Analog Input/Output interface Card "VF1A-AIO"

Thank you for purchasing our analog input/output interface card "VF1A-AIO". This manual has indicated note when attaching "VF1A-AIO" to Doesa VF1A series.

1. INSTALLATION

(1) Preparation of attachment

This option card requires an attachment.

Please prepare an attachment according to inverter capacity. Refer to Table 1.1 for the form of an attachment.

Table 1.1 Attachment form lists

Inverter capacity	Attachment form
VF1A-G44A0S4 or less	VF1A-ADP1
VF1A-G59A0S4/VF1A-G72A0S4	VF1A-ADP2
VF1A-G85A0S4 or above	VF1A-ADP3

(2) Means of installation

Please refer to the instruction manual of VF1A-ADP□ for the installation procedure of this option.

2. ACCEPTANCE INSPECTION

Check the following:

(1)　An AIO interface card and two screws (M3 × 8) are contained in the package.

(2)　The AIO interface card is not damaged during transportation--no defective parts, dents or warps.

(3)　The model name "VF1A-AIO" is printed on the AIO interface card. (See Figure 2.1.)

If you suspect the product is not working properly or if you have any questions about your product, contact the shop where you bought the product or your local IDEC branch office.
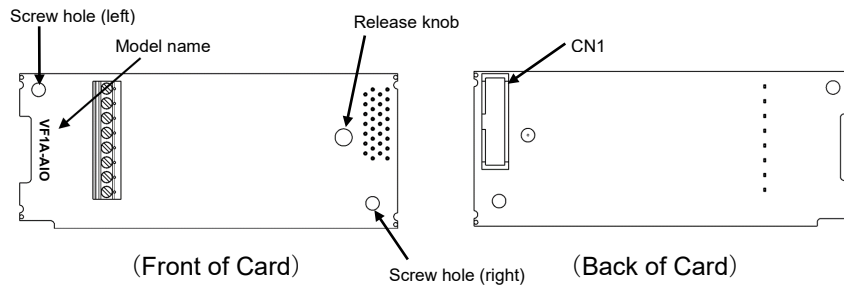
Figure 2.1 Names of Parts on AIO Interface Card (VF1A-AIO)

3. OPERATING ENVIRONMENT

Install the inverter equipped with this interface card in an environment that satisfies the requirements listed in Table 3.1. For the items not covered in this section, the specifications of the inverter itself apply.

Table 3.1 Environmental Requirements

Item	Specifications
Site location	Refer to a target inverter's instruction manual.
Relative humidity	5 to 95% (No condensation)
Atmosphere	The inverter must not be exposed to dust, direct sunlight, corrosive gases, flammable gases, oil mist, vapor or water drops. Pollution degree 2 (IEC60664-1) (Note)
	The atmosphere can contain a small amount of salt.
	(0.01 mg/cm^2 or less per year)
	The inverter must not be subjected to sudden changes in temperature that will cause condensation to form.
Altitude	1,000 m max.
Atmospheric pressure	86 to 106 kPa

(Note) Do not install the inverter in an environment where it may be exposed to lint, cotton waste or moist dust or dirt which will clog the heat sink of the inverter. If the inverter is to be used in such an environment, install it in a dustproof panel of your system.

4. WIRING AND CABLING

4.1 Wiring of interface card

Perform wiring for the interface card observing the precautions below. Refer to the wiring examples shown in Figure 4.3.

(1) Turn the inverter's power OFF.
(2) Use shielded wires.
(3) To prevent malfunction due to noise, keep the wiring for the interface card away from the main circuit wiring and other power lines as far as possible. Never install them in the same wire duct.
(4) Complete wiring before turning the inverter ON.
(5) See Table 4.1 for the specifications of the terminal block on the interface card.

   When using stripped wires (without attaching a crimp terminal), strip the wire end by 5 to 7 mm. (Figure 4.1) When using a crimp terminal, attach a vinyl-insulated ferrule.

   Loosen the terminal screw, insert the wire end into above the metal part of the terminal block, and tighten the screw to fasten it. (Figure 4.2)

Table 4.1 Terminal Specifications

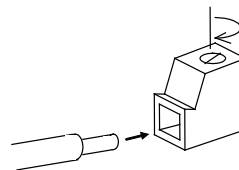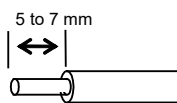| Item	Specifications
Wire size	AWG24 to AWG18 (0.25 to 0.75 mm^2), wire with rated temperature 105°C (UL) recommended
Terminal screw size	M2
Tightening torque	0.22 to 0.25 N-m

5 to 7 mm

Figure 4.1 Wire End Treatment (For Connection to Terminals on Interface Card)

Figure 4.2 Connecting to a Terminal on Interface Card

⚠WARNING

- Before changing the switches, turn OFF the power and wait for the time shown in a target inverter's instruction manual to elapse. Make sure that the charging lamp is turned OFF. Further, make sure, using a multimeter or a similar instrument, that the DC link bus voltage between the terminals P(+) and N(-) has dropped to the safe level (+25 VDC or below).
- Qualified electricians should carry out wiring.
  Otherwise, an electric shock could occur.
- In general, the covers of the control signal wires are not specifically designed to withstand a high voltage (i.e., reinforced insulation is not applied). Therefore, if a control signal wire comes into direct contact with a live conductor of the main circuit, the insulation of the cover might break down, which would expose the signal wire to a high voltage of the main circuit. Make sure that the control signal wires will not come into contact with live conductors of the main circuit.
  Failure to observe this precaution could cause an electric shock or fire.

⚠CAUTION

Noise may be emitted from the inverter, motor and wires. Take appropriate measures to prevent the nearby sensors and devices from malfunctioning due to such noise.
An accident could occur.
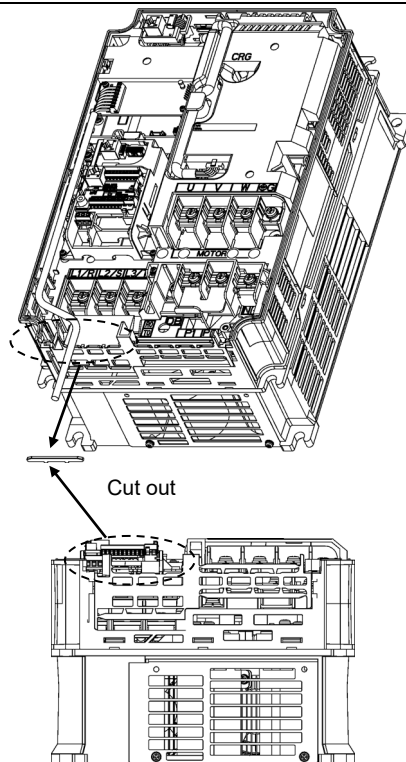
Cut out

VF1A-G72A0S4 example

Cut out part of the wiring guide and pass through the wires from the AIO interface card.

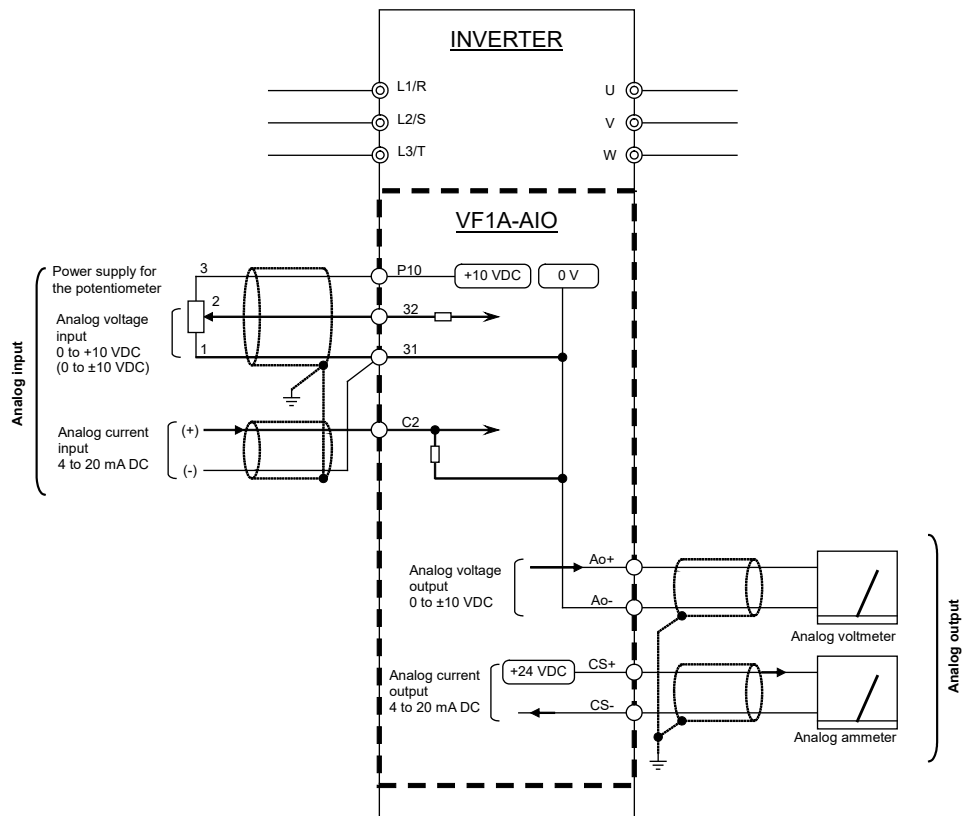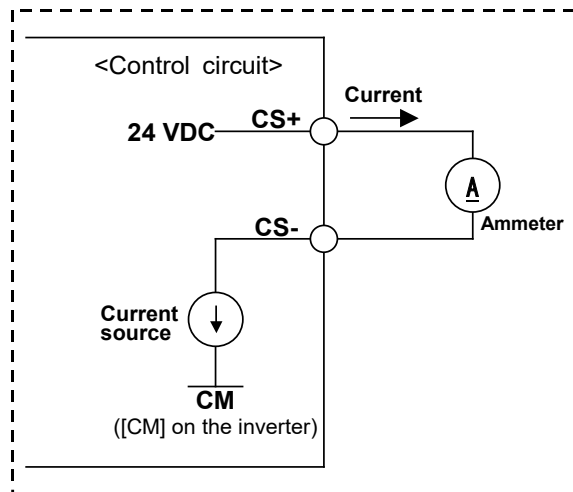## 4.2 Basic Connection Diagram

Figure 4.3 Basic Connection Diagram

5. TERMINAL FUNCTIONS

Terminal function list is shown in table 5.1.

Table 5.1 Terminals and Specifications

Classifi-cations	Symbol	Name	Functions
Analog input	P10	Power supply for the potentiometer	Power supply for frequency command potentiometer (Variable resistor: 1 to 5 kΩ) The potentiometer of 1/2 W rating or more should be connected. (10 VDC, 10 mA DC max.)
	32	Analog voltage input	(1) Used as analog voltage input from external equipment. Refer to "6 Configuring Inverter's Function Codes" for the contents of a signal. (2) Hardware specifications • Input voltage: 0 to ±10 VDC/0 to ±100% (0 to ±5 VDC/0 to ±100%) • Input impedance: 22 kΩ • The maximum input is ±15 VDC, however, the voltage higher than ±10 VDC is handled as ±10 VDC. • Resolution: 1/3000 • Adjustable range of the gain: 0.00 to 200%
	C2	Analog current input	(1) Used as analog current input from external equipment. Refer to "6 Configuring Inverter's Function Codes" for the contents of a signal. (2) Hardware specifications • Input current: 4 to 20 mA DC/0 to 100% • Input impedance: 250 Ω • The maximum input is +30 mA DC, however, the current larger than +20 mA DC is handled as +20 mA DC. • Resolution: 1/3000 • Adjustable range of the gain: 0.00 to 200%
	31	Analog common	Reference terminal for [P10], [32] and [C2]. Isolated from terminals [CS+] and [CS-]. Same potential as terminals [Ao-] and [11] on the inverter.
Analog output	Ao+	Analog voltage output (+)	(1) Outputs the monitor signal of analog DC voltage (0 to ±10 VDC). Refer to "6 Configuring Inverter's Function Codes" for the contents of a signal. (2) Hardware specifications • Output voltage: 0 to ±10 VDC • Input impedance of the external device: Min. 5 kΩ (at 0 to 10 VDC output) • Resolution: 1/3000 • Adjustable range of the gain: 0 to 300%
	Ao-	Analog voltage output (-)	Reference terminal for [Ao+]. Isolated from terminals [CS+] and [CS-]. Same potential as terminal [31] and [11] on the inverter.
	CS+	Analog current output (+)	(1) Outputs the monitor signal of analog DC current (4 to 20 mA DC). Refer to " 6 Configuring Inverter's Function Codes " for the contents of a signal. (2) Hardware specifications • Output current: 4 to 20 mA DC • Input impedance of the external device: Max. 500Ω (at 4 to 20 mA DC output) • Resolution: 1/3000 • Adjustable range of the gain: 0 to 300%
	CS-	Analog current output (-)	

6. CONFIGURING INVERTER'S FUNCTION CODES

Table 6.1 lists the function codes related to the analog input/output interface card.

Table 6.1 Function Codes and Parameters

Function code	Name	Data setting range	Change when running *1	Data copy *2	Default setting
o60	Terminal [32] function (Mode Selection)	0: No Assignment 1: Auxiliary frequency command 1 2: Auxiliary frequency command 2 3: PID command 5: PID feedback amount 6: Ratio setting 7: Analog torque limit value A 8: Analog torque limit value B 9: Torque bias amount 10: Torque command 11: Torque current command 17: Speed limit value of FWD 18: Speed limit value of REV 20: Analog signal input monitor	N	Y	0
o61	(Offset adjustment)	-5.0 to +5.0%	Y*	Y	0.0
o62	(Gain adjustment)	0.00 to 200.00%	Y*	Y	100.00
o63	(Filter setting)	0.00 to 5.00s	Y	Y	0.05
o64	(Gain base point)	0.00 to 100.00%	Y*	Y	100.00
o65	(polarity)	0: Bipolar 1: Unipolar	N	Y	1
o66	(Bias)	-100.00 to 100.00%	Y*	Y	0.00
o67	(Bias base point)	0.00 to 100.00%	Y*	Y	0.00
o69	(Display Unit)	1 to 80 * Please refer to the J105 of User's Manual of a target inverter	N	Y	2
o70	(Maximum scale)	-999 to 0.00 to 9990	N	Y	100.0
o71	(Minimum scale)	-999 to 0.00 to 9990	N	Y	0.00
o75	Terminal [C2] function (Current range selection)	0: 4 to 20mA (0 to 100%) 1: 0 to 20mA (0 to 100%) 10: 4 to 20mA (-100 to 100%) 11: 0 to 20mA (-100 to 100%)	N	Y	0
o76	(Mode selection)	Same as o60	N	Y	0
o77	(Offset adjustment)	-5.0 to +5.0%	Y*	Y	0.0
o78	(Gain adjustment)	0.00 to 200.00%	Y*	Y	0
o79	(Filter setting)	0.00 to 5.00s	Y	Y	0.05
o81	(Gain base point)	0.00 to 100.00%	Y*	Y	100.00
o82	(Bias)	-100.00 to 100.00%	Y*	Y	0.00
o83	(Bias base point)	0 to 100.00%	Y*	Y	0.00
o85	(Display unit)	1 to 80 * Please refer to the J105 of User's Manual of a target inverter	N	Y	2
o86	(Maximum scale)	-999 to 0.00 to 9990	N	Y	0.00
o87	(Minimum scale)	-999 to 0.00 to 9990	N	Y	0.00

1 Y: Possible, Y: Possible, N: Impossible
   (For details about Y* and Y, refer to the User's Manual of a target inverter.)

*2 Y: Possible, N: Impossible

Table 6.1 Function Codes and Parameters (continued)

Function code	Name	Data setting range	Change when running *1	Data copy *2	Default setting
o90	Terminal [Ao] function (Mode selection)	0 : Output frequency 1 (before slip compensation) 1 : Output frequency 2 (after slip compensation) 2 : Output current 3 : Output voltage 4 : Output torque 5 : Load factor 6 : Input power 7 : PID feedback amount 8 : PG feedback value (speed) 9 : DC link bus voltage 10 : Universal AO 13 : Motor output 14 : Calibration 15 : PID command (SV) 16 : PID output (MV) 17 : Position deviation in synchronous operation 18 : Heat sink temperature 21 : PG feedback value 111: Customizable logic output signal 1 112: Customizable logic output signal 2 113: Customizable logic output signal 3 114: Customizable logic output signal 4 115: Customizable logic output signal 5 116: Customizable logic output signal 6 117: Customizable logic output signal 7 118: Customizable logic output signal 8 119: Customizable logic output signal 9 120: Customizable logic output signal 10	Y	Y	0
o91	(Gain adjustment)	0 to 300%	Y*	Y	100
o93	(Polarity)	0 : Bipolar 1 : Unipolar	N	Y	1
o96	Terminal [CS] (Mode selection)	Same as o90	Y	Y	0
o97	(Gain adjustment)	0 to 300%	Y*	Y	100

1 Y: Possible, Y: Possible, N: Impossible
   (For details about Y* and Y, refer to the User's Manual of a target inverter.)

*2 Y: Possible, N: Impossible

7. FUNCTION CODE DETAIL

This section details the function codes.

■ AI function（o60, o76）

Configure function codes o60 and o76 to assign functions to terminals [32] and [C2].

Table 7.1 Function code detail (AI function)

o60/o76	Function	Description	Definition of 100%
0	No assignment	The analog input function is disable by default	-
1	Auxiliary frequency command 1	0 to ±10 V/0 to ±100% 4 to 20 mA/0 to +100% • Positive during forward rotation • Negative during reverse rotation	Maximum frequency
2	Auxiliary frequency command 2		
3	PID command	0 to ±10 V/0 to ±100% 4 to 20 mA/0 to +100% • Under PID process control: Unipolar • Under dancer reference position control: Bipolar	100% of the PID command
5	PID feedback amount	0 to ±10 V/0 to ±100% 4 to 20 mA/0 to +100%	100% of the PID feedback amount
6	Ratio setting	0 to +10 V/0 to +100% 4 to 20 mA/0 to +100%	Ratio 1
7	Analog torque limit value A	0 to ±10 V/0 to ±200% 4 to 20 mA/0 to +200%	Rated motor torque
8	Analog torque limit value B		
9	Torque bias amount	0 to ±10V/0 to ±200% 4 to 20mA/0 to +200%	Rated motor torque
10	Torque command	0 to ±10V/0 to ±200% 4 to 20mA/0 to +200%	Rated motor torque
11	Torque current command	0 to ±10V/0 to ±200% 4 to 20mA/0 to +200%	Rated motor torque
17	Speed limit value of FWD	0 to ±10V/0 to ±100% 4 to 20mA/0 to +100%	Maximum frequency
18	Speed limit value of REV		
20	analog signal input monitor	0V to +10V / Display coefficient B (E41) to display coefficient A (E42) 4 to 20mA / Display coefficient B (E41) to display coefficient A (E42)	-

■ **Gain (o62, o64, o78 and o81)**
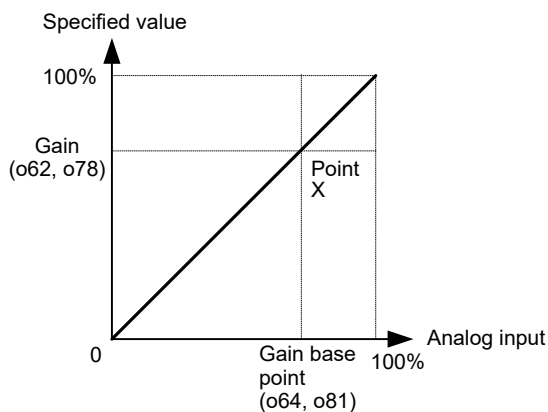
■ **Filter (o63 and o79)**

o63 and o69 configure a filter time constant for an analog voltage and current input, respectively. The larger the time constant, the slower the response. Specify the proper filter time constant taking into account the response speed of the machine (load).

- Data setting range: 0.00 to 5.00 (s)

■ **Polarity (o65)**

o65 configures the input range for analog input voltage.

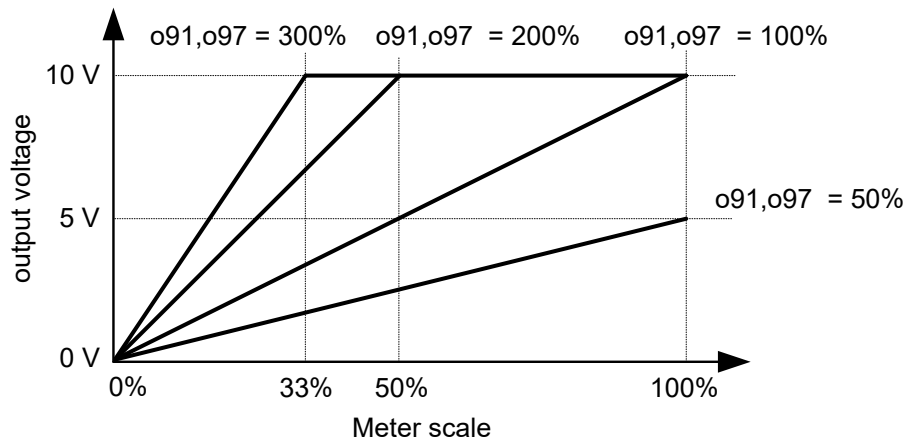| o65	Specifications for terminal input
0	-10 to +10 V
1	0 to +10 V (A negative component of the input will be regarded as 0 VDC.)

■ AO function（o90, o96）

Configure function codes o90 and o96 to assign functions to terminals [Ao] and [CS].

Table 7.2   Function code detail (AO function)

o90/o96	Function	Description	Definition of 100%
0	Output frequency 1 (before slip compensation)	0 to ±10 V/0 to ±100% 4 to 20 mA/0 to +100%	Maximum frequency
1	Output frequency 2 (after slip compensation)		
2	Output current	0 to ±10 V/0 to ±200% 4 to 20 mA/0 to +200%	Inverter rated current
3	Output voltage	0 to +10 V/0 to 100% 4 to 20 mA/0 to 100%	200V series：250V 400V series：500V
4	Output torque	0 to ±10 V/0 to ±200% 4 to 20 mA/0 to +200%	Motor rated torque
5	Load factor	0 to +10 V/0 to +200% 4 to 20 mA/0 to +200%	Motor rated load
6	Input power	0 to +10 V/0 to +200% 4 to 20 mA/0 to +200%	Inverter rated output
7	PID feedback amount	0 to +10 V/0 to +100% 4 to 20 mA/0 to +100%	100% of the PID feedback amount
8	PG feedback value (speed)	0 to ±10 V/0 to ±100% 4 to 20 mA/0 to +100%	Maximum frequency
9	DC link bus voltage	0 to +10 V/0 to 100% 4 to 20 mA/0 to 100%	200V series：500V 400V series：1000V
10	Universal AO	0 to ±10 V/0 to ±100% 4 to 20 mA/0 to +100	20000d
13	Motor output	0 to ±10 V/0 to ±200% 4 to 20 mA/0 to +200%	Motor rated output
14	Calibration	Outputs 10 V or 20 mA.	-
15	PID command (SV)	0 to ±10 V/0 to ±100% 4 to 20mA/0 to +100%	100% of PID command amount
16	PID output (MV)	0 to ±10V/0 to ±100% 4 to 20mA/0 to +100%	Maximum frequency
17	Position deviation in synchronous operation	0 to ±10V/0 to ±180° 4 to 12 to 20mA/-180 to 0 to +180°	-
18	Heat sink temperature	0 to +10V/0 to 200% 4 to 20mA/0 to 200%	100℃
21	PG feedback value	0 to ±10V/0 to ±100% 4 to 20mA/0 to +100%	Maximum frequency
111 to 120	Customize logic output signals 1 to 10	0 to ±10V/0 to ±100% 4 to 20mA/0 to +100%	100% of logic output

■ **Gain (o91 and o97)**

■ **Polarity (o93)**

o93 configures the output range for analog output voltage.

o93	Specifications for terminal input
0	-10 to +10 V
1	0 to +10 V (A negative component reverses the output. Example: -5V → +5V)

8. I/O CHECKING

"I/O Checking" in your inverter program mode displays the I/O status of external signals on the monitor of the keypad. Refer to "I/O Checking" of the inverter User's manual for the operation method.

9. PROTECTIVE FUNCTION

Option communications error（ $Er-4$ ）

Problem　A communications error occurred between the analog input/output interface card and the inverter.

Possible Causes	What to Check and Suggested Measures
(1) There is a problem with the connection between the interface card and the inverter.	Check whether the connector on the interface card is firmly engaged with that of the inverter. ➔　Reload the interface card into the inverter.
(2) Strong electrical noise.	Check whether appropriate noise control measures have been implemented (e.g. correct grounding and routing of signal wires, communications cables, and main circuit wires). ➔　Implement noise control measures.

Note　When no o code is displayed even if an interface card is mounted, check whether the connector on the interface card is firmly engaged with that of the inverter. In this case, $Er-4$ does not appear.

Option error（ $Er-5$ ）

Problem　　An error occurred on the analog input/output interface card.

Possible Causes	What to Check and Suggested Measures
(1) An error occurred on the interface card mounted on the inverter.	Check whether the error sub-code monitored b_c1 of LED display is "10" due to the hardware fault. ➔ The nonvolatile memory on the interface card is defective. Contact your IDEC representative.