2	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A	MS3102 A20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
08A□1 15A□1 30A□1	MS3102 A20-4P	MS3108 B20-4P	MS3106 B20-4P	MS3057 -12A				

MECHANICAL SPECIFICATIONS

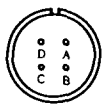
Accuracy (T. I. R)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0.04 (0.0016)	
Flange diameter concentric to shaft Ⓑ	0.04 (0.0016)	
Shaft run out Ⓒ	0.02 (0.0008)	

T. I. R. (Total Indicator Reading)

Servomotors with a brake are also available. For detailed information, refer to related Bulletins (TSE-S800-11.1).

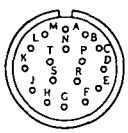
CONNECTOR SPECIFICATIONS

Motor Receptacle



A	Phase U
B	Phase V
C	Phase W
D	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	—	—

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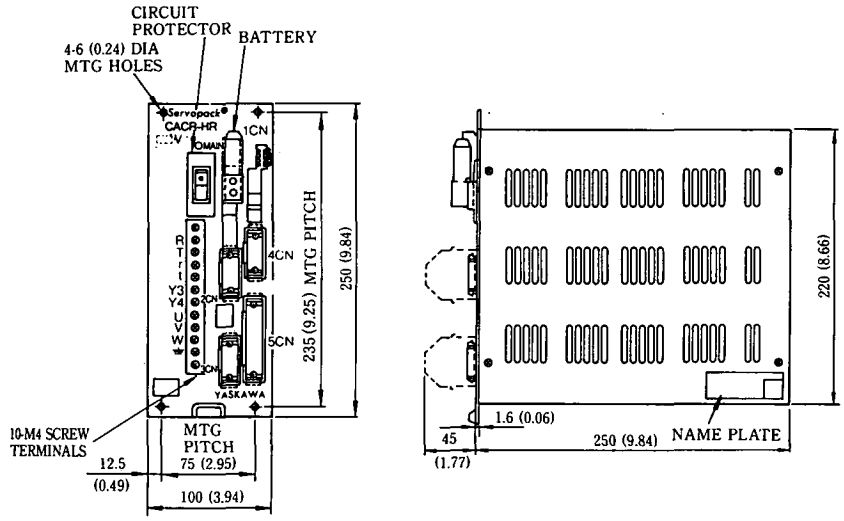
13.3 SERVOPACK

13.3.1 Rack-mounted Type CACR-HR□□BAB□□

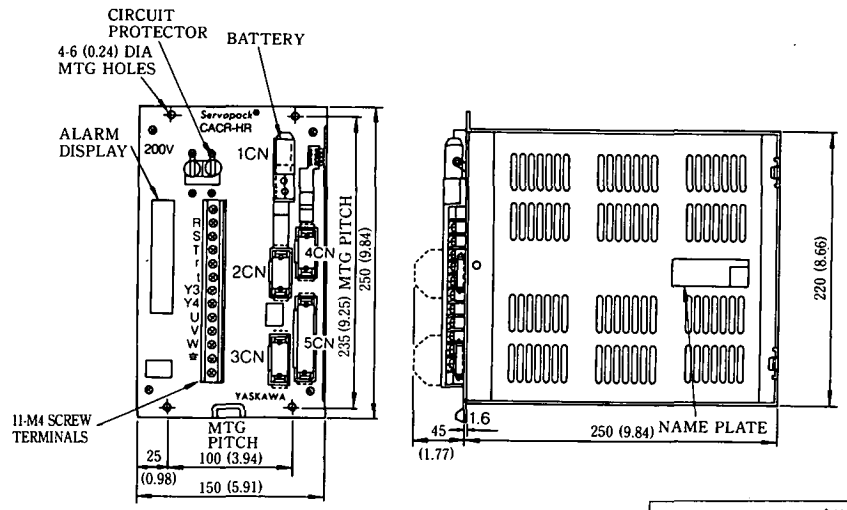
Dimensions in mm (inches)

CACR-HRA5BAB11 to -HR03BAB11, CACR-HRA5BAB12 to -HR05BAB12



Type CACR-HR	Approx Mass kg(lb)
A5BAB12	3.7 (8.2)
01BAB12	
02BAB12	
03BAB12	
05BAB12	
A5BAB11	
01BAB11	
02BAB11	
03BAB11	

CACR-HR05BAB11, CACR-HR10BAB to -HR15BAB



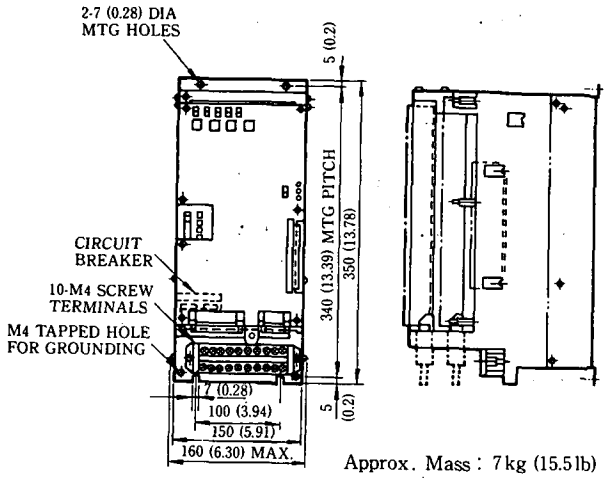
Type CACR-HR	Approx Mass kg(lb)
10BAB	5.7(12.6)
15BAB	5.9(13.0)
05BAB11	5.7(12.0)

Attachments
2CN connector for cable Case : MR-20L Receptacle : MR-20M (Made by Honda Tsushin Co.)
3CN connector for cable Case : MR-20L Receptacle : MR-20F (Made by Honda Tsushin Co.)
4CN connector for cable Case : MR-20L Receptacle : MR-20F (Made by Honda Tsushin Co.)
5CN connector for cable Case : MR-50L Receptacle : MR-50F (Made by Honda Tsushin Co.)

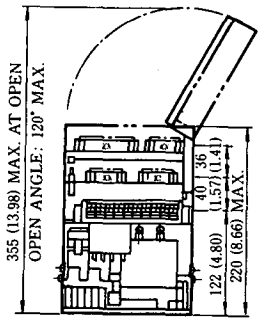
13.3.2 Base-mounted Type CACR-HR⬚⬚BB

Dimensions in mm (inches)

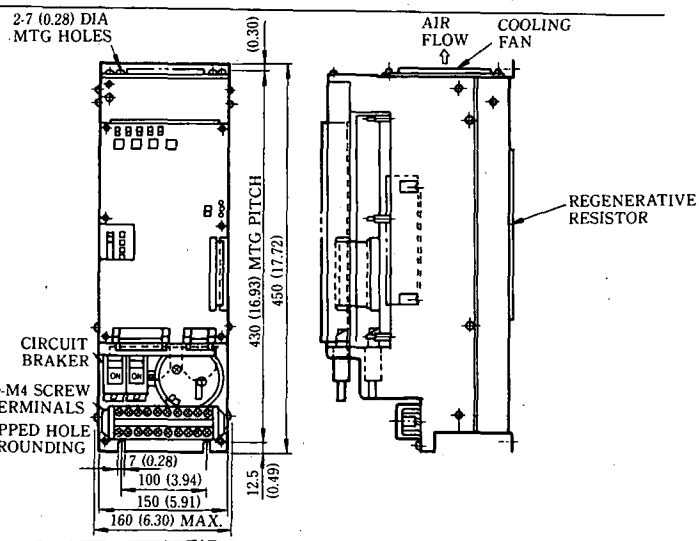
CACR-HR03BB to -HR15BB



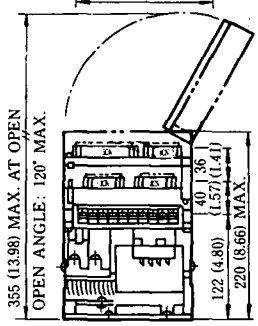
Approx. Mass : 7kg (15.5lb)



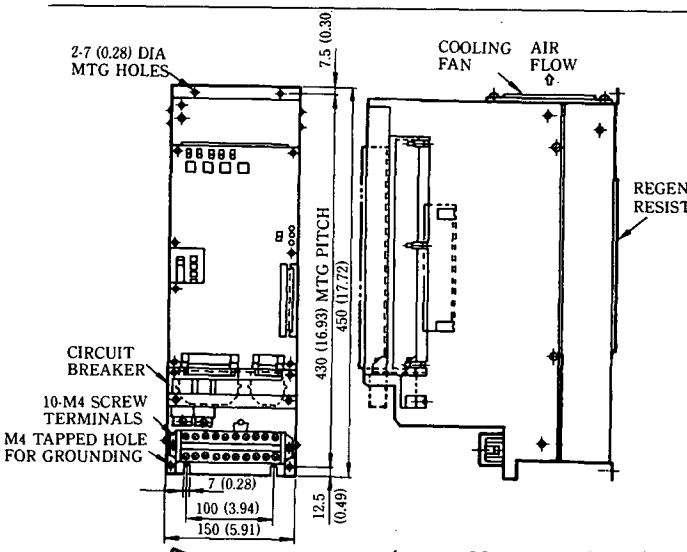
CACR-HR20BB, -HR30BB



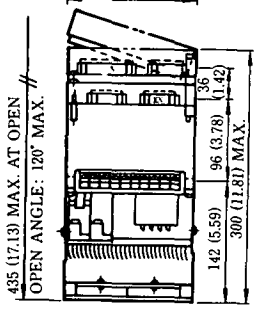
Approx. Mass : 9kg (19.9lb)



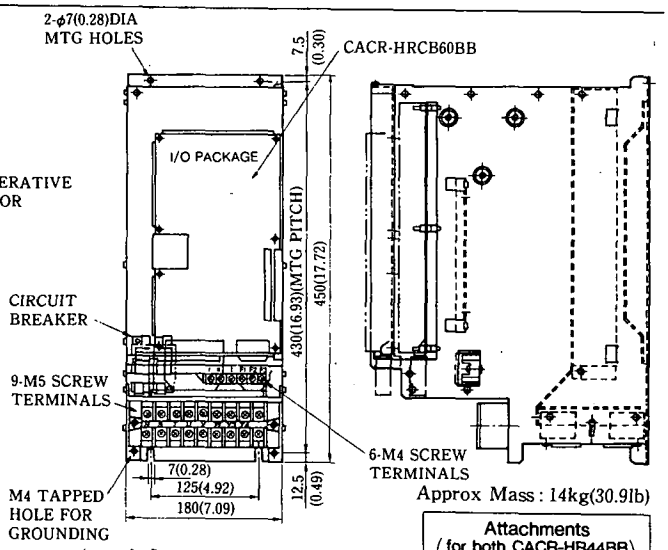
CACR-HR44BB



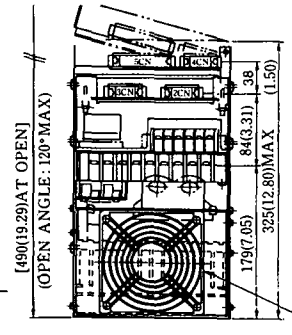
Approx. Mass : 12kg (26.5lb)



CACR-HR60BB



Approx Mass : 14kg(30.9lb)



Attachments (for both CACR-HR44BB and -HR60BB)
2CN connector for cable Case : MR-20L Receptacle : MR-20M*
3CN connector for cable Case : MR-20L Receptacle : MR-20F*
4CN connector for cable Case : MR-20L Receptacle : MR-20F*
5CN connector for cable Case : MR-50L Receptacle : MR-50F*

*Made by Honda Tsushin Co.

14 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 setting in checking method.

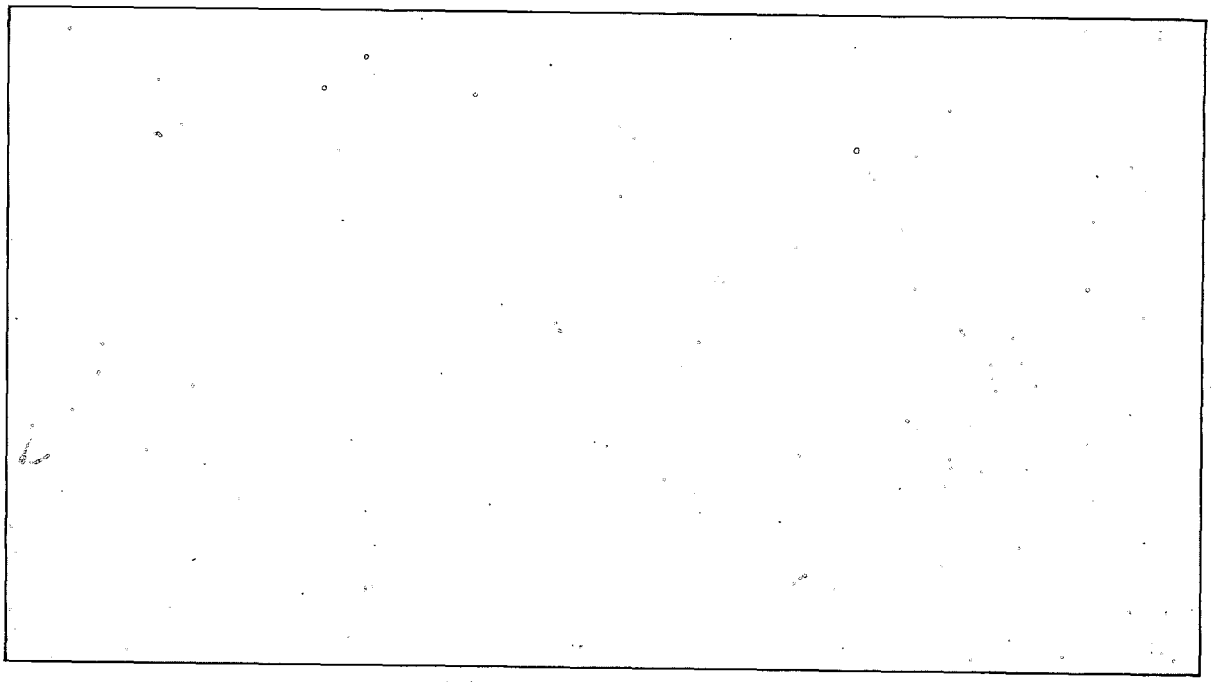
When it is required for YASKAWA to set parameters before delivery, fill out your machine configuration and specifications (sections □) and the required items in Par. 14.7 and contact your YASKAWA representative.

14.1 APPLICATIONS

14.2 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 or speed reference)	
Parameter Setter	PF803-ASY	

14.3 MACHINE CONFIGURATION

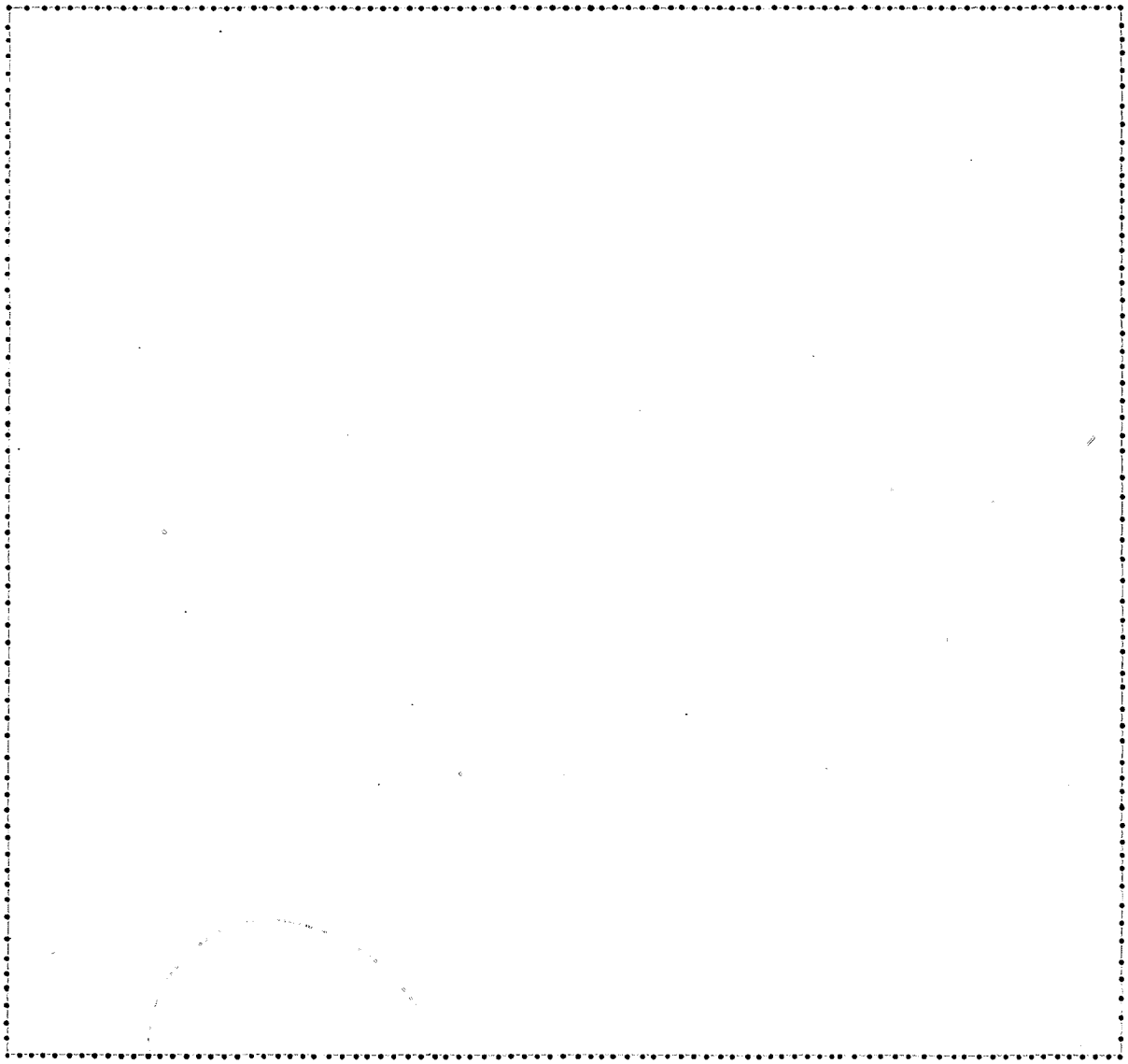


14.4 SPECIFICATIONS

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

14.5 SPEED DIAGRAM



14.6 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	1 to 10000000	Rotation	
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)

14.6 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: Pr72 function setting		0: not provided, 1: provided		
	b5: Pr65 function setting		0: not provided, 1: provided		
	b6: Pr66 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	Feedforward Compensation Value		0 to 100	%	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 overtravel (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		0 0 0 0 0 0 0
	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		0 0 0 0 0 0 0 0
	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, 73 to 75, 78 to 89, 91 to 99 are for future use and all are set to "0"

14.7 PARAMETER CHECK LIST

14.7.1 Parameters Related to Motor Used

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

M Series		F Series		G Series		D Series	
Motor Type USAMED-	Code	Motor Type USAFED-	Code	Motor Type USAGED-	Code	Motor Type USADED-	Code
	0	02[ ][ ]1	10	02[ ][ ]1	50		40
03[ ][ ]1	1	03[ ][ ]1	11	03[ ][ ]1	51		41
06[ ][ ]1	2	05[ ][ ]1	12	05[ ][ ]1	52	05E [ ]	42
09B [ ] 2	3	09[ ][ ]1	13	09[ ][ ]1	53	10E [ ]	43
12B [ ] 2	4	13C [ ] 2	14	13A [ ] 2	54	15E [ ]	44
20B [ ] 2	5	20C [ ] 2	15	20A [ ] 2	55	22E [ ]	45
30B [ ] 2	6	30C [ ] 2	16	30A [ ] 2	56	37E [ ]	46
44B [ ] 2	7	44C [ ] 2	17	44A [ ] 2	57		47
USAMKD-60B [ ] 2	8		18		58		48

S Series		R Series (For 200V)		R Series (For 100V)		P Series	
Motor Type USASEM-	Code	Motor Type USAREM-	Code	Motor Type USAREM-	Code	Motor Type USAPEM-	Code
02A [ ]	20		30		60		70
03A [ ]	21		31		61		71
05A [ ]	22	A5C [ ] 2	32	A5D [ ] 2	62		72
08A [ ]	23	01C [ ] 2	33	01D [ ] 2	63	01C [ ] 2	73
15A [ ]	24	02C [ ] 2	34	02D [ ] 2	64	02C [ ] 2	74
	25	03C [ ] 2	35	03D [ ] 2	65	03C [ ] 2	75
30A [ ]	26	05C [ ] 2	36	05D [ ] 2	66	05C [ ] 2	76
	27	07C [ ] 2	37		67	07C [ ] 2	77

Encoder type

- Method: ☐ Absolute encoder (Pr9 = 0)
  ☐ Incremental encoder (Pr9 = 1)
- Number of pulses: ☐ 1024 pulses/rev (Pr8 = 4096)
  ☐ 2048 pulses/rev (Pr8 = 8192)
  ☐ 2500 pulses/rev (Pr8 = 10000)
  ☐ 8192 pulses/rev (Pr8 = 32768)

14.7.2 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)

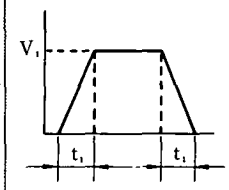
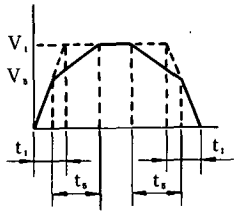
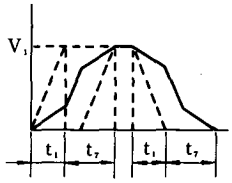
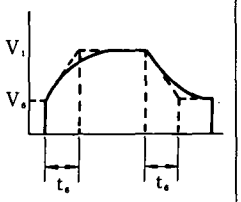
⑤ Reference unit(minimum) A = _____(mm): position resolution

⑥ Load moving amount-per load shaft rotation P= _____ (mm)(Pr11=P/A)

(Note) Limiting conditions: $0.01 \leq (Pr8 \times Pr12)/(Pr11 \times Pr13) \leq 100$

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 Pr17b4=0 Pr68 to Pr71 Settings are not required.	Pr17b2=1 Pr17b4=0 Pr68 to Pr71 Settings are not required.	Pr17b4=0 Pr20b3=1 Pr68 to Pr71 Settings are not required.	☐ Pr17b2=0 Pr68=0	☐ Pr17b2=1 Pr68=0	☐ Pr20b3=1 Pr68=0	☐ Pr68=1 Pr17b2, Pr20b3 Setting are not required.
☐ Manual Mode				☐ Pr17b2=0 Pr69=0	☐ Pr17b2=1 Pr69=0	☐ Pr20b3=1 Pr69=0	☐ Pr69=1 Pr17b2, Pr20b3 Setting are not required.
☐ Pulse Mode				☐ 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)

14.7.3 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)		▨
	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)

14.7.4 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

14.7.5 Parameters Related to Position Control

① Speed loop gain

Motor inertia J_M = _____

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

$Pr2 = 20 \times (J_L + J_M)/J_M$

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)

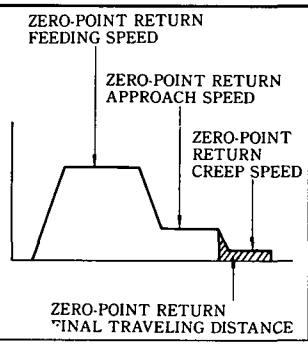
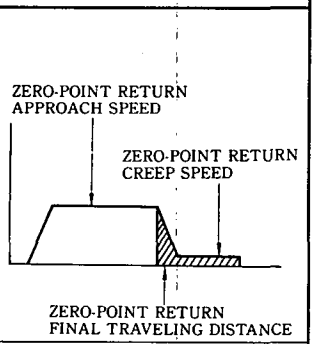
└→ Positioning near range N = _____ mm (inch)
(Pr45 = N/A)

14.7.6 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 status
- ☐ 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)

14.7.6 Selection Function (Cont'd)

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)

⑨ Backlash compensation

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

☐ Used (Pr18b1=1)

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

$Pr42 = (\delta \times 32768 \times Pr12)/(A \times Pr11 \times Pr13)$

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)

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Due to ongoing product modification/improvement, data subject to change without notice.