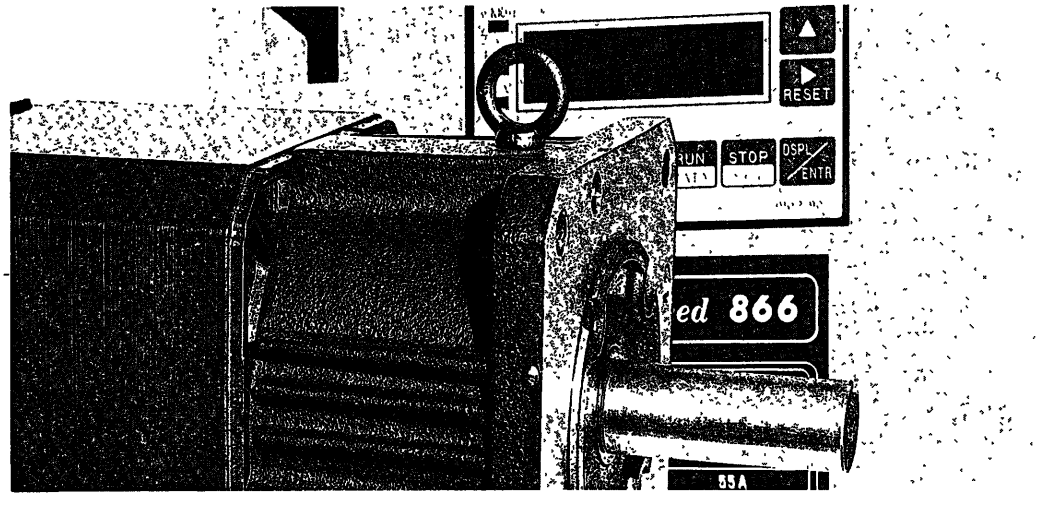
Varispeed-866 SERIES

LARGE-CAPACITY/HIGH-OUTPUT AC SERVO DRIVE

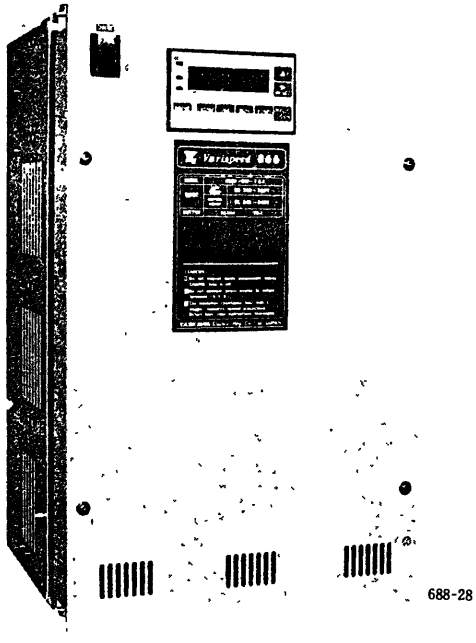
VECTOR-& DIGITAL-CONTROLLED IM
DRIVE 3 TO 50 HP (2.2 TO 37 kW)

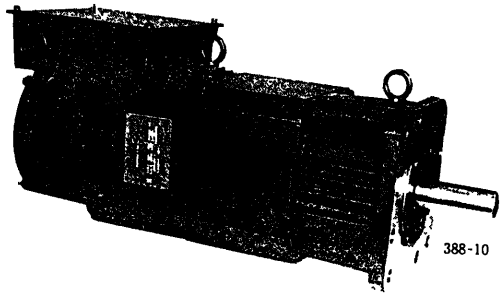
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YASKAWA

Yaskawa now introduces a new member, VS-866, of our AC servo drives.
The VS-866 consists mainly of an IM (squirrel-cage induction motor) and its servo driver. This wide range of motors can be driven in any one of three types of controls: speed, positioning, and high precision torque controls to meet your every need for a drive system. Especially, these controls solve a lot of user requirements: wide range of speed control, high power rate for quicker response, and lower torque ripple.





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CONTENTS

Page

1 RATINGS AND SPECIFICATIONS 1

1.1 RATINGS AND SPECIFICATIONS OF SERVOMOTOR 1
1.2 RATINGS AND SPECIFICATIONS OF SERVO DRIVER 3
1.3 RATINGS AND SPECIFICATIONS OF POWER UNIT 4
1.4 MODEL DESIGNATION 4

2. CHARACTERISTICS 5

2.1 SPEED-TORQUE CHARACTERISTICS 5
2.2 MECHANICAL CHARACTERISTICS OF MOTOR 7
2.2.1 Shaft Coupling Method 7
2.2.2 Motor Fastening Bolts 7
2.2.3 Mechanical Strength 7
2.2.4 Allowable Radial and Thrust Loads 7
2.2.5 Machining Accuracy 8

3. STANDARD COMBINATION 9

4. FUNCTIONS 11

4.1 CONTROL FUNCTIONS 11
4.2 STATUS MONITOR FUNCTIONS 13
4.3 RROTECTIVE FUNCTIONS 14
4.3.1 Protective Functions for Servo Driver 14

5. CONFIGURATION 15

5.1 FUNCTION BLOCK DIAGRAM 15
5.2 INTERNAL SEQUENCE BLOCK DIAGRAM 16

6. CONTROL SIGNALS 17

6.1 SEQUENCE INPUT SIGNALS (1CN35 TO 46) 17
6.2 REFERENCE INPUT SIGNALS (1CN3 TO 8) 21
6.3 SEQUENCE OUTPUT SIGNALS 25
6.4 MONITORING ANALOG OUTPUT SIGNALS 27
6.5 ENCODER (PG) PULSE OUTPUT CIRCUIT (PAO,*PAO,PBO,*PBO,PCO,*PCO) 28
6.5.1 Incremental Encoder (Standard) 28
6.5.2 Absolute Encoder 29

7. USER CONSTANTS 36

8. SYSTEM DESIGN PRECAUTIONS 42

9. MONITOR PANEL OPERATION 54

9.1 KEY FUNCTIONS 54
9.2 MONITOR PANEL FUNCTIONS 55

Page
9.3 DRIVE MODE 56
9.3.1 Monitors 56
9.3.2 Reference/Variable Display 58
9.3.3 Operation on Monitor Panel 58
9.3.4 Failure Mode 59
9.3.5 Failure Trace 60
9.4 PROGRAM MODE 60
9.4.1 Setting and Referencing User Constants (Data) 60
9.4.2 User Constant (Memory Switch) Setting and Referencing 61

10. INSTALLATION AND WIRING 66

10.1 INSTALLATION OF SERVOMOTOR 66
10.2 INSTALLING SERVO DRIVER AND POWER UNIT 67
10.3 WIRING EXAMPLE 69
10.4 WIRING PRECAUTIONS 71
10.4.1 Main Circuit Wiring 71
10.4.2 Control Circuit Wiring 72
10.4.3 Grounding Wire 72
10.5 TERMINALS 73
10.6 WIRE 75
10.7 POWER LOSS 79

11. TEST RUN 80

11.1 PREPARATIONS 80
11.2 CONTROLLER CHECK (POWER ON) 80
11.3 CONSTANT SETTING 81
11.4 TRIAL OPERATION METHOD 81
11.4.1 Operation on Monitor Panel 82
11.4.2 Operation by External Reference 83
11.4.3 Checking for Test Run 83
11.4.4 Setting up Absolute Encoder 83

12. MAINTENANCE 84

12.1 DAILY CHECK LIST 84
12.2 PERIODICAL MAINTENANCE 85
12.3 PERIODICAL CHECK LIST AND ACTION TO BE TAKEN 86
12.4 REPLACING THE INVERTER COOLING FAN 87
12.5 SPARE PARTS 88

13. TROUBLESHOOTING 89

13.1 MOTOR MALFUNCTION 90
13.2 ERROR INDICATION AND ERROR PROCESSING 93

14. DIMENSIONS in mm (inch) 97

15. PERIPHERAL UNITS 105

INDEX

	Subject	Par.	Page
A	Absolute Encoder	6.5.2	29
	Allowable Radial and Thrust Loads	2.2.4	7
C	CHARACTERISTICS	2.	5
	Checking for Test Run	11.4.3	83
	CONFIGURATION	5.	15
	CONSTANT SETTING	11.3	81
	CONTROLLER CHECK (POWER ON)	11.2	80
	Control Circuit Wiring	10.4.2	72
	CONTROL FUNCTIONS	4.1	11
	CONTROL SIGNALS	6.	17
D	DAILY CHECK LIST	12.1	84
	DIMENSIONS in mm (inch)	14.	97
	DRIVE MODE	9.3	56
E	ENCODER (PG) PULSE OUTPUT CIRCUIT (PAO,*PAO,PBO,*PBO,PCO,*PCO)	6.5	28
	ERROR INDICATION AND ERROR PROCESSING	13.2	93
F	Failure Mode	9.3.4	59
	Failure Trace	9.3.5	60
	FUNCTIONS	4.	11
	FUNCTION BLOCK DIAGRAM	5.1	15
G	Grounding Wire	10.4.3	72
I	Incremental Encoder (Standard)	6.5.1	28
	INSTALLATION AND WIRING	10.	66
	INSTALLATION OF SERVOMOTOR	10.1	66
	INSTALLING SERVO DRIVER AND POWER UNIT	10.2	67
	INTERNAL SEQUENCE BLOCK DIAGRAM	5.2	16
K	KEY FUNCTIONS	9.1	54
M	Machining Accuracy	2.2.5	8
	Main Circuit Wiring	10.4.1	71
	MAINTENANCE	12.	84
	MECHANICAL CHARACTERISTICS OF MOTOR	2.2	7
	Mechanical Strength	2.2.3	7
	MODEL DESIGNATION	1.4	4
	MONITORING ANALOG OUTPUT SIGNALS	6.4	27
	Monitors	9.3.1	56
	MONITOR PANEL FUNCTIONS	9.2	55
	MONITOR PANEL OPERATION	9.	54
	Motor Fastening Bolts	2.2.2	7
	MOTOR MALFUNCTION	13.1	90

	Subject	Par.	Page
O	Operation by External Reference	11.4.2	83
	Operation on Monitor Panel	11.4.1	82
	Operation on Monitor Panel	9.3.3	58
P	PERIODICAL CHECK LIST AND ACTION TO BE TAKEN	12.3	86
	PERIODICAL MAINTENANCE	12.2	85
	PERIPHERAL UNITS	15.	105
	POWER LOSS	10.7	79
	PREPARATIONS	11.1	80
	PROGRAM MODE	9.4	60
	PROTECTIVE FUNCTIONS	4.3	14
	Protective Functions for Servo Driver	4.3.1	14
R	RATINGS AND SPECIFICATIONS	1	1
	RATINGS AND SPECIFICATIONS OF POWER UNIT	1.3	4
	RATINGS AND SPECIFICATIONS OF SERVOMOTOR	1.1	1
	RATINGS AND SPECIFICATIONS OF SERVO DRIVER	1.2	3
	Reference/Variable Display	9.3.2	58
	REFERENCE INPUT SIGNALS (1CN3 TO 8)	6.2	21
	REPLACING THE INVERTER COOLING FAN	12.4	87
S	SEQUENCE INPUT SIGNALS (1CN35 TO 46)	6.1	17
	SEQUENCE OUTPUT SIGNALS	6.3	25
	Setting and Referencing User Constants (Data)	9.4.1	60
	Setting up Absolute Encoder	11.4.4	83
	Shaft Coupling Method	2.2.1	7
	SPARE PARTS	12.5	88
	SPEED-TORQUE CHARACTERISTICS	2.1	5
	STANDARD COMBINATION	3.	9
	STATUS MONITOR FUNCTIONS	4.2	13
	SYSTEM DESIGN PRECAUTIONS	8.	42
T	TERMINALS	10.5	73
	TEST RUN	11.	80
	TRIAL OPERATION METHOD	11.4	81
	TROUBLESHOOTING	13.	89
U	User Constant (Memory Switch) Setting and Referencing	9.4.2	61
	USER CONSTANTS	7.	36
W	WIRE	10.6	75
	WIRING EXAMPLE	10.3	69
	WIRING PRECAUTIONS	10.4	71

1 RATINGS AND SPECIFICATIONS

1.1 RATINGS AND SPECIFICATIONS OF SERVOMOTOR

• Servomotor General Specifications

Time Rating: 50% ED

Insulation: Class F

Dieletric Voltage: 1500 VAC for one minute

Insulation Resistance: 10 MΩ or more by 500 VDC

Ambient Temperature: 0 to 40℃

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

Vibration: V10 max.

Noise: 1500 rpm series, 22 kW or less ···· 75 dB(A) max.

30 kW or more ···· 78 dB(A) max.

750 rpm series, 11 kW or less ···· 75 dB(A) max.

15 kW or more ···· 78 dB(A) max.

Mounting: Flange-mounted (Foot-mounted available)

Finish in Munsel Notation: N1.5

• Detector Specifications

Standard:

Incremental encoder (6000 pulses/rev)

Option:

Absolute encoder (8192 pulses/rev)

(1) 1500 r/min series

Table 1.1 Ratings and Specifications of 1500 r/min Series Servo Motor

Type UAAC□□□-□□□□		KA-03A □□#2	KA-04A □□#2	KA-06A □□#2	KA-08A □□#2	KA-11A □□#2	KA-15A □□#2	KA-22A □□#2	KA-30A □□#2	KA-37A □□#2
Rated Output (50% ED)	kW HP	2.2 3	3.7 5	5.5 7.5	7.5 10	11 15	15 20	22 30	30 40	37 50
Continuous Output	kW HP	1.5 2	2.2 3	3.7 5	5.5 7.5	7.5 10	10 13.4	13 17.4	22 30	26 35
Rated Speed	r/min	1500								
Max Speed	r/m.	2000 (Constant power for 1500 to 2000 r/min)								
Rated Torque (50% ED)	N.m lb.in	14.0 124	23.5 208	35.0 310	47.7 422	70.0 620	95.4 844	140 1239	191 1690	235 2115
Continuous Torque	N.m lb.in	9.51 84.2	14.0 124	23.5 208	35.0 310	47.7 422	63.6 563	82.7 732	140 1239	166 1469
Peak Torque	%	200								
Rated Current	A	20	27	39	55	76	101	139	188	224
Current at 200% Torque	A	38	52	74	111	149	195	277	376	445
Power Rate	kW/s HP/s	75.5 101	112 150	170 228	228 306	312 418	385 516	429 575	603 808	694 930
Unit Accel Time	ms	30.0	33.0	32.3	32.9	35.1	38.7	51.2	49.5	53.2
Moment Inertia of Motor J*	kg·cm²x10⁻³ lb·in·S²x10⁻³	28.8 23.7	49.3 43.7	72.0 63.8	100 88.5	157 139	236 209	458 405	605 536	798 707
Enclosure		Totally-enclosed, externally fan-cooled							Dripproof protected externally fan-cooled	

□ in type designation is determined by output (pulses/rev) of optical encoder as follows:
- Standard: A (incremental 6000 pulses/rev)
- Optional: S (absolute 8192 pulses/rev)

(2) 750 r/min series

Table 1.2 Ratings and Specifications of 750 r/min Series Servo Motor

Type UAAC [ ][ ]-[ ][ ][ ]		KL-03A [ ]*2	KL-04A [ ]*2	KL-06A [ ]*2	KL-08A [ ]*2	KL-11A [ ]*2	LL-15A [ ]*2	LL-19A [ ]*2
Rated Output (50% ED)	kW HP	2.2 3	3.7 5	5.5 7.5	7.5 10	11 15	15 20	18.5 25
Continuous Output	kW HP	1.5 2	2.2 3	3.7 5	5.5 7.5	7.5 10	11 15	15 20
Rated Speed	r/min	750						
Max Speed	r/min	1000 (Constant power for 750 to 1000 r/min)						
Rated Torque (50% ED)	N.m lb.in	28.0 248	47.0 416	70.0 620	95.4 844	140 1239	191 1690	235 2115
Continuous Torque	N.m lb.in	19.1 169	28.0 248	47.1 417	70.0 620	95.4 844	140 1239	191 1690
Peak Torque	%	200						
Rated Current	A	19	32	44	58	80	108	129
Current at 200% Torque	A	34	63	86	112	161	217	259
Power Rate	kW/s HP/s	109 146	222 297	312 418	385 516	429 575	603 808	694 930
Unit Accel Time	ms	20.2	16.7	17.6	19.5	25.5	24.7	26.6
Moment Inertia of Motor J^{*}	kg·cm²x10⁻³ lb·in·S²x10⁻³	72.0 63.8	100 88.5	157 139	236 209	458 405	605 536	798 707
Enclosure		Totally-enclosed, externally fan-cooled					Dripproof protected externally fan-cooled	

* [ ] in type designation is determined by output (pulses/rev) of optical encoder as follows:
  - Standard: A (incremental 6000 pulses/rev)
  - Optional: S (absolute 8192 pulses/rev)

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1.2 RATINGS AND SPECIFICATIONS OF SERVO DRIVER

Table 1.3

Model	1500r/min Series CIMR-S\J-	03\	04\	06\	08\		11\	15\	22\	30\	37\
	750r/min Series CIMR-S\J-	03L	—	04L	06L	08L	11L	15L	19L	—	—
Rated Capacity kVA		6	9	13	18		25	35	45	60	80
Rated Current A		18	27	40	55		80	110	135	190	240
Power Supply	Main	240 to 340 VDC									
	Control	210 to 310 VDC									
	Fan	Single-phase 200/220\AC $^{+10\%}_{-15\%}$ 50/60Hz ±5%									
Overcurrent Capacity		200% 10 sec									
Rated Output Voltage		Three-phase 190\ (in 300\DC input)									
Inverter Type		Transistorized PWM inverter									
Control Method		Vector control (digital control)									
Control Specifications	Speed — Control Range	1:3000 or more									
	Speed — Accuracy	Analog ref: ±0.2% (25±10℃)									
	Speed — Frequency Characteristic	400rad/s									
	Torque — Repeatability	±2% (±0.5%*1)									
	Accel/Decel Time Setting	0 to 10s (in unit of 2ms)									
I/O Signals	Speed Reference *2	±6\ at rated speed(±10\ at rated speed: optional)									
	Torque Reference *2	±3V at rated torque(±6V at rated torque: optional)									
	Torque Limit *2	FWD/REV run torque limit:+3V/100%									
	Sequence Input	Servo ready, servo O\, emergency stop, fault reset, integral reset, ASR constant selection (4 types), low speed selection, sensor O\, synchronous signal, reference input prohibition, torque/speed selection									
	Sequence Output	Completion of servo ready, running, zero speed, fault, alarm, answer signal									
	Speed (Positioning) Signal Output	Dividing ratio: 1/\ or 2/\ (\: 1 to 32) *2 Dividing ratio: \/8192 (\: set value) *3									
Contained Functions	Protective Functions	Overcurrent, overvoltage, undervoltage, overload, overspeed, blown fuse, heatsink overheat, motor overheat									
	Indication	input, output, fault									
	Monitor Output — Speed	±6V at ±100%									
	Monitor Output — Torque	±3V at ±100%									
	Monitor Output — Current	+5V at 100%									
Conditions	Ambient Temperature and Humidity	• Operation: 0 to +55℃, 90 % RH or less (non-condensing) • Storage: −20 to +60℃, 90 % RH or less (non-condensing)									
	Height	1000 meters max. at indoor									
	Ambient Atomosphere	Free from corrosive gases and dust									
	Vibration	0.5G or below									

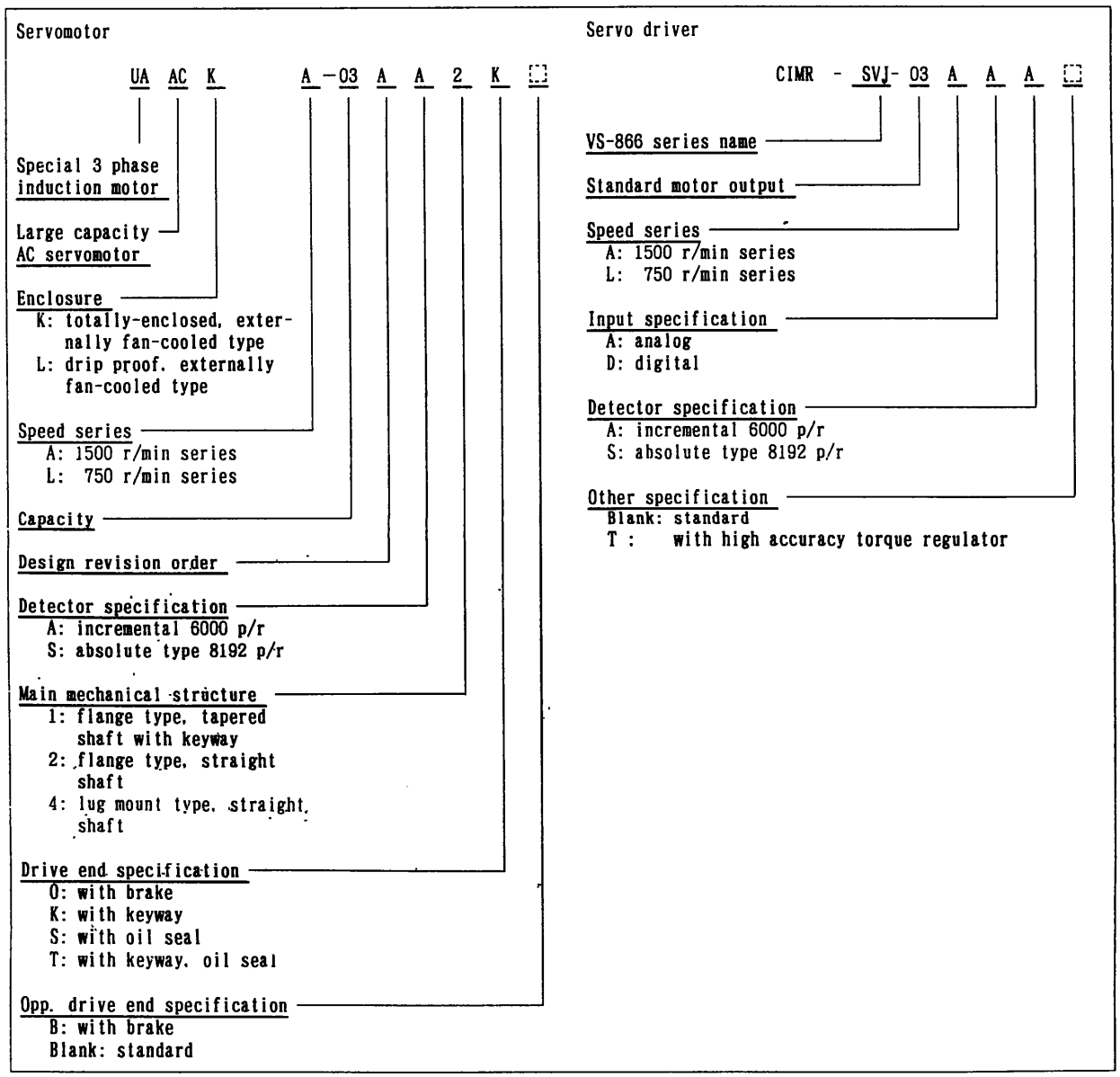
*1 For option (with high precision torque controller).
*2 For incremental encoder.
*3 For absolute encoder.

1.3 RATINGS AND SPECIFICATIONS OF POWER UNIT

Table 1.4

Power Unit Model		NPSN-0303L	NPSO-0503L	NPSO-0803L	NPSO-1303L
Rated Output kw(HP)		7.5 (10)	15 (20)	25 (34)	40 (54)
Input Power	Power Supply	3 phase, 200/220 VAC (+10%−15%) 50/60 Hz			
	Capacity kVA	10	20	30	50
DC Output	Rated Voltage	300 VDC for 220 VAC input			
	Rated Current ADC	25	50	80	130
	Overcurrent Capacity	200% 10 s			
Control Power Output	Voltage	300 VDC for 200 VAC input			
	Current	2 ADC for up to 4 drives			

1.4 MODEL DESIGNATION

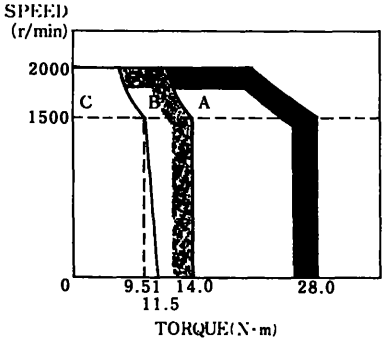


2. CHARACTERISTICS

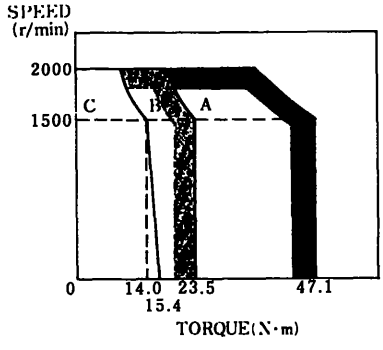
2.1 SPEED-TORQUE CHARACTERISTICS

(1) 1500r/min Series

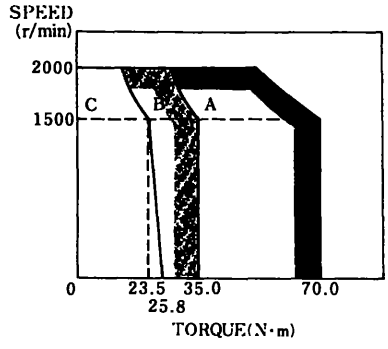
UAACKA-03A 2.2/1.5kW



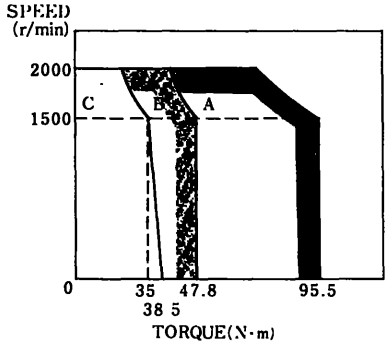
UAACKA-04A 3.7/2.2kW



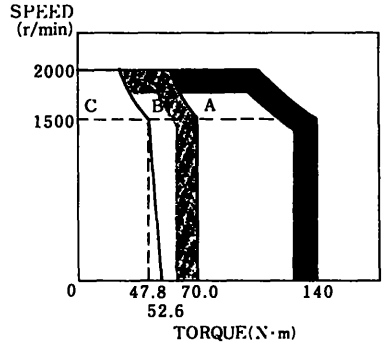
UAACKA-06A 5.5/3.7kW



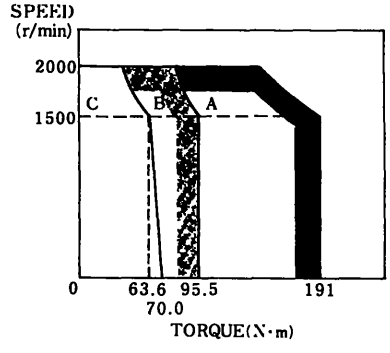
UAACKA-08A 7.5/5.5kW



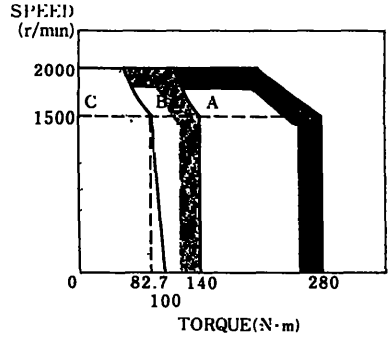
UAACKA-11A 11/7.5kW



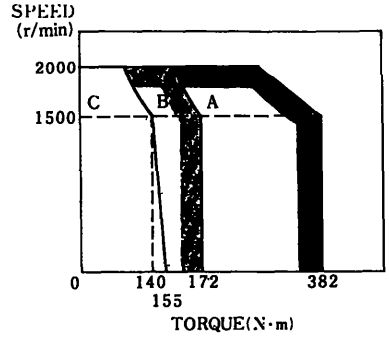
UAACKA-15A 15/11kW



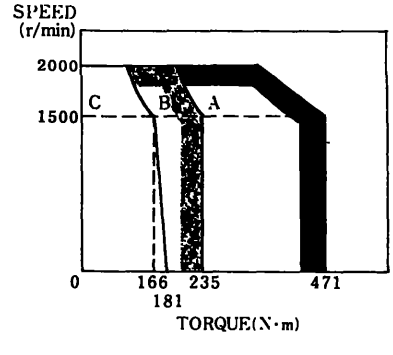
UAACLA-22A 22/13kW



UAACLA-30A 30/22kW



UAACKA-37A 37/26kW

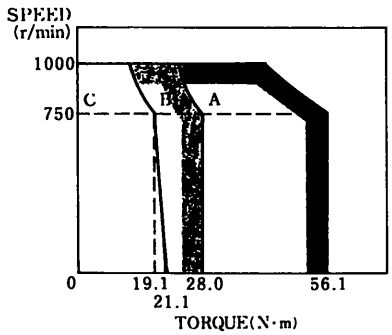


A ···INTERMITTENT DUTY ZONE
B ···50% ED DUTY ZONE
C ···CONTINUOUS DUTY ZONE

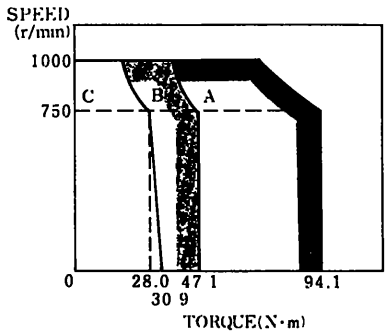
Note: The range between 1500 and 2000r/min is constant output characteristics.

(2) 750 r/min Series

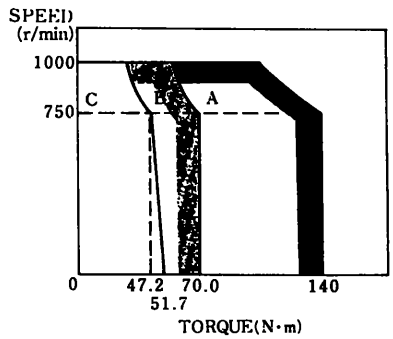
UAACKA-03A 2.2/1.5kW



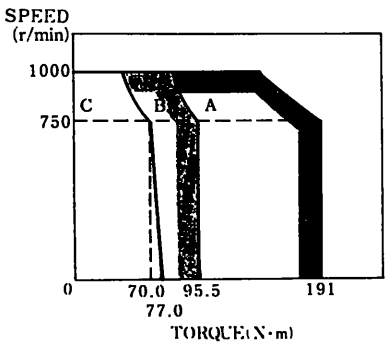
UAACKA-04A 3 7/2.2kW



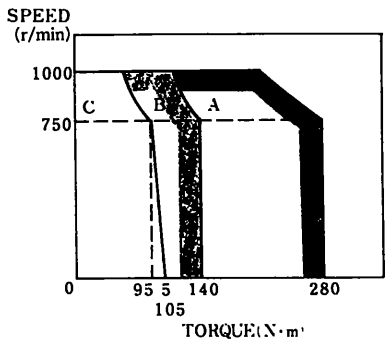
UAACKA-06A 5.5/3.7kW



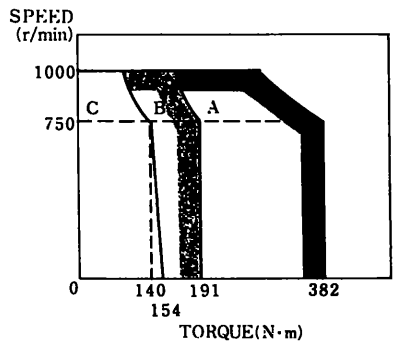
UAACKA-08A 7.5/5.5kW



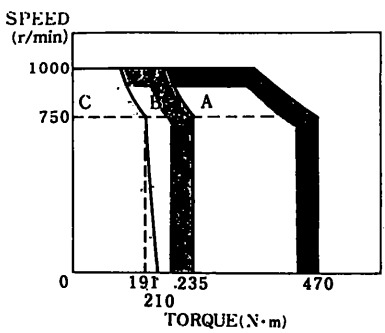
UAACKA-11A 11/7.5kW



UAACLL-15A 15/11kW



UAACLL-19A 18.5/15kW



A ···INTERMITTENT DUTY ZONE
B ···50% ED DUTY ZONE
C ···CONTINUOUS DUTY ZONE

Note: The range between 750 and 1000r/min is constant output characteristics.

2.2 MECHANICAL CHARACTERISTICS OF MOTOR

2.2.1 Shaft Coupling Method

A direct coupling is standard for drive method between motor shaft and load.
In case of a belt drive type, the radial load on shaft increases.
For allowable radial load on shaft, refer to par. 2.2.4.

2.2.2 Motor Fastening Bolts

For fastening the motor flange, use hexagon socket head bolts (JIS B1176, strength division 10.9).
For tightening torque for motor fastening bolts, refer to Table 2.1.

2.2.3 Mechanical Strength

The servo motor output shaft stands up to 200% of instantaneous peak torque.
Contact your Yaskawa representative for the following cases.

- J_L is more than 5 times J_M
- Winding change unit is optionally used

2.2.4 Allowable Radial and Thrust Loads

Tables 2.2 and 2.3 show the allowable load to servo motor output shaft.
Contact your Yaskawa representative for the following cases.

- Radial load point closes to the drive end from center of the output shaft
- J_L is more than 5 times J_M
- Winding change unit is optionally used

Table 2.1 Tightening Torque for Motor Set Bolts

Motor Model		Bolt Size	Bolt Tightening Torque kg·cm(lb in)
1500 rpm Series	750 rpm Series		
UAACKA-03AA2K	—	M12	610 (529.5)
UAACKA-04AA2K	—		
UAACKA-06AA2K	UAACKL-03AA2K		
UAACKA-08AA2K	UAACKL-04AA2K	M12	610 (529.5)
UAACKA-11AA2K	UAACKL-06AA2K		
UAACKA-15AA2K	UAACKL-08AA2K		
UAACKA-22AA2K	UAACKL-11AA2K	M16	950 (824.7)
UAACLA-30AA2K	UAACLL-15AA2K		
UAACLA-37AA2K	UAACLL-19AA2K		

Table 2.2 Load Allowable to Output Shaft of 1500 rpm Series

Motor model	Allowable Radial Load kg(lb)	Allowable Thrust Load kg(lb)
UAACKA-03AA2K	210 (463)	90 (198)
UAACKA-04AA2K	220 (485)	90 (198)
UAACKA-06AA2K	220 (485)	90 (198)
UAACKA-08AA2K	330 (727)	135 (297)
UAACKA-11AA2K	340 (749)	150 (330)
UAACKA-15AA2K	280 (617)	170 (374)
UAACKA-22AA2K	510 (1123)	220 (485)
UAACLA-30AA2K	510 (1123)	220 (485)
UAACLA-37AA2K	510 (1123)	220 (485)

Table 2.3 Load Allowable to Output Shaft of 750 rpm Series

Motor Model	Allowable Radial Load kg(lb)	Allowable Thrust Load kg(lb)
UAACKL-03AA2K	220 (485)	90 (198)
UAACKL-04AA2K	330 (727)	135 (297)
UAACKL-06AA2K	340 (749)	150 (330)
UAACKL-08AA2K	280 (617)	170 (374)
UAACKL-11AA2K	510 (1123)	220 (485)
UAACLL-15AA2K	510 (1123)	220 (485)
UAACLA-19AA2K	510 (1123)	220 (485)

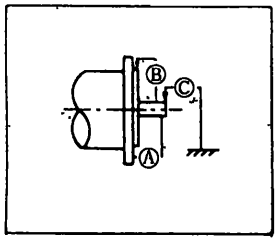
2.2.5 Machining Accuracy

Table 2.4 shows the accuracy of servo motor output shaft and counterpart to mount on.

Table 2.4 Machining Accuracy Unit mm (inch)

Motor Model		Accuracy (T.I.R.)		
1500 rpm Series	750 rpm Series	Flange Surface Perpendicular to Shaft Ⓐ	Flange Diameter Concentric to Shaft Ⓑ	Shaft Run Out Ⓒ
UAACKA-03AA2K	–	0.04 (0.0016)	0.04 (0.0016)	0.02 (0.0008)
UAACKA-04AA2K	–			
UAACKA-06AA2K	UAACKL-03AA2K			
UAACKA-08AA2K	UAACKL-04AA2K			0.022 (0.0009)
UAACKA-11AA2K	UAACKL-06AA2K			
UAACKA-15AA2K	UAACKL-08AA2K			
UAACKA-22AA2K	UAACKL-11AA2K	0.056 (0.039)	0.05 (0.002)	
UAACLA-30AA2K	UAACLL-15AA2K			
UAACLA-37AA2K	UAACLL-19AA2K			

Note: T.I.R. denotes Total Indicator Reading on dial gauge.



3. STANDARD COMBINATION

(1-motor dvive, No regenerative load, Decel. time duty 20% ED max.)

Table 3.1 1500 r/min Series

Servomotor		Servo Driver		Power Unit*1		When $J_L \leq 2 \times J_M$ *2				When $J_L \leq 5 \times J_M$ *2			
Capacity kW(HP)	Model UAACKA-	Capacity kVA	Model CIMR-SVJ-	Capacity kW(HP)	Model	No. of Braking Resistors*3	No. of Braking Units*4	Thermal Relay*5 Model	Thermal Relay*5 Q'ty	No. of Braking Resistors*3	No. of Braking Units*4	Thermal Relay*5 Model	Thermal Relay*5 Q'ty
2.2 (3)	03A□□□	6	03A□□□	7.5 (10)	VPSN-0303L	Unnecessary				Unnecessary			
3.7 (5)	04A□□□	9	04A□□□	7.5 (10)	VPSN-0303L					1	1	RH18-1.7P	1
5.5 (7.5)	06A□□□	13	06A□□□	7.5 (10)	VPSN-0303L					1	1	RH18-1.7P	1
7.5 (10)	08A□□□	18	08A□□□	15 (20)	VPSO-0503L					1	1	RH18-1.7P	1
11 (15)	11A□□□	25	11A□□□	15 (20)	VPSO-0503L					2	1	RH18-3P	1
15 (20)	15A□□□	35	15A□□□	25 (33)	VPSO-0803L	1	1	RH18-1.7P	1	3	1	RH18-5P	1
22 (30)	22A□□□	45	22A□□□	25 (33)	VPSO-0803L	3	1	RH18-5P	1	5	1	RH18-7P	1
30 (40)	30A□□□	60	30A□□□	40 (53)	VPSO-1303L	6	2	RH18-5P	2	8	2	RH18-7P	2
37 (50)	37A□□□	80	37A□□□	40 (53)	VPSO-1303L	8	2	RH18-7P	2	10	2	RH18-7P	2

*1 Combination of power unit, braking resistors, braking units and thermal relays depends on operating conditions or system configuration.

*2 J_L : Moment of load inertia (kg·cm², lb in·s²×10⁻¹)
J_M : Moment of motor inertia (kg·cm² lb in·s²×10⁻¹)

*3 Braking resistor is GRZG 600W, 30Ω (R007195) manufactured by Nippon Resistor Mfg. Co., Ltd.

*4 Braking unit is CDBR-2022 manufactured by Yaskawa.

*5 Thermal relay is manufactured by Yaskawa.

Table 3.2 Connector Cable for Detector (Provided by user)

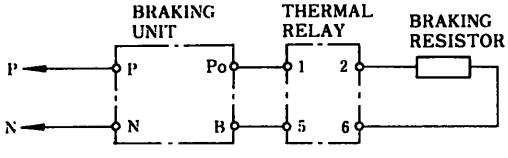
Receptacle	MS3102A20-29P
Plug	L type: MS3108B20-29S Straight: MS3106B20-29S
Cable Clamp	MS3057-12A
Cable	DP8409179

Note: Connector (1CN; 2CN) for servo driver is attached.

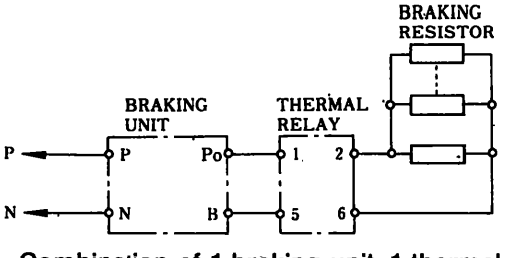
Table 3.3 750 r/min Series

Servomotor		Servo Driver		Power Unit*1		When $J_L \leq 2 \times J_M$ *2				When $J_L \leq 5 \times J_M$ *2			
Capacity kW(HP)	Model UAACKA-	Capacity kVA	Model CIMR-SVJ-	Capacity kW(HP)	Model	No. of Braking Resistors*3	No. of Braking Units*4	Thermal Relay*5 Model	Thermal Relay*5 Q'ty	No. of Braking Resistors*3	No. of Braking Units*4	Thermal Relay*5 Model	Thermal Relay*5 Q'ty
2.2 (3)	03A□□□	6	03L□□□	7.5 (10)	NPSA-0303L	Unnecessary				Unnecessary			
3.7 (5)	04A□□□	13	04L□□□	7.5 (10)	NPSA-0303L								
5.5 (7.5)	06A□□□	18	06L□□□	7.5 (10)	NPSA-0303L								
7.5 (10)	08A□□□	18	08L□□□	15 (20)	NPSO-0503L								
11 (15)	11A□□□	25	11L□□□	15 (20)	NPSO-0503L					1	1	RH18-1.7P	1
15 (20)	15A□□□	35	15L□□□	25 (33)	NPSO-0803L					1	1	RH18-1.7P	1
18.5 (25)	19A□□□	45	19L□□□	25 (33)	NPSO-0803L					2	1	RH18-3P	1

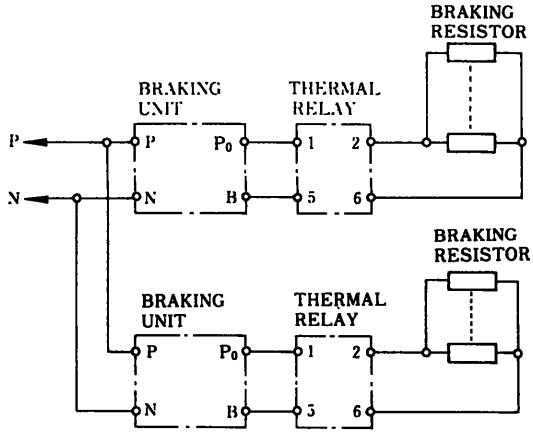
*1 Combination of power unit, braking resistors, braking units and thermal relays depends on operating conditions or system configuration.
*2 J_L : Moment of load inertia (kg·cm², lb in·s²×10⁻¹)
J_M : Moment of motor inertia (kg·cm², lb in·s²×10⁻¹)
*3 Braking resistor is GRZG 600W, 30Ω manufactured by Nippon Resistor Mfg. Co., Ltd.
*4 Braking unit is CDBR-2022 manufactured by Yaskawa.
*5 Thermal relay is manufactured by Yaskawa.



(a) Combination of 1 each braking unit, thermal relay and braking resistor.



(b) Combination of 1 braking unit, 1 thermal relay and 2 to 5 braking resistors.



(c) Combination of 2 braking units, 2 thermal relay and several braking resistors.

Fig. 3.1 Connection of Braking Resistors, Braking Units and Thermal Relays (for Standard Combinations)

4. FUNCTIONS

4.1 CONTROL FUNCTIONS

VS-866 can select a control mode according to use by constants (internal memory switch) or sequence input. See Table 4.1 and Fig. 4.1.

Table 4.1 Control Mode

Control Mode	Select signal		Description	Remarks
	TOCM *	TSEL †		
Speed Control I	OFF	Invalid	• Motor speed is controlled by speed reference. • Forward, reverse or particular torque limit can be referenced externally.	3 input references: • Speed reference • Forward torque limit • Reverse torque limit
Speed Control II	ON	Open	• Motor speed is controlled by speed reference. • Torque limit (same value for forward and reverse) is controlled externally.	2 input references: • Speed reference • Torque limit
Torque Control		Close	• Motor torque is controlled by torque reference. • Speed limit is referenced externally.	2 input references: • Torque reference • Speed limit

*1 TOCM is a memory switch (least-significant bit of select/set value Cn30). When TOCM is set at ON, the switching between speed control II and torque control by open/close of TSEL is possible during run.

*2 TSEL is sequence input (1CN-43).

Note:
1. Speed control I (TOCM:OFF) is pre-set at the factory. TOCM is operated on monitor panel.

2. In speed control (I, II) mode, operation without external torque limit (without torque limit reference) is available by selecting via memory switch.

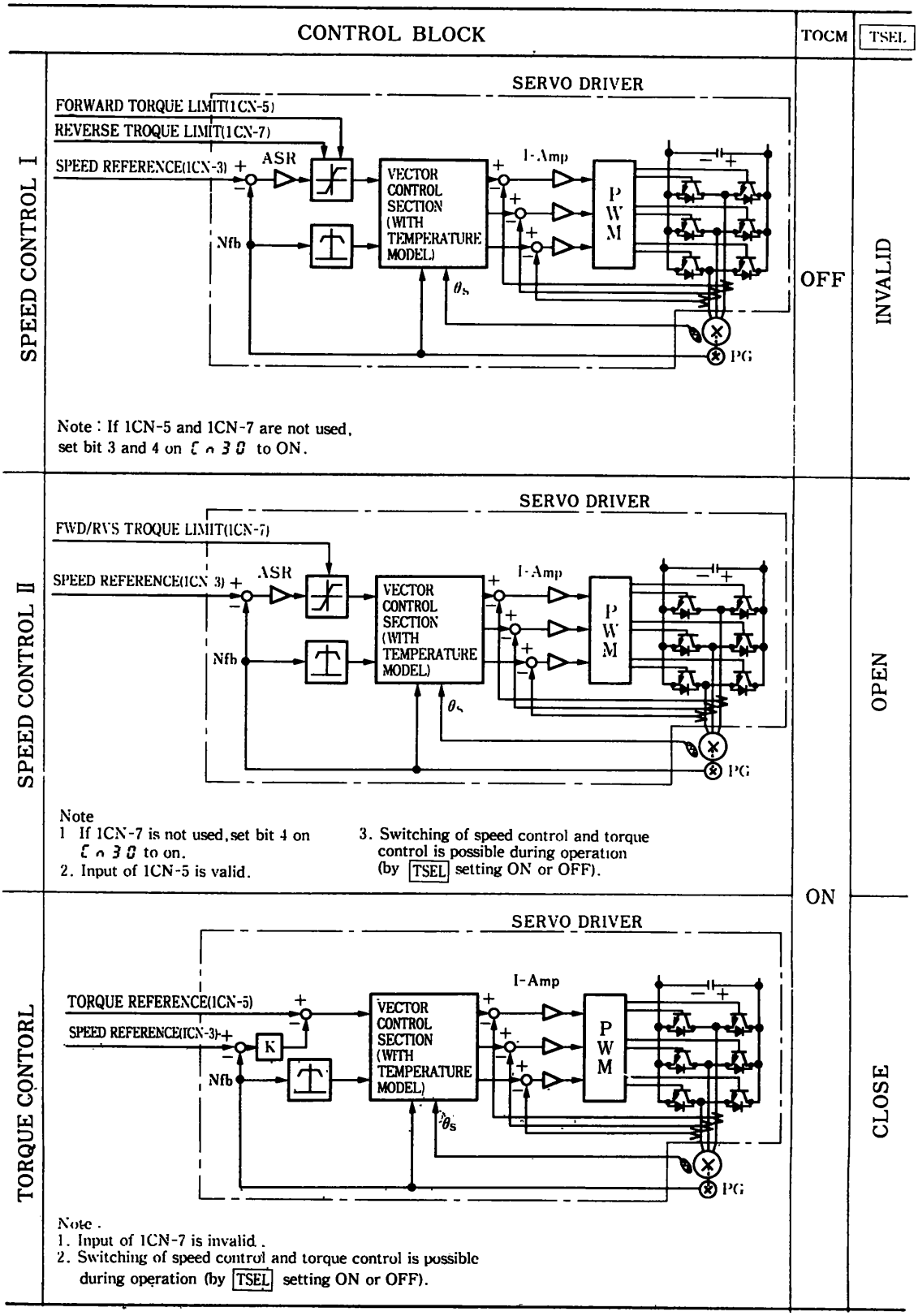


Fig 4 - 1 Control Function Block Diagram

4.2 STATUS MONITOR FUNCTIONS

Status monitor function (Table 4.2) is provided for various drive-run status functions. Keying on a monitor panel displays a desired status on LED.
(For details, refer to Sect. 9. MONITOR PANEL OPERATION.)

Table 4.2 Status Monitor Functions

Monitor Display	Abbreviation	Name	Unit	Resolution	Remarks
Un01	NREF	Speed reference	%	0.1	—
Un02	NFB	Speed feedback	r/min	1	—
Un03	TREF	Torque reference	%	0.1	—
Un04	TFB	Torque feedback	%	0.1	When high accuracy torque regulator is provided
Un05	TLF	Forward torque limit	%	0.1	Mortoring under forward running, Regeneration under reverse running
Un06	TLR	Reverse torque limit	%	0.1	Monitoring under reverse running, Regeneration under forward running
Un07	I2R	Secondary current reference	%	0.1	—
Un08	FLX	Magnetic flux reference	%	0.1	—
Un09	I1R	Primary current reference	%	0.1	—
Un10	SFR	Slip reference	%	0.1	—
Un11	F1R	Primary frequency reference	Hz	0.01	—
Un12	MTEMP	Motor temperature	℃	1	—
Un13	VPN	Main circuit DC voltage	V	0.1	—
Un14	STS	Status	HEX	-	See Table 9.3.
Un15	SFTNO1	Software No. 1	-	-	Main unit
Un16	SFTNO2	Software No. 2	-	-	Option
Un17	1ADD	CH1 AD data	HEX		7FFF/10V, 1CN-3 Input data
Un18	2ADD	CH2 AD data	HEX		7FFF/10V, 1CN-5 Input data
Un19	3ADD	CH3 AD data	HEX		7FFF/10V, 1CN-7 Input data

4.3 PROTECTIVE FUNCTIONS

4.3.1 Protective Functions for Servo Driver

If an failure occurs during operation, a protective function is actuated to protect the equipment and the system. The failure is displayed on the monitor panel and is notified by a sequence output signal. VS-866 divides failure into 3 levels. According to the level, protective operation is selected. See Table 4.3.

Table 4.3 Protective Functions for Servo Dirver

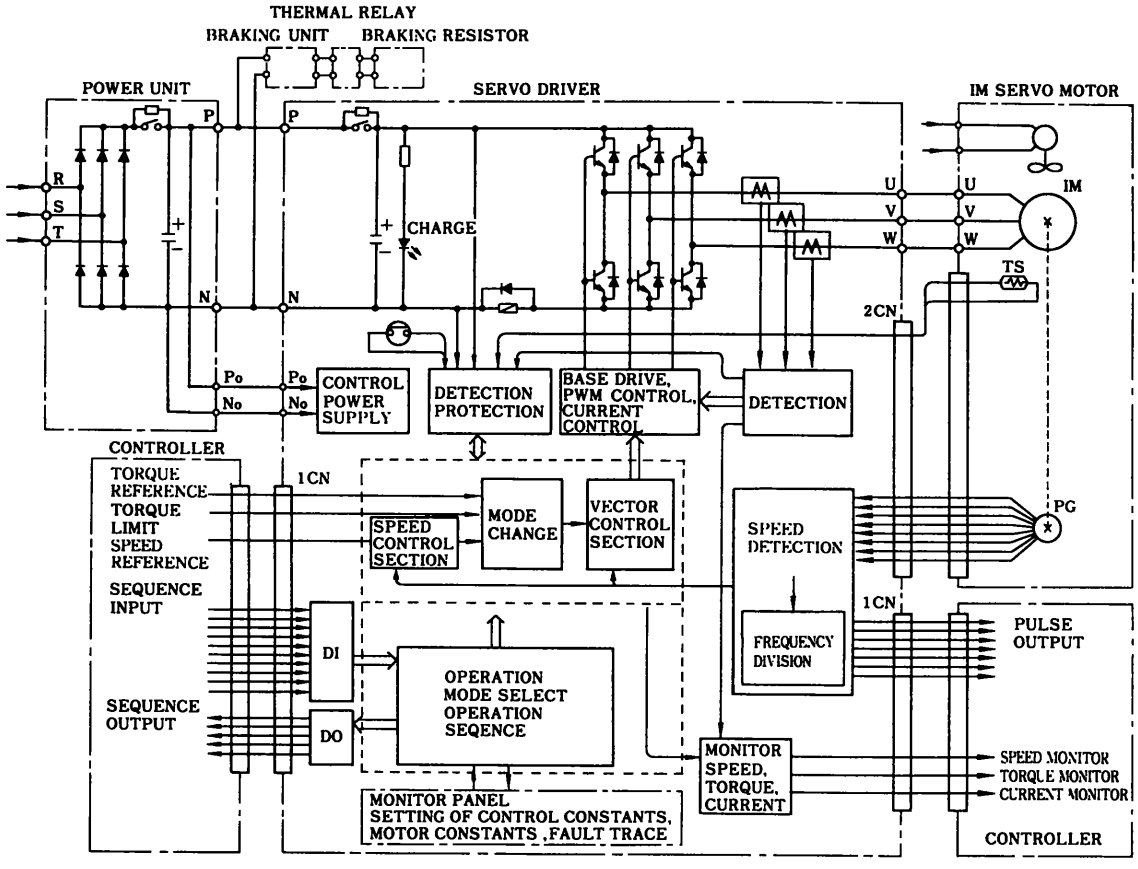
Failure Level		Protective Action	Monitor Panel Display	Sequence Output	Example
Low ↑	Alarm	Operation can be continued, however, error A or B may result. Stop the operation immediately and check for the cause.	Detail of an error such as: oLn (motor overloaded)	ALM; ON (1CN 28)	• Servo driver overload (oL1) • Motor overload (oLn) • ABS PG (pulse generator) error (rPS) • Overvoltage 1 (oL) • Overcurrent 1 (CLR)
	Trouble A	Makes an emergency stop automatically and cuts off the power after stopping. (Coasting after braking stop)	Detail of an error such as: oHn (motor overheat)	FLT; ON (1CN 29)	• Servo driver overheat (oH1) • Motor overheat (oHn) • Excessive speed (oS) • Thermistor open circuit (oHL) • Main circuit low voltage(PUU), etc.
↓ High	Trouble B	Current is cut off automatically. (Coasting immediately.)	Detail of an error such as: FU (fuse blown)	FLT; ON (1CN 29)	• Overcurrent 2 (oU) • Overvoltage 2 (oC) • Fuse blown (FU) • PG open circuit (PS) • Control circuit low voltage (CUU), etc.

Table 4.4 Protective Functions for Power Unit

Failure	Description	Contact	Status	Remarks
Fuse Blown	Unit fuse blown. Turn off the power.	5-6	ON (closed)	—
Overheat	Heat sink overheated. Stop operation.	3-4	ON (closed)	—
Magnetic Contactor Open	Magnetic contactor in unit is open. Stop operation.	1-2	OFF (open)	OFF before turning on the power. (Turned on after waiting approximately 0.3 second atfer turning on the power.)

5. CONFIGURATION

5.1 FUNCTION BLOCK DIAGRAM



Note : See par 10.3 "Wiring Example" for detailed connection

Fig. 5.1 Function Block Diagram

5.2 INTERNAL SEQUENCE BLOCK DIAGRAM (Figs. 5.2, 5.3)

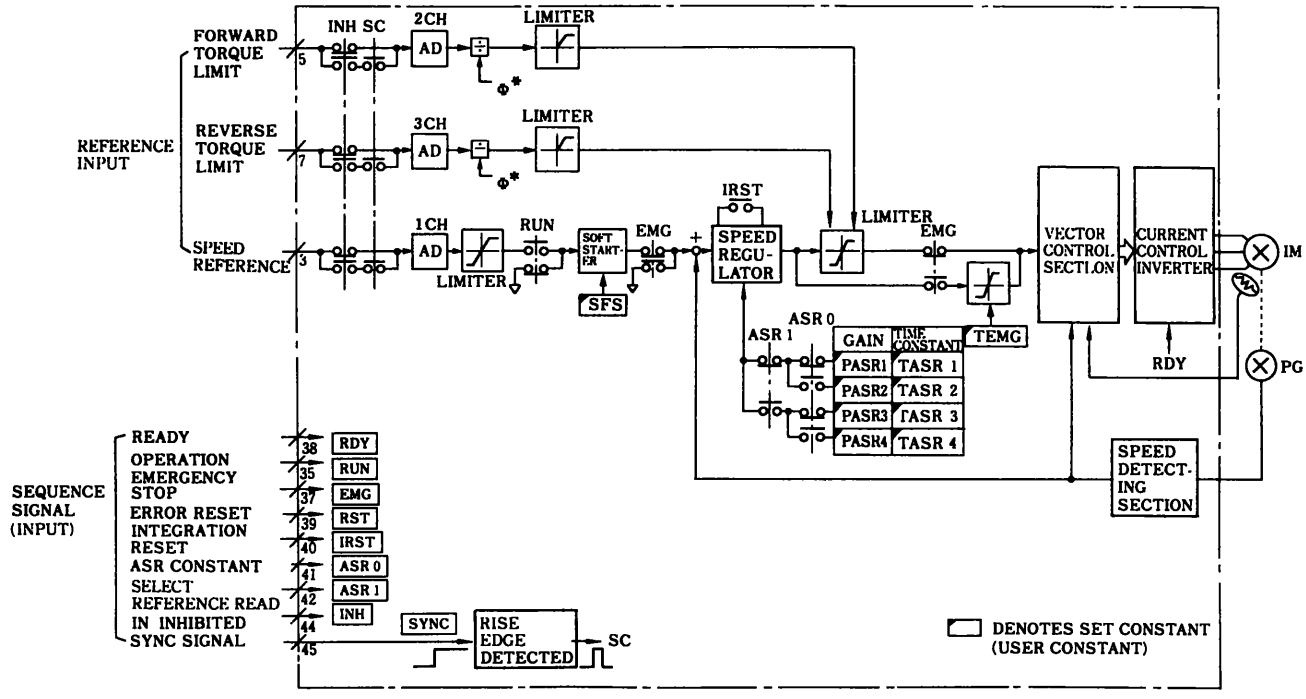
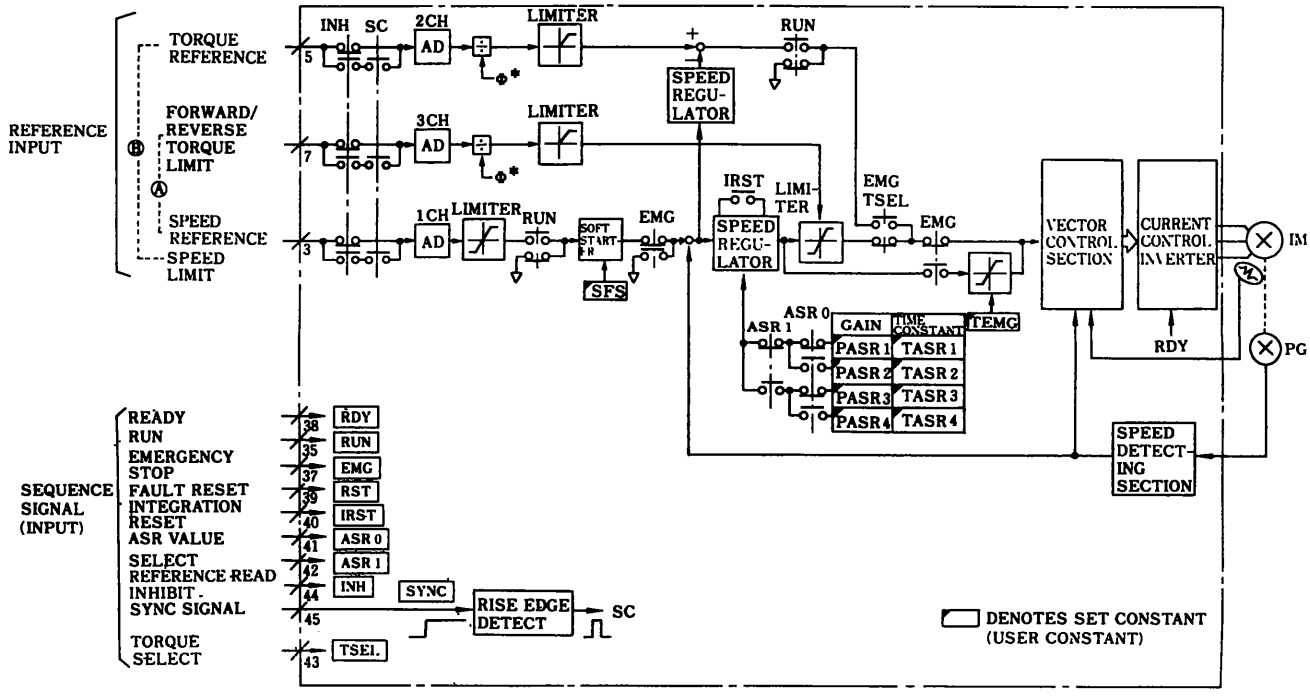


Fig. 5.2 Internal Sequence Block Diagram (Speed Control Ⅰ)



TSEL	Control mode	Reference input 1CN-3	1CN-5	1CN-7
ON	Torque control	Speed limit	Torque Reference	Invalid
OFF	Speed control	Speed Reference	Invalid	Torque limit

Note: For reference input, only two inputs are effective by sequence signal " torque select " (TSEL).

Fig. 5.3 Internal Sequence Block Diagrgram (Speed Control Ⅱ, Torque Control)

6. CONTROL SIGNALS

6.1 SEQUENCE INPUT SIGNALS (1 CN 35 TO 46)

(1) Design the input signals, taking the following into consideration.
The relay ratings must be 30V or more and 20mA or more when a relay contact is used.
The signals delay roughly 1msec by the filter in the level conversion circuit of the input section.

(2) Fig. 6.1 shows the input circuit and Table 6.1 shows signal description.

(3) The ON/OFF states of the input signals can be checked by LED indication (Fig. 6.2) on the monitor panel. Refer to Par. 9, "MONITOR PANEL OPERATION."

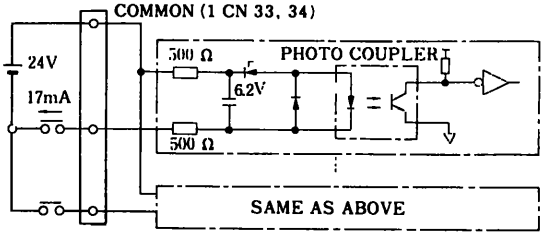


Fig. 6.1 Input Interface Circuit (Sequence Input)

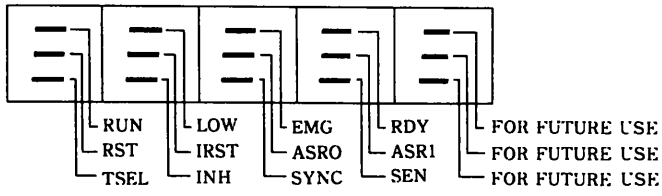


Fig. 6.2 Monitor Panel Displays (Sequence Input)

Table 6.1 Sequence Input Signals (1CN)

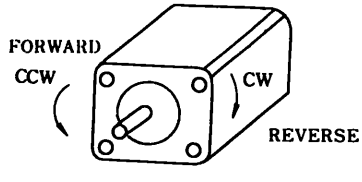
Signal Name	Pin Number	On Signal	Description
Ready RDY	38	Close	• An excitation current flows to motor if RDY is switched on. In about 0.5sec, a magnetic flux is established. (Preparations to start operation have been finished.) • The motor is freed if RDY is switched off during operation. (Motor current is cut off by the base block of the power transistor in the main circuit.) • Operation cannot be resumed unless RUN is switched off after switching off RDY
Run RUN	35	Close	• The motor control state (SERVO ON) sets up by switching on RUN. Operation matching the reference starts. • Switch on RDY. Wait more than 0.5sec and switch on RUN. (Approximately 0.5sec is needed to establish a magnetic flux.) • During speed control: The motor rotates counterclockwise* (CCW) by FWD-run reference voltage, and it rotates clockwise* (CW) by RVS-run reference voltage. • During torque control mode: The motor generates torque in a counterclockwise* (CCW) by FWD-run reference voltage, and it generates torque in a clockwise* (CW) by RVS-run reference voltage. *Viewed from the load side 

Table 6.1 Sequence Input Signals (1CN) (Cont'd)

<table>
<tr><th>Signal Name</th><th>Pin Number</th><th>On Signal</th><th>Description</th></tr>
<tr><td>Run
RUN
(Cont'd)</td><td>35</td><td>Close
</td><td>• Switch off RUN during operation to set the motor to:
(a) Operation ready state after deceleration and stopping. (Speed control mode)
(b) The motor generated torque becomes zero and assumes an operation ready state after stopping. (Torque control mode)</td></tr>
<tr><td>Emer-gency Stop
EMG</td><td>37</td><td>Open
</td><td>• When switching off EMG during operation, the motor stops in an emergency.
• The motor braking torque (%) becomes the set value (Cn-17) if EMG is switched off. (100% is preset at the factory.)
• Switch off RUN temporarily and switch on RUN again to resume operation after switching off EMG. (Interlock is operating.)</td></tr>
<tr><td>ASR Select
ASR0
ASR1</td><td>41
42</td><td>Close
</td><td>• Proportional gain and integration time of the speed controller (ASR) can be selected from four combinations of ON and OFF of ARS0 and ASR1
<table>
<tr><th rowspan="2"></th><th colspan="2">Input Signal</th><th colspan="2">ASR Constant</th></tr>
<tr><th>ASR0 (41)</th><th>ASR1 (42)</th><th>Proportional gain</th><th>Integral time</th></tr>
<tr><td>1</td><td>Open</td><td>Open</td><td>PASR1 (Cn04)</td><td>TASR1 (Cn05)</td></tr>
<tr><td>2</td><td>Close</td><td>Open</td><td>PASR2 (Cn06)</td><td>TASR2 (Cn07)</td></tr>
<tr><td>3</td><td>Open</td><td>Close</td><td>PASR3 (Cn08)</td><td>TASR3 (Cn09)</td></tr>
<tr><td>4</td><td>Close</td><td>Close</td><td>PASR4 (Cn10)</td><td>TASR4 (Cn11)</td></tr>
</table>
• ASR constants can be changed only if RUN is switched off and the revolution speed is zero. (Constants cannot be changed during operation.)</td></tr>
<tr><td>ASR Integ-ration Reset
IRST</td><td>40</td><td>Close
</td><td>• Reset the integration value of the speed controller (ASR) to 0. The reset time is discharged by the time constant of the integration time.
• The speed control becomes P control if operated with IRST switched on
• Remaining under non-operation status for a long period, the motor can be prevented from rotating by the reference drift, etc. (at no load torque)</td></tr>
</table>

Table 6.1 Sequence Input Signals (1CN) (Cont'd)

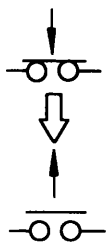
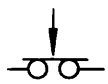
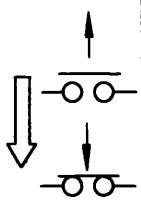
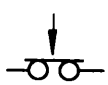
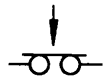
Signal Name	Pin Number	On Signal	Description
Error Reset RST	39	Close → Open 	• If RST is switched on and off, memory of fault (FLT) and alarm (ALM) is reset. (Resetting is performed by the leading edge signal of RST. • If fault (FLT) operates, reset it after removing the cause for the fault. • Alarm (ALM) can be reset even during operation. • Fault (FLT) can be reset only if RUN is switched off. • The fault can be reset when momentary type pushbutton is depressed and then released.
Reference Read Inhibit INH	44	Close 	• Switch on INH to prohibit reading of reference input and to hold the value immediately before. If SYNC is switched off and then on, the value at this time is read. (Refer to par. 8(3).) • Use INH in combination with SYNC only timing for reference switch is specially required. • Reference input cannot be accepted if INH is switched on. Be sure to switch it off at all times.
Synchronizing Signal SYNC	45	Open→ Close 	• Use SYNC and INH together only when reference change timing is specially required. • Switch SYNC off and then on again to synchronize scans of internal arithmetic operations of the servo driver by this timing. (Synchronization of scans) • Switch SYNC off and then on again while INH is switched on, and reference input is read only once simultaneously with synchronization of scans. (b) Switch it on normally.
Torque Control Select TSEL	43	Close 	• Becomes effective only if the internal memory switch TOCM (least significant bit of Cn30) is 1. • Switch on TSEL to set up the torque control mode, controlling the motor shaft torque in accordance with the torque reference. • Switch off TSEL to set up the Speed Control II mode, controlling the motor shaft revolution speed in accordance with the speed reference. (See the sequence block diagram in par. 5.2.) • By using INH and SYNC in combination, speed control and torque control can be switched at any timing during operation. (Refer to par. 8(3).) • The control mode can be switched only by switching TSEL off and than on again.

Table 6.1 Sequence Input Signals (1CN) (Cont'd)

Signal Name	Pin Number	On Signal	Description
Sensor ON SEN Note: Valid for absolute encoder	46	Close 	• Switch on SEN while RDY is switched off to read absolute value date from PG (refer to par. 6.5.2) and to start normal operation. • Effective only if the absolute value encoder is used. • Normally must be switched on. • Becomes ineffective if RDY is switched on. (Disregarded during operation.)
Low Speed Select LOW (Option)	36	Close 	• This signal is used when the winding change unit (option) is installed and is operated. • Switch LOW on when RDY is switched off and the motor is stopped to select low-speed winding. • Changes are not made during motor revolution or if RDY is switched on.

6.2 REFERENCE INPUT SIGNALS (1CN 3 TO 8)

Design reference input signals (analog voltage references) taking the following conditions into consideration.

(1) Use twisted pair shielded wire for input signals and securely connect the shielded wire to pin 50 of 1CN.

(2) The maximum rating of input signals is ±15V. Design the system so that this voltage is not exceeded under any conditions.

(3) The input impedance is 10kΩ.

(4) Fig. 6.3 and Table 6.2 show the input circuit and signal description.

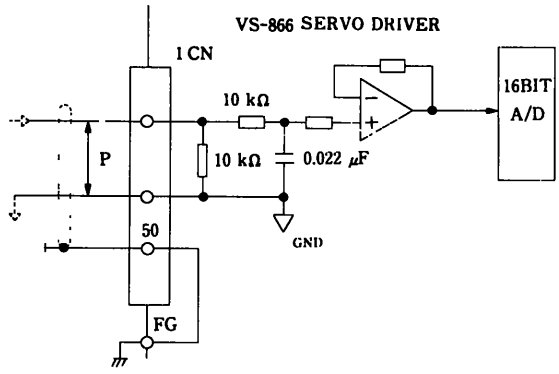


Fig. 6.3 Input Interface Circuit (Command Input)

Table 6.2 Input Reference Signals (1CN) (Cont'd)

Signal Name	Pin Number	Description
Speed Reference NREF or Speed Limit NLIM	3-4 (4;GND)	• The rated input voltage is ±6V DC or ±10V DC. Select 6 or 10V by SELCD2 (Cn30). (The voltage was preset to 6V at the factory prior to shipment.) • The allowable input voltage is ±15V DC. Limited by 105% (6.3V) if the 6V controller is selected. Limited by 100% (10.0V) if the 10V controller is selected. • The input impedance is 10kΩ. • A speed reference is given if the speed control mode is selected. The reference voltage and motor speed have the following relationship.

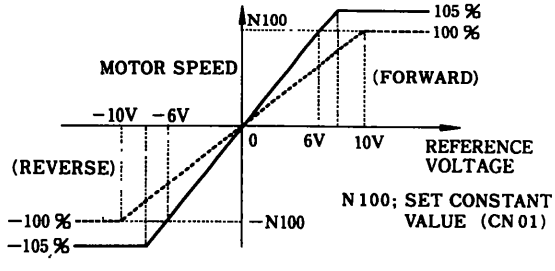
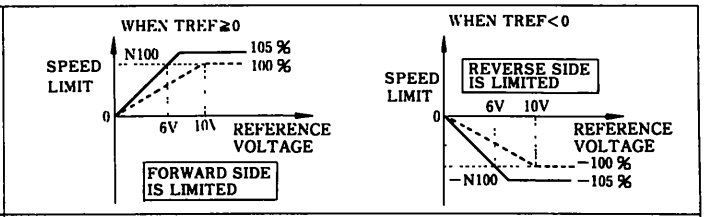


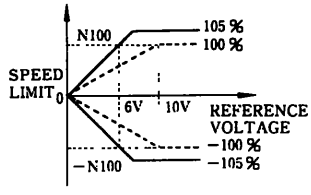
Table 6.2 Input Reference Signals (1CN) (Cont'd)

Signal Name	Pin Number	Description
Speed Reference NREF or Speed Limit NLIM (Cont'd)	3-4 (4;GND)	• Speed limit applies if the torque control mode is set. The relationship between the reference voltage and limit value is as follows.

One side Limit (Standard)



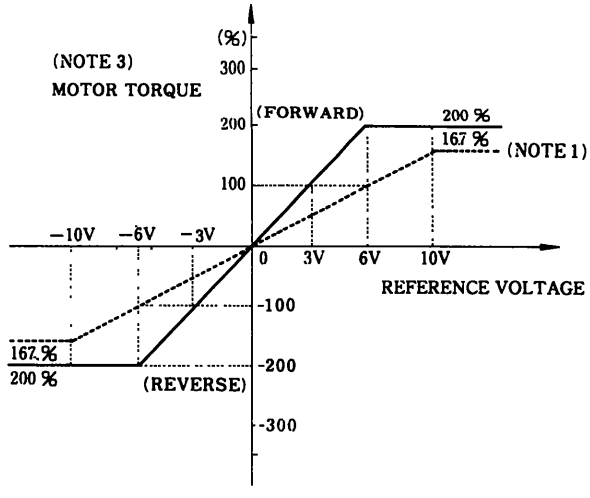
Both side Limit



Both forward and reverse directions are limited.

- NREF and NLIM become effective if the operation signal RUN is switched on.
- One-side (same polarity as torque reference) or both-side limit can be selected for speed limit NLIM. Select by SELCD2 (Cn30). One-side limit is preset at the factory prior to shipment.

Torque Reference TREF or Forward Torque Limit PTQL	5-6 (6;GND)	• Torque reference applies during operation in the torque control mode operation. The relationship between the reference voltage and motor torque is shown below.



Note:
1. Gain selection between 100%/3V and 100%/6V can be set by SELCD2 (Cn30). (100%/3V is preset at the factory prior to shipment.)
2. The rated motor torque is 100%.

Table 6.2 Input Reference Signals (1CN) (Cont'd)

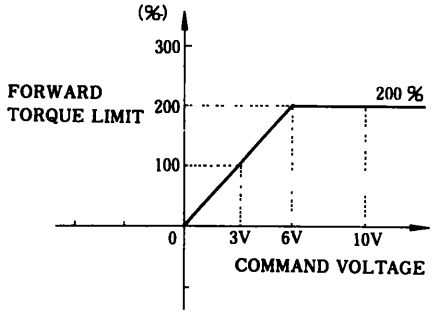
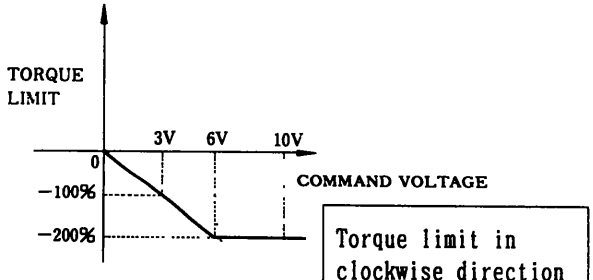
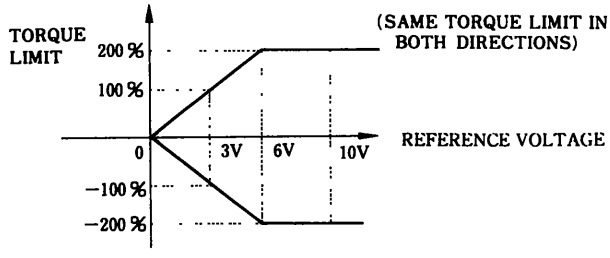
Signal Name	Pin Number	Description
Torque Reference TREF or Forward Torque Limit PTQL (Cont'd)	5-6 (6;GND)	• In operation in the speed control mode I, forward-side torque limit applies. The relationship between the reference voltage and torque limit value is as follows. The limit applies to the set torque.  Torque limit in counterclockwise direction viewed from load side. Note: 1. Negative voltages are regarded as zero voltages. 2. No-use selection of torque limit references is possible in accordance with the selection of SELCD2 (Cn30). • This input becomes ineffective if operation is in the speed control mode II.
Reverse Torque Limit NTQL or Both Side Torque Limit ATQL	7-8 (8;GND)	• In operation in the speed control mode I, reverse-side torque limit applies. The relationship between the reference voltage and torque limit value is as follows.  Torque limit in clockwise direction viewed from load side. Note: 1. Negative voltages are regarded as zero voltages. 2. No-use selection of torque limit references is possible in accordance with the selection of SELCD2 (Cn30).

Table 6.2 Input Reference Signals (1CN) (Cont'd)

Signal Name	Pin Number	Description
Reverse Torque Limit NTQL or Both Side Torque Limit ATQL (Cont'd)	7-8 (8;GND)	• Both-direction torque limit sets if operation is in the speed control mode II. The relationship between the reference voltage and torque limit value is as follows.  Note: 1. Negative voltages are regarded as zero voltages. 2. No-use selection of both-direction torque limit is possible by SELCD2 (Cn30).

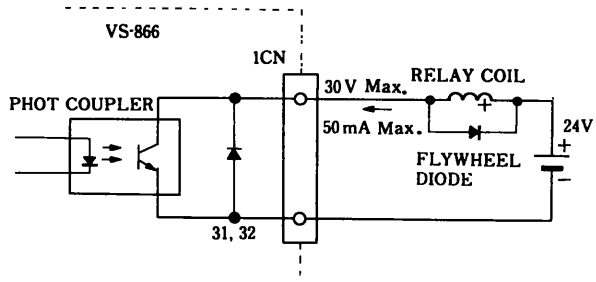
6.3 SEQUENCE OUTPUT SIGNALS

(1) Use the output signals under the following conditions.
- The output circuit uses a photo coupler. The capacity is 24V DC 50mA.
- Be sure to connect a flywheel diode parallel to the coil when switching an inductive load such as an external relay on and off. (Connect with the correct polarities.)
- Connect a protective resistor in series to the load due to current limit the load is a capacitive load.

(2) Fig. 6.4 and Table 6.3 show the output circuit and signal description.

(3) Output signal on/off state can be checked by LED indication on the monitor panel (see Fig. 6.5). Refer to par. 9 for the operating method.

(4) After the power is turned on, it takes approximately 1 second maximum until sequence output signal operates normally. When the power is turned on, it takes approximately 1 second maximum (200 to 300 ms) for initial set of servo driver.



Note that all photo coupler emitters are commoned (1CN 31, 32).

Fig. 6.4 Output Interface Circuit

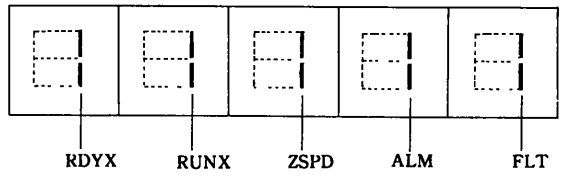


Fig. 6.5 Monitor Panel Display

Table 6.3 Sequence Output Signals (1CN)

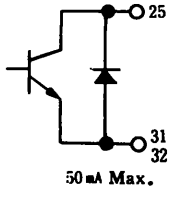
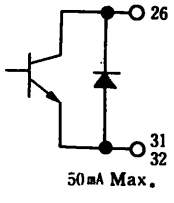
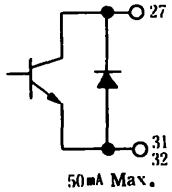
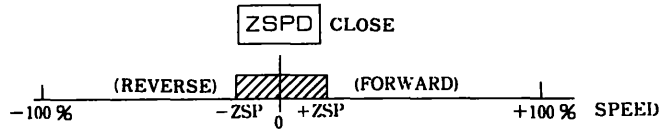
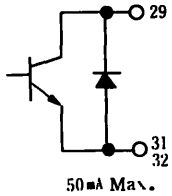
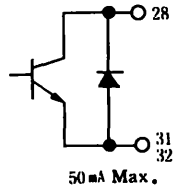
Signal Name	Pin No.	Description
Ready RDYX		• Switches on when the servo driver is ready to be operated. • Switches off if trouble occurs with the driver. Does not switch off on the alarm level. • An excitation current flows to the motor if RDYX is switched on. • RDYX does not switch off by input of the EMG reference.
Run RUNX		• Switches on during servo operation. (Servo on) • Operates when the RUN reference is switched on. Operation condition continues until the speed slows below the zero-speed level by switching off the RUN reference. • Switches off if the driver is faulty, if the RDY reference is switched off, or if the EMG reference is switched on.

Table 6.3 Sequence output Signals (1CN) (Cont'd)

Signal Name	Pin No.	Description
Zero Speed ZSPD		• Switches on if the motor speed becomes lower than the set value (Cn13 ZSP). • Holds for 50msec or more, once operated. 
Trouble FLT		• FLT is output simultaneously and the motor rapidly decelerates and stops or makes coasting stop if an overcurrent or overload protection function operates. • Reset FLT by inputting RST after removing the trouble cause. • Switch off the RUN input and then switch on to resume operation after a stop by FLT
Alarm ALM		• An alarm is output on the level before trouble occurs, trouble prevention operation such as current limit is performed, and ALM is output simultaneously with detection of an alarm. • Input RST after removing the trouble cause before resetting ALM

6.4 MONITORING ANALOG OUTPUT SIGNALS

Use monitoring analog output signals under conditions as shown in Table 6.4.

Table 6.4 Monitoring Analog Output Signals

<table>
<tr><th>Signal Name</th><th>Output Signal Level</th><th>Description</th></tr>
<tr><td>Speed Monitor

NMONI

1CN 19-20
(20:GND)</td><td>±6V/±100%

±10V max.

Load impedance 2kΩ min.</td><td>• The motor speed can be monitored by connecting a voltmeter externally.
• Connect a voltmeter of the following specifications when connecting to the voltmeter for speedometer.
• Outputs by 12-bit DA converter.
<table><tr><th></th><th>Specifications</th></tr><tr><td>Type</td><td>Voltmeter</td></tr><tr><td>Operating principle</td><td>Moving coil type</td></tr><tr><td>Rated current</td><td>1mA</td></tr><tr><td>Class</td><td>2.5 or higher</td></tr></table>• Output is performed every sampling time of 2msec.</td></tr>
<tr><td>Torque Monitor
TMONI

1CN 21-22
(22:GND)</td><td>±10V max.

±3V/100%

2kΩ min.</td><td>• Motor torque can be monitored by connecting a voltmeter externally.
• The voltmeter specifications are the same as those for the speed monitor above.
• Output is performed every sampling time of 2sec.
• Outputs by 12-bit DA converter.</td></tr>
<tr><td>Current Monitor
IMONI

1CN 48-49
(49:GND)</td><td>±5V/100%

Servo driver rating

2kΩ min.</td><td>• The voltmeter specifications are the same as those for the speed monitor above.
• Motor current (3-phase) detect signal is output at 3-phase full-wave rectified.</td></tr>
</table>

Note: Analog output for monitor is a control signal Therefore, the cable should be separated from main circuit cables and other power cables and as short as possible (20 meters or below for shielded cables). If the cable is extended, be sure to insulate by using isolator.

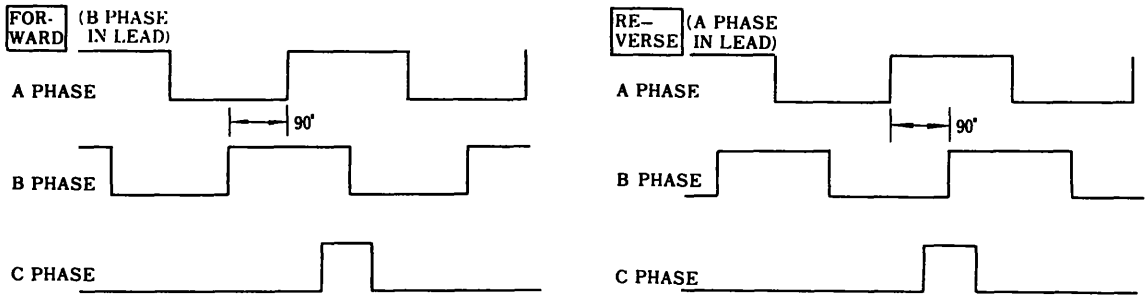
6.5 ENCODER (PG) PULSE OUTPUT CIRCUIT (PAO, *PAO, PBO, *PBO, PCO, *PCO)

6.5.1 Incremental Encoder (Standard)

Phases A, B and C (original point) signals for PG (6000 pulses/rev) are output. Use these signals as positioning signals. The output signal specifications are as follows.

(1) Signal form and output phase

- 2-phase (A, B) pulse with 90° pulse difference
- Original point pulse (phase C)



Note: Phase C is synchronized with phase A.

Fig. 6.6

(2) Pulse resolution

The PG outputs 6000 pulses/rev. The pulse frequency can be further divided into 1/N (N=1 to 32) or 2/N (N=2 to 32), by using the divider in the servo driver. The phase relation is the same in (1), above.

The dividing ratio must be able to divide the pulses of the pulse generator. Table 6.7 shows dividing ratio and the number of pulses to be set after dividing. Setting is performed by user constant (Cn 18).

Table 6.5 PG Frequency Dividing Ratio and Numbers of Output Pulses

Frequency Dividing Ratio	Output Pulses after Dividing	Frequency Dividing Ratio	Output Pulses after Dividing
1/1	6000 pulses/rev	1/8	750 pulses/rev
2/3	4000 pulses/rev	1/10	600 pulses/rev
1/2	3000 pulses/rev	1/12	500 pulses/rev
2/5	2400 pulses/rev	2/25	480 pulses/rev
1/3	2000 pulses/rev	1/15	400 pulses/rev
1/4	1500 pulses/rev	1/16	375 pulses/rev
1/5	1200 pulses/rev	1/20	300 pulses/rev
1/6	1000 pulses/rev	1/24	250 pulses/rev
2/15	800 pulses/rev	1/25	240 pulses/rev
		1/30	200 pulses/rev

6.5.1 Incremental Encoder (Standard)(Cont'd)

(1) Output circuit and receiver circuit.

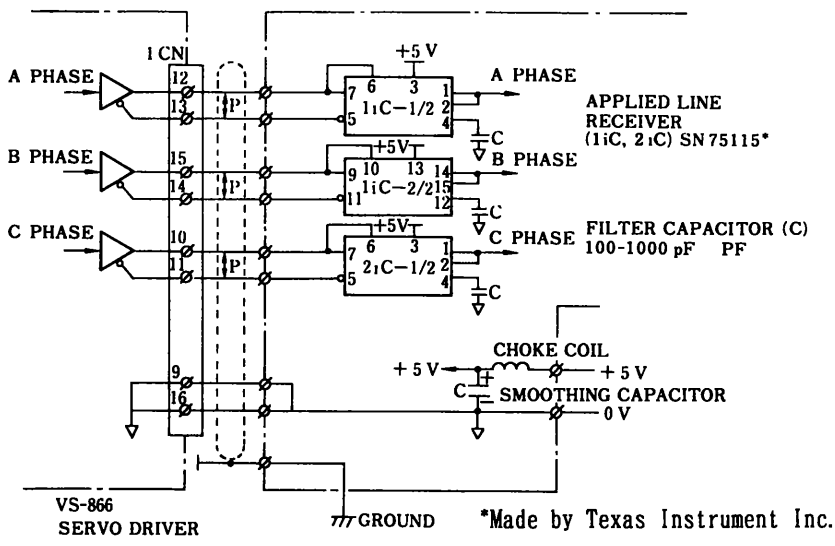


Fig. 6.7 Output Circuit and Receiver Circuit

6.5.2 Absolute Encoder

(1) Pulse output configuration

Fig. 6.1 shows the configuration of the absolute encoder pulse output circuit.

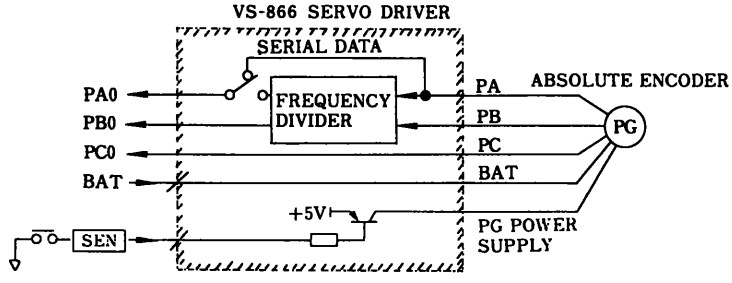


Fig. 6.8 Absolute Encoder Pulse Output

When SEN signal is input (closed contact), absolute data are first output from PA0 as serial data, then as initial incremental pulse PA0, PB0 (2-phase pules with 90-degree phase difference). After this, output operation similar to normal incremental encoder (2-phase pulse with 90-degree phase difference) is performed.

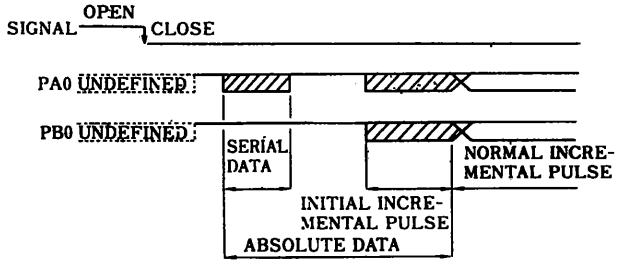


Fig. 6.9 Absolute Data Output

(2) Absolute data contents

• Serial data:

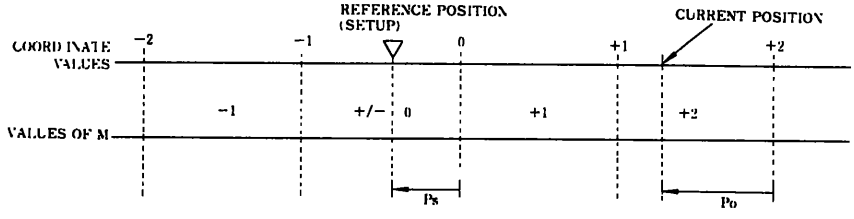
Indicates the position of the motor shaft (in terms of revolutions) from the reference position (value set at setup time).

• Initial incremental pulse:

Pulse is output at the same pulse speed as rotation is made at about 2747 rpm from the motor shaft origin position to the current motor shaft position.

Assuming that the serial data value is M (revolutions), the initial incremental pulse count value is Po (pulses), and the number of output pulses per revolution of the motor axis (depending on divider circuit setting) is R (pulses/rev) and initlal incremental pulse at reference position is Ps(pulse), the current position P can be found by the expression:

$$P_M = M \times R + P_O - P_S$$



P_E : Current value read-out from encoder

M : Multirevolution data

P_O : Initial incremental pulses read-out from encoder (Normally, negative value)

P_S : Initial incremental pulses read-out at setup point (Normally, negative value.)

P_M : Current value required in system

R : Number of pulses per encoder revolution (32768 pulses for this encoder)

$$P_F = M \times R + P_O$$

$$P_M = P_E - P_S$$

(3) Receiver circuit

Fig. 6.10 shows an example of an absolute encoder output processing circuit.

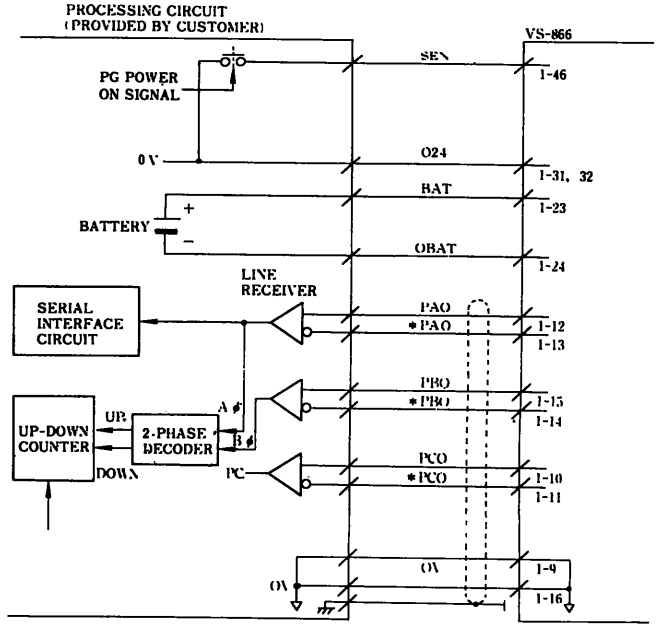


Fig. 6.10 Example of Output Processing Cricuit.

6.5.2 Absolute Encoder (Cont'd)

(4) Absolute data reception

Process absolute data in the following sequence:

Condition: sequence input [RDY] is open.

[SEN] signal is not accepted when [RDY] is closed.

① Switch on the [SEN] signal.

② After 100 ms, set serial data reception-waiting-state.

③ Clear the up-down counter for count incremental pulses.

④ Receive serial data of 8 bytes.

⑤ Normal incremental operation state is entered in approximate 50 ms after the last serial data is received.

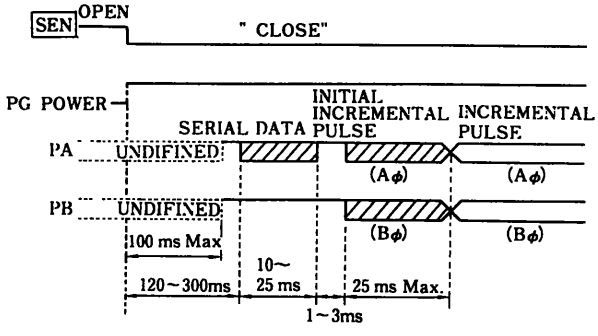


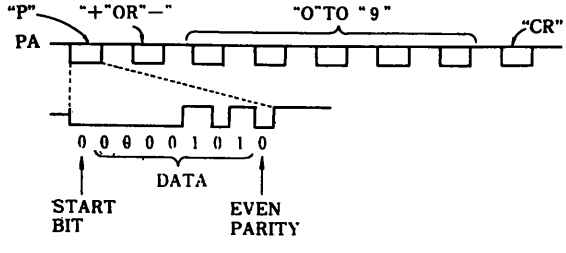
Fig. 6.11 Receive Processing of Absolute Data.

Cautions for [SEN] signal:

1. The [SEN] signal is part of the sequence input signals.
   Power is supplied to PG when the signal is switched on.
   Once the [SEN] signal is received, the [SEN] or [RDY] signal is not accepted(disregarded) until sending of the serial data initial incremental pulse is finished.
2. The [SEN] signal is not accepted if the encoder is in normal operation and the controller is operated. (The [SEN] signal is switched on to off or vice versa only during base blocking such as [RDY] switched off.)

(5) Serial data specifications

Transmission Mode	Asynchronous(ASYNC)
Baud Rate	9600 baud
Start Bit	1 bit
Stop Bit	1 bit
Parity	Even
Character Code	ASCII 7 bits
Data Format	8 characters: (P)(+/-)(0 to 9)×5-digit (CR)



① Serial data of 8 bytes (8 characters) is sent.

Format: P±XXXXX CR

Carriage Return Code

Digit from 0 to 9

② The serial data displays the number of revolutions from the reference point (set at setup time).

③ Zero rotation is represented by either P+00000 (CR) or P-00000 (CR).

④ For ±99999 revolutions or more, a correct value is not output.

(6) Incremental pulse

Initial incremental pulse giving absolute data and normal incremental pulse are output through the frequency divider. The frequency divider is set by using CN18.

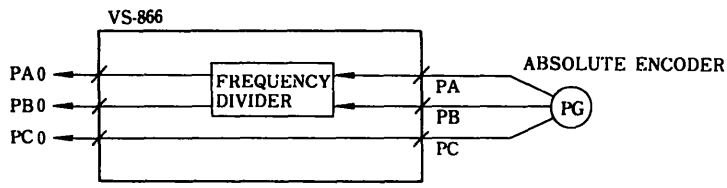
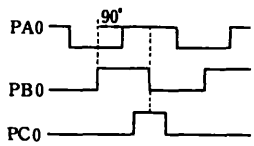


Fig. 6.12 Incremental Pulses

① Output Phase

• For foward running.



• For reverse running.

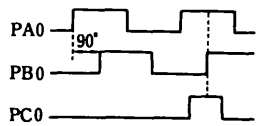
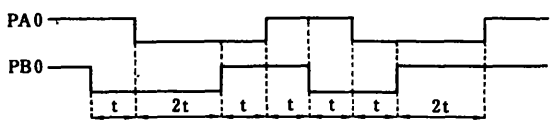


Fig. 6.13 Forward/Reverse Output Phase

PC0 (origin pulse) synchronizes with PA0, but the pulse width becomes narrow because PC0 is not divided. If the dividing ratio is not 1/2n, accurate 90-degree phase difference is not made and the pulses are output as shown in Fig. 6.14:



(The phase difference t, 2t part equally exists within one revolution, thus the minimum position error results.)

Fig. 6.14 Freguency Dividing Ratio and Output Phase Difference

6.5.2 Absolute Encoder (Cont'd)

② Frequency dividing setting

According to a required resolution, set the user constant (CN18PGRAT) to the number of pulses (N).

$$\text{Frequency dividing ratio} = \frac{\text{Number of pulses (N)}}{8192}$$

* Output frequency is N pulses/rotation.

(7) Absolute value encoder specification

Table 6.6 and Fig. 6.15 show the main specifications and block diagrams of the absolute-value encoder. The detection data are transmitted by combining serial data and two-phase pulses and are interfaced with the same number of signal lines as those of the incremental encoder.

Table 6.6 Main Specifications of Absolute Encoder

Type	Pulse code with battery backup. (Battery voltage 2.8-4.5V)
Number of Pulses	8192 basic pulses/rev (× 4)
Maximum Speed	±99999 rev
Data Transmission	Start up: serial data + initial incremental pulse
	Steady: incremental pulse, same as incremental encoder
Recommended Battery	Lithium cell ER6C made by Toshiba Battery

Note: The absolute-value encoder battery has to be replaced periodically. A battery is estimated to have a life of 10 years. Refer to (9) in par. 6.5.2 for the method to replace the battery.

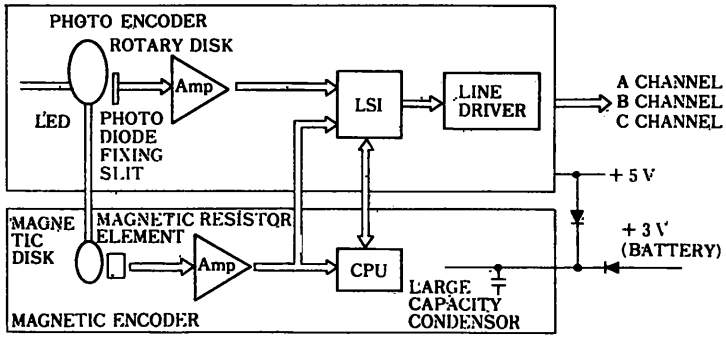


Fig. 6.15 Block Diagram of Absolute Encoder

(8) Setup method :

If revolution data is to be set to 0 at motor test run or the absolute encoder is not connected to the battery for more than four days, the following setup is required:(In the latter case, the internal elements may not operate normally because the encoder capacitor is discharged.) Perform the setup in numerical sequence. If this is not done, trouble may occur.

• How to set up (A)

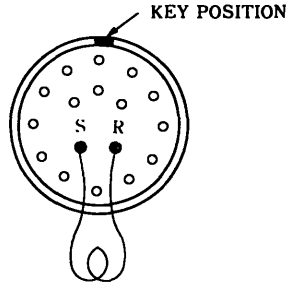
① Turn off VS-866 input power supply. Make sure the monitor panel display has disappeared.

② Remove PG cable between the encoder and control device.

③ Short circuit across R and S pins of the encoder connector for 2 minutes or more to discharge the encoder capacitor charge.

④ Wire the cable normally connect the battery to the encoder.

⑤ Turn on the control device, output [SEN] signal and perform absolute data reception. If absolute error " APS " is displayed on the monitor panel, start again from ①.



• How to set up (B)

① Turn off VS-866 input power supply.

② As shown in Fig. 6.16, remove 2CN of control device and short circuit across PG cable by the control device connector for 2 minutes or more.

④ to ⑤ Same as (A).

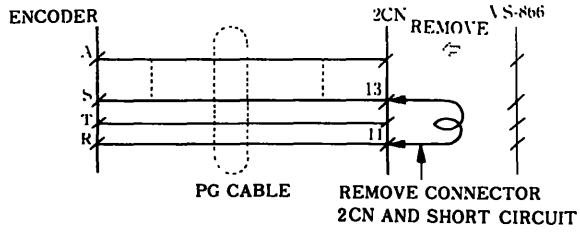


Fig. 6.16 How to Set up by PG Cable

(9) How to replace battery :

Follow the procedures below to replace the battery (prepared by user) for absolute encoder. A lithium cell ER6C has a life of approximately 10 years.

① Turn on the servo driver, close [SEN] signal and wait for more than 3 minutes. Keep [RDY] closed. The encoder capacitor will be charged.

② Replace the battery. The servo driver may be left on or off.

Thus the battery can be replaced without destroying rotation data of the encoder.

〔The encoder functions properly for 4 days after performing① (without battery).〕

(10) Battery module

The absolute encoder has to detect motor rotation even when power supply is off. The encoder is backed-up by a large capacitor ; however, it should be backed-up by a battery as well. Therefore, the battery module (JEPMC-2010) with a lithium cell, voltage drop detection circuit, LED for voltage drop information, and I/O function are prepared.

The battery module checks the battery voltage at 5V power supply on and detects the alarm of voltage drop according to the absolute encoder specification.

When the battery module detects the alarm, the encoder externally outputs an alarm signal as I/O signal and lights the alarm LED on the module.

After alarm detection, replace the battery within 3 weeks.

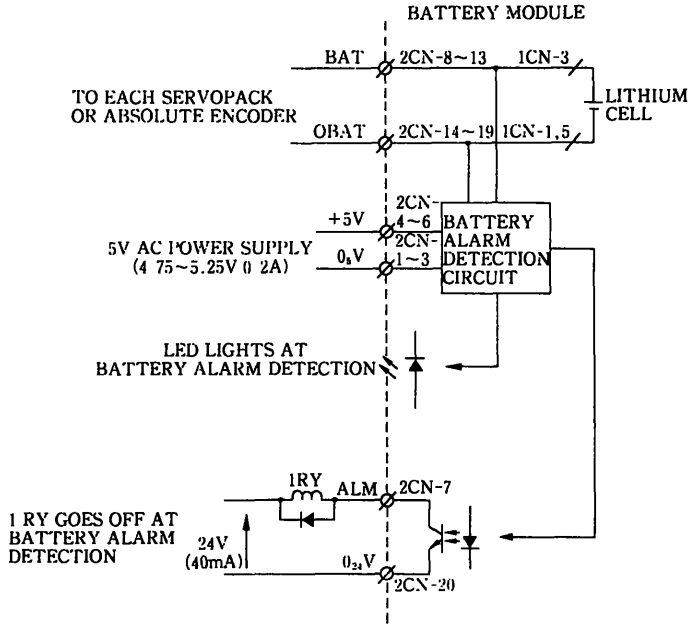


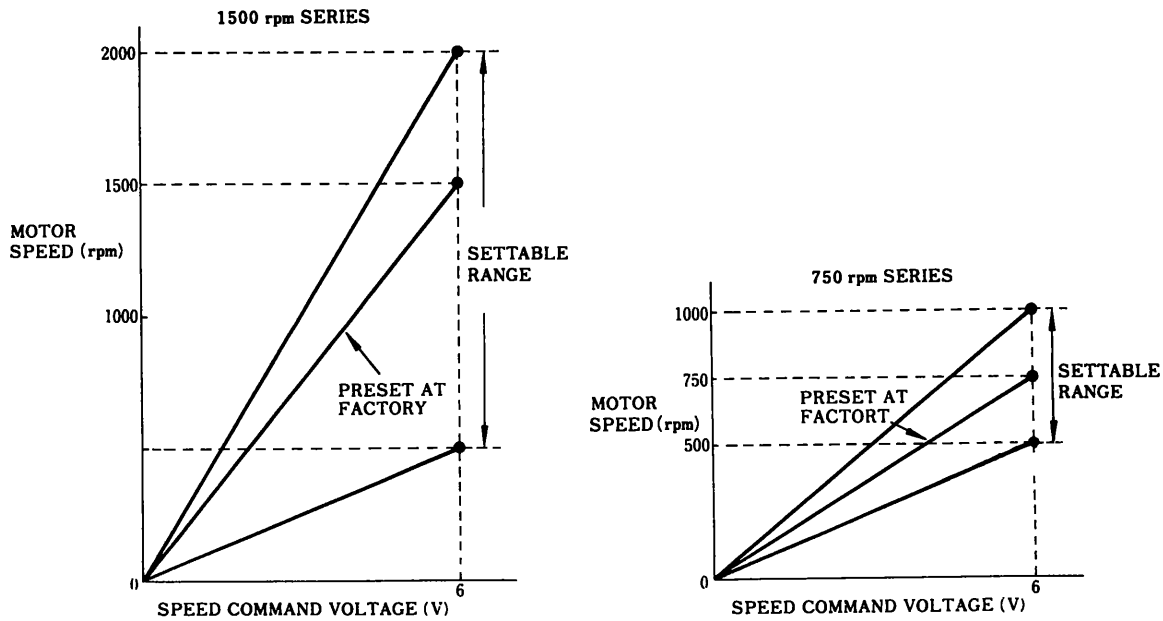
Fig 6.17 Battery Module Signal Circuitry

7. USER CONSTANTS

VS-866 (servo driver) has the following user constants allowing settings and changes in accordance with the system. Use these constants after understanding the in meanings.
Setting and changes can be performed on the monitor panel. (Refer to sect. 9. "MONITOR PANEL OPERATION.")

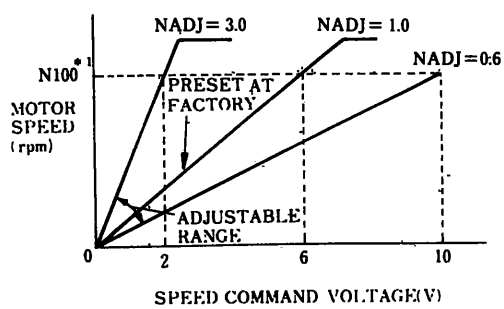
(1) Rated speed: C n 0 1 (N100). "Cn" is the abbreviation of Constant Number.

- Set the motor speed when the speed reference voltage (1CN between 3 and 4) is 6V. *
  * 10V can be selected by setting a select/set constant.
- The settable range is 500 to 2000 rpm for the 1500 rpm series and 500 to 1000 rpm for the 750 rpm series.
- 1500 and 750 rpm are preset for the 1500 and 750 rpm series at the factory prior to shipment.



(2) Speed reference adjustment gain: C n 0 2 (NADJ)

- This is a adjustment constant of the motor spped. The adjustable range is 0.6000 to 3.0000.
- For position control, the set value is larger, the position loop gain is higher.
- 1.0 is preset at the factory prior to shipment.



*N100: Set value of Cn01 (rpm)

(3) Speed zero adjustment: Cn03 (NOFS)

- This constant is for speed reference offset voltage adjustment. Adjust in accordance with sect. 11, "TEST RUN."
- The adjustable range is -0.9 to +0.9V. (Set value: F488 to BB8)
- 0 has been preset at the factory prior to shipment.

(4) Speed controller constant: Cn04 to Cn11 (PASR1, TASR1, ···, PASR4, TASR4)

- Constants for the proportional gain (PASR) and integration time (TASR) for the speed controller (proportion-integration operation).
- Four sets of proportional gains and integration constants are preset in VS-866. Select an optimal setting by the sequence signals ASR0 (1CN-41) and ASR1 (1CN-42) in accordance with the load specifications. Table 7.1 shows the criteria for selection of the speed controller constants.

Table 7.1 Speed Controller Constants

	Speed Controller Constant Select Signal		Speed Controller Constant *2	
J_L/J_M *1	ASR0(1CN-41)	ASR1(1CN-42)	Proportional gain	Integral time
0.5 to 2.0	Open	Open	PASR1; Cn04(20)	TASR1; Cn05(50msec)
2.0 to 4.0	Closed	Open	PASR2; Cn06(40)	TASR2; Cn07(50msec)
4.0 to 7.0	Open	Closed	PASR3; Cn08(60)	TASR3; Cn09(50msec)
7.0 or more	Closed	Closed	PASR4; Cn10(110)	TASR4; Cn11(50msec)

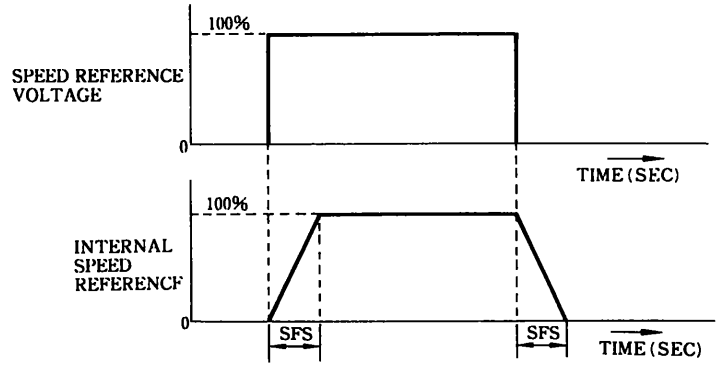
*1 J_L Moment of load inertia (kg • cm², lb • in • s² × 10^{-3})
J_M Moment of motor inertia (kg • cm², lb • in • s² × 10^{-3})
*2 Factory set value in (parentheses.)

- Switch off ASR0 and ASR1 and set Cn04 at 10 if GD^2_L = 0 when operating the motor without a load (J_L = 0).
- Settings of the constants can be changed using the monitor panel.
- The adaptability increases as the proportional gain becomes higher. However, if the proportional gain is too high, overspeed results and response becomes unstable.
  The system becomes more stabilized as the integration time constant becomes longer, even though the response to load disturbance may delay the integration time.

(5) Soft starter time: Cn12 (SFS)

- This is the time setting until the internal speed reference reaches from 0 rpm to the rated speed or vice versa.
- The settable range is 0.000 to 10.000sec; 0.000sec has been preset at the factory prior to shipment.
- Set to 0.000 during position control.

7. USER CONSTANTS (Cont'd)



(6) Zero-speed level: Cn13 (ZSP)

- This is the set constant for the motor zero-speed decision level. (The set value is set by % for rated speed Cn01.)
- If the motor speed (feedback value) falls below this set value, the sequence output ZSPD switches on (1CN between 27 and 31: conducted).
- Note that coasting may be caused if the motor speed falls below this set value in an emergency stop.
- The settable range is 0.0 to 20.0% and 2.0% has been preset at the factory prior to shipment.

(7) Speed monitor adjustment gain: Cn14 (SMADJ)

- This is the adjustment gain constant of the speed monitor (1CN 19-20) output voltage.
- The adjustable range is 0.9 to 1.1. 1.0 has been preset at the factory prior to shipment.
- If the set value is 1.0, ±6V/±rated speed (+ for forward revolutions, - for reverse revolutions) will result.

(8) Torque meter adjustment gain: Cn15 (TMADJ)

- This is the adjustment gain constant of the torque monitor (1CN 21-22) output voltage.
- The adjustable range is 0.9 to 1.1. 1.0 has been preset at the factory.
- If the set value is 1.0, ±3V/± rated torque (+ for forward side and - for reverse side) will result.

(9) J_L : Cn16 (GD^2)

- Setting is not necessary.

(10) Emergency stop torque: Cn17 (TEMG)

- Braking torque in an emergency stop is set. (The set value is % of the motor rated torque.)
- Braking is performed in accordance with this set torque to stop the machine if sequence input EMG (1CN 37-31) is switched off or if the emergency stop mode activates due to a power failure or for other reasons.
- The settable range is 0 to 350%. However, recommended setting is 100 to 200%.
- 100% is preset at the factory prior to shipment.

(11) PG dividing ratio: Cn18 (PGRAT)

- Detected pulses (Pulses A and B) from the PG (pulse generator) are divided by the dividing ratio set in this section and are output to 1CN 12 to 14.
- The set values are different for the incremental encoder (standard) and absolute value encoder (optional).

Incremental encoder

Dividing ratio 1/N : Set the value of N. (N: 1 to 32)

Dividing ratio 2/N : Set "2" in the highest digit and set the value of N. (N:2 to 32)

Example: 1/5 division. Set value 00005

2/5 division. Set value 20005

Absolute value encoder

Dividing ratio N/8192: Set the value of N. (N:2 to 8192)

(12) Voltage adjustment: Cn19 (VADJ)

- This is the constant needed to make fine adjustment of the excitation current of the motor to be coupled and to adjust to the required voltage (no-load voltage).
- Set in accordance with sect.11, "TEST RUN."
- The settable range is 0.8 to 1.2. 1.0 is preset at the factory prior to shipment.

(13) Ambient temperature: Cn20 (TEMP)

- The servo motor ambient temperature is set. Do not attempt to adjust except ultra precision torque control.
- The settable range is -10 to +60℃. 20℃ is preset at the factory prior to shipment.

(14) ASR output filter: Cn21 (DTL)

- This is the filter constant of the speed controller output.
- Used only if there is excessive play in the mechanical system and the proportional gain of the speed controller cannot be increased to a high value.
- Normally set to 1.0msec.
- The settable range is 1.0 to 20.0msec. 1.0msec is preset at the factory prior to shipment.

(15) Forward-side torque limit: Cn22 (TLF)

- This is the limit value for motor forward revolution torque.
- Other torque limit of 200% is set internally. If set higher than 200%, the limit value will be 200 %.
- The settable range is 0.0 to 350.0%. 350.0% is preset at the factory prior to shipment.

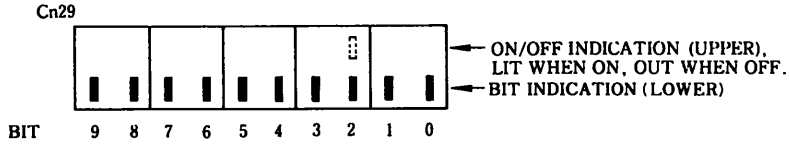
(16) Reverse-side torque limit: Cn23 (TLR)

- This is the limit value for motor reverse revolution torque.
- Other torque limit of 200% is set internally. If set higher than 200%, the limit value will be 200%.
- The settable range is 0.0 to 350.0%. 350.0% is preset at the factory prior to shipment.

7. USER CONSTANTS (Cont'd)

(17) Selecting/setting constant 1: Cn29 (SELCD1)

• This constant selects and sets the operation mode. (Bit setting)



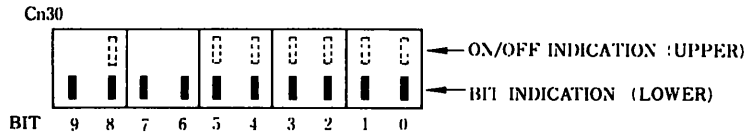
[ ]:Standard factory-adjusted setting

Bit	Abbreviation	Name	Setting	
			OFF	ON
0	SETRW	Setting-constant setting	Setting/reference disable	Setting/reference enable
1	OTSEL	Overtravel selecting	Without overtravel	With overtrevel
2	LOCL/REM	Local/Remote	Remote (External reference)	Local (Monitor panel)
3	NLIMREV	Speed limit polarity	Plus voltage valid	Minus voltage invalid
4	PTQLREV	Forward torque limit polarity	Plus voltage valid	Minus voltage invalid
5	TLQSEL	Output during torque limit	Disable	Enable
6	UCNSEL	Constant change during operation	Disable	Enable
7	PREF	RS-232C communication mode selection	—	Do not set to ON.
8	PASOCN1		—	
9	PASOCN2		—	

Note: See par. 8 "SYSTEM DESIGN PRECAUTIONS" for details and operating method.

(18) Selecting/setting constant 2: Cn30 (SELCD2)

• This constant selects the control mode, reference input level and others. (Bit setting)



□ :Standard factory-adjusted setting

Bit	Abbreviation	Name	Setting	
			OFF	ON
0	TQCM	Torque control mode	Setting/reference disable	Setting/reference enable
1	SPDSEL	Speed reference voltage	6V/100%	10V/100%
2	TRQSEL	Torque reference voltage	3V/100%	6V/100%
3	2CH-AD	1CN-5 input	Enable	Disable
4	3CH-AD	1CN-7 input	Enable	Disable
5	DLMT	Speed limit function	Single side	Both side
6	FNFSEL	Field forcing	Enable	Do not set to ON.
7	IPPI	–	–	
8	REVSEL	Rotating-direction selecting	Clockwise rotation* at FWD-run reference pulses	Counterclockwise rotation at FWD-run reference pulses
9	PGNEG	PG disconnection detection	Enable	Disable

*When viewed from the drive end

Note: See par.8 "SYSTEM DESIGN PRECAUTIONS" for details and operating method.

8. SYSTEM DESIGN PRECAUTIONS

Pay attention to the following items when designing the operation sequence of VS-866.

(1) Set up a sequence that will switch off the magnetic contactor (MC) on the input side of the power unit if the thermal relay for protection of the braking resistors trips. (To prevent burning of braking resistors.)

(2) The motor sets to a coasting state if [RDY] is switched off during operation.
Note: Braking stop in the event of a power failure:
Operate the sequential power (24 VDC) back-up and delay release relay so that [RDY] does not switch off more than 1sec, after a power failure. If [RDY] switches off before stopping, the motor sets to a coasting stop at this time.

(3) Dispersion of reference and mode switching timing
The dispersions of timing at which the internal value of VS-866 actually changes to fluctuations of the external reference voltage (speed and torque references) or control mode select input TSEL are less than 2msec. Eliminate select time dispersions as follows if dispersions are not desiredbecause of special applications.
Step 1 : Switch on [INH]. (Reference reading will be prohibited.)
Step 2 : Change the reference voltage or [TSEL].
Step 3 : Switch on [SYNC] and then switch it off again.
Step 4 : Reset [INH] to off.
By switching the reference and control modes by these steps, the reference is read within 2msec after switching on [SYNC] and dispersions of select timing can be eliminated almost entirely.

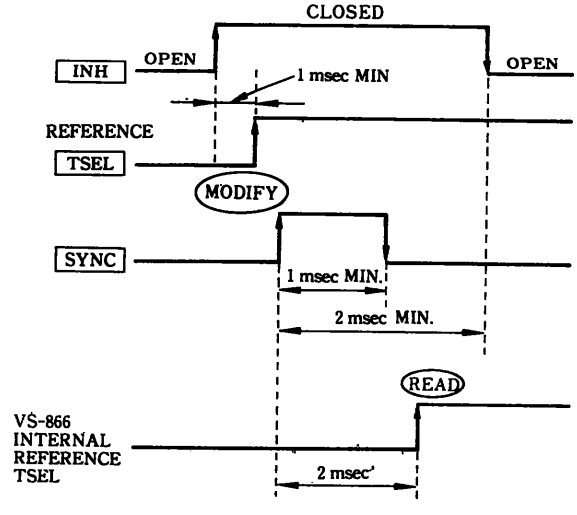
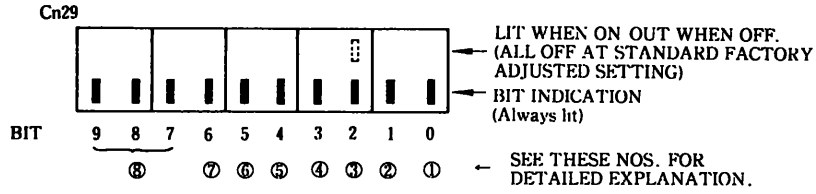


Fig. 8.1 Time Chart

(4) Selecting/Setting constant 1: Cn29 (SELCD1)



① Bit 0: SETRW [ ] : Standard factory-adjusted setting

OFF	Setting-constant setting/reference enable
ON	Setting-constant setting/reference disable

↑
Set to ON when setting-constant (Cn31 to Cn50) setting is changed.
Normally, do not attempt to adjust.

② Bit 1: OTSEL (Usable for P-ROM No. NSJ000110 and beyond)

OFF	Without overtravel (P-OT, N-OT)
ON	With overtravel

↑
Set to ON when forward/reverse running inhibit (P-OT/N-OT) by external sequence input is used. Open the P-OT/N-OT. For details, see the following "Forward/reverse Running Inhibit (P-OT/N-OT) Control Mode."

Note: The functions INH (reference input stop) and LOW (constant-speed winding selection) are not performed. For detailed, see "Forward/reverse Running Inhibit (P-OT/N-OT)" on the next page.

	Cn29 Bit 1	
	OFF	ON
1CN-44	INH	P-OT
1CN-36	LOW	N-OT

8. SYSTEM DESIGN PRECAUTIONS (Cont'd)

• Forward/reverse Running Inhibit (P-OT/N-OT)

Control Mode: Speed Control I or II

These modes are used when linear operation is not required to advance beyond a position.

<Setting> Set bit 1 on Cn29 to ON.

<Result> The functions of sequence input [INH] and [LOW] (1CN-44, 36) are changed as follows.

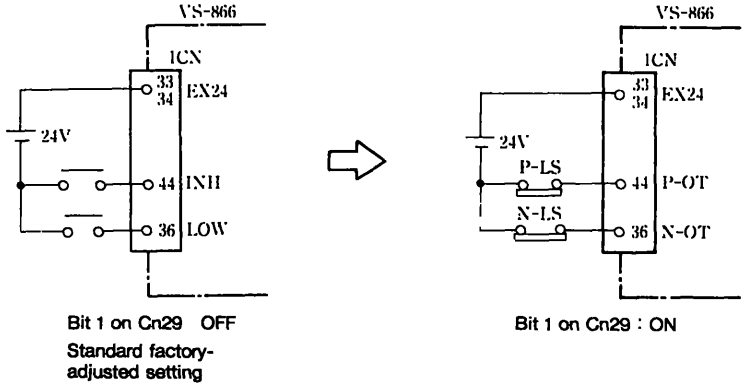


Fig. 8.2 Circuit Diagram of 1CN-44 and-36

- Forward-running inhibit at P-LS opening, and reverse-running inhibit at N-LS opening.
- At P-LS or N-LS opening, VS-866 stops after deceleration. The braking torque is normal torque limit value (external torque limit reference or internal torque limit setting value).
- At P-LS opening: FWD-run reference not accepted.
  RVS-run reference accepted.
  At N-LS opening: FWD-run reference accepted.
  RVS-run reference not accepted.
  At both openings: Zero-speed control is executed without regard to reference voltage.

Note:

1. The forward (reverse) run means counterclockwise (clockwise) rotation when viewed from the drive end without regard to ON/OFF of bit 8 on Cn30.
2. These modes are also effective at torque control. The braking torque at P-LS and N-LS opening is fixed (200%) and not changed in this status.

③ Bit 2: LOCL/REM

OFF	Remote (External reference operation) selection
ON	Local (Monitor panel operation) selection

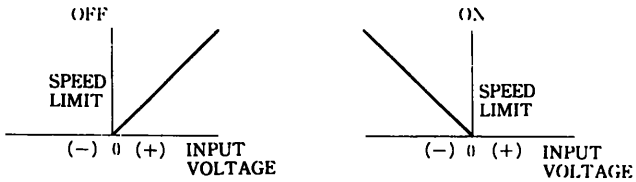
↑
Set to ON when the motor is run at monitor panel operation during test run, etc. Speed reference and RUN/STOP operation can be input from monitor panel.

Note: Be sure to close the external sequence input [RDY] and [EMG], because these inputs are effective even with local mode selection.

④ Bit 3: NLIMREV (Usable for P-ROM No. NS J000110 and beyond)

OFF	Speed limit input, plus voltage valid
ON	Speed limit input, minus voltage valid

↑
Set to ON when speed limit input voltage is used at minus voltage during torque control.



Note: This setting is invalid for speed control.

⑤ Bit 4: PTQLREV (Usable for P-ROM No. NSJ000110 and beyond)

OFF	Forward-side torque limit input, minus voltage valid
ON	Forward-side torque limit input, plus voltage valid

⑥ Bit 5: TLQSEL (Usable for P-ROM No. NSJ000110 and beyond)

OFF	Sequence output able during torque limit
ON	Sequence output disable during torque limit

↑
Set to ON when sequence output signal is required during torque limit.

The sequence output (1CN-30) is turned on while torque is limited by external torque limit input or internal torque limit setting value (Cn22, Cn23).

Note: When this bit is turned on, the content of 1CN-30 signal is changed.

	Bit 5	
	OFF	ON
1CN-30	HI/LO	TLQSEL

↑
Switching answer signal
for using winding switch unit (option)

⑦ Bit 6: UCNSEL (Usable for P-ROM No. NSJ000110 and beyond)

OFF	User constant can be changed during operation
ON	User constant can not be changed during operation

↑
Set to ON when positioning loop gain (Kp) is adjusted by using Cn02 at test-run of positioning control. The constant can be changed even during motor operation.

Note: After adjusting, be sure to turn it OFF.
Do not change other constants during motor operation.
For details, see the following "Adjusting of Positioning Loop Gain (kp) "

8. SYSTEM DESIGN PRECAUTIONS (Cont'd)

• Adjusting of Positioning Loop Gain (kp)

This adjustment is performed for the most suitable positioning control by combining positioning unit (e.g. position pack).

Adjusting constant	User constant Cn20 (NADJ)
Adjusting method	Adjust in combination with servomotor and driven machine.

(a) Connect oscilloscope or scale scope to the 1CN 19㊐-20㊍ of Servo driver or check terminal [SM] – [GND] of control card. (speed monitor)

(b) After turning on the START signal of positioning unit, operates the motor and monitors speed monitor waveform.

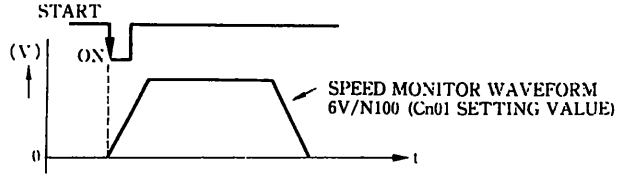
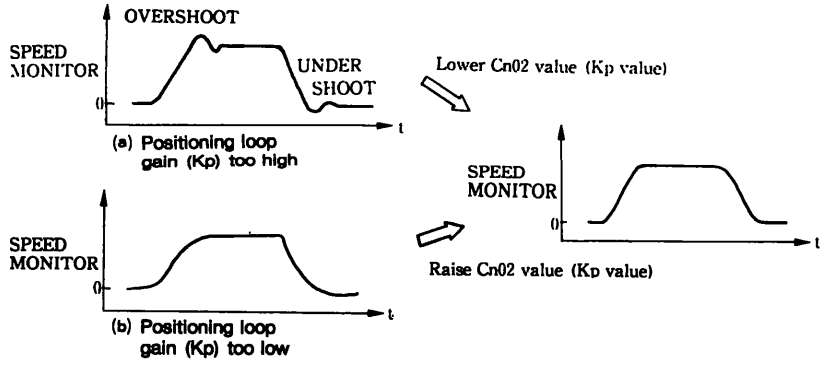


Fig. 8.3 Speed Monitor Waveform

(c) The standard factory-adjusted setting of Cn02 is 1.0000 and the adjustable range is 0.6000 to 3.0000.

If the leading edge or trailing edge in speed monitor waveform overshoot or undershoot, lower the setting value of user constant Cn02 (NADJ).



Note: Cn02 value can be changed only when the sequence input [RUN] is opening. However, for P-ROM No. NSJ000110 and beyond, Cn02 value can also be changed during operation by turning on bit 6 of Cn29.

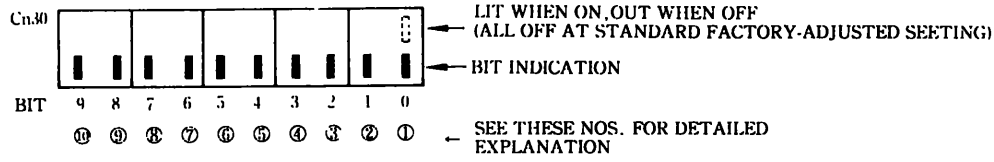
Fig. 8.4 Speed Monitor Waveform

⑧ Bits 7 to 9: PREF, PASOCN1, PASOCN 2

These bits are used to select RS-232C communication mode for delivery inspection. Do not tamper with these bits.

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(5) Selecting/setting constant 2: Cn30 (SELCD 2)



① Bit 0: TQCM [ ]: Standard factory-adjusted setting

OFF	Speed control I
ON	Torque control, Speed control II

↑
Set to ON when torque control is used (including switching speed control and torque control during operation).

② Bit 1: SPDSEL

OFF	6V/rated speed
ON	10V/rated speed

↑
Set to ON when speed-reference voltage level is required: 10V/rated speed.

③ Bit 2: TQRSEL

OFF	6V/rated speed
ON	10V/rated speed

↑
Set to ON when torque-reference voltage level is required: 6V/rated torque.

④ Bit 3: 2CH-AD (Usable only for speed control I)

OFF	Forward torque limit input is not used.
ON	Forward torque limit input is used.

↑
• At speed control:
Set to ON when forward torque limit input is not used (not connected) in speed control. Internal torque limit is 200%. If it is set at 200% or below, set limit value (%) to Cn22.

• At torque control:
Torque reference is acceptted without regard to ON/OFF of this bit.

8. SYSTEM DESIGN PRECAUTIONS (Cont'd)

⑤ Bit 4: 3CH-AD (Usable for speed control I and II)

OFF	Reverse torque limit, RVS/FWD torque limit input is used.
ON	Reverse torque limit, RVS/FWD torque limit input is not used.

↑

- At speed control I:

  Set to ON when reverse torque limit is not used. The internal torque limit is 200%. If it is set at 200% or below, set limit value (%) to $C\cap23$.

- At speed control II:

  Set to ON when RVS/FWD torque limit is not used. The internal torque limit is 200%. If it is set at 200% or below, set forward torque limit to $C\cap22$ and reverse and reverse torque limit to $C\cap23$

⑥ Bit 5: DLMT (at speed control)

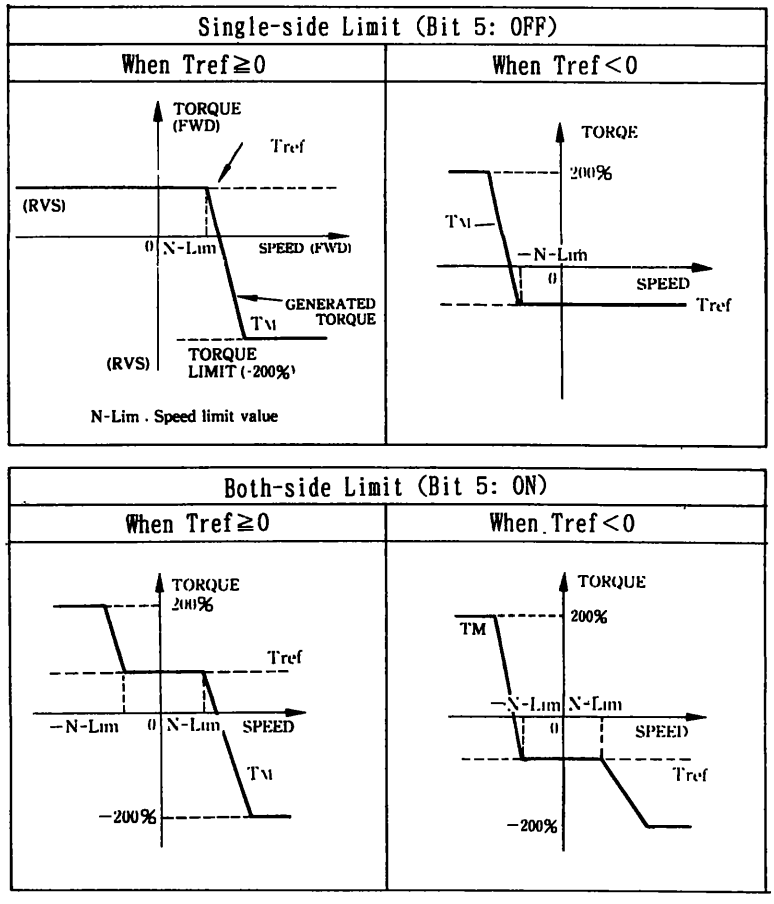
OFF	Torque reference direction* limit
ON	FWD/RVS direction limit

↑

- At torque control:

  Normally speed control is only torque reference direction* because of overrun protection. Set to ON for FWD/RVS direction limit operation.

  *The motor rotates counterclockwise (when viewed from the drive end) by plus torque reference and rotates clockwise by minus torque reference.



⑦ Bit 6: FNFSEL

OFF	Field forcing enable
ON	Field forcing disable

↑
Normally, this bit should be kept OFF.

VS-866 is executing field forcing because of shorting motor-flux form time at initial excitation (RDY ⇨ ON). If bit 6 is turned ON, field forcing is not executed.

⑧ Bit 7: IPPI

Do not tamper with this bit.

⑨ Bit 8: REVSEL

OFF	Counterclockwise* rotation at plus speed reference voltage	*when viewed from the drive end
ON	Clockwise rotation* at plus speed reference voltage	

↑
Set to ON for changing the motor rotation direction. The output pulse phase from VS-866 after executing PG pulse dividing determined by motor rotating direction.

⑩ Bit 9: PGNEG

OFF	PG disconnection detection able
ON	PG disconnection detection disable

↑
Set to ON when PG disconnection detection is not executed such as mechanical stop by stopper. Normally, this bit should be kept OFF.

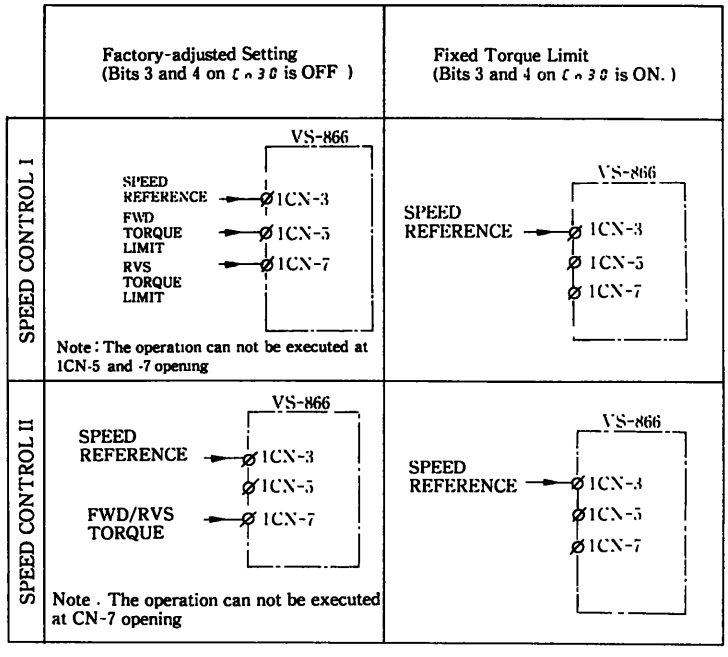
8. SYSTEM DESIGN PRECAUTIONS (Cont'd)

(6) Selecting when external torque limit input is not used

When VS-866 is used at speed control mode and torque limit signal (1CN-5, 7) is not input (connected):

<Setting> Set bits 3 and 4 on Cn30 to ON.

<Result> VS-866 can be used without external torque limit at fixed torque limit on speed control. Torque limit value of FWD/RVS side becomes 200% of rated torque (50%ED). If it is set at 200% or below, set the data to Cn23 or Cn24.



Note:

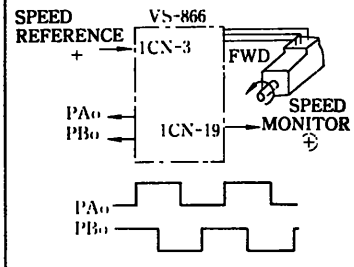
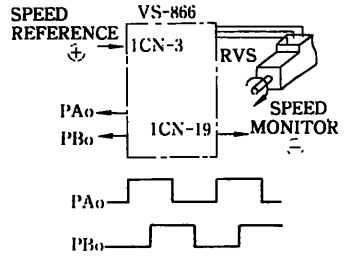
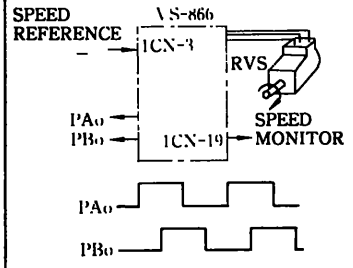
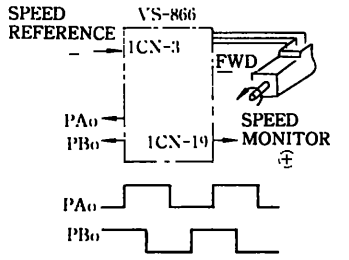
1. If the external torque limit is not input, when bits 3 and 4 on Cn30 remain OFF; the VS-866 can not be operated. In this case, the torque limit reference is regarded as 0%,
2. For torque control, bits 3 and 4 setting on Cn30 are irrelevant to the VS-866 operation.

(7) Setting of motor reverse running.

This is set when the relationship between speed reference polarity (plus/minus) and motor running direction (FWD/RVS) are changed.

<Setting> Set bit 8 on Cn30 to ON.

<Explanation> See table below.

Reference	Factory-adjusted Setting (Bit 8 on Cn 30 is OFF.)	Reverse-running Setting (Bit 8 on Cn 30 is ON.)
Plus (+)		
Minus (−)		

Note:

1. These settings are effective only at speed controls I and II.
2. For torque control, the speed limit direction is not changed.
3. The connection need not be changed.
   However, if Yaskawa Servopack (synchronous motor) is connected at reverse-running setting, phases PA_0 and PB_0 differ. To make the same phases as in the Table above, reverse the connections of PB_0 and $*PB_0$.
4. For using the absolute encoder, normal incremental pulse and initial incremental pulse in absolute data are output in the direction opposite to the normal direction. However, serial data code in the absolute data are not reversed. Therefore, use reversed serial data code when making the opposite direction connection.

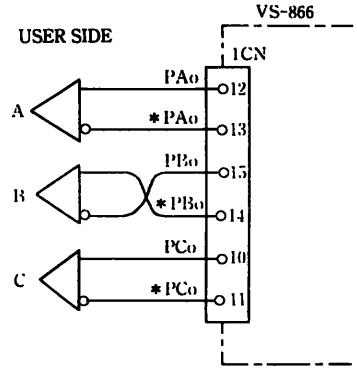


Fig. 8.5

8. SYSTEM DESIGN PRECAUTIONS (Cont'd)

(8) Motor zero-speed control

This function is used to keep stop status of the motor at speed control (P-I control).

To stop the motor, set the reference voltage to 0V at speed control.

For analog input, it is difficult to keep 0V perfectly. The motor may rotate if it remains at 0V setting. To prevent motor rotation, execute the following way.

① Open sequence input [RUN]:

Torque will not be generated to disturb the load.

② Close sequence input [IRST] to switch speed control to the P-control:

The speed regulation becomes large and causes load disturbance. See figure below.

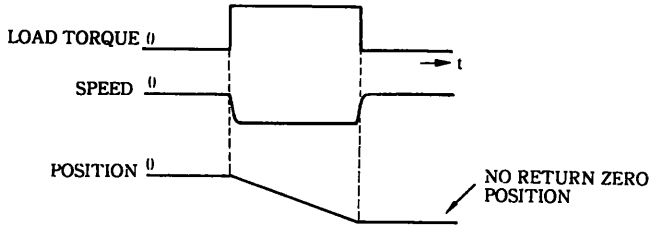


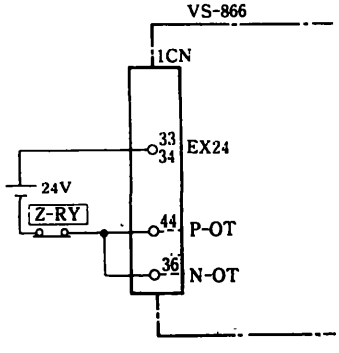
Fig. 8.6 Speed Response for Load Disturbance at P control

(P-ROM No. NSJ000110 and beyond)

VS-866 can be zero-speed control by switching sequence input.

<Setting> Set bit 1 (Second from right) on Cn29 to ON.

<Result> The functions of 1CN-44 (INH) and 1CN-36 (LOW) are changed.



	Bit 1 on Cn29			
	OFF* ⇨		ON*	
1CN-44	INH	Reference read-in stop	P-OT	Forward-running prohibit at open
1CN-36	LOW	Low-speed winding selection	N-OT	Reverse-running prohibit at open

Fig. 8.7

- Be sure to close [Z-RY] to rotate the motor.
- When [Z-RY] becomes open, internal speed reference is set at 0 without regard to the external speed reference input.
- If [Z-RY] becomes open during operation, the motor becomes zero-speed control after stopping.
- Soft starter does not function.
- The motor never rotates by drift even if speed control remains PI control ([IRST] opening). See Fig. 8.8.

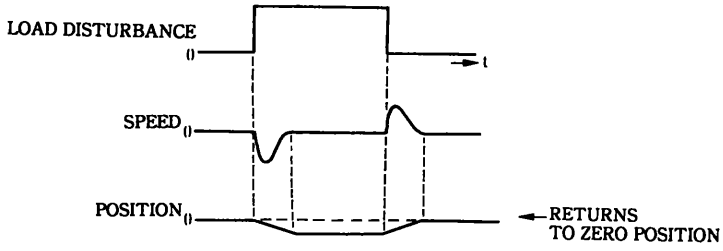


Fig. 8.8 Speed Response for Load Disturbance at P-I Control

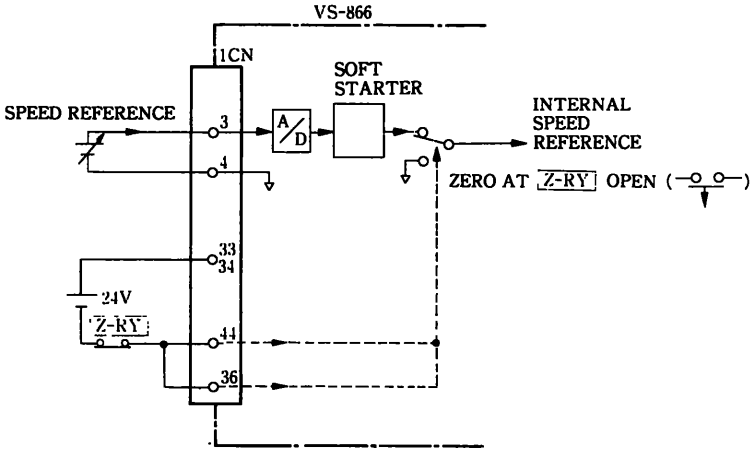
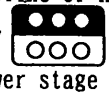


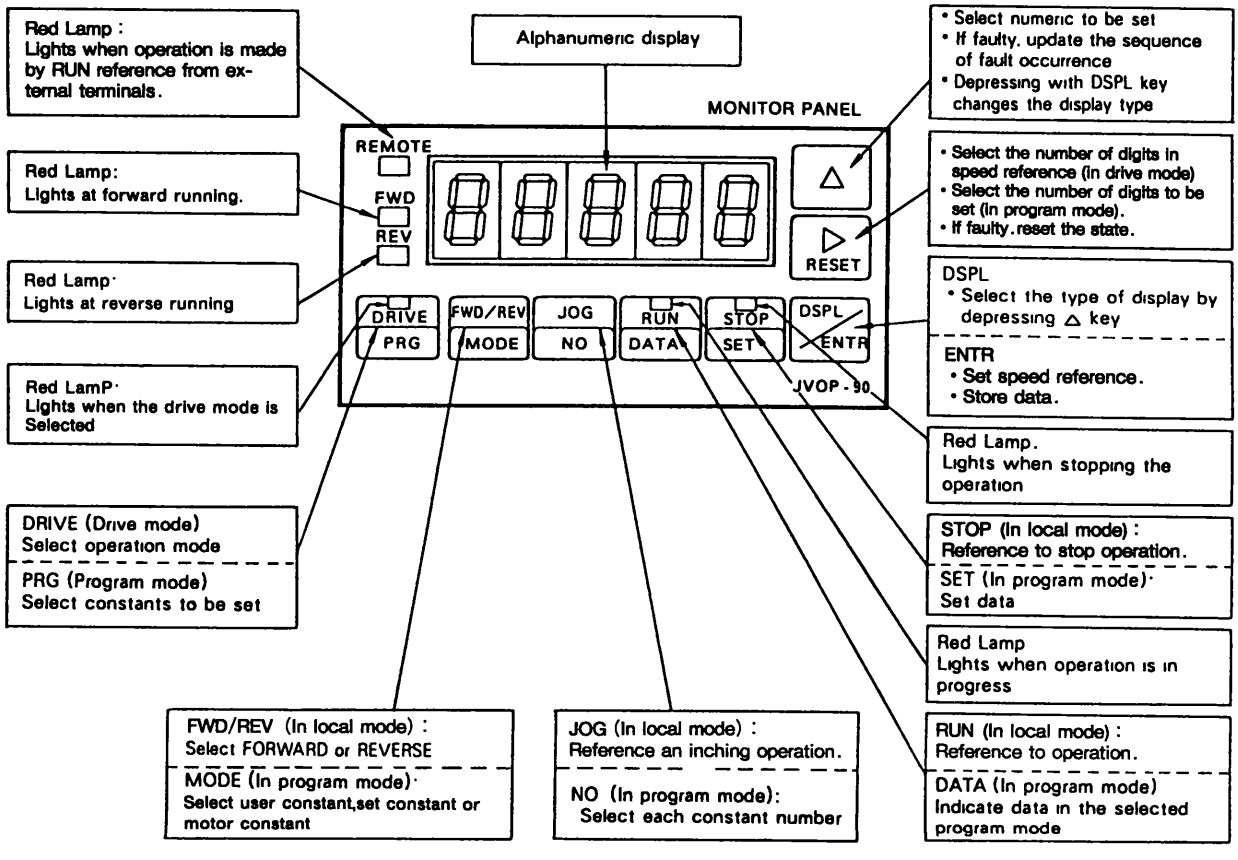
Fig. 8.9

9. MONITOR PANEL OPERATION

9.1 KEY FUNCTIONS

• Outline of key functions.

Key  functions as explained in the upper stage when a drive mode is selected and in the lower stage when a program mode is selected.



• Constant setting data on the monitor panel remain conserved even when power is turned off.

• Details of an error are stored even when power is turned off and can be checked after turning on the power.

• Monitor mode can be changed during operation.

• Program mode can be changed at stopping.

Note: In case of remote drive mode, this panel is used for displaying variables.

9.2 MONITOR PANEL FUNCTIONS.

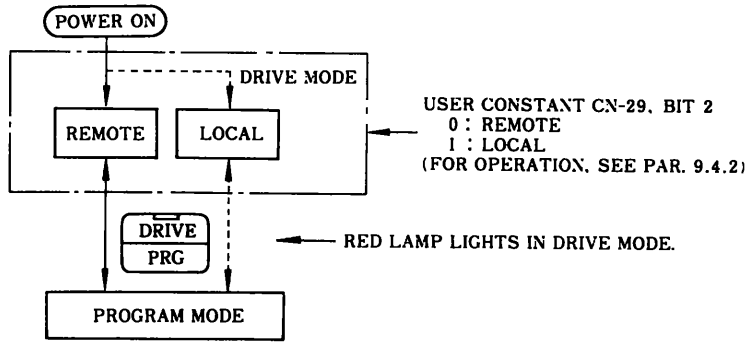
Table 9.1 shows monitor panel functions.

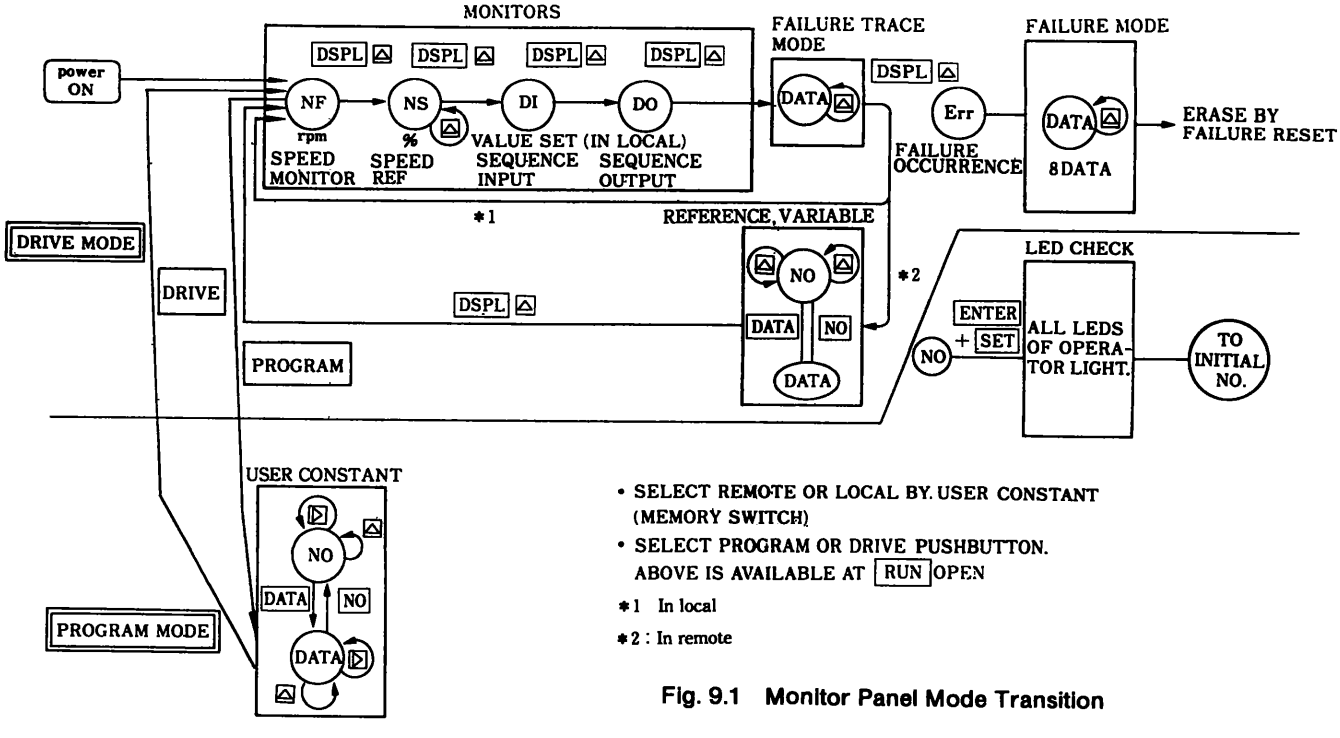
Table 9.1 Monitor Panel Functions

Mode			Description	
Drive Mode	Remote	Normal operation (by external terminal reference)	Reference and variable displayed	• Monitors for speed, speed reference, sequence input, sequence output • Failure display • Failure trace*
	Local	Test run (by reference on monitor panel)	Speed reference setting, run operation on monitor panel	
Program Mode		Setting and display of constants	Setting and display of constants	

* Trace of failure occurrence before power failure

When the control power is turned on, a drive mode (remote or local) is posted. Remote or local is selected by user constant (Cn-29).
Fig. 9.1 shows a mode transition diagram for the monitor panel.





- SELECT REMOTE OR LOCAL BY USER CONSTANT (MEMORY SWITCH)
- SELECT PROGRAM OR DRIVE PUSHBUTTON. ABOVE IS AVAILABLE AT RUN OPEN

*1 In local

*2 : In remote

Fig. 9.1 Monitor Panel Mode Transition

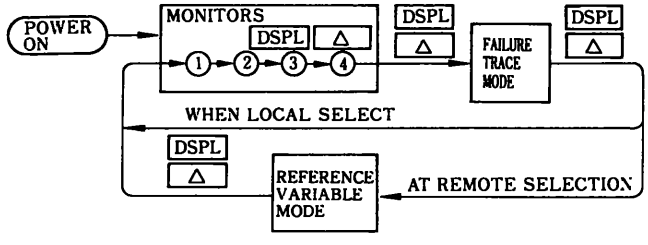
9.3 DRIVE MODE

9.3.1 Monitors

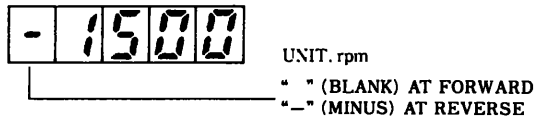
The speed, speed reference and I/O signals are monitored by use of the monitor panel. When in the local mode, the speed reference can be set.

	Monitor Type	Description
1	Speed monitor	Displays motor speed in rpm
2	Speed reference monitor	Displays speed reference in %
3	Input signal monitor	Sequence input signal ON/OFF
4	Output signal monitor	Sequence output signal ON/OFF

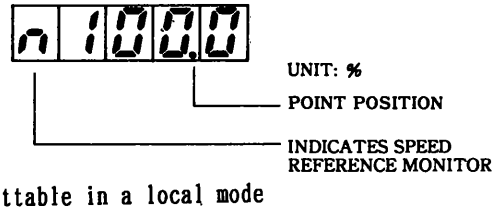
After turning on power, the monitored speed in the drive mode is indicated. Depress the DSPL/ENTR and △ keys simultaneously to change the monitor type. Repeat this operation twice (once for the local mode) to return to indicate the speed monitor during display of the output signal monitor.



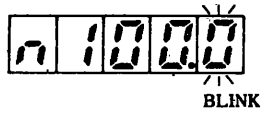
① Speed monitor



② Speed reference monitor



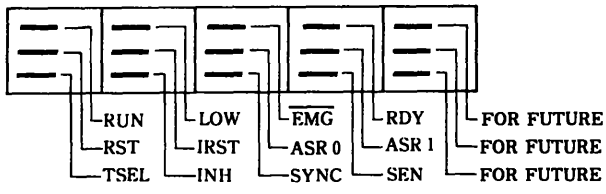
Speed reference is settable in a local mode



- Select the digits to be set by operating the ▷ key. The numerals of the digits which allow values blink.
- Depress the △ key to increase the numeral of the set digit by 1. Set to the desired set value.
- Depress the DSPL/ENTR key after setting values for the digits. The set value can now be used as a speed reference. This set value cannot be stored if power is turned off.

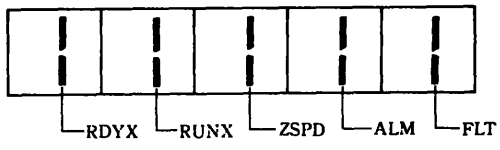
③ Input signal monitor

Supervises an input signal status. When a contact input is "closed", a relevant position lights. The status of input signals is monitored. (The applicable location lights if "on" during contact input.)



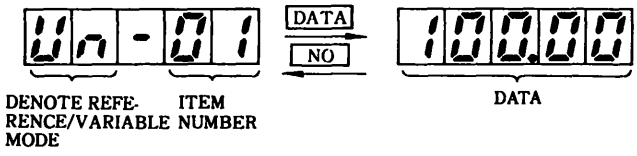
④ Output signal monitor

The status of output signals is monitored. The applicable location lights while output operation is ON.



9.3.2 Reference/Variable Display

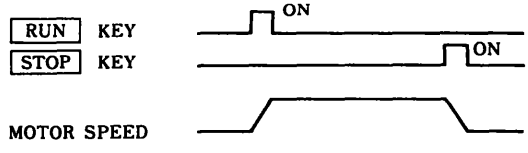
This mode can be set up during the remote mode. Depress [DSPL/ENTR] and [△] keys simultaneously in each monitor mode or error trace mode to change into reference and variable display mode.
Table 9.2 lists up references and variables.



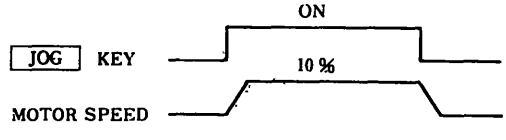
(1) Set an item number by [▷] and [△].
(2) The item number data is displayed by depressing [RUN/DATA].
(3) The item number is displayed by depressing [JOG/NO.].
(4) Repeat (1) through (3) as required.

9.3.3 Operation on Monitor Panel

① Select local mode.
Depress [DRIVE/PRG] key to enter program mode. As shown in par 9.4.2, turn on bit data 2-bit (third from the right) of Cn29. Then local mode is selected. (Turn off after the operation.)
② [FWD/REV/MODE] key
Selects forward or reverse at speed control.
FWD or REV LED lights up accordingly.
③ [RUN/DATA] and [STOP/SET] keys
Used instead of sequence input signal [RUN].
Speed control is performed according to a set speed reference (sign depends on [FWD/REV] operation). See par. 9.3.1 ②. When [RUN] or [STOP] key is operated, the LED lights.



④ [JOG/NO.] key
For jogging. Jog speed reference is 10 % (sign depends on [FWD/REV/MODE] key) of user constant Cn01 (rated speed).



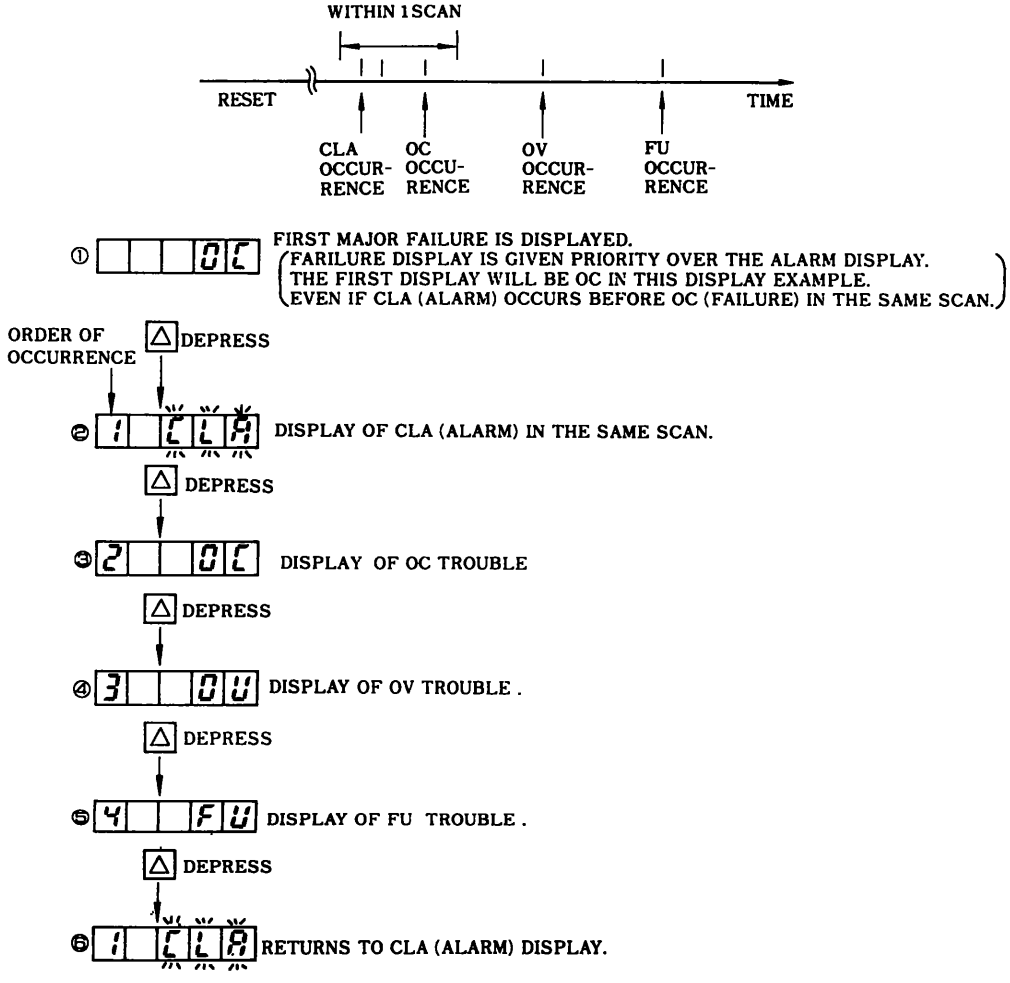
⑤ Sequence input
[RDY], [EMG], [IRST], [RST] and [SEN] operate as in the remote mode. Switch off all other sequence input by remote selection and raise to local mode selection.

9.3.4 Failure Mode

If a failure is detected in the drive mode, the failure mode will set up and failures and alarms of 28 types as shown in Table 9.4 are displayed regardless of the display mode.

- Failure display sequence

  If several failures occur, the failure occurrence sequence after error resetting will be displayed in a maximum of eight types.



9.3.5 Failure Trace

In the failure trace function, details of failures that have occurred before a power failure are stored in the NV-RAM and are displayed when power is restored.

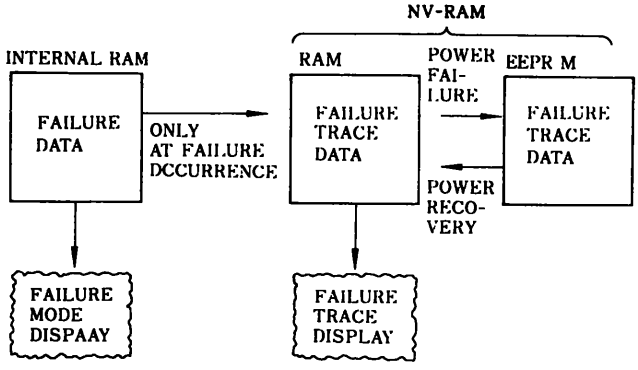
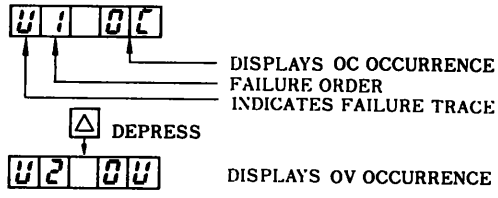


Fig. 9.3 Saving Failure Date

Failure trace display is the same as failure mode display except "U" is displayed before failure occurrence Nos.

Example :

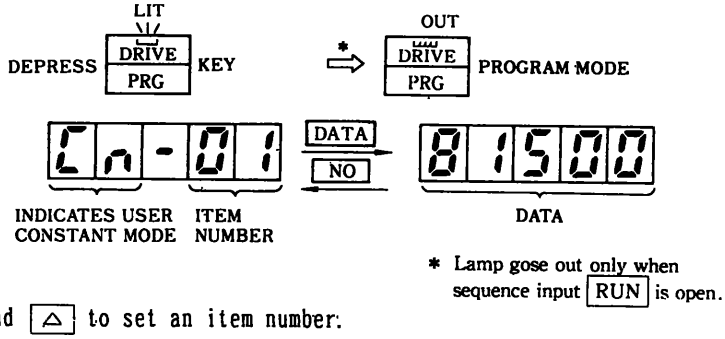


9.4 PROGRAM MODE

User constants are set or referenced in the program mode.

Table 9.5 lists up user constants. Set them referring to par. 7 "USER CONTANTS".

9.4.1 Setting and Referencing User Constants (Data)



(1) Depress ▷ and △ to set an item number.

(2) Depress RUN/DATA to display data of the item number.

(3) Depress ▷ and △ to set data.

(4) Depress STOP/SET and DSPL/ENTR to store the data.

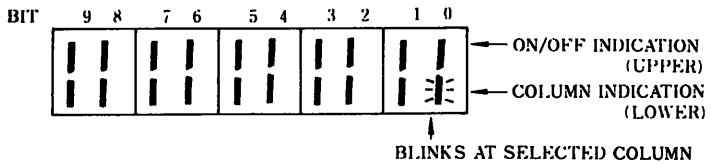
(5) Depressing JOG/NO. returns to the item number display.

(6) Repeat steps (1) to (5) as required.

In case of display only, skip the steps (3) and (4).

9.4.2 User Constant (Memory Switch) Setting and Referencing

Data of user constants Cn-29 and 30 is set and referenced by bits as memory switches.



① Select the digit to be set by operating the [▷] key.
The bit (lower side) of the selected digit will blink.
② Depress the [△] key to change the status of the bit (upper side) for switching on and off of the set digit. (Lit if ON, not lit if OFF.)
③ Repeat steps ① and ② as necessary.
④ Depress the [STOP/SET] key and then the [DSPL/ENTR] key to store the data.
Table 9.2 lists the details of the bits of memory switches Cn-29 and -30.

Table 9.2 Status Monitor Functions

Monitor Display	Abbreviation	Name	Unit	Resolution	Remarks
Un01	NREF	Speed reference	%	0.1	–
Un02	NFB	Speed feedback	rpm	1	–
Un03	TREF	Torque reference	%	0.1	–
Un04	TFB	Torque feedback	%	0.1	When high accuracy torque regulator is provided
Un05	TLF	Forward torque limit	%	0.1	Mortoring under forward running, Regeneration under reverse running
Un06	TLR	Reverse torque limit	%	0.1	Mortoring under reverse running, Regeneration under forward running
Un07	12R	Secondary current reference	%	0.1	–
Un08	FLX	Magnetic flux reference	%	0.1	–
Un09	11R	Primary current reference	%	0.1	–
Un10	SFR	Slip reference	%	0.1	–
Un11	FIR	Primary frequency reference	Hz	0.01	–
Un12	MTEMP	Motor temperature	℃	1	–
Un13	VPN	Main circuit DC voltage	V	0.1	–
Un14	STS	Status	HEX	-	See Table 9.3.
Un15	SFTNO1	Software No.1	-	-	Main unit
Un16	SFTNO2	Software No.2	-	-	Option
Un17	1ADD	CH1 AD data	HEX		7FFF/10V, 1CN-3 input data
Un18	2ADD	CH2 AD data	HEX		7FFF/10V, 1CN-5 input data
Un19	3ADD	CH3 AD data	HEX		7FFF/10V, 1CN-7 input data

Table 9.3 Status (Un 14) Bits

BIT	Abbrevi-ation	Name	Remarks
0	RDYX	Ready	—
1	RUNX	Run	—
2	ZSP	Zero speed	—
3	FOR	Forward	—
4	REV	Reverse	—
5	EMG	Emergency stop	—
6	BB	Base block	—
7	TLIM	Torque limit	—
8	CLIM	Current limit	—
9	NLIM	Speed limit	At torque control
10	WCHG	Low speed winding select	When winding change unit is optionally used
11	FLTA	Trouble A	Decelerate and stop
12	FLTB	Trouble B	Base block
13	ALM	Alarm	Run continues
14	NVRAMC	NV-RAM change	—
15	—	—	—

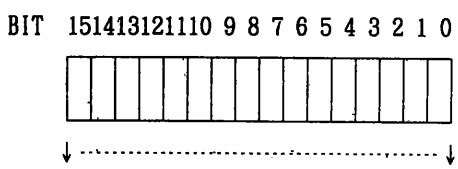


Table 9.4 Failure Display

No.	Display	Abbreviation	Alarm	Trouble*	Meaning	LIN †	INI †
1	ROM	ROM		Ⓢ	PROM	○	○
2	NV2	NV2		Ⓑ	NV-RAM2		○
3	NV1	NV1		Ⓑ	NV-RAM1	○	○
4	RM0	RM0		Ⓑ	External RAM		○
5	RM1	RMI		Ⓑ	Internal RAM		○
6	PGC	PGC		Ⓑ	PG counter error		○
7	CdE	CDE		Ⓑ	Constant data error		○
8	Rd	AD		Ⓢ	Reference AD converter	○	
9	RdC	ADC		Ⓢ	CPU AD converter	○	
10	LF	LF	○		Load fault	○	
11	OP	OP	○	INIⒷ	Option error	○	○
12	OLI	OLI	○		Inverter overload	○	
13	OLM	OLM	○		Motor overload	○	
14	MC	MC		Ⓢ	NCON error	○	
15	CUV	CUV		Ⓑ	Control UV	○	
16	PUV	PUV		Ⓢ	Power UV	○	
17	APG	APG	○		ABS PG error	○	
18	WCG	WCG		Ⓑ	Winding change error	○	
19	FU	FU		Ⓑ	Fuse blow	○	
20	PG	PG		Ⓑ	PG open circuit	○	
21	OS	OS		Ⓢ	Overspeed	○	
22	OHL	OHL		Ⓢ	Thermistor open circuit	○	
23	OHI	OHI		Ⓢ	Inverter overheat	○	
24	OH2	OH2		Ⓢ	Inverter low-frequency overload	○	
25	OHM	OHM		Ⓢ	Motor overheat	○	
26	OV	OV		Ⓑ	Overvoltage	○	
27	VL	VL	○		Overvoltage	○	
28	OC	OC		Ⓑ	Overcurrent	○	
29	CLA	CLA	○		Overcurrent	○	
30	•••••••	—		Ⓑ	CPU down	○	○

○: Occurring *Ⓢ: Stop Ⓑ: Base block (coasting)

†LIN : on line INI : initial

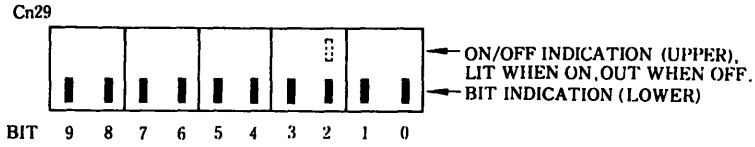
Table 9.5 User Constants (Cn-01 to Cn-30)

No.	Abbreviation	Name	Unit	Low Limit	High Limit	Factory set at:
Cn01	*N100	Rated speed	r/min	500	2000	1500 (for 1500rpm series)
					1000	750 (for 750rpm series)
Cn02	NADJ	Speed reference adjust gain	—	0.6000	3.0000	1.0000
Cn03	NOFS	Speed zero adjust	HEX	F488 (-3000)	BB8 (3000)	0
Cn04	PASR1	Speed control P set 1	—	0	250	20
Cn05	TASR1	Speed control I set 1	ms	5	1000	50
Cn06	PASR2	Speed control P set 2	—	0	250	40
Cn07	TASR2	Speed control I set 2	ms	5	1000	50
Cn08	PASR3	Speed control P set 3	—	0	250	60
Cn09	TASR3	Speed control I set 3	ms	5	1000	50
Cn10	PASR4	Speed control P set 4	—	0	250	110
Cn11	TASR4	Speed control I set 4	ms	5	1000	50
Cn12	SFS	Soft starter	s	0.000	10.000	0.000
Cn13	ZSP	Zero speed level	%	0.0	20.0	2.0
Cn14	SMADJ	Speedometer adjust	—	0.90	1.10	1.00
Cn15	TMADJ	Torque meter adjust	—	0.90	1.10	1.00
Cn16	GD^2	Load JL	—	0.00	10.00	0.00
Cn17	TEMG	Emergency stop torque	%	0.0	350.0	100.0
Cn18	*PGRAT	PG frequency dividing ratio	—	1	20032	1 (incremental) 8192(absolute)
Cn19	VADJ	Voltage adjust	—	0.80	1.20	1.00
Cn20	TEMP	Ambient temperature	℃	-10	60	20
Cn21	DTL	ASR output filter	ms	1.0	20.0	1.0
Cn22	TLF	Forward torque limit	%	0.0	350.0	350.0
Cn23	TLR	Reverse torque limit	%	0.0	350.0	350.0
Cn29	*SELCD1	Select/set constant1	Bits	0000000000	1111111111	0000000000
Cn30	*SELCD2	Select/set constant2	Bits	0000000000	1111111111	0000000000

Note: Items marked * can be set only when stopping.

Table 9.6 Bits for SELCD 1 and SELCD 2

• Cn29 (SELCD1) select/set value 1

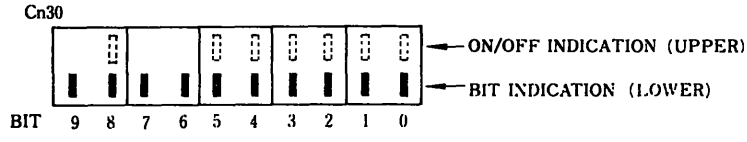


□ :Standard factory-adjusted setting

Bit	Abbreviation	Name	Setting	
			OFF	ON
0	SETRW	Setting-constant setting	Setting/reference disable	Setting/reference enable
1	OTSEL	Overtravel selecting	Without overtravel	With overtravel
2	LOCL/REM	Local/Remote	Remote (External reference)	Local (Monitor panel)
3	NLIMREV	Speed limit polarity	Plus voltage valid	Minus voltage invalid
4	PTQLREV	Forward torque limit polarity	Plus voltage valid	Minus voltage invalid
5	TLQSEL	Output during torque limit	Disable	Enable
6	UCNSEL	Constant change during operation	Disable	Enable
7	PREF	RS-232C communication mode selection	—	Do not set to ON.
8	PASOCN1		—	
9	PASOCN2		—	

Note: See par. 8 "SYSTEM DESIGN PRECAUTIONS" for details and operating method.

• Cn30 (SELCD2) select/set value 2



□ :Standard factory-adjusted setting

Bit	Abbreviation	Name	Setting	
			OFF	ON
0	TQCM	Torque control mode	Setting/reference disable	Setting/reference enable
1	SPDSEL	Speed reference voltage	6V/100%	10V/100%
2	TRQSEL	Torque reference voltage	3V/100%	6V/100%
3	2CH-AD	1CN-5 input	Enable	Disable
4	3CH-AD	1CN-7 input	Enable	Disable
5	DLMT	Speed limit function	Single side	Both side
6	FNFSEL	Field forcing	Enable	Do not set to ON.
7	IPPI		—	
8	REVSEL	Rotating-direction selecting	Clockwise rotation* at plus speed reference voltage	Counterclockwise rotation* at plus speed reference voltage
9	PGNEG	PG disconnection detection	Enable	Disable

*When viewed from the drive end

Note: See par. 8 "SYSTEM DESIGN PRECAUTIONS" for details and operating method.

10. INSTALLATION AND WIRING

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.

10.1 INSTALLATION OF SERVOMOTOR

Servomotor can be installed either in horizontal direction or in the downward direction of vertical axis. When installed in the downward direction of vertical axis, UAACLA-30AA2K and UAACLA-37AA2K types (1500 rpm series) and UAACLL-15AA2K or UAACLL-19AA2K types (750 rpm series) need top cover. External dimensions must be taken into consideration. For installation in the upward direction of vertical axis, contact your YASKAWA.

(1) Before mounting

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

(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 amout of splashed water or oil (IP 44 structure). UAACLA-30AA2K and UAACLA-37AA2K types (1500 rpm) and UAACLL-15AA2K and UAACLL192AK types (750 rpm) have motors of dropproof protected type.

(3) Environmental conditions

Ambient Temperature: 0℃ to +40℃

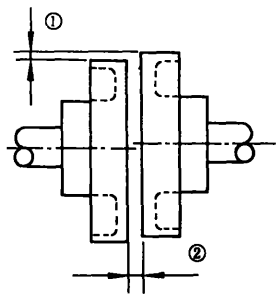
Storage Temperature: -20℃ to +60℃

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

(4) Load coupling

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

Use flexible coupling with direct drive. The alignment should be made in accordance with the figure below.



① Measure the gap between the straightedge and coupling halves at four equidistant points of the coupling. Each reading should not exceed 3/100mm.

② 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 3/100mm.

10.2 INSTALLING SERVO DRIVER AND POWER UNIT

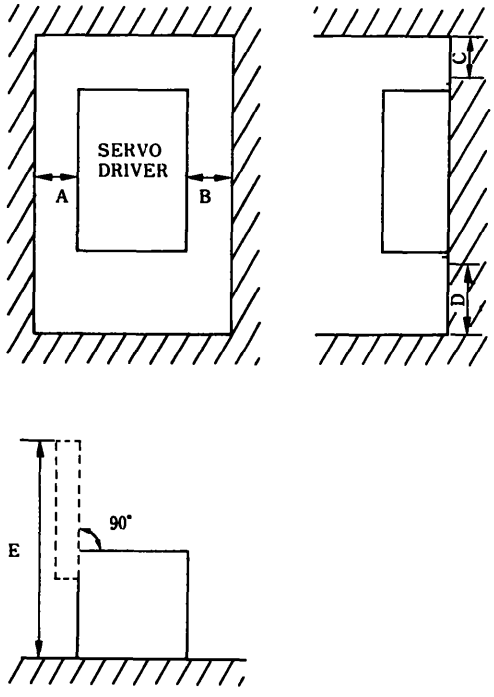
Use VS-866 under the following conditions.

(1) The ambient temperature is 0 to 55℃. When installing in a control panel, consider a cooling design so the interior temperature is not beyond this range.
(2) The humidity is relatively low (90% relative max. Non condensing.)
(3) Not exposed to elements or water drops.
(4) Not exposed to direct sunshine.
(5) Free from dust, metallic powder or corrosive gases.
(6) Not exposed to excessive vibrations.

Install VS-866 vertically with the external wiring downward.

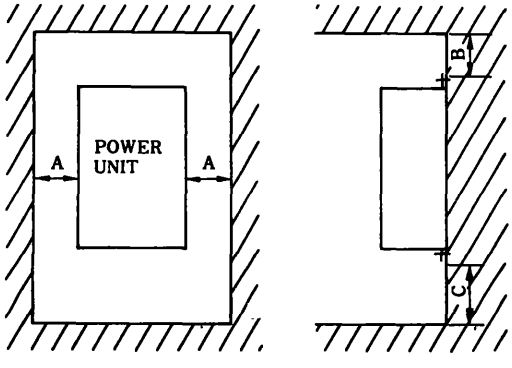
As shown in Figs. 10.1 and 10.2, secure a space for cooling and servicing.

10.2 INSTALLING SERVO DRIVER AND POWER UNIT (Cont'd)



Dimensions / kVA	A	B	C	D	E
6	85	30	00	100	350
9					
13					400
18				150	485
25					515
35					590
45					665
60					790
80					

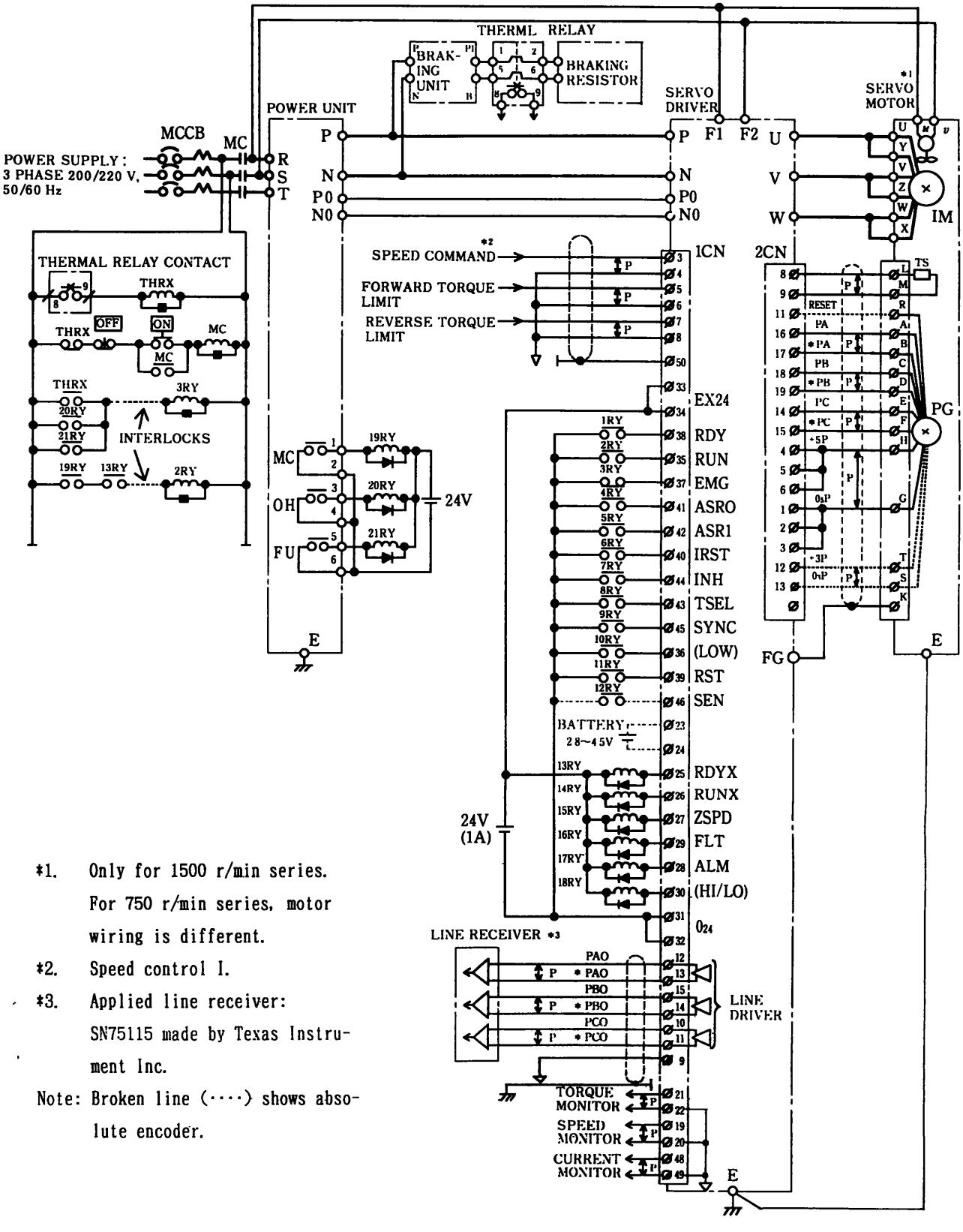
Fig. 10. 1 Location Servo Driver



Dimensions / MODEL	A	B	C
NPSN-0303L	30	100	100
NPSO-0503L			
NPSO-0803L			150
NPSO-1303L			

Fig. 10.2 Location for Power Unit

10.3 WIRING EXAMPLE



*1. Only for 1500 r/min series. For 750 r/min series, motor wiring is different.

*2. Speed control I.

*3. Applied line receiver: SN75115 made by Texas Instrument Inc.

Note: Broken line (····) shows absolute encoder.

Fig. 10.3 Wiring Example

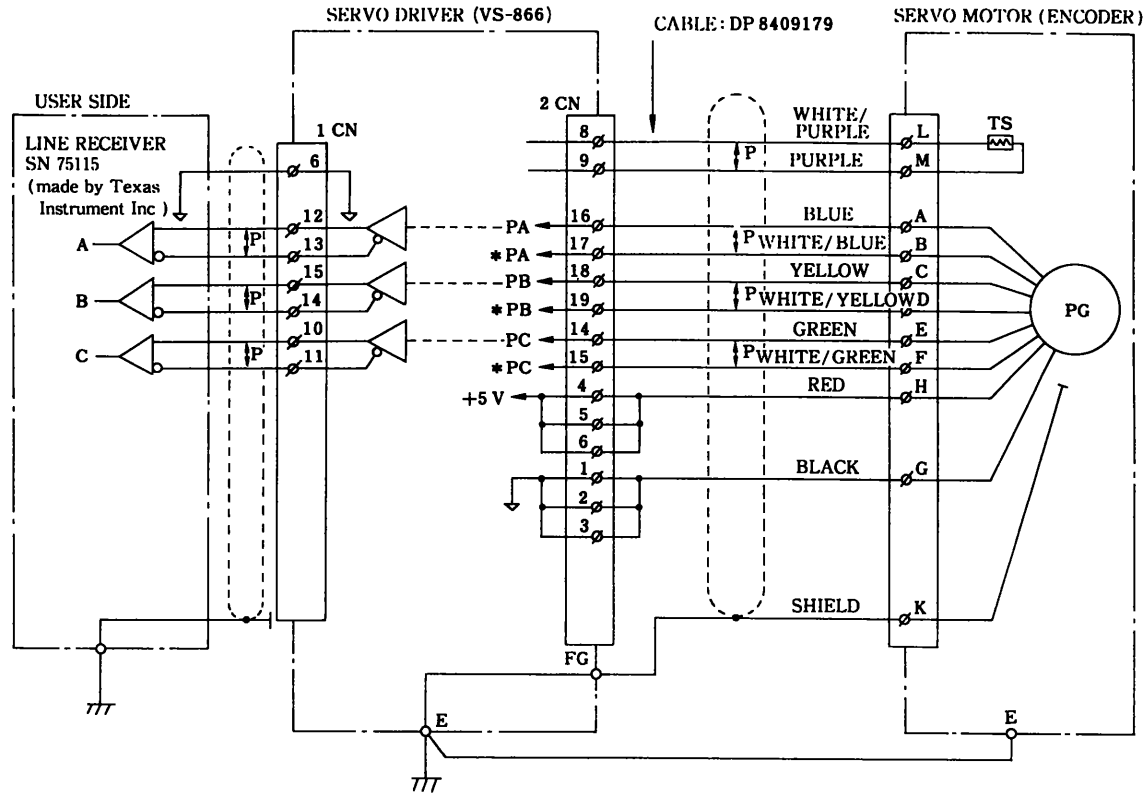


Fig.10.4 Connection of Incremental Encoder and Output Processing

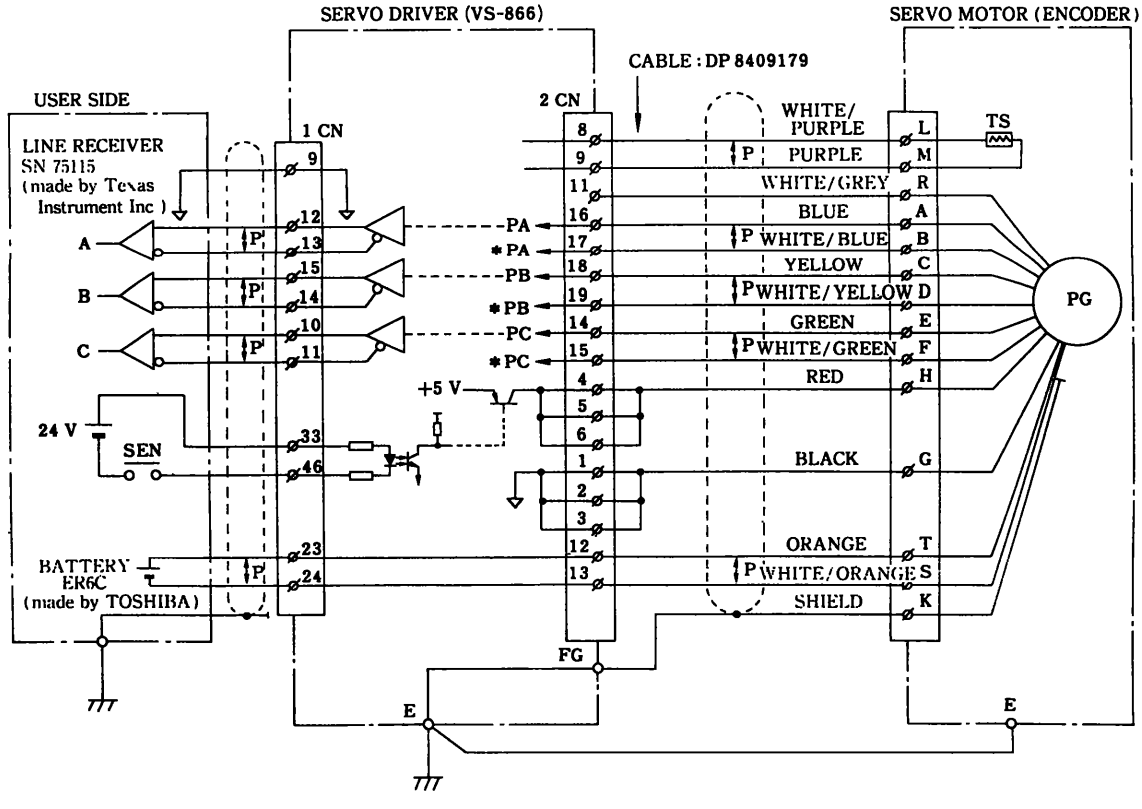


Fig.10.5 Connection of Absolute Encoder and Output Processing

10.4 WIRING PRECAUTIONS

Observe the following when installing external interconnection wiring. Check interconnection wiring after installing wiring. Do not check the buzzer of the control circuit.

10.4.1 Main Circuit Wiring

(1) A wiring circuit breaker (MCCB) and a magnetic contactor (MC) are recommended to be connected between the AC main circuit power supply and power supply unit input terminals R, S and T.

(2) Select an earth (ground) leakage breaker with a sensitivity current of 200mA or more and operating time of 0.2sec or more to prevent malfunction. The type must be suitable for use of an inverter and not to be activated by a shock wave.

(3) Be sure to connect a surge absorber to magnetic contactors, control relays and solenoid brake coils used near the controller. Table 10.1 shows recommended surge absorbers.

Table 10.1 Application of Surge Absorber (Example)

Device \ Serge Absorber		Model	Specifications	Code
200V to 230V	Large capacity coil other than of relay	DCR2-50A22E	250V AC 0.5 μF + 200 Ω	C 002417
	Control relay LY-2, -3 of Omron, HH-22, -23 of Fuji Electric, NM-2, -4 of Omron	DCR2-10A25C	250V AC 0.1 μF + 100 Ω	C 002482

Note : The surge absorber is manufactured by Marcon Electronics.

(4) The phase rotation directions of the power supply unit input terminals R, S and T can be in any direction.

(5) Do not connect power supply to the output terminals U, V and W.

(6) Connect the servo driver output terminals U, V and W matching with the motor terminals U, V and W.

(7) The wire connections of the motors of the 1500 and 750 rpm series differ. Check this before making connections.

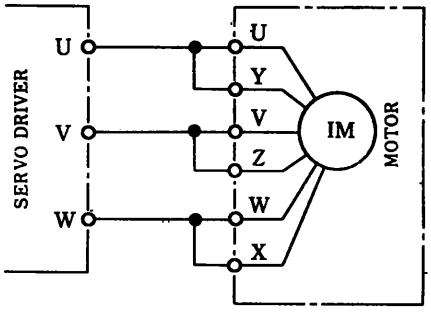


Fig.10.6 1500r/min Series Motor Wiring

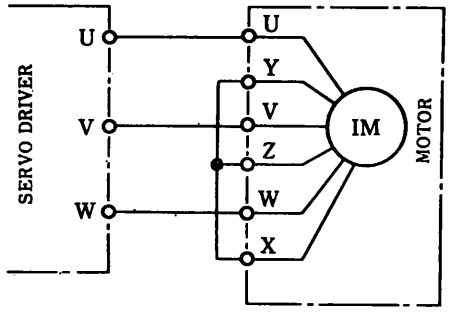


Fig.10.7 750r/min Series Motor Wiring

(8) Never connect a power factor capacitor, radio noise filter or reactor between the controller and motor.

(9) Do not connect the output sides (Po and B) of the damping units by common wiring if several braking units are installed in parallel.

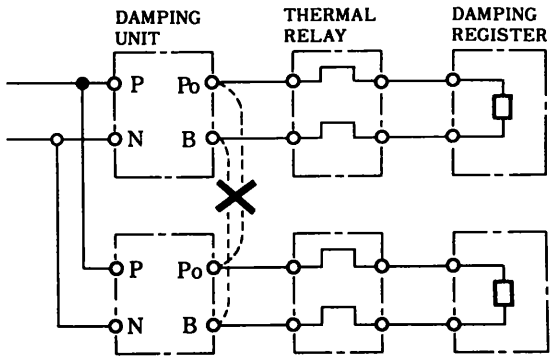


Fig.10.8

10.4.2 Control Circuit Wiring

(1) Separate the control circuit wiring (connector terminal 1CN and 2CN connecting cable) from main circuit wiring (N, P, U, V, W, F1, F2) or power cables.

(2) For control wiring, use twist shielded wires or twist pair shielded wires and process the ends as shown in Fig. 10.5 to avoid malfunction by noise. The wire length must be less than 20m.

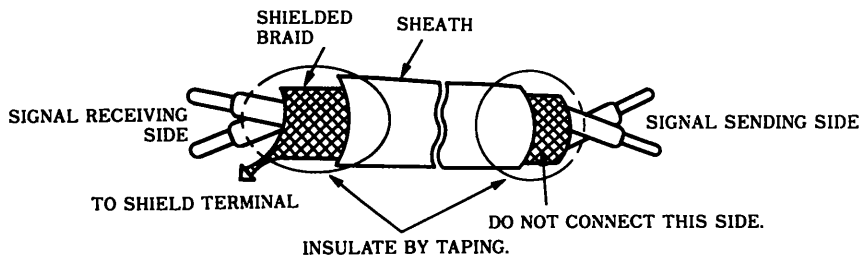


Fig.10.9 Shielded Wire End Process

10.4.3 Grounding Wire

Perform grounding firmly in the following procedures. Wrong grounding may cause a malfunction.

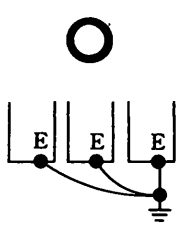
(1) Connect the control device grounding terminal E to 100Ω max..

(2) Do not use the grounding cable or electrode together with welder or other heavy duty equipment. Separate the grounding wire away from that of large-current electrical equipment.

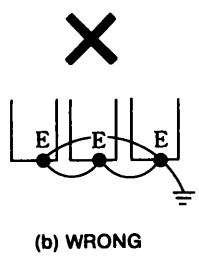
(3) Determine the grounding cable size in conformity with the technical standard for electric facilities; and make the length as short as possible.

(4) Even when the control device or motor is grounded through channel base, iron plate, etc., connect the grounding terminal to ground without fail.

(5) When there are several control devices, perform grounding as shown in Fig. 10.10 (a) without making a loop as shown in (b). No loop is allowed between control device and motor. [Fig. 10.11(b)]

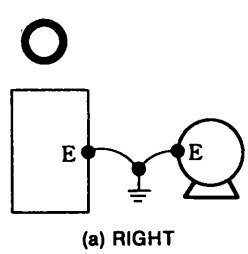


(a) RIGHT

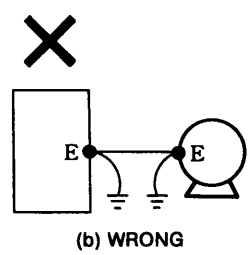


(b) WRONG

Fig.10.10 How to Ground Several Control Devices



(a) RIGHT



(b) WRONG

Fig.10.11 How to Ground Motor and Control Device

10.5 TERMINALS

Tables 10.2 and 10.3 list the power unit and servo driver terminals.

Table 10.2 Power Unit Terminals

Symbol		Name	Description
Main Circuit	R, S, T	Main circuit power input terminal	3 phases, 200/220 V AC, 50/60 Hz
	P, N	Main circuit DC output terminal	240-340 V DC for servo driver main circuit power
	P1, P2	DC reactor terminal	Shorted normally. (Already shorted at factory)
Control Circuit	PO, NO	Control power output terminal	240-340 V DC for servo driver control power
	1, 2	Contactor answer signal terminal	Closed when main circuit magnetic contactor is ON.
	3, 4	Converter overheat signal terminal	Closed when overheated.
	5, 6	Fuse blown signal terminal	Closed when fuse is blown.

Table 10.3 Servo Driver Terminals

Symbol		Name	Description
Main Circuit	P, N	Main circuit power input terminal	240-340 V DC supplied from power unit
	U, V, W	Servo driver output terminal	Connected to motor terminals U, V, W, X, Y, Z
Control Circuit	PO, NO	Control power input terminal	240-340 V DC supplied from power unit
	F1, F2	Fan power input terminal	Single phase, 200/220 VAC, 50/60 Hz
	E	Ground terminal	Earth(ground). Class 3 or better
	1CN	Input/output single connector terminal	Rererence input, sequence I/O monitor output, PG output
	2CN	PG connector terminal	PG signal, PG power, motor temperature detect signal

(MR-50)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
+15V	SG	VREF	SG	FTLM	SG	RTLM	SG	SG	PCO	*PCO	PAO	*PAO	*PBO	PBO	—	—	FG
		Speed reference input		Forward torque limit input		Reverse torque limit input			PG output signal (C phase)		PG output signal (A phase)		PG output signal (B phase)				
		19	20	21	22	23	24	25	26	27	28	29	30	31	32		
		VMONI	SG	TMONI	SG	BAT	SG	RDYX	RUNX	ZSPD	ALM	FLT	H/L	COM	COM		
		Speed monitor		Torque monitor		Battery input		Ready	Run	Zero speed	Alarm	Fault	winding change answer	Common			
								Sequence output									
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
EX24V	EX24V	RUN	LOW	EMG	RDY	RST	IRST	ASRO	ASR1	TSEL	INH	SYNC	SEN	—	IMONI	SG	FG
External power source		Run	Low speed select	Emergency stop	Ready	Fault reset	ASR integration reset	ASR constant select		Torque control	Read inhibit	Sync signal	Sensor ON		Current monitor		
Sequence input																	

1CN terminal arrangement

(MR-20)

1	2	3	4	5	6	7
0V	0V	0V	+5V	+5V	+5V	0V
PG 0V			PG 5V			

8	9	10	11	12	13
THM +	THM −	—	Reset	BAT +	BAT −
Thermistor input				Battery input	

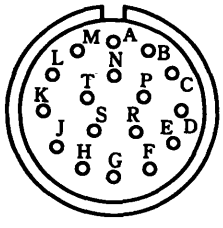
14	15	16	17	18	19	20
PC	*PC	PA	*PA	PB	*PB	—
PG input signal (C phase)		PG input signal (A phase)		PG input signal (B phase)		

SG : signal ground

FG : frame ground

2CN terminal arrangement

Fig.10.12 Servo Driver 1CN and 2CN Terminal



A	A channel output (PA)	K	Shielded
B	$\overline{A}$ channel output (*PA)	L	Thermistor
C	B channel output (PB)	M	Thermistor
D	$\overline{B}$ channel output (*PB)	N	—
E	Z channel output (PC)	P	—
F	$\overline{Z}$ channel output (*PC)	R	Reset
G	0 V	S	0 V (battery)
H	+5 V DC	T	3 V (battery)
J	F.G (frame ground)	-	—

(Note)

Note: R, S and T are for absolute encoder. (Connection is not required for incremental type.)

Fig.10.13 Arrangement Detector (PG) Receptacle Terminal

10.6 WIRE

Tables 10.4 and 10.5 list recommended wires for VS-866. The recommended wire sizes are based on wires of an allowable conductor temperature of 80℃, ambient temperature of 55℃ and not bundled. If other wires are used, the wire sizes will differ. If wires are to be bundled or are put in a wire duct, the ambient temperature differs and the allowable current decreases. These factors must be taken into consideration when wires are selected.

Table 10.4 Power Unit Wires (Reference)

Rated Output kW (HP)		7.5 (10)	15 (20)	25 (33)	40 (53)
Main Circuit AC Input	Power Capacity kVA	10	20	30	50
	Applied wire mm² (AWG)	3.5 (12)	8 (8)	22 (4)	38 (1)
R, S, T	Terminal Thread	M5	M6	M8	M8
Main Circuit DC Output	Current A	33	65	103	168
	Applied wire mm² (AWG)	3.5 (12)	14 (6)	22 (4)	50 (1/0)
P, N	Terminal Thread	M5	M6	M6	M8
Control Power DC Output	Current A	1.2 MAX			
	Applied Wire mm² (AWG)	1.25 (16)			
PO, NO	Terminal Thread	M4			
Control Circuit	Applied Wire mm² (AWG)	1.25 (16)			
1 - 6	Terminal Thread	M4			
Grounding	Applied Wire mm² (AWG)	3.5 (12)			
E	Terminal Thread	M4			

Table 10.5 Servo Driver Wires (Reference)

Rated Capacity kVA		6	9	13	18	25	35	45	60	80
Main Circuit DC Input	Current A	25		30	43	58	85	116	170	200
	Applied wire mm² (AWG)	3.5 (12)		3.5 (12)	5.5 (10)	8 (8)	22 (4)	30 (2)	50 (1/0)	60 (2/0)
P, N	Terminal thread	M4		M5	M6	M6	M6	M8	M8	M8
Servo Driver Output	Current A	27		40	55	80	110	133	190	240
	Applied wire mm² (AWG)	3.5 (12)		5.5 (10)	8 (8)	14 (6)	22 (4)	30 (2)	60 (2/0)	60 (2/0)
U, V, W	Terminal thread	M4		M5	M6	M6	M8	M8	M8	M8
Control Power Input	Current A	0.3								
	Applied wire mm² (AWG)	1.25 (16)								
P0, N0	Terminal thread	M4								
Fan Power Input	Applied wire mm² (AWG)	1.25 (16)								
F1, F2	Terminal thread	M4								
Ground	Applied wire mm² (AWG)	3.5 (12) to 5.5 (10)								
	Terminal thread	M4								

Note : The table below shows the maximum connecting wire sizes when round compression terminal (JIS C2805) is used for wiring.

Rated Capacity kVA	6	9	13	18	25	35	45	60	80
P, N Terminals mm²(AWG)	5.5 (10)		8 (8)	14 (6)	22 (4)	22 (4)	38 (1)	60 (2/0)	60 (2/0)
U, V, W Terminals mm²(AWG)	5.5 (10)		8 (8)	14 (6)	22 (4)	38 (1)	60 (2/0)	60 (2/0)	60 (2/0)

Table 10.6 1CN and 2CN Receptacles (provided by Yaskawa)

	Manufacturer	Model	Specifications
1CN	Honda Tsushin Kogyo	MR-50LF	Soldered type (50P)
2CN		MR-20LF	Soldered type (20P)

Table 10.7 Arrangement Detector (PG) Receptacle (Prepared by User)

Name	Model
Receptacle	MS3102A20-29P
L-type Plug	MS3108B20-29S
Cable Clamp	MS3057-12A

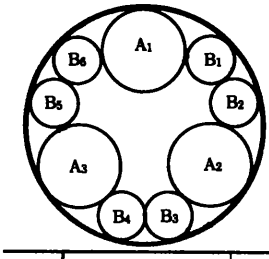
Table 10.8 Typical 1CN and 2CN Cables (Prepared by User)

	Size	Number of Cores
1CN	0.3 mm^2	Coaxical, 50 cores *1
2CN	0.5mm^2×3 0.2mm^2×6P	In pair, stranded *2

*1 : Vinyl coated wires for electrical equipment can be used with 1CN signal wires, with the exception of analog signal wires.
Pay attention to the following when selecting signal wires.
- Install signal wires separate from the main circuit wiring and install point-to-point with the shortest possible distances to minimize effects of noise.
The outside dimensions of bundled wires must be smaller than the connector outlet.
(MR-50LF: ϕ16, MR-20LF: ϕ11)

*2 : Use composite KQVV-SW DP8409179 (AWG 16 x 3C, AWG 26 x 6P) manufactured by Fujikura.

Table 10.9 Typical 2CN-PG Cables

Yaskawa Drawing No.	DP8409179
Manufacturer	Fujikura Cable Co.
Specifications	Composite KQVV-SW AWG 16×3C AWG 26×6P
Connection Method	Soldering
Internal Composition and Lead Color	

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

10.7 POWER LOSS

Tables 10.10 and 10.11 show power loss of servo driver and power supply unit.

Table 10.10 Power Loss of Servo Driver (at Reted Output)

Series	Type CIMR-SVJ-	Power Loss W (HP)
1500 rpm	03A	210 (280)
	04A	300 (400)
	16A	340 (453)
	08A	550 (733)
	11A	700 (933)
	15A	950 (1267)
	22A	1470 (1960)
	30A	1670 (2227)
	37A	2300 (3067)
750 rpm	03L	210 (280)
	04L	270 (360)
	06L	420 (560)
	08L	540 (720)
	11L	710 (947)
	15L	980 (1307)
	19L	1300 (1733)

Table 10.11 Power Loss of Power Unit

Type	Power Loss W
NPSN-0303L	70 (93)
NPSO-0503L	120 (160)
NPSO-0803L	180 (240)
NPSO-1303L	290 (387)

11. TEST RUN

11.1 PREPARATIONS

Check the following items before making trial operation.

(1) Is power within the rated value?

(2) Are I/O connections of the main and control circuits correct?

- Input side of power supply unit (power supply side) (Phase revolution is optional)···· Ⓡ, Ⓢ, Ⓣ
- Power supply unit ⟷ servo driver ···· Ⓟ, Ⓝ, Ⓟ0, Ⓝ0

  Inverse connection of P and N may damage the equipment.
- Servo driver ⟷ motor ····· Ⓤ, Ⓥ, Ⓦ

  Normal operation is not possible if phase rotation is incorrect.
- Motor wire connections

  1500 rpm series: Delta connection

  750 rpm series: Star connection

(3) Connection with an encoder (PG).

(4) Operation of the external sequence circuit.

11.2 CONTROLLER CHECK (POWER ON)

Turn power on after checking that sequence input [RUN] switched off and the speed reference input is 0V.

Turn power on and check the indicator lamps and display as follows.

Power supply unit
- SOURCE lamp lit (white)
- CHARGE LED lit (red)

Servo driver
- Monitor panel "0" displayed
- CHARGE LED lit (red)

Check in accordance with section 12, "TROUBLESHOOTING", if wrong data is displayed or if the display is different from the display items mentioned above when power is turned on.

11.3 CONSTANT SETTING

Set in accordance with sect. 7 "USER CONSTANTS" and sect. 9 "MONITOR PANEL OPERATION", matching the machine specifications. Set speed zero adjustment (Cn03) and voltage adjustment (Cn19) as follows:

(1) Speed zero adjustment (Cn03)

The necessary adjustment was made at the factory prior to shipment and no readjustment is needed. However, if fine adjustment is necessary, adjustment is possible using this constant.

Adjusting method:

① Input 0V as the speed reference (1CN between 3 and 4).

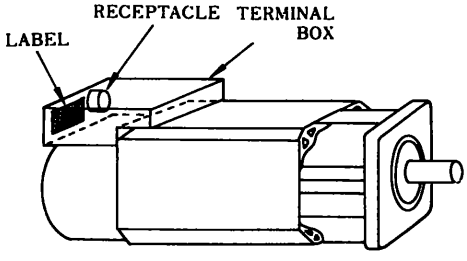
② Operate the monitor panel and read by displaying CHI AD data (Un17)

③ Set the value of Un17 in Cn03.

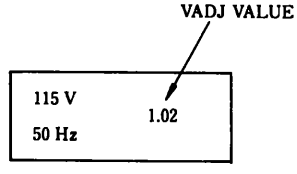
(2) Voltage adjustment (Cn19)

This is the constant to set dispersions of the motor circuit constant.

① Set VADJ value expressed on the label in motor terminal box at Cn19.



LABEL POSITION



LABEL EXAMPLE

11.4 TRIAL OPERATION METHOD

Operate the servo motor without a load in trial operation to avoid unexpected troubles. If trial operation must be performed mounted on an other machine, perform trial operation in a condition that allows an emergency stop anytime.

NOTE

- Be sure to perform trial operation in the SPEED CONTROL mode.
- If the J_L is less than 1/2 of the J_M such as the motor alone installed without a load, set the speed controller proportional gain (Cn04) to 10. The motor may hunt if the gain is high.
- Switch on the sequence input EMG during trial operation, but allow the input to be switched off anytime if trouble occurs.
- Check the installation of the motor and secure the safety around the motor shaft before starting operation.

11.4.1 Operation on Monitor Panel

Read Par. 9 "MONITOR PANEL OPERATION" thoroughly before operation.

(1) Select local mode. (Monitor panel operation)
Turn on 2 bits of C n 2 9.

(2) Close sequence input [RDY], [EMG] (RDY, EMG)

(3) Motor rotates while [JOG/NO.] on the monitor panel is depressed. (10% speed) Check that the motor rotates correctly.

(4) Depressing [△] key changes the mode into speed reference mode with [DSPL/ENTR] depressed. Key in speed reference (%). For safety operation, key in 10% for the beginning.

Example:

[Operation]	[Display]	
When the power is ON;	0	Speed monitor (r/min)
• Depress [DSPL/ENTR] and [△] simultaneously.	n 0.0	Speed reference (%) monitor (r/min)
• Depress [▷] several times to make digit to be changed blink. (Twice in this example)	n 00.0 Blinks	
	n 01.0 Blinks	Speed reference 10%
• Values are changed by depressing [△] for a desired value.	n 01.0	Setting completed
• Depress [DSPL/ENTR]		

(5) Depress [RUN/DATA], the motor rotate at a set speed.
[FWD/REV/MODE] changes the rotating direction.

(6) Increase the set value of speed reference slowly enough to check if there is no abnormal noise, smell or vibration.

(7) Depress [STOP/SET] to stop the motor.

11.4.2 Operation by External Reference

(1) Switch on (close) sequence input [RDY] after checking that the speed reference input is 0V. An excitation current flows to the motor at this time.

(2) Input approximately 1.5V (50%) to forward-side torque limitation (1CN5-6) and inverse-side torque limitation (1CN7-8). Input of limit valules is not necessary if external torque limitation is not used (if Bits 3 and 4 of Cn30 are set to ON).

(3) Switch on (close) sequence input [RUN] and slowly increase the speed reference from 0V to rotate the motor at a speed proportional to the reference voltage.

(4) The motor rotates in a forward direction (counterclockwise as viewed from the load side) if the reference voltage is positive. The motor rotates in a reverse direction if the voltage is negative. (See Fig. 11.1)

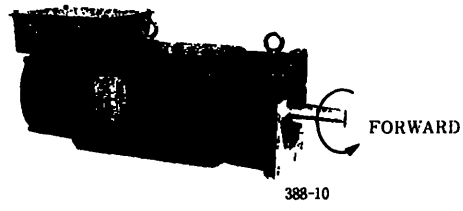


Fig. 11.1 Motor Forward Direction

11.4.3 Checking for Test Run

At test run, check the following.

- Abnormal vibration
- Unusual noise
- Excessive temperature

In case of error occurrence, refer to Par. 12. "TROUBLESHOOTING".

11.4.4 Setting up Absolute Encoder

It is necessary to store a machine original point or reference position with the absolute encoder installed on the machine (step). For procedure, refer to Par. 6.5.2 (8) "setup "Setup method."

12. MAINTENANCE

Plan and perform maintenance and management to keep the VS-866 Drives in good condition.

⚠ - Warning of electric shock

When an inspection is made on the VS-866 do not touch the inside at least 5 miniutes after the power supply is turned OFF. Verify that the smoothing capacitor electric discharge has been completed before starting maintenance.

At this time, the charge indicator lamp "CHARGE" is extinguished.

12.1 DAILY CHECK LIST

Check the items listed in the following table daily.

Table 12.1 Daily Check List

Classification	Check Procedure		Criteria	Remedy
	Check Item	Method		
Ambient	Ambient temperature	Thermometer	Inverter: 0℃ to +55℃ (Above freezing) Motor: 0℃ to +40℃	Improve installantion environment to meet the specification.
	Humidity	Hydrometer	90% RH or lower (Non-condensing)	Keep to the specification.
	Ventilation	Visual check	Entry and exhaust ports must not be obstructed.	Remove obstacles.
Power conditons	Voltage	Voltmeter	Must be form +10% to −15% of rated voltage.	Adjust voltage within the specified range (by a tap changer).
	Current	Ammeter	Must not be greater than the rating. Must be free from cyolic fluctuations.	Adjust load.
Appearance	Dust and stains (with dust.etc.) on the inverter Dust and stains on the motor shaft opening	Visual check	Must not be present	Clean if dirty.
Operation status	Vivration	Touch or use a vibrometer.	Must be free from unusual vibration or increase in magnitude.	If allowable limit is exceeded, stop operation and correct the cause.
	Odor	Smell.	Must be free from burning odor.	Stop operation and correct the cause.
	Abnormal sound	Listen.	Must be free from unusual sound or increase of noise.	If operation is hindered, stop operation and correct the cause.
	Rise of inverter or motor temperature	Touch with care or use a thermometer.	Must be free from excessive temperature rise over normal operating temperature.	Stop operation and cool the system. Check for abnormality in the cooling system (e.g. the fan). Repair if damaged.
Around the bearing	Bearing noise	Listen or use a stethoscopic rod.	Must be free from unusual sound or increase of noise.	Replace the bearing.
	Vibration	Touch or use a vibrometer.	Must be free from excessive vibration.	
	Bearing temperature	Touch with care or use a thermometer.	Must be free from excessive temperature rise over normal operationg temperature.	
	Grease	Visual check	Must not be leaking.	Correct the cause and restore the normal condition.
Motor cooling Fan	Operation state	Visual or aural check	Normal operation	Correct the cause of fan stoppage or replace the motor if damaged.

12.2 PERIODICAL MAINTENANCE

Observe the following procedures and clean the inverter periodically.

(1) If an air filter is used in the control panel, clean the filter once a month.

(2) Dust on electronic components can lead to overheating and insulation deterioration. Remove dust periodically. Dust or oil on the heat sink placed on the back of the controller may impair heat dissipation and result in a failure. Clean the heat sink once every six months by blowing compressed air or with a dry cloth. (Clean more frequently if necessary.)

12.3 PERIODICAL CHECK LIST AND ACTION TO BE TAKEN

Refer to Table 12.2 to plan a maintenance schedule for periodic inspection.

Table 12.2 Periodic Inspection

Classification	Check Procedure		Criteria	Remedy
	Check Item	Method		
Daily Inspection Conditions	Inspection record	Visual	–	Use the information in periodic inspection.
Installation Conditions	Tightening bolts of the inverter and the motor	Visual	Must not be loose.	Tighten the bolts.
Grounding	Grounding pins of the inverter and the motor	Visual	Must be grounded securely.	Restore the initial condition and tighten.
Coating	Peeling and Corrosion	Visual	Must be free from damage, discoloration, peeling, and corrosion.	Apply anti-corrosion coating.
Cables and Connections	Loose connection, break in wire cover, terminal box	Visual	Must be free from loose connection or break. Must be free from deterioration or deformation.	Restore the initial condition and tighten.
Cooling Fan	Vibration	Touch.	Must be free from unusual vibration or increase in magnitude.	Replace the cooling fan.
	Abnormal sound	Check by hearing	Must be free from unusual sound or increase of noise.	
Electrolytic Capacitor	Leak and expansion	Visual Check	Must be free from abnormalities such as leak of liquid or expansion.	Replace the parts.
	(Capacitance measurement)	(Capacitance measurement instrument)	(Must be within the specifications.)	
Relays and Contactors	Abnormal sound when functioning	Listen.	Must be free from chattering noise.	Replace the parts.
Resistors	Cracks in insulating material	Visual check	Must be free from abnormalities.	Replace the parts.
	Break in wire	Circuit tester and the like	Must be within the specifications.	
PC Board	Discoloration	Visual	Must be free from abnormal or partial discoloration.	Replace the PC board.
Control Circuit	Operation check	Inverter standalone operation	Output voltage phases must be balanced well.	Adjust the PC board or repair the inverter.
Insulation Resistance	Inverter (Between the main circuit and ground)	Insulation resistance meter	Must be above the specifications.	Repair.
	Motor (Between the stator and ground)		500VDC 10MΩ or more	Dry the stator windings. If insulation is not within specs, repair.
1. Shaft Coupling	Sunk keys	Visual	Must be free from damage and deformation.	Replace parts.
	Shaft coupling without key		Alignment marks must match.	Restore initial conditions.
2. V-belt	Tightening reamer bolt		Must not be loose.	Tighten the bolt.
	Abrasion		Abrasion must be slight.	Replace the parts.

Table 12.2 Periodic Inspection (cont'd)

Classification	Check Procedure		Criteria	Remedy
	Check Item	Method		
Motor	Bearing	Listen or use a vibrometer. (Period:12000 hours or two years)	Must be free from unusual sound, vibration increase or temperature rise.	Disassemble and replace the worn parts.
	Cooling fan	Listen or use a vibrometer. (Period:15000 hours or two years)		Replace the cooling fan.

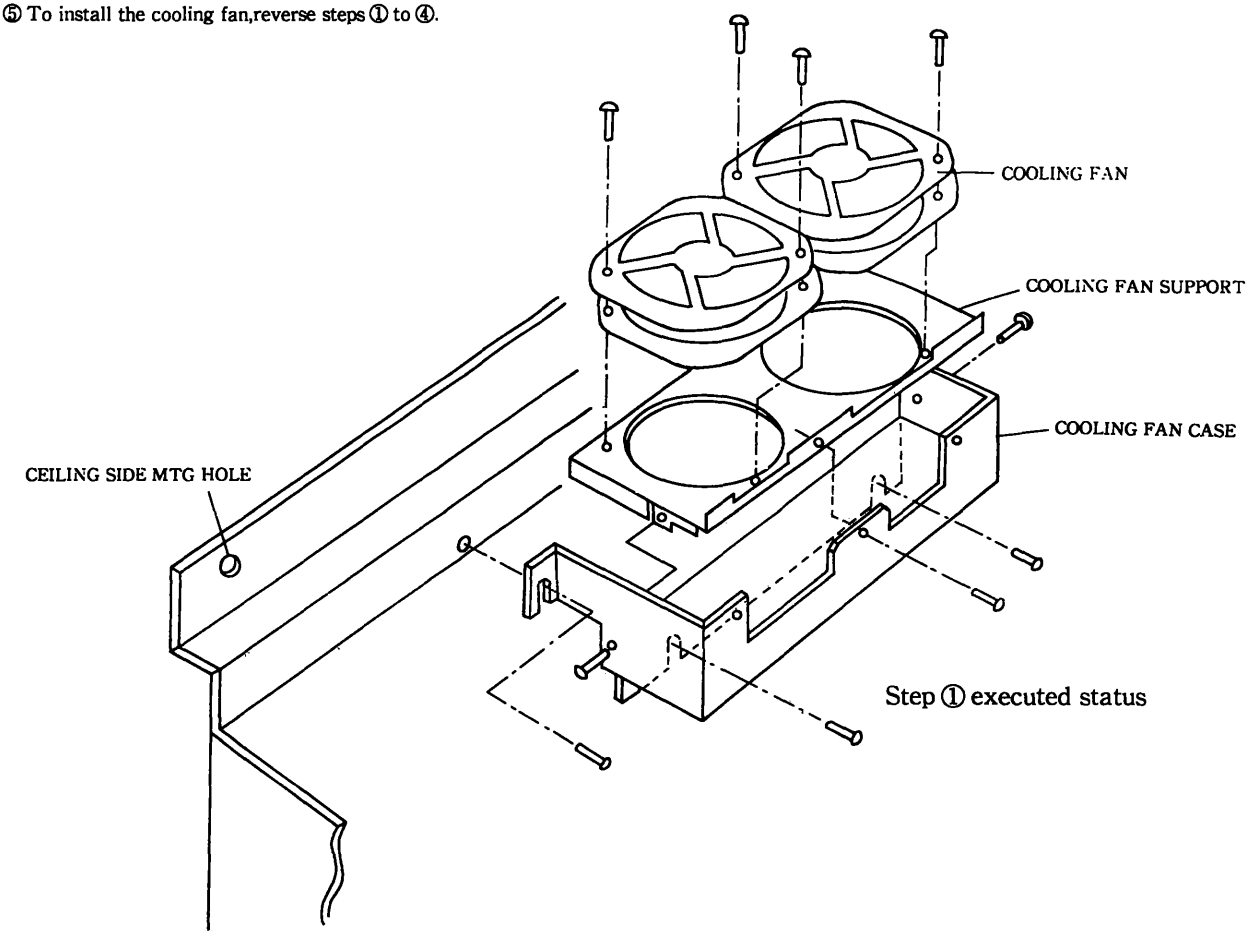
12.4 REPLACING THE INVERTER COOLING FAN

The inverter houses a fan for cooling the heat sink. Replace the fan after a total operation time of about 20,000 hours. (See Fig. 12.1)

⚠ – Precaution on replacing the cooling fan

Never replace the cooling fan nor remove/connect cables when power is ON.
(Otherwise, injury by electric shock or the rotating fan may occur.)

① Open the board frame(for control board mounting)and remove the base drive board.
② Remove screws "a" and the cooling fan case.
③ Remove screws "b" and the cooling fan bearing.
④ Remove screws "c" and the cooling fan.
⑤ To install the cooling fan,reverse steps ① to ④.



12.5 SPARE PARTS

Servo Driver

Servo Driver Model	Spare Parts / Specification	Fransistor Module	Fuse	Control Board	Base Drive	Cooling Fan
03A□□ 04A□□ 03L□□	Model	6DI10A-050	CR2LS-50	Analog input JPAC-C389 -S□□□□ ETC00920X -S□□□□□	JPAC-C373	4715PS-22T-B30-B00
	Code No.	STR000254	FU000797		ETC00889X	FAN000130
06A□□ 04L□□	Model	2DI200A-050P-03	CR2LS-75		JPAC-C374	4715PS-22T-B30-B00
	Code No.	STR000474	FU000792		ET000890X	FAN000130
08A□□ 06A□□ 08L□□	Model	QM200DY-H	CR2LS-100		JPAC-C375	4715PS-22T-B30-B00
	Code No.	STR000288	FU000794		ETC00891X	FAN000130
11A□□ 11L□□	Model	QM300HA-H	CR2L-140		JPAC-C376	5915PC-22T-B30-B00
	Code No.	STR000173	FU000793		ETC00892X	FAN000131
15A□□ 15L□□	Model	QM400HA-H	CR2L-200	Digital input JPAC-C388 -S□□□□ ETC00919X -S□□□□□	JPAC-C377	5915PC-22T-B30-B00
	Code No.	STR000230	FU000751		ETC00893X	FAN000131
22A□□ 19L□□	Model	QM500HA-H	CR2L-260		JPAC-C378	5915PC-22T-B30-B00
	Code No.	STR000316	FU000834		ETC00894X	FAN000131
30A□□	Model	QM400HA-H	CR2L-350		JPAC-C379	5915PC-22T-B30-B00
	Code No.	STR000231	FU000795		ETC00895X	FAN000131
37A□□	Model	QM500HA-H	CR2L-450		JPAC-C380	5915PC-22T-B30-B00
	Code No.	STR000317	FU000825		ETC00896X	FAN000131

Power Unit

Power Supply Model	Spare Parts / Specification	Rectifier Diode	AC Fuse	DC Fuse	Control Power Fuse	Cooling Fan
NPSN-0303L	Model	50L6P43	25SHA-60S with MS3000-1	25SHA-75S with MS3000-1	P430	—
	Code No.	SID000395	FU000826	FU000827	FU000372	—
NPSO-0503L	Model	100Q6P43	25SHA-125S with MS3000-1	25SHA-150S with MS3000-1	P430	4715PS-22T-B30-B00
	Code No.	SID000408	FU000828	FU000829	FU000372	FAN000130
NPSO-0803L	Model	RM100DZ-H	25SH-160S with MS3000-1	25SH-180S with MS3000-1	P430	4715PS-22T-B30-B00
	Code No.	SID000332	FU000830	FU000831	FU000372	FAN000130
NPSO-1303L	Model	RM150DZ-H	25SH-260S with MS3000-1	25SH-300S with MS3000-1	P430	4715PS-22T-B30-B00
	Code No.	SID000418	FU000832	FU000833	FU000372	FAN000130

13. TROUBLESHOOTING

If an operation trouble has occurred, locate it and take measures properly in the following procedure. If the trouble cannot be remedied by such a procedure, contact your Yaskawa representative.

Precautions During Trouble Diagnosis

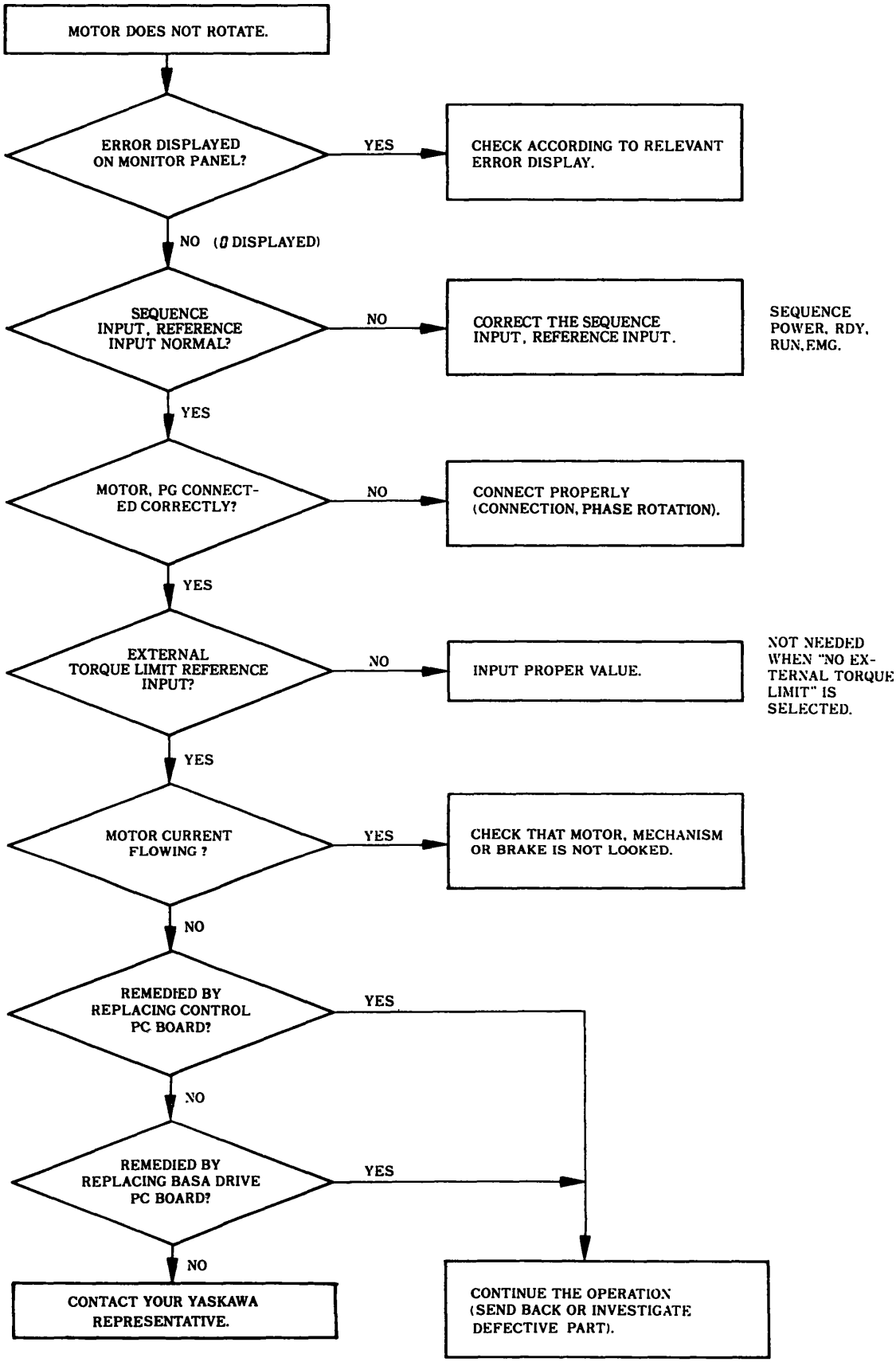
(1) Never remove or reinstall wires when power is supplied.

(2) Check or handle the main circuit only after turning power off and the CHARGE indicator lamp goes out. Measure the DC busbar voltage between P and N using a tester and make sure that it is safe.

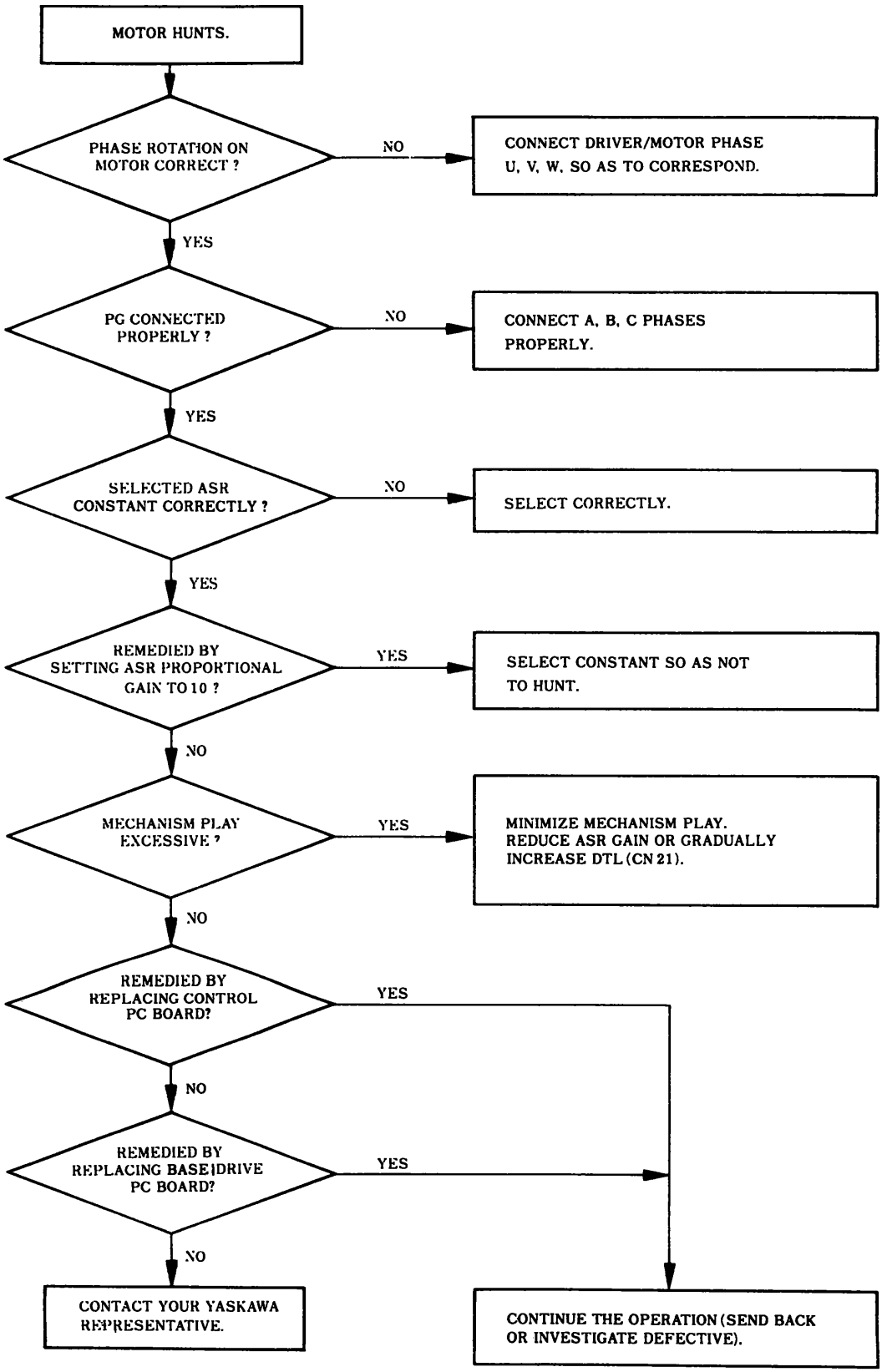
(3) Trouble display is stored even if power is turned off and can be checked by the error trace data shown on the monitor panel when power is turned on again. If power is turned off again, the memory data is erased.
Therefore, the error trace data must be recorded.

13.1 MOTOR MALFUNCTION

• Motor does not rotate.

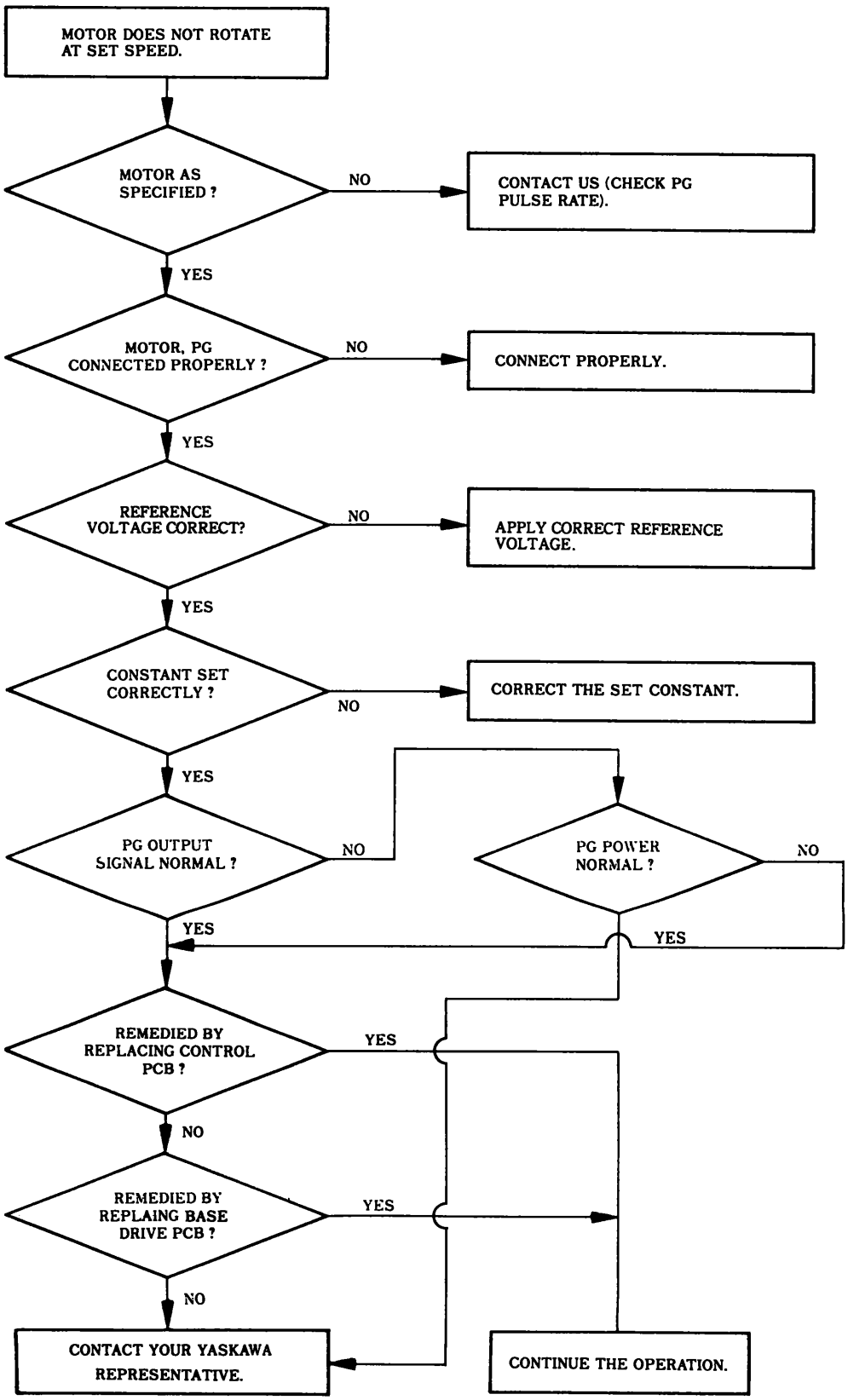


• Motor hunts.


MOTOR HUNTS.
PHASE ROTATION ON MOTOR CORRECT ?
NO
CONNECT DRIVER/MOTOR PHASE U, V, W, SO AS TO CORRESPOND.
YES
PG CONNECTED PROPERLY ?
NO
CONNECT A, B, C PHASES PROPERLY.
YES
SELECTED ASR CONSTANT CORRECTLY ?
NO
SELECT CORRECTLY.
YES
REMEDIED BY SETTING ASR PROPORTIONAL GAIN TO 10 ?
YES
SELECT CONSTANT SO AS NOT TO HUNT.
NO
MECHANISM PLAY EXCESSIVE ?
YES
MINIMIZE MECHANISM PLAY. REDUCE ASR GAIN OR GRADUALLY INCREASE DTL (CN 21).
NO
REMEDIED BY REPLACING CONTROL PC BOARD?
YES
NO
REMEDIED BY REPLACING BASE DRIVE PC BOARD?
YES
NO
CONTACT YOUR YASKAWA REPRESENTATIVE.
CONTINUE THE OPERATION (SEND BACK OR INVESTIGATE DEFECTIVE).

13.1 MOTOR MALFUNCTION (Cont'd)

· Motor does not rotate at a set speed.



13.2 ERROR INDICATION AND ERROR PROCESSING

Table 13.1 Error Indication and Error Processing

Error Indication	Operation Level	Cause	Check	Corrective Action
OC CLA Over-current	OC Operates when the servo driver output current (motor current) exceeds 4.5× [rated current of servo driver] (Example CIMR-SVJ-03AAA Ioc=4.5×18=81(A))	Wiring error	Check if the wiring between servo driver motors is correct according to the connection diagram. (Main circuit, PG line)	Correct the wiring.
		Operation error	Check that the grounding of the servo driver and motor are connected correctly.	Ground the servo driver and motor using a cable of the specified size.
		Short-circuit of load	• Measure the resistance between motor terminals to check that there are no short circuits. • Check that there is no broken cable between the servo driver and motor.	If the motor is not operating properly, replace the motor. If the cable is damaged, replace the cable.
	CLA Operates at 4× [rated current of servo driver] (Example CIMR-SVJ-03AAA ICLA =4 ×18=72(A))	Grounding fault	Check that there is no grounding fault between the servo driver output and the grounding point.	Correct the grounding fault, if any.
		Power transistor module error	Check the resistance between the terminals of the transistor module	Replace the transistor module.
		Control card /base drive card error	Replace the card to see if it operates normally.	Replace the card. (Contact your YASKAWA representative.)
OU UL Over-voltage	OU Operates when the voltage between main circuit P-N exceeds 420 V DC. UL Operates when the voltage between P-N becomes 395 V DC.	The power supply voltage is high.	Check the voltage between the input terminals. • Voltage between the power supply unit input terminals (R, S, T) : 170 to 242 V AC • Servo driver input voltage (between P-N) : 240 to 340 V DC.	Set the power supply voltage to conform to the specifications. (Change the tap of the power transformer, etc.)
		Braking unit, brake resistor failure during deceleration.	• Check the wiring of the braking unit and brake resistor. • Use a tester to check if the brake resistor is connected. • Recheck the selection of the brake resistor (including the machine system GD^2).	Correct the failure.
OS Overspeed	Operates when the motor speed reaches 120% the Cn01 preset value.	Poor adjustment	Check if the speed control unit constant (Cn04 to Cn11) and the position loop gain (Cn02) setting values are appropriate.	Readjust the value.
		Excess regenerative load	Determine if there is excess regenerative load. (Regenerative torque of 200% or more.)	Reduce the regenerative load. Expand the servo driver and servo motor capacity.

Table 13.1 Error Indication and Error Processing (Cont'd)

Error Indication	Operation Level	Cause	Check	Corrective Action
CUU Control power supply low voltage	CUU Operates when P_0-N_0 falls below 170V DC.	The input voltage is low.	Check the voltage between the input terminals. Between main circuit P-N Between control circuit P_0-N_0 Normal level : 170V to 242V	Raise the input voltage so that it conforms to the specifications.
PUU Main power supply low voltage	PUU Operates when P-N falls below 220V DC.	Power failure, open phase of the input voltage	Check the voltage between the input terminals of the power supply unit.	Adjust the voltage to the normal voltage.
		Control card /base drive card failure	Replace the card to see if it operates normally.	Replace the card. (Contact your YASKAWA representative)
OL 1 Servo driver overload	OL operation time Current / Operation time 100% / ∞ 150% / 50 seconds 200% / 10 seconds	Overload	Check if the servo driver is not operating when exceeding the OL operation time.	Lighten the load.
		Wiring failure (wiring error, wire disconnection)	Check if the wiring between the servo driver motor is as shown in the connection diagram. (Main circuit, PG line)	Correct the wiring.
OH 1 Servo driver overheat	Operates when the heat sink is overheated. Note: Operated temperature differs depending on the motor outputs. (65℃ to 90℃)	Overload	Check if the servo driver is not operating when exceeding the OL operation time.	Lighten the load.
		The ambient temparature of the servo driver is high.	Check that the ambient temparature of the servo driver is less than 55℃.	Cool the servo driver so that the ambient temperature is under 55℃.
		Deterioration of the cooling function	Check if the servo driver cooling fan has stopped, or if excessive oil and dust has adhered to the cooling fan.	Correct the error.
OH2 Low frequency	Operates when the low frequency (less than 3Hz) is overloaded.	Overload at low-frequency of inverter output curre nt	Check the load if the inverter output current is under 3Hz frequency.	Lighten the load at low-speed.
OLM Motor overload	OLM Operates when the motor temperature exceeds 140℃.	Motor overload	If the motor temperature is actually rising, check the load torque.	Lighten the load.
		Motor cooling error	Check if the servo driver cooling fan has stopped, or if dust is blocking the ventilation path.	Correct the error.

Table 13.1 Error Indication and Error Processing (Cont'd)

Error Indication	Operation Level	Cause	Check	Corrective Action
OHn Motor overheat	OHn Operates when the motor temperature exceeds 155℃.	Short circuit of thermosensor signal line	Check with a tester.	Correct the error.
FU Fuse blow	Operates when the servo driver fuse is blown.	Same as overcurrent (OC).	Check if the fuse is broken. Refer to the descriptions of overcurrent (OC). Check the power transistor.	Replace the fuse. Always check the power transistor, and replace the transistor, if abnormal.
PG PG signal error	Operates if the PG pulse is not fed back for 5 seconds after the speed reference is input under an operation ready state.	PG cable disconnection	Check the wiring and conductivity of the PG cable	Correct the error.
		Main circuit disconnection	Check the connection between servo driver motors (U, V, W).	Correct the error.
		The servo motor shaft is mechanically bound.	Check the area surrounding the machine. Check that no error occurs by separating the shaft from the machine. Check that the brake is freed.	Correct the error.
	Operates when the absolute encoder is used even if a fault exists with serial data received.	Absolute encoder and peripheral errors	Check the absolute encoder and peripherals.	Replace the board or the encoder. (Contact your YASKAWA representative.)
APG Absolute encoder error	Initial serial data error if it occurs immediately after inputting the SEN signal. Encoder pulse number error if it occurs during motor running.	PG cable error	Check the wiring and conductivity of the PG cable	Correct the failure.
		Mulfunction by noise	Check the gronding	Check that the grounding line is connected correctly.
		Data backup error at initial serial data occurrence	Check the battery voltage is under 3V.	Replace the battery.
			Check that more than 4 days have passed since the battery is disconnected.	Perform the set-up of the absolute encoder
		Control card error	Shut down the power. After monitor panel display is off, turn on the power again.	Replace the control card. (Contact your YASKAWA representative)
		Absolute encoder error		Replace the absolute encoder. (Contact your YASKAWA representative)

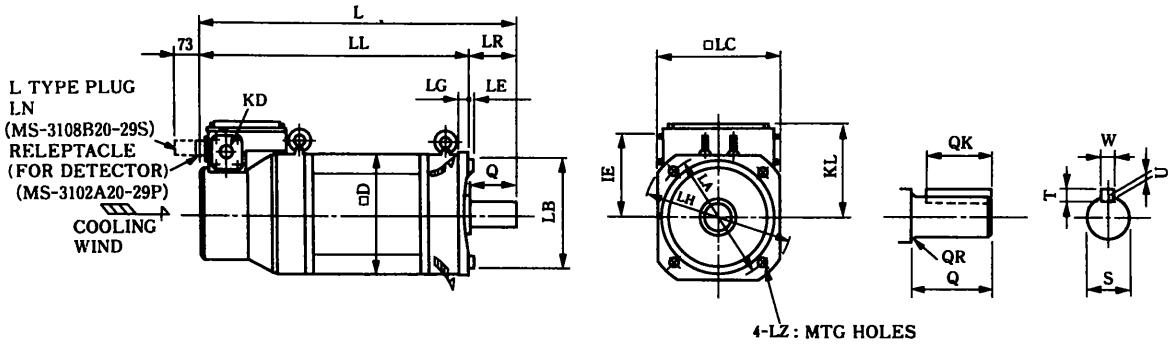
13.2 ERROR INDICATION AND ERROR PROCESSING (Cont'd)

Table 13.1 Error Indication and Error Processing (Cont'd)

Error Indication	Operation Level	Cause	Check	Corrective Action
nC MC on error	Operates when the electro-magnetic contactor that controls the servo driver internal rush current dose not close.	The input voltage of the main circuit is low.	Check the input voltage between P-N : 170 to 242 V	Raise the voltage so that it is within the input voltage specifications.
		Servo driver error	Check that the MC is on.	Replace the servo driver. (Contact your YASKAWA representative)
OHL Abnormally low motor temperature	Operates when the temperature of the motor falls below −14℃.	Broken thermister	Check the thermister signal line with a tester.	Repair the signal line.
		The temperature of the motor is too low.	Check the ambient temperature of the motor. Specification : 0 to 40℃	Increase the surrounding area so that the ambient temperarure of the motor meets the specified temperature.
AOn,nU2 nU1,AnO An1,PGC Ad,AdC Control error	Operates when serious error is detected by self diagnosis.	Control card error	Turn off the power supply once, and then turn it on again after the indication on the monitor panel goes out.	If the error is displayed again, replace the controller. (Contact your YASKAWA representative.)
		Control circuit operation error		Check that the grounding line is connected correctly.
OP Option error	Operates when error occurs in the signal exchange between the option card and the control card.	Option card mount error	Check the connection at the connector of the option card.	Connect firmly.
		Option card error	Replace the option card once to check if it operates properly.	Replace the option card. (Contact your YASKAWA representative.)
LF Load failure	Operates when cable disconnection is detected between the servo driver and servo motor.	Open phase/ line disconnection of load	Check the wiring.	Repair the error.

14. DIMENSIONS in mm (inch)

(1) Servomotor (Flange-mounted)



Servomotor		L	LA	LB	LC	LE	LG	LH	LL	LR	LZ	D	IE	KD	KL
1500rpm Series	750rpm Series														
UAACKA-03A□2K	—	467 (18.4)	200 (7.87)	114.3 $^{0}_{-0.025}$ (4.5 $^{0}_{-0.00098}$)	180 (7.09)	3.2 (0.126)	18 (0.908)	230 (9.06)	387 (15.2)	80 (3.15)	13.5 (0.531)	174 (6.85)	128 (5.04)	34 (1.34)	141 (5.55)
UAACKA-04A□2K	—	505 (19.9)							425 (16.7)						
UAACKA-06A□2K	UAACKL-03A□2K	545 (21.5)							465 (18.3)						
UAACKA-08A□2K	UAACKL-04A□2K	570 (22.4)	215 (8.46)	180 $^{0}_{-0.040}$ (7.09 $^{0}_{-0.00158}$)	204 (8.03)	5 (0.197)	20 (0.789)	250 (9.84)	460 (18.1)	110 (4.33)	14 (0.551)	204 (8.03)	144 (5.67)	42.5 (1.67)	159 (6.26)
UAACKA-11A□2K	UAACKL-06A□2K	625 (24.6)							515 (20.3)						
UAACKA-15A□2K	UAACKL-08A□2K	700 (27.6)							590 (23.2)						
UAACKA-22A□2K	UAACKL-11A□2K	650 (25.6)	300 (11.8)	250 $^{0}_{-0.040}$ (9.84 $^{0}_{-0.00190}$)	280 (11.0)		22 (0.866)	350 (13.8)	540 (21.3)		18 (0.709)	260 (10.2)	172 (6.77)		183 (7.20)
UAACLA-30A□2K	UAACLL-15A□2K	695 (27.4)							585 (23.0)						
UAACKA-37A□2K	UAACLL-19A□2K	755 (29.7)							645 (25.4)						

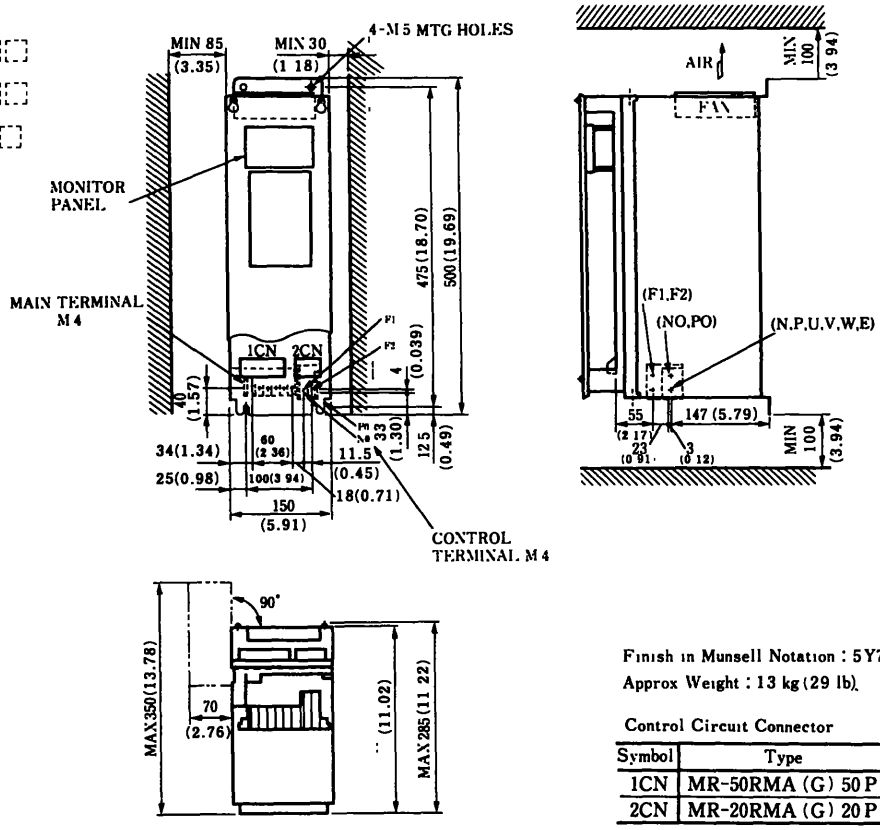
Servomotor		Shaft End							Approx Weight kg(lb)
1500rpm Series	750rpm Series	Q	QK	QR	S	T	V	W	
UAACKA-03A□2K	—	80 (3.15)	60 (2.36)	0.5 (0.0197)	38 $^{+0.018}_{+0.002}$ (1.50 $^{+0.00071}_{+0.00008}$)	8 (0.315)	5 (0.197)	10 (0.394)	35 (77)
UAACKA-04A□2K	—								45 (99)
UAACKA-06A□2K	UAACKL-03A□2K								55 (121)
UAACKA-08A□2K	UAACKL-04A□2K	110 (4.33)	90 (3.54)	1 (0.0394)	42 $^{+0.018}_{+0.002}$ (1.65 $^{+0.00071}_{+0.00008}$)			12 (0.472)	50 (110)
UAACKA-11A□2K	UAACKL-06A□2K								65 (143)
UAACKA-15A□2K	UAACKL-08A□2K								70 (154)
UAACKA-22A□2K	UAACKL-11A□2K			2 (0.0787)	55 $^{+0.030}_{+0.11}$ (2.17 $^{+0.00118}_{+0.00043}$)	10 (0.394)	6 (0.236)	16 (0.630)	115 (254)
UAACLA-30A□2K	UAACLL-15A□2K								135 (298)
UAACKA-37A□2K	UAACLL-19A□2K								165 (364)

Note : L-type plug and cable clamp for connecting receptacte are not provided.

14. DIMENSIONS in mm (inch)(Cont'd)

(2) Servo Drivers

- CIMR-SVJ-03AA□□□
- CIMR-SVJ-04AA□□□
- CIMR-SVJ-03LA□□□

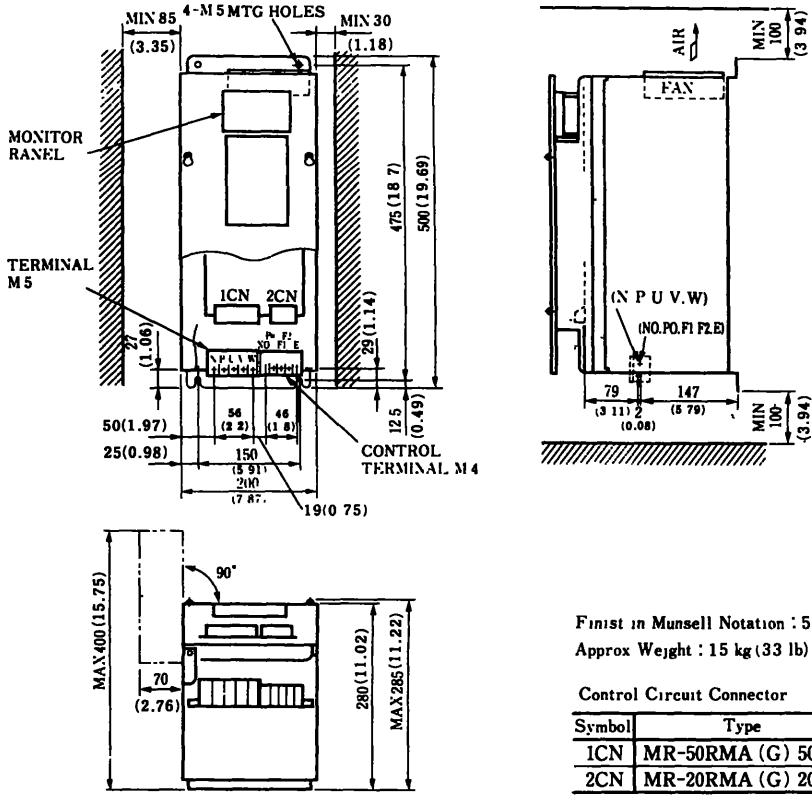


Finish in Munsell Notation : 5Y7/1
Approx Weight : 13 kg (29 lb)

Control Circuit Connector

Symbol	Type
1CN	MR-50RMA (G) 50P
2CN	MR-20RMA (G) 20P

- CIMR-SVJ-06AA□□□
- CIMR-SVJ-04LA□□□

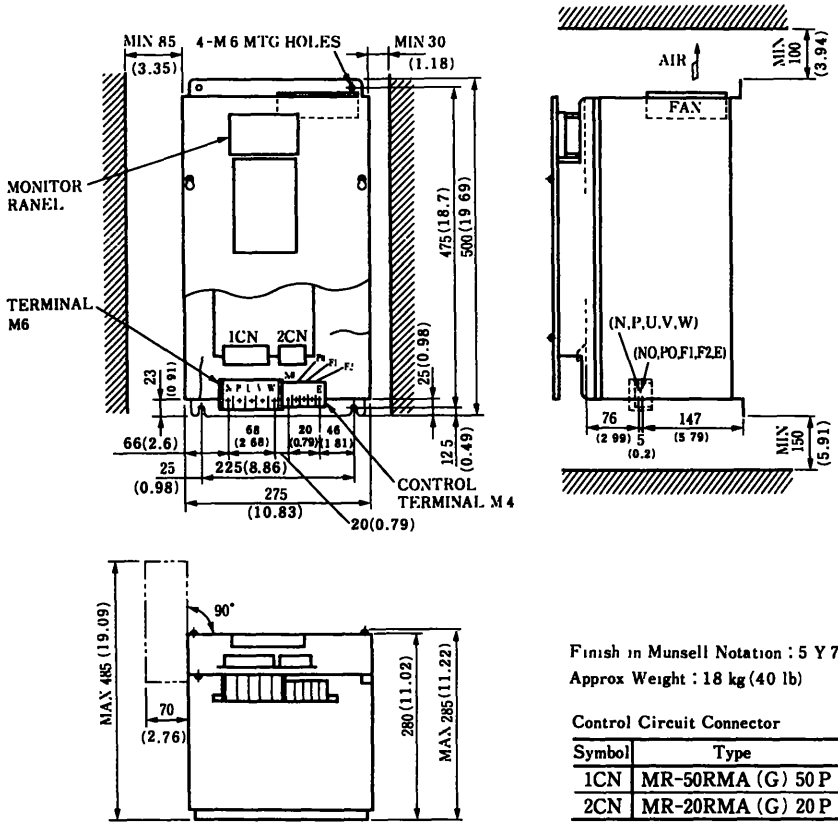


Finist in Munsell Notation : 5 Y 7/1
Approx Weight : 15 kg (33 lb)

Control Circuit Connector

Symbol	Type
1CN	MR-50RMA (G) 50P
2CN	MR-20RMA (G) 20P

- CIMR-SVJ-08AA□□□
- CIMR-SVJ-06LA□□□
- CIMR-SVJ-08LA□□□

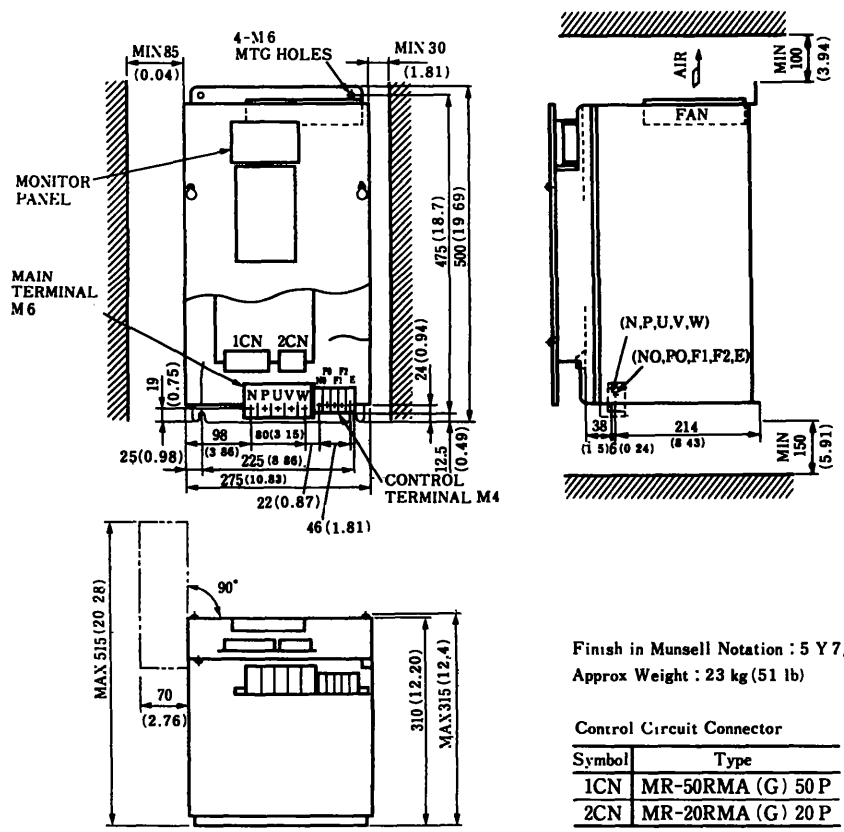


Finish in Munsell Notation : 5 Y 7/1
Approx Weight : 18 kg (40 lb)

Control Circuit Connector

Symbol	Type
1CN	MR-50RMA (G) 50 P
2CN	MR-20RMA (G) 20 P

- CIMR-SVJ-11AA□□□
- CIMR-SVJ-11LA□□□



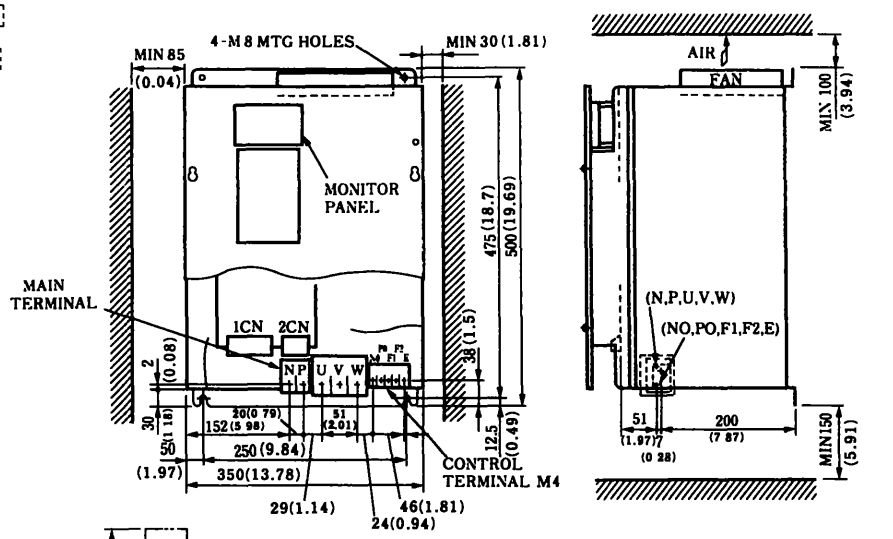
Finish in Munsell Notation : 5 Y 7/1
Approx Weight : 23 kg (51 lb)

Control Circuit Connector

Symbol	Type
1CN	MR-50RMA (G) 50 P
2CN	MR-20RMA (G) 20 P

14. DIMENSIONS in mm (inch)(Cont'd)

- CIMR-SVJ-15AA□□□
- CIMR-SVJ-15LA□□□

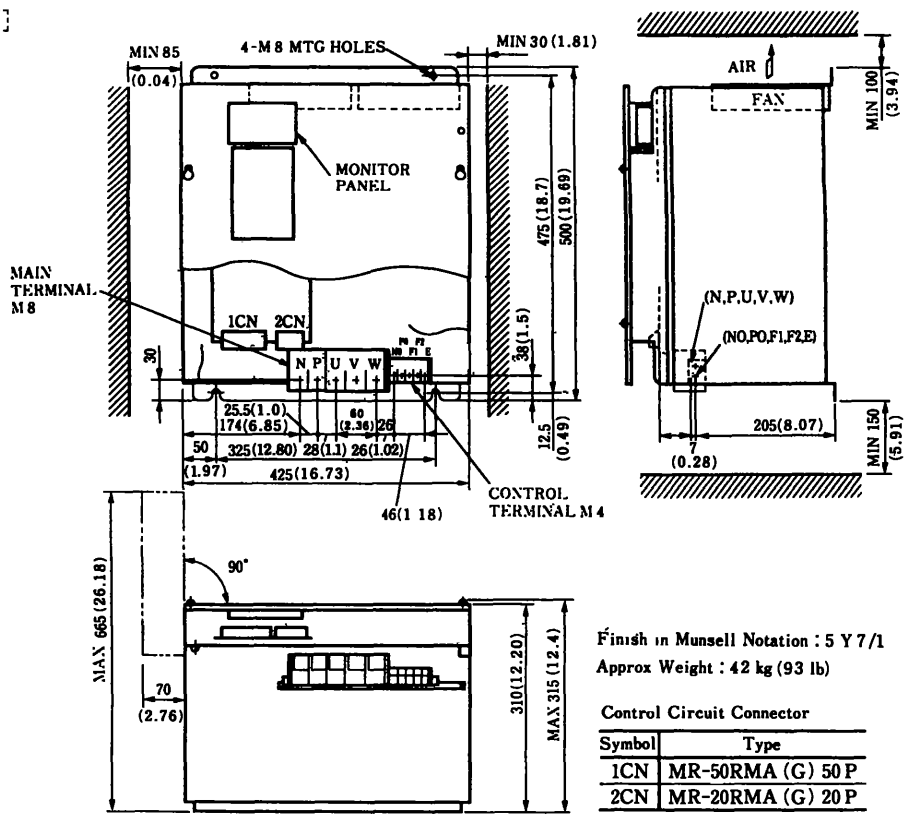


Finish in Munsell Notation : 5 Y 7/1
Approx Weight : 30 kg (66 lb)

Control Circuit Connector

Symbol	Type
1CN	MR-50RMA (G) 50 P
2CN	MR-20RMA (G) 20 P

- CIMR-SVJ-22AA□□□
- CIMR-SVJ-19LA□□□

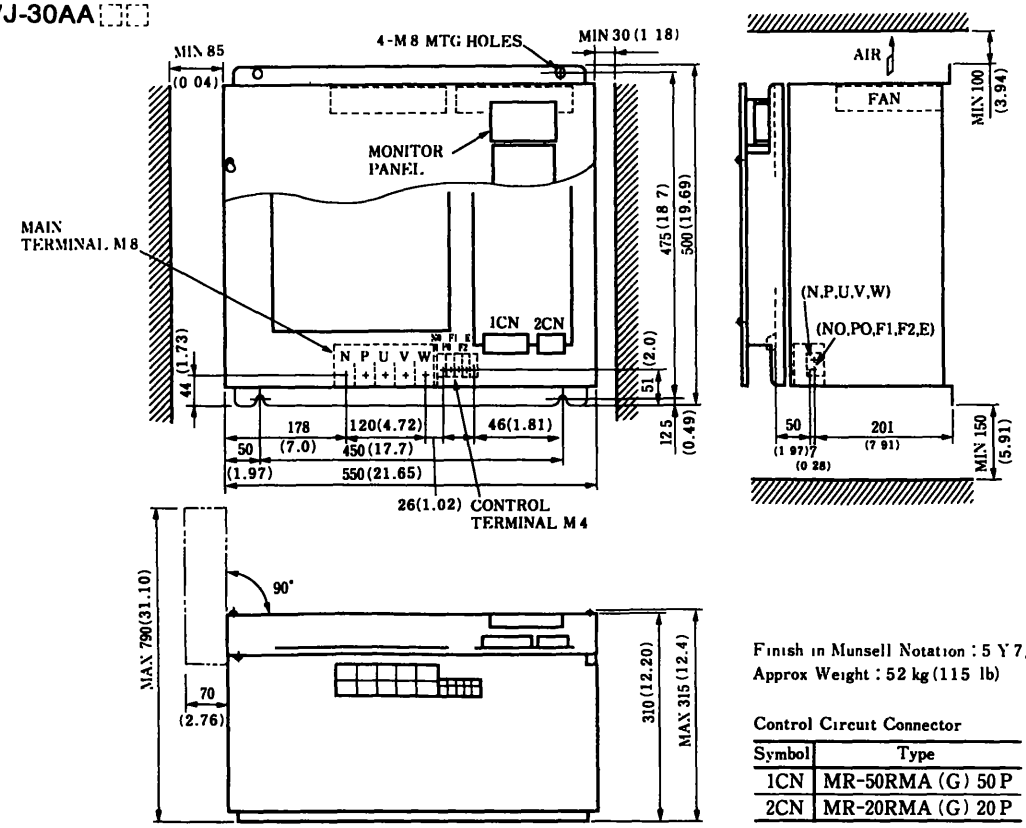


Finish in Munsell Notation : 5 Y 7/1
Approx Weight : 42 kg (93 lb)

Control Circuit Connector

Symbol	Type
1CN	MR-50RMA (G) 50 P
2CN	MR-20RMA (G) 20 P

• CIMR-SVJ-30AA□□

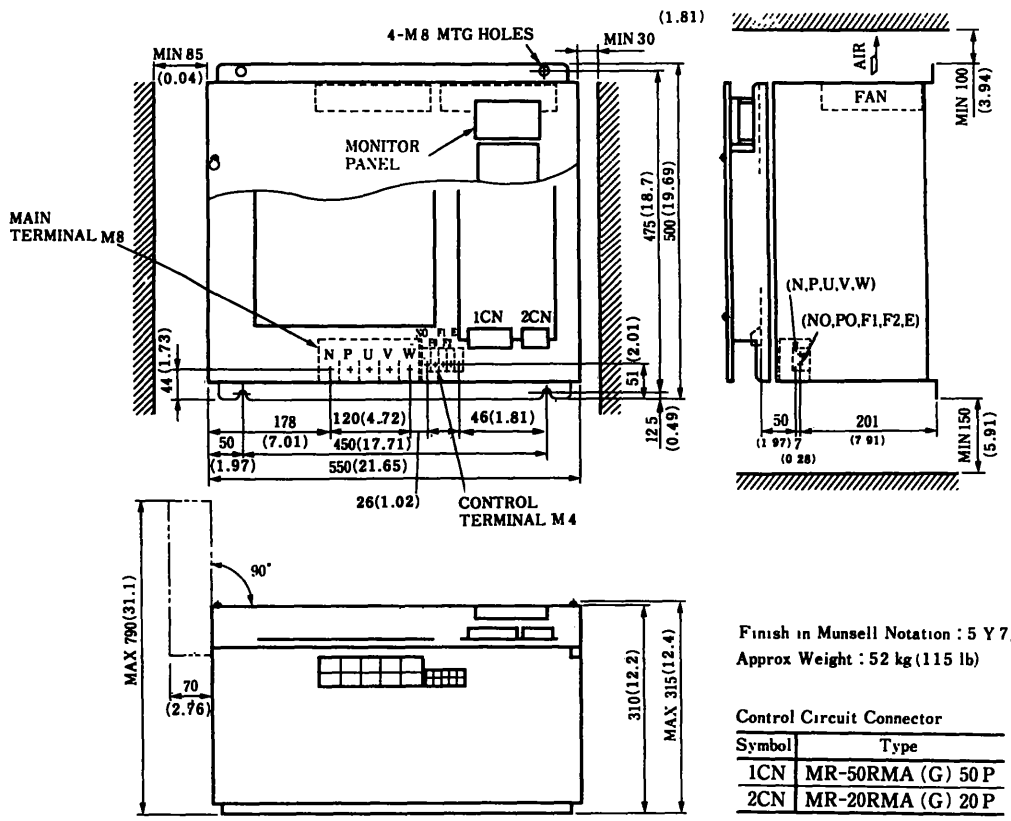


Finish in Munsell Notation : 5 Y 7/1
Approx Weight : 52 kg (115 lb)

Control Circuit Connector

Symbol	Type
1CN	MR-50RMA (G) 50 P
2CN	MR-20RMA (G) 20 P

• CIMR-SVJ-37AA□□



Finish in Munsell Notation : 5 Y 7/1
Approx Weight : 52 kg (115 lb)

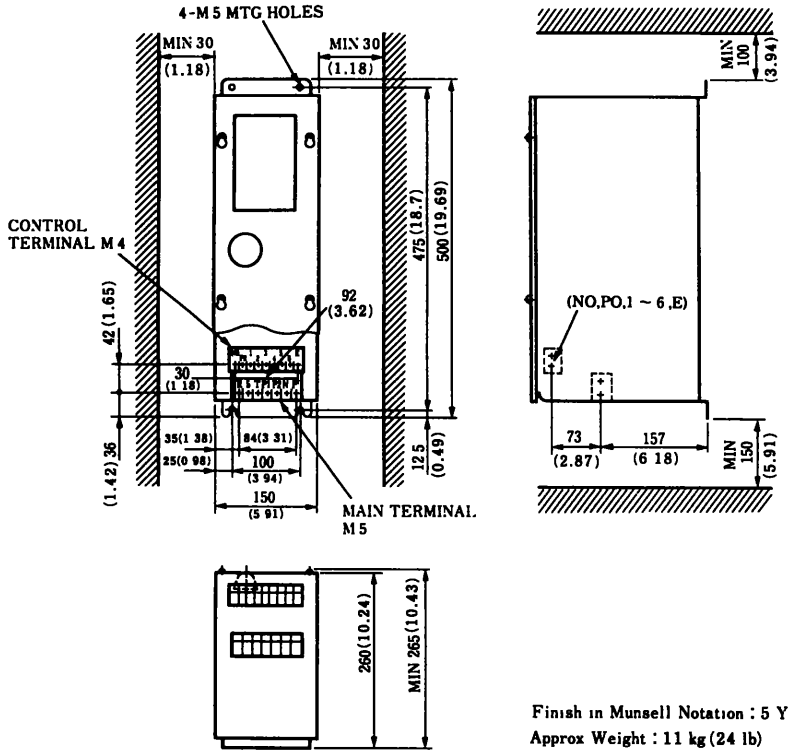
Control Circuit Connector

Symbol	Type
1CN	MR-50RMA (G) 50 P
2CN	MR-20RMA (G) 20 P

14. DIMENSIONS in mm (inch)(Cont'd)

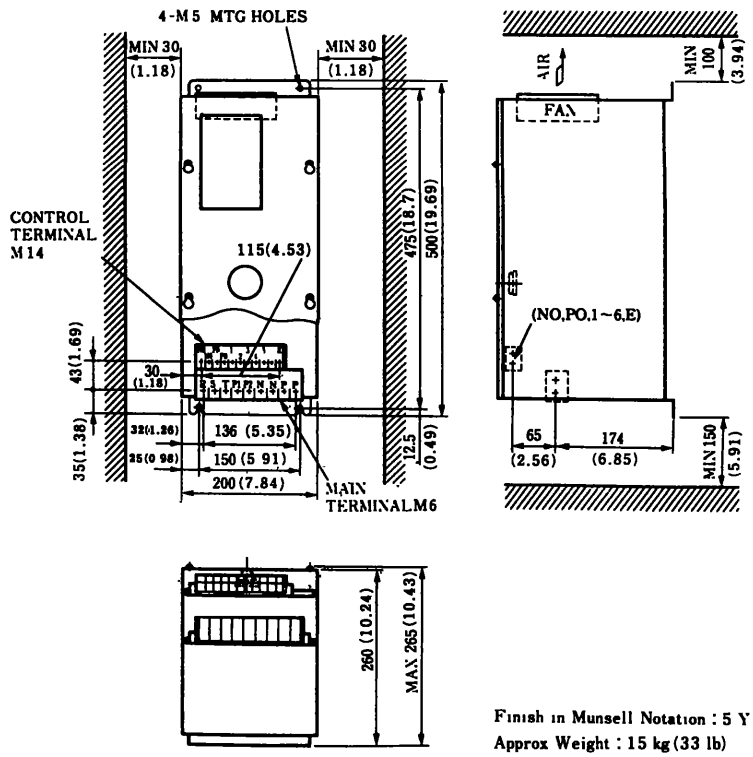
(3) Power units

• NPSN-0303L



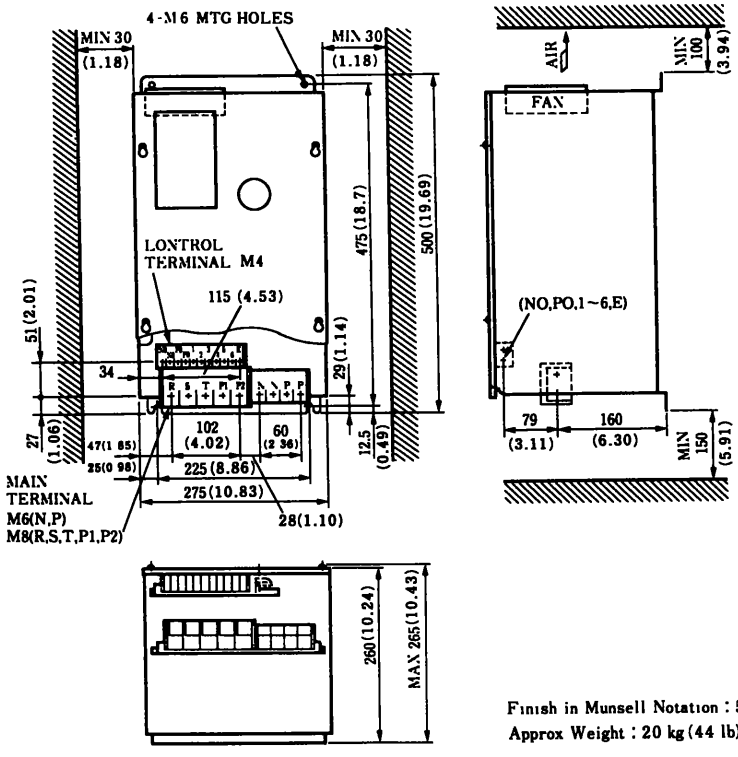
Finish in Munsell Notation : 5 Y 7/1
Approx Weight : 11 kg (24 lb)

• NPSO-0503L



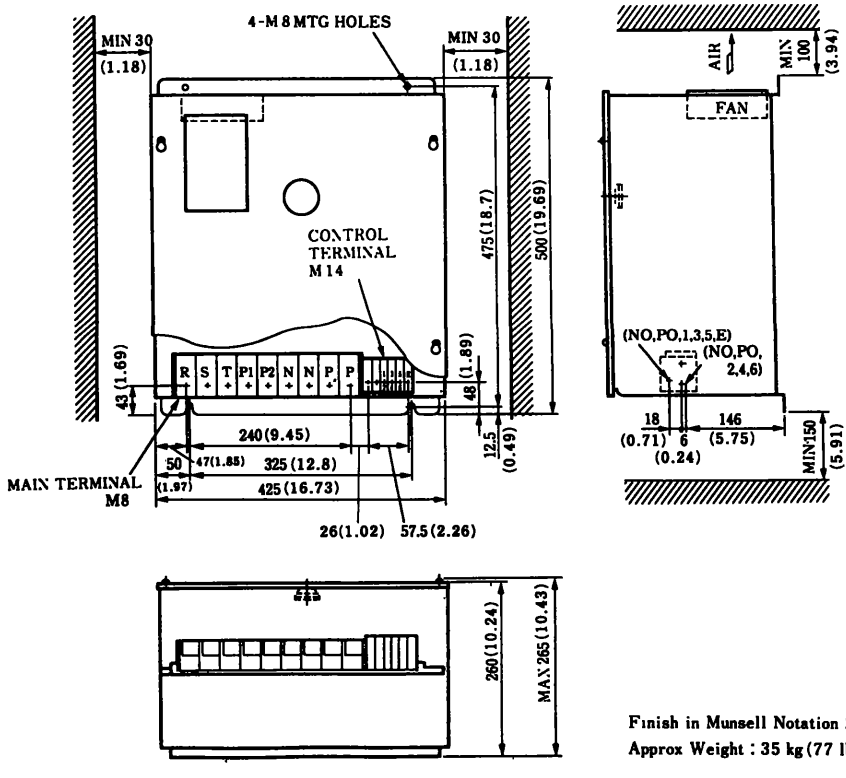
Finish in Munsell Notation : 5 Y 7/1
Approx Weight : 15 kg (33 lb)

• NPSO-0803L



Finish in Munsell Notation : 5 Y 7/1
Approx Weight : 20 kg (44 lb)

• NPSO-1303L

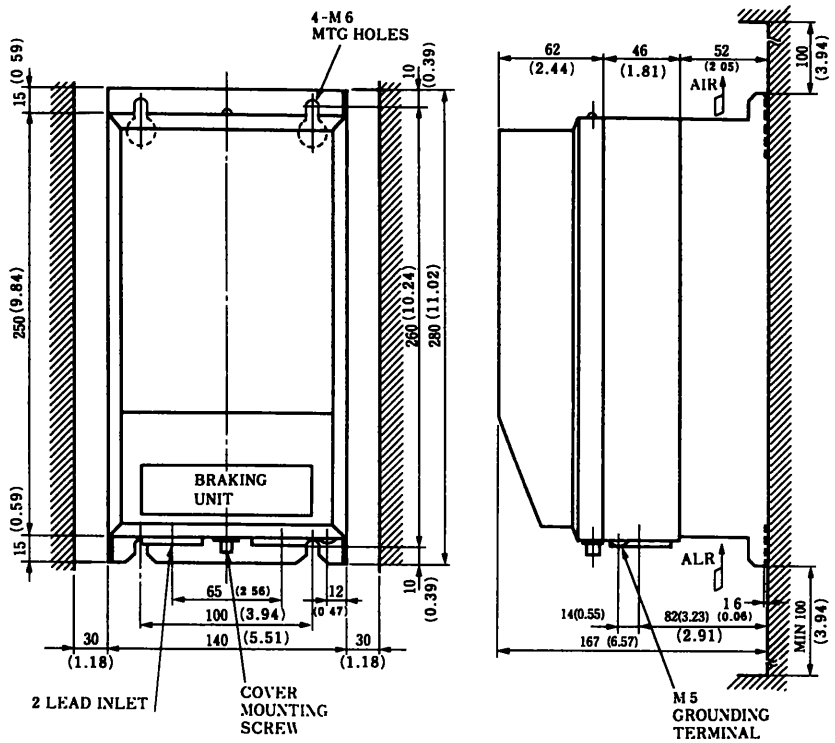


Finish in Munsell Notation : 5 Y 7/1
Approx Weight : 35 kg (77 lb)

14. DIMENSIONS in mm (inch)(Cont'd)

(4) Damping Unit

• CDBR-2022

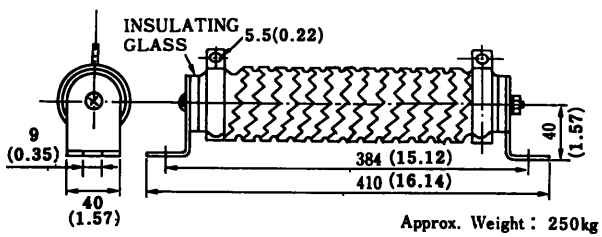


Finish in Munsell Notation : Cover–5 PB 3/9
Case–5 Y 7/1

Approx Weight : 4 kg (9 lb)

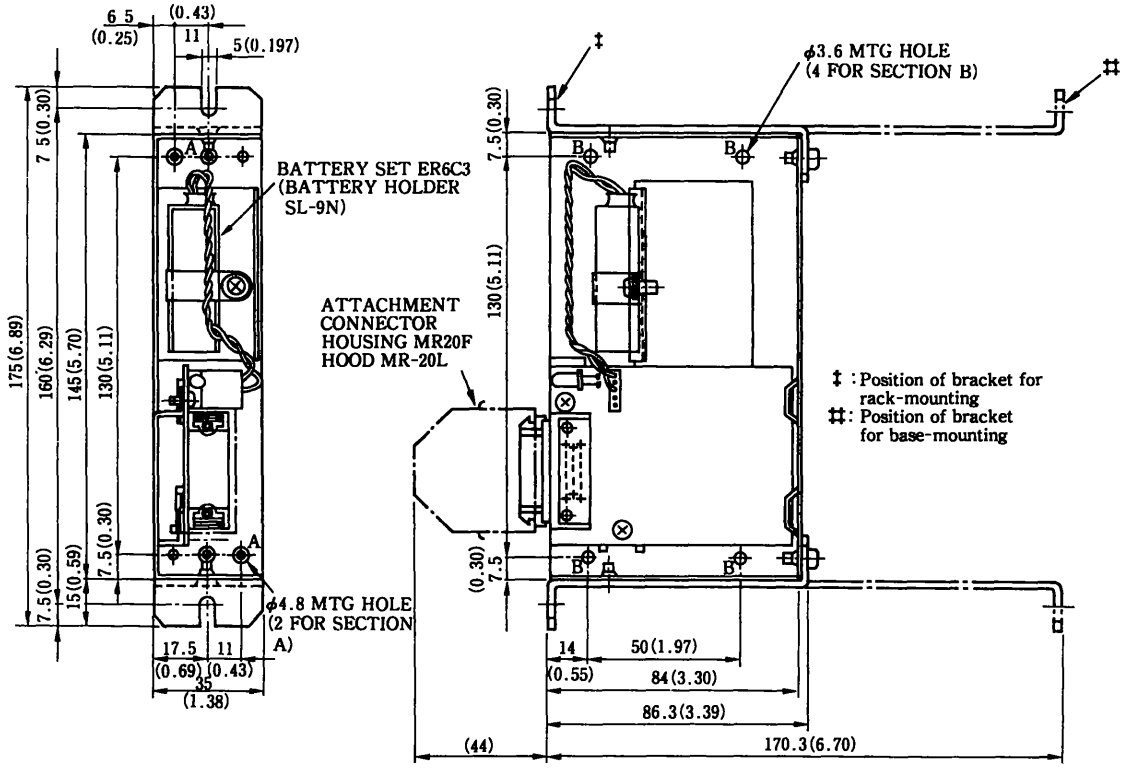
(5) Braking Resistor

• GRZG 600 W 30 Ω (R 007195)



Approx. Weight : 250kg (551 lb)

(6) Battery Module

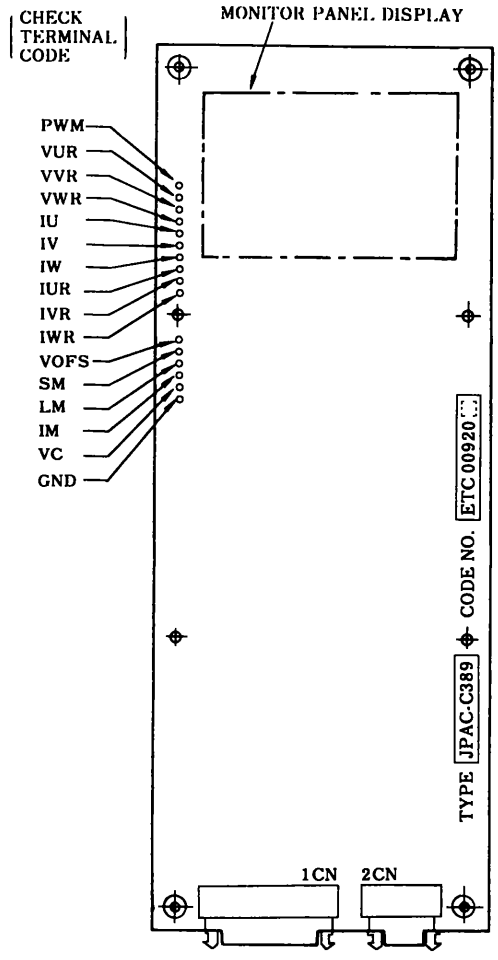


15 PERIPHERAL UNITS

Applicable Inverter		Rated Capacity KVA	Raetd Current A	Molded Case Circuit Braker (MCCB) (Model and Rated)*1	Magnetic Contactor (Model)*2	AC Reactor Model UZBA-B (Model and Rated)*3
1500r/min Series CiMR-SVJ-	750r/min Series CiMR-SVJ-					
03A □□	03L □□	6	18	NF50-CS, AC50A, 3P	HI-20ETU	X002492, 30A, 0.35mH
04A □□	–	9	27	NF100-CS, AC75A, 3P	HI-30ETU	X002493, 40A, 0.265mH
06A □□	04L □□	13	40	NF100-CS, AC100A, 3P	HI-35ETU	X002498, 90A, 0.12mH
08A □□	06L □□	18	55	NF255-CS, AC125A, 3P	HI65E2TU	X002555, 120A, 0.09mH
	08L □□					
11A □□	11L □□	25	80	NF225-CS, AC175A, 3P	HI-100E2TU	X002556, 160A, 0.07mH
15A □□	15L □□	35	110	NF225-CS, AC225A, 3P	HI-125E2TU	X002557, 200A, 0.05mH
22A □□	19L □□	45	135	NF400-CS, AC300A, 3P	HI-200E2TU	X002559, 280A, 0.039mH
30A □□	–	60	190	NF400-CS, AC300A, 3P	HI-20E2TU	X002559, 280A, 0.039mH
37A □□	–	80	240	NF400-CS, AC400A, 3P	HI-300E	X002560, 360A, 0.026mH

*1 Manufactured by MITUBISHI ELECTRIC CORP.
*2 Manufactured by YASKAWA CONTROL CO., LTD.
*3 Manufactured by YASKAWA ELECTRIC CORPORATION

APPENDIX CHECK TERMINAL



Note: Check terminal codes shown on the PC board.

Code	Name	Description
PWM	PWM carrier signal	Carrier signal (3kHz) of main circuit transistor switching.
VUR VVR VWR	U-phase V-phase W-phase } Voltage reference	Voltage reference for each phase (Current amplifier output, forward running) Amplitude and frequency differ according the speed.
IU IV IW	U-phase V-phase W-phase } current	Current for each phase (Forward running)
IUR IVR IWR	U-phase V-phase W-phase } current reference	Current reference for each phase (Forward running)
VOFS	Voltage reference synthetic signal	Check signal within industrial
SM	Speed monitor	motor speed monitor singal • ± 6V / N100 • Setting value (r/min) for N100: Cn01 • + at forward running, − at reverse running
LM	Torque monitor	Motor torque monitor signal • ± 3V / ± motor rated torque • + at forward running, − at reverse running
IM	Current monitor	Motor current monitor signal • + 5V / servo driver rated current
VC	Internal power supply	+ 5V
GND	Signal ground	0V

Note:
1. Do not moinitor check terminals during operation. (Only SM, LM and IM can be monitored during operation.)
2. The standard for each check terminal is GND.
3. In monitoring, be sure not to short-circuit between check terminals. The internal element may be destroyed by short circuiting.
4. Be sure to set the load resistance value between check terminal and GND at 10kΩ or more.
5. Normally, do not connect anything to check terminals.
6. The signals of SM, LM and IM are the same as speed monitor, torque monitor, and current monitor since they are being output from 1CN.

NOTES

MEMO

Varispeed-866 SERIES

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VECTOR-& DIGITAL-CONTROLLED IM DRIVE 3 TO 50 HP (2.2 TO 37 kW)

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Phone (02) 776-7844 Fax (02) 753-2639
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YASKAWA ELECTRIC CORPORATION

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