MITSUBISHI ELECTRIC

TRANSISTORIZED INVERTER

-INSTRUCTION MANUAL-

12-BIT DIGITAL INPUT

FR-A5AX

Thank you for choosing the Mitsubishi transistorized inverter option unit.
This instruction manual gives handling information and precautions for use of this equipment. Incorrect handling might cause an unexpected fault. Before using the equipment, please read this manual carefully to use the equipment to its optimum.
Please forward this manual to the end user.

This section is specifically about safety matters

Do not attempt to install, operate, maintain or inspect this product until you have read through this instruction manual and appended documents carefully and can use the equipment correctly. Do not use this product until you have a full knowledge of the equipment, safety information and instructions.
In this instruction manual, the safety instruction levels are classified into "WARNING" and "CAUTION".

⚠ **WARNING**	**Assumes that incorrect handling may cause hazardous conditions, resulting in death or severe injury.**
⚠ **CAUTION**	**Assumes that incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause physical damage only.**

Note that the CAUTION level may lead to a serious consequence according to conditions. Please follow the instructions of both levels because they are important to personnel safety.

SAFETY INSTRUCTIONS

1. Electric Shock Prevention

⚠ WARNING

- **While power is on or when the inverter is running, do not open the front cover. You may get an electric shock.**
- **Do not run the inverter with the front cover removed. Otherwise, you may access the exposed high-voltage terminals and charging part and get an electric shock.**
- **If power is off, do not remove the front cover except for wiring or periodic inspection. You may access the charged inverter circuits and get an electric shock.**
- **Before starting wiring or inspection, switch power off, wait for more than 10 minutes, and check for no residual voltage with a tester or the like.**

⚠ WARNING

- Any person who is involved in the wiring or inspection of this equipment should be fully competent to do the work.
- Always install the option unit before wiring. Otherwise, you may get an electric shock or be injured.
- Handle this option unit with dry hands to prevent an electric shock.
- Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Otherwise, you may get an electric shock.

2. Injury Prevention

⚠ CAUTION

- Apply only the voltage specified in the instruction manual to each terminal to prevent burst, damage, etc.
- Ensure that the cables are connected to the correct terminals. Otherwise, burst, damage, etc. may occur.
- Always make sure that polarity is correct to prevent burst, damage, etc.
- While power is on or for some time after power-off, do not touch the inverter as it is hot and you may get burnt.

3. Additional instructions

Also note the following points to prevent an accidental failure, injury, electric shock, etc.:

(1) Transportation and mounting

⚠ CAUTION

- Do not install or operate the option unit if it is damaged or has parts missing.
- Do not stand or rest heavy objects on the product.
- Check that the mounting orientation is correct.
- Prevent screws, metal fragments or other conductive bodies or oil or other flammable substance from entering the inverter.

(2) Test operation and adjustment

⚠ CAUTION

- Before starting operation, confirm and adjust the parameters. A failure to do so may cause some machines to make unexpected motions.

(3) Usage

⚠ WARNING
● Do not modify the equipment.

⚠ CAUTION
● When parameter clear or all parameter clear is performed, each parameter returns to the factory setting. Re-set the required parameters before starting operation. ● For prevention of damage due to static electricity, touch nearby metal before touching this product to eliminate static electricity from your body.

(4) Maintenance, inspection and parts replacement

⚠ CAUTION
● Do not test the equipment with a megger (measure insulation resistance).

(5) Disposal

⚠ CAUTION
● Treat as industrial waste.

(6) General instruction

All illustrations given in this manual may have been drawn with covers or safety guards removed to provide in-depth description. Before starting operation of the product, always return the covers and guards into original positions as specified and operate the equipment in accordance with the manual.

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1.PRE-OPERATION INSTRUCTIONS

1.1 Unpacking and Product Confirmation

Take the option unit out of the package, check the unit name, and confirm that the product is as you ordered and intact.
Functions arailable differ between FR-A500(L)/F500(L) series and FR-V500 series, always check before using.

- SERIAL number check
  This product may be used with the FR-A520-0.4K to 22K manufactured in and after July 1997. Any of the models may be used with this unit if its SERIAL number indicated on the rating plate and package has "J77○○○○○○" or later version.
  SERIAL is made up of 1 version symbol and 8 numeric characters indicating year, month, and control number as shown below.

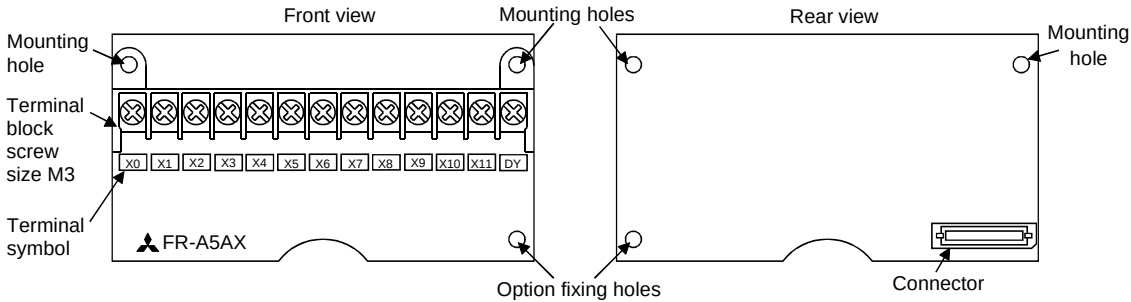
J	7	7	○○○○○○
Symbol	Year	Month	Control number
SERIAL number			

1.2 Packing Confirmation

Make sure that the package includes the following

- Instruction manual.....1
- Mounting screws M3 × 10 2

1.3 Structure



2.INSTALLATION

2.1 Pre-Installation Instructions

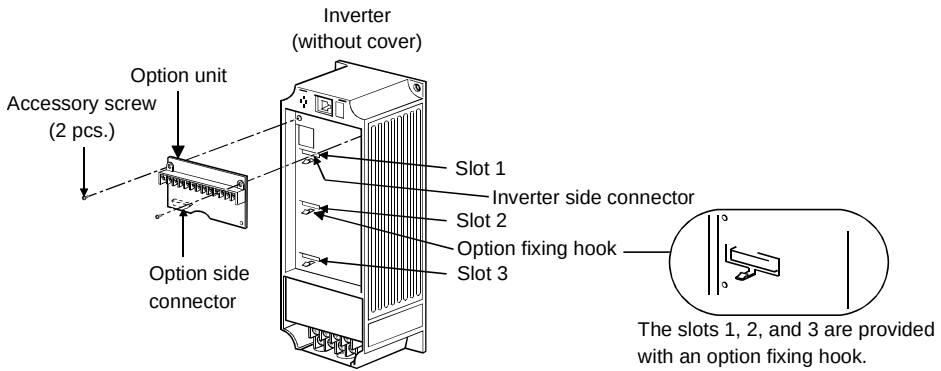
Make sure that the input power of the inverter is off.

⚠ CAUTION
⚠ **With input power on, do not install or remove the option unit. Otherwise, the inverter and option unit may be damaged.**

2.2 Installation Procedure

(1) Securely insert the connector of the option unit far into the connector of the inverter. At this time, fit the option fixing holes snugly. For the position of slot, refer to the next page.
Also be sure to fit the unit into the option fixing hook (For the FR-A500(L)/ FR-F500(L) series, it is available in Aug., 2000).

(2) Securely fix the option unit to the inverter on both sides with the accessory mounting screws. If the screw holes do not match, the connector may not have been plugged snugly. Check for loose plugging.



CAUTION

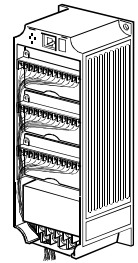
1. **Only one type of option per inverter may be used. When two or more options are mounted, priority is in order of slots 1, 2 and 3, the options having lower priority are inoperative.**
2. **When the inverter cannot recognize that the option is mounted, it displays the option error. The errors shown differ according to the mounting slots 1, 2, 3.**

Mounting Position	Error Display
Slot 1	E.OP1
Slot 2	E.OP2
Slot 3	E.OP3

2.3 Wiring

Route the wires so that they do not take up a lot of space in the control circuit terminal block of the option unit. During wiring, do not leave wire off-cuts in the inverter. They may cause a fault, failure or malfunction. Use the space on the left side of the control circuit terminal unit to route the wires.

Cable routing



REMARKS

The wires with large gaze may not be connected to the terminal block. When connected in parallel, all wires may not fit in the wiring space due to the increased number of wires. In such cases, perform wiring by using a junction terminal block.

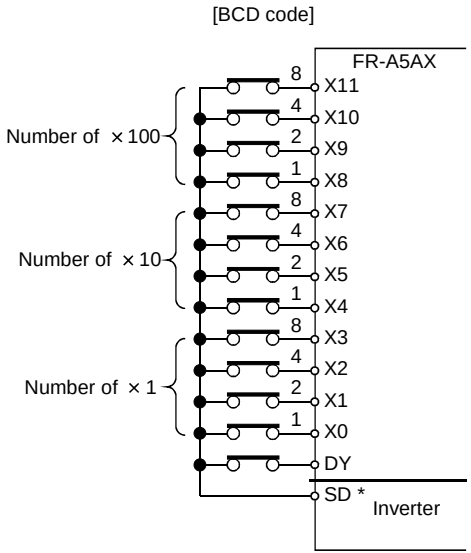
⚠ CAUTION

⚠ When installing the inverter front cover, the cables to the inverter's control circuit terminals and option terminals should be routed properly in the wiring space to prevent them from being caught between the inverter and its cover.

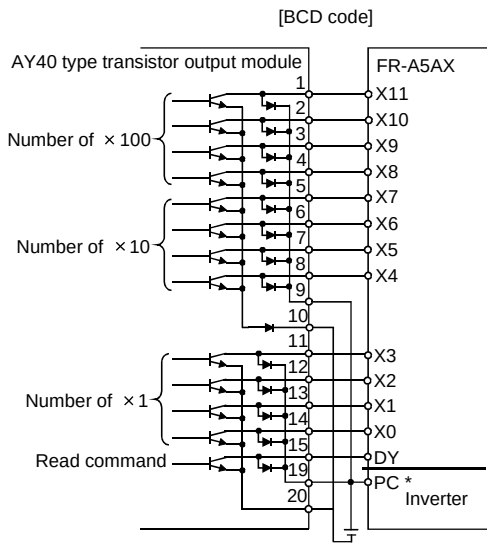
3.12-BIT DIGITAL INPUT

3.1 Wiring Examples

(1)Relay contact signal input



(2)Open collector signal input



REMARKS

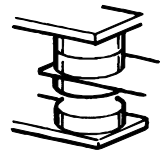
AY40 type unit requires 24VDC power.

(For sink logic)

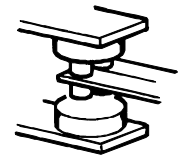
*: Use terminals SD or PC on the inverter.

REMARKS

1. As the input signals are at low level, use two parallel micro signal contacts or a twin contact for relay contact inputs to prevent a contact fault.



Micro signal contancts



Twin contancts

2. A transistor of the following specifications should be selected for the open collector signal: Electrical characteristics of the transistor used
   - $I_C \geq 10mA$
   - Leakage current: 100μA maximum
   - $V_{CE} \geq 30V$
   - If $I_C \geq 10mA$, $V_{CE\ (sat)}$ voltage is 3V maximum
3. The control logic is the same as that of the inverter (factory-set to sink). When the logic of the inverter is changed to source, the option logic also switches to source. For details on changing the control logic, refer to the inverter instruction manual.

3.2 Terminals

Terminal Symbol	Description
X0 to X11	Digital signal input terminals (frequency/speed setting signal terminals) Used to input a 3-digit BCD (999 maximum) (refer to page 6) or 12-bit binary (FFFH maximum) relay contact or open collector signal.
DY	Data read timing input signal Used when a digital signal read timing signal is necessary. Data is only read while the DY signal is on. By switching the DY signal off, the X0 to X11 data before signal-off is retained. (Refer to page 12.)
SD	Common terminal (sink) Common terminal for digital and data read timing signals. This terminal is the SD terminal of the inverter.
PC	External transistor common terminal (source) When connecting the transistor output (open collector output) of a programmable controller (PC), etc., connect the external power common (+) to this terminal to prevent a fault occurring due to leakage current. When you have selected the source logic, this terminal is used as a common terminal. This terminal is the PC terminal of the inverter.

4.PARAMETERS

4.1 Parameter List

This option unit does not function if the parameter values are factory setting values. Set the following parameter values according to the application:

4.1.1 FR-A500(L)/F500(L) Series

Parameter Number	Function name		Setting Range	Factory Setting	Setting Increments
300	BCD code input	Bias	0 to 400Hz	0Hz	0.01Hz
301		Gain	0 to 400Hz, 9999	60Hz	0.01Hz
302	Binary input	Bias	0 to 400Hz	0Hz	0.01Hz
303		Gain	0 to 400Hz, 9999	60Hz	0.01Hz
304	Selection of digital input type and analog compensation input enable/disable		0, 1, 2, 3, 9999	9999	1
305	Data read timing signal on-off selection		0, 1	0	1

4.1.2 FR-V500 Series

Parameter Number	Function name		Setting Range	Factory Setting	Setting Increments
300	BCD code input	Bias	0 to 3600r/min	0r/min	0.1r/min
301		Gain	0 to 3600r/min, 9999	1500r/min	1r/min
302	Binary input	Bias	0 to 3600r/min	0r/min	0.1r/min
303		Gain	0 to 3600r/min, 9999	1500r/min	1r/min
304	Selection of digital input type and analog compensation input enable/disable		0, 1, 2, 3, 9999	9999	1
305	Data read timing signal on-off selection		0, 1	0	1
329	Digital input unit selection		0, 1, 2	1	1
447	Digital trque command bias		0 to 400%	1%	0%
448	Digital trque command gain		0 to 400%	1%	150%

REMAKS

- For Pr.329, write is disabled during operation even when "2" is set in Pr.77. When changing the parameter setting, stop the operation.
- Binary input. . . . . load input data in hexadecimal
  BCD code input . . . load input data in decimal

4.2 Parameter Setting

(1) Input selection [Pr.304 "Selection of digital input type and analog compensation input enable / disable."]
You can select the digital input signal type and whether compensation for digital input by analog input is enabled or not. When the setting is "9999" (factory setting), the 12-bit digital input is invalid.

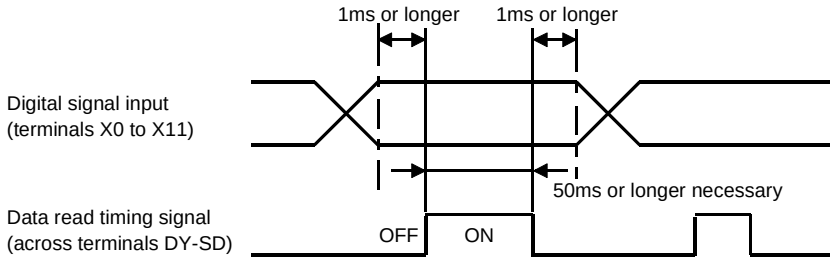
Digital Input Signal Type	Analog Compensation Input*	
	Compensation disable	Compensation enable
BCD code input	0	2
Binary input	1	3

*: The analog compensation input signal is entered across inverter 1-5. For the setting of "0" or "1", the analog compensation input is not accepted.

(2) Data read timing signal on-off selection (Pr.305)

Pr.305 setting	Description
0	The set frequency data (set speed data) entered from the digital signal input terminals is always imported independently of whether the DY signal is on or off. Digital signal input directly changes output frequency.
1	The set frequency data (set speed data) entered from the digital signal input terminals is imported only when the DY signal is on. The set frequency data (set speed data) is not imported when the DY signal is off. Therefore, if the input status of the X0-X11 signal changes, the set frequency data (set speed data) before off of the DY signal is valid.

● How to use DY signal



(3) Bias adjustment [Pr.300], [Pr.302]

Bias adjustments can be made for the digital input signal.

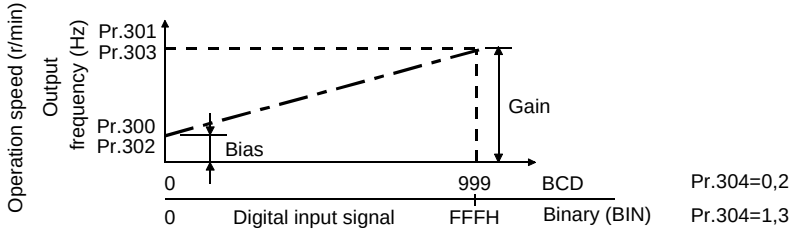
Set the set frequency (set speed) at the digital input of 0.

•BCD code input. . . . . Set the output frequency in Pr.300.

•Binary input. . . . . Set the output frequency in Pr.302.

(4) Gain adjustment [Pr.301], [Pr.303]
The gain may be set in either of the following two ways:

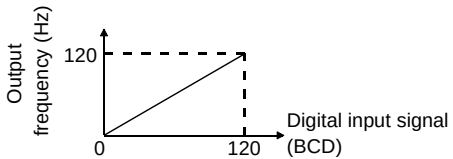
- How to set the output frequency at the input signal of 999 (BCD code) or FFFH (binary) (The factory setting is 60Hz (1500r/min. for the FR-V500 series) for this input signal.)



CAUTION

The maximum output frequency (maximum operation speed) for operation with the digital input is the "gain" value set in Pr.301 and Pr.303.
To set the maximum output frequency to 60Hz or more with the FR-A500(L)/F500(L) series and the maximum operation speed to 1500r/min or more with the FR-V500 series, change the "gain" from the control panel or parameter unit.

- How to set the BCD code or binary value as the output frequency (output speed) setting
When "9999" is set in Pr.301 (BCD code) or Pr.303 (binary), the digital input value is set (unchanged) as the output frequency (output speed).
(For example, to set the output frequency to 120Hz at the BCD code input of "120")



REMAKS

When this setting method is used, "bias" setting (Pr.300 or Pr.302) cannot be made.

(5) Digital input unit selection (Pr.329) (available with the FR-V500 series only)
When "9999" is set in Pr.301(BCD code input gain) or Pr.303(binary input gain), the increment when the digital signal is set as output speed can be set.

Pr.329 setting	Input Value Increments
0	0.1r/min
1 (factory setting)	1r/min
2	10r/min

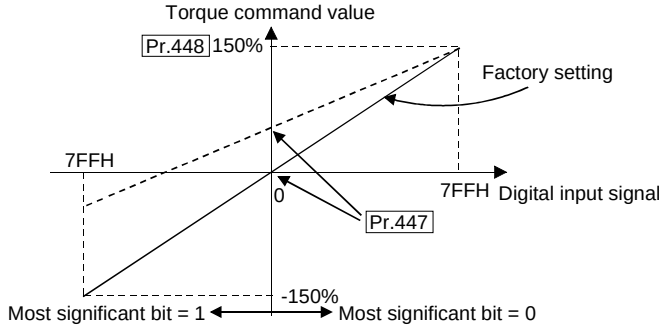
REMARKS

When the values other than "9999" are set in Pr.301 or Pr.303, Pr.329 is made invalid.

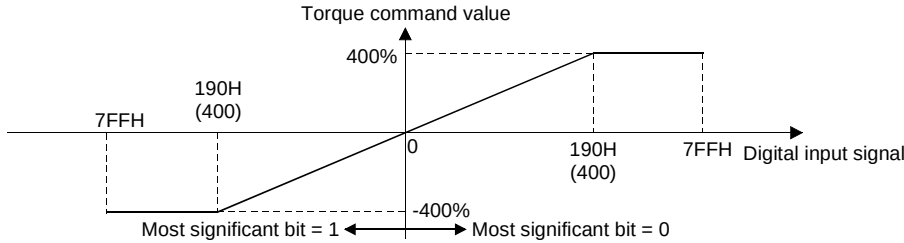
<Example>
Pr.329=0
BCD code = 111 → 11.1r/min
binary = 100H (256 in the decimal system) → 25.6r/min
Pr.329=1
BCD code = 111 → 111r/min
binary = 100H (256 in the decimal system) → 256r/min
Pr.329=2
BCD code = 111 → 1110r/min
binary = 100H (256 in the decimal system) → 2560r/min

(6) Digital torque command (Pr.447, Pr.448) (available with the FR-V500 series only)

- When "9999" is set in Pr.304 and "4" in Pr.804 "torque command selection" (The parameter setting can be made only when the FR-A5AX is mounted on the inverter.), digital torque command of the FR-A5AX (12bit) is made valid.
  The input signal uses 11 lower bits as torque command and the most significant bit as sign. (When the most significant bit is 1, torque command value is negative.)



- When Pr.448 = "9999" , digital input value is torque command value.



4.3 Instructions

(1) Acceleration/deceleration time
When the frequency is set with the digital input signal, the acceleration/deceleration time is the period of time required to reach the "acceleration/deceleration reference frequency" set in Pr. 20. This is the same as when using the analog signal input.

(2) There are the following restrictions on the digital input signal:
- When the signal is used to enter a BCD code, 0AH to 0FH entries are ignored during operation and the previous inputs are used to continue operation.

(3) When the 12-bit digital input is valid (Pr. 304 setting is other than "9999"), the signals below are made invalid.
1) FR-A500(L)/F500(L) series
Terminal assignment of input signal is determined according to Pr.180 to Pr.186 (input terminal function selection).

Signal Name	Description	Remarks
RH/RM/RL/REX	Multi-speed selection	
AU	Current input selection	
CS	Selection of automatic restart after instantaneous power failure	Valid if the Pr. 57 setting is other than "9999"
2	Frequency setting (voltage signal)	
1	Frequency setting auxiliary input	Valid if the Pr.304 setting is "2 or 3"
4	Current input	

2) FR-V500 series

Terminal assignment of input signal is determined according to Pr.180 to Pr.183 and Pr.187 (input terminal function selection).

Signal Name	Description
RL	Low speed operation command
RM	Middle speed operation command
RH	High speed operation command
RL	Remote setting (setting clear)
RM	Remote setting (deceleration)
RH	Remote setting (acceleration)
REX	15-speed selection(combination with RL, RM, RH)

(4) If 0-5V (0-10V) is entered into terminal 1 of the inverter from the external variable resistor with the option (FR-A5AX) mounted on the inverter, operation is performed at the frequency (speed), which is the sum of the BCD code input of the FR-A5AX and the auxiliary input from terminal 1, only when 2 or 3 is set in Pr. 304.

When switching the inputs e.g. between volume input to perform manual operation and BCD code input to perform automatic operation, set the BCD code input to "0" under manual operation.

REMARKS

When performing an auxiliary input using terminal 1 with the FR-V500 series, set "0" (factory setting) in Pr.868 "Terminal 1 function assignment".

5.SPECIFICATIONS

5.1 Specifications

- Digital input signal type . . . . . 3-digit BCD code or 12-bit binary
- Digital input signal selection . . . . . From operation panel or parameter unit
- Input current . . . . . 5mA (24VDC) per circuit
- Input . . . . . Contact signal or open collector input
- Adjustment functions . . . . . (1) Bias and gain
  (2) Analog compensation input
  (Use control panel or parameter unit for setting.)

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Date	*Manual Number	Revision
Sep., 1997	IB(NA)-66808-A	First edition
Jan., 2002	IB(NA)-66808-B	Addition Adaptable inverters