Soft Servo
SYSTEMS, INC

Hardware and Wiring Manual for the VersioBus II Interface System

Revision 1.30

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⚠ CAUTION

The DC-155 servo-related I/O and general I/O have different characteristics. Only the servo-related input is sourcing. The servo-related output, the general inputs, and the general outputs are sinking.

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VersioBus II Release Notes

Soft Servo Systems, Inc. is pleased to announce the immediate availability of VersioBus II, the next generation of the VersioBus fiber-optic communication protocol originally developed by Soft Servo Systems. The new VersioBus II protocol is a proprietary 5 Mbps real-time fiber-optic digital servo and I/O communication protocol that provides enhanced reliability and security, and supports a 1 ms multi-axis (up to 16 axes) interpolation cycle.

The difference between the VersioBus and VersioBus II interface systems, from a customer's point of view, is just a matter of using new part numbers for the VersioBus II hardware components. The appearance, hardware specifications, connections, wiring and setup remain exactly the same. Each VersioBus hardware component has a corresponding VersioBus II hardware component that uses the new VersioBus II communication protocol, as shown in the following table:

Component Type	VersioBus	VersioBus II
VersioBus PCI Adapter Board	FP-95	FP-105
VersioBus ISA Adapter Board	FP-80	FP-85
VersioBus PC104 Adapter Board	FP-104	FP-114
Servo Interface Module	DC-150	DC-155
I/O Module	IM-300	IM-305

When ordering a ServoWorks CNC or SMP product for the VersioBus II interface system, you will need to use "V2P" or "V2I" as the suffix for the product part number ["V2P" and "V2I" replace the "VBP" and "VBI" suffixes used for the older VersioBus interface system.] For instance, "3S-MCQ-V2I" indicates ServoWorks MC-Quad with an FP-85 (ISA) adapter board and a DC-155 servo interface module. [The "P" in the suffix indicates a PCI adapter board, the "I" indicates an ISA adapter board.]

The VersioBus and VersioBus II protocols are not compatible. In other words, VersioBus hardware components (adapter boards, servo interface modules and I/O modules) cannot be included in the same network as VersioBus II hardware components. Care must be taken to avoid mixing VersioBus and VersioBus II products in the same system.

The same VersioBus fiber-optic cable works for both VersioBus and VersioBus II interface systems. The HW-100 handwheel and the breakout boxes (TB36A, TB36B and TB37BD) that were optional components in the VersioBus interface system are also optional components in the VersioBus II interface system. These components do not use a fiber-optic protocol, and can be used interchangeably with existing VersioBus interface systems and with any new VersioBus II interface systems.

If you are using an existing VersioBus system, replacement VersioBus hardware components (FP-80s, FP-95s, FP-104s, DC-150s and IM-300s) will be made available for one year, after which they will be discontinued.

Please contact sales@softservo.com with any questions you may have regarding this new protocol.

Safety Notes

PC Location

CAUTION

It is strongly recommended that you do not locate the PC inside the electric cabinet, to minimize the possibility of problems due to electrical noise being introduced into the PC motherboard (through air and/or poorly shielded wires such as keyboard, mouse or handwheel cables). Such noise could affect the PCI or ISA bus data flow within the PC, or possibly even the CPU/memory operations of the PC. In fact, it is recommended that you locate the PC as far from the servo drives (the main source of electrical noise) as practicality permits.

Mounting Location

CAUTION

Never use VersioBus II components in an area where those components could be exposed to water (such as splashing), due to the risk of electric shock or fire.

CAUTION

Never use VersioBus II components next to flammable items, or in a corrosive or flammable atmosphere, due to the risk of electric shock or fire.

Operational Precautions

CAUTION

The VersioBus II interface system is for incremental encoders only. Do not use the VersioBus II interface system with absolute encoders.

⚠ CAUTION

Set all system parameters before operating any components in the VersioBus II interface system. See the *Reference Manual for ServoWorks CNC Parameters and Functions*, the *ServoWorks S-100T Parameters Manual*, or the *Reference Manual for SMP Parameters and Functions*.

⚠ CAUTION

Test the Emergency Stop before operating any components in the VersioBus II interface system. Make sure the Emergency Stop can be applied at any time.

⚠ CAUTION

Never open up any VersioBus II components, or touch the inside of any VersioBus II component. Doing so may result in damage to the component, or could result in electrical shock.

⚠ CAUTION

Be sure no wiring is exposed before operating any components in the VersioBus II interface system.

⚠ CAUTION

Do not change the wiring while the power is on, due to the risk of electrical shock or injury.

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1.1 Descriptions of VersioBus II Adapter Boards

FP-85: A dual-link VersioBus™ II ISA adapter board for the host PC

FP-105: A dual-link VersioBus™ II PCI adapter board for the host PC

FP-114: A dual-link VersioBus™ II PC104 adapter board for the host PC

FP-85 **FP-105** **FP-114**

Figure 1-1: Photos of Dual-Link VersioBus II Adapter Boards

1.2 VersioBus II Adapter Board Functional Specifications

FUNCTION/FEATURE	SPECIFICATIONS
Communication	2 half-duplex channels (a servo network and an I/O network) of VersioBus II connections
I/F to DC-155 or DC-125	Up to 4 DC-155s or DC-125s (maximum 16-axis control and 128-point general I/O)
I/F to IM-305 I/O Module	Up to 4 IM-305s (maximum 256 points of additional general I/O)
Maximum Distance Between Modules	10 m (upgradeable to 500 m with commercial glass fiber optic cable)
On-Board I/O Interface	I/O connectors for a handwheel (pulse generator), and 32 points of general purpose I/O signals
Dimensions (including card edge connectors)	FP-85: 104 mm x 160 mm FP-105: 108 mm x 175 mm FP-114: 96 mm x 178 mm
Red LED for HandWheel Status (FP-105 only)	Status Indicators For A **Single-Ended** Handwheel: 1) No LED: no handwheel is connected 2) Solid LED: a handwheel is connected 3) Flashing LED: a handwheel is connected, and each flash of the LED corresponds to one click of the handwheel's dial Status Indicators For A **Differential** Handwheel: 1) No LED: no handwheel is connected OR a handwheel is connected and the "Select Axis" switch is NOT set to "OFF" 2) Solid LED: a handwheel is connected AND the "Select Axis" switch IS set to "OFF"

Table 1-1: Functional Specifications of VersioBus II Adapter Boards

1.3 VersioBus II Adapter Board Schematics

1.3.1 FP-85 Schematic

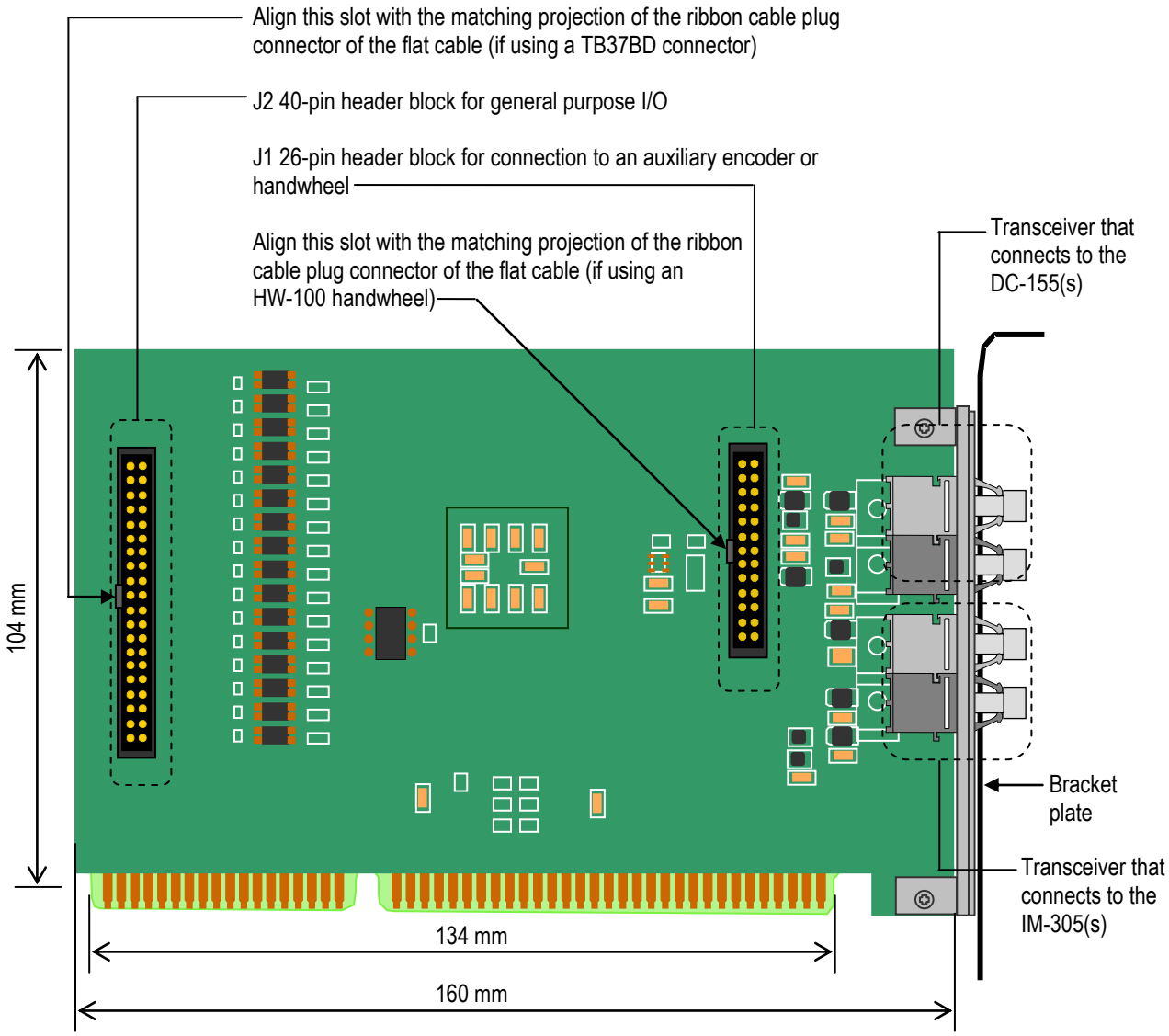


Figure 1-2: FP-85 VersioBus II Dual-Link Fiber-Optic Adapter Board

NOTE: Use a small ISA riser card to attach the FP-85 to the motherboard of the PC.

1.3.2 FP-105 Schematic

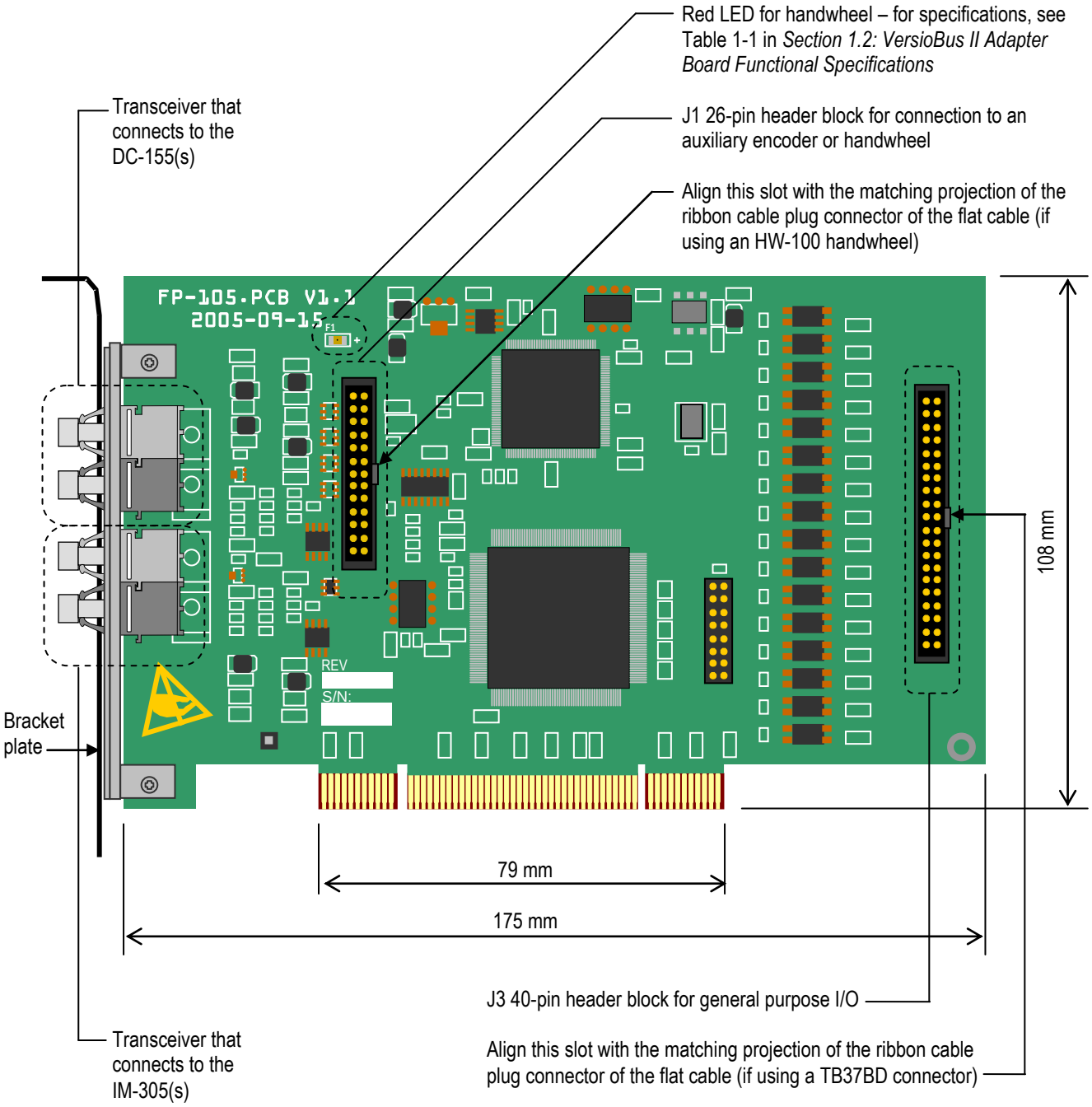


Figure 1-3: FP-105 VersioBus II Dual-Link Fiber-Optic Adapter Board

1.3.3 FP-114 Schematic

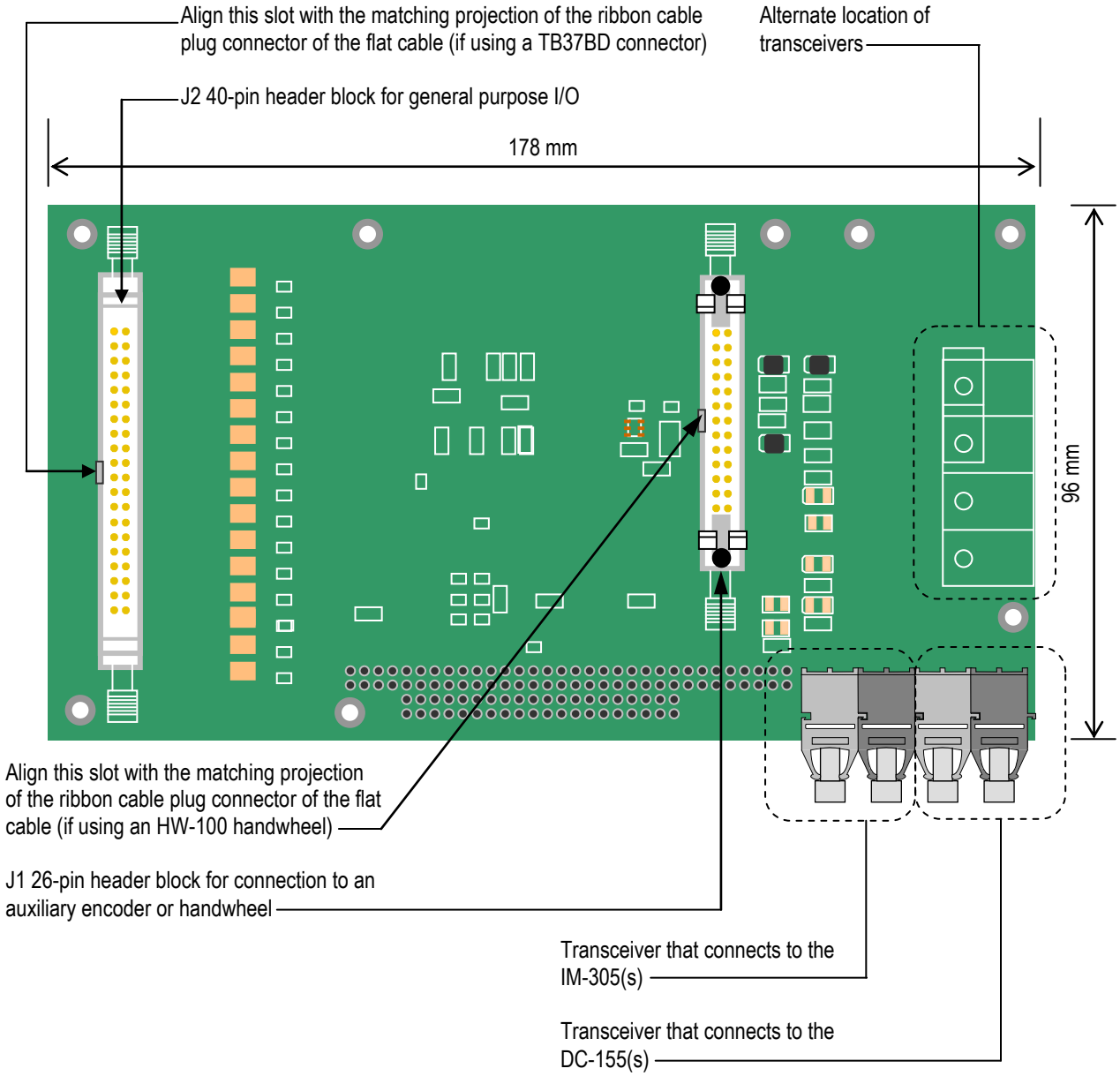
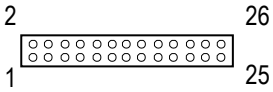


Figure 1-4: FP-114 VersioBus II Dual-Link Fiber-Optic Adapter Board

1.4 VersioBus II Adapter Board Pin Assignments

1.4.1 Handwheel Header Block

This applies to the J1 Header Block on the FP-85, the J1 Header Block on the FP-105 and the J1 Header Block on the FP-114.



PIN NO.	I/O	SIGNAL	PIN NO.	I/O	SIGNAL
1	I	Encoder Signal A, Low Side	14	I	Axis Y Selection[2]
2	I	Encoder Signal A, High Side	15	I	Axis Z Selection[2]
3	I	Digital Ground	16	I	Axis 4 Selection[2]
4	I	Encoder Signal B, Low Side	17	I	Axis 5 Selection[2]
5	I	Encoder Signal B, High Side	18	O	V_{CC} (5V)
6	I	Digital Ground	19	O	V_{CC} (5V)
7	I	Encoder Input Select[1]	20	I	NC
8	I	X1 pulse multiplication	21	I	NC
9	I	X10 pulse multiplication	22	I	NC
10	I	X100 pulse multiplication	23	I	NC
11	I	NC	24	I	NC
12	I	LOGIC E-STOP	25	I	NC
13	I	Axis X Selection[2]	26	I	NC

Table 1-2: Pin Assignments for the Handwheel Header Block

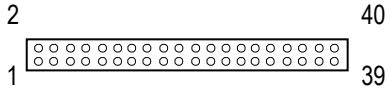
NOTES:

1) Pin 7 changes automatically in the internal circuitry of the VersioBus II adapter board according to whether the attached handwheel has single-ended encoder output or differential encoder output.

2) The axis selector pins should be connected to one of the ground pins (pin 3 or pin 6) for the signal to be registered. Refer to Figure 1-8.

3) For the HW-100 handwheel, this header block connects to a panel-mount, DB25F Handwheel and Handwheel Emergency Stop connector. See pages 1-10 and 1-11 for handwheel connections and pin definitions. The connection to the header block is described in *Chapter 5: HW-100 Handwheel*.

1.4.2 Local I/O Header Block (J2 Header Block on the FP-85, the J3 Header Block on the FP-105 and the J2 Header Block on the FP-114)



PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	IN0 (Digital Input 0)	21	OUT1 (Digital Output 1)
2	IN1 (Digital Input 1)	22	OUT2 (Digital Output 2)
3	IN2 (Digital Input 2)	23	OUT3 (Digital Output 3)
4	IN3 (Digital Input 3)	24	OUT4 (Digital Output 4)
5	IN4 (Digital Input 4)	25	OUT5 (Digital Output 5)
6	IN5 (Digital Input 5)	26	OUT6 (Digital Output 6)
7	IN6 (Digital Input 6)	27	OUT7 (Digital Output 7)
8	IN7 (Digital Input 7)	28	NC
9	COM0_IN_GND (Common Ground 0) – for use with all digital inputs (pins 1-8, 10-17)	29	COM2_B_GND (Common Ground 2) – for digital outputs 8 – 15 (pins 30-37)
10	IN8 (Digital Input 8)	30	OUT 8 (Digital Output 8)
11	IN9 (Digital Input 9)	31	OUT 9 (Digital Output 9)
12	IN10 (Digital Input 10)	32	OUT 10 (Digital Output 10)
13	IN11 (Digital Input 11)	33	OUT 11 (Digital Output 11)
14	IN12 (Digital Input 12)	34	OUT 12 (Digital Output 12)
15	IN13 (Digital Input 13)	35	OUT 13 (Digital Output 13)
16	IN14 (Digital Input 14)	36	OUT 14 (Digital Output 14)
17	IN15 (Digital Input 15)	37	OUT 15 (Digital Output 15)
18	NC	38	NC
19	COM1__A_GND (Common Ground 1) – for digital outputs 0 – 7 (pins 20-27)	39	NC
20	OUT0 (Digital Output 0)	40	NC

Table 1-3: Pin Assignments for the Local I/O Header Blocks on the FP-85, the FP-105 and the FP-114

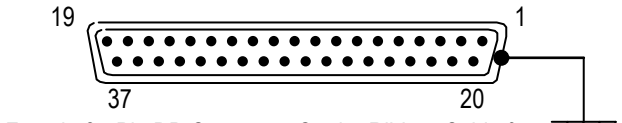
NOTES:

- **For a single power supply, jumper COM1_A_GND and COM2_B_GND together.**
- This header block connects to a panel-mount, DB37F I/O connector. Soft Servo Systems, Inc. offers the TB37BD to provide a simple interface to I/O devices. Refer to *Chapter 4: Breakout Boxes* for information on the TB37BD Connector.

1.5 Pin Assignments for Bracket Connectors to a VersioBus II Adapter Board

1.5.1 Pin Assignments for a DB37F On-Board I/O Port Attached to a VersioBus II Adapter Board

Soft Servo Systems offers receptacle hardware for easily creating an on-board I/O port in the host PC attached to the VersioBus II adapter board that has been inserted in the host PC. This cable assembly consists of a DB-37 female receptacle with a one foot long ribbon cable (with a PC bracket) that connects to the local I/O header block (the J2 header block on the FP-85, the J3 header block on the FP-105 and the J2 header block on the FP-114). [A breakout box, such as the TB37BD, can be easily connected to this I/O port by using a ribbon jumper cable (with one to one pin assignments).]

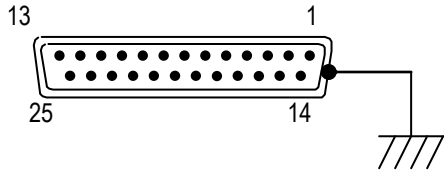


Female 37-Pin DB Connector On the Ribbon Cable for Connection to the Local I/O Header Block

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	INB0	20	INB1
2	INB2	21	INB3
3	INB4	22	INB5
4	INB6	23	INB7
5	COM0_GND (for inputs)	24	INB8
6	INB9	25	INB10
7	INB11	26	INB12
8	INB13	27	INB14
9	INB15	28	NC
10	COM1_GND (for outputs 0 – 7, pins 11-14 & 29-32)	29	OUTB0
11	OUTB1	30	OUTB2
12	OUTB3	31	OUTB4
13	OUTB5	32	OUTB6
14	OUTB7	33	NC
15	COM2_GND (for outputs 8 – 15, pins 16-19 & 34-37)	34	OUTB8
16	OUTB9	35	OUTB10
17	OUTB11	36	OUTB12
18	OUTB13	37	OUTB14
19	OUTB15		

Table 1-4: Pin Assignments for a TB37F Port Attached to an FP-85, an FP-105 or an FP-114

1.5.2 Pin Assignments for a DB25F Handwheel Port Attached to a VersioBus II Adapter Board



Female 25-Pin DB Connector On the Ribbon Cable for Connection to the J1 Header Block on the FP-85, the J1 Header Block on the FP-105 or the J1 Header Block on the FP-114

PIN NO.	NAME	SIGNAL
1	A_LO	Encoder Signal A, Low Side
2	GND	Digital Ground
3	B_HI	Encoder Signal B, High Side
4	DIF_SEL	Encoder Input Select
5	X10	X10
6		Not used
7	X-Axis	Axis X
8	Z-Axis	Axis Z
9	5-Axis	Axis 5 (Optional)
10	V_{cc}	V_{cc} (5V)
11		Not used
12		Not used
13		Not used
14	A_HI	Encoder Signal A, High Side
15	B_LO	Encoder Signal B, Low Side
16	GND	Digital Ground
17	X1	X1
18	X100	X100
19	E-STOP	LOGIC E-STOP
20	Y-Axis	Axis Y
21	4-Axis	Axis 4
22	V_{cc}	V_{cc} (5V)
23		Not used
24		Not used
25		Not used

Table 1-5: Pin Assignments for a TB25F Port Attached to a VersioBus II Adapter Board

1.6 VersioBus II Adapter Board On-Board I/O Specifications, Internal Circuitry & Wiring Diagrams

1.6.1 16-Point Inputs (IN00-IN15)

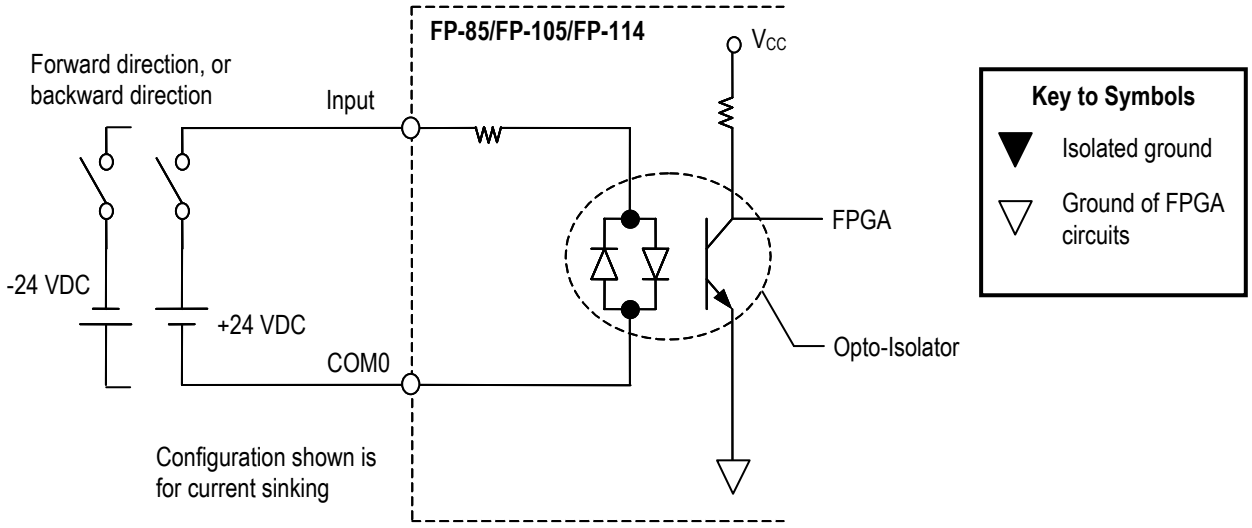


Figure 1-5: Internal Circuitry and Wiring for IN00 – IN15

FUNCTION/FEATURE	SPECIFICATIONS
Inputs	16 (sink)
Common	1 (COM0)
Input Voltage Range	10.2 to 26.4 VDC or –10.2 to –26.4 VDC
ON Voltage Level	9.5 VDC minimum
OFF Voltage Level	3.5 VDC maximum
Input Impedance	3 kΩ
Input Current	4.6 mA @ 12 VDC 9.6 mA @ 24 VDC
Minimum ON Current	3.5 mA
Maximum OFF Current	1 mA
OFF to ON Response	Less than 100 μs
ON to OFF Response	Less than 100 μs

Table 1-6: Specifications for IN00 – IN15

1.6.2 16-Point Outputs (OUT00-OUT15)

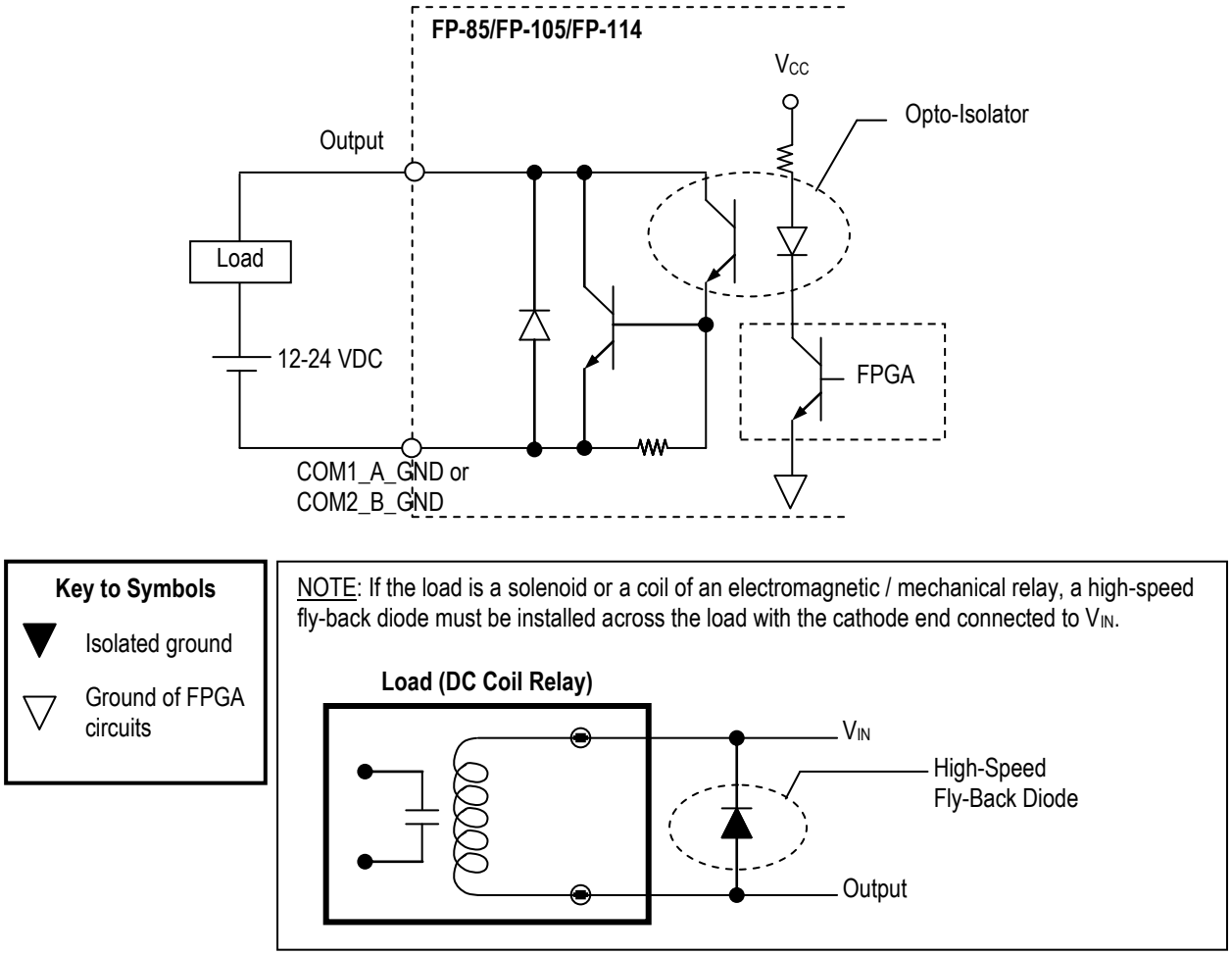


Figure 1-6: Internal Circuitry and Wiring for OUT00 – OUT15

FUNCTION/FEATURE	SPECIFICATIONS
Outputs	16 (sink)
Commons	2
Operating Range	10.8 to 26.4 VDC or –10.8 to –26.4 VDC
Type	NPN Open Collector
Peak Voltage	35 VDC
On Voltage Drop	0.1 VDC maximum
Maximum Load Current	50 mA per point (internal or external power for servo-related I/O)
Maximum Leakage Current	5 μA
External DC Required	12–24 VDC ±10%, 40 mA maximum
OFF to ON Response	Less than 100 μs
ON to OFF Response	Less than 100 μs

Table 1-7: Specifications for OUT00 – OUT15

1.6.3 Single-Ended Handwheel Encoder Connection

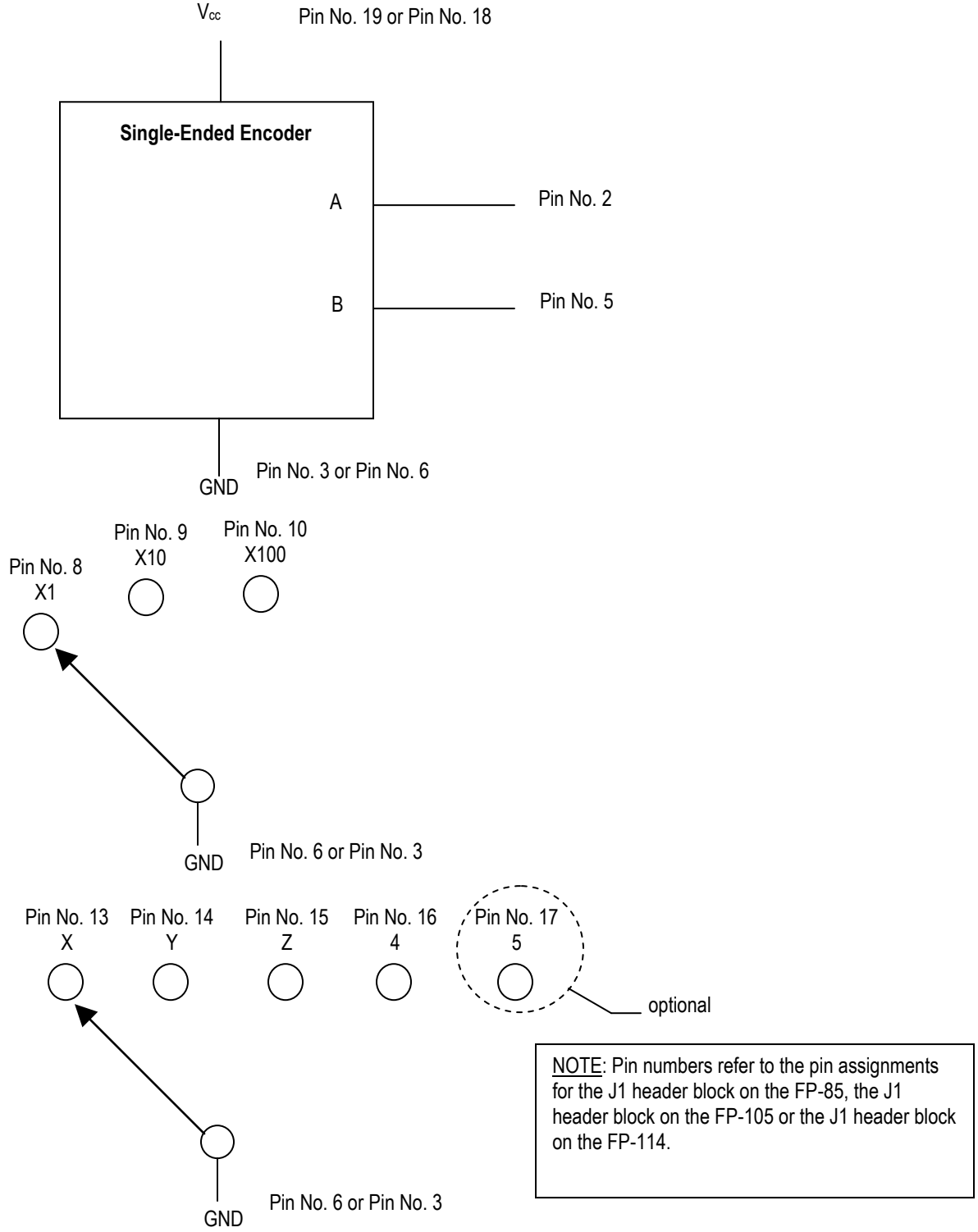
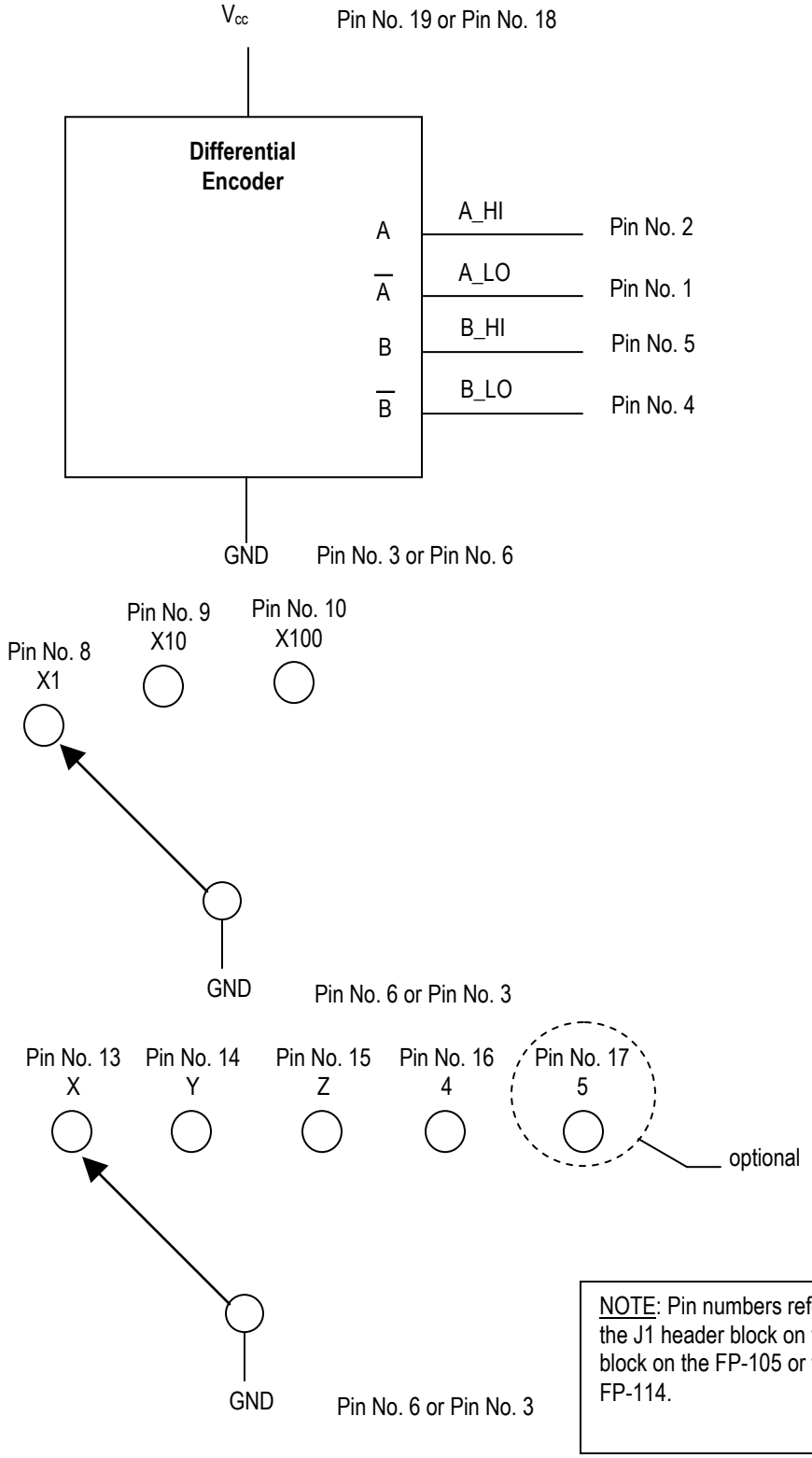


Figure 1-7: Internal Circuitry and Wiring for a Single-Ended Handwheel Encoder Connection

CONNECT JUMPER WIRES AS FOLLOWS: Connect Pin No. 7 to Pin No. 1 and Pin No. 4 via jumper wires.

1.6.4 Differential Handwheel Encoder Connection



NOTE: Pin numbers refer to the pin assignments for the J1 header block on the FP-85, the J1 header block on the FP-105 or the J1 header block on the FP-114.

Figure 1-8: Internal Circuitry and Wiring for a Differential Handwheel Encoder Connection

1.7 Comparison of VersioBus II Adapter Boards

FUNCTION/ FEATURE	FP-85	FP-105	FP-114
Photo			
Dimensions	104 mm x 160 mm	108 mm x 175 mm	96 mm x 178 mm
Connector	ISA card edge connector	PCI card edge connector	PC104 stacking connector
Local I/O header block	J2 header block	J3 header block	J2 header block
LED	None	Red LED for handwheel status (see specifications)	None

Table 1-8: Comparison of VersioBus II Adapter Boards

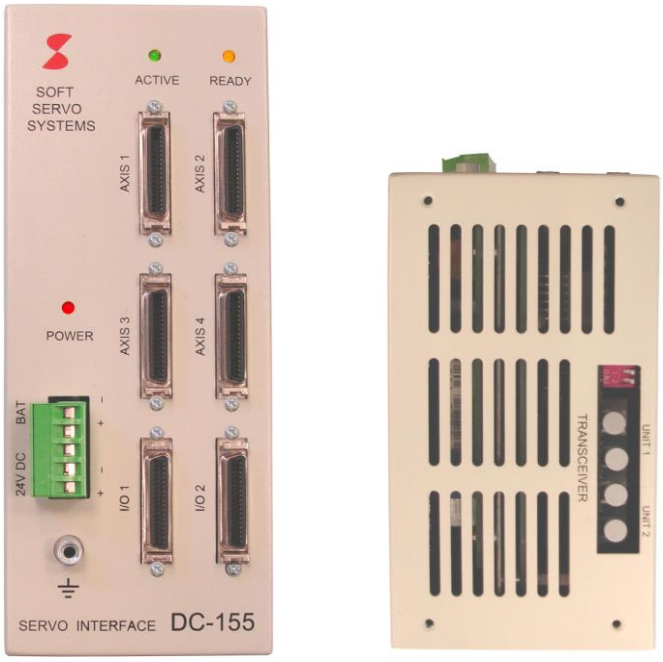
Chapter 2: Servo Interface Modules

The DC-155 is a VersioBus II servo interface module that interfaces with up to four servo axes and has 16 input bits and 16 output bits.

NOTE: The DC-155 has been discontinued and replaced by the DC-125J servo interface module. Please see *Section 2.9: DC-125J* for more information on the DC-125J servo interface module.

2.1 DC-155 Description

DC-155: Four-axis servo drive & I/O interface module for incremental encoders



FRONT **BOTTOM**

Figure 2-1: Photos of DC-155 Remote Servo Interface Module

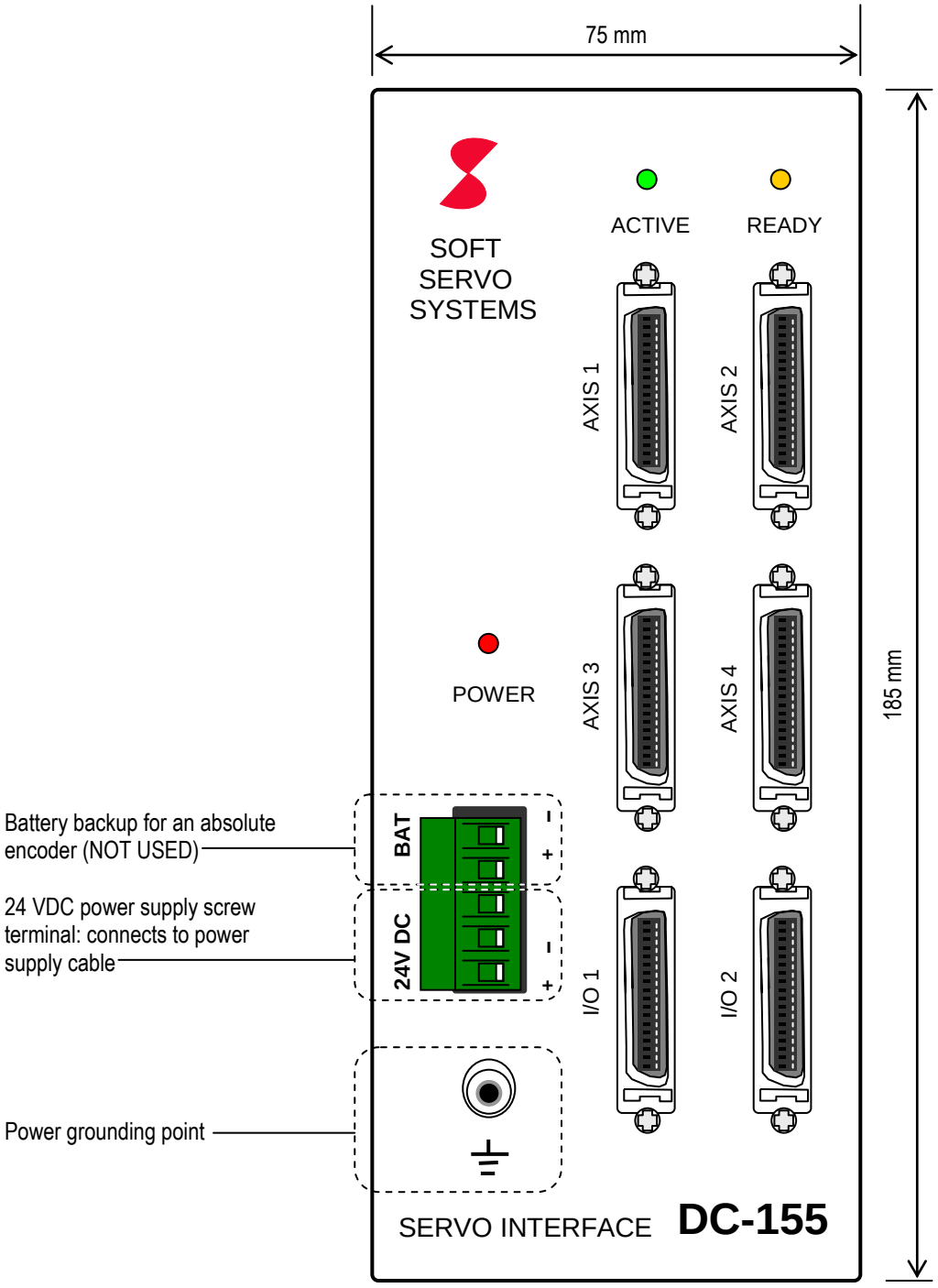


Figure 2-2: DC-155 VersioBus II Remote Servo Interface Schematic Front Diagram

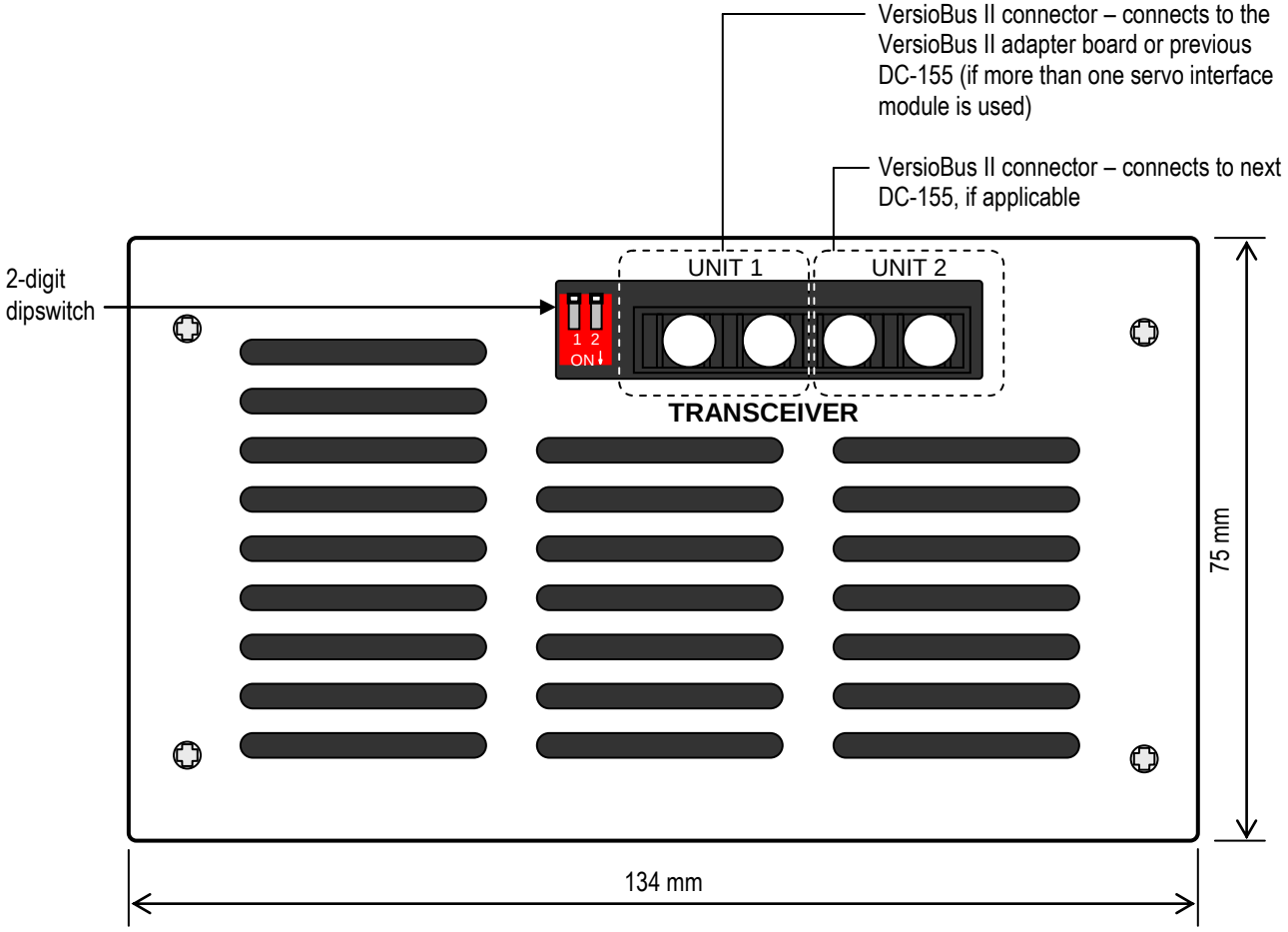
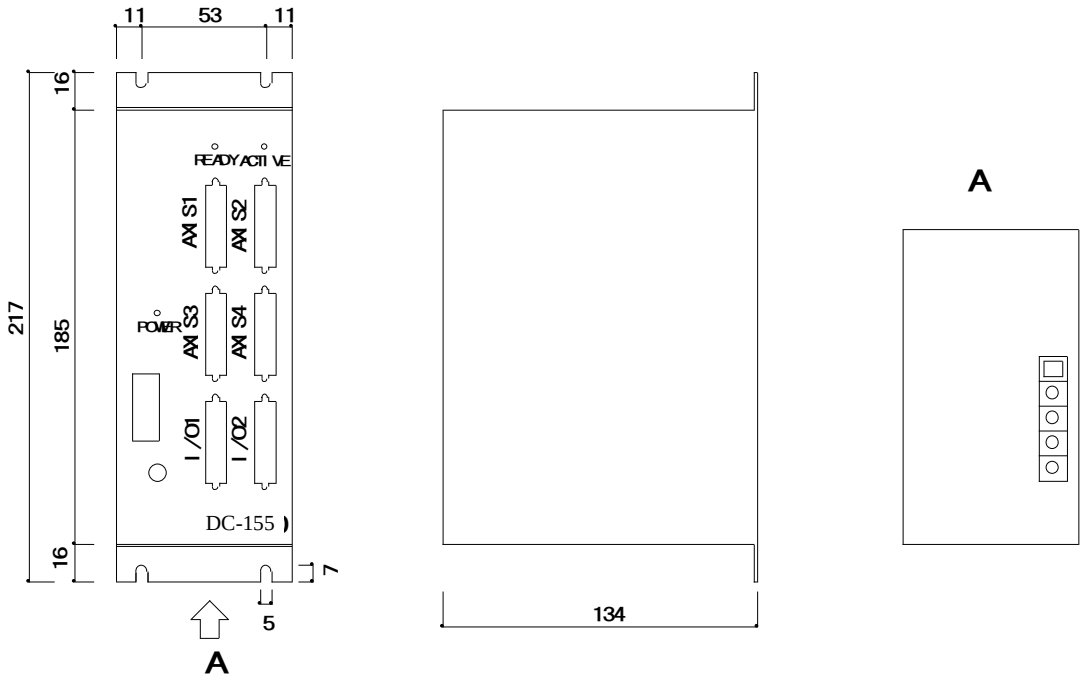


Figure 2-3: DC-155 VersioBus II Remote Servo Interface Schematic Bottom Diagram



FRONT **SIDE** **BOTTOM**

Figure 2-4: DC-155 Dimensions with Brackets in Millimeters

2.2 DC-155 Functional Specifications

FUNCTION/FEATURE	SPECIFICATIONS
Communications	VersioBus II (a proprietary 5 Mbps real-time fiber-optic communication protocol) connections
Servo Axes	4 axes
Daisy Chainable (Scalable)	Up to 4 DC-155s (maximum 16-axis control)
Connectors	6 × 36 pin IEEE 1284 MDR connector (4 × AXIS, 2 × I/O) Recommended connector and shell: • 3M™ 10136-3000VE [Mini D Ribbon (MDR) Connectors, Wiremount Plugs & Accessories, Solder Plug Connector, Non-RoHS Compliant] • 3M™ 10336-52F0-008 [Mini D Ribbon (MDR) Connectors, Plastic Solder Plug Junction Shell, Non Shielded]
Mounting	Brackets and 4 M4 size screws (included with each DC-155)
Servo Types	DC and AC servo motors
Encoder Type	Incremental encoders
Maximum Frequency of Encoder Pulses	5 MHz
Input Power	24 VDC ±15%, maximum load current 800 mA
Output Power for Servo-Related I/O	24 VDC ±15%, maximum total load current 250 mA
Output Power for Encoder(s)	5 VDC ±15%, isolated, maximum load current 1000 mA/unit
Dimensions	185 mm (height excluding brackets) x 75 mm x 134 mm deep (height including brackets is 217 mm)
Analog Outputs	4 channels, 16 bits, ±10V, ±2%
Digital I/O	• Servo commands and status: 11 points • Limit and home switches: 12 points (3 dedicated inputs per axis) • General uncommitted digital I/O: 16/16 points (generally connected with breakout terminal box TB36A or TB36B)

Table 2-1: DC-155 Functional Specifications (1 of 2)

FUNCTION/FEATURE	SPECIFICATIONS
Programmable	Servo types, encoder types, I/O setting
Voltage Endurance	500 VDC for 1 minute (between input/output and frame ground)
Insulation Resistance	50 MΩ or more at 500 VDC (between input/output and frame ground)
Ambient Operating Temperature	0 to 55° C
Ambient Storage Temperature	-25° to 70° C
Ambient Humidity	20% to 80% RH, no condensation
Cooling System	Passive air cooling

Table 2-2: DC-155 Functional Specifications (2 of 2)

2.3 DC-155 Dipswitch Settings

If you are using more than one DC-155, you must give each DC-155 a unique identification number. Identify the first DC-155 as "1," the second DC-155 as "2," the third DC-155 as "3," and so forth. The first DC-155 is the one directly connected to the FP-85, FP-105 or FP-114. The second DC-155 is the next DC-155 in the daisy chain, and so on.

NOTE: It's very important that you correctly identify your DC-155s with the proper dipswitch identification numbers:

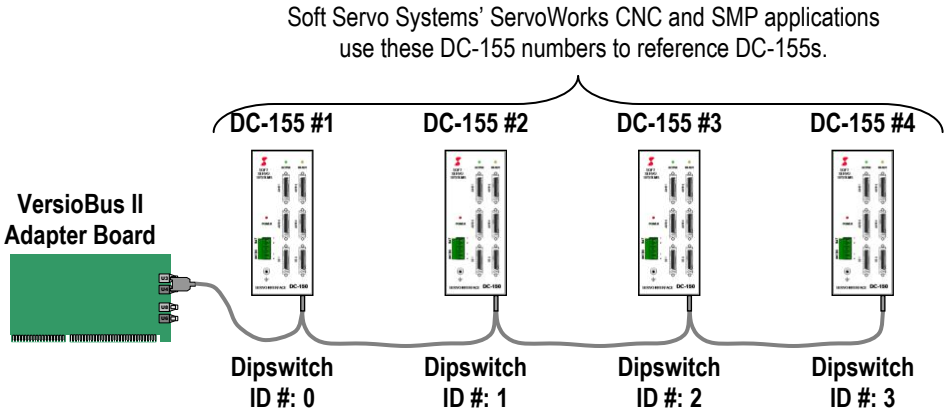


Figure 2-5: Dipswitch ID Numbers for Daisy-Chained DC-155s

You must specify the identification number on a DC-155 by flipping the switches on the 2-digit dipswitch on the DC-155. The following figure shows the configurations of switch locations, which correspond to identification numbers 1 through 4 – use these as your guide.

[NOTE: For single DC-155 usage, the dipswitch ID number has to be set to 0, which is the factory default.]

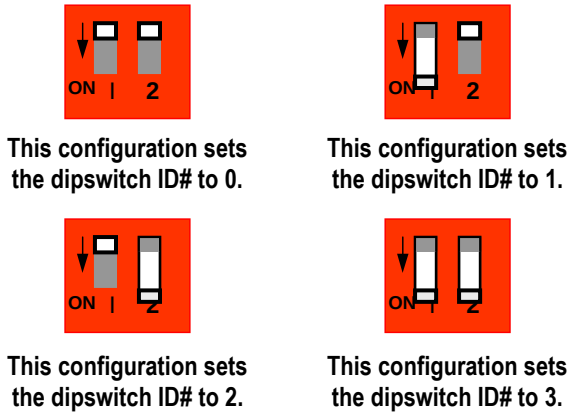


Figure 2-6: Possible 2-Digit Dipswitch Configurations

2.4 DC-155 Pin Assignments

2.4.1 Axis Connector Pin Assignments (Axis 1-4 Connectors)

PIN NO.	NAME	I/O	SERVO FUNCTION
1			
2	SS3	I	Servo Status 3
3	SS1	I	Servo Status 1
4	FAULT	I	Amp Fault
5	SC3	O	Servo Command 3
6	SC1	O	Servo Command 1
7	RST	O	Amp Reset (Alarm Reset)
8	GND		Isolated 24V Return
9	V_{OUT}	O	Isolated 24 VDC Output For Servo-Related I/O
10			
11			
12	+5V	O	5 VDC for Encoders, 1000 mA/unit Maximum, Isolated
13			
14	E_Z_H	I	Encoder Signal Z, High Side
15	E_B_H	I	Encoder Signal B, High Side
16	E_A_H	I	Encoder Signal A, High Side
17			
18	A_OUT	O	Analog Command
19	AGND		Analog Ground
20	GND		Isolated 24V Return
21	SS2	I	Servo Status 2
22	SS0	I	Servo Status 0
23	GND		Isolated 24V Return
24	SC2	O	Servo Command 2
25	SC0	O	Servo Command 0
26	SVON	O	Amp Enable (Servo On)
27	GND		Isolated 24V Return
28			
29			
30			
31			
32	E_Z_L	I	Encoder Signal Z, Low Side
33	E_B_L	I	Encoder Signal B, Low Side
34	E_A_L	I	Encoder Signal A, Low Side
35	SG		Signal Ground
36	AGND		Analog Ground

Table 2-3: DC-155 Axis Connector Pin Assignments (Axis 1-4 Connectors)

2.4.2 General I/O Connector Pin Assignments – I/O Connector 1

PIN NO.	NAME	I/O	SERVO AND I/O FUNCTION
1	COM1		Common 1 (Ground for digital outputs)
2	DO6	O	Digital Output 6
3	DO4	O	Digital Output 4
4	DO3	O	Digital Output 3
5	DO1	O	Digital Output 1
6	COM1		Common 1 (Ground for digital outputs)
7			
8			
9			
10	DI7	I	Digital Input 7
11	DI5	I	Digital Input 5
12	DI3	I	Digital Input 3
13	DI1	I	Digital Input 1
14	COM0		Common 0 (Ground for digital inputs)
15	NLS1	I	Negative Limit Switch 1
16	GND		24V Return (isolated digital ground common for servo-related inputs such as limit switches & home switches)
17	NLS0	I	Negative Limit Switch 0
18	GND		24V Return (isolated digital ground common for servo-related inputs such as limit switches & home switches)
19	COM1		Common 1 (Ground for digital outputs)
20	DO7	O	Digital Output 7
21	DO5	O	Digital Output 5
22	COM1		Common 1 (Ground for digital outputs)
23	DO2	O	Digital Output 2
24	DO0	O	Digital Output 0
25	COM1		Common 1 (Ground for digital outputs)
26	AGND	I	Analog Ground
27	AGND	I	Analog Ground
28	COM0		Common 0 (Ground for digital inputs)
29	DI6	I	Digital Input 6
30	DI4	I	Digital Input 4
31	DI2	I	Digital Input 2
32	DI0	I	Digital Input 0
33	PLS1	I	Positive Limit Switch 1
34	HS1	I	Home Switch 1
35	PLS0	I	Positive Limit Switch 0
36	HS0	I	Home Switch 0

Table 2-4: DC-155 General I/O Connector Pin Assignments (I/O Connector 1)

2.4.3 General I/O Connector Pin Assignments – I/O Connector 2

PIN NO.	NAME	I/O	SERVO AND I/O FUNCTION
1	COM2		Common 2 (Ground for digital outputs)
2	DO14	O	Digital Output 14
3	DO12	O	Digital Output 12
4	DO11	O	Digital Output 11
5	DO9	O	Digital Output 9
6	COM2		Common 2 (Ground for digital outputs)
7			
8			
9			
10	DI15	I	Digital Input 15
11	DI13	I	Digital Input 13
12	DI11	I	Digital Input 11
13	DI9	I	Digital Input 9
14	COM0		Common 0 (Ground for digital inputs)
15	NLS3	I	Negative Limit Switch 3
16	GND		24V Return (isolated digital ground common for servo-related inputs such as limit switches & home switches)
17	NLS2	I	Negative Limit Switch 2
18	GND		24V Return (isolated digital ground common for servo-related inputs such as limit switches & home switches)
19	COM2		Common 2 (Ground for digital outputs)
20	DO15	O	Digital Output 15
21	DO13	O	Digital Output 13
22	COM2		Common 2 (Ground for digital outputs)
23	DO10	O	Digital Output 10
24	DO8	O	Digital Output 8
25	COM2		Common 2 (Ground for digital outputs)
26	AGND	I	Analog Ground
27	AGND	I	Analog Ground
28	COM0		Common 0 (Ground for digital inputs)
29	DI14	I	Digital Input 14
30	DI12	I	Digital Input 12
31	DI10	I	Digital Input 10
32	DI8	I	Digital Input 8
33	PLS3	I	Positive Limit Switch 3
34	HS3	I	Home Switch 3
35	PLS2	I	Positive Limit Switch 2
36	HS2	I	Home Switch 2

Table 2-5: DC-155 General I/O Connector Pin Assignments (I/O Connector 2)

2.5 DC-155 Specifications, Internal Circuitry & Wiring Diagrams

⚠ CAUTION

The DC-155 servo-related I/O and general I/O have different characteristics. Only the servo-related input is sourcing. The servo-related output, the general inputs, and the general outputs are sinking.

2.5.1 DC-155 Servo-Related Digital Inputs: FAULT, SS0-SS3 (Servo Status), HS0-HS3 (Home Switches), PLS0-PLS3 and NLS0-NLS3 (Positive and Negative Limit Switches)

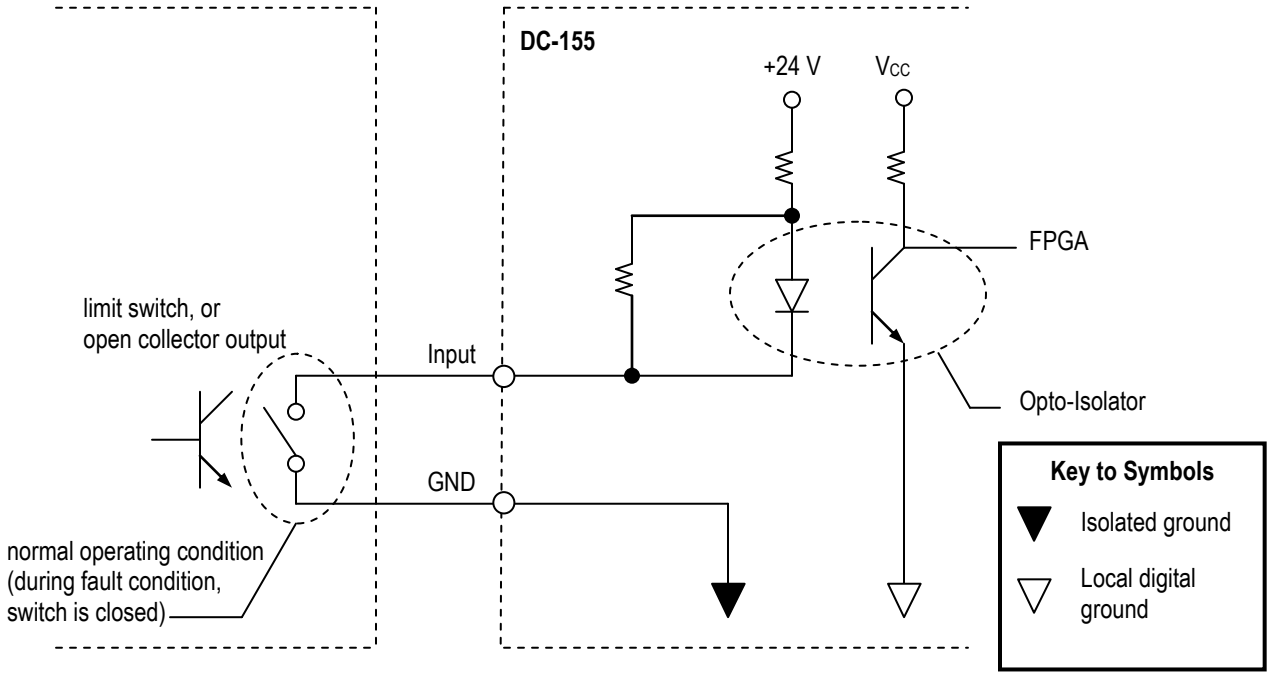


Figure 2-7: Internal Circuitry and Wiring Diagram for DC-155 Servo-Related Digital Inputs

FUNCTION/FEATURE	SPECIFICATIONS
Inputs Per Axis	8 (Source)
ON State Terminal Voltage	0 VDC
OFF State Terminal Voltage	24 VDC ±10% (internally provided)
ON State Sourcing Current	3 mA minimum
OFF State Sourcing Current	1 mA maximum
OFF to ON Response	Less than 100 μs
ON to OFF Response	Less than 100 μs
Maximum State Sourcing	4 mA per point

Table 2-6: Specifications for DC-155 Servo-Related Digital Inputs

2.5.2 DC-155 Servo-Related Digital Outputs: SVON, RST, SC0-SC3

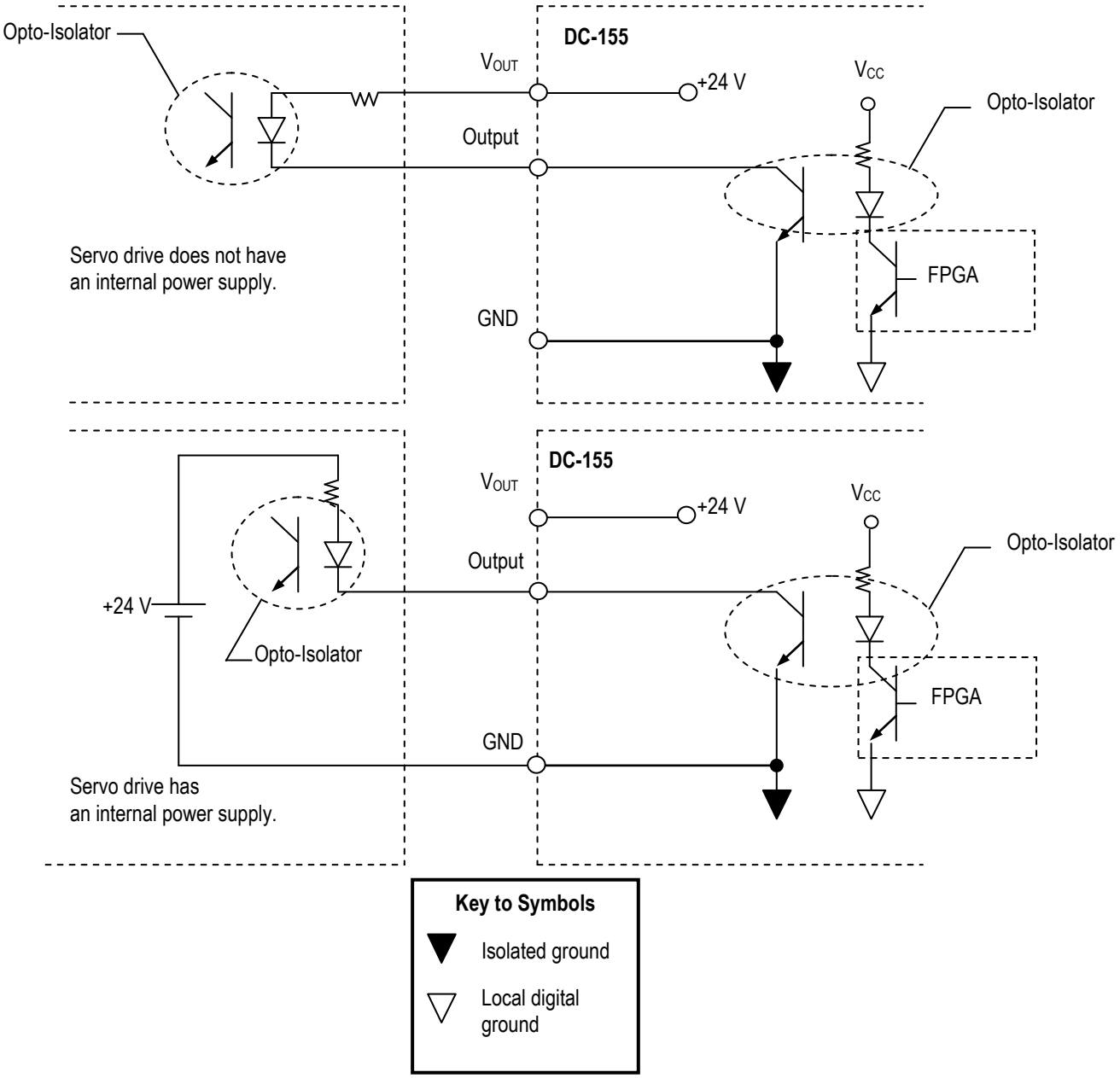


Figure 2-8: Internal Circuitry and Wiring Diagram for DC-155 Servo-Related Digital Outputs

FUNCTION/FEATURE	SPECIFICATIONS
Outputs Per Axis	6 (sink)
Operating Range	10.8 to 26.4 VDC or –10.8 to –26.4 VDC
Type	NPN Open Collector
Peak Voltage	35 VDC
Maximum Load Current	50 mA per point (internal or external power for servo-related I/O)
Maximum Leakage Current	5 μA
OFF to ON Response	Less than 100 μs
ON to OFF Response	Less than 100 μs

Table 2-7: Specifications for DC-155 Servo-Related Digital Outputs

2.5.3 DC-155 General I/O Connector Digital Inputs (DI00-DI15)

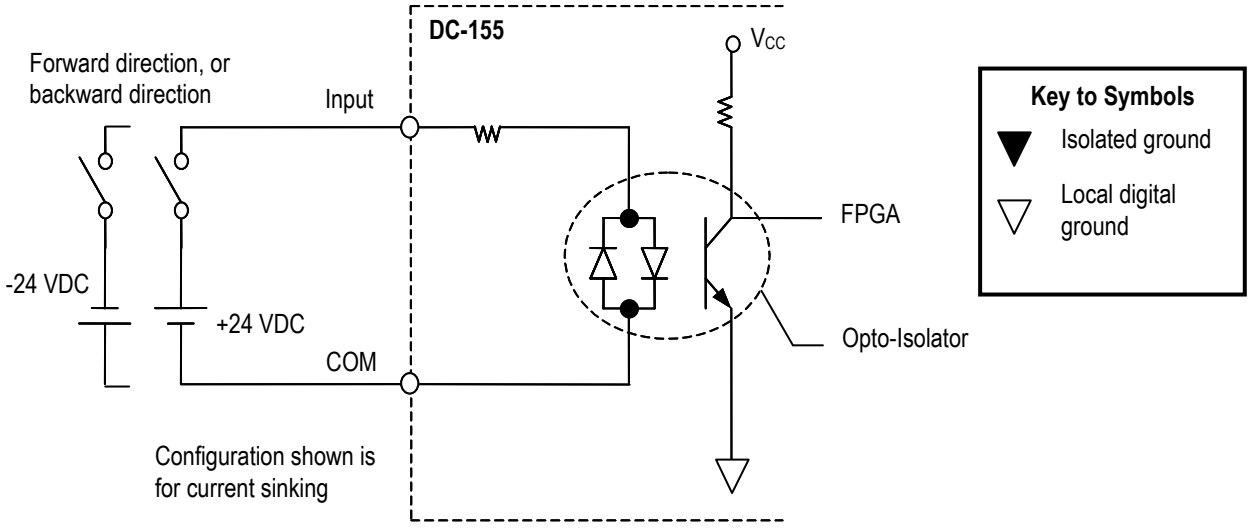


Figure 2-9: Internal Circuitry and Wiring Diagram for DC-155 General I/O Connector Digital Inputs

FUNCTION/FEATURE	SPECIFICATIONS
Inputs Per Module	16 (sink)
Common Grounds Per Module	2
Common Terminals Per Common Ground	2
Input Voltage Range	10.2 to 26.4 VDC or –10.2 to –26.4 VDC
ON Voltage Level	10.2 VDC minimum
OFF Voltage Level	3.5 VDC maximum
Input Impedance	3 kΩ
Input Current	4.6 mA @ 12 VDC 9.6 mA @ 24 VDC
Minimum ON Current	3.5 mA
Maximum OFF Current	1 mA
OFF to ON Response	Less than 100 μs
ON to OFF Response	Less than 100 μs

Table 2-8: Specifications for DC-155 General I/O Connector Digital Inputs

2.5.4 DC-155 General I/O Connector Digital Outputs (DO00-DO15)

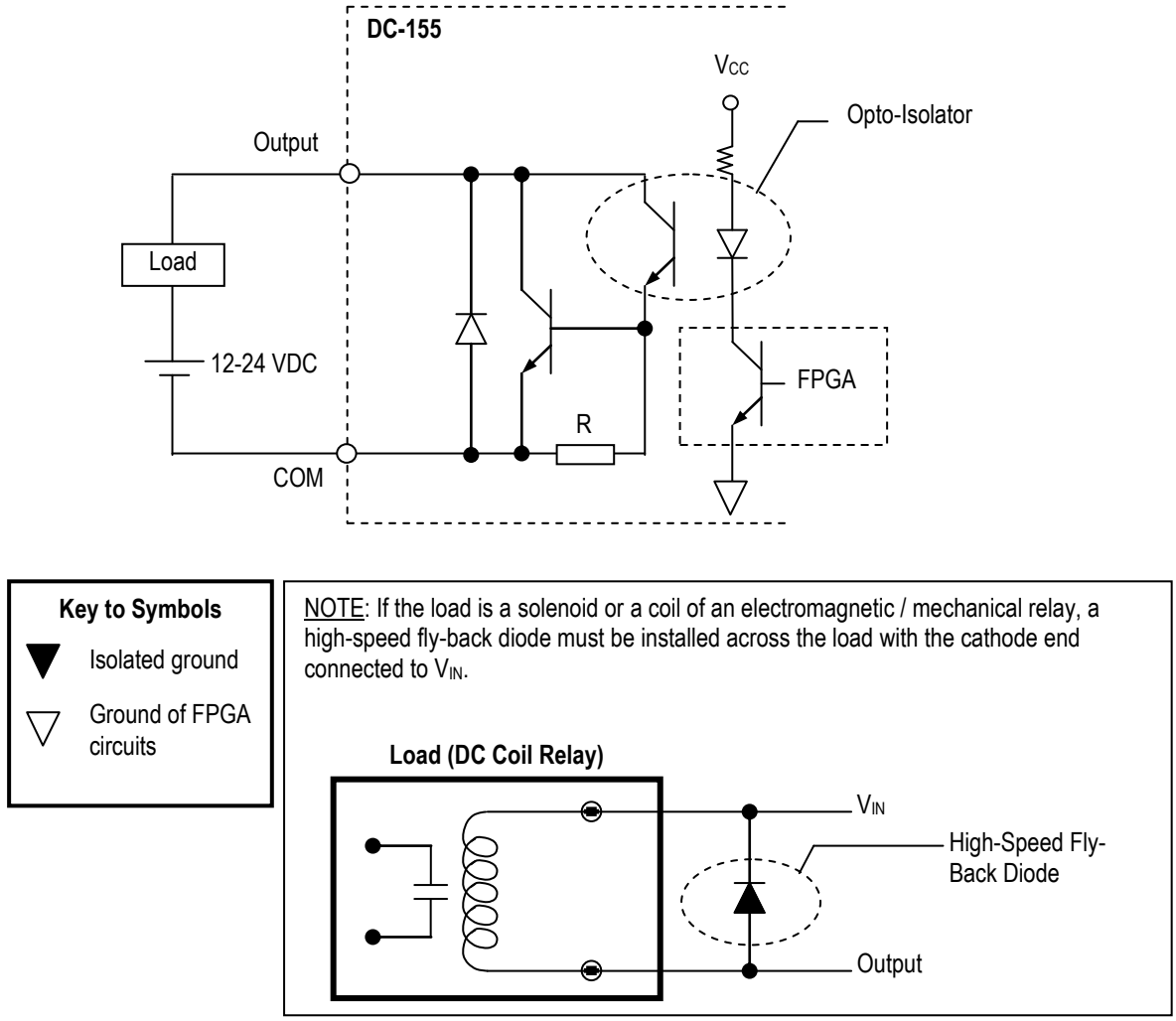


Figure 2-10: Internal Circuitry and Wiring Diagram for DC-155 General I/O Connector Digital Outputs

FUNCTION/FEATURE	SPECIFICATIONS
Outputs Per Module	16 (sink)
Common Grounds Per Module	2
Common Terminals Per Common Ground	5
Operating Range	10.8 to 26.4 VDC or –10.8 to –26.4 VDC
Type	Opto-isolated
Peak Voltage	30 VDC
On Voltage Drop	0.1 VDC maximum
Maximum Load Current	100 mA per point 500 mA per common ground 100 mA per common terminal
Maximum Leakage Current	0.1 mA
External DC Required	12–24 VDC ±10%, 200 mA maximum
OFF to ON Response	Less than 100 μs
ON to OFF Response	Less than 100 μs

Table 2-9: Specifications for DC-155 General I/O Connector Digital Outputs

2.6 DC-155 Schematic Servo Motor and Encoder Connections

Both essential and optional connections required to operate the servo motor are shown. You can interface either directly to the servo amplifier or directly with the encoder.

2.6.1 Axis Arrangement #1: Essential Servo Motor Connections in the VersioBus II System When the Servo Amplifier Provides the Encoder Signals

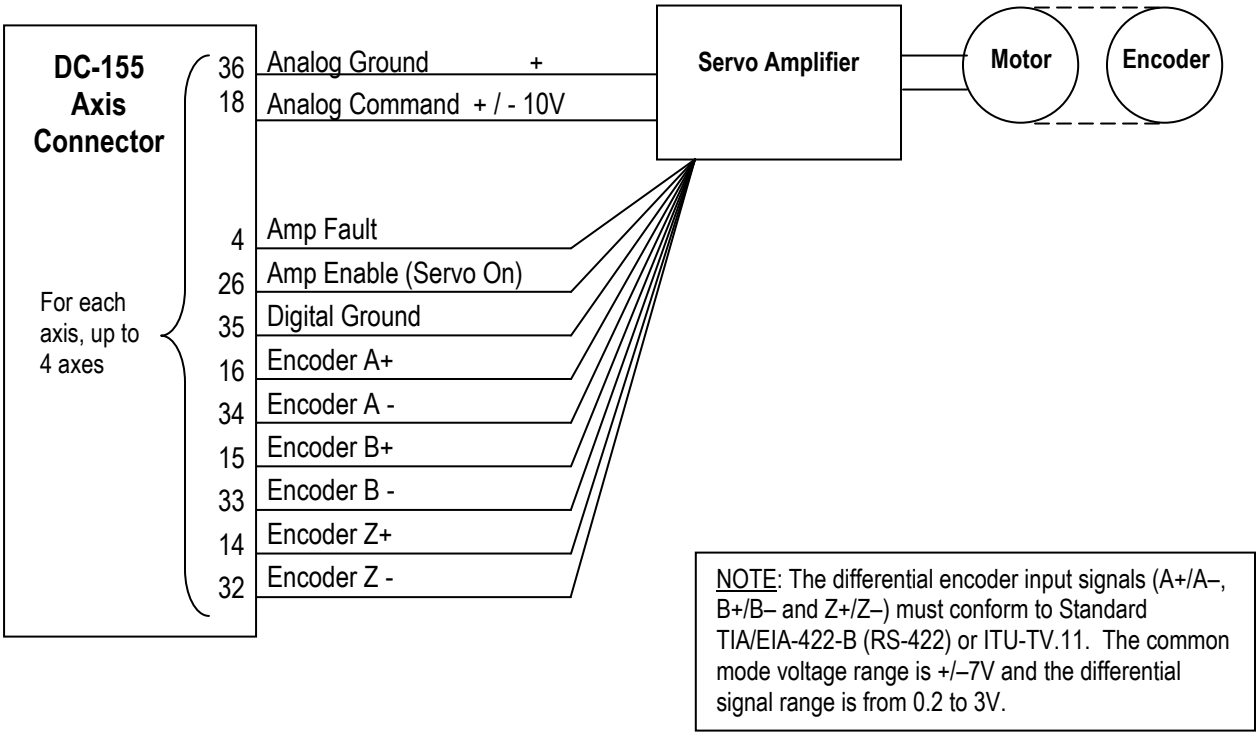


Figure 2-11: Wiring Diagram for Essential Servo Motor Connections in the VersioBus II System When the Servo Amplifier Provides the Encoder Signals

2.6.2 Axis Arrangement #2: Essential Servo Motor Connections in the VersioBus II System When the Signals Come Directly From the Encoder

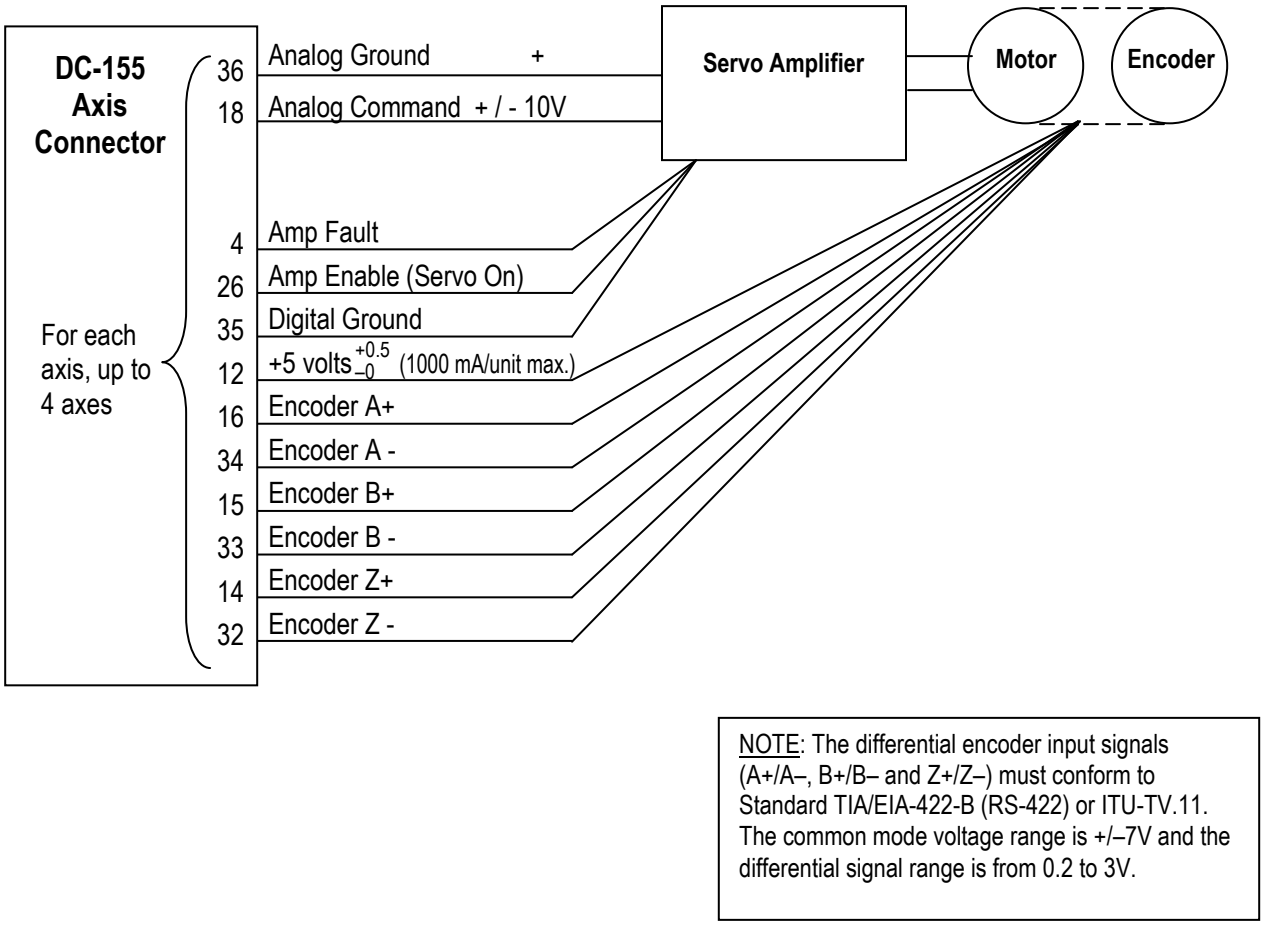


Figure 2-12: Wiring Diagram for Essential Servo Motor Connections in the VersioBus II System When the Signals Come Directly From the Encoder

2.6.3 Optional Servo Motor Connections

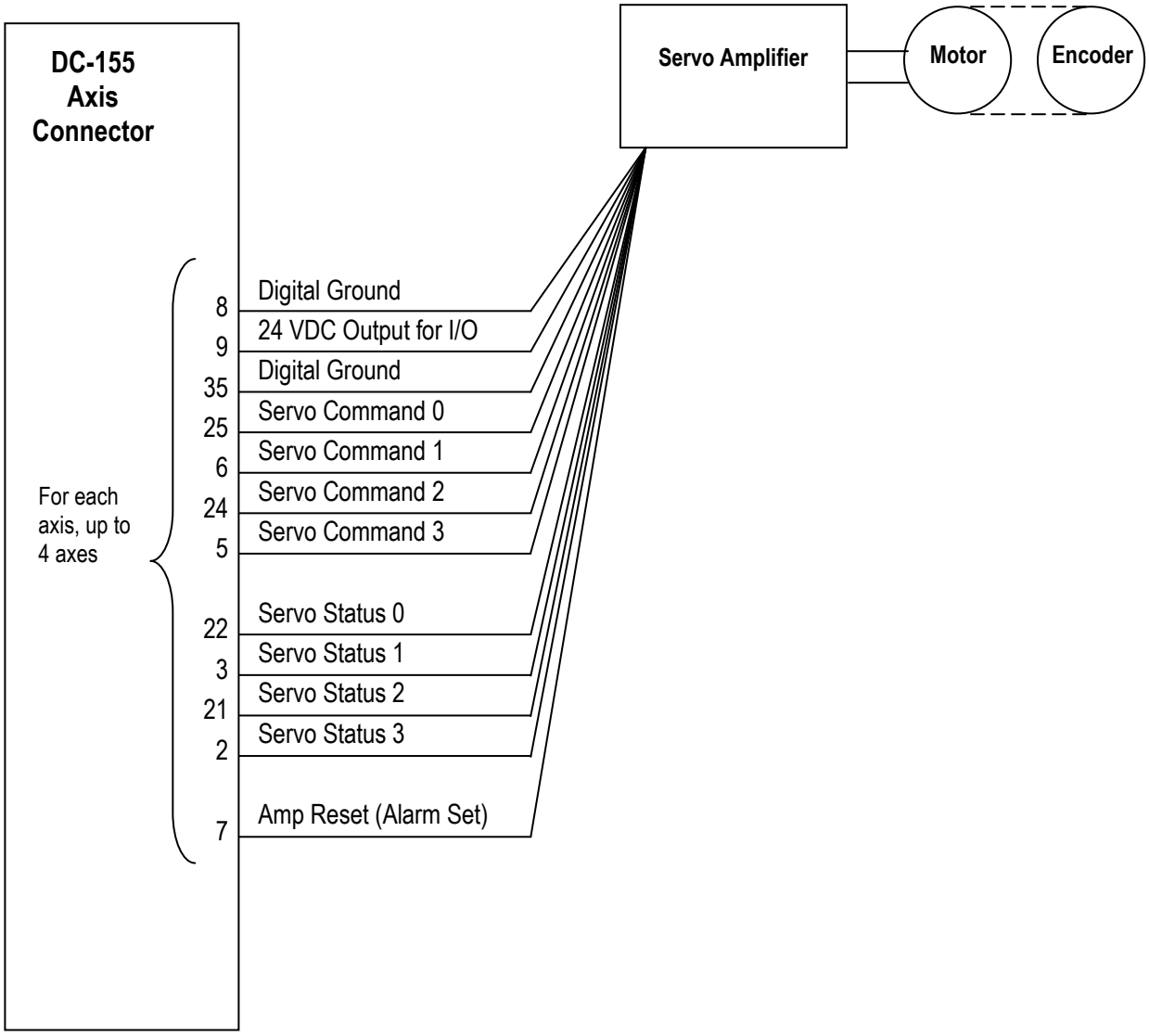


Figure 2-13: Wiring Diagram for Optional Servo Motor Connections

2.6.4 Typical Connection Between a Differential Encoder and the DC-155

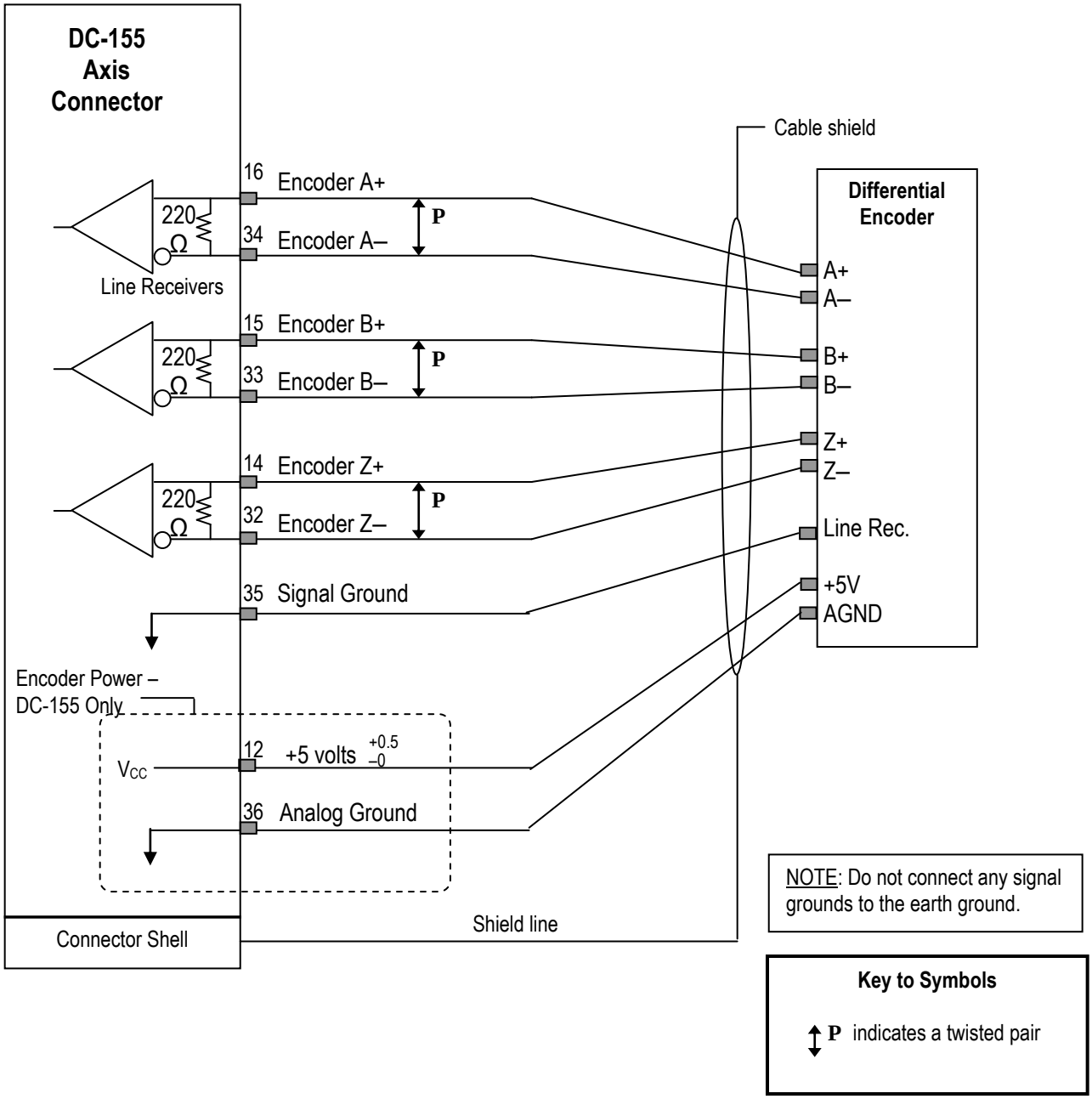


Figure 2-14: Wiring Diagram for a Typical Connection Between a Differential Encoder and the DC-155

2.7 Cable Connections – DC-155 to Specific Servo Drives

The following pages contain schematics for the direct cable connection between the DC-155 axis connector, and specific servo drives for several manufacturers. The manufacturer's name and the servo drive model are included.

Key to Tables

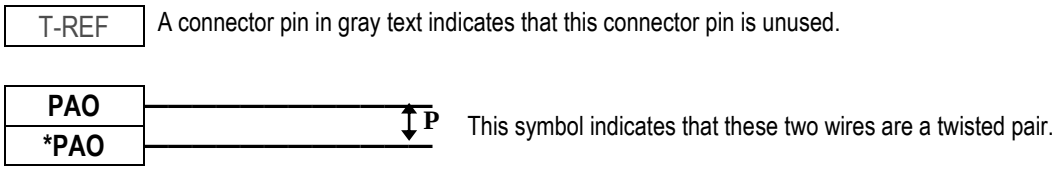


Figure 2-15: Key to Recommended Direct Cable Connections Tables

2.7.1 Recommended Direct Cable Connections Between the DC-155 Axis Connector & the YASKAWA Sigma I (SGDA) Servo Drive (Incremental Encoder)

SGDA 1CN			DC-155 AXIS CONNECTOR			TB36A	TB36B
Signal Name	*Connector Pin #*		*Connector Pin #*	*AXIS Signal*	*Servo Function*	*Corresponding Pin #'s*	
T-REF	1						
SG–T	2						
V–REF	**3**	P	18	A OUT	Analog Command	1-1	18
SG–V	**4**	P	36	AGND	Analog Ground	1-2	36
SEN	5						
0SEN	6						
/BK	7						
/V–CMP	8						
/TGON	9						
SG–COM	10						
/P–CL	11						
/N–CL	12						
+24VIN	**13**		9	V_{OUT}	Isolated 24 VDC Output	2-1	9
/S–ON	**14**		26	SVON	Amp Enable (Servo On)	2-4	26
/P–CON	15						
P–OT	16						
N–OT	17						
/ALMRST	**18**		7	RST	Amp Reset (Alarm Reset)	2-5	7
SG–PG	**19**		35	SG	Signal Ground	1-4	35
PAO	**20**	P	16	E_A_H	Encoder Signal A, High Side	1-5	16
***PAO**	**21**	P	34	E_A_L	Encoder Signal A, Low Side	1-6	34
PBO	**22**	P	15	E_B_H	Encoder Signal B, High Side	1-7	15
***PBO**	**23**	P	33	E_B_L	Encoder Signal B, Low Side	1-8	33
PCO	**24**	P	14	E_Z_H	Encoder Signal Z, High Side	1-9	14
***PCO**	**25**	P	32	E_Z_L	Encoder Signal Z, Low Side	1-10	32
PSO	26						
*PSO	27						
BAT	28						
BAT0	29						
ALO1	30						
ALO2	31						
ALO3	32						
SG–AL	33						
ALM	**34**	P	4	FAULT	Amp Fault	2-11	4
ALM–SG	**35**	P	23	GND	Digital Ground (Isolated)	2-10	23
FG	**36**						
			Connector Case				

Table 2-10: Recommended Direct Cable Connections to the YASKAWA Sigma I (SGDA) Servo Drive

2.7.2 Recommended Direct Cable Connections Between the DC-155 Axis Connector & the YASKAWA Sigma I (SGDB) Servo Drive (Incremental Encoder)

SGDB 1CN			DC-155 AXIS CONNECTOR			TB36A	TB36B
Signal Name	*Connector Pin #*		*Connector Pin #*	*AXIS Signal*	*Servo Function*	*Corresponding Pin #'s*	
T-REF	9						
SG	10						
V–REF	**5**	P	18	A OUT	Analog Command	1-1	18
SG–V	**6**	P	36	AGND	Analog Ground	1-2	36
SEN	4						
SG	1						
PL1	3						
PL2	13						
/TGON+	**27**		22	SS0	Servo Status 0	2-12	22
/TGON-	**28**		23	GND	Digital Ground (Isolated)	2-10	23
/P–CL	45						
/N–CL	46						
+24VIN	**47**		9	V_{OUT}	Isolated 24 VDC Output	2-1	9
/S–ON	**40**		26	SVON	Amp Enable (Servo On)	2-4	26
/P–CON	41						
P–OT	42						
N–OT	43						
/ALMRST	**44**		7	RST	Amp Reset (Alarm Reset)	2-5	7
SG	**2**		35	SG	Signal Ground	1-4	35
PAO	**33**	P	16	E_A_H	Encoder Signal A, High Side	1-5	16
***PAO**	**34**	P	34	E_A_L	Encoder Signal A, Low Side	1-6	34
PBO	**35**	P	15	E_B_H	Encoder Signal B, High Side	1-7	15
***PBO**	**36**	P	33	E_B_L	Encoder Signal B, Low Side	1-8	33
PCO	**19**	P	14	E_Z_H	Encoder Signal Z, High Side	1-9	14
***PCO**	**20**	P	32	E_Z_L	Encoder Signal Z, Low Side	1-10	32
PSO	48						
*PSO	49						
BAT	21						
BAT0	22						
ALO1	37						
ALO2	38						
ALO3	39						
PL3	18						
ALM+	**31**	P	4	FAULT	Amp Fault	2-11	4
ALM–	**32**	P	23	GND	Digital Ground (Isolated)	2-10	23
FG	**50**						
			Connector Case				

Table 2-11: Recommended Direct Cable Connections to the YASKAWA Sigma I (SGDB) Servo Drive

2.7.3 Recommended Direct Cable Connections Between the DC-155 Axis Connector & the YASKAWA Sigma II (SGDH) Servo Drive (Incremental Encoder)

SGDH CN1			DC-155 AXIS CONNECTOR			TB36A	TB36B
Signal Name	*Connector Pin #*		*Connector Pin #*	*AXIS Signal*	*Servo Function*	*Corresponding Pin #'s*	
SG	**1**		35	SG	Signal Ground	1-4	35
SG	2						
PL1	3						
SEN	4						
V–REF	**5**	P	18	A_OUT	Analog Command	1-1	18
SG	**6**	P	36	AGND	Analog Ground	1-2	36
PULS	7						
/PULS	8						
T–REF	9						
SG	10						
SIGN	11						
/SIGN	12						
PL2	13						
/CLR	14						
CLR	15						
—	16						
—	17						
PL3	18						
PCO	**19**	P	14	E_Z_H	Encoder Signal Z, High Side	1-9	14
/PCO	**20**	P	32	E_Z_L	Encoder Signal Z, Low Side	1-10	32
BAT(+)	21						
BAT(–)	22						
—	23						
—	24						
/V–CMP+ (/COIN+)	25						
/V–CMP– (/COIN–)	26						
/TGON+	27						
/TGON	28						
/S–RDY+	29						
/S-RDY	30						
ALM+	**31**	P	4	FAULT	Amp Fault	2-11	4
ALM	**32**	P	23	GND	Digital Ground (Isolated)	2-10	23

Table 2-12: Recommended Direct Cable Connections to the YASKAWA Sigma II (SGDH) Servo Drive (1 of 2)

SGDH CN1			DC-155 AXIS CONNECTOR			TB36A	TB36B
Signal Name	*Connector Pin #*		*Connector Pin #*	*AXIS Signal*	*Servo Function*	*Corresponding Pin #'s*	
PAO	**33**	P	16	E_A_H	Encoder Signal A, High Side	1-5	16
/PAO	**34**		34	E_A_L	Encoder Signal A, Low Side	1-6	34
PBO	**35**	P	15	E_B_H	Encoder Signal B, High Side	1-7	15
/PBO	**36**		33	E_B_L	Encoder Signal B, Low Side	1-8	33
AL01	37						
AL02	38						
AL03	39						
/S–ON	**40**		26	SVON	Amp Enable (Servo On)	2-4	26
P–CON	41						
P–OT	42						
N–OT	43						
/ALM–RST	**44**		7	RST	Amp Reset (Alarm Reset)	2-5	7
/P–CL	45						
/N–CL	46						
+24V –IN	**47**		9	V_{OUT}	Isolated 24 VDC Output	2-1	9
PSO	48						
*PSO	49						
FG	50						
			Connector Case				

Table 2-13: Recommended Direct Cable Connections to the YASKAWA Sigma II (SGDH) Servo Drive (2 of 2)

2.7.4 Recommended Direct Cable Connections Between the DC-155 Axis Connector & the Mitsubishi MELSERVO-J2-A Servo Drive (Incremental Encoder)

MELSERVO CN1A		DC-155 AXIS CONNECTOR			TB36A	TB36B
Signal Name	*Connector Pin #*	*Connector Pin #*	*AXIS Signal*	*Servo Function*	*Corresponding Pin #'s*	
LG	1					
X	2					
X	3					
P15R	4					
LZ	**5**	14	E_Z_H	Encoder Signal Z, High Side	1-9	14
LA	**6**	16	E_A_H	Encoder Signal A, High Side	1-5	16
LB	**7**	15	E_B_H	Encoder Signal B, High Side	1-7	15
SP1	8					
COM	9					
SG	10					
X	11					
X	12					
X	13					
OP	14					
LZR	**15**	32	E_Z_L	Encoder Signal Z, Low Side	1-10	32
LAR	**16**	34	E_A_L	Encoder Signal A, Low Side	1-6	34
LBR	**17**	33	E_B_L	Encoder Signal B, Low Side	1-8	33
SA	18					
RD	19					
SG	20					

Table 2-14: Recommended Direct Cable Connections to the Mitsubishi MELSERVO-J2-A Servo Drive (1 of 2)

MELSERVO CN1B			DC-155 AXIS CONNECTOR			TB36A	TB36B
Signal Name	*Connector Pin #*		*Connector Pin #*	*AXIS Signal*	*Servo Function*	*Corresponding Pin #'s*	
LG	**1**	———	36	AGND	Analog Ground	1-2	36
VC	**2**	———	18	A_OUT	Analog Command	1-1	18
VDD	3						
DO1	4						
SON	**5**	———	26	SVON	Amp Enable (Servo On)	2-4	26
TLC	6						
SP2	7						
ST1	8						
ST2	**9**	———	23	GND	Digital Ground (Isolated)	2-10	23
SG	**10**	———	27	GND	Digital Ground (Isolated)	2-2	27
P15R	11						
X	12						
COM	**13**	———	9	V_{OUT}	Isolated 24 VDC Output	2-1	9
RES	**14**	———	7	RST	Amp Reset (Alarm Reset)	2-5	7
EMG	**15**	———	8	GND	Digital Ground (Isolated)	2-3	8
LSP	16						
LSN	17						
ALM	**18**	———	4	FAULT	Amp Fault	2-11	4
ZSP	19						
SG	**20**	———	20	GND	Digital Ground (Isolated)	2-16	20

Table 2-15: Recommended Direct Cable Connections to the Mitsubishi MELSERVO-J2-A Servo Drive (2 of 2)

2.8 FPGA Hardware Shell Architecture

2.8.1 FPGA Hardware Shell Architecture for AC and DC Motors

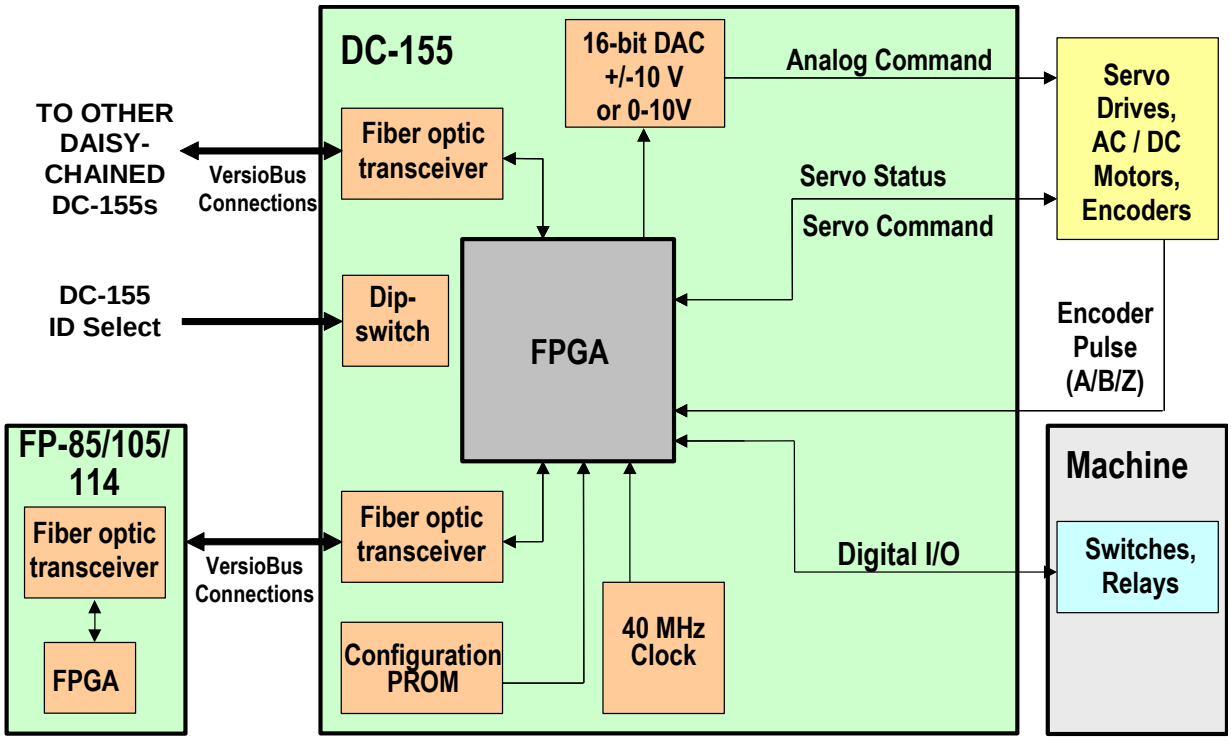


Figure 2-16: Schematic Diagram: DC-155 FPGA Hardware Shell Architecture for AC and DC Motors

2.8.2 FPGA Hardware Shell Architecture for Linear Scales

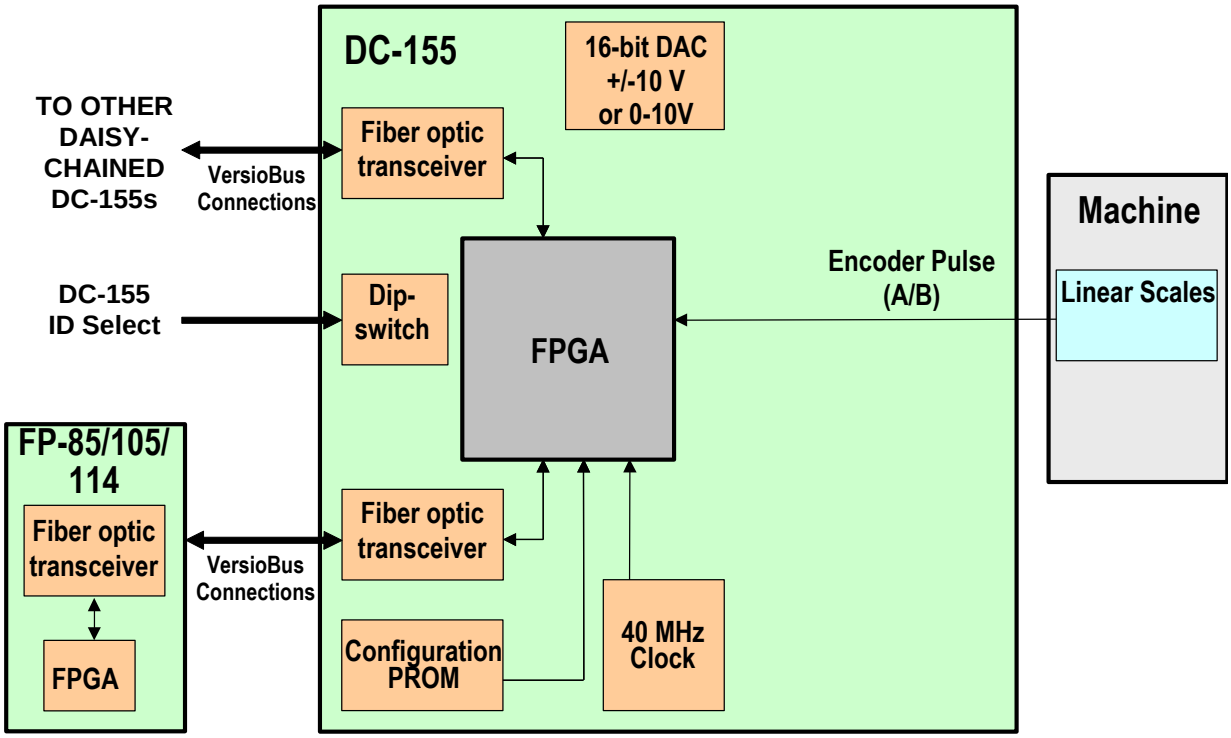


Figure 2-17: Schematic Diagram: DC-155 FPGA Hardware Shell Architecture for Linear Scales

2.9 DC-125J Servo Interface Module

The DC-125J servo interface module replaces the discontinued DC-155 servo interface module.

2.9.1 DC-125J Diagrams

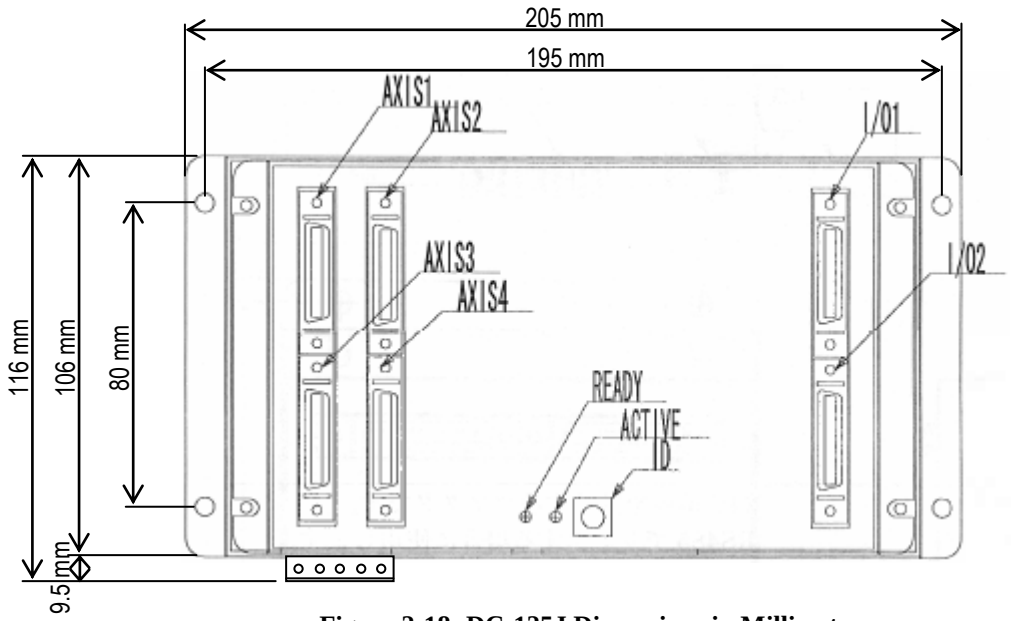


Figure 2-18: DC-125J Dimensions in Millimeters

2.9.2 DC-125J Functional Specifications

FUNCTION/FEATURE	SPECIFICATIONS
Communications	VersioBus II (a proprietary 5 Mbps real-time fiber-optic communication protocol) connections
Servo Axes	4 axes
Daisy Chainable (Scalable)	Up to 4 DC-155s (maximum 16-axis control)
Connectors	6 × 36 pin IEEE 1284 MDR connector (4 × AXIS, 2 × I/O) Recommended connector and shell: • 3M™ 10136-3000VE [Mini D Ribbon (MDR) Connectors, Wiremount Plugs & Accessories, Solder Plug Connector, Non-RoHS Compliant] • 3M™ 10336-52F0-008 [Mini D Ribbon (MDR) Connectors, Plastic Solder Plug Junction Shell, Non Shielded]
Servo Types	DC and AC servo motors

Table 2-16: DC-125J Functional Specifications (1 of 2)

FUNCTION/FEATURE	SPECIFICATIONS
Communications	VersioBus II (a proprietary 5 Mbps real-time fiber-optic communication protocol) connections
Servo Axes	4 axes
Daisy Chainable (Scalable)	Up to 4 DC-155s (maximum 16-axis control)
Connectors	6 × 36 pin IEEE 1284 MDR connector (4 × AXIS, 2 × I/O) Recommended connector and shell: • 3M™ 10136-3000VE [Mini D Ribbon (MDR) Connectors, Wiremount Plugs & Accessories, Solder Plug Connector, Non-RoHS Compliant] • 3M™ 10336-52F0-008 [Mini D Ribbon (MDR) Connectors, Plastic Solder Plug Junction Shell, Non Shielded]
Servo Types	DC and AC servo motors
Encoder Type	Incremental encoders
Maximum Frequency of Encoder Pulses	2 MHz
Input Power	24 VDC ±20%, maximum load current 30 A
Output Power for Servo-Related I/O	24 VDC, maximum total load current 300 mA
Dimensions	106 mm (116 mm including power connector) x 205 mm x 54 mm deep
Analog Outputs	4 channels, 16 bits, ±10V
Digital I/O	• Servo commands and status: 12 points • Limit and home switches: 12 points (3 dedicated inputs per axis) • General uncommitted digital I/O: 16/16 points (generally connected with breakout terminal box TB36A or TB36B)
Ambient Operating Temperature	0 to 55° C
Ambient Storage Temperature	-10° to 70° C
Ambient Humidity	0% to 100% RH, no condensation
Cooling System	Passive air cooling
Operating Environment	No corrosive gases, dust in environment.

Table 2-17: DC-125J Functional Specifications (2 of 2)

2.9.3 DC-125J ID Rotary Switch Setting

The ID rotary switch on the DC-125J must be set depending on your VersioBus II network configuration, as described in the table below. The first DC-125J is the one directly connected to the FP-85, FP-105 or FP-114. The second DC-125J is the next DC-125J in the daisy chain, and so on. You may have a maximum of four DC-125J modules in your VersioBus II network.

LOCATION OF DC-125	ID ROTARY SWITCH VALUE
First	8
Second	9
Third	A
Fourth	B

Table 2-18: DC-125J ID Rotary Switch Setting

2.9.4 DC-125J Pin Assignments

2.9.4.1 Axis Connector Pin Assignments (Axis 1-4 Connectors)

PIN NO.	NAME	I/O	I/O TYPE	SERVO FUNCTION
1				
2				
3				
4	FAULT	I	IN1	Amp Fault (Amp Alarm)
5				
6				
7	RST	O	OUT1	Amp Reset (Alarm Reset)
8	IO_GND			I/O Ground
9	IO_24V			24V VDC Output for I/O
10				
11				
12				
13				
14	Z	I	IN3	Encoder Signal Z, High Side
15	B	I	IN3	Encoder Signal B, High Side
16	A	I	IN3	Encoder Signal A, High Side
17				
18	A_OUT	O	OUT4	Analog Command Output, ±10V
19	GND			Encoder Ground
20	IO_GND			I/O Ground
21				
22				
23	IO_GND			I/O Ground
24				
25				
26	SVON	O	OUT1	Amp Enable (Servo On)
27	IO_GND			I/O Ground
28				
29				
30	IO_GND			I/O Ground
31				
32	nZ	I	IN3	Encoder Signal Z, Low Side
33	nB	I	IN3	Encoder Signal B, Low Side
34	nA	I	IN3	Encoder Signal A, Low Side
35	GND			Encoder Ground
36	AGND			Analog Ground

**See Section 2.9.5: DC-125J Internal Circuitry and Wiring Diagrams for more information regarding each of the input and output types.*

Table 2-19: DC-125J Axis Connector Pin Assignments (Axis 1-4 Connectors)

2.9.4.2 General I/O Connector Pin Assignments – I/O Connector 1

PIN NO.	NAME	I/O	I/O TYPE	SERVO AND I/O FUNCTION
1	O_COM			Output Common (Ground)
2	OUT6	O	OUT2	Digital Output 6
3	OUT4	O	OUT2	Digital Output 4
4	OUT3	O	OUT2	Digital Output 3
5	OUT1	O	OUT2	Digital Output 1
6	O_COM			Output Common (Ground)
7				
8				
9				
10	IN7	I	IN2	Digital Input 7
11	IN5	I	IN2	Digital Input 5
12	IN3	I	IN2	Digital Input 3
13	IN1	I	IN2	Digital Input 1
14	I_COM			
15	NLS1	I	IN2	Negative Limit Switch 1
16				
17	NLS0	I	IN2	Negative Limit Switch 0
18				
19	O_COM			Output Common (Ground)
20	OUT7	O	OUT2	Digital Output 7
21	OUT5	O	OUT2	Digital Output 5
22	O_COM			Output Common (Ground)
23	OUT2	O	OUT2	Digital Output 2
24	OUT0	O	OUT2	Digital Output 0
25	O_COM			Output Common (Ground)
26				
27				
28	I_COM			
29	IN6	I	IN2	Digital Input 6
30	IN4	I	IN2	Digital Input 4
31	IN2	I	IN2	Digital Input 2
32	IN0	I	IN2	Digital Input 0
33	PLS1	I	IN2	Positive Limit Siwtch 1
34	HS1	I	IN2	Home Switch 1
35	PLS0	I	IN2	Positive Limit Switch 0
36	HS0	I	IN2	Home Switch 0

**See Section 2.9.5: DC-125J Internal Circuitry and Wiring Diagrams for more information regarding each of the input and output types.*

Table 2-20: DC-125J General I/O Connector Pin Assignments (I/O Connector 1)

2.9.4.3 General I/O Connector Pin Assignments – I/O Connector 2

PIN NO.	NAME	I/O	I/O TYPE	SERVO FUNCTION
1	O_COM			Output Common (Ground)
2	OUT14	O	OUT2	Digital Output 14
3	OUT12	O	OUT2	Digital Output 12
4	OUT11	O	OUT2	Digital Output 11
5	OUT9	O	OUT2	Digital Output 9
6	O_COM			Output Common (Ground)
7				
8				
9				
10	IN15	I	IN2	Digital Input 15
11	IN13	I	IN2	Digital Input 13
12	IN11	I	IN2	Digital Input 11
13	IN9	I	IN2	Digital Input 9
14	I_COM			
15	NLS3	I	IN2	Negative Limit Switch 3
16				
17	NLS2	I	IN2	Negative Limit Switch 2
18				
19	O_COM			Output Common (Ground)
20	OUT15	O	OUT2	Digital Output 15
21	OUT13	O	OUT2	Digital Output 13
22	O_COM			Output Common (Ground)
23	OUT10	O	OUT2	Digital Output 10
24	OUT8	O	OUT2	Digital Output 8
25	O_COM			Output Common (Ground)
26				
27				
28	I_COM			
29	IN14	I	IN2	Digital Input 14
30	IN12	I	IN2	Digital Input 12
31	IN10	I	IN2	Digital Input 10
32	IN8	I	IN2	Digital Input 8
33	PLS3	I	IN2	Positive Limit Siwtch 3
34	HS3	I	IN2	Home Switch 3
35	PLS2	I	IN2	Positive Limit Switch 2
36	HS2	I	IN2	Home Switch 2

**See Section 2.9.5: DC-125J Internal Circuitry and Wiring Diagrams for more information regarding each of the input and output types.*

Table 2-21: DC-125J General I/O Connector Pin Assignments (I/O Connector 2)

2.9.5 DC-125J Internal Circuitry and Wiring Diagrams

2.9.5.1 DC-125J IN1 (Servo-Related Digital Inputs)

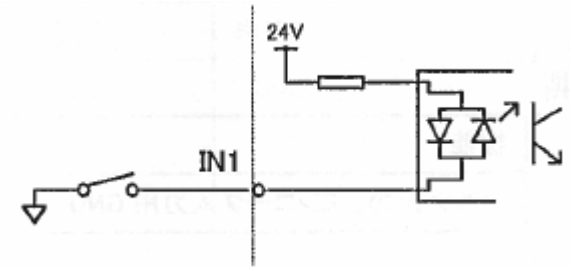


Figure 2-19: Internal Circuitry and Wiring Diagram for DC-125J IN1 Inputs

FUNCTION/FEATURE	SPECIFICATIONS
Source/Sink	Source
Operating Voltage	24V

Table 2-22: Specifications for DC-125J IN1 Inputs

2.9.5.2 DC-125J OUT1 (Servo-Related Digital Outputs)

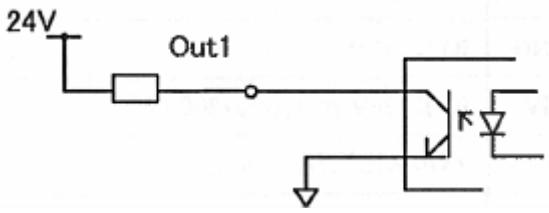


Figure 2-20: Internal Circuitry and Wiring Diagram for DC-125J OUT1 Outputs

FUNCTION/FEATURE	SPECIFICATIONS
Source/Sink	Sink
Operating Voltage	24V
Max Current	50 mA

Table 2-23: Specifications for DC-125J OUT1 Outputs

2.9.5.3 DC-125J IN 2 (General Digital Inputs, Limit Switch Inputs, Home Switch Inputs)

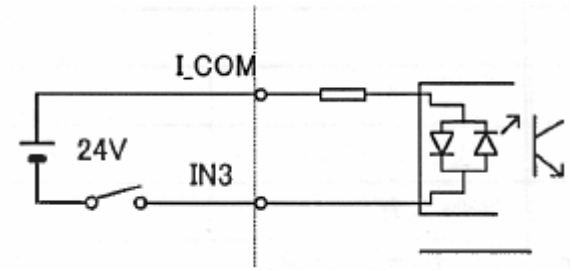


Figure 2-21: Internal Circuitry and Wiring Diagram for DC-125J IN2 Inputs

FUNCTION/FEATURE	SPECIFICATIONS
Source/Sink	Source
Operating Voltage	24V
On Voltage	15V
Off Voltage	5V
Input Impedance	5.1 kΩ

Table 2-24: Specifications for DC-125J IN2 Inputs

2.9.5.4 DC-125J OUT2 (General Digital Outputs)

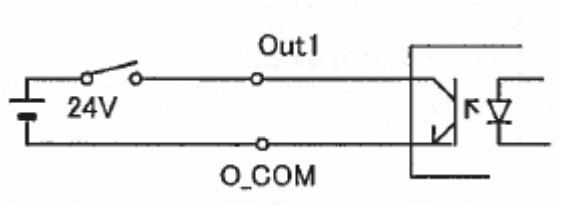


Figure 2-22: Internal Circuitry and Wiring Diagram for DC-125J OUT2 Outputs

FUNCTION/FEATURE	SPECIFICATIONS
Source/Sink	Sink
Operating Voltage	24V
Max Current	50 mA

Table 2-25: Specifications for DC-125J OUT2 Outputs

2.9.5.5 DC-125J IN3 (Encoder Input)

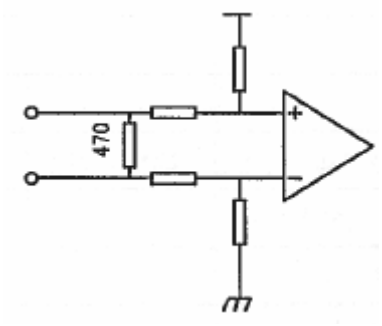


Figure 2-23: Internal Circuitry and Wiring Diagram for DC-125J IN3 Inputs

FUNCTION/FEATURE	SPECIFICATIONS
Maximum Frequency	2 MHz
Input Impedance	470 Ω
Input Signal	26LS32 Equivalent

Table 2-26: Specifications for DC-125J IN3 Inputs

2.9.5.6 DC-125J OUT4 (Analog Command Output)

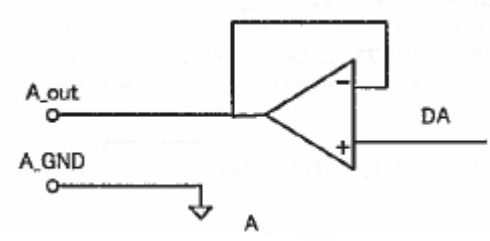


Figure 2-19: Internal Circuitry and Wiring Diagram for DC-125J OUT4 Outputs

FUNCTION/FEATURE	SPECIFICATIONS
Output Voltage Range	±10V
Resolution	16 bits

Table 2-27: Specifications for DC-125J OUT4 Outputs

Chapter 3: I/O Modules

Currently, there is only one model of VersioBus II I/O module.

3.1 IM-305 Description

IM-305: General 32-bit input / 32-bit output module with built-in screw terminals and surface-mounted LEDs.

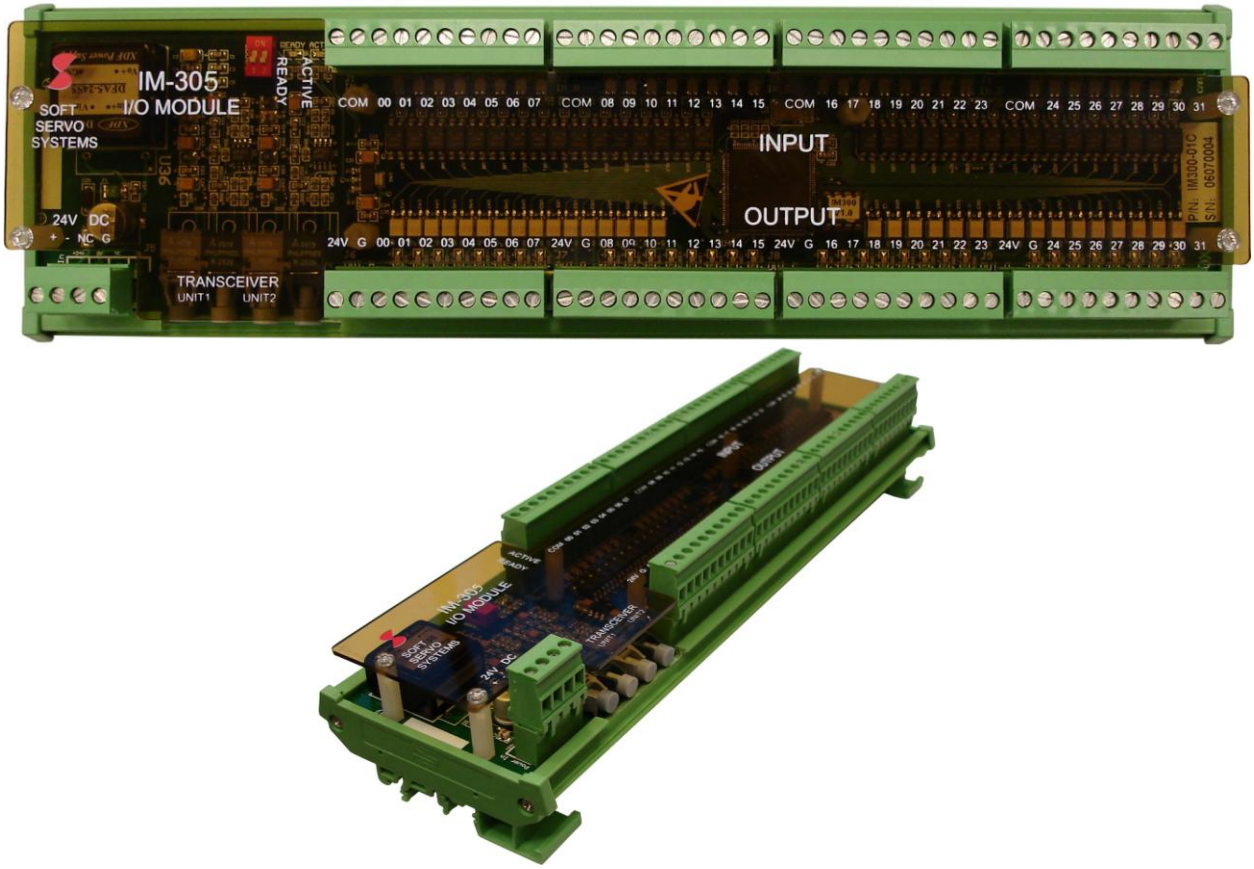


Figure 3-1: Photos of the IM-305 General I/O Module

3.2 IM-305 Functional Specifications

FUNCTION/FEATURE	SPECIFICATIONS
Communications	VersioBus II (a proprietary 5 Mbps real-time fiber-optic communication protocol) connections
Daisy Chainable	Up to 4 IM-305s (maximum 256 points of additional I/O)
Screw Terminals	8 terminal blocks, 10 screw terminals each (wire entry terminals)
Output Points	32 points, optically isolated
Input Points	32 points, optically isolated
Mounting	DIN Rail
Input Power	24 VDC ±10%, 300 mA maximum
Dimensions	87 mm x 304 mm x 57 mm deep

Table 3-1: IM-305 Functional Specifications

3.3 IM-305 Dipswitch Settings

If you are using more than one IM-305, you must give each IM-305 a unique identification number. Identify the first IM-305 as "1," the second IM-305 as "2," the third IM-305 as "3," and so forth. The first IM-305 is the one directly connected to the VersioBus II adapter board. The second IM-305 is the next IM-305 in the daisy chain, and so on.

NOTE: It's very important that you correctly identify your IM-305s with the proper dipswitch identification numbers:

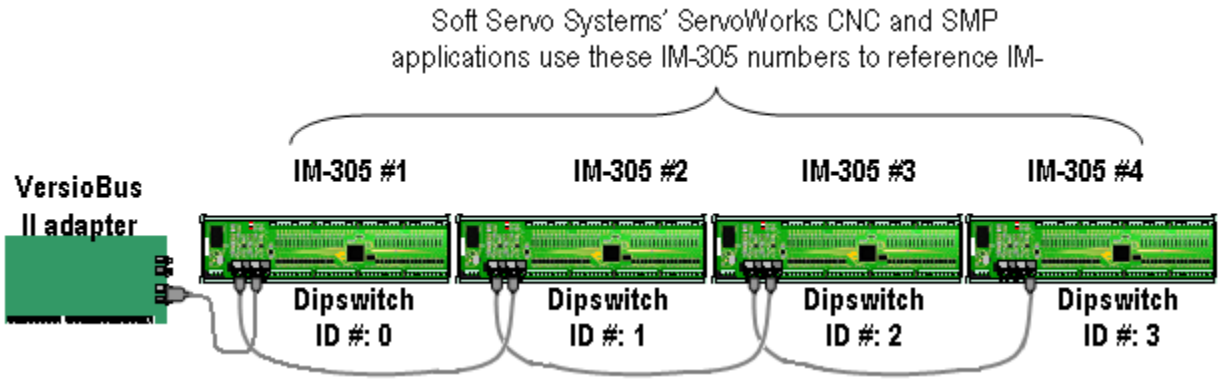


Figure 3-2: Dipswitch ID Numbers for Daisy-Chained IM-305s

You must specify the identification number on an IM-305 by flipping the switches on the 2-digit dipswitch on the IM-305. The following figure shows the configurations of switch locations, which correspond to identification numbers 1 through 4 – use these as your guide.

[NOTE: For single IM-305 usage, the dipswitch ID number has to be set to 0, which is the factory default.]

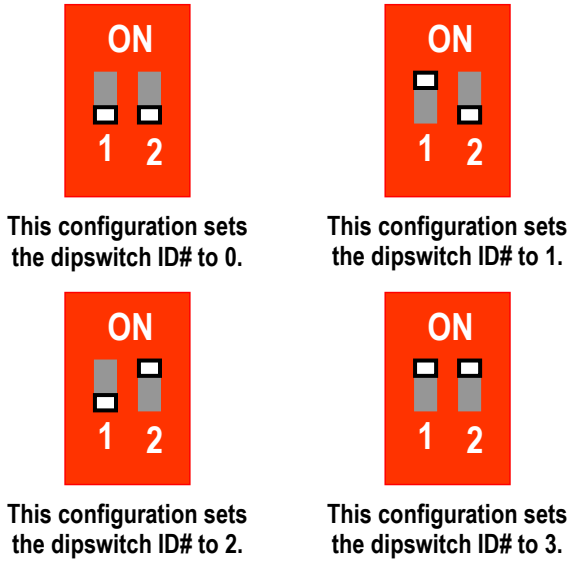


Figure 3-3: Possible 2-Digit Dipswitch Configurations

3.4 IM-305 Terminal Number Assignments

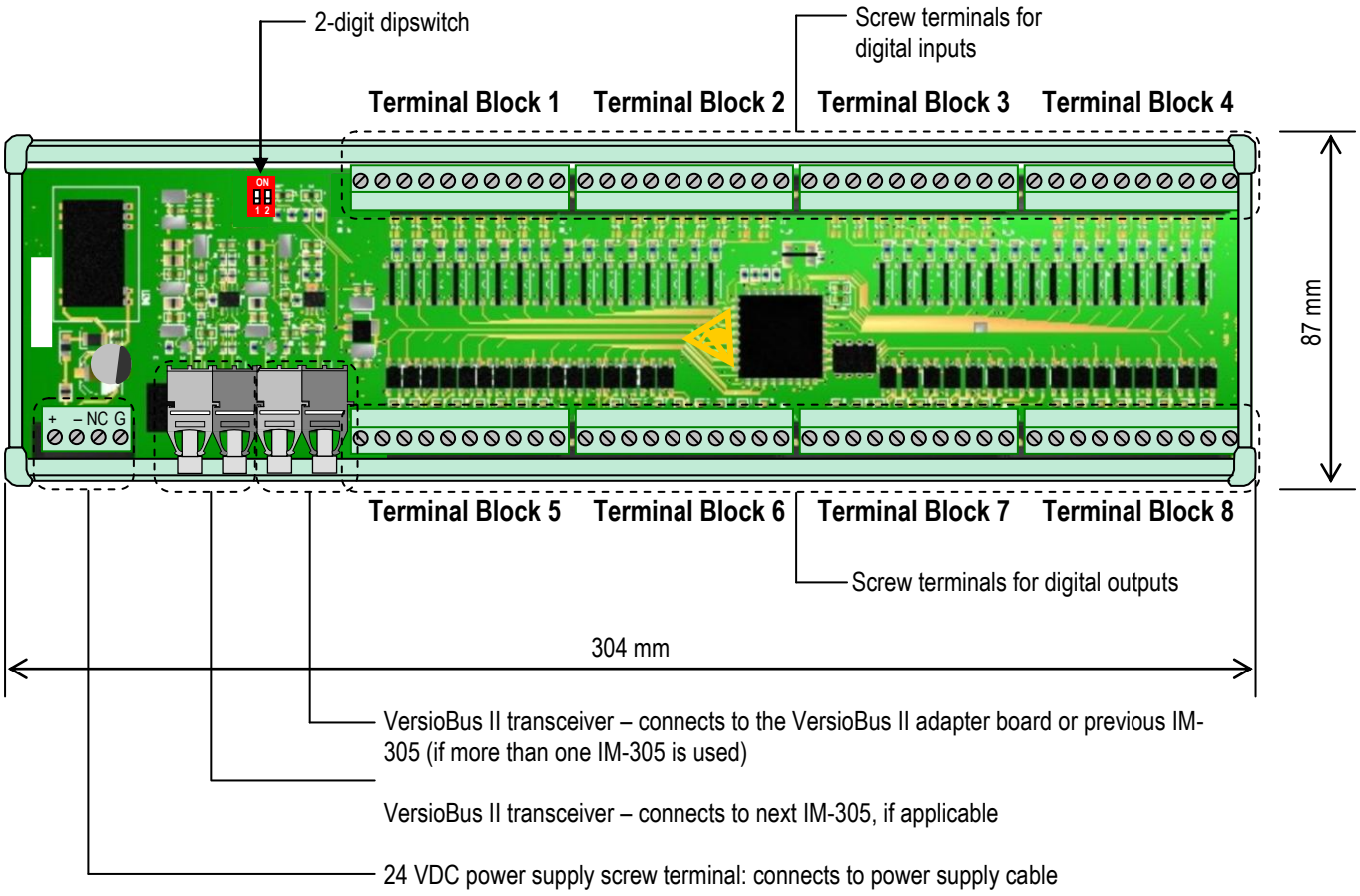


Figure 3-4: IM-305 VersioBus II General I/O Module Schematic Diagram

3.5 Screw Terminals for IM-305 General Digital Inputs (GDI00-GDI31)

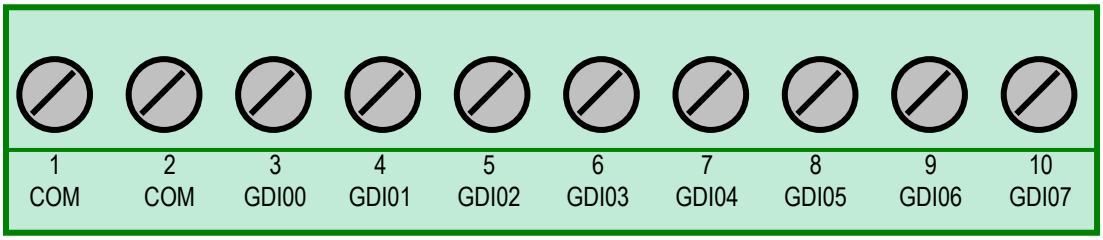


Figure 3-5: Screw Terminal Numbers for General Digital Inputs (TERMINAL BLOCK 1 – IM-305)

TERMINAL BLOCK 1		
PIN NO.	**SIGNAL**	**DESCRIPTION**
1	COM	Internally Isolated Common Ground
2	COM	Internally Isolated Common Ground
3	GDI00	General Digital Input 0
4	GDI01	General Digital Input 1
5	GDI02	General Digital Input 2
6	GDI03	General Digital Input 3
7	GDI04	General Digital Input 4
8	GDI15	General Digital Input 5
9	GDI06	General Digital Input 6
10	GDI07	General Digital Input 7

Table 3-2: Screw Terminal Pin Assignments for General Digital Inputs (TERMINAL BLOCK 1 – IM-305)

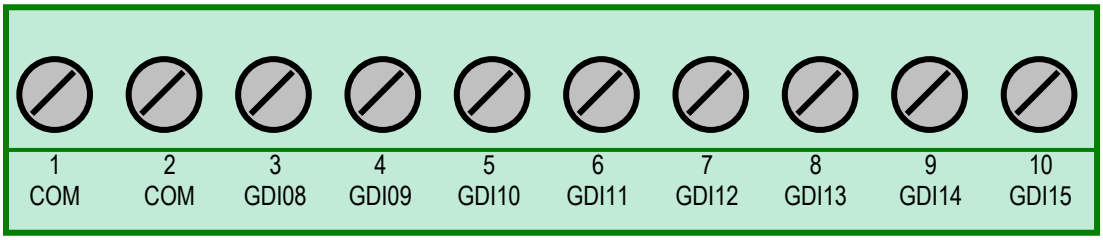


Figure 3-6: Screw Terminal Numbers for General Digital Inputs (TERMINAL BLOCK 2 – IM-305)

TERMINAL BLOCK 2		
PIN NO.	**SIGNAL**	**DESCRIPTION**
1	COM	Internally Isolated Common Ground
2	COM	Internally Isolated Common Ground
3	GDI08	General Digital Input 8
4	GDI09	General Digital Input 9
5	GDI10	General Digital Input 10
6	GDI11	General Digital Input 11
7	GDI12	General Digital Input 12
8	GDI13	General Digital Input 13
9	GDI14	General Digital Input 14
10	GDI15	General Digital Input 15

Table 3-3: Screw Terminal Pin Assignments for General Digital Inputs (TERMINAL BLOCK 2 – IM-305)

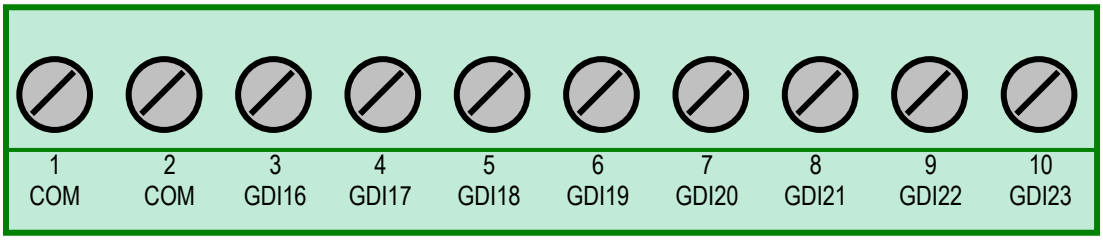


Figure 3-7: Screw Terminal Numbers for General Digital Inputs (TERMINAL BLOCK 3 – IM-305)

TERMINAL BLOCK 3		
PIN NO.	**SIGNAL**	**DESCRIPTION**
1	COM	Internally Isolated Common Ground
2	COM	Internally Isolated Common Ground
3	GDI16	General Digital Input 16
4	GDI17	General Digital Input 17
5	GDI18	General Digital Input 18
6	GDI19	General Digital Input 19
7	GDI20	General Digital Input 20
8	GDI21	General Digital Input 21
9	GDI22	General Digital Input 22
10	GDI23	General Digital Input 23

Table 3-4: Screw Terminal Pin Assignments for General Digital Inputs (TERMINAL BLOCK 3 – IM-305)

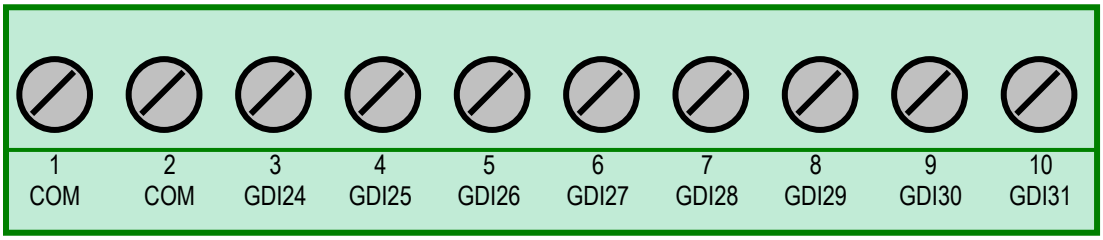


Figure 3-8: Screw Terminal Numbers for General Digital Inputs (TERMINAL BLOCK 4 – IM-305)

TERMINAL BLOCK 4		
PIN NO.	**SIGNAL**	**DESCRIPTION**
1	COM	Internally Isolated Common Ground
2	COM	Internally Isolated Common Ground
3	GDI24	General Digital Input 24
4	GDI25	General Digital Input 25
5	GDI26	General Digital Input 26
6	GDI27	General Digital Input 27
7	GDI28	General Digital Input 28
8	GDI29	General Digital Input 29
9	GDI30	General Digital Input 30
10	GDI31	General Digital Input 31

Table 3-5: Screw Terminal Pin Assignments for General Digital Inputs (TERMINAL BLOCK 4 – IM-305)

3.6 Screw Terminals for IM-305 General Digital Outputs (GDO00-GDO31)

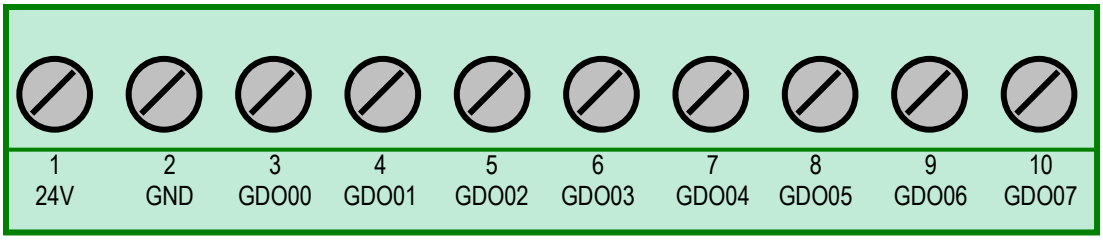


Figure 3-9: Screw Terminal Numbers for General Digital Inputs (TERMINAL BLOCK 5 – IM-305)

TERMINAL BLOCK 5		
PIN NO.	**SIGNAL**	**DESCRIPTION**
1	24V	24 VDC Input
2	GND	Internally Isolated Common Ground
3	GDO00	General Digital Output 0
4	GDO01	General Digital Output 1
5	GDO02	General Digital Output 2
6	GDO03	General Digital Output 3
7	GDO04	General Digital Output 4
8	GDO15	General Digital Output 5
9	GDO06	General Digital Output 6
10	GDO07	General Digital Output 7

Table 3-6: Screw Terminal Pin Assignments for General Digital Inputs (TERMINAL BLOCK 5 – IM-305)

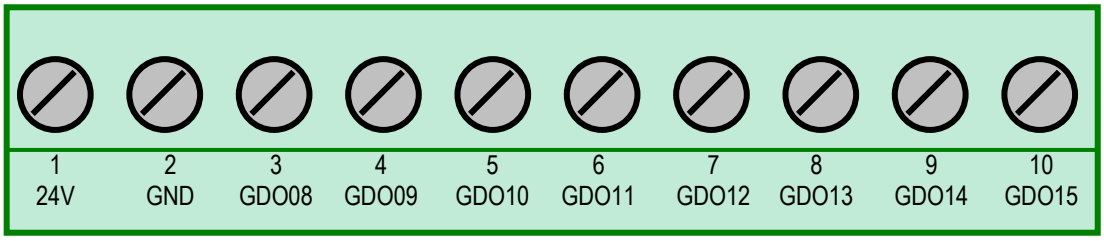


Figure 3-10: Screw Terminal Numbers for General Digital Inputs (TERMINAL BLOCK 6 – IM-305)

TERMINAL BLOCK 6		
PIN NO.	**SIGNAL**	**DESCRIPTION**
1	24V	24 VDC Input
2	GND	Internally Isolated Common Ground
3	GDO08	General Digital Output 8
4	GDO09	General Digital Output 9
5	GDO10	General Digital Output 10
6	GDO11	General Digital Output 11
7	GDO12	General Digital Output 12
8	GDO13	General Digital Output 13
9	GDO14	General Digital Output 14
10	GDO15	General Digital Output 15

Table 3-7: Screw Terminal Pin Assignments for General Digital Inputs (TERMINAL BLOCK 6 – IM-305)

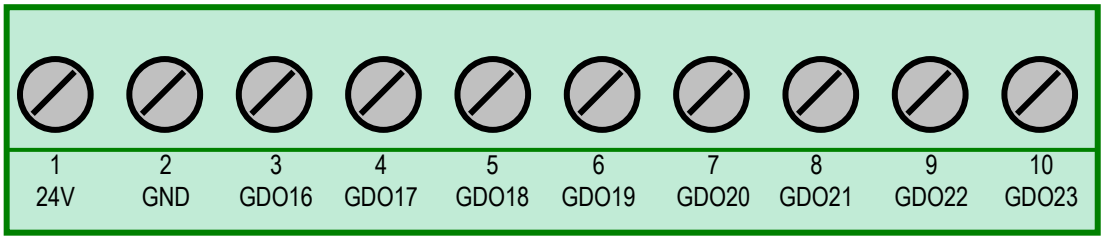


Figure 3-11: Screw Terminal Numbers for General Digital Inputs (TERMINAL BLOCK 7 – IM-305)

TERMINAL BLOCK 7		
PIN NO.	**SIGNAL**	**DESCRIPTION**
1	24V	24 VDC Input
2	GND	Internally Isolated Common Ground
3	GDO16	General Digital Output 16
4	GDO17	General Digital Output 17
5	GDO18	General Digital Output 18
6	GDO19	General Digital Output 19
7	GDO20	General Digital Output 20
8	GDO21	General Digital Output 21
9	GDO22	General Digital Output 22
10	GDO23	General Digital Output 23

Table 3-8: Screw Terminal Pin Assignments for General Digital Inputs (TERMINAL BLOCK 7 – IM-305)

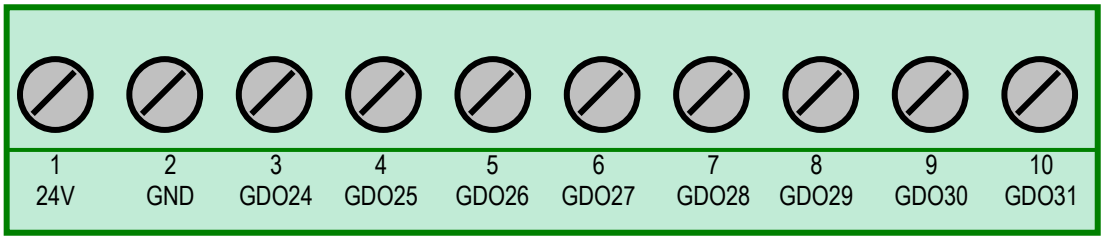


Figure 3-12: Screw Terminal Numbers for General Digital Inputs (TERMINAL BLOCK 8 – IM-305)

TERMINAL BLOCK 8		
PIN NO.	**SIGNAL**	**DESCRIPTION**
1	24V	24 VDC Input
2	GND	Internally Isolated Common Ground
3	GDO24	General Digital Output 24
4	GDO25	General Digital Output 25
5	GDO26	General Digital Output 26
6	GDO27	General Digital Output 27
7	GDO28	General Digital Output 28
8	GDO29	General Digital Output 29
9	GDO30	General Digital Output 30
10	GDO31	General Digital Output 31

Table 3-9: Screw Terminal Pin Assignments for General Digital Inputs (TERMINAL BLOCK 8 – IM-305)

3.7 IM-305 Specifications, Internal Circuitry & Wiring Diagrams

3.7.1 IM-305 General Digital Inputs (GDI00-GDI31)

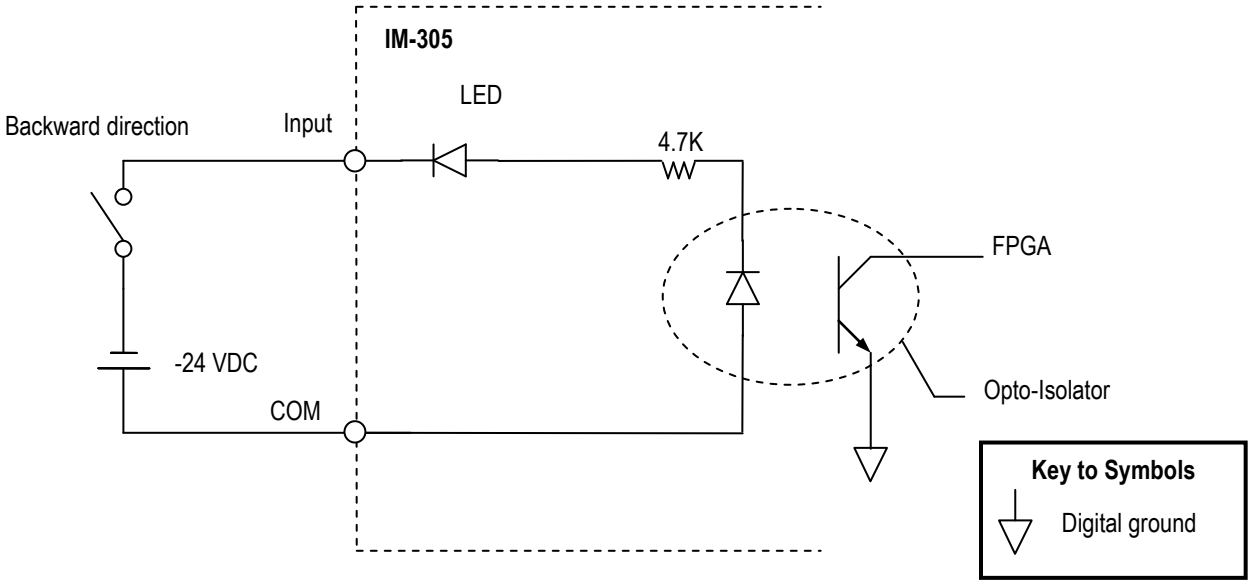


Figure 3-13: Internal Circuitry and Wiring Diagram for IM-305 General Digital Inputs

FUNCTION/FEATURE	SPECIFICATIONS
Inputs Per Module	32 (sink)
Common Grounds Per Module	4 (8 terminal points)
Input Voltage Range	–12.2 to –26.4 VDC
ON Voltage Level	7.1 VDC minimum
OFF Voltage Level	4.8 VDC maximum
Input Impedance	5 KΩ
Input Current	4.6 mA @ 24 VDC
Minimum ON Current	1 mA
Maximum OFF Current	0.5 mA
OFF to ON Response	Less than 100 μs
ON to OFF Response	Less than 100 μs

Table 3-10: Specifications for IM-305 General Digital Inputs

3.7.2 IM-305 General Digital Outputs (GDO00-GDO31)

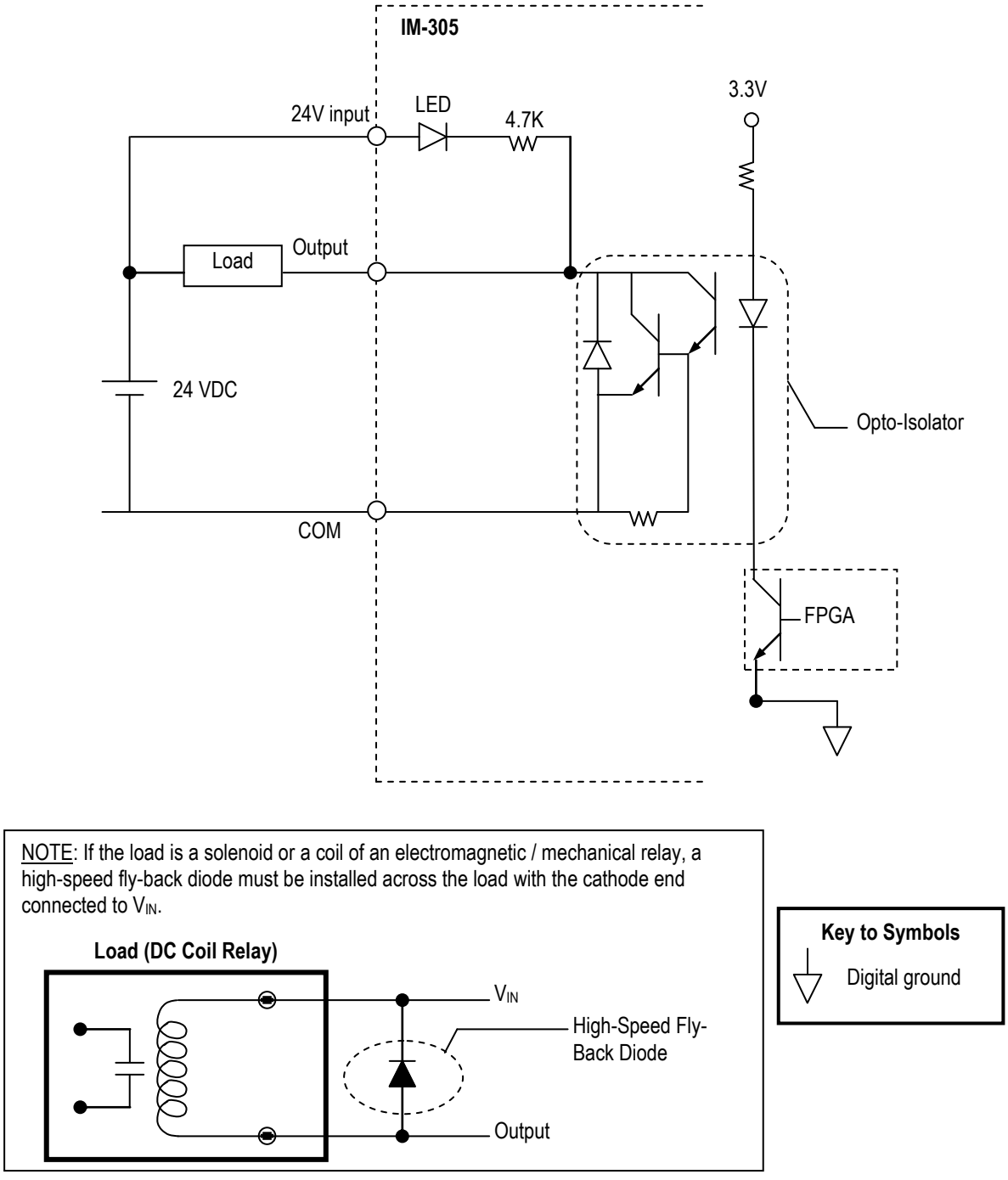


Figure 3-14: Internal Circuitry and Wiring Diagram for IM-305 General Digital Outputs

FUNCTION/FEATURE	SPECIFICATIONS
Outputs Per Module	32 (sink)
Common Grounds Per Module	4
Operating Range	10.8 to 26.4 VDC or –10.8 to –26.4 VDC
Type	Darlington
Peak Voltage	300 VDC
ON Voltage Drop	1.2 VDC maximum
Maximum Load Current	120 mA per point 960 mA per common
Maximum Leakage Current	0.1 mA
External DC Required	24 VDC ±10%, 200 mA maximum
OFF to ON Response	Less than 100 μs
ON to OFF Response	Less than 100 μs

Table 3-11: Specifications for IM-305 General Digital Outputs

Chapter 4: Breakout Boxes

4.1 Breakout Boxes – Descriptions

TB36A: 36-pin screw terminal module (for the DC-155) with two terminal blocks for spade terminals

TB36B: Compact 36-pin screw terminal module (for the DC-155) with a single terminal block for wire entry screw terminals

TB37BD: 37-pin screw terminal module (for making connections between the operator's panel and the PC) with a single terminal block for wire entry screw terminals

TB36A **TB36B** **TB37BD**

Figure 4-1: Photos of TB36A, TB36B and TB37BD Breakout Boxes

4.2 TB36A / TB36B / TB37BD Functional Specifications

FUNCTION/FEATURE	SPECIFICATIONS
Screw Terminals	TB36A: 2 terminal blocks, 18 screw terminals each TB36B: 1 terminal block, 36 screw terminals TB37BD: 1 terminal block, 37 screw terminals
Mounting	DIN Rail
Dimensions	TB36A: 93 mm x 80 mm x 56 mm deep TB36B: 93 mm x 80 mm x 50 mm deep TB37BD: 77 mm x 102 mm x 57 mm deep

Table 4-1: Functional Specifications for TB36A, TB36B and TB37BD Breakout Boxes

4.3 TB36A Terminal Number Assignments

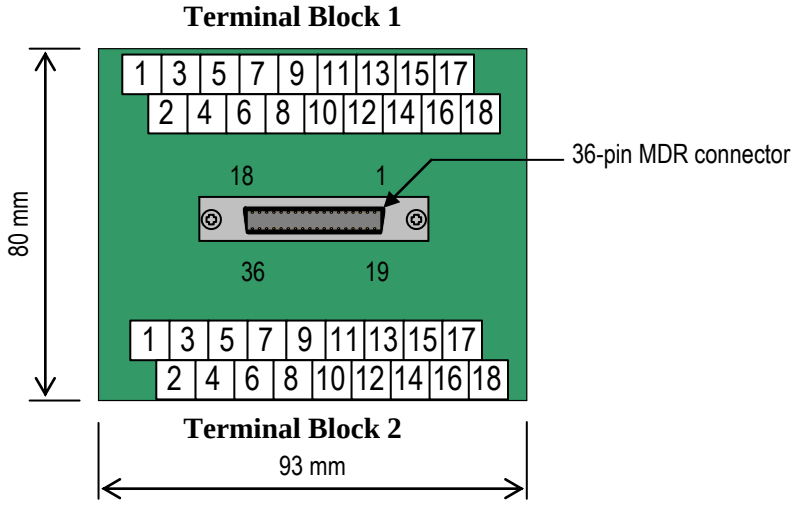


Figure 4-2: TB36A Breakout Box Terminal Number Assignments

⚠ CAUTION

NOTE: The pin assignments for the 36-pin connector are not the same as the pin numbers for the 36 screw terminals. In other words, screw terminal #1 does not connect to pin #1. See the terminal number pin assignments for the TB36A and the TB36B later in this chapter.

4.4 TB36A Terminal Number Assignments for When TB36A Is Connected to the DC-155 Axis Connector

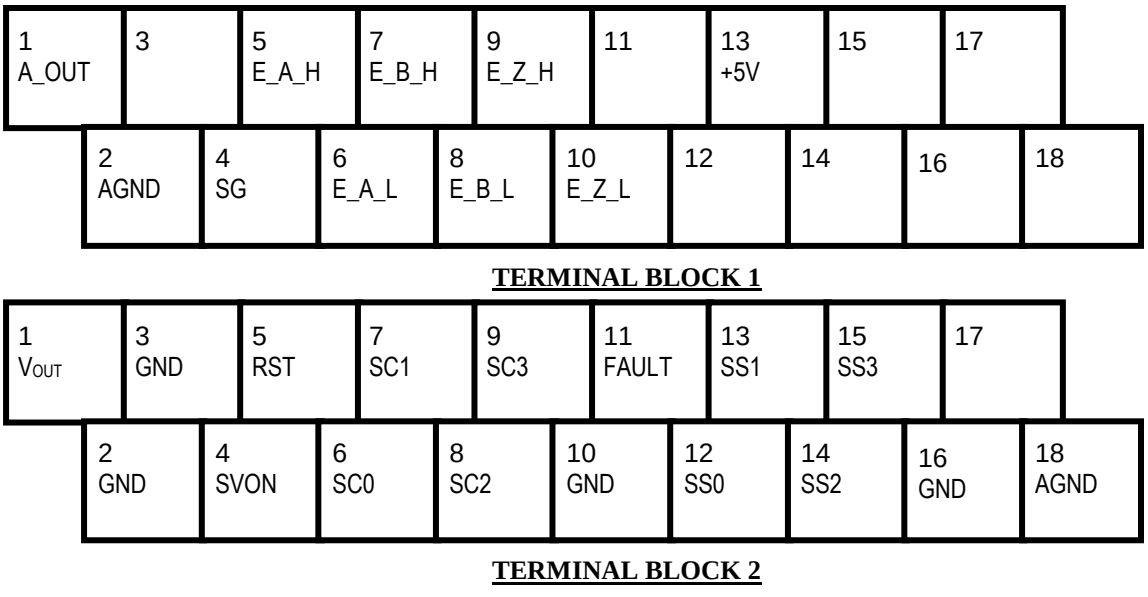


Figure 4-3: TB36A Terminal Number Assignments for When TB36A Is Connected to DC-155 Axis Connector

4.5 TB36A Terminal Number Assignments for When TB36A Is Connected to the DC-155 I/O 1 Connector

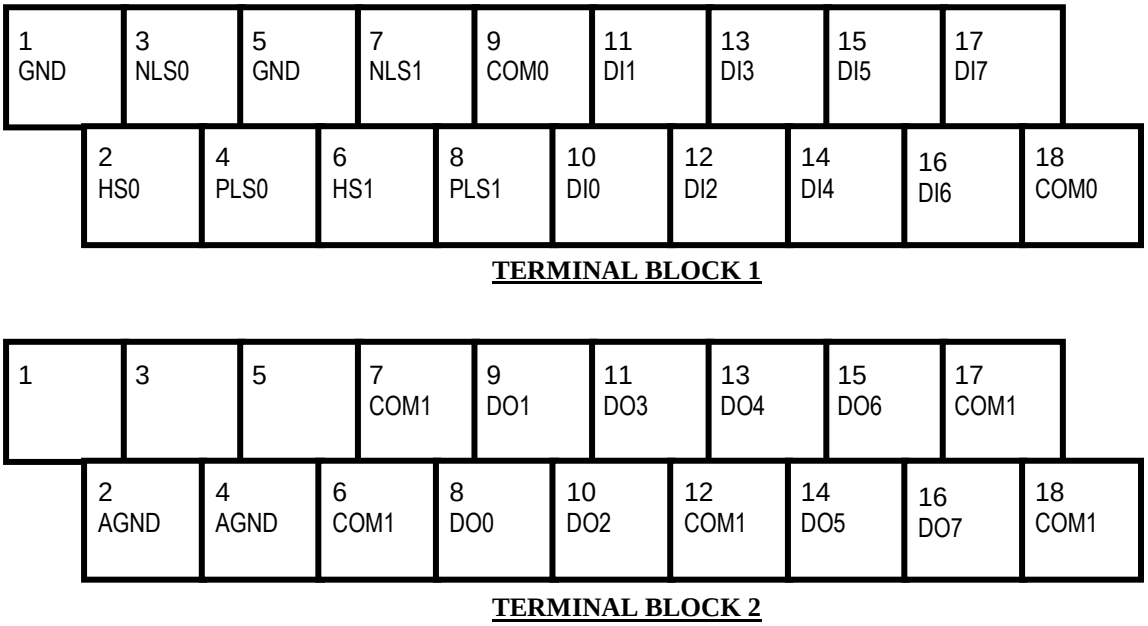


Figure 4-4: TB36A Terminal Number Assignments for When TB36A Is Connected to the DC-155 I/O 1 Connector

4.6 TB36A Terminal Number Assignments for When TB36A Is Connected to the DC-155 I/O 2 Connector

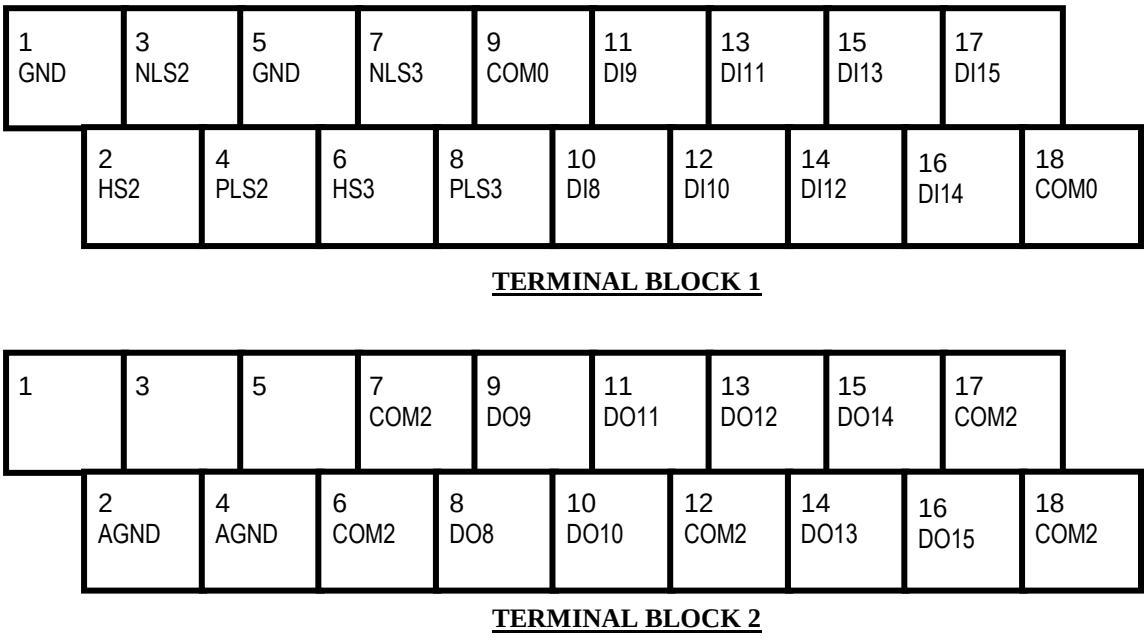


Figure 4-5: TB36A Terminal Number Assignments for When TB36A Is Connected to the DC-155 I/O 2 Connector

4.7 TB36B Terminal Number Assignments

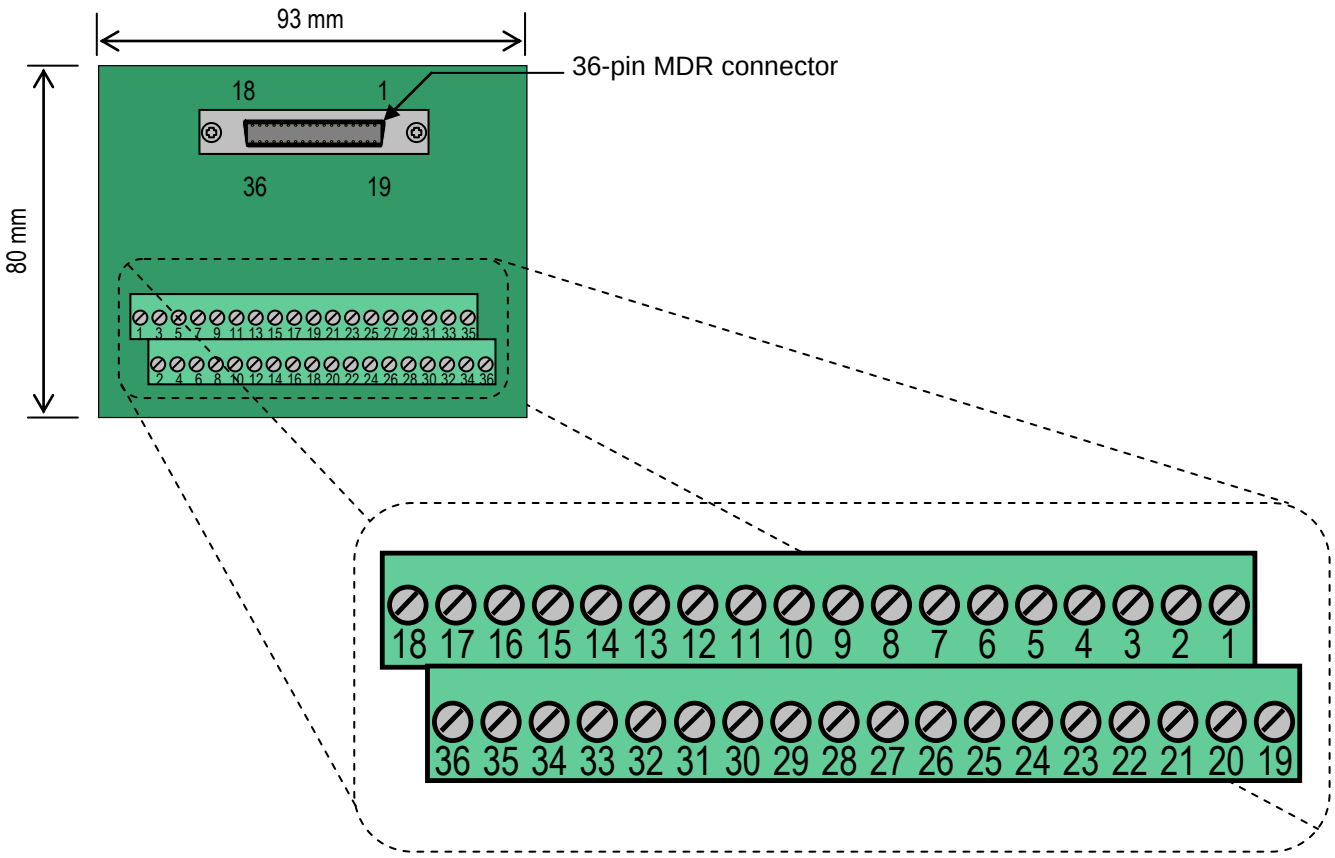


Figure 4-6: TB36B Breakout Box Terminal Number Assignments

CAUTION

NOTE: The pin assignments for the 36-pin connector are the same as the pin numbers for the 36 screw terminals. In other words, screw terminal #1 connects to pin #1.

4.8 TB36B Terminal Number Assignments for When the TB36B is Connected to the DC-155 Axis, I/O 1 & I/O 2 Connectors

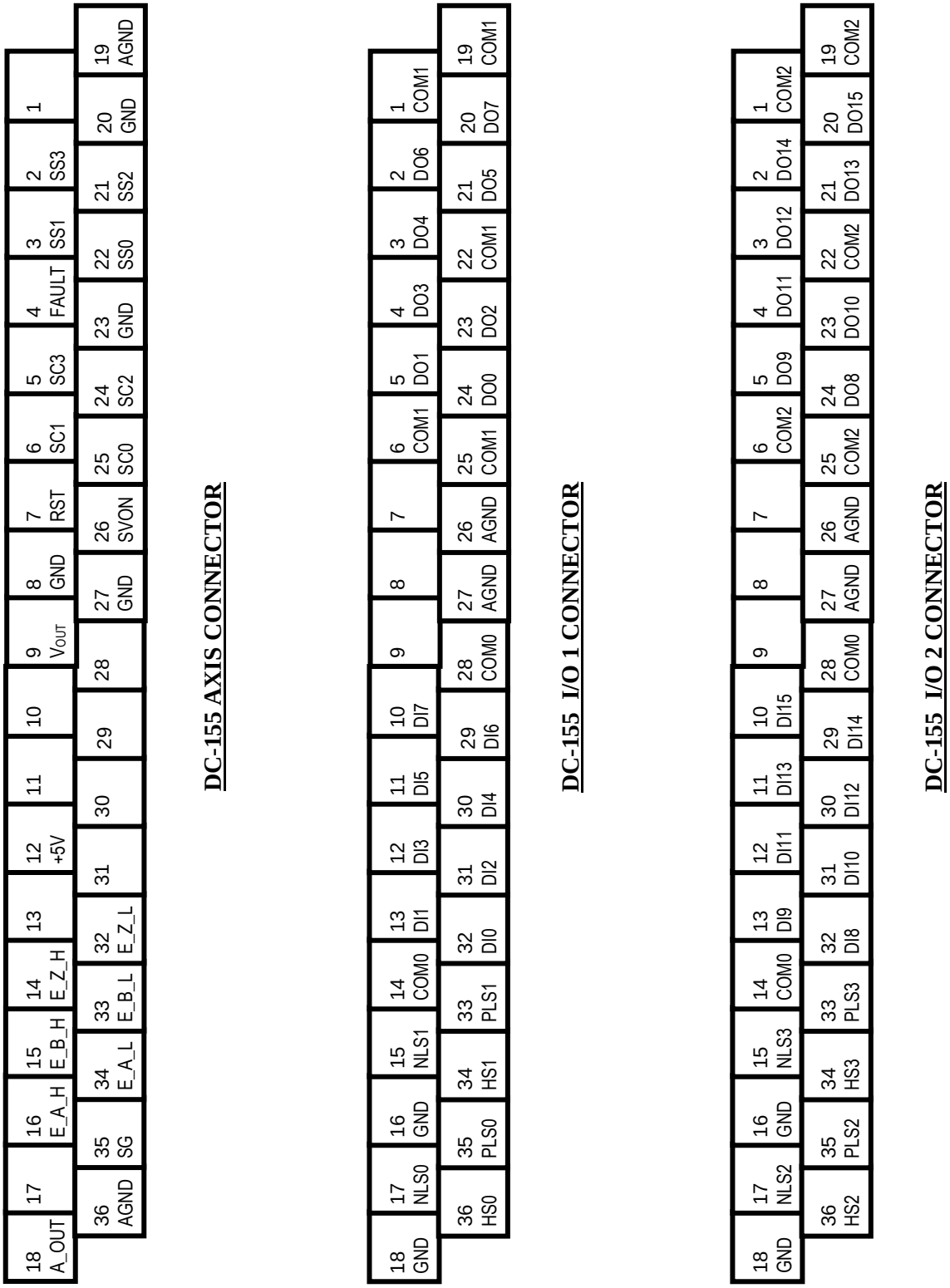


Figure 4-7: TB36B Terminal Number Assignments

4.9 TB36A & TB36B Terminal Pin Number Assignments

P: Represents a twisted pair

Cable Length: 0.5 m (1.64 ft)

TB36A		TB36B	DC-155 AXIS and I/O Connectors			
Terminal Block #	*Terminal #*	*Terminal #*	*Connector Pin #*	*AXIS Signal*	*I/O 1 Signal*	*I/O 2 Signal*
1	1	18	18	A_OUT	GND	GND
	2	36	36	AGND	HS0	HS2
	3	17	17		NLS0	NLS2
	4	35	35	SG	PLS0	PLS2
	5	16	16	E_A_H	GND	GND
	6	34	34	E_A_L	HS1	HS3
	7	15	15	E_B_H	NLS1	NLS3
	8	33	33	E_B_L	PLS1	PLS3
	9	14	14	E_Z_H	COM0	COM0
	10	32	32	E_Z_L	DI0	DI8
	11	13	13		DI1	DI9
	12	31	31		DI2	DI10
	13	12	12	+5V	DI3	DI11
	14	30	30		DI4	DI12
	15	11	11		DI5	DI13
	16	29	29		DI6	DI14
	17	10	10		DI7	DI15
	18	28	28		COM0	COM0
2	1	9	9	V_{OUT}		
	2	27	27	GND	AGND	AGND
	3	8	8	GND		
	4	26	26	SVON	AGND	AGND
	5	7	7	RST		
	6	25	25	SC0	COM1	COM2
	7	6	6	SC1	COM1	COM2
	8	24	24	SC2	DO0	DO8
	9	5	5	SC3	DO1	DO9
	10	23	23	GND	DO2	DO10
	11	4	4	FAULT	DO3	DO11
	12	22	22	SS0	COM1	COM2
	13	3	3	SS1	DO4	DO12
	14	21	21	SS2	DO5	DO13
	15	2	2	SS3	DO6	DO14
	16	20	20	GND	DO7	DO15
	17	1	1		COM1	COM2
	18	19	19	AGND	COM1	COM2
			Connector Case			

Table 4-2: TB36A & TB36B Terminal Pin Number Assignments – SORTED BY TB36A TERMINAL #

NOTE: twisted pairs not shown.

TB36A		TB36B	Cable Length: 0.5 m (1.64 ft)	DC-155 AXIS and I/O Connectors			
Terminal Block #	*Terminal #*	*Terminal #*		*Connector Pin #*	*AXIS Signal*	*I/O 1 Signal*	*I/O 2 Signal*
2	17	1		1		COM1	COM2
2	15	2		2	SS3	DO6	DO14
2	13	3		3	SS1	DO4	DO12
2	11	4		4	FAULT	DO3	DO11
2	9	5		5	SC3	DO1	DO9
2	7	6		6	SC1	COM1	COM2
2	5	7		7	RST		
2	3	8		8	GND		
2	1	9		9	V_{OUT}		
1	17	10		10		DI7	DI15
1	15	11		11		DI5	DI13
1	13	12		12	+5V	DI3	DI11
1	11	13		13		DI1	DI9
1	9	14		14	E_Z_H	COM0	COM0
1	7	15		15	E_B_H	NLS1	NLS3
1	5	16		16	E_A_H	GND	GND
1	3	17		17		NLS0	NLS2
1	1	18		18	A_OUT	GND	GND
2	18	19		19	AGND	COM1	COM2
2	16	20		20	GND	DO7	DO15
2	14	21		21	SS2	DO5	DO13
2	12	22		22	SS0	COM1	COM2
2	10	23		23	GND	DO2	DO10
2	8	24		24	SC2	DO0	DO8
2	6	25		25	SC0	COM1	COM2
2	4	26		26	SVON	AGND	AGND
2	2	27		27	GND	AGND	AGND
1	18	28		28		COM0	COM0
1	16	29		29		DI6	DI14
1	14	30		30		DI4	DI12
1	12	31		31		DI2	DI10
1	10	32		32	E_Z_L	DI0	DI8
1	8	33		33	E_B_L	PLS1	PLS3
1	6	34		34	E_A_L	HS1	HS3
1	4	35		35	SG	PLS0	PLS2
1	2	36		36	AGND	HS0	HS2
				Connector Case			

Table 4-3: TB36A & TB36B Terminal Pin Number Assignments – SORTED BY CONNECTOR PIN #

4.10 TB37BD Terminal Number Assignments

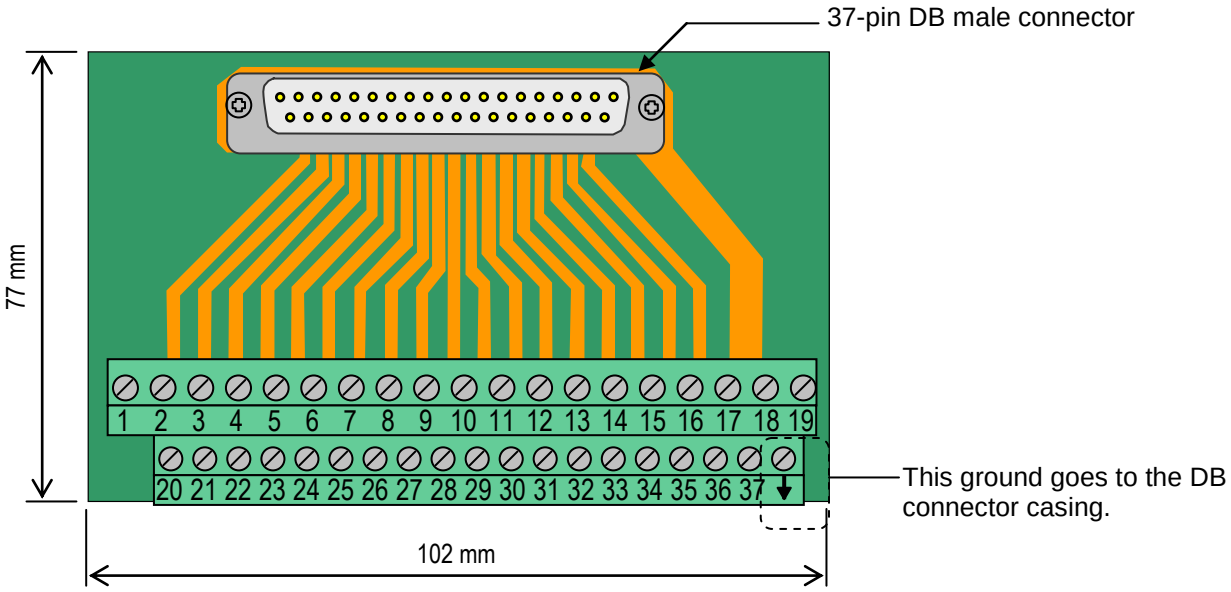


Figure 4-8: TB37BD Breakout Box Terminal Number Assignments

The pin numbers for the TB37BD are the same as the pin numbers for the 37 screw terminals: screw terminal #1 connects to pin #1.

4.11 TB37BD Connector

Receptacle hardware for easily attaching the TB37BD to the VersioBus II adapter board that has been inserted in the host PC.

This cable assembly consists of a DB-37 female receptacle with a one foot long cable that connects to the local I/O header block (the J2 header block on the FP-85, the J3 header block on the FP-105 and the J2 header block on the FP-114).

See *Section 1.5: Pin Assignments for Bracket Connectors to a VersioBus II Adapter Board* for more information.

4.12 TB37BD Terminal Pin Number Assignments

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	IN0	20	IN1
2	IN2	21	IN3
3	IN4	22	IN5
4	IN6	23	IN7
5	COM0_GND (for inputs)	24	IN8
6	IN9	25	IN10
7	IN11	26	IN12
8	IN13	27	IN14
9	IN15	28	NC
10	COM1_GND (for outputs 0 – 7, pins 11 – 14 & 29 – 32)	29	OUT0
11	OUT1	30	OUT2
12	OUT3	31	OUT4
13	OUT5	32	OUT6
14	OUT7	33	NC
15	COM2_GND (for outputs 8 – 15, pins 16 – 19 & 34 – 37)	34	OUT8
16	OUT9	35	OUT10
17	OUT11	36	OUT12
18	OUT13	37	OUT14
19	OUT15		

Table 4-4: TB37BD Terminal Pin Number Assignments

NOTES:

- COM1 is for outputs 0 – 7 (pins 11 – 14 and 29 – 32).
- COM2 is for outputs 8 – 15 (pins 16 – 19 and 34 – 37).

Chapter 5: HW-200 Handwheel

5.1 HW-200 Description

HW-200: Handwheel pulse generator with an Axis Selection Switch, a Multiplier Selection Switch, a Handwheel Dial and an Emergency Stop Button.

Figure 5-1: Photo of HW-200 Handwheel

5.2 HW-200 Functional Specifications

FUNCTION/FEATURE	SPECIFICATIONS
Axis Selection Switch	Axes X, Y, Z, 4, 5
Multiplier Selection Switch	X1, X10, X100, X1000
Emergency Stop Button	E-STOP switch with RESET
Dimensions	163 mm x 70 mm x 63 mm deep

Table 5-1: HW-200 Functional Specifications

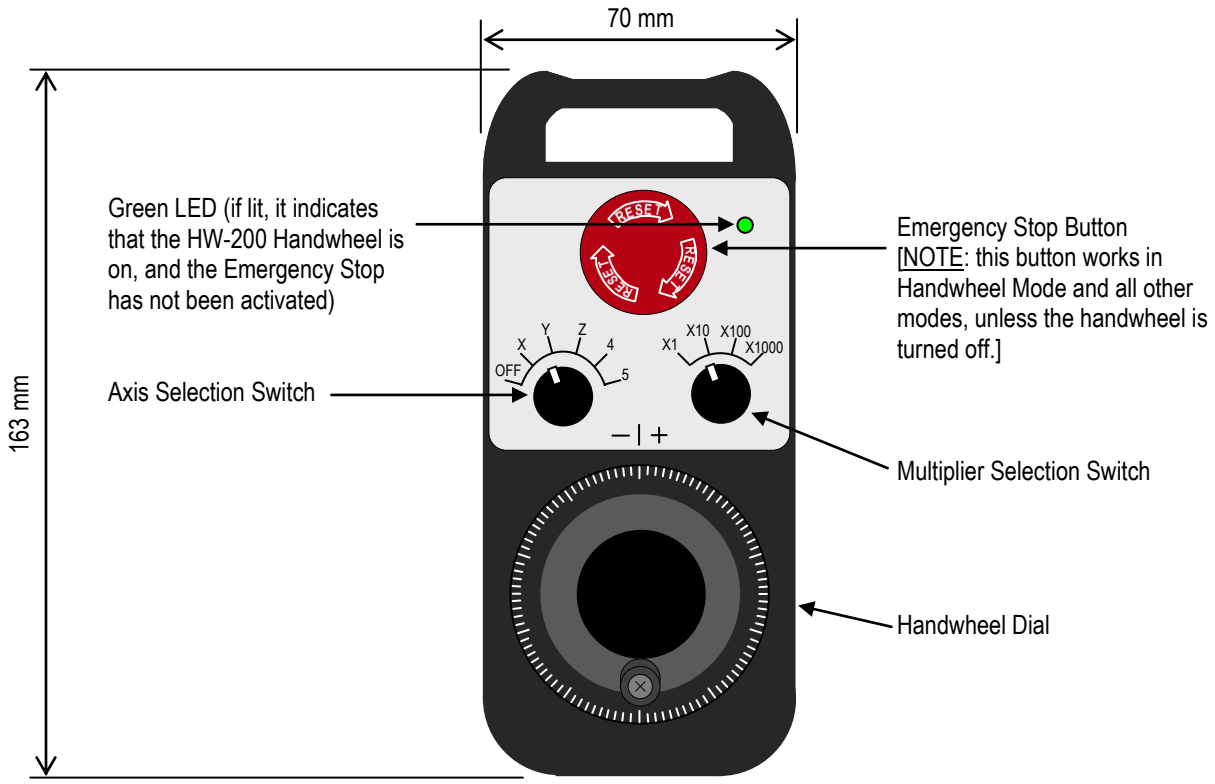


Figure 5-2: HW-200 Handwheel Schematic Diagram

For use with an off-the-shelf PC, the HW-200 is shipped with a flat cable attached to its cord. The flat cable connects to the J1 header block on the FP-85, the J1 header block on the FP-105 or the J1 header block on the FP-114, via a handwheel/handwheel E-STOP connector, as shown:

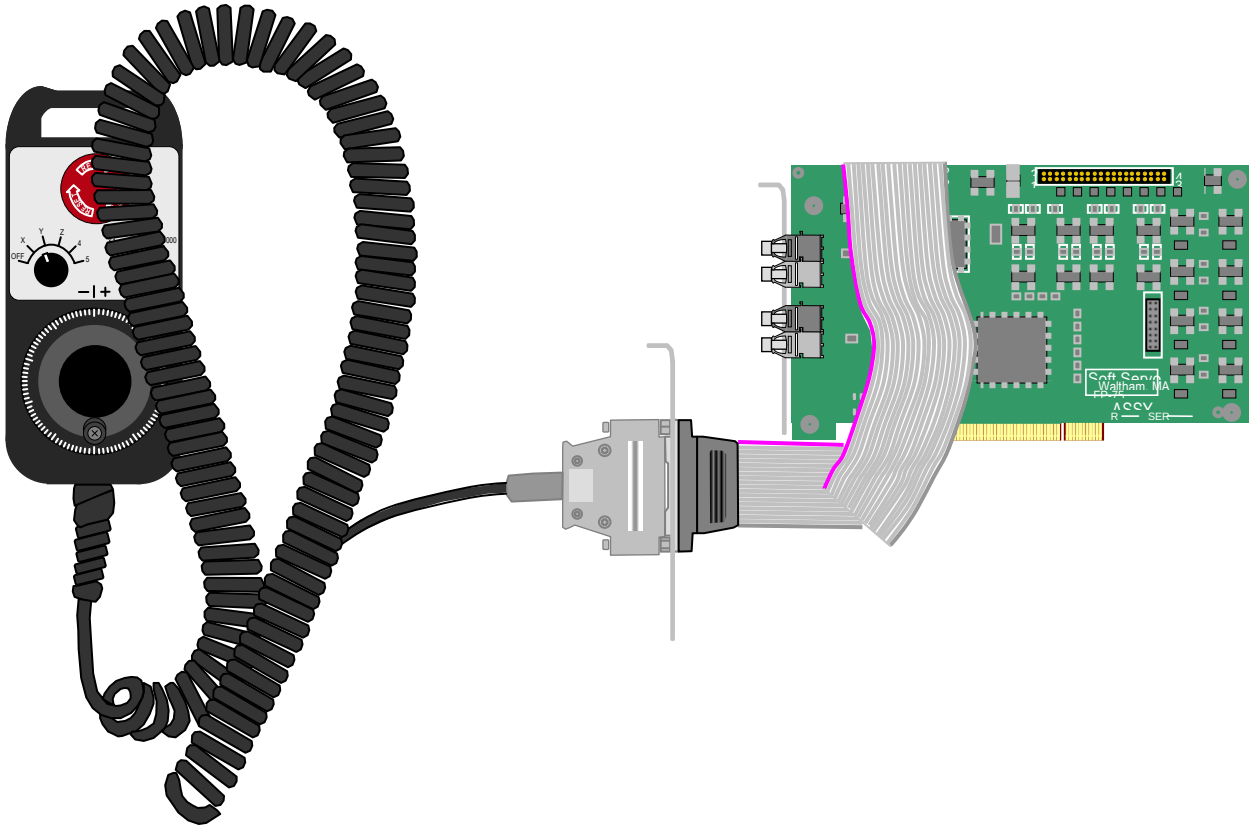
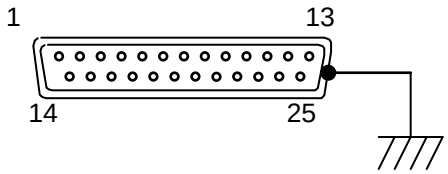


Figure 5-3: Connection of the HW-200 Handwheel to a VersioBus II Adapter Board

5.3 HW-200 Pin Assignments for the 25-Pin DB Handwheel Connectors



Male 25-Pin DB HW-100 Connector
of the HW-100 Cord

PIN NO.	NAME	SIGNAL
1	A_LO	Encoder Signal A, Low Side
2	GND	Digital Ground
3	B_HI	Encoder Signal B, High Side
4	DIF_SEL	Encoder Input Select
5	X10	X10
6	X1000	X1000
7	X-Axis	Axis X
8	Z-Axis	Axis Z
9	5-Axis	Axis 5
10	V_{cc}	V_{cc} (5V)
11	E-STOP-B-1	Handwheel E-STOP button connection 1
12	E-STOP-B-2	Handwheel E-STOP button connection 2
13	E-STOP-B-2	Handwheel E-STOP button connection 2
14	A_HI	Encoder Signal A, High Side
15	B_LO	Encoder Signal B, Low Side
16	GND	Digital Ground
17	X1	X1
18	X100	X100
19	E-STOP	LOGIC E-STOP
20	Y-Axis	Axis Y
21	4-Axis	Axis 4
22	V_{cc}	V_{cc} (5V)
23	E-STOP-B-1	Handwheel E-STOP button connection 1
24	E-STOP-B-1	Handwheel E-STOP button connection 1
25	E-STOP-B-2	Handwheel E-STOP button connection 2

Table 5-2: HW-200 Pin Assignments for the 25-Pin DB Handwheel Connectors

5.4 HW-200 Wiring Diagrams

5.4.1 E-STOP / Handwheel Connections

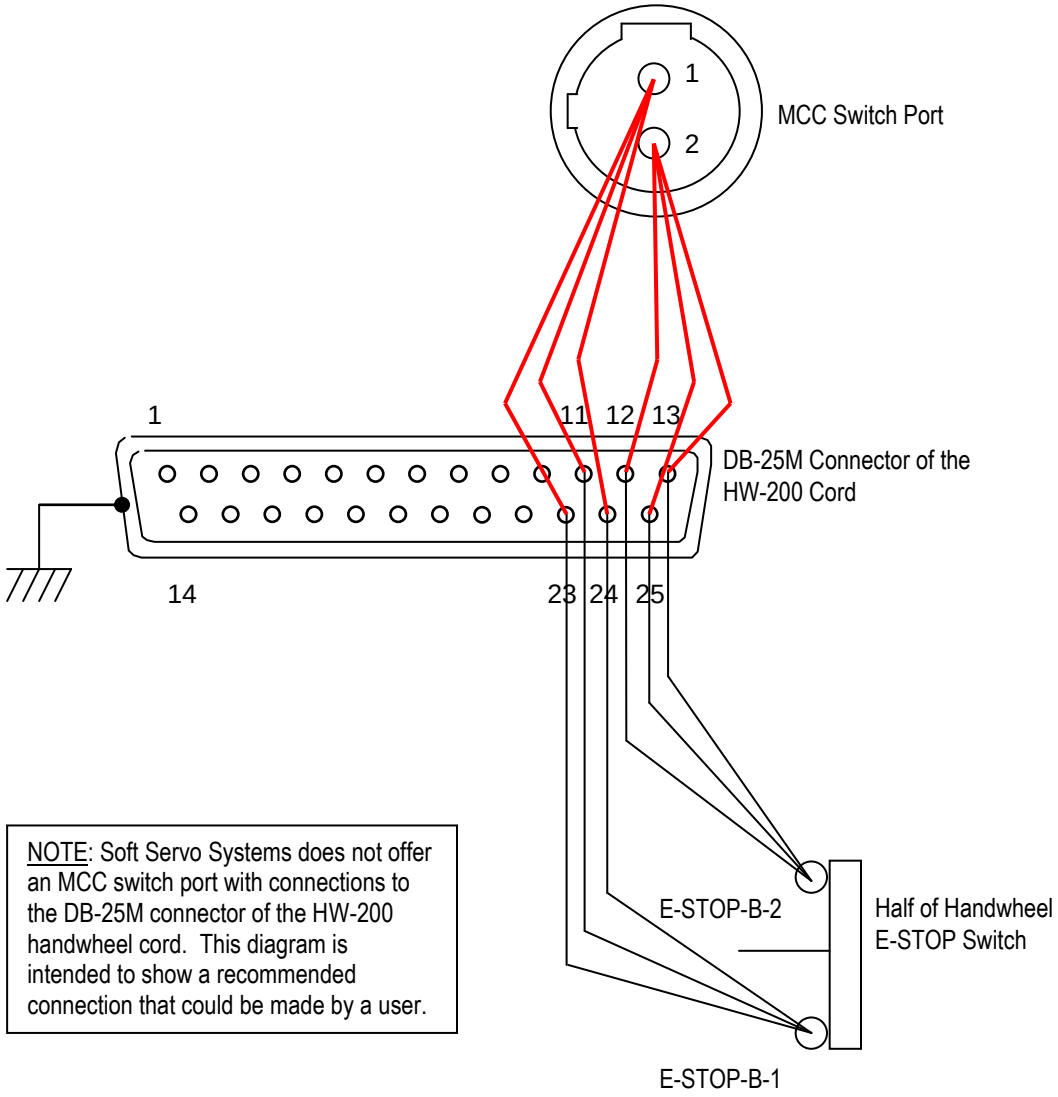


Figure 5-4: Wiring Diagram for E-STOP/Handwheel Connection

Chapter 6: HW-100 Handwheel

6.1 HW-100 Description

HW-100: Handwheel pulse generator with an Axis Selection Switch, a Multiplier Selection Switch, a Handwheel Dial and an Emergency Stop Button.

NOTE: The HW-100 Handwheel has been discontinued and replaced by the HW-200 Handwheel. Please see *Chapter 5: HW-200 Handwheel* for more information regarding the HW-200 Handwheel.

Figure 6-1: Photo of HW-100 Handwheel

6.2 HW-100 Functional Specifications

FUNCTION/FEATURE	SPECIFICATIONS
Axis Selection Switch	Axes X, Y, Z, 4, 5
Multiplier Selection Switch	X1, X10, X100, X1000
Emergency Stop Button	E-STOP switch with RESET
Dimensions	170 mm x 79 mm x 69 mm deep

Table 6-1: HW-100 Functional Specifications

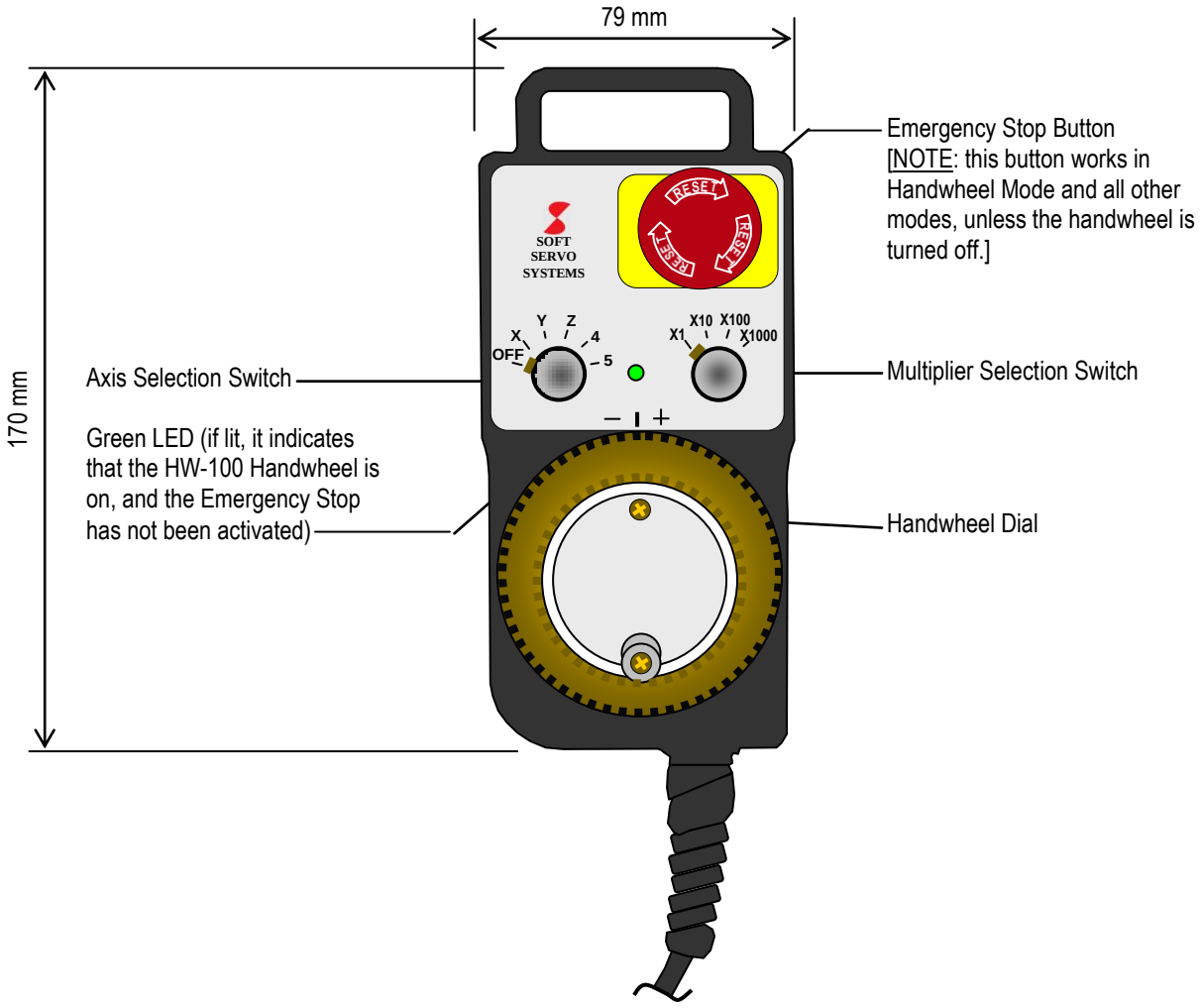


Figure 6-2: HW-100 Handwheel Schematic Diagram

For use with an off-the-shelf PC, the HW-100 is shipped with a flat cable attached to its cord. The flat cable connects to the J1 header block on the FP-85, the J1 header block on the FP-105 or the J1 header block on the FP-114, via a handwheel/handwheel E-STOP connector, as shown:

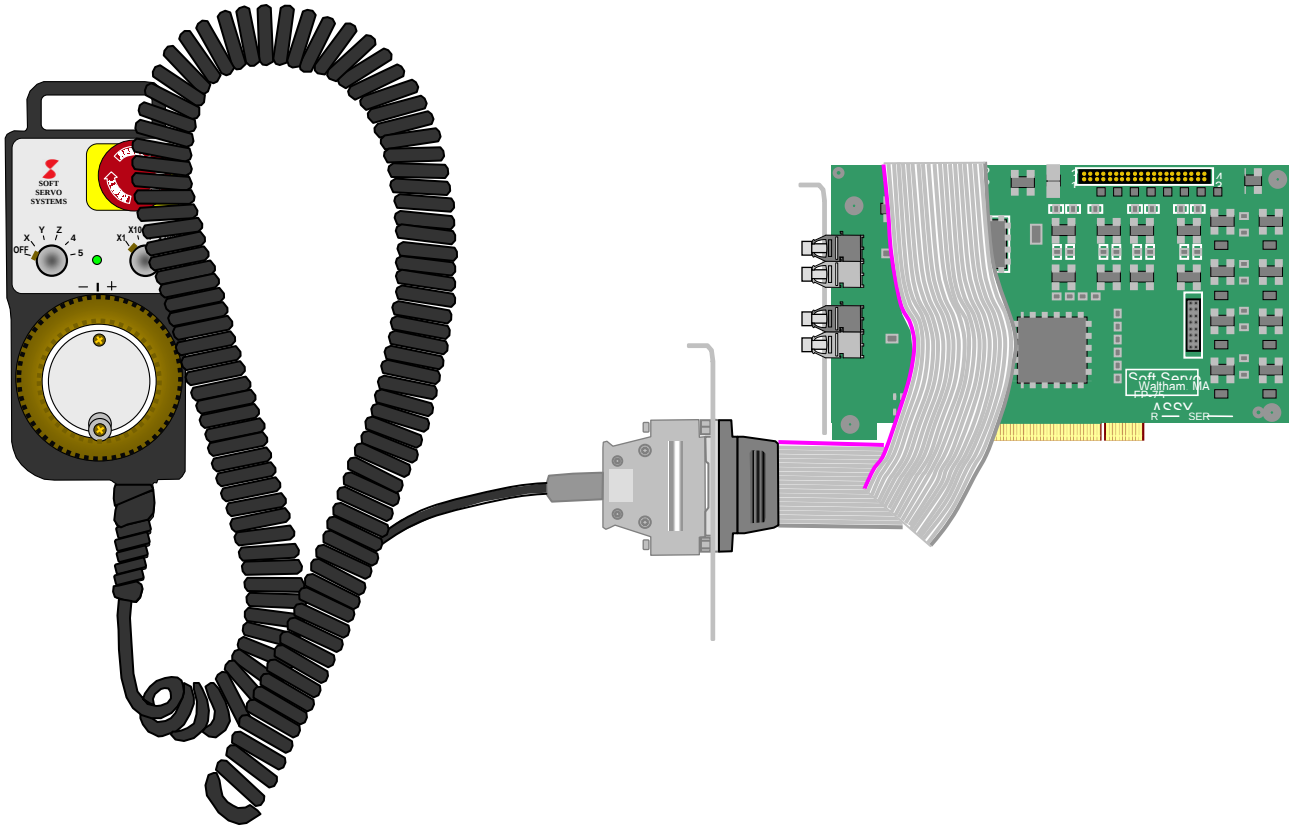
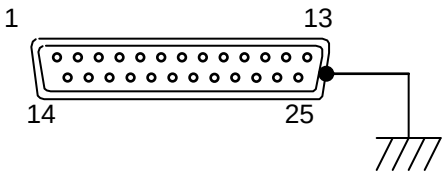


Figure 6-3: Connection of the HW-100 Handwheel to a VersioBus II Adapter Board

6.3 HW-100 Pin Assignments for the 25-Pin DB Handwheel Connectors



Male 25-Pin DB HW-100 Connector
of the HW-100 Cord

PIN NO.	NAME	SIGNAL
1	A_LO	Encoder Signal A, Low Side
2	GND	Digital Ground
3	B_HI	Encoder Signal B, High Side
4	DIF_SEL	Encoder Input Select
5	X10	X10
6	X1000	X1000 (Optional)
7	X-Axis	Axis X
8	Z-Axis	Axis Z
9	5-Axis	Axis 5 (Optional)
10	V_{cc}	V_{cc} (5V)
11	E-STOP-B-1	Handwheel E-STOP button connection 1
12	E-STOP-B-2	Handwheel E-STOP button connection 2
13	E-STOP-B-2	Handwheel E-STOP button connection 2
14	A_HI	Encoder Signal A, High Side
15	B_LO	Encoder Signal B, Low Side
16	GND	Digital Ground
17	X1	X1
18	X100	X100
19	E-STOP	LOGIC E-STOP
20	Y-Axis	Axis Y
21	4-Axis	Axis 4
22	V_{cc}	V_{cc} (5V)
23	E-STOP-B-1	Handwheel E-STOP button connection 1
24	E-STOP-B-1	Handwheel E-STOP button connection 1
25	E-STOP-B-2	Handwheel E-STOP button connection 2

Table 6-2: HW-100 Pin Assignments for the 25-Pin DB Handwheel Connectors

6.4 HW-100 Specifications, Internal Circuitry & Wiring Diagrams

6.4.1 Coiled-Cable Specifications

FUNCTION/FEATURE	SPECIFICATIONS
Material	25 AWG #28 Polyester insulated wires (19 x 0.08 mm copper / tin)
Dielectric Voltage	AC 500 V (for 1 minute)
Resistance	253 Ω per 1 kilometer
Insulation	100M Ω per 1 kilometer

Table 6-3: Specifications for Coiled-Cable

6.4.2 E-STOP Switch Specifications

VOLTAGE	CURRENT
125 VAC	5A
250 VAC	3A

Table 6-4: Specifications for E-STOP Switch

6.4.3 E-STOP / Handwheel Connections

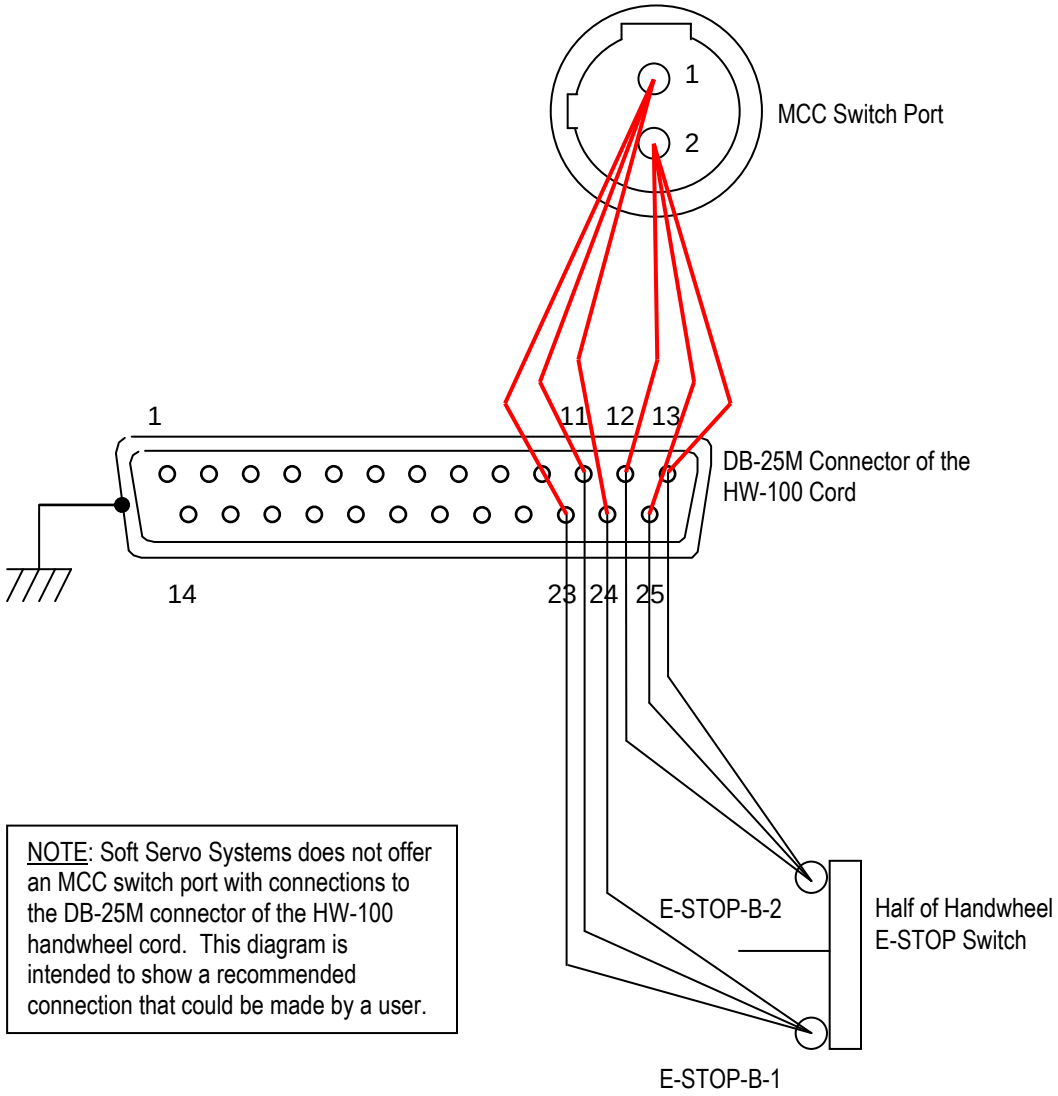


Figure 6-4: Wiring Diagram for E-STOP/Handwheel Connection

Chapter 7: DIN Rail Specifications

Many VersioBus II modules, including the IM-305, the TB36A, the TB36B and the TB37BD, are designed for DIN rail installation. There are two types of DIN rail that can be used for these VersioBus II module. These two types are shown in the following figure:

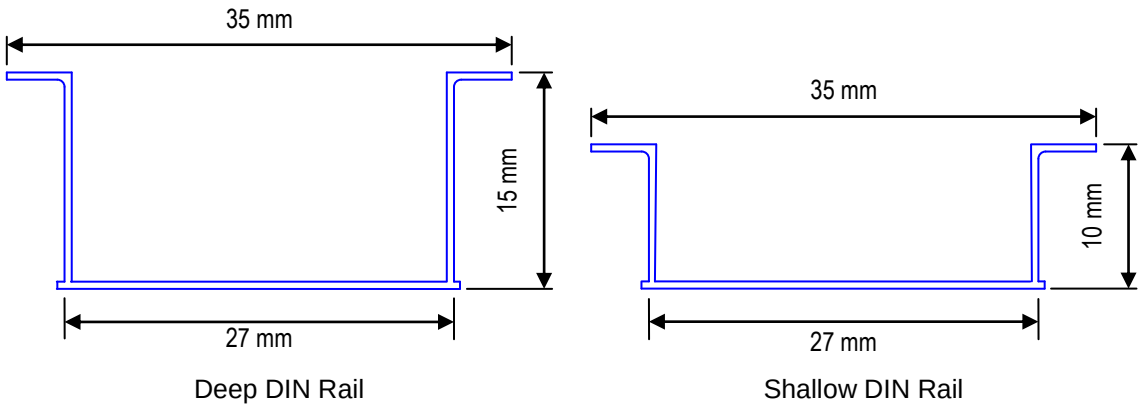


Figure 7-1: DIN Rail Dimensions

You must attach the DIN rail (both deep and shallow DIN rail) with #10 or M6 screws. The screws should be spaced a maximum of 12" (305 mm) apart.

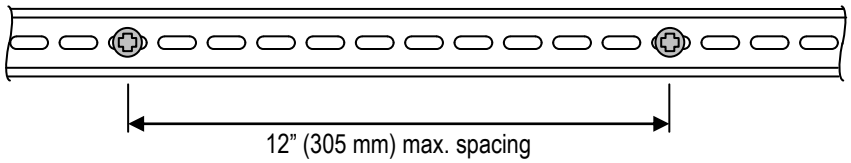


Figure 7-2: DIN Rail Mounting

To ensure easy installation or removal of the modules, we recommend that you place screws at each module. At least two screws should be provided for each IM-305 module, and at least one screw should be provided for each TB36A, TB36B or TB37BD module.

To install a module onto a DIN rail, snap the back of the module onto the DIN rail (insert the top of the rail, and then press down while pressing in at the bottom of the module). Be sure to hold the module horizontally when pressing down.

Each module should slide on the DIN rail. If it doesn't slide easily, press the module down while moving it.

Chapter 8: Wiring Examples for Connections

8.1 Typical Power Wiring Diagram

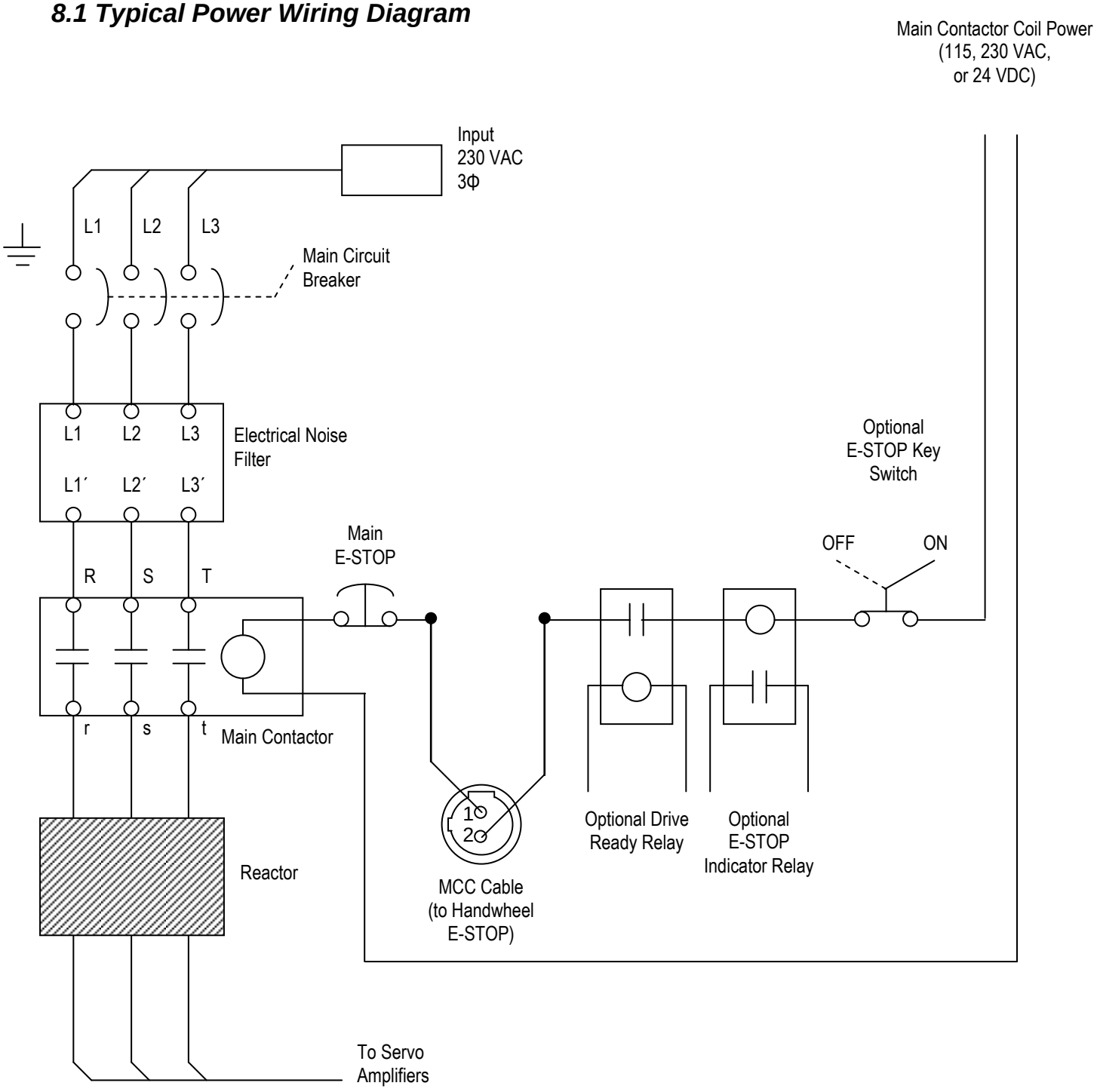


Figure 8-1: Typical Power Wiring Diagram

8.2 Wiring Example of an Analog Signal

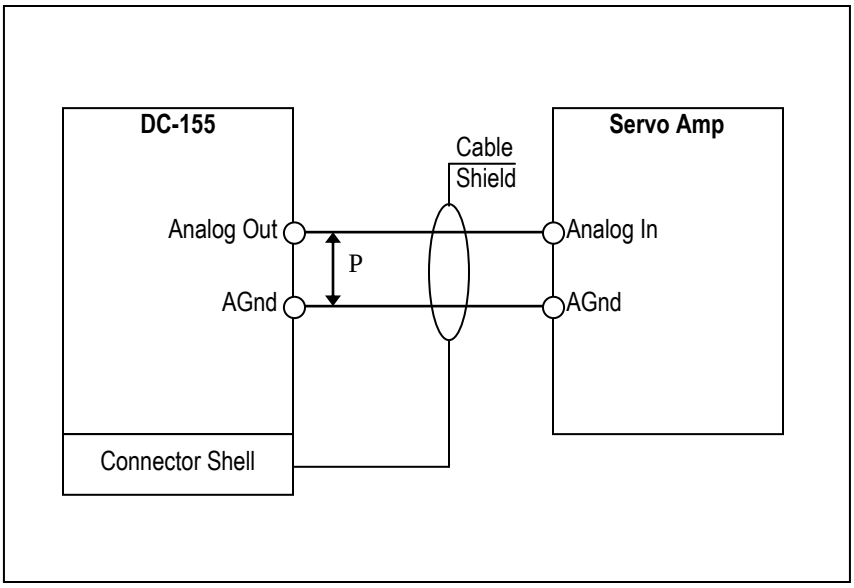


Figure 8-2: Wiring Example of an Analog Output Signal

8.3 Wiring Examples of General Digital Bi-Directional Input

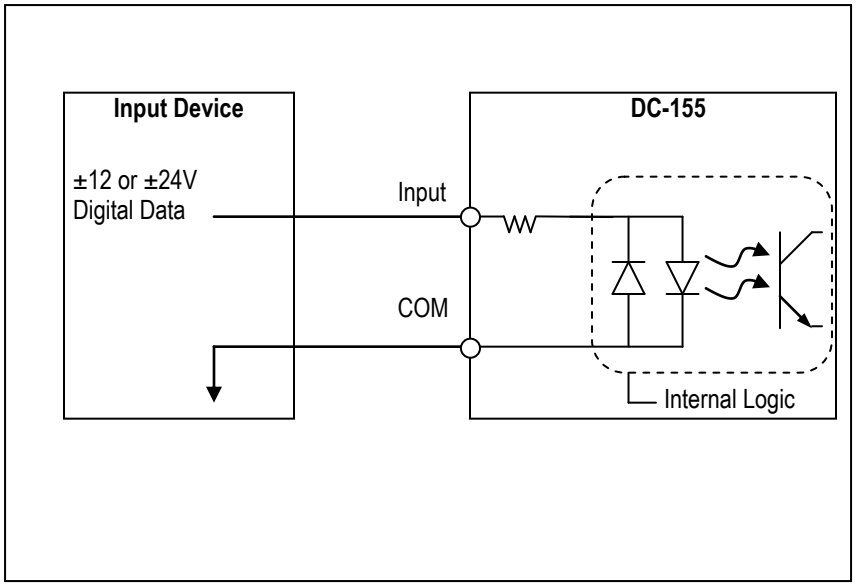


Figure 8-3: Bi-Directional Signal Example #1

8.4 Wiring Examples of Servo-Related Digital Output

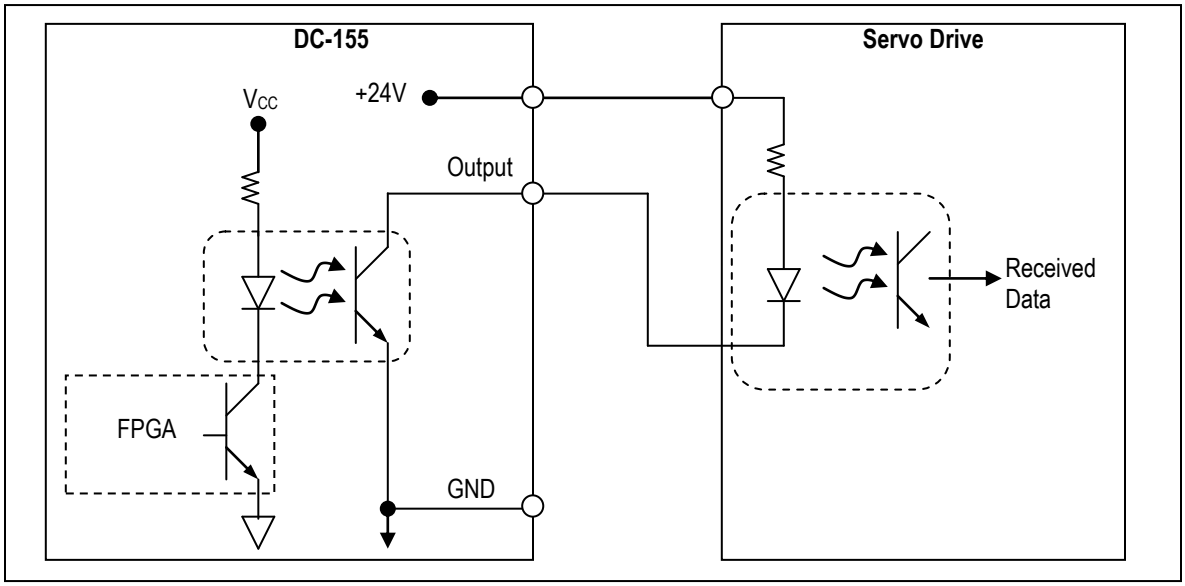


Figure 8-4: Wiring Example of a Servo-Related Output in Which the Servo Drive Uses Power Provided by the DC-155 to Operate the Opto-Isolator

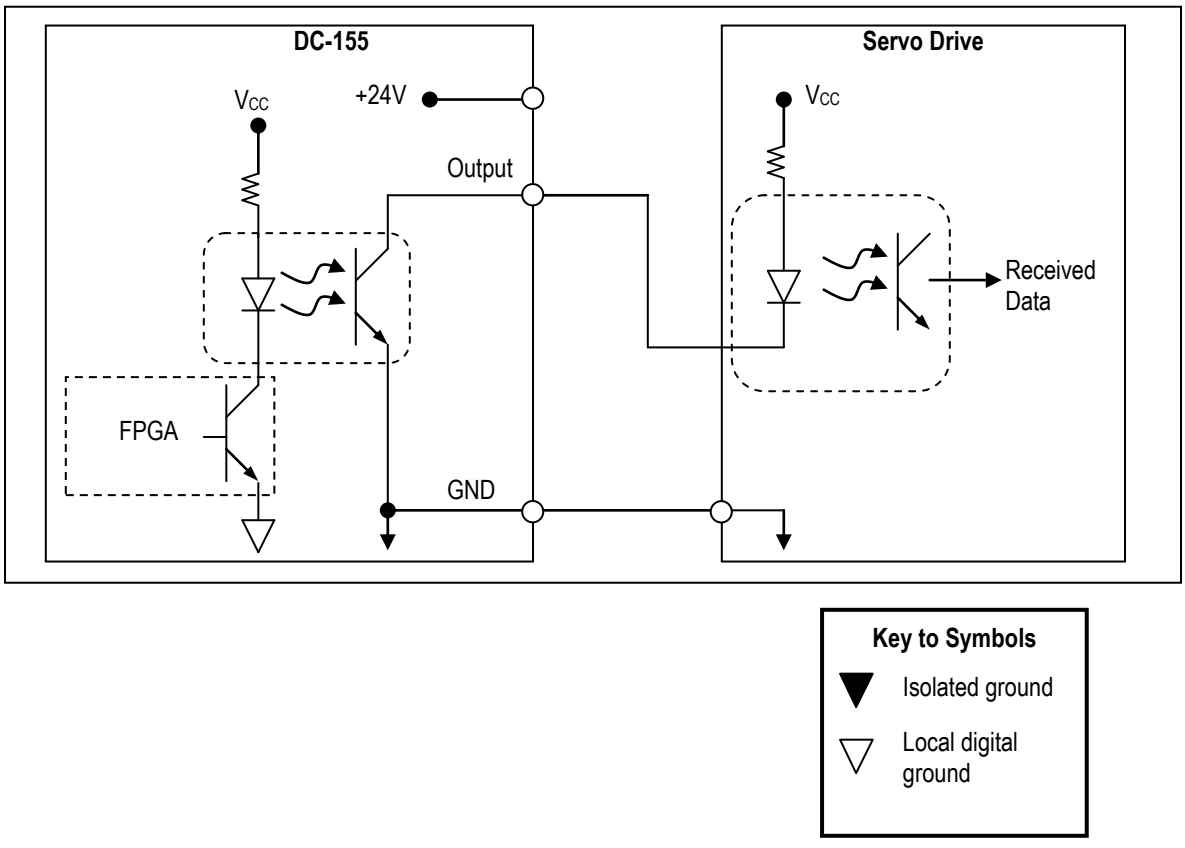


Figure 8-5: Wiring Example of a Servo-Related Output in Which the Servo Drive Uses Internal Power to Operate the Opto-Isolator

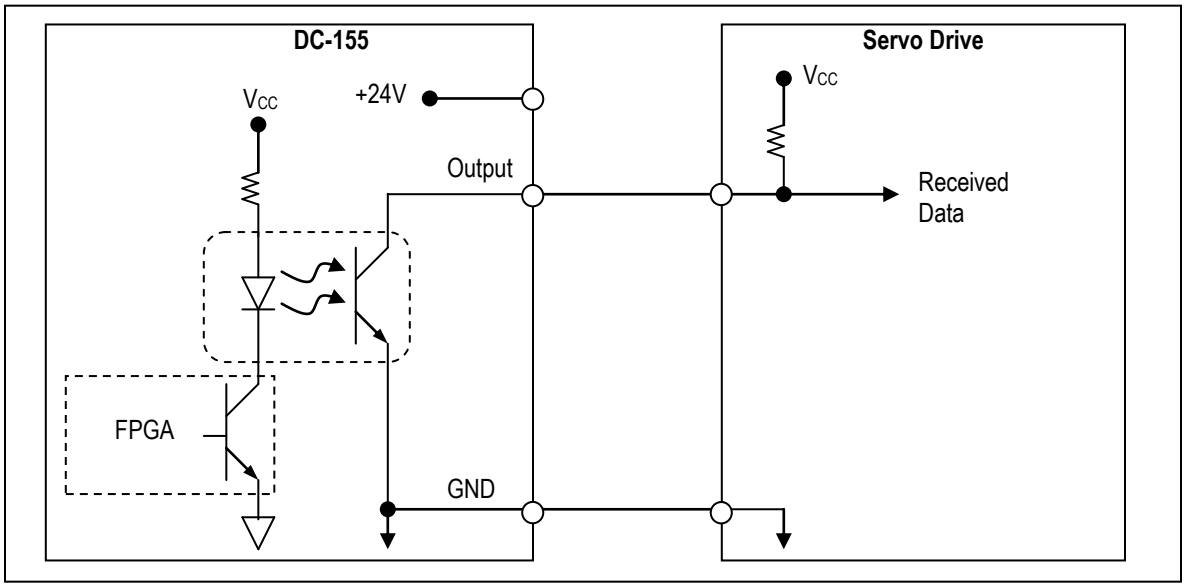


Figure 8-6: Wiring Example of a Servo-Related Output in Which the Servo Drive Does Not Use an Opto-Isolator

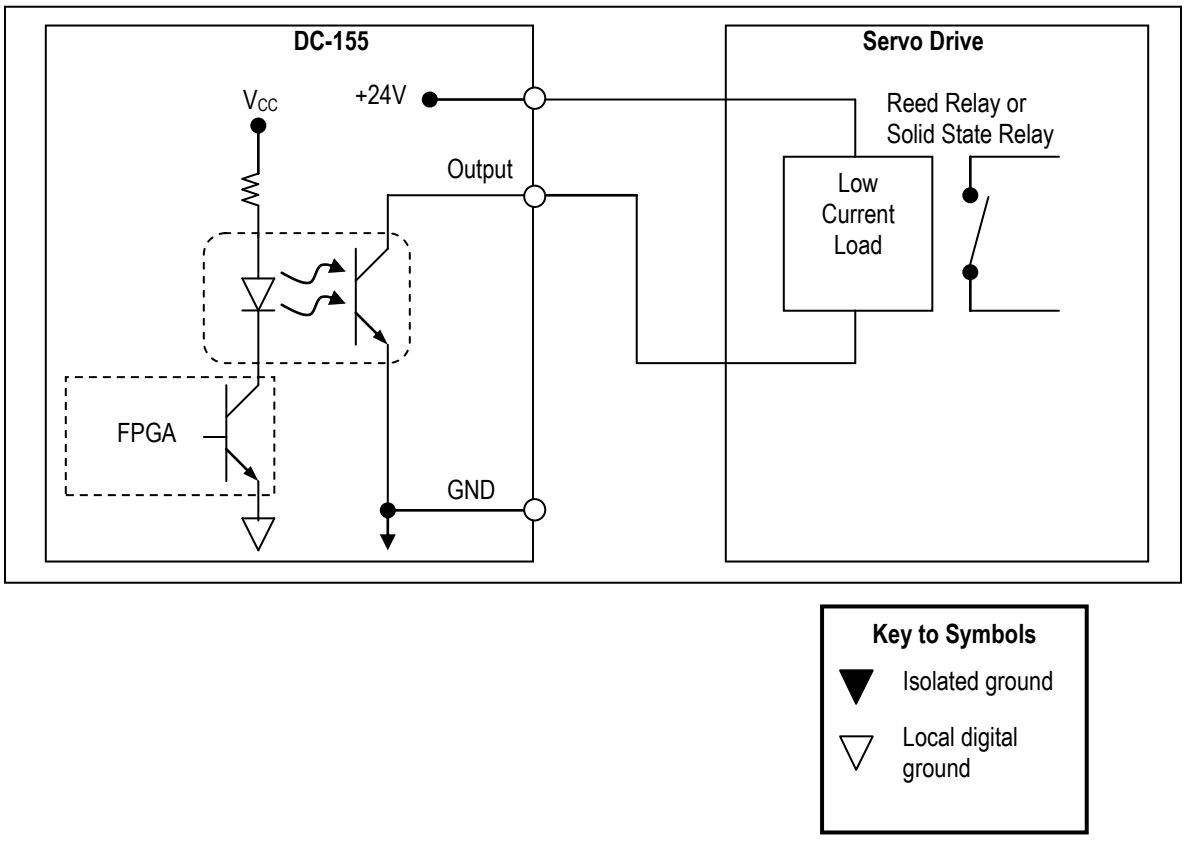


Figure 8-7: Wiring Example of a Servo-Related Output in Which the Servo Drive Employs DC-155 Output to Drive Low Current Load Using +24V Provided

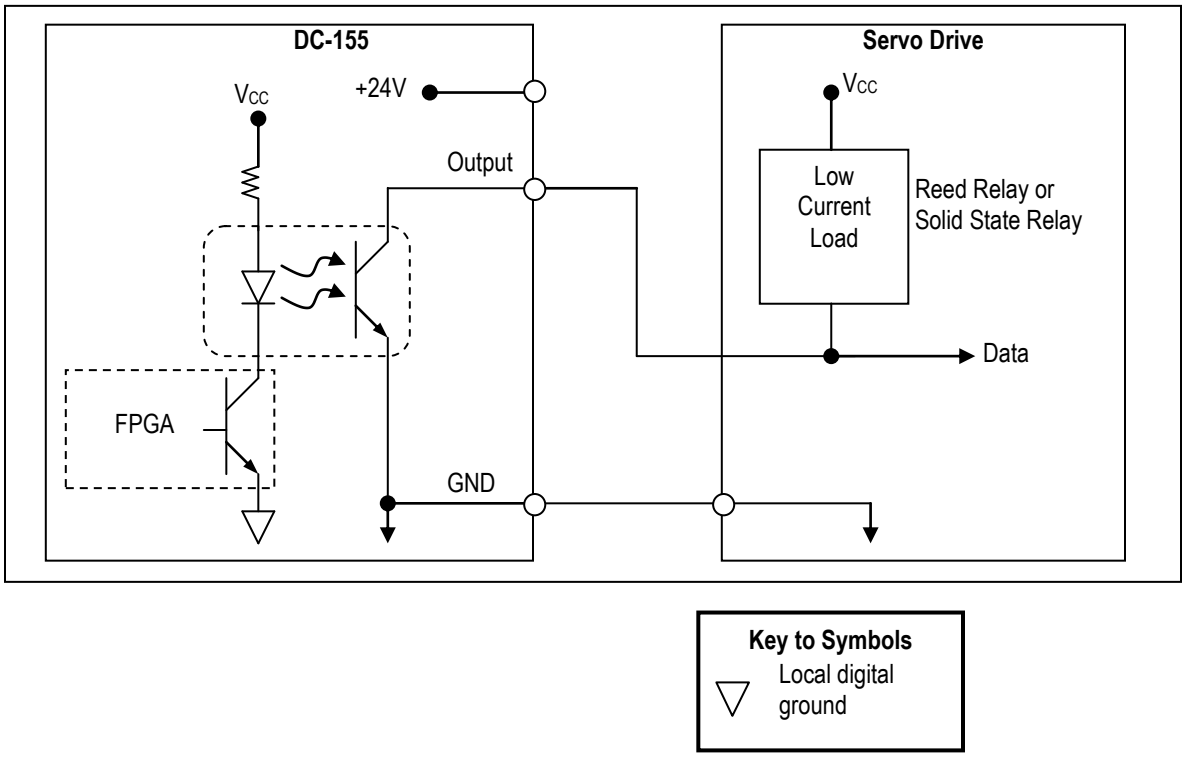


Figure 8-8: Wiring Example of a Servo-Related Output in Which the Servo Drive Employs DC-155 Output to Drive Low Current Load Without the +24V Provided

8.5 Wiring Examples of Servo-Related Digital Input

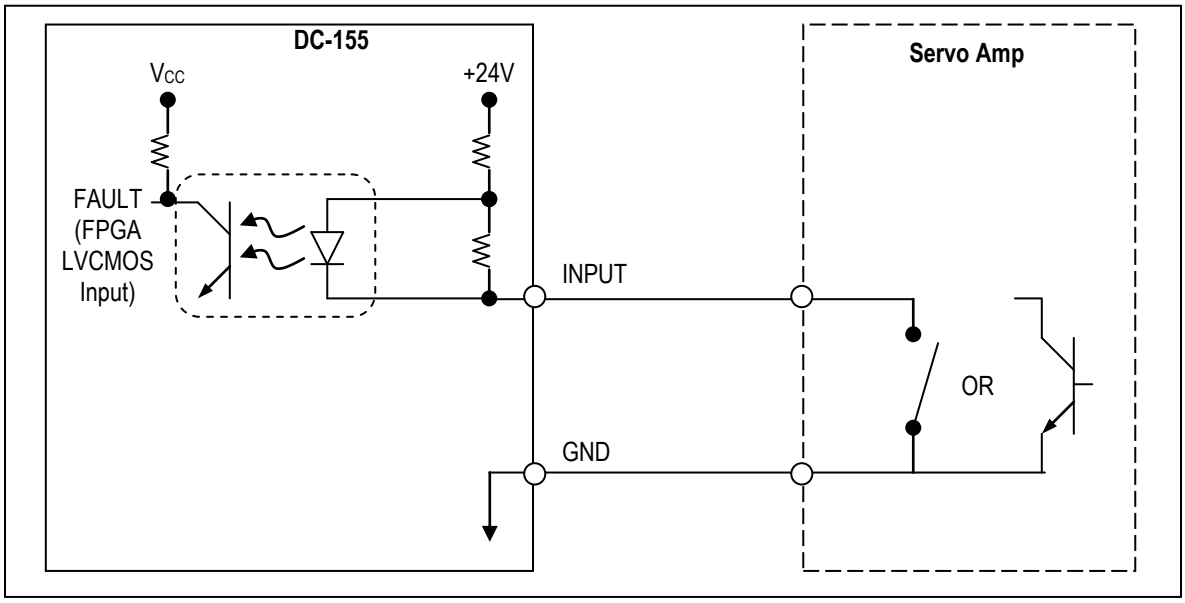


Figure 8-9: Wiring Example of a Pull-Down Switch or Open Collector Logic Signal

8.6 Wiring Examples of General Input

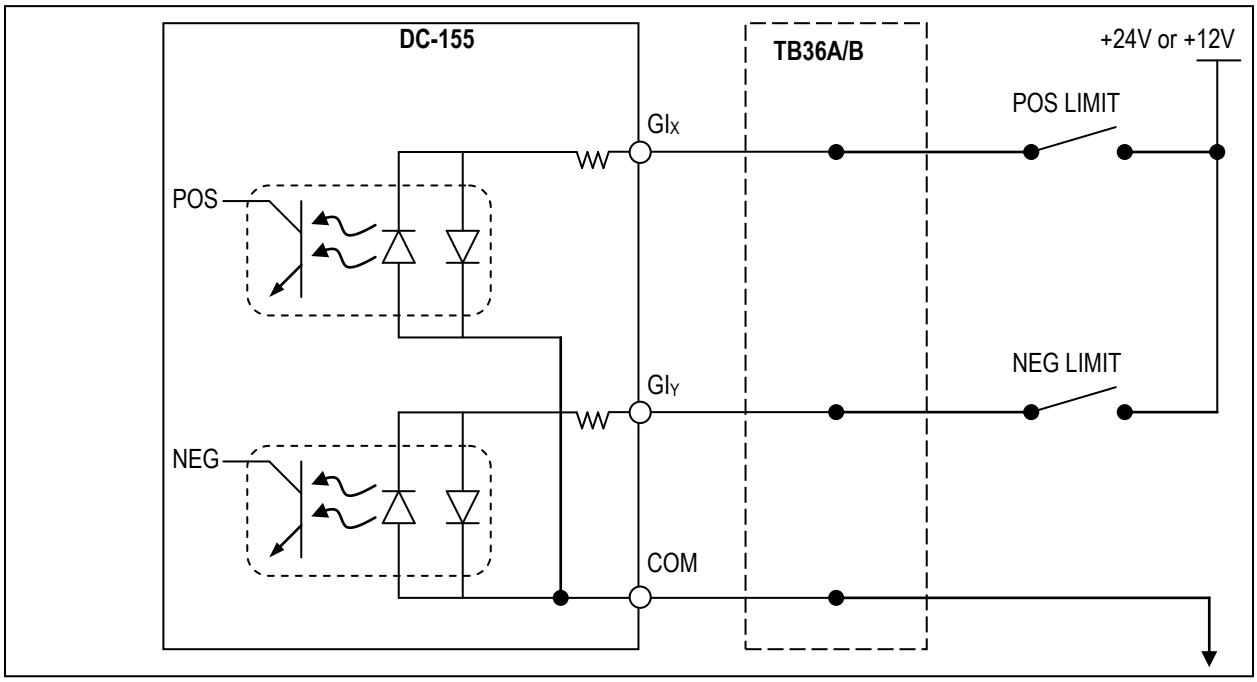


Figure 8-10: Wiring Example of Normally Closed Limit Switches (Common Ground Connection) Connected to DC-155 General Input

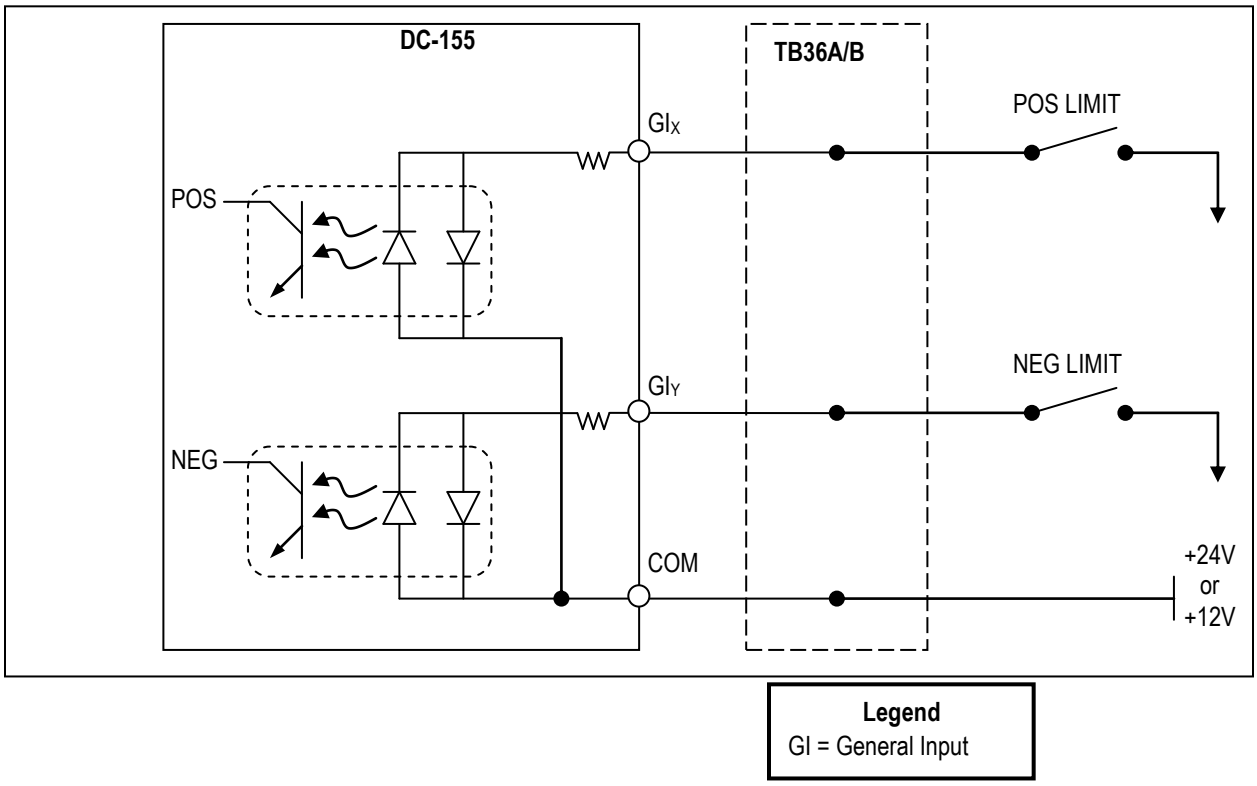


Figure 8-11: Wiring Example of Normally Closed Limit Switches (Common "+" Supply Connection) Connected to DC-155 General Input

8.7 Wiring Example of General Output

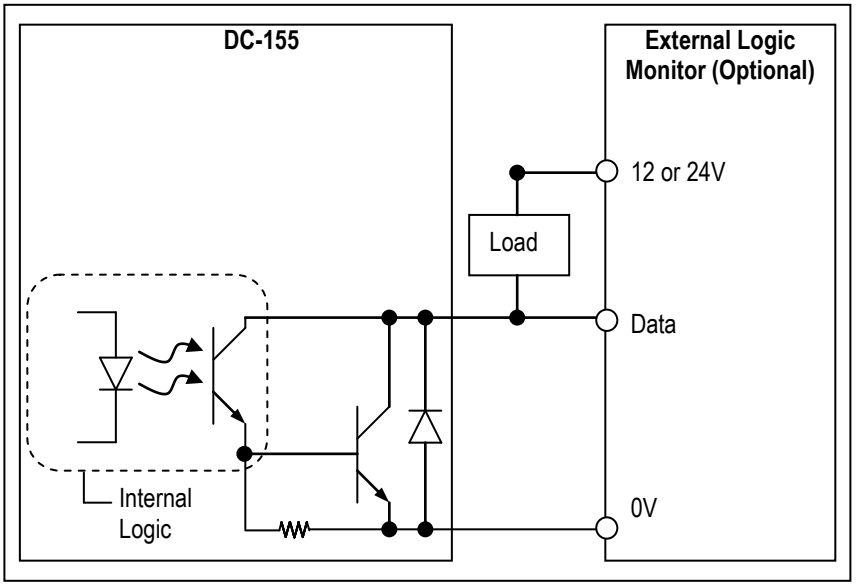


Figure 8-12: Wiring Example of a General Digital Output Signal for a DC-155

8.8 Wiring Example of a Ground Connection

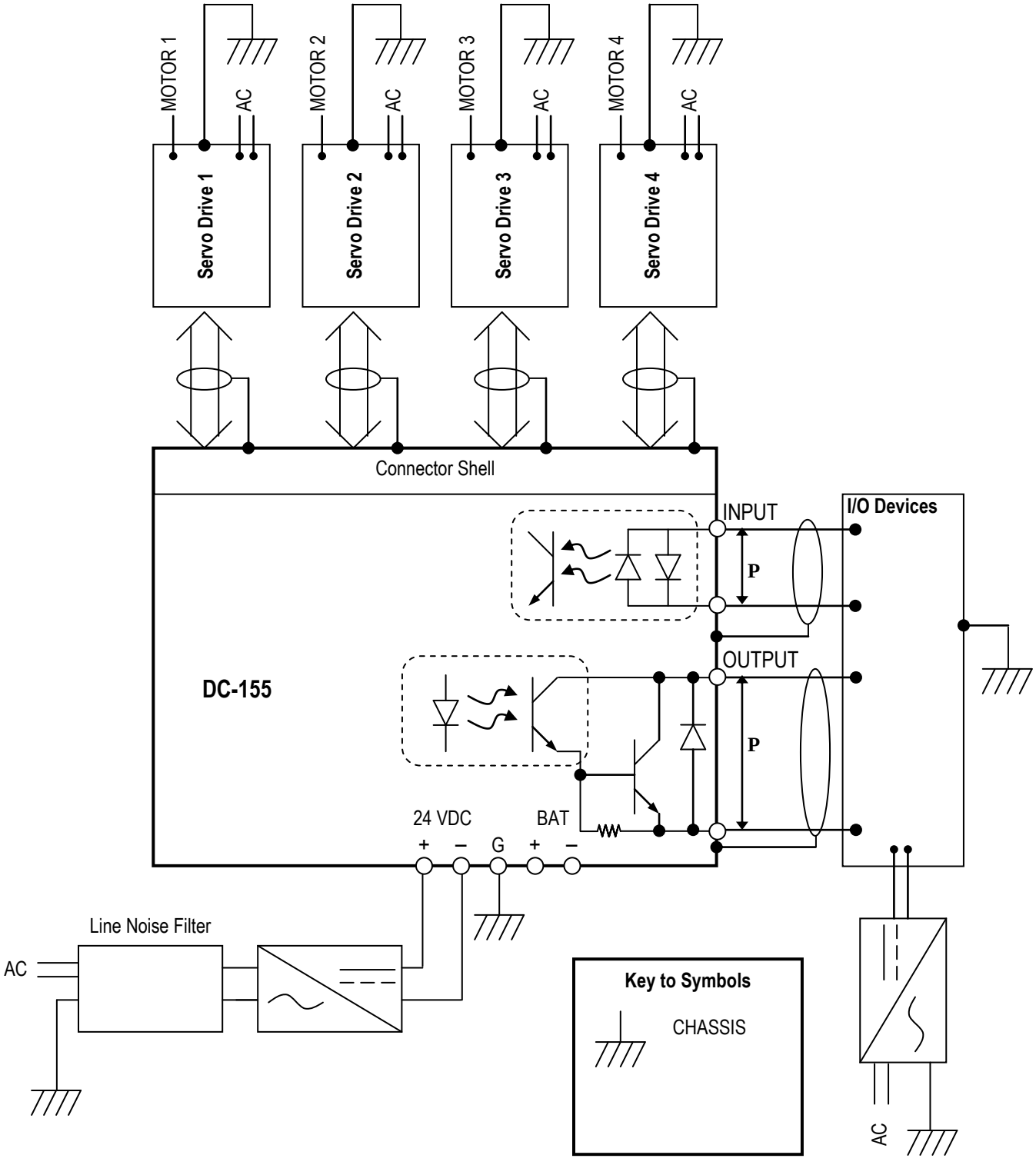


Figure 8-13: Wiring Example of a Ground Connection for a DC-155