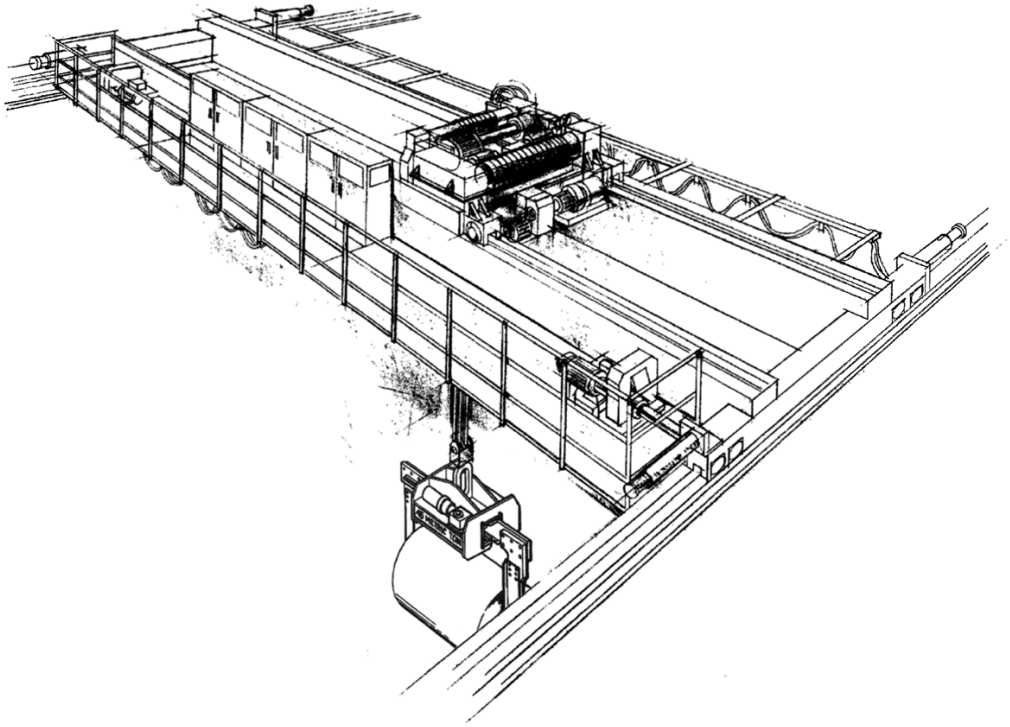


IMPULSE•G+ & VG+ Series 4

Adjustable Frequency/Vector Crane Controls

AC Digital Input/Output Installation Manual

MAGNETEK
MATERIAL HANDLING

September 2011
Part Number: 144-23967

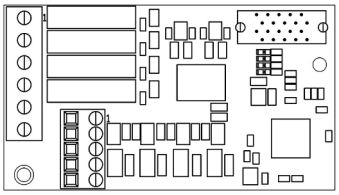
1. Preface and Safety

Magnetek manufactures products used as components in a wide variety of industrial systems and equipment. The selection and application of Magnetek products remain the responsibility of the equipment manufacturer or end user. Magnetek accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any Magnetek product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and fail safely under all circumstances. All systems or equipment designed to incorporate a product manufactured by Magnetek must be supplied to the end user with appropriate warnings and instructions as to the safe use and operation of that part. Any warnings provided by Magnetek must be promptly provided to the end user. Magnetek offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the Magnetek manual. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED. Magnetek assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

Applicable Documentation

The following manuals are available for the option:

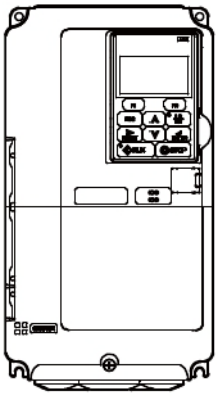
Digital Input S4IO Option



IMPULSE®•G+/VG+ Series 4 Digital Input S4IO Installation Manual
Manual No: 144-23967

Read this manual first. The installation manual is packaged with the option and contains information required to install the option and set up related drive parameters.

MPULSE•G+/VG+ Series 4 Drive



IMPULSE®•G+/VG+ Series 4 Quick Start Guide

IMPULSE®•G+/VG+ Series 4 Instruction Manual

The drive manuals cover basic installation, wiring, operation procedures, functions, troubleshooting, and maintenance information. The manuals also include important information about parameter settings and drive tuning.

Access http://www.magnetekmh.com to obtain Magnetek instruction manuals.

Terms

Drive: IMPULSE®•G+/VG+ Series 4

Option: IMPULSE®•G+/VG+ Series 4 Option Digital Input S4IO

DIO: Digital Input Option

MFDI: Multi-Function Digital Input

MFDO: Multi-Function Digital Output

Registered Trademarks

Trademarks are the property of their respective owners.

Supplemental Safety Instructions

Read and understand this manual before installing, operating, or servicing this option. Install the option according to this manual and local codes.

The following conventions indicate safety messages in this manual. Failure to heed these messages could cause fatal injury or damage products and related equipment and systems.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It may also be used to alert against unsafe practices.

NOTICE

NOTICE indicates an equipment damage message.

NOTE: A NOTE statement is used to notify installation, operation, programming, or maintenance information that is important, but not hazard-related.

General Safety

General Precautions

- The diagrams in this book may include options and drives without covers or safety shields to illustrate details. Be sure to reinstall covers or shields before operating any devices. Use the option according to the instructions described in this manual.
- Any illustrations, photographs, or examples used in this manual are provided as examples only and may not apply to all products to which this manual is applicable.
- The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual.
- When ordering new copies of the manual, contact a Magnetek representative and provide the manual number shown on the front cover.

DANGER

Heed the safety messages in this manual.
Failure to comply may result in death or serious injury**.**

The operating company is responsible for any injuries or equipment damage resulting from failure to heed the warnings in this manual.

NOTICE

Do not modify the drive or option circuitry.
Failure to comply could result in damage to the drive or option and will void warranty. Magnetek is not responsible for any modification of the product made by the user. This product must not be modified.

Do not expose the drive or option to halogen group disinfectants.
Failure to comply may cause damage to the electrical components in the drive or option.
Do not pack the drive in wooden materials that have been fumigated or sterilized.
Do not sterilize the entire package after the product is packed.

2. Product Overview

About This Product

The Digital Input/Output Option S4IO allows the user to expand the number of drive multi-function digital inputs and digital outputs. The S4IO option board has four photocoupler digital input signals, each requiring a typical input signal of 120 VAC 8mA (24 VAC and 48 VAC are optional). The S4IO option board also has four relay outputs. Each relay output signal is capable of loads up to 250 VAC 1A or 30 VDC 1A.

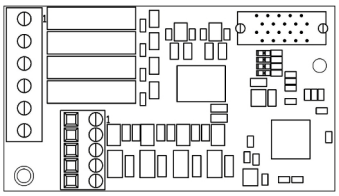
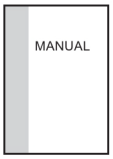
S4IO Model	I1-I4		O1-O6	
	Voltage	Frequency	Voltage	Current
S4IO-120A60	120 VAC	60 Hz	120 VAC	1.0 A
S4IO-48A60	48 VAC	60 Hz	120 VAC	1.0 A
S4IO-24A60	24 VAC	60 Hz	120 VAC	1.0 A

3. Receiving

Please perform the following tasks upon receiving the option:

- Inspect the option for damage. Contact the shipper immediately if the option appears damaged upon receipt.
- Verify receipt of the correct model by checking the model number printed on the option nameplate (refer to Figure 1 on page 7 for more information).
- Contact your supplier if you have received the wrong model or the option does not function properly.

Option Package Contents

Description:	Option	Screws (M3)	Installation Manual
--			
Quantity	1	3	1

Tools Required for Installation

- A Phillips screwdriver (M3 metric / #1, #2 U.S. standard size) is required to install the option.
- A straight-edge screwdriver (blade depth: 0.015” [0.4 mm], width: 0.098” [2.5 mm]) is required to wire the option terminal block.
- A pair of diagonal cutting pliers.
- A small file or medium-grit sandpaper.

NOTE: Tools required to prepare option cables for wiring are not listed in this manual.

4. Option Components

AC Digital Input S4IO Option

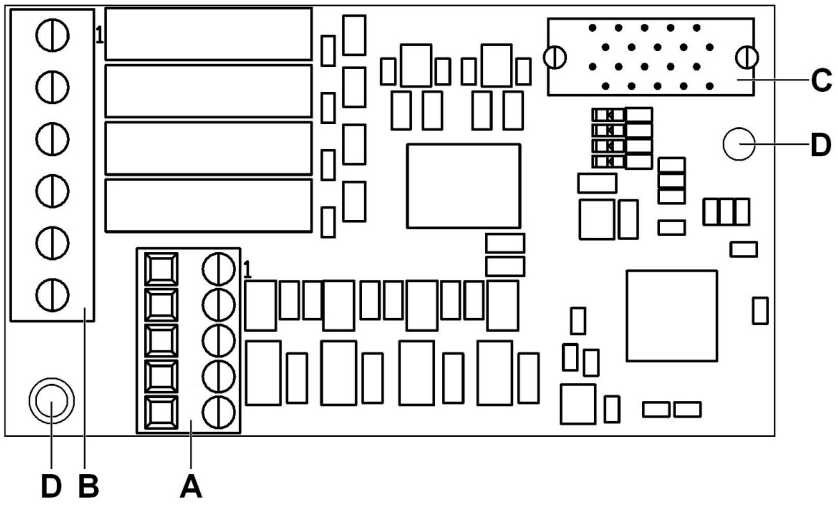


Figure 1: Digital Input/Output Option

Terminal Blocks

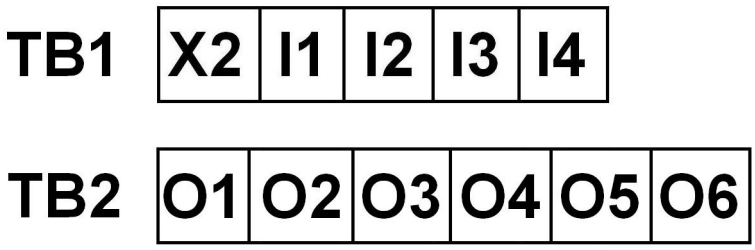


Figure 2: Terminal Blocks

Refer to Table 3 on page 18 for details on terminal functions and signal levels.

5. Installation Procedure

Section Safety

DANGER

Electric Shock Hazard

Do not connect or disconnect wiring while the power is on.
Failure to comply will result in death or serious injury.

Disconnect all power to the drive and wait at least the amount of time specified on the drive front cover safety label. After all indicators are off, measure the DC bus voltage to confirm safe level, and check for unsafe voltages. The internal capacitor remains charged after the power supply is turned off.

WARNING

Electrical Shock Hazard

Do not remove the front cover of the drive while the power is on.
Failure to comply could result in death or serious injury.

The diagrams in this section may include options and drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating any devices. Use the option according to the instructions described in this manual.

Do not allow unqualified personnel to use equipment.
Failure to comply could result in death or serious injury.

Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment, and maintenance of this product.

Do not touch circuit boards while the power to the drive is on.
Failure to comply could result in death or serious injury.

Do not use damaged wires, place excessive stress on wiring, or damage the wire insulation.
Failure to comply could result in death or serious injury.

Fire Hazard

Tighten all terminal screws to the specified tightening torque.
Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

NOTICE

Damage to Equipment

Observe proper electrostatic discharge (ESD) procedures when handling the option, drive, and circuit boards.
Failure to comply may result in ESD damage to circuitry.

Never shut the power off while the drive is running or outputting voltage.
Failure to comply may cause the application to operate incorrectly or damage the drive.

Do not operate damaged equipment.
Failure to comply may cause further damage to the equipment.
Do not connect or operate any equipment with visible damage or missing parts.

Do not use unshielded cable for control wiring.
Failure to comply may cause electrical interference resulting in poor system performance.
Use shielded twisted-pair wires and ground the shield to the ground terminal of the drive.

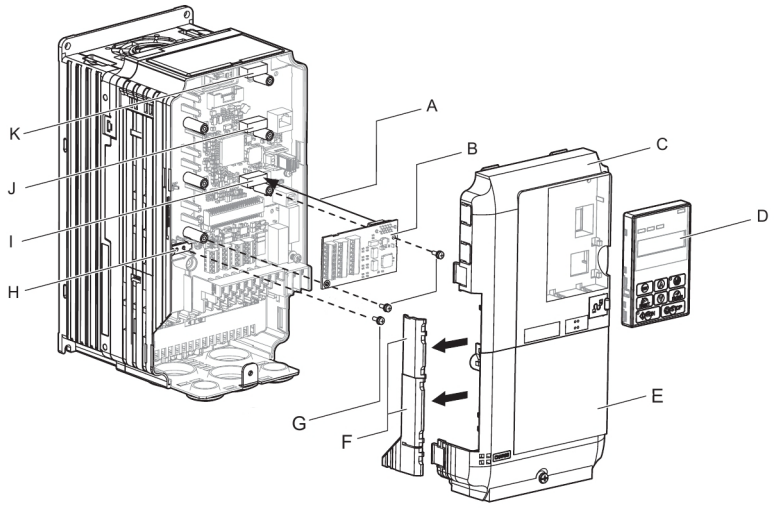
Properly connect all pins and connectors.
Failure to comply may prevent proper operation and possibly damage equipment.

Check wiring to ensure that all connections are correct after installing the option and connecting any other devices.
Failure to comply may result in damage to the option.

Prior to Installing the Option

Prior to installing the option, wire the drive, make the necessary connections to the drive terminals, and verify that the drive functions normally. Refer to the Quick Start Guide packaged with the drive for information on wiring and connecting the drive.

Figure 3 shows an exploded view of the drive with the option and related components for reference.



A – Insertion point for CN5
B – Option card
C – Front cover
D – Digital operator
E – Terminal cover
F – Removable tabs for wire routing
G – Included screws
H – Drive grounding terminal (FE)
I – Connector CN5-A
J – Connector CN5-B
K – Connector CN5-C

Figure 3: Drive Components with Option

Installing the Option

Refer to the instructions below to install the option.

1. Shut off power to the drive, wait the appropriate amount of time for voltage to dissipate, then remove the digital operator (D) and front covers (C, E). Refer to the Quick Start Guide packaged with the drive for directions on removing the covers. Cover removal varies depending on drive size.

DANGER

Electrical Shock Hazard.

Disconnect all power to the drive and wait at least the amount of time specified on the drive front cover safety label. After all indicators are off, measure the DC bus voltage to confirm safe level, and check for unsafe voltages before servicing to prevent electric shock. The internal capacitor remains charged even after the power supply is turned off.

NOTICE

Damage to Equipment

Observe proper electrostatic discharge procedures (ESD) when handling the option, drive, and circuit boards. Failure to comply may result in ESD damage to circuitry.

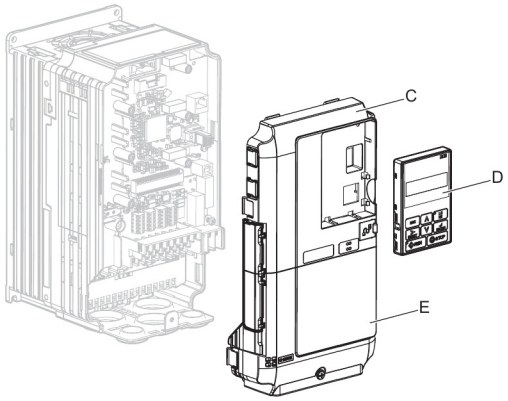


Figure 4: Remove the Front Covers and Digital Operator

2. Insert the option card (B) into the CN5-A (I), CN5-B (J), or CN5-C (K) connector located on the drive and fasten it into place using two of the included screws (G).

NOTE: Install the option to ports CN5-B and CN5-C on the drive for monitoring purposes only and input levels will be displayed in monitor U1-17. The option will not set the frequency reference or replace the drive analog input with higher resolution inputs when connected to ports CN5-B or CN5-C.

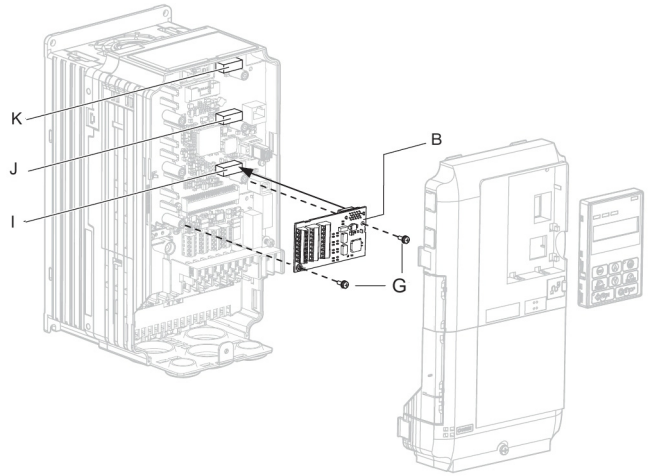


Figure 5: Insert the Option Card

3. Prepare and connect the wire ends as shown in Figure 6 and Figure 7. Refer to Wire Gauges, Tightening Torques, and Crimp Terminals on page 17 to confirm that the proper tightening torque is applied to each terminal. Take particular precaution to ensure that each wire is properly connected and wire insulation is not accidentally pinched into electrical terminals.

WARNING

Fire Hazard.

Tighten terminal screws to the specified tightening torque. Loose electrical connections could result in death or serious injury by fire due to overheating. Tightening screws beyond the specified tightening torque may cause erroneous operation, damage the terminal block, or cause a fire.

NOTICE

Heat shrink tubing or electrical tape may be required to ensure that cable shielding does not contact other wiring. Insufficient insulation may cause a short circuit and damage the option or drive.

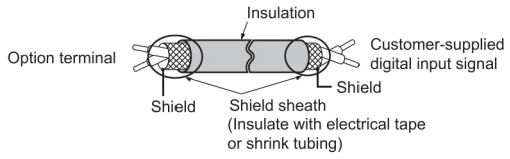


Figure 6: Preparing Ends of Shielded Cable

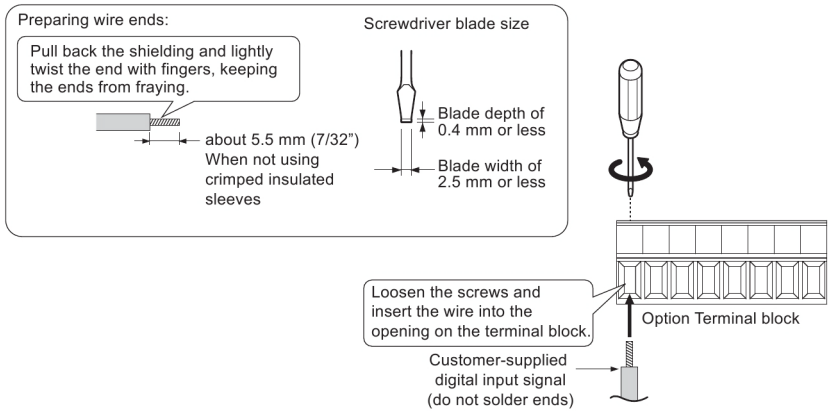


Figure 7: Preparing and Connecting Cable Wiring

4. Wire the customer-supplied digital input signal to the terminal blocks on the option. Refer to Figure 8 for wiring instructions.

Connection Diagram

Refer to Table 3 on page 18 for a detailed description of the option board terminal functions. To ensure accurate control, use a stable power supply for the voltage reference source.

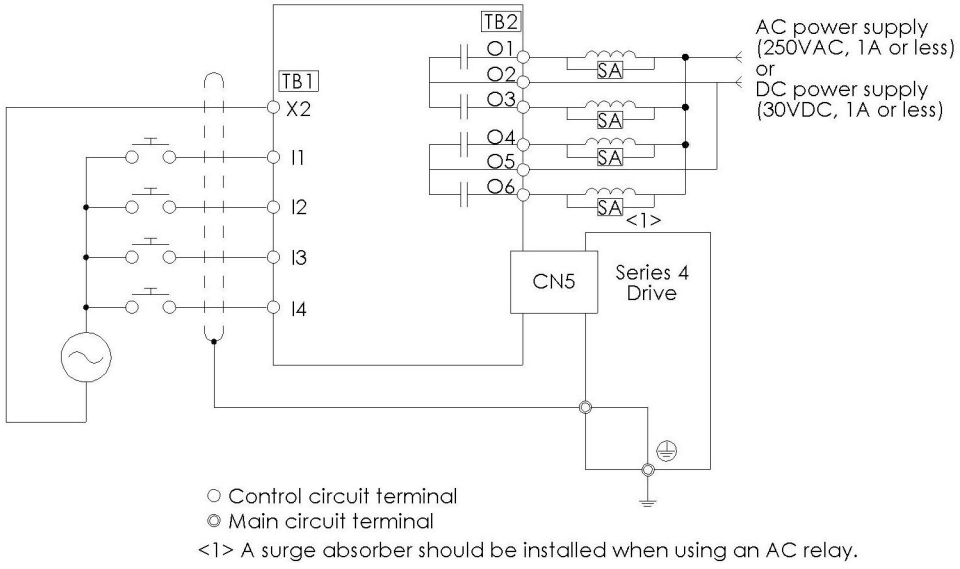


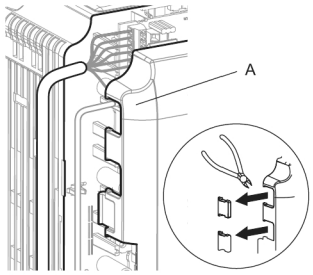
Figure 8: Option Connection Diagram

5. Route the option wiring.

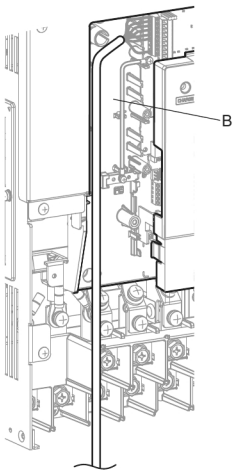
Depending on the drive model, some drives may require routing the wiring through the side of the front cover to the outside. In these cases, cut out the perforated openings on the left side of the drive front cover as shown in Figure 9-A and leave no sharp edges to damage wiring.

Route the wiring inside the enclosure as shown in Figure 9-B for drives that do not require routing through the front cover.

Refer to the IMPULSE®•G+/VG+ Series 4 Instruction Manual for more information.



A – Route wires through the openings provided on the left side of the front cover. *<1>*



B – Use the open space provided inside the drive to route option wiring.

<1> The drive will not meet NEMA Type 1 requirements if wiring is exposed outside the enclosure.

Figure 9: Wire Routing Examples

6. Replace and secure the front covers of the drive (C, E) and replace the digital operator (D).

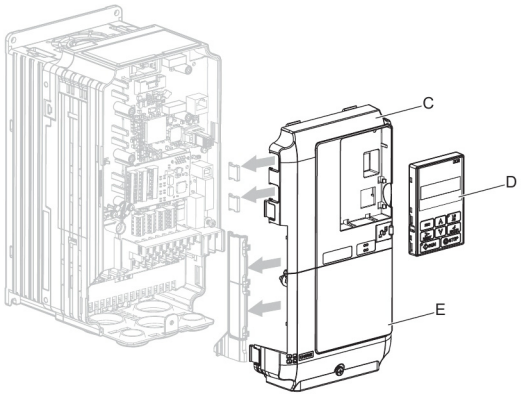


Figure 10: Replace the Front Covers and Digital Operator

NOTE: Take proper precautions when wiring the option so that the front covers will easily fit back onto the drive. Make sure cables are not pinched between the front covers and the drive when replacing the covers.

7. Set drive parameters in Table 4 for proper option performance.

Wire Gauges, Tightening Torques, and Crimp Terminals

Wire Gauges and Tightening Torques

Wire gauge and torque specifications are listed in Table 1.

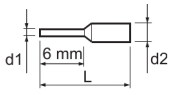
Table 1: Wire Gauges and Tightening Torques

Terminal Size	Screw Size	Tightening Torque N-m (in-lb)	Bare Cable		Crimp Terminals		Wire Type
			Applicable Gauges mm^2	Recomm. Gauge mm^2	Applicable Gauges mm^2	Recomm. Gauge mm^2	
X2 I1 to I4	M2	0.22 to 0.25 (1.95 to 2.21)	Stranded wire: 0.25 to 1.0 (24 to 17 AWG) Solid wire: 0.25 to 1.5 (24 to 16 AWG)	0.75 (18 AWG)	0.25 to 0.5 (24 to 20 AWG)	0.5 (20 AWG)	Shielded twisted pair, etc.
O1 to O6	M3	0.5 to 0.6 (4.43 to 5.31)	Stranded wire: 0.14 to 1.5 (26 to 16 AWG) Solid wire: 0.14 to 1.5 (26 to 16 AWG)		0.25 to 1.5 (24 to 16 AWG)		

Crimp Terminals

Magnetek recommends using CRIMPFOX 6 by Phoenix Contact or equivalent crimp terminals with the specifications listed in Table 2 for wiring to ensure proper connections.

Table 2: Crimp Terminal Sizes

	Wire Gauge mm^2	Phoenix Contact Model	L mm (in)	d1 mm (in)	d2 mm (in)
	0.25 (24 AWG)	AI 0.25 - 6YE	10.5 (13/32)	0.8 (1/32)	2 (5/64)
	0.34 (22 AWG)	AI 0.34 - 6TQ	10.5 (13/32)	0.8 (1/32)	2 (5/64)
	0.5 (20 AWG)	AI 0.5 - 6WH	14 (9/16)	1.1 (3/64)	2.5 (3/32)
	1.0 (16 AWG)	AI 1-6RD	12 (15/32)	1.5 (1/16)	3.0 (1/8)

Terminal Functions

Table 3: Option Terminal Functions

Terminal Block	Terminal	Description
TB1	X2	MFDI Common
	I1	DIO MFDI Terminal 1
	I2	DIO MDFI Terminal 2
	I3	DIO MDFI Terminal 3
	I4	DIO MDFI Terminal 4
TB2	O1	Relay output 1
	O2	Relay 1 and 2 common
	O3	Relay output 2
	O4	Relay output 3
	O5	Relay 3 and 4 common
	O6	Relay output 4

6. Related Parameters

The parameters outlined in the following sections are used to set up the drive for operation with the option. Set parameters as needed. Parameter setting methods can be found in the drive Quick Start Guide or Instruction Manual.

Table 4: Input Related Parameters

Parameter Code	Display	Function	Range	Initial Value
C9-01	Digital In Sel	Provides additional programmable MFDI	0 - 2	0
	0 Disabled	No additional MFDI are being used.		
	1 Enabled S4IO	Additional MFDI from S4I using C9-02 ~ C9-05		
	1 Enabled DI-A3	Additional MFDI from DI-A3 using C9-02 ~ C9-19		
	3 Serial	Additional MFDI from MB RTU using C9-02 ~ C9-19		
C9-02	DIO Terminal 1	MFDI by S4IO. See H1-0x settings in the IMPULSE®•G+/VG+ Series 4 Instruction Manual for MFDI selections.	0–FF	0F
C9-03	DIO Terminal 2		0–FF	0F
C9-04	DIO Terminal 3		0–FF	0F
C9-05	DIO Terminal 4		0–FF	0F

Table 5: Output Related Parameters

Parameter Code	Display	Function	Range	Initial Value
F5-01	DO Ch1 Select	MFDO by S4IO	0–140	0F
F5-02	DO Ch2 Select	Refer to drive instruction manual for more informatioin on setting the F5 parameters.	0–140	0F
F5-03	DO Ch3 Select		0–140	0F
F5-04	DO Ch4 Select		0–140	0F
F5-09	DO Function Sel	Digital output mode selection. This value cannot be changed when the S4IO board is installed.	2	2

Parameter F5-09

Set parameter F5-09 to select the option output mode.

Table 6 shows the changes in the output terminal contents according to the output mode set in F5-09.

Table 6: Output Terminal

Terminal Block	Terminal	F5-09 = 2 Multi-Function Output
TB2	O1-O2	Determined by F5-01
	O3-O2	Determined by F5-02
	O4-O5	Determined by F5-03
	O6-O5	Determined by F5-04

7. Troubleshooting

Drive-Side Error Codes

Table 7 lists the various fault codes related to the option. Refer to the drive's Instruction Manual for further details on fault codes.

Check the following items first when an error code occurs on the drive:

- Cable connections.
- Make sure the option is properly installed to the drive.
- Did a momentary power loss interrupt communications?

Table 7: Fault Displays, Causes, and Possible Solutions

Digital Operator Display	Fault Name
oFA01	Option Fault (CN5-A)
oFA01	Option is not properly connected
Cause	**Possible Solution**
Option at drive port CN5-A was changed during run.	Turn the power off and check the connectors between the drive and option.
Digital Operator Display	**Fault Name**
oFb01	Option Fault (CN5-B)
oFb01	Option is not properly connected
Cause	**Possible Solution**
Option at drive port CN5-B was changed during run.	Turn the power off and check the connectors between the drive and option.
Digital Operator Display	**Fault Name**
oFb02	Option Fault (CN5-B)
oFb02	Two of the same options are connected simultaneously
Cause	**Possible Solution**
DI-A3 option connected to CN5-B port while another option was connected to CN5-A port.	Only one of the options, DI-A3, AI-A3, or SI-XX can be connected to the drive at the same time.
Digital Operator Display	**Fault Name**
oFC01	Option connection error at drive port CN5-C
Cause	**Possible Solution**
Option at drive port CN5-C was changed during run.	Turn the power off and check the connectors between the drive and option.

Digital Operator Display	Fault Name
	Option Fault (CN5-C)
oFC02 oFC02	Two of the same options are connected simultaneously
Cause	**Possible Solution**
DI-A3 option connected to CN5-C port while another option was connected to CN5-A port.	Only one of these options, DI-A3, AI-A3, or SI-XX can be connected to the drive at the same time.
Digital Operator Display	**Fault Name**
oPE05 oPE05	Run command/frequency reference source selection error
Cause	**Possible Solution**
Frequency reference is assigned to an option (b1-01 = 3) but an option is not connected.	Reconnect the option to the drive.

Preventing Noise Interference

Take the following steps to prevent erroneous operation caused by noise interference:

- Use shielded wire for the signal lines.
- Limit the length of wiring under 50 m (164 ft.).
- Separate the control wiring to the option, main circuit wiring, and power lines.

8. Specifications

Table 8: Option Specifications

Items	Specifications
Model	S4IO
Input Terminals	4 terminals
Input Signal Type (Parameter Settings)	Binary 16-bit,4-digit BCD Binary 12-bit, 3-digit BCD Binary 8-bit, 2-digit BCD
Input Signal	120 VAC/60 Hz
Output Terminals	4 outputs
Output Signal	Max. allowable voltage/current: 250 VAC/1A, 30 VDC/1A
Ambient Temperature	-10 °C to +60 °C (14 °F to 140 °F)
Humidity	95% RH or lower with no condensation
Storage Temperature	-20 °C to +70 °C (-4 °F to 158 °F) allowed for short-term transport of the product
Area of Use	Indoor (free of corrosive gas, airborne particles, etc.)
Altitude	1000 m (3280 ft.) or lower