

Chapter 6. HARDWARE REFERENCE

Chapter Objectives

The information in this chapter will enable you to:

- Use this chapter as a quick reference tool for most system specifications (dimensions & performance) and switch settings
- Use this chapter as a quick reference tool for proper I/O connections

Environmental Specifications

Parker Compumotor recommends you operate and store your SD/IFX system under the following conditions:

- Operating Temperature: 32° to 122°F (0° to 50°C)
- Relative Humidity: 0% to 95% (non-condensing)
- Maximum Heatsink Temperature: 185°F (85°C)
- Storage Temperature: -40° to 185°F (-40° to 85°C)

If you are using a Compumotor rotary stepper motor, the maximum motor case temperature is 255°F (125°C). If you are using a motor from another vendor, refer to the manufacturer's environmental specifications.

System Specifications

IFX Indexer Specifications

Parameter	Value
Input Power Voltage Current Maximum Ripple Minimum Low Line Maximum High Line	+24VDC 300mA ±1VDC 22VDC (Ripple: +1 to -0VDC) 28VDC (Ripple: +0 to -1VDC)
Performance Position range Coordinate system Velocity range Acceleration range Signal Output	0 - 1,999,999,999 steps Absolute or incremental 0.0001 - 100.0 rps (0.006 - 6,000 rpm) 0.01 - 999.99 rps ² Open-collector step, direction, and shutdown signals
Command Interface Type Communications parameters Configuration	RS-232C, three-wire (Tx, Rx, GND) implementation. Required minimum voltage swing on Rx line is ±3V. 1200 - 9600 baud (user-selectable), 8 data bits, 1 stop bit, no parity Up to 8 IFX indexers may controlled from a single RS-232C port when connected in a daisy-chain configuration.
Sequence Storage Memory type Number of motion programs Program length	EEPROM (2K characters) 7 Up to 256 characters/sequence

Table 6-1. IFX Indexer Specifications

SD Drive Specifications

Parameter	Value
Amplifiers Type Motor resolution Protection Open-circuit Short-circuit Over-temperature Nominal output current (Two-phase-on) Maximum Stepping Rate Nominal chopping frequency	Bipolar Chopper 200 or 400 steps/rev (User-selectable) Phase-to-phase (<u>not</u> phase-to-ground) If heatsink exceeds 185°F (85°C) 2A/phase (SD2), 3A/phase (SD3) Adjustable with DIP switches 10kHz @ 200 steps /rev 20kHz @ 400 steps /rev 15kHz
Command Interface SD drive module Input impedance Input logic level Output circuits Output logic levels SD drive mounted in an SC rack Input	Built-in pull-up resistors (4kΩ) to +12V Low (logic 0) 0 to +2V or short-circuit High (logic 1) +10V to +12V or open-circuit Open-collector NPN transistors Low (transistor switched to 0V) +1V max. @ 15mA max. High (transistor off) +24V max. Step input is high going pulse, 5μS min. width Maximum pulse rate is 100kHz Inputs are fully optically isolated and require a TTL-type signal to operate. >3.5VDC high, <0.8VDC low. User-supplied step and direction signals must be capable of providing up to 20mA.
Power Drive supply voltage Logic supply voltage Drive supply current 18-0-18VAC for +24VDC 26-0-26VAC for +36VDC Fuses FS1 (Logic Supply) FS2 (Motor Supply)	18-0-18 to 26-0-26VAC, or 24 to 36VDC 18-0-18VAC or +24VDC at 350mA max. 1.5A (SD2), 2.2A (SD3) 1.5A (SD2), 2.2A (SD3) 1A 3.15A (SD2), 4A (SD3)
Internal Oscillator Speed range	40 - 1,000 step/sec
Motors Type Accuracy grade Minimum inductance Current range	2-Phase hybrid or permanent magnet (normally 1.8°) 3% or 5% 1mH 0.5A - 3.0A (SD2), 2.0A - 4.0A (SD3)

Table 6-2. SD Drive Specifications

**RM Motor
Specifications
(Compumotor-
Supplied)**

	NEMA SIZE 23			NEMA SIZE 34	
	RM 57-51	RM 57-83	RM 57-102	RM 83-62	RM 83-93
Motor Compatibility SD2 SD3	Yes Yes	Yes Yes	Yes Yes	No Yes	No Yes
Rotor Inertia oz-in ² (Kg-cm ²)	0.48 (0.088)	1.28 (0.234)	1.75 (0.320)	3.50 (0.64)	6.70 (1.23)
Bearings					
Thrust load lb. (Kg)	25 (11.32)	25 (11.32)	25 (11.32)	50 (22.64)	50 (22.64)
Radial load lb. (Kg)	15 (6.79)	15 (6.79)	15 (6.79)	25 (11.32)	25 (11.32)
End play in. Reversing load (cm) equal to 1 lb.	0.005 (same for all RM motors) (0.013) (same for all RM motors)				
Radial play in. per 0.5 lbs. load (cm)	0.0008 (same for all RM motors) (0.002) (same for all RM motors)				
Motor cable length	10' (same for all RM motors)				
Motor weight lbs. (Kg)	1.6 (0.73)	2.4 (1.09)	3.2 (1.45)	3.8 (1.73)	5.12 (2.33)
Accuracy *	3% (same for all RM motors)				
Minimum inductance	0.5mH (same for all RM motors)				

Table 6-3. RM Motor Specifications

I/O Pinouts and Connectors

Figure 6-1 illustrates the pinouts and connectors on the SD/IFX motherboard.

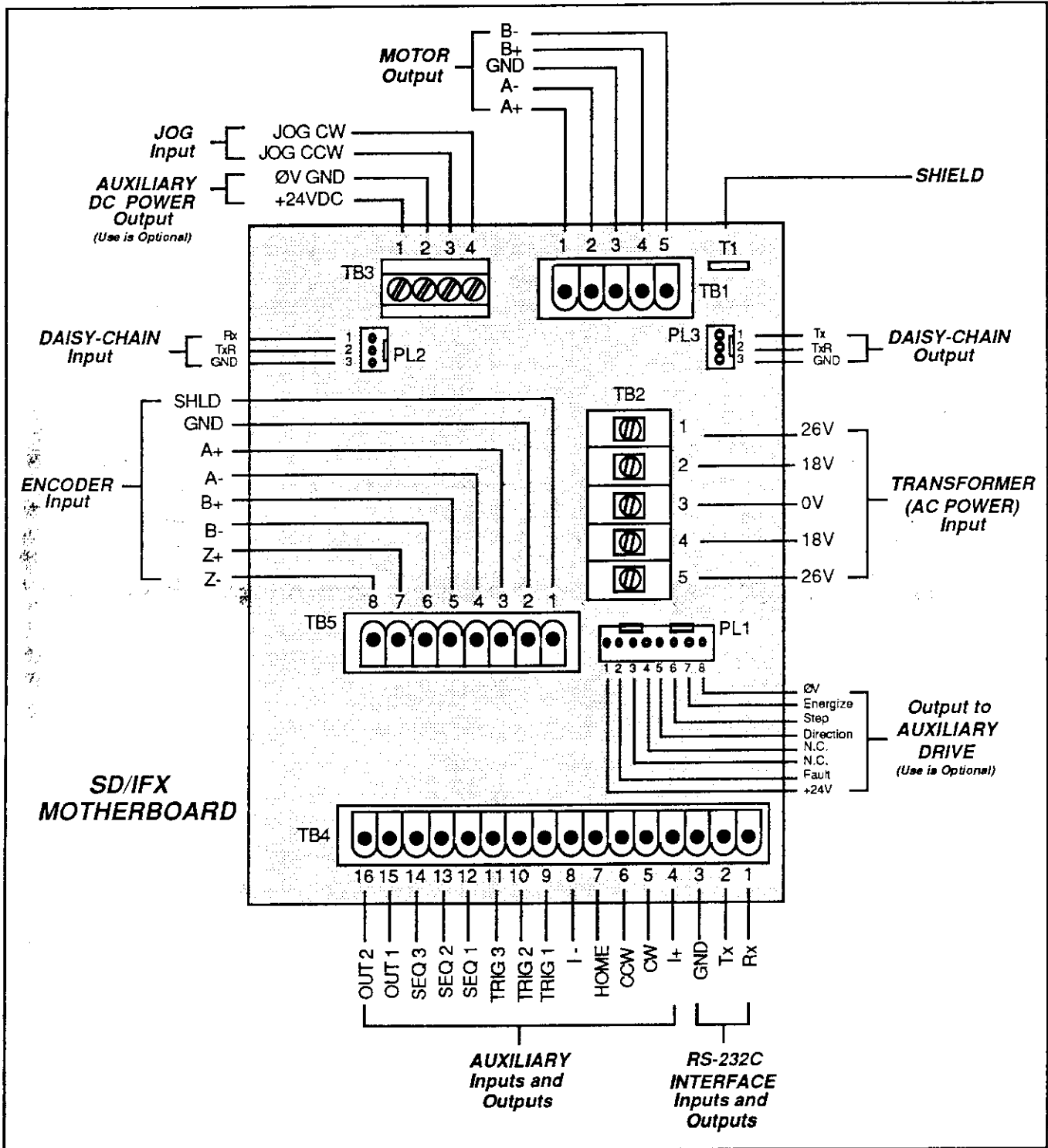


Figure 6-1. SD/IFX Motherboard Pinouts and Connectors

I/O Specifications

The different types of I/O identified in the following tables are as follows:

GROUND = Isolated ground for logic signals.

RS-232C = Standard RS-232C I/O. Optically isolated inside the drive.

SNK = Sinking input. Optically isolated. Requires a ground to activate

OC = Open collector output. Optically isolated.

Interface and I/O (TB4)

Pin	Name	Type	Input/Output	Min. Current	Max. Current	Voltage
1	Rx	RS-232C	Input			
2	Tx	RS-232C	Output			
3	GND	GROUND	Ground			
4	Opto+ (+)	POWER	Output	-----	250mA	12VDC
5	CW	SNK	Input	5mA	100mA	
6	CCW	SNK	Input	5mA	100mA	
7	HOME	SNK	Input	5mA	100mA	
8	Iso. GND (-)	POWER	Output	5mA	100mA	ØVDC
9	TRIG 1	SNK	Input	5mA	100mA	
10	TRIG 2	SNK	Input	5mA	100mA	
11	TRIG 3	SNK	Input	5mA	100mA	
12	SEQ 1	SNK	Input	5mA	100mA	
13	SEQ 2	SNK	Input	5mA	100mA	
14	SEQ 3	SNK	Input	5mA	100mA	
15	OUT 1	OC	Output	12mA	25mA	Vce=70VDC
16	OUT 2	OC	Output	12mA	25mA	Vce=70VDC

Table 6-4. Interface and I/O Specifications

Encoder (TB5)

Pin	Name	Type	Input/Output	Current	Voltage
1	SHLD	SHIELD	Input	-----	-----
2	GND	GROUND	Input	-----	-----
3	A+	SNK	Input	8mA	5VDC (max)
4	A-	SNK	Input	8mA	5VDC (max)
5	B+	SNK	Input	8mA	5VDC (max)
6	B-	SNK	Input	8mA	5VDC (max)
7	Z+	SNK	Input	8mA	5VDC (max)
8	Z-	SNK	Input	8mA	5VDC (max)

Table 6-5. Encoder I/O Specifications

**Jog Inputs/
Aux. DC
Power
Output (TB3)**

Pin	Name	Type	Input/Output	Current	Voltage
1	+24V	POWER	Output	100mA*	18-24VDC
2	0V	POWER	Output	-----	-----
3	JOG CCW	SNK**	Input	-----	-----
4	JOG CW	SNK**	Input	-----	-----

* 100mA max. (TB3 pin 1 and PL1 pin 1 combined)

** This input is not optically isolated.

Table 6-6. Auxiliary DC Power I/O Specifications

Aux. Drive (PL1) (input to Auxiliary Drive connector with respect to the drive)

Pin	Name	Type	Input/Output	Current	Voltage
1	+24V	POWER	Output	100mA*	24VDC
2	Fault	SNK	Output	15mA max	-----
3	Not Used	-----	-----	-----	-----
4	Not Used	-----	-----	-----	-----
5	Direction	OC	Input	12mA	-----
6	Step	OC	Input	16mA	-----
7	Energize	OC	Input	12mA	-----
8	0V	POWER	-----	-----	-----

* 100mA max. (TB3 pin 1 and PL1 pin 1 combined)

Table 6-7. Auxiliary Drive I/O Specifications

Daisy-Chain IN (PL2)

Pin	Name	Type	Input/Output	Current	Voltage
1	Rx	RS-232C	Input	-----	±12VDC max
2	TxR	RS-232C	Output	-----	±12VDC max
3	GND	GROUND	Ground	-----	-----

Table 6-8. Daisy Chain (IN) I/O Specifications

Daisy-Chain OUT (PL3)

Pin	Name	Type	Input/Output	Current	Voltage
1	Tx	RS-232C	Output	-----	±12VDC max
2	TxR	RS-232C	Input	-----	±12VDC max
3	GND	GROUND	Ground	-----	-----

Table 6-9. Daisy Chain (OUT) I/O Specifications

I/O Descriptions

RS-232C Interface	<p>The SD/IFX system uses a simple three-wire implementation of RS-232C serial communication. RS-232C Transmit (Tx), Receive (Rx) and Ground (GND) signals are transmitted via connector TB4 pins 1, 2, and 3. The RS-232C factory default settings are as follows:</p> <ul style="list-style-type: none">• Baud rate: 9,600• Data bits: 8• Stop bits: 1• Parity: none• Echo: OFF (Full Duplex) <p>The IFX does not support handshaking in any form.</p>
Opto + (I+)	<p>This output (pin 4) provides +12VDC. It is not intended to power external peripheral devices. It is an internal supply that powers all of the IFX's Auxiliary I/O. An LED may be connected between OPTO + and a programmable output for visual verification of the output.</p>
CW and CCW	<p>Pins 5 and 6 on TB4 are the Clockwise and Counterclockwise end-of-travel limit inputs. The CW and CCW limit inputs are activated in the high state and require a normally closed load-activated switch to Isolated ground (I-). When either the CW or CCW limit switch inputs go active the motor is brought to an immediate halt (no deceleration). These inputs therefore prevent the load from crashing into a mechanical stop and damaging equipment or hurting personnel. These inputs are optically isolated to improve the IFX's noise immunity.</p> <p><i>NOTE: Compumotor ships the IFX indexer from the factory with the CW and CCW limits enabled. This means that the motor will not run unless you issue the Limit Disable (LD3) command.</i></p>
Home	<p>You can use the home input (TB4 pin 7) to establish a home reference position. The Home limit input on the IFX is optically isolated, and is normally high. A normally open, load-activated switch to Isolated GND is the most common way for determining the home position. You can initiate the Go Home function by issuing the Go Home (GH) command.</p>
Isolated GND (I-)	<p>This input (TB4 pin 8) provides a common ground for CW, CCW, Home limit inputs, Trigger inputs, and Sequence Select inputs (pins 5 - 7 and 9 - 14).</p>
TRIG1, TRIG2, and TRIG3	<p>These triggers (TB4 pins 9 - 11) are optically isolated inputs. They are normally open (no current flowing). To activate the Trigger inputs, you need to close the Trigger input to Isolated GND. These inputs are used in conjunction with the Trigger (TR) command.</p>

**SEQ1,
SEQ2, and
SEQ3**

These sequence inputs (TB4 pins 12 - 14) are optically isolated and are normally open (no current flows). To activate a sequence input, you need to close the sequence input switch to Isolated GND. The sequence configuration must be stable for 50 msec to be recognized by the IFX. You can use these inputs to execute sequences with a PLC or in conjunction with the **XP** command.

**OUT1 and
OUT2**

These are optically-isolated open-collector outputs (TB4 pins 15 and 16). They are normally off (no current flows). When these inputs are on (conducting current), they can each sink up to 12mA of current. You can control these inputs with the **O** command.

Outputs #1 and #2 are the collector of a transistor, and Iso. GND (I-) is the logic ground connected to the emitter of the output transistors. You must use a pull-up resistor when powering these outputs.

**Encoder
Inputs**

These are optically isolated TTL (0-5VDC) inputs (TB5 pins 1 - 8) that receive A+, A-, B+, B-, Z+, and Z- pulses from a differential or a single-ended incremental encoder. Encoders with open-collectors may require pull-up resistors.

**Motor
Outputs**

Table 6-10 contains output power (via SD/IFX motherboard connector TB1) designations for the motor.

Function	Motor Connector Pin #	Color
A+	1	Red
A-	2	Black
GND (Earth)	3	Shield
B+	4	White
B-	5	Green

Table 6-10. Output Wiring to the Motor

**Auxiliary
Drive
Outputs**

Connector PL1 provides eight IFX or SD-generated drive control outputs to control an auxiliary drive external to the SD/IFX Motherboard configuration. Because these eight control signals are transmitted between the IFX and the SD drive within the SD/IFX motherboard circuitry, *PL1 is not normally used in the SD/IFX system.* You may, however, use PL1 if you need to slave another SD drive to the same IFX indexer. The connection is made with an 8 pin ramped connector. The eight drive control signals are as follows:

- Pin 1 = +24 Volts
- Pin 2 = Fault
- Pin 3 = *Not Connected*
- Pin 4 = *Not Connected*
- Pin 5 = Direction
- Pin 6 = Step
- Pin 7 = Energize
- Pin 8 = \emptyset V

Jog Inputs

Pins 3 and 4 on TB4 are the clockwise and counter-clockwise jog inputs. The CW and CCW jog inputs are activated in the low state and require a normally open contact to ground (Pin 2). When either the CW or CCW jog inputs are activated, the motor moves in the specified direction. The direction of rotation (CW or CCW) is determined while facing the front of the motor. The jog inputs allow you to move the motor without using software commands. *NOTE: When you use these inputs, the IFX is not aware of the change in position.*

CAUTION

These inputs are not optically isolated; consequently you should take precautions against electrical noise.

I/O Circuit Diagrams

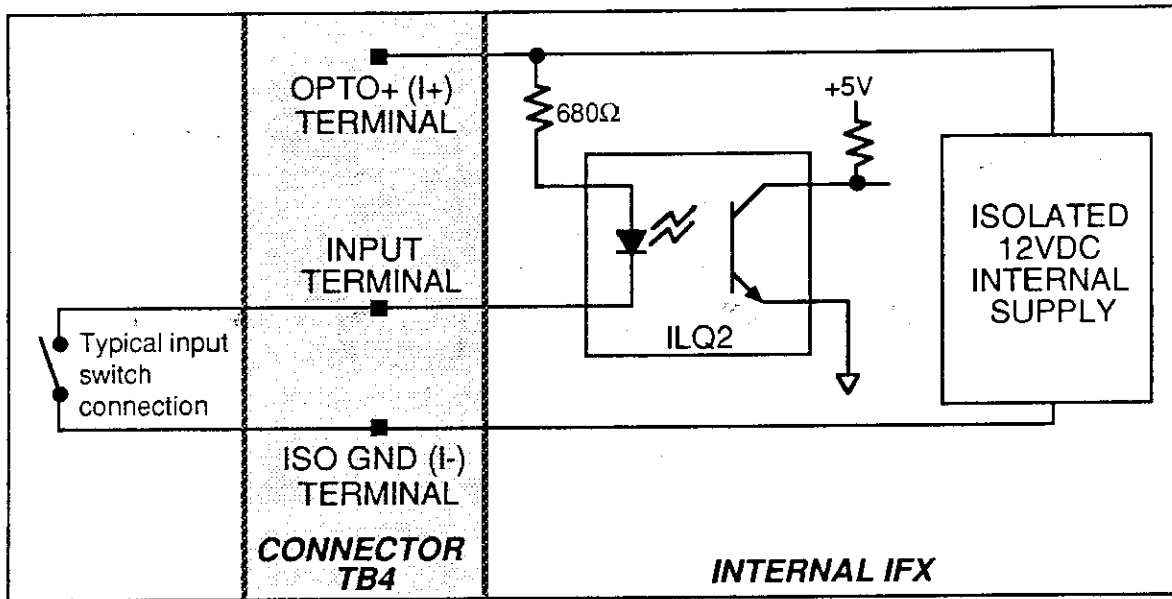


Figure 6-2. Typical Input Circuit

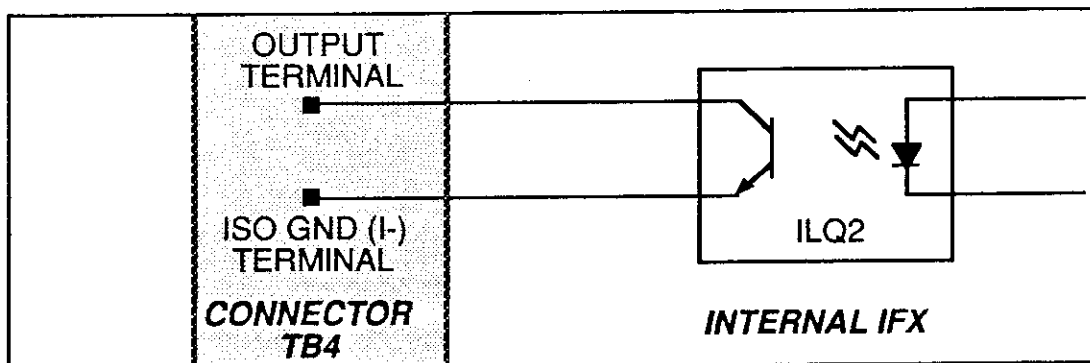


Figure 6-3. Typical Output Circuit

I/O Wiring Diagrams

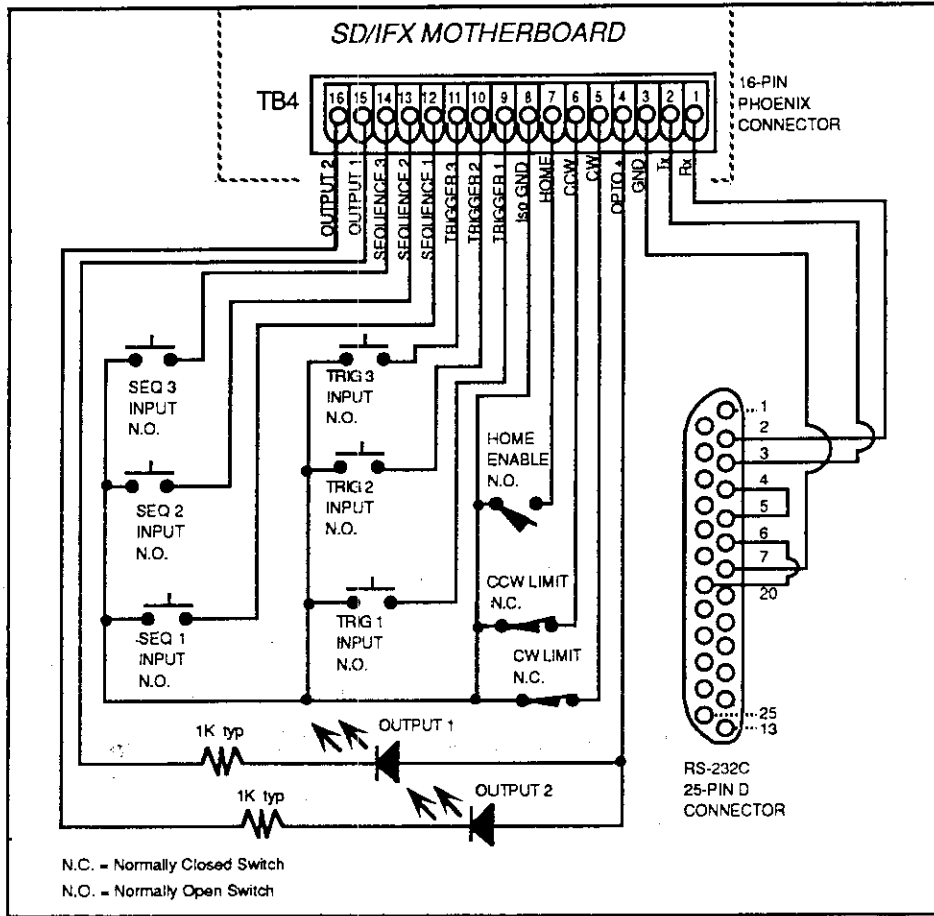


Figure 6-4. RS-232C Interface and I/O Wiring Diagram

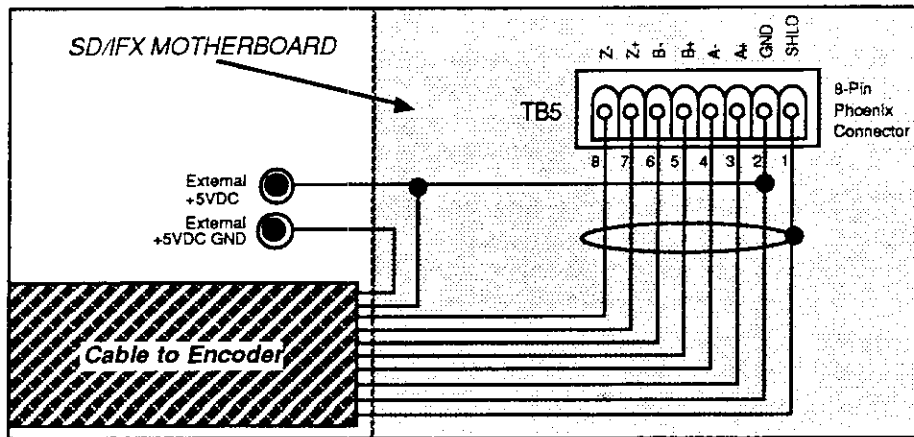


Figure 6-5. Sample Encoder I/O Wiring Diagram

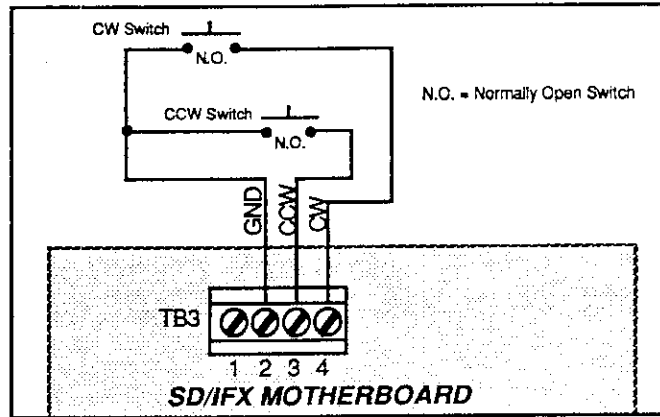


Figure 6-6. Jog I/O Wiring Diagram

Sequence Selection Table

The IFX allows the user to define up to 7 sequences, identified by the the numbers 1 - 7. Using the **XP** command or a PLC, you can execute pre-defined sequences 1 - 7 depending on the configuration of the three sequence select inputs as shown in Table 6-11.

Sequence	SEQ 1	SEQ 2	SEQ 3
1	ON	ON	ON
2	OFF	ON	ON
3	ON	OFF	ON
4	OFF	OFF	ON
5	ON	ON	OFF
6	OFF	ON	OFF
7	ON	OFF	OFF
8*	OFF	OFF	OFF
* Non-valid sequence			
OFF = open switch (not pulled to ground) ON = closed switch (pulled to ground)			

Table 6-11. Sequence Selection Table

Factory Default Settings

This section provides the SD/IFX system default settings as well as the optional settings.

SD Drive DIP Switch Settings

Motor Current (Switches 1 - 4)

Table 6-12 below shows the settings of motherboard switches 1-4 for RM Series motor currents. Table 6-13 provides the full range of current setting for motors not supplied by Compumotor. The values shown in both tables are two-phase-on levels, and are nominal values in that they depend on motor inductance. *When selecting the current, be sure not to exceed the current rating of the motor.*

Motor	Drive Current	Applicable Drives	SW1	SW2	SW3	SW4
RM57 - 51 (Series)	1.4A	SD2	OFF	ON	OFF	ON
"	1.5A	SD3	ON	OFF	OFF	OFF
RM57 - 51 (Parallel)	2.0A	SD2	OFF	OFF	OFF	OFF
"	2.7A	SD3	OFF	OFF	OFF	ON
RM57 - 83 (Series)	1.4A	SD2	OFF	ON	OFF	ON
"	1.5A	SD3	ON	OFF	OFF	OFF
RM57 - 83 (Parallel)	2.0A	SD2	OFF	OFF	OFF	OFF
"	2.7A	SD3	OFF	OFF	OFF	ON
RM57 - 102 (Series)	2.0A	SD2	OFF	OFF	OFF	OFF
"	3.0A	SD3	OFF	OFF	OFF	OFF
RM57 - 102 (Parallel)	2.0A	SD2	OFF	OFF	OFF	OFF
"	3.0A	SD3	OFF	OFF	OFF	OFF
RM83 - 62 (Series)	2.1A	SD3	OFF	ON	OFF	ON
RM83 - 62 (Parallel)	3.0A	SD3	OFF	OFF	OFF	OFF
RM83 - 93 (Series)	2.7A	SD3	OFF	OFF	OFF	ON
RM83 - 93 (Parallel)	3.0A	SD3	OFF	OFF	OFF	OFF

Table 6-12. Motor Current DIP Switch Settings (Compumotor-Supplied Motors)

Nominal Current		DIP Switch Settings			
SD2	SD3	SW1	SW2	SW3	SWS4
2.0A	3.0A	OFF	OFF	OFF	OFF
1.8A	2.7A	OFF	OFF	OFF	ON
1.6A	2.4A	OFF	OFF	ON	OFF
1.4A	2.1A	OFF	ON	OFF	ON
1.2A	1.8A	OFF	ON	ON	ON
1.0A	1.5A	ON*	OFF*	OFF*	OFF*

* Factory Default Setting

Table 6-13. Motor Current DIP Switch Settings (Full Range)

Jumper Settings

- Master Drive** Located on the SD drive card, Jumper LK1 is factory-installed. **DO NOT REMOVE THIS JUMPER.**
- Slave Drive** Jumper LK2 is never installed. **DO NOT INSTALL THIS JUMPER.** Installing this jumper greatly increases sensitivity to electrical noise.
- Full/Half-Step Modes** Jumper LK3 is located on the drive card. With this jumper installed, the drive will function in the full-step mode, producing 200 steps/rev. When this jumper is not installed, the drive will function in the half-step mode, producing 400 steps/rev. The half-step mode is preferred in most applications, the slight torque loss being offset by smoother operation at low speeds; consequently, the drive is shipped from the factory with this jumper not installed.
- Energize** Jumper LK4 is located on the drive card. With this jumper installed, the drive will remain energized and the Shutdown (ST) command will have no effect on the drive. When Jumper LK4 is not installed, the Shutdown command will affect the drive. The SD drive is factory-configured with this jumper installed.
- Daisy-Chain Circuit** SD/IFX systems ordered with multiple IFX units are factory-wired in a daisy-chain. Jumper LK2 on the back of the SD/IFX motherboard is factory-set to position **B** on all units except for the last unit in the chain (LK2 of the last unit is set to position **A**).
- Device Address** Table 6-14 provides the default and optional device address settings for Jumpers JU1, JU2, and JU3 on the IFX indexer card (single-axis). Daisy-chained units are factory set with the appropriate address. The SD/IFX unit closest to the left side of the rack (as viewed from the back) is given address 1.

Address	JU1	JU2	JU3
1	ON*	ON*	ON*
2	OFF	ON	ON
3	ON	OFF	ON
4	OFF	OFF	ON
5	ON	ON	OFF
6	OFF	ON	OFF
7	ON	OFF	OFF
8	OFF	OFF	OFF

* Factory Default Setting

Table 6-14. IFX Address Settings

Baud Rate

Table 6-15 shows the default baud rate settings for Jumpers JU4, JU5, JU6, and JU7 on the IFX indexer card.

Baud Rate	JU4	JU5	JU6	JU7
9,600	OFF*	OFF*	OFF*	ON*
4,800	ON	OFF	OFF	OFF
2,400	OFF	ON	OFF	OFF
1,200	OFF	OFF	ON	OFF

* Factory Default Setting

Table 6-15. Indexer Baud Rate Jumper Settings

**Transformer Wiring
(Compumotor-Supplied Transformers)**

The SD/IFX system may be equipped with one of the following transformer models. The transformer used in your system depends on your application.

- Model TO116 - 100VA
- Model TO119 - 300VA
- Model TO120 - 450VA

Input power to and output power from the transformer are AC. The drive receives AC power from the transformer via TB2 on the SD/IFX motherboard. Each of these transformers for the SD/IFX system is factory set to operate with 110VAC input power (see Figure 6-7). If your application requires different supply voltages, use Table 6-16 to select a proper wiring arrangement.

CAUTION

Always wire the transformer first, then check the secondary output voltages on open-circuit **BEFORE** you connect the transformer to the SD/IFX motherboard. *Note: Be sure to connect the AC ground (GND) to SCN (Earth Ground).*

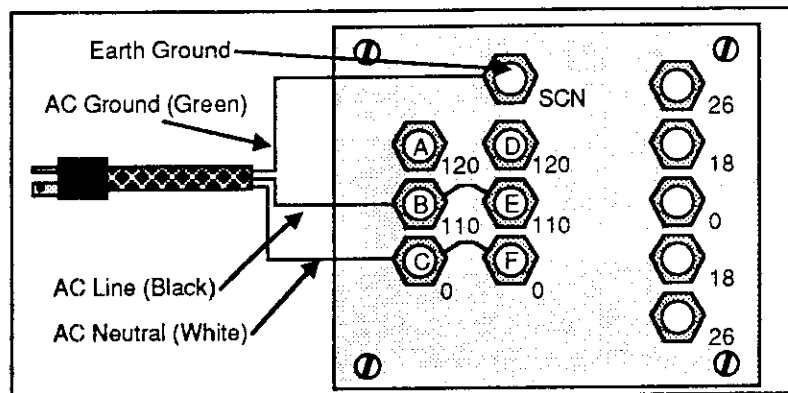


Figure 6-7. Transformer Wiring (Showing Factory Setting)

Input Voltage	Connect AC Line to:	Connect AC Neutral to:	Connect Studs:
110*	B	C	B&E; C&F
120	A	C	A&D; C&F
220	B	F	C&E
230	A	F	C&E
240	A	F	C&D

* Factory Setting

Table 6-16. Default and Optional Transformer Settings

Dimensional Drawings

SC Rack

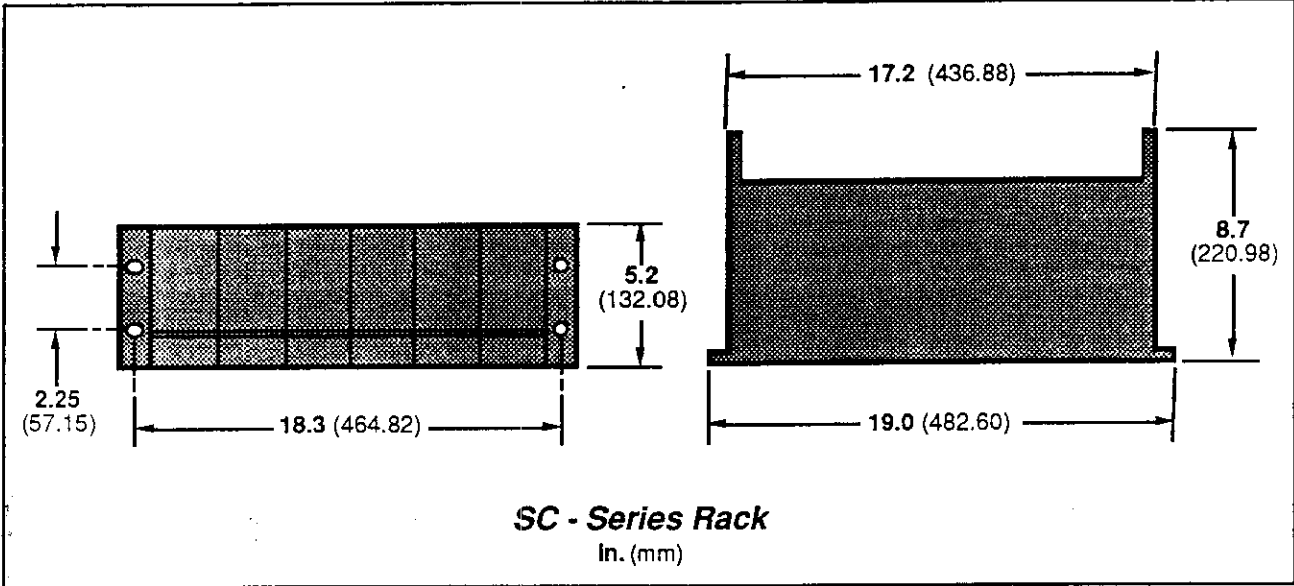


Figure 6-8. SC Rack Dimensions

Transformers

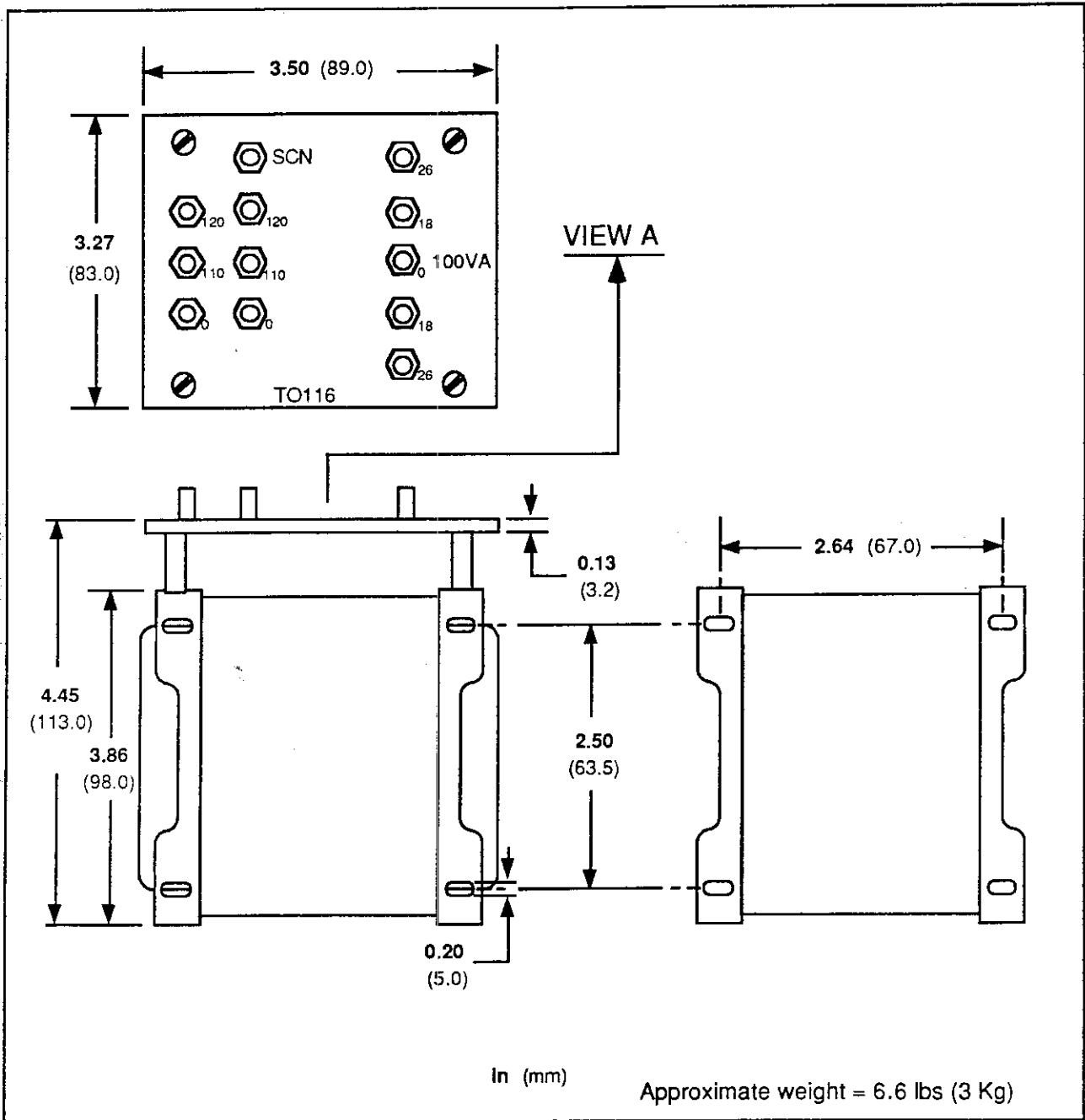


Figure 6-9. Transformer Model TO116 Dimensions

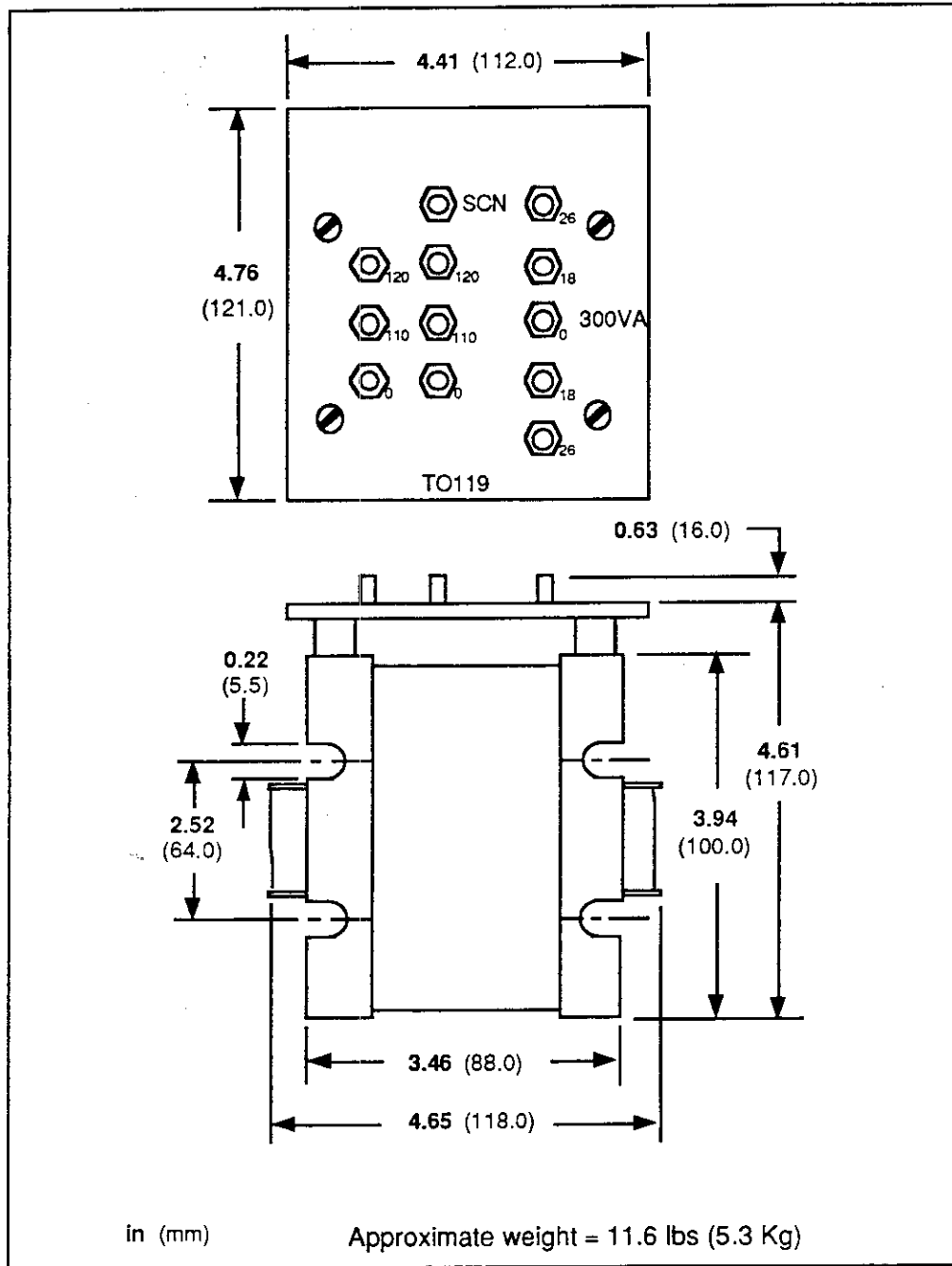


Figure 6-10. Transformer Model TO119 Dimensions

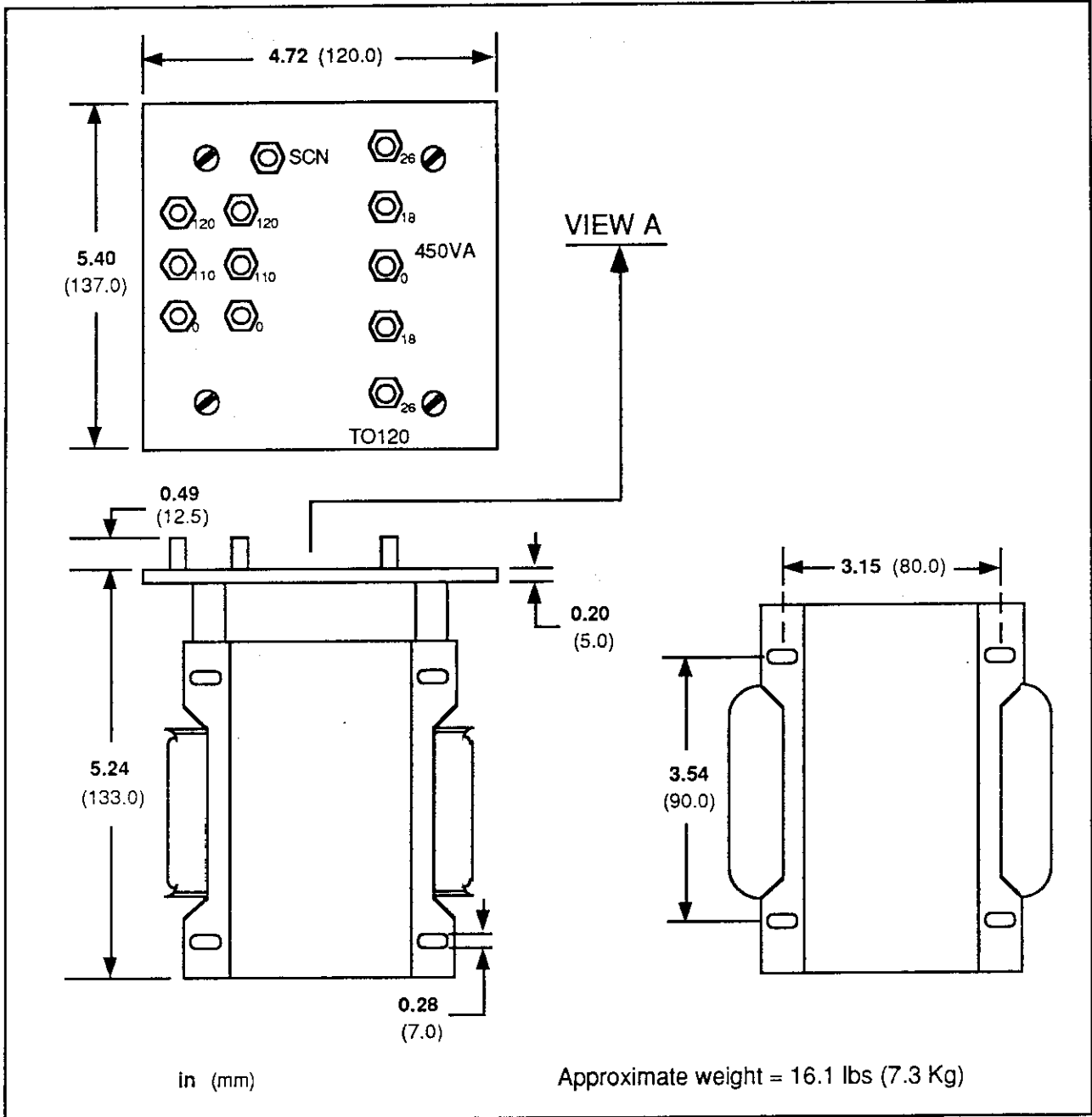


Figure 6-11. Transformer Model TO120 Dimensions

Motors

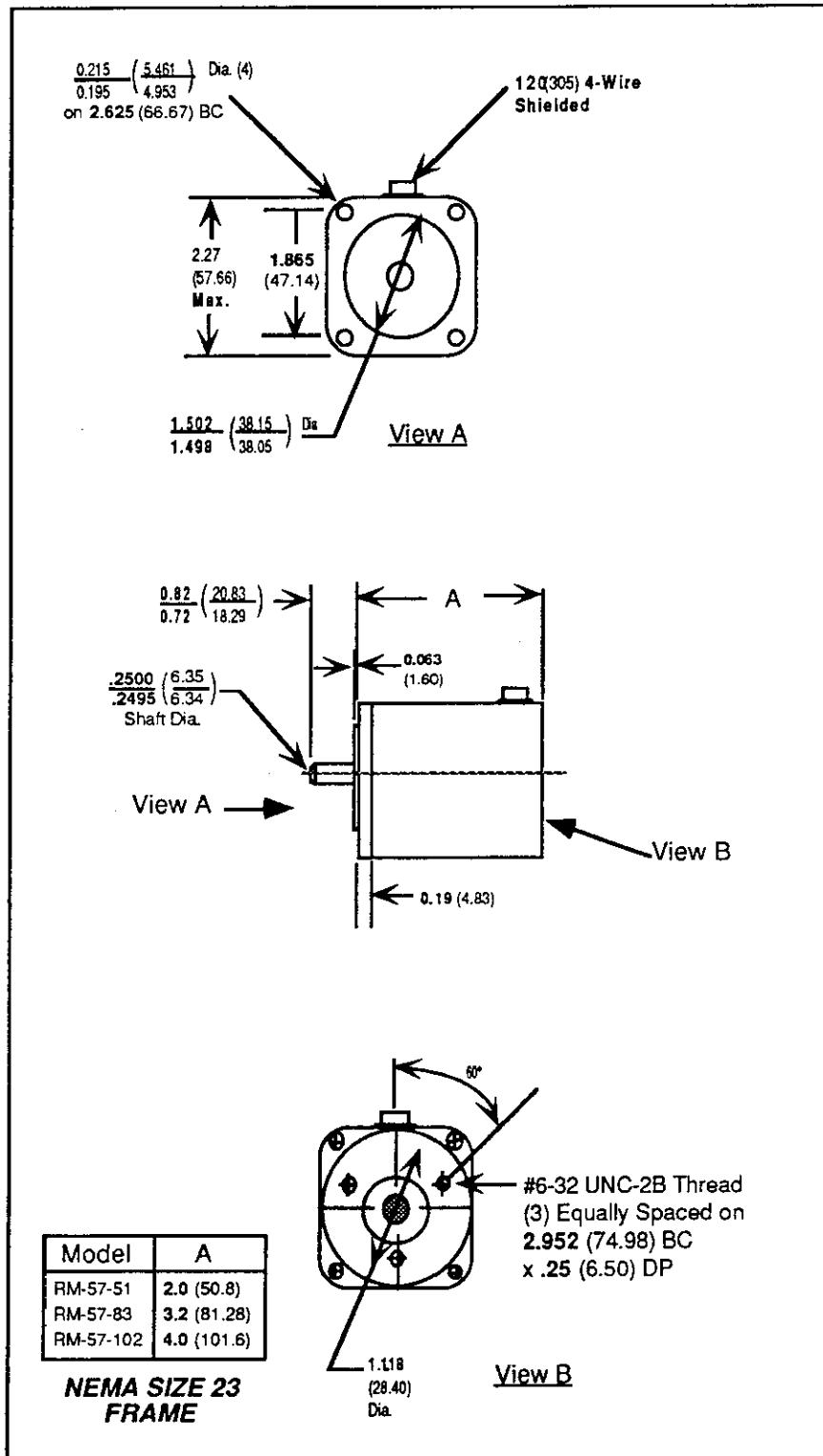


Figure 6-12. NEMA Size 23 Motor Dimensions

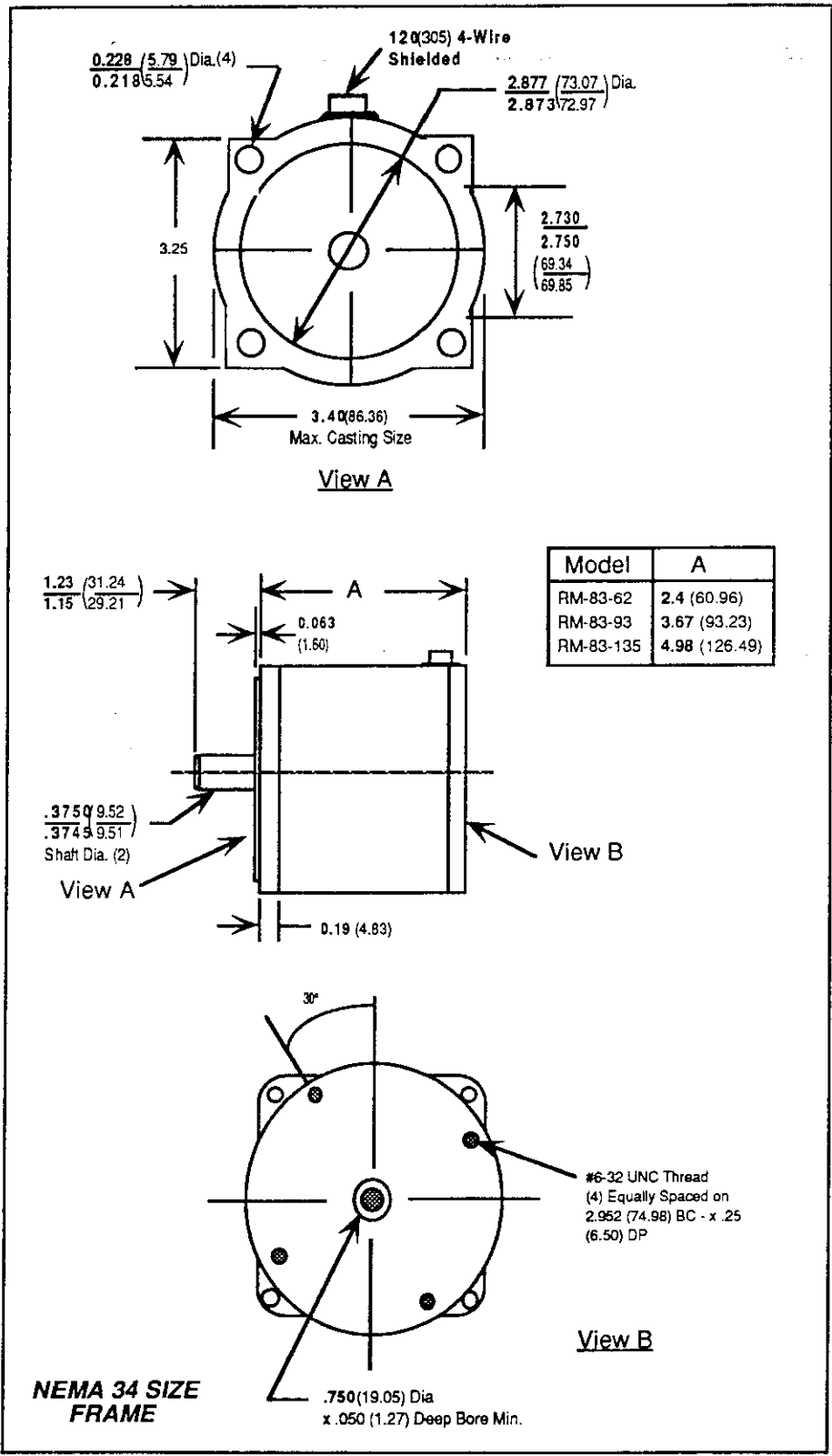


Figure 6-13. NEMA Size 34 Motor Dimensions

Torque/Speed Curves

