MITSUBISHI ELECTRIC

800 series

INVERTER

Plug-in option

FR-A8AZ

INSTRUCTION MANUAL

Bipolar analog output function

High resolution analog input function

Motor thermistor interface

Safety instructions

Thank you for choosing this Mitsubishi Electric inverter plug-in option.
This Instruction Manual provides handling information and precautions for use of this product. Incorrect handling might cause an unexpected fault. Before using this product, read this Instruction Manual carefully to ensure proper use.
Please forward this Instruction Manual to the end user.

Do not attempt to install, operate, maintain or inspect this product until you have read this Instruction Manual and supplementary documents carefully. Do not use this product until you have a full knowledge of this product mechanism, safety information and instructions. In this Instruction Manual, the safety instruction levels are classified into "WARNING" and "CAUTION".

⚠WARNING Incorrect handling may cause hazardous conditions, resulting in death or severe injury.

⚠CAUTION Incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause only material damage.

Note that even the **⚠CAUTION** level may lead to a serious consequence depending on conditions. Be sure to follow the instructions of both levels as they are critical to personnel safety.

◆ **Electric shock prevention**

⚠WARNING

- Do not remove the front cover or the wiring cover of the inverter while the inverter power is ON, and do not operate the inverter with the front cover or the wiring cover removed as the exposed high voltage terminals or the charging part of the circuitry can be touched. Doing so may cause an electric shock.
- Even if power is OFF, do not remove the front cover of the inverter except for wiring or periodic inspection as the inside of the inverter is charged. Doing so may cause an electric shock.
- Before wiring or inspection, check that the display of the inverter operation panel is OFF. Any person who is involved in wiring or inspection shall wait for 10 minutes or longer after the power supply has been cut off, and check that there are no residual voltage using a digital multimeter 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 wiring or inspection of this product shall be fully competent to do the work.
- This product must be installed before wiring. Otherwise you may get an electric shock or be injured.
- Do not touch this product or handle the cables with wet hands. Doing so may cause an electric shock.
- Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Doing so may cause an electric shock.

◆ **Injury prevention**

⚠CAUTION

- The voltage applied to each terminal must be as specified in the Instruction Manual. Otherwise an explosion or damage may occur.
- The cables must be connected to the correct terminals. Otherwise an explosion or damage may occur.
- The polarity (+ and -) must be correct. Otherwise an explosion or damage may occur.
- While power is ON or for some time after power OFF, do not touch the inverter as it will be extremely hot. Doing so may cause burns.

◆ **Additional instructions**

The following instructions must be also followed. If this product is handled incorrectly, it may cause unexpected fault, an injury, or an electric shock.

⚠CAUTION

Transportation and installation

- Do not install or operate this product if it is damaged or has parts missing.
- Do not stand or place heavy objects on this product.
- Ensure the mounting orientation of this product is correct.
- Foreign conductive objects must be prevented from entering the inverter. That includes screws and metal fragments or flammable substance such as oil.
- If halogens (including fluorine, chlorine, bromine, and iodine) contained in fumigants for wood packages enter this product, the product may be damaged. Prevent the entry of fumigant residuals or use an alternative method such as heat disinfection. Note that sterilization or disinfection of wood packages should be performed before packing the product.

Test operation

- Before starting operation, confirm or adjust the parameter settings. Failure to do so may cause some machines to make unexpected motions.

⚠WARNING

Usage

- Do not modify this product.
- Do not remove any part which is not instructed to be removed in the Instruction Manuals. Doing so may lead to a failure or damage of this product.

⚠CAUTION

Usage

- As all parameters return to their initial values after Parameter clear or All parameter clear is performed, the parameters must be set again as required before the operation is started.
- To avoid damage to this product due to static electricity, static electricity in your body must be discharged before you touch this product.

Maintenance, inspection and parts replacement

- Do not carry out a megger (insulation resistance) test.

Disposal

- This product must be treated as industrial waste.

General instruction

- For clarity, illustrations in this Instruction Manual may be drawn with covers or safety guards removed. Ensure all covers and safety guards are properly installed prior to starting operation.

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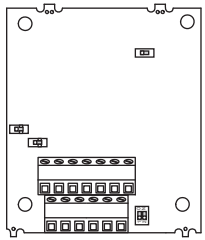
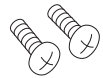
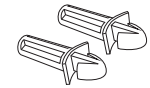
1 PRE-OPERATION INSTRUCTIONS

1.1 Unpacking and product confirmation

Take the plug-in option out of the package, check the product name, and confirm that the product is as you ordered and intact.
This product is a plug-in option made for the FR-A800 series.

1.1.1 Product confirmation

Check the enclosed items.

Plug-in option: 1 	Mounting screw (M3 × 8 mm): 2 (Refer to page 12.) 	Spacer: 2 (Refer to page 12.) 

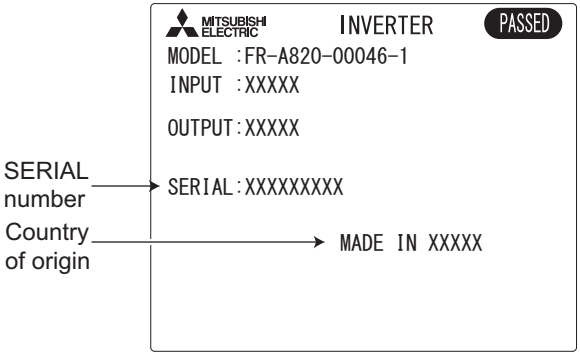
NOTE

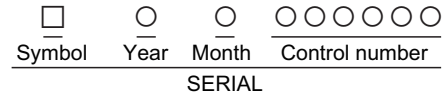
- Connection diagrams in this Instruction Manual appear with the control logic of the input terminals as sink logic, unless otherwise specified. (For the control logic, refer to the Instruction Manual (Detailed) of the inverter.)

1.1.2 SERIAL number check

The FR-A8AZ can be used with the models of inverters listed below which have the following SERIAL number. Check the SERIAL number indicated on the inverter rating plate or package.

Rating plate example



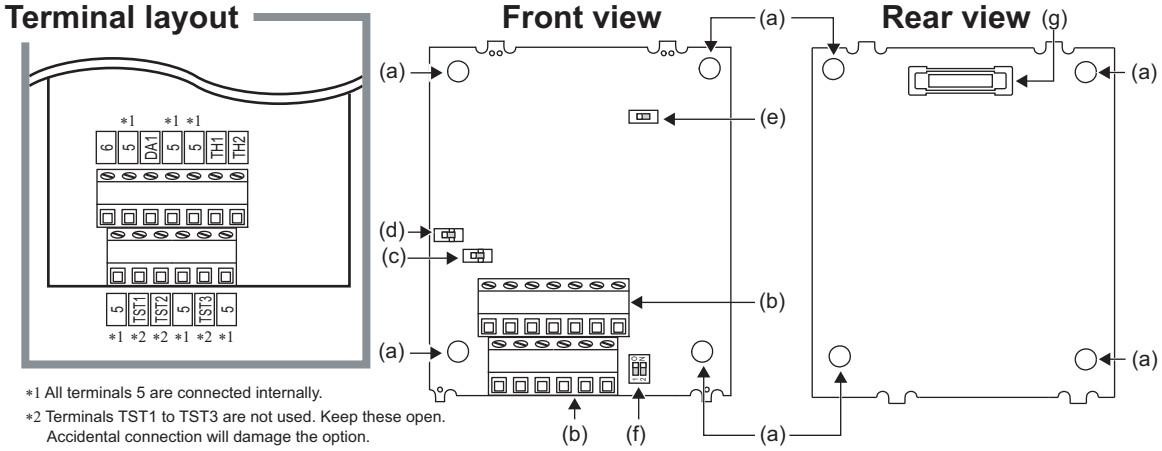


The SERIAL consists of one symbol, two characters indicating the production year and month, and six characters indicating the control number.
The last digit of the production year is indicated as the Year, and the Month is indicated by 1 to 9, X (October), Y (November), or Z (December).

FR-A800 series

Model	Country of origin indication	SERIAL number
FR-A820-00046(0.4K) to 04750(90K) FR-A840-00023(0.4K) to 06830(280K) FR-A842-07700(315K) to 12120(500K) FR-A846-00023(0.4K) to 03610(132K)	MADE in Japan	□52○○○○○○ or later
	MADE in China	□53○○○○○○ or later

1.2 Component names



*1 All terminals 5 are connected internally.

*2 Terminals TST1 to TST3 are not used. Keep these open. Accidental connection will damage the option.

Symbol	Name	Description	Refer to page
a	Mounting hole	Used to fix this product to the inverter by inserting a mounting screw or a spacer.	12
b	Terminal block	Wire the input or output devices.	16
c	Switch for thermistor calibration (SW2)	Change the setting when calibrating the thermistor.	41
d	Switch for manufacturer setting (SW1)	Do not change the switch setting from the initial setting. ()	—
e	Switch for manufacturer setting (SW3)	Do not change the switch setting from the initial setting. (OFF )	—
f	Switch for manufacturer setting (SW4)	Do not change the switch setting from the initial setting. (Switches 1 and 2 are ON  .)	—
g	Board mounted option connector	Used to connect this product to the option connector on the inverter.	12

2 INSTALLATION AND WIRING

2.1 Pre-installation instructions

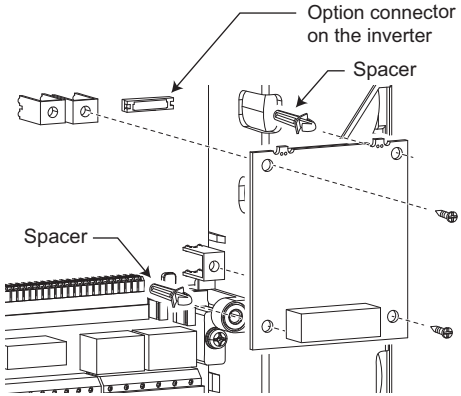
Check that the inverter's input power and the control circuit power are both OFF.

⚠CAUTION

- Do not install or remove the plug-in option while the input power is ON. Doing so may damage the inverter or plug-in option.
- To avoid damage due to static electricity, static electricity in your body must be discharged before you touch the product.

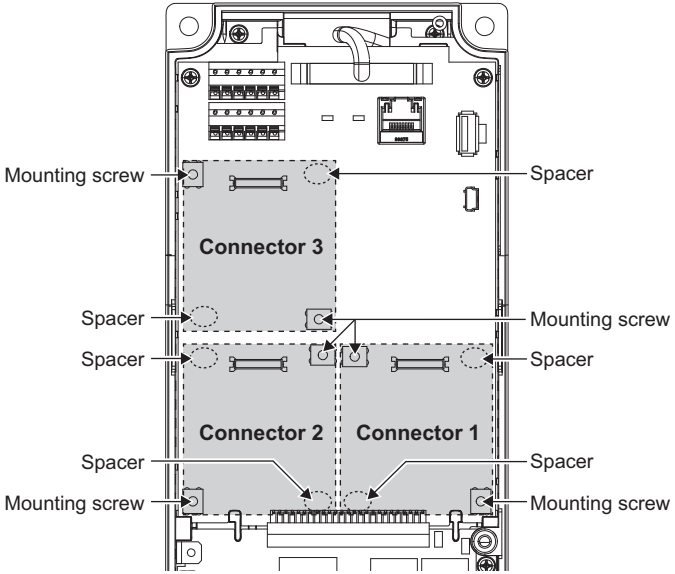
2.2 Installation procedure

1. Remove the inverter front cover. (Refer to Chapter 2 of the Instruction Manual (Detailed) of the inverter for instructions for removing the front cover.)
2. Insert two spacers into the mounting holes that will not be used for mounting screws (see the diagrams on page 13 to identify the holes).
3. Fit the board mounted option connector on this product to the guide of the option connector on the inverter, and insert the option as far as it goes.
4. Fasten this product to the inverter using the two mounting screws through the holes on either side (tightening torque 0.33 N·m to 0.40 N·m). If the screw holes do not line up, the connector may not be inserted deep enough. Check the connector.

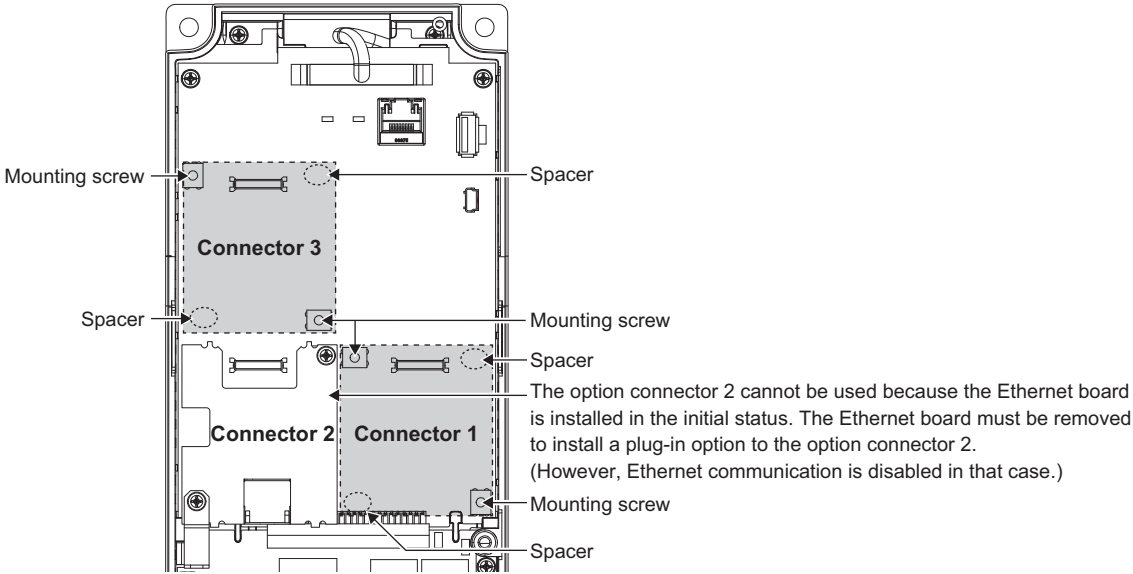


Example of installation to connector 1

◆ **Insertion positions of screws and spacers (RS-485 model)**



◆ Insertion positions of screws and spacers (Ethernet model)



NOTE

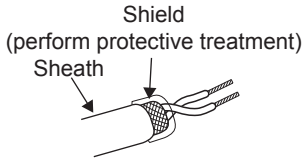
- When installing/removing the plug-in option, hold the sides of the option. Do not press on the parts on the option circuit board. Stress applied to the parts by pressing, etc. may cause a failure.
- Be careful not to drop mounting screws during the installation or removal of the plug-in option.
- Only one option attached to the option connector with high priority can function at once if more than one option of the same name are installed together on an inverter. Priority is given to option connectors in descending order (1 to 3), and options having a lower priority do not function.
- When the inverter cannot recognize the option due to improper installation or any other reason, the protective function (E.1 to E.3) is activated and the inverter cannot be operated. The indication shown (when a fault occurs) depends on the connector used (option connector 1 to 3).

Mounted position	Fault indication
Option connector 1	
Option connector 2	
Option connector 3	

- When removing the plug-in option, remove the two screws on either side, and then pull it straight out. Pressure applied to the option connector and to the option board may break the option.

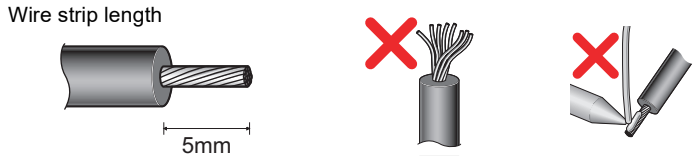
2.3 Wiring

1. Wire the shielded twisted pair cable after stripping its sheath to make its cables loose.
Also, protect the shielded cable of the shielded twisted pair cable to ensure that it will not make contact with the conductive area.

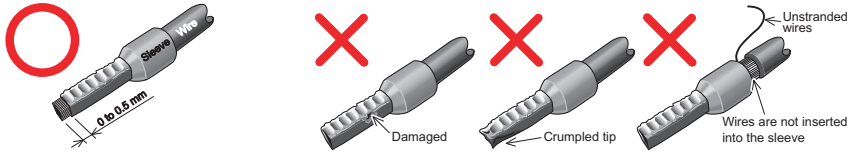


Shielded twisted pair cable

Strip the wires as follows. If too much of the wire is stripped, a short circuit may occur with neighboring wires. If not enough of the wire is stripped, wires may become loose and fall out.
Twist the stripped end of wires to prevent them from fraying. Do not solder them.



Use a crimp terminal as necessary.
When using the crimp terminal, make sure that the stranded wire do not come out of the terminal.



NOTE

- Crimp terminals commercially available (as of April 2023. The product may be changed without notice.)

Terminal screw size	Wire gauge (mm^2)	Ferrule part No.		Manufacturer	Crimping tool model No.
		With insulation sleeve	Without insulation sleeve		
M2	0.3	AI 0,34-6TQ	A 0,34-7	Phoenix Contact Co.,Ltd.	CRIMPFOX 6
	0.5	AI 0,5-6WH	A 0,5-6		

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

Screw size	Tightening torque	Wire gauge	Screwdriver
M2	0.22 N•m to 0.25 N•m	0.3 mm^2 to 0.75 mm^2	Small flathead screwdriver (Tip thickness: 0.4 mm/tip width: 2.5 mm)

NOTE

- The wiring length should be 30 m at the maximum.
- Under-tightening may cause cable disconnection or malfunction. Over-tightening may cause a short circuit or malfunction due to damage to the screw or option unit.
- When wiring the RS-485 terminals on the inverter with the plug-in options installed, be careful not to let RS-485 cables touch the option circuit boards and the inverter circuit board. This is to prevent a malfunction due to electromagnetic noises.

⚠CAUTION

- Do not use terminals TST1 to TST3 as junction terminals because they are used in the option unit. Doing so may damage the plug-in option.
- After wiring, do not leave wire offcuts in the inverter. Doing so may cause a fault, failure, or malfunction.

3 PARAMETER LIST

Use the following parameters with the FR-A8AZ.
Set these as required.

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value	Refer to page
326[*1]	G062	Motor temperature feedback reference	0 to 150℃, 9999	1℃	9999	47
406[*1]	T060	High resolution analog input selection	0, 2 to 6, 9999	1	9999	27
407[*1]	T620	Motor temperature detection filter	0 to 100 s, 9999	1 s	9999	37
408[*1]	H023	Motor thermistor selection	0, 1	1	0	37
750[*1]	M061	Motor temperature detection level	0 to 200℃	1℃	75℃	37
751[*1]	M046	Reference motor temperature	1 to 200℃	1℃	150℃	37
838[*1]	M304	DA1 terminal function selection	[*3]	1	2	21
839[*1]	M350	DA1 output filter	0 to 5 s	0.001 s	0.05 s	21
846	G236	Torque bias balance compensation	0 to 10 V, 9999	0.1 V	9999	27
847	G237	Fall-time torque bias terminal 1 bias	0 to 400%, 9999	1%	9999	27
848	G238	Fall-time torque bias terminal 1 gain	0 to 400%, 9999	1%	9999	27
857[*1]	M380	DA1-0V adjustment	900 to 1100%	1%	1000%	21
C0(900)[*2]	M310	FM/CA terminal calibration	—	—	—	21
C29(925)[*1*2]	H041	Motor temperature detection calibration (analog input)	0 to 200%	0.1%	100%	37
C30(926)[*2]	T680	Terminal 6 bias frequency (speed)	0 to 590 Hz	0.01 Hz	0 Hz	27
C31(926)[*2]	T681	Terminal 6 bias (speed)	0 to 300%	0.1%	0%	27
C32(927)[*2]	T682	Terminal 6 gain frequency (speed)	0 to 590 Hz	0.01 Hz	60 Hz/50 Hz[*4]	27
C33(927)[*2]	T683	Terminal 6 gain (speed)	0 to 300%	0.1%	100%	27

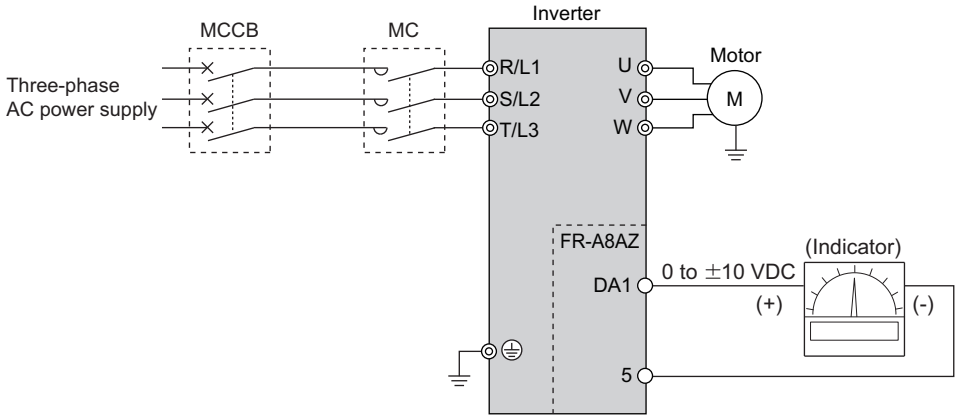
Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value	Refer to page
C34(928)*2	T684	Terminal 6 bias command (torque)	0 to 400%	0.1%	0%	27
C35(928)*2	T685	Terminal 6 bias (torque)	0 to 300%	0.1%	0%	27
C36(929)*2	T686	Terminal 6 gain command (torque)	0 to 400%	0.1%	150%	27
C37(929)*2	T687	Terminal 6 gain (torque)	0 to 300%	0.1%	100%	27

*1 Setting can be made only when the FR-A8AZ is mounted.
*2 The parameter number in parentheses is the one for use with the LCD operation panel and the parameter unit.
*3 Same as the setting range of **Pr.158 AM terminal function selection**. For the details, refer to the Instruction Manual (Detailed) of the inverter.
*4 Differs according to types. (FM type/CA type)

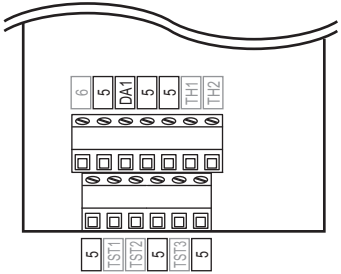
4 BIPOLAR ANALOG OUTPUT

Bipolar analog output is available with FR-A8AZ.
Outputting 0 to ±10 VDC 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 (±10 VDC).
5	Common terminal	Common terminal of terminal DA1

4.3 Bipolar analog outputting parameter

4.3.1 Parameter list

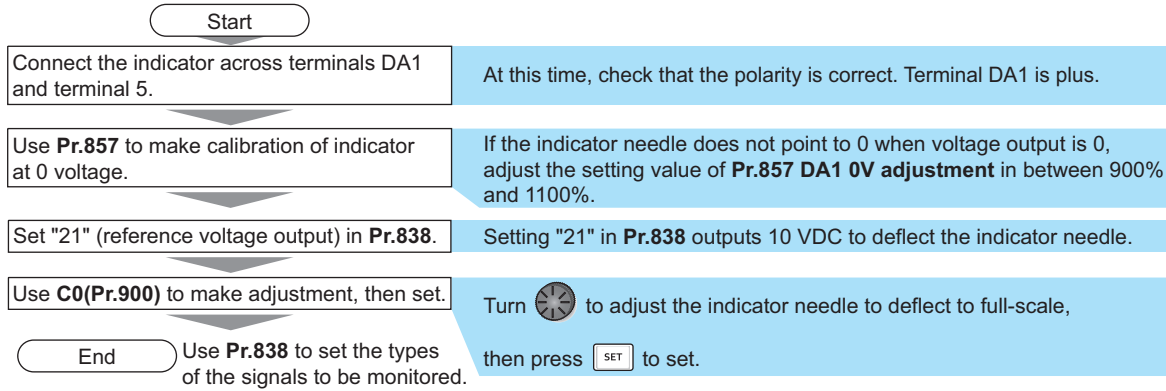
The following parameters are used for outputting bipolar analog.

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value
838*1	M304	DA1 terminal function selection	*3	1	2
839*1	M350	DA1 output filter	0 to 5 s	0.001 s	0.05 s
857*1	M380	DA1-0V adjustment	900 to 1100%	1%	1000%
C0(900)*2	M310	FM/CA terminal calibration	—	—	—

*1 Setting can be made only when the FR-A8AZ is mounted.
*2 The parameter number in parentheses is the one for use with the LCD operation panel and the parameter unit.
*3 Same as the setting range of **Pr.158 AM terminal function selection**. For the details, refer to the Instruction Manual (Detailed) of the inverter.

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

Refer to the following flow chart to calibrate the indicator.



NOTE

- If calibration is performed without setting "21" (reference voltage output) in **Pr.838**, terminal FM of the inverter is calibrated.
- When FR-A8AZ is remounted on other inverter, use **Pr.857** and **C0 (Pr.900)** of the inverter with the option to calibrate again.
- When FR-A8AZ and FR-A8AY are used 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-A8AY. (**Pr.309** and **Pr.310** are parameters for FR-A8AY. Refer to the Instruction Manual of the FR-A8AY for details of **Pr.309** and **Pr.310**.)

4.3.3 Monitor item list

- Set the monitor to be output to the terminal DA1 (bipolar analog output (0 to ±10 VDC voltage output)) in **Pr.838 DA1 terminal function selection**. The settings of **Pr.838** are the same as those of **Pr.158 AM terminal function selection**. For the details of **Pr.158**, refer to the Instruction Manual (Detailed) of the inverter.
- For the following monitor items, values with minus signs can be output from terminal DA1. Setting **Pr.290** and **Pr.1018** is not required.

Pr.838	Types of monitor	Full-scale value
1	Output frequency[*1]	**Pr.55**
6	Running speed[*1]	Value is **Pr.55** converted by **Pr.37**, **Pr.144**.
7	Motor torque[*2]	**Pr.866**
17	Load meter[*2]	**Pr.866**
32	Torque command[*2]	**Pr.866**
33	Torque current command[*2]	**Pr.866**
34	Motor output[*3]	Rated motor capacity
36	Torque monitor (driving/regenerative polarity switching)[*3]	**Pr.866**
46	Motor temperature	**Pr.751**
54	PID deviation	100%
70	PLC function analog output(SD1301)	100%
87	Remote output value 1	1000%
88	Remote output value 2	1000%
89	Remote output value 3	1000%
90	Remote output value 4	1000%
91	PID manipulated variable	100%
94	Second PID deviation	100%
96	Second PID manipulated variable	100%
98	Control circuit temperature	100°C

*1 Positive output during forward rotation and negative output during reverse rotation.
*2 Positive output at forward power driving or reverse regenerative driving and negative output at reverse power driving or forward regenerative driving.
*3 Positive output at forward power driving or reverse power driving and negative output at forward regenerative driving or reverse regenerative driving.

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 5 s with **Pr.839**.
- Increasing the setting stabilizes the terminal DA1 output more but reduces the response level.

NOTE

- Response time of the terminal DA1 is a total of the set value in **Pr.839 DA1 output filter** and a variable (up to 5 ms).
- When **Pr.839**="0", the instantaneous values are monitored for the following items.

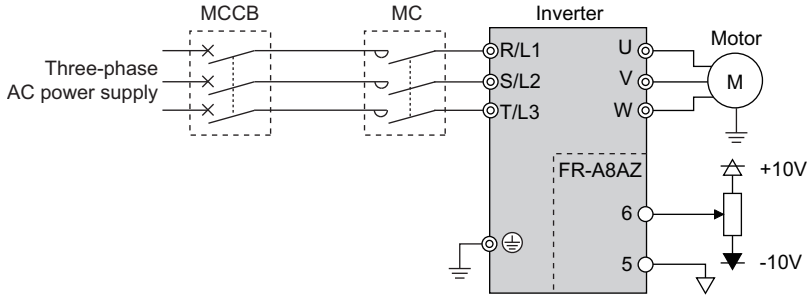
Pr.838	Types of monitor
6	Running speed
7	Motor torque
17	Load meter
32	Torque command
33	Torque current command
36	Torque monitor (driving/regenerative polarity switching)

- **Pr.1106 Torque monitor filter** and **Pr.1107 Running speed monitor filter** are disabled to terminal DA1 output.

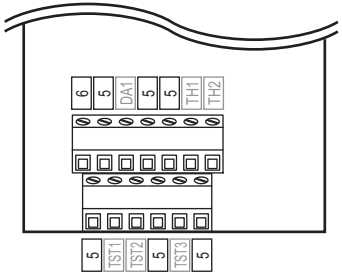
5 HIGH RESOLUTION ANALOG INPUT

High resolution analog input is available with FR-A8AZ.
Inputting 0 to ±10 VDC 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 ±10 VDC high resolution (16 bits) analog voltage input. Use **Pr.406 High resolution analog input selection** to select terminal function. Maximum permissible voltage: ±20 VDC
5	Common terminal	Common terminal of terminal 6

5.3 High resolution analog input parameter

5.3.1 Parameter list

Use the following parameters for high resolution analog input.

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value
406[*1*2]	T060	High resolution analog input selection	0, 2 to 6, 9999	1	9999
846	G236	Torque bias balance compensation	0 to 10 V, 9999	0.1 V	9999
847	G237	Fall-time torque bias terminal 1 bias	0 to 400%, 9999	1%	9999
848	G238	Fall-time torque bias terminal 1 gain	0 to 400%, 9999	1%	9999
C30(926)[*3]	T680	Terminal 6 bias frequency (speed)	0 to 590 Hz	0.01 Hz	0 Hz
C31(926)[*3]	T681	Terminal 6 bias (speed)	0 to 300%	0.1%	0%
C32(927)[*3]	T682	Terminal 6 gain frequency (speed)	0 to 590 Hz	0.01 Hz	60 Hz/50 Hz[*4]
C33(927)[*3]	T683	Terminal 6 gain (speed)	0 to 300%	0.1%	100%
C34(928)[*3]	T684	Terminal 6 bias command (torque)	0 to 400%	0.1%	0%
C35(928)[*3]	T685	Terminal 6 bias (torque)	0 to 300%	0.1%	0%
C36(929)[*3]	T686	Terminal 6 gain command (torque)	0 to 400%	0.1%	150%
C37(929)[*3]	T687	Terminal 6 gain (torque)	0 to 300%	0.1%	100%

*1 Setting can be made only when the FR-A8AZ is mounted.
*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 LCD operation panel and the parameter unit.
*4 Differs according to types. (FM type/CA type)

5.3.2 Selection of terminal 6 function (Pr.406)

◆ Terminal 6 function list

Functions of terminal 6 change according to the **Pr.406** setting and control method.
When a function is assigned to the terminal 6 while the same function is assigned to the terminal 1, 2, or 4, the input to the terminal 1, 2 or 4 becomes invalid.

Pr.406 setting	V/F control/ Advanced magnetic flux vector control	Real sensorless vector control/ vector control/PM sensorless 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	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.

◆ Filter of terminal 6 input

When giving the speed command or limiting the speed from terminal 6 input, settings of **Pr.822 Speed setting filter 1** and **Pr.832 Speed setting filter 2** are valid.
When giving the torque command or limiting the torque from terminal 6 input, settings of **Pr.826 Torque setting filter 1** and **Pr.836 Torque setting filter 2** are valid.
When "9999 (initial value)" is set in **Pr.822**, **Pr.832**, **Pr.826**, and **Pr.836**, **Pr.74 Input filter time constant** is valid.
For details on **Pr.822**, **Pr.832**, **Pr.826**, **Pr.836**, and **Pr.74**, refer to the Instruction Manual (Detailed) of the inverter.

◆ 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.252 Override bias and **Pr.253 Override gain** become valid for terminal 6, and the override compensation value is set for terminal 6 input.
Pr.849 Analog input offset adjustment becomes valid for terminal 6 and terminal 6 input is provided with offset.
Refer to the Instruction Manual (Detailed) of the inverter for details of **Pr.242**, **Pr.252**, **Pr.253** and **Pr.849**.

◆ Torque bias of terminal 6

When "6" is set in **Pr.406**, 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.

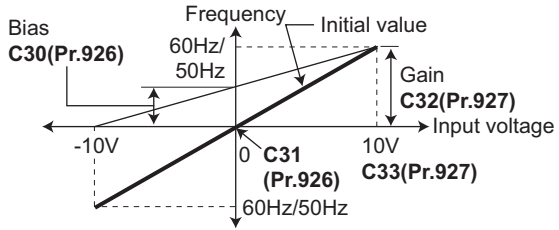
5.3.3 Calibration of terminal 6 (Pr.148, Pr.149, Pr.846 to Pr.848, C30 to C37)

◆ 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.252**, **Pr.253**, **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 0 V input**	**Pr.149 Stall prevention level at 10 V 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**	**Pr.826**, **Pr.836**
9999 (initial value)	—	—	—	—

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

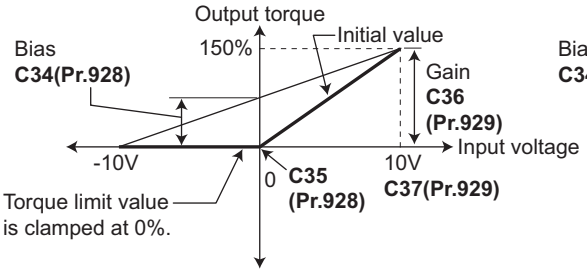


When **Pr.406** = "0, 5", terminal 6 acts as speed command or speed limit input and **C30 to C33** are used for calibration parameter.

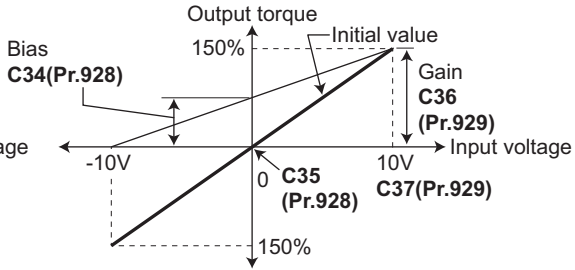
◆ Calibration of torque command/torque limit (Pr.406 = "2, 3, 4")

When **Pr.406** = "2, 3, 4" under Real sensorless vector control, vector control, or PM sensorless vector control, terminal 6 acts as torque command or torque limit input and **C34 to C37** are used for calibration parameters.

<Torque limit, regenerative torque limit>



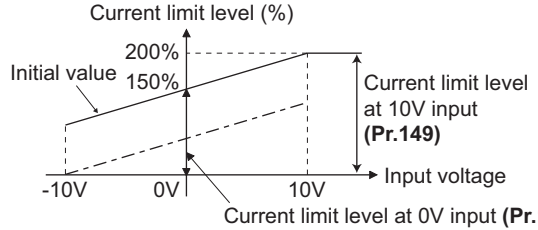
<Torque command>



5

◆ 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.

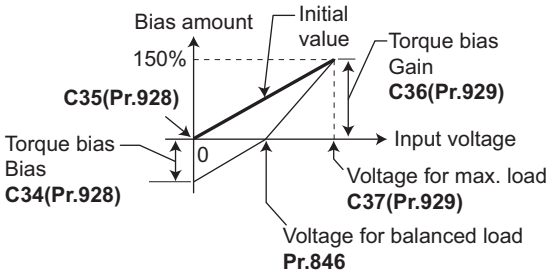


◆ Calibration of torque bias input (Pr.406 = "6")

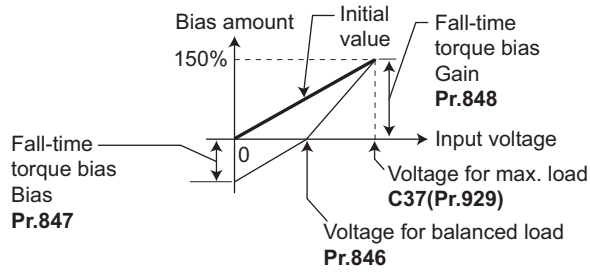
When **Pr.406** = "6", terminal 6 acts as torque bias input and **Pr.846 to Pr.848**, **C34 to C37** are used for calibration parameter.

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

<When the motor runs in forward rotation direction>

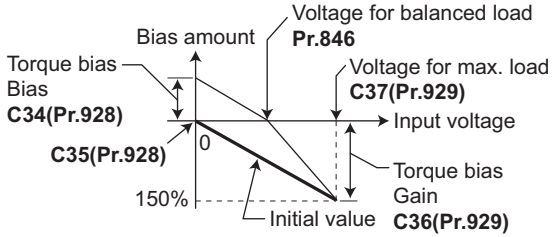


<When the motor runs in reverse rotation direction>

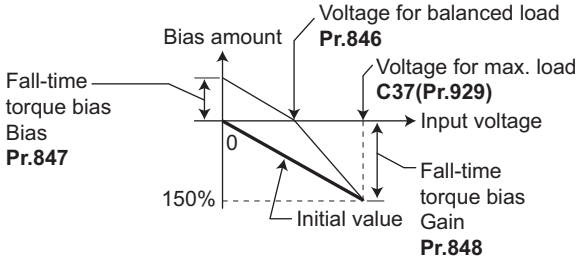


Pr.840 = "2" (at regeneration when the motor is in forward rotation)

<When the motor runs in reverse rotation direction>



<When the motor runs in forward rotation direction>



5.4 Noise reduction techniques

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

◆ Measures at wiring

Separate the power cable as far away as possible from the signal cable.
Use a shielded twisted pair cable for a signal cable.
Take one of appropriate measures below for the shielded cable.

- Connect to terminal 5 of the FR-A8AZ.
- Connect to the common terminal of an analog command device.
- Connect to both terminal 5 of the FR-A8AZ and common terminal of the analog command device.
- Leave both terminal 5 of the FR-A8AZ and common terminal of the analog command device open. (Float the potential of the shield cable.)

◆ Measures of inverter

- If a large 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)**.

NOTE

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

◆ Measures of option

- Install the line noise filter FR-BLF (FR-BSF01 for the 3.7K or lower).

NOTE

- Refer to the Instruction Manual (Detailed) of the inverter for details of measures for EMI.

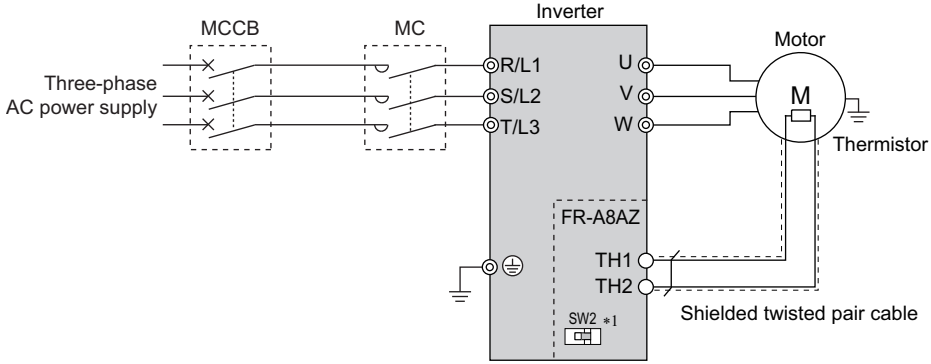
5.5 Specifications

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

6 MOTOR THERMISTOR INTERFACE

A vector-controlled motor with thermistor (SF-V5RU□□□□□T/A) detects the motor temperature with the motor-side thermistor and sends the detected temperature to the inverter as a feedback. This operation reduces fluctuation of the generated torque due to temperature changes. The detected motor temperature can be output as an output signal (Y55 signal) or be displayed on the monitor.
Torque accuracy is ±3%.

6.1 Connection diagram

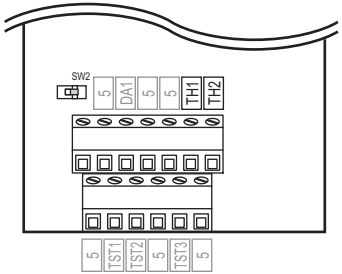


*1 When calibrating the thermistor, change the switch for thermistor calibration. (Refer to page 41)

NOTE

- The motor temperature detection is valid for the first motor. When applying the second motor (RT signal is ON), temperature detection is not performed.
- To detect temperature with FR-A8AZ, 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	Switch for thermistor calibration	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 thermistor interface.
Following parameters are available only when used with FR-A8AZ.

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value
326*1	G062	Motor temperature feedback reference	0 to 150℃, 9999	1℃	9999
407*1	T620	Motor temperature detection filter	0 to 100 s, 9999	1 s	9999
408*1	H023	Motor thermistor selection	0, 1	1	0
750*1	M061	Motor temperature detection level	0 to 200℃	1℃	75℃
751*1	M046	Reference motor temperature	1 to 200℃	1℃	150℃
C29(925)*1*2	H041	Motor temperature detection calibration (analog input)	0 to 200%	0.1%	100%

*1 Setting can be made only when the FR-A8AZ is mounted.
*2 The parameter number in parentheses is the one for use with the LCD operation panel and the parameter unit.

6.3.2 Thermistor setting

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

Pr.	Pr. group	Name	Initial value	Minimum setting increments	Setting range	Description
408	H023	Motor thermistor selection	0	1	0	SF-V5RU□□□□□□T
					1	SF-V5RU□□□□□□A

6.3.3 Enabling the motor thermistor

When **Pr.407 Motor temperature detection filter** is set to a value other than "9999", the motor thermistor is enabled to activate the motor thermal protection and slip compensation.

- Normally set about "30 s" in **Pr.407**.
- When the response is slow to the motor temperature, set a smaller value.

◆ Motor thermal

- When the motor temperature remains at 145℃ or higher for 10 seconds, the Motor overload trip (E.THM) is activated to shut off the inverter output.
- When the motor temperature goes below -30℃ during operation, the Motor overload trip (E.THM) is activated to shut off the inverter output. The Motor overload trip (E.THM) does not occur during a stop.

NOTE

- When operation is performed with the 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** to make the thermal protection function valid. When the setting remains "9999", motor protection is not activated. (When **Pr.407** = "9999", the electronic thermal O/L relay operates based on the current value set in **Pr.9 Electronic thermal O/L relay**.)

◆ Slip compensation (R2 compensation)

Slip compensation (R2 compensation) is available under Vector control. Refer to page 47 for details.

6.3.4 Thermistor calibration (C29)

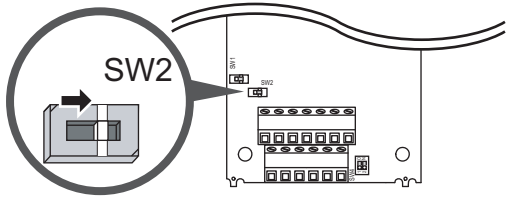
Perform calibration of the inverter and FR-A8AZ (thermistor interface) at installation, before starting the motor.

NOTE

- Calibration must be performed at installation.

◆ **Calibration method**

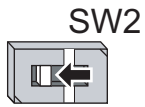
1. Set the switch for thermistor calibration (SW2) to align with the line to bring the FR-A8AZ to the calibration status.



2. Read **C29 (Pr.925)** and set the compensation value.

- Compensation using the operation panel (FR-DU08) ☞ Refer to page 42
- Compensation using the LCD operation panel (FR-LU08) ☞ Refer to page 43

3. After the compensation is completed, return the switch for thermistor calibration (SW2) to the original position.

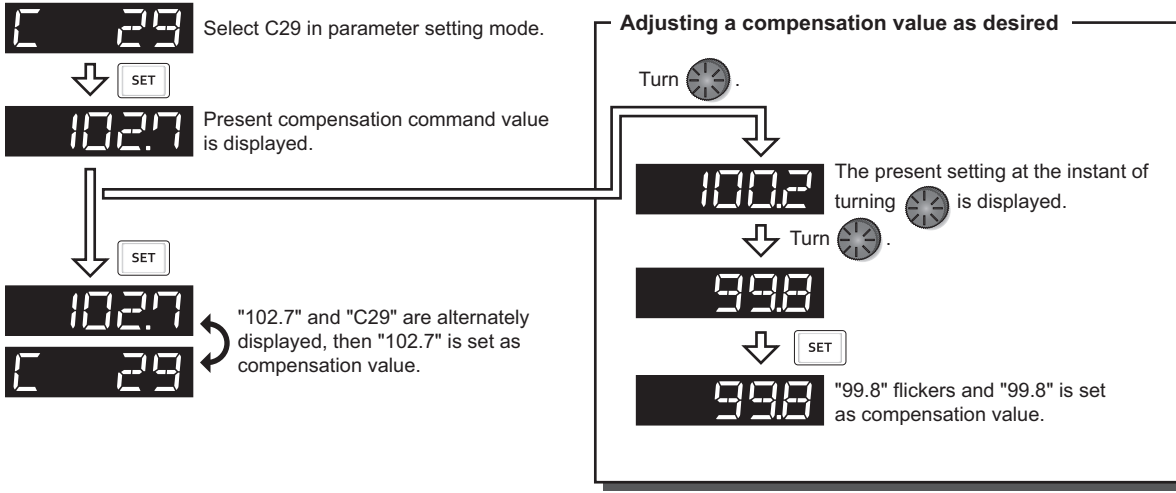


NOTE

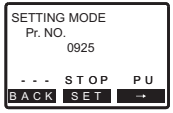
- Always return the SW2 to the original position after calibration. If the motor is started in the calibration status, the Motor overload trip (E.THM) is activated to shut off the inverter output.

◆ Operation example of compensation value setting

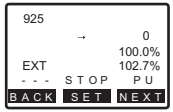
• Calibration using the operation panel (FR-DU08)

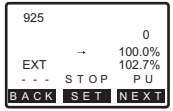


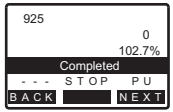
• Calibration using the LCD operation panel (FR-LU08)



Select **Pr.925** in parameter setting mode. (Also selectable from the functional list in the quick menu, the initial value list or the parameter change list in the function menu.)

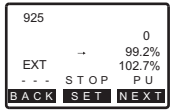




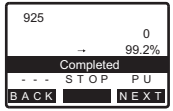


"102.7" is set as compensation value.

Adjusting a compensation value as desired



Turn until "99.2" appears.



"99.2" is set as compensation value.

6.3.5 Motor temperature detection signal

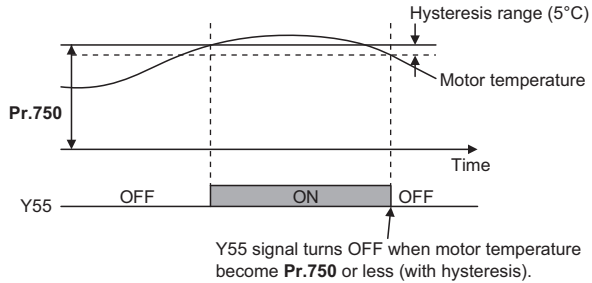
When motor temperature exceeds the detection level, motor temperature detection signal (Y55) is output. (Set **Pr.407 Motor temperature detection filter** ≠ "9999")

Set "55 (positive logic)" or "155 (negative logic)" in the following parameters to output the motor temperature detection signal (Y55) when motor temperature exceeds the detection level.

- **Pr.190 to Pr.196 Output terminal function selection** (Refer to the Instruction Manual (Detailed) of the inverter for details.)
- **Pr.313 to Pr.319 DO0 to DO6 output function selections** (Refer to the Instruction Manual of FR-A8AY for details.)
- **Pr.320 to Pr.322 RA1 to RA3 output function selections** (Refer to the Instruction Manual of FR-A8AR for details.)

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value
750*1	M061	Motor temperature detection level	0 to 200℃	1℃	75℃

*1 Setting can be made only when the FR-A8AZ is mounted.



NOTE

- The motor temperature detection signal is not available when **Pr.407** = "9999".

6.3.6 Motor temperature monitor output

The motor temperature can be monitored using PU, DU, terminal AM, terminal FM/CA, RS-485 communication, or each output option. (Set **Pr.407 Motor temperature detection filter** ≠ "9999")

Set "46" in the following parameters.

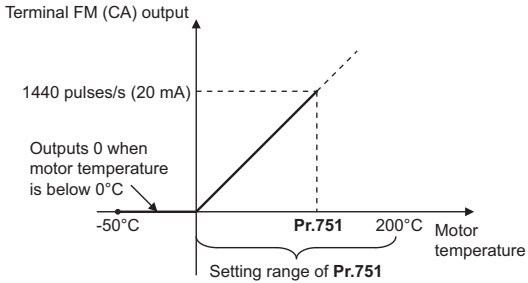
- **Pr.52 Operation panel main monitor selection, Pr.54 FM/CA terminal function selection, Pr.158 AM terminal function selection** (Refer to the Instruction Manual (Detailed) of the inverter for details.)
- **Pr.306 Analog output signal selection, Pr.310 Analog meter voltage output selection** (Refer to the Instruction Manual of FR-A8AY for details.)
- **Pr.838 DA1 terminal function selection** (Refer to page 22)

Set the following parameter to adjust the motor temperature on the full scale.

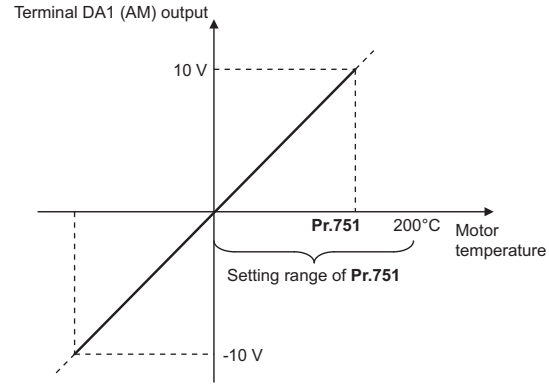
Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value
751*1	M046	Reference motor temperature	1 to 200℃	1℃	150℃

*1 Setting can be made only when the FR-A8AZ is mounted.

Output from terminal FM (CA)



Output from terminal DA1 (AM *1)



*2 When **Pr.290 Monitor negative output selection** = "1, 3, 5, or 7"

NOTE

- When **Pr.407** = "9999", motor temperature monitor is not activated.

6.3.7 Slip compensation

When **Pr.407 Motor temperature detection filter** ≠ "9999", slip compensation is enabled under vector control for the motor with an encoder. The slip frequency is compensated by **Pr.326 Motor temperature feedback reference** and the detected temperature.

When using the motor constant set by offline auto tuning or set directly, set in **Pr.326** the motor temperature for when the motor constant (R2) was determined.

Pr.	Pr. group	Name	Initial value	Minimum setting increments	Setting range	Description
326*1	G062	Motor temperature feedback reference	9999	1℃	0 to 150℃	Set the motor temperature for when the motor constant (R2) was determined.
					9999	The slip frequency is compensated with a reference temperature of 75℃.

*1 Setting can be made only when the FR-A8AZ is mounted.

NOTE

- When **Pr.407** ≠ "9999", magnetic flux observer under vector control for the motor with an encoder (**Pr.95 Online auto tuning selection** = "2") is invalid.

Appendix 1 Instructions for compliance with the EU Directives

The EU Directives are issued to standardize different national regulations of the EU Member States and to facilitate free movement of the equipment, whose safety is ensured, in the EU territory.
Since 1996, compliance with the EMC Directive that is one of the EU Directives has been legally required. When a manufacturer confirms its equipment to be compliant with the EMC Directive, the manufacturer must declare the conformity and affix the CE marking.

- The authorized representative in the EU

The authorized representative in the EU is shown below.
Name: Mitsubishi Electric Europe B.V.
Address: Mitsubishi-Electric-Platz 1, 40882 Ratingen, Germany

◆ EMC Directive

We declare that this product conforms with the EMC Directive when installed in a compatible inverter, and affix the CE marking on the packaging plate.

- EMC Directive: 2014/30/EC
- Standard(s): EN 61800-3 (Second environment / PDS Category "C3")

■ Note

- To install and wire the inverter, refer to the "Instructions for compliance with the EU Directives" in the Instruction Manual enclosed with the inverter.
- Confirm that the final integrated system with the inverter conforms with the EMC Directive.

◆ EU RoHS Directive

We declare that this product conforms with the EU RoHS Directive (2011/65/EU) when installed in a compatible inverter, and affix the CE marking on the packaging plate.

Appendix 2 Instructions for EAC

The product certified in compliance with the Eurasian Conformity has the EAC marking on the packaging plate.

Note: EAC marking

In 2010, three countries (Russia, Belarus, and Kazakhstan) established a Customs Union for the purposes of revitalizing the economy by forming a large economic bloc by abolishing or reducing tariffs and unifying regulatory procedures for the handling of articles.

Products to be distributed over these three countries of the Customs Union must comply with the Customs Union Technical Regulations (CU-TR), and the EAC marking must be affixed to the products.

For information on the country of origin, manufacture year and month, and authorized sales representative (importer) in the CU area of this product, refer to the following:

• Country of origin indication

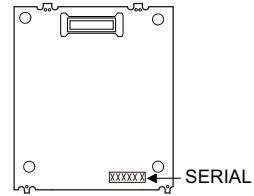
Check the package of this product.

Example: MADE IN JAPAN

• Manufactured year and month

Check the SERIAL number indicated on this product.

□	○	○	○○○
Symbol	Year	Month	Control number
SERIAL			



The SERIAL consists of one symbol, two characters indicating the production year and month, and three characters indicating the control number. The last digit of the production year is indicated as the Year, and the Month is indicated by 1 to 9, X (October), Y (November), or Z (December).

• Authorized sales representative (importer) in the CU area

The authorized sales representative (importer) in the CU area is shown below.

Name: Mitsubishi Electric Turkey A.S. Head Office

Address: Serifali Mahallesi Kale Sokak. No:41 34775 Umraniye, Istanbul, Turkey

Phone: +90-216-969-25-00

Fax: +90-216-661-44-47

Appendix 3 Restricted Use of Hazardous Substances in Electronic and Electrical Products

The mark of restricted use of hazardous substances in electronic and electrical products is applied to the product as follows based on the “Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products” of the People's Republic of China.

电器电子产品有害物质限制使用标识要求

本产品中所含有的有害物质的名称、含量、含有部件如下表所示。

• 产品中所含有害物质的名称及含量

部件名称 *2	有害物质 *1					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
电路板组件（包括印刷电路板及其构成的零部件，如电阻、电容、集成电路、连接器等）、电子部件	×	○	×	○	○	○
金属壳体、金属部件	×	○	○	○	○	○
树脂壳体、树脂部件	○	○	○	○	○	○
螺丝、电线	○	○	○	○	○	○

上表依据 SJ/T11364 的规定编制。

○：表示该有害物质在该部件所有均质材料中的含量均在 GB/T26572 规定的限量要求以下。

×：表示该有害物质在该部件的至少一种均质材料中的含量超出 GB/T26572 规定的限量要求。

*1 即使表中记载为 ×，根据产品型号，也可能会有有害物质的含量为限制值以下的情况。

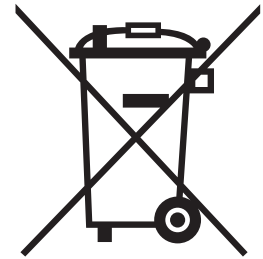
*2 根据产品型号，一部分部件可能不包含在产品中。

Appendix 4 Referenced Standard (Requirement of Chinese standardized law)

This Product is designed and manufactured accordance with following Chinese standards.
EMC: GB/T 12668.3

Appendix 5 Regarding Directive on Waste Electrical and Electronic Equipment

This symbol mark is for EU countries only, and is according to the directive 2012/19/ EU Article 14 Information for users and Annex IX.
This symbol mark means that electrical and electronic equipment, at their end-of-life, should be disposed of separately from your household waste.



Appendix 6 Compliance with the UK certification scheme

We declare that this product conforms with the related technical requirements under UK legislation when installed in a compatible inverter, and affix the UKCA (UK Conformity Assessed) marking on the packaging plate.
Approval conditions are the same as those for the EU Directives. (Refer to page 48.)

UKCA marking:
The UKCA marking is used for products sold in the markets of Great Britain (England, Wales, and Scotland) from January 1, 2021 after the departure of the UK from the EU on January 31, 2020.

MEMO

REVISIONS

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

Revision date	*Manual number	Revision
Feb. 2015	IB(NA)-0600578ENG-A	First edition
Mar. 2024	IB(NA)-0600578ENG-B	Added • Instructions for compliance with the EU Directives • Instructions for EAC • Restricted Use of Hazardous Substances in Electronic and Electrical Products • Referenced Standard (Requirement of Chinese standardized law) • Regarding Directive on Waste Electrical and Electronic Equipment • Compliance with the UK certification scheme

INVERTER

MITSUBISHI ELECTRIC CORPORATION

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IB(NA)-0600578ENG-B(2403) MEE Printed in Japan