Specifications for

VS-626MTII Drive

AC Adjustable Speed Drives for Machine Tools Spindle

Specifications
SIE-S626-1.2

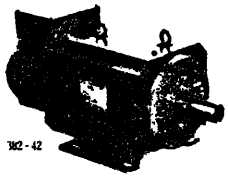
July 1983

INTRODUCTION

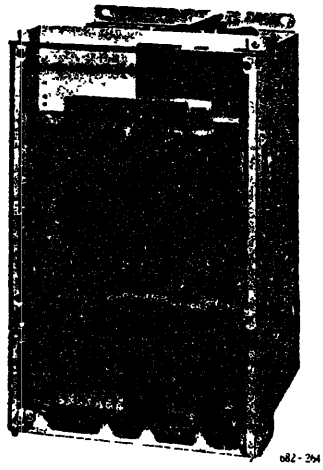
These specifications cover the machine tool spindle drive system, Varispeed-626MTII (VS-626MTII). Before initial operation with a VS-626MTII, these specifications must be thoroughly read, and retained for future reference.

The maximum speed obtained with a VS-626MTII is substantially higher than those with conventional DC motor speed control systems. To prevent accidents resulting from these high speeds, care should be taken in operating machines with your VS-626MTII. When you intend to use your VS-626MTII in configurations not described in this manual, contact our service department.

Spindle Motor
Flange-Mounted
Type EEVA-51KM



Spindle Motor
Foot-Mounted
Type EEA-1KM



Controller VS-626MTII
Type CIMR-MTII-7.5K

—— CONTENTS ——

1. SPINDLE AC MOTOR

1.1 Outline

The VS-626MTII spindle AC motor is an induction motor exclusively designed to drive machine tool spindles. It is available in two versions; a flange- and a foot-mounted type. The features of these spindle AC motors are as follows.

. 1500 to 6000 RPM(A Ratio of 1:4) at Constant Output Range
The exceptionally rigid motor structure and precision manufactured bearings permit 6000 rpm.
Thorough analysis of application requirements plus drive motor structure and characteristics establish the most ideal motor-controller combination. This provides optimum drive performance for a wide constant output range at speeds from 1500 to 6000 rpm maximum.

. Exclusively-designed Motor for Spindle Drive
Totally-enclosed, external fan-cooled, squirrel-cage motors are specifically designed for operation where oil mist, iron particles, machining chips, etc. exist. To meet space requirements for machine tools, the motors are available in slender, flange-mounted types and conventional foot-mounted types: both are compact and light weight .
The drive motor incorporates endplay-free bearings, and allows both direct coupling and gear connection to the machine and all angle mounting (for 30-minute rating, 15 kW or less) with drive extension up or down.
The exclusively-designed cooling fan configuration accomplishes low noise operation (76-80 dB).

. Unique Motor Cooling System
Flange-mounted motors employ a unique cooling system. A small integrated fan circulates air inside the enclosure, and the outside fan induces fresh cooling air through openings on the drive end and exhausts the air from to the opposite. Thus the heat generated by the drive motor is not transmitted to the driven machine; the machine is entirely free from the influence of the heat.

. High Reliability
Totally-enclosed, multipole brushless resorver for speed detection provide maximum performance dependability in concert with that of the AC motor.

1.2 Specifications and Characteristics

Table 1.1 Specifications of AC Spindle Motors

Rated Output kW (30-Minute/ Continuous Rating)	Flange-mounted type EEVA-51kM	5.5 / 3,7	-	7.5 / 5.5	-	11 / 7.5	-	15 / 11	-	18.5 / 15	-	22 / 18.5	-
	Foot-mounted type EEA-IKM	-	5.5 / 3.7	-	7.5 / 5.5	-	11 / 7.5	-	15 / 11	-	18.5 / 15	-	22 / 18.5
Applicable VS-626MTII Controller Type CIMR-MTII- [ ] K		5.5		7.5		11		15		18.5		22	
Rated Current A (30-minute/Continuous Rating)		34 / 25	40 / 29	43 / 35	53 / 42	74 / 55		97 / 75	103 / 80	100 / 85		121 / 105	
Output Torque at 1500 rpm kg.m		2.40		3.57		4,86		7.14		9.73		12.00	
Rotor GD^2 $kg.m^2$		0.057	0.063	0.081	0.12	0.15		0.20	0.27	0.42		0.49	
Overload Capacity		120%, 60 sec of 30-minute rating											
Cooling Method		Totally-enclosed externally fan-cooled type											
Insulation		F	E	F	E	F	E	F	E	F			
Operating Temperature of Thermal Protector °C (Normally Close Type)		155 ±7	120 ±5	155 ±7	120 ±5	155 ±7	120 ±5	155 ±7	120 ±5	155 ± 7			
Vibration		V-10 or below											
Noise (A) level		78	76	78	76	78	76	78	76	80			
Speed Detector		Multipole resolver (TDIA-72B)											
Finish in Munsell Notation	Flange-mounted type	N1.5											
	Foot-mounted type	2.5 PB 5/2											
Ambient Temperature, Humidity		-10 to + 40°C, 90% RH or below											
Standards		Comply with JIS*, JEM†, JEC‡											

* Japanese Industrial Standard
† The standard of Japan Electrical Manufacturers' Association
‡ Standard of Japanese Electrical Committee

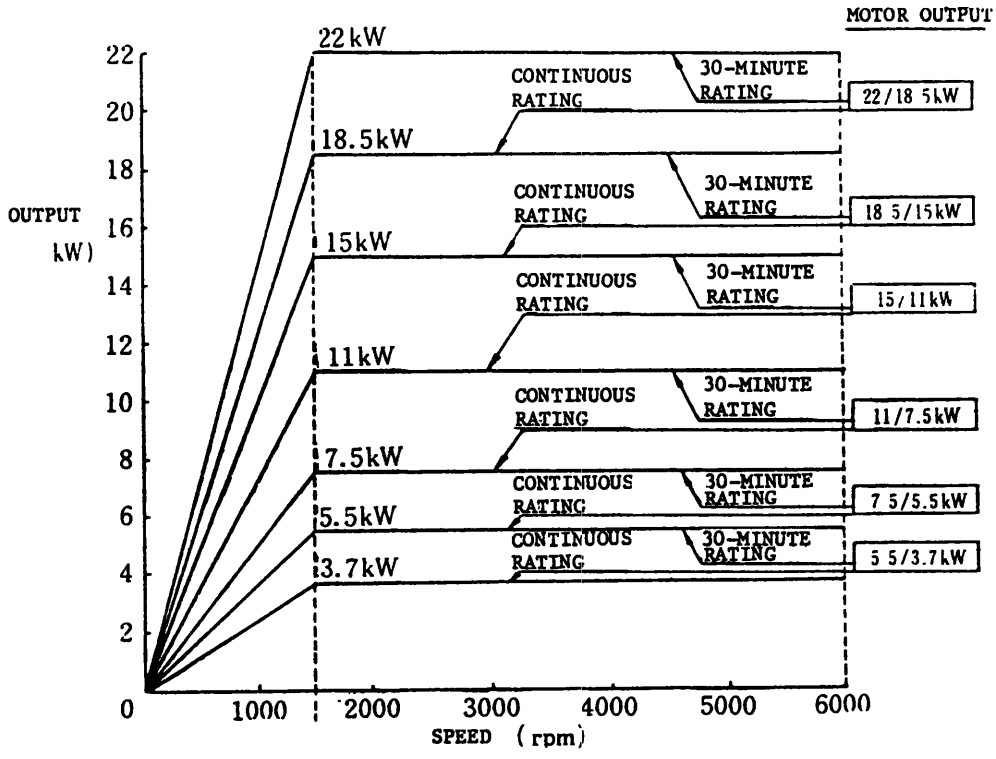


Fig. 1.1 (a) Output-Speed Characteristics

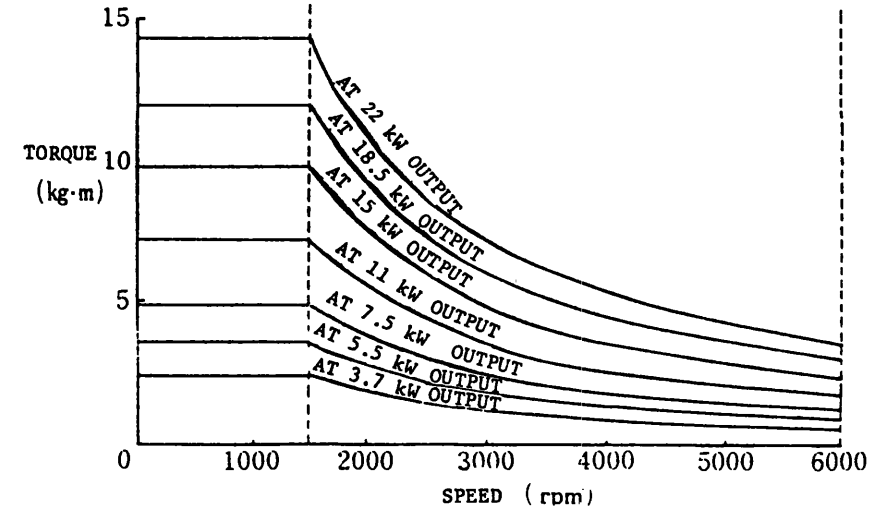
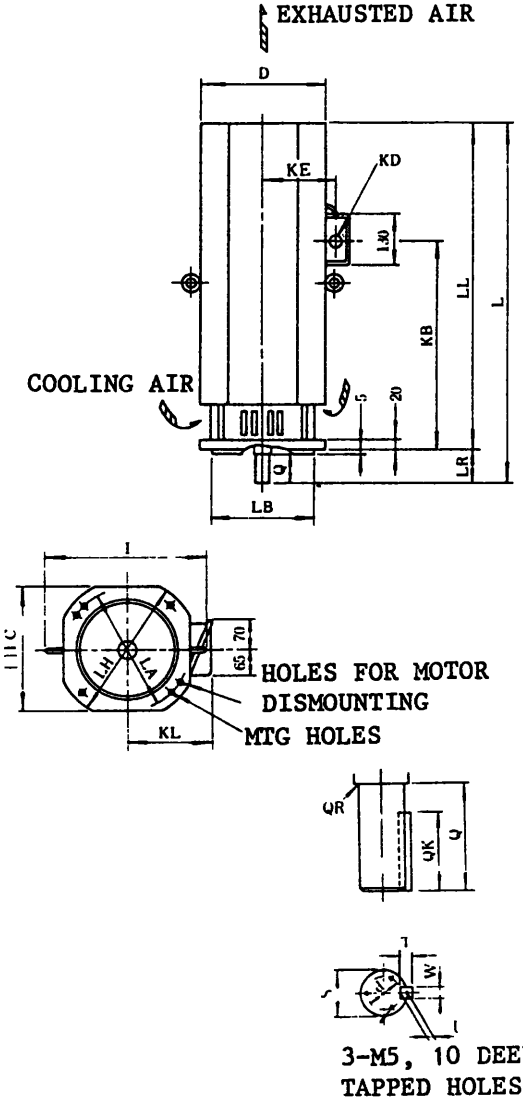


Fig. 1.1 (b) Torque-Speed Characteristics

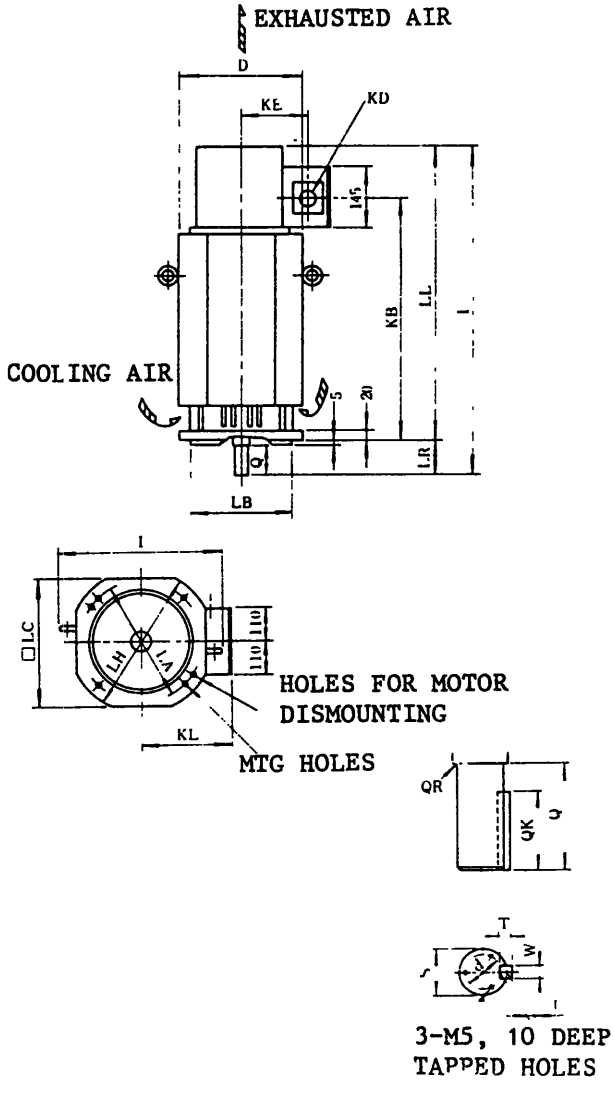
1.3 Dimensions in mm

FLANGE-MOUNTED TYPE

. 5.5/3.7 kW -15/11 kW (7.5/5-20/15Hp)



. 18.5/15kW, 22/18.5 kW (25/20, 30/25 Hp)

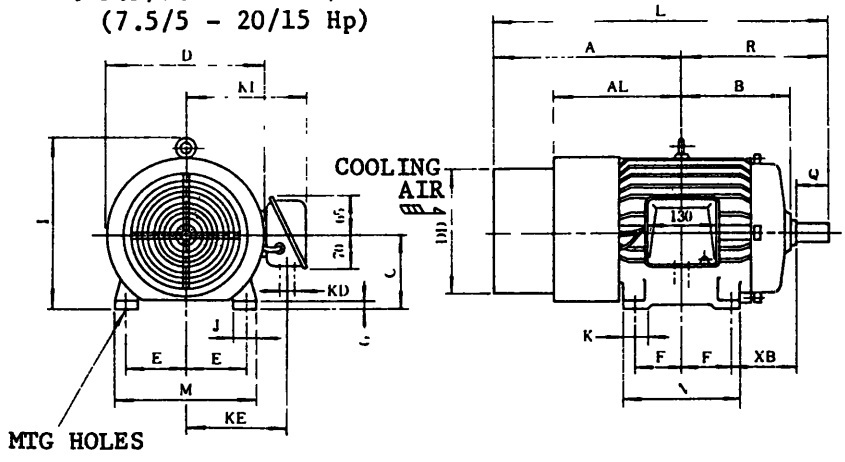


Rated Ouput kW (Hp)		L	LA	LB	LC	LH	LL	LR	D	I	KB	KD	KE	KL	Shaft Extension								Bearing No.		Approx Weight	Cooling Fan, Type
30-Minute Rating	Continuous Rating														Q	QK	QR	S	T	U	W	d	Drive End	Opp Drive End	kg	
5.5(7.5)	3.7(5)	630	215	180 $^{0}_{-0.040}$	204	250	630	80	205	280	395	33	128	158	80	70	1	32 $^{0}_{-0.016}$	8	5	10	22	6308M$_2$C$_3$P$_6$	6307C$_3$P$_6$	73	175P5-1
7.5(10)	5.5(7.5)	710	215	180 $^{0}_{-0.040}$	204	250	630	80	205	280	395	33	128	158	80	70	1	32 $^{0}_{-0.016}$	8	5	10	22	6308M$_2$C$_3$P$_6$	6307C$_3$P$_6$	85	175P5-1
11 (15)	7.5(10)	715	265	230 $^{0}_{-0.046}$	250	300	605	110	260	365	360	33	165	195	110	90	1	48 $^{0}_{-0.016}$	9	5.5	14	40	6310M$_2$C$_3$P$_6$	6307C$_3$P$_6$	113	200P5-3
15 (20)	11 (15)	765	265	230 $^{0}_{-0.046}$	250	300	655	110	260	365	410	33	165	195	110	90	1	48 $^{0}_{-0.016}$	9	5.5	14	40	6310M$_2$C$_3$P$_6$	6307C$_3$P$_6$	132	200P5-3
18.5(25)	15 (20)	720	265	230 $^{0}_{-0.046}$	250	300	610	110	260	335	525	42.5	135	175	110	90	1	48 $^{0}_{-0.016}$	9	5.5	14	40	6310M$_2$C$_3$P$_6$	6210M$_2$C$_3$P$_6$	140	200P5-3
22 (30)	18.5(25)	755	265	230 $^{0}_{-0.046}$	250	300	645	110	260	335	560	42.5	135	175	110	90	0	55 $^{+0.030}_{+0.011}$	10	6	16	45	6311M$_2$C$_3$P$_6$	6210M$_2$C$_3$P$_6$	170	200P5-3

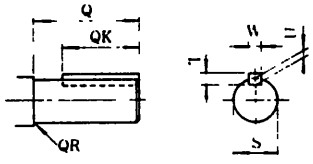
FOOT-MOUNTED TYPE

For Reference Only

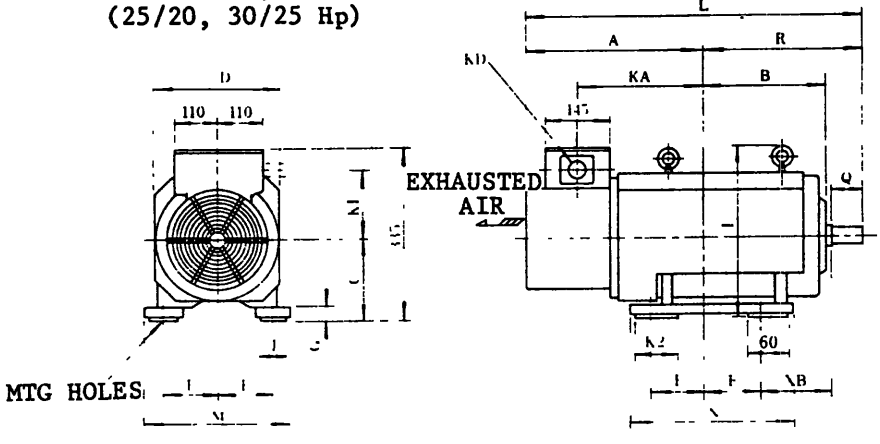
. 5.5/3.7 kW - 15/11 kW
(7.5/5 - 20/15 Hp)



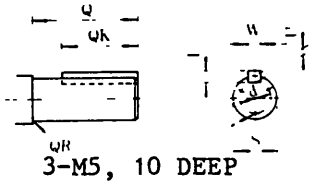
Detail of Shaft Extension



. 18.5/15 kW, 22/18.5 kW
(25/20, 30/25 Hp)



Detail of Shaft Extension



Rated Output kW(Hp)		A	AL	B	C-0.5	D	DD	E	F	G	I	J	K	K2	KA	KD	KE	KL	L
30-Minute Rating	Continuous Rating																		
5.5(7.5)	3.7 (5)	305	-	135	112	245	-	95	70	15	275	35	35	-	-	33	155	185	505
7.5(10)	5.5(7.5)	338	228	151	132	275	216	108	70	15	330	45	40	-	-	33	175	225	577
11 (15)	7.5 (10)	358	248	171	132	275	216	108	89	15	330	45	40	-	-	33	175	225	616
15 (20)	11 (15)	380	-	205	160	320	-	127	105	18	390	50	45	-	-	33	195	230	703
18.5(25)	15 (20)	358	-	211	160	260	-	127	105	16	330	50	-	60	218	42.5	135	-	681
22 (30)	18.5(25)	370	-	233	160	260	-	127	127	16	330	50	-	70	288	42.5	135	-	715

Rated Output kW(Hp)		M	N	R	XB	Z	Shaft Extension								Bearing No.		Approx Weight	Cooling Fan Type
30-Minute Rating	Continuous Rating						Q	QK	QR	S	T	U	W	d	Drive End	Opp Drive End		
5.5(7.5)	3.7 (5)	225	170	200	70	12	60	45	1	28-0.016	7	4	8	-	6306ZZ	6305ZZ	55	200P5 H3
7.5(10)	5.5(7.5)	260	170	239	89	12	80	60	3	32-0.016	8	5	10	-	6308M2C3P6	6306ZZC3	70	200P5 H3
11 (15)	7.5 (10)	260	210	258	89	12	80	60	3	32-0.016	8	5	10	-	6308M2C3P6	6306ZZC3	80	200P5 H3
15 (20)	11 (15)	300	250	323	108	15	110	90	1	42-0.016	8	5	12	-	6309M2C3P6	6307C3P6	115	300P54H-3
18.5(25)	15 (20)	290	278	323	108	15	110	90	1	48-0.016	9	5.5	14	40	6310M2C3P6	6210M2C3P6	135	200P5-3
22 (30)	18.5(25)	290	320	345	108	15	110	90	0	55+0.030 +0.011	10	6	16	45	6311M2C3P6	6210M2C3P6	165	200P5-3

1.4 Installation

1.4.1 Installing Spindle AC Motor

Location

. See that air flow through the cooling fan is completely free from obstruction.

. See that the motor is free from direct splashing of cutting oil from the machine tool.

. Mounting base, bed or frame must be solid and rigid enough to sustain the motor or its dynamic load during operation so as to minimise vibration.

Mounting

. Motors rated for 15 kW (30-minute) or below permit all angle mounting.

. Motors rated for 18.5 or 22 kW (30-minute) permit to drive-end -down mounting (inclusive).

Connection with machine

. For V-belt drive, the shafts of the motor and driven machine are parallel to each other, and align the sheaves.

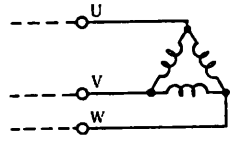
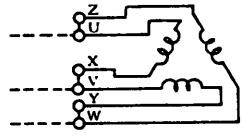
. For a gear drive, install the motor with the shaft paralleled with the machine spindle, and the gears meshing centrally.

. The high speed of the spindle AC motor may induce vibration if the driven members are even slightly out of balance. Take this carefully into consideration when designing the driven machine members such as gears and pulleys.

1.5 Wiring

Make interconnections of the spindle motor and cooling fan with wires as follows.

Table 1.2 Terminals of Spindle Motor and Cooling Motor

Spindle Motor Output kW		Spindle Motor		Cooling Fan Motor		
		Connection	Terminal screw	Motor type	Terminal	Terminal screws
5.5/3.7	Flange-mounted		M5	175P5-1	u, v	M4
	Foot-mounted			200P5H3	u,v,w	
7.5/5.5	Flange-mounted		M8	175P5-1	u, v	
	Foot-mounted			200P5H3	u,v,w	
11/7.5	Flange-mounted			200P5-3		
	Foot-mounted			200P5H3		
15/11	Flange-mounted		M10	200P5-3		
	Foot-mounted			300P54H-3		
18.5/15			M8	200P5-3		
22/18.5						

For selection of protective relay, refer to Table 1.3.

Table 1.3 Specifications of Cooling Fan

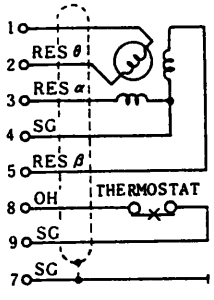
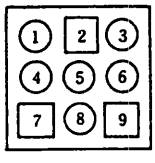
Cooling Fan Motor* Type	Phase	Power Supply	Input kW	Current A		Recommended Protective Relay†	
				With rated	With locked	Thermal ralay	Magnetic contactor
175P5-1	Single	200 VAC, 50 Hz; 200 VAC, 60 Hz; 220 VAC, 60 Hz	70/70/85	0.6/0.55 /0.6	1.1/0.66 /0.73	RH-18/ 1.2P	HI-10-2E
200P5-3	Three		65/95 /100	0.25/0.3 /0.3	0.8/0.76 /0.84	RH-18/ 0.8P	
200P5H3							
300P54H-3			60/70 /80	0.4/0.35 /0.4	1.2/1.1 /1.2		

* Made by Toryo Cosan Co., Ltd.
† Made by Yaskawa Electric Co., Ltd.

(3) Wiring of control signal lead

Connect resolver signal lead and detecting relay for motor overload according to Table 1.4.

Table 1.4 Connection of Control Signal Lead

Pin No.	Signal	Connection in AC Spindle Motor	Connector for AC Spindle Motor	Lead	Connector of Controller	
					Type	Pin No.
1	Resolver detection signal (RESθ)		Type MLP-09 made by Nippon pressure terminal Co., Ltd. Connector receptacle 	Vinly cable with braided copper shield 0.3 mm² twisted-pair 4P  SHIELD	MR-20LF made by Honda Tsushin Kogyo K.K.	5
2						6
3	Resolver excitation signal					1
4	SG (COMMON)					2.3
5	Resolver excitation signal					4
6	Ground terminal					-
7	SG					20
8	Motor overheat detection (OH)					7
9	SG					8

Note: Do not connect to connector for AC spindle motor.

2. VS-626MTII CONTROLLER

2.1 Outline

The VS-626MTII controller is vector-controlled, high-performance transistor inverter to control a machine tool spindle AC motor, with the following features.

(1) Compact size

With the use of integrated elements, the complete system has been built compact and light.

(2) Efficient control

With the adoption of a regenerative braking system, the braking efficiency is high, and with the use of the special circuitry, commutation failure during a power failure is eliminated.

(3) High reliability and ease of maintenance

Through the adoption of LSIs, high reliability has been achieved by miniaturizing parts and reducing their member. With the adoption of function modules, maintenance is simplified.

(4) Electric orientation control (option)

With the use of an electric orientation control system, the mechanism for spindle orientation has been simplified and the reliability and service life have been increased.

(5) Easy application for totally-enclosed control panels

Several special heat-dissipation designs suitable for incorporation in totally-enclosed control panels are available in semi-standard series.

2.2 System Configuration

VS-626MTII drive is composed of a spindle AC motor, Controller VS-626MTII and Optional units such as a spindle orientation controller and D/A converter.

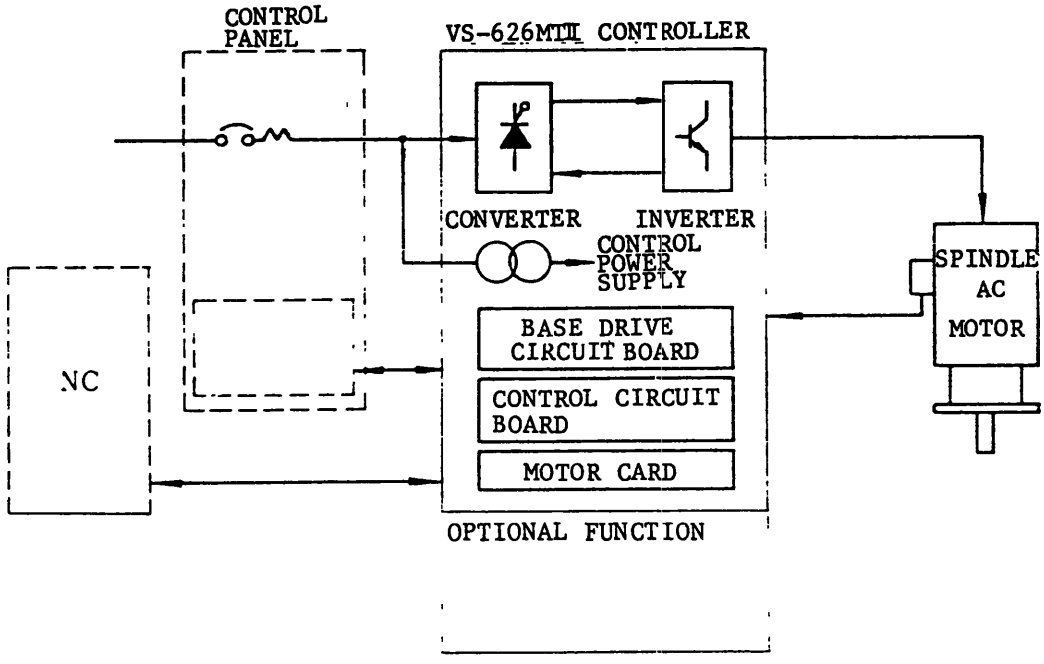


Fig. 2.1 VS-626MTII System Configuration

2.3 Specifications and Functions

2.3.1 Specifications

Table 2.1 Specifications

VS-626MTII Controller Type CIMR-MTII-[ ]	5.5K	7.5K	11K	15K	18.5K	22K
Power Supply	Three-phase, 200V (±10%), 50 or 60Hz; 220V ($^{+10}_{-15}$%), 50 or 60Hz; 240V ($^{+5}_{-20}$%), 60Hz					
Rated Output Current A (120%/100%)	64/53	64/53	89/74	130/108	130/108	170/140
Maximum Required Power Supply at 30-Minute Rating kVA	9	12	19	24	30	35
Calorific Power W (Continuous Rating/30-Minute Rating)	320/400	400/520	530/750	780/1030	900/1080	1120/1320
Weight kg	28		36	45	48	52
Circuitry	PWM transistor inverter control					
Control System	Vector control with automatic field-weakening control					
Braking Method	Regenerative braking					
Adjustable Speed Range	40 - 6000 rpm					
Speed Regulation	0.2% (load variation 10 - 100%)					
Overload Capacity	120%, 60 sec of 30-minute rating					
Speed Command Voltage	± 10 VDC or +10 VDC (forward and reverse signals)					
Ambient Temperature	-10 to +55°C					
Humidity	10 to 95% RH					
Allowable Vibration	0.5 G or below					
Installation	Free from dirt, dust, liquid and other harmful gases					
Standard	JIS*, JEM†, JEC‡					

* Japanese Industrial Standard
† The Standard of Japan Electrical Manufacturers' Association
‡ Standard of Japanese Electrotechnical Committee

2.3.2 Functions

The VS-626MTII controller is designed basically to control the operation of the VS-626MTII spindle AC motor, driving it at commanded speeds at the rated output.

The VS-626MTII is further provided with a protection and monitoring functions to protect, and insure full display of performance of, the spindle drive motor, its electrical circuits and the driven machine.

Tables 2.2 and 2.3 show the protection and monitoring functions respectively.

Table 2.2 Protection Functions

Name	Code	Description	Detection Method	Operation & Display
Motor overheated	OH	Motor burnout	Built-in thermostat operates.	Current interruption by base blocking Red LED illuminates
Cooling fan malfunctioned	FAN M		Thermal overload relay operates.	
	FAN C	Destruction of controller elements	Heat sink mounted thermostat operates.	
Instantaneous overcurrent	OC		Transistor instantaneous overcurrent.	
Overload	OL		120% of 30-min rated current for 60 sec.	
Overvoltage	OV	Spindle system malfunctioned	DC bus voltage	
Undervoltage	UV		Supply voltage	
Blown fuse	ACFU	Destruction of controller elements	Input AC fuse blown	
	DCFU	Controller destruction	DC fuse blown	
Overspeed	OS	Spindle system malfunctioned	Speed detection by resolver and motor current frequency. detection	
		Motor mechanism damaged		
Optioned status	. When one of the protective functions above activates, the closed contact signal (1C) will be sent. . Optional status is activated at all times to indicate either normal or trouble condition.			
Function hold	. When one of the protective functions above activities, this function holds in the respective circuit. . To reset the function, push the reset button in the VS-626MTII or make an external signal.			

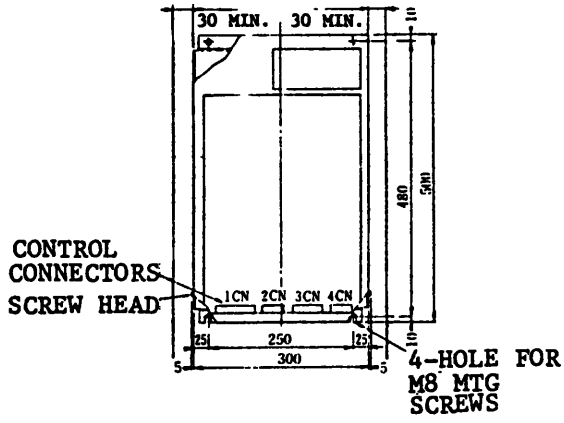
Table 2.3 Status Monitoring Function

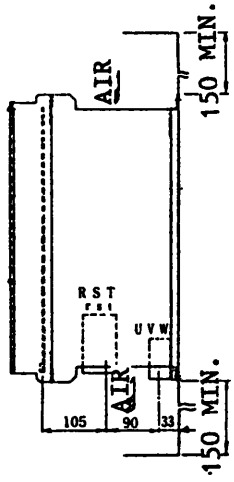
Name	Code	Description
Zero-speed signal	Z-SPD	Indication of motor stop (below 30 rpm)
Speed coincidence signal	AGREE	Indication of motor speed coincident with commanded speed
Speed detecting signal	N-DET	Indication of motor speed reaching set speed
Excessive speed deviation signal	DEV	Indication of actual speed 50% or more deviating to set speed
Torque detecting signal	T-DET	Indication of torque reaching set level
Speedometer signal	SMSIG	External display of motor speed
Load meter signal	LMSIG	External display of load factor with respect to 30-minute rated output

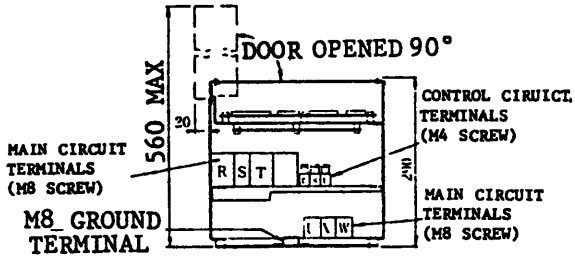
2.4 VS-626MTII Dimensions in mm

THIRD ANGLE PROJECTION

For 5.5 kW/3.7 kW (Enclosed type)







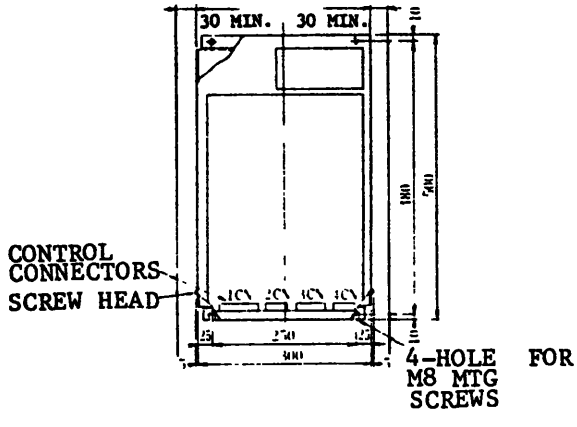
FINISH IN MUNSELL NOTATION	5Y7/1
APPROX. WEIGHT	28KG

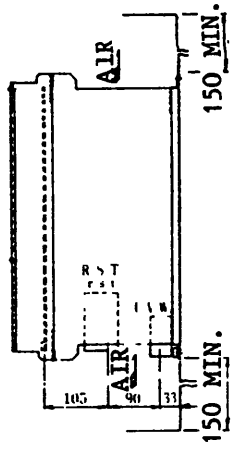
CONTROLLER TYPE
CIMR-MTK-5.5K

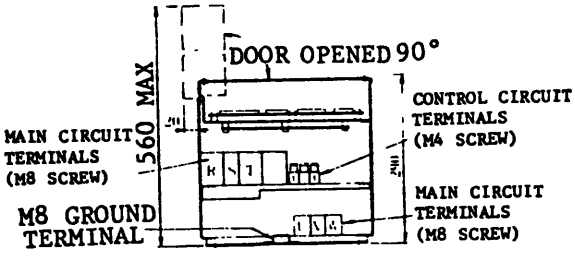
CONTROL SIGNAL CONNECTOR TYPE

CONNECTOR NO.	TYPE
1CN	MR-50RMA(G) 50P
2CN	MR-16RMA(G) 16P
3CN	MR-34RMA(G) 34P
4CN	MR-20RMA(G) 20P

For 7.5 kW/5.5 kW (Enclosed type)







FINISH IN MUNSELL NOTATION	5Y7/1
APPROX. WEIGHT	28KG

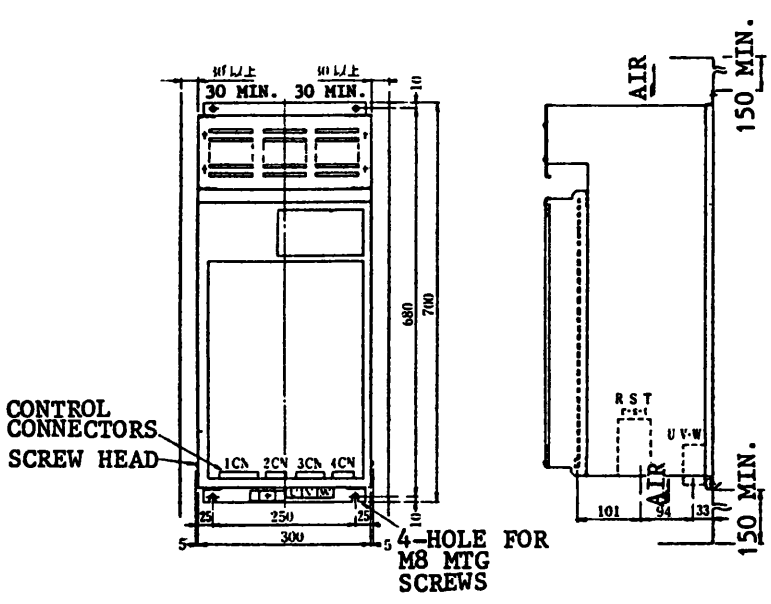
CONTROLLER TYPE
CIMR-MRK-7.5K

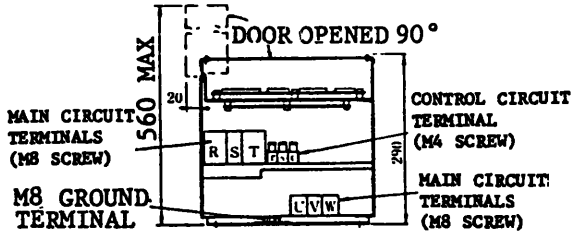
CONTROL SIGNAL CONNECTOR TYPE

CONNECTOR NO.	TYPE
1CN	MR-50RMA(G) 50P
2CN	MR-16RMA(G) 16P
3CN	MR-34RMA(G) 34P
4CN	MR-20RMA(G) 20P

For 11 kW/7.5 kW (Enclosed type)

THIRD ANGLE PROJECTION





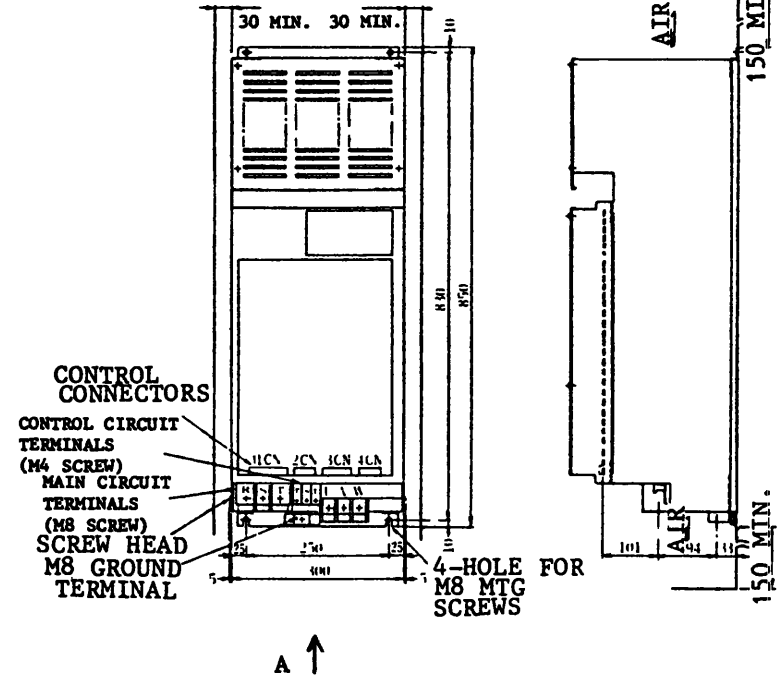
FINISH IN MUNSELL NOTATION	5Y7/1
APPROX. WEIGHT	36KG

CONTROLLER TYPE
CIMR-MTX-11K

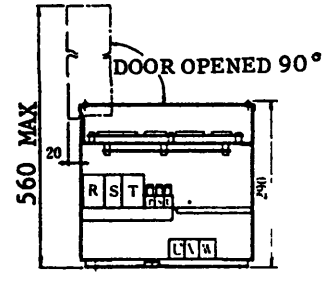
CONTROL SIGNAL CONNECTOR TYPE

CONNECTOR NO.	TYPE
1CN	MR-50RMA(G) 50P
2CN	MR-16RMA(G) 16P
3CN	MR-34RMA(G) 34P
4CN	MR-20RMA(G) 20P

For 15 kW/11 kW (Enclosed type)



VIEW A



FINISH IN MUNSELL NOTATION	5Y7/1
APPROX. WEIGHT	45KG

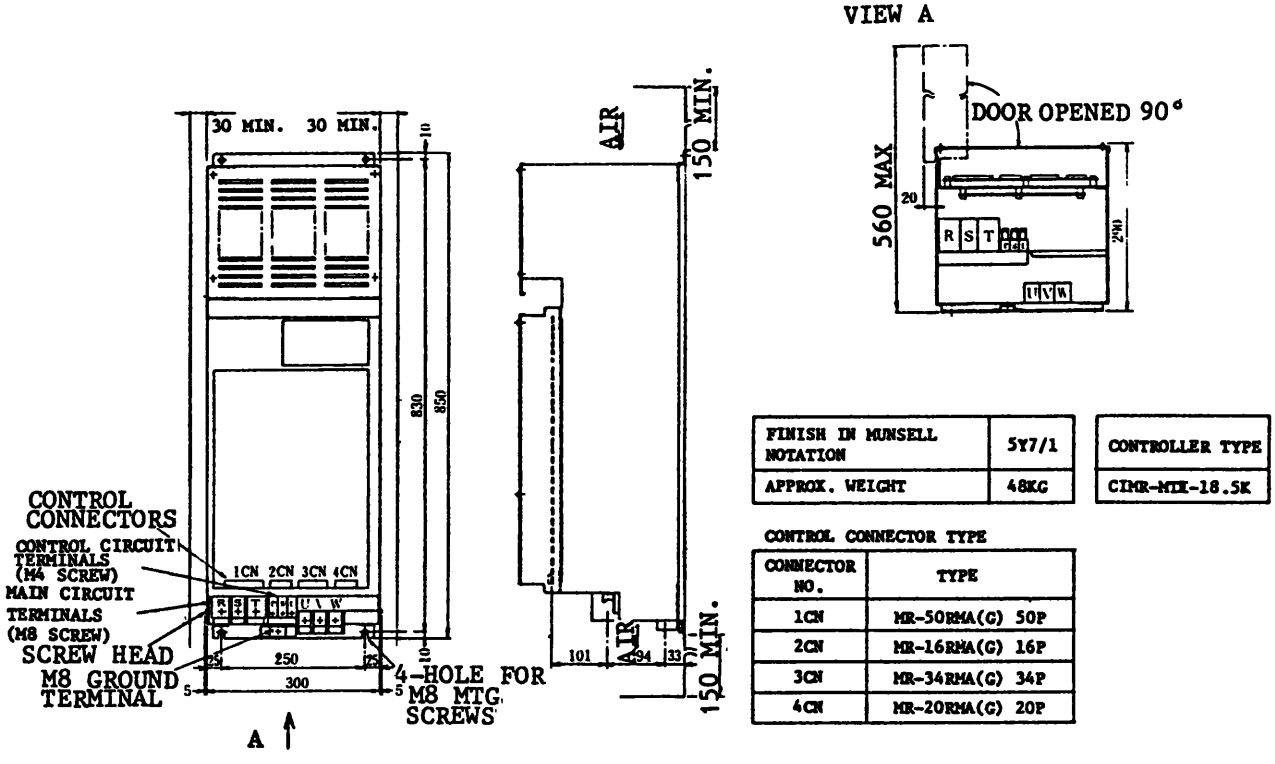
CONTROLLER TYPE
CIMR-MTX-15K

CONTROL CONNECTOR TYPE

CONNECTOR NO.	TYPE
1CN	MR-50RMA(G) 50P
2CN	MR-16RMA(G) 16P
3CN	MR-34RMA(G) 34P
4CN	MR-20RMA(G) 20P

For 18.5 kW/15 kW (Enclosed type)

THIRD ANGLE PROJECTION



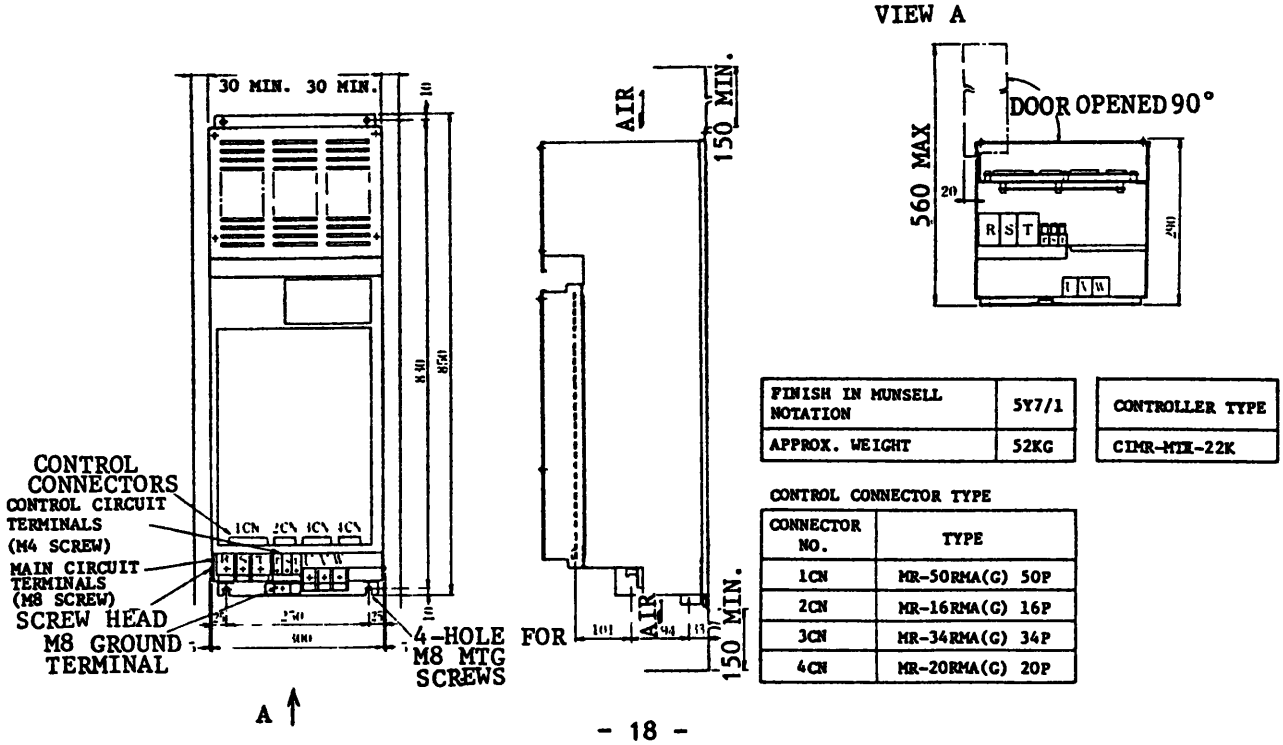
FINISH IN MUNSELL NOTATION	5Y7/1
APPROX. WEIGHT	48KG

CONTROLLER TYPE
CIMR-MIH-18.5K

CONTROL CONNECTOR TYPE

CONNECTOR NO.	TYPE
1CN	MR-50RMA(G) 50P
2CN	MR-16RMA(G) 16P
3CN	MR-34RMA(G) 34P
4CN	MR-20RMA(G) 20P

For 22 kW/ 18,5 kW (Enclosed type)



FINISH IN MUNSELL NOTATION	5Y7/1
APPROX. WEIGHT	52KG

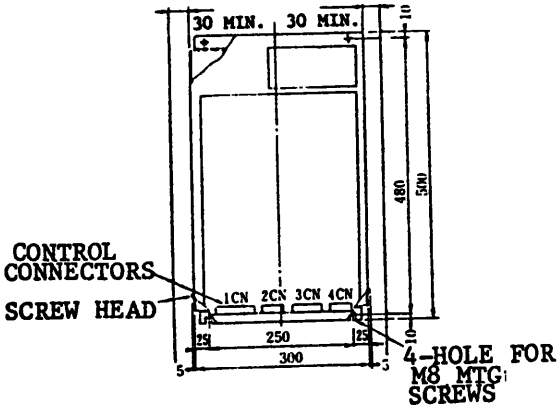
CONTROLLER TYPE
CIMR-MIH-22K

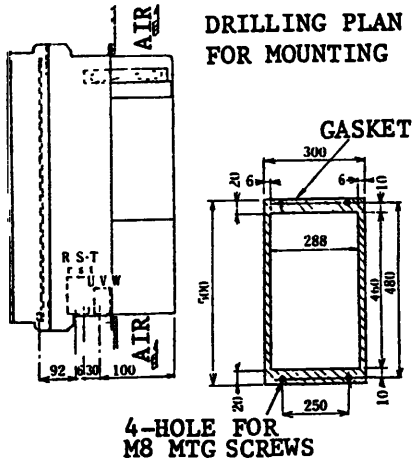
CONTROL CONNECTOR TYPE

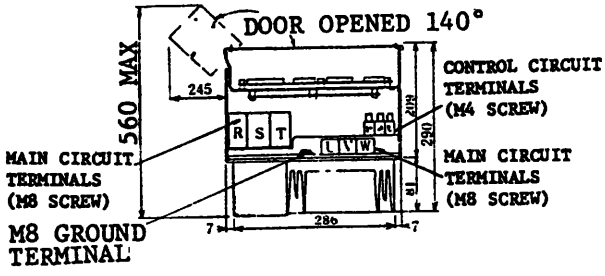
CONNECTOR NO.	TYPE
1CN	MR-50RMA(G) 50P
2CN	MR-16RMA(G) 16P
3CN	MR-34RMA(G) 34P
4CN	MR-20RMA(G) 20P

For 5.5 kW/3.7 kW (Totally-enclosed type)*

THIRD ANGLE PROJECTION







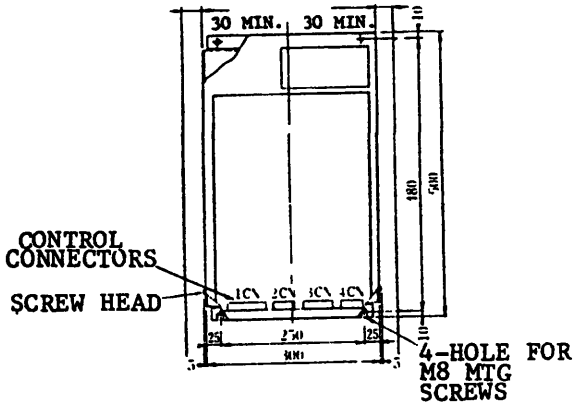
FINISH IN MUNSELL NOTATION	5Y7/1
APPROX. WEIGHT	28KG

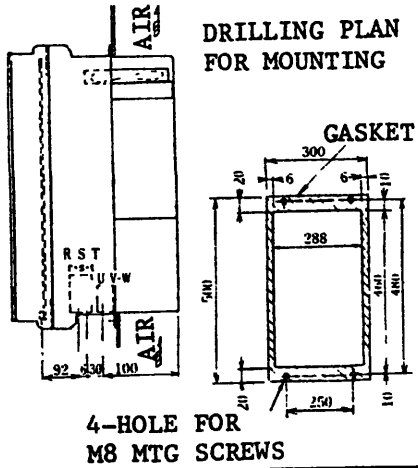
CONTROLLER TYPE
CIMR-MIK-5.5K.T

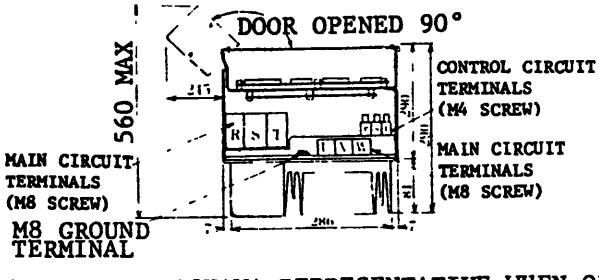
CONTROL CONNECTOR TYPE

CONNECTOR NO.	TYPE
1CN	MR-50RMA(G) 50P
2CN	MR-16RMA(G) 16P
3CN	MR-34RMA(G) 34P
4CN	MR-20RMA(G) 20P

For 7.5 kW/5.5 kW (Totally-enclosed type)*







FINISH IN MUNSELL NOTATION	5Y7/1
APPROX. WEIGHT	28KG

CONTROLLER TYPE
CIMR-MIK-7.5K.T

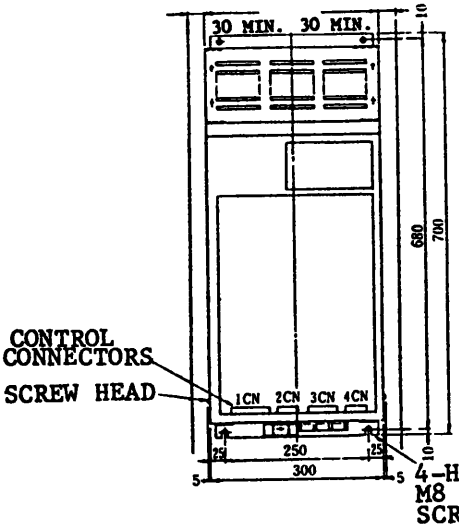
CONTROL CONNECTOR TYPE

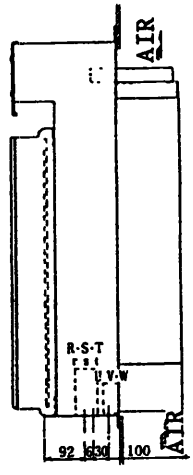
CONNECTOR NO.	TYPE
1CN	MR-50RMA(G) 50P
2CN	MR-16RMA(G) 16P
3CN	MR-34RMA(G) 34P
4CN	MR-20RMA(G) 20P

* CONTACT YASKAWA REPRESENTATIVE WHEN ORDERING

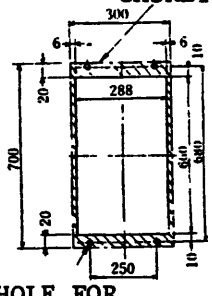
For 11 kW/7.5 kW (Totally-enclosed type)*

THIRD ANGLE PROJECTION



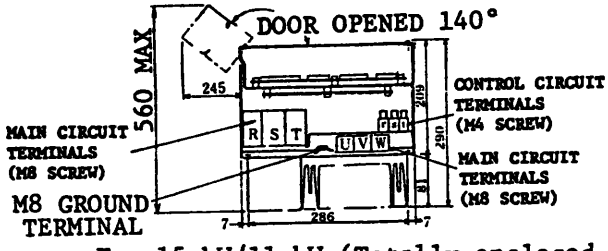


DRILLING PLAN FOR MOUNTING GASKET



FINISH IN MUNSELL NOTATION	5Y7/1
APPROX. WEIGHT	36KG

CONTROLLER TYPE
CIMR-MIK-11K.T



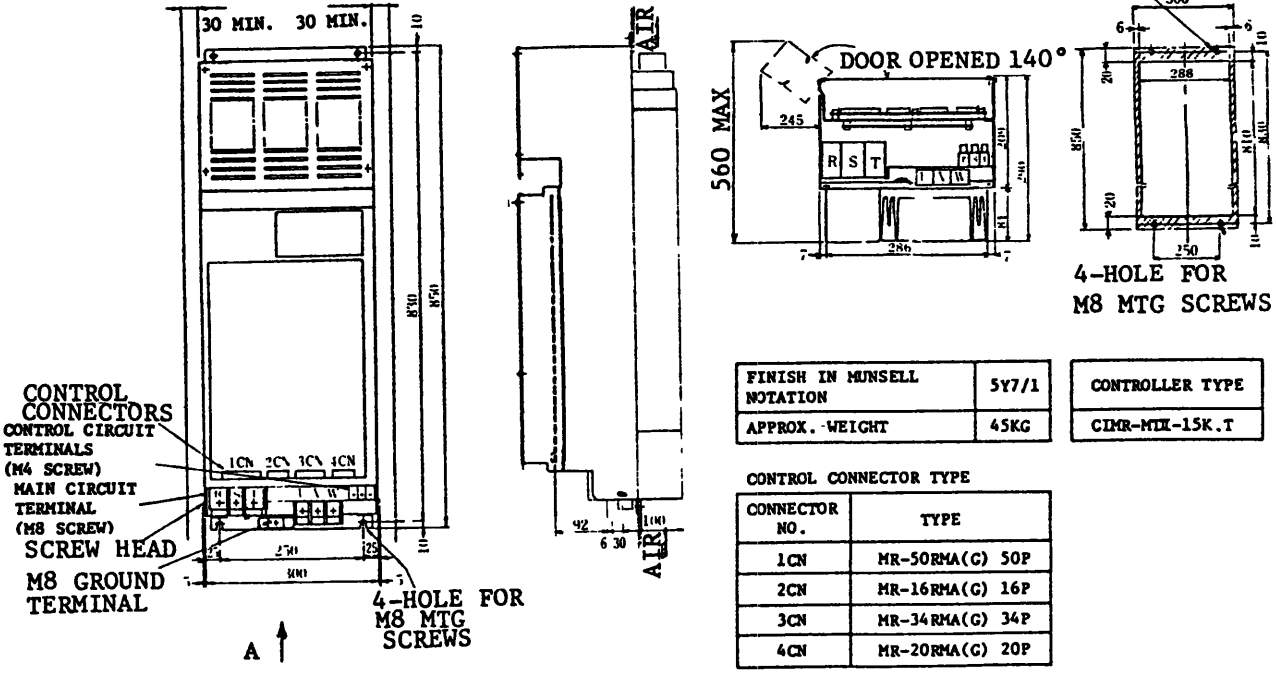
CONTROL CONNECTOR TYPE

CONNECTOR NO.	TYPE
1CN	MR-50RMA(G) 50P
2CN	MR-16RMA(G) 16P
3CN	MR-34RMA(G) 34P
4CN	MR-20RMA(G) 20P

For 15 kW/11 kW (Totally-enclosed type)*

DRILLING PLAN FOR MOUNTING GASKET

VIEW A



FINISH IN MUNSELL NOTATION	5Y7/1
APPROX. WEIGHT	45KG

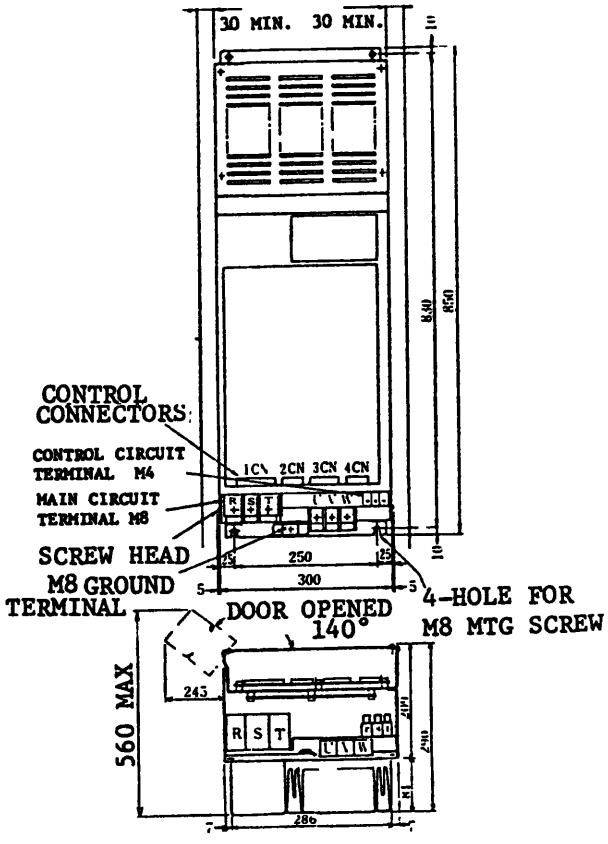
CONTROLLER TYPE
CIMR-MIK-15K.T

CONTROL CONNECTOR TYPE

CONNECTOR NO.	TYPE
1CN	MR-50RMA(G) 50P
2CN	MR-16RMA(G) 16P
3CN	MR-34RMA(G) 34P
4CN	MR-20RMA(G) 20P

* CONTACT YASKAWA REPRESENTATIVE WHEN ORDERING

For 18.5 kW/15 kW (Totally-enclosed type)*

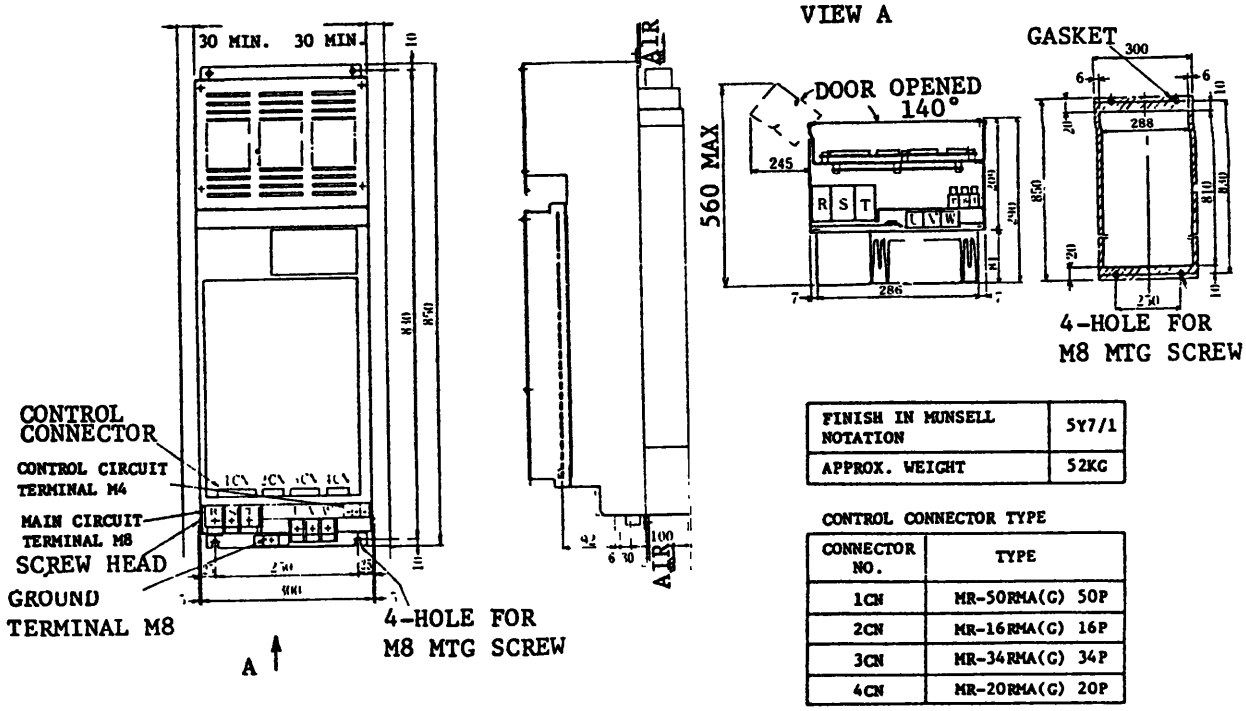


FINISH IN MUNSELL NOTATION	5Y7/1
APPROX. WEIGHT	48KG

CONTROL CONNECTOR TYPE

CONNECTOR NO.	TYPE
1CN	MR-50RMA(G) 50P
2CN	MR-16RMA(G) 16P
3CN	MR-34RMA(G) 34P
4CN	MR-20RMA(G) 20P

For 22 kW/18.5 kW (Totally-enclosed type)*



FINISH IN MUNSELL NOTATION	5Y7/1
APPROX. WEIGHT	52KG

CONTROL CONNECTOR TYPE

CONNECTOR NO.	TYPE
1CN	MR-50RMA(G) 50P
2CN	MR-16RMA(G) 16P
3CN	MR-34RMA(G) 34P
4CN	MR-20RMA(G) 20P

* CONTACT YASKAWA REPRESENTATIVE WHEN ORDERING

2.5 Installation

2.5.1 Installing controller

To install the VS-626MTII controller in a power control panel or the like, take the following into consideration.

(1) Heat dissipation

- Incorporate heat dissipating features into the design, in due consideration of the heat generating rate.
- For the heat generation rates of the different types, refer to Table 2.1. STANDARD SPECIFICATIONS.
- Maintain the ambient temperature of the controller between -10 to +55°C.
- To maintain the cooling performance of the controllers, maintain 150 mm space both above (discharge side) and below (suction side) the controller, as far as possible. Be sure to secure at least 100 mm and 50 mm spaces above and below the controller respectively.

(2) Maintenance

- In designing the panel housing, take the convenience of maintenance work into consideration.
- For mounting and replacing the controller, secure at least 30 mm space on both the right and left sides between controller and the side walls.
- The front panel of the controller is hinged to open 90°. Be sure to allow sufficient space to fully open the front panel.
- The I/O terminals and the control signal connectors are located at the lowermost part of the controller.
- Be sure to allow space below the controller so that cables can be easily connected to the terminals and connectors.
- Fig. 2.2 shows the mounting space.

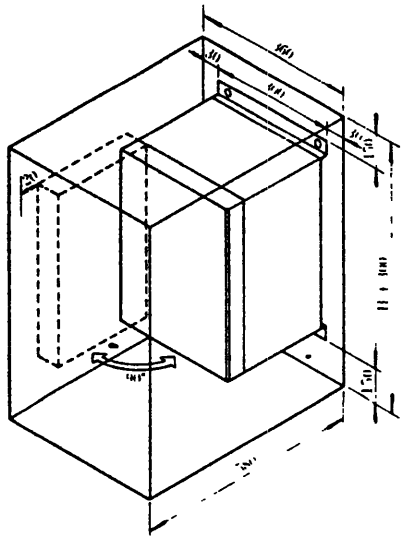


Fig. 2.2 Controller Mounting Space (Enclosed Type)

(3) Totally-enclosed type

. Be sure to provide the rear panel of the controller with a cooling air flow space. Secure 85 to 90 mm for dimension D in Fig. 2.3.

. The cooling air amount must be $3m^3/min$.

. Insert packings under the units when installing them, to avoid clearance.

. The front panel opens 140°.

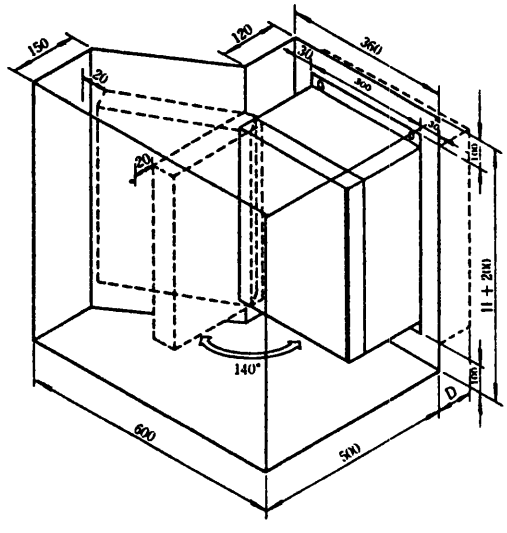


Fig. 2.3 Controller Mounting Space (Totally-enclosed Type)

2.5.2 Wiring

In installing the power lines and control lines, take the following into consideration.

(1) Power line and terminal

Table 2.4 shows the type and size of the cables to be used, and the terminals sizes.

Table 2.4 Lead Specifications

CIMR-MTII -[]	Input					Output			
	Lead		VS-626MTII Controller			Lead		Motor	
	Type	Size mm^2	Terminal	Terminal Screw	Terminal	Type	Size mm^2	Terminal	Terminal Screw
5.5K	600V Cabtyre cable	5.5	R,S,T, E	M8	U,V,W, E	600V Cabtyre cable	5.5	U,V,W, E	*
7.5K		8					8		M8
11K		14					14		
15K		22					22		M10
18.5K		30					30	U,V,W, X,Y,Z, E	M8
22K		38					38		

* M5 for the flange-mounted type motor and M4 for foot-mounted type motor.

(2) Control power supply lead and cooling fan motor power lead

Table 2.5 Lead Specifications

Application	Lead		Screw terminal		Note
	Type	Size	Terminal	Size	
Control power supply lead	600V vinyl-insulated lead	2 mm^2	r,s,t	M4	—
Cooling fan power lead			(u,v,w)*		*

* Since type EEVA-51KM flange-mounted motors (5.5kW/3.7kW, 7.5kW/5.5kW) are provided with a single-phase fan motor, only terminals U and V are furnished.

(3) Control signal lead

Table 2.6 shows the specifications for the connectors and cables for the control signals

Table 2.6 Connector & Lead Specifications

Connector No.	Application	Connector		Lead	
		Type MR-	Maker	Type	Size
1CN	I/O interface	50LF	Honda Tsushin Kogyo K.K.	* Vinyl cable with braided copper shield	0.3 mm^2 coaxial 50-core
2CN	Meter signal	16LF			0.3 mm^2 twisted-pair 4-P
3CN	-	34LF			-
4CN	Motor interface	20LF			0.3 mm^2 twisted-pair 4-P

* Except for lines for analog signals, signal lines 1CN and 2CN may also be in conventional vinyl lead (0.5 mm^2) for electric appliances, provided the following are observed.

. To minimize adverse effects of noise, the signal lead and the power lead should be separately run through as short a passage as possible.

. The outer diameter of the cable bundle must be smaller than the size of the connector outlet opening given below.

Connector type MR-50LF:	16 mm diameter
Connector type MR-16LF:	9 mm diameter
Connector type MR-20LF:	11 mm diameter

2.6 Wiring Diagram

Fig. 2.4 shows the connection between the controller and the motor, and the input and output signals. The connector connections for the input and output signals are shown in Table 2.7 through 2.9. Refer to the diagram and tables when designing interfaces to NC and power sequencers.
Fig. 2.5 shows the block diagram for VS-626MTII controller.

Table 2.7 1CN Signal List

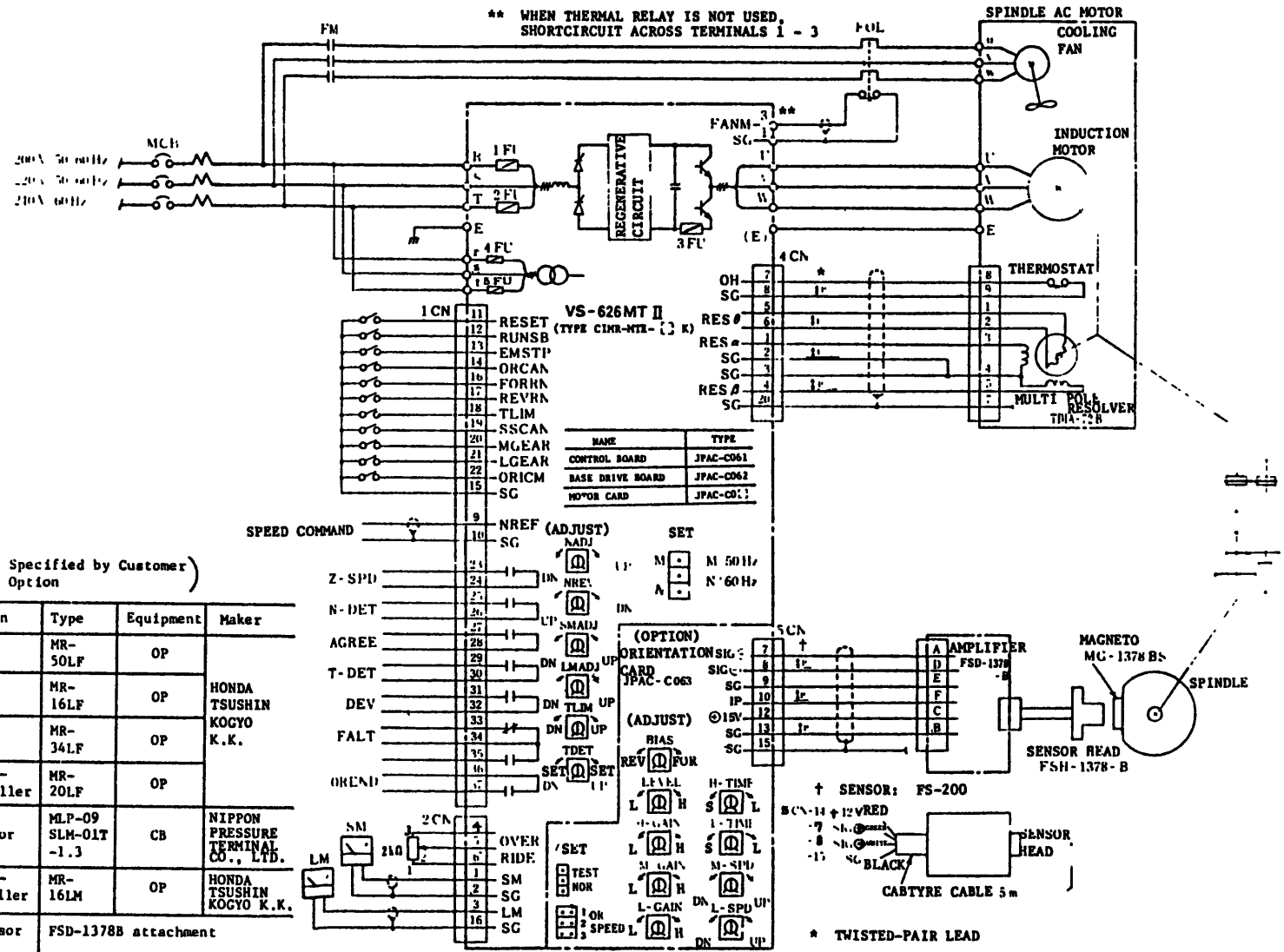
Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	+15 V			33	Malfunction (FALT)
2				34	
3	SG	19	Soft start cancel (S SCAN)	35	
4		20	M gear selection (M GEAR)	36	Orientation completion (OREND)
5	-15 V	21	L gear selection (L GEAR)	37	
6		22	Orientation (ORICM)	38	-
7	-	23	Zero speed (Z-SPD)	39	-
8	SG	24		40	-
9	Speed command (N COM)	25	Speed detecting (N DET)	41	SG
10	SG	26		42	
11	Malfunction reset (RESET)	27	Speed coincidence (AGREE)	43	
12	Ready signal (RUN SB)	28		44	
13	Emergency stop (EM STP)	29	Torque detecting (T DET)	45	
14	Override cancel (ORCAN)	30		46	
15	SG	31	Excessive speed deviation (DEV)	47	
16	Forward run (FORRN)	32		48	
17	Reverse run (REVRN)			49	
18	Torque limit selection (T LIM)			50	

Table 2.8 2CN Signal List

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	Speed meter (SMSIG)			11	-
2	SG	7	SG	12	-
3	Load meter (LM SIG)	8	-	13	-
4	Override(ORCOM)	9	-	14	-
5		10	-	15	-
6				16	SG

Table 2.9 4CN Signal List

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	Resolver exciting (RES α)	8	SG	14	SG
2	SG	9	-	15	-
3		10	-	16	-
4	Resolver exciting (RES β)	11	-	17	-
5	Resolver Detecting(RES θ)	12	-	18	-
6		13	-	19	-
7	Motor overheat (OH)			20	SG



CONNECTOR (CB: Specified by Customer, OP: Option)

No.	Code	Application		Type	Equipment	Maker
1	1CN	I/O interface		MR-50LF	OP	HONDA TSUSHIN KOGYO K.K.
2	2CN	Meter		MR-16LF	OP	
3	3CN	Option		MR-34LF	OP	
4	4CN	Motor Interface	Con-troller	MR-20LF	OP	
5	-		Motor	MLP-09 SLM-01T -1.3	CB	NIPPON PRESSURE TERMINAL CO., LTD.
6	5CN	Orienta-tion	Con-troller	MR-16LM	OP	HONDA TSUSHIN KOGYO K.K.
7	-		Sensor	FSD-1378B attachment		

Fig. 2.4 Wiring Diagram

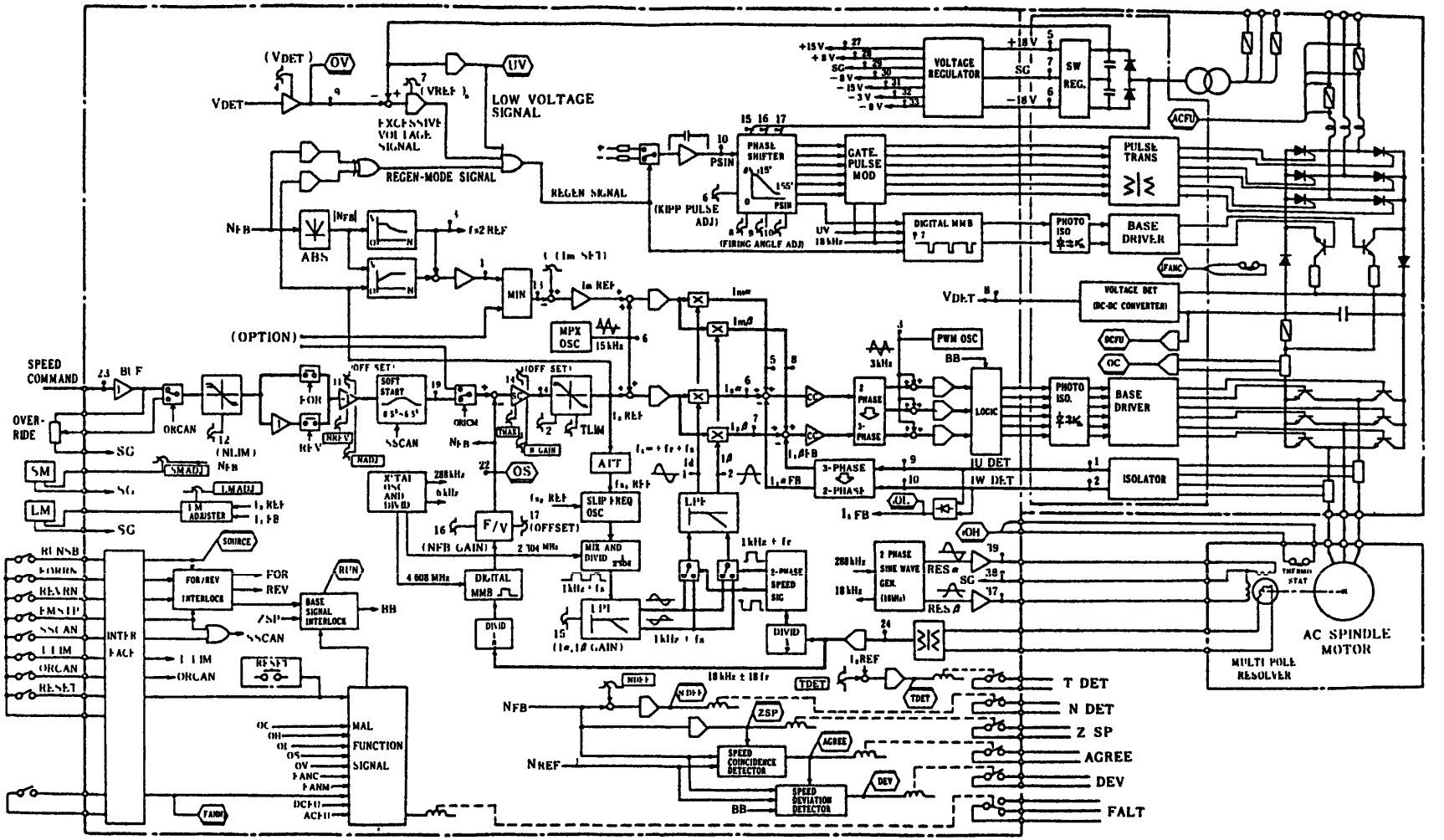


Fig. 2.5 VS-626MTII Controller Block Diagram

2.7 Control Signal

2.7.1 Contact input signal

When designing input signals, take the following conditions into consideration.

- When relay contacts, etc. are used, the contact capacity must be 30 V or above (15 mA or above).
- The filter in the level shifter circuit in the input section causes approximately 5 msec delay in the signals.
- Since a pull-up resistor is incorporated in the circuit, contactless signals can also be inputted. In this case, input signals 20 V or above for the HIGH level, and 2 V or below for LOW level.
- Fig. 2.6 shows the input circuit, and Table 2.10 gives the signal functions.

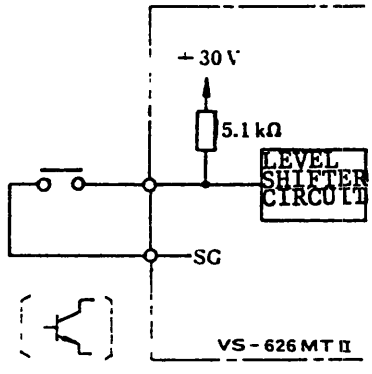
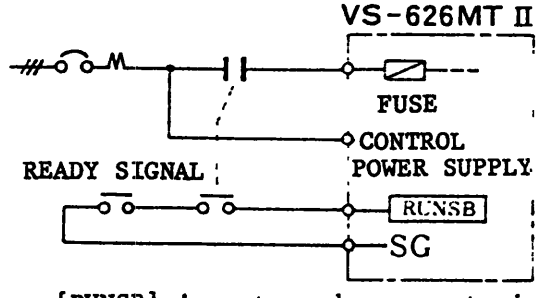


Fig. 2.6 Input Circuit

Table 2.10 (a) Functions of Input Signals

Signal	Connector No.	Pin No.	On Signal	Function
Ready RUNSB	1CN	12	CLOSE	. After power is applied, and [RUNSB] closes, and SOURCE (green) LED lights. . When [RUNSB] is opened during run, base is blocked instantly, and the motor current is interrupted. . Where a magnetic contactor is used for the main circuit input, if the magnetic contactor is operated on and off independently, the input side AC fuse will be blown. To prevent this, be sure to include an auxiliary contact for the magnetic contactor or an equivalent contact in the [RUNSB] condition, as shown below.  . Where [RUNSB] is not used, connect pin (12) to SG.

Note: SG is pin (15), pins (41) - (50) of 1CN.

Table 2.10 (b) Function of Input Signals

Signal	Connector No.	Pin No.	On Signal	Function
2. Forward Run [FORRN]	1CN	16	CLOSE	. With [RUNSB] closed (SOURCE LED ON), and the speed command positive, when [FORRN] is closed, the motor runs CCW as viewed from drive end; and when [REVRN] is closed, the motor runs CW. Therefore, when speed commands and run signals are combined, the motor runs in the directions shown below.
3. Reverse Run [REVRN]		17	CLOSE	

Speed command		⊕	⊖
Run Signal	[FORRN]	CCW	CW
	[REVRN]	CW	CCW

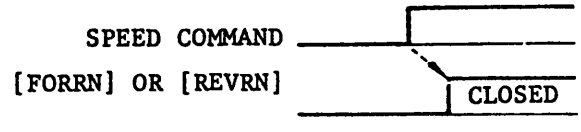
. When the signal is opened during run, the motor is stopped by the regenerative braking, and then, the motor current is interrupted by base blocking.

. The RUN LED (green) is on during run, and off during halt.

. The acceleration and deceleration time is set with the soft starter DIP switch. The time between halt and 100% rated speed can be set between 0.5 and 6.5 seconds at 0.5 sec increments. However, for some load GD^2 values, the set accel/decel time may be exceeded.

. When [FORN] and [REVRN] are closed simultaneously, the motor stops. In this case, if whichever of them becomes open, the motor resumes running, so that care must be taken to avoid accident.

. When [FORN] or [REVRN] is closed, the motor runs at the speed specified by a speed command. Be sure to first command a speed when running the motor.



. When a trouble occurs during run, base is blocked immediately to interrupt the motor current, and the RUN LED is extinguished.

Table 2.10 (b) Function of Input Signals (Cont'd)

Signal	Connector No.	Pin No.	On Signal	Functions
4. Emergency stop [EMSTP]	1CN	13	OPEN	. When [EMSTP] is opened during run, the motor is quickly stopped by regenerative braking, and then, the current is interrupted. . When [EMSTP] is closed again, the motor becomes ready to run again, so that if a speed command is sent, and [FORRN] or [REVRN] is closed, the motor is restarted. Therefore, be sure to open [FORRN] or [REVRN] before closing [EMSTP]. . When [EMSTP] is not to be used, connect pin (13) to SG.

Table 2.10 (c) Functions of Input Signals

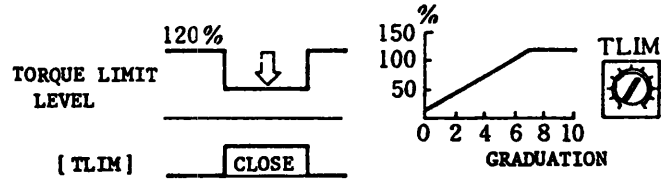
Signal	Connector No.	Pin No.	On Signal	Function
5. Torque Limit [T LIM]	1CN	18	CLOSE	. This signal is for temporarily limiting the motor torque with a mechanically oriented spindle or gear shift. . When [T LIM] is closed, the torque is limited. . The torque limit level is preset by a potentiometer (T LIM) in the controller between 15 and 120%.  . When [T LIM] is not be used, leave pin (18) open.
6. Over-ride Cancel [ORCAN]		14	OPEN	. This signal is for selectively applying an override to an external spindle speed command to change the cutting condition. . When [ORCAN] is opened, the override is cancelled. . For the adjustment of the override value, refer to Table 2.11.
7. Soft-start Cancel [SSCAN]		19	CLOSE	. This signal is for cancelling the soft start function so that speed reference is changed by speed command without delay, for inching or other special control modes. (Speed reference N_{REF}: controller CH19) . When [SSCAN] is closed, the accel/decel set time is neglected, and the motor is accelerated or decelerated in short time by the current limit accel/decel function. . When [SSCAN] is not to be used, leave pin (19) open.

Table 2.10 (c) Functions of Input Signals (Cont'd)

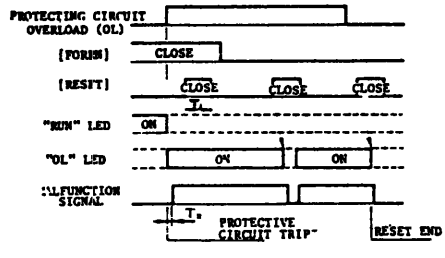
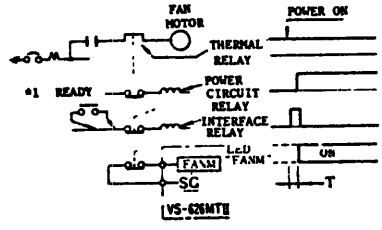
Signal	Connector No.	Pin No.	On Signal	Function
8. Malfunction Reset [RESET]	1CN	11	OPEN ⇩ CLOSE or CLOSE ⇩ OPEN	. This signal is for restoring the run ready state after eliminating the cause of the tripping of the protective circuit, as the result of overload. . [RESET] is effective only after the tripping of a protecting circuit. . While [FORRN] or [REVRN] is closed, resetting is not possible. . The [RESET] switch incorporated in the controller is equivalent to this signal in function. . Resetting is effected at the edge of [RESET]. Therefore, close [RESET] if open, and open it if closed. . In the protective circuit sequence, resetting has priority. The timing chart for resetting is given below.  T1: Reset pulse width (> 0.7 sec) T2: Malfunction signal delay time (approx. 50 msec)

Table 2.10 (d) Functions of Input Signal

Signal	Connector No.	Pin No.	On Signal	Function
9. Motor Over-heat [OH]	4CN	7	OPEN	. This signal is for interrupting motor current and to display the malfuction, when the motor temperature exceeds the specified value. . When [OH] is opened, the motor current is instantly interrupted by baseblocking, and OH LED (red) lights. . To discriminate serious trouble from other trouble, connect pin (7) to SG (pin (8) or pin (14) of 4CN), where the thermostat contact is used in an external sequence. In this case, to avoid noise in the resolver signal, run separate cables for the resolver and for motor thermostat detection.

Table 2.10 (e) Functions of Input Signal

Signal	Terminal No.	On Signal	Function
10. Cooling Fan Malfunction [FANM]	Screw Terminal (M4) 3	CLOSE	. This signal is for detecting trouble in cooling fan motor, and for interrupting the motor current and displaying the malfunction . When [FANM] is opened, the motor current is instantly interrupted by base blocking, and the FANM LED (red) lights. . Use shielded lead for wiring [FANM]. . When the thermal relay for [FANM] is not used, or where it is used, but with an external sequence, connect terminal ③ to SG [terminal ① or ②]. . Where [FANM] signal is generated after processing the thermal relay contact with an external sequence, there are some cases that wrong signal is inputted as the [FANM] signal with some circuits, as shown below. Care should be taken in designing.  *1 To prevent erroneous operation of [FANM] interlock the interface relay with the READY signal. T: FANM ACTUATION TIME (0.1 sec)

2.7.2 Analog Input Signal

When designing analog input signals, take the information given in Table 2.11 into consideration.

Table 2.11 Functions of Input Signals

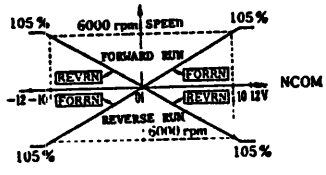
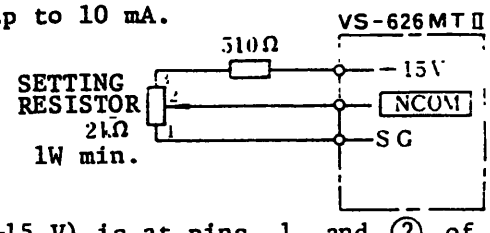
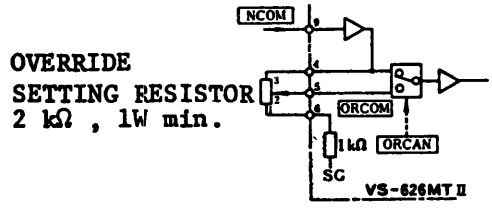
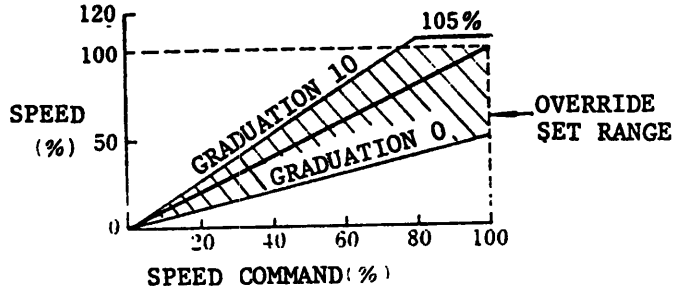
Signal	Connector No.	Pin No.	Function
1. Speed Command [NCOM]	1CN	9	. Rated input voltage is ±10 VDC. . The allowable input voltage is ±12 VDC. However, since the controller limits it at 105% of rated value, the maximum speed of the motor is limited at 105% of the rated speed. . The input impedance of [NCOM] is 50 kΩ . . With various combinations of [NCOM] and run signals, speeds and directions of rotation shown below are obtained.  . [NCOM] is effective and the motor runs when run signal [FORRN] or [REVRN] is closed. . While [FORRN] or [REVRN] is on, sometimes the motor will not stop completely even when [NCOM] is set to 0 V. To stop the motor completely, open [FORRN] or [REVRN] whichever is closed. (While either is closed, current flows.) . To improve noise resistance, use shielded lead for the [NCOM] circuit. . When setting [NCOM] manually, the output (±15 V) of the controller can be used, provided the current is kept up to 10 mA.  Output (+15 V) is at pins 1 and ② of 1CN, and -15 V is at pins ⑤ and ⑥ of 1CN, and SG is either pin ③, ④ or ⑩ of 1CN.

Table 2.11 Functions of Input Signals (Cont'd)

Signal	Connector No.	Pin No.	Function
2. Over-ride [ORCOM]	1CN	5	. When applying a speed override, close [ORCAN]. Use a 2 kΩ resistor as the setting resistor, and use the following circuit.  . Override speeds can be set between 50 and 130% of the set speed, but actually, speeds above 105% of the rated speed is not obtained. The characteristic curves are shown below. 

2.7.3 Contact Output Signal

Use these contact signals under the following conditions.

- For output signals, reed relays are used. Their contact capacity is 24 VDC, 0.1 ADC.
- The contact chattering time is within 1 msec.
- To switch external relays or other inductive loads, be sure to connect a CR spark-killer in parallel to the load, and keep the surge voltage across the contacts below 200 V.
- Where a capacitive load is to be controlled, connect a protective resistor in series to the load to limit current.
- Fig. 2.7 shows the output circuit, and Table 2.12 gives functions of the output signals.

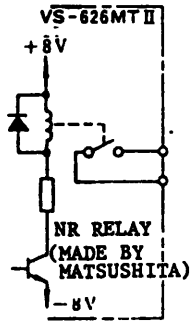


Fig. 2.7 Output Circuit

Table 2.12 (a) Functions of Output Signals

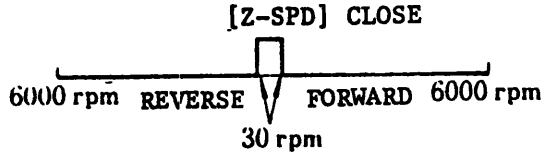
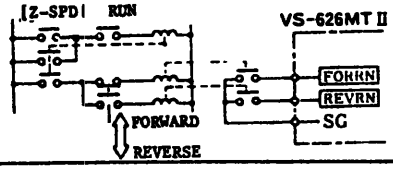
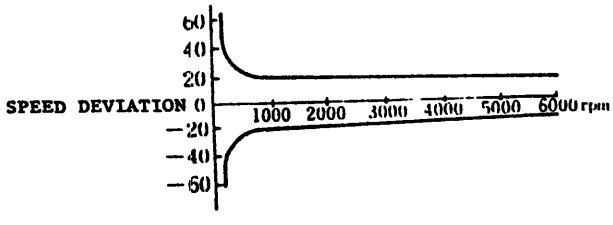
Signal	Connector No.	Contact and Pin No.	Function
1. Zero Speed [Z-SPD]	1CN		. When the motor speed drops below the set level (30 rpm), [Z-SPD] closes, and Z-SPD LED (green) lights.  . Since [Z-SPD] is outputted irrespective of [FORRN] and (REVRN), it can be used as a safety run interlock signal. An example for this usage is shown below. 
2. Speed Coincidence [AGREE]			. When the motor speed enters the preset range of [NCOM], [AGREE] closes, and AGREE LED (green) lights. However, while a run signal is open or [Z-SPD] is closed, it is not outputted. . When this signal is used as an answer to S command in NC program operation, the program is advanced to the next step. 

Table 2.12 (b) Functions of Output Signal

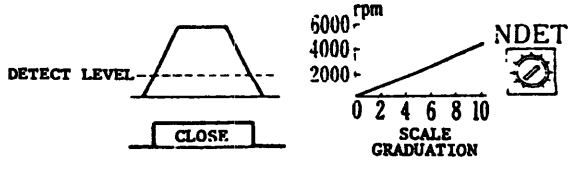
Signal	Connector No.	Contact and Pin No.	Function
3. Malfunction [FALT]	1CN		. When protective circuit for overcurrent or overload tripped, the motor current is instantly interrupted, and the motor stops after running by ineatia. Upon current interruption, [FALT] is outputted. . The [FALT] relay may be selectively in the normally closed or normally-open mode. The contact is "C" type. (The normally-closed mode is the standard.) . While [FALT] is outputted, the motor cannot run. . When [FALT] is used to reset [NCOM], [FORRN] or [REVRN], displays a spindle alarm visual signal. . [FALT] is sent to LEDs on the controller to light. For these, refer to Section 3.2 and Table 3.2. . For the relationship between [FALT] and [RESET], refer to 8. Malfunction reset [RESET] in Table 2.10(c).
4. Speed Detection [N-DET]			. When the motor speed drops below a preset level, [N-DET] closes, and the N-DET LED (green) lights. . The speed detection level is set between 30 and 4000 rpm with potentiometer (N-DET) in the controller.  . [N-DET] operates regardless of the run direction signals. . [N-DET] can be used as the detection signal for the speed suitable for clutch actuation or gear shifting. . The standard setting is 600 rpm.

Table 2.12 (b) Functions of Output Signal (Cont'd)

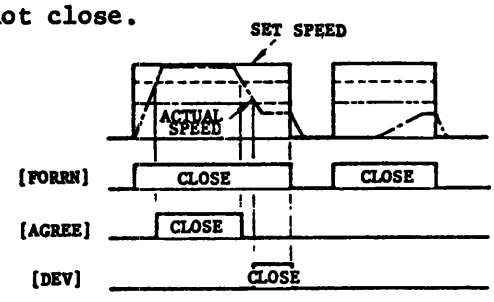
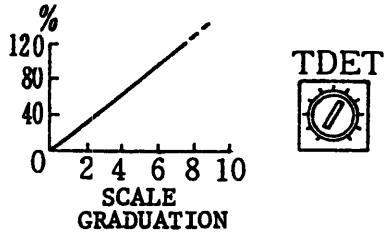
Signal	Connector No.	Contact and Pin No.	Function
5. Excessive Speed Deviation [DEV]	1CN		. When the motor speed deviates 50% or more from the level set by [NCOM] due to overloading, etc., [DEV] is closed and the DEV LED (red) lights. . When the speed deviation decreases below 50%, [DEV] opens automatically. . Unless [AGREE] has been outputted during run previously, [DEV] will not close even when the speed deviation exceeds 50%. Therefore, where [FORRN] or [REVRN] is closed, and [NCOM] is inputted, but the motor remains still, [DEV] will not close.  . Since [DEV] is outputted when the cutting tool takes an excessive cut or other conditions detrimental to the tool and the machine develop, it can be used as a spindle alarm signal.

Table 2.12 (c) Function of Output Signal

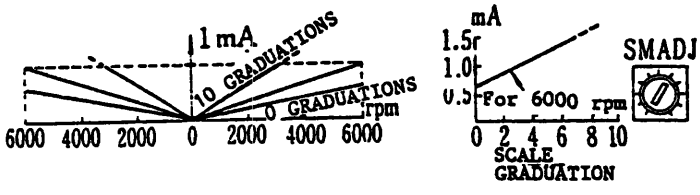
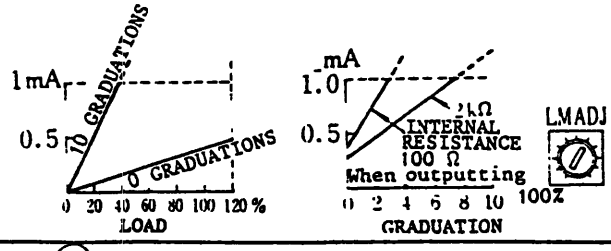
Signal	Connector No.	Contact and Pin No.	Function
6. Torque Detection [T-DET]	1CN		. When torque increases above a specified level, [T-DET] closes, and the "T-DET" LED (green) lights. . The torque detection level can be set between 0 and 120% with the potentiometer (T-DET) in the controller.  . [T-DET] can be used as a signal for checking the torque limit function, and for determining the load conditions.

2.7.4 Analog Output Signal

Use the analog output signals in the following conditions.

Table 2.13 Function of Output Signal

<table>
<tr><th>Signal</th><th>Connector No.</th><th>Pin No.</th><th>Function</th></tr>
<tr><td>1. Speedometer Signal [SMSIG]</td><td>2CN</td><td>1</td><td>. When an external speedometer is connected, the motor speed can be monitored.
. [SMSIG] outputs DC current proportional to the motor speed, regardless of the run direction.
. Select a speedometer which satisfies the following specifications.

One-way Swing DC Ammeter
<table><tr><th>Type</th><th>Moving coil</th></tr><tr><td>Rated current</td><td>1 mA full-scale</td></tr><tr><td>Quality class</td><td>Class 2.5 or higher</td></tr><tr><td>Internal resistance</td><td>2 kΩ max.</td></tr></table>. The level of [SMSIG] is adjustable with potentiometer [SMADJ].
 
*1. Internal resistance of tachometer is 100 Ω.
. Since (SMADJ) is only for adjusting the speedometer, the actual speed is not influenced by it.
. The forward and reverse run speed accuracy is ±2% max. of the rated speed.</td></tr>
<tr><td>2. Load meter Signal [LMSIG]</td><td></td><td>3</td><td>. The load meter indicates the percentage of the actual load to the 30-minute rated output of the motor.
. Select a load meter conforming to the same specifications as the speedometer.
. [LMSIG] can be adjusted by the potentiometer (LMADJ).
  </td></tr>
</table>

Note: For the meter SG, use pins (2) and (16) of 2CN.

2.8 Spare Parts

Main parts used in VS-626 MTII Controller are shown in Table 2.14. It is recommended that more than one set of fuses be stocked at all times.

Table 2.14 Spare Parts for VS-626MTII

Parts Name	VS-626MTII Controller Type CIMR-MTII-□□K	Parts Type	Code	Q'ty	Remarks
AC circuit fuse (ACFU)	5.5, 7.5	25SH75	FU696	2	Required spare parts
	11, 15	25SH100	FU697	2	
	18.5, 22	25SH150	FU699	2	
DC circuit fuse (DCFU)	5.5, 7.5	25SH75	FU696	1	
	11	25SH100	FU697	1	
	15	25SH125	FU698	1	
	18.5	25SH150	FU699	1	
	22	25SH200	FU700	1	
Control circuit fuse	5.5-22	F-7161	FU383	2	
Surge absorber	5.5-22	TNR-15G471K	XX139	3	Optional spare parts
Transister module	5.5, 7.5	MG100G1AL1	STR141	6	
		EVK71-050	STR142	1	
	11			6	
		EVL31-050	STR143	1	
	15, 18.5	EVK71-050	STR142	11	
	22			3	
		EVL31-050	STR143	9	
Thyristor module	5.5-15	TM55DZ-H	SCR197	3	
	18.5, 22	TM90DZ-H	SCR198	3	
Diode module	5.5-11	RM60C2Z-H	SID304	2	
	15-22			4	
Control circuit board	5.5-22	JPAC-C061	ETC581X	1	
Base drive board	5.5-22	JPAC-C062	ETC582X	1	
Motor card	5.5 Foot-mounted type	JPAC-C079	ETC599X	1	
		JPAC-C070	ETC590X	1	
	7.5 Flange-mounted type	JPAC-C071	ETC591X	1	
		JPAC-C072	ETC592X	1	
	11	JPAC-C073	ETC593X	1	
	15 Foot-mounted type	JPAC-C074	ETC594X	1	
	15 Flange-mounted type	JPAC-C075	ETC595X	1	
	18.5	JPAC-C076	ETC596X	1	
	22	JPAC-C077	ETC597X	1	

3. MAGNETIC SENSOR TYPE SPINDLE ORIENTATION

3.1 Outline

Instead of the conventional mechanical spindle orientation system for use with NC machine tools, VS-626MTII stops the spindle at a specified angular position by an electrical method.
This system has the following features.

(1) Simple mechanism

A magnetic unit on the spindle and a magentic sensor on the stationary member are the only devices required. No stopper, pin, nor cylinder is required.

(2) Short orientation time

The position detection signal from the magnetic sensor forms a servo loop for accurate positioning in a short period of time even when the spindle is running at maximum speed.

(3) Reliability and service life improvement

Decisive reduction of positioning shock leading to higher reliability and longer service life.

(4) Economical advantage

Simplified mechanism and power control sequence make for substantial reduction in cost.

3.2 System Configuration

The spindle orientation system is composed of spindle AC motor, a VS-626MTII controller, an orientation card, a spindle position detector magnet and a magent sensor. See Fig. 3.1.
The system operates at an orientation command (with NC, [M19] command).

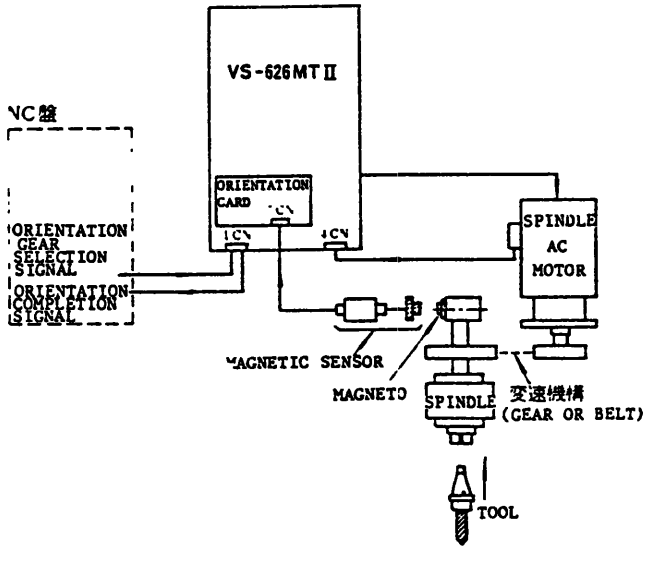


Fig. 3.1

3.3 Spindle Orientation Specifications

Table 3.1 Standard Specifications

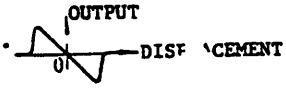
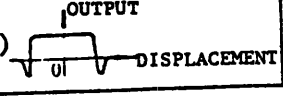
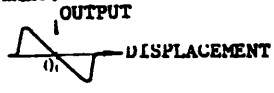
Item	Functions
1. Position detection mode	Displacement detection based on the detection of magnetic flux generated by a magneto and a magnetic sensor.
2. Stop position	Position corresponding to the center-to-center alignment of the magneto body and the magnetic sensor head. Adjustable within ±1° with a potentiometer.
3. Stop position repeating accuracy	±0.2° or below (When the magneto body is mounted on a 120 mm diameter outer surface, excluding mechanical error and error caused by external magnetic fields.)
4. Reaction torque	Continuous rated torque/±0.1° displacement
5. Required input signal 5.1 Orientation signal 5.2 M gear select signal 5.3 L gear select signal	Orientation mode: CLOSE 1CN ㉒ - SG M gear select: CLOSE 1CN ⑳ - SG L gear select: CLOSE 1CN ㉑ - SG * When H gear is selected, both M and L gear select signals are CLOSE.
6. Output signal 6.1 Orientation end signal	Upon completing orientation, CLOSE signal 1CN ㊱ - ㊲
7. Orientation card	Type: JPAC-C063
8. Magneto	Type: MH-1378BS MG-1444 * Standard type is MG-1378BS
9. Magnetic sensor	Type: FS-1378B FS-200-A * Standard type is FS-1378B.

3.3.1 Detector specifications

Table 3.2 Magneto Specifications

Item	Specifications	
	MG-1378BS	MG-1444
Detection Range mm	±15	±13
Allowable Speed rpm (Mounted on 120 mm dia. outer surface)	6000	3300
Weight g	32	20
Maker	Makome Corporation	

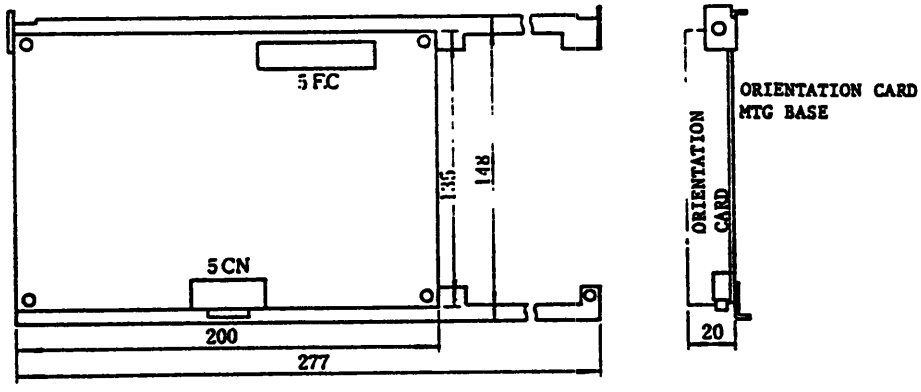
Table 3.3 Sensor Specifications

Item	Specifications	
	FS-1378B	FS-200A
1. Configuration	Sensor head-amp separate type Sensor head: FSH-1378B Amplifier: FSD-1378B	Sensor head-amp integral type
2. Power supply 2.1 Voltage 2.2 Current	150 VDC ±5% 100 mA max.	12 VDC ±10% 50 mA max.
3. Output 3.1 Position signal (level) (for control) (offset) (Output impedance) 3.2 Position signal (range) (for monitor) (offset)	±4 V min. ±0.2 V max.  1.5 kΩ 30° min.* (+2.4 V min.)  ±0.5 V max.	±8 V min. ±0.2 V max. 1.5 kΩ 
4. Service temperature range	-10 to +50°C	
5. Output terminal	With round connector (Made by TAJIMI MUSEN DENKI K.K.) (Terminal arrangement) A: Position signal + B: SG C: +15 V D: Position signal - E: Range signal - F: Range signal +	With 5 meter cable 6 mm dia, 4-core rubber-sheathed cable [Wiring] Red: +12 V Black: SG Green: Ouput + White: Output -
6. Maker	MAKOME Corporation	

* When magneto is mounted on 120 mm dia. outer surface on spindle.

3.4 Dimensions in mm

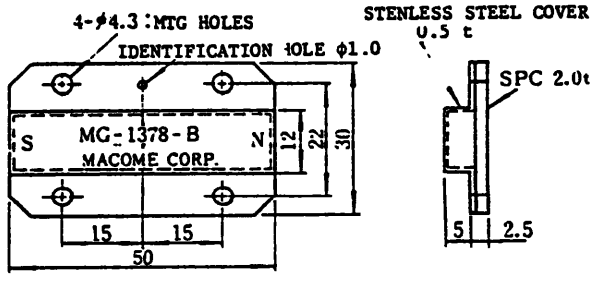
3.4.1 Orientation card (Type JPAC-C063)



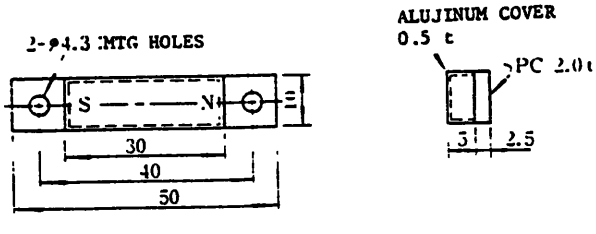
Notes:
1. Orientation card mtg. base is standard component.
2. When orientation card is ordered, it is mounted in VS-626MTII controller before shipment.

3.4.2 Magneto

(1) MG-1378BS



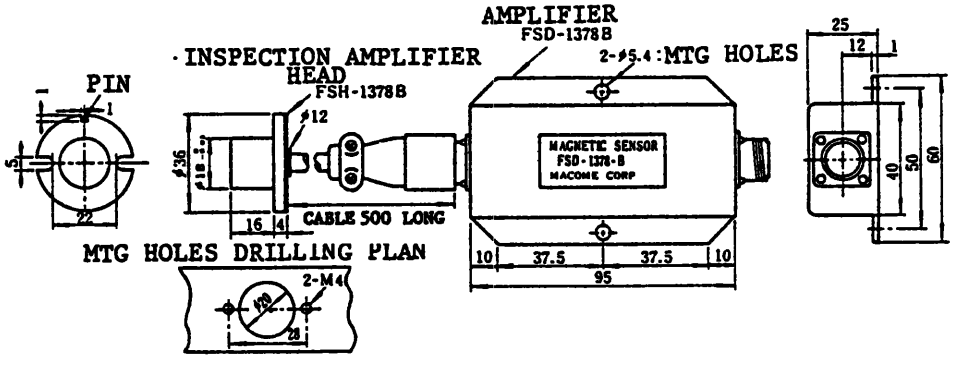
(2) MG-1444



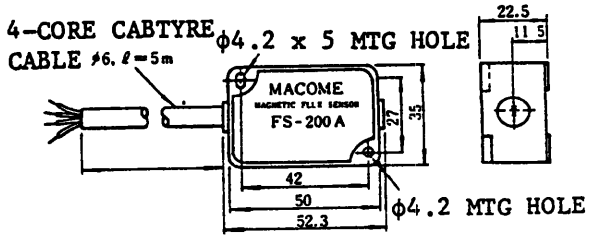
3.4.3 Magnetic sensor

(1) Type FS-1378B

Dimensions in mm

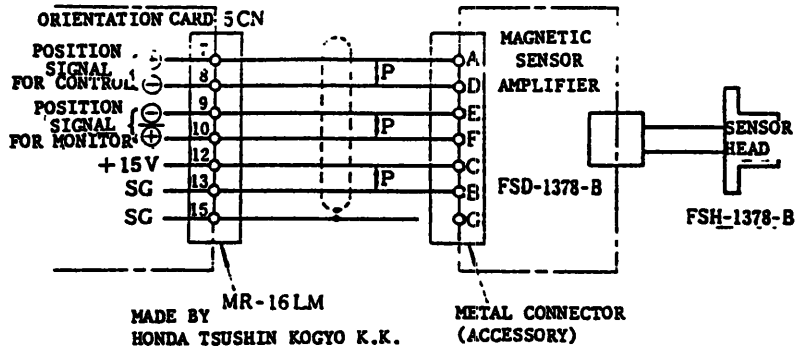


(2) Type FS-200A



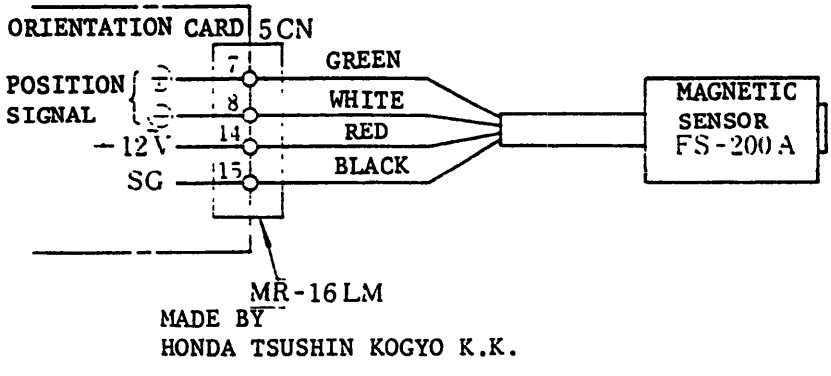
3.5 Interconnections between Devices

3.5.1 For type FS-1378B



Notes:
1. Connection lead should be vinyl cable with braided copper shield ($0.3\ mm^2$ twisted-pair 3-P).
2. $\overline{\ \ }$ shows twisted-pair leads.

3.5.2 For type FS-200A



3.5.3 List of connector signal

Table 3.4 List of Connector Signal

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	-			11	SG
2	-	7	Position signal ⊕	12	+15 V
3	-	8	Position signal ⊖	13	SG
4	-	9	Range signal ⊖	14	+12 V
5	-	10	Range signal ⊕	15	SG
6	-			16	-

3.6 Outline of Operation

The VS-626MTII has two operating modes: the normal mode in which the spindle is controlled by external orientation signals, and the test mode in which the spindle is controlled by card test signals for adjustment.

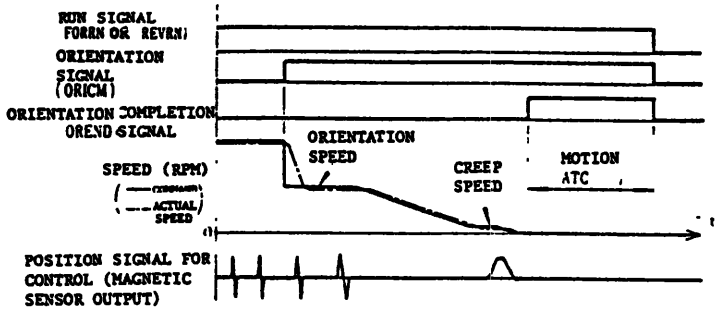
3.6.1 Normal mode

When an orientation signal is received while the spindle is in motion (or standing still), the spindle immediately decelerates (or accelerates) to the preset orientation speed.

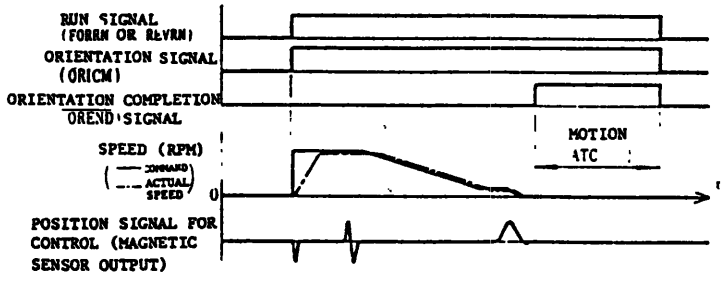
When the spindle passes the target stop position first time after attaining the preset speed, the soft start function incorporated in the orientation card is started, and the spindle is first decelerated to the preset creep speed, and then, as the magneto comes into alignment with the magentic sensor, it is stopped by the serveo loop.

Thereupon, the OR-END LED (green) lights, and an OR-END signal is outputted (contact CLOSE).

After stopping at the specified angular position, the spindle is under control to remain in the position until the command is cleared, so that it resists any external force exerted to displace it from the sotp position.



(a) Orientation when Spindle is Running



(b) Orientation when Spindle is at Standstill

Fig. 3.2 Time Chart for Orientation Operation

3.6.2 Test mode

When the selection connector on the orientation card (JPAC-C063) is connected in the test mode, the LED (red) built into the test button [TPB] lights.

With FORRN or REVRN as well as ORICM (orientation signal) inputted, when TPB is pushed, the spindle starts to run at the orientation speed. When the spindle passes the stop position for the first time after TPB is released, the spindle stopping sequence, same as in the normal mode, is started to shortly stop the spindle at the specified angular position.

Upon stopping the spindle, the OR-END LED (green) lights, but no OR-END signal is outputted, so that the spindle can be repeatedly tested for the orientation motion with the TPB button.

Fig. 3.3 shows the time chart for the test mode orientation operation.

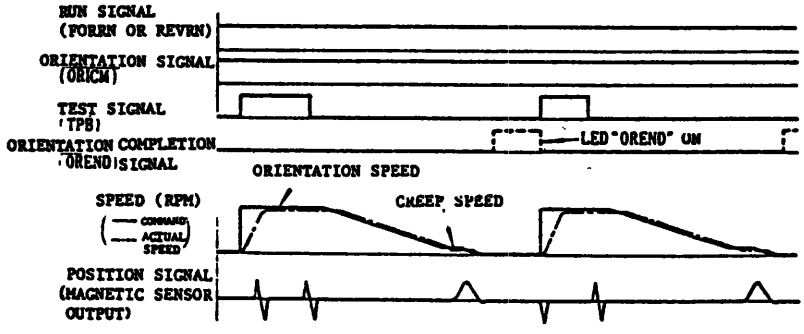


Fig. 3.3 Time Chart for Test Mode Orientation

*1 Since no OR-END signal is outputted in the test mode, a time-error state may be created with a system in which an orientation time monitoring arrangement is incorporated. With these systems, the relevant parameter or timer setting should be change for the intended orientation test in advance.

3.7 Description of Control Signals

3.7.1 Contact input signal

When designing input signals for the orientation system, take the following into consideration.

. Relay contacts used for these signals must be of a capacity of 30 V or over (15 mA or over).

. A delay of approximately 5 msec caused by a filter in the level conversion circuit in the input area is to be taken into account.

. Since a pull-up resistor is incorporated, the use of non-contact input signals is also possible. In this case, input signals at 20 V min. for HIGH level and 2 V max. for LOW level.

. Fig. 3.4 shows the input circuit, and Table 3.5 gives a description of signals.

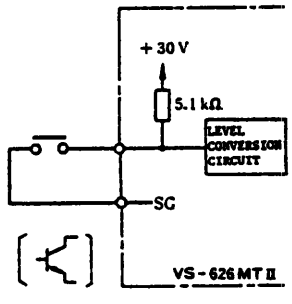


Fig. 3.4 Input Circuit

Table 3.5 Description of Input Signals

Name	Connector No.	Pin No.	On Level	Description
1. Orientation [ORICM]	1CN	22	L (CLOSE)	. Command signal for use with the electric orientation system . For executing an orientation command, a run signal, [FORRN] or [REVRN], is required, in addition to [ORICM]. . Whe [ORICM] is inputted, the spindle immediately decelerates and comes to stop at the specified angular position. . When the operation such as tool changing, for which spindle orientation is required is over, clear the run signal and [ORICM]. . When the system is to be energized with the power supply switch, be sure [ORICM] is opened in advance. . If the spindle is stopped in the EMERGENCY mode during the orientation process, be sure to clear [ORICM].
2. Gear Select [M GEAR]		20	L (CLOSE)	. This signal is for selectively engaging gears between the spindle and the spindle drive motor to obtain proper spindle speeds to shorten the time spent in the orientation process. . For the speed ratios and the gears, refer to Table 3. . To engage the H gear, open both [M GEAR] and [L GEAR]. . If [M GEAR] and [L GEAR] are inputted simultaneously, the orientation time and accuracy are adversely influenced. Never input them together.
3. Gear Select [L GEAR]		21		

Table 3.6 Gear Select and Gear Ratio

Gear Stage	Gear	Gear Ratio ($\fallingdotseq \frac{\text{Spindle Speed}}{\text{Motor Speed}}$)	Gear Select	
			M GEAR	L GEAR
1	-	1.5 — 0.6	×	×
	-	0.6 — 0.15	O	×
	-	0.2 — 0.05	×	O
2	HIGH	1.5 — 0.6	×	×
	LOW	0.6 — 0.15	O	×
	HIGH	1.5 — 0.6	×	×
	LOW	0.2 — 0.05	×	O
	HIGH	0.6 — 0.15	O	×
	LOW	0.2 — 0.05	×	O
3	HIGH	1.5 — 0.6	×	×
	MEDIUM	0.6 — 0.15	O	×
	LOW	0.2 — 0.05	×	O

Note: For gear ratio other than value in table, contact the company.

O...ON, contact closed
×...OFF, contact opened

3.7.2 Contact output signal

Use the orientation signal under the following conditions

- Use a reed relay for output signals. The contact capacity should be 24 VAC, 0.1 ADC.
- The contact chatter must be 1msec max.
- When switching an inductive load such as relay, be sure to connect a CR spark-killer in parallel to the load. Keep the surge voltage across the contacts below 200 V.
- When a capacitive load is connected, connect a series resistor to restrict the current.
- Fig. 3.5 shows the output circuit and Table 3.7 gives a description of the output signals.

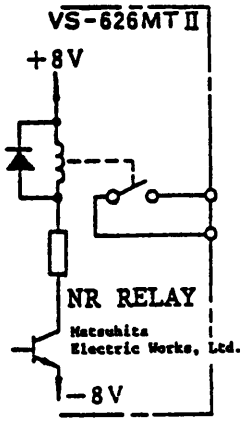


Fig. 3.5

Table 3.7 Description of Output Signals

Name	Connector No.	Contact & Pin No.	Description
1. Orientation end [OREND]	1CN	36 37	. [OREND] is outputted (contact CLOSE) when the spindle has been stopped at the specified angular position within ±0.2°, by [ORICM]. . While [OREND] is being outputted, the spindle angular displacement is compensated exerting a reaction torque against an external torque. However, if the spindle has been obviously displaced by a strong external torque, stop operation, and clear [OREND]. . Connect an external sequence circuit for outputting an alarm signal when [OREND] is not outputted within a preset time after receiving [ORICM].

*1. When the FS-1378B magnetic sensor is used, a monitoring position signal can be used to open [OREND] if the spindle is displaced after the end of an orientation process.
When the FS-200A is used, [OREND] cannot be opened when once the spindle has been oriented, unless [ORICM] is opened, because FS-200A has no monitoring position signal.

3.8 Installing Magneto and Magnetic Sensor

The magento is installed on the spindle, and the magnetic sensor is installed on a stationary part. Their relative position must be such that when the spindle is in the intended stop position, the magneto and the magnetic sensor are aligned center-to-center.

3.8.1 Installing

Fig. 3 shows the installing method, and Table 3.8 gives the required mounting accuracy.

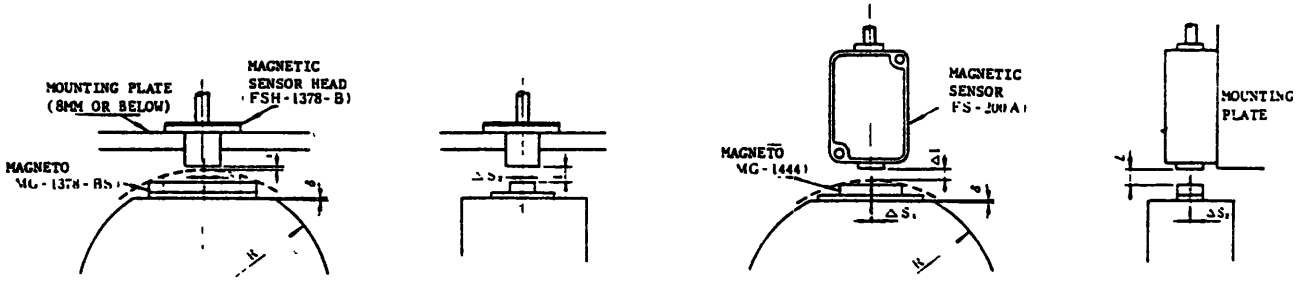
Table 3.8 Mounting Accuracy

No.	Dimensions	Code	MG1378-BS/ FS-1378-B	MG-1444/ FS-200A
1	Radius of spindle member*	R	60-70 mm	60-70 mm
2	Gap (center of magneto to magnetic sensor†)	L	6 mm (6-8 mm)	5 mm (3-7 mm)
3	Gap(end of magneto to magnetic sensor†)	ΔL	1-2 mm	1-2 mm
4	Center position error of magneto and magnetic sensor‡	ΔS1, ΔS2	0.5 mm max.	0.5 mm max.
5	Angular displacement error from datum planc ‡	δ	0.2° max.	0.2° max.

* In determining the diameter of the spindle member for installing the magneto take the permissible maximum peripheral speed of the magneto into consideration.

† The L value is a recommended value. Adjust the gap so as to satisfy the ΔL requirement.

‡ In aligning magneto to the mechanical center line of the system such as the spindle nose key of a machining center, observe the specified mounting accuracy standards for the center position and angular position of the magneto.



(a) MG-1378-BS/FS-1378-B (b) MG-1444/FS-200A

Fig. 3.6 Installing Magneto and Magnetic Sensor

3.8.2 Mounting direction

In installing the magneto and the magnetic sensor, pay attention to their polarity. If they are mounted with the wrong polarity, operation will be malfunctioned

(1) For MG-1378-BS/FS-1378-B

As shown in Fig. 3.7, install the magneto and the magnetic sensor so that the identification hole on the magneto and the head pin groove on the sensor are on the same side of the center line.

With respect to the running direction of the magneto, install the magneto so that the identification hole is on the left of the center line viewed in the running direction.

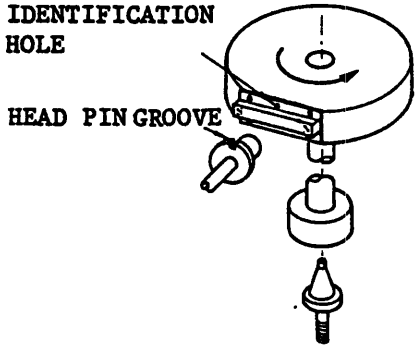


Fig. 3.7 Magneto and Magnetic Sensor Mounting Direction

(2) For MG-1444/FS-200A

As shown in Fig. 3.8, where the spindle turns forward in the CCW direction, install the magneto so that its N comes on the right and S left as viewed from a stationary position, and install the magnetic sensor with the nameplate up.

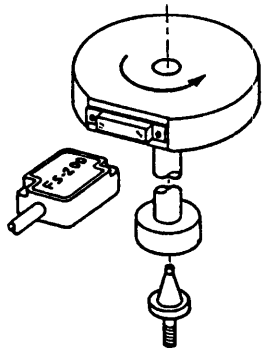


Fig. 3.8 Magneto and Magnetic Sensor Mounting Direction

3.8.3 Precautions in Mounting

(1) Although the sensor head is designed to be resistant to oil and water, seal the bushes with sillicone adhesive or the like where the sensor is subject to frequent splashing from oil or water.

(2) In designing the mounting arrangement for the sensor amplifier and connecting cables, avoid exposing them to water and oil splashes.

(3) Avoid bringing units generating magnetic fields such as solenoids and magnets near the magneto and the magnetic sensor.

(4) In installing the magnetic sensor head and the magneto, take care not to mechanically damage them.

(5) Take care to prevent iron powder or the like from depositing on the magneto.

(6) Install the magneto on the spindle, in order to avoid stopping position deviations due to backlash.

(7) Make the cable connecting the magnetic sensor amplifier and the orientation card not more than 20 meters in length.

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