ANALOG SPEED REFERENCE (BIPOLAR) (AI-14B)
MODEL DS387

Before installing this option, a TECHNICALLY QUALIFIED INDIVIDUAL, who is familiar with this type of equipment and hazards involved, should READ this ENTIRE INSTRUCTION SHEET.

IMPORTANT

This option may have been installed by the factory. However, certain steps can only be completed at the installation site. Therefore, review and then perform those steps which complete the installation process.

If you are installing this option in a: Use Section:

GPD 515/G5 .... A (Sheet 2)
VCD 703 .... B (Sheet 7)
GPD 503 .... C (Sheet 11)

CAUTION

THIS OPTION CONTAINS ELECTROSTATIC SENSITIVE DEVICES. PERSONEL SHOULD BE GROUNDED BEFORE REMOVING CONTENTS FROM THE CARTON AND INSTALLING INTO THE EQUIPMENT.

WARNING

HAZARDOUS VOLTAGE CAN CAUSE SEVERE INJURY OR DEATH.
LOCK ALL POWER SOURCES FEEDING DRIVE IN "OFF" POSITION.

Section A: Installation in a GPD 515

INTRODUCTION

When installed, this option allows the user to interface three separate high resolution analog input signals, each of which may be either current or voltage (13-bit plus sign). These signals can act as a direct replacement for the three existing analog inputs available on the drive (3-channel individual mode), or the signals can be added together and used as a single frequency reference (3-channel addition mode). Gain and Bias are adjustable for both modes using drive parameters. Polarity (sign) of the speed reference controls direction of motor rotation.

INSTALLATION

A1.   Disconnect all electrical power to drive.

A2.   Remove drive front cover. Check that CHARGE indicator lamp inside drive is off.

A3.   Verify voltage has been disconnected by using a voltmeter to check for voltage at incoming power terminals (L1, L2, L3).

  NOTE: If this option is being installed in a GPD 515 with speed feedback, the speed feedback card needs to be temporarily un-installed to allow access to the connector 2CN on the Drive's Control Board and TC1-TC4 on the AI-14B option card.

A4.   See Figure A1. Install the option on the Main Control Board, 1PCB, and ensure 2CN is properly connected. Make sure Electrostatic procedure is followed.
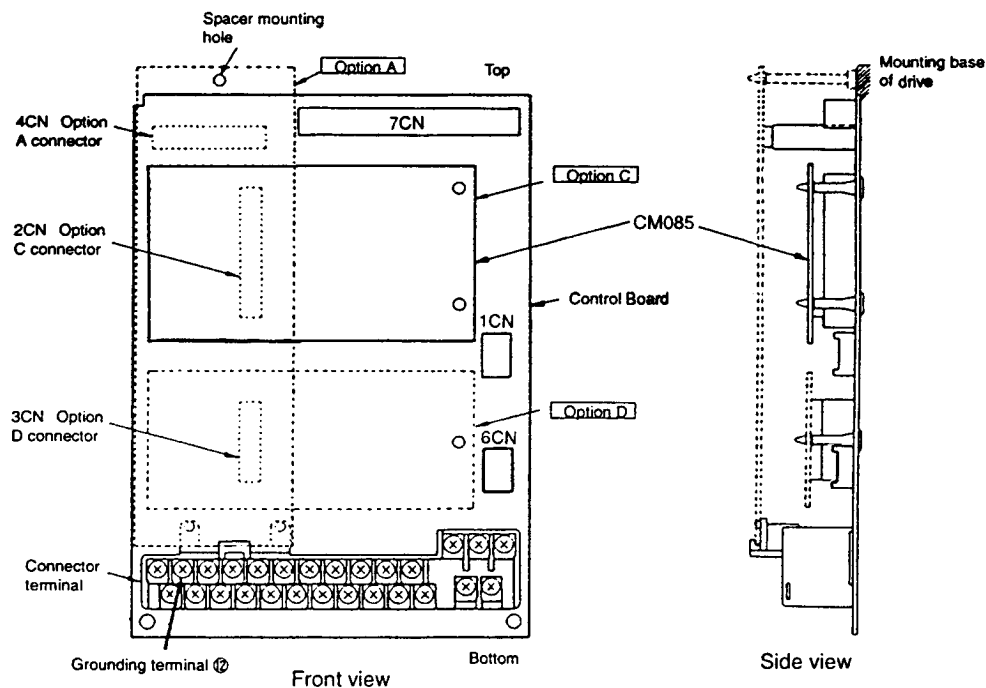

Figure A1. Installation of Analog Speed Reference (AI-14B) in GPD 515/G5

Table A1. AI-14B Specifications in GPD 515

Parameter	Value
Input Signal Level	0 to ±10V DC (Input Impedance: 20k) 0 to 20mA (input impedance : 500)
Input Resolution	Voltage: 13 bits (1/8192) plus sign (polarity) Current: 1/6554

A5. Determine whether a voltage or current signal will be inputted on each of the channels of the AI–14B board, and set selection jumpers accordingly (see Figure A2).

A6. Wiring. See Figure A3 for Analog Speed Reference connections. See Table A2 for terminal functions.
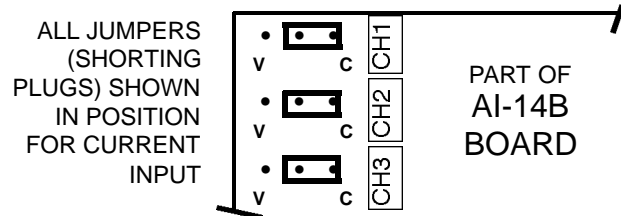
ALL JUMPERS (SHORTING PLUGS) SHOWN IN POSITION FOR CURRENT INPUT

PART OF AI-14B BOARD

Figure A2. Voltage/Current Selection on AI-14B

Table A2. Terminal Functions of AI-14B

Terminal	Function	Signal Level	Notes
TC1	Analog voltage/current input	Voltage Input: Input voltage: 0 to ±10V/0 to ±100% Input impedance: 20K	— Input Resolution: Voltage: 1/8192 (13 bits) plus sign (polarity) Current: 1/6554
TC2	Analog voltage/current input	Current Input: Input current: 0 to 20mA/0 to ±100% Input impedance: 500	— Signal Linearity: ±0.1%
TC3	Analog voltage/current input		— Terminal screws are metric size M3.
TC4	Signal common	0V	

CAUTION

KEEP ANALOG SPEED REF. (I.E. CONTROL CIRCUIT) WIRING SEPARATE FROM MAIN CIRCUIT INPUT/OUTPUT WIRING.

CAUTION

TO PREVENT ERRONEOUS OPERATION CAUSED BY NOISE INTERFERENCE, USE SHIELDED CABLE FOR CONTROL WIRING, AND LIMIT DISTANCE TO 10M (33 FEET) OR LESS.

CAUTION

IF ANY OF THE CONTROL SIGNAL INPUT TERMINALS (TC1 THRU TC3) ARE NOT USED, JUMPER THEM TO 0V TERMINAL (TC4).

IMPORTANT

Because the analog speed reference is converted by 1/16384 resolution, the voltage source accuracy of the analog speed reference source must be considered. To ensure speed control accuracy, use a high precision power supply for the voltage source.

Route wires from the drive and connect to the peripheral device. Refer to "Electrical Installation" in the drive technical manual for further information on use of shielded cable.
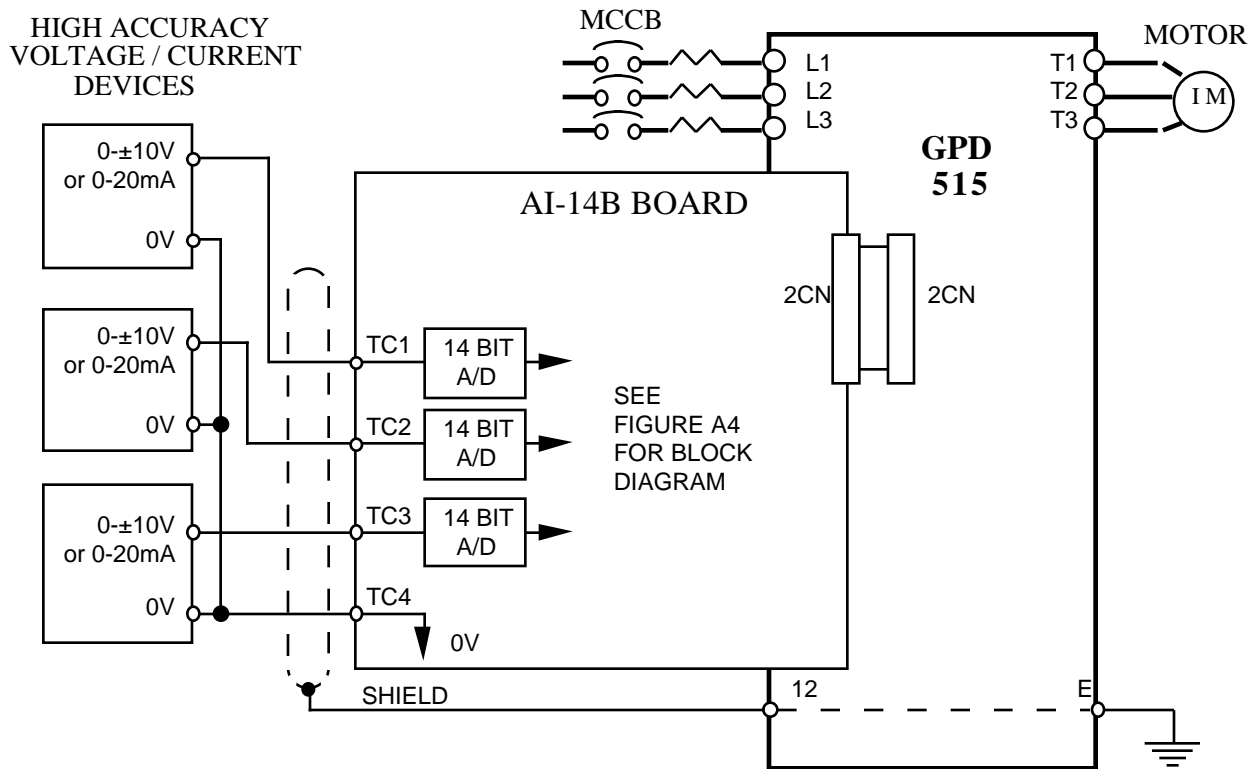

Figure A3. Interconnection for Analog Speed Reference (AI-14B) Circuit in GPD 515

A7.   Adjustments.

There are no adjustments to be made on the Analog Speed Reference option; however, the GPD 515 will have to be reprogrammed for the input requirement(s) of the remote device and the reversing or non-reversing requirement of the specific application.

WARNING

IF THE APPLICATION REQUIRES THAT REVERSE MOTOR
ROTATION BE PROHIBITED, PARAMETER **b1-04** MUST BE SET
TO " **1** " SO THAT THE MOTOR WILL STOP ANY TIME
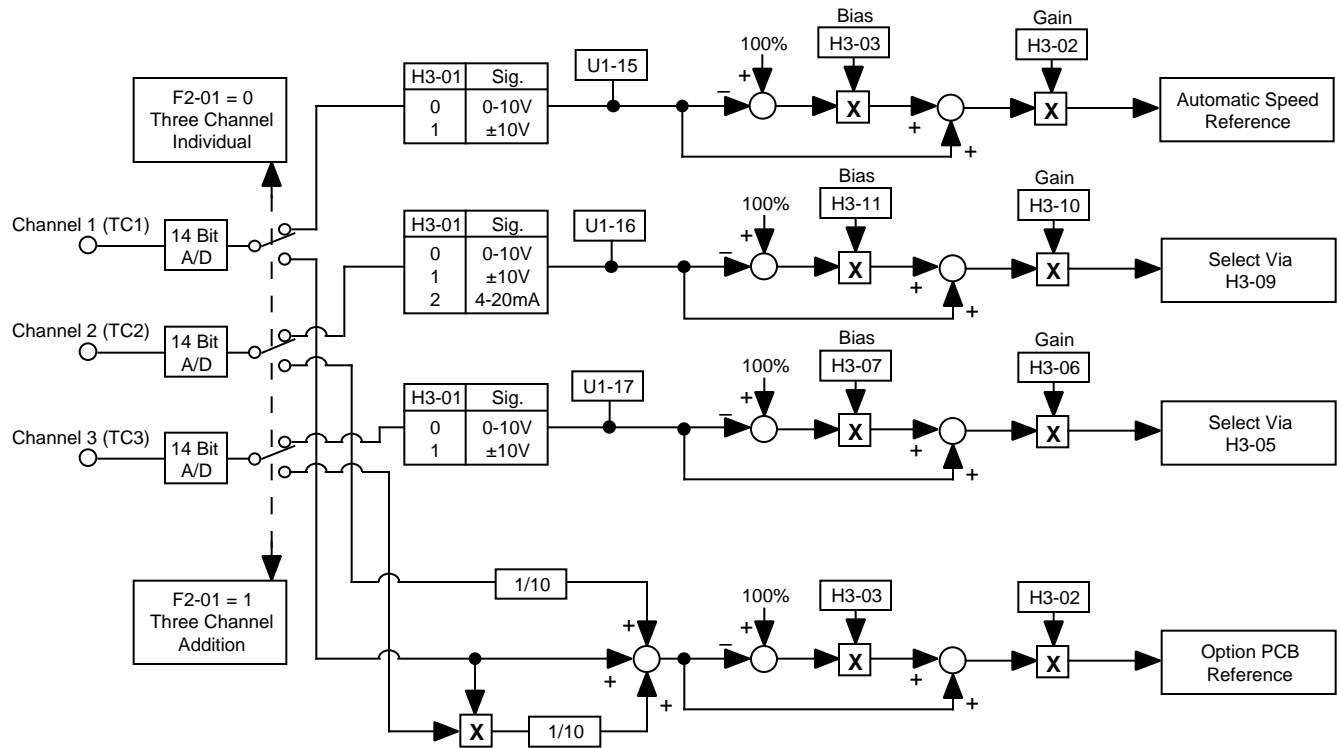POLARITY OF THE SPEED REFERENCE GOES NEGATIVE.

Figure A4. AI-14B Block Diagram

As Figure A4 shows, there are two possible modes of operation for the AI-14B board when it is installed in the GPD 515. These modes are selected by drive parameter **F2-01** (AI-14B Input Selection). When **F2-01** is set to " 0 ", 3-channel individual mode is selected. In this mode the AI-14B replaces the analog inputs on the GPD 515 main control board (see Table A3). When **F2-01** is set to " 1 ", 3-channel addition mode is selected. In this mode the AI-14B adds the three channels together. This new "added" signal replaces the automatic speed reference input (terminal 13) when reference source is set to "Option PCB" (**b1-01** = 3).

Table A3.   AI-14B Configuration in the GPD 515

Mode	AI-14B Terminal	"Equivalent" Terminal on GPD 515 Control Board	"Gain" Parameter ***	"Offset" Parameter ***
3-Channel Individual *	TC1	13	H3-02	H3-03
	TC2	14	H3-06	H3-07
	TC3	16	H3-10	H3-11
3-Channel Addition **	TC1	13	H3-02	H3-03
	TC2			
	TC3			

*   When using the 3-Channel Individual mode, Channel 1 (TC1) becomes the automatic speed reference, Channel 2 (TC2) can be configured using parameter **H3-09** (see section 5.22 of the GPD 515 technical manual), and Channel 3 (TC3) can be configured using parameter **H3-05**.

**   In order to use the 3-Channel Addition mode, parameter **b1-01** (Reference Source) must be set to " 3 " (Option Board).

$$\text{Frequency Reference} = TC1 + \frac{TC2}{10} + \frac{TC3 \times TC1}{10}$$

***   See Figure A5.
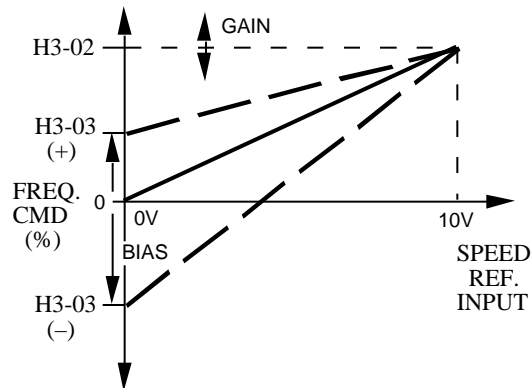
Figure A5. Gain and Bias Adjustments for GPD 515
(shown for Channel 1 (TC1) of the AI-14B option board)

A8.   Reinstall and secure the drive cover.

A9.   Place this instruction sheet with the drive technical manual.

THIS COMPLETES INSTALLATION OF THIS OPTION IN THE GPD 515.

Section B: Installation in a VCD 703

INTRODUCTION

When installed, this option allows the user to interface three separate high resolution voltage signals (13-bit plus sign). These signals can be programmed for speed reference, torque reference, torque limit, or torque comp. Gain for the input signals is adjusted by using drive constants. Polarity (sign) of the speed reference controls direction of motor rotation.

INSTALLATION

B1.   Disconnect all electrical power to drive.

B2.   Remove drive front cover. Check that CHARGE indicator lamp inside drive is off.

B3.   Verify voltage has been disconnected by using a voltmeter to check for voltage at incoming power terminals (L1, L2, L3).

B4.   See Figure B1. Install the option on the Main Control Board, 1PCB, and ensure 2CN is properly connected. Make sure Electrostatic procedure is followed.
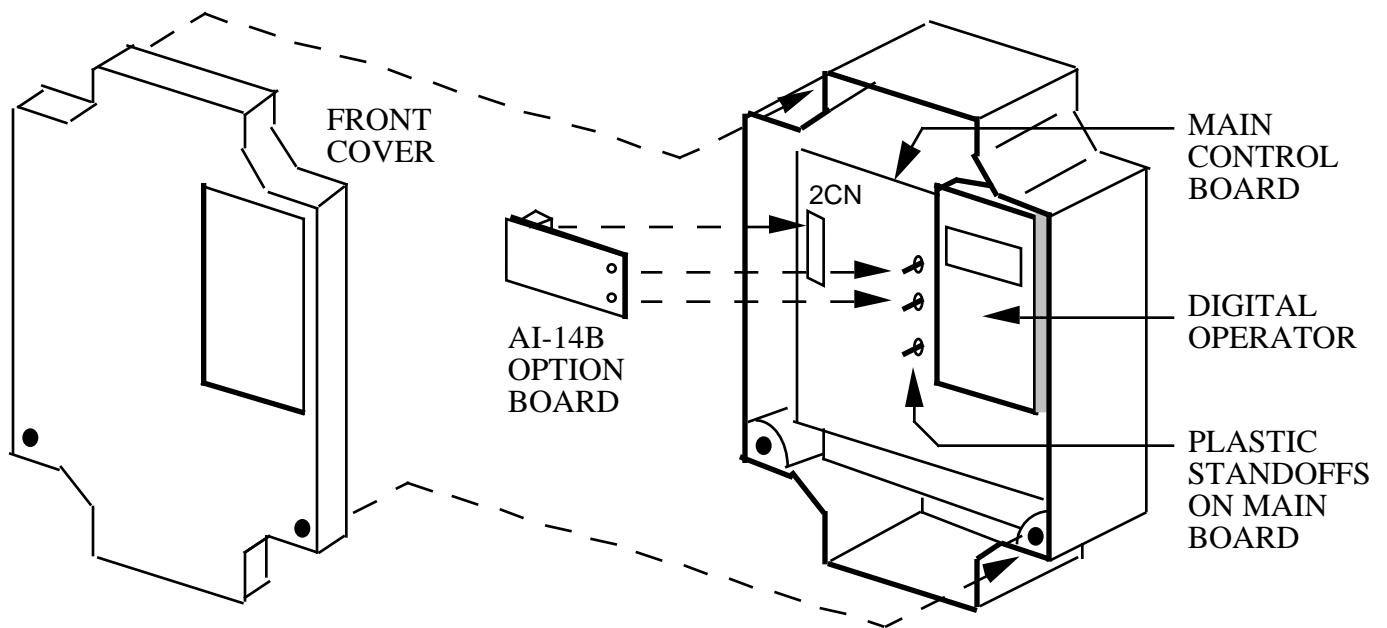

Figure B1. Installation of Analog Speed Reference (AI-14B) in VCD 703

Table B1.   AI-14B Specifications in VCD 703

Parameter	Value
Input Signal Level	0 to ±10V DC (Input Impedance: 20k)
Input Resolution	Voltage: 13 bits (1/8192) plus sign (polarity)

B5.   For VCD 703, all input selection jumpers on the AI–14B board must be set to "V" (see Figure B2).

B6.   Wiring.   See Figure B3 for Analog Speed Reference connections. See Table B2 for terminal functions.
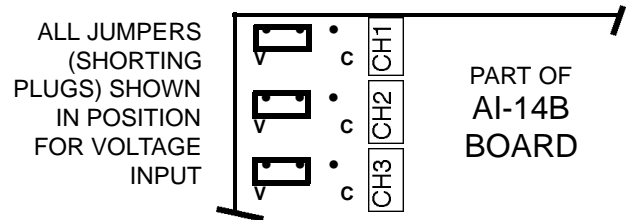
ALL JUMPERS (SHORTING PLUGS) SHOWN IN POSITION FOR VOLTAGE INPUT

PART OF AI-14B BOARD

Figure B2. Voltage/Current Selection on AI-14B

Table B2.   Terminal Functions of AI-14B

Terminal	Function	Signal Level	Notes
TC1	Analog voltage input	Voltage Input: Input voltage: 0 to ±10V/0 to ±100% Input impedance: 20K	— Input Resolution: Voltage: 1/8192 (13 bits) plus sign (polarity)
TC2	Analog voltage input		
TC3	Analog voltage input		— Signal Linearity: ±0.1%
TC4	Signal common	0V	— Terminal screws are metric size M3.

CAUTION

KEEP ANALOG SPEED REF. (I.E. CONTROL CIRCUIT) WIRING SEPRATE FROM MAIN CIRCUIT INPUT/OUTPUT WIRING.

CAUTION

TO PREVENT ERRONEOUS OPERATION CAUSED BY NOISE INTERFENCE, USE SHIELDED CABLE FOR CONTROL WIRING, AND LIMIT DISTANCE TO 10M (33 FEET) OR LESS.

CAUTION

IF ANY OF THE CONTROL SIGNAL INPUT TERMINALS (TC1 THRU TC3) ARE NOT USED, JUMPER THEM TO 0V TERMINAL (TC4).

IMPORTANT

Because the analog speed reference is converted by 1/16384 resolution, the voltage source accuracy of the analog speed reference source must be con-sidered. To ensure speed control accuracy, use a high precision power supply for the voltage source.

Route wires from the drive and connect to the peripheral device. Refer to "Electrical Installation" in the drive technical manual for further information on use of shielded cable.
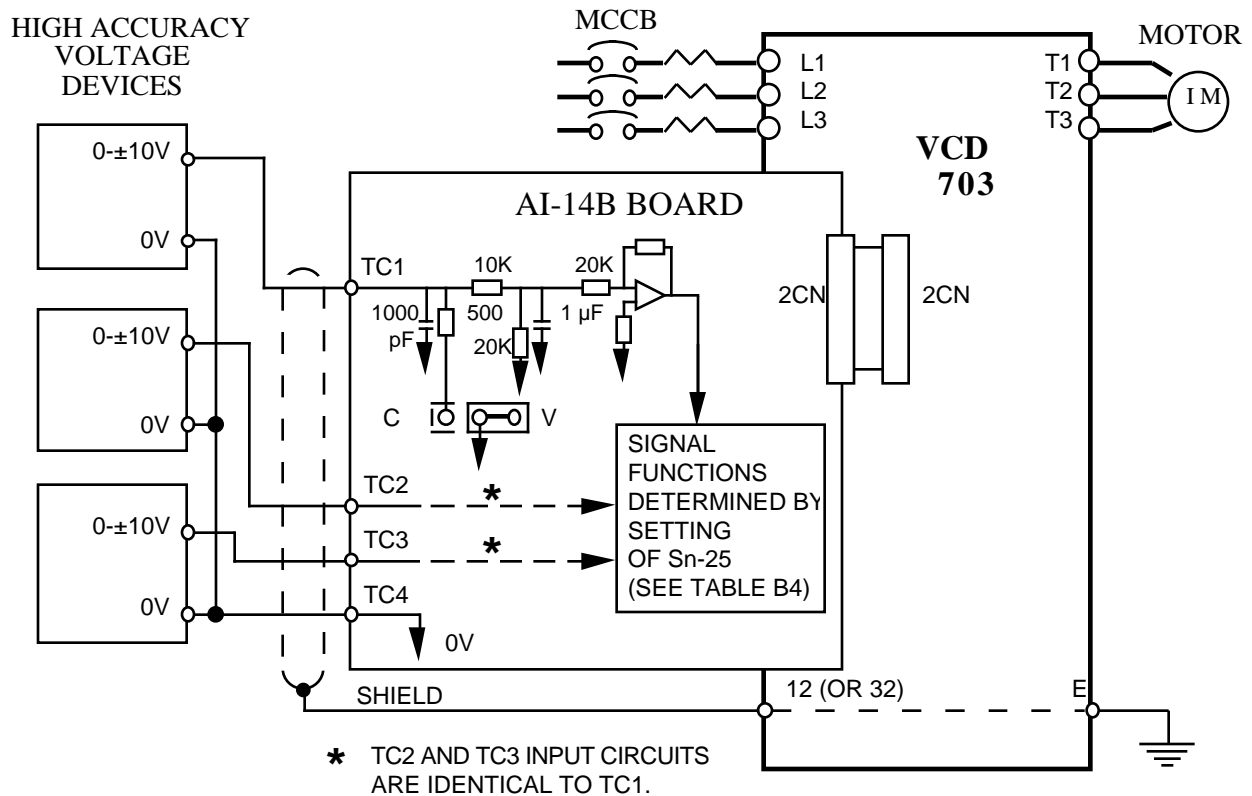
Figure B3. Interconnection for Analog Speed Reference (AI-14B) Circuit in VCD 703

B7. Adjustments

There are no adjustments to be made on the Analog Speed Reference option; however, the VCD 703 will have to be reprogrammed for the input requirement of the remote device and the reversing or non-reversing requirement of the specific application.

WARNING

IF THE APPLICATION REQUIRES THAT REVERSE MOTOR
ROTATION BE PROHIBITED, Sn-05 MUST BE SET TO X X **1** X
SO THAT THE MOTOR WILL STOP ANY TIME POLARITY OF THE
SPEED REFERENCE GOES NEGATIVE.

IMPORTANT

For the Analog Speed Reference circuit to function properly, system constant Sn-04
must be set to XXX 0 and Sn-08 must be set to XXX 0 (input to AI-14B replaces
auto speed reference signal).

(1) GAIN: Adjustment of the gain of the speed or torque reference commands is done by changing
the associated VCD 703 constants; see Table B3.

Table B3. Setting Gain of Speed Reference Commands

Constant No.	Description	Setting Range	Incre-ment	Factory Setting
Cn-30	AI-14B Chan. 1 Gain	0.0 to 1000.0 (%)	0.1	100.0
Cn-31	AI-14B Chan. 2 Gain	0.0 to 1000.0 (%)	0.1	100.0
Cn-32	AI-14B Chan. 3 Gain	0.0 to 1000.0 (%)	0.1	100.0

(2) Reference Inputs: The AI-14B can be programmed for either speed mode references or torque mode references by programming Sn-25; see Table B4.

Table B4. Selecting Speed or Torque Mode

SET VALUE	CONTROL MODE *	AI-14B INPUTS		
		CH 1	CH 2	CH 3
0000	ASR I	Speed Reference	Not Used	Not Used
0001	ASR II	Speed Reference	Speed Ref. Trim	Torque Compensation
0010	ASR III	Speed Reference	Fwd. Torque Limit (TLF)	Rev. Torque Limit (TLR)
0011	ASR IV	Speed Reference	Torque Limit (TLF, TLR)	Torque Compensation
1000	ATR I	Speed Limit	Torque Reference	Torque Compensation
1001	ATR II	Not Used	Torque Reference	Not Used

* ASR : Speed control mode; ATR : Torque control mode

NOTE: To increase control accuracy, use a high-accuracy, stabilized power supply.

(3) Monitor Display: Inputs to the AI-14B can be monitored by the VCD 703 by using the Un-XX constants.

Un-36	=	CH1 input voltage (V)	10V / 10V
Un-37	=	CH2 input voltage (V)	10V / 10V
Un-38	=	CH3 input voltage (V)	10V / 10V

B8.   Reinstall and secure drive cover.

B9.   Place this instruction sheet with the drive technical manual.

THIS COMPLETES INSTALLATION OF THIS OPTION IN THE VCD 703.

Section C: Installation in a GPD 503

INTRODUCTION

When installed, this option allows the user to interface three separate high resolution analog input signals, each of which may be either current or voltage (13-bit plus sign). These signals are added by the AI-14B board and the result is applied to the drive as a high accuracy 0-±10V frequency reference. Gain and bias for the input reference is adjusted by using drive constants. Polarity (sign) of the speed reference controls direction of motor rotation.

INSTALLATION

C1.   Disconnect all electrical power to drive.

C2.   Remove drive front cover. Check that CHARGE indicator lamp inside drive is off.

C3.   Verify voltage has been disconnected by using a voltmeter to check for voltage at incoming power terminals (L1, L2, L3).

C4.   See Figure C1. Install the option on the Main Control Board, 1PCB, and ensure 2CN is properly connected. Make sure Electrostatic procedure is followed.
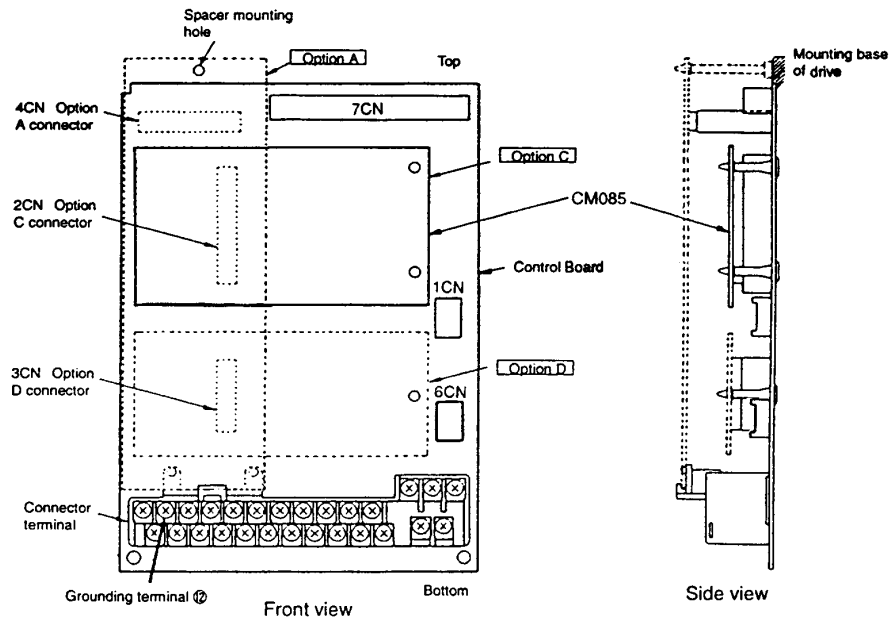

Figure C1. Installation of Analog Speed Reference (AI-14B) in GPD 503

Table C1.   AI-14B Specifications in GPD 503

Parameter	Value
Input Signal Level	0 to ±10V DC (Input Impedance: 20k) 40 to 20mA (input impedance : 500)
Input Resolution	Voltage: 13 bits (1/8192) plus sign (polarity) Current: 1/6554

C5.   Determine whether a voltage or current signal will be inputted on each of the channels of the AI–14B board, and set selection jumpers accordingly (see Figure C2).

6.   Wiring.   See Figure C3 for Analog Speed Reference connections. See Table C2 for terminal functions.
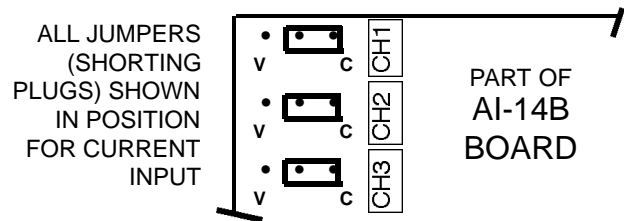
ALL JUMPERS (SHORTING PLUGS) SHOWN IN POSITION FOR CURRENT INPUT

PART OF
AI-14B
BOARD

Figure C2. Voltage/Current Selection on AI-14B

Table C2.   Terminal Functions of AI-14B

Terminal	Function	Signal Level	Notes

TC1	Analog voltage/current input	Voltage Input:
		 Input voltage: 0 to ±10V/0 to ±100%
		 Input impedance: 20K
			— Input Resolution:
			    Voltage: 1/8192 (13 bits) plus
			    sign (polarity)
			    Current: 1/6554

TC2	Analog voltage/current input		
TC3	Analog voltage/current input	Current Input: Input current: 4 to 20mA/0 to ±100% Input impedance: 500	— Signal Linearity: ±0.1% — Terminal screws are metric size M3.
TC4	Signal common	0V	

CAUTION

KEEP ANALOG SPEED REF. (I.E. CONTROL CIRCUIT) WIRING SEPRATE FROM MAIN CIRCUIT INPUT/OUTPUT WIRING.

CAUTION

TO PREVENT ERRONEOUS OPERATION CAUSED BY NOISE INTERFERENCE, USE SHIELDED CABLE FOR CONTROL WIRING, AND LIMIT DISTANCE TO 10M (33 FEET) OR LESS.

CAUTION

IF ANY OF THE CONTROL SIGNAL INPUT TERMINALS (TC1 THRU TC3) ARE NOT USED, JUMPER THEM TO 0V TERMINAL (TC4).

IMPORTANT

Because the analog speed reference is converted by 1/16384 resolution, the voltage source accuracy of the analog speed reference source must be considered. To ensure speed control accuracy, use a high precision power supply for the voltage source.

Route wires from the drive and connect to the peripheral device. Refer to "Electrical Installation" in the drive technical manual for further information on use of shielded cable.
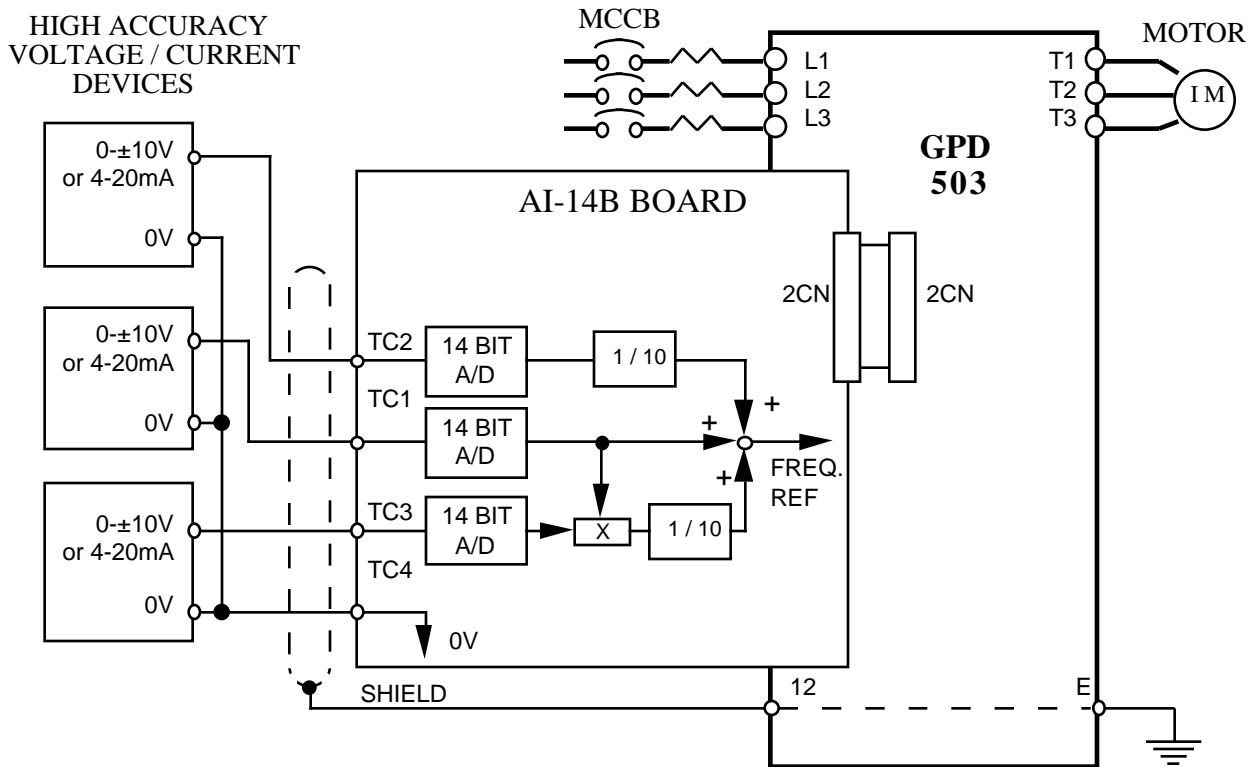
Figure C3. Interconnection for Analog Speed Reference (AI-14B) Circuit in GPD 503

C7.   Adjustments.

There are no adjustments to be made on the Analog Speed Reference option; however, the GPD 503 will have to be reprogrammed for the input requirement of the remote device and the reversing or non-reversing requirement of the specific application.

WARNING

IF THE APPLICATION REQUIRES THAT REVERSE MOTOR
ROTATION BE PROHIBITED, Sn-25 MUST BE SET TO X X X **1**
SO THAT THE MOTOR WILL STOP ANY TIME POLARITY OF
THE SPEED REFERENCE GOES NEGATIVE.

IMPORTANT

For the Analog Speed Reference circuit to function properly, system constant
Sn-04 must be set to X X X 0 and Sn-08 must be set to X X X 0 (input to AI-14B
replaces auto speed reference signal).

Adjustment of the bias and gain of the frequency command are done by changing the associated GPD 503 constants; see Figure C4 and Table C3.
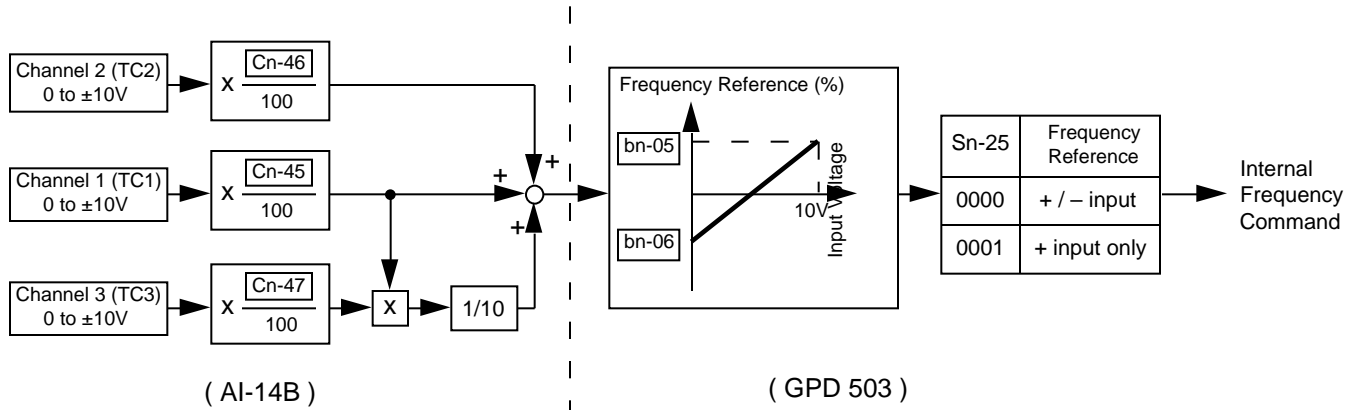
Figure 5. Frequency Command Gain and Bias Adjustments

Table 3. Setting Bias and Gain of Frequency Command

Constant No.	Description	LHP GPD 503			HHP GPD 503		
		Setting Range	Incre-ment	Factory Setting	Setting Range	Incre-ment	Factory Setting
bn-05	Freq. Reference Gain	0.0 to 1000.0 (%)	1.0	100.0	0.0 to 1000.0 (%)	0.1	100.0
bn-06	Freq. Reference Bias	-100 to 100 (%)	1	0	−100.0 to 100.0 (%)	0.1	0.0
Cn-45	AI-14B Chan. 1 Gain	Constant not used; Fixed gain of 100%			0.0 to 1000.0 (%)	0.1	100.0
Cn-46	AI-14B Chan. 2 Gain	Constant not used; Fixed gain of 10%			0.0 to 1000.0 (%)	0.1	10.0
Cn-47	AI-14B Chan. 3 Gain	Constant not used; Fixed gain of 10%			0.0 to 1000.0 (%)	0.1	10.0

EXAMPLE:
With all channel inputs at maximum, the frequency command (displayed on Digital Monitor) is only 59 Hz. To obtain 60 Hz maximum frequency command, the required correction factor (Gain) is 60 Hz/59 Hz = 1.01695 = 101.7%. Therefore, program bn-05 setting to **101.7** (%).

C8. Reinstall and secure drive cover.

C9. Place this instruction sheet with the drive technical manual.

THIS COMPLETES INSTALLATION OF THIS OPTION IN THE GPD 503.