MITSUBISHI ELECTRIC

700 series

INVERTER
Plug-in option
FR-A7AZ
INSTRUCTION MANUAL

Bipolar analog output function

High resolution analog input function

Motor thermistor interface

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Thank you for choosing this Mitsubishi Inverter plug-in option. 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 even 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 or wiring 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, check to make sure that the indication of the inverter operation panel is off, wait for at least 10 minutes after the power supply has been switched off, and check that there are no residual voltage using a tester or the like. The capacitor is charged with high voltage for some time after power off and it is dangerous.
- Any person who is involved in the wiring or inspection of this equipment should be fully competent to do the work.
- Always install the plug-in option before wiring. Otherwise, you may get an electric shock or be injured.
- Do not touch the plug-in option with wet hands. Otherwise you may get 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. Otherwise, burst, damage, etc. may occur.**
- **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 damage, etc. Otherwise, burst, damage may occur.**
- **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 plug-in option 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 other conductive bodies such as screws and metal fragments or other flammable substance such as oil from entering the inverter.**

2) Trial run

⚠ 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.**
- **Do not perform parts removal which is not instructed in this manual. Doing so may lead to fault or damage of the inverter.**

⚠ CAUTION

- **When parameter clear or all parameter clear is performed, reset the required parameters before starting operations. Each parameter returns to the initial value.**
- **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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II

1 PRE-OPERATION INSTRUCTIONS

1.1 Inverter Type

The inverter type, 55K and 75K stated in this Instruction Manual differs according to each -NA, -EC, -CH(T) versions. Refer to the following correspondence table for each inverter type. *(Refer to the instruction manual of each inverter for the inverter type.)*

For example, "for the 75K or more" indicates "for the FR-A740-01440-NA or more" in the case of FR-A740 of NA version.

		NA	EC	CH
A700	FR-A720-55K	FR-A720-02150-NA	—	—
	FR-A720-75K	FR-A720-02880-NA	—	—
	FR-A740-55K	FR-A740-01100-NA	FR-A740-01800-EC	FR-A740-55K-CHT
	FR-A740-75K	FR-A740-01440-NA	FR-A740-02160-EC	FR-A740-75K-CHT

1

1.2   Unpacking and Product Confirmation

Take the plug-in option out of the package, check the unit name, and confirm that the product is as you ordered and intact.

This product is a plug-in option dedicated for the FR-A700 series.

Refer to *page 4* for details of compatible inverters.

1.2.1   Packing confirmation

Check the enclosed items.

Plug-in option 1	Mounting screw (M3 × 6mm) .... 2 *(Refer to page 8.)*	Hex-head screw for option mounting (5.5mm) .... 1 *(Refer to page 8.)*
		5.5mm

1.2.2 Parts

Switch for manufacturer setting (SW3)
Do not change from initially-set status
(1, 2: OFF ▦).

Switch for manufacturer setting (SW1)
Do not change from initially-set status
(1, 2: ON ▦).

Switch for thermistor calibration (SW2)
Change the setting when calibrating the
thermistor. *(Refer to page 34.)*

Connector
Connect to the inverter
option connector.
(Refer to page 8.)

1
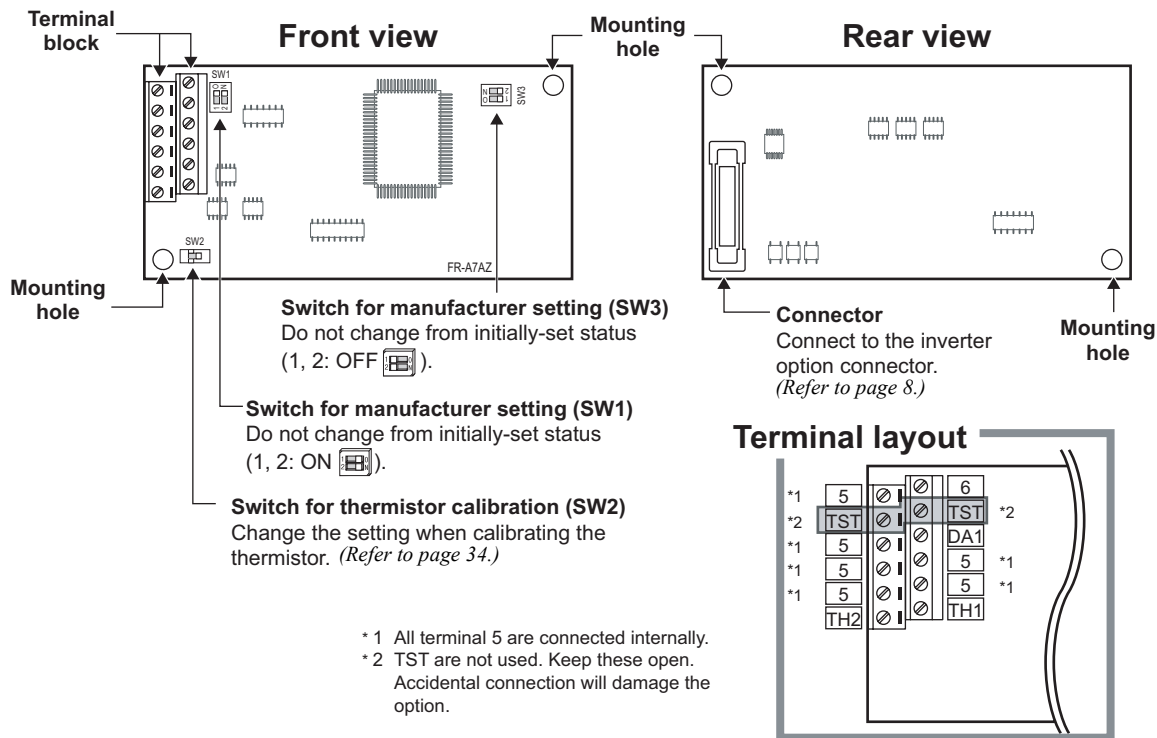
* 1 All terminal 5 are connected internally.
* 2 TST are not used. Keep these open.
   Accidental connection will damage the
   option.

Terminal layout

*1	5			6	
*2	TST			TST	*2
*1	5			DA1	
*1	5			5	*1
*1	5			5	*1
	TH2			TH1	

1.3   Compatible inverters

This product can be used with the inverter assembled in and after July 2006.
Check the SERIAL number indicated on the inverter rating plate or package.
Refer to the inverter manual for the location of the rating plate.

Rating plate example

□	6	7	○○○○○○
Symbol	Year	Month	Control number

SERIAL (Serial No.)

The SERIAL consists of 1 version symbol, 2 numeric characters or 1 numeric
character and 1 alphabet letter indicating year and month, and 6 numeric
characters indicating control number.
Month is indicated as 1 to 9, X (October), Y (November), and Z (December).

(1) Japanese specification/NA specification

Type	SERIAL (the first three digits)
FR-A720-0.4K to 90K, FR-A740-0.4K to 500K	□67○○○○○○○ or later
FR-A720-00030 to 03460-NA, FR-A740-00015 to 09620-NA	

(2) CHT specification

Type	SERIAL	Type	SERIAL
FR-A740-0.4K/0.75K-CHT	M67○○○○○○○ or later	FR-A740-185K to 250K-CHT	F67○○○○○○○ or later
FR-A740-1.5K to 3.7K-CHT	N67○○○○○○○ or later	FR-A740-280K-CHT	G67○○○○○○○ or later
FR-A740-5.5K/7.5K-CHT	M67○○○○○○○ or later	FR-A740-315K-CHT	F67○○○○○○○ or later
FR-A740-11K to 22K-CHT	N67○○○○○○○ or later	FR-A740-355K-CHT	D67○○○○○○○ or later
FR-A740-30K to 55K-CHT	K67○○○○○○○ or later	FR-A740-400K/450K-CHT	F67○○○○○○○ or later
FR-A740-75K to 160K-CHT	G67○○○○○○○ or later	FR-A740-500K-CHT	G67○○○○○○○ or later

1

(3) EC specification

Type	SERIAL (the first three digits)
FR-A740-00023 to 00620-EC	E67 or later
FR-A740-00770 to 12120-EC*	D67 or later

* For the FR-A740-00770 to 12120-EC
  Check the SERIAL indicated on the Serial number sticker shown below.

Serial number sticker example
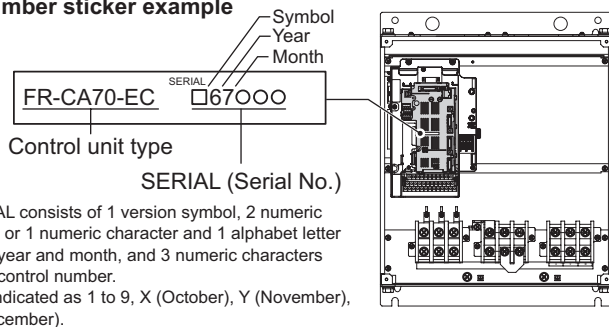
Symbol
Year
Month

SERIAL

FR-CA70-EC   □67○○○

Control unit type

SERIAL (Serial No.)

The SERIAL consists of 1 version symbol, 2 numeric characters or 1 numeric character and 1 alphabet letter indicating year and month, and 3 numeric characters indicating control number.
Month is indicated as 1 to 9, X (October), Y (November), and Z (December).

• To check the SERIAL, the front cover must be removed.
  For the removal of the front cover, refer to the inverter manual.

2 / INSTALLATION AND WIRING

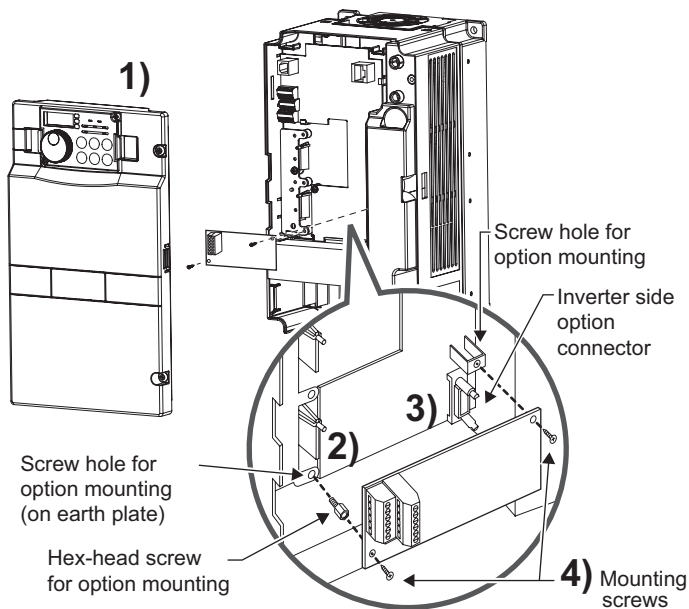## 2.1 Pre-Installation Instructions

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

⚠️**CAUTION**

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

2.2   Installation Procedure

Screw hole for option mounting

Inverter side option connector

Screw hole for option mounting (on earth plate)

Hex-head screw for option mounting

4) Mounting screws

1) Remove the inverter front cover.

2) Mount the hex-head screw for option mounting into the inverter screw hole (on earth plate). (size 5.5mm, tightening torque 0.56N·m to 0.75N·m)

3) Securely fit the connector of the plug-in option to the inverter connector along the guides.

4) Securely fix the both right and left sides of the plug-in option to the inverter with the accessory mounting screws. If the screw holes do not line-up, the connector may not have been plugged snugly. Check for loose plugging.

REMARKS

After removing two screws on the right and left places, remove the plug-in option.
(When the plug-in option is mounted in the connector 3, it is easier to remove the plug-in option after removing a control circuit terminal block.)

8

═══ **CAUTION** ═══

- **Only one type of option per inverter may be used. When two or more options are mounted, priority is in order of inverter option connectors 1, 2 and 3, the options having lower priority are inoperative.**
- **When the inverter cannot recognize that the option is mounted due to improper installation, etc., " $E.\ \ 1$ to $E.\ \ 3$ " (option alarm) are displayed. The errors shown differ according to the mounting positions (connectors 1, 2, 3).**

Mounting Position	Error Display
Connector 1	$E.\ \ 1$
Connector 2	$E.\ \ 2$
Connector 3	$E.\ \ 3$

- **Take care not to drop a hex-head screw for option mounting or mounting screw during mounting and removal.**
- **Pull out the option straight to remove. Otherwise, the connector may be damaged by some applied force.**

2

2.3 Wiring

(1) Strip off the sheath of the cable to wire.
Strip off the sheath about the size below. If the length of the sheath pealed is too long, a short circuit may occur among neighboring wires. If the length is too short, wires might come off.
Wire the twisted pair shielded cable after stripping its sheath to make its cables loose.
Also, protect the shielded cable of the twisted pair shielded cable to ensure that it will not make contact with the conductive area.

Cable stripping size

5mm
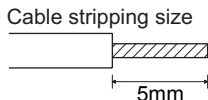
Wire the stripped cable after twisting it to prevent it from becoming loose.
In addition, do not solder it.
Use a bar type terminal as required.

REMARKS

Information on bar terminals
Introduced products (as of August, 2005): Phoenix Contact Co.,Ltd.

Terminal Screw Size	Bar Terminal Model (with insulation sleeve)	Bar Terminal Model (without insulation sleeve)	Wire Size (mm^2)
M2	AI 0.5-6WH	A 0.5-6	0.3 to 0.5

· Bar terminal crimping tool: CRIMPFOX ZA3 (Phoenix Contact Co., Ltd.)

When using the bar terminal (without insulation sleeve),
use care so that the twisted wires do not come out.
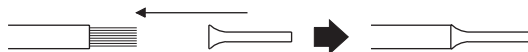
= **CAUTION** =

The wiring length should be 30m maximum.

(2) Loosen the terminal screw and insert the cable into the terminal.

Screw Size	Tightening Torque	Cable Size	Screwdriver
M2	0.22N·m to 0.25N·m	0.3mm^2 to 0.75mm^2	Small $\ominus$ flat-blade screwdriver (Tip thickness: 0.4mm/tip width: 2.5mm)

CAUTION

Undertightening can cause cable disconnection or malfunction. Overtightening can cause a short circuit or malfunction due to damage to the screw or unit.

(3) For wiring of **22K* or less**, route wires between the control circuit terminal block and front cover. If cables can not be routed between the control circuit terminal block and front cover due to the increased number of cables, remove a hook of the front cover and use a space become available.
For wiring of **30K* or more**, use the space on the left side of the control circuit terminal block.
* The inverter type of 22K and 30K in each -NA, -EC versions are as follows.
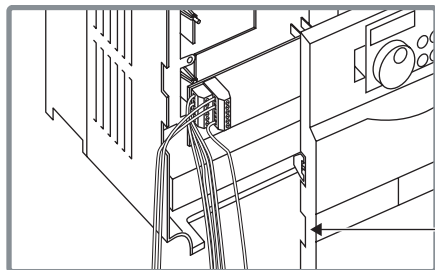
Cut off with a nipper, etc.
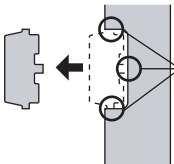
Cut off a hook on the inverter front cover side surface.
(Cut off so that no portion is left.)

Control circuit terminal block
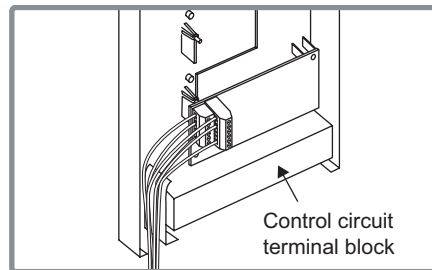
22K or less   **30K or more**

		NA	EC
A700	FR-A720-22K	FR-A720-00900-NA	—
	FR-A740-22K	FR-A740-00440-NA	FR-A740-00620-EC
	FR-A720-30K	FR-A720-01150-NA	—
	FR-A740-30K	FR-A740-00570-NA	FR-A740-00770-EC

REMARKS

When the hook of the inverter front cover is cut off for wiring, the protective structure (JEM1030) changes to open type (IP00).

⚠ CAUTION

⚠ **When performing wiring using the space between the inverter front cover and control circuit terminal block, take care not to subject the cable to stress.**
⚠ **After wiring, wire offcuts must not be left in the inverter. They may cause a fault, failure or malfunction.**

3 PARAMETER LIST

Use the following parameters with the FR-A7AZ.
Set these as required.

Parameter Number	Name	Setting Range	Minimum Increments	Initial Value	Refer to Page
406 *1	High resolution analog input selection	0, 2 to 6, 9999	1	9999	20
407 *1	Motor temperature detection filter	0 to 100s, 9999	1	9999	31
408 *1	Motor thermistor selection	0, 1	1	0	31
838 *1	DA1 terminal function selection	1 to 3, 5 to 14, 17, 18, 21, 24, 32 to 34, 36, 50, 52, 53	1	2	15
839 *1	DA1 output filter	0 to 5s	0.001s	0.05s	15
846	Torque bias balance compensation	0 to 10V, 9999	0.1V	9999	20
847	Fall-time torque bias terminal 1 bias	0 to 400%, 9999	1%	9999	20
848	Fall-time torque bias terminal 1 gain	0 to 400%, 9999	1%	9999	20
857 *1	DA1-0V adjustment	900 to 1100%	1%	1000%	15
C0 (900) *2	FM(CA) terminal calibration	–	–	–	15
C18 (920)	Terminal 1 gain command (torque/magnetic flux)	0 to 400%	0.1%	150%	20
C19 (920)	Terminal 1 gain (torque/magnetic flux)	0 to 300%	0.1%	100%	20
C29 (925) *1, 2	Motor temperature detection calibration (analog input)	0 to 200%	0.1%	100%	31
C30 (926) *2	Terminal 6 bias frequency (speed)	0 to 400Hz	0.01Hz	0Hz	20

3

Parameter Number	Name	Setting Range	Minimum Increments	Initial Value	Refer to Page
C31 (926) *2	Terminal 6 bias (speed)	0 to 300%	0.1%	0%	20
C32 (927) *2	Terminal 6 gain frequency (speed)	0 to 400Hz	0.01Hz	60Hz (50Hz) *3	20
C33 (927) *2	Terminal 6 gain (speed)	0 to 300%	0.1%	100%	20
C34 (928) *2	Terminal 6 bias command (torque)	0 to 400%	0.1%	0%	20
C35 (928) *2	Terminal 6 bias (torque)	0 to 300%	0.1%	0%	20
C36 (929) *2	Terminal 6 gain command (torque)	0 to 400%	0.1%	150%	20
C37 (929) *2	Terminal 6 gain (torque)	0 to 300%	0.1%	100%	20

*1   They can be set only when used with the FR-A7AZ.

*2   The parameter number in parentheses is the one for use with the parameter unit (FR-PU07/FR-PU04).

*3   The initial value of the EC and CHT version is 50Hz.

4 BIPOLAR ANALOG OUTPUT

Bipolar analog can be output with the FR-A7AZ.
Outputting 0 to ±10VDC enables output frequency, output voltage, etc. to be monitored with a DC voltage meter.

4.1 Connection Diagram
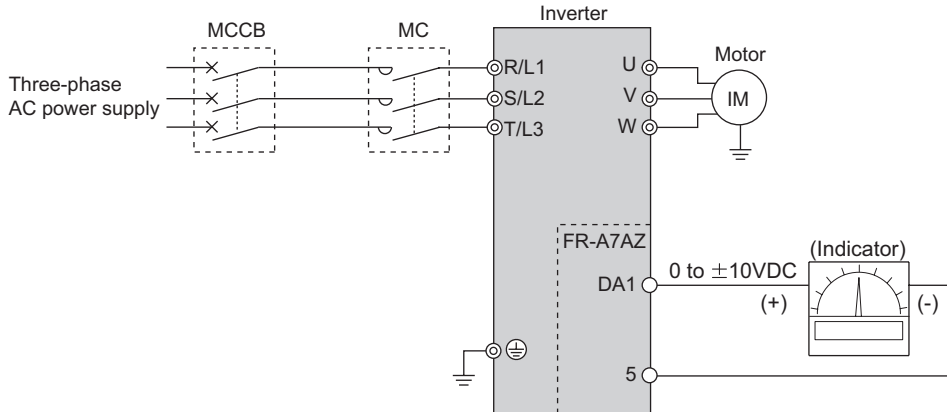
4.2   Terminals
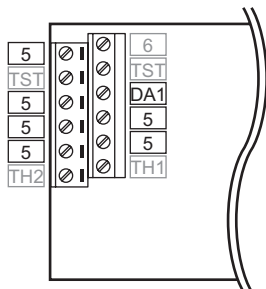
Terminal Symbol	Terminal Name	Description
DA1	Bipolar analog output terminal	Connect a DC indicator (±10VDC).
5	Common terminal	Common terminal of the DA1

4.3   Bipolar Analog Outputting Parameter

4.3.1   Parameter list

The following parameters are used for outputting bipolar analog.

Parameter Number	Name	Setting Range	Minimum Increments	Initial Value
838 *1	DA1 terminal function selection	1 to 3, 5 to 14, 17, 18, 21, 24, 32 to 34, 36, 50, 52, 53	1	2
839 *1	DA1 output filter	0 to 5s	0.001s	0.05s
857 *1	DA1-0V adjustment	900% to 1100%	1%	1000%
C0 (900) *2	FM(CA) terminal calibration	—	—	—

*1   They can be set only when used with the FR-A7AZ.

*2   The parameter number in parentheses is the one for use with the parameter unit (FR-PU07/FR-PU04).

4.3.2   Calibration of the indicator (Pr. 838, Pr. 857, C0)

Refer to the following flow chart to calibrate the indicator.

Start

| Connect the indicator across terminal DA1 and terminal 5. | At this time, check that the polarity is correct. Terminal DA1 is plus. |

| Use *Pr. 857* to make calibration of indicator at 0 voltage. | If the indicator needle does not point to 0 when voltage output is 0, adjust the setting value of *Pr. 857 DA1 0V adjustment* in between 900% and 1100%. |

| Set "21" (reference voltage output) in *Pr. 838*. | Setting "21" in *Pr. 838* outputs 10VDC to deflect the indicator needle. |

| Run the inverter | If the inverter is at a stop, (press the (FWD) or (REV)) to start the inverter. (Motor needs not be connected.) |

| Use *C0 (Pr. 900)* to make adjustment, then set. | Turn ⊙ to adjust the indicator needle to deflect to full-scale, then press (SET) to set. |

End

Use *Pr. 838* to set the types of the signals to be monitored. *(Refer to page 18.)*

=== **CAUTION** ===

· **Performing calibration without setting "21" (reference voltage output) in *Pr. 838*, terminal FM of the inverter is calibrated.**
· **When the FR-A7AZ used was remounted on other inverter, use *Pr. 857* and *C0 (Pr. 900)* of the inverter remounted with the option to calibrate again.**
· **When used with the FR-A7AZ and FR-A7AY together with "1 or 11" set in *Pr. 309 Analog output signal voltage/ current switchover* and "21" set in *Pr. 310 Analog meter voltage output selection*, *C0 (Pr. 900)* calibrates terminal AM0 of the FR-A7AY. (*Pr. 309* and *Pr. 310* are parameters for the FR-A7AY. Refer to the instruction manual of the FR-A7AY for details of *Pr. 309* and *Pr. 310*.)**

4

4.3.3   Monitor item list

· Set the monitor to be output to the terminal DA1 (bipolar analog output (0 to ±10VDC voltage output)) in *Pr. 838 DA1 terminal function selection*.
· Refer to the following table and set the monitor to be displayed. Refer to the inverter manual (applied) for details of monitors.

Pr. 838 Setting	Types of Monitor	Increments	Terminal DA1 Full Scale Value
1 *1	Output frequency	0.01Hz	*Pr. 55*
2	Output current	0.01A/0.1A *2	*Pr. 56*
3	Output voltage	0.1V	400V/800V
5	Frequency setting value	0.01Hz	*Pr. 55*
6 *1	Running speed	1(r/min)	The value converted with the *Pr. 37* value from *Pr. 55*.
7 *3	Motor torque	0.1%	*Pr. 866*
8	Converter output voltage	0.1V	400V/800V
9	Regenerative brake duty	0.1%	*Pr. 70*
10	Electronic thermal relay function load factor	0.1%	100%
11	Output current peak value	0.01A/0.1A *2	*Pr. 56*
12	Converter output voltage peak value	0.1V	400V/800V
13	Input power	0.01kW/ 0.1kW *2	Rated inverter power × 2
14	Output power	0.01kW/ 0.1kW *2	Rated inverter power × 2
17 *3	Load meter	0.1%	*Pr. 866*
18	Motor excitation current	0.01A/0.1A *2	*Pr. 56*
21	Reference voltage output	–	–
24	Motor load factor	0.1%	200%

Pr. 838 Setting	Types of Monitor	Increments	Terminal DA1 Full Scale Value
32 *3	Torque command	0.1%	*Pr. 866*
33 *3	Torque current command	0.1%	*Pr. 866*
34 *4	Motor output	0.01kW/ 0.1kW *2	Rated motor capacity
36 *4, 5	Torque monitor (driving/regenerative polarity switching)	–	*Pr. 866*
50	Power saving effect	Variable according to parameters	Inverter capacity
52	PID set point	0.1%	100%
53	PID process value	0.1%	100%

*1   Positive (plus) output during forward rotation and negative (minus) output during reverse rotation.
*2   Differ according to capacities. (55K or less/75K or more) The inverter type, 55K and 75K differ according to -NA and -EC versions. *(Refer to page 1.)*
*3   Positive voltage is output during forward driving/reverse regeneration and negative voltage is output during reverse driving/forward regeneration.
*4   Positive voltage is output during forward driving/reverse driving and negative voltage is output during forward regeneration/reverse regeneration.
*5   Torque monitor can not be assigned to the terminal FM(CA)/AM of the inverter.

4.3.4 Terminal DA1 response level adjustment (Pr. 839)

· The response level of the output voltage of the terminal DA1 can be adjusted between 0 and 5s with *Pr. 839*.

· Increasing the setting stabilizes the terminal DA1 output more but reduces the response level.

REMARKS

Response time of the terminal DA1 is a total of the set value in *Pr.839 DA1 output filter* and a variable (up to 5ms).
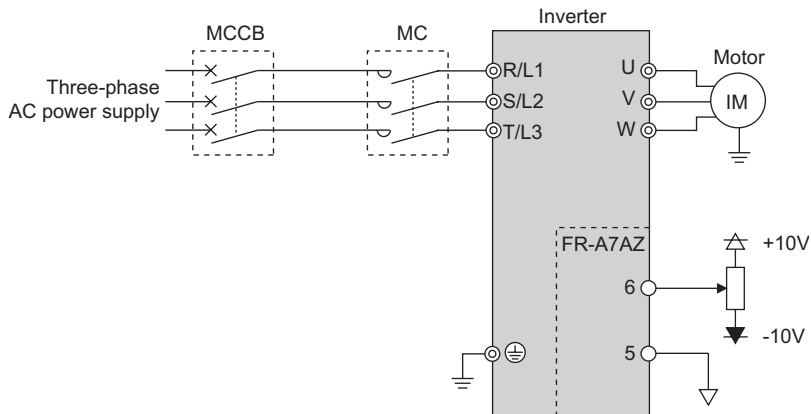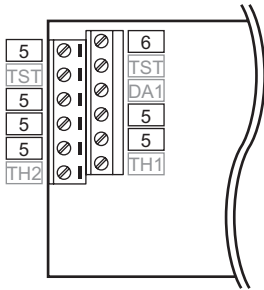
5 HIGH RESOLUTION ANALOG INPUT

High resolution analog can be input with the FR-A7AZ.
Inputting 0 to ±10VDC voltage enables speed command, torque limit command, torque command, torque bias, and stall prevention operation level input.

5.1 Connection Diagram

5.2   Terminals

Terminal Symbol	Terminal Name	Description
6	High resolution input terminal	Terminal for 0 to ±10VDC high resolution (16bit) analog voltage input. Use *Pr. 406 High resolution analog input selection* to select terminal function. Maximum permissible voltage: ±20VDC
5	Common terminal	Common terminal of terminal 6

5

5.3 High Resolution Analog Input Parameter

5.3.1 Parameter list

Use the following parameters for high resolution analog input.

Parameter Number	Name	Setting Range	Minimum Increments	Initial Value
406 *1, *2	High resolution analog input selection	0, 2 to 6, 9999	1	9999
846	Torque bias balance compensation	0 to 10V, 9999	0.1V	9999
847	Fall-time torque bias terminal 1 bias	0 to 400%, 9999	1%	9999
848	Fall-time torque bias terminal 1 gain	0 to 400%, 9999	1%	9999
C18 (920) *3	Terminal 1 gain command (torque/magnetic flux)	0 to 400%	0.1%	150%
C19 (920) *3	Terminal 1 gain (torque/magnetic flux)	0 to 300%	0.1%	100%
C30 (926) *1, *3	Terminal 6 bias frequency (speed)	0 to 400Hz	0.01Hz	0Hz
C31 (926) *1, *3	Terminal 6 bias (speed)	0 to 300%	0.1%	0%
C32 (927) *1, *3	Terminal 6 gain frequency (speed)	0 to 400Hz	0.01Hz	60Hz (50Hz) *4
C33 (927) *1, *3	Terminal 6 gain (speed)	0 to 300%	0.1%	100%
C34 (928) *1, *3	Terminal 6 bias command (torque)	0 to 400%	0.1%	0%
C35 (928) *1, *3	Terminal 6 bias (torque)	0 to 300%	0.1%	0%
C36 (929) *1, *3	Terminal 6 gain command (torque)	0 to 400%	0.1%	150%
C37 (929) *1, *3	Terminal 6 gain (torque)	0 to 300%	0.1%	100%

*1 They can be set only when used with the FR-A7AZ.

*2 For *Pr. 406* , write is disabled during operation even when "2" is set in *Pr. 77*. When changing the parameter setting, stop the operation.

*3 The parameter number in parentheses is the one for use with the parameter unit (FR-PU07/FR-PU04).

*4 The initial value of the EC and CHT version is 50Hz.

5.3.2 Selection of terminal 6 function (Pr. 406)

(1) Terminal 6 function list

Functions of terminal 6 change according to the *Pr. 406* setting and control method.

Assigning same functions assigned to terminal 1, 2, and 4 to terminal 6 make terminal 1, 2, and 4 input invalid.

Pr. 406 Setting	V/F Control/ Advanced Magnetic Flux Vector Control	Real Sensorless Vector Control/ Vector Control		Vector Control	Remarks
		Speed control	Torque control	Position control	
0	Speed command	Speed command	Speed limit	—	Speed command and speed limit are not available with terminal 2.
2	—	Regenerative torque limit (*Pr. 810* = 1)	—	Regenerative torque limit (*Pr. 810* = 1)	Regenerative torque limit is not available with terminal 1.
3	—	—	Torque command (*Pr. 804* = 0)	—	Torque command is not available with terminal 1.
4	Stall prevention operation level input (*Pr. 810* = 1)	Torque limit (*Pr. 810* = 1)	Torque command (*Pr. 804* = 0)	Torque limit (*Pr. 810* = 1)	Stall prevention operation level input and torque limit are not available with terminal 1 or 4. Torque command is not available with terminal 1.
5	—	—	Forward/reverse rotation speed limit (*Pr. 807* = 2)	—	Forward/reverse rotation speed limit is not available with terminal 1.
6	—	Torque bias (*Pr. 840* = 1, 2, 3)	—	—	Torque bias is not available with terminal 1.
9999 (initial value)	—	—	—	—	Terminal 6 is invalid.

5

(2) Filter of terminal 6 input

When giving the speed command or limitting the speed from terminal 6 input, settings of *Pr. 822 Speed setting filter 1* and *Pr. 832 Speed setting filter 2* are made valid.

When giving the torque command or limitting the torque from terminal 6 input, settings of *Pr. 826 Torque setting filter 1* and *Pr. 836 Torque setting filter 2* are made valid.

Refer to the inverter manual (applied) for details of *Pr. 822 Speed setting filter 1, Pr. 832 Speed setting filter 2, Pr. 826 Torque setting filter 1, and Pr. 836 Torque setting filter 2* .

(3) Calibration and adjustment of terminal 6

When "0" is set in *Pr.406,* terminal 6 is used for speed command and speed limit inputs, and terminal 2 becomes invalid for those inputs.

Pr. 242 Terminal 1 added compensation amount (terminal 2) becomes valid for terminal 6 and compensation of terminal 6 input is made by terminal 1 input.

Pr. 849 Analog input offset adjustment becomes valid for terminal 6 and terminal 6 input is provided with offset.

Refer to the inverter manual (applied) for details of *Pr. 242 Terminal 1 added compensation amount (terminal 2)* and *Pr. 849 Analog input offset adjustment* .

(4) Torque bias of terminal 6

When "6" is set in *Pr. 406 High resolution analog input selection*, terminal 6 is used for torque bias input. *Pr. 846 Torque bias balance compensation, Pr. 847 Fall-time torque bias terminal 1 bias, Pr. 848 Fall-time torque bias terminal 1 gain* become valid for terminal 6.

## 5.3.3 Calibration of terminal 6 (Pr. 148, Pr. 149, Pr. 846 to Pr. 848, C30 to C37)

(1) Terminal 6 calibration parameter

Use the following parameters for calibration of terminal 6 according to the *Pr. 406* setting.

Pr. 406 Setting	Terminal 6 Function	Calibration Parameters		Related Parameters
		Bias setting	**Gain setting**	
0	Speed command/ speed limit	C30 (Pr. 926) Terminal 6 bias frequency (speed) C31 (Pr. 926) Terminal 6 bias (speed)	C32 (Pr. 927) Terminal 6 gain frequency (speed) C33 (Pr. 927) Terminal 6 gain (speed)	*Pr. 822, Pr. 832* *Pr. 242, Pr. 849*
2	Regenerative torque limit	C34 (Pr. 928) Terminal 6 bias command (torque) C35 (Pr. 928) Terminal 6 bias (torque)	C36 (Pr. 929) Terminal 6 gain command (torque) C37 (Pr. 929) Terminal 6 gain (torque)	*Pr. 826, Pr. 836*
3	Torque command	C34 (Pr. 928) Terminal 6 bias command (torque) C35 (Pr. 928) Terminal 6 bias (torque)	C36 (Pr. 929) Terminal 6 gain command (torque) C37 (Pr. 929) Terminal 6 gain (torque)	*Pr. 826, Pr. 836*
4	Torque limit/ torque command	C34 (Pr. 928) Terminal 6 bias command (torque) C35 (Pr. 928) Terminal 6 bias (torque)	C36 (Pr. 929) Terminal 6 gain command (torque) C37 (Pr. 929) Terminal 6 gain (torque)	*Pr. 826, Pr. 836*
	Stall prevention operation level	*Pr. 148 Stall prevention level at 0V input*	*Pr. 149 Stall prevention level at 10V input*	
5	Forward rotation reverse rotation speed limit	C30 (Pr. 926) Terminal 6 bias frequency (speed) C31 (Pr. 926) Terminal 6 bias (speed)	C32 (Pr. 927) Terminal 6 gain frequency (speed) C33 (Pr. 927) Terminal 6 gain (speed)	*Pr. 822, Pr. 832*
6	Torque bias	C34 (Pr. 928) Terminal 6 bias command (torque) C35 (Pr. 928) Terminal 6 bias (torque) Pr. 846 Torque bias balance compensation Pr. 847 Fall-time torque bias terminal 1 bias	C36 (Pr. 929) Terminal 6 gain command (torque) C37 (Pr. 929) Terminal 6 gain (torque) Pr. 846 Torque bias balance compensation Pr. 848 Fall-time torque bias terminal 1 gain	
9999 (initial value)	—	—	—	

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**(2) Calibration of speed command/speed limit (*Pr. 406* = "0, 5")**

When *Pr. 406* = "0, 5", terminal 6 acts as speed command or speed limit input and *C30 to C33* are used for calibration parameter.
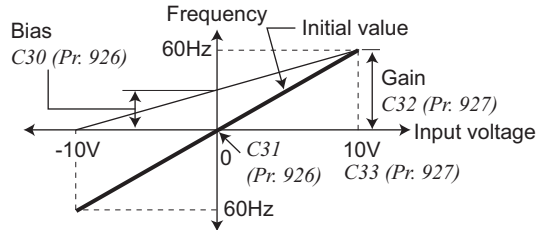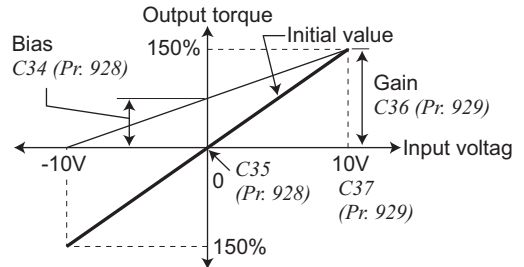

(3) Calibration of torque command/torque limit (*Pr. 406* = "2, 3, 4")

When *Pr. 406* = "2, 3, 4" under real sensorless vector control or vectorl control, terminal 6 acts as torque command or torque limit input and *C34 to C 37* are used for calibration parameters.

<Torque limit, regenerative torque limit>   **<Torque command>**
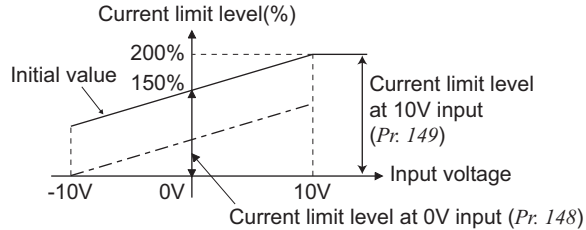

26
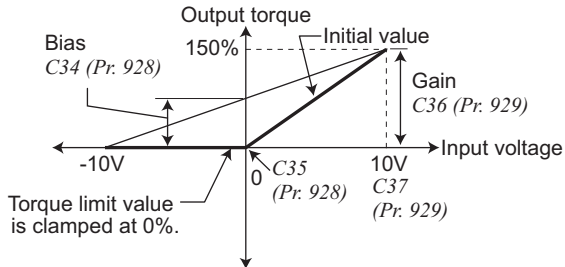
(4) Calibration of stall prevention operation level (*Pr. 406* **= "4")**
When *Pr. 406* = "4" under V/F control and advanced magnetic flux vector control, terminal 6 acts as stall prevention operation level and *Pr. 148* and *Pr. 149* are used for calibration parameter.
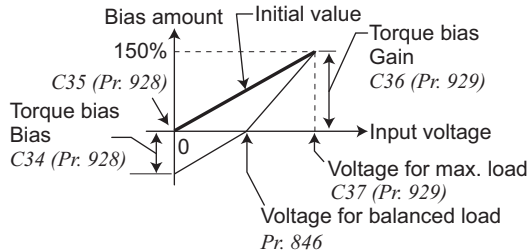
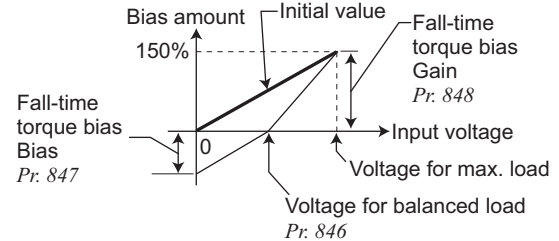## (5) Calibration of torque bias input (*Pr. 406* = "6")

When *Pr. 406* = "6", terminal 6 acts as torque bias input and *Pr. 846 to Pr. 848, C34 to C37* are used for calibration parameter.

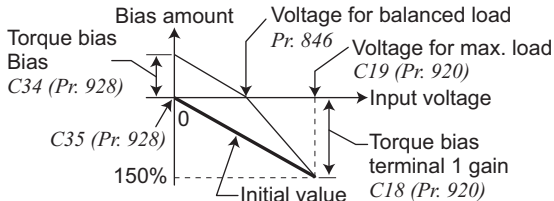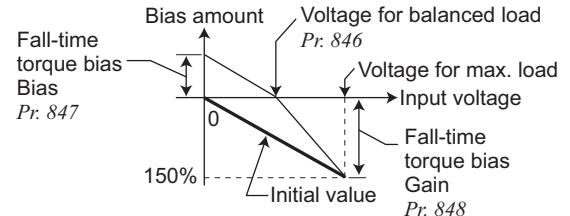*Pr. 840* = "1" (at driving when the motor is in forward rotation)

<When the motor runs in forward rotation direction>   **<When the motor runs in reverse rotation direction>**

Pr. 840 = "2" (at regeneration when the motor is in forward rotation)

<When the motor runs in forward rotation direction>   **<When the motor runs in reverse rotation direction>**

5.4   Noise Reduction Techniques

When operation is unstable due to Electro-Magnetic Interference (EMI), take measures refering to below.

(1) Measures at wiring
· Separate the power cable as far away as possible from the signal cable.
· Use a twisted pair sheilded cable for a signal cable.
   Take any of appropriate measures below for a sheilded cable.

> · Connect to terminal 5 of the FR-A7AZ.
> · Connect to the common terminal of an analog command device.
> · Connect to both terminal 5 of the FR-A7AZ and common terminal of the analog command device.
> · Leave both terminal 5 of the FR-A7AZ and common terminal of the analog command device open. (leave the sheilded cable suspended)

(2) Measures of inverter
· If a larger value is set in *Pr. 72 PWM frequency selection*, decrease the *Pr. 72* setting. (Noise from the motor increases.)
· Increase the setting of speed (torque) setting filter *Pr. 822, Pr. 832 (Pr. 826, Pr. 836)* .

===== CAUTION =====

As changing the speed (torque) setting filter will affect the response level of the inverer to the command, adjust the setting by looking at the machine movement.

(3) Measures of option
· Install line noise filter FR-BLF (FR-BSF01 for the 3.7K or less).

Refer to the inverter manual (applied) for details of measures for EMI.

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5.5   Specifications

Frequency setting resolution ..... 0.01Hz/0 to 60Hz (-10 to +10V)
(0.015Hz/0 to 60Hz when option is not mounted)
Torque setting resolution .... 0.024%/0 to 100% (-10 to +10V)
(0.1%/0 to 100% when option is not mounted)
Input resistance 10kΩ
Maximum input voltage .... ±20VDC

6 / MOTOR THERMISTOR INTERFACE

When using a dedicated motor with thermistor for vector control (SF-V5RU□□□□□T/A), feeding back the motor temperature detected by the motor side thermistor to the inverter can reduce fluctuation of torque generated due to temperature.

Torque accuracy is ±3%.

6.1 Connection Diagram
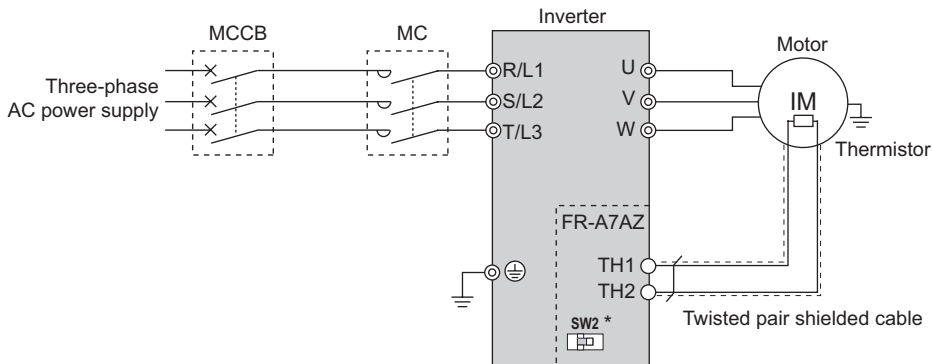
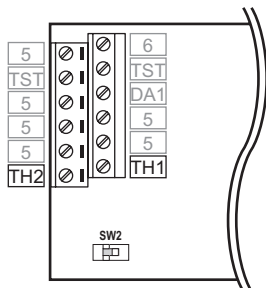* When calibrating the thermistor, change the thermistor calibration status switch. *(Refer to page 34.)*

=== CAUTION ===

To detect temperature with the FR-A7AZ, be sure to use the SF-V5RU□□□□□T/A, a dedicated motor with thermistor.

6.2   Terminals

Terminal Symbol	Terminal Name	Description
TH1	Thermistor input 1	Input the motor side thermistor output signal.
TH2	Thermistor input 2	
SW2	Thermistor calibration status switch	When calibrating at installation, change the switch to place the inverter in calibration status.

6.3   Motor Thermistor Parameter

6.3.1   Parameter list

Parameters below are used for motor therminstor interface.
Following parameters are available only when used with the FR-A7AZ.

Parameter Number	Name	Setting Range	Minimum Increments	Initial Value
407	Motor temperature detection filter	0 to 100s, 9999	9999	1
408	Motor thermistor selection	0, 1	1	0
C29 (925) *	Motor temperature detection calibration (analog input)	0 to 200%	0.1%	100%

* The parameter number in parentheses is the one for use with the parameter unit (FR-PU07/FR-PU04).

6.3.2 Thermistor setting

When using the thermistor interface, set *Pr. 408 Motor thermistor selection* according to the motor type.
It is factory set to "0" (SF-V5RU□□□□□T). Set this parameter according to the motor used.

| Parameter	Name	Initial Value	Minimum Setting Increments	Setting Range	Description
408	Motor thermistor selection	0	1	0	SF-V5RU□□□□□T
				1	SF-V5RU□□□□□A

6.3.3 Thermistor calibration (C29)

Perform calibration of the inverter and FR-A7AZ (thermistor interface) before starting the motor at installation.

=== **CAUTION** ===
· **Calibration must be performed at installation.**

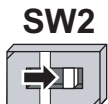### **(1) Calibration method**

1) Set the thermistor calibration status switch (SW2) to the line to place the FR-A7AZ in the calibration status.
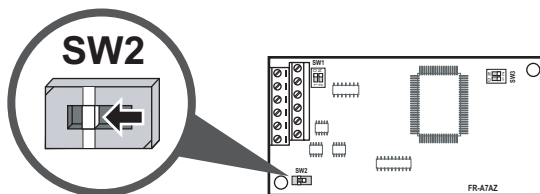
2) Read *C29 (Pr. 925)* and set the compensation value.

· Compensation using the operation panel (FR-DU07) ☞ *refer to page 35*
· Compensation using the parameter unit (FR-PU07) ☞ *refer to page 36*

3) After compensation, reset the thermistor calibration status switch (SW2) to the original position.

=== **CAUTION** ===
· **Always return the SW2 to the original position after calibration. Starting the motor in the calibration status results in motor thermal (E. THM), shutting off the inverter output.**
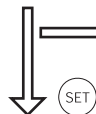
(2) Operation example of compensation value setting
1) Calibration using the operation panel (FR-DU07)

C 29 Select C29 in parameter setting mode.

(SET)

102.7 Current compensation command value is displayed.

(SET)

102.7
C 29 "102.7" and "C29" are alternately displayed, then "102.7" is set as compensation value.

Adjusting a compensation value as desired

Turn ○ .

100.2 The current setting at the instant of turning ○ is displayed.
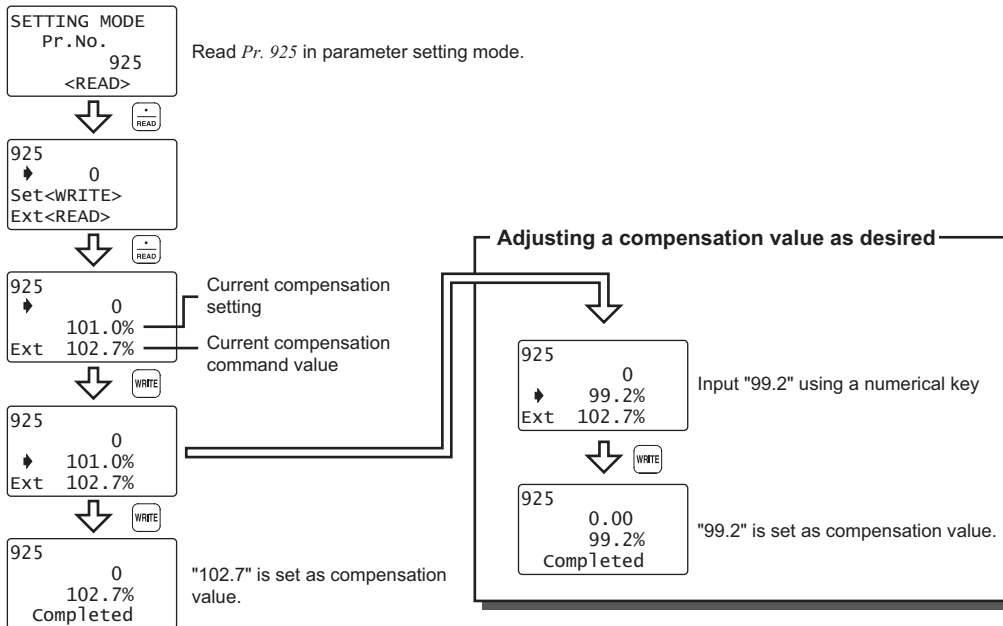
Turn ○ .

99.8

(SET)

99.8 "99.8" flickers and "99.8" is set as compensation value.

2) Calibration using the parameter unit (FR-PU07)

```
SETTING MODE
  Pr.No.
        925
   <READ>
```
Read *Pr. 925* in parameter setting mode.

⇩ [•/READ]

```
925
♦      0
Set<WRITE>
Ext<READ>
```

⇩ [•/READ]

```
925
♦      0
      101.0%
Ext  102.7%
```
Current compensation setting — 101.0%
Current compensation command value — 102.7%

⇩ [WRITE]

```
925
       0
♦    101.0%
Ext  102.7%
```

⇩ [WRITE]

```
925
       0
     102.7%
   Completed
```
"102.7" is set as compensation value.

Adjusting a compensation value as desired

⇩

```
925
       0
♦     99.2%
Ext  102.7%
```
Input "99.2" using a numerical key

⇩ [WRITE]

```
925
      0.00
      99.2%
   Completed
```
"99.2" is set as compensation value.

6.3.4   Motor thermal

When *Pr. 407* ≠ "9999", thermal protection function by the motor thermistor is made valid.

When *Pr. 407* = "9999" (initial value), thermal protection function by motor thermistor is not activated.

(Electronic thermal relays operate following the current value set in *Pr.9 Electronic thermal O/L relay.*)

· Normally set about "30s" in *Pr. 407* .

· Adjust to set a small value when the response is slow to the motor temperature.

· When the motor temperature remains at 145°C for 10s, the inverter protection function (E.THM) activates to shut off the inverter output.

· When the motor temperature goes below -30°C during operation, the inverter protection function (E.THM) activates to shut off the inverter output. Motor thermal (E.THM) does not occur during a stop.

===== **CAUTION** =====

· **When operation is performed with thermal protection function valid without a thermistor or in the calibration status, protection function activates to shut off the inverter output.**

· **Since a dedicated motor with thermistor has no thermal protector, always set a value other than "9999" in** *Pr. 407 Motor temperature detection filter* **to make the thermal protection function valid. When the setting remains "9999", motor protection is not activated.**

REVISIONS

Print Date	*Manual Number	Revision
Jul., 2006	IB(NA)-0600288ENG-A	First edition