



VS-616/676 Series Option Instruction Manual

Isolated Analog Monitor Card AO-12B2

WARNING

PRECAUTIONS

1. Read this instruction manual in its entirety before installing the Isolated Monitor Card AO-12B2 or operating the inverter with this card installed.
2. DO NOT connect or disconnect wiring, or perform signal checks while the electrical power is turned ON.

Failure to observe these and other precautions indicated in this manual will expose the user to high voltages, resulting in serious injury or death. Damage to equipment may also occur.

CAUTION

NOTE

The Option Card uses CMOS IC chips. Therefore, the card could become damaged when physically handled if static electricity is present. The person handling the card should wear a discharge strap to eliminate the possibility of static charge (if present) affecting the card.

Failure to observe this precaution may result in equipment damage.

NOTICE

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INTRODUCTION

The Isolated Analog Card AO-12B2 mounts to an inverter's control board via connection to option port 3CN, and is used to output dual analog signals for monitoring the inverter's status: output frequency, output current, etc. The signal level is jumper selectable for -10 to +10 VDC, 0-20mA, or 4-20mA ranges.

The channels are isolated from the inverter, but not from each other.

Table 1: Description

Name	Code Number	Specifications
Isolated Analog Monitor Card AO-12B2	73600-D0110	Output Resolution : 11 bits + SIGN bit (1/2048) Isolated Output Signal Level : -10 to +10 volts (5 mA max.) 0 to 20 ma* 4 to 20 ma* *Note: 600Ω maximum load Output Channel : Two (2) channels Isolation : 2500 VAC

The Isolated Analog Monitor Card can be used on any of the following inverters. When inquiring with the factory, please refer to the specific inverter's model and code number.

VS-616G3*
VS-616G5
VS-616H3*
VS-676VG3
VS-616VH3

* When used with the G3 and H3 Series Inverters, the AO-12B2 Output Resolution is 11 bits (without sign, positive polarity output)

INSTALLATION

1. Before attempting to install or use the Isolated Analog Monitor Card AO-12B2, read the following instructions.
2. After unpacking the card, verify that you have received the correct code number and that no damage had occurred during shipping. Contact your YASKAWA representative should you require any assistance.
3. Turn OFF the main electrical power to the inverter, and allow sufficient time (usually 5 minutes) for the DC bus to decay to less than 50V DC. The DC bus voltage can be measured by removing the terminal strip cover, and then using the B1/⊕ and ⊖ terminals located on the main terminal strip.
4. Remove the inverter's cover by first removing the digital operator.
 - a) For smaller inverters, push inward (on the cover) at the indented area located near the bottom on each side of the cover. While lifting the cover, pivot the cover's bottom upward.
 - b) Larger inverters have screws to hold their covers in place that must be removed. (Refer to the VS-616/ VS-676 Series User's Manual, if necessary).
5. Check that the indicator CHARGE lamp is OFF (power OFF indication).
6. Place the Monitor Card onto the standoff post in the Control Board, aligning the Monitor Card's connector with the Control Board's 3CN connector. Refer to *Fig. 1 Location of Isolated Analog Monitor Card AO-12B2*.
7. Gently, push the Monitor Card downward onto the standoff post until it protrudes through the card's mounting hole, while aligning and connecting the card's female connector to the control board's 3CN male connector.
8. Connect the Monitor Card's grounding cable (green wire) to the control board's Terminal No.12 (G) ground terminal screw.

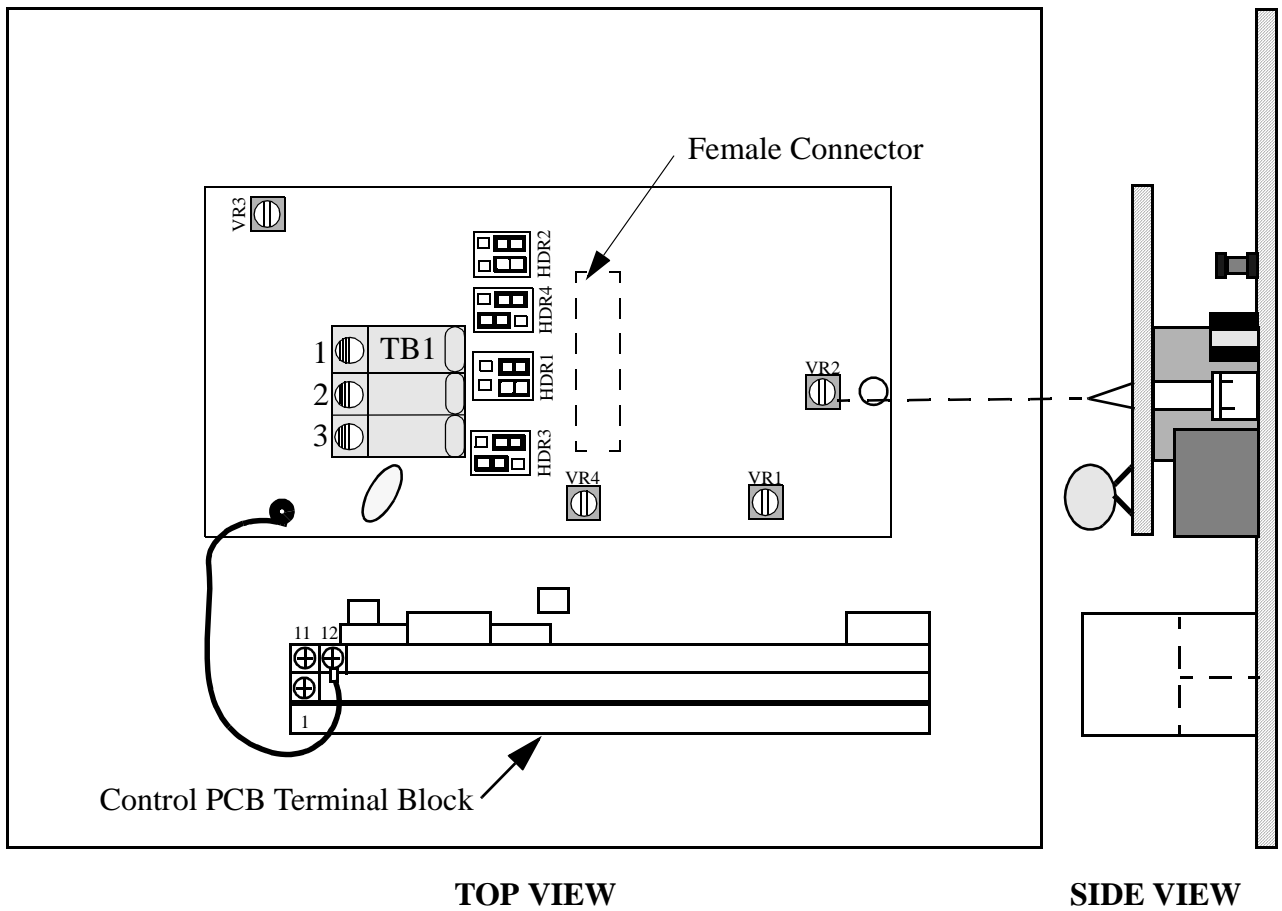


Fig. 1 Location of Isolated Analog Monitor Card AO-12B2

Note: VR1,VR2 VR3 and VR4 are factory calibrated and should *not* be readjusted.



Monitor Card & Code Number Locations

Fig. 2 Underside of Card

INTERCONNECTION BETWEEN EQUIPMENT

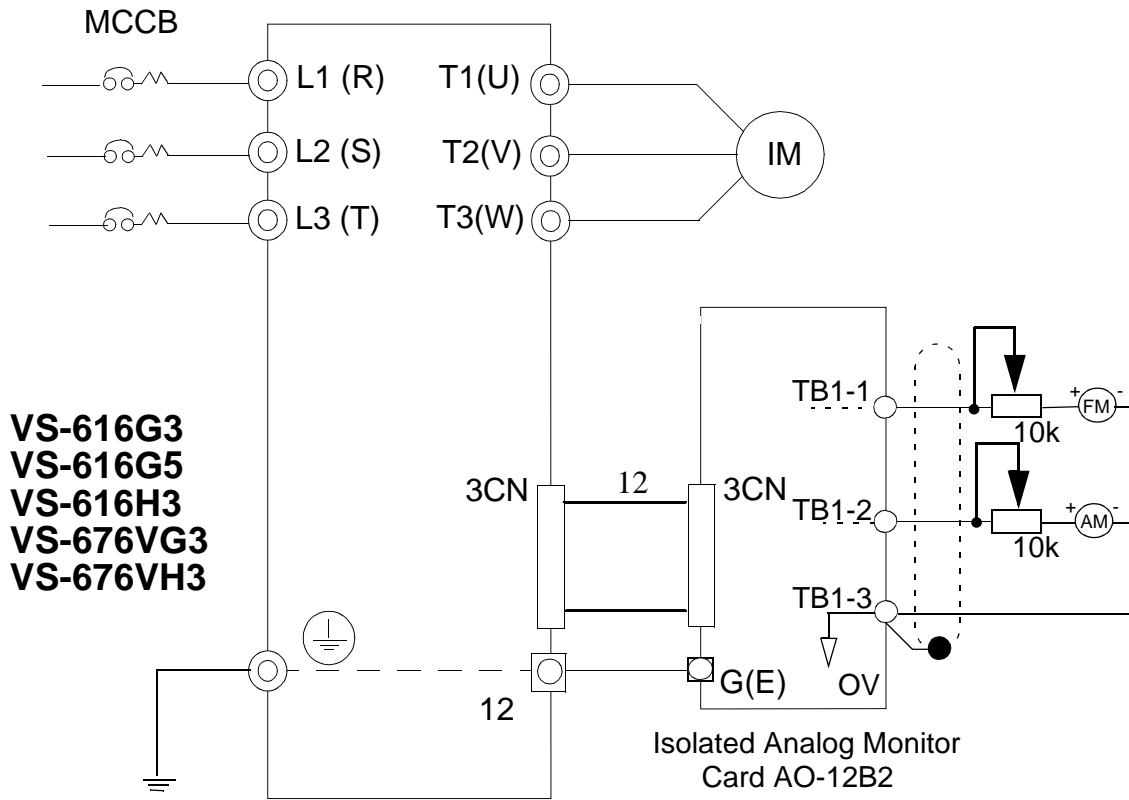


Fig. 3 Interconnection Between Inverter and Peripheral Equipment

Fig.3 shows interconnection of the inverter with the Isolated Analog Monitor Card AO-12B2, and peripheral equipment where the card is connected to analog meters.

Note: In some applications, trim resistors can be omitted by setting or adjusting program parameters (Gain).

⚠ CAUTION

WIRING NOTES

1. Separate the output signal wires that are connected to the Isolated Analog Monitor Card's terminal block (TB1) from the main circuit wires and other power cables.
2. Use a twisted pair-shielded wire to connect output signals. Connect the shield as shown in Fig. 3 to prevent noise interference.

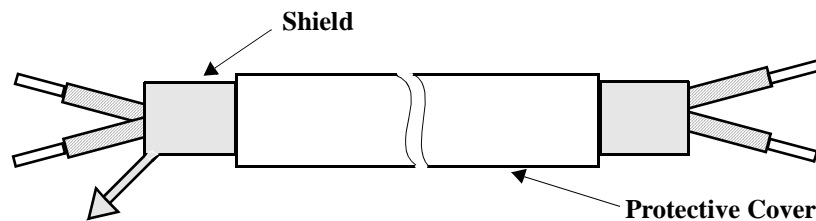


Fig.4 Shielded Wire

- A. **NEVER** connect the wire's shield to signal wires.
 - B. **CONNECT** the wire's shield (at the inverter side *only*) to terminal TB1-3.
 - C. **WRAP** insulating tape around exposed shielded, sheathed areas and wires where termination occurs.
3. Care must be taken in the selection of the twisted shielded wire over 50 feet long. The impedance of the wire should be sufficiently low to insure signal amplitude for proper operation of all equipment connected to the Isolated Analog Monitor Card AO-12B. In general, as the wire's length is increased, it's cross section or gauge must also increase.
 4. The National Electrical Code (NEC) and any applicable regional or local codes should be observed when wiring electrical devices.

WIRING

Refer to the following table for the external terminal designations.

Table 2: External Terminal Designations

Terminal Block Symbol	Terminal Number	Function
TB1	1	Isolated Monitor Output Channel 1 (+)
	2	Isolated Monitor Output Channel 2 (+)
	3	Common Monitor Output (-)

Wiring Connection Notes:

1. To prevent noise, use shielded wire as specified in Fig.4.
2. Separate the power wiring circuits (200VAC or greater) and relay wiring circuits (120VAC) from the control wires.
3. Wire lengths must be 164 feet (50 meters) or shorter.
4. Connect the AO-12B2 grounding lead wire (E) to the inverter control board's grounding terminal 12.
5. Applicable wire sizes for terminal block TB1 are as listed in the following table.

Table 3: Wire Sizes

Type	[mm ²]	AWG	I[A]	VAC[V]
Thin twisted wire	1	16	12	125
Solid Wire	1.5	16	12	125
UL	--	22-16	10	300
CSA	--	28-16	10	300
CSA	--	28-16	10	150

Stripping TB1 Signal Wires for Connection:

The following shows the correct length of insulation to be stripped in order to connect the wire to the Terminal Blocks TB1 Cable Selection:

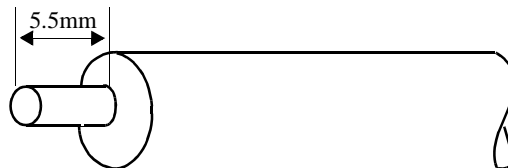


Fig.5 Terminal Block TB1 Side for Connecting Wire End

1. Cable too heavy exerts pressure on the Option Card and could cause failure.
2. Cable too thin could cause a poor connection or prematurely break or overheat.

JUMPER SELECTION

Figure 6 shows the AO-12B2 Option Card's terminal block and jumper locations.

The pin arrangement is also shown. Refer to Tables 4 & 5 for jumper configuration details.

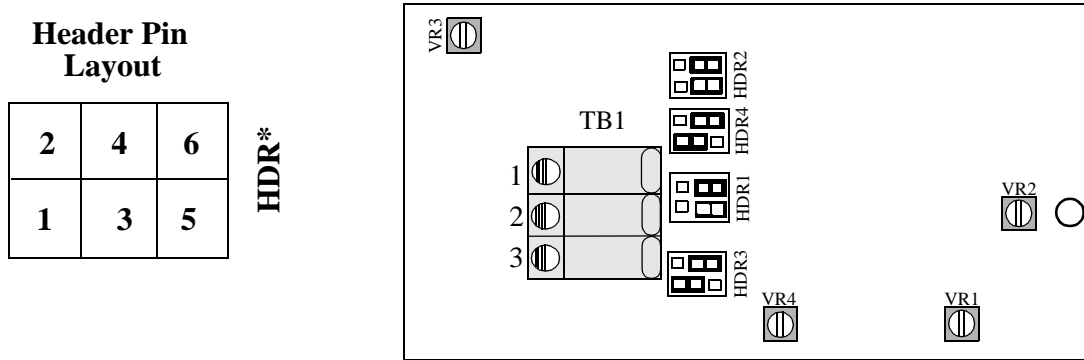


Fig. 6 Isolated Analog Monitor Card Header Layout Locations

Notes:

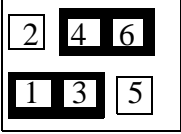
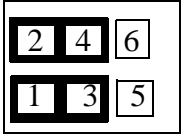
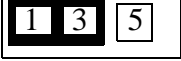

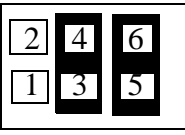
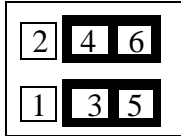

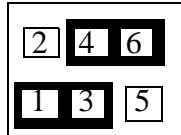

1. Jumpers HDR2 and HDR4 setup Terminal 1.
2. Jumpers HDR1 and HDR3 setup Terminal 2.

Table 4: Channel One Jumper Selections

Signal Level		HDR4 Jumper Positions		HDR2 Jumper Positions		
Voltage	(-10 to 10)	4 to 6		2 to 4		
		1 to 3		1 to 3		
Current	0-20mA	3 to 4				
		5 to 6				
	4-20mA*	4 to 6			4 to 6	
		1 to 3			3 to 5	

* Default is 4-20mA setting.

Table 5: Channel Two Jumper Selections

Signal Level		HDR3 Jumper Positions		HDR1 Jumper Positions	
Voltage	(-10 to 10)	4 to 6		2 to 4	
		1 to 3		1 to 3	
Current	0-20mA	3 to 4		4 to 6	
		5 to 6			
	4-20mA*	4 to 6			
		1 to 3			

* Default is 4-20mA setting.

EXTERNAL TERMINAL FUNCTIONS

AO-12B2 Monitor Card has three (3) output terminals for connection to peripheral equipment.

Table 6: Terminal Functions

Terminal Symbol	Function	Signal Level	Output Accuracy	Remarks
TB1-1	Analog signal output: channel 1*	Selectable by jumpers -10+10 VDC 0-20mA 4-20mA	Refer to the following programming setting tables	Output resolution: 11 bits +SIGN (1/2048)
TB1-2	Analog signal output: channel 2*			
TB1-3	Common terminal	0 volts	--	--

* The signal monitored on TB1-1 or TB2-1 can be selected by setting the inverter’s program parameters. For details, refer to the specific “PROGRAMMING SETTINGS” tables.

- Output analog signal levels of TB1-1 or TB1-2 can be adjusted by setting the inverter program parameters. For details, refer to “OUTPUT SIGNAL LEVEL SETTING”.
- When AO-12B2 is mounted on VS-616G3 or VS-616H3, the output signal level varies 0 to +10 volts. In this case, negative polarity (0 to -10) cannot be output.
- Output signal level can be adjusted to a maximum of 10 volts by setting program constants.

PROGRAMMING PARAMETER SETTINGS

Program the output terminal to the desired signal using the parameters in the following tables:

- Table 7: Programming settings with G3
- Table 8: Programming settings with H3
- Table 9: Programming settings with G5
- Table 10: Programming settings with VG3 or VH3

Table 7: Programming Settings With VS-616G3

Terminal	Program Parameter Number	Set Value	Output Contents	Output Accuracy
TB1-1 Channel 1	Sn-28 1st/2nd digit	00	Output frequency: Max. frequency/100%	1.0%
		01	Output current: Inverter rated voltage/100%	3.0%
TB1-2 Channel 2	Sn-28 1st/2nd digit	10	Output voltage reference Input voltage/100%	1.5%
		11	DC voltage (V_{PN}) 400V/100% (200Vclass) 800V/100% (400Vclass)	1.5%

Note: Refer to “OUTPUT SIGNAL LEVEL SETTING” for 100% output signal level in output

Table 8: Programming Settings With VS-616H3

Terminal	Program Constant No.	Set Value	Output Contents	Output Accuracy
TB1-1 Channel 1	bn-15	1	Frequency reference: Max. frequency/100%	1.0%
		2	Output frequency: Max. frequency/100%	3.0%
		3	Output current Rated current/100%	1.5%
		4	Output voltage reference: input voltage/100%	1.5%
		5	DC voltage (V_{PN}) 400v/100% (200V class)	
TB1-2 Channel 2	bn-17	6	Output Power (\pm indication): Rated power (kW) 100%	10%
		17	Speed feedback (PG,G): Max. frequency/100%	
		18	Compensated frequency (PG,TG): Max. frequency/100%	
		19	Voltage feedback (AVR): Input voltage/100%	
		20	Compensated voltage (AVR): Input voltage/100%	
		21	Momentary reduced value: Max. frequency/100%	

Note: Refer to “OUTPUT SIGNAL LEVEL SETTING” for 100% output signal level in output content.

Table 9: Programming Settings With VS-616G5

Terminal	Program Constant No.	Set Value	Output Content	Output Accuracy
TB1-1 Channel 1	F4-01	01	Frequency reference 10V/max. output frequency	0.2%
		02	Output frequency 10V/max. output frequency	0.2%
		03	Output current 10V/inverter rated current	3%
		05	Motor speed 10V/max. output frequency	0.2%
		06	Output voltage 10V/200V or 400V	3%
		07	DC bus voltage 10V/400V or 800V	3%
		08	Output power 10V/inverter capacity (kW)	5%
		09	Torque reference (internal) 10V/motor rated torque	5%
		15	Terminal 13 input voltage 10V/10V or 20ma	0.2%
		16	Terminal 14 input voltage 10V/10V or 20mA	0.2%
TB1-2 Channel 2	F4-03	17	Terminal 16 input voltage 10V/10V or 20ma	0.2%
		18	Motor secondary current (Iq) 10V/motor rated primary current	5%
		19	Motor exciting current (Id) 10V/motor rated primary current	5%
		20	Output frequency after soft-start 10V/max. output frequency	0.2%
		21	ASR input 10V/max. output frequency	0.2%
		22	ASR output 10V/motor rated primary current	5%
		23	Speed deviation 10V/max. output frequency	0.2%
		24	PID feedback amount 10V/max. output frequency	0.2%
		26	Output Voltage Referenced (Vg) 10V/200V or 400V	0.2%
		27	Output Voltage Referenced (Vd) 10V/200V or 400V	0.2%



Table 10: Programming With VS-676VG3 or VS-676VH3

Terminal	Program Parameter Number	Set Value	Output Contents	Output Accuracy
TB1-1 Channel 1	bn-15	01	Frequency reference 10V/max. output frequency	
		02	Output frequency 10V/max. output frequency	
		3	Output current: Motor rated current 100%	3.0%
		4	Output voltage reference: No-load voltage/100%	1.5%
		5	DC voltage (V_{PN}) 400V/100% (200V class) 800V/100% (400V class)	
		21	Speed reference (SFS input) Max. rotation speed/100%	1.0%
		22	Speed reference (SFS output) Max. rotation speed/100%	
		23	Speed feedback: Max. rotation speed/100%	
		24	Ext. torque reference: Motor	
		25	Torque compensation: Motor rated torque/100%	
26	Torque ref. (internal) Motor rated torque/100%			
27	Torque feedback: Motor rated torque/100%			
28	ASR input (speed deviation): Motor rated secondary current/100%			
29	ASR output (after filter): Motor rated secondary current/100%			
30	Slip frequency: Rated slip frequency/100%			
TB1-2 Channel 2	bn-17	31	Primary frequency reference: Max. synchronous frequency/100%	1.0%
		32	Motor temperature: 200°C/100%	



OUTPUT SIGNAL LEVEL SETTING

Output signal level of external terminal TB1-1 or TB1-2 can be set by programming the appropriate parameter to a value as indicated by 10 volts (or 4-20mA) x setting value /100%.

Applicable Inverter	External Terminal	Program Constant No.	Setting Range	Setting Unit	Initial Value
VS-616G3	TB1-1	bn-11	0.00 to 2.55	0.01	1.00
	TB1-2	bn-12			0.50
VS-616H3	TB1-1	bn-16	0.000 to 10.000	0.001	1.000
	TB1-2	bn-18			0.500
VS-676VG3	TB1-1	bn-23	0.000 to 10.000	0.001	1.000
VS-676VH3	TB1-2	bn-25			
VS-616G5	TB1-1	F4-02	0.00 to 2.50	0.01	1.00
	TB1-2	F4-04			0.50

Programming Example:

Program a G5 inverter to output a signal on Channel 2 of the AO-12B2 Option Card proportional to output current. The desired signal level is 10 volts at 200% of inverter rated output current.

Step 1. Verify that the option card is properly installed and wired.

Step 2. Jumper Settings:

Channel 2 as output voltage -10 to +10 VDC

HDR1 Jumpers in position 2 to 4 and 1 to 3

HDR3 Jumpers in position 4 to 6 and 1 to 3

Refer to Pages 9 and 10 for further details.

Step 3. Program Channel 2 to desired signal.

Output current = > F4-03=03

Refer to Table 9 on Page 14.

Step 4. Program desired signal amplitude.

If voltage desired is 10V @ 200% current,
this means 5V @ 100% current.

$$\text{So, } 10\text{V} \times \frac{\text{Setting Value}}{100\%} = 5\text{V}$$

Thus, a setting value of 50% or 0.50 is necessary, F4-04 = 0.50

Step 5. Verify operation.



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