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DRIVE UNIT

MOTION CONTROL SYSTEM (MCS) / (MCSII)

MAINTENANCE MANUAL

(5th Edition)

Pub No. 4742-E-R1 (SEH4-001-R5) Mar. 2003

OKUMA

SAFETY PRECAUTIONS

The controller described in this manual consists of electric parts and units.
To prevent accidents and also failure and burning of electric parts and units due to improper interconnection of them and also connection of power cables, please read the manual carefully and strictly observe the items indicated below.

(1) Before connecting or disconnecting/removing a unit, shut off all power supplies and discharge parts in units which have been charged. Otherwise, injury, or failure or burning of a unit may occur.

(2) Check the specifications of the power supply to be connected. Failure or burning of a unit may occur if power supply voltage does not match the power requirements of the unit or if the polarity is incorrect.

(3) Connect inputs and outputs of a unit correctly. If they are connected incorrectly, failure or burning of a unit may occur.

(4) Always ground units and connect the P.E. earth cable of the electric cabinet. Otherwise, electric shock may cause if leakage occurs.

(5) Insert an over current protection device (breaker, fuse) to the power supply which is connected to units. Otherwise, cables or units may be burnt or fire may be cause due to short circuit.

(6) When manufacturing cables used for connecting units, make sure that the size of cables matches the carrying current. Especially, power cables must be manufactured carefully. If the current capacity of the cable is insufficient, the cable may be heated to be burnt or fire may be caused.

(7) The electric cabinet and the operation box where units are installed must be water-and dust-proof construction. Otherwise, injury, or failure or burning of a unit may occur.

(8) Make sure to use a thermostat incorporated in motors and units to protect devices. Otherwise, devices may be burnt or fire may be caused.

The following warning indications are used in this manual to draw special attention to information of particular importance.

⚠ DANGER	:	Indicates an imminent hazard which, if not avoided, will result in death or serious injury.
⚠ WARNING	:	Indicates hazards which, if not avoided, could result in death or serious injury.
⚠ CAUTION	:	Indicates hazards which, if not avoided, could result in minor injuries or damage to devices or equipment.
NOTICE	:	Indicates precautions relating to operation or use.

Keep this manual carefully so that you can read it whenever you need the information in this manual.
The contents of the manual may be changed due to improvements of the product.

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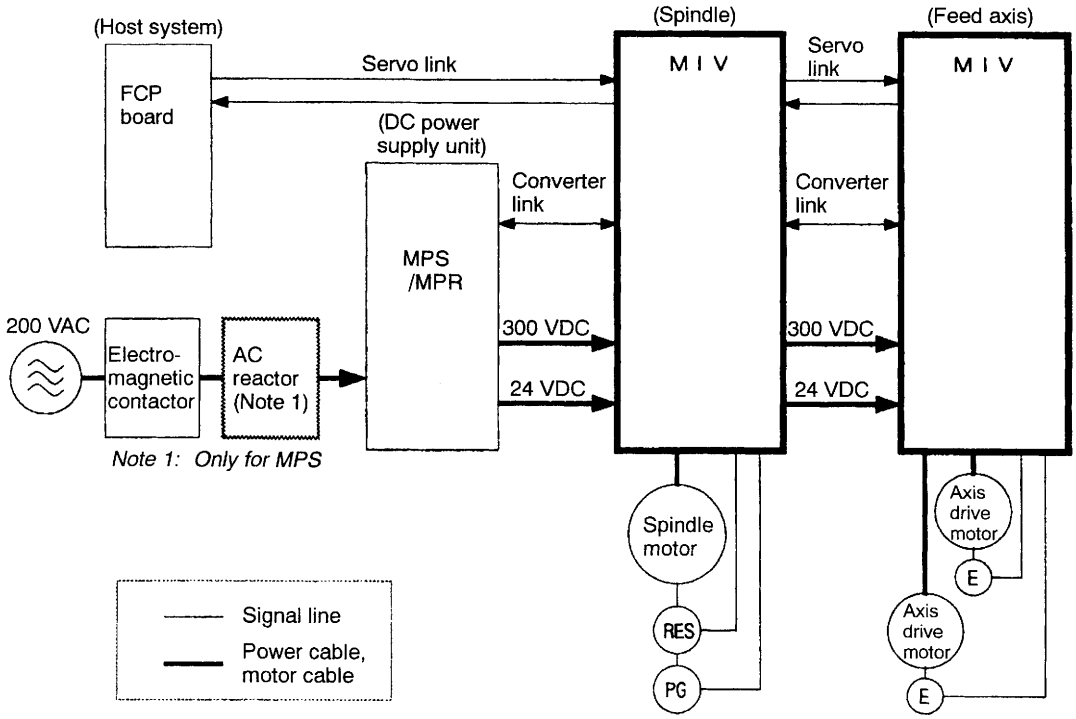
SECTION 1 INVERTER UNIT (MIV UNIT)

Okuma motion control system (MCS) consists of an inverter unit and a DC power supply unit. This section describes the maintenance and inspection methods for the inverter unit (to be referred to as MIV unit, hereafter).

1. System Configuration

MIV unit is an inverter unit that drives spindle motors and axis drive motors. Connection of MIV unit with peripheral is shown below.

- A DC power supply is connected to MIV unit to supply 300 VDC and 24 VDC (control power).
- MIV unit communicates with peripherals through the servo link, the encoder link, and the converter link.
- MIV unit has a built-in control board specially used for motor control to control a spindle motor and an axis drive motor.
- Two types of MIV unit are provided; one-axis specification which controls one motor and two-axis specification which controls two motors.
- A DC power supply unit can be connected to more than one MIV unit.



Inverter Unit System Configuration

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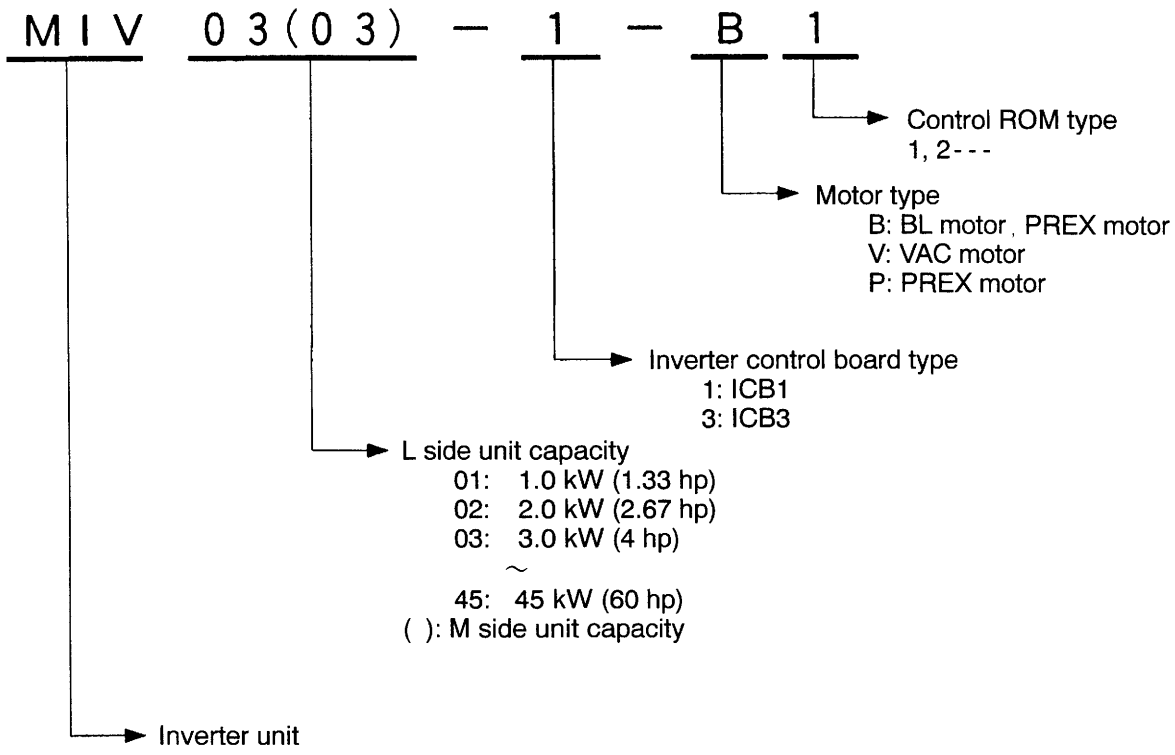
2. Classification of MIV Units

2-1. Designation of MIV Units

MIV unit names consist of codes indicating unit capacity, inverter control board type, motor type, and control ROM type as shown below.



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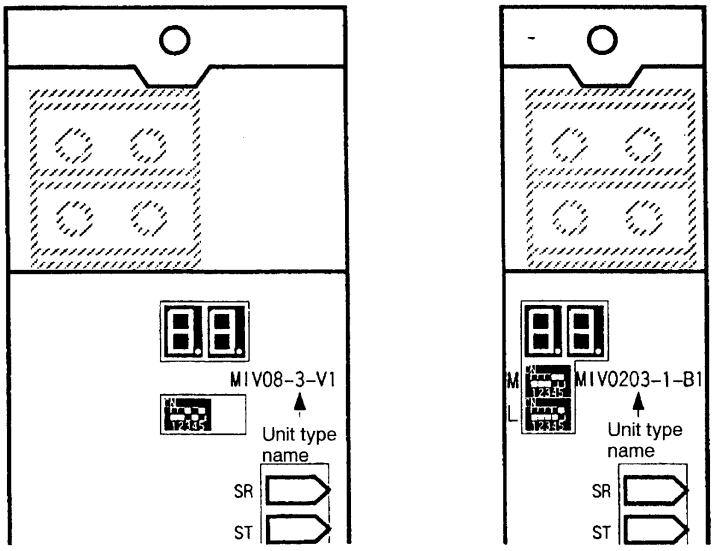
MIV unit type name is shown at the front of the unit either by seal or printed characters.When changing the unit, use the same type.



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2-2. Configuration of MIV Units

Component parts of MIV unit are indicated below.

2-2-1. MIV Unit for BL Motors

(1) 1-axis specification MIV unit: for BL motors, PREX motor
Configuration of 1 set of MIV unit: Inverter control board, Display card, Inverter unit

In the table below, indication of "(1)" in the Q'ty column indicates that any of the indicated units should be selected meeting the motor capacity.

Category	Order Name	Q'ty	Order No.	Description
Inverter control board	ICB1-S	(1)	1006-2101	BL motor 1-axis control board (Discontinued)
	ICB1S-P	(1)	1006-2107	PREX motor 1-axis control board (Discontinued)
	ICB1F-S	(1)	1006-2111	BL/PREX motor 1-axis control board (Discontinued)
	ICB1H-S	(1)	1006-2121	BL/PREX motor 1-axis control board (*1)
Display card	MFP1 CARD	1	1006-2105	Card with status indicator
Inverter unit	MIV01-1 PU	(1)	1006-2211	1-axis control inverter unit: Applicable motor capacity. 1.8 kW (2.4 hp)
	MIV02-1 PU	(1)	1006-2212	1-axis control inverter unit: Applicable motor capacity 2.8 kW (3.73 hp)
	MIV03-1 PU	(1)	1006-2213	1-axis control inverter unit: Applicable motor capacity 3 kW (4 hp)
	MIV04-1 PU	(1)	1006-2214	1-axis control inverter unit: Applicable motor capacity 4 kW (5.3 hp)
	MIV05-1 PU	(1)	1006-2215	1-axis control inverter unit: Applicable motor capacity 4.8 kW (6.4 hp)
	MIV06-1 PU	(1)	1006-2218	1-axis control inverter unit: Applicable motor capacity 6 kW (8 hp) (production discontinued)
	MIV08-1 PU	(1)	1006-2219	1-axis control inverter unit: Applicable motor capacity 7.5 kW (10 hp) (production discontinued)
	MIV06DB-1 PU	(1)	1006-2265	1-axis control inverter unit: Applicable motor capacity 6 kW (8 hp)
	MIV08DB-1 PU	(1)	1006-2266	1-axis control inverter unit: Applicable motor capacity 7.5 kW (10 hp)
	MIV15-1 PU	(1)	1006-2220	1-axis control inverter unit: Applicable motor capacity 15 kW (20 hp)
	MIV22-1 PU	(1)	1006-2221	1-axis control inverter unit: Applicable motor capacity 22 kW (30 hp)
DBR unit	DBR8	(1)	1006-2246	Dynamic brake resistor unit used for MIV06-1 and MIV08-1 (production discontinued)

(*1) ICB1H-S is compatible with ICB1-S, ICB1S-P and ICB1F-S.

(2) 2-axis specification MIV unit: for BL motors
Configuration of 1 set of MIV unit: Control board + Display card + Inverter unit

In the table below, indication of "(1)" in the Q'ty column indicates that any of the indicated units should be selected meeting the motor capacity.

Category	Order Name	Q'ty	Order No.	Description
Control board	ICB1	(1)	1006-2100	BL motor 2-axis control board (Discontinued)
	ICB1F	(1)	1006-2110	BL/PREX motor 2-axis control board (Discontinued)
	ICB1H	(1)	1006-2120	BL/PREX motor board (*1)
Display card	MFP1 CARD	1	1006-2105	Card with status indicator
Inverter unit	MIV0101-1 PU	(1)	1006-2224	2-axis control inverter unit: Applicable motor capacity 1.8 kW × 1.8 kW (2.4 hp × 2.4 hp)
	MIV0102-1 PU	(1)	1006-2225	2-axis control inverter unit: Applicable motor capacity 1.8 kW × 2.8 kW (2.4 hp × 3.73 hp)
	MIV0202-1 PU	(1)	1006-2226	2-axis control inverter unit: Applicable motor capacity 2.8 kW × 2.8 kW (3.73 hp × 3.73 hp)
	MIV0103-1 PU	(1)	1006-2227	2-axis control inverter unit: Applicable motor capacity 1.8 kW × 3 kW (2.4 hp × 4 hp)
	MIV0203-1 PU	(1)	1006-2228	2-axis control inverter unit: Applicable motor capacity 2.8 kW × 3 kW (3.73 hp × 4 hp)
	MIV0303-1 PU	(1)	1006-2229	2-axis control inverter unit: Applicable motor capacity 3 kW × 3 kW (4 hp × 4 hp)
	MIV0104-1 PU	(1)	1006-2230	2-axis control inverter unit: Applicable motor capacity 1.8 kW × 4 kW (2.4 hp × 5.3 hp)
	MIV0204-1 PU	(1)	1006-2231	2-axis control inverter unit: Applicable motor capacity 2.8 kW × 4 kW (3.73 hp × 5.3 hp)
	MIV0404-1 PU	(1)	1006-2232	2-axis control inverter unit: Applicable motor capacity 4 kW × 4 kW (5.3 hp × 5.3 hp)

(*1) ICB1H-S is upward compatible with ICB1and ICB1F.

2-2-2. MIV Unit for VAC Motors

(1) MIV unit: for VAC motors
Configuration of 1 set of MIV unit: Control board + Display card + Inverter unit

In the table below, indication of "(1)" in the Q'ty column indicates that any of the indicated units should be selected meeting the motor capacity.

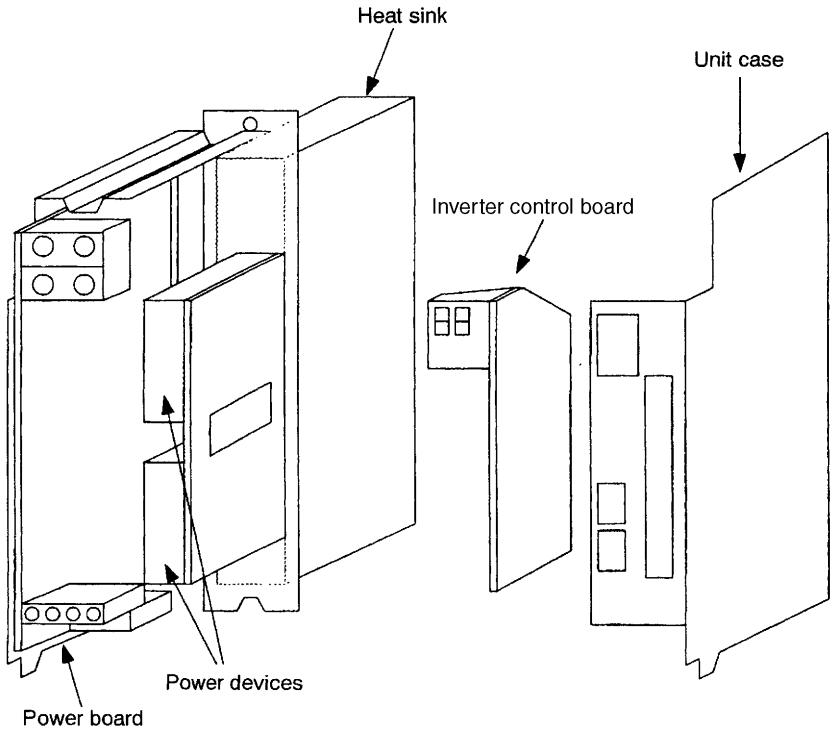
Category	Order Name	Q'ty	Order No.	Description
Control board	ICB3	(1)	1006-2102	VAC/VAC-P motor control board (Discontinued)
	ICB3F	(1)	1006-2112	VAC motor control board (Discontinued)
	ICB3H	(1)	1006-2122	VAC/VAC-P motor control board (*1)
Display card	MFP1 CARD	1	1006-2105	Card with status indicator
Inverter unit	MIV04-3 PU	(1)	1006-2254	Inverter unit: Applicable motor capacity 1.1 kW (1.5 hp)
	MIV06-3 PU	(1)	1006-2256	Inverter unit: Applicable motor capacity 5.5 kW (7.5 hp)
	MIV08-3 PU	(1)	1006-2257	Inverter unit: Applicable motor capacity 7.5 kW (10 hp)
	MIV14-3 PU	(1)	1006-2268	Inverter unit: Applicable motor capacity 14 kW (18.67 hp)
	MIV15-3 PU	(1)	1006-2258	Inverter unit: Applicable motor capacity 15 kW (20 hp)
	MIV22-3 PU	(1)	1006-2259	Inverter unit: Applicable motor capacity 22 kW (30 hp)
	MIV30-3 PU	(1)	1006-2260	Inverter unit: Applicable motor capacity 30 kW (40 hp)
	MIV45-3 PU	(1)	1006-2261	Inverter unit: Applicable motor capacity 45 kW (60 hp)

(*1) ICB3H is upward compatible with ICB3 and IC3F.

2-3. Construction of MIV Units

Construction of MIV unit is shown below.

(1) Construction of MIV01 to MIV05 and MIV0101 to MIV0404



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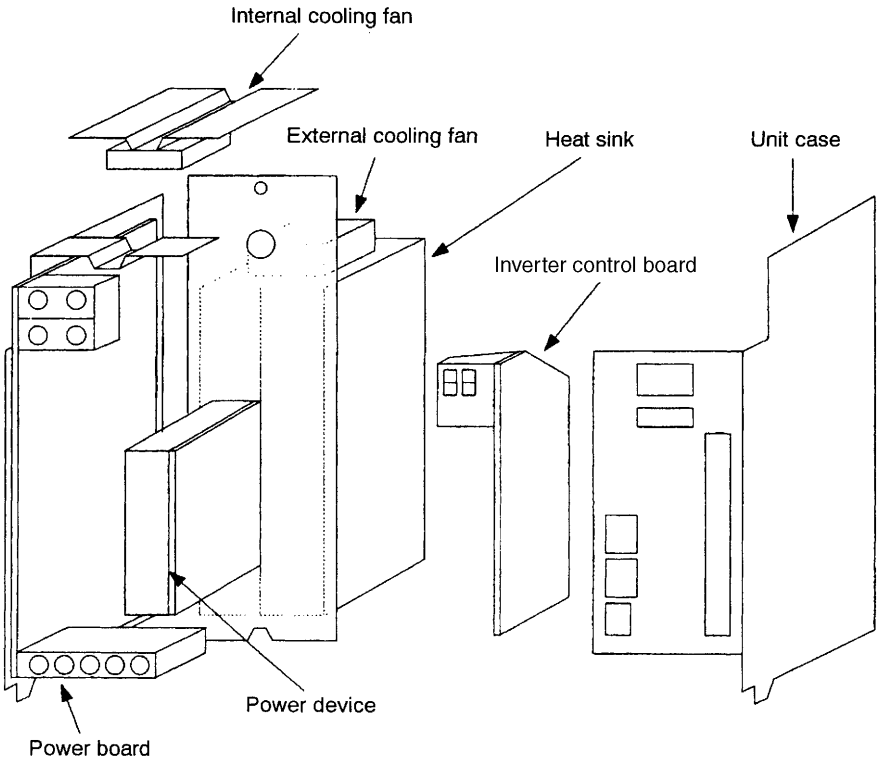
(2) Construction of MIV06 and MIV08



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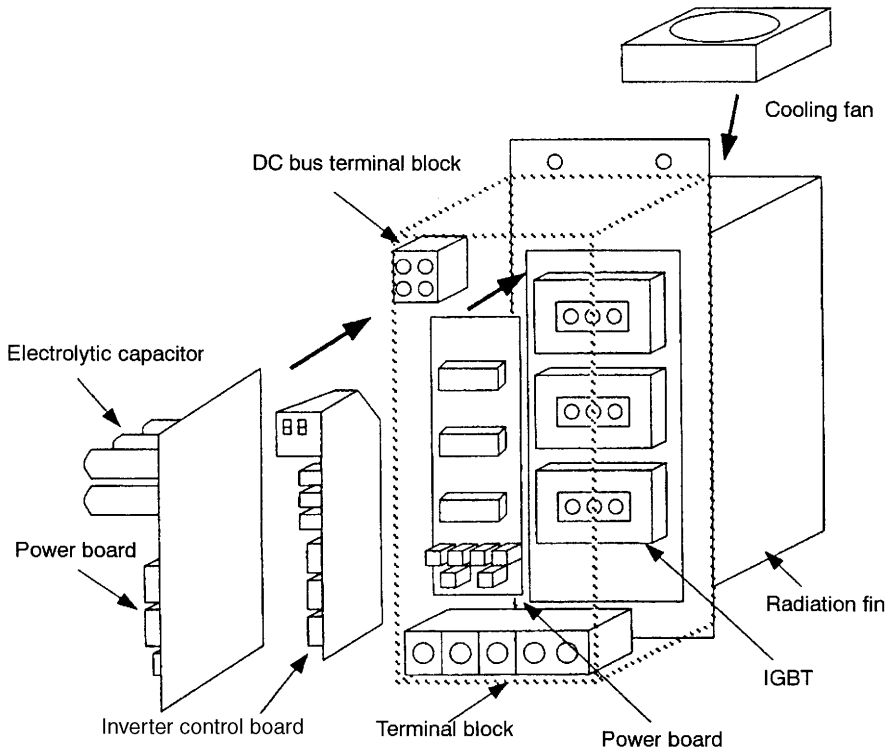
(3) Construction of MIV15 and MIV22



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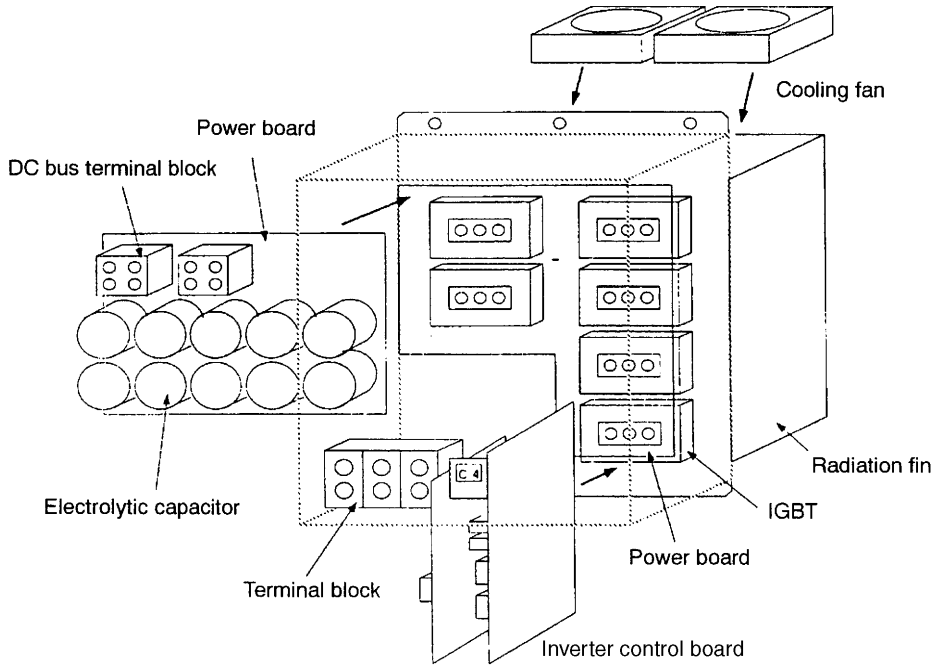
(4) Construction of MIV30 and MIV45



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2-4. MIV Unit Selection Tables by Motor Types

2-4-1. BL Motors

For BL motor control, 1-axis and 2-axis specification MIV units are provided.
The standard combinations of BL motor types and MIV unit types are shown below.
(Note that the relationship may be changed according to the machine specification.)

(1) Max. torque/Rated torque = 300%

Motor Type	Rated Motor Output {kW (hp)}	MIV Unit	
		1-axis spec.	2-axis spec.*
BL-MC24J-30	0.75 (1)	MIV01-1	MIV0101-1 (L/M) MIV0102-1 (L) MIV0103-1 (L) MIV0104-1 (L)
BL-MC25J-30	0.75 (1)		
BL-MC50J-20	1 (1.33)		
BL-MC100J-12	1.2 (1.6)		
BL-MC50J-30	1.5 (2)		
BL-MC75J-20	1.5 (2)		
BL-MC150J-12	1.8 (2.4)		
BL-MC95J-20	2 (2.67)	MIV02-1	MIV0102-1 (M) MIV0202-1 (L/M) MIV0203-1 (L) MIV0204-1 (L)
BL-MC100J-20	2 (2.67)		
BL-MC75J-30	2.2 (2.93)		
BL-MC200J-12	2.4 (3.2)		
BL-MC140J-20	2.8 (3.73)		
BL-MC95J-30	3 (4)	MIV03-1	MIV0103-1 (M) MIV0203-1 (M) MIV0303-1 (L/M) * MIV0404-1 (L)
BL-MC100J-30	3 (4)		
BL-MC150J-20	3 (4)		
BL-MC300J-12	3.6 (4.8)	MIV04-1	MIV0104-1 (M) MIV0204-1 (M) MIV0404-1 (L/M)
BL-MC190J-20	4 (5.33)		
BL-MC200J-20	4 (5.33)		
BL-MC140J-30	4.2 (5.6)	MIV05-1	
BL-MC400J-12	4.8 (6.4)		
BL-MC300J-20	6 (8)	MIV06DB-1	
BL-MC400J-15	6 (8)		
BL-MP400J-20	6.7 (8.93)	MIV08DB-1	
BL-MH700J-10	7 (9.33)		
BL-MC500J-15	7.5 (10)		
BL-MP300J-30	5.1 (6.8)	MIV15-1	
BL-MP400J-25	6.2 (8.27)		
BL-MP500J-20	7.1 (9.47)		

* MIV0304-1 unit does not have a 2-axis control type. Use MIV0404 unit.

(2) Max. torque/Rated torque = 500%

Motor Type	Rated Motor Output {kW (hp)}	MIV Unit	
		1-axis spec.	2-axis spec.
BL-MC24J-30	0.75 (1)	MIV01-1	MIV0101-1 (L/M) MIV0102-1 (L) MIV0103-1 (L) MIV0104-1 (L)
BL-MC25J-30	0.75 (1)		
BL-MC50J-20	1 (1.33)		
BL-MC100J-12	1.2 (1 .6)	MIV02-1	MIV0102-1 (M) MIV0202-1 (L/M) MIV0203-1 (L) MIV0204-1 (L)
BL-MC50J-30	1.5 (2)		
BL-MC75J-20	1.5 (2)		
BL-MC150J-12	1.8 (2.4)	MIV03-1	MIV0103-1 (M) MIV0203-1 (M) MIV0303-1 (L/M)
BL-MC95J-20	2 (2.67)		
BL-MC100J-20	2 (2.67)		
BL-MC75J-30	2.2 (2.93)		
BL-MC200J-12	2.4 (3.2)		
BL-MC140J-20	2.8 (3.73)	MIV05-1	
BL-MC95J-30	3 (4)		
BL-MC100J-30	3 (4)		
BL-MC150J-20	3 (4)		
BL-MC300J-12	3.6 (4.8)		
BL-MC200J-20	4 (5.33)		
BL-MC140J-30	4.2 (5.6)	MIV08DB-1	
BL-MC400J-12	4.8 (6.4)		
BL-MP400J-20	6.7 (8.93)	MIV22-1	
BL-MP300J-30	5.1 (6.8)	MIV22-1*	
BL-MP400J-25	6.2 (8.27)		
BL-MP500J-20	7.1 (9.47)		

* Only for this combination, max. torque/rated torque = 430%.

2-4-2. VAC Motors

The relationship between VAC motor types and MIV unit types is shown below.
(Note that the relationship may be changed according to the machine specification.)

Rated Motor Output {kW (hp)}	MIV Unit
VAC 2.2/1.1 (2.93/1.46)	MIV04-3
VAC 3.7/2.2 (4.93/2.93)	MIV06-3
VAC 5.5/3.7 (7.33/4.93)	
VAC 7.5/5.5 (10/7.33)	
VAC 11/7.5 (14.67/10)	MIV08-3
VAC 15/11 (20/14.67)	MIV15-3
VAC 18.5/1 5 (24.67/20)	
VAC 22/18.5 (29.33/24.67)	MIV22-3
VAC 30/22 (40/29.33)	
VAC 37/30 (49.33/40)	MIV30-3
VAC 45/37 (60/49.33)	MIV45-3
VAC 55/45 (73.33/60)	

3. Cautions on Changing Units

3-1. General Precautions

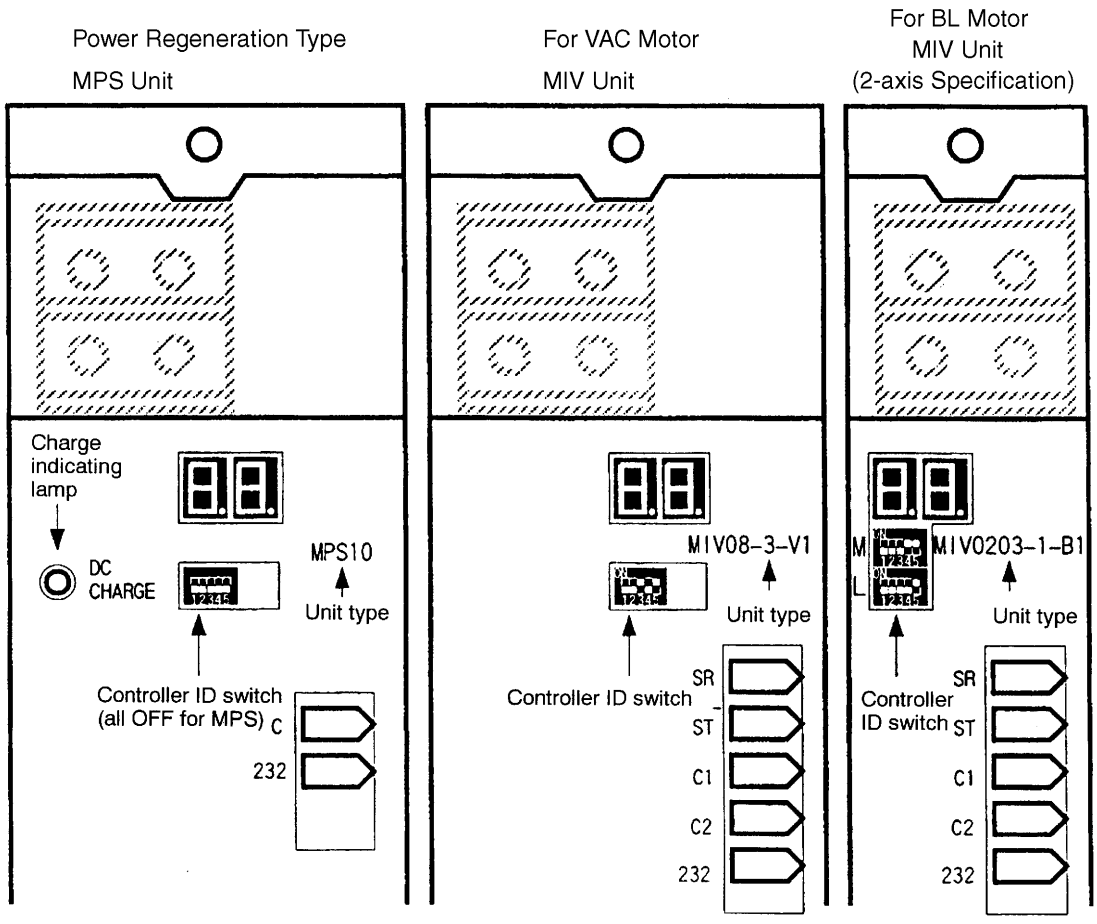
The items that require special attention when changing MIV unit are indicated below.

⚠ WARNING

MIV unit has a large-capacitance capacitor in the unit. When changing MIV unit, shut off the power and wait until the charge indicating lamp goes off. (Wait for at least 2 minutes after shutting off the power.)

(1) It is necessary to set a controller ID number after changing MIV unit. Set the controller ID number referring to 5 "Controller ID Number" in this manual or the circuit diagram after changing the MIV unit.

(2) Unit type of MIV units differs according to the unit capacity, the control board and the software (ROM). When changing a unit, make sure to use the unit of the same type.



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⚠ WARNING

High voltage is applied to the upper and lower terminal blocks in the unit.
Do not remove the plastic terminal block cover while the power is on.

(3) The procedure for removing the plastic cover at the upper and lower terminal blocks is indicated below.

- Plastic cover at the upper terminal block
  After pushing in the lock lightly, tilt the cover 10 deg. to the front and the cover can be taken out upward.
- Plastic cover at the lower terminal block
  After pushing in the lock lightly, turn the cover 90 deg. then pull the cover to the front and the cover can be removed.

3-2. Unit Replacement Procedure

(1) Replacement of MIV06-1, MIV08-1 and DBR8
If any of 1006-2218 (MIV06-1), 1006-2219 (MIV08-1) and 1006-2246 (DBR8) is faulty, replace the unit according to the following instructions.

Old unit name		New unit name	Replacement method
MIV06-1+DBR8	→	MIV06DB-1	Remove DBR8. (See the reference drawing given below.)
MIV08-1+DBR8	→	MIV08DB-1	Remove DBR8. (See the reference drawing given below.)
MIV06-1	→	MIV06DB-1	Same as the regular procedure for replacing unit.
MIV08-1*1	→	MIV08DB-1	Same as the regular procedure for replacing unit.

*1: MIV08-1 for the PREX motor does not have DBR8.

NOTICE

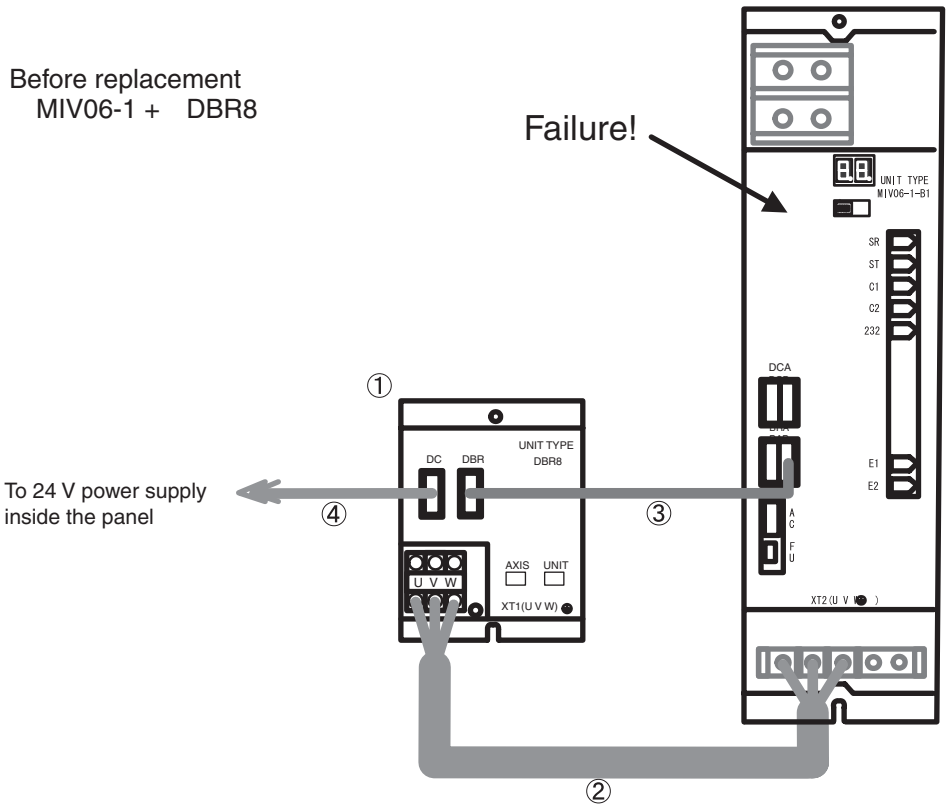
Avoid changing from MIV06DB1 to MIV06-1 or MIV08DB-1 to MIV08-1.
If changed, trouble will occur.

(2) Replacement of MIV14-3
Replace MIV14-3 with the upper grade unit MIV15-3. In this case, it is not necessary to install the software such as servo data.

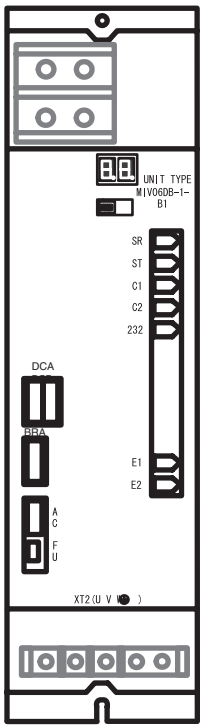
Old unit name		New unit name
MIV14-3	→	MIV15-3

Unit replacement diagram

Replacement of MIV06-1 + DBR8 with MIV06DB-1 is explained here as an example.



After replacement
MIV06DB-1 only



Besides the faulty MID06-1,
remove and collect the following items:

① DBR8 unit
② Cables between DBR8 terminal block and MIV06-1 terminal block
③ Cables between DBR8 connector [DBR] and MIV06-1 connector [BRB]
④ Cables between DBR8 connector [DC] and terminal block of control box

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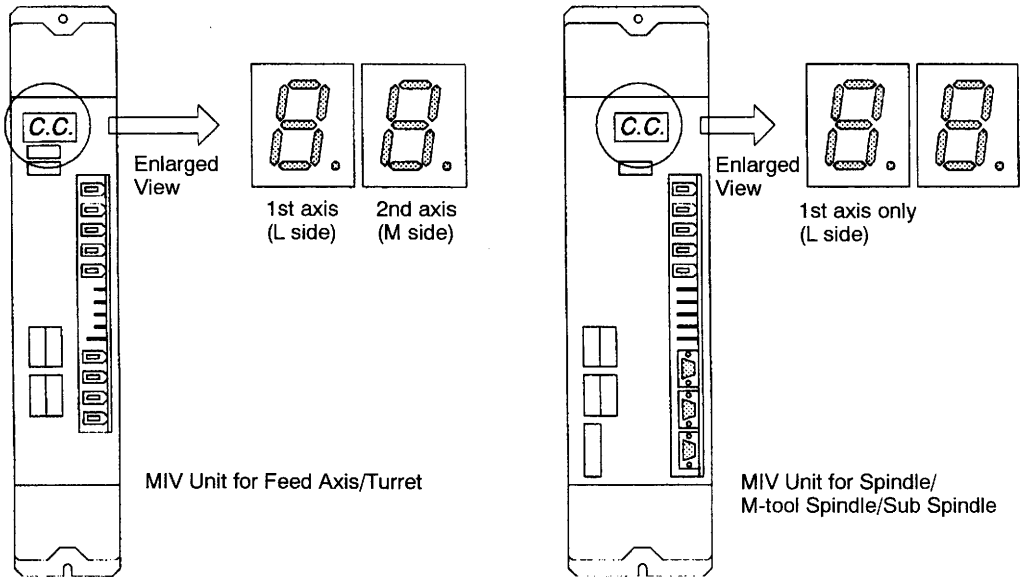
4. Indication of Operating Status

MIV unit shows the operating status at the 7-segment LED provided at the front of the unit. Two display modes (normal operation status display mode and alarm status display mode) are provided and at the occurrence of an alarm, the 7-segment LED displays an error number so that the cause of the alarm can be assumed.

4-1. Arrangement of Status Indicating LED



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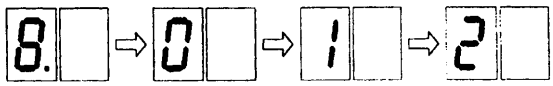
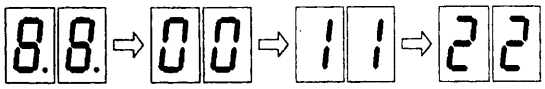
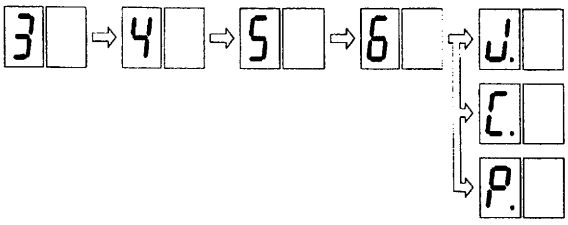
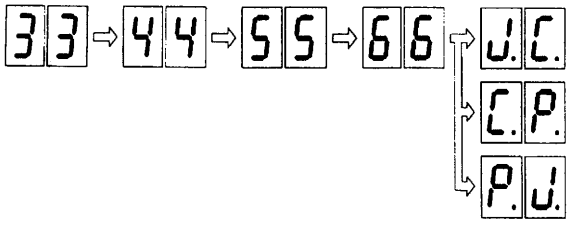
4-2. Contents of Indication

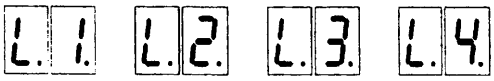
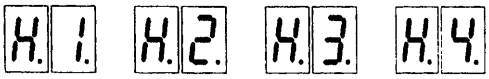
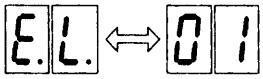
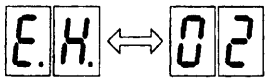
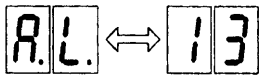
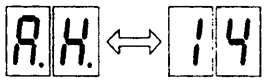
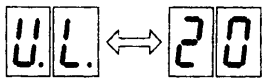
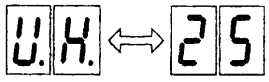
4-2-1. Indication of Normal Operation Status

Status	Indication by 7-segment LED (Example)	Remark
At power ON	 • At L-side only Indication changes in the following order: All segments lit → "0" → "1" → "2"	In the case of 1 -axis specification, only L-side 7-segment LED lights.
	 • At both L-side and M side Indication changes in the following order: All segments lit → "0" → "1" → "2"	In the case of 2-axis specification, 7-segment LED's light at both L- and M side.
At start-up	(*1)  • At L-side only Indication changes in the following order: "3" → "4" → "5" → "6" → "J (C, P)"	In the case of 1-axis specification, only L-side 7-segment LED lights.
	(*1)  • At L-side Indication changes in the following order: "3" → "4" → "5" → "6" → "J (C, P)" At M-side Indication changes in the following order: "3" → "4" → "5" → "6" → "C (J, P)"	In the case of 2-axis specification, 7-segment LED's light at both L- and M side.

(*1) Displays the preset mode among the three operation state. In the case of the 2-axis specification unit, the mode is displayed for L side and M side, respectively.

All segments lit	:	Indicates the power on state.
0	:	Initialization process of hardware such as memory of MCS controller (initialization phase 0).
1	:	Setting up process of fundamental operation environment for the axis to be controlled (initialization phase 1).
2	:	Initialization process through shake hand communication with the host system (initialization phase 2).
3	:	Transmission process of data corresponding to the axis control specification (initialization phase 3).
4	:	Conversion and check process of the data transmitted in the initialization phase 3 (initialization phase 4).
5	:	Synchronous processing with the host system to start the position detection interrupt processing (initialization phase 5).
6	:	Establishes the actual position by starting the servo link automatic communication mode. After that the state transfers to the operation state (initialization phase 6).
J (C, P)	:	Displays the mode of operation state. J : Velocity mode C : Tool path mode P : Positioning mode

4-2-2. Indication of Alarm Status

Status	Indication by 7-segment LED (Example)	Remark
RAM initialization error		L1 : L side internal RAM error L2: L side external RAM error Data bus L3: L side external RAM error Address bus L4: L side external RAM error Memory device
		H1 : M side internal RAM error H2: M side external RAM error Data bus H3: M side external RAM error Address bus H4: M side external RAM error Memory device
Exception error (Note 1)	 Displays "EL" and 01" alternately.	L side Exception error No.: 01
	 Displays "EH" and "02" alternately.	M side Exception error No.: 02
Alarm (Note 2)	 Displays "AL" and "13" alternately.	L side Alarm No.: 13
	 Displays "AH" and "14" alternately.	M side Alarm No.: 14
Warning (Note 3)	 Displays "UL" and "20" alternately.	L side Warning No.: 20
	 Displays "UH" and "25" alternately.	M side Warning No.: 25

Note

1) For exception error numbers, refer to 4-3-1 "Exception Error Number Table".
2) For alarm numbers, refer to 4-3-2 "Alarm Number Table".
3) For warning numbers refer to 4-3-3 "Warning Number Table".

4-3. Error Number Tables

4-3-1. Exception Error Number Table

[Hex] indicates hexadecimal notation.

No.	Name	Description/Alarm Code	Corrective Action
01	Control board error	An error occurred with the control board. XXXXXXXX 1 : Access error 2: PWM synchronization error 3: PWM buffer operation error Other code: Offset error of A/D converter for current detection YYYYYZZZZZ YYYYY = A/D converter offset at CH1 ZZZZZ = A/D converter offset at CH2	Change the MIV unit.
02	Control voltage ±12 V/+24 V error	With the control circuit, ±12 V or +24 V raised or lowered excessively. XXXXYYYY If XXXX ≠ FFFF [Hex], ±12 V power is abnormal. For MCS, XXXX = Detected voltage of +12 V power Normal range: 11.118 to 13.356 V Allowable data range: 8E00 to AAC0 [Hex] YYYY = Absolute value of -12 V power detected voltage Normal range: -13.44 V to -11.046 V Allowable data range: 8D40 to AA00 [Hex] For MCS II, XXXX = Detected voltage of +12 V power Normal range: 11.234 to 13.166 V Allowable data range: AE00 to CC00 [Hex] YYYY = Absolute value of -12 V power detected voltage Normal range: -13.716 V to -10.678 V Allowable data range: A580 to D480 [Hex] If XXXX = FFFF, +24 V power is abnormal. XXXX = FFFF [Hex] (fixed) For MCS, YYYY = Detected voltage of +24 V power Normal range: 19.9 V to 26.2 V Allowable data range: 5C88 to 79D4 [Hex] For MCS II, YYYY = Detected voltage of +24 V power Normal range: 19.6 V to 26.1 V Allowable data range: 8A80 to B840 [Hex]	Change the MIV unit.
03	OPF error	An error occurred with the option program file. XXXXXXXX 1 : ID code "OPF1" error 2 : End code "ED" error 3 : Sum check error 4 : Board name error	Change the MIV unit. Check the option program file.

No.	Name	Description/Alarm Code	Corrective Action
8	Magnetic encoder power supply error	The magnetic encoder voltage has risen or dropped exceeding the normal range. If XXXX = 0012 [Hex], +12 V power supply for PG is abnormal. YYYY =+12 V detected voltage (12 V = BA00 [Hex]) Normal range: 12.01 to 13.56 V Allowable data range: BA00 to D240 [Hex] If XXXX = 0005 [Hex], +5 V power supply for PG is abnormal. YYYY = +5 V detected voltage (5 V = C1C0 [Hex]) Normal range: 4.01 to 5.56 V Allowable data range: BA00 to D240 [Hex] However, if YYYY = FFFF, the power supply failed to reach the allowable range within the predetermined time.	
9	Encoder power supply error	The magnetic encoder voltage has risen or dropped exceeding the normal range. If XXXX = FFFF [Hex], encoder source voltage is abnormal. YYYY = +12 V detected voltage (12 V = BA00 [Hex]) Normal range: 12.01 to 13.56 V Allowable data range: BA00 to D240 [Hex]	
10	Control power supply +3.3 V error	Error status register	
11	Control power supply +5 V error	In case of MCS Error status register In case of MCS II XXXX = Fixed at FFFF [Hex] YYYY = +5 V detected voltage (5 V = 4D80 [Hex]) Normal range: 4.63 to 5.44 V Allowable data range: B340 to D2C0 [Hex]	Change the MIV unit.
12	Gate signal error	An error occurred with the gate signal. XXXXXXXX = Error status register	Change the MIV unit.
13	Inverter bridge error	An error occurred with the power device. XXXXXXXX = Error status register	Change the MIV unit.
14	Motor over current error	Abnormal current flow through the power device. XXXXXXXX = Error status register	Change the MIV unit.
20	INT6 loop error IR1MAIN loop error	An error occurred with CPU processing. XXXXXXXX = Error status register	Change the MIV unit.
21	INT5 loop error IR2MAIN loop error	An error occurred with CPU processing. XXXXXXXX = Error status register	Change the MIV unit.
22	INT4 loop error	An error occurred with CPU processing. XXXXXXXX = Error status register	Change the MIV unit.

No.	Name	Description/Alarm Code	Corrective Action
23	INT3 loop error	An error occurred with CPU processing. XXXXXXXX = Error status register	Change the MIV unit.
24	INT2 loop error	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
25	INTI loop error IR3MAIN loop error	An error occurred with CPU processing. XXXXXXXX = Error status register	Change the MIV unit.
26	Access error	An error occurred with CPU processing. XXXXXXXX = Error status register	Change the MIV unit.
28	Parity error	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
29	Watchdog error	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
30	IRQ7 interruption IRQ4 interruption	An error occurred with CPU processing. XXXXXXXX = Error status register	Change the MIV unit.
31	NMI interruption	An error occurred with CPU processing. XXXXXXXX = Error status register	Change the MIV unit.
32	General illegal command	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
33	Slot illegal command	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
34	CPU address error	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
35	DMA address error DMAC/DTC address error	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
36	Undefined trap instruction	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
37	Undefined interruption	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
38	DMAC	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
39	ITU MTU	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
40	SCI	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
41	REF BSC	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
42	A/D	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
43	Not used		
44	User break	The user break controller functioned XXXXXXXX = PC at the occurrence of the error	Reset the user break controller.
45	DTC	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
46	CNT	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.
47	I/O	An error occurred with CPU processing. XXXXXXXX = PC at the occurrence of the error	Change the MIV unit.

4-3-2. Alarm Number Table

[Hex] indicates hexadecimal notation.

No.	Name	Description/Alarm Code	Corrective Action
01	Power supply unit error	An error occurred with the power supply unit. 0000XYZZ X = Alarm number 0: DC voltage alarm 1: AC input voltage alarm 2: Control power error 3: Control status error 4: Regeneration overload 5: Heat sink overheat 6: CPU error 7: Spare Y = Power supply unit status bit 3 = 1 : An alarm occurred with the power supply unit bit 2 = 1 : DC power is being supplied bit 1 = 1 : OPRON input is close bit 0 = 1 : PWON input is close ZZ = Alarm data If X (alarm number) = 0 Indicates DC voltage by 7F[Hex] = 500 V. If X (alarm number) = 2 1: +5 V voltage error 2: +12 V voltage error 3: -12 V voltage error If X (alarm number) = 3 1: Over current in power line 2: Power device error 3: Converter bridge short-circuit 4: Regeneration error If X (alarm number) = 4 Not defined If X (alarm number) = 5 Not defined If X (alarm number) = 6 Not defined	Check the source voltage. Check the operation conditions. Check the error No. of MPS/MPR unit. Change the MPS/MPR unit. Change the MIV unit.
02	Converter link error	An error occurred with the converter link and monitoring of the power supply unit was disabled. X00000YY X = 0 Communication error YY = Communication status X = 1 Time out error (communication is interrupted) YY=0	Change the converter link cable. Change the MIV unit. Change the MPS/MPR unit.
03	Inverter DC bus voltage error	DC bus voltage of the inverter unit raised or lowered excessively. XXXXYYYY XXXX = Over voltage value [In case of MCS] (Displayed when 7FE0 [HEX] = 500 V for MCS) [In case of MCSII] (Displayed when 7FE0 [HEX] = 550 V for MCS II) YYYY = Under voltage value [In case of MCS] (Displayed when 7FE0 [HEX] = 500 V for MCS) [In case of MCSII] (Displayed when 7FE0 [HEX] = 550 V for MCS II)	Check the source voltage. Change the MIV unit. Change the MPS/MPR unit.

No.	Name	Description/Alarm Code	Corrective Action
04	Motor power line over current	The inverter unit detected over current through the motor power line. XXXXYYYY [In case of BL/PREX] XXXX = Detected U-phase current value (Displayed in hexadecimal: 3FFF[Hex] = Max. momentary current) YYYY = Detected V-phase current value (Displayed in hexadecimal: 3FFF[Hex] = Max. momentary current) [In case of VAC] XXXX = U-phase detected current (AAA [Hex] = Max. momentary current) YYYY = V-phase detected current (AAA [Hex] = Max. momentary current)	Change the motor. Change the MIV unit.
05	Inverter overheat	Inverter unit temperature raised excessively. XXXXXXXX = 1 (fixed)	Check the operation conditions. Change the MIV unit.
06	Inverter overload (electronic thermal relay)	The overload protection function was activated since the inverter load exceeded the specified value. XXXXYYYY XXXX = Υ of the protection curve at the detection of overload YYYY = Cumulative data at the detection of overload	Check the operation conditions. Reduce the cutting load torque. Check the servo data file. Change the MIV unit.
07	Commercial power source error	Input voltage to the power supply unit raised or lowered excessively. XXXXXXXX = Voltage value at the detection of error. (Displayed in hexadecimal: 01[Hex] = 0 volt) (Displayed in hexadecimal: 80[Hex] = 300 volts)	Check the source voltage. Change the diameter and length of the power cable. Change the MPS/MPR unit.
08	Not used (Inverter version error)		
09	Motor winding changeover error	An error occurred at the changeover of winding. XXXXXXXX 00000001[Hex]: Detection of ON at the LOW side MC 00000002[Hex]: Detection of ON at the HIGH side MC 00000003[Hex]: Detection of ON of both LOW side and HIGH side MC 00000004[Hex]: Winding changeover time out 10100001[Hex]: Servo data file error	Change the winding changeover magnet switch.

No.	Name	Description/Alarm Code	Corrective Action
10	Encoder communication error	An error occurred in communication through the encoder link. XXYYZZZZ XX = FF[Hex] (fixed) YY = 00[Hex] Detection of error at motor attached encoder. 01[Hex]: Detection of error at shaft attached encoder. 02[Hex]: Detection of error at separately installed encoder. 03[Hex]: Detection of error at absolute scale. 04[Hex]: Detection of error at sub-slider ZZZZ = Encoder link status at the detection of error bit 15 = 1: Error in the communication with the separately installed encoder bit 14 = 1: Error in the communication with the absolute scale 2 bit 13 = 1: Error in the communication with the shaft attached encoder or absolute scale bit 12 = 1: Error in the communication with the motor attached encoder bit 11 : Undefined bit 10 = 1 : AT mode send loop error bit 9 = 1: Receive IF section data number over error bit 8: Undefined bit 7: Undefined bit 6 = 1 : Modulation code error bit 5 = 1 : CRC error bit 4 = 1 : Format error bit 3 = 1 : Double send error bit 2 = 1 : Double receive error bit 1 = 1 : Parity error bit 0 = 1 : Timeout error	Check the encoder of the corresponding axis. Change the encoder link cable. Change the MIV unit.
11	Encoder error	The motor attached encoder failed to detect the position data. XXYYZZZZ XX = Error code of encoder YY = Detailed status of encoder ZZZZ = Multi-turn position data If the multi-turn position data exceeded the allowable turn range: XX = 0 (fixed) YY = 1 (fixed) ZZZZ = Multi-turn position data	Change the motor attached encoder.

No.	Name	Description/Alarm Code	Corrective Action
12	Encoder initialization error	An error occurred in the initialization processing of the motor attached encoder. XXYYZZZZ XX = Initialization processing sequence number at the detection of error 0: Reset 1: Network address setting 2: Basic communication information request 3: Communication version change 4: Device information acquire 5: Parameter change 6: AT mode start YY = Error contents 0: Communication error 1: Send start time-over error 2: Send finish time over error 3: Receive finish time-over error 4: Response address error 5: Response code error 6: Parameter error ZZZZ = Data If YY = 0 Encoder link status at the detection of error If YY = 1, 2, 3 Sent frame information If YY = 4 Network address of the device that gave response If YY = 5 Received frame information If YY = 6 The number showing the parameter that detected the error. 1: Insufficient number of received parameters 2: Incompatibility of basic communication information 3: Incompatibility of mufti-turn detection range 4: Incompatibility of communication protocol version However, when the MCS detected abnormal voltage applied to the fuse used in the power supply unit to the encoder XXYY is fixed to FFFF [HEX]. ZZZZ = Detected voltage (Displayed when FFC0 [HEX] = 2 V)	Change the motor attached encoder. Change the encoder link cable. Change the MIV unit.
13	Shaft attached encoder error	The shaft attached encoder failed to detect the position data. XXYYZZZZ Format is the same as explained in alarm No. 11.	Change the shaft attached encoder.
14	Shaft attached encoder initial-ization error	An error occurred in the initialization processing of the shaft attached encoder. XXYYZZZZ Format is the same as explained in alarm No. 12	Change the shaft attached encoder. Change the encoder link cable. Change the MIV unit.
15	Absolute scale error	The absolute scale failed to detect the position data. XXYYZZZZ Format is the same as explained in alarm No. 11.	Change the abso-lute scale.

No.	Name	Description/Alarm Code	Corrective Action
16	Absolute scale initialization error	An error occurred in the initialization processing of the absolute scale. XXYYZZZZ Format is the same as explained in alarm NO. 12	Change the absolute scale. Change the encoder link cable. Change the MIV unit.
17	Magnetic encoder error	The magnetic encoder failed to detect the position data, or mismatch occurred between the magnetic encoder gear tooth number and servo data file setting value. XXXXYYYY XXXX = Contents of error 000A [Hex] = A-phase voltage error 000B [Hex] = B-phase voltage error 000C [Hex] = Magnetic encoder pulse signal error Other =A value set in the servo data file when magnetic encoder pulse count-over or marker-latched data error occurs (Set number pulses or gear teeth) YYYY = Error data If XXXX = 000A [Hex]: A-phase voltage value If XXXX = 000B [Hex]: B-phase voltage value If XXXX = 000C [Hex]: 0 (fixed) In other cases: Magnetic encoder count value or detected number of gear teeth	Check the servo data file. Change the magnetic encoder. Change the magnetic encoder cable.
18	Resolver error	The resolver failed to detect the position data. XXXXXXXX = 1: Disconnection error 2: Abnormal value detected	Change the resolver. Change the resolver cable. Change the MIV unit.
19	PG count-over	Mismatch between the 1 -turn count value of the magnetic encoder and the setting value in the servo data file. XXXXYYYY XXXX = Servo data file setting value (PG 1-turn count value) YYYY = Count value	Check the servo data file. Change the magnetic encoder. Change the magnetic encoder cable.
20	Motor overheat	Motor temperature raised excessively. XXXXYYYY XXXX = 0 (fixed) If YYYY = 0010 [Hex] Overheat If YYYY = 0011 [Hex] Motor overheat [BL/PREX motor only] If YYYY = 0012 [Hex] Encoder overheat [BL/PREX motor only] If YYYY = 0013 [Hex] Overheat of motor and encoder [BL/PREX motor only]	Check the operation conditions. Change the motor of the corresponding axis. Change the motor attached encoder. Change the encoder link cable.

No.	Name	Description/Alarm Code	Corrective Action
21	Servo link communication error	A communication error occurred with the servo link and commands from the NC cannot be received. XXXXYYYY XXXX = 0 (fixed) YYYY = Bits indicate the details of communication error. (Servo link error status at the detection of error) bit 15 = 1: Second B buffer error bit 14 = 1: Second A buffer error bit 13 = 1: First B buffer error bit 12 = 1: First A buffer error bit 11 = 1: MT buffer error bit 10 = 1: Relay processing error bit 9 = 1: Receive interface section data number error bit 8 = 1: Wire breakage error bit 7 = 1: Address pointer error bit 6 = 1: Modulation code error bit 5 = 1: CRC error bit 4 = 1: Format error bit 3 = 1: Double send error bit 2 = 1: Double receive error bit 1 = 1: Parity error bit 0 = 1: Time-out error	Change the servo link cable. Change the MIV unit. Change the FCP board.
22	Servo link cable breakage	The servo link cable was broken and commands from the NC cannot be received. XXXXYYYY XXXX = Wire breakage position 0000[Hex]: Immediately upstream the corresponding unit 8000[Hex]: Upstream the corresponding unit YYYY = Servo link error status at the detection of error	Change the servo link cable. Change the MIV unit. Change the FCP board.
23	Servo link protocol error	Format or timing of the data sent from the NC to the inverter unit is erroneous. XXXXXXXX 1: A-buffer software synchronization error 2: A-buffer format code error 3: B-buffer software synchronization error 4: B-buffer format code error 5: B-buffer block number error	Check the NC software. Change the MIV unit. Change the FCP board.
24	Servo data error	The servo data sent from the NC during initialization or operation cannot be processed. XXXXYYZZ XXXX = ID number of the error detected data [Hex] YY = Set number of the error detected data ZZ = Details of error 1: Outside the setting range 2: Setting timing error 3: Data not transmitted 4: Calculation error 5: Other	Check the servo data file. Check the NC software. Change the MIV unit.

No.	Name	Description/Alarm Code	Corrective Action
25	Command error	Contents of the positioning commands are incorrect. Error in set/mode/coordinate system change XXXXYYYY XXXX 0010[Hex]: Positioning mode Point number over 0011[Hex]: Positioning mode Negative command value 0012[Hex]: Positioning mode Command value > 1 turn of control objective 0013[Hex]: Positioning mode Positioning point table not transmitted 0014[Hex]: Positioning mode Not rotary axis 0015[Hex]: Positioning mode Command format is not point. 0016[Hex]: Positioning mode Positioning sub mode error 0021[Hex]: Set changeover designation Set number over 0022[Hex]: Mode Undefined mode 0023[Hex]: Mode Positioning/tool path mode conditions 0024[Hex]: Coordinate system Coordinate system designation error 0030[Hex]: Undefined bit data of the servo link A-buffer is turned ON. 0031[Hex]: Undefined bit data of the servo link B-buffer is turned ON. 0040[Hex]: Mode was changed to AT mode although time synchronization instruction has not been received. YYYY = Error data If XXXX is 0010 - 0016 [Hex], it indicates the positioning sub mode. 0: Program mode 1: Search mode 2: Pulse handle mode 3: Teaching mode	Check the servo data file. Check the NC software. Change the MIV unit.
26	CON speed over	An incremental value of position command (SRCOND) sent from the NC to the inverter unit exceeded the allowable value. XXXXXXXX = Specified CON velocity 2^-16 [pr/Tp] (Speed mode: [Su/Tc]) The following data indicates special cases. 1: An error occurred in preliminary check since the value is too large. 2: The internal position command value (SRCON) exceeded the absolute stroke value of the encoder. (Only for a linear axis)	Check the servo data file. Check the NC software.

No.	Name	Description/Alarm Code	Corrective Action
27	Speed command over	The speed command value exceeded the allowable value. XXXXXXXX= Specified velocity command value. 2^-32 [2.5KHz]	Reduce inertia and friction resistance in mechanical system. Change the MIV unit. Change the motor. Check the source voltage.
28	DIFF over	In the position control, position error is excessively large. XXXXXXXX = Detected position error 2^-16 [pr/Tp]	Reduce inertia and friction resistance in mechanical system. Change the MIV unit. Change the motor.
29	APA speed over	Feedrate of an axis is abnormally fast in comparison to the rapid feedrate of that axis, or detected values changed abnormally due to the failure of the position encoder. XXXXXXXX = Detected APA velocity 2^-16 [pr/Tp] The following data indicates special cases. 1: In a linear axis, stroke was exceeded. 2: In a rotary axis, stroke (360°) was exceeded. 3: In an axis with a limited stroke, its stroke was exceeded.	Change the MIV unit. In the case of BL motor: Change the motor attached encoder. Change the encoder link cable. In the case of VAC motor: Change the magnetic encoder. Change the magnetic encoder cable.
30	Full-closed loop error	Error amount between the detected position data by the full-closed loop position encoder and the motor attached position encoder exceeded the allowable value. XXXXXXXX = Number of error detection times	Execute full-closed loop synthesized offset value. Change the absolute scale or shaft attached position encoder. Reduce lost motion amount in the drive system.
31	Speed over	Actual motor speed is excessively high. XXXXXXXX = Detected speed 2^-32 [2.5KHz]	Change the MIV unit. In the case of BL motor: Change the motor attached encoder. Change the encoder link cable. In the case of VAC motor: Change the magnetic encoder. Change the magnetic encoder cable.

No.	Name	Description/Alarm Code	Corrective Action
32	Speed deviation too large	Deviation between the command speed and actual speed was excessively large. XXXXYYYY In case of MCS XXXX = Detected torque (sum of torque in 3.2-msec period) ±2^-12 [MAXTRQ] If Tv = 0.4 msec 7FFF[Hex] corresponds to the maximum momentary torque. If Tv = 0.8 msec. 3FFF[Hex] corresponds to the maximum momentary torque. YYYY = Detected acceleration rate (average in 3.2-msec period) ±2^-16 [vr/3.2 ms/3.2 ms] ≒ 0.1 [min^{-1}/ms] In case of MCSII XXXX = Detected torque ±2^-15 [MAXTRQ] YYYY = Detected acceleration rate ±2^-16 [2.5KHz/3.2 ms] If XXXX = 0 and YYYY = 1, the error data is "0" due to underflow.	Reduce cutting torque Change the MIV unit. Change the motor.
33	Collision detection	The NC torque limiter function detected the interference of an axis from the relationship of "motor output = motor acceleration rate". XXXXYYYY XXXX = Detected torque (sum of torque in 3.2-msec period) ±2^-12 [MAXTRQ] If Tv = 0.4 msec 7FFF[Hex] corresponds to the maximum momentary torque. If Tv = 0.8 msec. 3FFF[Hex] corresponds to the maximum momentary torque. YYYY = Detected acceleration rate (average in 3.2-msec period) ±2^-16 [vr/3.2 ms/3.2 ms] ≒ 0.1 [min^{-1}/ms] In case of ICB-H XXXX = Detected torque ±2^-15 [MAXTRQ] YYYY = Detected acceleration rate ±2^-16 [2.5KHz/3.2 ms] If XXXX = 0 and YYYY = 1, the error data is "0" due to underflow.	Eliminate the interference in the mechanical drive system. Check the setting value of NC torque limiter. Change the motor attached encoder. Change the MIV unit. Change the motor.
34	Emergency stop time over	At the activation of an emergency stop function, the machine could not stop within the preset time. XXXXXXXX 1: Emergency stop time over 2: Deceleration time over in emergency stop 3: Deceleration time over in alarm stop	Check the servo data file. Check the NC soft-ware. Change the MIV unit. Change the motor.

No.	Name	Description/Alarm Code	Corrective Action
35	Not used (servo axis belt breakage)		
36	Separately installed encoder initialization error	An error occurred in the initialization processing of the separately installed encoder. XXYYZZZZ Format is the same as explained in alarm No. 12.	Change the separately installed encoder. Change the encoder link cable. Change the MIV unit.
37	APA error	Calculation error occurred during the calculation of APA. XXXXXXXX 1: Linear axis division stroke over 2: Semi-closed loop position data conversion error ([pr] → [pf]) 3: Underflow in synthesizing 4: Overflow in synthesizing 5: Hybrid control input overflow 6: Hybrid control initialization overflow	Change the motor attached position encoder, and the shaft attached position encoder or the absolute scale. Check the servo data file. Change the MIV unit.
38	Motor overload (electronic thermal relay)	The overload protection function was activated since the motor load exceeded the specified value. XXXXYYYY XXXX = ϒ of the protection curve at the detection of overload YYYY = Cumulative data at the detection of overload	Check the operation conditions. Reduce the cutting load torque. Check the servo data file. Change the MIV unit. Change the motor.
39	Changed absolute sub-slider error	When changed to absolute scale, the sub-slider is not detected. The format is the same as that of the encoder error (alarm No. 11).	Change the sub slider. Change the encoder link cable for sub slider. Change the MIV unit.
40	Tandem control communication error	In tandem control, an error occurred in communication data from the master axis. (Only slave axis is detected.) XXXX = Description of error 0001: The communication data counter limit is not reached. 0002: The format code of communication data is unknown. YYYY = Data If xxxx = 0001 Fixed at 0 If xxxx = 0002 Unknown format code (lower byte)	Change the MIV unit. Change the servo link cable.

4-3-3. Warning Number Table

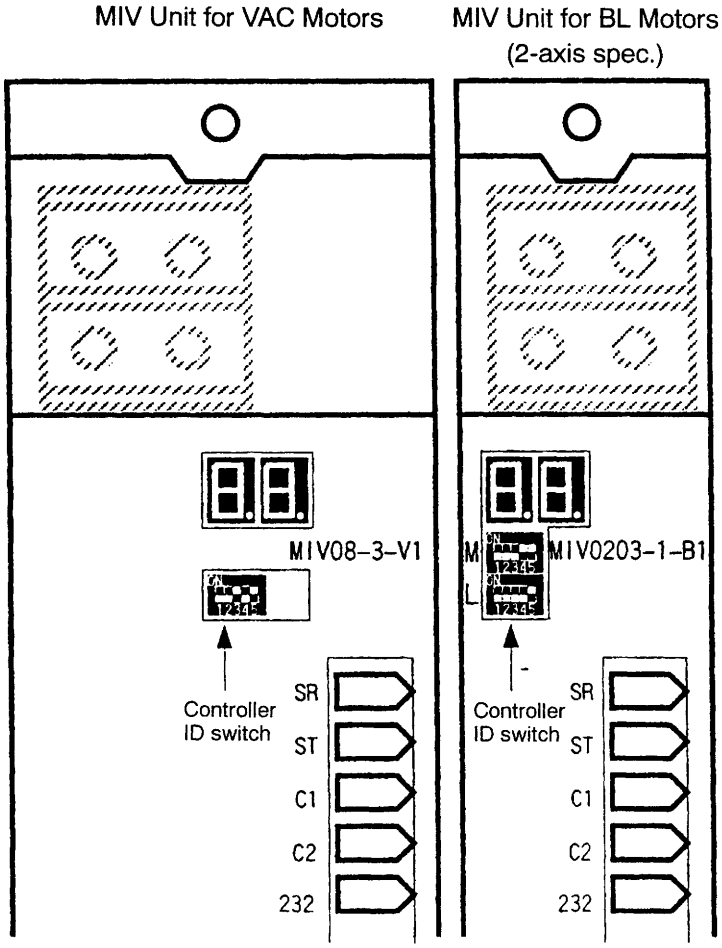
[Hex] indicates hexadecimal notation.

No.	Name	Description/Alarm Code	Corrective Action
01	Power supply unit error	There is a possibility that the power supply unit is faulty. 0000XYZZ X = Alarm number 4: Regeneration overload 5: Heat sink overheat Y = Power supply unit status bit 3 = 1: Undefined bit 2 = 1: DC power is being supplied bit 1 = 1: OPRON input is close bit 0 = 1: PWON input is close ZZ = Alarm data If X (alarm number) = 4 00 If X (alarm number) = 5 00	Check the source voltage. Check the operation conditions. Check the MIV unit. Check the MPS/ MPR unit.
05	Inverter overheat	There is a possibility of overheat of inverter. XXXXXXXX = 1 (fixed)	Check the operation conditions. Check the MIV unit.
07	Commercial power source error	There is a possibility that the input voltage is incorrect. XXXXXXXX = Voltage value at the detection of error. (Displayed in hexadecimal: 01[Hex] = 0 volts) (Displayed in hexadecimal: 80[Hex] = 300 volts)	Check the source voltage. Check the power cable. Check the MPS/ MPR unit.
20	Motor overheat	There is a possibility of overheat of motor. XXXXXXXX = 1 (fixed)	Check the operation conditions. Check the VAC motor. Check the BL motor. Check the motor attached encoder.
25	Command error	Processing of the command is impossible. XXXXYYYY XXXX = 0 (fixed) YYYY 0001[Hex]: Undefined data ID No. (data communication interface) 0002[Hex]: Address/address pointer mismatch (data communication interface) 0003[Hex]: Specified SDF set number error (data communication interface) 0004[Hex]: Communication/miscellaneous code error (data communication interface) 0005[Hex]: Size error (data communication interface) 0006[Hex]: Write disable (data communication interface) 0007[Hex]: Outside the limit range (data communication interface) 0100[Hex]: Deceleration distance over (positioning)	Check the servo data file. Check the NC software. Check the MIV unit.

5. Controller ID Number

MIV units are connected to the network by servo link. In the servo link, the FCP board functions as the master station and MIV units including the one controlling the spindle function as slave stations. Accordingly, it is necessary to set the controller ID number at the MIV units according to the axis names. For the setting of a controller ID number, a 5-bit switch is provided; set the ID number referring to the controller ID table.

- 2-axis spec. MIV unit for BL motors: Set the L and M side switches.
- 1-axis spec. MIV unit for BL motors: Set the L side switch. M side switch should be all OFF.
- MIV unit for VAC motors: Set the L side switch.
- The switch setting numbers are also shown on the electric circuit diagrams.



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Controller ID No. Tables

(1) ID Numbers of Lathes' and Grinders' OSP

Controller ID No.	ID No. Switch Setting					Axis Category	Axis Name	Description
	1	2	3	4	5			
1					ON	1st NC controlled axis	XA	A saddle side X-axis, or R side X-axis
2				ON		2nd NC controlled axis	YA	Y-axis
3				ON	ON	3rd NC controlled axis	ZA	A saddle side Z-axis, or R side Z-axis
4			ON			4th NC controlled axis	WA	W-axis or ZC-axis
5			ON		ON	5th NC controlled axis	SA	1st spindle or R side spindle
6			ON	ON		6th NC controlled axis	MA	A saddle side M-axis, or R side M-axis
7			ON	ON	ON	7th NC controlled axis	XB	B saddle side X-axis, or L Side X-axis
8		ON				8th NC controlled axis	ZB	B saddle side Z-axis, or L side Z-axis
9		ON			ON	9th NC controlled axis	SB	Spindle 2 or L side spindle
10		ON		ON		10th NC controlled axis	MB	B saddle side M-axis, or L side M-axis
11		ON		ON	ON	11th NC controlled axis	LXA (RZA)	Loader X-axis, or loader R side X-axis Robot RZA-axis
12		ON	ON			12th NC controlled axis	LYA (RCA)	Loader Y-axis, or loader R side Y-axis Robot RCA-axis
13		ON	ON		ON	13th NC controlled axis	LZA	Loader Z-axis, or loader R side Z-axis
14		ON	ON	ON		14th NC controlled axis	LXB	Loader L side X-axis
15		ON	ON	ON	ON	15th NC controlled axis	LYB	Loader L side Y-axis
16	ON					16th NC controlled axis	LZB	Loader L side Z-axis
17	ON				ON	17th NC controlled axis		Spare
18	ON			ON		18th NC controlled axis		Spare
19	ON			ON	ON	19th NC controlled axis		Spare
20	ON		ON			1st PLC controlled axis	TA	A saddle turret rotation axis
21	ON		ON		ON	2nd PLC controlled axis	TB	B saddle turret rotation axis
22	ON		ON	ON		3rd PLC controlled axis	GA	ATC magazine axis
23	ON		ON	ON	ON	4th PLC controlled axis	EC	ATC EC axis
24	ON	ON				5th PLC controlled axis	EZ	ATC EZ axis
25	ON	ON			ON	6th PLC controlled axis	PA/ (OCA)	AAC PA axis / (Electric cylinder)
26	ON	ON		ON		7th PLC controlled axis	GB/ (OTA)	ATC 2nd magazine / (Turret clamp)
27	ON	ON		ON	ON	8th PLC controlled axis		Spare
28	ON	ON	ON			9th PLC controlled axis		Spare
29	ON	ON	ON		ON		SFT*	Safety speed monitor (1 to 3)

NOTICE

Blank box in the ID No. Switch Setting column indicate "OFF".

(2) ID Numbers of Machining Centers' OSP

Controller ID No.	ID No. Switch Setting					Axis Category	Axis Name	Description
	1	2	3	4	5			
1					ON	1st NC controlled axis	X	X-axis or master axis of synchronized X-axes
2				ON		2nd NC controlled axis	Y	Y-axis or master axis of synchronized Y-axes
3				ON	ON	3rd NC controlled axis	Z	Z-axis or master axis of synchronized Z-axes
4			ON			4th NC controlled axis	U	U-axis or master axis of synchronized U-axes
5			ON		ON	5th NC controlled axis	V	V-axis or master axis of synchronized V-axes
6			ON	ON		6th NC controlled axis	W	W-axis or master axis of synchro-nized W-axes
7			ON	ON	ON	7th NC controlled axis	A	A-axis
8		ON				8th NC controlled axis	B	B-axis
9		ON			ON	9th NC controlled axis	C	C-axis
10		ON		ON		10th NC controlled axis	*s	Slave axis of synchronized axes; * = X, Y, Z, U, V, W
11		ON		ON	ON	11th NC controlled axis	S	Spindle (1st axis)
12		ON	ON			12th NC controlled axis	SB	Spindle (2nd axis)
13		ON	ON		ON	13th NC controlled axis	*s	Slave axis of the synchronized 2nd axis
14		ON	ON	ON		14th NC controlled axis	*s	Slave axis of the synchronized 3rd axis
15		ON	ON	ON	ON	1st PLC controlled axis	MA	Magazine A rotation axis
16	ON					2nd PLC controlled axis	MB	Magazine B rotation axis (multi-magazine spec.)
17	ON				ON	3rd PLC controlled axis	MC	Magazine C rotation axis (multi-magazine spec.)
18	ON			ON		4th PLC controlled axis	TS	ATC tool change arm rotation axis
19	ON			ON	ON	5th PLC controlled axis	TI	ATC tool change arm IN/OUT axis
20	ON		ON			6th PLC controlled axis	PA	APC pallet change feed axis (A side)
21	ON		ON		ON	7th PLC controlled axis	PB PL	APC pallet change feed axis (B side) Multi-pallet APC rotation axis
22	ON		ON	ON		8th PLC controlled axis	AT	ATC tool change arm tilt axis
23	ON		ON	ON	ON	9th PLC controlled axis	AA CB	MC magazine rotation axis AAC carrier axis (sub arm axis)
24	ON	ON				10th PLC controlled axis	AB	AAC magazine rotation axis
25	ON	ON			ON	11th PLC controlled axis	CA	ATC carrier axis
26	ON	ON		ON		12th PLC controlled axis	WA	EC W axis (column up and down)
27	ON	ON		ON	ON	13th PLC controlled axis	PL	Rotary axis of multi-pallet APC
28	ON	ON	ON			14th PLC controlled axis		Spare
29	ON	ON	ON		ON		SFT*	Safety speed monitor (1 to 3)

NOTICE

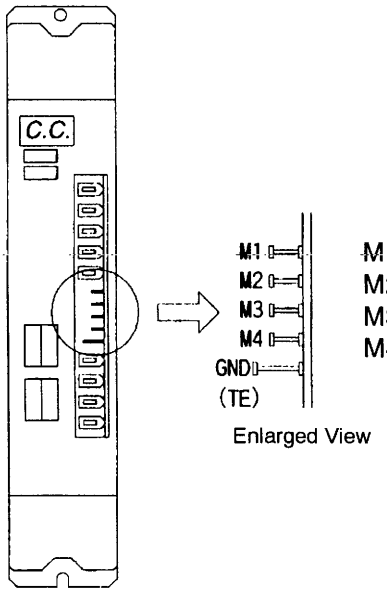
Blank box in the ID No. Switch Setting column indicate "OFF".

6. Description of Waveform Monitor

The MIV unit equipped with ICB3 allows observation of the servo waveform by connecting an oscilloscope to the monitor terminal.
The MIV unit equipped with ICB-F or ICB-H allows observation of the waveform of the servo at the monitor terminal of the SWM monitor unit if an SWM monitor unit is connected.

6-1. MIV Unit for Feed Axes/Turrets/Machine Axes

6-1-1. Arrangement of Monitor Terminals



M1: Motor speed of 2nd axis (M side)
M2: Motor output torque of 2nd axis (M side)
M3: Motor speed of 1st axis (L side)
M4: Motor output torque of 1st axis (L side)

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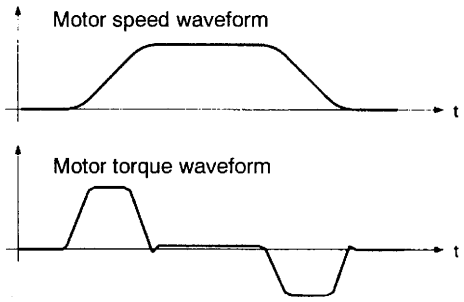
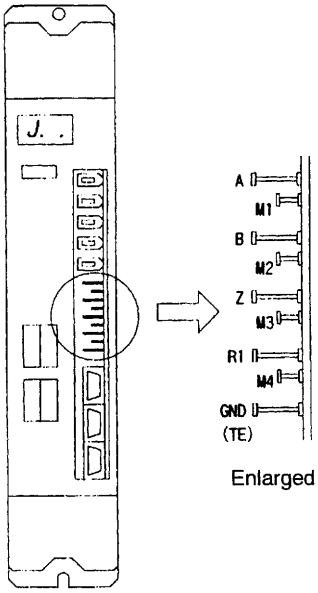
6-1-2. Monitor Signals

<table>
<tr><th>Monitor Terminal</th><th>Description</th><th>Waveform (Example)</th></tr>
<tr><td>M1</td><td>Motor speed of 2nd axis (M side)
• Output voltage range: -3 V to +3 V
• Unit: 1562 min^{-1}/V</td><td rowspan="2"> 

</td></tr>
<tr><td>M2</td><td>Motor output torque of 2nd axis (M side)
• Output voltage range: -3 V to +3 V
• Unit Motor peak torque at 3 V</td></tr>
<tr><td>M3</td><td>Motor speed of 1st axis (L side)
• Output voltage range: -3 V to +3 V
• Unit: 1562 min^{-1}/V</td><td rowspan="2">Same as above</td></tr>
<tr><td>M4</td><td>Motor output torque of 1st axis (L side)
• Output voltage range: -3 V to +3 V
• Unit: Motor peak torque at 3 V</td></tr>
</table>

6-2. MIV Unit for Spindle/M-tool Spindle/Sub Spindle

6-2-1. Arrangement of Monitor Terminals



Enlarged View

A: A-phase signal of magnetic encoder
B: B-phase signal of magnetic encoder
Z: Z-phase signal of magnetic encoder
R1: Resolver signal

M1: Motor speed
M2: Motor output torque
M3: Motor voltage error (d-axis component)
M4: Motor voltage error (q-axis component)

GND (TE): Connect common of oscilloscope

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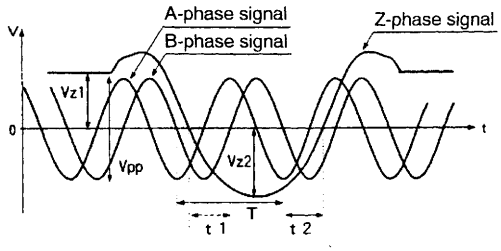
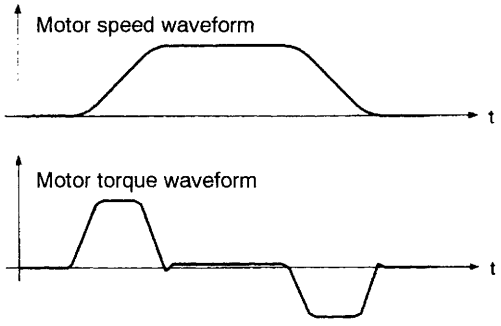
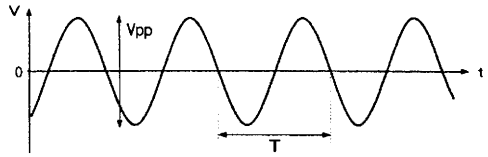
6-2-2. Monitor Signals

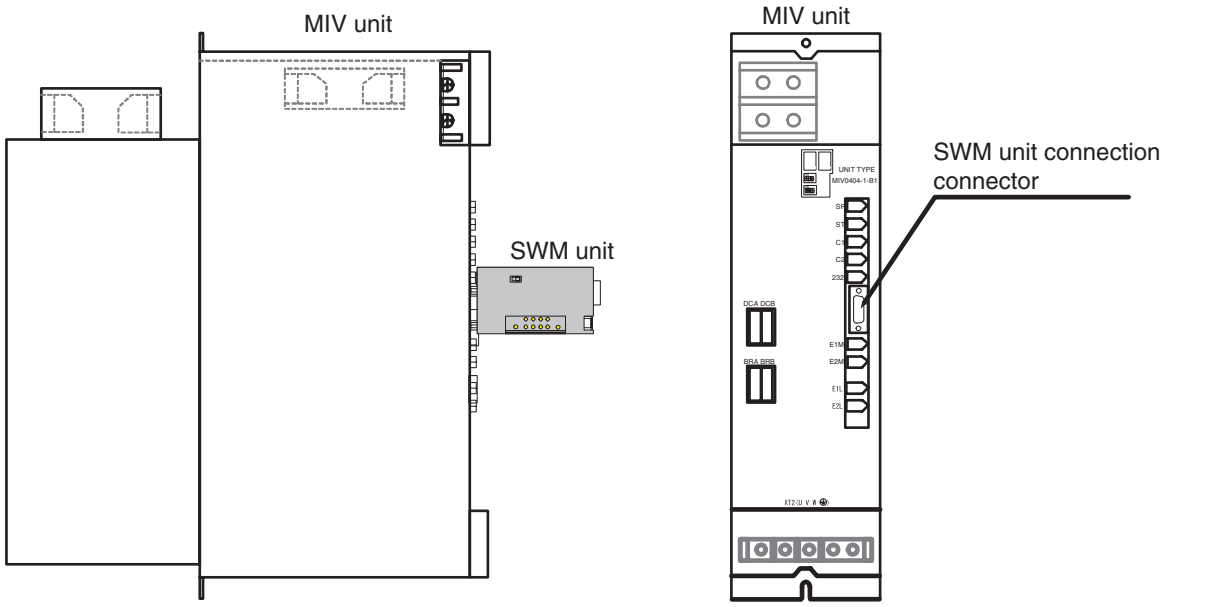
Monitor Terminal	Description	Waveform (Example)
A	A-phase signal of magnetic encoder • Vpp: 2.6 to 4.6 V (3.3 V if gap adjustment is correct.)	
B	B-phase signal of magnetic encoder • Vpp: 2.6 to 4.6 V (3.3 V if gap adjustment is correct.)	
Z	Z-phase signal of magnetic encoder • Vz1: 1.4 V or higher • Vz2: 0.5 V or higher • t1, t2: 0.1T to 0.4T (Value T differs according to speed)	
M1	Motor speed • Output voltage range: -3 V to +3 V • Unit: 1562 min^{-1}/V	
M2	Motor output torque • Output voltage range: -3 V to +3 V • Unit: Motor peak torque at 3 V	
R1	Resolver signal • Vpp: 6.0 V (typ.) • T Approx. 0.128 msec (7.81 kHz) (Value T differs slightly according to speed)	
M3	Motor voltage error (d-axis component) • Output voltage range: -3 V to +3 V • Unit: V (multiplication factor: 1/42)	
M4	Motor voltage error (q-axis component) • Output voltage range: -3 V to +3 V • Unit: V (multiplication factor: 1/42)	

6-3. SWM Monitor Unit

6-3-1. Connection

- Be sure to turn off the control power of the MIV unit before connecting the SWM unit. (Disconnect the 24 VDC connector or turn off the circuit breaker of the machine.)
- Connect the SWM monitor unit directly to the MIV unit as shown in the figure below. (No indication is given to the connector with which the SWM unit is connected, refer to the figure below.)

(1) SWM unit connection drawing for MIV*-1



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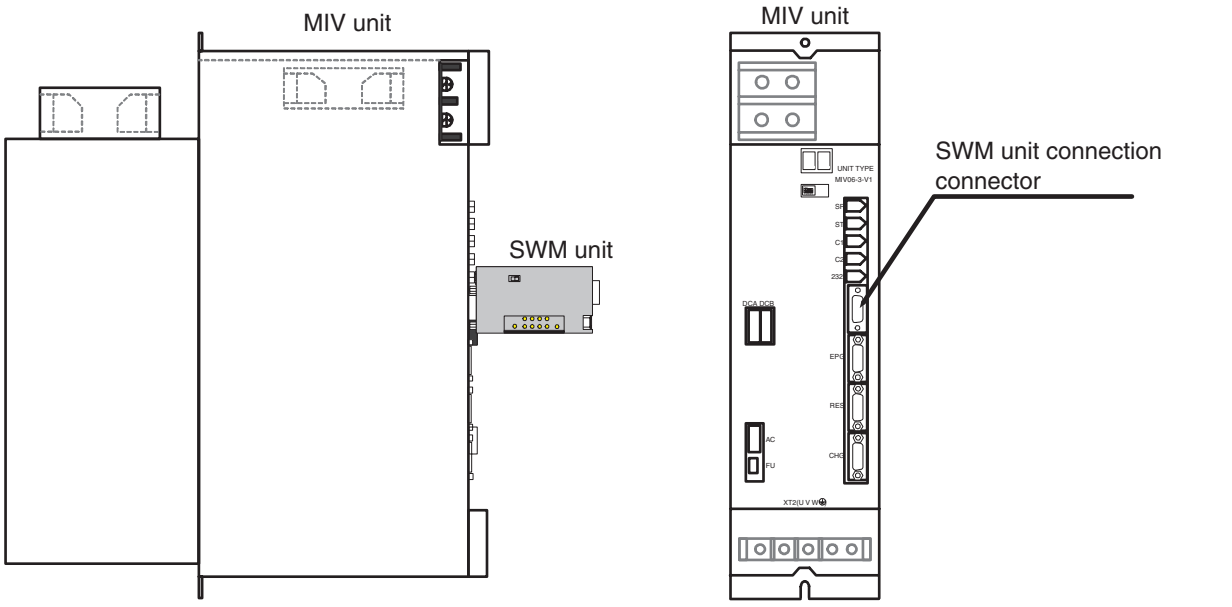
(2) SWM unit connection drawing for MIV*-3



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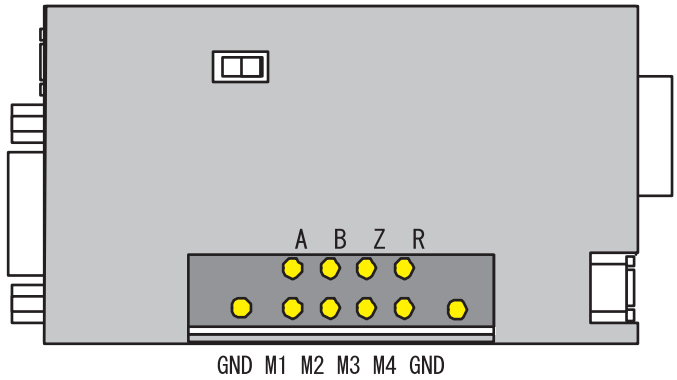
6-3-2. Layout of Monitor Terminals



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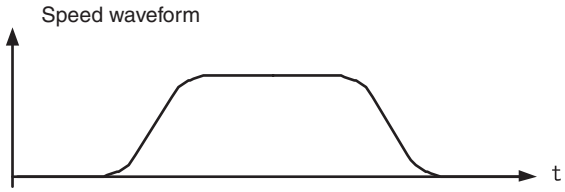
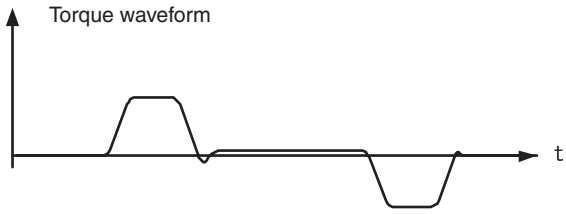
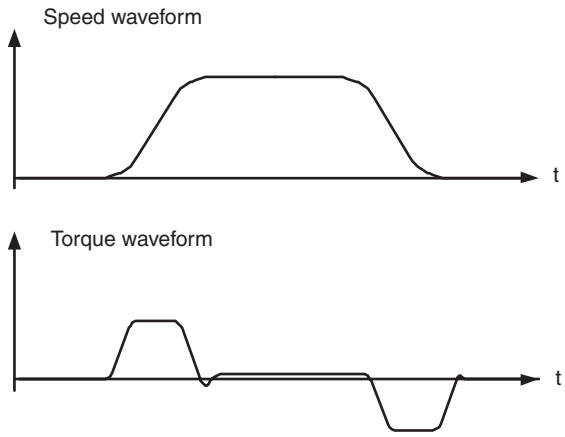
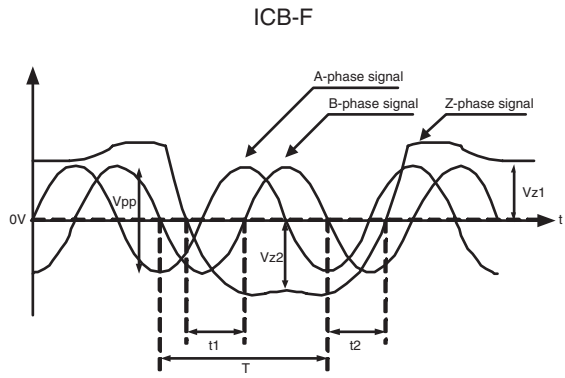
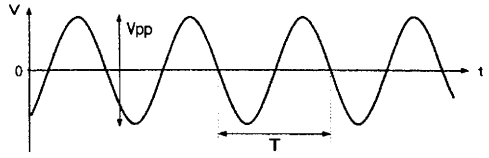
6-3-3. Description of Monitor Terminal Signals

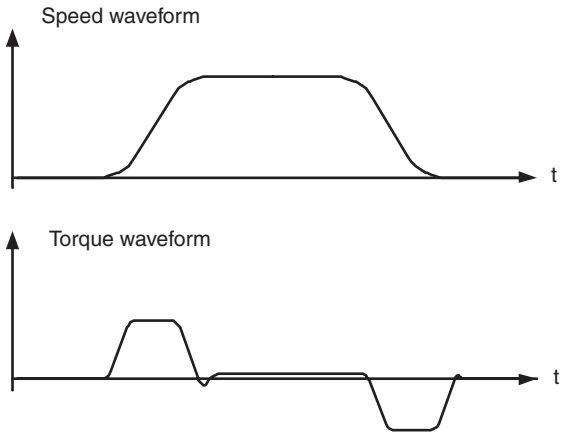
(1) Connection with ICB1F or ICB1F-S

Monitor terminal	Description	Waveform
M1	Motor speed of the 1st axis (on L side) • Output voltage range: -3 V to +3 V • Unit: 1562 min^{-1}/V	
M2	Motor output torque of 1st axis (on L side) • Output voltage range: -3 V to +3 V • Unit: Motor peak torque at 3 V	
M3	Motor speed of 2nd axis (on M side) • Output voltage range: -3 V to +3 V • Unit: 1562 min^{-1}/V	Same as above
M4	Motor output torque of 2nd axis (on M side) • Output voltage range: -3 V to +3 V • Unit: Motor peak torque at 3 V	

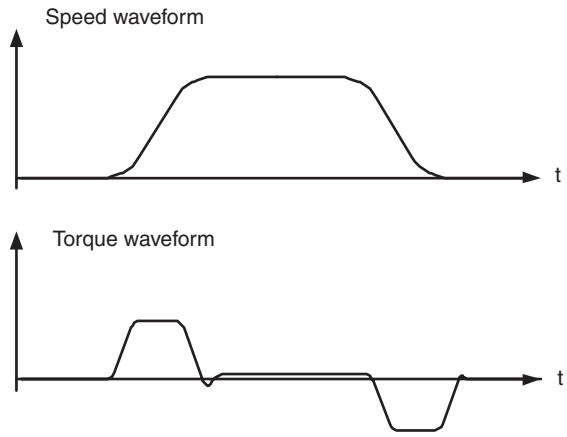
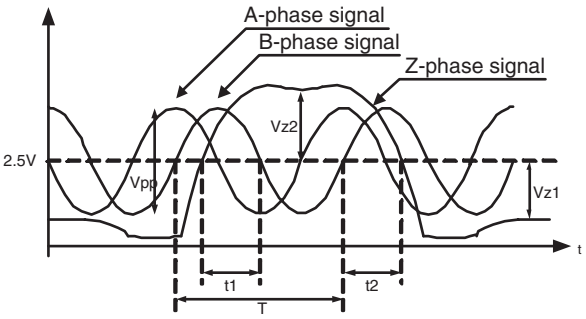
(2) Connection with ICB3F

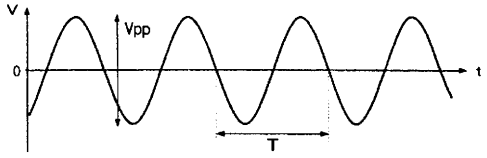
<table>
<tr><th>Monitor terminal</th><th>Description</th><th>Waveform</th></tr>
<tr><td>M1</td><td>Motor speed
• Output voltage range: -3 V to +3 V
• Unit: 1562 min^{-1}/V</td><td rowspan="2"> 
</td></tr>
<tr><td>M2</td><td>Motor output torque
• Output voltage range: -3 V to +3 V
• Motor peak torque at 3 V</td></tr>
<tr><td>M3</td><td>Motor voltage error (d-axis component)
• Output voltage range: -3 V to +3 V
• Unit: V (Output multiplication 1/42)</td><td></td></tr>
<tr><td>M4</td><td>Motor voltage error (q-axis component)
• Output voltage range: -3 V to +3 V
• Unit: V (Output multiplication 1/42)</td><td></td></tr>
<tr><td>A</td><td>A-phase signal of magnetic encoder
• Vpp in the figure on the right: 2.6 to 4.6 V (3.3 V when gap is normally adjusted)</td><td rowspan="3"> 
</td></tr>
<tr><td>B</td><td>B-phase signal of magnetic encoder
• Vpp in the figure on the right: 2.6 to 4.6 V (3.3 V when gap is normally adjusted)</td></tr>
<tr><td>Z</td><td>Z-phase signal of magnetic encoder
• Vz1 in the figure on the right: 1.4 V or above
• Vz2 in the figure on the right: 0.5 V or above
• t1, t2 in the figure on the right: 0.1 to 0.4T ("T" changes according to the rpm.)</td></tr>
<tr><td>R</td><td>Resolver signal
• Vpp in the figure on the right: 6.0 V (typ)
• T in the figure on the right: About 102.4 µsec (9.77 KHz) ("T" changes slightly according to the rpm.)</td><td> 
</td></tr>
</table>

(3) Connection with ICB1H or ICB1H-S

<table>
<tr><th>Monitor terminal</th><th>Description</th><th>Waveform</th></tr>
<tr><td>M1</td><td>Motor speed of 1st axis (on L side)
• Output voltage range: -3 V to +3 V
• Unit: 1562 min^{-1}/V</td><td rowspan="2"> 
</td></tr>
<tr><td>M2</td><td>Motor output torque of 1st axis (on L side)
• Output voltage range: -3 V to +3 V
• Unit: Motor peak torque at 3 V</td></tr>
<tr><td>M3</td><td>Motor speed of 2nd axis (on M side)
• Output voltage range: -3 V to +3 V
• Unit: 1562 min^{-1}/V</td><td rowspan="2">Same as above</td></tr>
<tr><td>M4</td><td>Motor output torque of 2nd axis (on M side)
• Output voltage range: -3 V to +3 V
• Unit: Motor peak torque at 3 V</td></tr>
</table>

(4) Connection with ICB3H

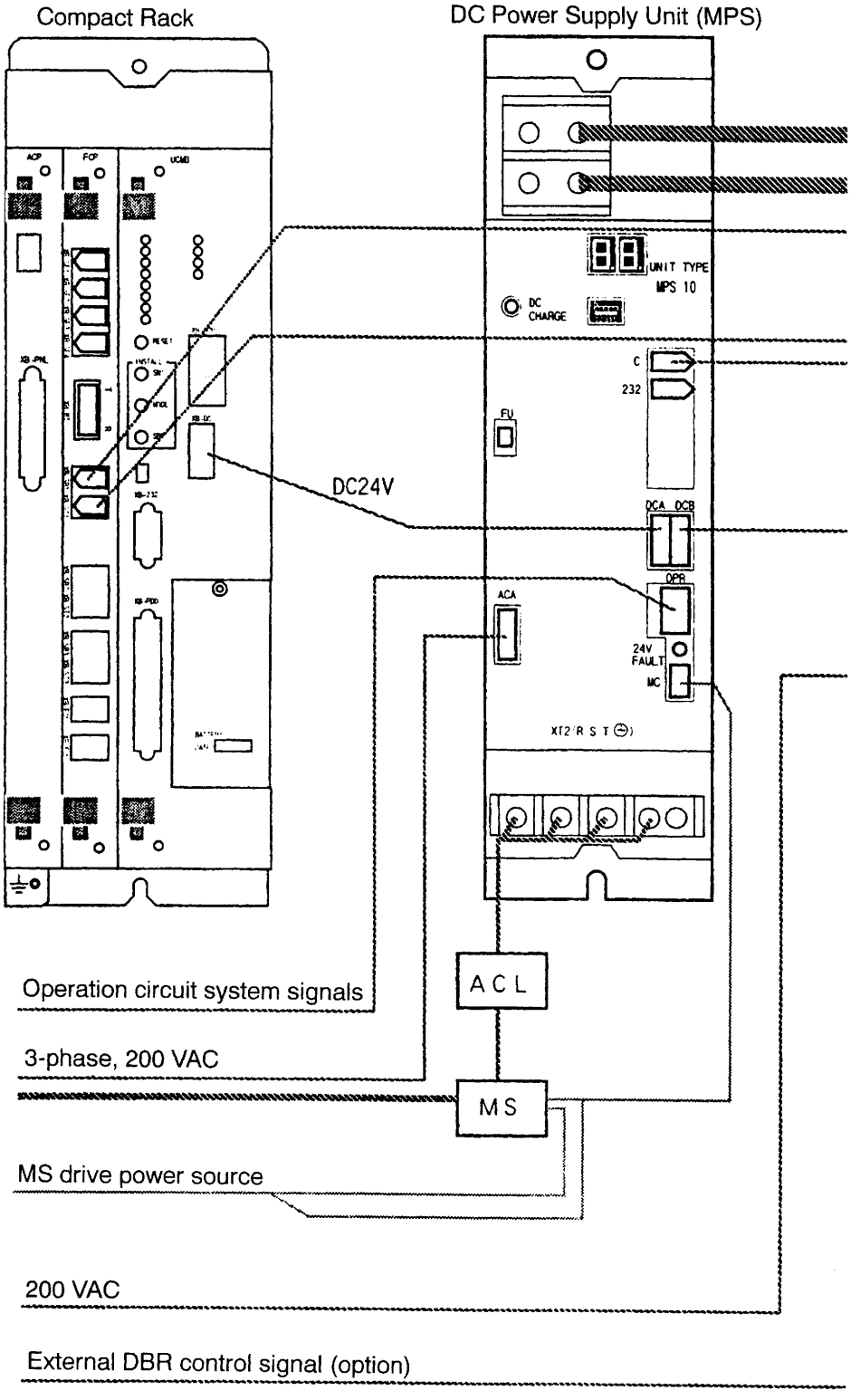
<table>
<tr><th>Monitor terminal</th><th>Description</th><th>Waveform</th></tr>
<tr><td>M1</td><td>Motor speed
• Output voltage range: -3 V to +3 V
• Unit: 1562 min^{-1}/V</td><td rowspan="2"> 
</td></tr>
<tr><td>M2</td><td>Motor output torque
• Output voltage range: -3 V to +3 V
• Unit: Motor peak torque at 3 V</td></tr>
<tr><td>M3</td><td>Motor voltage error (d-axis component)
• Output voltage range: -3 V to +3 V
• Unit: V (Output multiplication 1/42)</td><td></td></tr>
<tr><td>M4</td><td>Motor voltage error (q-axis component)
• Output voltage range: -3 V to +3 V
• Unit: V (Output multiplication 1/42)</td><td></td></tr>
<tr><td>A</td><td>A-phase signal of magnetic encoder
• Vpp in the figure on the right: 2.6 to 4.6 V (3.3 V when gap is normally adjusted)</td><td rowspan="3">ICB-H
 

(The signal oscillates around 2.5 V line.)</td></tr>
<tr><td>B</td><td>B-phase signal of magnetic encoder
• Vpp in the figure on the right: 2.6 to 4.6 V (3.3 V when gap is normally adjusted)</td></tr>
<tr><td>Z</td><td>Z-phase signal of magnetic encoder
• Vz in the figure on the right: 1.4 V or above
• Vz2 in the figure on the right: 0.5 V or above
• t1, t2 in the figure on the right: 0.1 to 0.4T ("T" changes according to the rpm.)</td></tr>
<tr><td>R</td><td>Resolver signal
• Vpp in the figure on the right: 6.0 V (typ)
• T in the figure on the right: About 102.4 μsec (9.77 KHz) ("T" changes slightly according to the rpm.)</td><td> 
</td></tr>
</table>

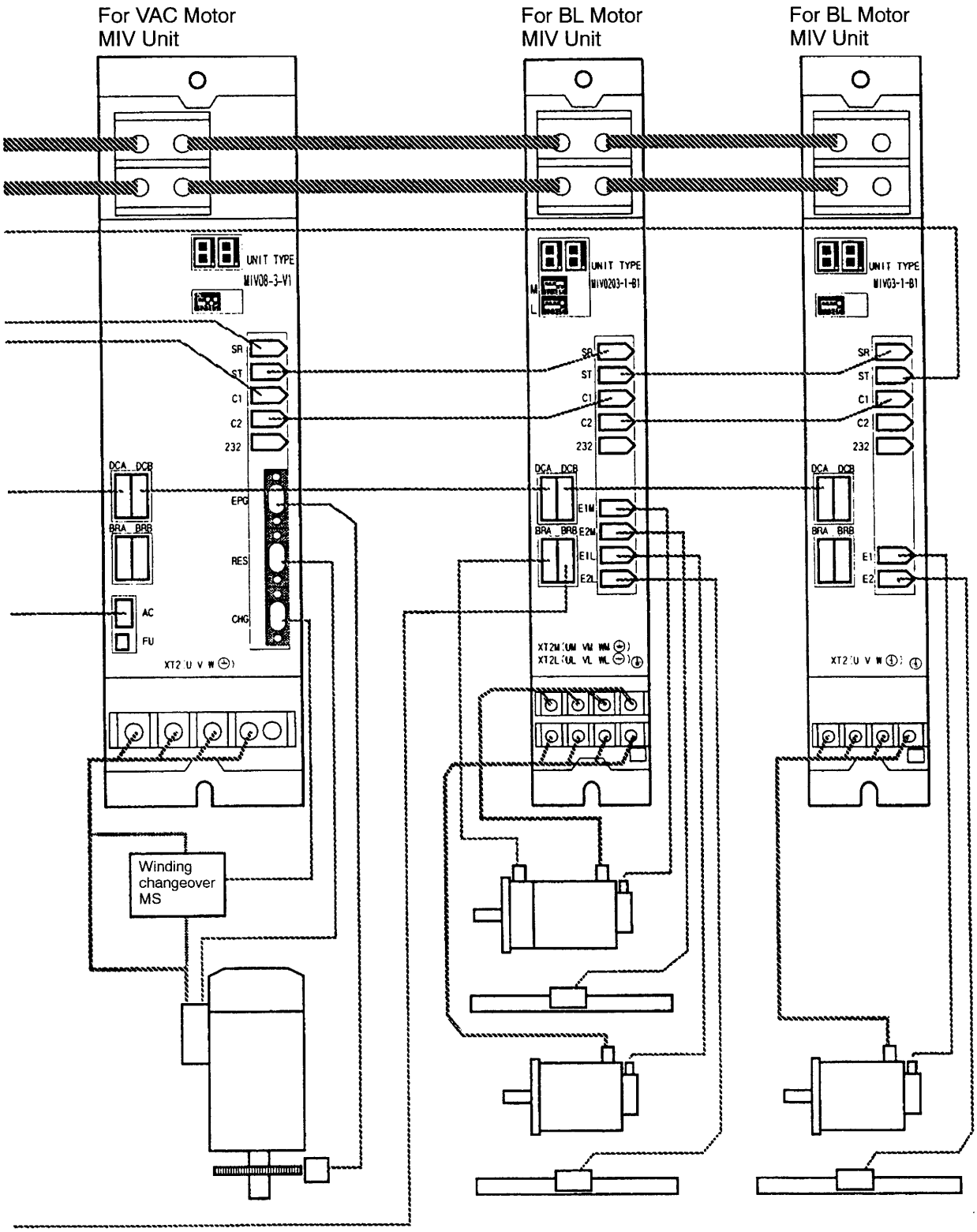
7. Connection

This section shows the connection diagram of MCS and the connector pin layout of MIV unit.

7-1. System Connection



EIOSPCSA1029R01



EIOSPCSA1030R01

7-2. Terminal Block Screw Size

Refer to 8 "MIV Unit External Dimensions".

7-3. Connectors

(1) Connector name: SR
Type (manufacturer): 53460-0611 (Molex)
Pin layout

1	N.C.	2	N.C.
3	SLDI	4	SLDI-N
5	(SLDCOM)	6	(SLDCOM-N)

(2) Connector name: ST
Type (manufacturer): 53460-0611 (Molex)
Pin layout

1	N.C.	2	N.C.
3	SLDO	4	SLDO-N
5	(SLDCOM)	6	(SLDCOM-N)

(3) Connector name: C1, C2
Type (manufacturer): 53460-0611 (Molex)
Pin layout

1	SG	2	SG
3	PSRDY-N	4	SVALM-N
5	PSD	6	PSD-N

(4) Connector name: 232
Type (manufacturer): 53460-0611 (Molex)
Pin layout

1	SG	2	SG
3	RSTX-S	4	RSRX-S
5	RSTX	6	RSRX

(5) Connector name: E1M
Type (manufacturer): 53460-0611 (Molex)
Pin layout

1	N.C.	2	N.C. (TP1)
3	ELD-S	4	ELD-N-S
5	N.C.	6	N.C. (TP2)

(6) Connector name: E2M
Type (manufacturer): 53460-0611 (Molex)
Pin layout

1	+12 V	2	SG
3	ELD-S	4	ELD-N-S
5	N.C.	6	N.C.

(7) Connector name: E1L
Type (manufacturer): 53460-0611 (Molex)
Pin layout

1	N.C.	2	N.C. (TP3)
3	ELD	4	ELD-N
5	N.C.	6	N.C. (TP4)

(8) Connector name: E2L
Type (manufacturer): 53460-0611 (Molex)
Pin layout

1	+12 V	2	SG
3	ELD	4	ELD-N
5	N.C.	6	N.C.

(9) Connector name: DCA/DCB
Type (manufacturer): 1-178137-2 (AMP)
Pin layout

A-1	P24	B-1	P24
A-2	C24	B-2	C24
A-3	N.C.	B-3	N.C.

(10) Connector name: BRA/BRB
Type (manufacturer): 1-178137-2 (AMP)
Pin layout

A-1	MB2	B-1	DB1
A-2	MB1L	B-2	DB2
A-3	MB1M (Note 1)	B-3	N.C.

Note 1: Not necessary for 1-axis spec. MIV unit.

(11) Connector name: EPG
Type (manufacturer): D02-M15SAG-13L9 (JAE)
Pin layout

1	DA	6	+12	11	DB
2	SG	7	SG	12	SG
3	AA	8	AA-RT	13	DZ
4	AB	9	AB-RT	14	SG
5	AZ	10	AZ-RT	15	FG

(12) Connector name: RES
Type (manufacturer): D02-M15SAG-13L9 (JAE)
Pin layout

1	R1	6	R2	11	FG1
2	S1	7	S3	12	FG3
3	S2	8	S4	13	FG4
4	N.C.	9	N.C.	14	N.C.
5	OL	10	OL-COM	15	FG2

(13) Connector name: CHG
Type (manufacturer): D02-M15SAG-13L9 (JAE)
Pin layout

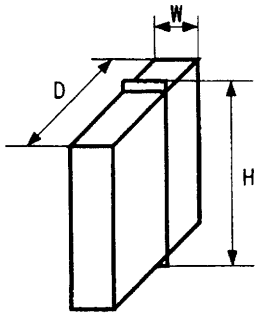
1	RLMSCHG	6	N.C.	11	RLMSCOM
2	RHMSCHG	7	N.C.	12	RHMSCOM
3	N.C.	8	N.C.	13	N.C.
4	LMSCHG1	9	HMSCHG1	14	N.C.
5	LMSCHG2	10	HMSCHG2	15	FG

(14) Connector name: AC
Type (manufacturer): 1-179276-2 (AMP)
Pin layout

1	AC1
2	AC2

8. MIV Unit External Dimensions

8-1. MIV Unit (1-axis Specification) for BL Motors



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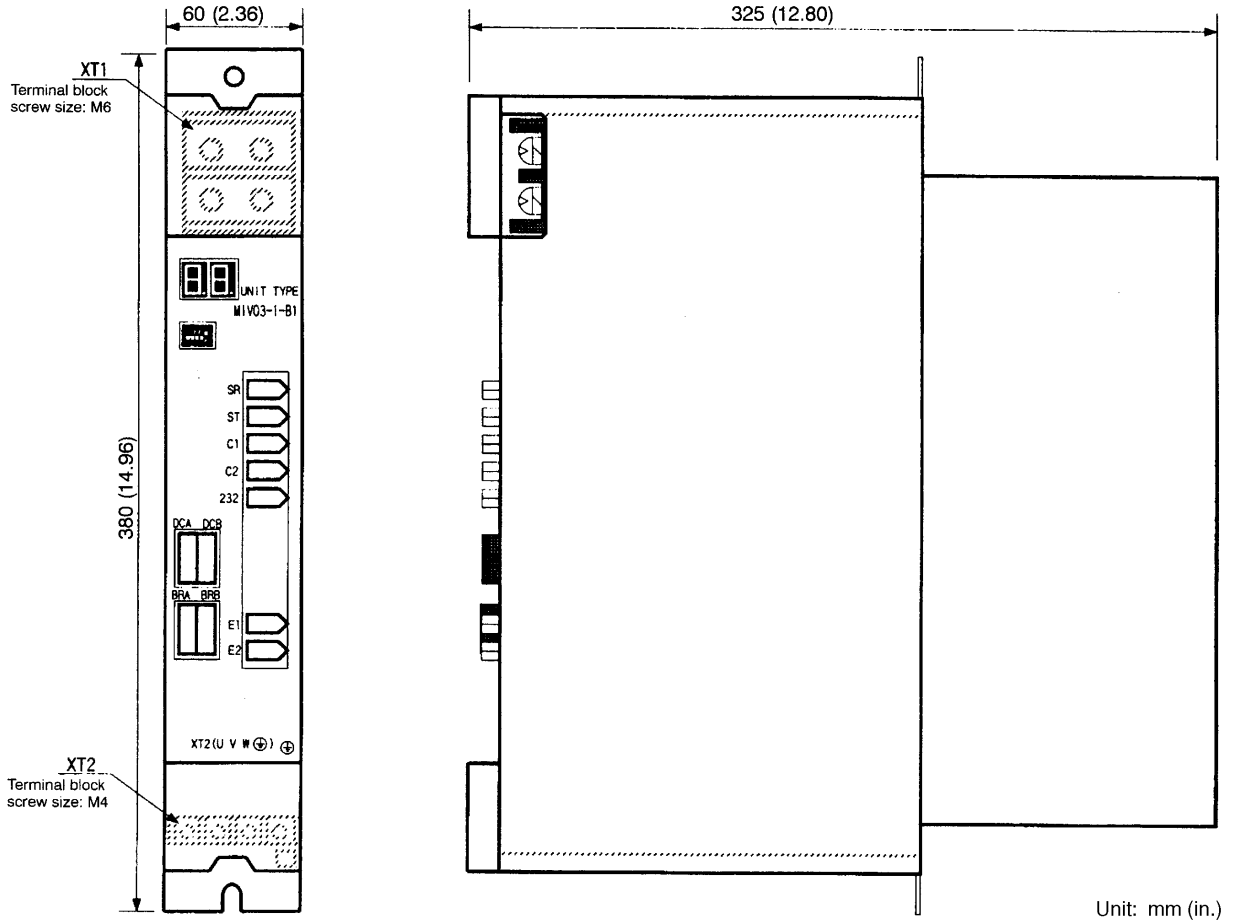
Unit Type	Rated Cont. Capacity {kW (hp)}	External Dimensions H × W × D {mm (in)}	Weight {kg (lb)}
MIV01-1	1.8 (2.4)	380 × 60 × 325 (14.96 × 2.36 × 12.79)	5.7 (12.5)
MIV02-1	2.8 (3.7)	380 × 60 × 325 (14.96 × 2.36 × 12.79)	5.7 (12.5)
MIV03-1	3.0 (4)	380 × 60 × 325 (14.96 × 2.36 × 12.79)	5.7 (12.5)
MIV04-1	4.0 (5.3)	380 × 60 × 325 (14.96 × 2.36 × 12.79)	5.7 (12.5)
MIV05-1	4.8 (6.4)	380 × 60 × 325 (14.96 × 2.36 × 12.79)	5.7 (12.5)
MIV06DB-1	6.0 (8)	380 × 100 × 325 (14.96 × 3.94 × 12.79)	7.3 (16.1)
MIV08DB-1	7.5 (10)	380 × 100 × 325 (14.96 × 3.94 × 12.79)	7.3 (16.1)
MIV15-1	15.0 (20)	380 × 150 × 325 (14.96 × 5.91 × 12.79)	11.2 (24.6)
MIV22-1	22.0 (30)	380 × 150 × 325 (14.96 × 5.91 × 12.79)	11.2 (24.6)

8-2. MIV Unit (2-axis Specification) for BL Motors

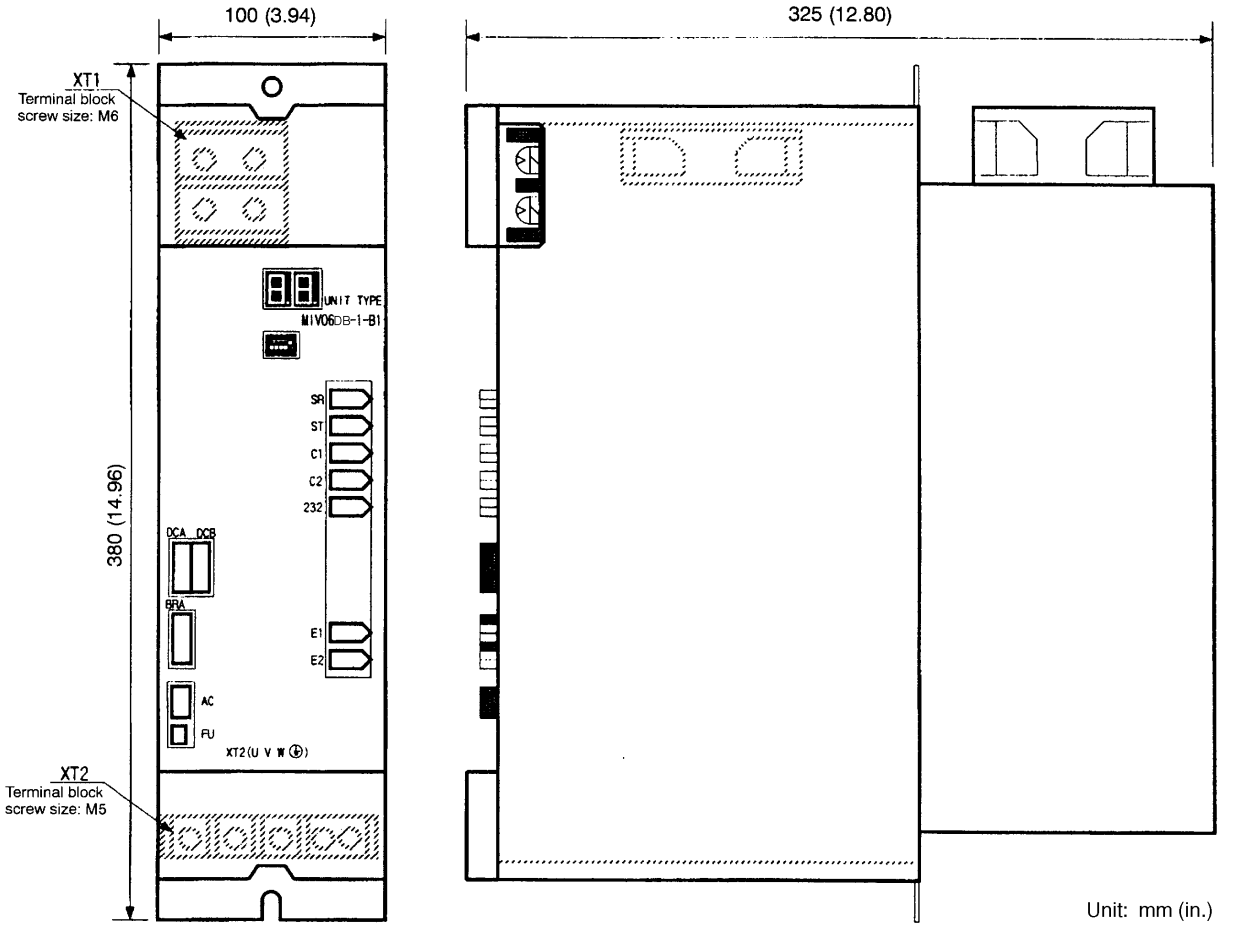
Unit Type	Rated Cont. Capacity {kW (hp)}		External Dimensions H × W × D {mm (in)}	Weight {kg (lb)}
	L Side	M Side		
MIV0101-1	1.8 (2.4)	1.8 (2.4)	380 × 60 × 325 (14.96 × 2.36 × 12.79)	6.3 (13.9)
MIV0102-1	1.8 (2.4)	2.8 (3.7)	380 × 60 × 325 (14.96 × 2.36 × 12.79)	6.3 (13.9)
MIV0202-1	2.8 (3.7)	2.8 (3.7)	380 × 60 × 325 (14.96 × 2.36 × 12.79)	6.3 (13.9)
MIV0103-1	1.8 (2.4)	3.0 (4)	380 × 60 × 325 (14.96 × 2.36 × 12.79)	6.3 (13.9)
MIV0203-1	2.8 (3.7)	3.0 (4)	380 × 60 × 325 (14.96 × 2.36 × 12.79)	6.3 (13.9)
MIV0303-1	3.0 (4)	3.0 (4)	380 × 60 × 325 (14.96 × 2.36 × 12.79)	6.3 (13.9)
MIV0104-1	1.8 (2.4)	4.0 (5.3)	380 × 100 × 325 (14.96 × 3.94 × 12.79)	7.8 (17.2)
MIV0204-1	2.8 (3.7)	4.0 (5.3)	380 × 100 × 325 (14.96 × 3.94 × 12.79)	7.8 (17.2)
MIV0404-1	4.0 (5.3)	4.0 (5.3)	380 × 100 × 325 (14.96 × 3.94 × 12.79)	7.8 (17.2)

8-3. MIV Unit (1-axis Specification) for VAC Motors

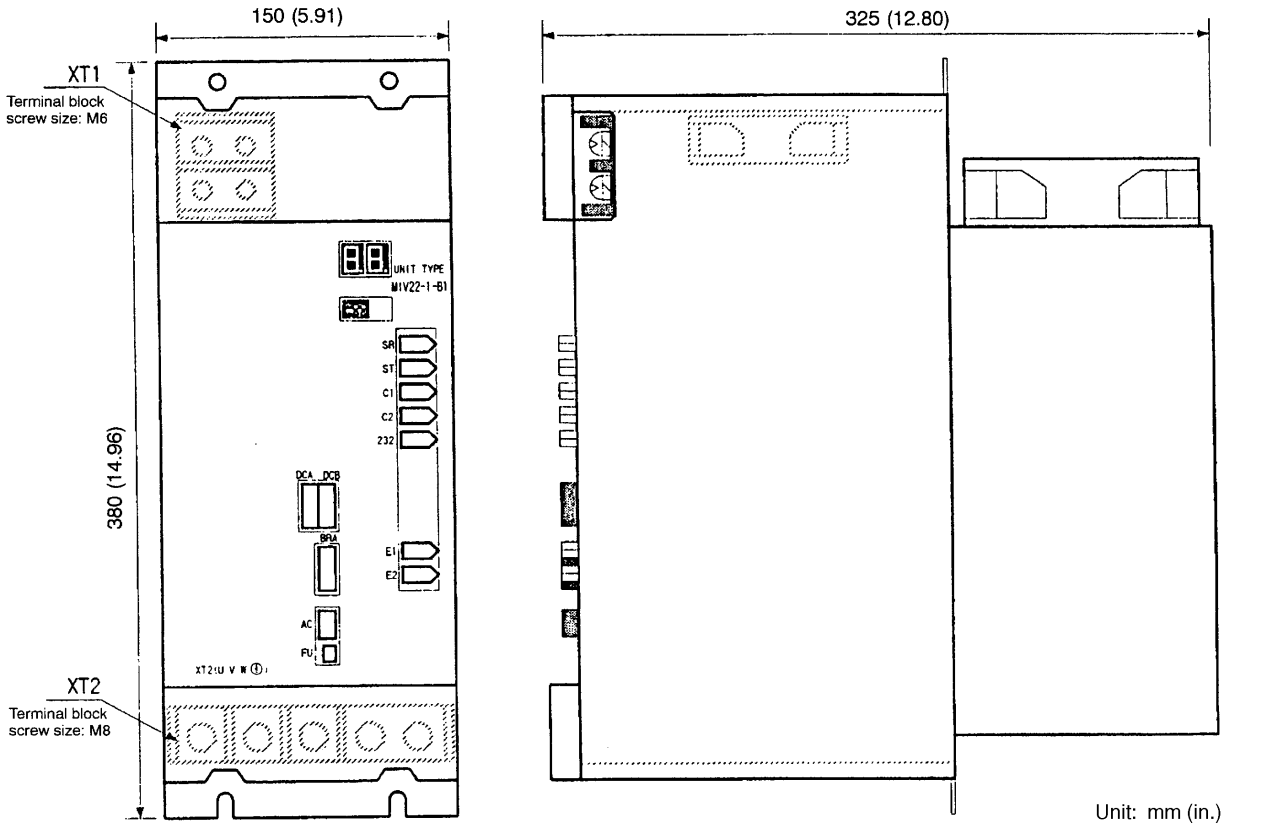
Unit Type	Rated Cont. Capacity {kW (hp)}	External Dimensions H × W × D {mm (in)}	Weight {kg (lb)}
MIV04-3	1.1 (1.5)	380 × 60 × 325 (14.96 × 2.36 × 12.79)	5.7 (12.5)
MIV06-3	5.5 (7.3)	380 × 100 × 325 (14.96 × 3.94 × 12.79)	7.3 (16.1)
MIV08-3	7.5 (10)	380 × 100 × 325 (14.96 × 3.94 × 12.79)	7.3 (16.1)
MIV15-3	15 (20)	380 × 150 × 325 (14.96 × 5.91 × 12.79)	11.2 (24.6)
MIV22-3	22 (30)	380 × 150 × 325 (14.96 × 5.91 × 12.79)	11.2 (24.6)
MIV30-3	30 (40)	380 × 300 × 325 (14.96 × 11.8 × 12.79)	24.0 (52.8)
MIV45-3	45 (60)	380 × 300 × 325 (14.96 × 11.8 × 12.79)	24.0 (52.8)



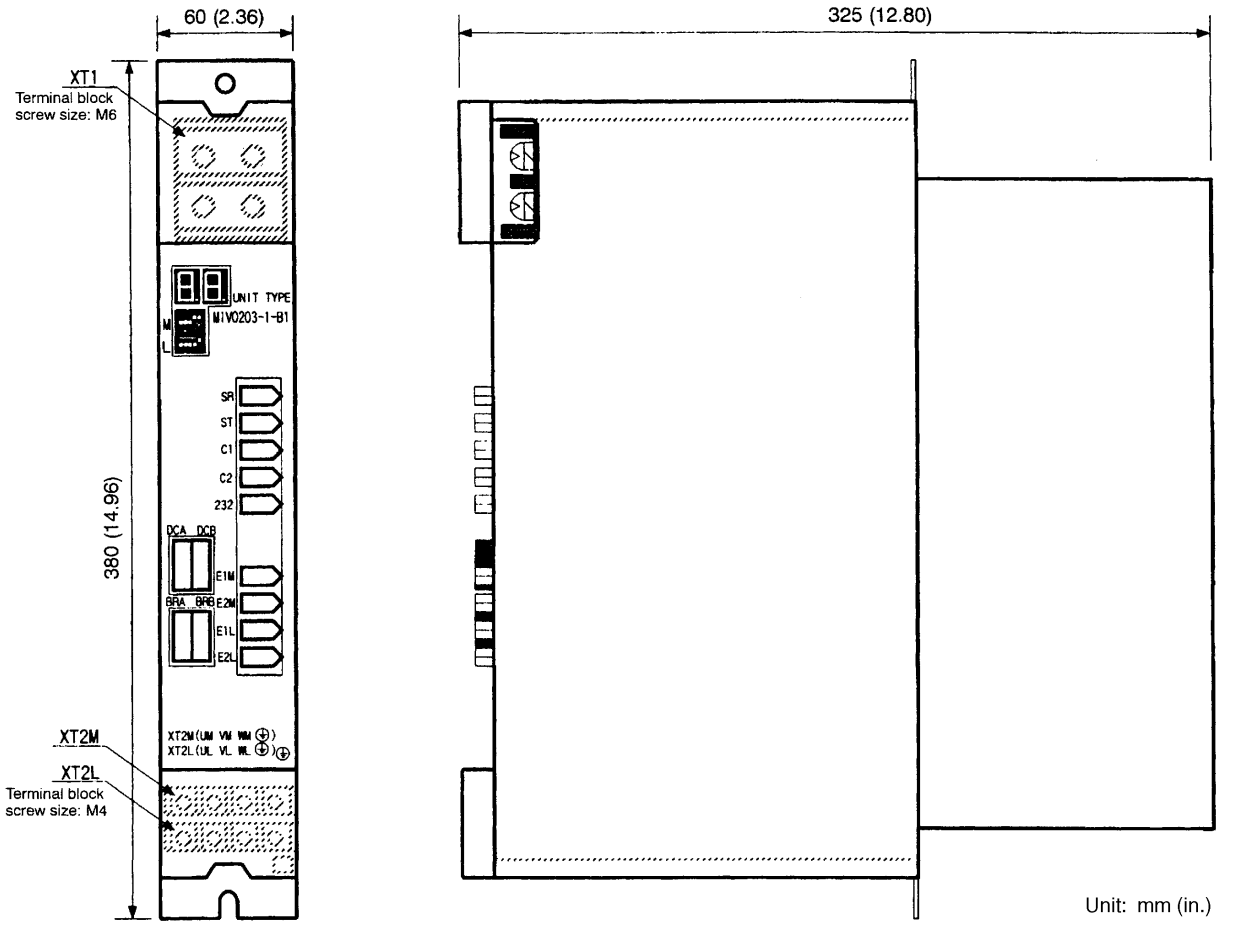
MIV Unit (1-axis Specification) for BL Motors
Unit Type: MIV01-1 to MIV05-1
Unit Weight: 5.7 kg (12.5 lb)



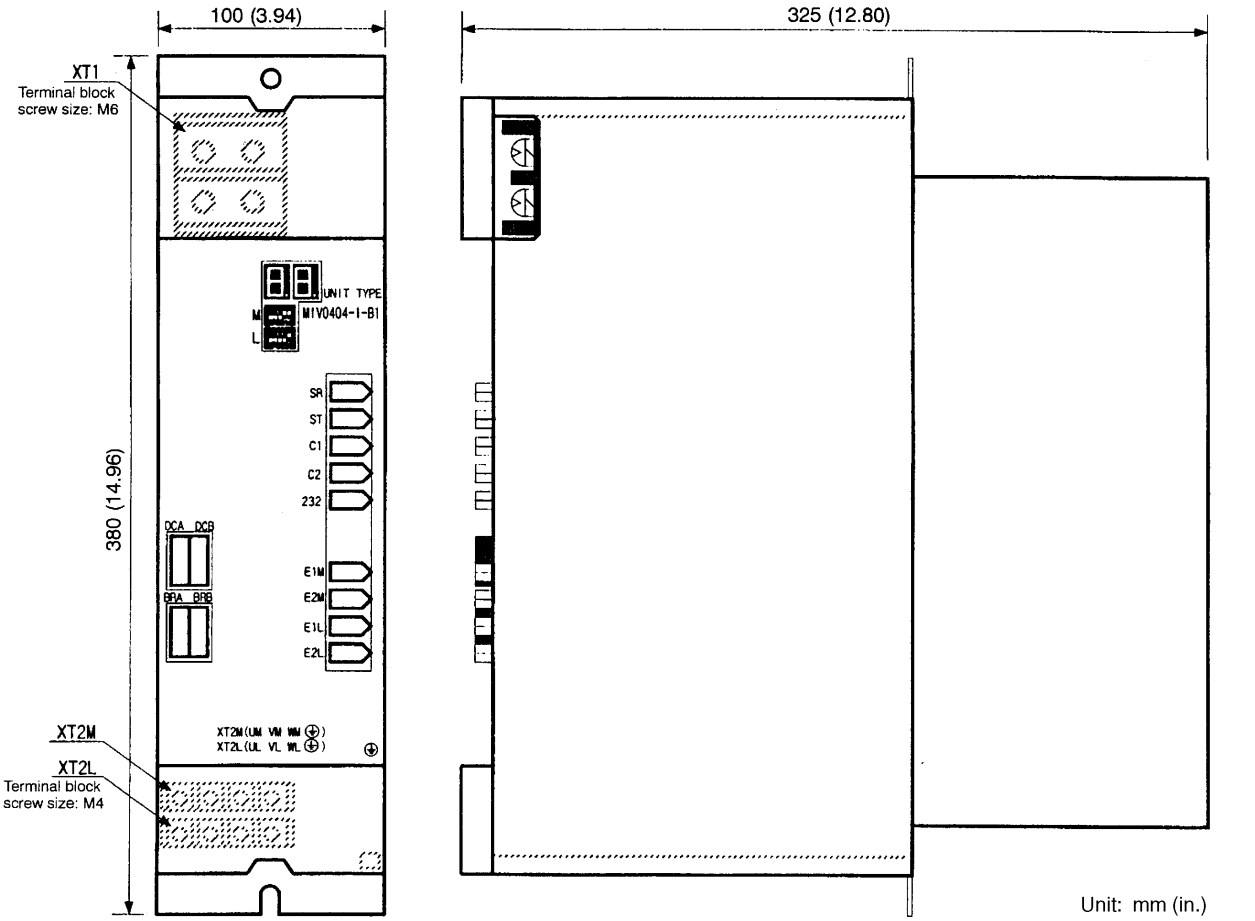
MIV Unit (1-axis Specification) for BL Motors
Unit Type: MIV06DB-1 to MIV08DB-1
Unit Weight: 7.5 kg (16.5 lb)



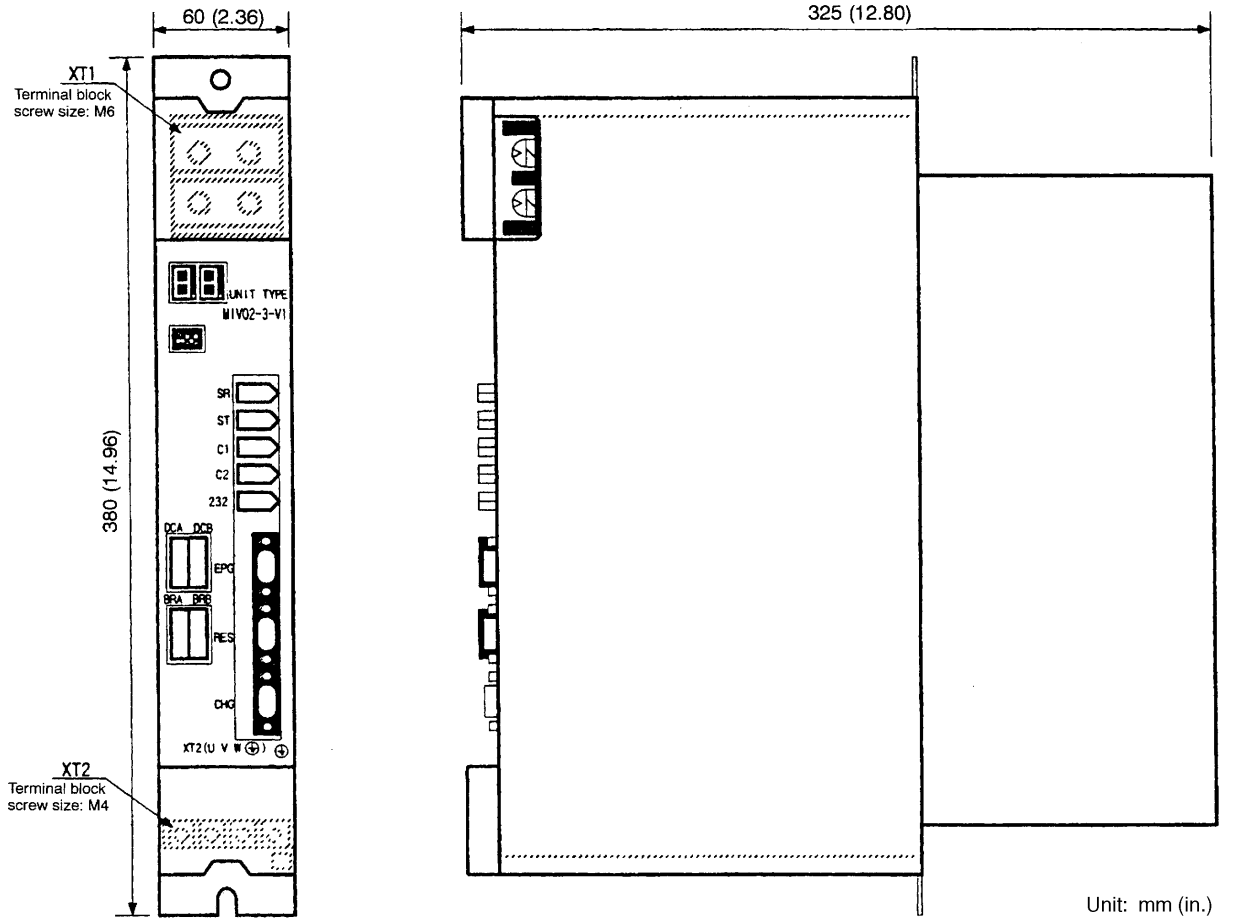
MIV Unit (1-axis Specification) for BL Motors
Unit Type: MIV15-1 to MIV22-1
Unit Weight: 11.2 kg (24.6 lb)



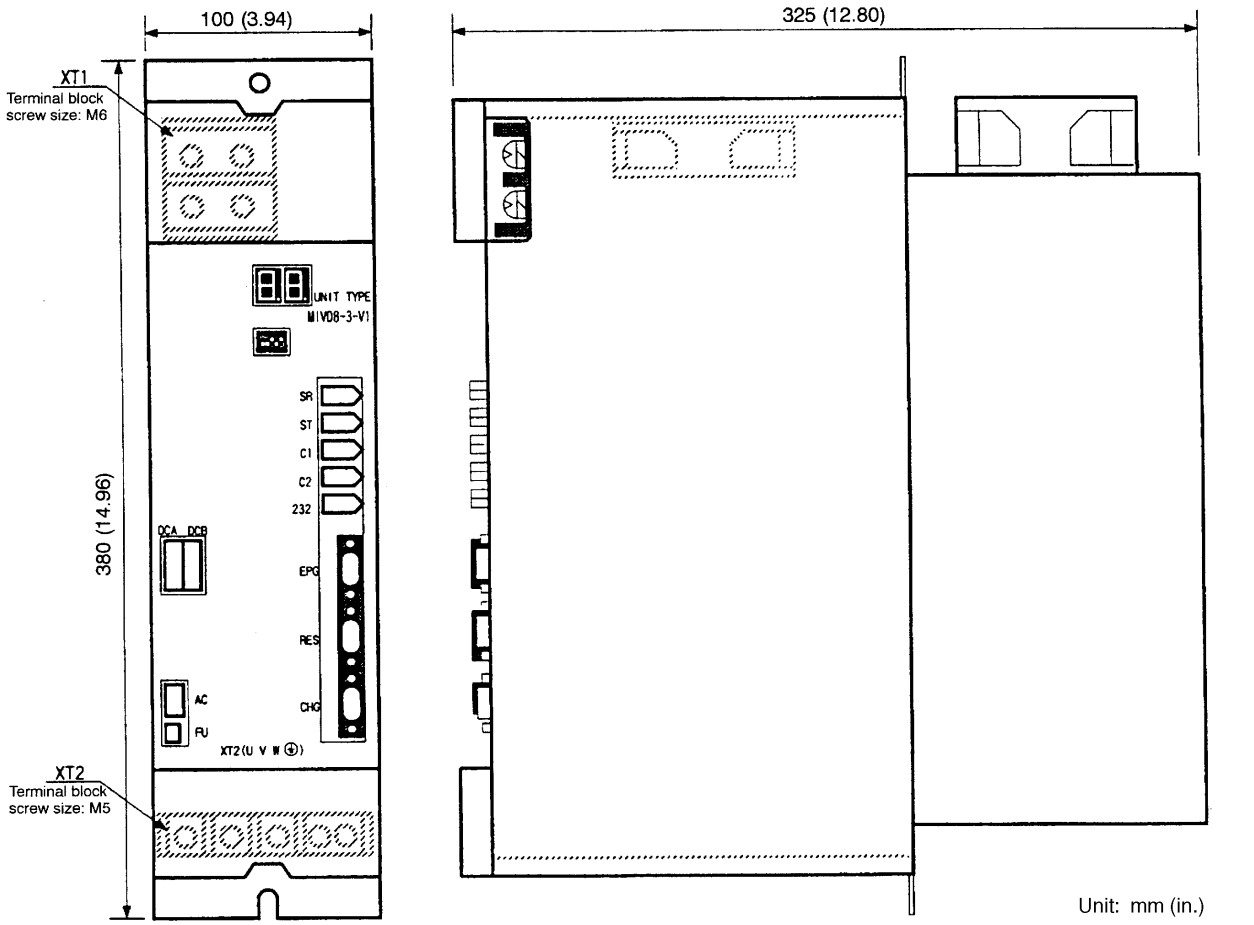
MIV Unit (2-axis Specification) for BL Motors
Unit Type: MIV0101-1 to MIV0303-1
Unit Weight: 6.3 kg (13.9 lb)



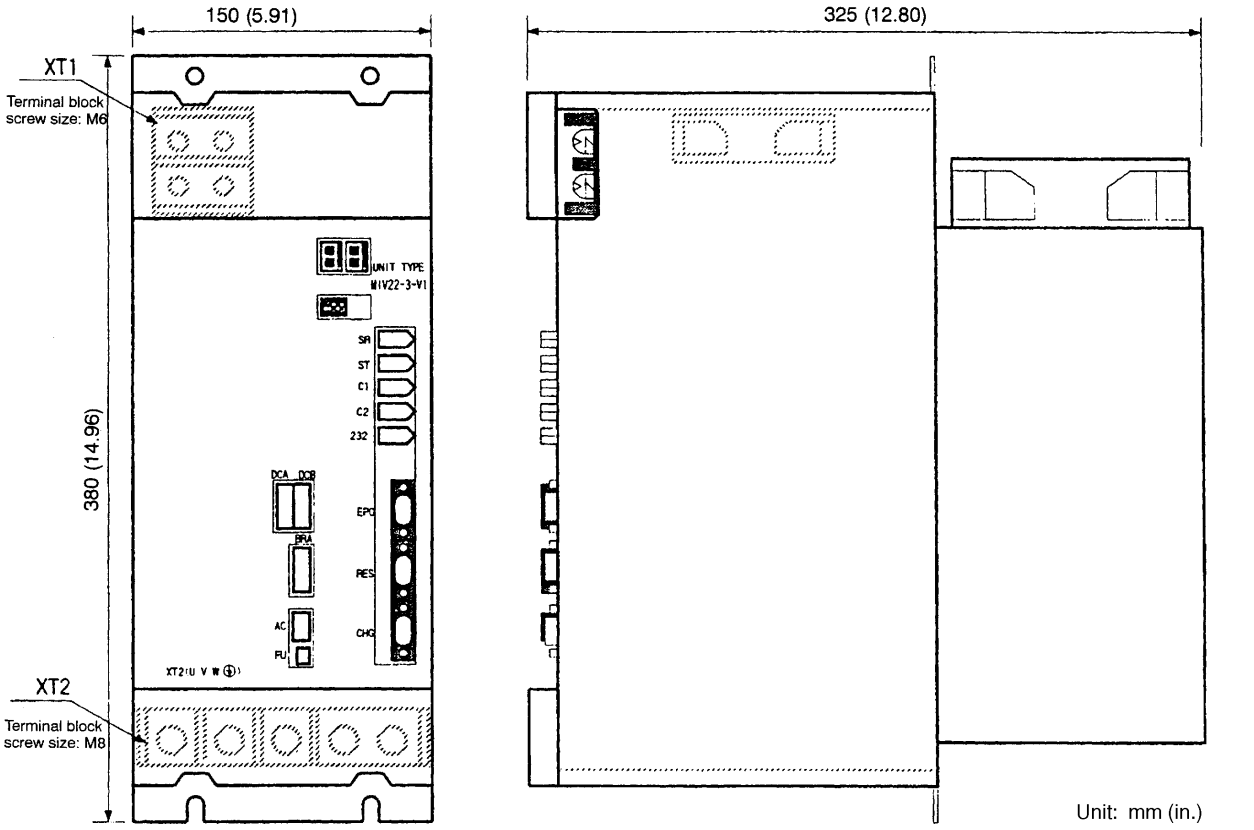
MIV Unit (2-axis Specification) for BL Motors
Unit Type: MIV0104-1 to MIV0404-1
Unit Weight: 7.8 kg (17.2 lb)



MIV Unit for VAC Motors
Unit Type: MIV04-3
Unit Weight: 5.7 kg (12.5 lb)

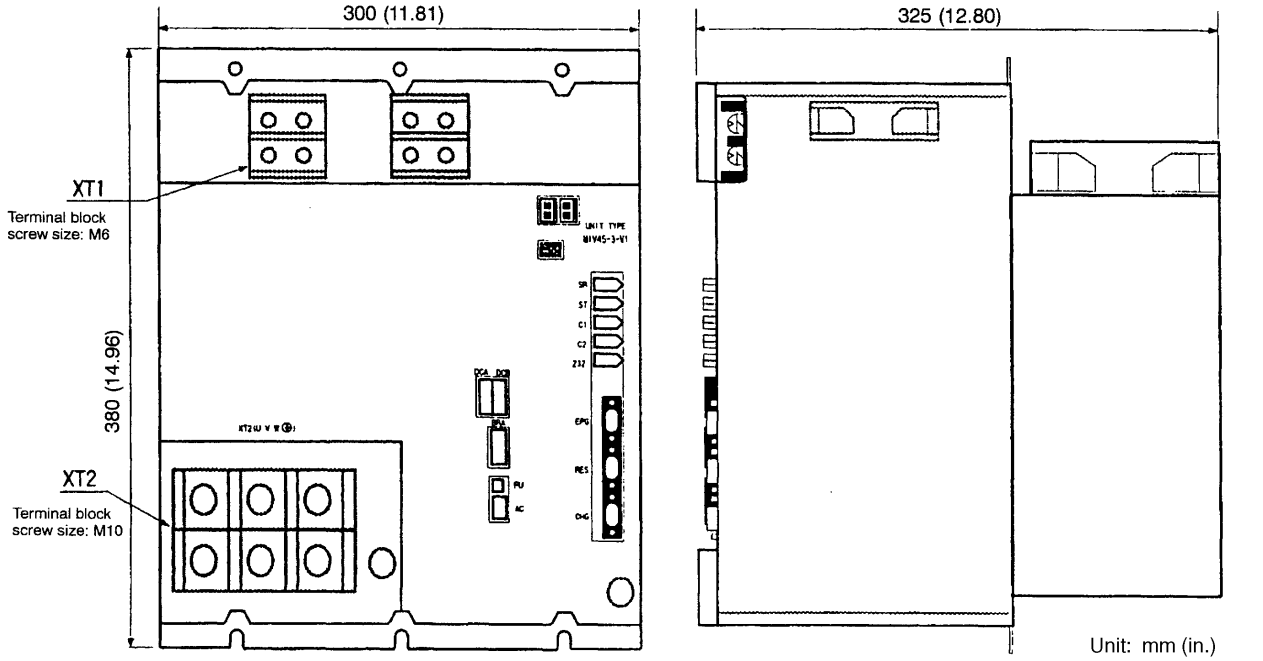


MIV Unit for VAC Motors
Unit Type: MIV06-3 to MIV08-3
Unit Weight: 7.3 kg (16.1 lb)



EIOSPCSA1039R01

MIV Unit for VAC Motors
Unit Type: MIV14-3 to MIV22-3
Unit Weight: 11.2 kg (24.6 lb)



EIOSPCSA1040R01

MIV Unit for VAC Motors
Unit Type: MIV30-3 to MIV45-3
Unit Weight: 24.0 kg (52.8 lb)

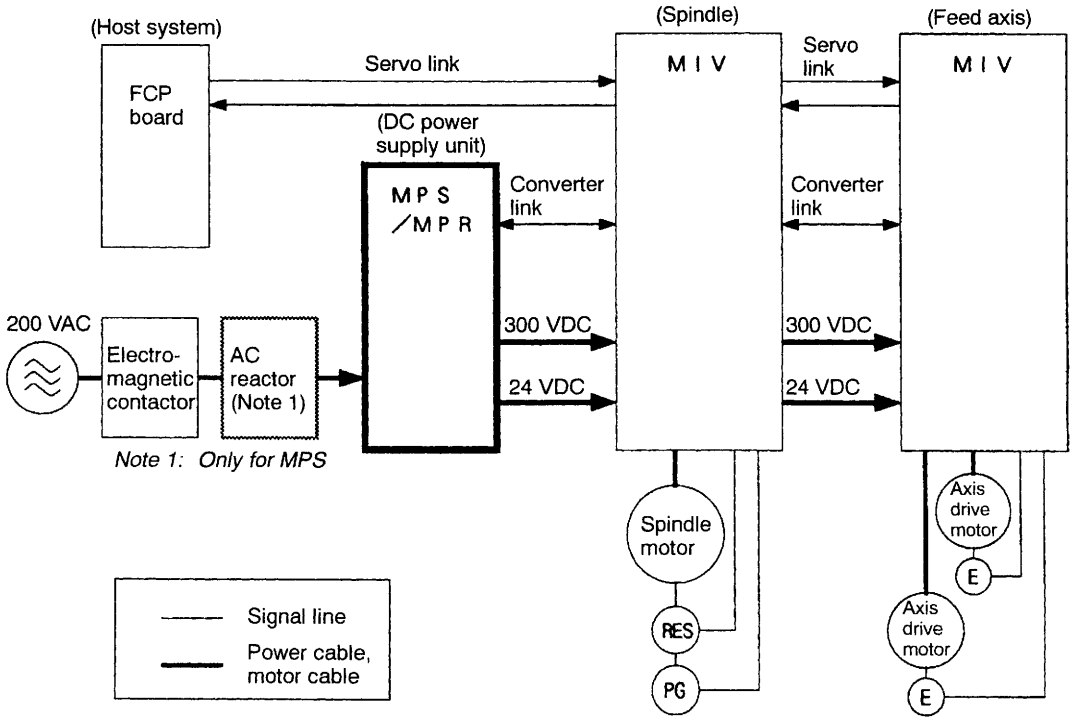
SECTION 2 DC POWER SUPPLY UNIT (MPS, MPR UNIT)

Okuma motion control system (MCS) consists of an inverter unit and a DC power supply unit. This section describes the maintenance and inspection methods for the power supply unit.

1. System Configuration

A DC power supply unit is a unit to supply DC power to MIV unit. Connection of a power supply unit with peripheral is shown below.

- A DC power supply unit is connected to MIV unit to supply 300 VDC and 24 VDC (control power).
- A DC power supply unit executes communications with MIV unit through the converter link.
- There are two types of DC power supply unit according to the regeneration method: power regeneration type (to be referred to as MPS unit, hereafter) and resistor regeneration type (to be referred to as MPR unit, hereafter).
- MPS unit is used in the system that includes a spindle drive motor and MPR unit is used in the system that is consisted only of axis drive motors.
- A DC power supply unit can be connected to more than one MIV unit.



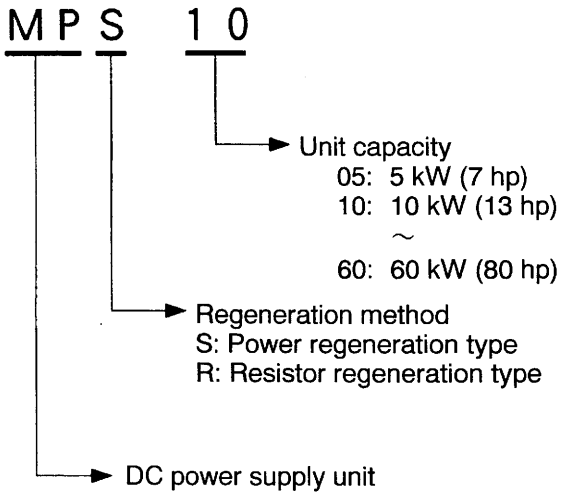
DC Power Supply Unit System Configuration

EIOSPCSA2001R01

2. Classification of DC Power Supply Units

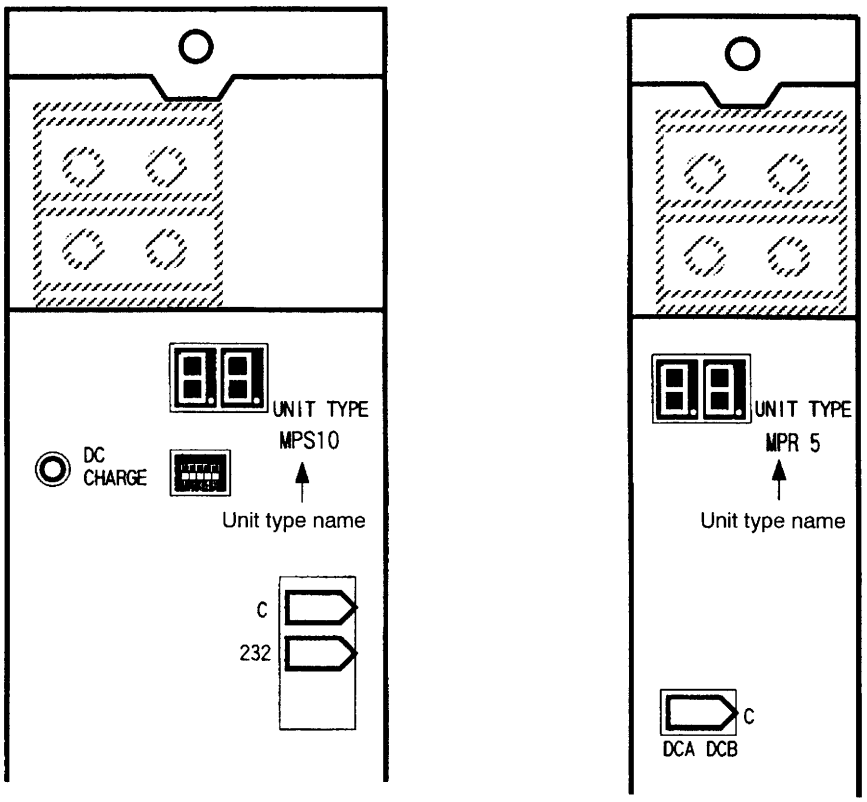
2-1. Designation of DC Power Supply Units

Power supply unit names consist of codes indicating regeneration method and unit capacity.



EIOSPCSA2002R01

DC power supply unit type name is shown at the front of the unit either by seal or printed .characters.
When changing the unit, use the same type.



EIOSPCSA2003R01

2-2. Configuration of Power Supply Units

Component parts of a power supply unit are indicated below.

2-2-1. Power Regeneration Type MPS Unit

(1) MPS unit: power regeneration type
Configuration of I set of power supply unit: PSB + MFP1 card + MPS PU + MPS-ACL

In the table below, indication of "(1)" in the Q'ty column indicates that any of the indicated units should be selected meeting the motor capacity.

Category	Order Name	Q'ty	Order No.	Description
Control board	PSB-MPS10	(1)	1006-2103	Power regeneration type control board for MPS10
	PSB-MPS30	(1)	1006-2104	Power regeneration type control board for MPS20 to 60
Display card	MFP1 CARD	1	1006-2105	Card with status indicator
Power regeneration type unit	MPS10 PU	(1)	1006-2200	DC power supply unit: Continuous power supply capacity 11 kW (15 hp)
	MPS20 PU	(1)	1006-2201	DC power supply unit Continuous power supply capacity 20 kW (27 hp)
	MPS30 PU	(1)	1006-2202	DC power supply unit: Continuous power supply capacity 30 kW (40 hp)
	MPS45 PU	(1)	1006-2203	DC power supply unit: Continuous power supply capacity 45 kW (60 hp)
	MPS60 PU	(1)	1006-2204	DC power supply unit: Continuous power supply capacity 60 kW (80 hp)
AC choke coil	MPS10-ACL	(1)	1006-2285	AC reactor for MPS10 (with Capacitor)
	MPS20-ACL	(1)	1006-2281	AC reactor for MPS20 (with Capacitor)
	MPS30-ACL	(1)	1006-2282	AC reactor for MPS30 (with Capacitor)
	MPS45-ACL	(1)	1006-2283	AC reactor for MPS45 (with Capacitor)
	MPS60-ACL	(1)	1006-2284	AC reactor for MPS60 (with Capacitor)

2-2-2. Resistor Regeneration Type MPR Unit

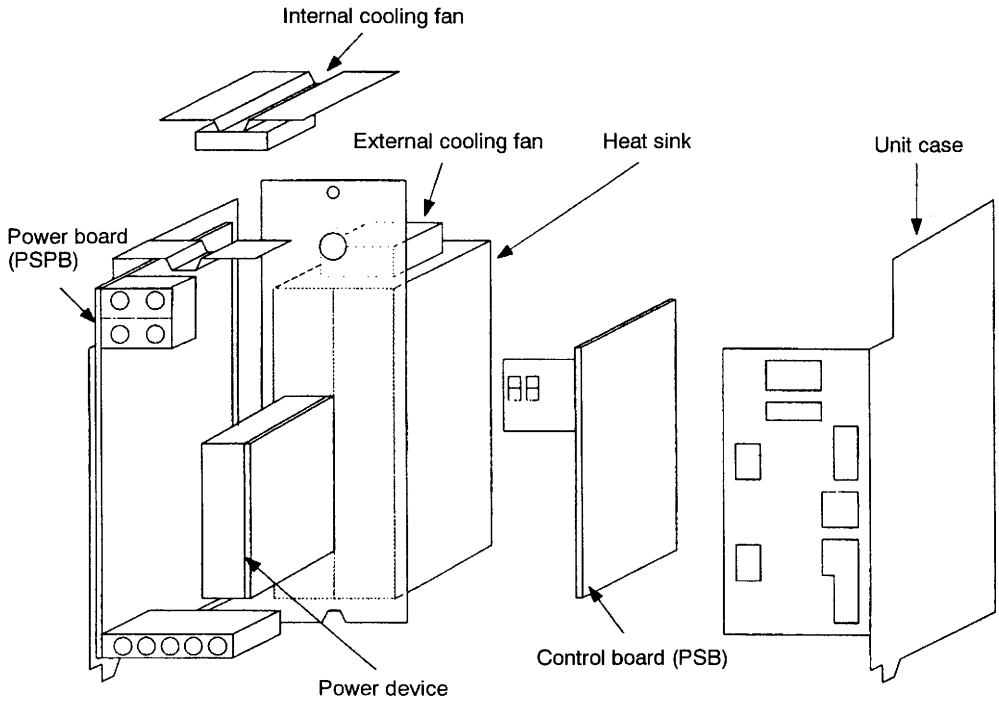
(1) MPR unit: resistor regeneration type
Configuration of 1 set of power supply unit: MPR* PU

Category	Order Name	Q'ty	Order No.	Description
Resistor regeneration type unit	MPR5 PU	(1)	1006-2205	DC power supply unit: Continuous power supply capacity 5 kW (6.7 hp)
	MPR10 PU	(1)	1006-2206	DC power supply unit: Continuous power supply capacity 10 kW (13.3 hp)

2-3. Construction of Power Supply Units

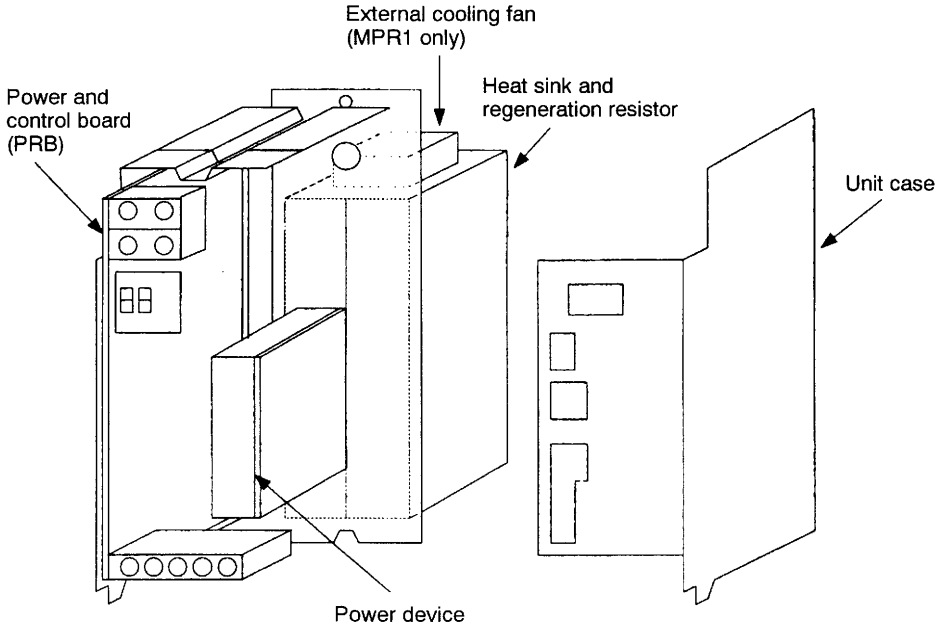
Construction of a power supply unit is shown below

(1) Construction of MPS10



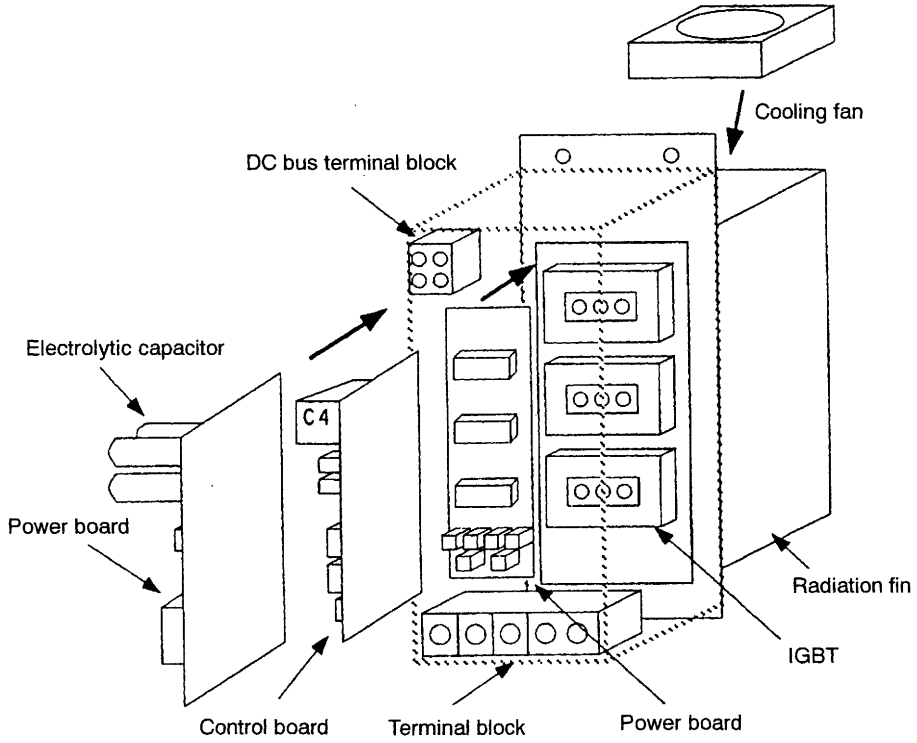
EIOSPCSA2004R01

(2) Construction of MPR10/MPR5



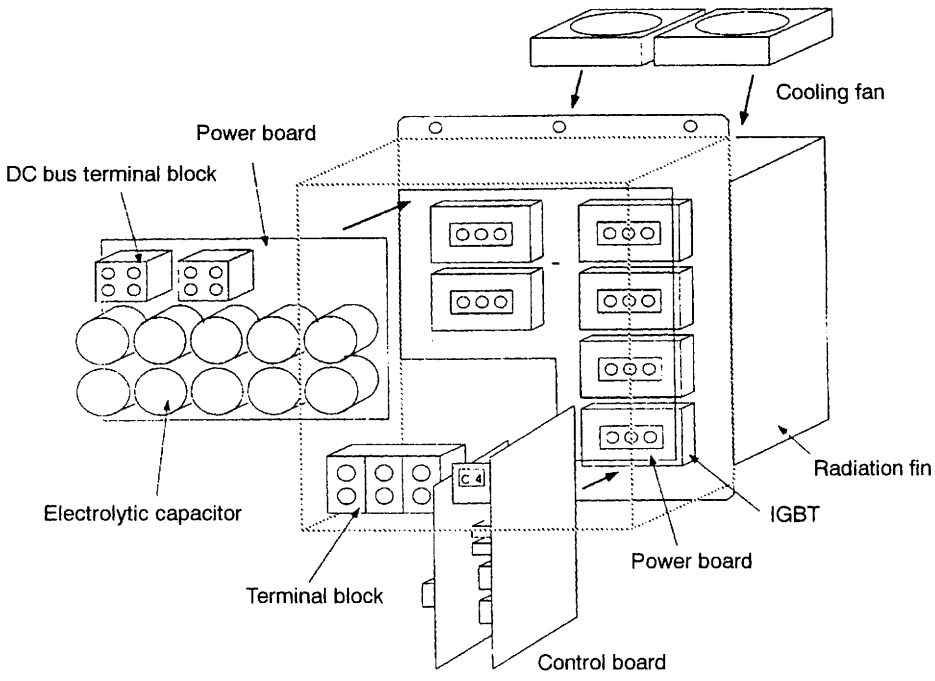
EIOSPCSA2005R01

(3) Construction of MPS20/MPS30



EIOSPCSA2006R01

(4) Construction of MPS45 and MPS60



EIOSPCSA2007R01

3. Cautions on Changing Units

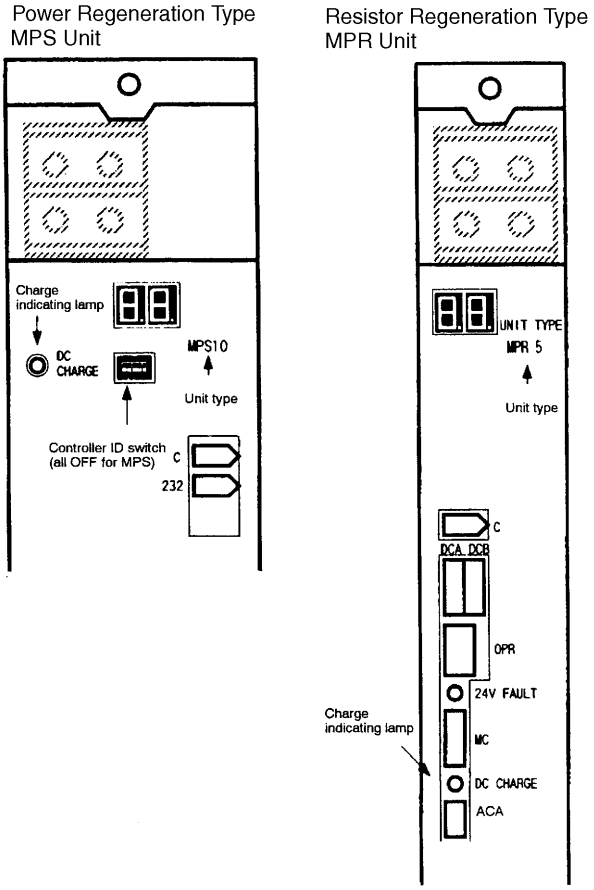
The items that require special attention when changing DC power supply unit are indicated below.

⚠ WARNING

A DC power supply unit (MPS/MPR) has a large-capacitance capacitor in the unit.
When changing MIV unit, shut off the power and wait until the charge indicating lamp goes off. (Wait for at least 2 minutes after shutting off the power.)

(1) For MPS unit, set the controller ID switch at all OFF.
MPR unit does not have a controller ID switch.

(2) Unit type of DC power supply units differs according to the regeneration method and unit capacity.
When changing a unit, make sure to use the unit of the same type.



EIOSPCSA2008R01

⚠ WARNING

High voltage is applied to the upper and lower terminal blocks in the unit.
Do not remove the plastic terminal block cover while the power is on.

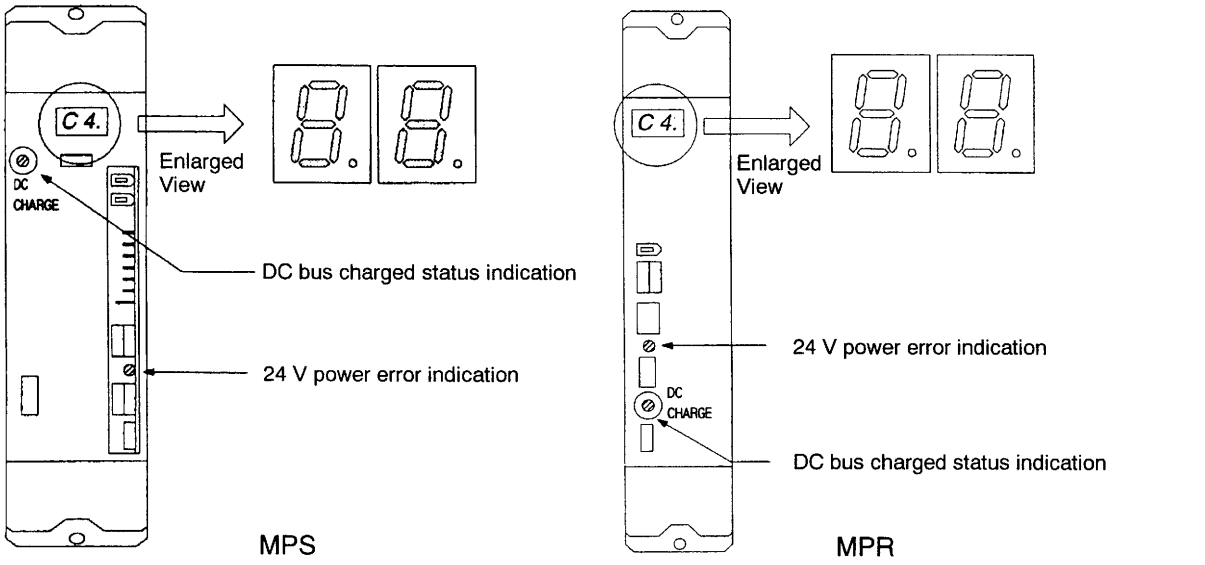
(3) The procedure for removing the plastic cover at the upper and lower terminal blocks is indicated below.

- Plastic cover at the upper terminal block
  After pushing in the lock lightly, tilt the cover 10 deg. to the front and the cover can be taken out upward.
- Plastic cover at the lower terminal block
  After pushing in the lock lightly, turn the cover 90 deg. then pull the cover to the front and the cover can be removed.

4. Indication of Operating Status

A DC power supply unit shows the operating status at the 7-segment LED provided at the front of the unit.
Two display modes (normal operation status display mode and alarm status display mode) are provided and at the occurrence of an alarm, the 7-segment LED displays an error number so that the cause of the alarm can be assumed.

4-1. Arrangement of Status Indicating LED

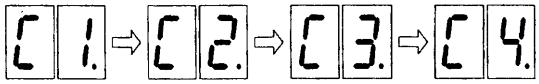
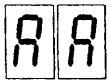


EIOSPCSA2009R01

7-segment LED	:	Indicates the operation status or an error number at the occurrence of an error.
DC bus charged status indication lamp	:	Indicates that the DC bus is being charged.
24 V power error indication lamp	:	Indicates that output of 24 V power supply is suspended due to the occurrence of an error in the power supply circuit. (1) Over voltage of input: Source voltage exceeding 253 Vrms was input. (2) Over current of output: Load current of 24 V power supply was excessively high. (3) Over voltage of output: Output voltage was excessively high due to an error in the internal circuit.

4-2. Contents of Indication

4-2-1. Indication of Normal Operation Status

Status	Indication by 7-segment LED (Example)	Remark
At power ON	 Note 1: A decimal point blinks. Note 2: If an error cocurred with MIV unit, "AA" is displayed (shown below) alternately with the indication shown above. 	

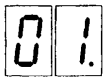
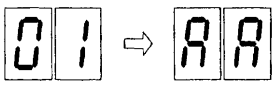
C1 : Indicates the status in which the initialization of the MPS/MPR unit has completed and the unit is waiting for the input of the PWON signal.

C2 : Indicates the status the DC bus is charged. The MPS/MPR unit turns on the magnet switch after the completion of charge, then transfers to the C3 state after it has confirmed the input of correct AC voltage.

C3 : Indicates the status the MPS/MPR unit is waiting for the ORPON signal.

C4 : Indicates the status the MPS/MPR unit has received the OPRON signal and is ready for supplying the power to and MIV unit.

4-2-2. Indication of Alarm Status

Status	Indication by 7-segment LED (Example)	Remark
Error (An error has occurred only with MPS/MPR unit)	 Note 1: A decimal point blinks.	The error number of the error that has occurred is displayed. For error numbers, refer to 4-3 "Error Number Table".
Error (An error has occurred with both MPS/MPR unit and MIV unit.)	 Note 2: The error number of the MPS/MPR unit error and "AA" are displayed alternately.	For error numbers, refer to 4-3 "Error Number Table".

4-3. Error Number Tables

No.	Name	Description	Corrective Action
01	DC voltage alarm Over voltage (OV)	DC bus voltage of the unit raised excessively.	Change the MPS/MPR unit. Change the MIV unit.
02	DC voltage alarm Under voltage (UV)	DC bus voltage of the unit lowered excessively.	Change the MPS/MPR unit. Change the MIV unit.
03	Commercial power source error Open phase (PH)	One or more phases of three phases of the power source lowered excessively. Or, voltage distortion is excessively large.	Check the power source voltage. Change the MPS/MPR unit.
04	Commercial power source error Main circuit power source error	An error occurred with the power source voltage.	Check the power source voltage. Change the MPS/MPR unit.
05	Control power source error (+5 V voltage error)	In the control line, +5 V raised or lowered excessively.	Change the MPS/MPR unit.
06	Control power source error (+12 V voltage error)	In the control line, +12 V raised or lowered excessively.	Change the MPS/MPR unit.
07	Control power source error (-12 V voltage error)	In the control line, -12 V raised or lowered excessively.	Change the MPS/MPR unit.
08	Over current in power cable	Abnormal current flow in the power cable.	Check the power cable. Change the MPS unit.
09	Power device error (IPMF)	An error occurred with the power device.	Check the power cable. Change the MPS unit.
10	Converter bridge short-circuit (IOCR)	Abnormal current flow through the power device.	Check the power cable. Change the MPS unit.
11	Regeneration error	An error occurred with regeneration control.	Check the power cable. Change the MPS/MPR unit.
12	Overload in regeneration (ROH)	Temperature of regeneration resistor raised excessively. (MPR unit only)	Check the operation conditions. Change the MPR unit.
13	Heat sink overheat (FOH)	Temperature of heat sink raised excessively.	Check the operation conditions. Change the MPS/MPR unit.
14	Converter link error	An error occurred with data sending processing in the converter link.	Check the communication cables. Change the MPS/MPR unit.
15	A/D error	An error occurred in A/D conversion.	Change the MPS/MPR unit.
16	Undefined alarm	An alarm not defined occurred.	Change the MPS/MPR unit.
17	Control power supply error (+24 V voltage error)	In the control circuit, +24 V raised or lowered excessively.	Check the control power source voltage . Change the MPS/MPR unit.
18 to 29	(Spare)		

Alarms specific to MPS unit are indicated below.

No.	Name	Description	Corrective Action
30	INT6 loop error	An error occurred with CPU processing.	Change the MPS unit.
31	INT4 loop error	An error occurred with CPU processing.	Change the MPS unit.
32	INT2 loop error	An error occurred with CPU processing.	Change the MPS unit.
33	A/D error	An error occurred with CPU processing.	Change the MPS unit.
34	CPU address error	An error occurred with CPU processing.	Change the MPS unit.
35	DMA address error	An error occurred with CPU processing.	Change the MPS unit.
36	RAM initialization error	An error occurred with CPU processing.	Change the MPS unit.
37	RAM parity error	An error occurred with CPU processing.	Change the MPS unit.
38	NMI interruption	An error occurred with CPU processing.	Change the MPS unit.
39	General illegal instruction	An error occurred with CPU processing.	Change the MPS unit.
40	Slot illegal instruction	An error occurred with CPU processing.	Change the MPS unit.
41	Undefined trap instruction	An error occurred with CPU processing.	Change the MPS unit.
42	Undefined interruption	An error occurred with CPU processing.	Change the MPS unit.
43	DMAC interruption	An error occurred with CPU processing.	Change the MPS unit.
44	ITU interruption	An error occurred with CPU processing.	Change the MPS unit.
45	SCI interruption	An error occurred with CPU processing.	Change the MPS unit.
46	REF interruption	An error occurred with CPU processing.	Change the MPS unit.
47 to 49	(Spare)		

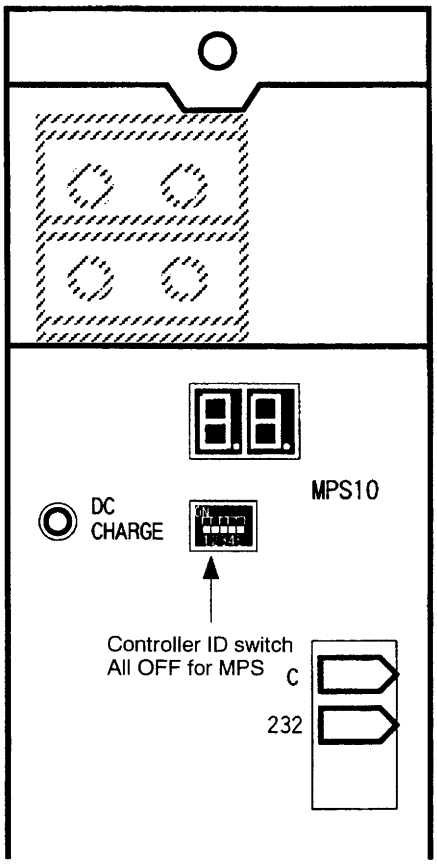
Alarms specific to MPS unit are indicated below.

No.	Name	Description	Corrective Action
50	INT6 loop error	An error occurred with CPU processing.	Change the MPR unit.
51	INT2 loop error	An error occurred with CPU processing.	Change the MPR unit.
52	RAM initialization error	An error occurred with CPU processing.	Change the MPR unit.
53	NMI interruption	An error occurred with CPU processing.	Change the MPR unit.
54	Undefined interruption	An error occurred with CPU processing.	Change the MPR unit.
55	FRT interruption	An error occurred with CPU processing.	Change the MPR unit.
56	8BT interruption	An error occurred with CPU processing.	Change the MPR unit.
57	SCI interruption	An error occurred with CPU processing.	Change the MPR unit.
58	A/D error	An error occurred with CPU processing.	Change the MPR unit.
59	(Spare)		

5. Controller ID Number

Since a DC power supply unit is not connected to the servo link, it is not necessary to set a controller ID number. With MPS unit, however, set the 5-bit controller ID switch to all OFF since the switch is used as the mode selection switch (changing to the adjustment mode).
MPR unit does not have a controller ID switch.

Power Regeneration Type MPS Unit



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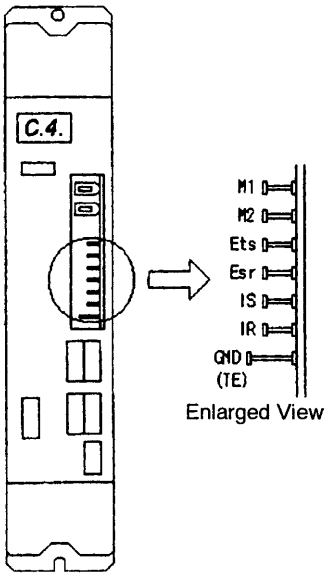
6. Description of Monitor Terminals

MPS unit has the monitor terminals to allow observation of waveform of power source voltage and current by connecting an oscilloscope to these terminals.

6-1. Arrangement of Monitor Terminals



M1: Monitor signal 1
M2: Monitor signal 2
Ets: Power source voltage across L3 and L2 terminals
Esr: Power source voltage across L2 and L1 terminals
IS: Power source current at L2 terminal
IR: Power source current at L1 terminal
GND(TE): Connect common of oscilloscope

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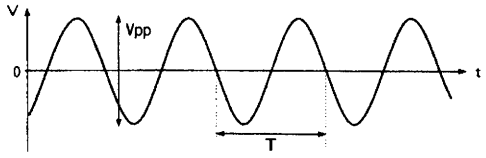
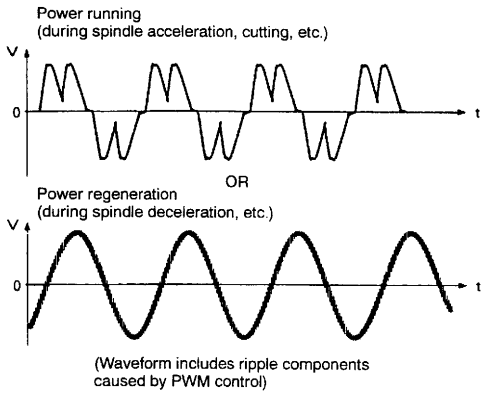
6-2. Monitor Signals

Monitor Terminal	Description	Waveform (Example)
M1	Monitor signal • Output voltage range: -3 V to +3 V (outputs an internal signal)	
M2	Monitor signal • Output voltage range: -3 V to +3 V (outputs an internal signal)	
Ets Esr	Power source voltage • Output voltage range: -2.5 V to +2.5 V • Unit: V (multiplication factor: 1/151) Vpp = 3.8 V for 200 V power source T = 16.7 msec for 60 Hz power source	
IS IR	Power source current • Output voltage range: -2.5 V to +2.5 V • Unit: Current limit value = 1.25 V (Current limit value varies according to the rated capacity of a unit.)	

7. Connection

7-1. System Connection

Refer to 7-1 "System Connection" in Section 1.

7-2. Terminal Block Screw Size

Refer to 8 "DC Power Supply Unit External Dimensions".

7-3. Connectors

(1) Connector name: C
Type (manufacturer): 53460-0611 (Molex)
Pin layout

1	SG	2	SG
3	PSRDY-N	4	SVALM-N
5	PSD	6	PSD-N

(2) Connector name: DCA/B
Type (manufacturer): 1-178137-2 (AMP)
Pin layout

A-1	+24 V	B-1	+24 V
A-2	SG	B-2	SG
A-3	N.C.	B-3	N.C.

(3) Connector name: OPR
Type (manufacturer): 178303-2 (AMP)
Pin layout

B-1	DBRC	A-1	DBRC-N
B-2	PWON	A-2	PWON-N
B-3	OPRON	A-3	OPRON-N

(4) Connector name: MC
Type (manufacturer): 1-179276-2 (AMP)
Pin layout

1	MC
2	MCCOM

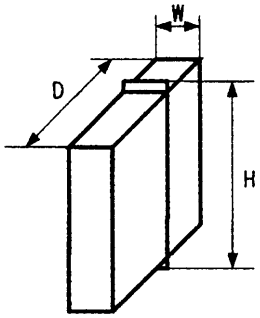
(5) Connector name: ACA
Type (manufacturer): 1-178138-2 (AMP)
Pin layout

1	R
2	S
2	T

M4 terminal block is used for MPS20, MPS30, MPS45 and MPS60.

8. DC Power Supply Unit External Dimensions

8-1. MPS Unit



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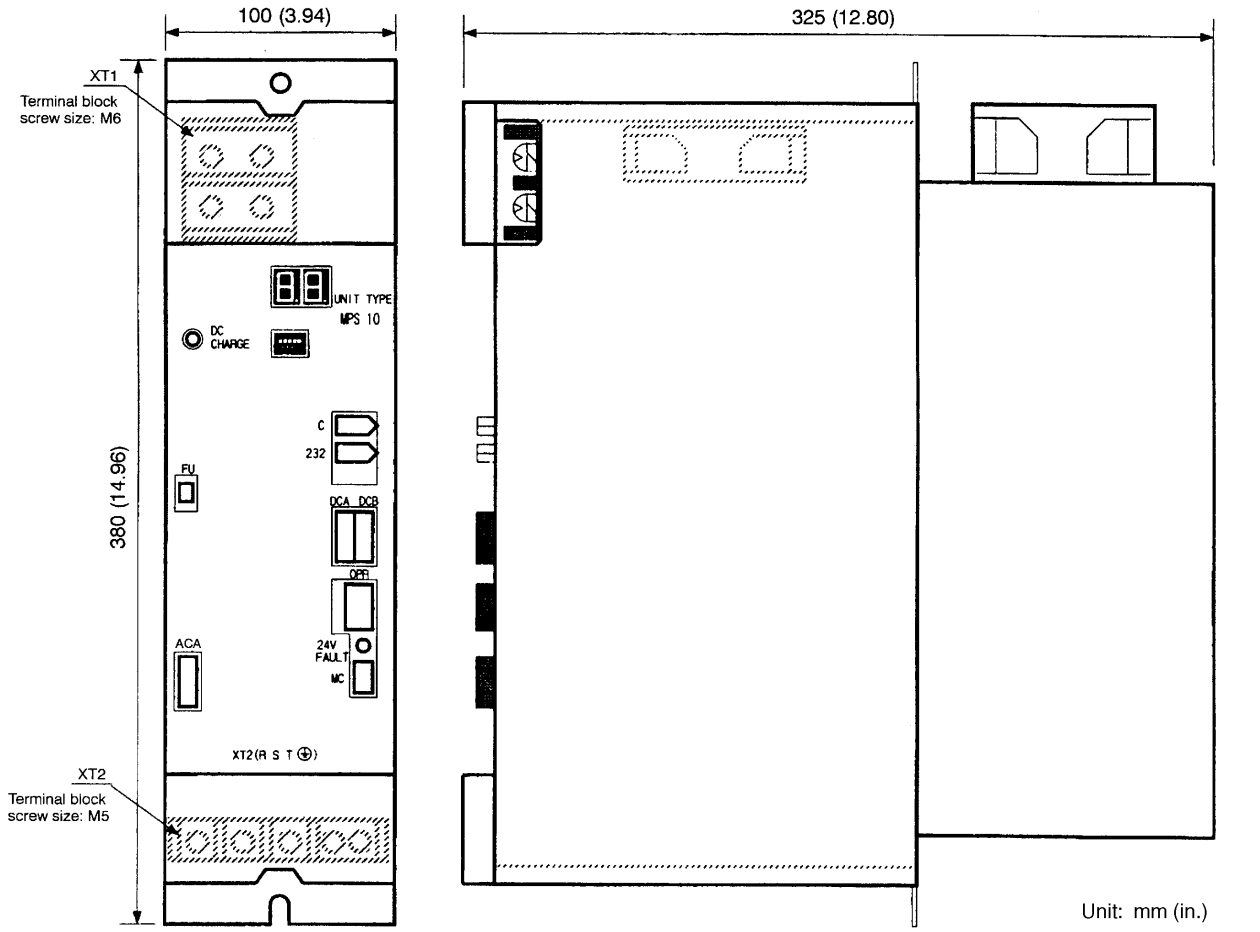
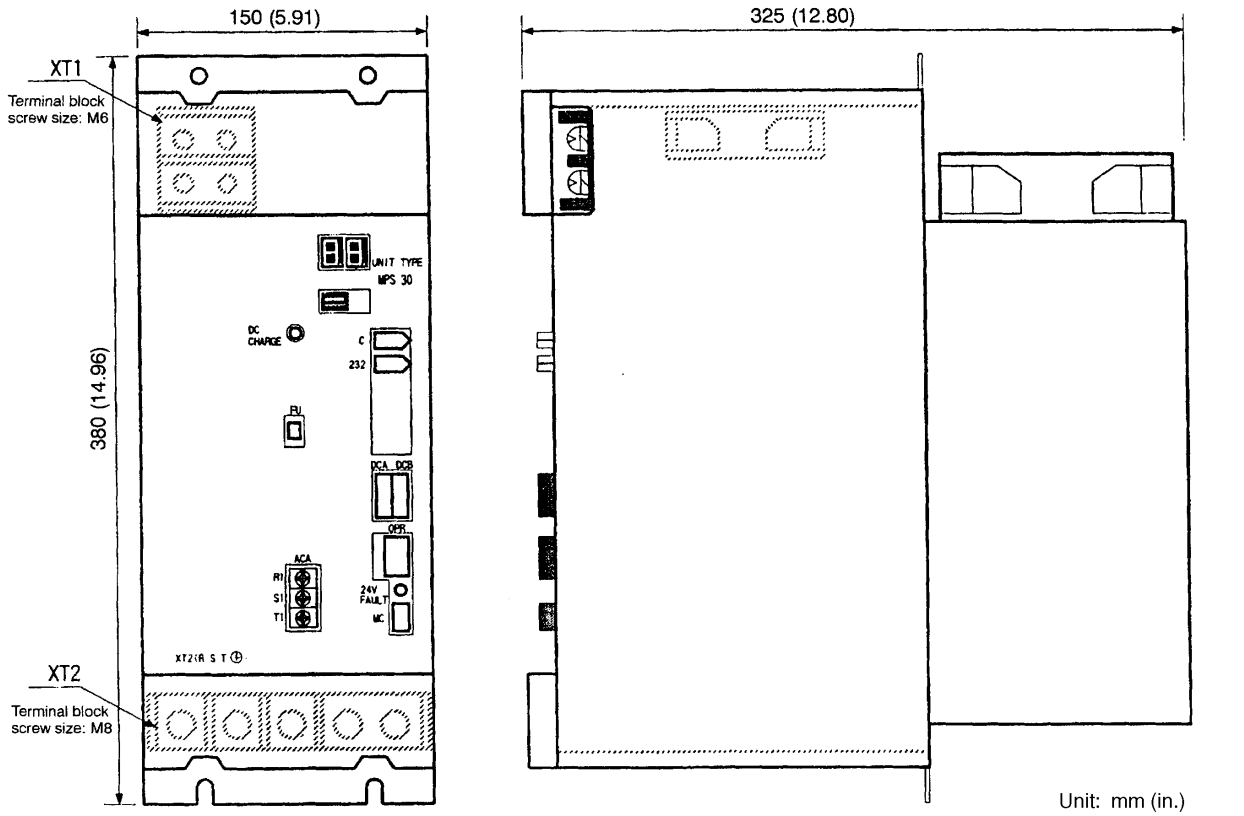
Unit Type	Rated Cont. Capacity {kW (hp)}	External Dimensions H × W × D {mm (in)}	Weight {kg (lb)}
MPS10	10 (13.3)	380 × 100 × 325 (14.96 × 3.94 × 12.79)	7.7 (16.9)
MPS20	20 (27)	380 × 150 × 325 (14.96 × 5.91 × 12.79)	11.8 (26.0)
MPS30	30 (40)	380 × 150 × 325 (14.96 × 5.91 × 12.79)	11.8 (26.0)
MPS45	45 (60)	380 × 300 × 325 (14.96 × 11.8 × 12.79)	25 (55)
MPS60	60 (80)	380 × 300 × 325 (14.96 × 11.8 × 12.79)	25 (55)

8-2. MPR Unit

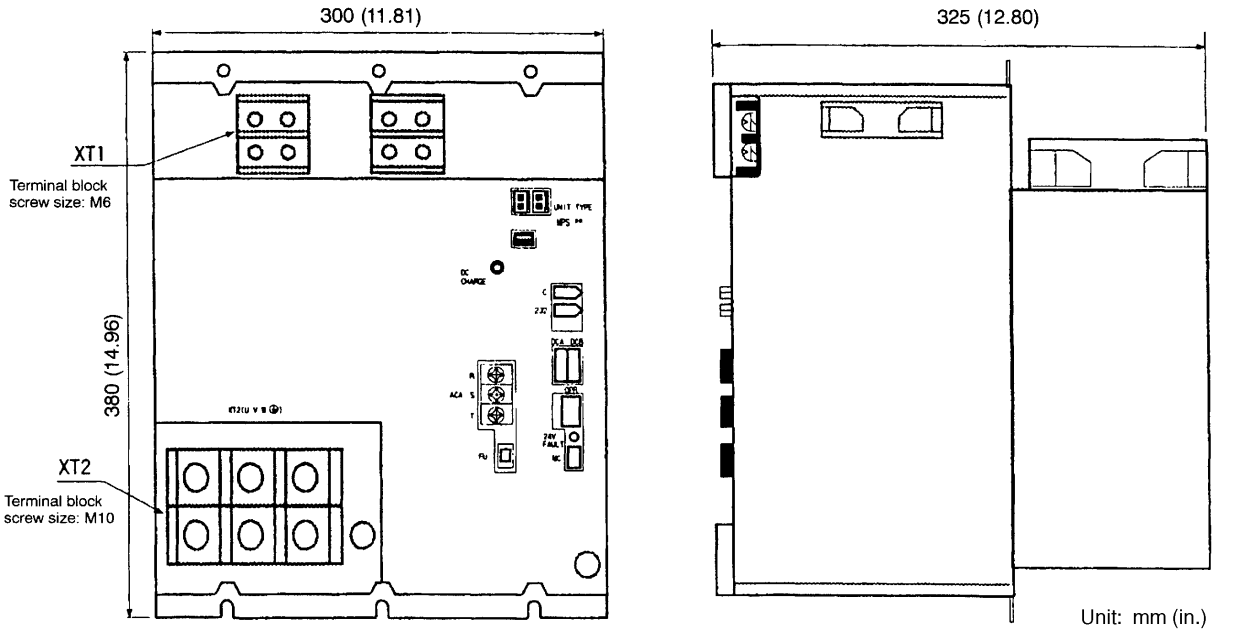
Unit Type	Rated Cont. Capacity {kW (hp)}	External Dimensions H × W × D {mm (in)}	Weight {kg (lb)}
MPR5	5 (6.7)	380 × 60 × 325 (14.96 × 2.36 × 12.79)	5.4 (11.9)
MPR10	10 (13.3)	380 × 100 × 325 (14.96 × 3.94 × 12 79)	8.0 (17.6)



MPS Unit: Power Regeneration Type
Unit Type: MPS10
Unit Weight: 7.7 kg (16.94 lb)



MPR Unit: Resistor Regeneration Type
Unit Type: MPS20 to 30
Unit Weight: 11.8 kg (26.0 lb)



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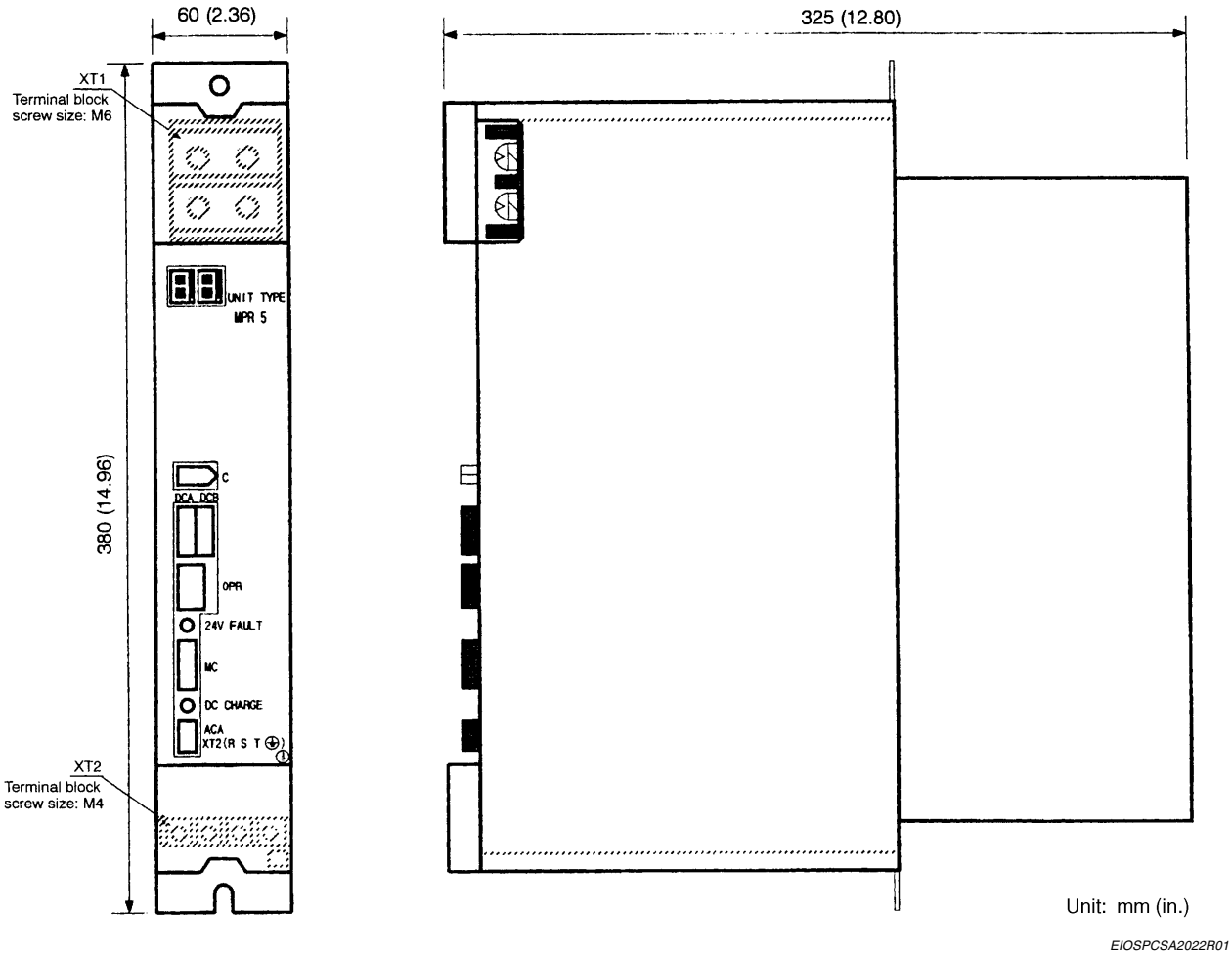
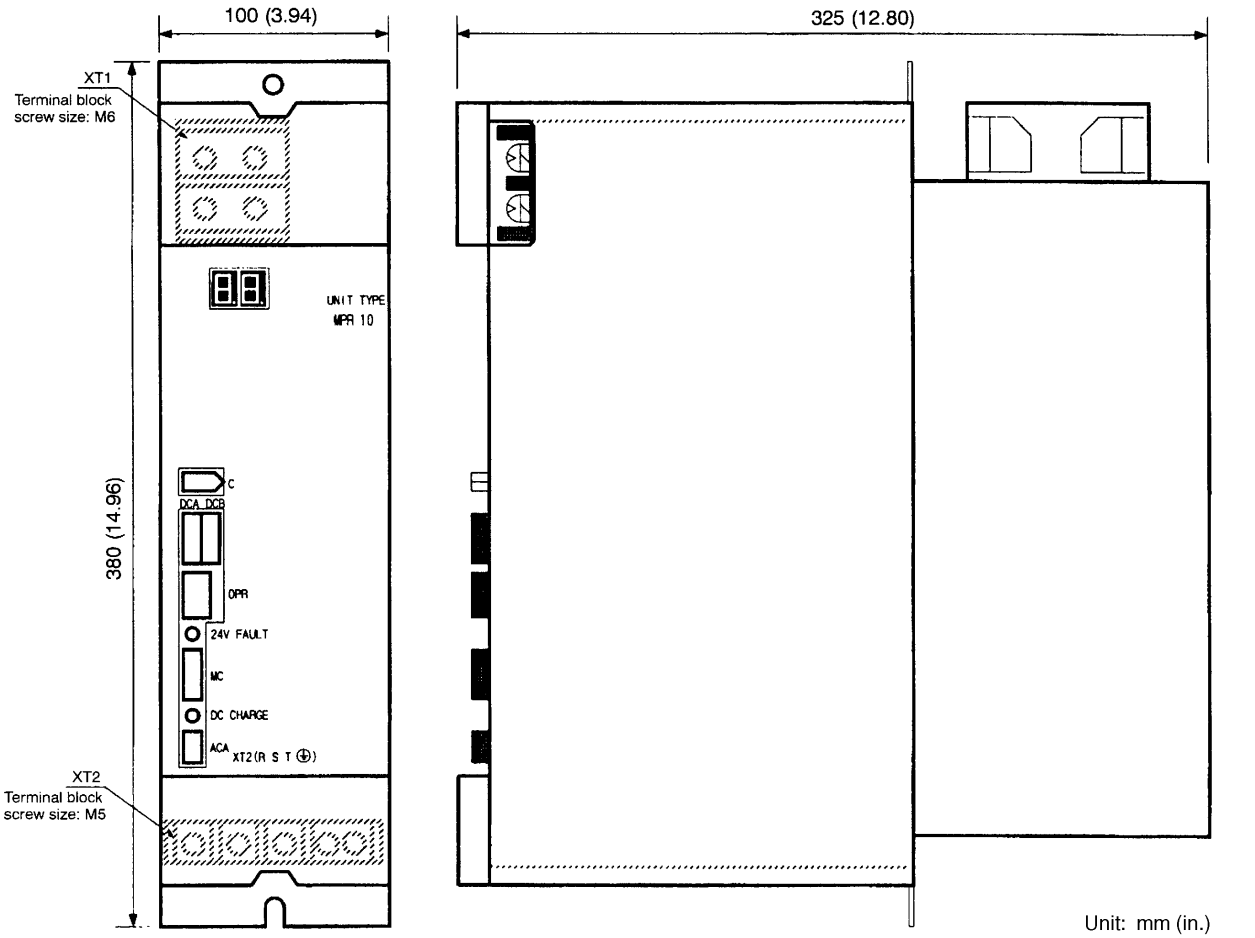
MPR Unit: Resistor Regeneration Type
Unit Type: MPS45 to 60
Unit Weight: 25 kg (55 lb)



MPR Unit: Resistor Regeneration Type
Unit Type: MPR5
Unit Weight: 5.4 kg (11.9 lb)



MPR Unit: Resistor Regeneration Type
Unit Type: MPR10
Unit Weight: 8.0 kg (17.6 lb)

SECTION 3 Appendix 1. Procedure for Replacing External Cooling Fan

Follow the procedure below to replace the external cooling fan of the MIV unit or MPS unit.

1. Diagnosis of Trouble

If the external cooling fan is broken down, the temperature of the heat sink rises abruptly and the following alarms are issued. (See "4. Indication of Operating Status" in Section 1 and Section 2.)

With MIV06 or MIV08	:	Inverter bridge error (The 7-segment LED shows "EL" and "13" alternately.)
With MIV15 to MIV45	:	Inverter overheat (The 7-segment LED shows "AL" and "05" alternately.)
With MPS10	:	Power element error (The 7-segment LED shows "09.")
With MPS20 to MPS60	:	Heat sink overheat (The 7-segment LED shows "13.")

When these alarms occur, check if the external cooling fan rotates in the power-on state. If it is stopped though the power is turned on, replace the external cooling fan in the following procedure.

2. Part Number

The main body of the cooling fan, drip-proof bushing and connector machined in advance are registered as a set with the following part numbers so that the external cooling fan can be replaced easily.
The external cooling fan varies according to the unit; prepare the external cooling fan matching the broken unit.

Unit	Part No.
MIV06, MIV08, MPS10	E1310-528-053
MIV15, MIV22, MPS20, MPS30	E1310-528-054
MIV30, MIV45, MPS45, MPS60	E1310-528-055

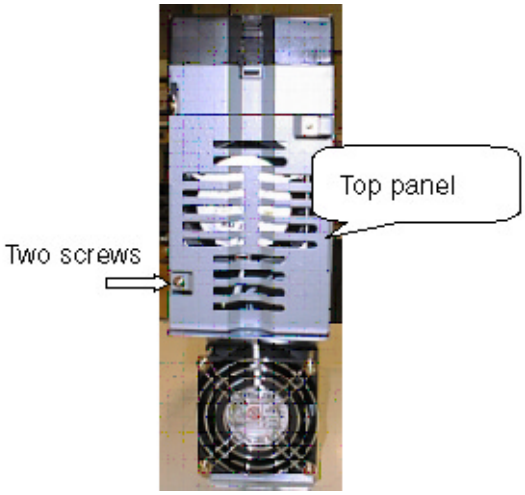
3. Replacement Procedure

The external cooling fan is installed to the heat sink located at the back of the unit. (Refer to Section 1, "2-3. Construction of MIV Unit" and Section 2, "2-3 Construction of Power Supply Unit.")
By following the instructions given in "3. Cautions on Changing Units" in Section 1 and 2, remove the broken unit from the control box and replace the external cooling fan in the following procedure.

3-1. Procedure for Replacing MIV06 to MIV22 and MPS10 to MPS30 Fan

Procedure :

1 Loosen the two screws fixing the top panel at the upper part of the unit to open the top panel.



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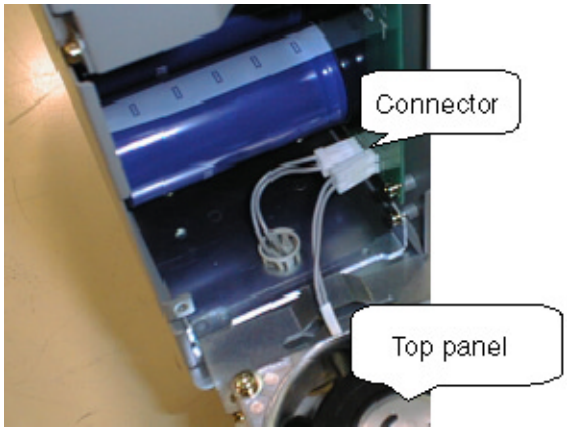
2 Disconnect the internal cooling fan and external cooling fan motor cable connectors and remove the top panel having been opened.
The figure below shows the connector of MIV08 (similar to MIV06 and MPS10).



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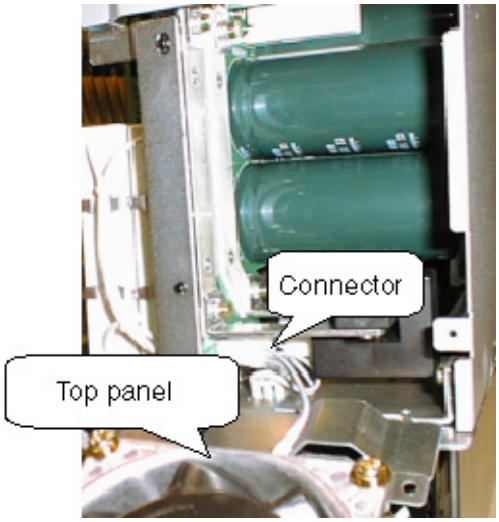
The figure below shows the connector of MPS20 (similar to MIV15, MIV22 and MPS30).



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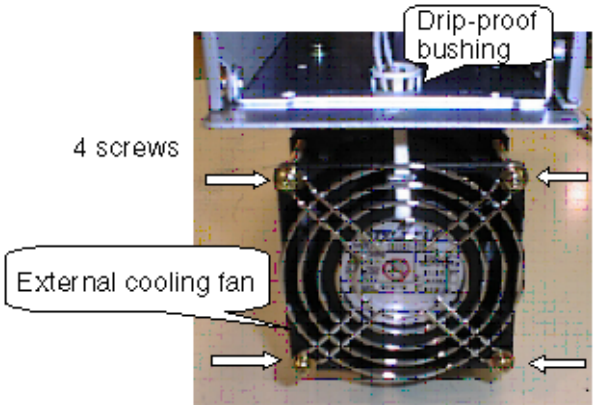
3 Loosen four screws to remove the external cooling fan from the heat sink.



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4 Remove the drip-proof bushing and remove the set of external cooling fan.
From now, reverse the procedure to install the set of new external cooling fan.

3-2. Procedure for Replacing MIV30, MIV45, MPS45 and MPS60 Fan

Procedure :

1 Remove the DC bus terminal block cover and front panel.

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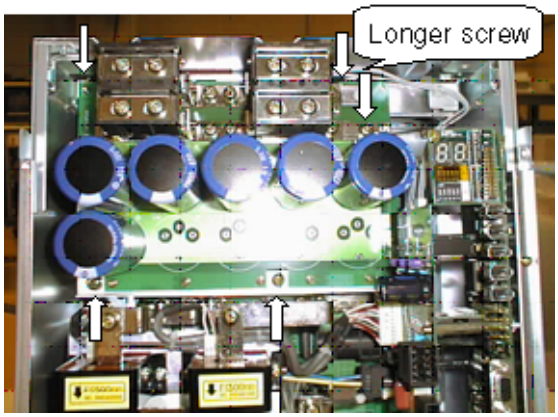
2 Loosen five screws to remove the DC bus board.
(Two of the five screws have different length; be careful during assembly of new fan.)



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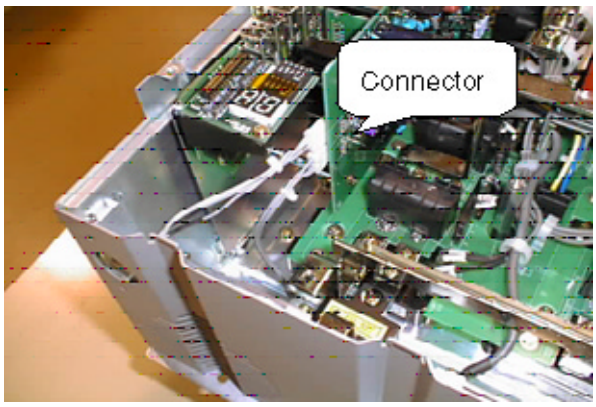
3 Disconnect the fan motor cable connector from the board.



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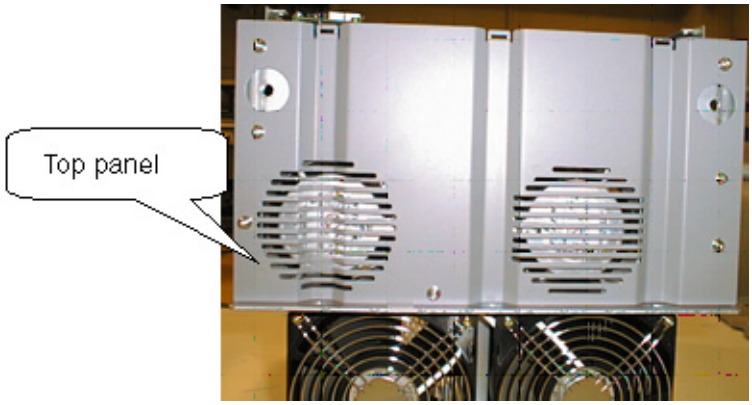
4 Remove the top panel.



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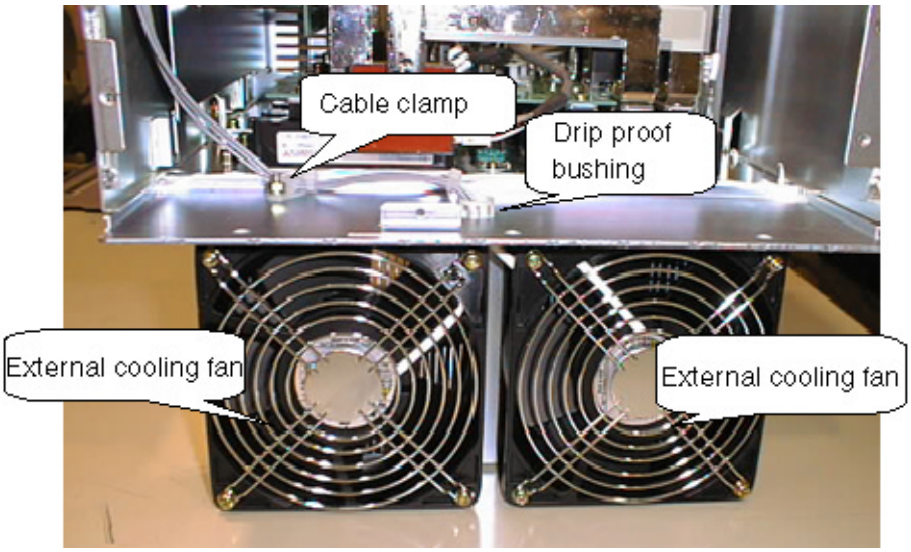
5 Loosen the M4 nut to disconnect the cable clamp.



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6 Loosen four screws to remove each of the external cooling fans from the heat sink.

7 Remove the drip-proof bushing to remove the set of external cooling fan.
Reverse the procedure to install the set of new external cooling fans and reassemble the unit.

4. Cautions

The drip-proof bushing of MIV06, MIV08, or MPS10 used for the machine delivered before June 1999 is fixed with silicone rubber for the enhancement of water tightness of the motor cable port of the external cooling fan. (Sufficient water tightness has been verified without silicone rubber and silicone rubber is not used now.)
For this reason, silicone rubber must be removed at the above-mentioned drip-proof bushing during replacement using sand paper or the like. (If old silicone rubber remains, water tightness may deteriorate substantially after replacement.)

LIST OF PUBLICATIONS

Manual Name: DRIVE UNIT MOTION CONTROL SYSTEM (MCS)/(MCSII) MAINTENANCE MANUAL

Manual No.: SEH4-001-R**

Edition	Date	Revision
01	Apr. '01	First
05	Mar. '03	5th