TL820 Automated Tape Library for DLT Cartridges

Field Service Manual

EK-TL820-SV

Revision A02

EK-TL820-SV, Revision A02, May 1, 1995, Made in USA.

FCC STATEMENT

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Any changes or modifications made to this equipment may void the user's authority to operate this equipment.

Operation of this equipment in a residential area may cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CISPR-22 WARNING!

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

ACHTUNG!

Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in welchen Fällen der Benutzer für entsprechende Gegenmassnahmen verantwortlich ist.

ATTENTION!

Ceci est un produit de classe A. Dans un environment domestique, ce produit peat causer des interférences radio lectriques. Il appartienl alors a l'utilisateur de prendre les mesures appropriées.

NOTICE FOR USA AND CANADA ONLY

If shipped to USA, use the UL LISTED power cord specified below for 100-120 V operation. If shipped to CANADA, use the CSA CERTIFIED power cord specified below for 100-120V operation.

Plug Cap	Parallel blade with ground pin (NEMA 5-15P Configuration)
Cord	Type: SJT, three 16 or 18 AWG wires
Length	Maximum 15 feet
Rating	Minimum 10 A, 125 V

ATTENTION

LIRE LA REMARQUE DANS LE MODE D'EMPLOI

REMARQUE

CETTE REMARQUE NE CONCERNE QUE LES ÉTATS-UNIS ET LE CANADA.

En cas d'envoi aux États-Unis, utiliser le cordon d'alimentation certifié UL et convenant pour 100-120 V.

En cas d'envoi au CANADA, utiliser le cordon d'alimentation CERTIFIÉ CSA et convenant pour 100-120 V.

Fiche	Broches paralléus avec une broche de mise à la terre (configuration NEMA 5-15P)
Cordon	Type: SJT, trifilaire 16 ou 18 AWG
Longeur	Maximum 15 pieds
Capacité	Minimum 10 A, 125 V

ZU IHRER SICHERHEIT

Vorsicht

Um Feuergefahr und die Gefahr eines elektrischen Schlages zu vermeiden. darf das Gerät weder Regen noch Feuchtigkeit ausgesetzt werden.

Um einen elektrischen Schlag zu vormeiden, darf das Gehäuse nicht geöffnet werden. Überlassen Sie Wartungsarbeiten stets nur einem Fachmann.

Achtung

Da der interne Laserstrahl in lhre Augen eindringen und Verletzungen verursachen kann, darf das Gehäuse nicht selbst geöffnet werden. Überlassen Sie Wartungearbeiten stets nur einem Fachmann.

Die Verwendung von Brillen, Kontaktlinsen usw.vergrössert die Gefahr.

Zur besonderen Beachtung

Zur Sicherheit

Sollte ein fester Gegenstand oder Flüssigkeit in das Geräteinnere gelangen, trennen Sie das Gerät von der Wandsteckdose ab und lassen Sie es von einem Fachmann überprufen, bevor Sie es weiter verwenden.

Zum Abziehen des Kabels fassen Sie stets am Stecker und niemals am Kabel selbst an.

Zur Aufstellung

Stellen Sie das Gerät weder auf einer weichen Unterlage (z. B. Decke, Teppich) noch in der Nahe von Vorhangen, Tapeten usw, auf, da hierdurch die Ventilationsöffnungen blockiert werden können.

Zur Reiningung

Verwenden Sie zur Reiningung des Gehäuses, des Bedienungspultes und der Bedienungselemente ein trockenes, weiches Tuch oder ein weiches, leicht mit mildem Haushaltsreiniger angefeuchtetes Tuch. Lösemittel wie Alkohol oder Benzin dürfen nicht verwendet werden, da diese die Gehäuseoberfläche ungreifen.

LASER STATEMENT

CLASS 1 LASER PRODUCT

CAUTION - This product contains a Class II laser. Laser light - DO NOT stare into beam. Avoid Exposure - Laser Light is emitted from the barcode scanner.

CAUTION - Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous exposure.

LASER KLASSE 1

VORSICHT : Dieses Produkt Enthdlt Einen Laser Der Kategorie II. Laserstrahlen - Der Strichcode-scanner Gibt Laserstrahlen aus. VERMEIDEN SIE jeden Blickkontakt und direkten kvrperlichen Kontakt mit diesen Strahlen.

VORSICHT : Ein nicht ordnungsgemd_er (siehe hier enthaltene Anweisungen) Einsatz bzw. Dnderungen der Betriebsleistung kvnnen einen gesundheitsgefdhrdenden Kontakt zur Folge haben.

APPAREIL À LASER DE CLASSE 1

ATTENTION : ce produit relhve de la classe laser II. Rayonnement laser - NE PAS fixer des yeux le rayon. Eviter les expositions - Le rayonnement laser est imis‘ partir du lecteur optique de code barre.

ATTENTION : L’utilisation de contrtles ou d’ajustements de performance des procidures autres que ceux indiquis ici peut entranner une exposition dangereuse.

PRODUCTO LÁSER DE CLASE 1

!ATENCISN! Este producto contiene laser de clase II. Luz laser - NO mire el rayo. Evite la exposicisn: la luz laser se emite desde el explorador de csdigo de barras.

!ATENCISN! El uso de los controles o ajustes para realizar procedimientos diferentes de los espicificados aqum puede provocar una exposicisn peligrosa.

LUOKAN 1 LASERLAITE

ATTENZIONE: questo prodotto emette una luce laser di Classe II. NON guardare il facsio di luce ed evitare di esporsi alla fonte del laser. Il fascio di luce laser h emesso dal dispositivo di scansione del codice a barre.

ATTENZIONE: l’uso di comandi o regolazioni per eseguire le procedure che non siano quelli specificati in questa documentazione pur causare rischi all ‘incolumit’ delle persone.

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Introduction 1

Purpose

The *TL820 Field Service Manual* contains information about the TL820 Automated Cartridge Library for Field Service Engineers (FSE) to service the library.

- Section 2,“Overview”, provides a system overview, including general system operation, theory of operation and detailed descriptions of the major components of the TL820.
- Section 3, “Replacement Procedures”, provides remove and replace procedures for all Field Replaceable Units (FRUs).
- Section 4, “Fault Isolation”, provides Maintenance Analysis Procedures (MAPS) for isolating faults to the FRU level.
- Section 5, “Adjustments and Alignments”, provides adjustment and alignment procedures and Periodic Maintenance (PM) for the library.
- Appendices provide tool requirements, cable diagrams and cartridge bin numbers.

Conventions Used in this Guide

WARNING ***Paragraphs marked by the warning icon indicate potential hazards to personal safety and are included to prevent injury.***

CAUTION ***Paragraphs marked by the caution icon indicate potential hazards to equipment and are included to prevent damage to equipment.***

The abbreviation “lb.” is used to indicate U.S. pounds for measurement of weight. Metric equivalents are also included for any measurement of weight.

The symbol ° is used to indicate measurement of temperature in degrees and measurement of angles in degrees. Measurements of temperature are provided in both Fahrenheit and Centigrade.

The symbol “is used to indicate a measurement of distance in inches, and the symbol ' is used to indicate a measurement of distance in feet. Metric equivalents are also included for any measurement of distance.

References

Documentation and contacts

To obtain further information and/or copies of documentation on this product, contact:

U.S. Software Supply Business
Digital Equipment Corporation
10 Cotton Road

Nashua, New Hampshire 03063-1260

The part number of each document will be required at the time of order.

Table 1: TL820 documentation

Document Number	Document Title	Document Description
EK-TL820-OP	TL820 Operator's Guide	This guide defines the control functions, operational procedures and end user maintenance procedures for the TL820 library.
EK-TL820-PG	TL820 Facilities Planning and Installation Guide	This manual describes facility requirements and provides procedures for first-time installation of a single library.
EK-TL820-SM	TL820 Diagnostic Software User's Manual	This manual describes how to install and use the TL820 Diagnostic Software Package, developed for field service personnel.

SCSI II specification

This Small Computer System Interface II communications specification is the proposed American National Standard for information systems, dated March 9, 1990. Copies may be obtained from:

Global Engineering Documents
2805 McGaw
Irvine, CA 92714
(800) 854-7179 or (714) 261-1455

TL820 Overview 2

System Block Diagram

The principal functional components of the TL820 library are the following:

- actuator driver PWA
- barcode scanner assembly
- carousel motor drive assembly
- extension axis assembly
- inport/outport device
- multi-unit controller
- pass-through mechanism
- robotic controller PWA
- vertical motor

Figure 1 on page 2-4 depicts the system at its most basic level. “Principles of Operation” on page 2-5 addresses the components outlined in Figure 1 in greater detail.

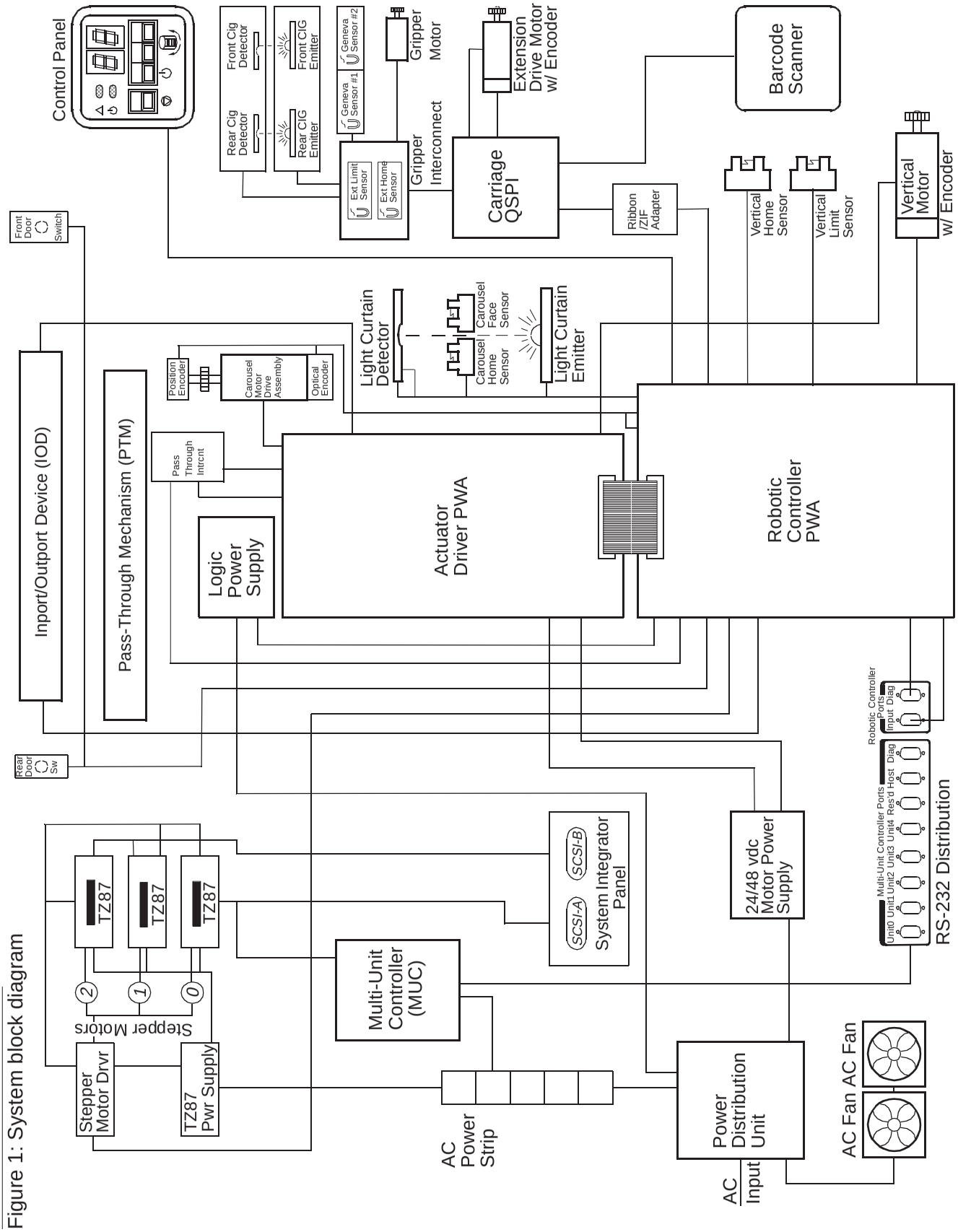


Figure 1: System block diagram

Principles of Operation

The component placement drawings (Figure 2 through Figure 4) show the physical location of most of the major components discussed in this section.

Figure 2: TL820 front view

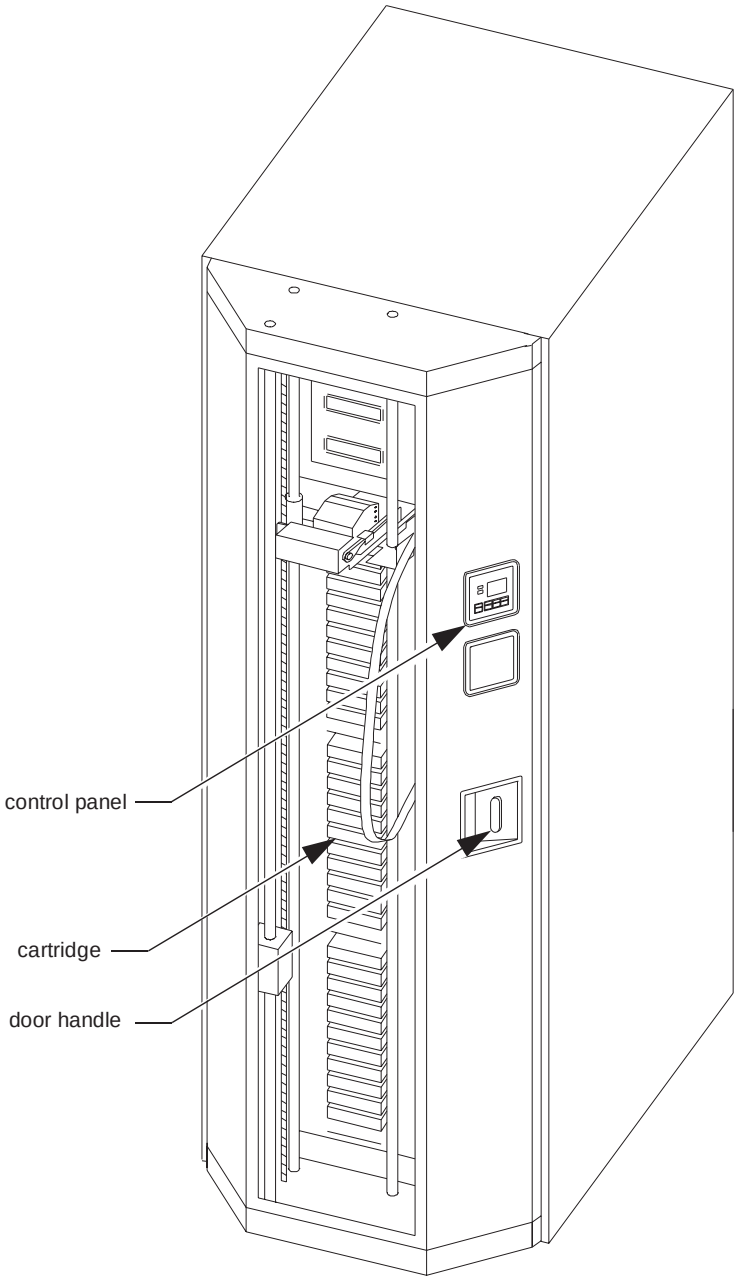


Figure 3: TL820 with door open

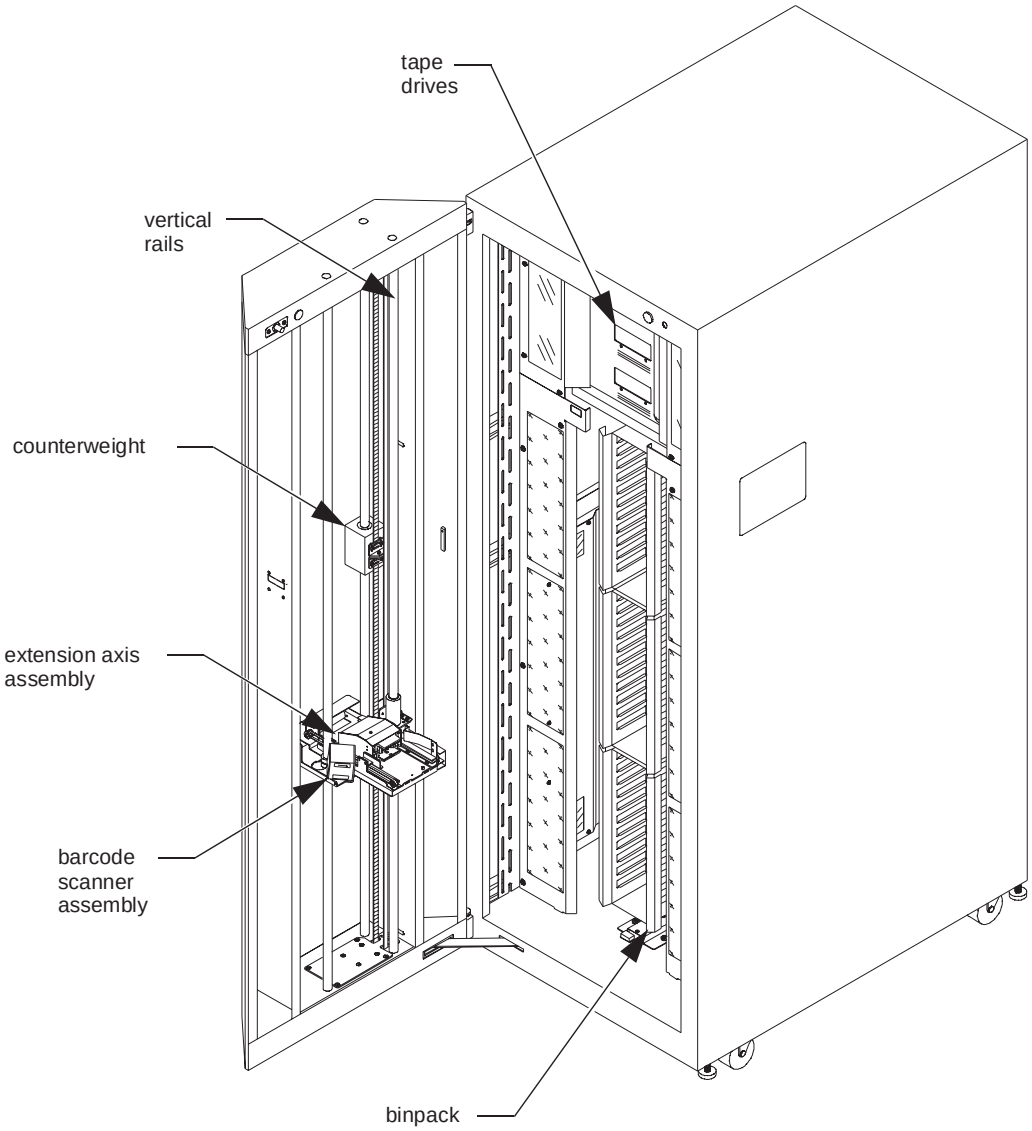
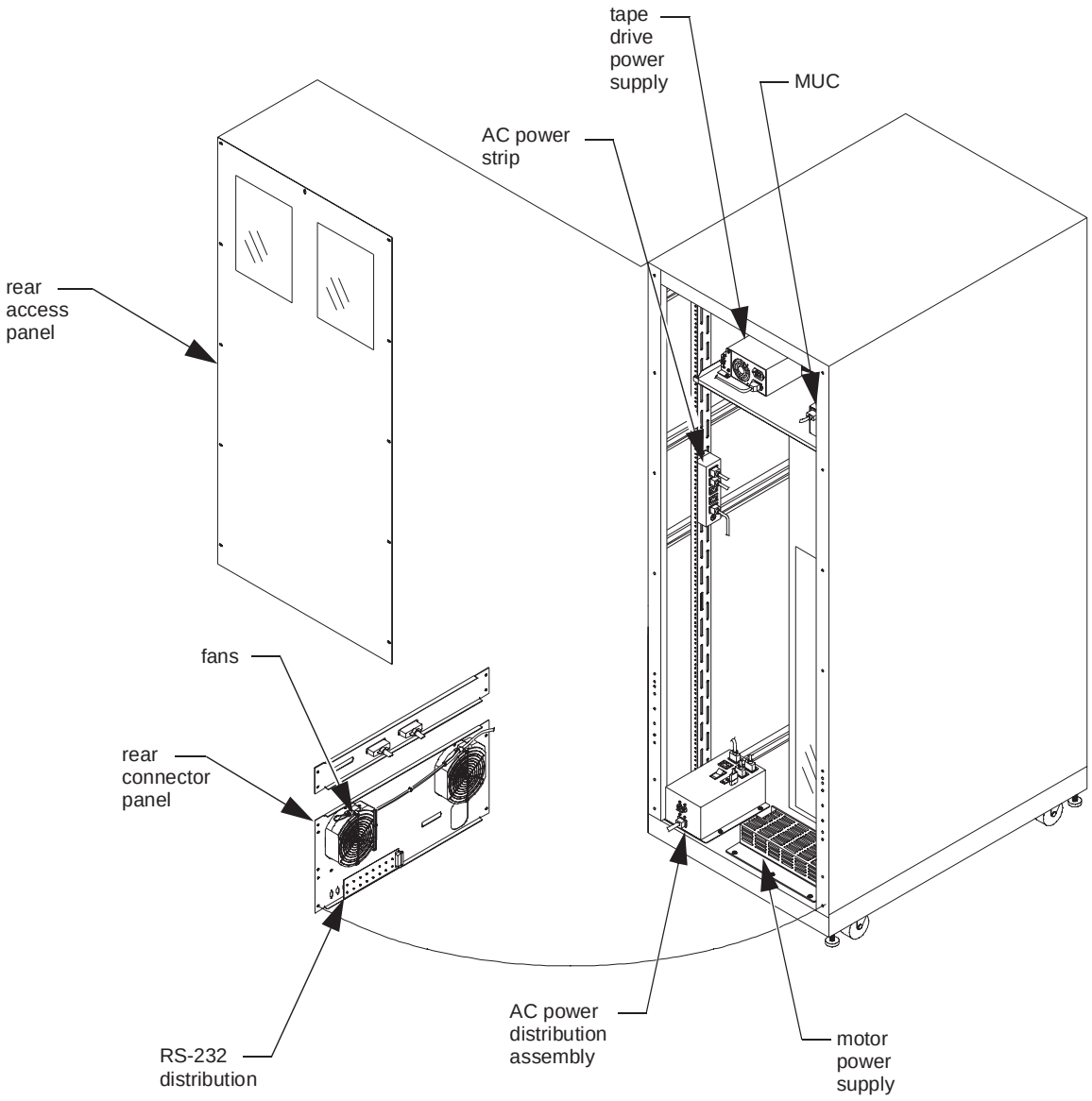


Figure 4: TL820 rear view



AC Power Distribution Assembly

The AC power distribution assembly, located in the rear of the cabinet, consists of the following components:

- IEC-320 AC power distribution unit, which is located in the rear, on the base of the cabinet.
- IEC-320 AC power strip, which is located in the rear along the left side of the cabinet.
- interconnecting power cable.

AC Power Distribution Unit

The AC power distribution unit operates with inputs of 115 VAC or 230 VAC. The fan power output is manually switched to operate on 115 VAC or 230 VAC. The input range switch for the fans is located on the top of the power distribution unit next to the power connector for the fans.

The AC power distribution assembly has two 10 amp circuit breakers that are connected in series:

- The primary circuit breaker is on the power distribution unit and is easily accessible from outside of the cabinet.
- The secondary circuit breaker is on the power strip and is not intended for access from outside of the cabinet.

The AC power distribution assembly has one on/off switch located on the top of the power distribution unit that is only accessible from inside the cabinet. There are a total of seven AC output receptacles available for use in the AC power distribution assembly not including the power receptacle for the fans.

The three AC receptacles located on the power distribution unit provide power to:

- the motor power supply
- the logic power supply
- one spare

The four AC receptacles located on the power strip provide power to:

- the tape drive power supply
- the Multi-Unit Controller (MUC)
- two spares

Fans

There are two AC fans located in the bottom rear of the cabinet. A filter is part of the fan assembly and requires scheduled routine maintenance.

Motor Power Supply

The motor power supply is located in the rear, on the base of the cabinet. The one DC power supply accommodates both +24 VDC and +48 VDC requirements. The power supply is self sensing for inputs of 115 VAC or 230 VAC.

Multi-Unit Controller (MUC) Assembly

The Multi-Unit Controller (MUC) is located in the rear, on the right side of tape drive shelf.

The MUC functions in the following capacities:

- When the host computer sends robotics control commands across the SCSI bus, the MUC picks the commands and converts them to RS-232C signals, then passes them on to the robotic controller via the MUC RS-232C distribution panel. Likewise, when RS-232C signals are returned from the robotic controller, the MUC converts them to SCSI signals for transmission to the host. The MUC communicates with the robotic controller at 9600 baud.
- Because the host communicates via a SCSI interface to the TL820, it does not accept unsolicited responses until it sends a “request sense” command. The MUC buffers all unsolicited responses as they are generated from the library, and sends them when the host sends a request.
- In a multi-unit library configuration, the MUC “distributes” robotic controller command signals to the correct library in the configuration via the MUC RS-232C distribution panel along with the logical unit number configured for each library.

RS-232 Distribution PWA

The RS-232 distribution PWA, located at the rear of the cabinet at the bottom, center of the fan/connector panel, is cabled to the MUC at connector J1 (25 pin).

There are eight 9-pin RS-232C distribution ports:

- Unit 0 through Unit 4, connect the MUC to each library (up to 5) in a multi- unit library configuration.
- Reserved port (the 6th port) is reserved for future use.
- HOST connects the library to the host computer if communicating RS-232C.
- DIAG connects the library to a remote PC for sending external diagnostics commands to the MUC.

Logic Power Supply

The logic power supply, located in the electronics housing on the front left inside panel of the cabinet, is a 45 watt supply with automatic sensing of 115 VAC or 230 VAC input at 50/60 hertz.

Outputs of +5 VDC and ±15 VDC are used to power logic on all of the electronic PWAs in the library with the exception of the stepper motor driver PWA. The stepper motor driver PWA uses only the ±15 VDC. The stepper motor driver receives its +5 VDC logic power from a different power supply, which is discussed in the tape drive power supply section.

Robotic Controller PWA

The robotic controller PWA, located in the electronics housing on the front left inside panel of the cabinet, interfaces either directly or indirectly to all of the electronics in the TL820.

The interface I/O on the robotic controller consists of the following:

- analog inputs
- analog outputs
- digital inputs
- digital outputs
- quadrature encoder inputs
- RS-232 communication ports
- Queued Serial Peripheral Interface (QSPI)

The robotic controller tracks and controls all of the actuators in the library by responding to RS-232C commands from a host computer or RS-232C commands through the diagnostic port.

When the library is equipped with the MUC, commands are received from a host computer over the SCSI interface on the MUC and are converted to RS-232C commands for the robotic controller.

Actuator Driver PWA

The actuator driver PWA, located in the electronics housing on the front left inside panel of the cabinet, interfaces with the robotic controller PWA and consists the following components:

- shunt Over Voltage Protection (OVP) regulator
- carousel motor interface
- vertical motor interface
- Pass-Through Conveyor Mechanism (PTM) motor interface
- Inport/Outport device (IOD) motor interface

Shunt OVP

The shunt OVP regulator on the actuator driver board serves two functions:

- over voltage protection of the motor power supply.
- rapid discharge of +48 VDC and +24 VDC in the event of a fault condition.

The OVP regulator “shunts” to ground any regenerated current that creates a voltage fluctuation above 51.5 VDC. Therefore, the +48 VDC supply line is regulated at a maximum +51.5 VDC. A fault condition is a direct result of the rapid discharge of the motor voltages. For example, a fault condition will occur when the door is opened, the STOP switch is pressed or excessive current is drawn by one of the actuators. The rapid discharge of the motor voltages causes an immediate shutdown of the motors (within 100 milliseconds).

Carousel motor interface

The actuator driver PWA receives low voltage analog commands from the robotic controller and amplifies the command signal to provide a high current drive signal to the carousel brush motor.

Vertical motor interface

The actuator driver PWA receives low voltage analog commands from the robotic controller and amplifies the command signal to provide a high current drive signal to the vertical brush motor.

PTM motor interface

The actuator driver PWA provides open loop motor drive current and open loop solenoid drive current to the PTM by Pulse Width Modulating (PWM) the motor and solenoid voltages.

Inport/Outport Device (IOD) motor interface

The actuator driver board provides open loop motor drive current to the IOD by Pulse Width Modulating (PWM) the motor and solenoid voltages.

Carousel Motor Driver Assembly and Carousel Drive Belt

The carousel motor assembly, located at the rear of the cabinet on the top left side of the carousel frame, is a +48 VDC motor with two optical encoders that provide relative position data. The carousel drive belt is attached to the carousel drive motor and carousel.

Vertical Motor and Vertical Drive Belt

The vertical motor, mounted in the base of the front door of the library, is a 48V DC brush motor. One end of the motor shaft holds a flanged pulley that engages the vertical drive belt. The opposite end holds an optical encoder that tracks the vertical carriage position.

The vertical drive belt, an open-ended belt (as opposed to a continuous loop), is driven by the vertical motor to propel the vertical carriage up and down the vertical rails. Attached to the belt is a counterweight designed to offset the weight of the vertical carriage and the extension axis.

Carousel Home and Face Sensor/Light Curtain Sensors

Carousel home and face sensors

The carousel home and face sensors are in the base of the cabinet near the front of the carousel assembly. They are adjacent to each other with the home sensor on the left, as viewed from the front of the cabinet.

The home sensor detects the “home” position of the carousel, while the face detects the “face” of each side of the carousel.

The infrared light sensors are positioned to be interrupted by opaque flags at the base of each octagon face. The home or “0” (zero) face has two flags, one to interrupt the home sensor and one to interrupt the face sensor. When both the home and face sensor beams are interrupted, the octagon is in the “home” position. Once the home position is found, control electronics locate the position of each face as a position relative to the home position. Opaque flags on each face are used to identify the exact position of each face.

Light curtain sensors

The carousel light curtain sensors consist of a light curtain emitter and a light curtain detector. The light curtain emitter is located on the same assembly with the home and face position sensors. The light curtain detector is located at the top inside center of the cabinet.

An infrared light beam is transmitted from the emitter, straight up in front of the exposed face of the carousel, to the detector. When a cartridge is improperly seated in a DLT binpack or tape drive, the cartridge will interrupt the light beam. As a safety measure, an interrupted beam generates a “fault” condition and prevents any motion by the robotics actuators.

Vertical Home/Limit Sensors

The vertical home sensor is located on the hinge side of the front door, approximately 52" (132 cm) above the base of the door.

The vertical limit sensor is located on the hinge side of the front door, approximately 1/2” (13 mm) above the base of the door.

An opaque flag on the vertical carriage indicates the presence of the vertical carriage and interrupts the infrared beam.

If the home sensor is interrupted, the vertical carriage is in the home position. If the limit sensor is interrupted, the vertical carriage is at the lower limit of its travel.

Door Flex/Ribbon Interface PWA and Umbilical Cable

The door flex/ribbon interface PWA is located approximately in the center of the front door, on the right side.

The door flex/ribbon interface PWA converts the ribbon cable from the robotic controller PWA to the umbilical cable, which leads to the extension axis assembly.

The door flex/ribbon interface PWA and umbilical cable carry all of the signals and power used by the extension axis assembly.

DLT Binpacks

The DLT binpacks store up to 11 cartridges each. The binpacks are mounted on the carousel. For more information regarding the binpacks, refer to the *TL820 Operator’s Guide*.

Extension Axis Assembly

The extension axis assembly, mounted on top of the vertical carriage, retrieves tape cartridges from the DLT binpacks and delivers them to one of the three tape drives.

The gripper mechanism on the extension axis assembly “picks” cartridges from stored locations (DLT binpacks, tape drives, or the PTM), and holds the cartridge while the vertical carriage moves to its destination. The gripper “places” the cartridge into the new location by moving forward until the cartridge is partially seated in the new location, then releases while the pusher and extension axis extend to fully seat the cartridge.

Extension drive motor and belt

The extension drive motor is located at the rear of the extension axis assembly. The extension belt is located along the left edge of the extension axis assembly. The 24V DC brush motor engages the belt, while the belt drives the cartridge gripper assembly forward and back on the extension rails of the extension axis assembly.

Carriage QSPI PWA

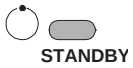
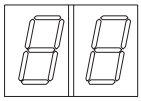
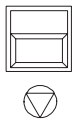
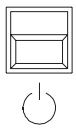
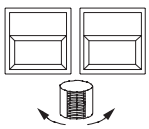
The carriage Queued Serial Peripheral Interface (QSPI) PWA is located on the bottom of the extension axis assembly. The carriage QSPI PWA uses the queued serial peripheral interface bus to communicate with the robotic controller PWA. The carriage QSPI performs several functions, including:

- Controlling forward and backward movement of the extension axis assembly.
- Interpreting input from the extension axis home and limit sensors.
- Controlling opening and closing motion of the gripper.
- Controlling forward movement and retraction of the gripper.
- Interpreting feedback from the gripper mechanism hall effect sensors.
- Interpreting feedback from the Cartridge In Gripper (CIG) sensors.

Front Control Panel

The front control panel, located on the outside of the front door, consists of the following buttons and indicators.

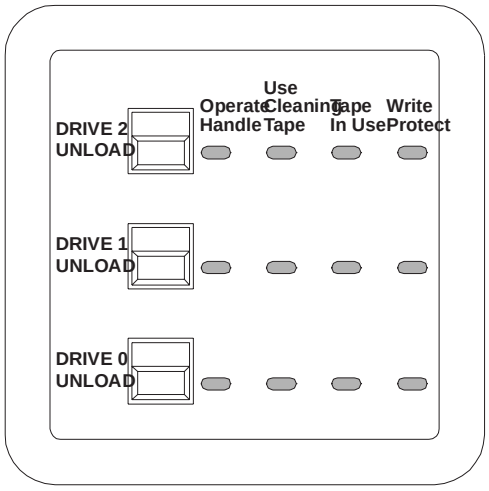
Table 2: Front control panel button functions

Button/Indicator	Description	Function
	FAULT indicator	Lights when one of the following occurs: 1) the library door is open. 2) the rear panel is removed. 3) you press the STOP button. 4) there is a system failure.
	STANDBY indicator	Lights when you press the STANDBY button to take the library offline.
	status display	Displays codes that describe the operating state of the library.
	STOP button	Allows you to disconnect power to robotic equipment in the library for the following situations: 1) opening the door to access the bin packs. 2) during the power-off procedure. 3) in an emergency. Press the STOP button to disconnect power to the robotic equipment.
	STANDBY button	Toggles the library between the online and offline states. Press the STANDBY button to place the library offline. When the library is offline it cannot receive commands from the host.
	← and →	Rotates the carousel. Used when mounting or removing binpacks or individual cartridges. The system must be offline for these buttons to operate.

Tape Drive Status Control Panel

The tape drive status control panel, located inside the front door on the tape drive cosmetic panel, is shown in Figure 5. The tape drive unload buttons and indicators are described in Table 3.

Figure 5: Tape drive status control panel



Note ***The control panel is functionally identical to the TZ87 tape drive front panel described in the TZ87 Series Cartridge Tape Subsystem, Owner's Manual (PN EK-OTZ87-OM). Refer to this manual for a more detailed description of the tape drive unload buttons and indicators.***

Table 3: Tape drive status control panel description

Button/Indicator	Description	Function
	Drive 2 Unload button	The three drive unload buttons correspond to the three TZ87 tape drives, which are numbered 0 through 2 from bottom to top. Pressing the unload button(s) causes the: 1) tape to rewind. 2) drive to reset. 3) cartridge to unload if possible.
	Drive 1 Unload button	
	Drive 0 Unload button	
	Operate Handle indicator(s)	Lights when the insert/release tape drive handle is ready to operate. **IMPORTANT!** The tape must be completely rewound and unloaded before removing the cartridge from the drive. Depending on tape position, this operation may take from 10 seconds to 2 minutes.
	Use Cleaning Tape indicator(s)	Lights when the drive head needs cleaning, or the current cartridge is bad. After unloading the cleaning cartridge, this indicator remains lit when one of the following occurs: 1) the cleaning operation was not complete. 2) the current cartridge is bad.
	Tape In Use indicator(s)	Lights after the cartridge is loaded and the tape loads into the drive.
	Write Protect indicator(s)	Lights when the tape is write-protected.

Front Door and Rear Access Panel Interlock Switches

The TL820 has two interlock switches, one for the front door and one for the rear access panel. When either the front door is opened or rear access panel is removed, a fault condition occurs and all motors immediately stop.

The front door interlock switch, located in the upper right corner of the cabinet, is a proximity switch. Opposite the switch is a magnet that trips the proximity switch when the door is closed.

The rear access panel interlock switch, located on the rear upper right corner, is a three-position switch. The switch is closed when the rear panel is closed, open when the rear panel is open, and closed when pulled out into the override position. The override position is used to service the library with the rear panel removed.

Barcode Scanner Assembly

The barcode assembly consists of the barcode scan head, which is mounted to the vertical carriage. The scan head communicates with the robotic controller PWA over an RS-232C communications link. During a cartridge inventory, the scan head illuminates and reads the barcode labels on the cartridges and transmits the result over the serial communications link to the robotic controller.

Inport/Outport Device (IOD)

The IOD, located on the hinge-side of the cabinet, allows cartridges to be inserted and removed into and out of the library without opening the front door. The motors and solenoids in the IOD are powered from the actuator driver PWA. The robotic controller PWA monitors the IOD sensors and generates the appropriate commands to the actuator driver PWA.

Pass-Through Conveyor Mechanism (PTM)

The PTM is located in the front of the library between the storage carousel and the tape drives. The PTM allows cartridges to transfer between the IOD and the library, or between units in a multi-unit configuration.The motors and solenoids in the PTM are powered from the actuator driver PWA. The robotic controller PWA monitors the PTM sensors and generates the appropriate commands to the actuator driver PWA.

Tape Drive Assembly

Tape drives

When viewed from the rear of the library, the three TZ87 differential SCSI DLT tape drives are located in the top of the cabinet on a shelf just above the carousel. Mounted on the right side of each tape drive is a stepper motor assembly that is used to electro-mechanically open and close the tape drive door.

Stepper motor driver PWA

When viewed from the rear of the library, the stepper motor driver board is located in the top, left rear of the cabinet approximately midway between the tape drives and the tape drive power supply. The stepper motor driver PWA receives commands from the robotic controller PWA. When a command is received from the robotic controller PWA, the stepper motor driver PWA responds by either opening or closing the individual tape drive doors, which are driven by stepper motors that are mechanically linked to the doors.

Tape drive power supply

When viewed from the rear of the library, the power supply for the tape drives is located in the top rear of the cabinet on the left side (see Figure 4 on page 2-7). The tape drive power supply receives AC power from the IEC-320 AC power strip. The tape drive power supply has a separate push button on-off switch which is located on the back of the power supply, near the fan shroud. The tape drive power supply also provides +5V and +12V power to the stepper motor driver board.

Cabinet

The TL820 cabinet is 28" x 40" x 78.56" (71 x 102 x 200 cm) and weighs approximately 700 lbs. (272 kg) without cartridges. The cabinet has storage capacity for 264 DLT cartridges and three TZ87 tape drives. The cabinet houses power, electronic and mechanical assemblies for automatic storage and retrieval of cartridges upon command from a host computer.

3 Replacement Procedures

Preparing the TL820 for Maintenance

WARNING ***Unless otherwise directed, perform replacement procedures with the library disconnected from its power source. Failure to remove power could result in injury or damage to the equipment.***

The procedures in this section are written assuming that the library has been prepared for maintenance. To prepare the library for maintenance, do the following:

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Disconnect the power cord from the AC power source.
3. Read through the entire maintenance procedure before working on the library.
4. Gather all necessary tools and parts before working on the library.

Note ***Unless otherwise directed, all procedures should be performed in reverse order for replacing the Field Replaceable Unit (FRU).***

CAUTION ***Do not attempt field repair of FRUs. The FRUs specified in this section are replaceable in the field, but must be repaired at the factory.***

Field Replaceable Unit (FRU) List

Table 4: FRU list

DEC Part No.	ATL Products Part No.	FRU Description	Page No.
29-31676-01	6203235	AC Power Distribution Unit (IEC-320)	3-6
29-31669-01	0495031	AC Power Strip (IEC-320)	3-8
29-31682-01	6204220	Actuator Driver PWA	3-10
29-31667-01	0405042	Barcode Scanner Assembly	3-12
29-31670-01	0645072	Carousel Drive Belt	3-14
29-31675-01	6203170	Carousel Motor Drive Assembly	3-16
29-31685-01	6204280	Carousel Home and Face Sensor/Light Curtain Emitter PWA Assembly	3-19
29-31677-01	6203300	DLT Binpack Assembly	3-21
29-31687-01	6205735	DLT IOD Assembly	3-23
29-31686-01	6205015	DLT PTM Tray Assembly	3-25
29-31674-01	6201710	Door Flex/Ribbon Interface PWA	3-18
29-31672-01	6201310	Extension Axis Assembly	3-28
29-31668-01	0475009	Fan (2 in parallel)	3-30
29-31673-01	6201650	Front Control Panel PWA	3-32
29-31680-01	6204059	Front Door Interlock Switch	3-34
29-31678-01	6203620	Light Curtain Detector PWA	3-37
29-31662-01	0355032	Logic Power Supply	3-39
29-31663-01	0355033	Motor Power Supply	3-41
29-31688-01	6209071	Multi-Unit Controller Assembly	3-43
29-31665-01	0365042	Rear Access Panel Interlock Switch	3-45
29-31681-01	6204210	Robotic Controller PWA	3-46
29-31679-01	6203650	RS-232 Distribution PWA	3-48
29-31661-01	0345051	Stepper Motor Assembly	3-51
29-31683-01	6204230	Stepper Motor Driver PWA	3-53

DEC Part No.	ATL Products Part No.	FRU Description	Page No.
29-31664-01	0355034	Tape Drive Power Supply	3-55
TZ87-AV	0405055	TZ87 Differential SCSI DLT Tape Drive	3-57
29-31684-01	6204254	Umbilical Cable	3-59
29-31666-01	0405024	Vertical Home /Limit Sensors	3-61
29-31689-01	6205322	Vertical Motor	3-63
29-31671-01	0645083	Vertical Drive Belt	3-67

AC Power Distribution Unit (IEC 320)

1. Remove power from the library by turning off the circuit breaker switch (a).
2. Remove the rear access panel (b) from the library.

Note ***Remove the top middle screw last, when removing the rear access panel and install it first, when replacing the panel. There is no need to remove the system integrator panel or rear connector panel to perform this procedure.***

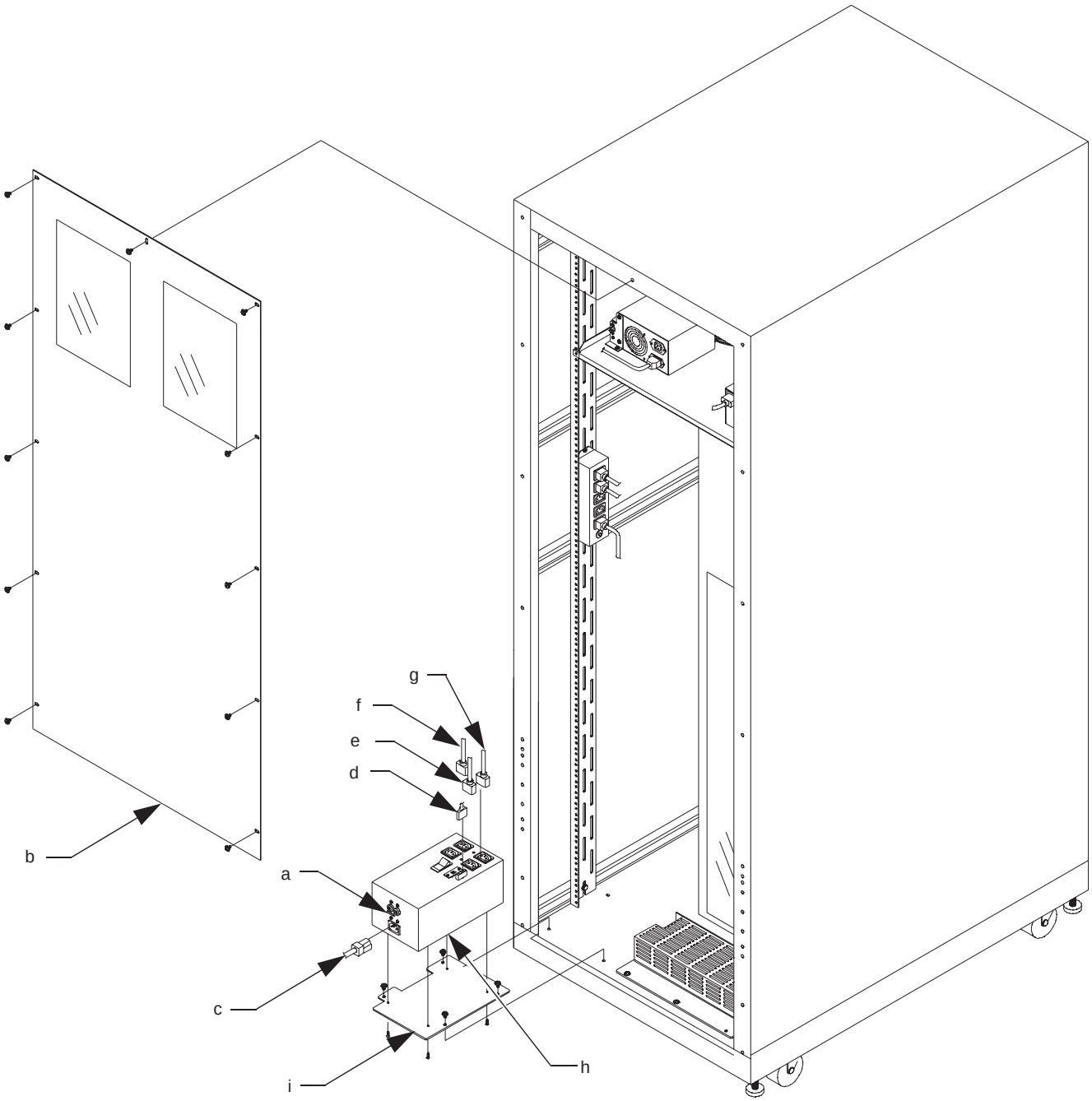
3. Disconnect the IEC power cord (c).
4. Disconnect the following cables from the AC power distribution unit:

   fan power cable (d)
   logic power supply cable (e)
   power strip power cable (f)
   motor power supply cable (g)

5. Remove the AC power distribution unit (h).
6. Remove the screws that secure the AC power distribution unit from the base of the cabinet.
7. Remove the mounting plate (i) from the AC power distribution assembly.
8. Reverse the procedure to install the new AC power distribution assembly.

Note ***Check the switch setting for the fan connector on the AC power distribution assembly to be sure that it is set to the same input voltage that was used originally.***

Figure 6: AC power distribution unit



AC Power Strip (IEC 320)

1. Remove power from the library by turning off the circuit breaker switch (a).
2. Remove the rear access panel (b) from the library.

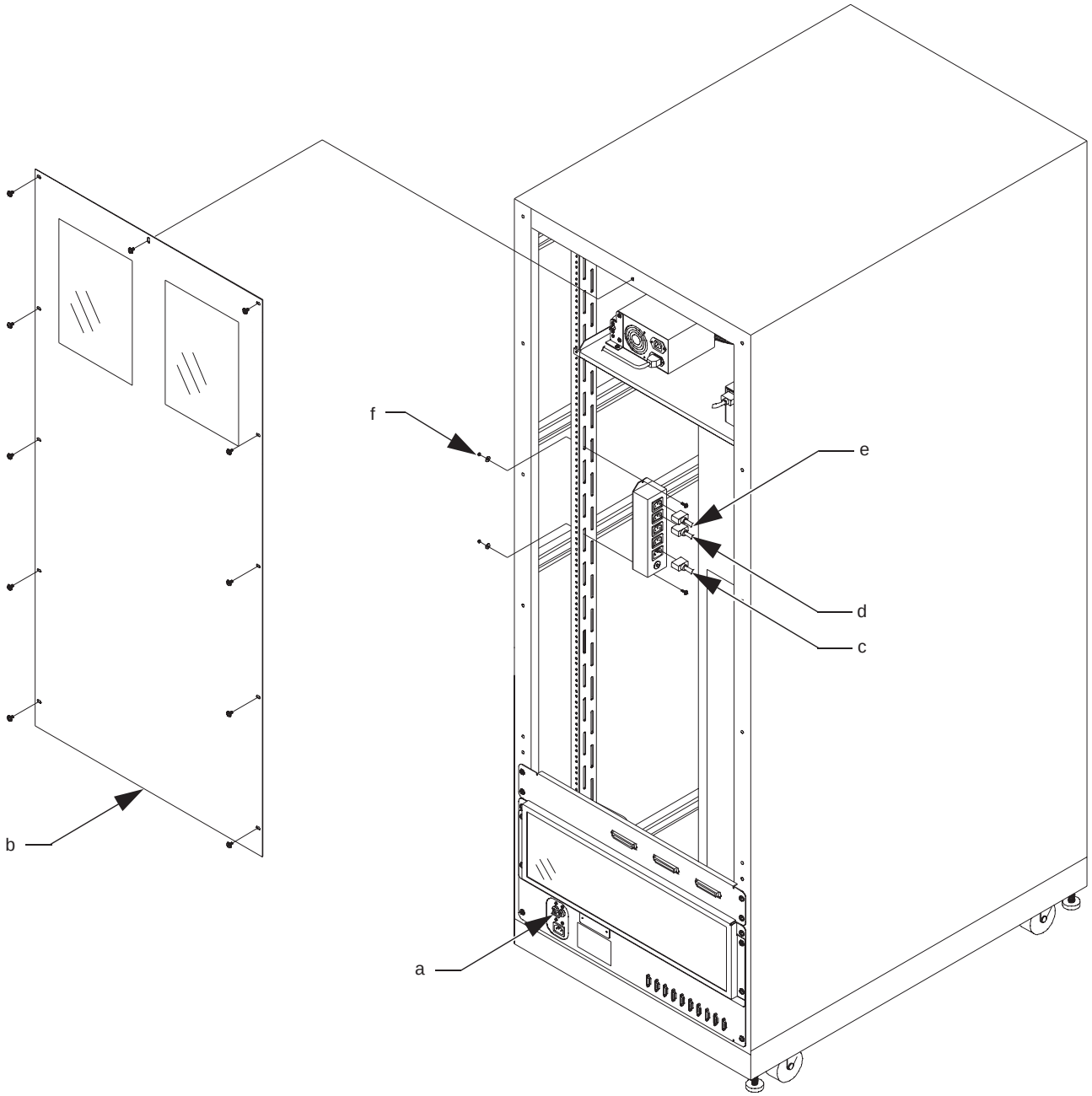
Note ***Remove the top middle screw last, when removing the rear access panel and install it first, when replacing the panel.***

3. Disconnect the following cables from the AC power strip:

   power strip power cable (c)
   MUC power cable (d)
   tape drive power supply cable (e)

4. Remove the screws (f) that secure the power strip to the cabinet.
5. Reverse the procedure to install the new AC power strip.

Figure 7: AC power strip



Actuator Driver PWA

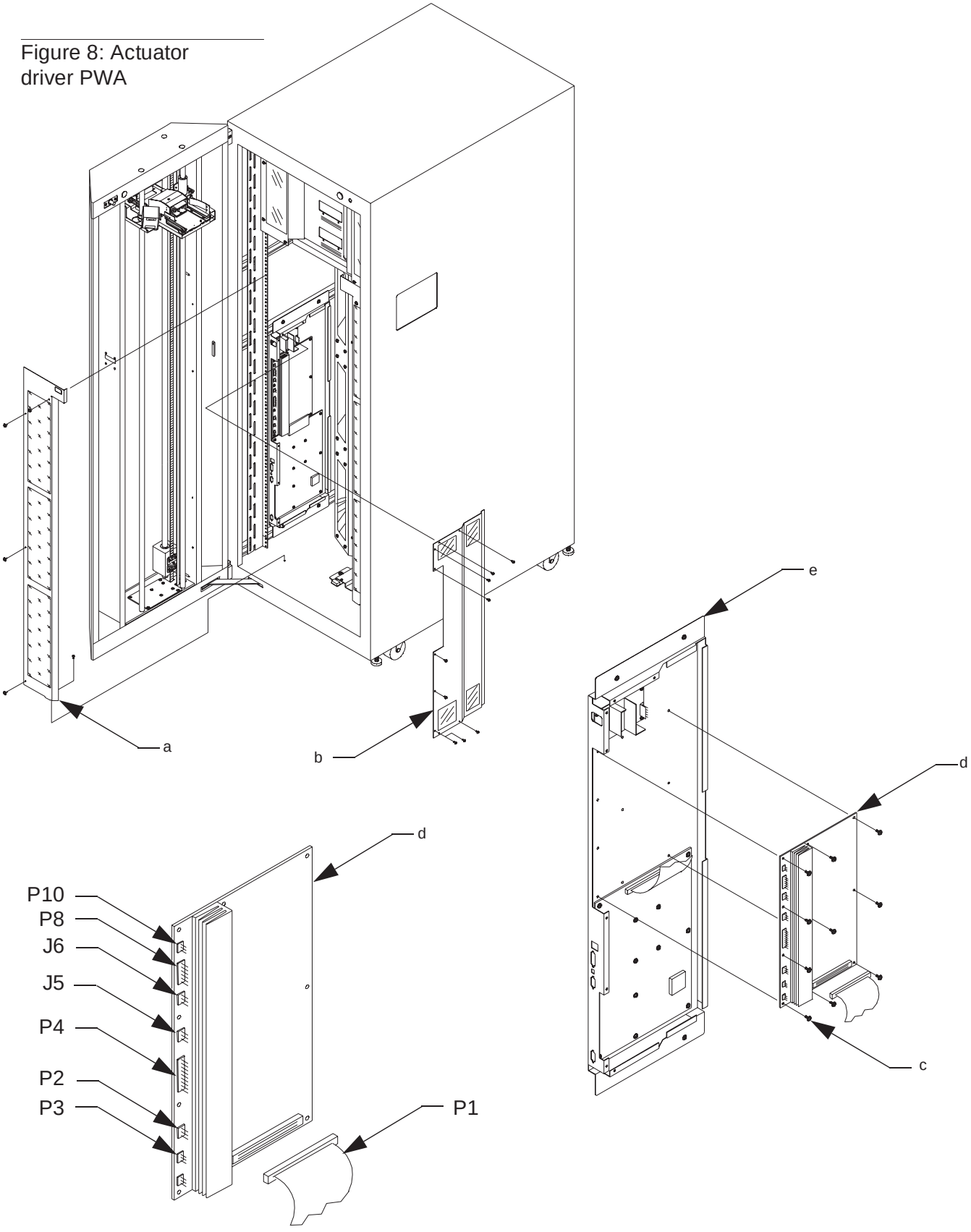
1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Remove the DLT binpacks from the library. Refer to binpack removal on page 3-20.
4. Remove the left cosmetic panel (a).
5. Remove the library electronics cover (b).
6. Disconnect the following connectors from the actuator driver PWA.

   :

actuator connector:	cable connector:	connects to:
P10	J10	motor power supply
P8	J8	motor power supply
J6	P6	carousel motor
J5	P5	vertical motor
P4	J4	IOD
P2	J2	PTM
P3	J3	PTM
P1	J1	robotic controller

7. Remove the screws (c) that secure the actuator driver PWA (d) to the electronics enclosure (e).
8. Reverse the procedure to install the new actuator driver PWA.

Figure 8: Actuator driver PWA



Barcode Scanner Assembly

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library and move the vertical carriage (a) to a position where the barcode scanner is easily serviced. Typically this position is slightly below eye level.
3. Disconnect the cable from the back of the barcode scanner (b).

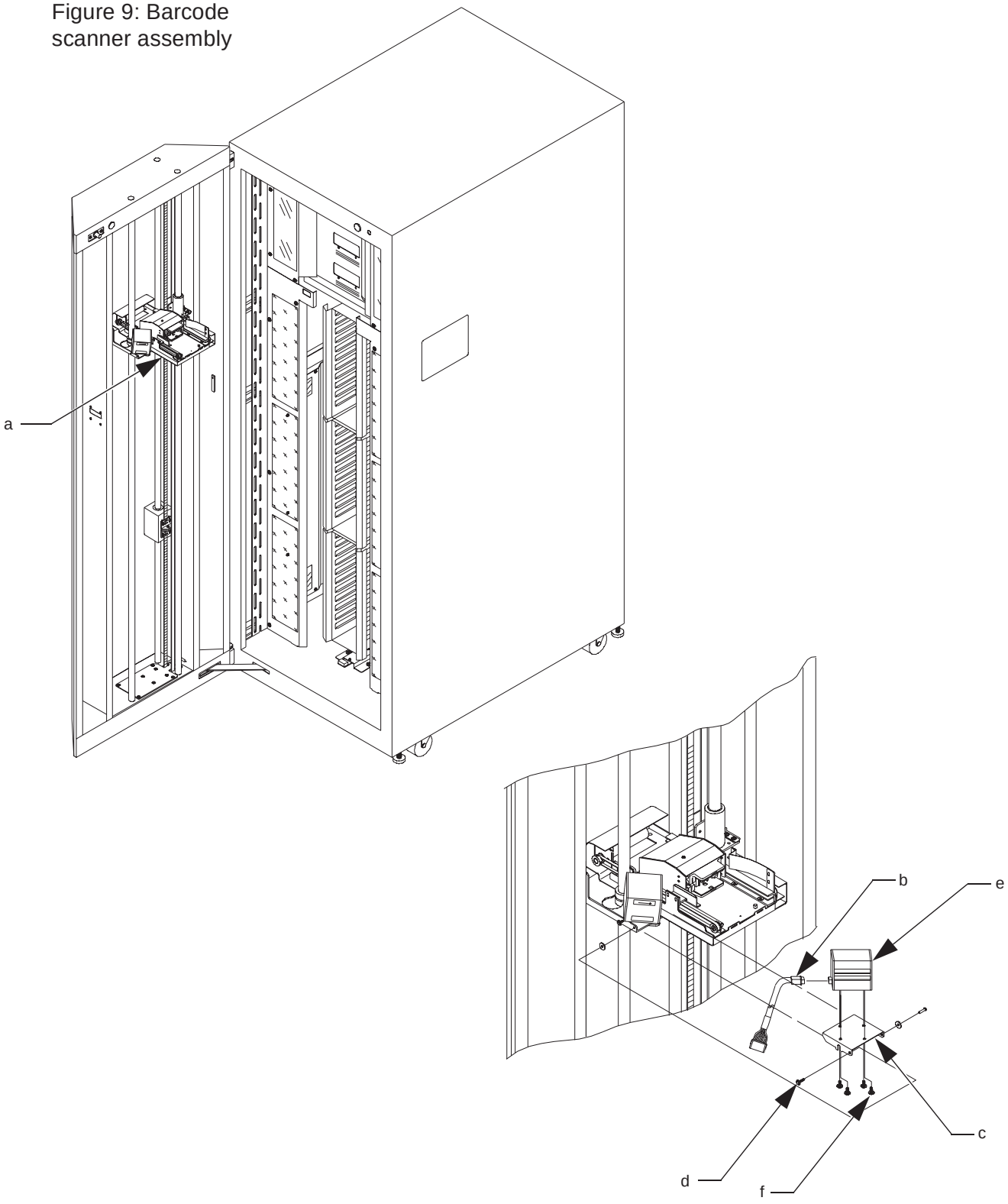
⚠ **CAUTION** ***Handle the barcode scanner carefully. Avoid touching the laser and sensor windows located at the front of the scan head.***

4. Remove the barcode scanner mounting plate (c) from the vertical carriage using an open-end wrench:
   a. *Loosen* the back two bolts that secure the scan head to the vertical carriage.
   b. Remove the front two bolts (d) that secure the scan head to the vertical carriage.
3. Remove the barcode scanner assembly (e) from the vertical carriage.
4. Remove the screws (f) that secure the barcode scanner to the mounting block.
5. Reverse the procedure to install the new barcode scanner assembly.

Note ***The TL820 Diagnostic Software is required for the following adjustment procedure. Refer to the TL820 Diagnostic Software User's Manual for more information on the Diagnostic Software.***

6. After installing the replacement scanner perform the following adjustment procedure:
   a. In the Move Actuators menu of the Diagnostic Software, select the Vertical Axis submenu.
   b. Select the Move to Bin option and select bin 0.
   c. In the System menu, select Loop Mode and then the Read Barcode option.
   d. Check the location of the beam. It should be in the middle of the barcode; if it is not, turn off Loop Mode, loosen and adjust the barcode pivot bracket.
   e. Repeat steps a through d.

Figure 9: Barcode scanner assembly



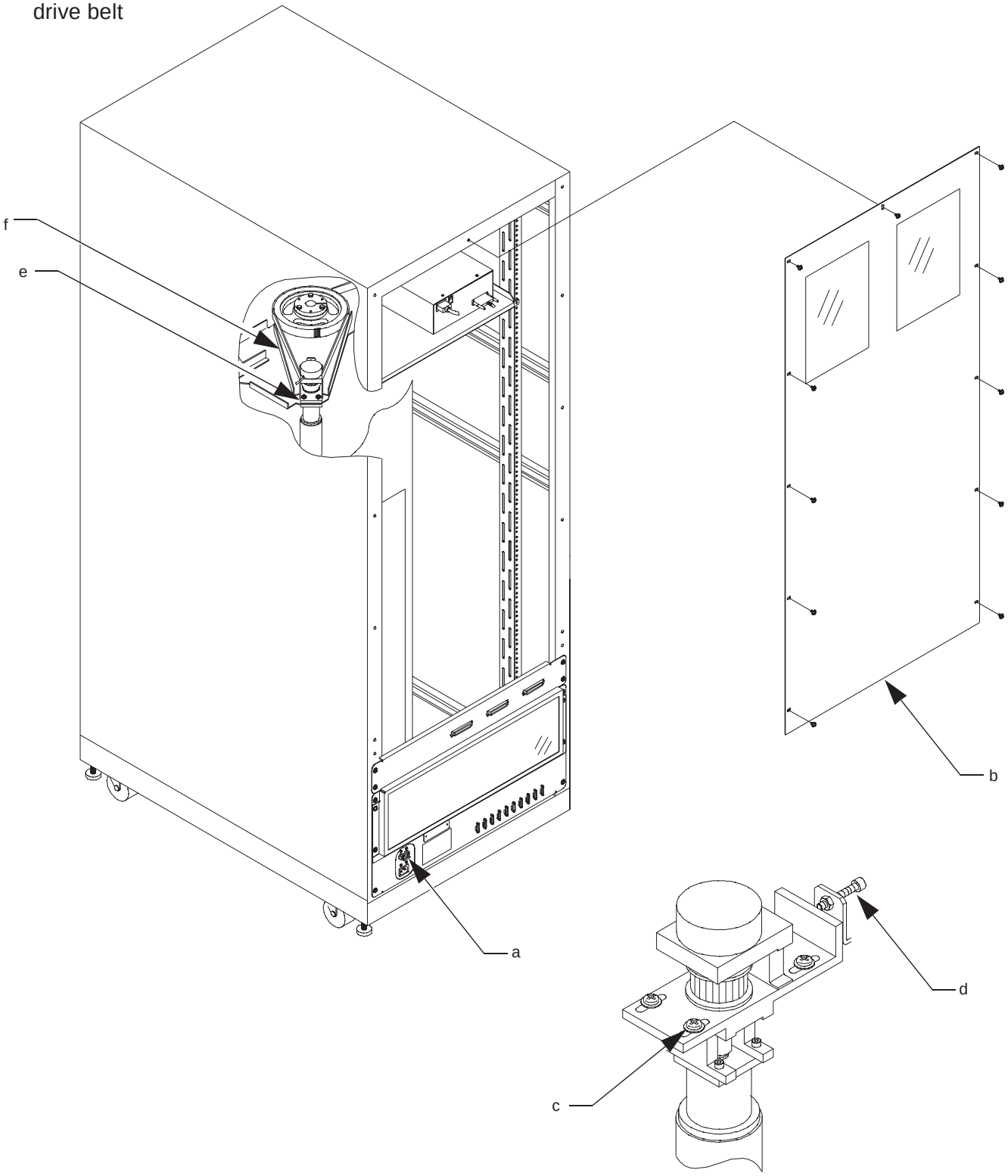
Carousel Drive Belt

1. Remove power from the library by turning off the circuit breaker switch (a).
2. Remove the rear access panel (b) from the library.

Note ***Remove the top middle screw last, when removing the rear access panel and install it first, when replacing the panel.***

3. Loosen the four bolts that secure the carousel drive motor assembly (c) to the carousel frame.
4. Unlock and loosen the carousel drive motor assembly adjustment screw (d).
5. Slide the carousel drive motor assembly (e) towards the carousel until there is enough slack for the carousel drive belt to be easily removed.
6. Remove the carousel drive belt (f).
7. Reverse the procedure to install the new carousel drive belt.
8. Tension the carousel drive belt by performing the procedure on page 5-7.

Figure 10: Carousel drive belt



Carousel Motor Drive Assembly

1. Remove power from the library by turning off the circuit breaker switch (see (a) in Figure 10 on page 3-15).
2. Remove the rear access panel from the library (see (b) in Figure 10 on page 3-15).

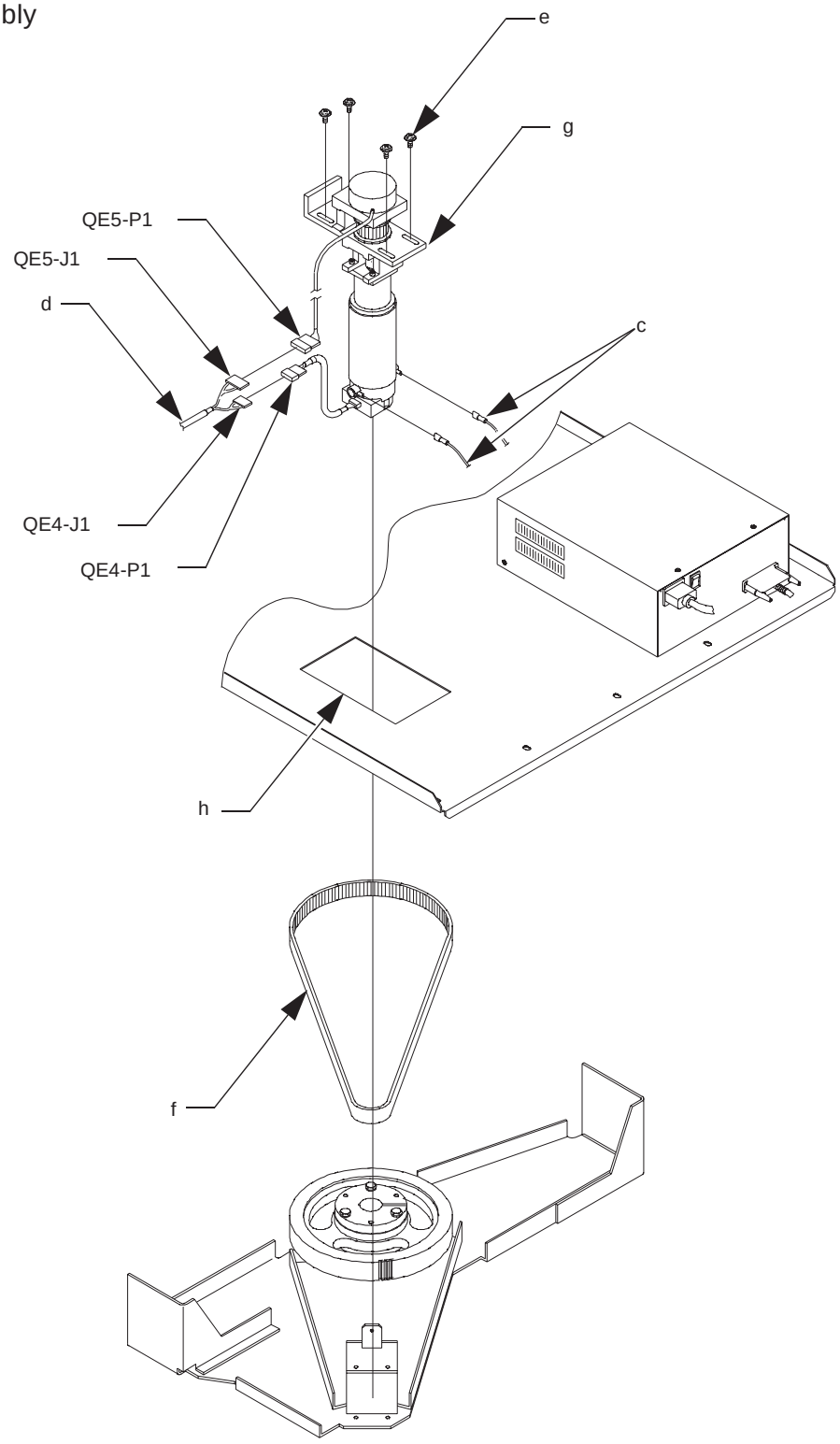
Note ***Remove the top middle screw last, when removing the rear access panel and install it first, when replacing the panel.***

3. Remove the tape drive power supply. See tape drive power supply removal on page 3-54.
4. Remove the stepper motor driver PWA. See stepper motor driver PWA removal on page 3-52.
5. Disconnect the following cables from the carousel motor drive assembly:

   motor power cables (black to black/red to red) (c)
   encoder cables (d)

6. Remove the screws (e) that hold the carousel motor drive assembly to the carousel frame.
7. Remove the carousel drive belt (f).
8. Remove the carousel motor drive assembly (g) by passing it through the cut out in the tape drive shelf (h).
9. Reverse the procedure to install the new carousel motor drive assembly.
10. Tension the carousel drive belt by performing the procedure on page 5-7.

Figure 11: Carousel motor drive assembly



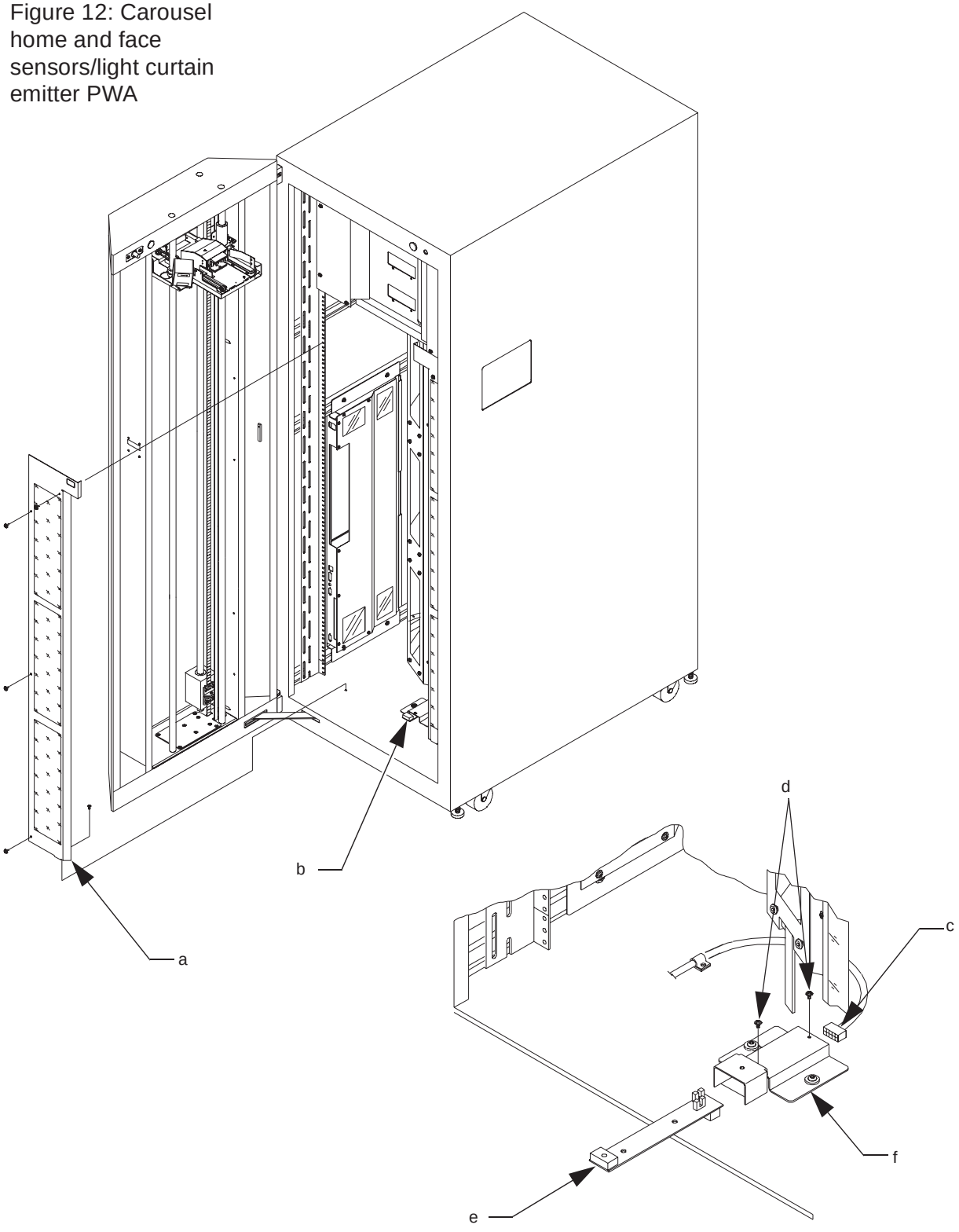
Carousel Home and Face Sensor/Light Curtain Emitter PWA

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Remove the DLT binpacks on the current face of the carousel. See binpack removal on page 3-20.
4. Remove the left cosmetic panel (a).
5. Locate the carousel sensor/light curtain emitter assembly (b) on the base of the cabinet, near the carousel.
6. Disconnect the cable (c) from the carousel sensor/light curtain emitter assembly.
7. Remove the screws (d) that secure the carousel sensor/light curtain emitter PWA to the mounting bracket and carefully pull the PWA (e) out.

⚠ **CAUTION** ***DO NOT remove the PWA mounting bracket (f). Removing the bracket will cause serious misalignment.***

8. Reverse the procedure to install the new carousel sensor/light curtain emitter assembly.

Figure 12: Carousel home and face sensors/light curtain emitter PWA



DLT Binpack Assembly

Note ***Document individual binpack locations prior to removal so the binpacks can be placed in the same position on the carousel when reinstalled.***

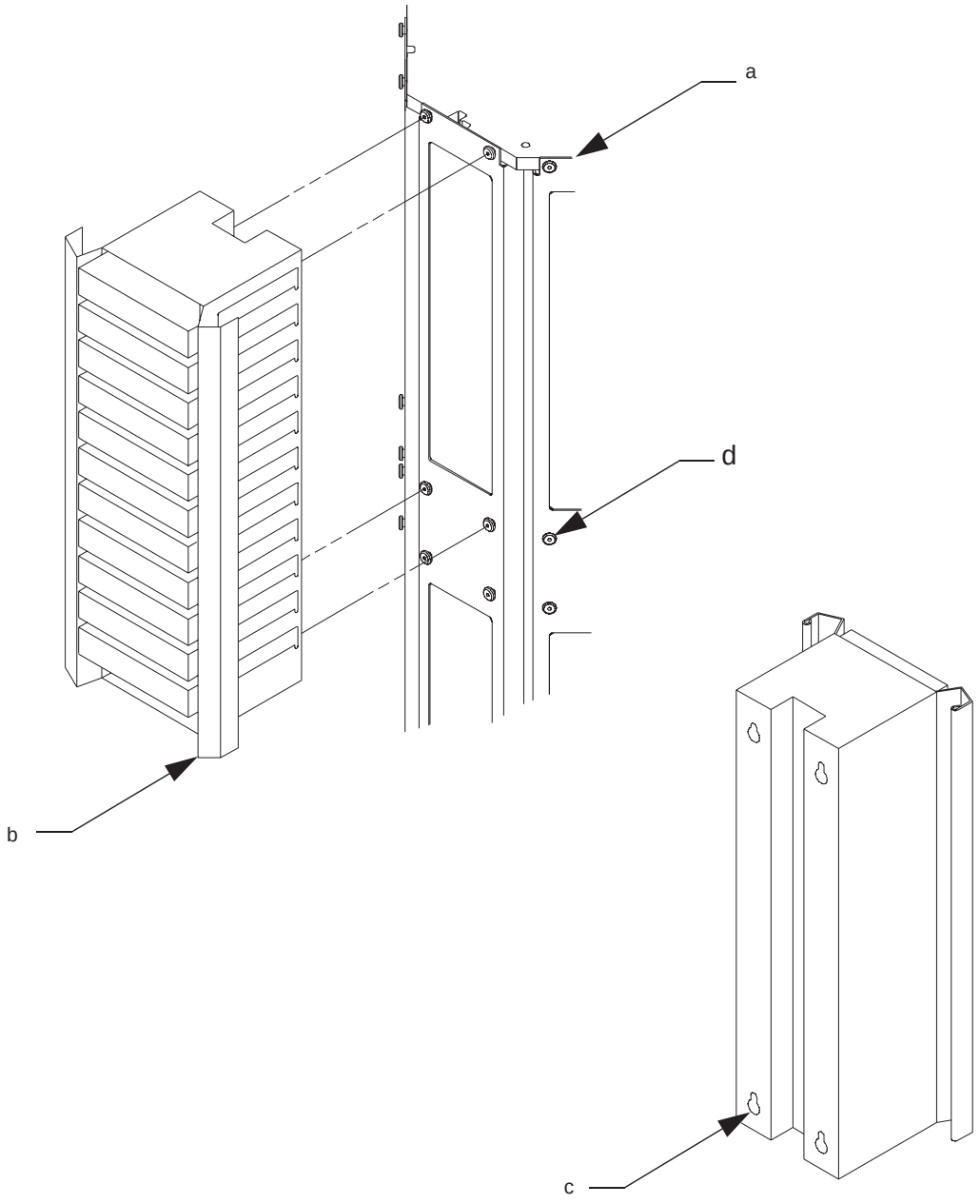
1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Manually rotate the carousel (a) until the desired carousel face with the binpack(s) is at the front.

⚠ **CAUTION** ***To prevent the carousel from being damaged, manually rotate the carousel by firmly holding and pushing one of the top binpacks on the carousel.***

Note ***When removing binpacks, it is best to completely empty one face of the carousel from bottom to top.***

4. Remove the binpacks (b) by lifting up slightly to disengage the key-hole shaped mounting holes (c) on the back of the binpacks and then pull the binpacks straight out and off the mounting buttons (d).
5. Refer to the *TL820 Operator's Guide* for more information on how to install binpacks.

Figure 13: DLT
binpack assembly



DLT IOD Assembly

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Verify that the two INPORT OPEN switch adjustment screws, which are located inside the outport bin and underneath the INPORT OPEN switch are completely to the rear so the switch does not protrude through the switch cutout in the IOD cover (see Figure 14).

Note ***Open the outport door to avoid interfering with the button on the bottom of the IOD.***

3. Remove the IOD cover (a) by removing the screws that secure the cover to the base of the IOD.
4. Gently slide the cover straight up until it clears the IOD and carefully pull it away from the library.
5. Disconnect the following cables from the IOD:

   J1 from P1
   J2 from P2
   ground strap

6. Loosen the four captive screws (b) that secure the IOD to the mounting bracket.
7. Lift the IOD up to disengage the two shoulder screws that hold it in position and carefully pull the IOD away from the library.

Note ***Leave the mounting bracket in place.***

8. Refer to the *TL820 IOD Installation Instructions* to install the new IOD.

Figure 14: Removing the IOD cover

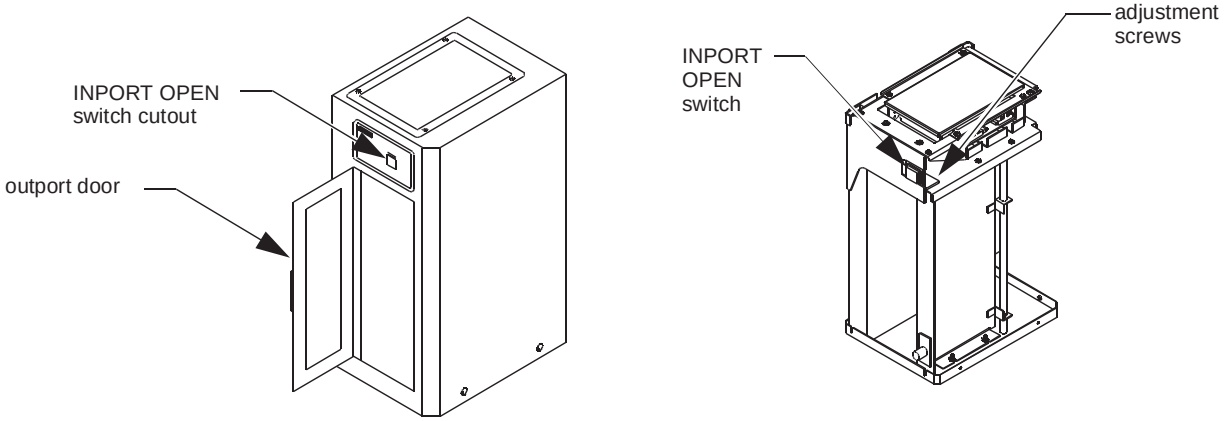
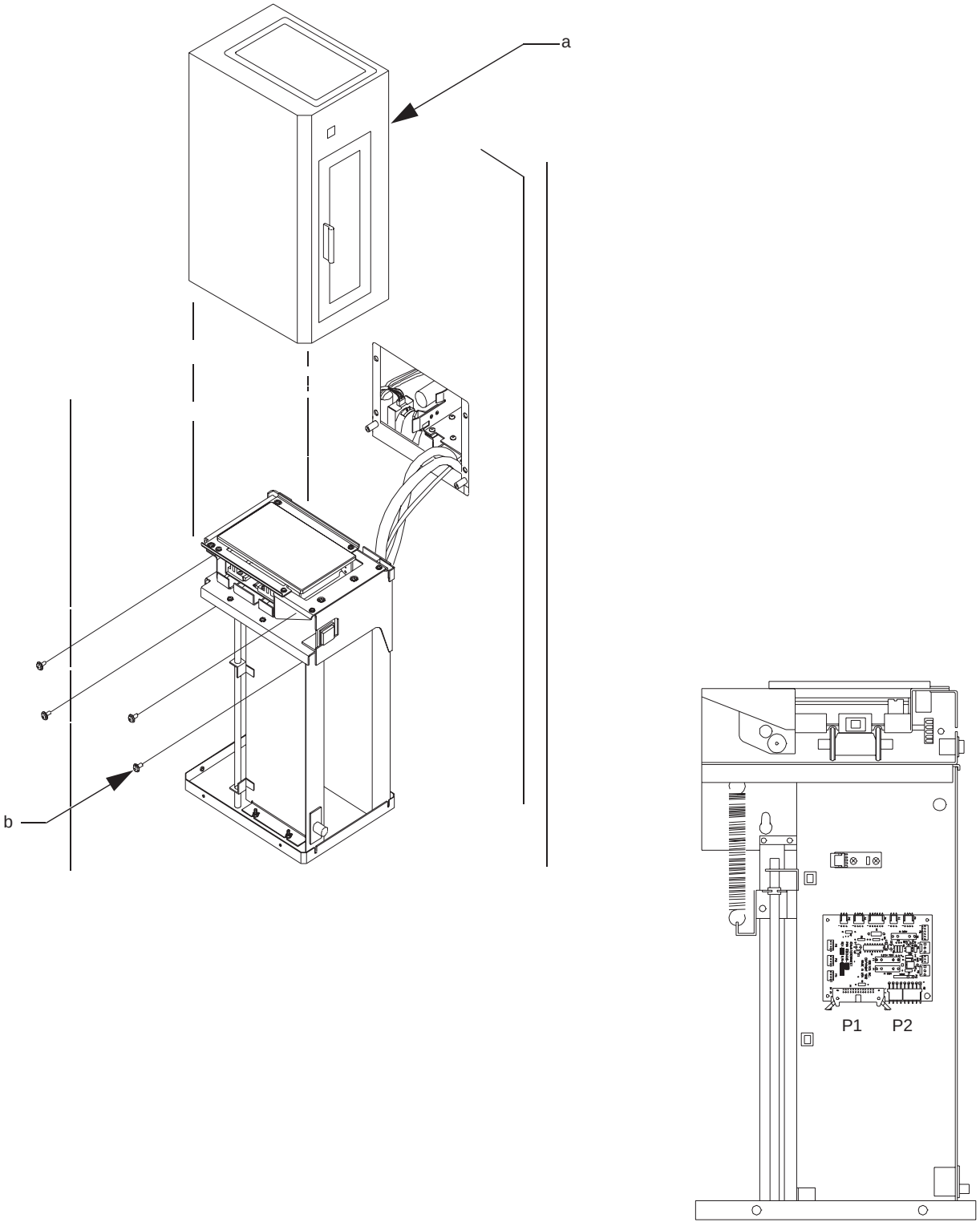


Figure 15: DLT IOD assembly



DLT PTM Tray Assembly

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library and remove the left-side and right-side vertical cosmetic panels (a) located just inside the door of the library.
3. Disconnect the following cables from the PTM (b):

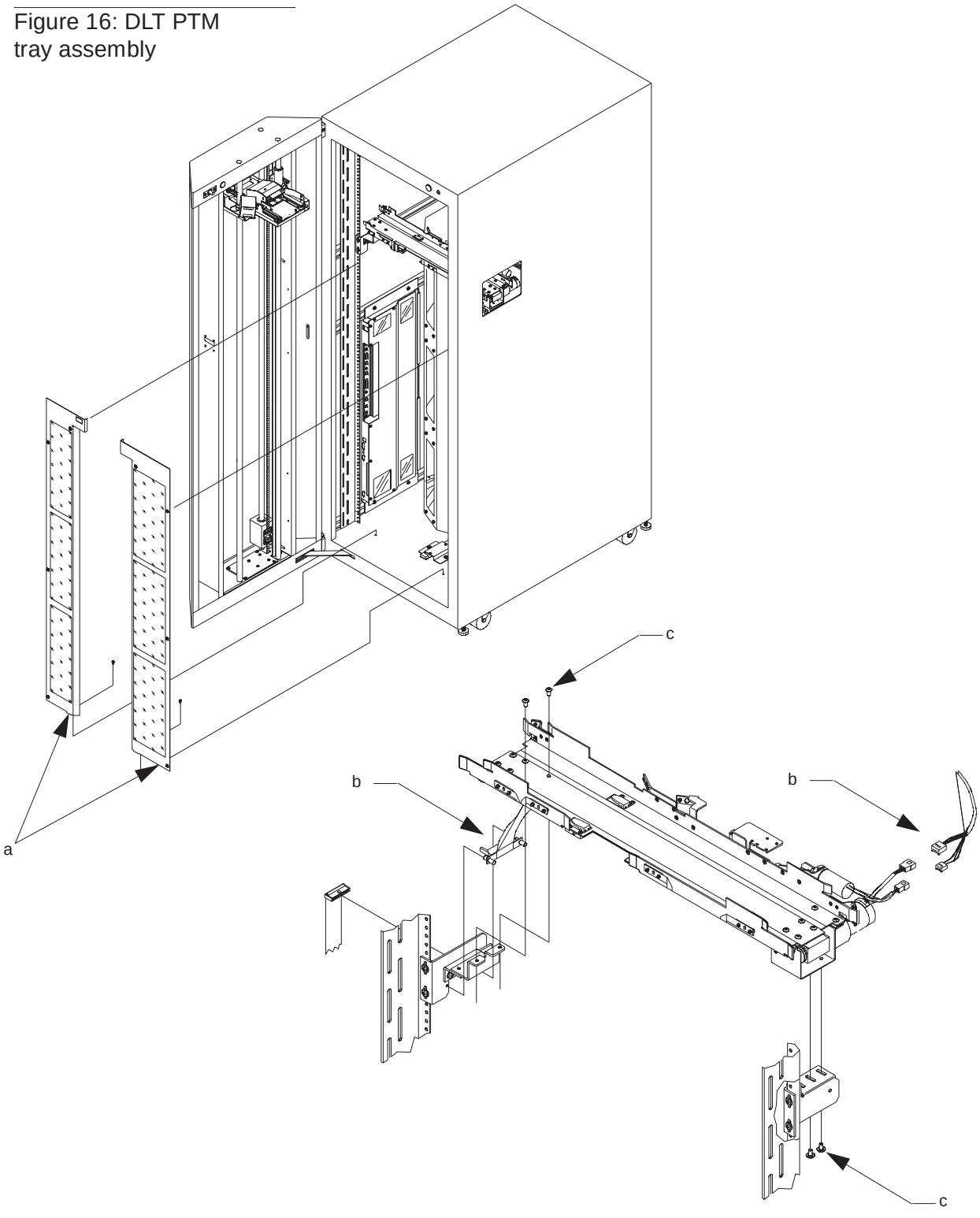
   K1_J1 (from the liftgate solenoid)
   M4_J1 (from the PTM motor)

Note ***For the following cable, pull the two securing posts from the left-side primary mounting bracket first.***

   A50_J1 (from the flex cable)

4. Remove the four screws (two on each side of the PTM tray) that secure the PTM tray to the mounting brackets (c).
5. Carefully lift and maneuver the PTM tray out and away from the cabinet.
6. Reverse the procedure to install the new PTM.

Figure 16: DLT PTM tray assembly



Door Flex/Ribbon Interface PWA

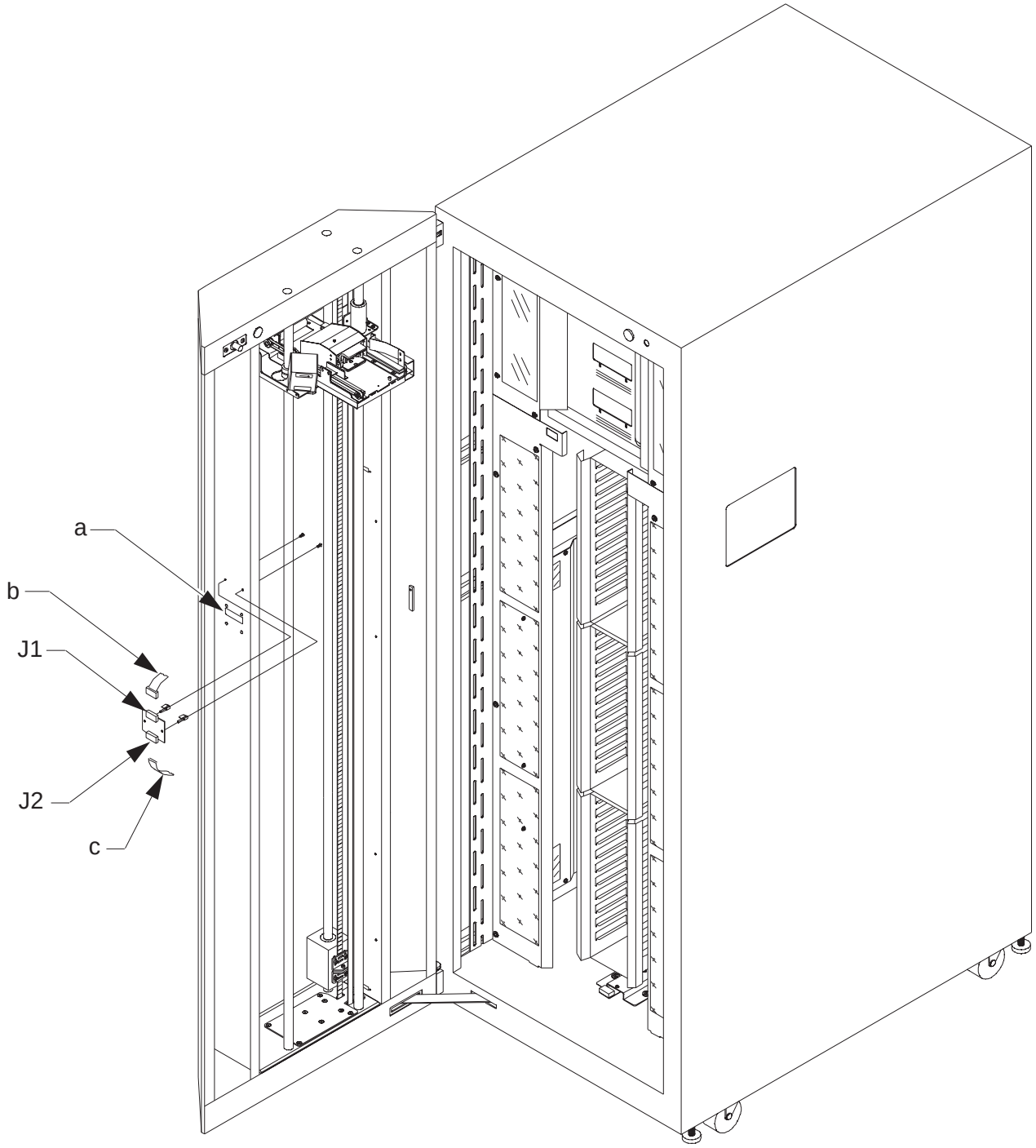
1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Locate the door/flex ribbon interface PWA (a) on the inside of the front door.
4. Disconnect the following cables from the door flex/ribbon interface PWA:

   ribbon cable (b)
   flex cable (c)

Note ***Unplug the flex cable by slightly pushing the sleeve of the connector open before pulling the cable out.***

5. Carefully remove the PWA.
6. Reverse the procedure to install the new door flex/ribbon interface PWA

Figure 17: Door flex/ribbon interface PWA



Extension Axis Assembly

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Locate the vertical carriage inside the door and move it to a position near the center of the vertical travel.
4. Remove the screws securing the bottom cover plate (a) to the extension axis assembly.
5. With the screws removed, move the cover plate forward and then to the right approximately 1" (2.5cm). Tilt the front of the cover plate down to the door window and push it up between the extension axis motor and the door window.
6. Disconnect the barcode scanner cable (b) from the QSPI PWA. The QSPI PWA is located underneath the extension axis assembly.
7. Disconnect the flex cable (c) from the extension axis assembly.

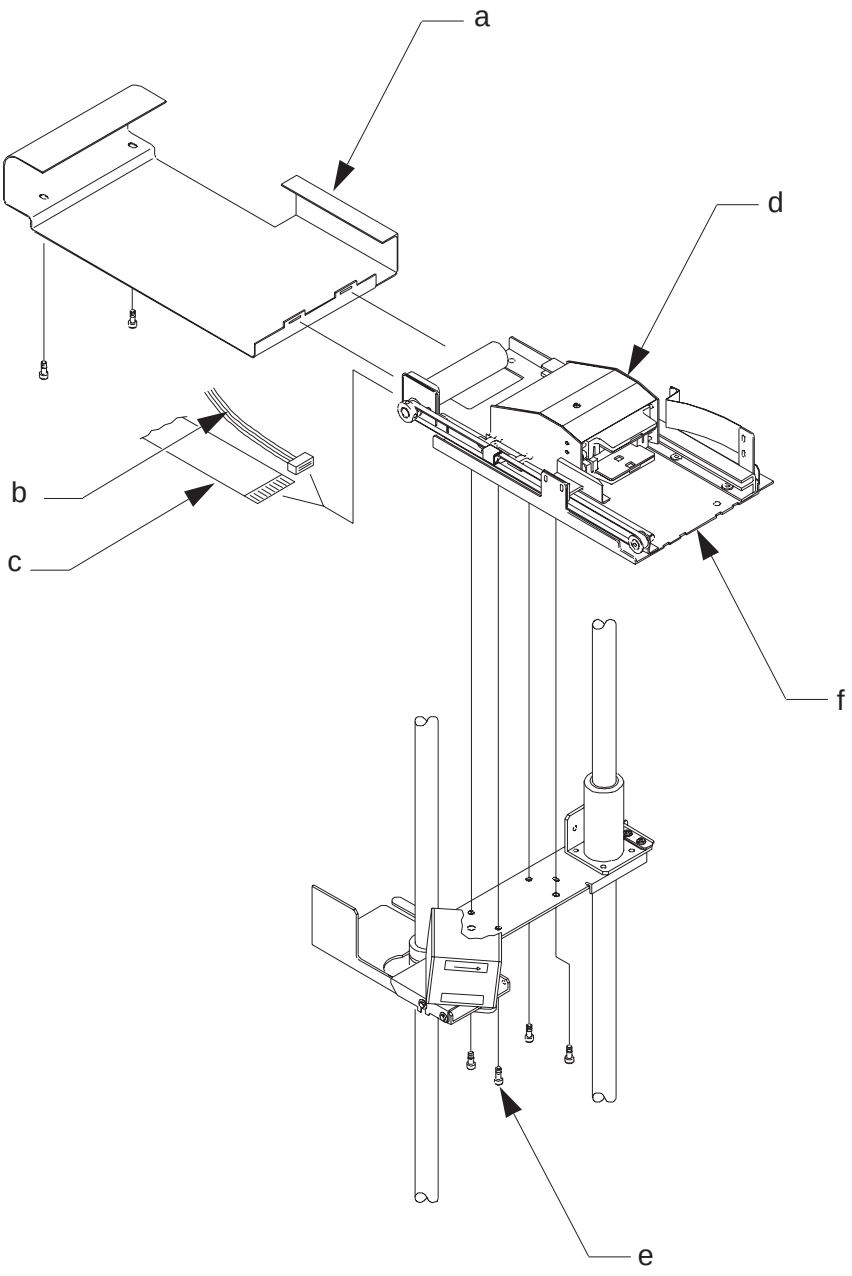
Note ***Unplug the flex cable by slightly pushing the sleeve of the connector open before pulling the cable out.***

8. Manually push the gripper assembly (d) along the extension assembly rails to the "home" position (toward the door window).
9. Remove the screws (e) that secure the extension axis to the vertical carriage. The mounting screws are accessible from the underneath side of the vertical carriage.

Note ***Hold the extension axis assembly securely when removing the last mounting screw.***

10. Lift and remove the extension axis assembly (f) *slowly*, allowing the vertical carriage to move to the top of the door as the counterweight slides to the bottom of the door when the extension axis is removed.
11. Reverse the procedure to install the new extension axis assembly.

Figure 18: Extension axis assembly



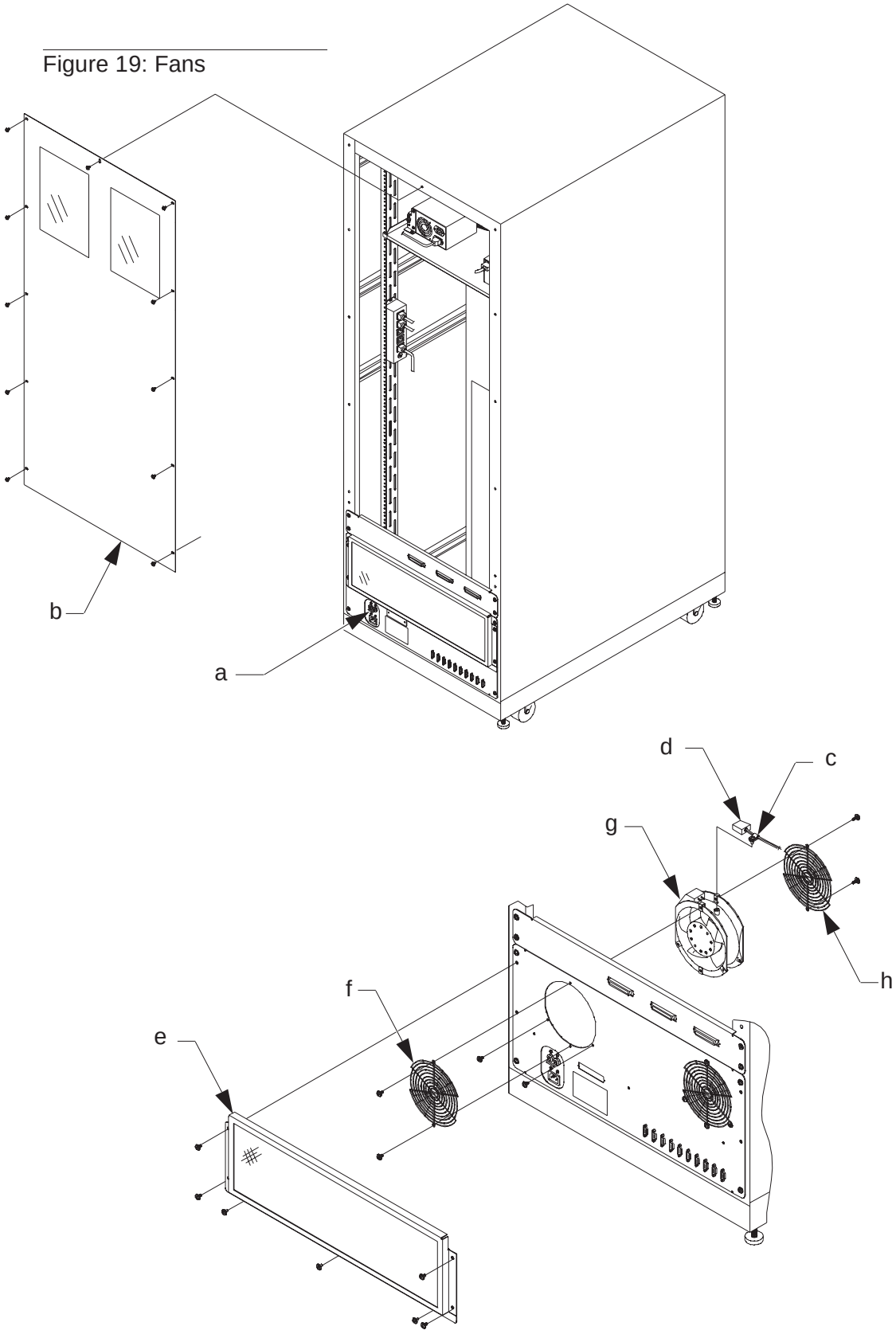
Fans

1. Remove power from the library by turning off the circuit breaker switch (a).
2. Remove the rear access panel (b) from the library.

Note ***Remove the top middle screw last, when removing the rear access panel and install it first, when replacing the panel.***

3. Remove the AC cable clamp (c). Unplug the AC cable (d) from the fan.
4. Remove the fan filter (e).
5. Remove the screws that secure the fan to the panel and the finger guard (f).
6. Remove the fan (g).
7. Remove the remaining finger guard (h).
8. Reverse the procedure to install the new fan.

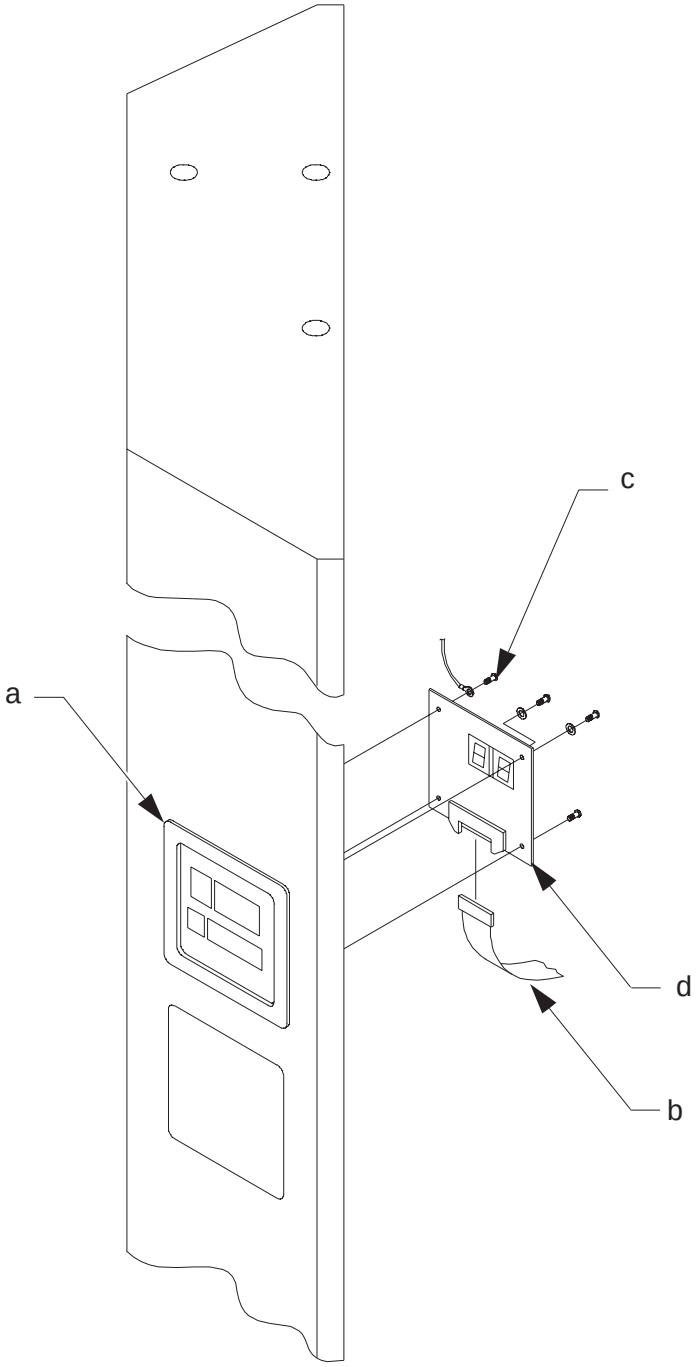
Figure 19: Fans



Front Control Panel PWA

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Locate the control panel (a) on the outside of the front door.
4. Disconnect the cable (b) from the control panel PWA.
5. Remove the screws (c) that secure the control panel PWA to the inside of the front door.
6. Remove the control panel PWA (d).
7. Reverse the procedure to install the new control panel PWA.

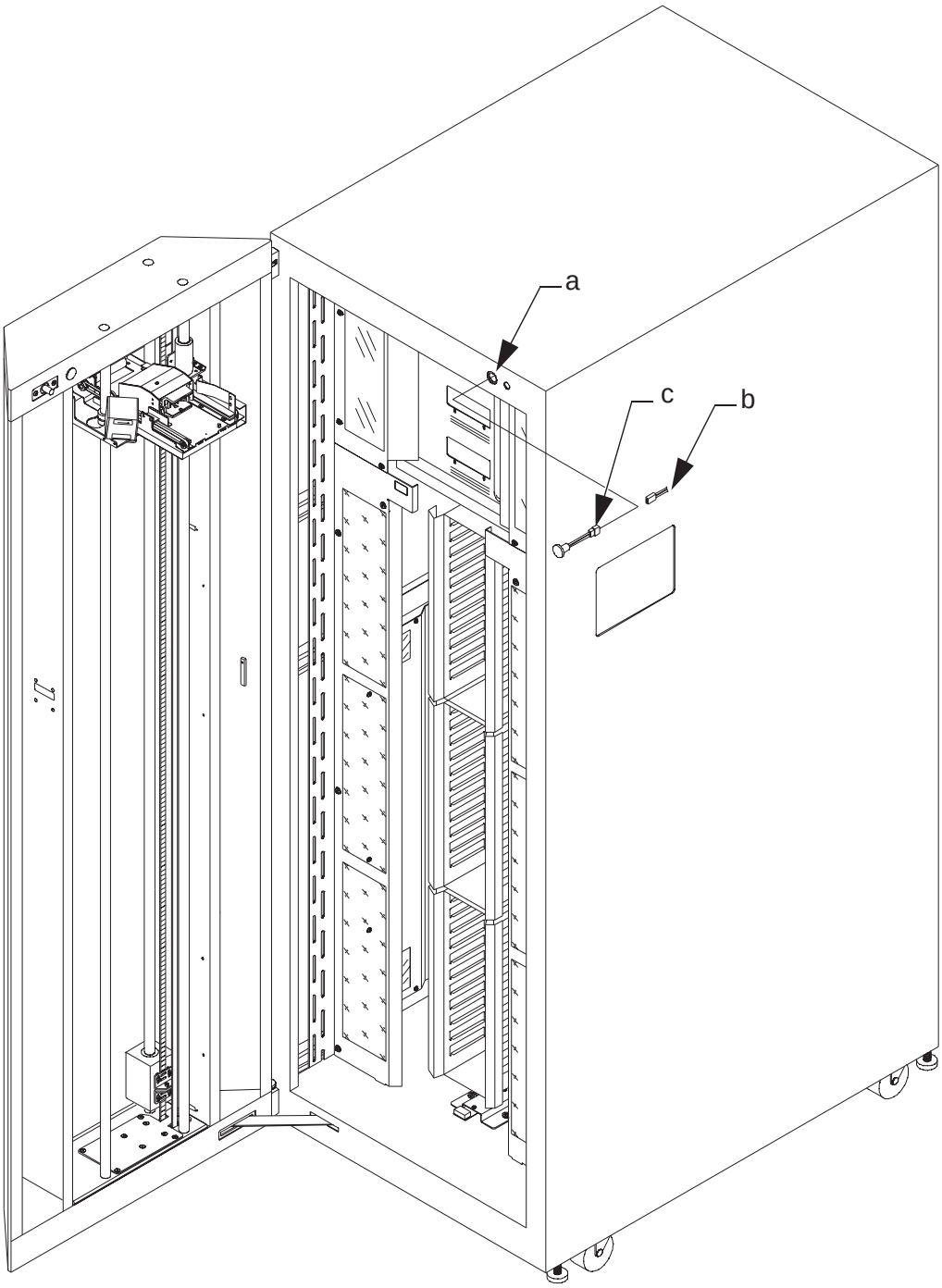
Figure 20: Front control panel PWA



Front Door Interlock Switch

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Locate the front door interlock switch (a) in the upper right corner of the cabinet.
4. Disconnect the cable to the switch assembly (b).
5. Remove the switch (c) by squeezing the retaining tabs on the sides of the switch and pushing the switch forward out of its mounting hole.
6. Reverse the procedure to install the new front door interlock switch.

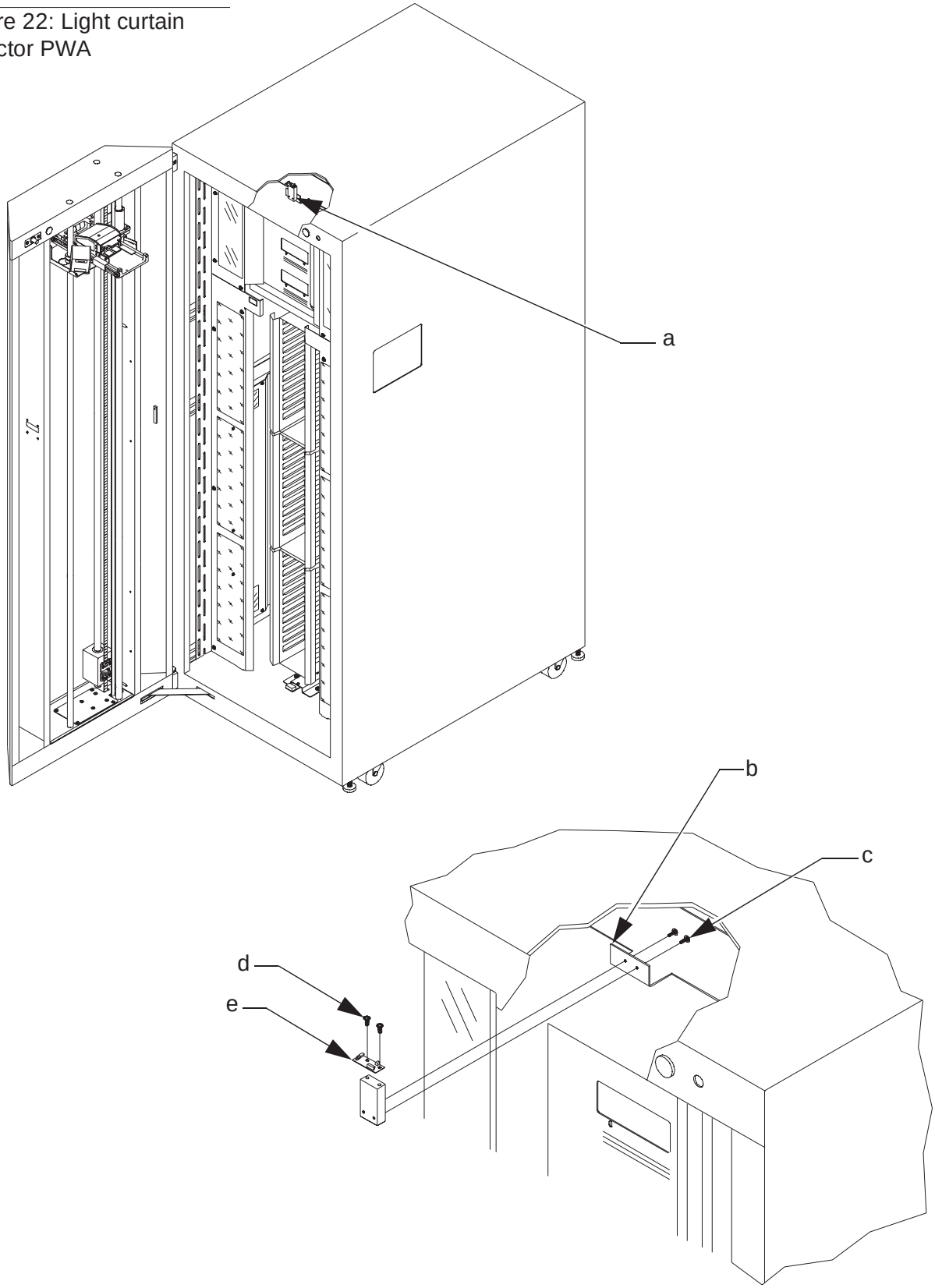
Figure 21: Front door interlock switch



Light Curtain Detector PWA

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Locate the light curtain detector PWA (a) directly above the tape drives.
4. Disconnect the cable to the light curtain detector PWA (b).
5. Remove the screws that secure the light curtain detector assembly to the library frame (mounting bracket) (c).
6. Remove the screws (d) securing the light curtain detector PWA (e) to the mounting block.
7. Reverse the procedure to install the new light curtain detector PWA.

Figure 22: Light curtain detector PWA



Logic Power Supply

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Remove the DLT binpacks from the library. See binpack removal on page 3-20.
4. Remove the left cosmetic panel (a).
5. Remove the library electronics cover (b).
6. Disconnect the following cables from the power supply:

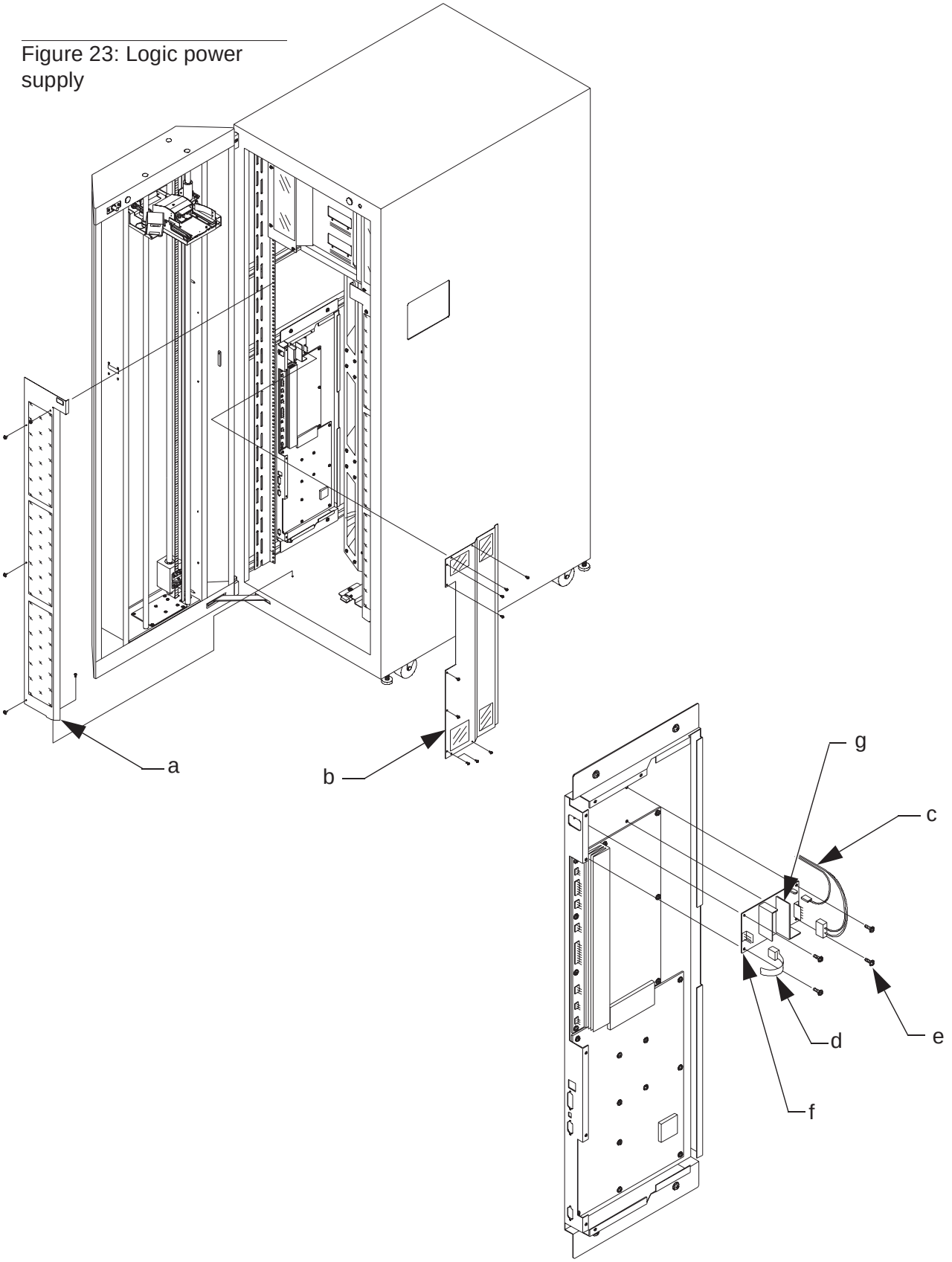
   input cable (c)
   output cable (d)

7. Remove the screws (e) that secure the logic power supply to the electronics enclosure.
8. Remove the logic power supply (f) from the electronics enclosure.

Note ***Leave the logic power supply insulator (g) in place.***

9. Reverse the procedure to install the new logic power supply.

Figure 23: Logic power supply



Motor Power Supply

1. Remove power from the library by turning off the circuit breaker switch (a).
2. Remove the rear access panel (b) from the library.

Note ***Remove the top middle screw last, when removing the rear access panel and install it first, when replacing the panel. There is no need to remove the system integrator panel or rear connector panel to perform this procedure.***

3. Disconnect the following cables from the motor power supply (see Figure 24):

   input power cable (c)
   output power cable(s) (c)

4. Remove the mounting plate (d) from the motor power supply.
5. Remove the screws (e) that secure the motor power supply to the base of the cabinet.
6. Remove the power supply.
7. Reverse the procedure to install the new motor power supply.

Figure 24: Motor power supply cable connections

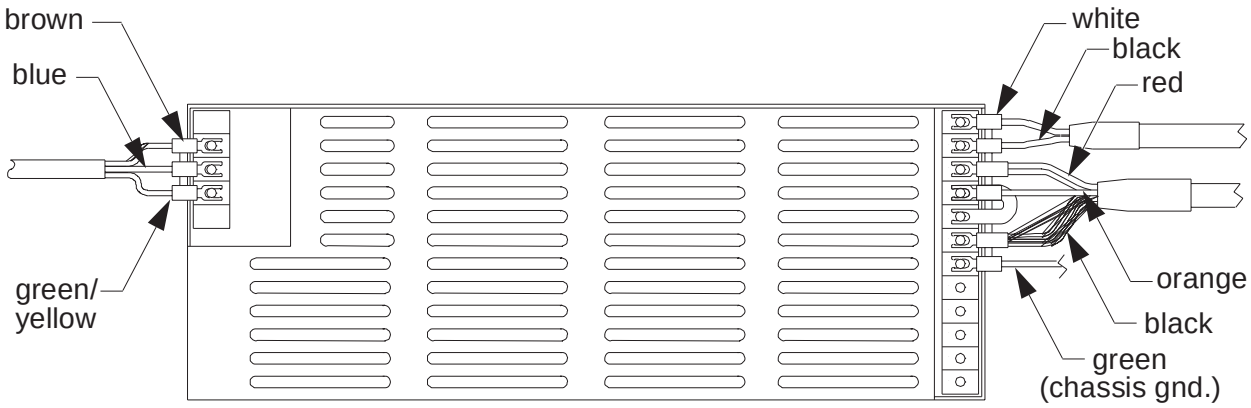
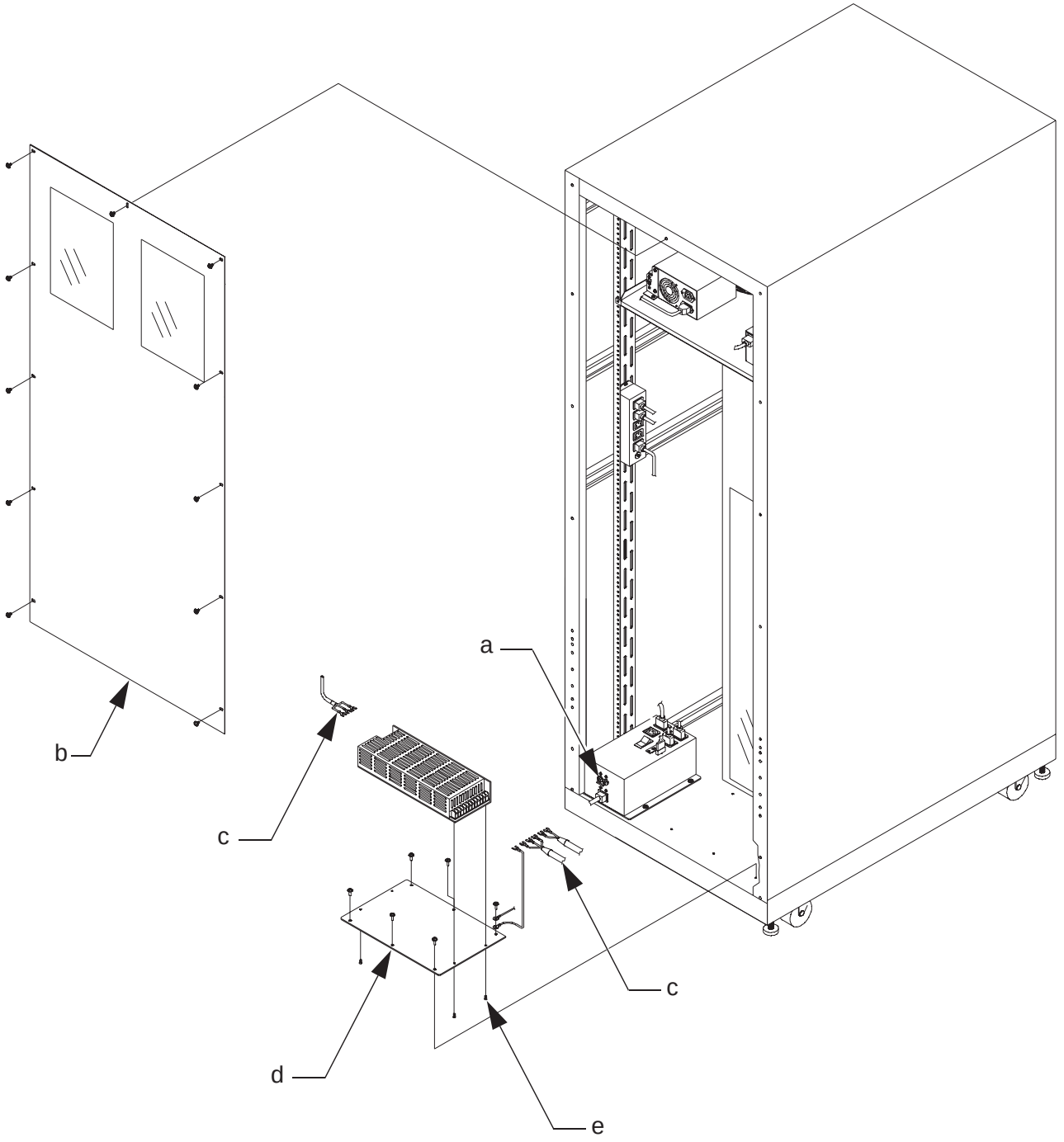


Figure 25: Motor power supply



Multi-Unit Controller (MUC) Assembly

1. Remove power from the library by turning off the circuit breaker switch (a).
2. Remove the rear access panel (b) from the library.

Note ***Remove the top middle screw last, when removing the rear access panel and install it first, when replacing the panel.***

3. Switch the MUC power switch to the OFF position.
4. Disconnect the following cables from the MUC assembly:

   input power cable (c)
   RS-232 distribution cable (d)
   SCSI cable (e)

5. Remove the screws (f) that secure the MUC to the tape drive shelf.
6. Remove the MUC (g).
7. Remove the SCSI terminator (h) from the old MUC assembly and install the terminator on the new MUC assembly.
8. Set DIP Switch (SW1) microswitches on the new MUC assembly to match the configuration on the old MUC assembly. (See Table 5 and Table 6 for reference.)

Note ***SW1 is located on the MUC rear panel next to the SCSI cable connector.***

9. Reverse the procedure to install the new MUC assembly.

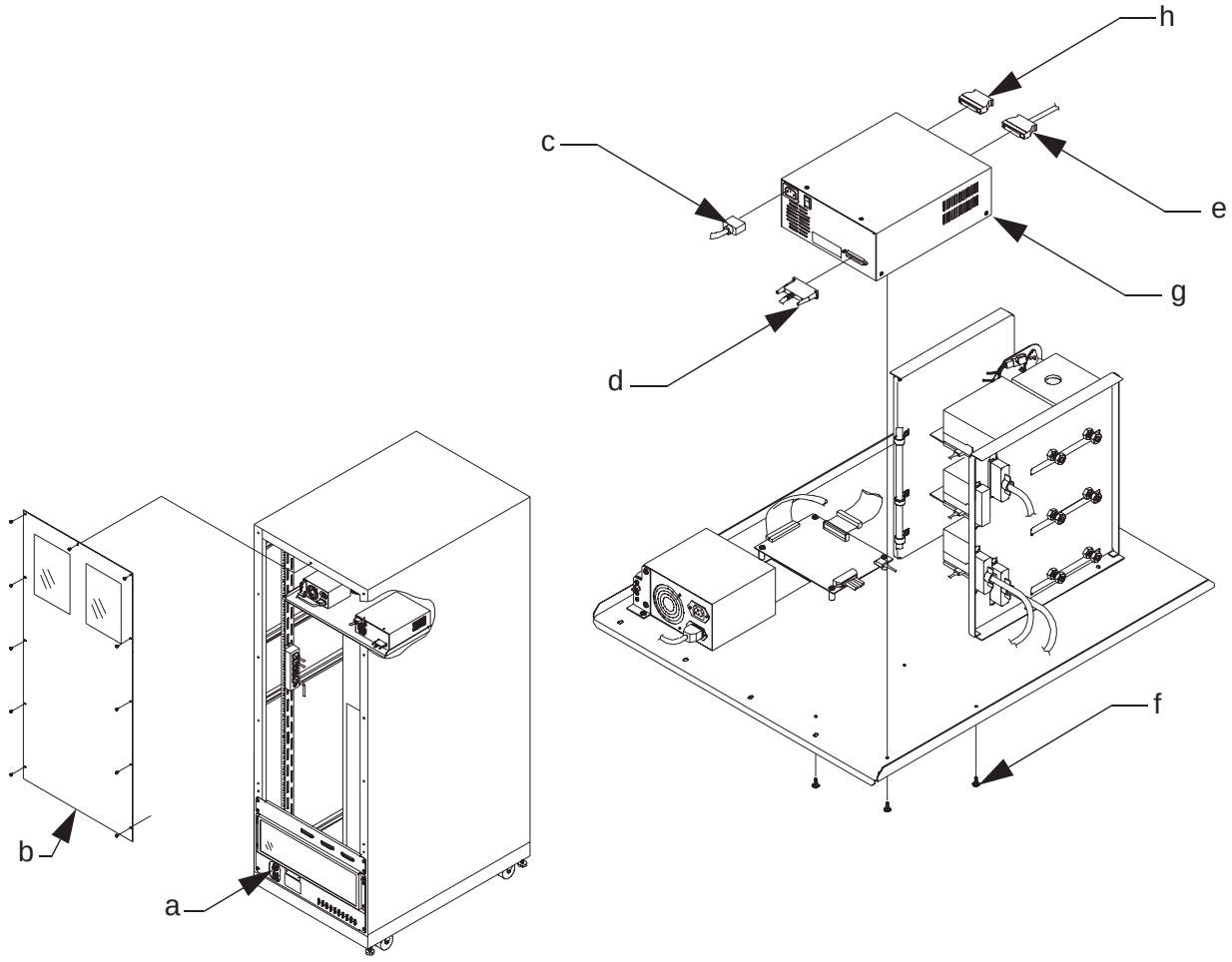
Table 5: MUC SW1 microswitch functions

Microswitch	Function
1, 2 and 3	SCSI Identification (see Table 6)
4 and 5	Reserved for testing. (Must be in the DOWN position.)
6	Disable Bus Reset on Power-Up (Default=Disabled/UP)
7	Host Selection (DOWN=SCSI/UP=RS-232) Note When this microswitch is UP, Table 6 is not applicable.
8	Reserved for testing. (Must be in the DOWN position.)

Table 6: SCSI IDs

SW1	SW2	SW3	SCSI ID
DOWN	DOWN	DOWN	0
UP	DOWN	DOWN	1
DOWN	UP	DOWN	2
UP	UP	DOWN	3
DOWN	DOWN	UP	4
UP	DOWN	UP	5
DOWN	UP	UP	6
UP	UP	UP	7

Figure 26: MUC assembly



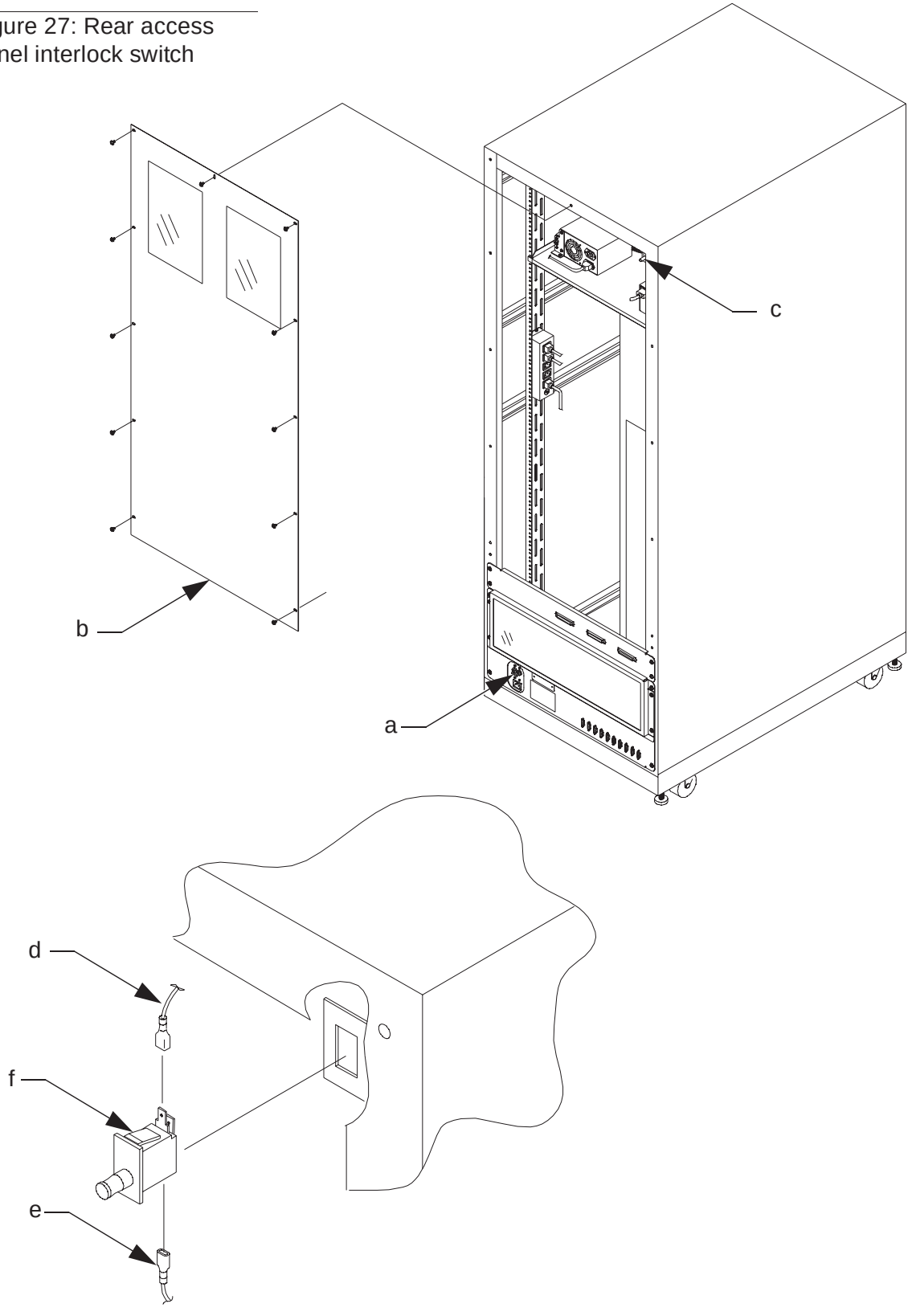
Rear Access Panel Interlock Switch

1. Remove power from the library by turning off the circuit breaker switch (a).
2. Remove the rear access panel (b) from the library.

Note ***Remove the top middle screw last, when removing the rear access panel and install it first, when replacing the panel.***

3. Locate the rear access panel interlock switch (c), which is located in the rear, upper right corner of the cabinet.
4. Remove the red (d) and black (e) wires from the switch terminals.
5. Remove the switch by squeezing the retaining tabs (f) on the sides of the switch and pushing the switch out of its mounting hole.
6. Install the new switch in the mounting hole.
7. Connect the red wire to the normally open (NO) terminal and the black wire to the common (COM) terminal on the switch.
8. Replace the rear access panel.
9. Return power to the library.

Figure 27: Rear access panel interlock switch



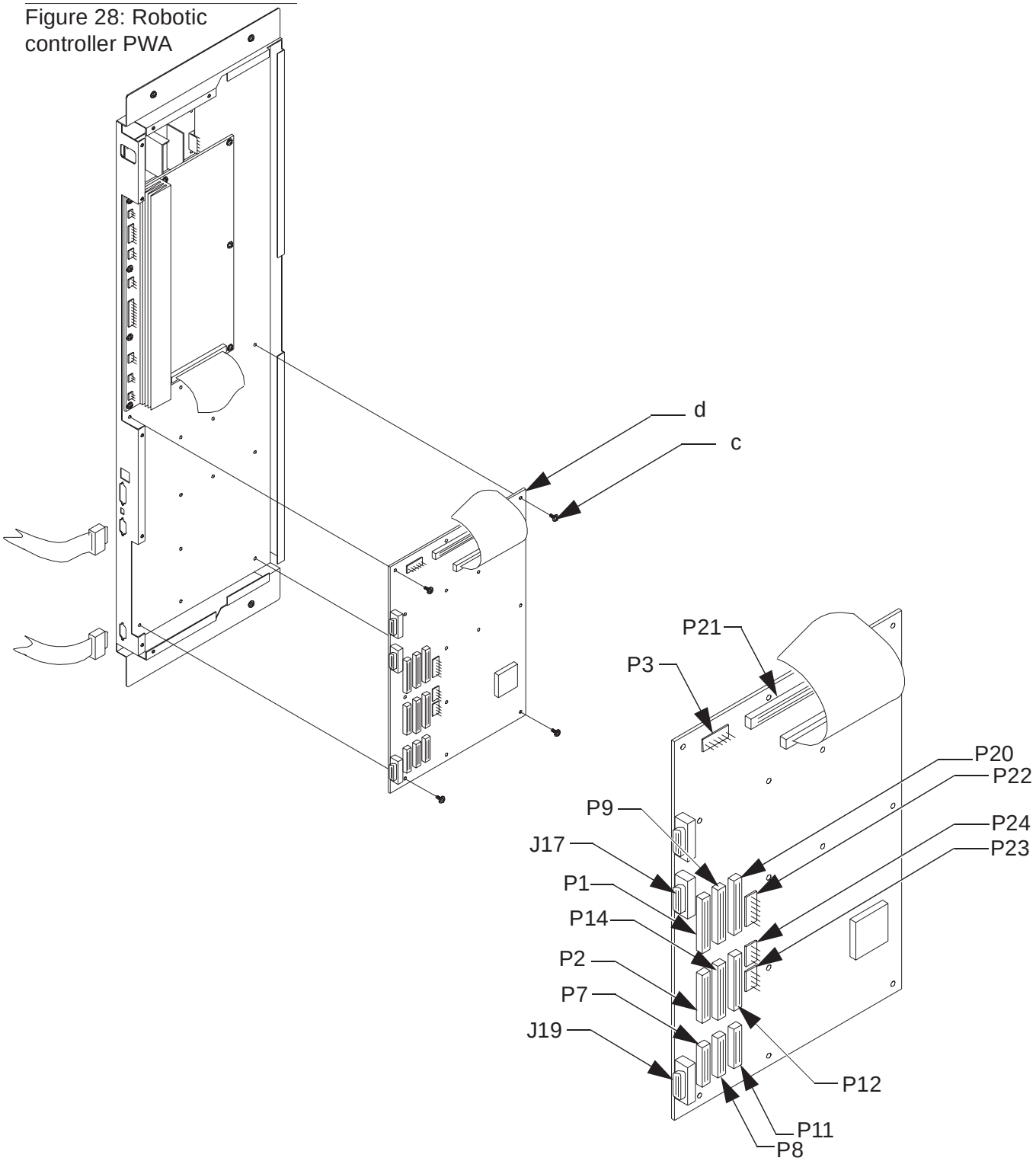
Robotic Controller PWA

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Remove the DLT binpacks from the library. See binpack removal on page 3-20.
4. Remove the left cosmetic panel (see (a) in Figure 8 on page 3-11). Remove the library electronics cover (see (b) in Figure 8 on page 3-11).
5. Disconnect the following cables from the robotic controller PWA:

robotic controller connector:	cable connector:	connects to:
P21	J21	actuator PWA
P3	J3	logic power supply
P9	J9	IOD
J17	P1	diag RS-232 port
P1	J1	PTM
P14	J14	control panel
P2	J2	light curtain/carousel sensors
P7	J7	carousel motor encoder
J19	P1	host RS-232 port
P8	J8	carousel output position encoder
P11	J11	vertical motor encoder
P12	J12	ribbon/ZIF adapter
P23	J23	vertical home sensor
P24	J24	vertical limit sensor
P22	J22	door switches
P20	J20	stepper motor driver PWA

6. Remove the screws (c) that secure the robotics controller PWA to the electronics enclosure. Remove the robotics controller PWA (d) from the electronics enclosure.
7. Verify that all jumpers on the new robotic controller PWA are installed correctly.
8. Reverse the procedure to install the new robotics controller PWA.

Figure 28: Robotic controller PWA



RS-232 Distribution PWA

1. Remove power from the library by turning off the circuit breaker switch (a).
2. Remove the rear access panel (b) from the library.

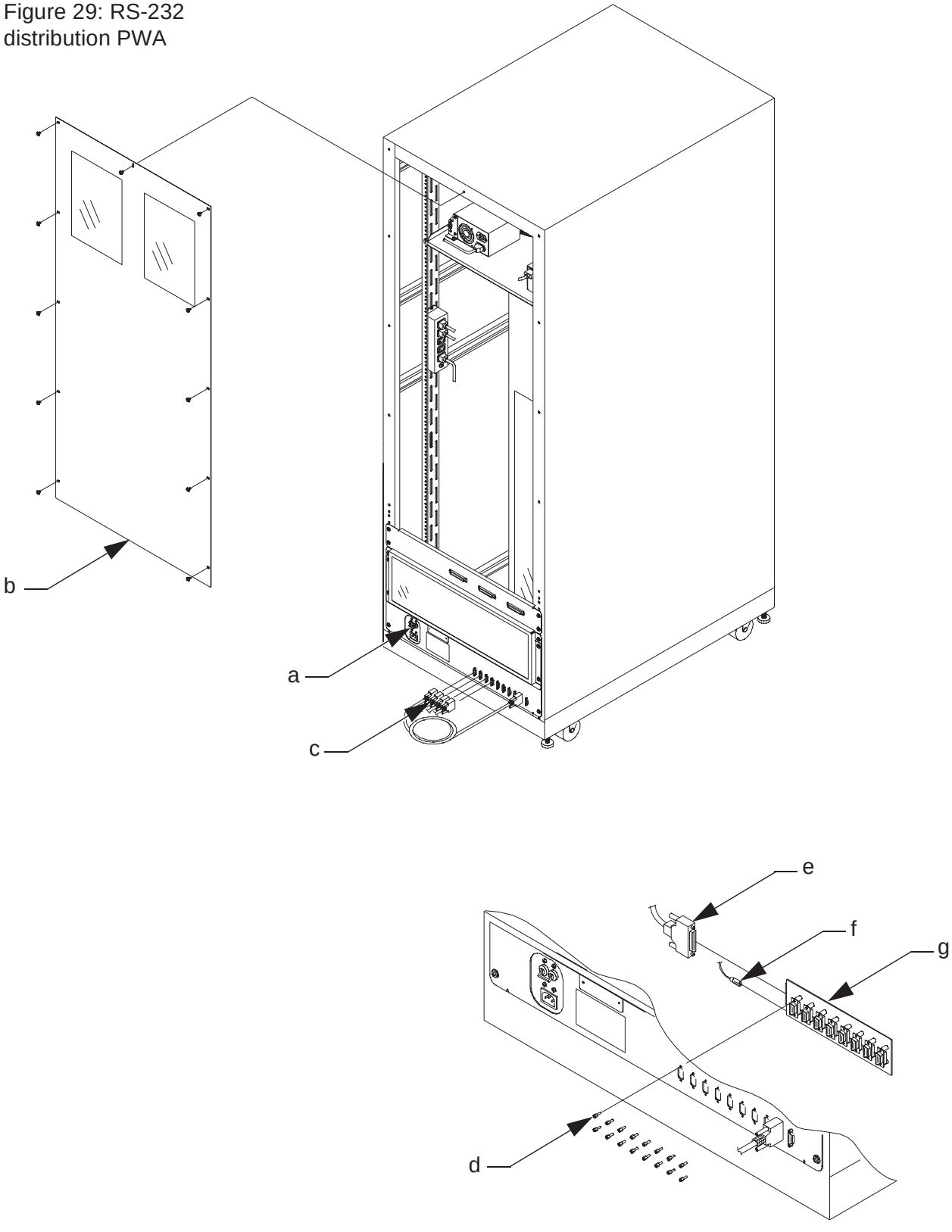
Note ***Remove the top middle screw last, when removing the rear access panel and install it first, when replacing the panel.***

3. Label and unplug all RS-232 cables (c) that are externally attached to the distribution panel at the ports labeled: UNIT 0 through UNIT 4, RESERVED, HOST and DIAG.
4. Remove the jackscrews (d) that secure the RS-232 distribution panel to the fan/connector panel.

Note ***The jackscrews are located at the top and bottom of each DB9 connector on the outside of the fan/connector panel.***

5. Unplug the DB25 cable (e) from J1 at the left end of the distribution PWA.
6. Unplug the ground cable (f) from the spade lug on the back of the distribution PWA.
7. Remove the RS-232 distribution PWA (g) from the fan/connector panel.
8. To reinstall the RS-232 distribution panel reverse the above procedure.

Figure 29: RS-232 distribution PWA



Stepper Motor Assembly

1. Remove power from the library by turning off the circuit breaker switch (see (a) in Figure 31 on page 3-53).
2. Remove the rear access panel from the library (see (b) in Figure 31 on page 3-53).

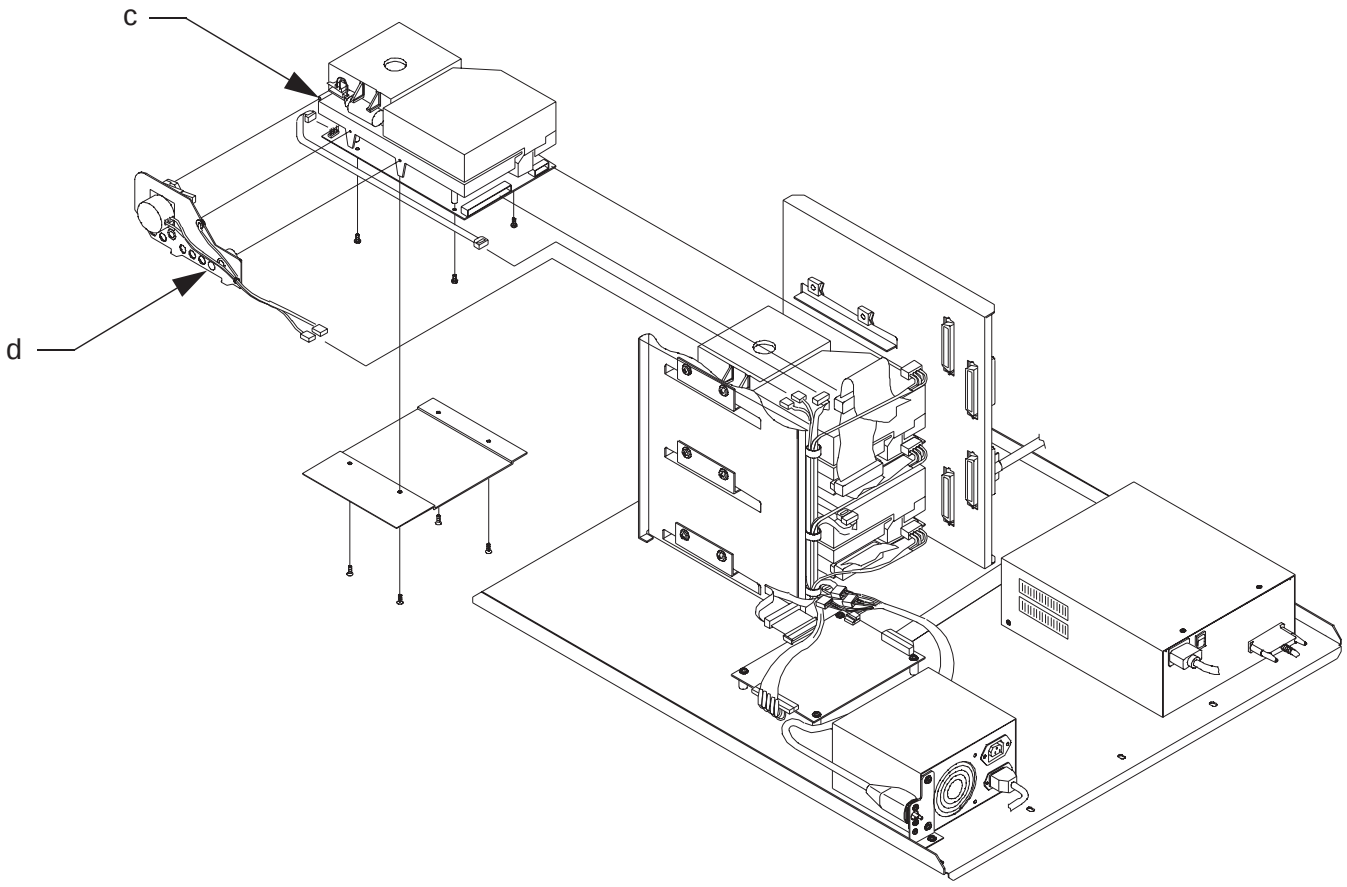
Note ***Remove the top middle screw last, when removing the rear access panel and install it first, when replacing the panel.***

3. Remove the TZ87 differential SCSI DLT tape drive that has the affected stepper motor assembly. See tape drive removal on page 3-56.
4. Loosen the captive screws (c) that secure the stepper motor assembly to the tape drive.
5. Remove the stepper motor assembly (d).
6. Reverse the procedure to install the new stepper motor assembly.

Note ***Observe the proper alignment of the handle sensor mechanism.***

7. Replace the TZ87 differential SCSI DLT tape drive. See page 3-56 for tape drive replacement.
8. Replace the rear access panel.
9. Return power to the library.

Figure 30: Stepper motor assembly



Stepper Motor Driver PWA

1. Remove power from the library by turning off the circuit breaker switch (a).
2. Remove the rear access panel (b) from the library.

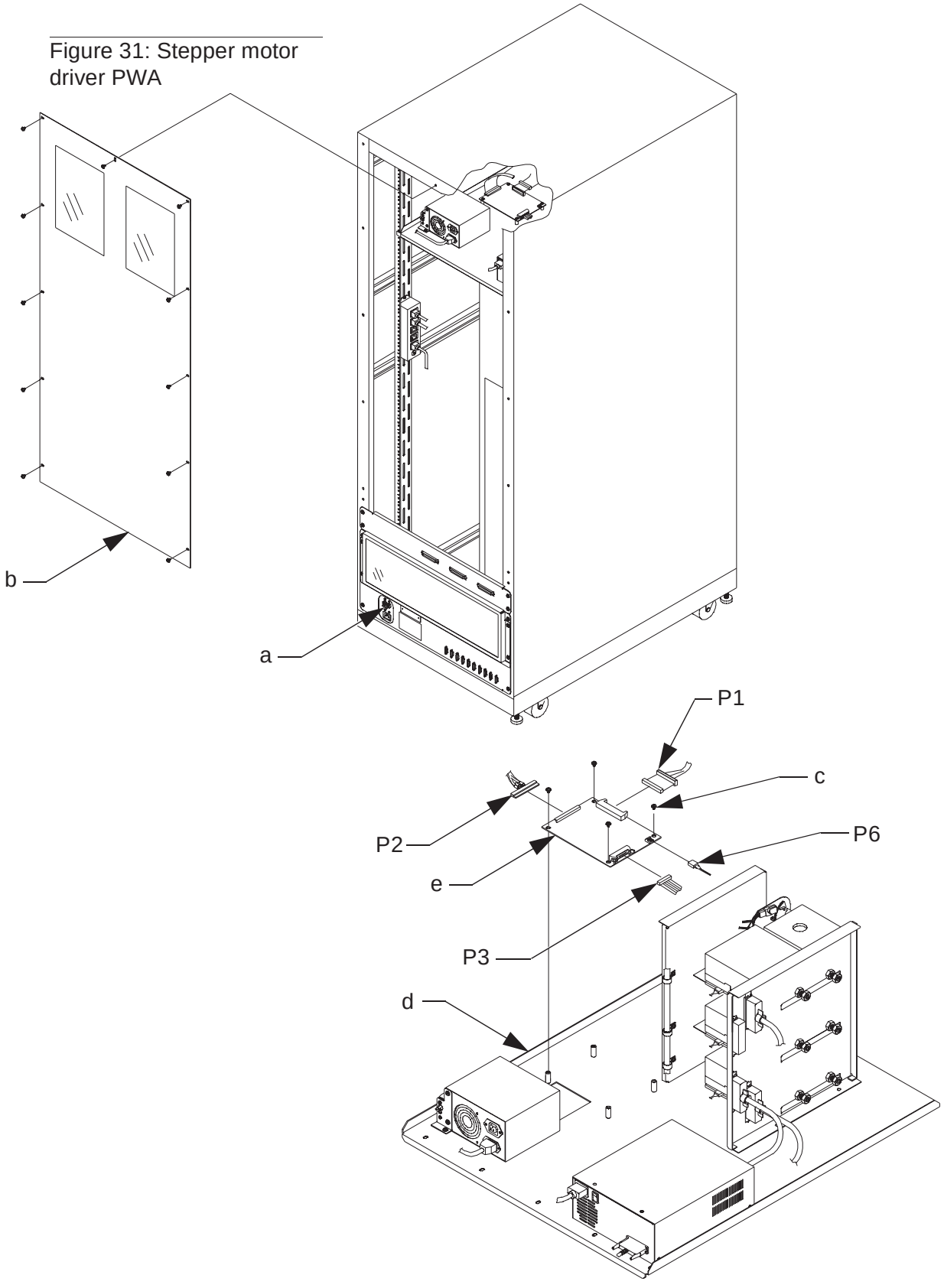
Note ***Remove the top middle screw last, when removing the rear access panel and install it first, when replacing the panel.***

3. Disconnect the following cables from the stepper motor driver PWA:

PWA connector:	cable connector:	connects to:
J1	P6	Tape Drive Power Supply (PS)
J2	P2	I/O Connector to Stepper Motor Assemblies
J3	P3	I/O Connector to the Robotic Controller
J4	P1	I/O Connector to the Tape Drives

4. Remove the screws (c) that secure the stepper motor driver PWA to the tape drive shelf (d).
5. Remove the stepper motor driver PWA (e).
6. Reverse the procedure to install the new stepper motor driver PWA.

Figure 31: Stepper motor driver PWA



Tape Drive Power Supply

1. Remove power from the library by turning off the circuit breaker switch (a).
2. Remove the rear access panel (b) from the library.

Note ***Remove the top middle screw last, when removing the rear access panel and install it first, when replacing the panel.***

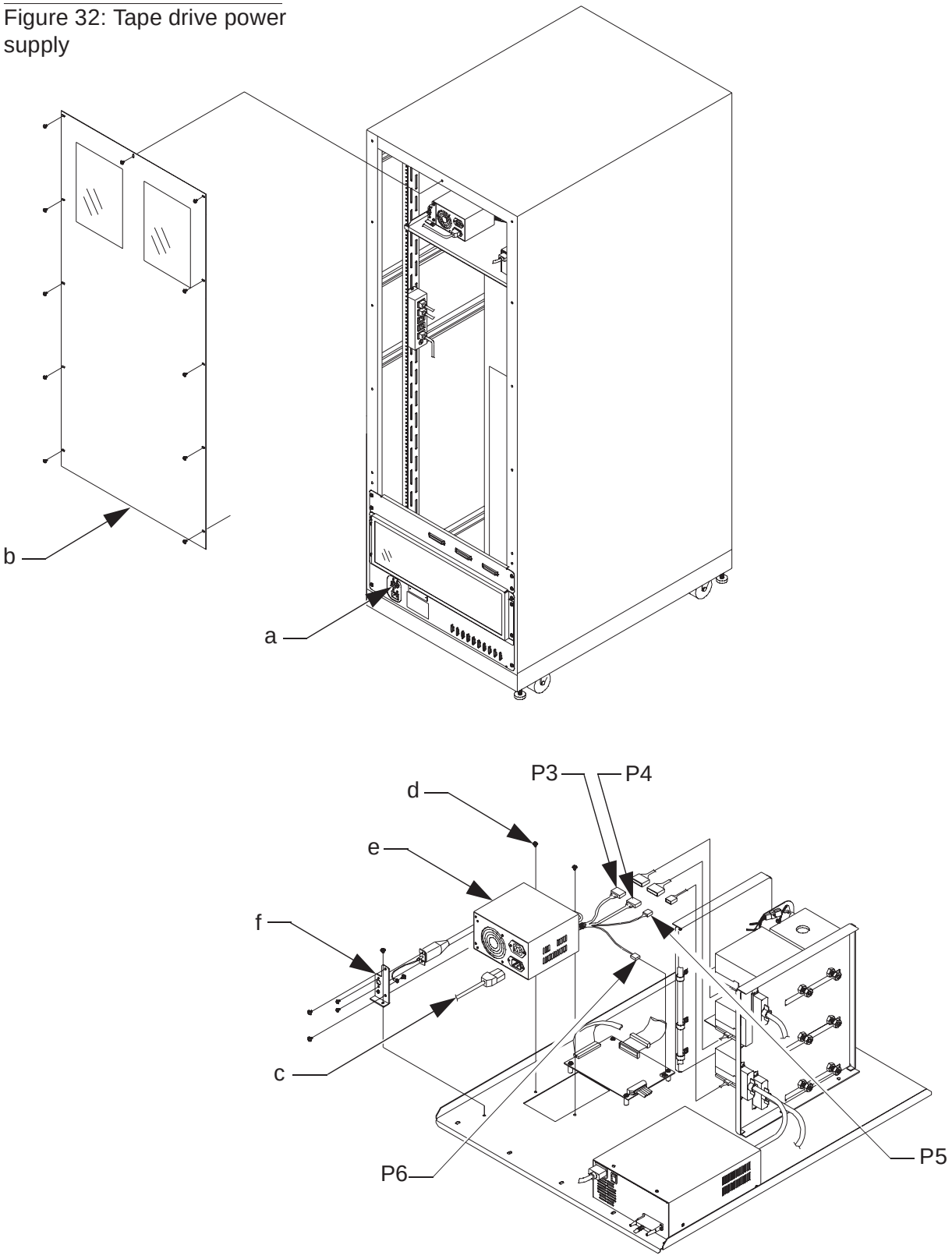
3. Switch the tape drive power supply power switch to the OFF position.
4. Remove the AC power cord (c).
5. Disconnect the power supply cable harness from the following:

power supply connector:	cable connector:	connects to:
P6	J1	stepper motor driver PWA
P3	J3	Drive 2
P4	J4	Drive 1
P5	J5	Drive 0

6. Remove the screws (d) that secure the tape drive power supply to the tape drive shelf.
7. Remove the tape drive power supply (e).
8. Remove the mounting bracket (f) that secures the on/off switch to the tape drive power supply.
9. Reverse the procedure to install the new tape drive power supply.

Note ***When reinstalling the tape drive power supply, be sure to place the power switch to the ON position.***

Figure 32: Tape drive power supply



TZ87 Differential SCSI DLT Tape Drive

1. Remove power from the library by turning off the circuit breaker switch.
2. Remove the rear access panel from the library.

Note ***Remove the top middle screw last, when removing the rear access panel and install it first, when replacing the panel.***

3. Open the front door of the library.
4. Remove the screws that secure the drive cosmetic panel (a).
5. From the rear of the library, disconnect the following cables from the affected tape drive:

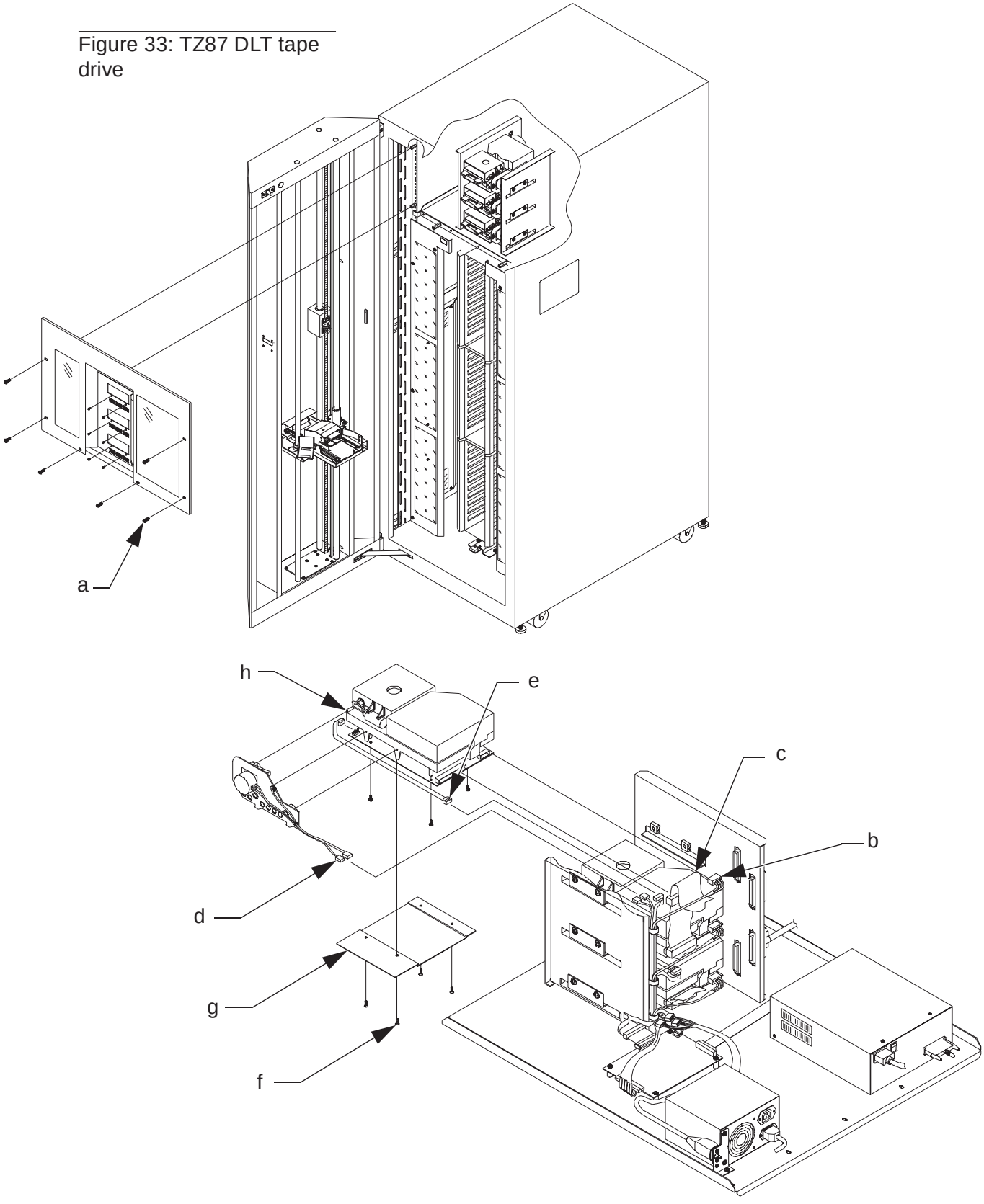
   power cable (b)
   SCSI cable (c)
   stepper motor assembly cables (d)
   tape sensor cable (e)

6. Remove the screws (f) that secure the affected tape drive to the tape drive rack (g).
7. From the front of the library, remove the affected tape drive.
8. Remove the screws (h) that secure the stepper motor assembly to the tape drive.

Note ***Be sure to remove the bezel and bottom plate from the replacement tape drive and reinstall them on the defective tape drive before returning the defective tape drive to the factory.***

9. Verify that the jumpers on the new TZ87 differential SCSI DLT tape drive are installed correctly.
10. Reverse the procedure to install the new TZ87 differential SCSI DLT tape drive.
11. Recheck tape drive alignment according to the procedure on page 5-12.

Figure 33: TZ87 DLT tape drive



Umbilical Cable

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Disconnect the umbilical cable (a) from the door flex/ribbon interface PWA (b).

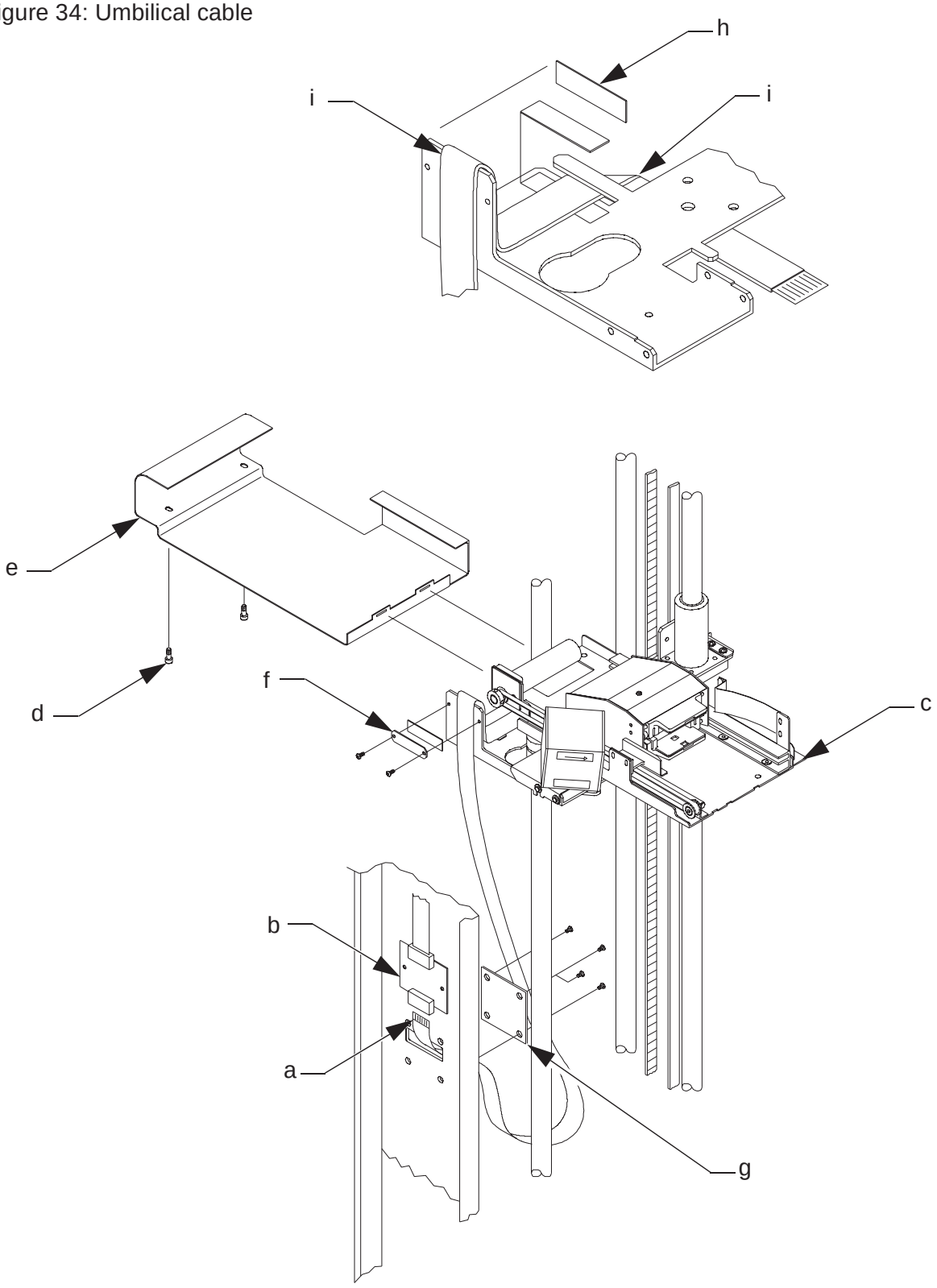
Note ***Unplug the flex cable by slightly pushing the sleeve of the connector open before pulling the cable out.***

4. Move the vertical carriage (c) to a position near the center of the vertical travel.
5. Remove the screws (d) securing the bottom cover plate (e) to the extension axis assembly.
6. With the screws removed, move the bottom cover plate to the front, then to the right approximately 1” (2.5cm). Tilt the front of the cover down to the door window and push the cover up between the extension axis motor and the door window.
7. Disconnect the flex cable from the extension axis assembly. See Figure 18 on page 3-29.

Note ***Unplug the flex cable by slightly pushing the sleeve of the connector open before pulling the cable out.***

8. Remove the clamp (f) securing the umbilical cable to the vertical carriage assembly.
9. Remove the clamp (g) securing the umbilical cable to the door.
10. Carefully detach the umbilical cable from the double sided tape (h) on the vertical carriage assembly.
11. Use the removed umbilical cable as a model to form the appropriate bends (i) in the new cable to be installed.
12. Install the new cable by reversing the above procedure.

Figure 34: Umbilical cable



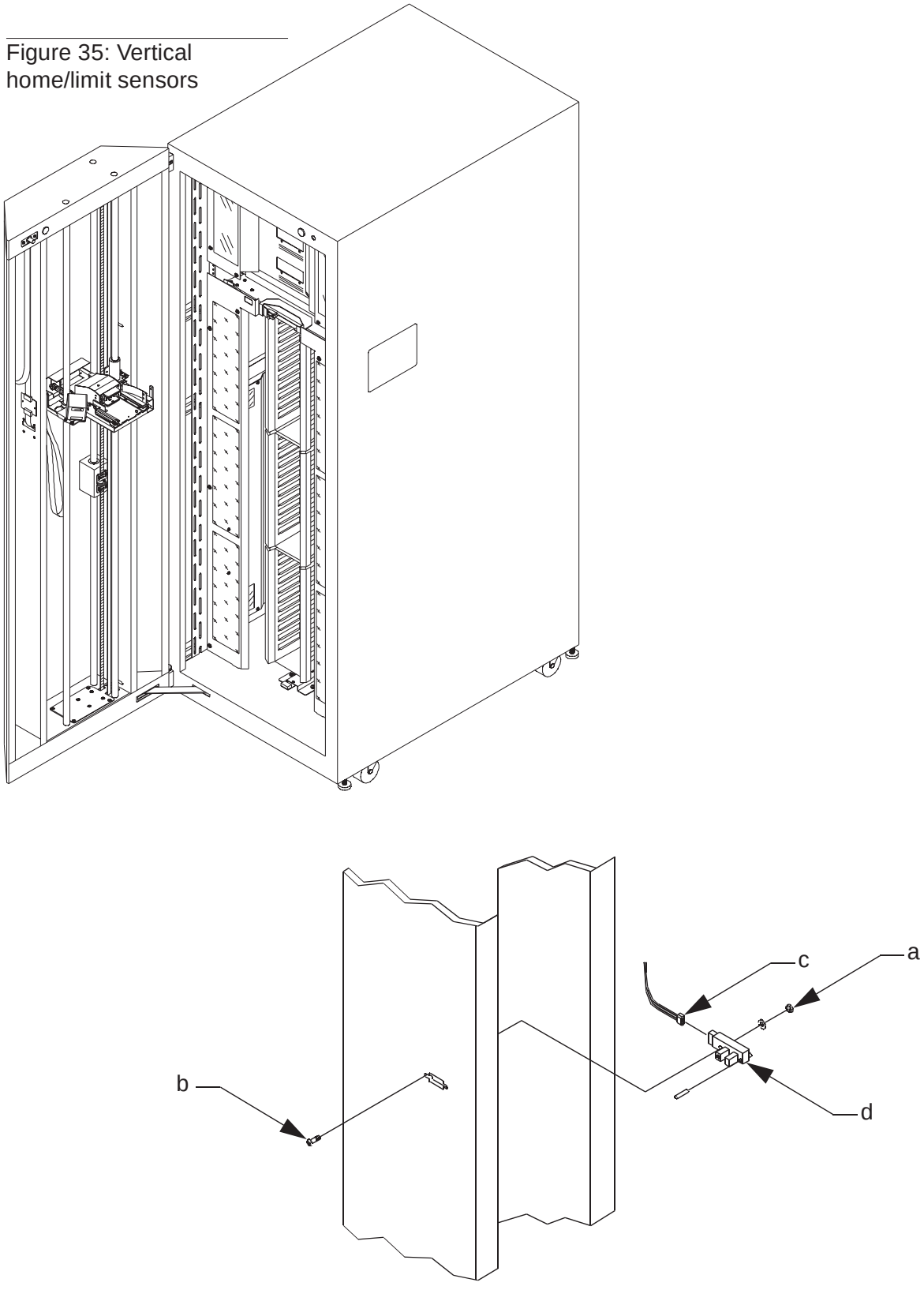
Vertical Home/Limit Sensors

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.

Note ***Both the vertical home and limit sensors are removed in the same manner.***

3. Locate the vertical home/limit sensor inside of the library door.
4. Remove the nut (a) and cap screw (b) securing the sensor to the door.
5. Unplug the sensor cable (c) and remove the sensor (d).
6. Reverse the procedure to install a new sensor.

Figure 35: Vertical home/limit sensors

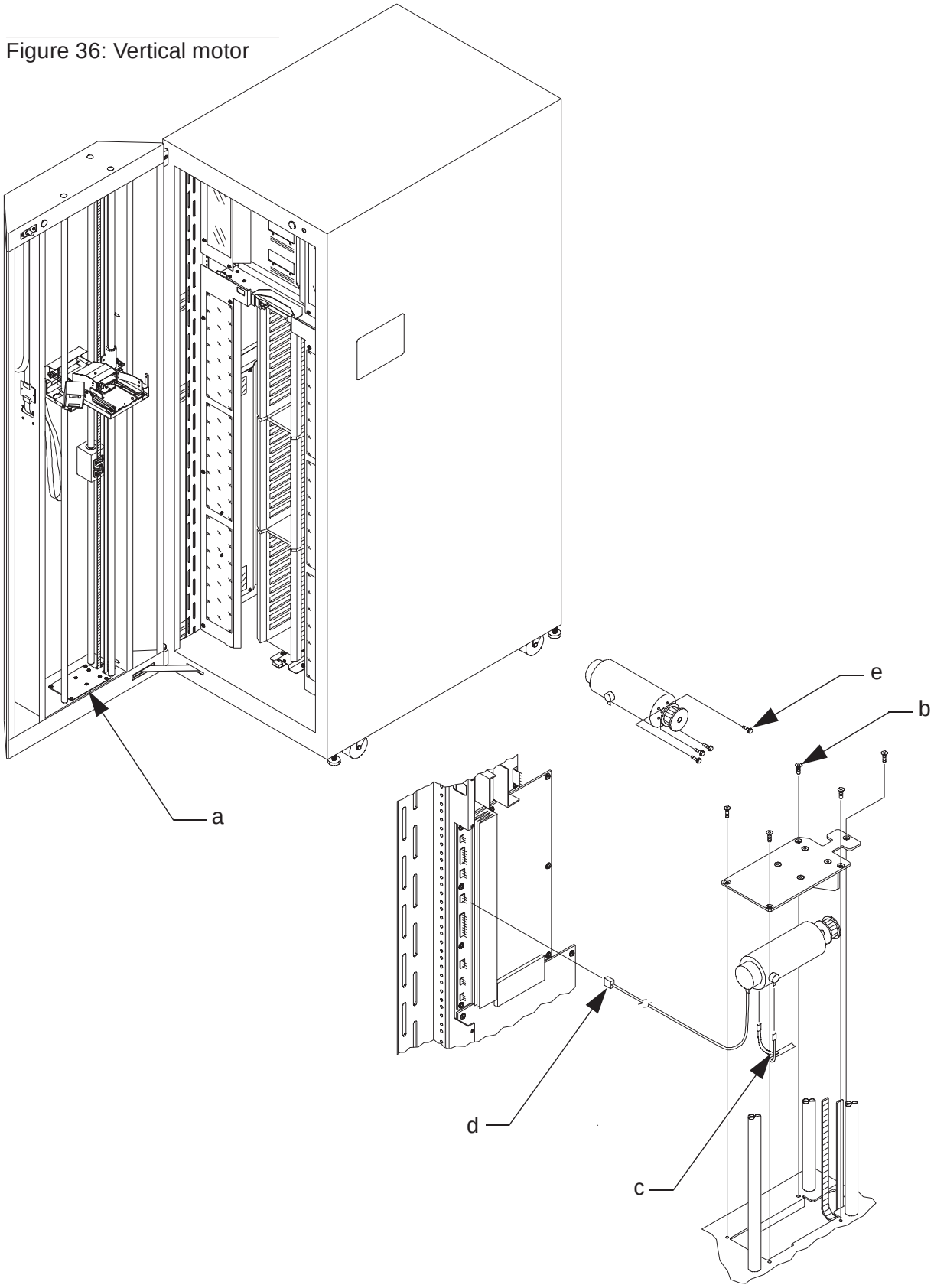


Vertical Motor

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Locate the vertical motor (a) in the base of the library door.
4. Remove the screws (b) that secure the vertical motor assembly to the base of the door.
5. Remove the vertical motor assembly from the door.
6. Disconnect the following cables from the vertical motor:

   motor power (c)
   encoder (d) (black to black/red to red)
7. Remove the vertical belt.
8. Remove the screws (e) that secure the vertical motor to the mounting plate.
9. Reverse the procedure to install the new vertical motor.
10. Adjust the belt tension by performing the procedure on page 5-3.

Figure 36: Vertical motor



Vertical Drive Belt

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Move the vertical carriage (a) to a position near the center of the vertical travel (see Figure 37).

⚠ CAUTION ***DO NOT loosen the belt clamping hardware until the hinged collars are securely in place. Loosening or removing a belt clamp without a collar in place will force the vertical carriage to fall and cause possible damage to the library.***

4. Place a hinged collar on the vertical rail directly below the counterweight to hold the counterweight in position on the vertical rail.
5. Place a hinged collar directly below the vertical carriage on either of the two vertical rails to hold the carriage in position on the vertical rails.

Removing the vertical drive belt

6. Remove the belt tension adjustment screw (b) from the counterweight belt clamps.

WARNING ***DO NOT stand between the vertical rails when removing the vertical carriage belt clamp. If the vertical belt is not properly secured, the counterweight can fall when the vertical carriage is released and cause serious personal injury.***

7. Remove the screws that secure the belt clamp to the vertical carriage and remove the belt clamp.
8. Loosen, but do not remove, the screws securing the upper (c) and lower (d) belt clamps to the counterweight.
9. Remove the ends of the belt from the upper and lower belt clamps.

Note ***Make note of the path of the belt: it is threaded up through the top plate and around the idler pulley (e), down to the base plate and around the motor pulley (f).***

10. Remove the belt.

Installing the new vertical drive belt

11. Thread the new belt over the idler pulley (e) and down to the upper belt clamp.

Note ***The idler pulley is accessed through the hole near the top on the hinge side of the door.***

12. Thread the belt beneath the upper belt clamp, until two belt teeth are visible, and tighten the clamp screws.

13. Thread the opposite end of the belt through the base plate, around the motor pulley and to the lower belt clamp.

14. Thread the belt under the lower belt clamp on the counterweight. Remove as much slack in the belt as possible and tighten the lower belt clamp screws.

15. Cut any excess length of the belt extending through the lower belt clamp.

16. Reinstall the belt tension adjustment screw and tighten until all noticeable slack is removed from the belt.

Note ***Do not over tighten the belt. It may be necessary to SLIGHTLY loosen the counterweight belt clamp screws to tighten the belt tensioning screw.***

Adjusting the vertical drive belt

17. Move the counterweight to the top of its travel.

Note ***The vertical carriage is not yet re-attached and will not move when the counterweight is moved.***

18. Loosen the hinged collar below the counterweight and move it up the rail. Tighten the collar to secure the counterweight at the top of the vertical travel.

19. Remove the hinged collar below the vertical carriage and move the vertical carriage down to the base plate. Position the vertical carriage the distance of one belt tooth above the base plate and reinstall the belt clamp.

20. Test the vertical belt tension:

a. Midway up the vertical travel of the belt, measure the force necessary to push the belt together so the sides just touch with the belt teeth interleaved. The force should be between 18 to 22 ounces (510-624 g).

b. To increase tension, turn the adjustment screw clockwise. To decrease tension, move the adjustment screw counterclockwise.

c. Tighten the four belt clamp screws on the counterweight to 30 in-lb. (3.39 N-m).

d. Recheck the tension.

Vertical carriage position adjustment

21. Position the counterweight against the rubber bumper at the top plate and position the vertical carriage toward the base plate. Locate the home/limit sensor flag and make sure the bottom edge is even with the bottom edge of the vertical limit sensor. If they are not even, do the following:

a. Locate the bearing clamp screws securing the vertical carriage to the linear bearing (g). Loosen the bearing clamp screws.

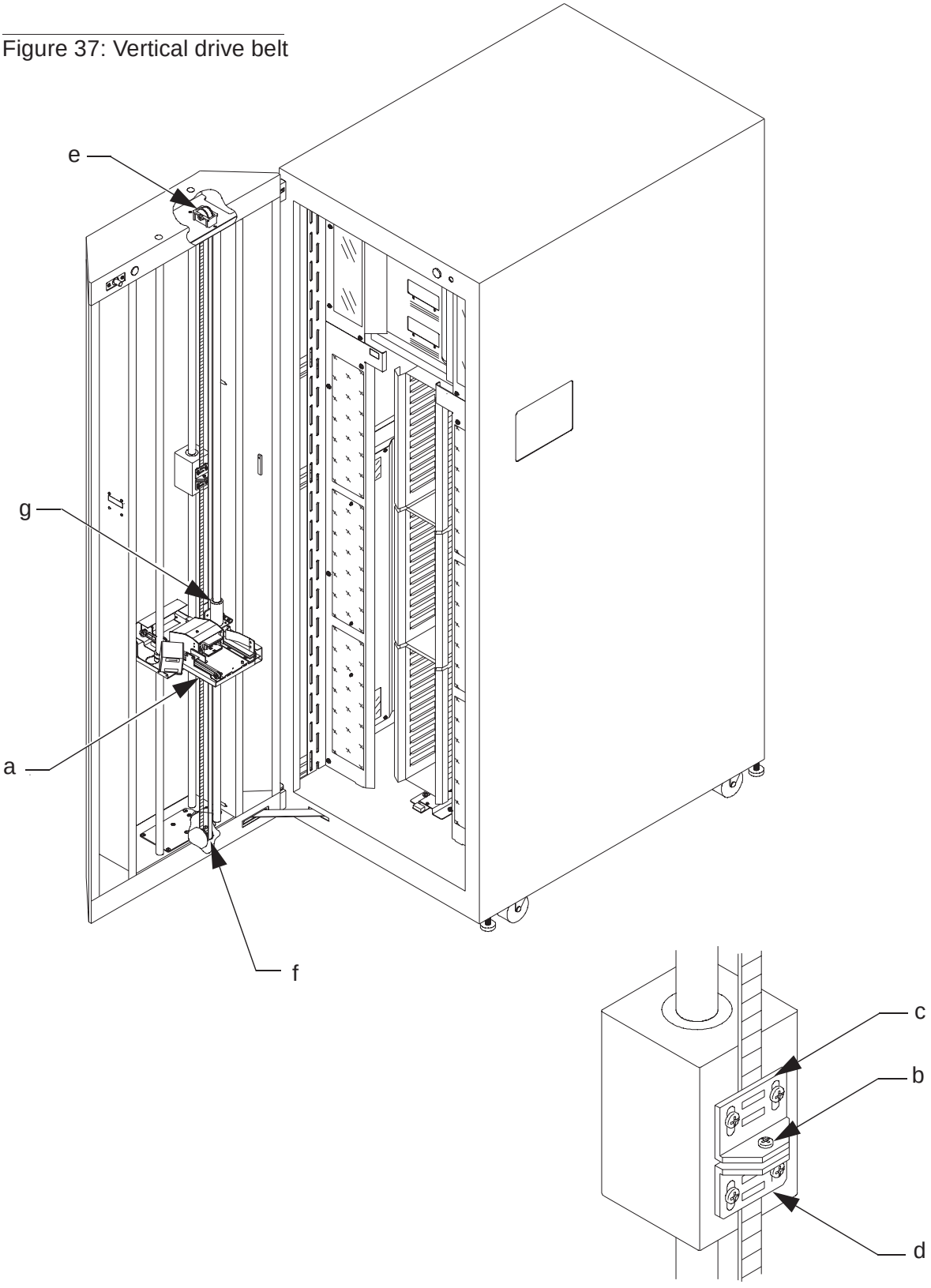
b. Move the vertical carriage slightly up or down the linear bearing to achieve the proper vertical position. Tighten the bearing clamp screws to 6 in-lb. (0.68 N-m).

Note ***Do not over tighten the bearing clamp screws. Even slight over tightening may cause mechanical binding in vertical carriage movement.***

22. Remove the hinged collar from beneath the counterweight.

23. Manually move the vertical carriage up and down the vertical rails and check for smooth travel along the entire length of the rails.

Figure 37: Vertical drive belt



4 Fault Isolation

Maintenance Analysis Procedures (MAPS)

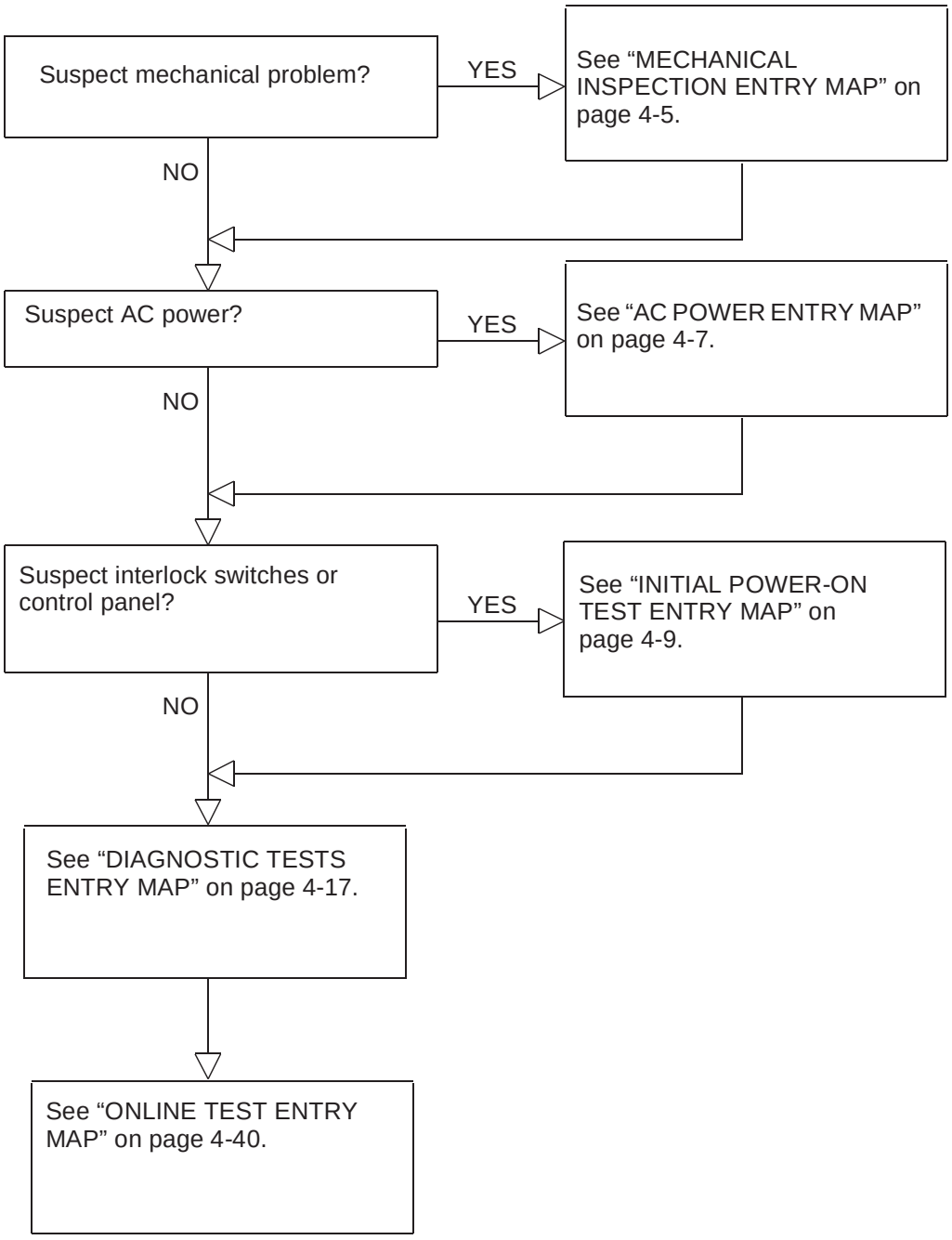
This section contains Maintenance Analysis Procedures (MAPS) for troubleshooting TL820 malfunctions.

Note ***To begin analysis of TL820 malfunctions, always refer to the FAULT ISOLATION ENTRY MAP on page 4-4.***

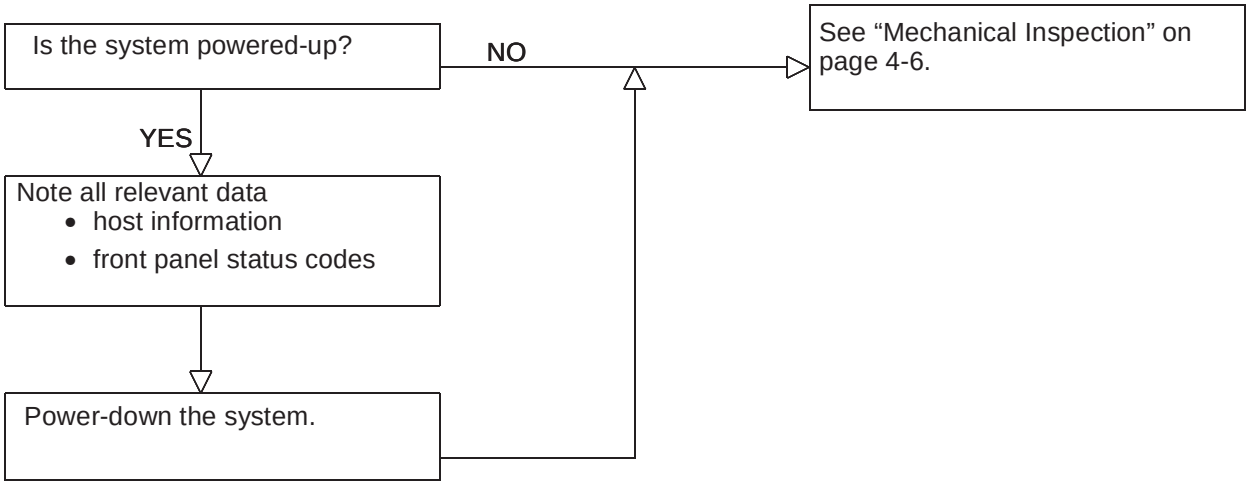
Diagnostic test procedures are covered in this section, however, refer to the *TL820 Diagnostic Software User's Manual* for more information on the Diagnostic Software. Since you must operate the library to check its performance, also have the *TL820 Operator's Guide* available.

Note ***Test the library after each corrective action. Stop maintenance when the symptom disappears.***

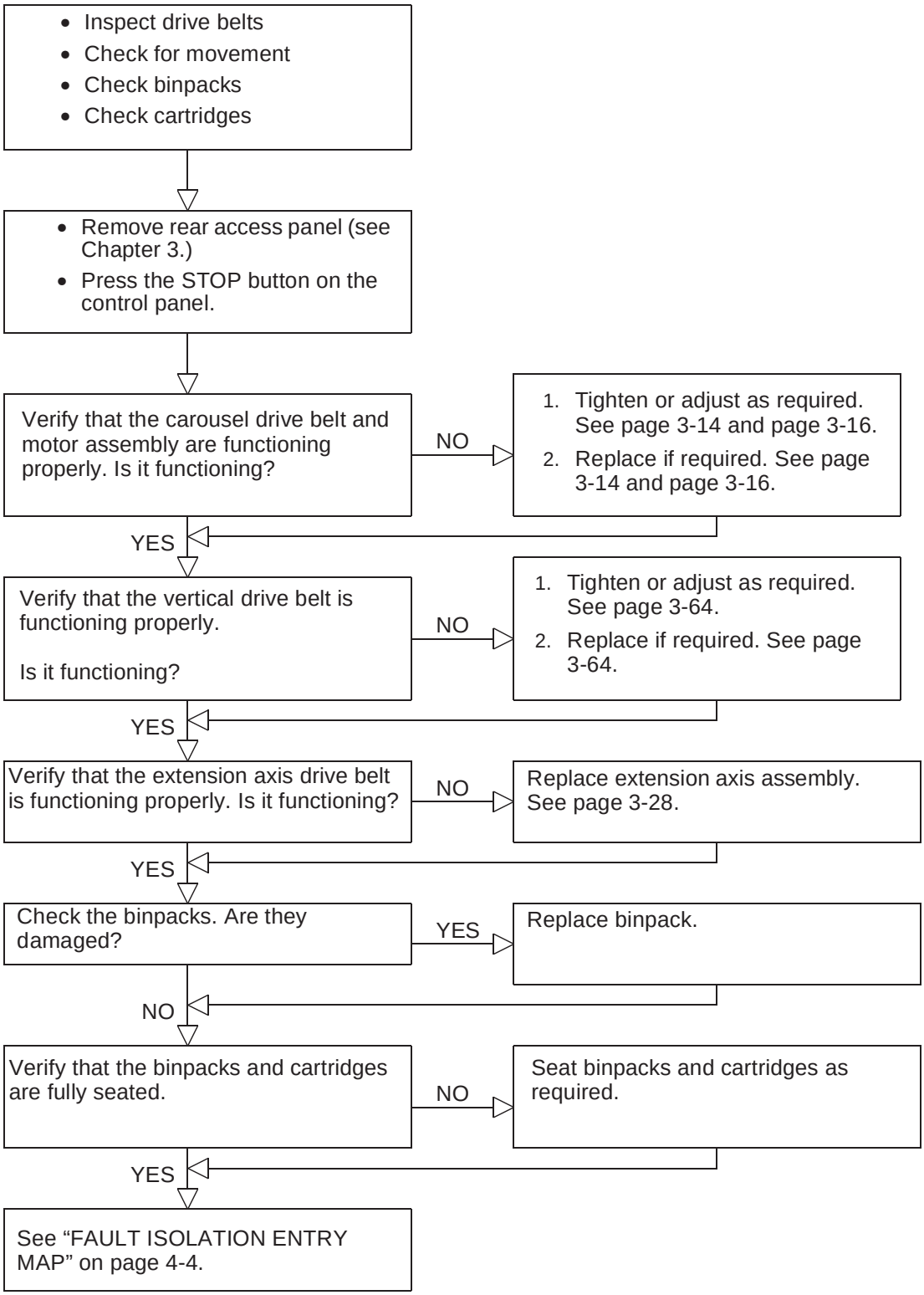
FAULT ISOLATION ENTRY MAP



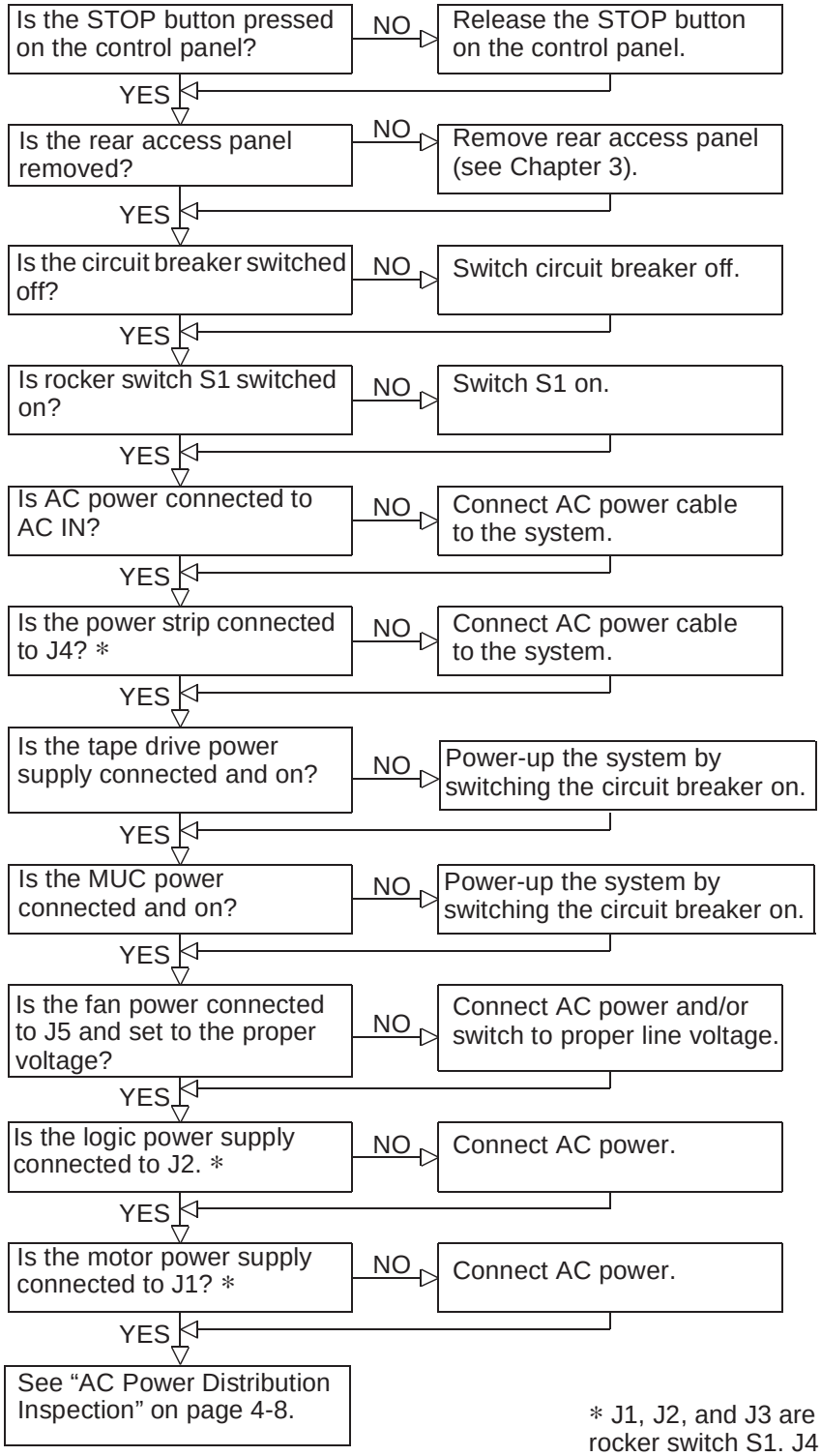
MECHANICAL INSPECTION ENTRY MAP



Mechanical Inspection

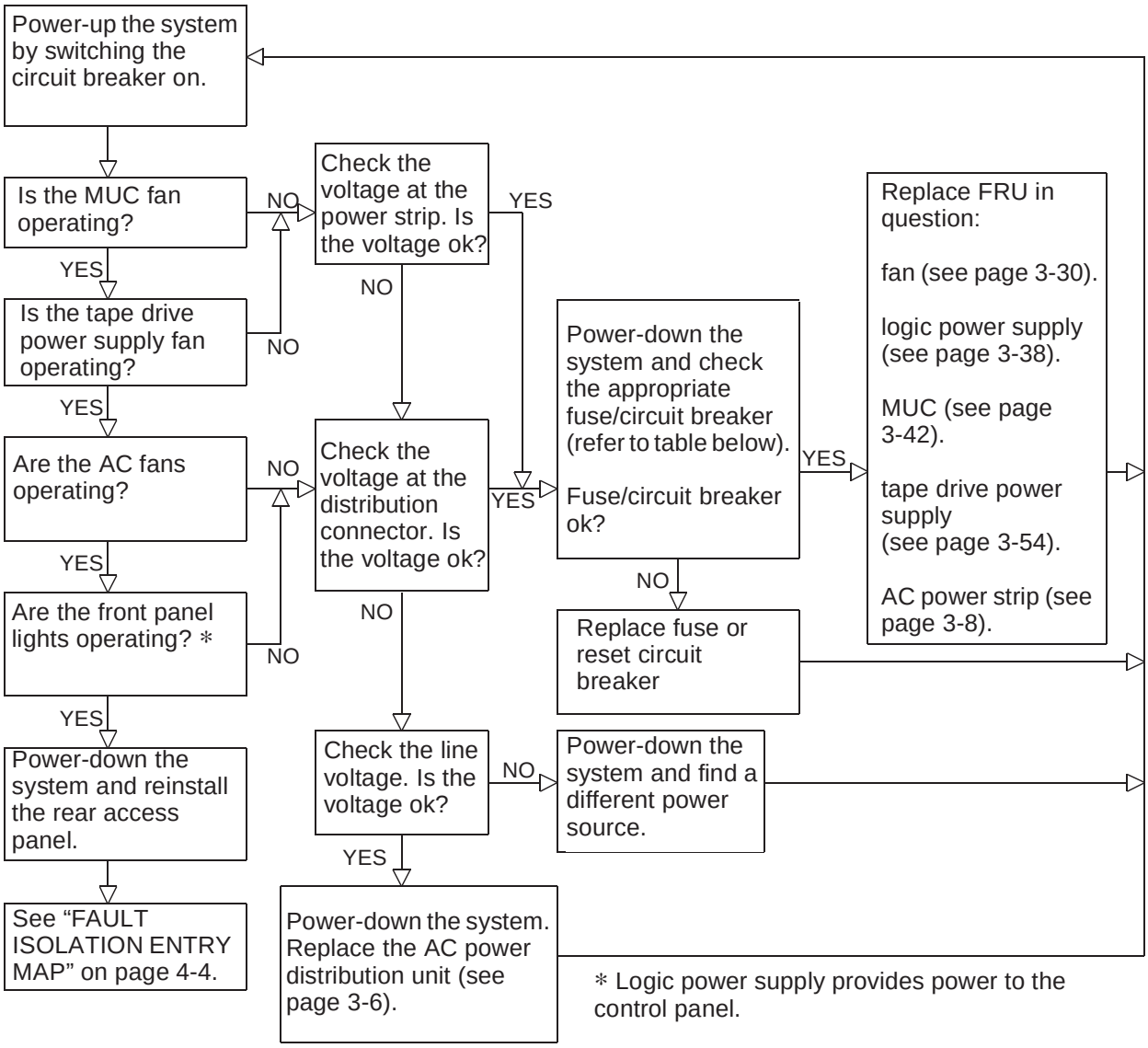


AC POWER ENTRY MAP



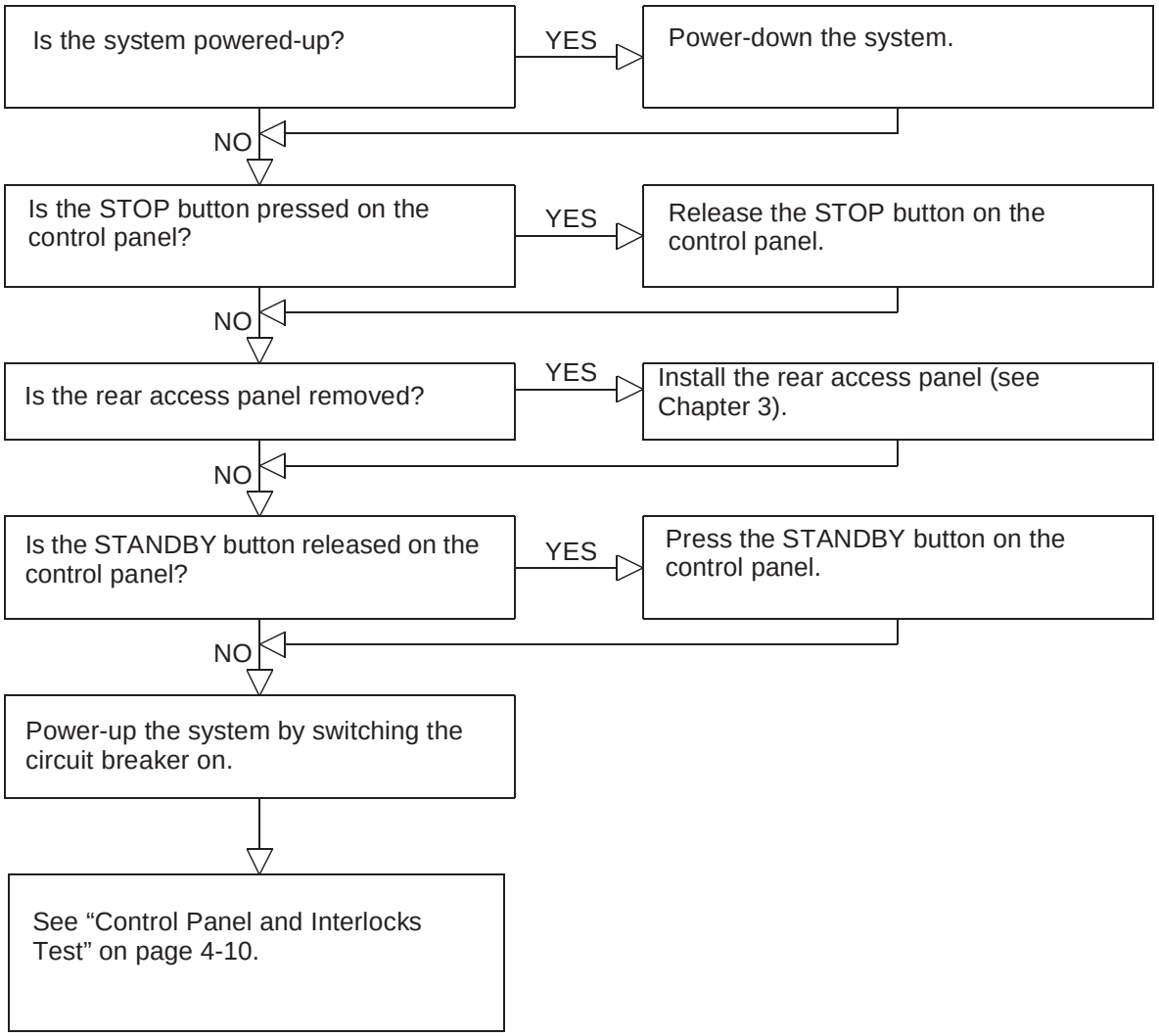
* J1, J2, and J3 are controlled by rocker switch S1. J4 is always on.

AC Power Distribution Inspection

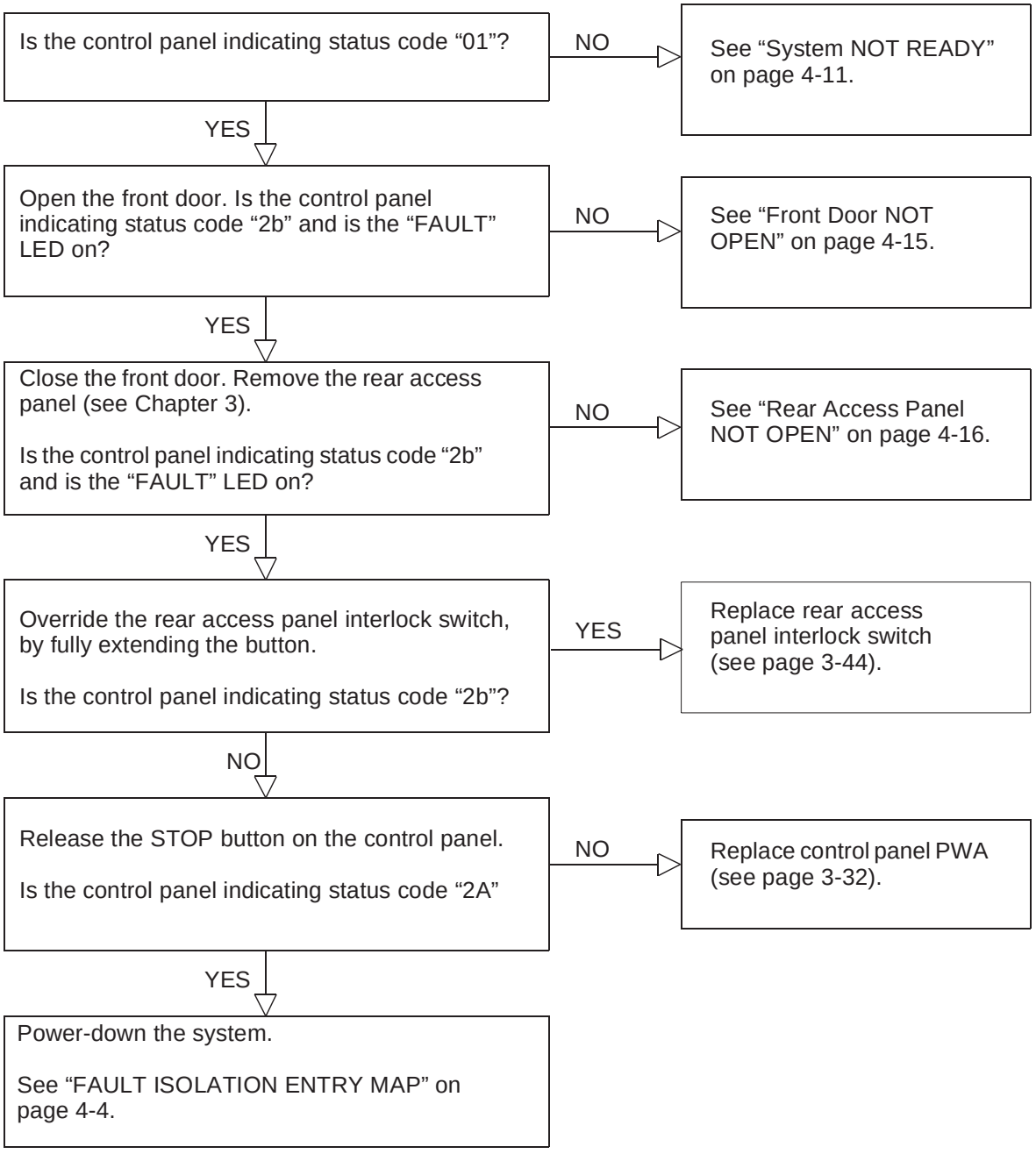


Assembly	Fuse Location	Fuse
Logic power supply	robotic controller PWA	F2 @ 3A
MUC	MUC	N/A
Tape drive power supply	Tape drive power supply	N/A
AC power strip	AC power strip	Circuit Breaker
Fan	N/A	None

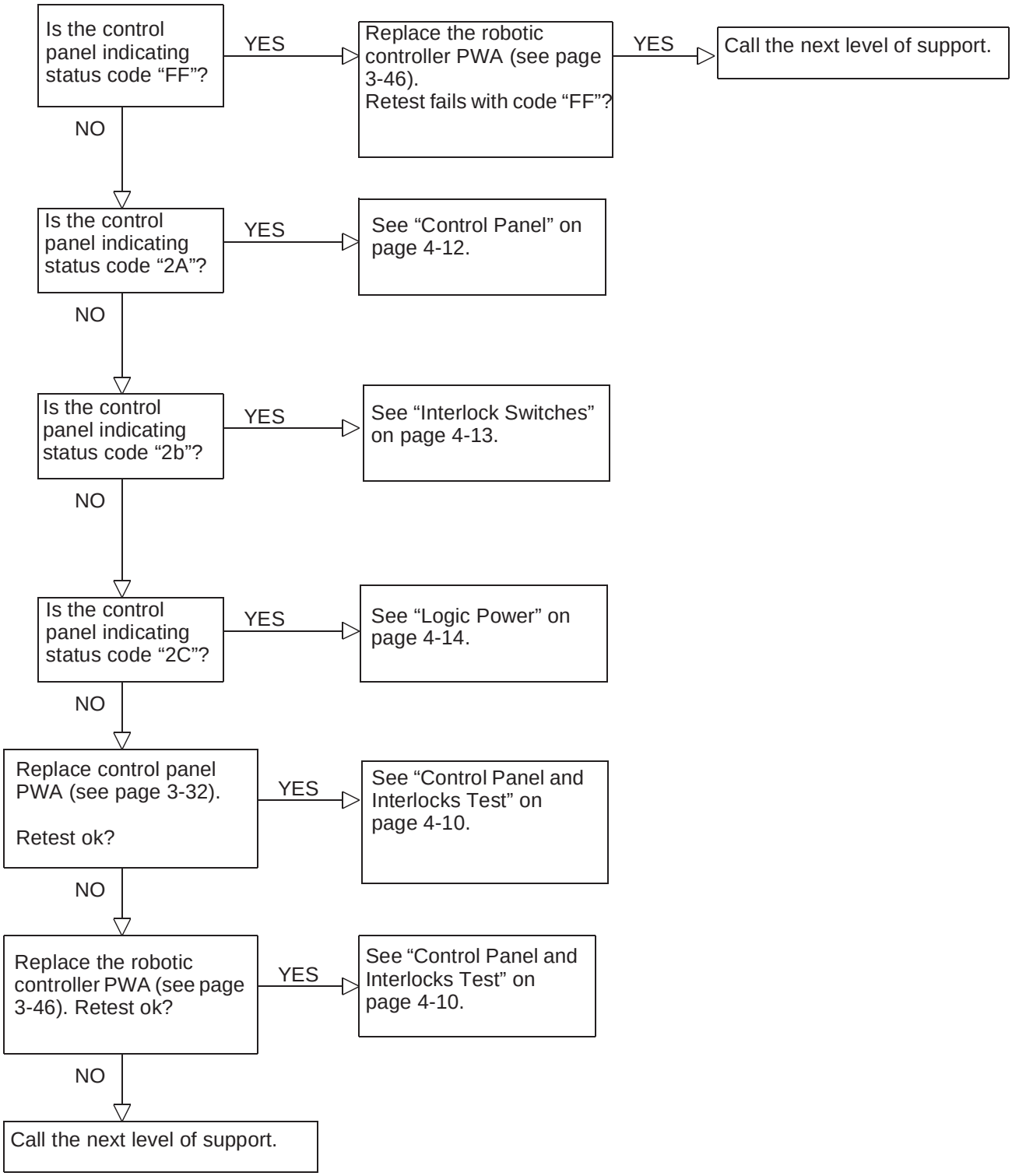
INITIAL POWER-ON TEST ENTRY MAP



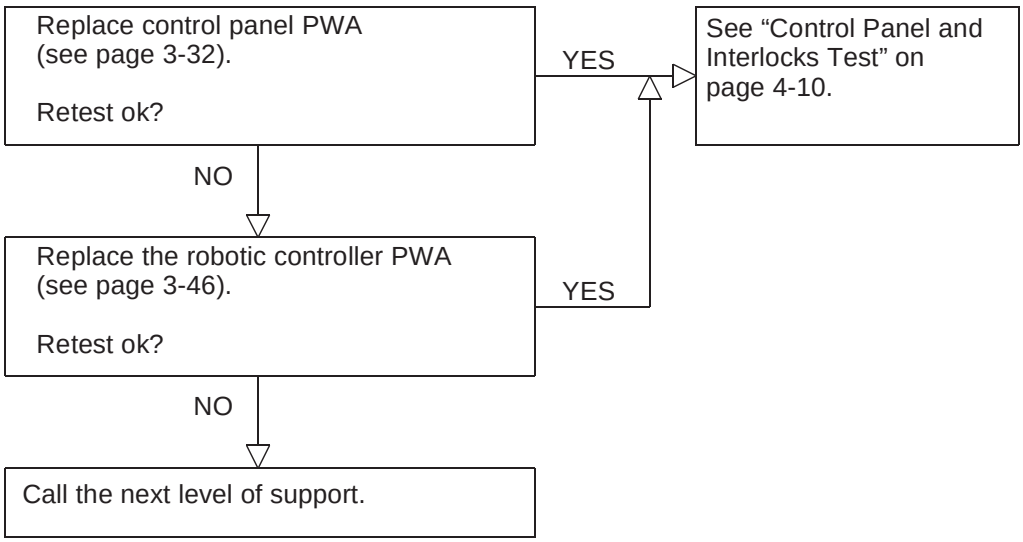
Control Panel and Interlocks Test



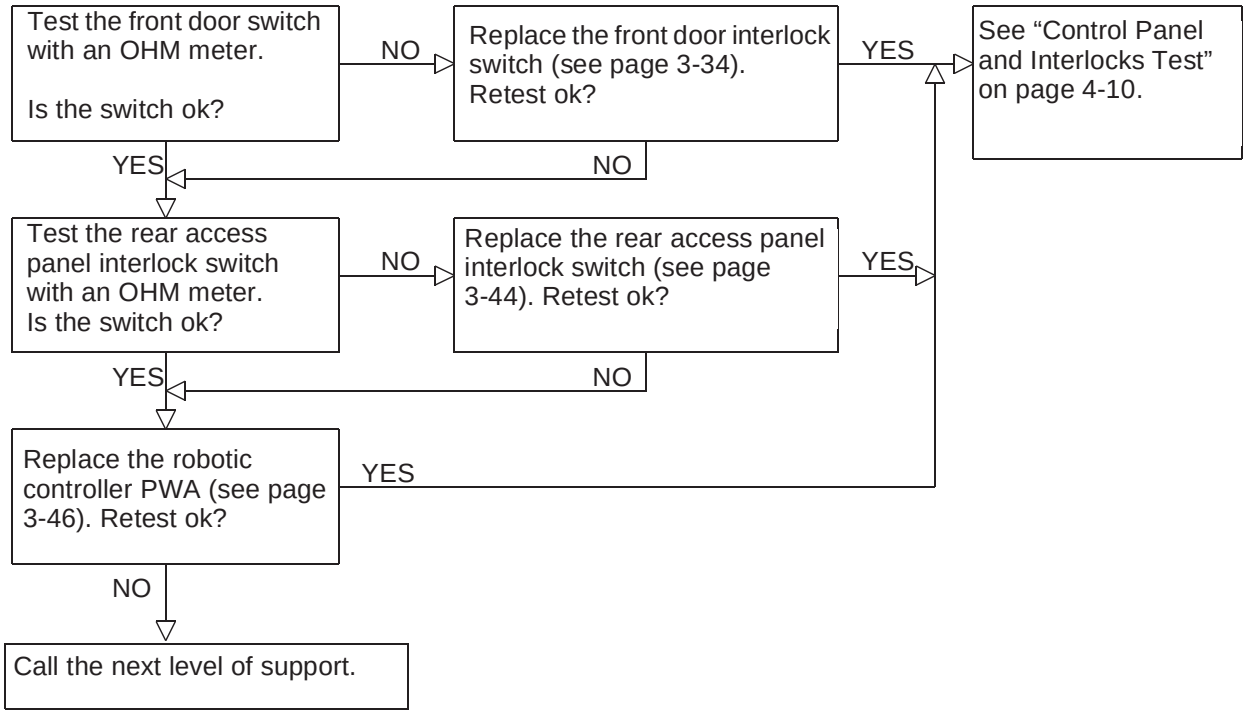
System NOT READY



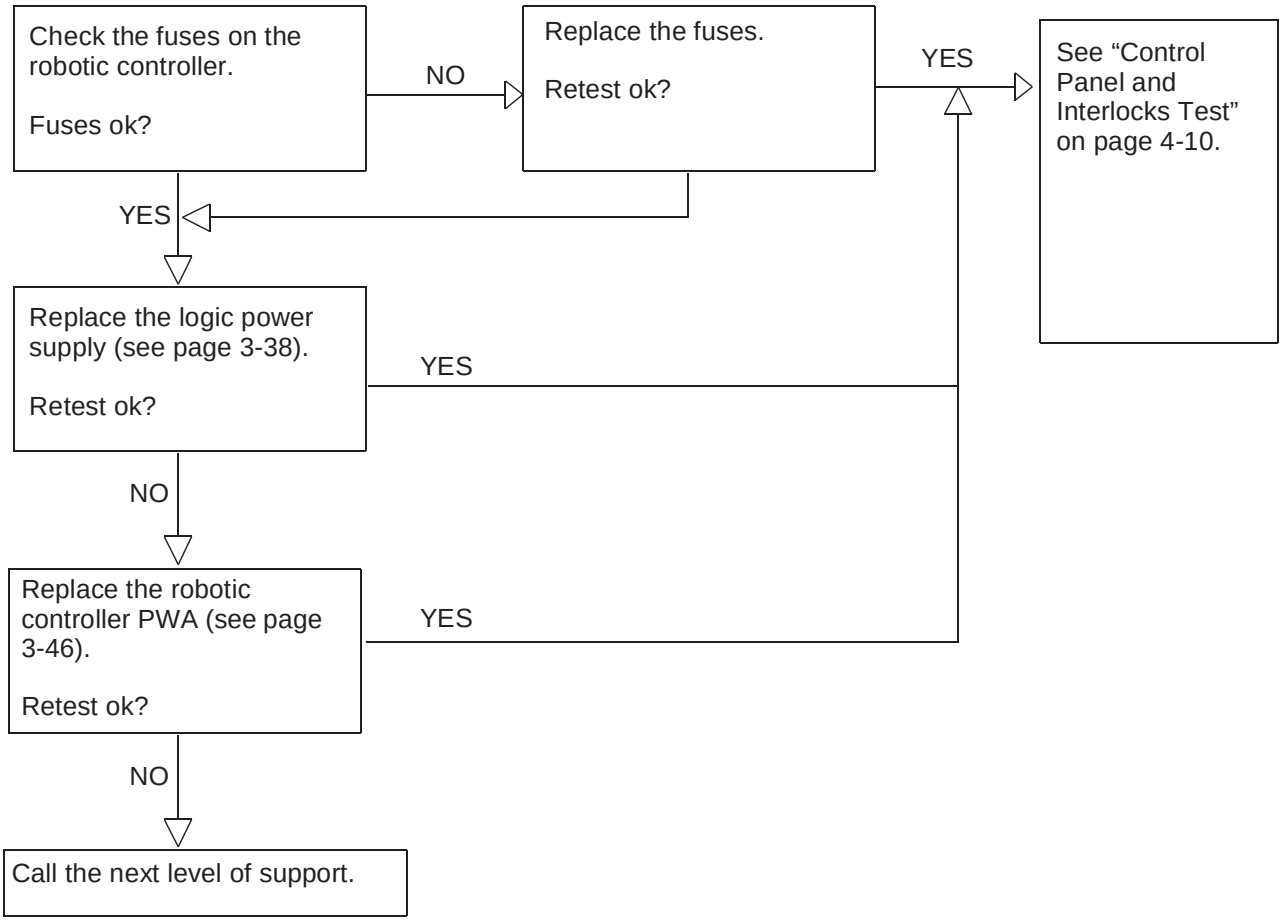
Control Panel



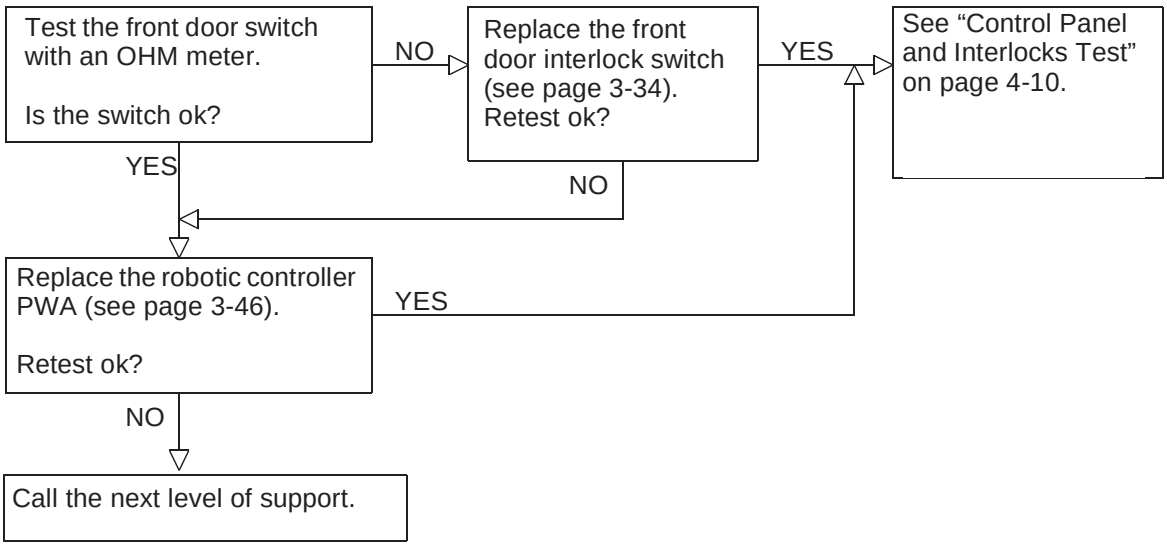
Interlock Switches



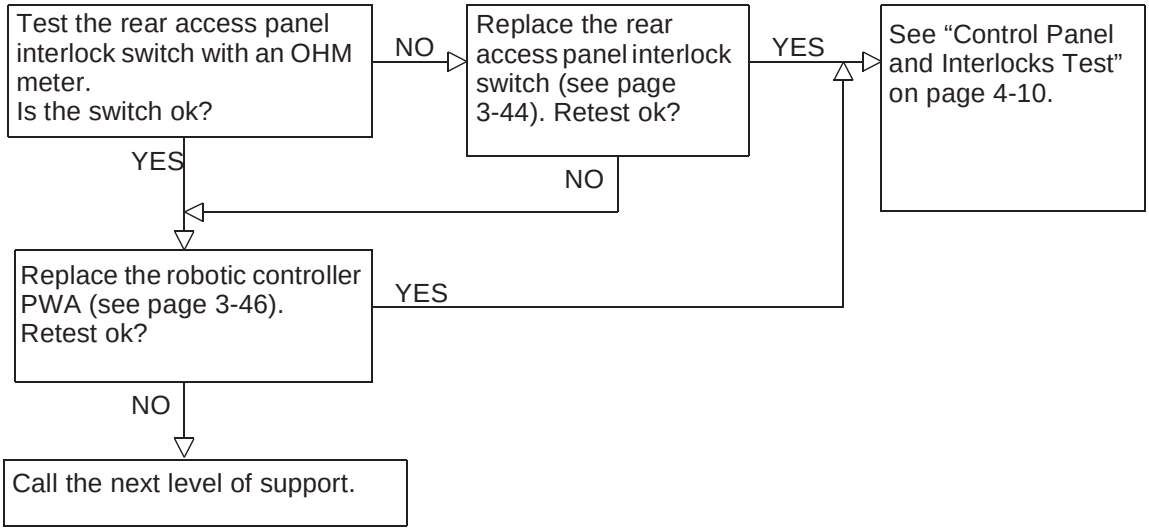
Logic Power


Check the fuses on the robotic controller.
Fuses ok?
NO
Replace the fuses.
Retest ok?
YES
See “Control Panel and Interlocks Test” on page 4-10.
YES
Replace the logic power supply (see page 3-38).
Retest ok?
YES
NO
Replace the robotic controller PWA (see page 3-46).
Retest ok?
YES
NO
Call the next level of support.

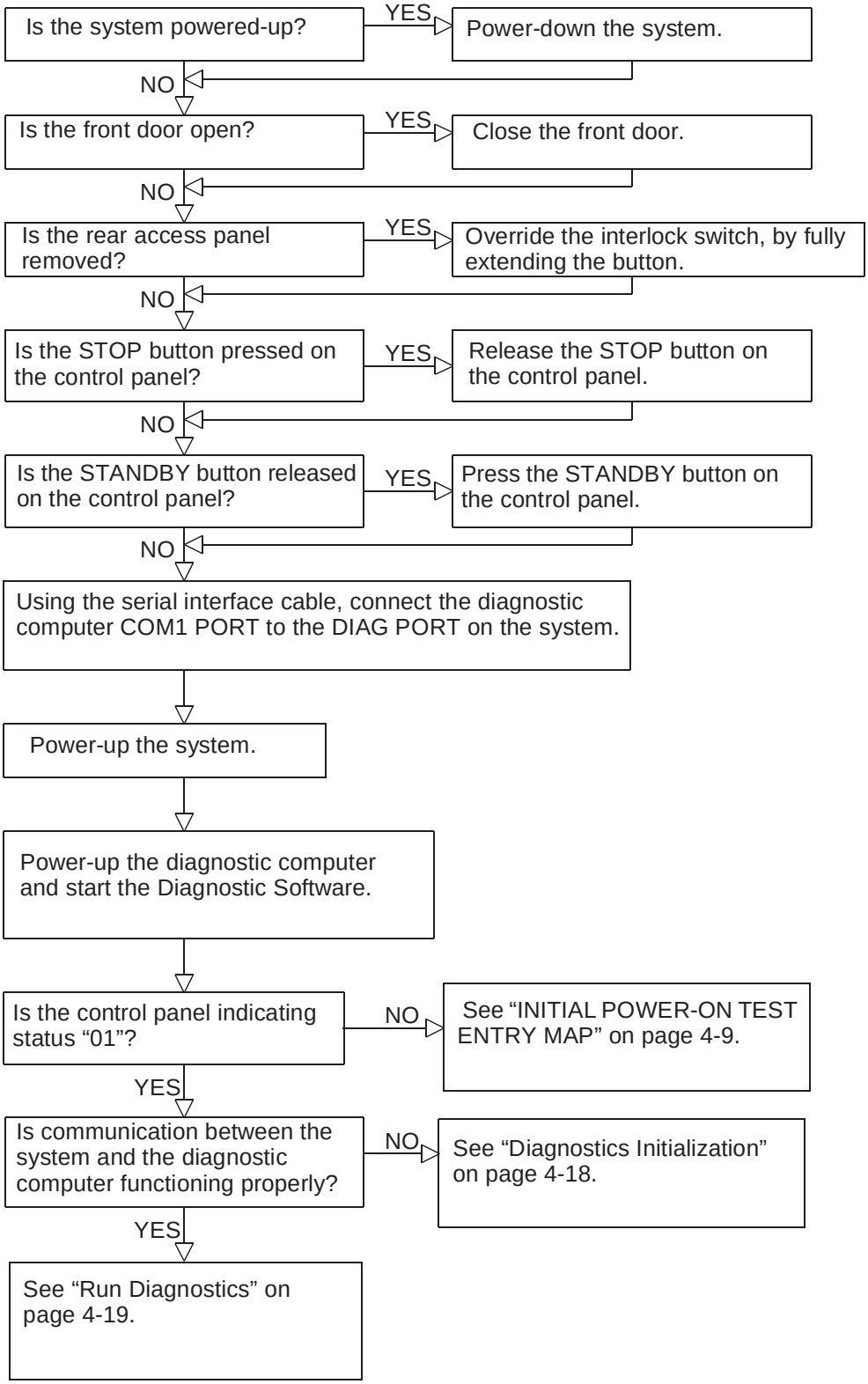
Front Door NOT OPEN



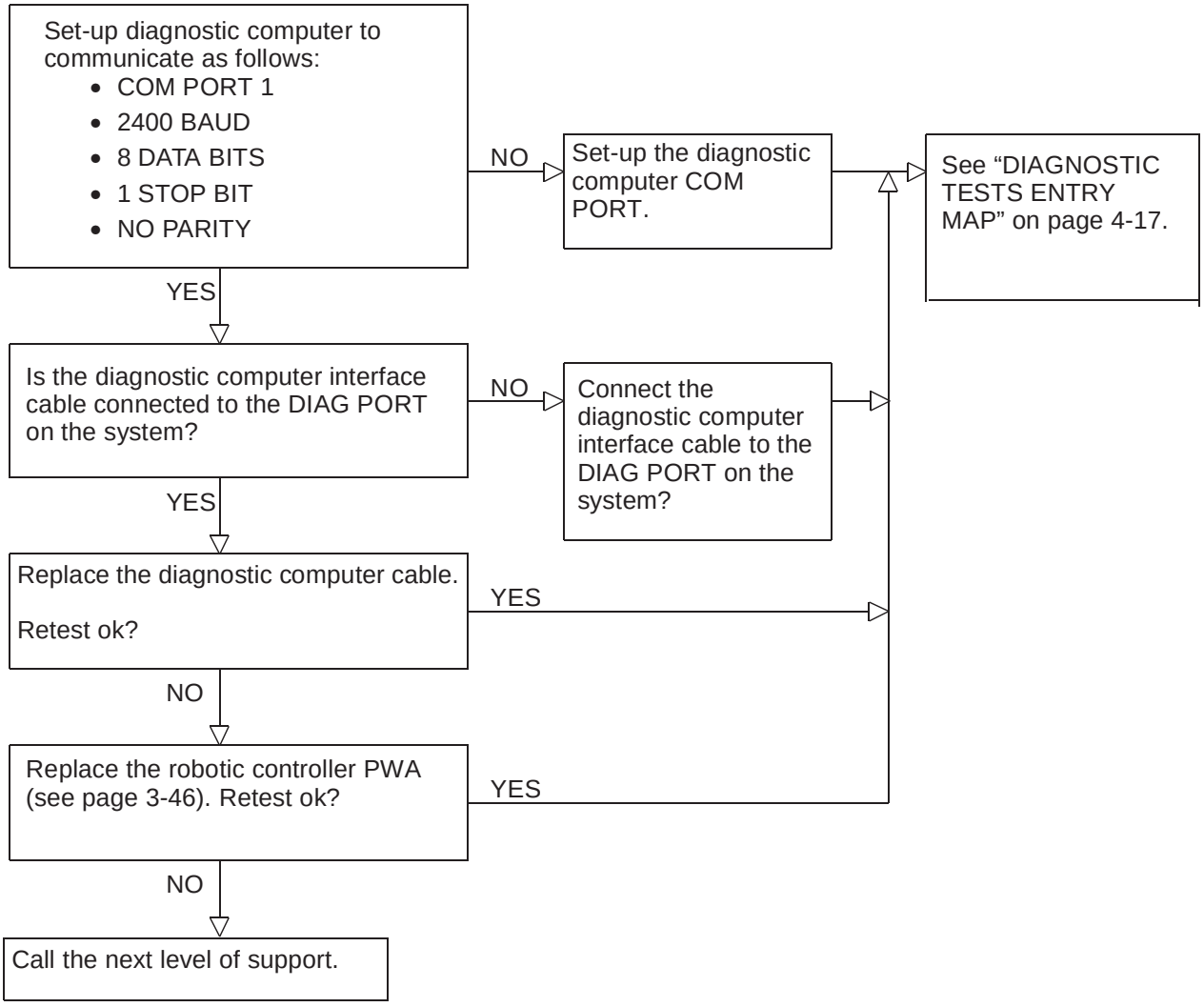
Rear Access Panel NOT OPEN



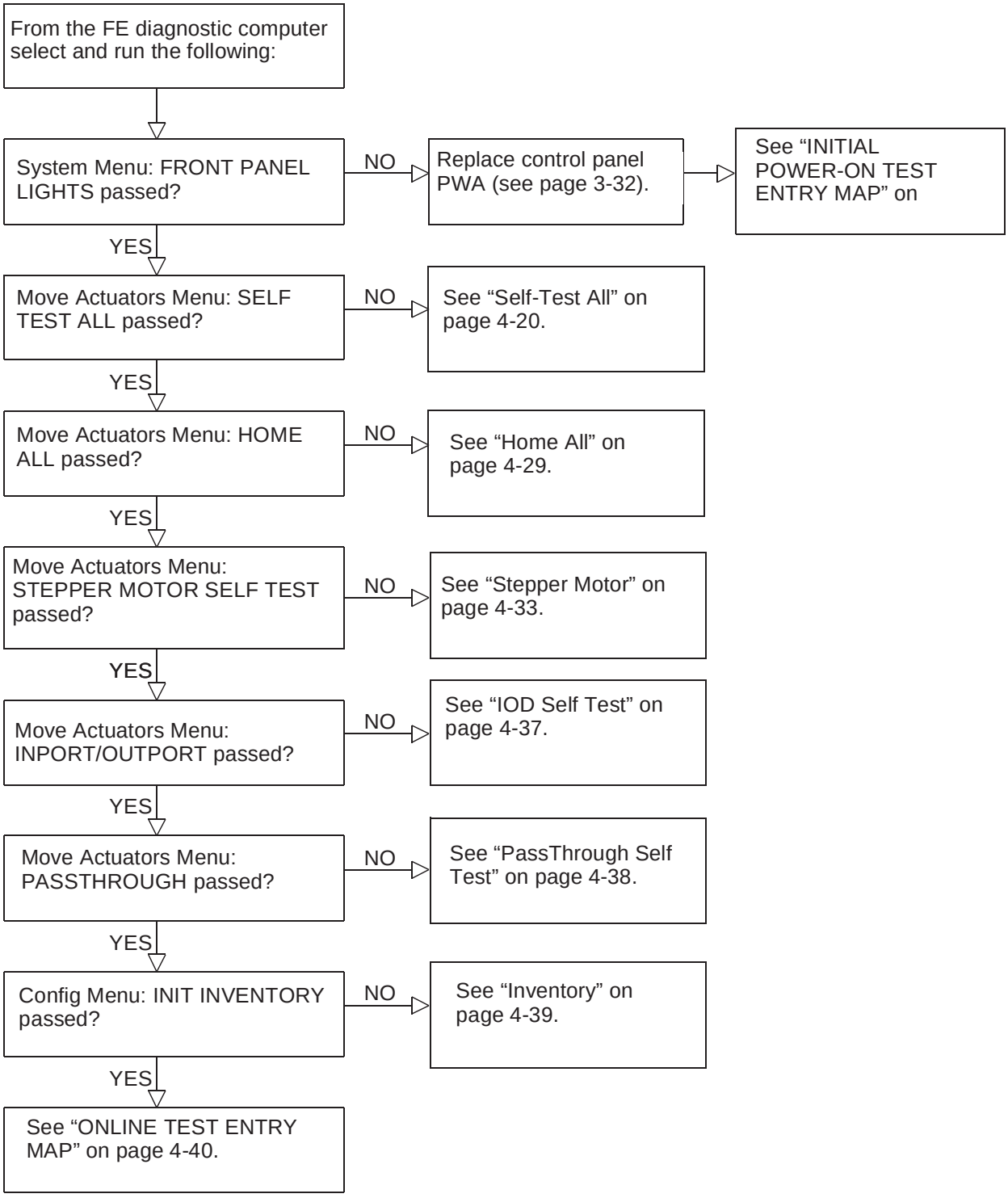
DIAGNOSTIC TESTS ENTRY MAP



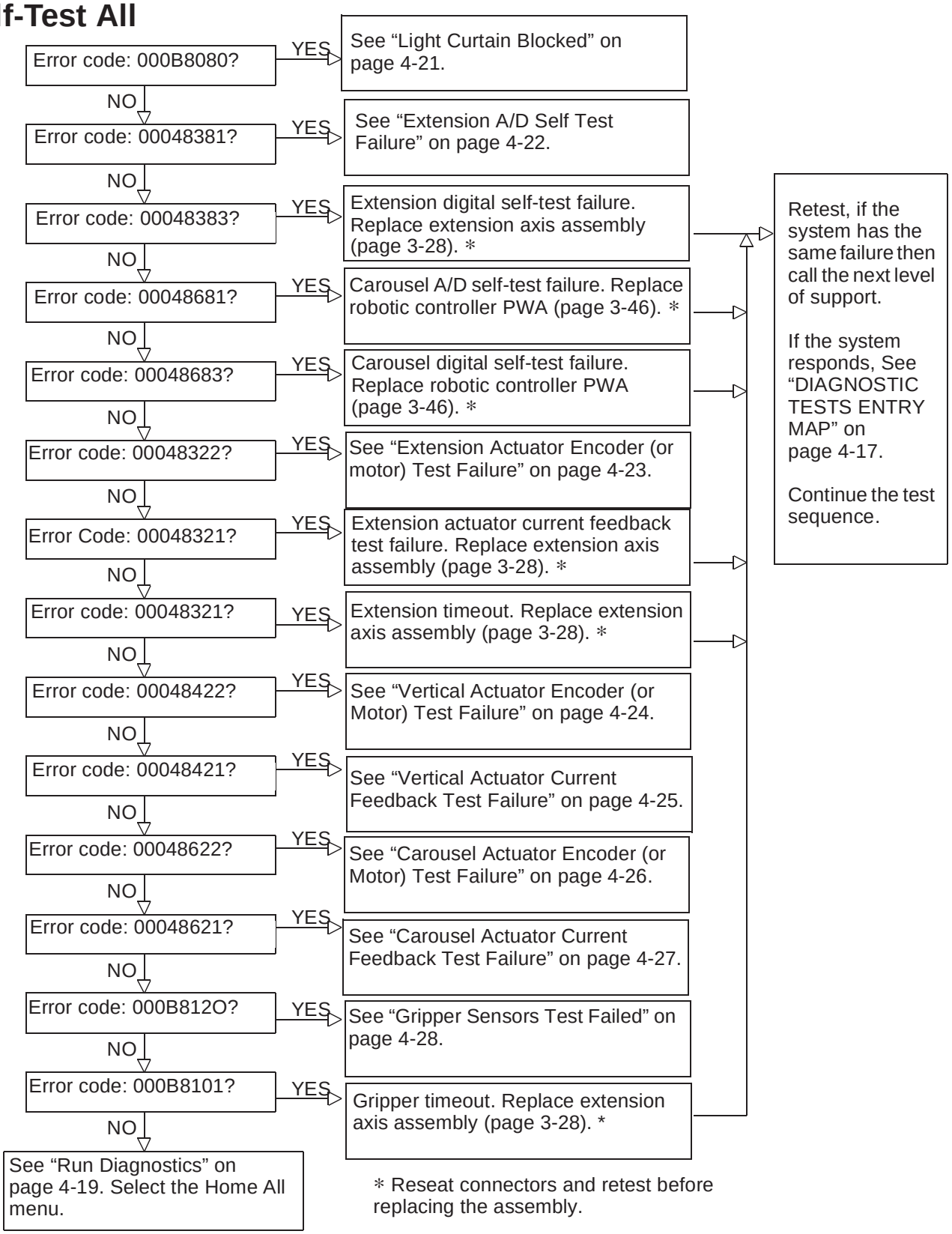
Diagnostics Initialization



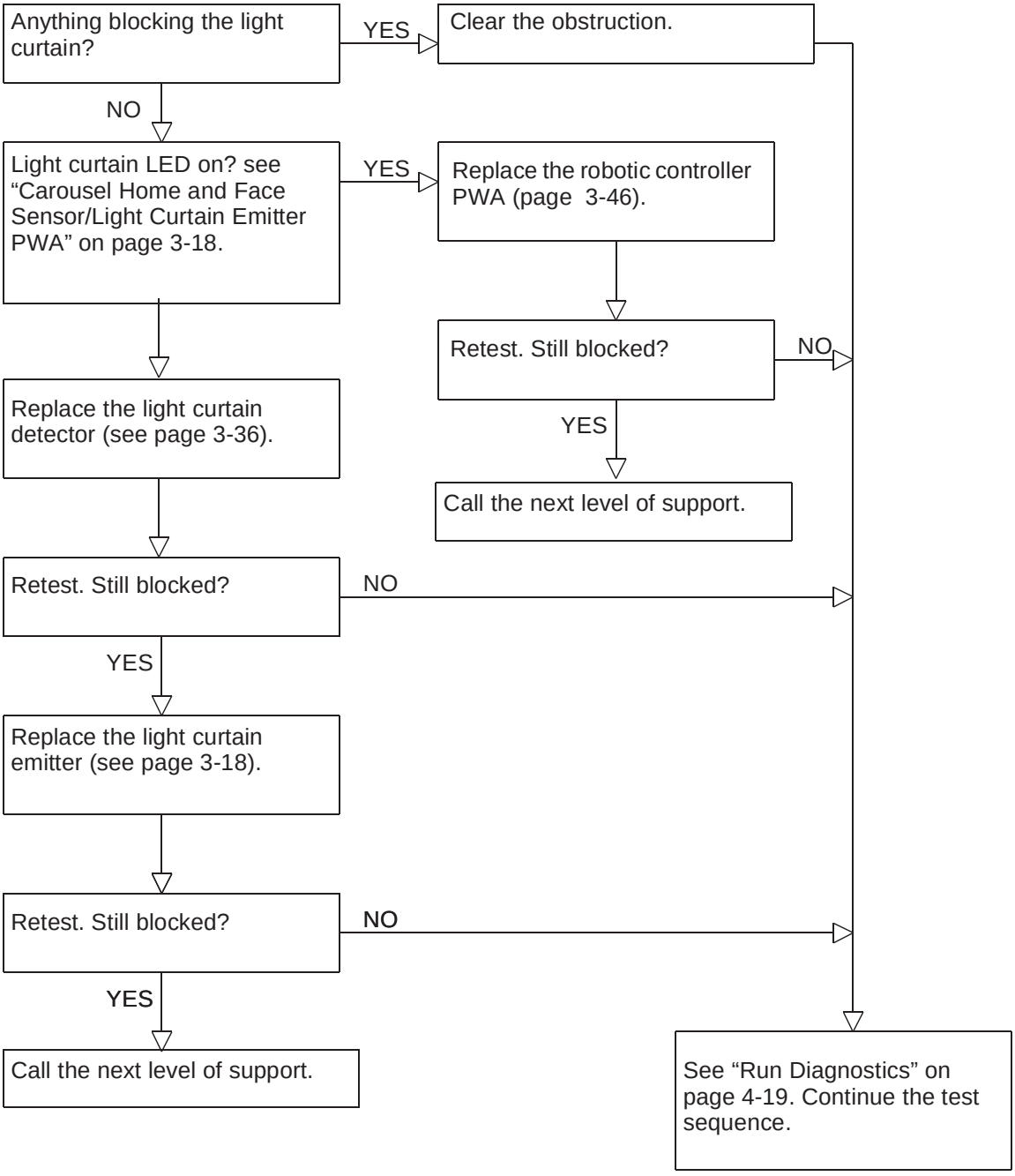
Run Diagnostics



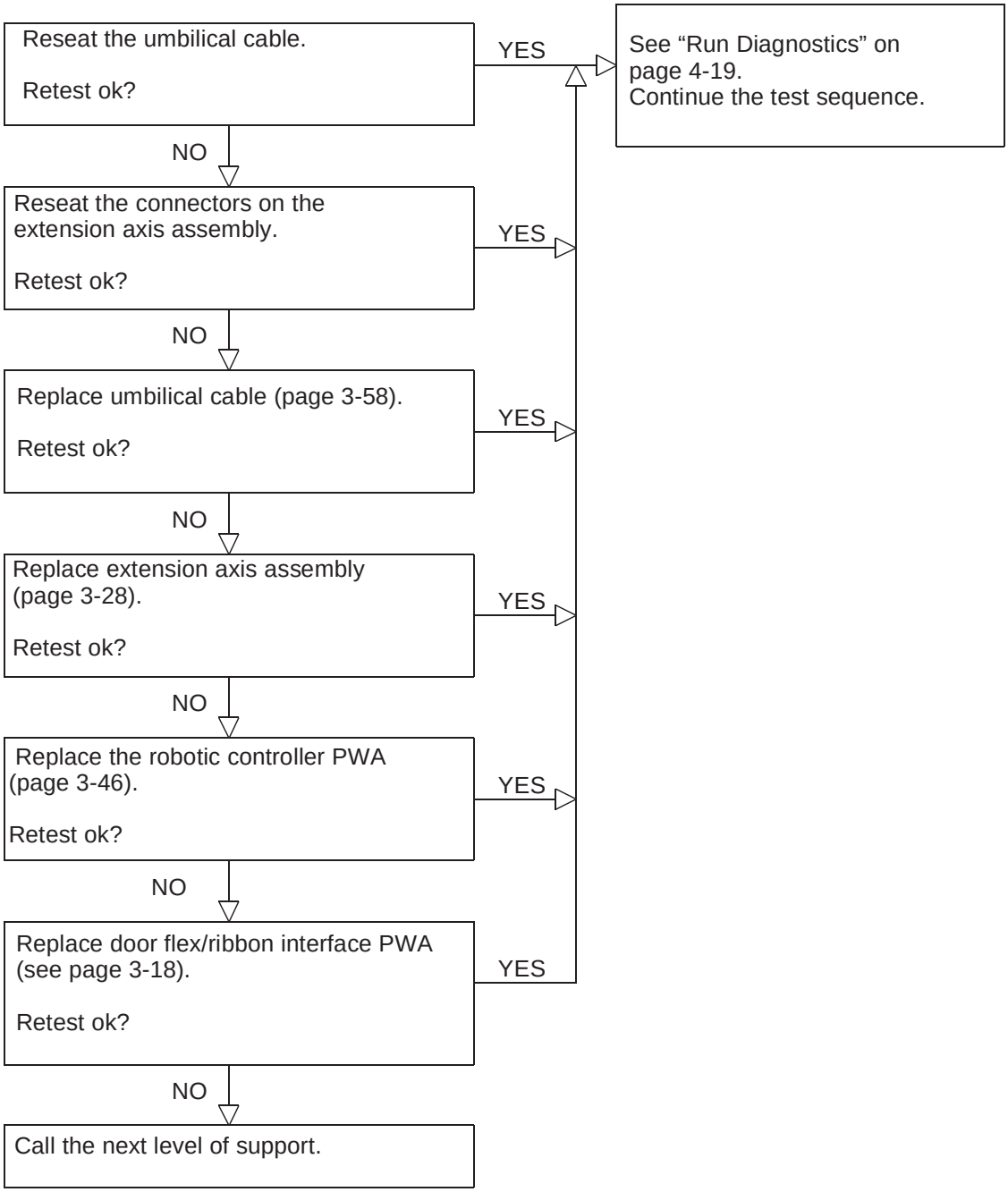
Self-Test All



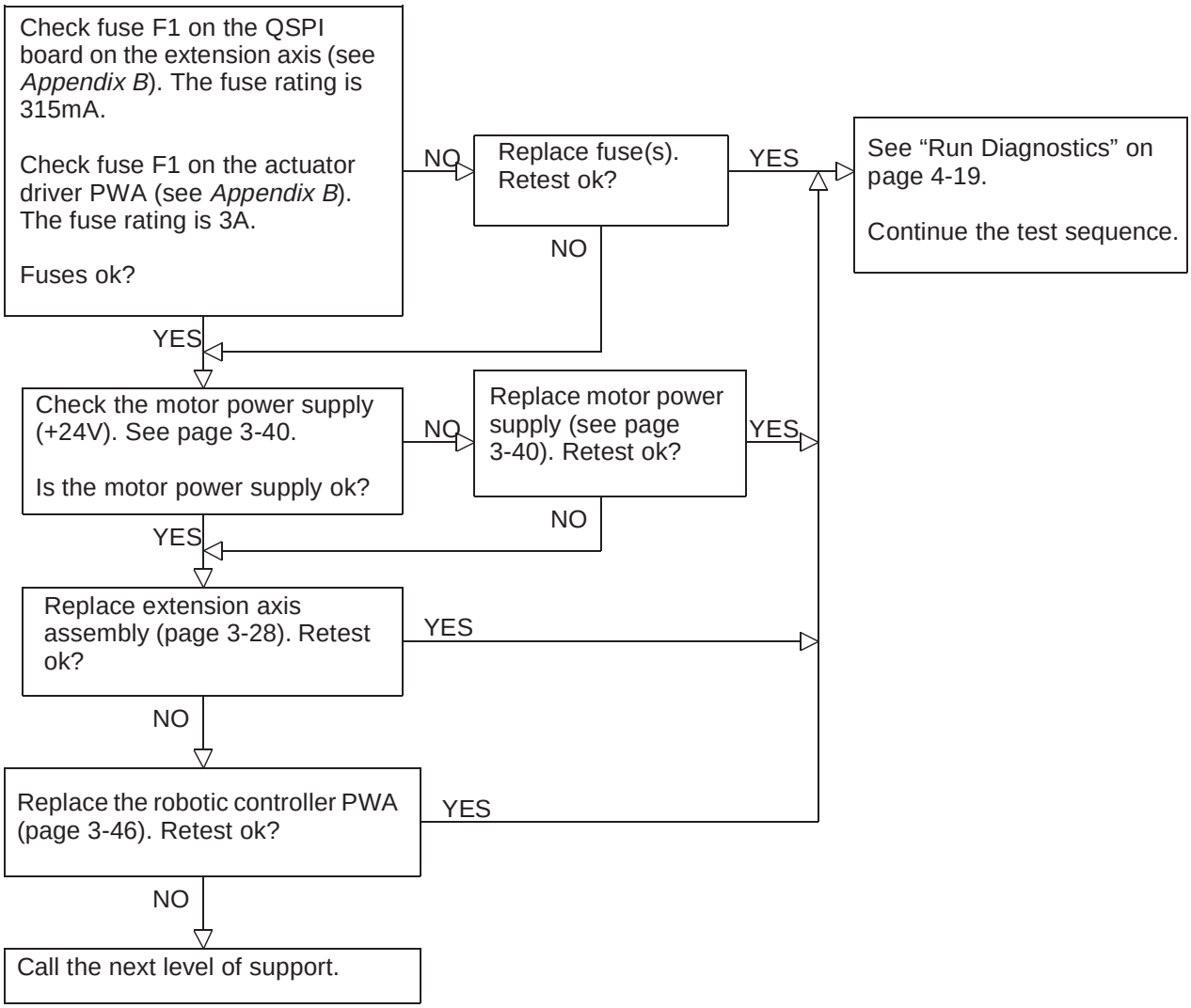
Light Curtain Blocked



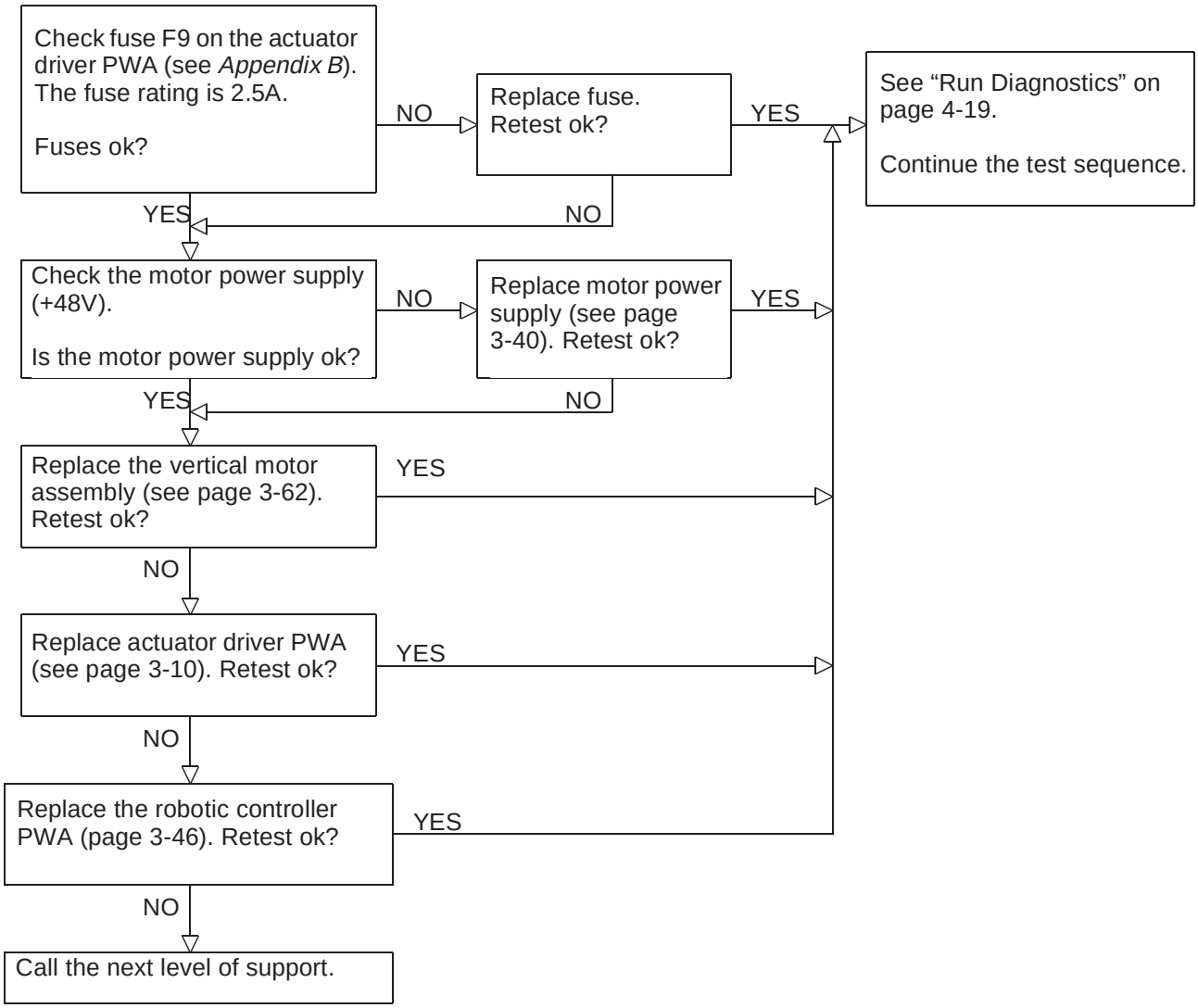
Extension A/D Self Test Failure



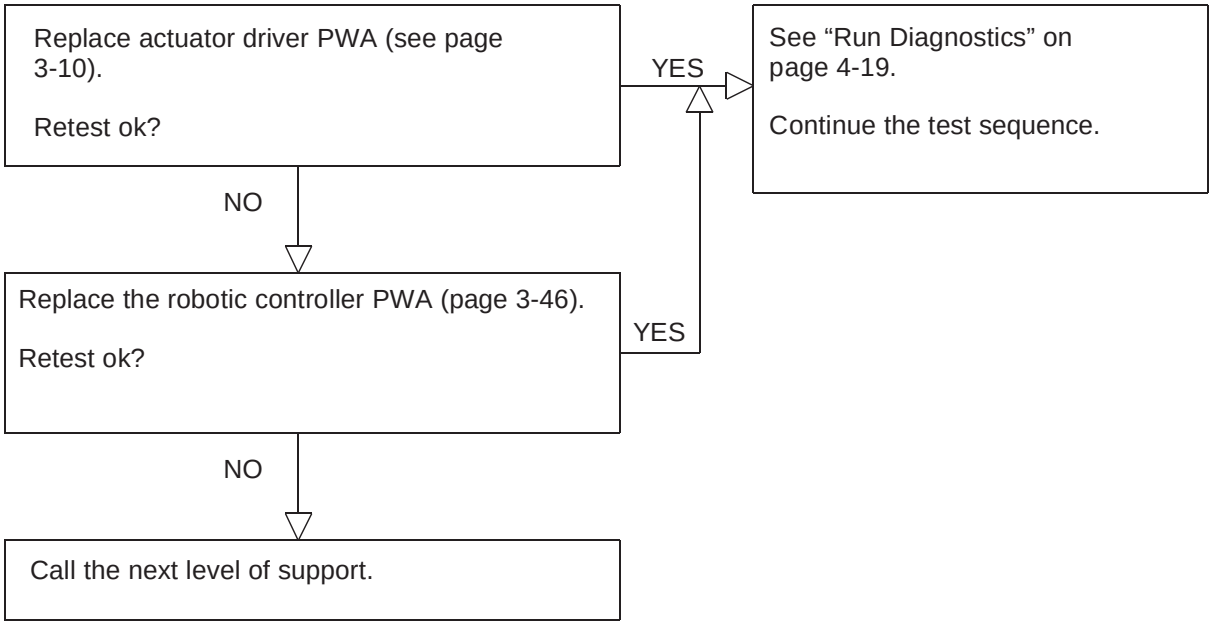
Extension Actuator Encoder (or motor) Test Failure



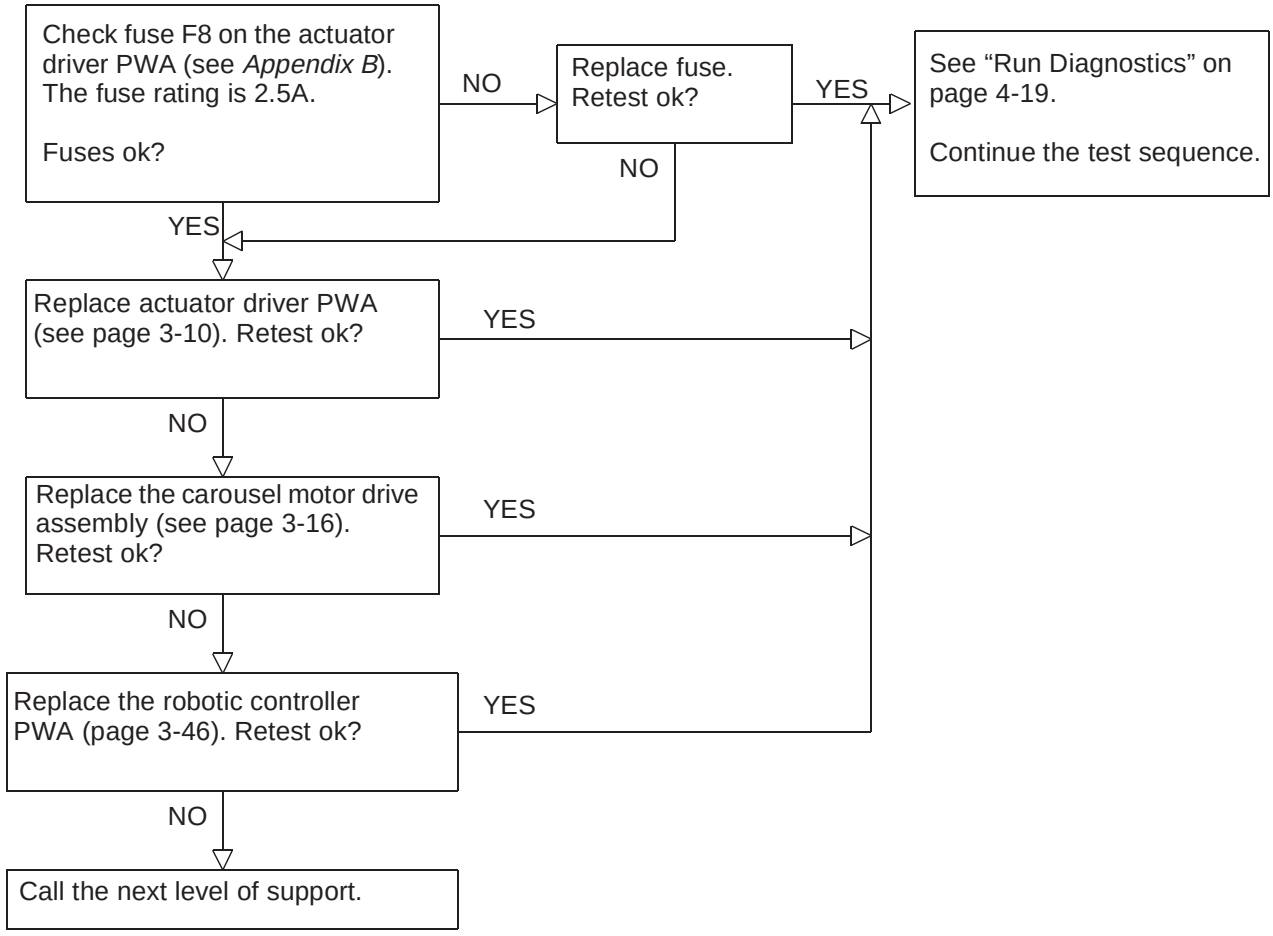
Vertical Actuator Encoder (or Motor) Test Failure



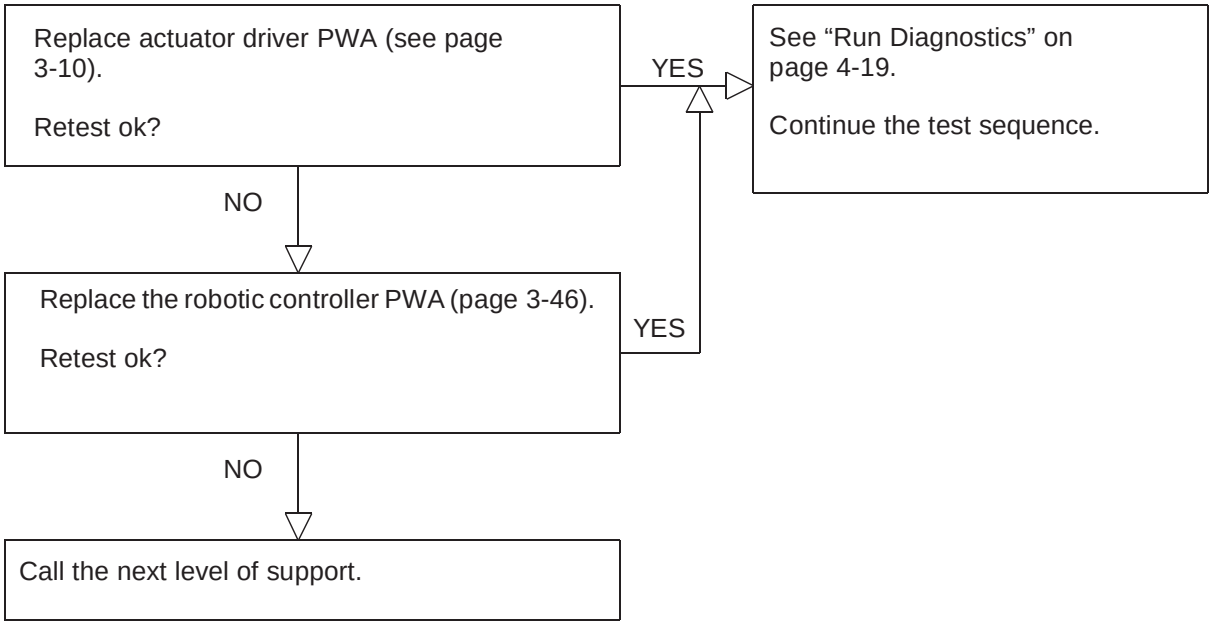
Vertical Actuator Current Feedback Test Failure



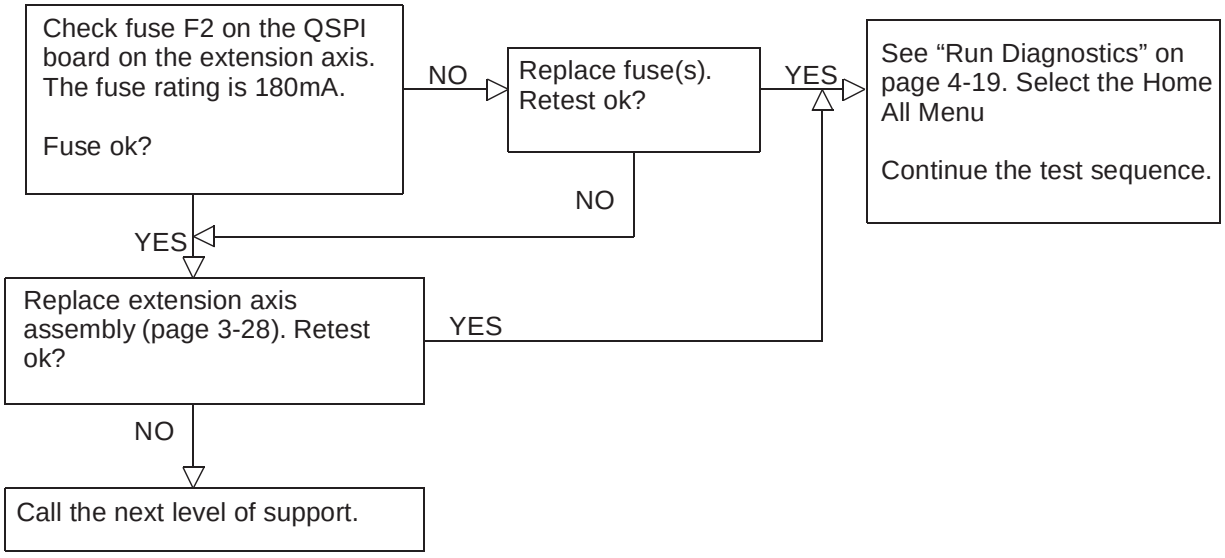
Carousel Actuator Encoder (or Motor) Test Failure



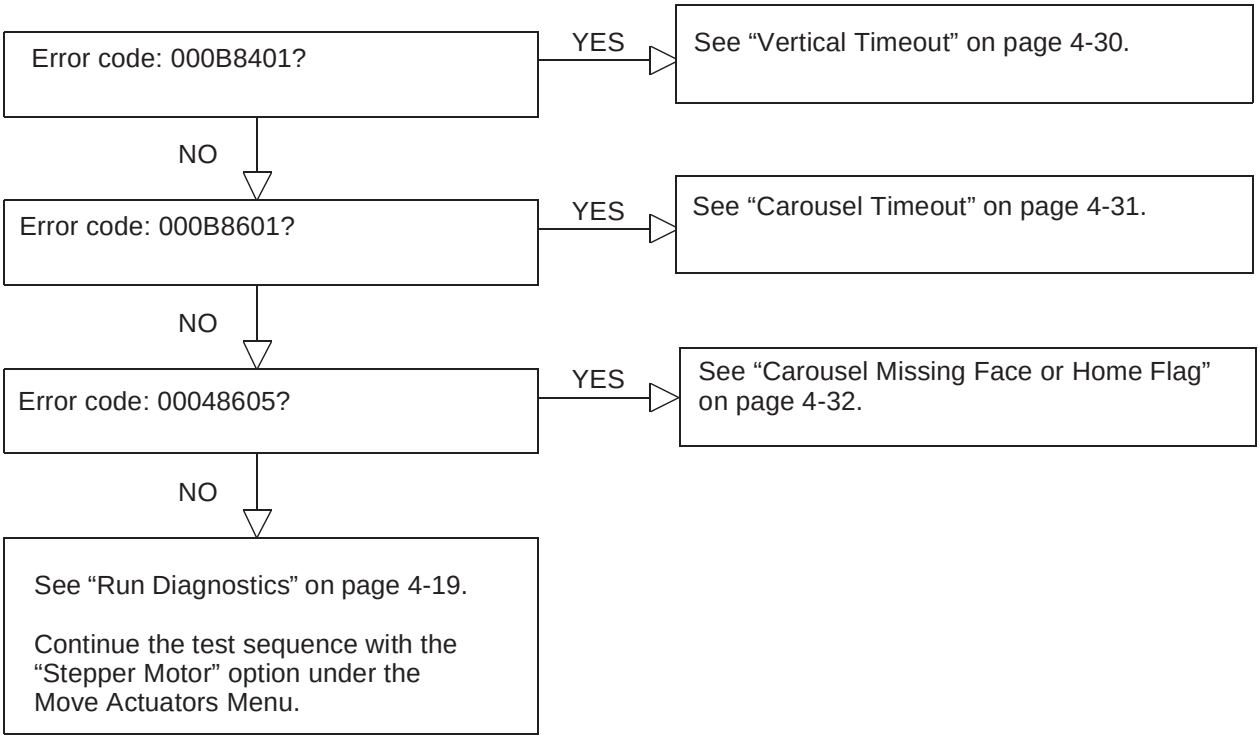
Carousel Actuator Current Feedback Test Failure



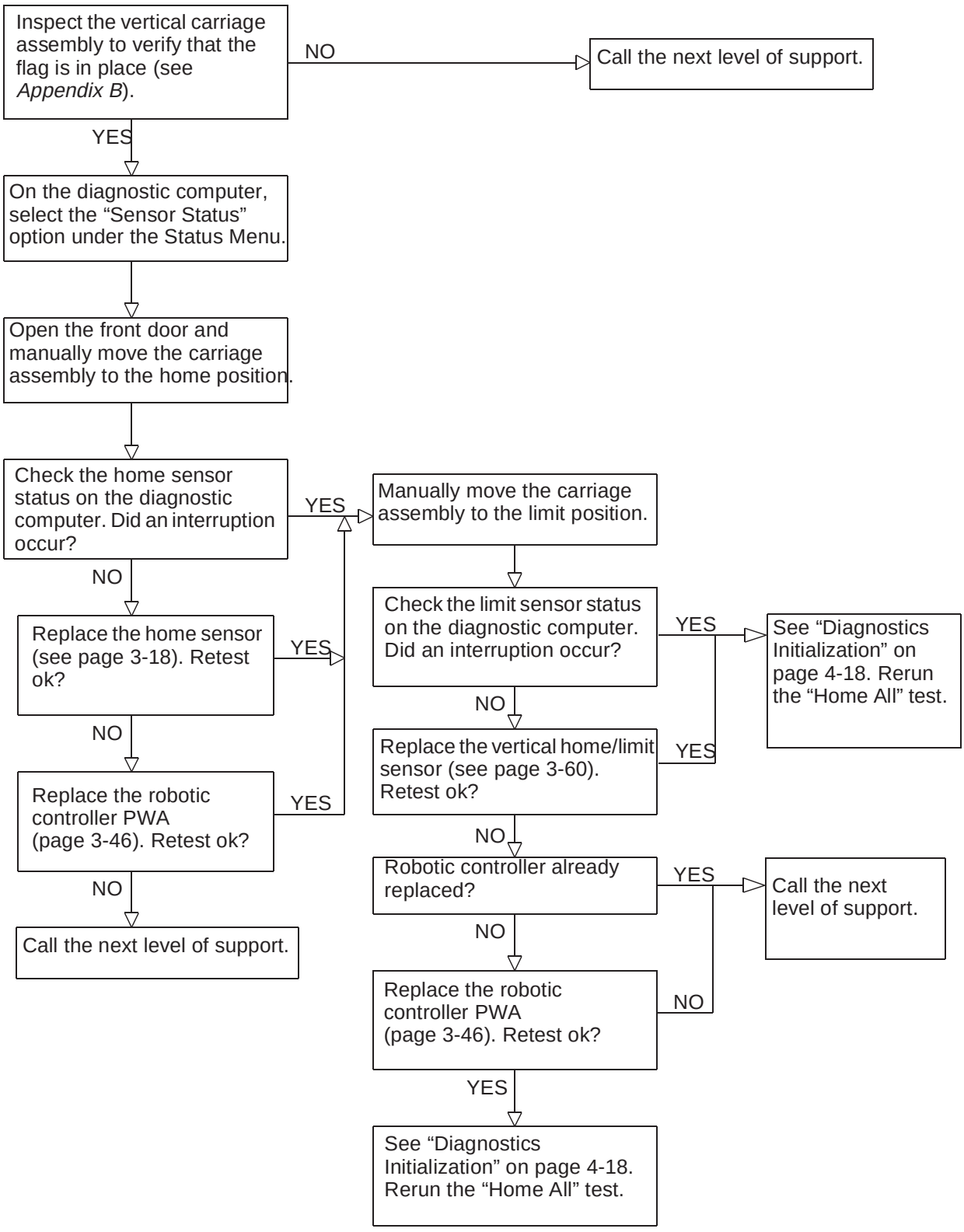
Gripper Sensors Test Failed



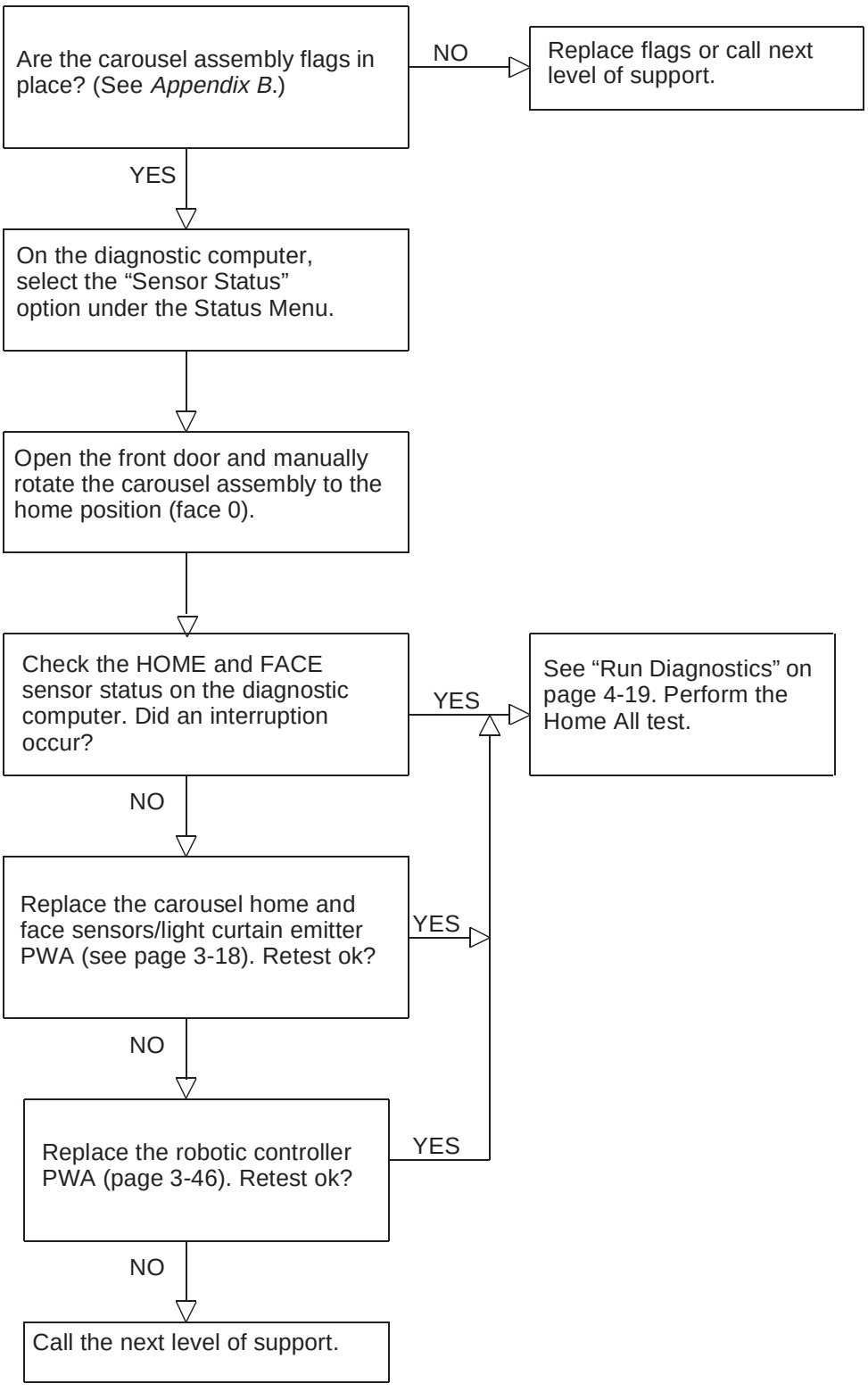
Home All


Error code: 000B8401?
YES
See “Vertical Timeout” on page 4-30.
NO
Error code: 000B8601?
YES
See “Carousel Timeout” on page 4-31.
NO
Error code: 00048605?
YES
See “Carousel Missing Face or Home Flag” on page 4-32.
NO
See “Run Diagnostics” on page 4-19.
Continue the test sequence with the “Stepper Motor” option under the Move Actuators Menu.

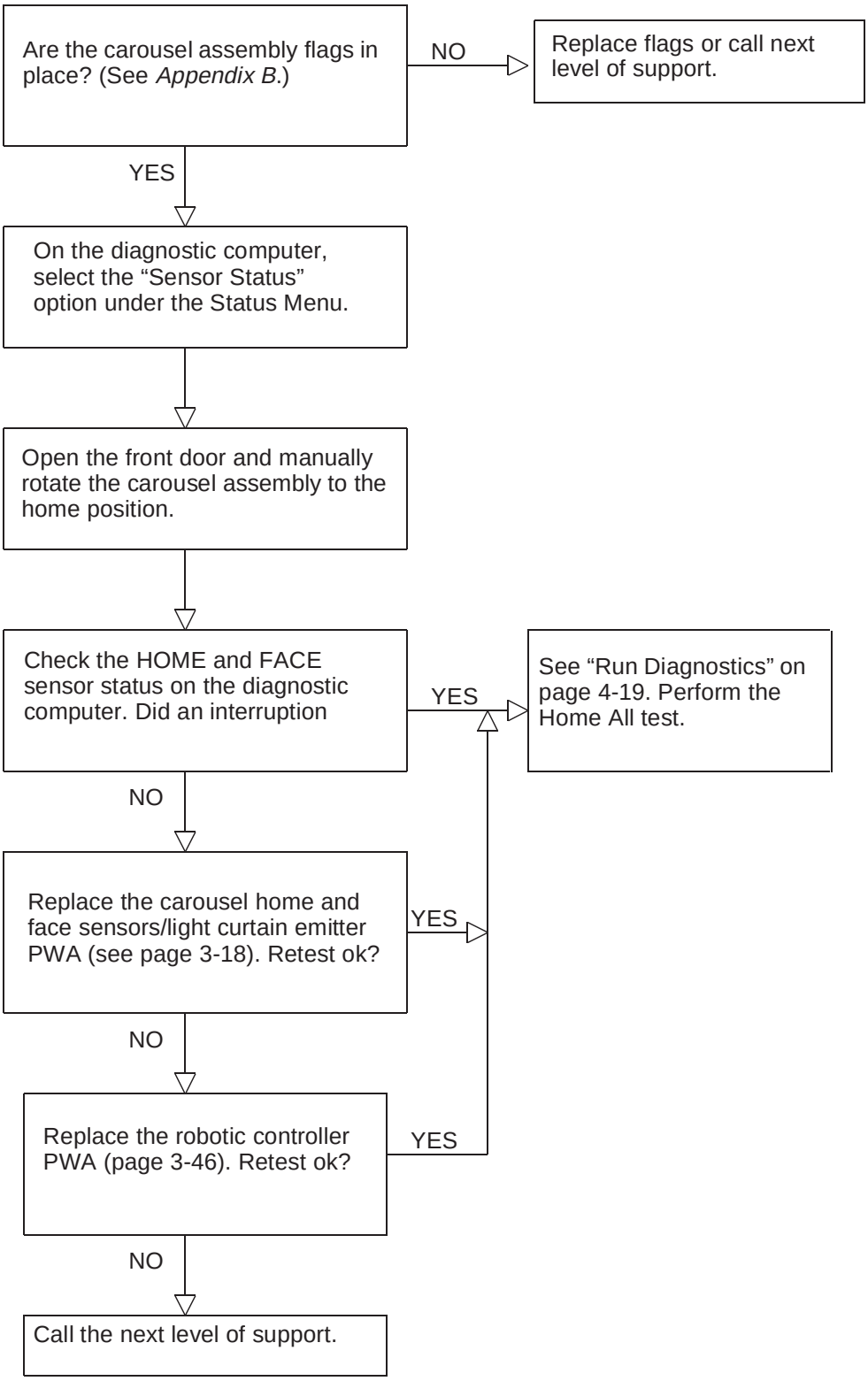
Vertical Timeout



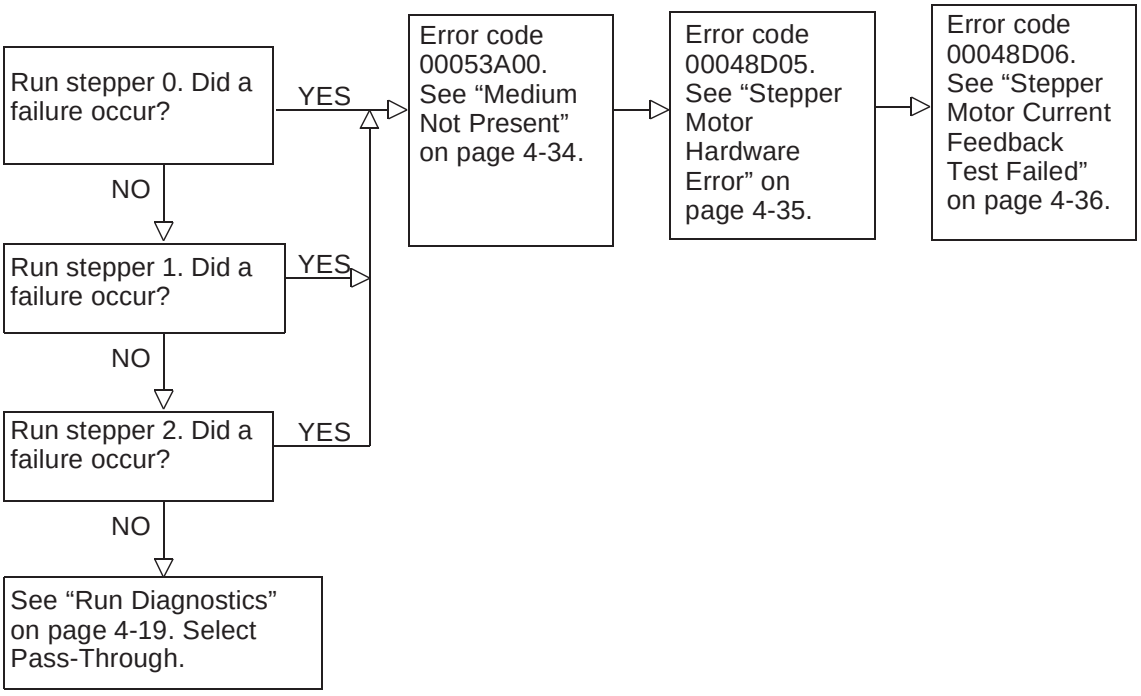
Carousel Timeout



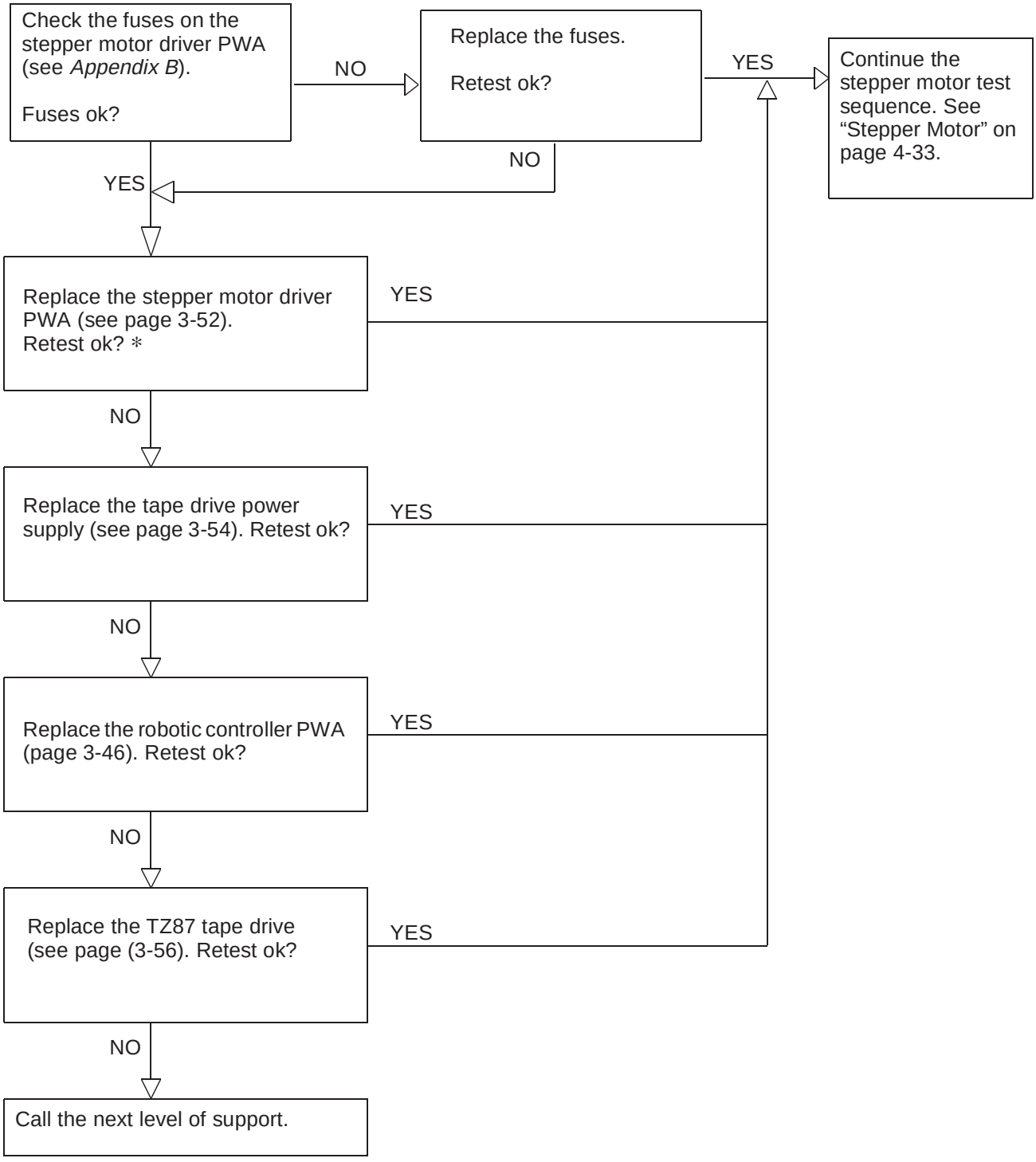
Carousel Missing Face or Home Flag



Stepper Motor

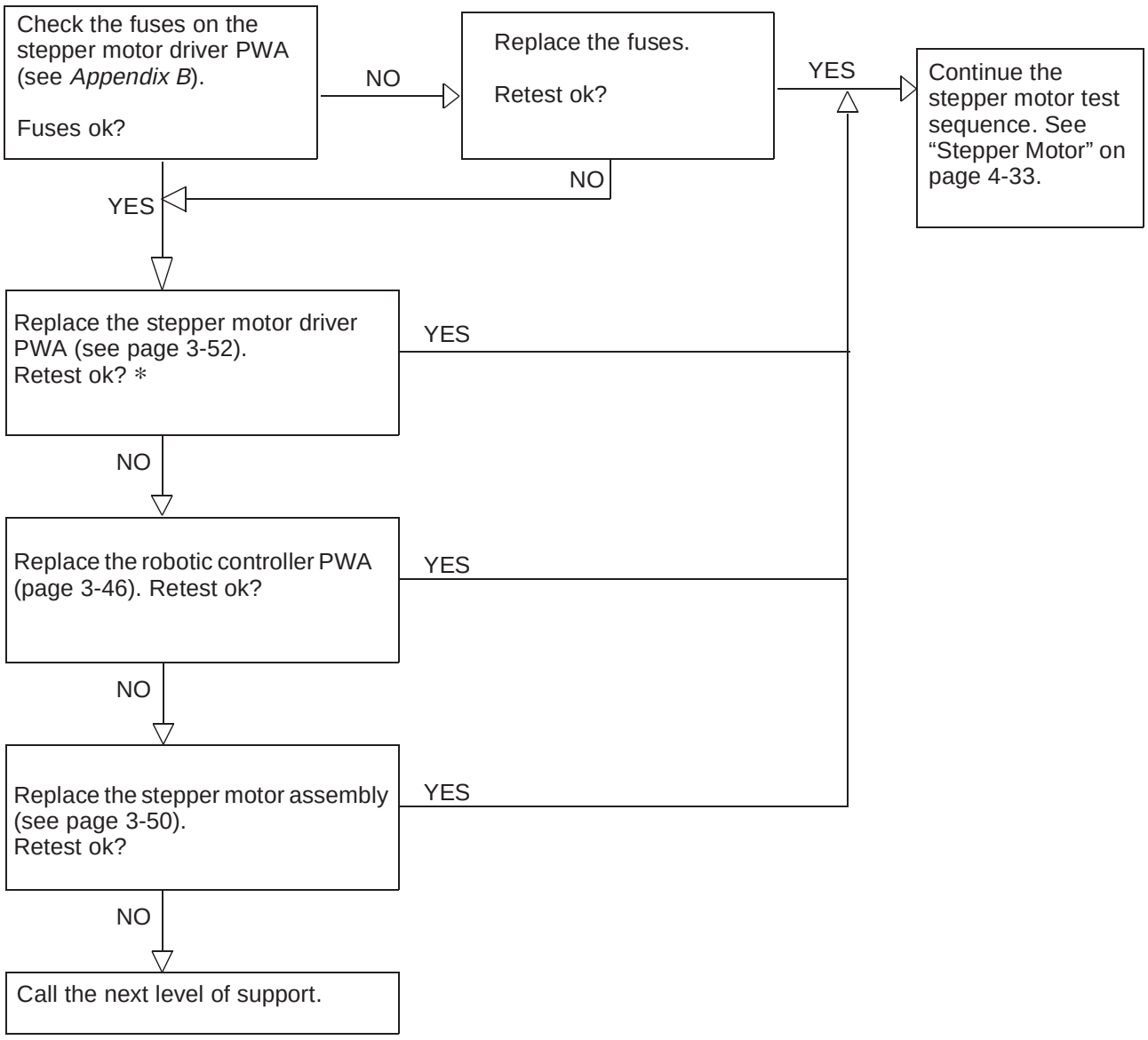


Medium Not Present



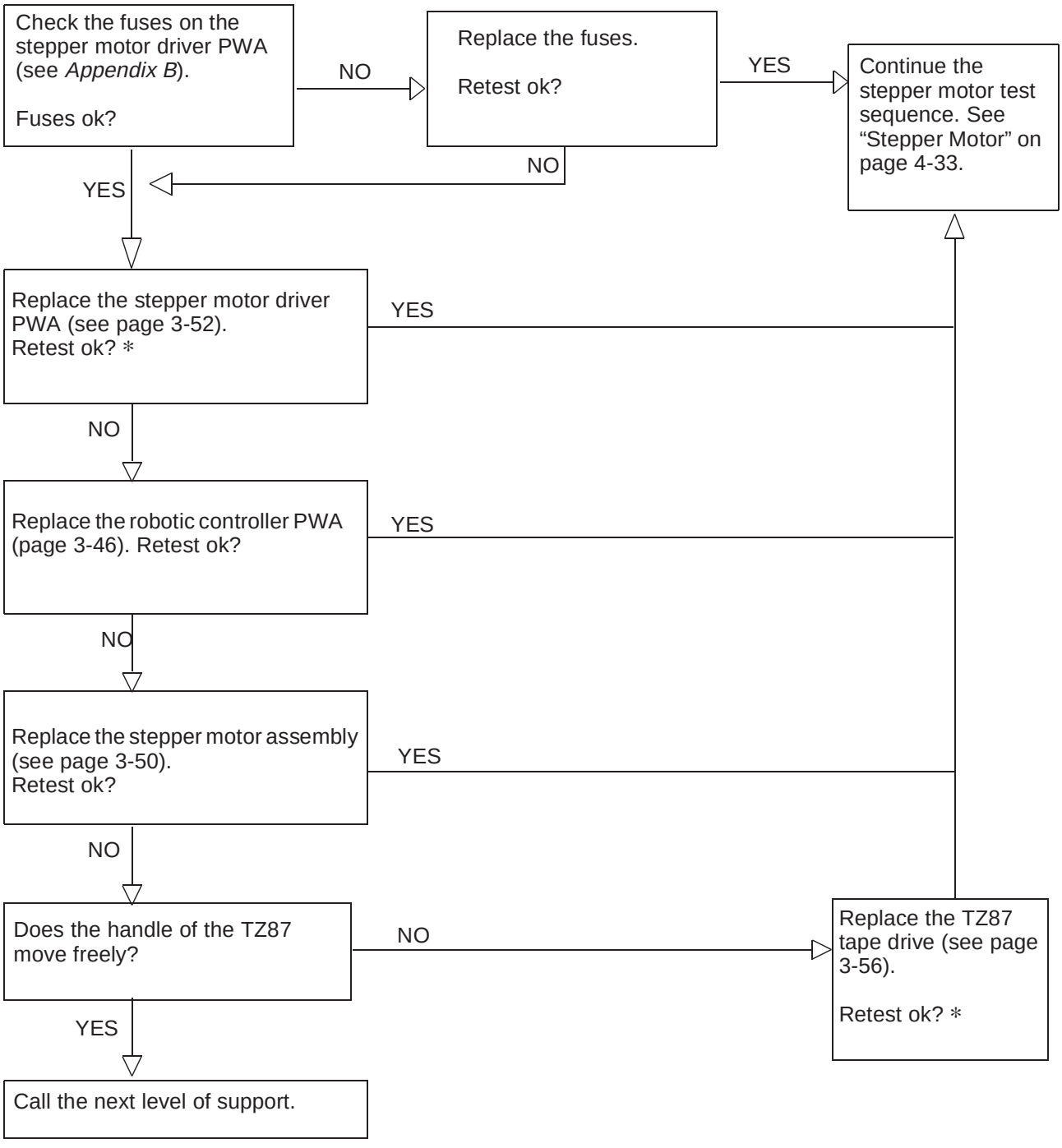
* Verify that all cables are seated correctly before replacing FRUs.

Stepper Motor Hardware Error



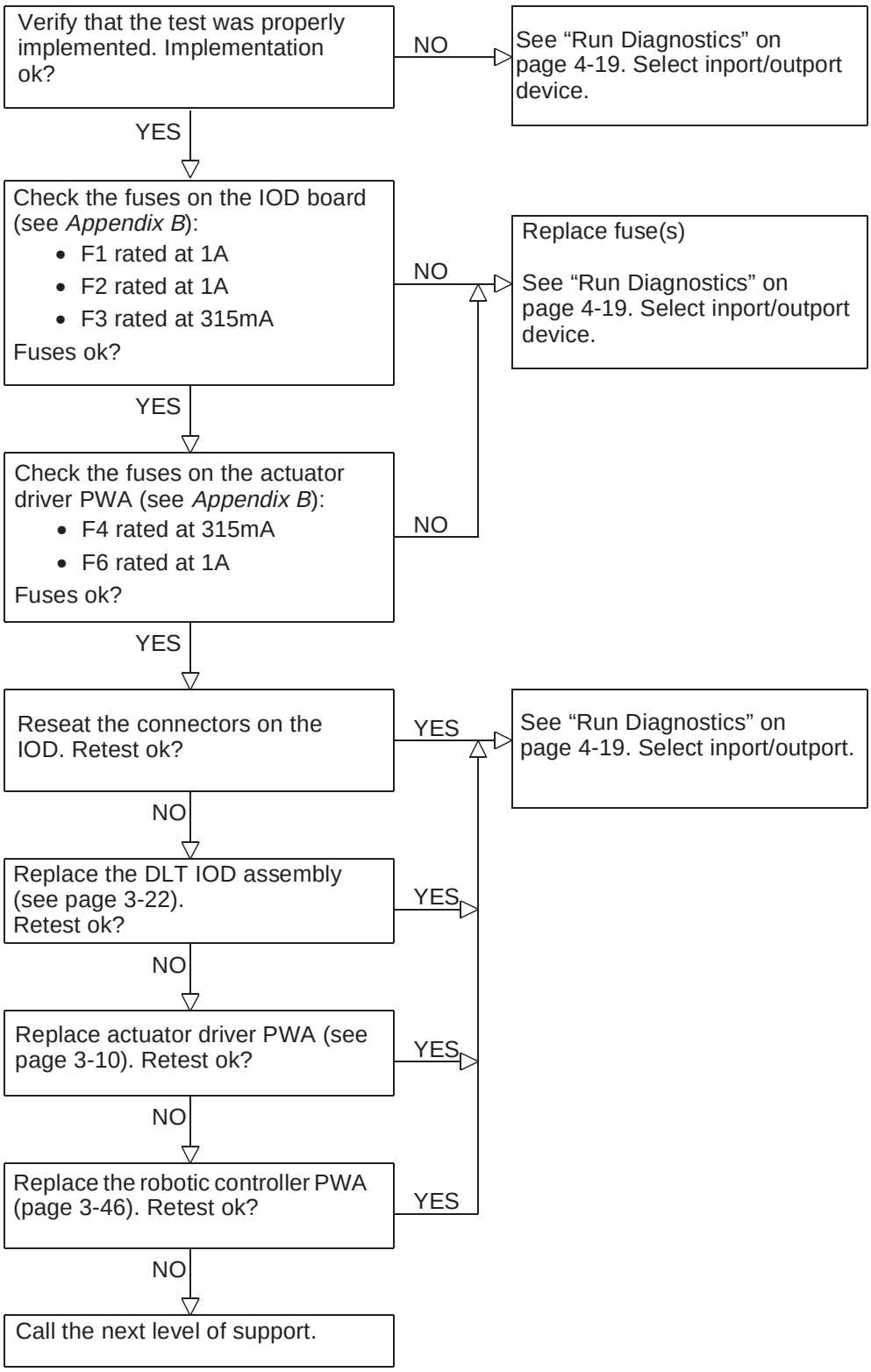
* Verify that all cables are seated correctly before replacing FRUs.

Stepper Motor Current Feedback Test Failed

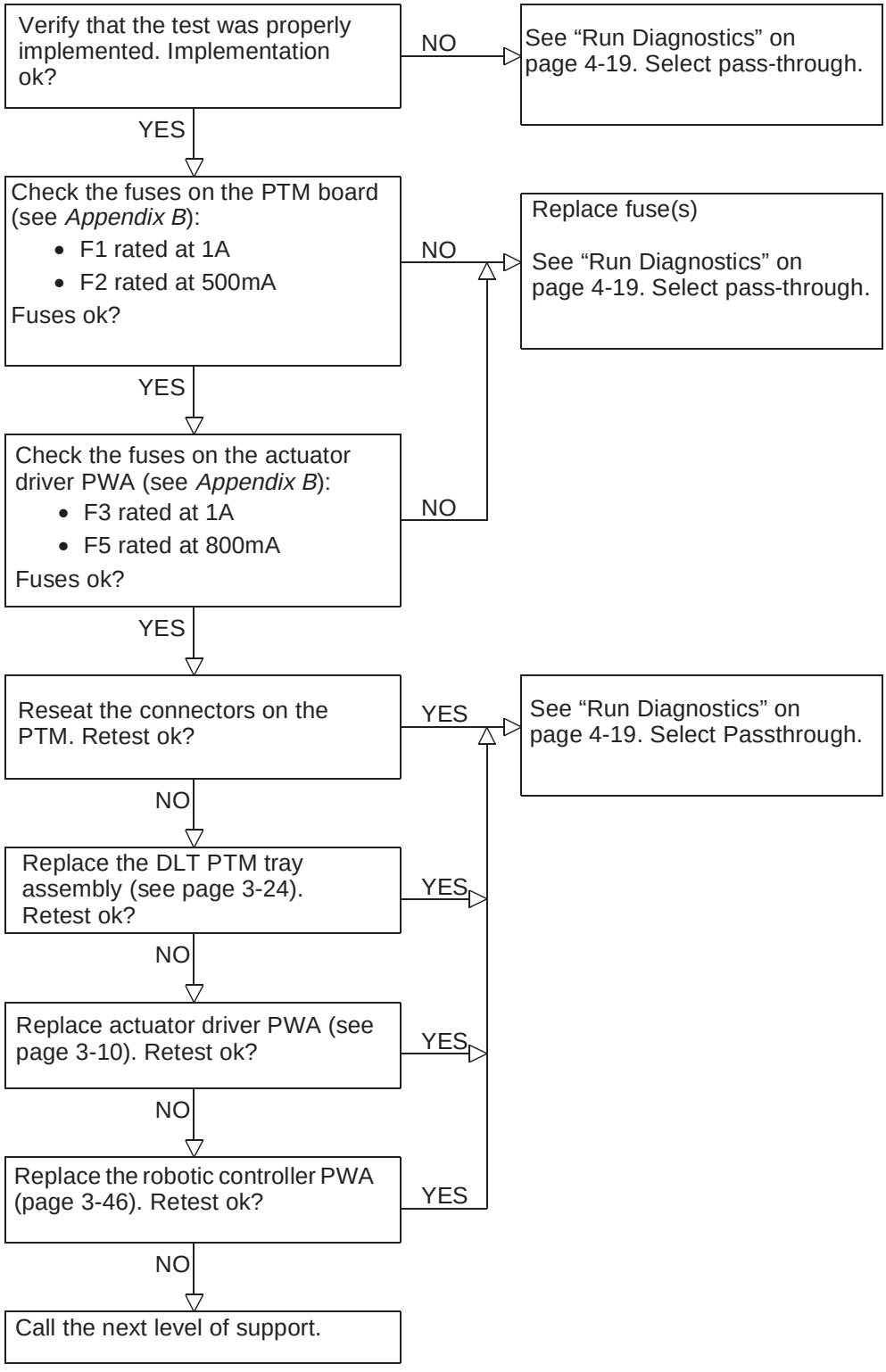


* Verify that all cables are seated correctly before replacing FRUs.

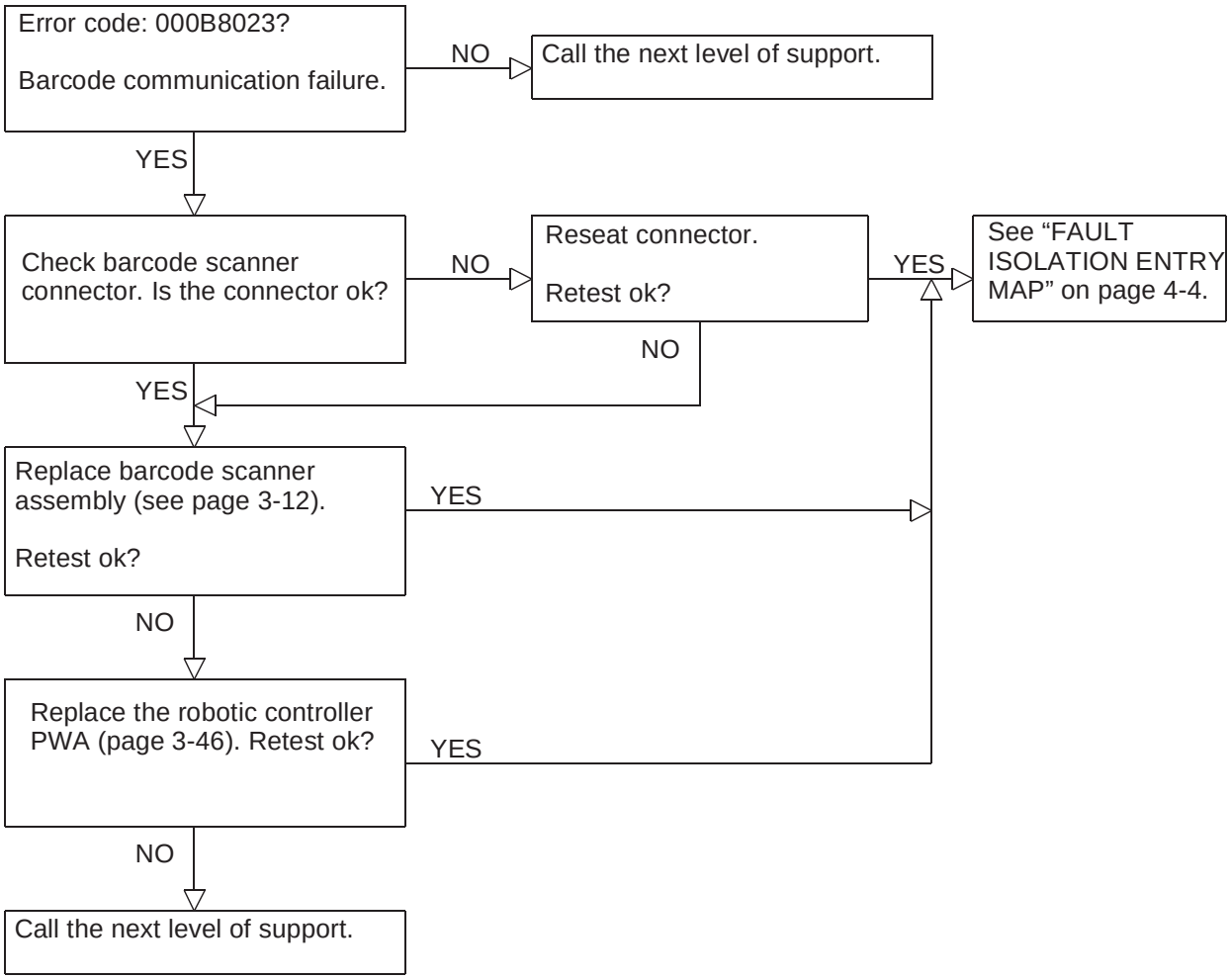
IOD Self Test



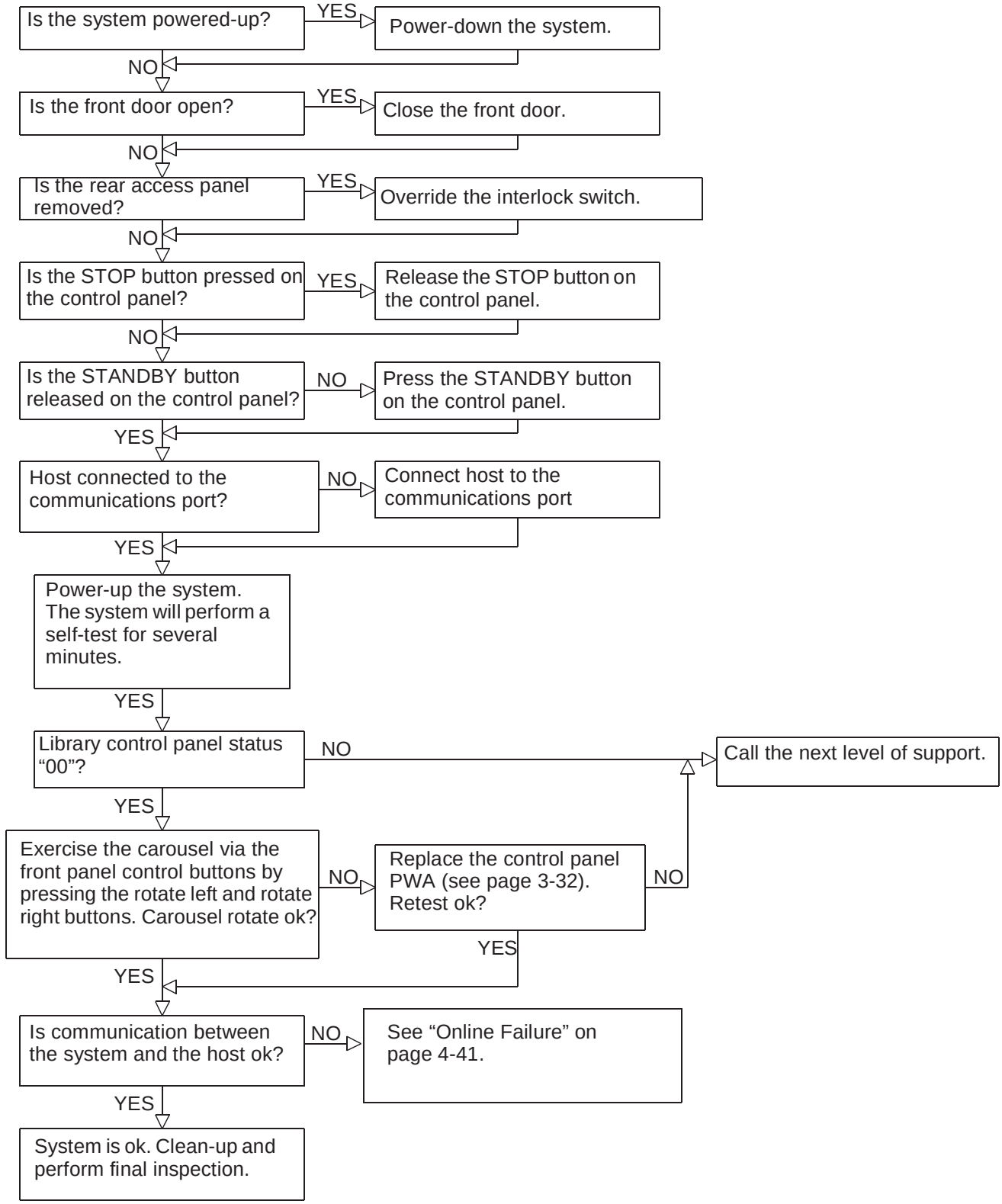
PassThrough Self Test



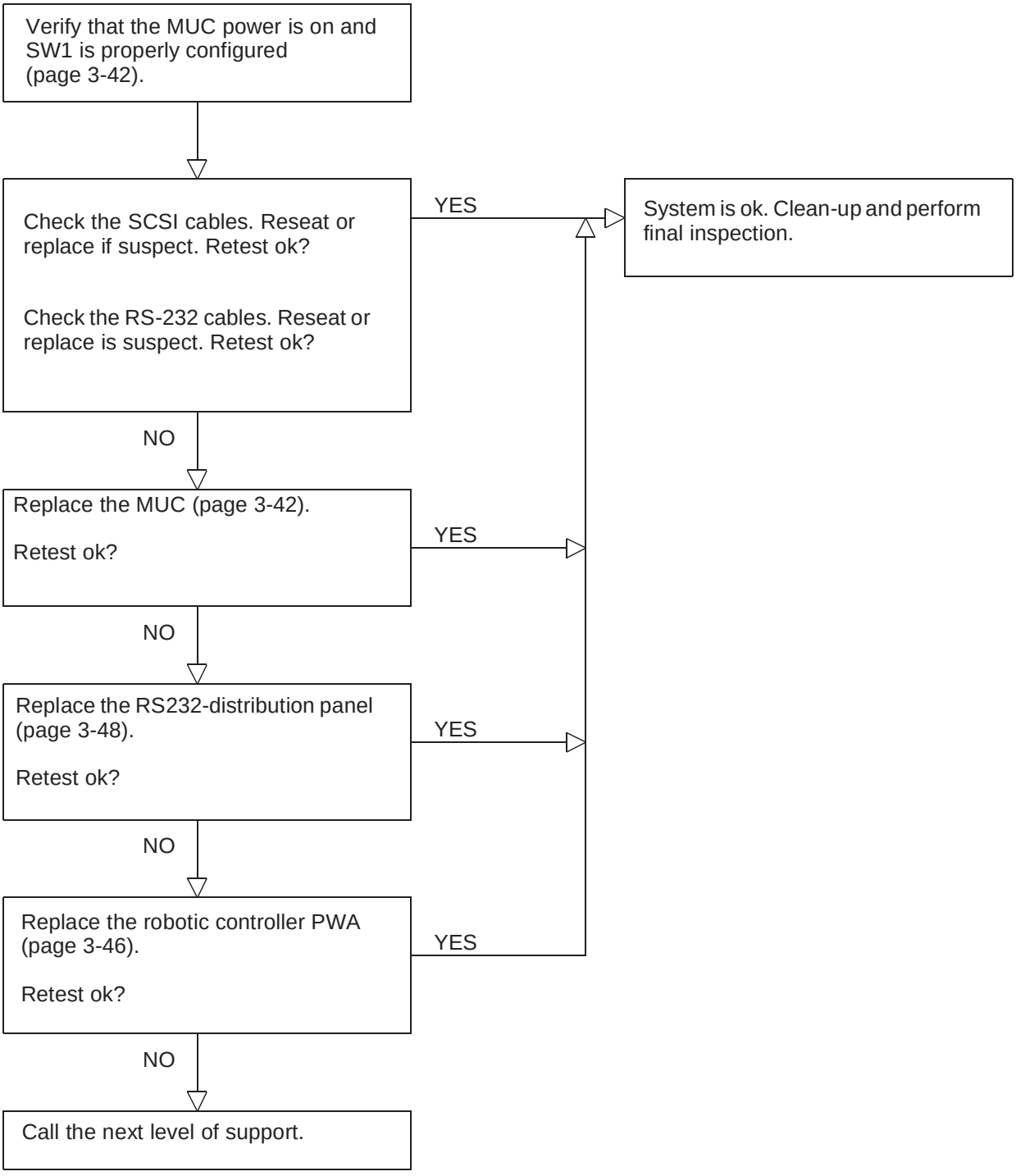
Inventory


Error code: 000B8023?
Barcode communication failure.
NO
Call the next level of support.
YES
Check barcode scanner connector. Is the connector ok?
NO
Reseat connector.
Retest ok?
YES
See “FAULT ISOLATION ENTRY MAP” on page 4-4.
NO
YES
Replace barcode scanner assembly (see page 3-12).
Retest ok?
YES
NO
Replace the robotic controller PWA (page 3-46). Retest ok?
YES
NO
Call the next level of support.

ONLINE TEST ENTRY MAP



Online Failure



5 Adjustments and Alignments

Adjustments

⚠CAUTION ***Over tensioning the belts can result in damage to the belt and other drive components. Under tensioning can result in degraded performance and system failure.***

Adjusting Vertical Axis Belt Tension

To test the vertical axis belt tension, refer to Figure 38 and do the following:

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Move the counterweight to the top of the door; this will position the vertical carriage at the base of the door.
4. Using a force gauge press on one side of the belt midway up the door.
5. Measure the force required to push the belt together so that the two sides just touch with the belt teeth interleaved.
6. The force should be between 18 and 22 ounces (510-623 g). If the belt tension is outside of this range, an adjustment is needed.

   To adjust the vertical axis belt tension, refer to Figure 38 and do the following:

7. Loosen the belt clamp screws holding the belt onto the counterweight.
8. Loosen the screws one-half revolution:

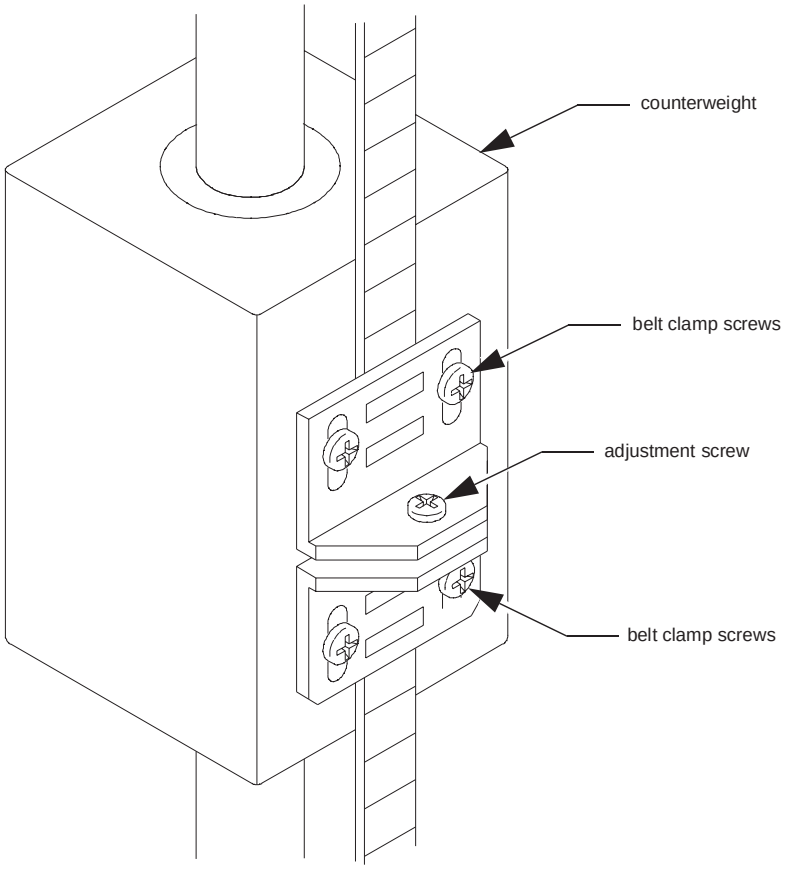
   a. If the measured force was greater than 22 ounces (623 g), turn the adjustment screw counterclockwise (as viewed from below) and recheck the tension.

   b. If the measured force was less than 18 ounces (510 g), turn the adjustment screw clockwise.

Note ***The adjustment screw will not normally need to be turned more than two revolutions.***

9. Tighten the belt clamp screws to 30 in-lb. (3.39 N-m) and recheck the belt tension.

Figure 38: Vertical axis belt tensioning



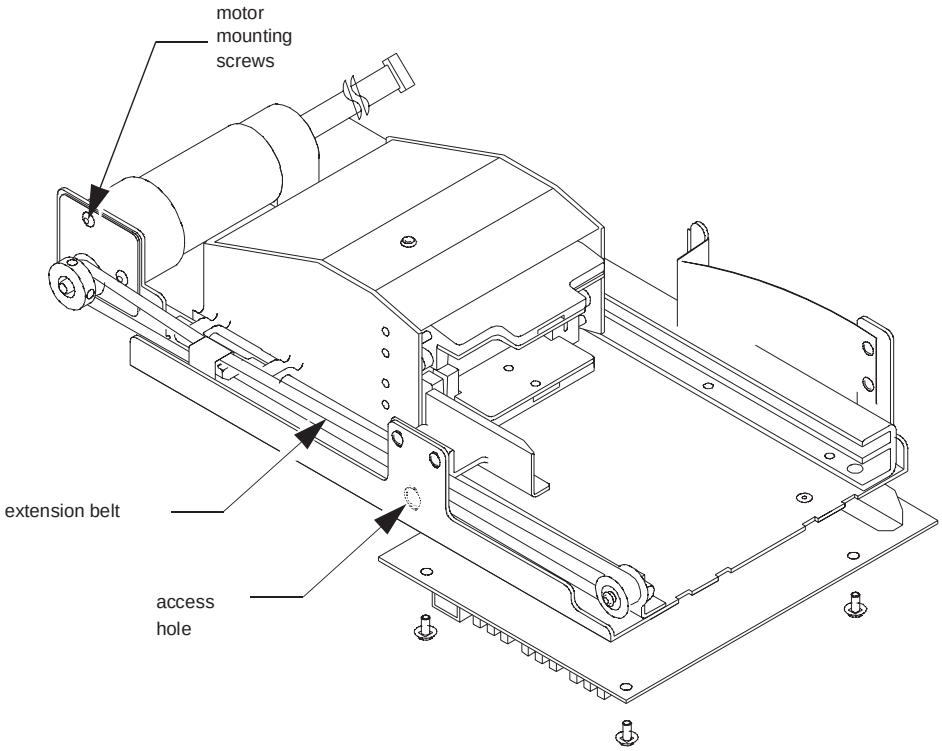
Tensioning the Extension Axis Belt

To test the extension axis belt tension, refer to Figure 39 and do the following:

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Remove the extension axis cover:
   a. Remove the two screws that hold the cover to the extension axis
   b. Slide the cover forward to disengage the cover from the notches at the front edge of the houseplate and rotate the cover down and upward between the extension axis and the library door window.
4. Move the gripper to the middle of the extension travel, which will position the extension belt clamp directly over the access hole in the baseplate.
5. Insert a force gauge through the access hole, and press up on the back of the bottom segment of the belt. Record the force reading with the belt just touching the bottom of the belt clamp.
6. The force should be between 2.7 and 3.7 ounces (76.6 - 105.0 g). If the belt tension is outside this range, an adjustment is needed.

   To adjust the extension axis belt tension, refer to Figure 39 and do the following:
7. Loosen the three extension motor mounting screws one revolution.
8. Grasp the motor by looping one finger over the sheet metal of the baseplate, and applying a light, steady force to tighten the belt. Snug the motor mounting screws while holding the motor.
9. Recheck the belt tension and readjust if necessary.
10. When the belt tension is correct, retighten the mounting screws to 6 in-lb., and recheck the tension.
11. Reinstall the extension axis cover by pushing it back on the notches on the baseplate and retighten the screws to 12 in-lb.

Figure 39: Extension axis belt tensioning



Tensioning the Carousel Drive Belt

To test the carousel axis belt tension, refer to Figure 40, and do the following:

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Remove the rear access panel from the library.

Note ***Remove the top middle screw last, when removing the rear access panel and install it first, when replacing the panel.***

3. Loosen the motor assembly mounting screws on revolution.
4. Locate the carousel belt tensioning locknut just above the carousel motor assembly.
5. Loosen the carousel belt tensioning locknut.
6. Using a torque wrench, set the torque value on the belt adjustment screw to approximately 2 in-lb. (0.23 N-m).

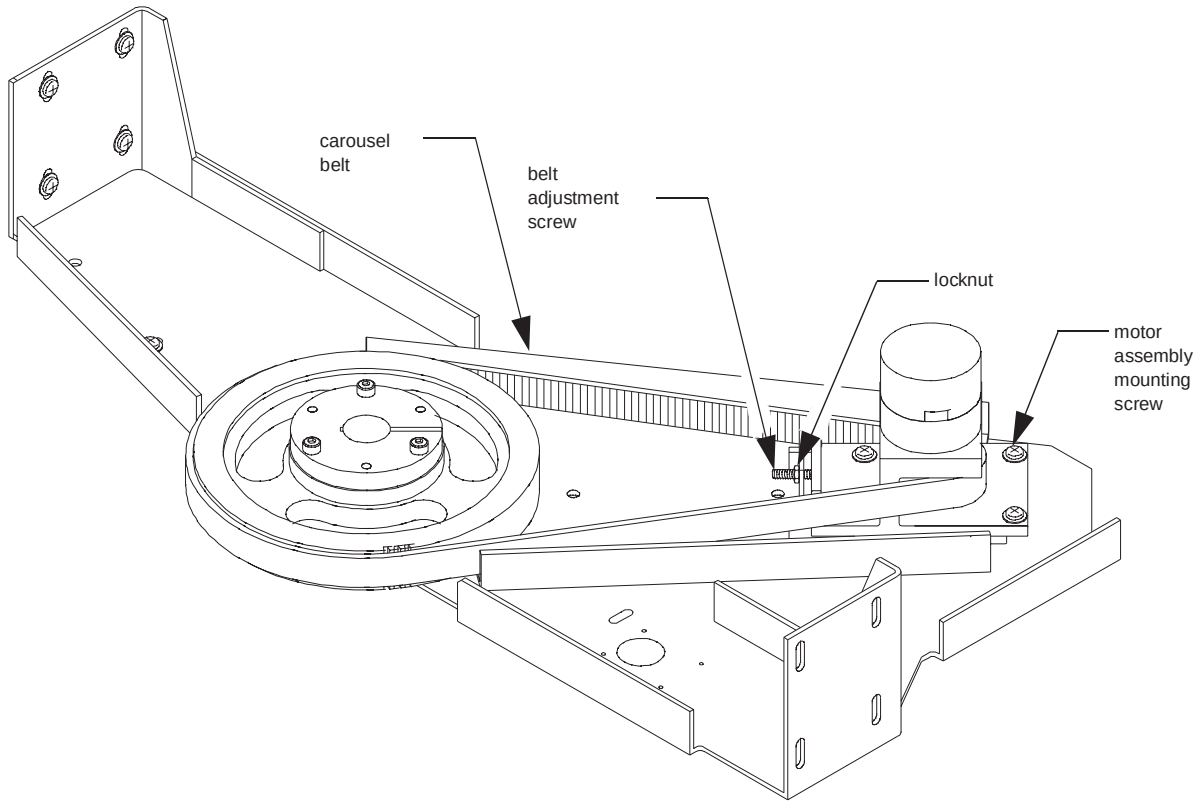
Note ***Adjust the carousel belt tension so that force of 26.60 ± 2.0 oz. applied at the center (± 0.25) of the belt span and perpendicular to the belt will deflect the belt 0.195.***

7. Retighten the locknut to approximately 15 ± 5.0 in-lb. (0.23 N-m).

Note ***When tightening the locknut, be sure to maintain the belt adjustment screw torque value.***

8. Retighten the motor assembly mounting screws to 35 ± 3.0 in-lb.

Figure 40: Carousel belt adjustment



Alignments

Aligning the Gripper Horizontally

The gripper must be aligned horizontally with the binpacks on the carousel so the cartridges can be moved from the gripper to the binpacks successfully.

Note ***The TL820 Diagnostic Software and Alignment Tool Kit (see Appendix A) are required for this alignment procedure. Refer to the TL820 Diagnostic Software User's Manual for more information on the Diagnostic Software.***

Verifying the gripper alignment

1. Open the front door of the library.
2. Locate the alignment label by removing the bottom binpack and turning the carousel slightly counterclockwise. The alignment label is located on the bottom of the carousel to the right of the light curtain PWA.

Note ***The alignment label indicates the proper face to use when horizontally aligning the gripper. The alignment label also indicates whether the carousel tool assembly should be installed near the top or the bottom of the carousel.***

3. Record the information on the alignment label.
4. Use the Move Actuators-Carousel Menu of the Diagnostic Software to move the carousel to the alignment face that is indicated on the alignment label.
5. Gently install the carousel tool assembly on the carousel:
   a. If the alignment label indicated "TOP", install the tool on the bottom two buttons that support the top binpack and the top two buttons that support the middle binpack.
   b. If the alignment label indicated "BOTTOM", install the tool on the bottom two buttons that support the middle binpack and the top two buttons that support the bottom binpack.

Note ***If the carousel moves even slightly when installing the carousel tool assembly, use the Move Actuators-Carousel Menu to move the carousel three faces clockwise, then use the Move Actuators-Carousel Menu to move the carousel back to the alignment face. This will ensure the alignment face is positioned at its centerline.***

6. Using the Move Actuators-Gripper menu, open the gripper jaws, and install the gripper tool assembly. Close the gripper jaws on the tool so the tool is held securely (just as a cartridge would be gripped).

Note ***It is important that the left edge of the gripper tool assembly (as viewed when standing inside the open door) be seated directly against the cartridge guide plate on the left edge of the extension axis.***

7. Attach the gripper tool cable assembly to the QSPI PWA. The QSPI PWA is located underneath the extension axis assembly. The LED on the cable will illuminate.

Note ***Always close and latch the front door slowly when aligning the gripper horizontally. If there is a possibility that the carousel has moved even slightly, use Move Actuators-Carousel Menu to move the carousel three faces clockwise, then use the Move Actuators-Carousel Menu to move the carousel back to the alignment face.***

8. Manually move the vertical carriage and the extension axis so the gripper is directly in front of the carousel tool assembly when the front door is closed. The objective is to have the left edge of the small flag that protrudes from the front center of the carousel tool assembly aligned with the left edge of the first yellow line on the gripper tool assembly (see insert "A" in Figure 41). The left edge of the carousel tool flag must be within the limits shown in insert "A" of Figure 41.

Note ***It may take more than one attempt to position the vertical and extension axes so the gripper tool assembly is directly across from the carousel tool assembly.***

Aligning the gripper

9. Open the front door and raise the vertical carriage so the underside of the carriage is visible.

10. Loosen (but do not remove) the attachment screws (see Figure 41) near the right vertical rail and slightly move the vertical carriage horizontally. Snug the attachment screws and recheck the gripper alignment.

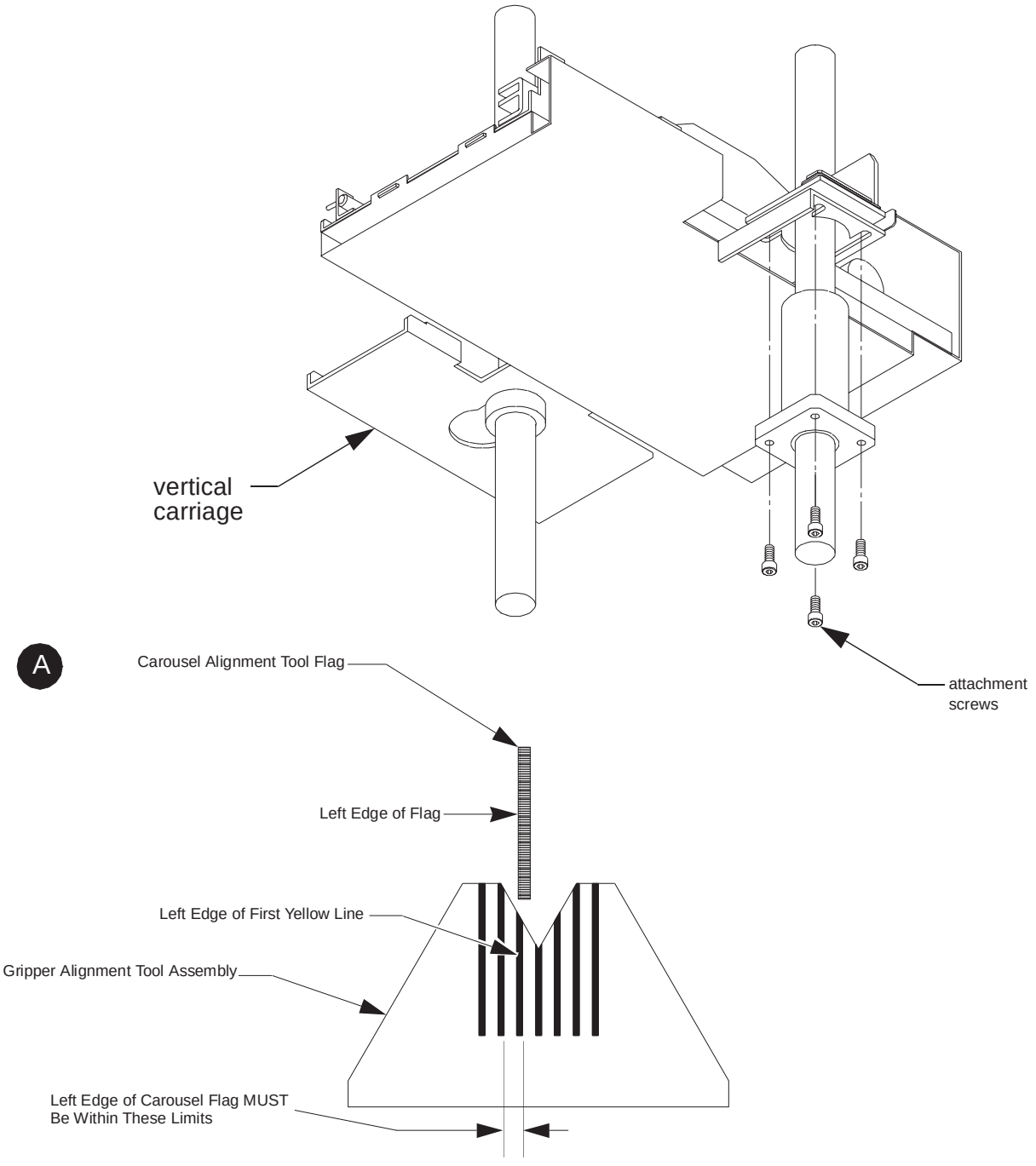
Note ***Be sure the carousel is properly positioned to the alignment face when checking horizontal alignment. If there is a possibility that the carousel has moved even slightly, use Move Actuators-Carousel Menu to move the carousel three faces clockwise, then use the Move Actuators-Carousel Menu to move the carousel back to the alignment face.***

11. When the proper alignment is achieved, tighten the attachment screws.

12. Recheck the alignment.

13. Remove the alignment tools and restore the TL820 to operating condition.

Figure 41: Vertical carriage



Aligning the Tape Drives

The tape drives must be positioned so their throats have the same vertical centerline as the binpacks on the alignment face of the carousel. The tape drives are numbered 0 through 2 from bottom to top.

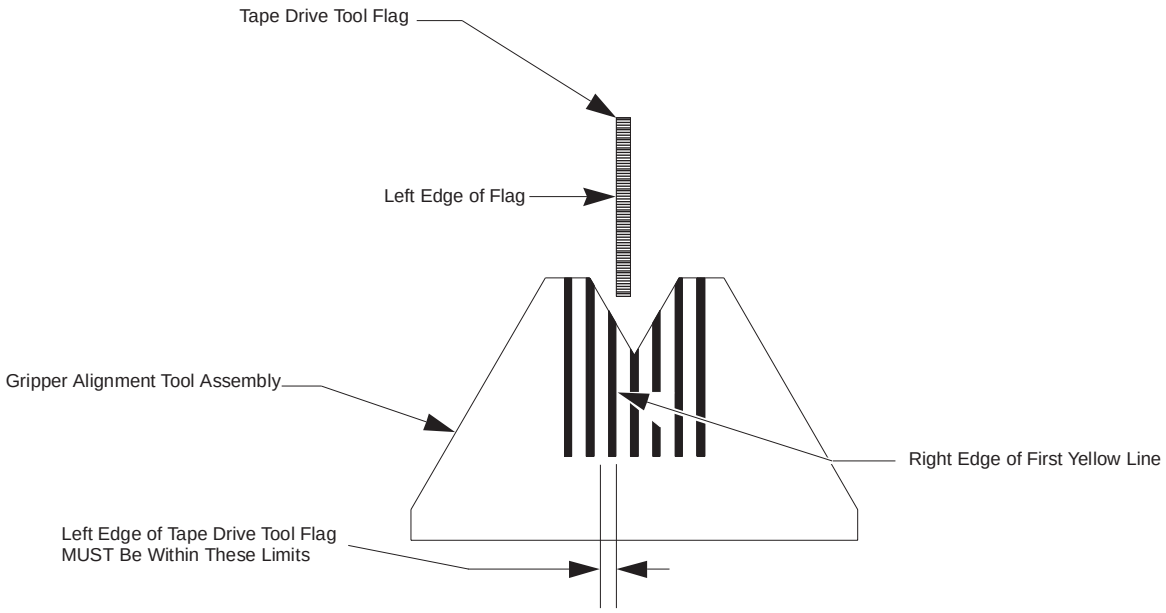
Note ***The TL820 Diagnostic Software and Alignment Tool Kit (see Appendix A) are required for this alignment procedure. Refer to the TL820 Diagnostic Software User's Manual for more information on the Diagnostic Software.***

1. Open the front door of the library.
2. Using the Move Actuators-Gripper menu of Diagnostic Software, open the gripper jaws, and install the gripper tool assembly. Close the gripper jaws on the tool so the tool is held securely (just as a cartridge would be gripped).

Note ***It is important that the left edge of the gripper tool assembly (as viewed when standing inside the open door) be seated directly against the cartridge guide plate on the left edge of the extension axis.***

3. Attach the gripper tool cable assembly to the QSPI PWA. The QSPI PWA is located underneath the extension axis assembly.
4. Install the tape drive tool assembly in tape drive 0 (bottom drive). Open the drive handle if it is closed.
5. Manually move the vertical carriage in front of the tape drive.
6. Manually move the extension axis forward so the gripper tool assembly and the tape drive tool assembly are directly across from each other.
7. *Slowly* close the front door. The left edge of the flag on the tape drive tool assembly should be aligned with the right edge of the first yellow line of the gripper tool assembly (see Figure 42). The left edge of the drive tool flag must be within the limits shown in Figure 42.
8. If adjustment is necessary, loosen the mounting screws securing the tape drive to the shelf. *Slightly* move the tape drive horizontally until the flag on the tape drive tool assembly is properly aligned per Figure 42.
9. Tighten the mounting screws to secure the tape drive to the shelf.
10. Repeat this procedure for tape drive 1 (middle drive) and tape drive 2 (top drive).

Figure 42: Horizontal alignment of drive to gripper

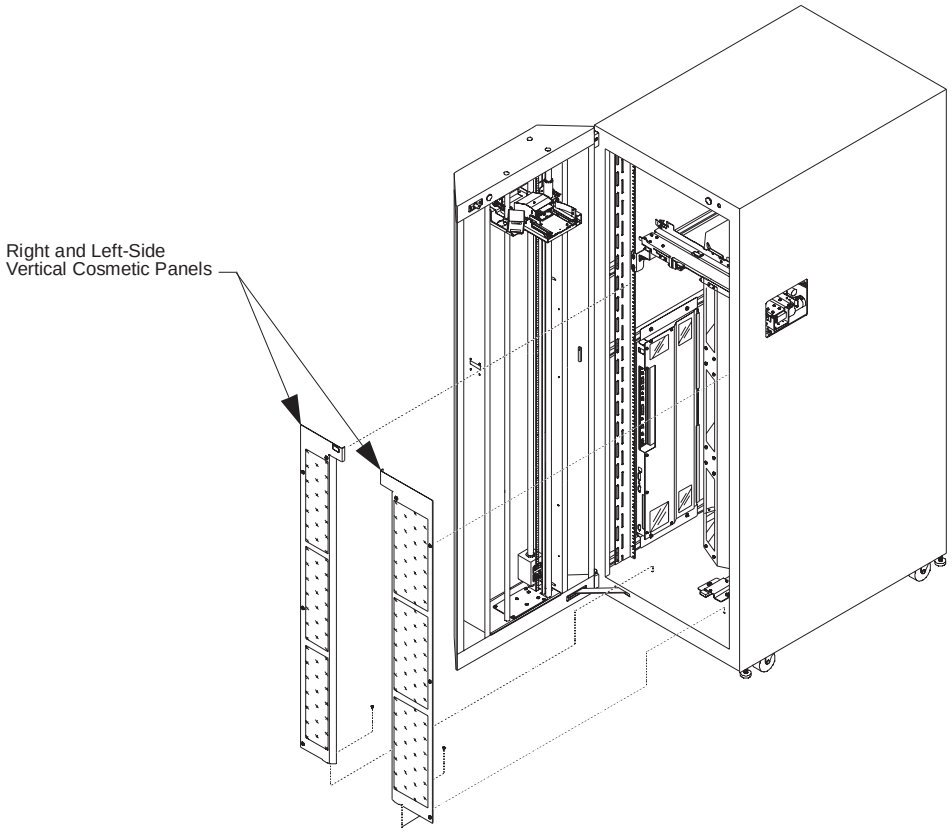


Horizontally Aligning the PTM

Note ***The following procedure is for the alignment of an existing PTM within a single library. If you have a multi-library system, additional alignments of both the vertical and fore/aft positions of the PTM, relative to any existing PTMs, may be necessary.***

1. At the rear of the library, set the main circuit breaker (CB1) to the down (off) position.
2. Open the front door of the library and remove all screws securing both the left and right-side Vertical Cosmetic Panels (Figure 44) to the library and remove the panels.

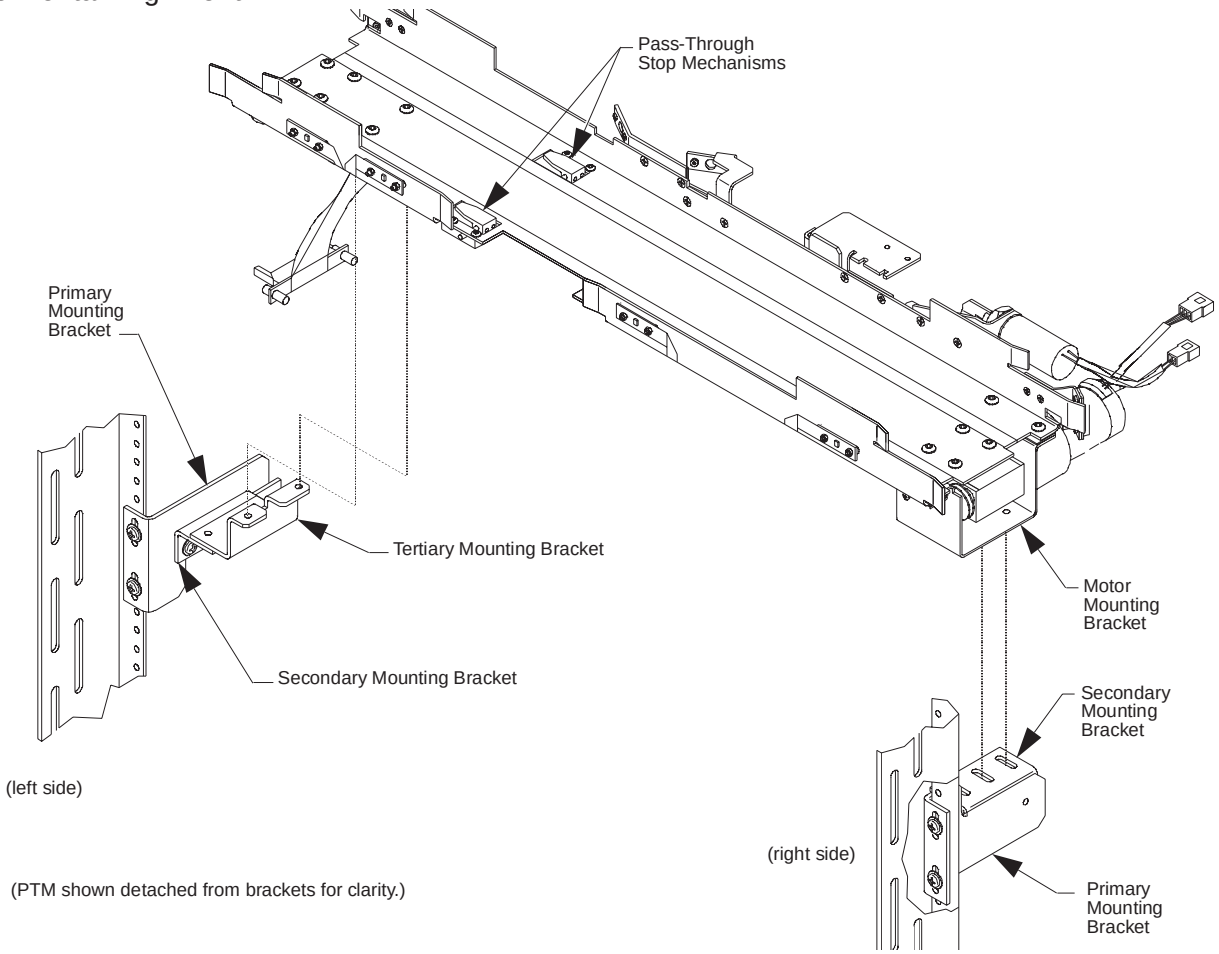
Figure 43: Vertical Cosmetic Panels



3. Place a cartridge in the PTM tray and make sure that the cartridge is touching the rear wall of the tray.
4. Fully seat a cartridge in slot #0. (Slot #0 is the top binslot of the carousel.)

5. Loosen but **DO NOT REMOVE** the screws (two each) securing the Secondary Mounting Brackets to the Primary Mounting Brackets (Figure 44).
6. Move the PTM tray towards the front (fore) or rear (aft) of the library so that the cartridge in the PTM tray is flush with the cartridge in slot #0.
7. Tighten the two screws on both Secondary Mounting Brackets securing them to the Primary Mounting Brackets. (Make sure that the PTM tray does not move during this process.)
8. Remove the cartridge from the PTM tray.
9. Loosen the screws securing the Motor Mounting Bracket to the right-side Secondary Mounting Bracket.
10. Loosen the screws securing the Tertiary Mounting Bracket to the left-side Secondary Mounting Bracket.

Figure 44: PTM Horizontal Alignment



Note ***The left/right alignment is made relative to the gripper tool.***

11. Place the Pass-Through Tool (from the alignment tool kit) into the PTM tray.

12. Manually raise the Pass-Through Stop Mechanisms (gates) and verify that the PTM tool is touching the rear wall of the PTM tray and the Stop Gates.

13. Install the Gripper Tool with the V-shaped plate into the gripper of the extension axis and verify that the tool is fully seated in the back of the gripper jaws and that the left side of the tool touches the Guide Rail.

14. Align the PTM relative to the gripper by moving it to the left or right, so that the flag of the PTM Tool is positioned relative to the Gripper Tool as shown in Figure 44. The limits of the alignment are the same as for aligning the carousel. (See insert "A" of Figure 41).

15. Tighten the two screws securing the Motor Mounting Bracket to the right-side Secondary Mounting Bracket (Figure 44).

16. Tighten the two screws securing the Tertiary Mounting Bracket to the left-side Secondary Mounting Bracket.

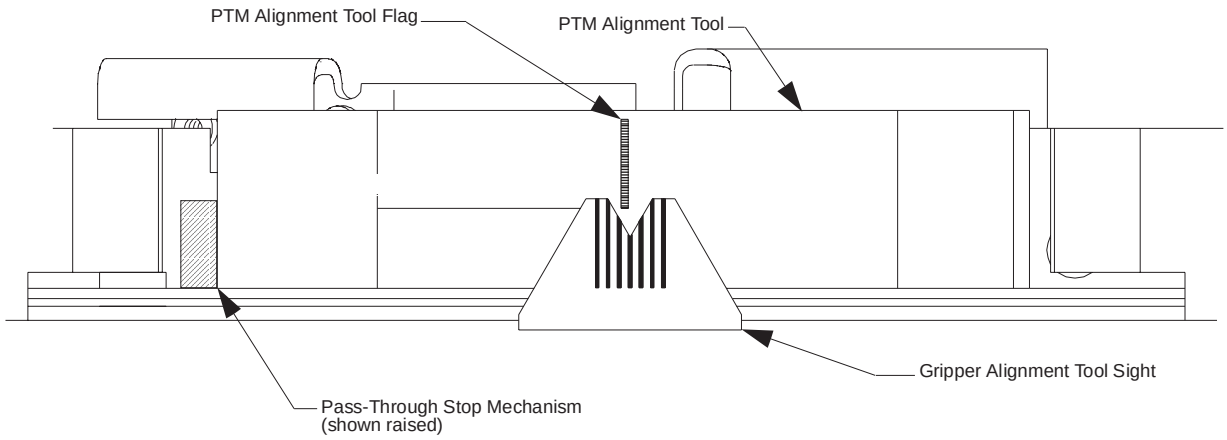
17. Repeat Step #14 to verify that the PTM is still aligned relative to the gripper.

18. Remove the PTM Tool from the tray and the Gripper Tool from the gripper.

19. Replace and secure the left and right-side Vertical Cosmetic Panels (Figure 44).

20. Close and latch the front door and apply power to the library.

Figure 45: PTM Alignment Position



Vertical Calibration

WARNING ***Horizontal alignment must be checked before performing the following procedure; not doing so could cause damage to the library.***

Setting vertical calibration is the process of identifying the vertical location of each bin slot, each tape drive and the PTM. Once identified, vertical calibration values are stored in non-volatile RAM.

Note ***The TL820 Diagnostic Software and Alignment Tool Kit (see Appendix A) are required for this alignment procedure. Refer to the TL820 Diagnostic Software User's Manual for more information on the Diagnostic Software.***

To set the vertical calibration values, do the following.

1. Open the front door of the library.
2. Locate the alignment label by removing the bottom binpack and turning the carousel slightly counterclockwise. The alignment label is located on the bottom of the cabinet just to the right of the light curtain bracket.

Note ***The alignment label indicates the proper face to use when performing vertical calibration. The alignment label also indicates whether the carousel tool assembly should be installed near the top or the bottom of the carousel.***

3. Record the information on the alignment label.
4. In the Move Actuators menu, select the Self Test All option. The system will perform a self-test which takes approximately 6 seconds.
5. Select the Home All option. The system will perform a home all which takes approximately 45 seconds.
6. Use the Move Actuators-Carousel Menu of the Diagnostic Software to move the carousel to the alignment face that is indicated on the alignment label.
7. Open the front door of the library and remove all bin packs from the selected face.
8. Gently install the carousel tool assembly on the carousel:
   a. If the alignment label indicated "TOP", install the tool on the bottom two buttons that support the top binpack and the top two buttons that support the middle binpack.
   b. If the alignment label indicated "BOTTOM", install the tool on the bottom two buttons that support the middle binpack and the top two buttons that support the bottom binpack.

Note ***If the carousel moves even slightly when installing the carousel tool assembly, use the Move Actuators-Carousel Menu to move the carousel three faces clockwise, then use the Move Actuators-Carousel Menu to move the carousel back to the alignment face. This will ensure the alignment face is positioned at its centerline.***

9. Install the front door magnetic override tool.

10. Using the Move Actuators-Gripper menu, open the gripper jaws, and install the gripper tool assembly. Close the gripper jaws on the tool, so the tool is held securely (just as a cartridge would be gripped).

Note ***It is important that the left edge of the gripper tool assembly (as viewed when standing inside the open door) be seated directly against the cartridge guide plate on the left edge of the extension axis.***

11. Attach the gripper tool cable assembly to the QSPI PWA. The QSPI PWA is located underneath the extension axis assembly.

Note ***The tape drives are numbered 0 through 2 from bottom to top.***

12. Install a tape drive tool assembly in each tape drive.

13. G*ently* move the stops on the PTM to a perpendicular position and install the PTM alignment cartridge.

Note ***Set the alignment cartridge on the conveyor belt with the left edge of the tool flush against the two stops at the left of the PTM. Allow the stops to go back to their starting positions.***

14. Close the front door.

Note ***Always close and latch the front door slowly when aligning the gripper horizontally. If there is a possibility that the carousel has moved even slightly, use Move Actuators-Carousel Menu to move the carousel three faces clockwise, then use the Move Actuators-Carousel Menu to move the carousel back to the alignment face.***

15. In the Align/Calibrate menu, select the Auto Calibrate option to generate the following pop-up:

a. Enter **2** for Bin Pack # – 2 is where the triangular carousel tool assembly is located, at the middle or #2 bin pack location.

b. Enter “0” as the Start Drive.

c. Enter “3” for number of drives.

d. Enter “Yes” for Pass Through.

e. Press the <ENTER> key.

When Auto calibration begins, the vertical and extension axes will move until the sensor on the gripper tool assembly finds the sensor interrupt flag on the front of the carousel tool assembly, the tape drive tool assembly, and the PTM alignment cartridge. The gripper will pause as each flag is found and write the vertical calibration value for the associated position to non-volatile RAM.

Since each carousel bin slot has a fixed vertical position relative to every other bin slot, it is only necessary to calibrate one bin slot and all bin slots will be updated simultaneously. Therefore, when the gripper finds the carousel tool assembly flag it will pause and write the entire calibration table for all bin slots in the library to non-volatile RAM.

Note ***Individual drives can be auto calibrated by entering:***

- “0” for Bin Pack #
- “n” as the Start Drive.
- “1” for number of drives.
- “none” for Pass Through.

A report of the calibration data can be automatically generated by selecting the appropriate drive menu in the Diagnostic Software.

Periodic Maintenance

There are two categories of Periodic Maintenance (PM) for the TL820: Operator and Field Service Engineer (FSE) maintenance. Table 7 outlines the PM for both the Operator and FSE.

Table 7: Periodic maintenance table

Periodic Maintenance Procedure	Operator Maintenance	FSE Maintenance	Page Number
Cleaning and lubricating the vertical rails	every 90 days	90 days after installation	5-22
Cleaning and lubricating the extension rails	every 90 days	90 days after installation	5-22
Cleaning and lightly lubricating the geneva mechanism inside the gripper	N/A	every 180 days	5-23
Checking and adjusting carousel belt tension	N/A	every 180 days	5-23
Checking and adjusting vertical axis belt tension	N/A	every 180 days	5-23
Checking and adjusting extension axis belt tension	N/A	every 180 days	5-23
Cleaning the fan filter	N/A	every 180 days	5-24

Note ***The first FSE PM is recommended 90 days after installation and is recommended every 180 days thereafter. The FSE may choose to perform the recommended 90 day operator PM as part of the 180 day visit.***

Periodic Maintenance Kit

The Periodic Maintenance Kit, includes the following supplies:

- (1) container of light grease
- 25 swabs
- 10 lint free cloths

Cleaning and Lubricating Vertical Rails

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Using a lint free cloth and isopropyl alcohol, clean all three of the vertical rails removing all dust and debris.
4. Using a second lint free cloth and light grease, lightly lubricate each of the vertical rails by rubbing the cloth up and down the entire length of the rail.
5. Manually move the vertical carriage up and down the vertical rails to completely distribute the applied lubricant, while checking for smooth vertical travel.

Cleaning and Lubricating Extension Rails

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Using a lint free cloth and isopropyl alcohol, clean the extension rail on the extension axis assembly.

Note ***Gently move the gripper assembly forward and back on the rail to gain access to the entire length of the rails for cleaning.***

4. Using a second lint free cloth and light grease, lightly lubricate the entire length of both extension rails by rubbing the lubricated cloth forward and back on the rails.
5. Manually move the gripper assembly forward and back on the rails to completely distribute the applied lubricant, while checking for smooth extension travel.

Cleaning and Lubricating the Gripper

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Open the front door of the library.
3. Remove the gripper cover.
4. Using a can of compressed air (or vacuum), carefully remove any dust and debris inside the gripper assembly.
5. Using a swab and isopropyl alcohol, clean all 4 of the pusher block shafts.
6. Using a second swab and light grease, lightly lubricate each of the rails.
7. Manually rotate the geneva driver back and forth:

Note ***The geneva driver does not rotate 360 degrees.***

a. Expose all four geneva pins, (two on the inside of the geneva wheel and two on the outside of the geneva wheel).

b. Lightly lubricate the geneva pins.

8. Reinstall the gripper axis cover.

Checking the Carousel Drive Belt Tension

See “Tensioning the Carousel Drive Belt” on page 5-7.

Checking the Vertical Axis Belt Tension

See “Adjusting Vertical Axis Belt Tension” on page 5-3.

Checking the Extension Axis Belt Tension

See “Tensioning the Extension Axis Belt” on page 5-5.

Cleaning the Fan Filter

1. Remove power from the library by turning off the circuit breaker switch, which is located on the lower left corner of the rear connector panel.
2. Remove the rear access panel from the library.

Note ***Remove the top middle screw last, when removing the rear access panel and install it first, when replacing the panel.***

3. Remove the AC cable clamp and unplug the AC cable from the fans (see Figure 19 on page 3-31).
4. Remove the fan filter (see Figure 19 on page 3-31) and clean the fans with a vacuum.
5. Reinstall fan filter and frame.

Appendix A: Tools

Required Tools

The TL820 is designed for long life reliability and ease of repair. The mean time between failure (MTBF) is 10,000 hours and the mean time to repair (MTTR) is 30 minutes. Field replaceable units (FRUs) are designed to meet the MTTR specification. An alignment tool kit is available to facilitate installation and maintenance.

Alignment Tool Kit

In addition to common field engineering tools and equipment, maintenance of the TL820 requires the Alignment Tool Kit (PN 29-31890-01) as shown in Figure A-1 and described in Table A-1.

Figure A-1: Alignment Tool Kit

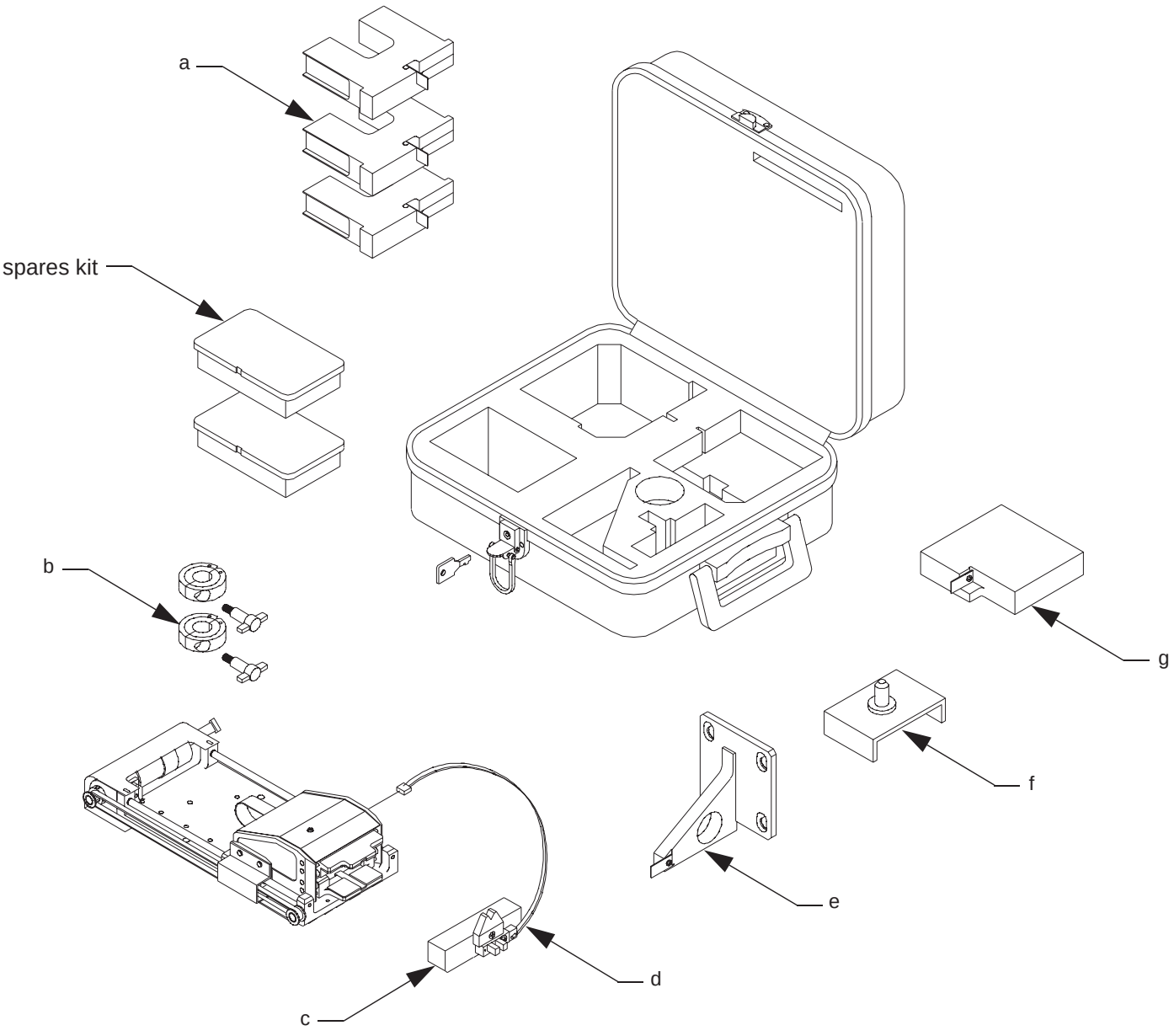


Table A-1: Alignment Toolkit

Call-out (Figure A-1)	Description	Function
a	Tape Drive Tool Assembly	Insert in tape drive to identify throat center line.
b	Collar, hinged	Install on vertical rail below counterweight and vertical carriage when performing maintenance that requires detachment of vertical belt.
c	Gripper Tool Assembly	Insert in gripper jaws, has V-sight on front for horizontal alignment and sensor on front for vertical calibration.
d	Gripper Tool Cable Assembly	Cable for gripper tool.
e	Carousel Tool Assembly	Install on carousel alignment face in place of bin pack to identify carousel center line.
f	Magnetic Override Tool	Install over front door interlock switch to override switch when servicing library with front door open.
g	Pass-Through Mechanism Tool Assembly	Open PTM gate and insert PTM tool on conveyor to identify center line of PTM throat.
not shown	IC Removal Tool	Remove firmware ICs (located in the spare's kit; refer to instruction insert).
not shown	Sensor Flags	Spare sensor flags (located in the spare's kit).
not shown	Sensors	Spare sensors (located in the spare's kit).

Other Tools

Table A-2 describes other tools, not sold by Digital Equipment Corporation which will be useful when maintaining the TL820.

Table A-2: Other tools

Manufacturer and Manufacture's P/N	**Description**	**Function**
Wagner FDK-8 29-31945-01	8 oz. force gauge	set extension axis belt tension
Wagner FDK-32 29-31944-01	32 oz. force gauge	set vertical belt tension
Mountz	adjustable torque wrench with 1/2” socket and 9/64” hex bit attachments	set carousel belt tension (2” lbs) and set vertical carriage to linear bearing attachment screws (6” lbs)

Appendix B: Fuse Locations

Figure B-1: IOD interconnect PWA

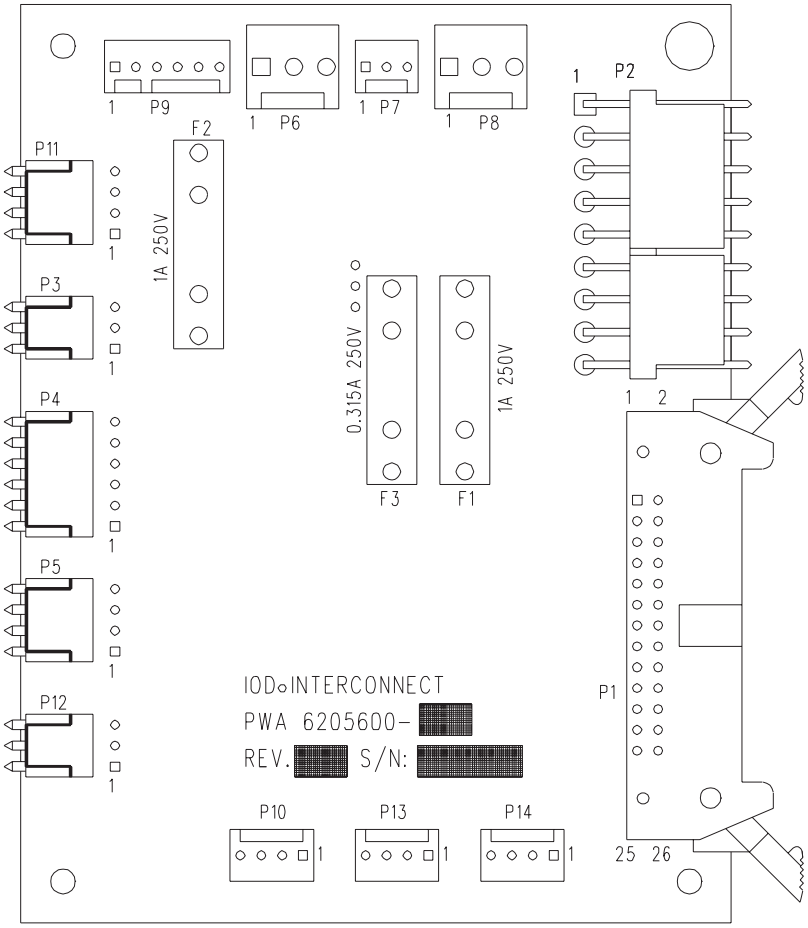


Figure B-2: Stepper motor driver PWA

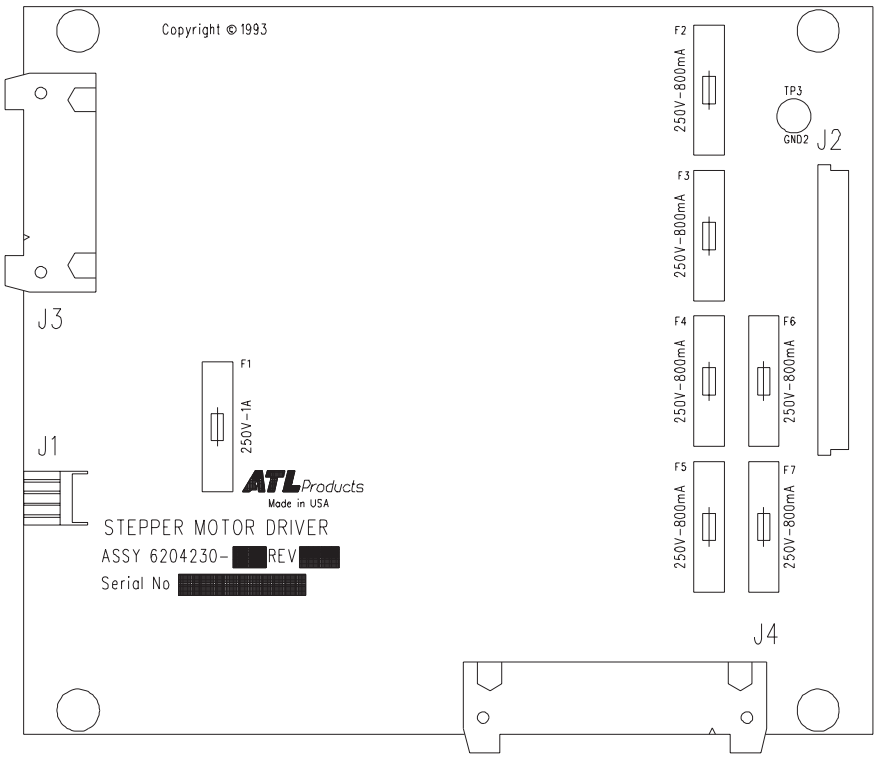


Figure B-3: Carriage QSPI interface PWA

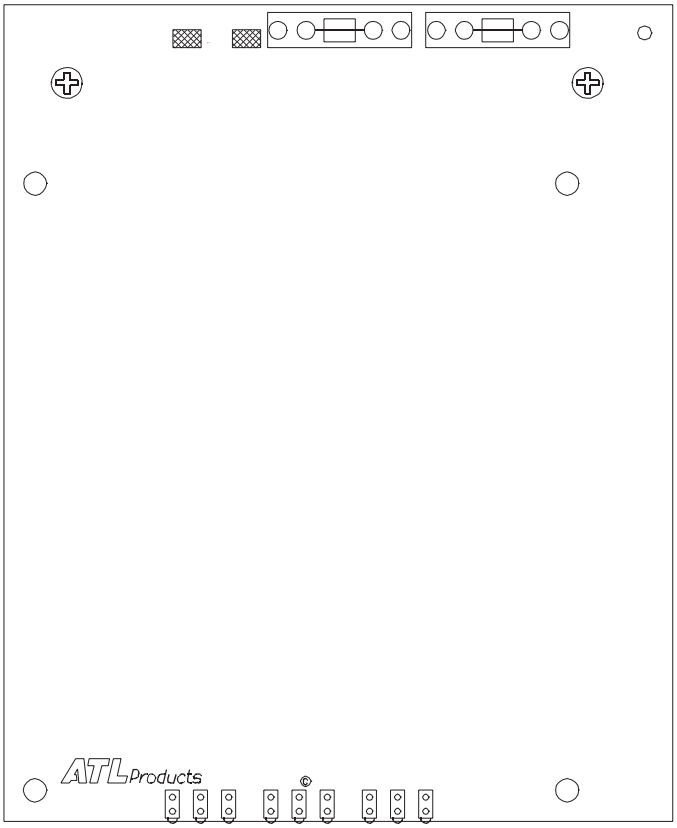


Figure B-4: Actuator driver PWA

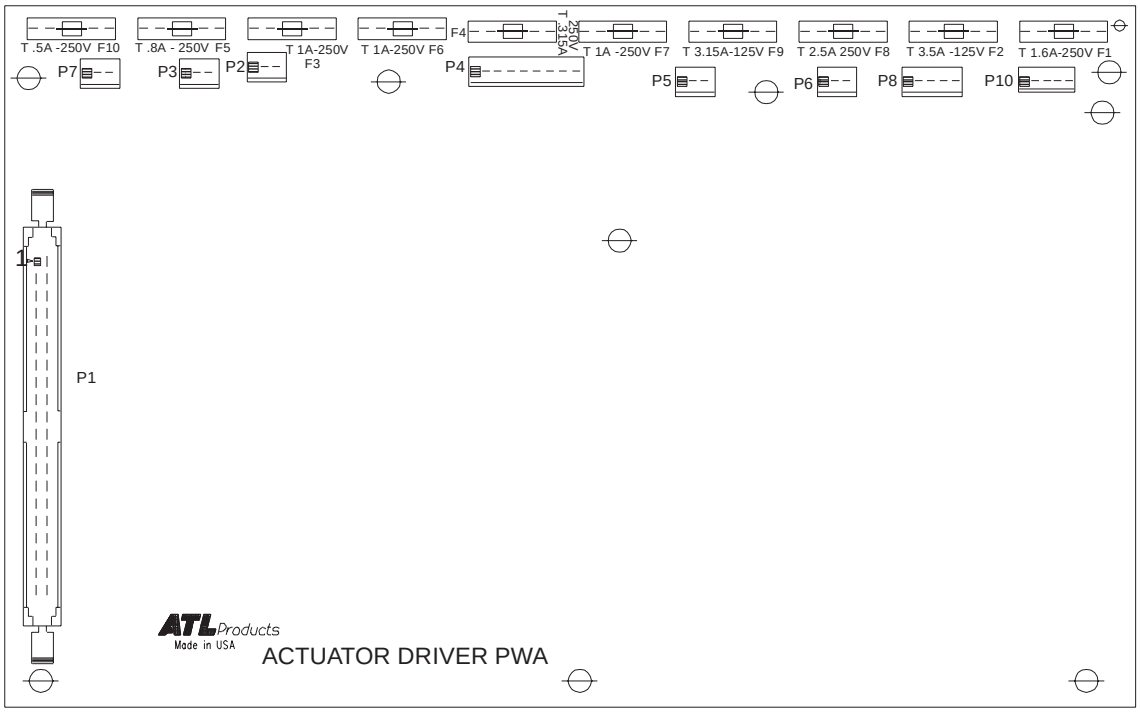


Figure B-5: Carousel flag location

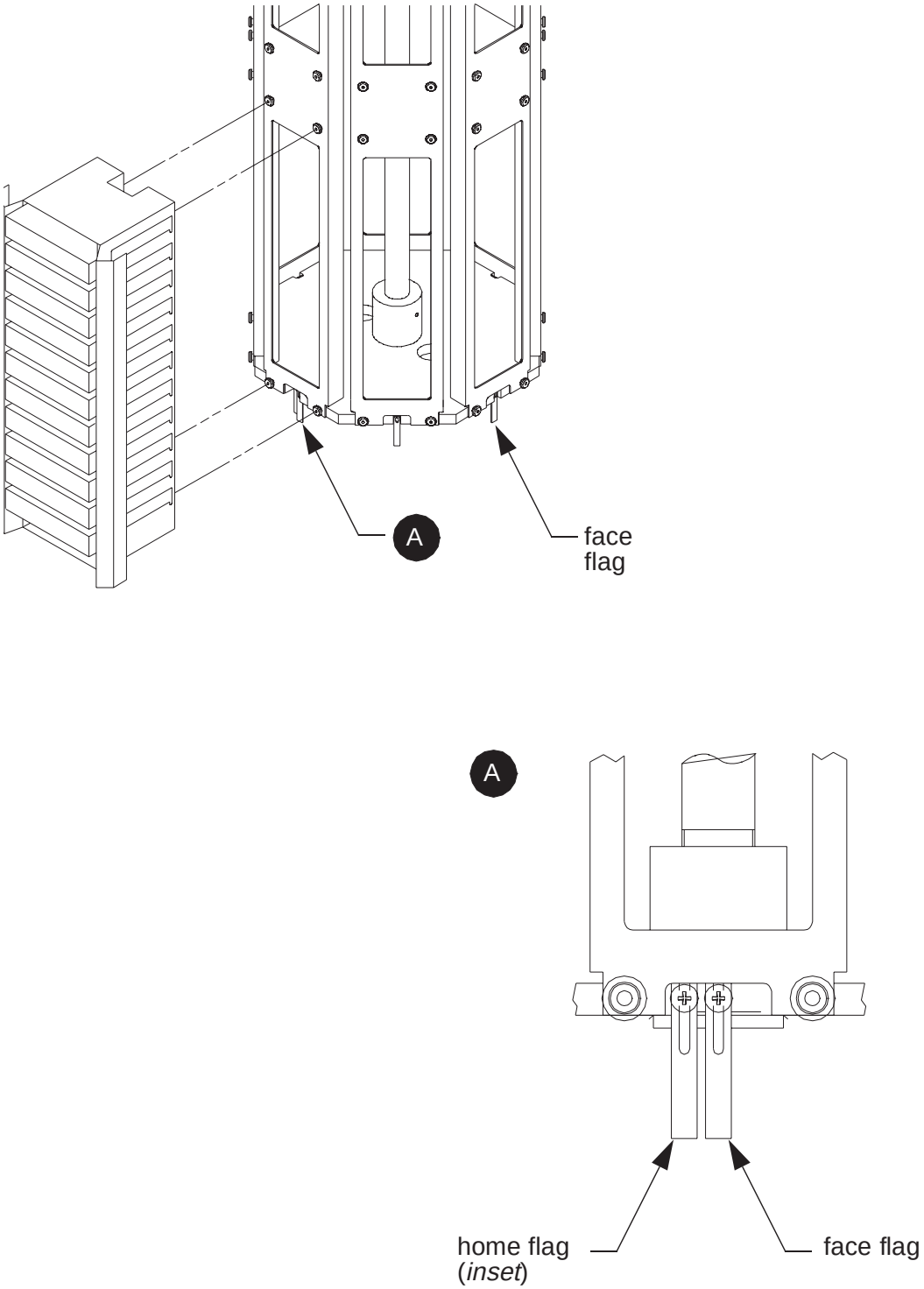
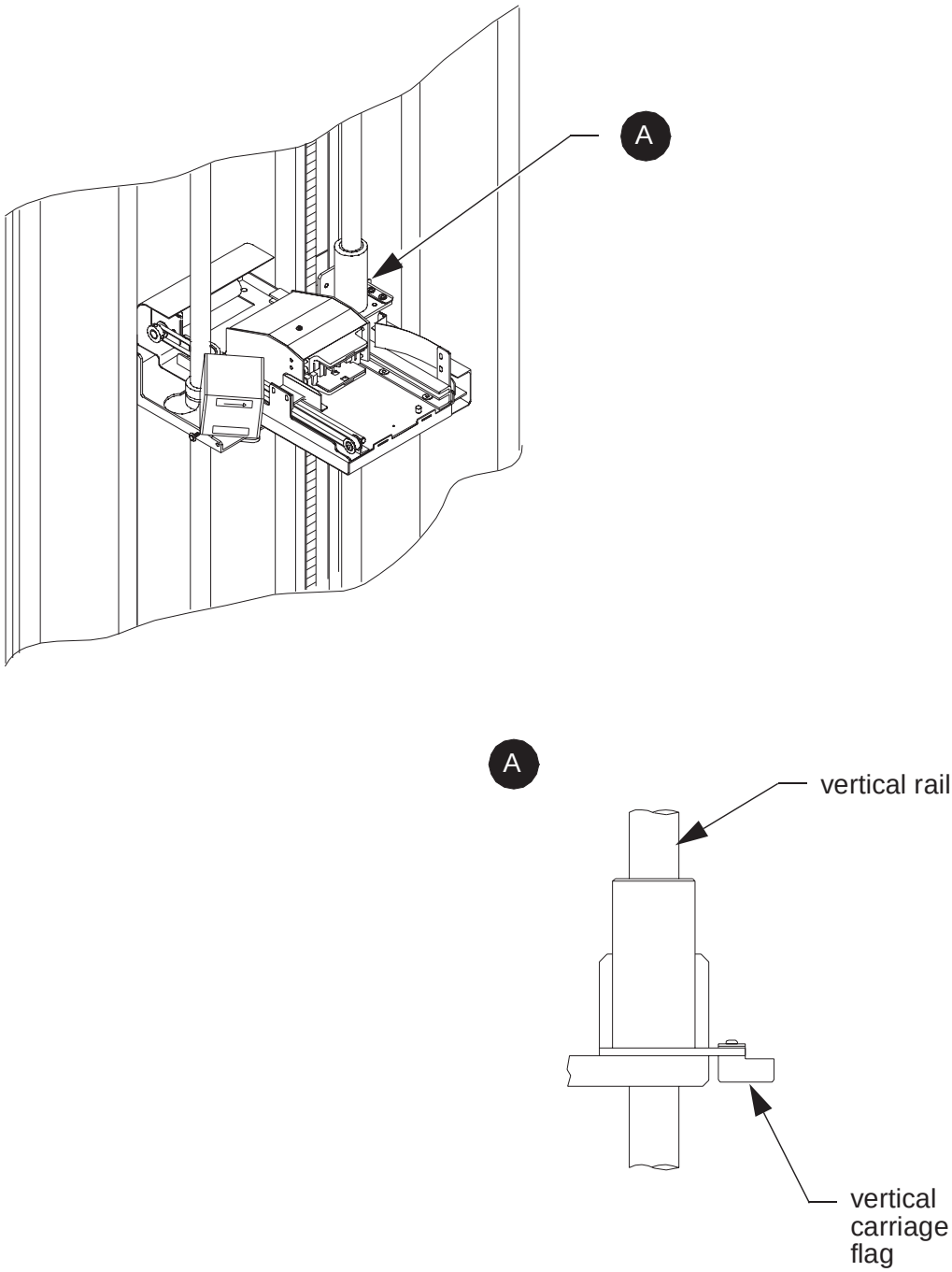


Figure B-6: Vertical carriage flag location



Appendix C: Sense Data Values

Table 1 lists message information that can be sent from the TL820 library unit to the host computer. In addition to definition, recovery suggestions where possible, and the host interface receiving the message, the table lists the following information.

- Sense Key
- Additional Sense Code (ASC),
- Additional Sense Code Qualifier (ASCQ), and
- Additional Sense Length (ASL) fields of the sense data block.

Valid host interfaces are listed below. If the interface is abbreviated in the table, the abbreviation is shown in parentheses.

- SCSI
- EIA/TIA-574 (TIA/EIA)
- Diagnostic (Diag)
- All

The messages and recovery/explanations use abbreviations. These abbreviations are spelled out below:

LU	Logical Unit/Library Unit
REQ'D	Required
DEV	Device
Diag	Diagnostics
NVRAM	Nonvolatile RAM
A/D	Analog-to-Digital

Table C-1: Sense Data Values (Hexadecimal)

Sense Key	ASC	ASCQ	ASL	Description Recovery/Explanation	Host Interface
0	00	00	00	NO ADDITIONAL SENSE INFORMATION No recovery necessary.	All
2	04	00	07	LOGICAL UNIT IS NOT READY, CAUSE NOT REPORTABLE Check library unit power. Retry command.	All
2	04	01	07	LOGICAL UNIT IN PROCESS OF BECOMING READY Wait for library unit to complete initialization.	All
2	04	03	07	LU IS NOT READY, MANUAL INTERVENTION REQ'D Initialization failed. Determine failure type by checking any previous error code returned to host. Correct the cause of the failure and toggle ONLINE/STANDBY switch.	All
2	08	00	07	LOGICAL UNIT COMMUNICATION FAILURE Check cables. Ensure library unit is powered on. Retry command.	SCSI
B	08	01	07	LOGICAL UNIT COMMUNICATION TIME-OUT Check cables. Ensure library unit is powered on. Retry command.	SCSI EIA/TIA
5	1A	00	07	PARAMETER LIST LENGTH ERROR Invalid parameter list length specified by Mode Select command.	SCSI EIA/TIA
5	20	00	07	INVALID COMMAND OPERATION CODE Verify host command format using the TL820 Software Interface Guide.	SCSI EIA/TIA
5	21	01	07	INVALID ELEMENT ADDRESS Check Mode Sense data for correct element addresses.	SCSI EIA/TIA
5	24	00	07	INVALID FIELD IN COMMAND DATA BLOCK Ensure all reserve fields are set to zero.	SCSI EIA/TIA
5	25	00	07	LOGICAL UNIT IS NOT SUPPORTED Verify the logical unit field specified in the command contains a legitimate logical unit number. Check cabling to logical unit(s).	SCSI EIA/TIA
5	26	00	07	INVALID FIELD IN PARAMETER LIST Verify Mode Select page fields.Verify that fields comply with the command format described in the TL820 Software Interface Guide.	SCSI EIA/TIA

Sense Key	ASC	ASCQ	ASL	Description Recovery/Explanation	Host Interface
5	26	02	07	PARAMETER VALUE INVALID Verify Mode Select page fields. Verify that fields comply with the command format described in the TL820 Software Interface Guide.	All
6	28	01	07	IMPORT OR EXPORT ELEMENT ACCESSED IOD door has been closed	All
6	29	00	07	POWER-ON, RESET OR BUS DEV. RESET OCCURRED Informational message. No action is necessary.	All
-none- OR 5	30 30	03 03	07 07	CLEANING CARTRIDGE INSTALLED Indicates that the element contains a cleaning cartridge that is not “used-up”. OR CLEANING CARTRIDGE INSTALLED • A cleaning cartridge cannot be removed from a drive because it it being used in a cleaning operation. • A cartridge cannot be placed into the drive because the drive is being cleaned. • A cartridge cannot be placed into an empty storage element because it is reserved for a cleaning cartridge that is currently in use in a drive cleaning operation.	SCSI EIA/TIA SCSI EIA/TIA
5	39	00	07	SAVING PARAMETERS NOT SUPPORTED Verify Save Parameter field in the Mode Sense command complies with the command format described in the TL820 Software Interface Guide.	SCSI EIA/TIA
5	3A	00	07	MEDIUM NOT PRESENT The inventory indicated that a cartridge was in this bin but no cartridge was sensed by the gripper when it attempted to pick it. Retry the command. Check for proper seating of the cartridge. It may also indicate that the tape is not ready to be picked from the drive because the tape is not fully unloaded. Retry the command. If the problem persists, check the function of the tape drive handle assembly. Manually unload the tape.	All

Sense Key	ASC	ASCQ	ASL	Description Recovery/Explanation	Host Interface
5	3B	0D	07	MEDIUM DESTINATION ELEMENT FULL Destination element address already contains a cartridge. Issue a Read Element Status command and retry move command. If the problem repeats, issue an Initialize Element Status command followed by a Read Element Status command and retry move command.	All
5	3B	0E	07	MEDIUM SOURCE ELEMENT EMPTY Source element address does not contain a cartridge. Issue a Read Element Status command and retry move command. If problem repeats issue an Initialize Element Status command followed by a Read Element Status command and retry the move command.	All
B	45	00	07	SELECT OR RE-SELECT FAILURE TL820 timed out trying to reselect host. Make sure host is running.	SCSI
4	47	00	07	SCSI PARITY ERROR Check cable connections and cable length.	SCSI
B	49	00	07	INVALID MESSAGE ERROR Received invalid message from logical unit. Check cable connections and cable length.	SCSI
5	4E	00	07	OVERLAPPED COMMANDS ATTEMPTED Second command was sent to logical unit, when previous was executing.	EIA/TIA
5	53	02	07	MEDIUM REMOVAL PREVENTED Prevent Medium Removal command was executed and command was received to export cartridge. Execute Allow Medium Removal command and retry move medium command.	SCSI EIA/TIA
6	54	00	07	SCSI TO HOST SYSTEM INTERFACE FAILURE Possible SCSI bus time-out or premature disconnect. Check cable connections and cable length.	SCSI
-none-	5A	01	07	OPERATOR MEDIUM REMOVAL REQUEST Indicates that the element contains a cleaning cartridge that is “used-up” and the system is unable to export the cleaning cartridge.	SCSI EIA/TIA
2	80	00	07	DOOR IS OPENED INVENTORY MAY HAVE BEEN CORRUPTED Close door and retry command. If the system is ONLINE, it executes its initialization procedure.	All

Sense Key	ASC	ASCQ	ASL	Description Recovery/Explanation	Host Interface
6	80	00	07	DOOR WAS OPENED INVENTORY MAY HAVE BEEN CORRUPTED Close door and retry command.	All
5	80	01	07	TRANSFER FULL - COMMAND CAN NOT BE EXECUTED Gripper has cartridge in it. Move cartridge to empty storage element using Move Medium command. Retry command.	All
5	80	02	07	BIN PAC MISSING If applicable, install the missing bin pac. Retry the command. If the problem persists, notify Field Service.	All
5	80	06	07	TRANSFER EMPTY - COMMAND CANNOT BE EXECUTED Gripper does not contain cartridge at beginning of place portion of Move Medium command.	All
B	80	06	07	TRANSFER EMPTY - COMMAND ABORTED Gripper does not contain cartridge at end of pick portion of Move Medium command.	All
2	80	07	07	SYSTEM IS EMERGENCY STOPPED (BUTTON IS CURRENTLY PUSHED) The STOP button on the status panel is in the on position. Press the STOP button to the off position.	All
6	80	07	07	SYSTEM STOP BUTTON WAS PRESSED (MAY CURRENTLY BE PRESSED) Check the STOP button. Retry command.	All
2	80	09	07	LOGICAL UNIT IS TURNED OFFLINE The ONLINE/STANDBY button on the status panel is in the STANDBY position. Press the ONLINE/STANDBY button to the ONLINE position.	SCSI EIA/TIA
6	80	09	07	LOGICAL UNIT STANDBY BUTTON WAS PRESSED Retry command.	SCSI EIA/TIA
B	80	10	07	LOAD RETRY FAILED TL820 was unable to successfully load the drive, even after retries. Check drive alignment. If problem continues, drive may need servicing	All
4	80	0A	07	NVRAM CHECKSUM FAILURE Nonvolatile RAM contents are corrupted. Ensure nonvolatile RAM ICs are seated correctly. Use the Diagnostic host to initialize nonvolatile RAM and calibrate system.	All

Sense Key	ASC	ASCQ	ASL	Description Recovery/Explanation	Host Interface
B	80	0B	07	COMMAND ABORTED BY USER Informational message. No action is necessary.	All
5	80	0C	07	UNIT DISABLED Issue Start Unit command.	SCSI EIA/TIA
B	80	0D	07	CARTRIDGE IS ONLY PARTIALLY GRIPPED (ONLY SEEN IN THE FRONT SENSOR). Issue a Move Medium command to move the cartridge from the transfer element to an empty storage element.	All
4	80	0F	07	LOW POWER ERROR Check power connections.	All
B	80	21	07	INVENTORY TIMEOUT Scanning of a carousel face using the barcode scanner did not complete within acceptable time limits. Issue an Initialize Element Status command.	All
5	80	22	07	ELEMENT CONTENTS UNKNOWN The contents of an element address are unknown. Issue a Read Element Status for the element address. If contents are still unknown issue an Initialize Element Status command.	All
4	80	23	07	BARCODE DECODER COMMUNICATION FAILURE Unable to initialize decoder. Verify that the decoder is powered on. Cycle power and/or check cable connections.	All
B	80	80	07	LIGHT CURTAIN BLOCKED Visually inspect system for obstructions. If obstruction exists remove source of obstruction. If obstruction does not exist check light curtain sensor.	All
4	80	81	07	LIGHT CURTAIN TEST FAILURE Start initialization again, and verify extension axis is moving out far enough to break the light curtain. If it is, then the Field Engineer should inspect the light curtain sensors.	SCSI EIA/TIA
B	81	00	07	GRIPPER FAILURE Gripper not on sensors at end of move. Issue a Rezero Unit command.	All
B	81	01	07	GRIPPER TIMEOUT Gripper did not reach desired position. Issue a Rezero Unit command.	All
B	81	02	07	GRIPPER EXTEND PUSHER FAILURE Gripper did not reach pusher extended position. Issue a Rezero Unit command.	All

Sense Key	ASC	ASCQ	ASL	Description Recovery/Explanation	Host Interface
B	81	03	07	GRIPPER OPEN FAILED ON EXTEND PUSHER Gripper did not reach open position. Issue a Rezero Unit command.	All
B	81	04	07	GRIPPER OPEN FAILURE Gripper did not reach open position. Issue a Rezero Unit command.	All
B	81	05	07	GRIPPER CLOSE FAILURE Gripper did not reach close position. Issue a Rezero Unit command.	All
B	81	10	07	GRIPPER INVALID STARTING POSITION Gripper position is unknown. Issue a Rezero Unit command.	All
4	81	20	07	GRIPPER SENSORS TEST FAILED Cartridge-in-Gripper sensors were not blocked by pusher during gripper self-test. Use Diagnostic interface to test pusher and Cartridge-in-Gripper sensors.	All
4	81	50	07	REAR CASSETTE IN GRIPPER SENSOR IS BLOCKED, BUT FRONT SENSOR IS CLEAR. Either the pusher is extended and blocking the sensor or possibly a cartridge is in the gripper, but the front sensor is not working. Issue a Rezero Unit command. If condition repeats, check for a cartridge in the gripper and issue a Move Medium to an empty storage element.	All
B	81	51	07	UNABLE TO PICK CARTRIDGE Cartridge was sensed in front gripper sensor, but was unable to seat cartridge in the rear gripper sensor. Check that gripper sensors are working and/or that tape was ejected far enough.	All
B	83	01	07	EXTENSION TIMEOUT Extension axis did not reach desired position. Retry command. If failure repeats use Diagnostic host to run extension self-test.	All
4	83	02	07	EXTENSION CURRENT FEEDBACK FAILURE Extension axis collided with obstruction. Determine cause of obstruction. Align and calibrate the system.	All
4	83	03	07	EXTENSION MECHANICAL POSITION ERROR Extension axis was unable to move to commanded position. Retry command. If failure repeats, use the Diagnostic host to run extension self-test.	All

Sense Key	ASC	ASCQ	ASL	Description Recovery/Explanation	Host Interface
B	83	10	07	EXTENSION INVALID ACTUATOR START POSITION Extension axis position is unknown. Issue a Rezero Unit command.	All
4	83	21	07	EXTENSION ACTUATOR CURRENT FEEDBACK TEST FAILURE Unable to detect current feedback during self-test. Restart unit. If failure repeats, use Diagnostic host to run extension self-test.	All
4	83	22	07	EXTENSION ACTUATOR ENCODER (OR MOTOR) TEST FAILURE The value of the extension encoder did not change during self-test. Restart unit. If failure repeats, use Diagnostic host to run extension self-test.	All
4	83	81	07	EXTENSION A/D SELF-TEST FAILURE The analog to digital converter failed during self-test. Restart unit. If failure repeats, use Diagnostic host to run extension self-test.	All
4	83	83	07	EXTENSION DIGITAL SELF-TEST FAILURE Unable to toggle test bit during self-test. Restart unit. If failure repeats, use Diagnostic host to run extension self-test.	All
B	84	01	07	VERTICAL TIMEOUT Vertical axis did not reach desired position within the time limits. Retry command. If failure repeats, use the Diagnostic host to run vertical self-test.	All
4	84	02	07	VERTICAL CURRENT FEEDBACK FAILURE Vertical axis collided with obstruction. Determine and remove the cause of obstruction.	All
4	84	03	07	VERTICAL MECHANICAL POSITION ERROR Vertical axis did not reach desired position. Retry command. If failure repeats, use the Diagnostic host to run vertical self-test.	All
B	84	10	07	VERTICAL INVALID ACTUATOR START POSITION Position of vertical axis is unknown. Issue a Rezero Unit command.	All
4	84	21	07	VERTICAL ACTUATOR CURRENT FEEDBACK TEST FAILURE Unable to detect current feedback during self-test. Restart unit. If failure repeats, use Diagnostic host to run vertical self-test.	All

Sense Key	ASC	ASCQ	ASL	Description Recovery/Explanation	Host Interface
4	84	22	07	VERTICAL ACTUATOR ENCODER (OR MOTOR) TEST FAILURE The value of the vertical encoder did not change during self-test. Restart unit. If failure repeats use Diagnostic host to run vertical self-test.	All
B	86	01	07	CAROUSEL TIMEOUT Carousel axis did not reach desired position. Retry command. If failure repeats use Diagnostic host to run carousel self-test.	All
B	86	02	07	CAROUSEL NOT ON FACE FLAG At the end of a carousel move, the carousel was not on a face flag. Issue a Rezero Unit command.	All
B	86	03	07	CAROUSEL MECHANICAL POSITION ERROR Carousel axis did not reach desired position. Retry command. If failure repeats, use the Diagnostic host to run vertical self-test.	All
B	86	04	07	CAROUSEL UNDEFINED POSITION Position of carousel axis is unknown. Issue a Rezero Unit command.	All
4	86	05	07	CAROUSEL IS MISSING FACE OR HOME FLAG Did not detect eight face flags during carousel homing or unable to find home flag.	All
B	86	06	07	CAROUSEL CORRECTION FAILURE Size of correction exceeded maximum correction size. Issue a Rezero Unit command.	All
4	86	07	07	CAROUSEL CURRENT FEEDBACK FAILURE Carousel axis collided with obstruction. Determine and remove the cause of obstruction.	All
B	86	08	07	CAROUSEL NOT ON HOME FLAG At the end of carousel homing, the carousel did not position itself on the home flag. Issue a Rezero Unit command.	All
B	86	10	07	CAROUSEL INVALID ACTUATOR START POSITION Position of carousel axis is unknown. Issue a Rezero Unit command.	All
4	86	21	07	CAROUSEL ACTUATOR CURRENT FEEDBACK TEST FAILURE Unable to detect current feedback during self-test. Restart unit. If failure repeats, use the Diagnostic host to run carousel self-test.	All

Sense Key	ASC	ASCQ	ASL	Description Recovery/Explanation	Host Interface
4	86	22	07	CAROUSEL ACTUATOR ENCODER (OR MOTOR) TEST FAILURE The value of the carousel encoder did not change during self-test. Restart unit. If failure repeats, use the Diagnostic host to run carousel self-test.	All
4	86	81	07	CAROUSEL A/D SELF-TEST FAILURE The analog to digital converter failed during self-test. Restart unit. If failure repeats, use Diagnostic host to run carousel self-test.	All
4	86	83	07	CAROUSEL DIGITIAL SELF-TEST FAILURE Unable to toggle test bit during self-test. Restart unit. If failure repeats, use the Diagnostic host to run carousel self-test.	All
6	88	00	07	WARNING SAFE TEMPERATURE EXCEEDED This is only a warning that the temperature in the system exceeds the normal operational temperature (91^{o}F). This feature is not available on those units whose top assembly number is 6101280.	All
4	88	01	07	MAXIMUM TEMPERATURE EXCEEDED System will shutdown and remains shutdown until temperature is down to an acceptable level (below 111^{o}F). This feature is not available on those units whose top assembly number is 6101280.	All
B	8A	00	07	MISSING CALIBRATION TOOL Calibration was started without the calibration tool inserted in the gripper. Insert calibration tool in gripper.	Diag
B	8A	01	07	MISSING CALIBRATION FLAG A calibration flag was not detected during calibration. Insert all required calibration cartridges.	Diag
5	8A	02	07	UNCALIBRATED POSITION System requires calibration.	All
5	8A	03	07	INVALID CALIBRATION PARAMETER A parameter entered during calibration was incorrect.	All
B	8B	00	07	PASS THROUGH BUSY An attempt was made to use a pass through that was already in use. Wait for busy pass through to complete. Retry command.	All

Sense Key	ASC	ASCQ	ASL	Description Recovery/Explanation	Host Interface
B	8B	01	07	PASS THROUGH TIMEOUT The pass through failed to move the cartridge to the desired location within a time-out period.	All
4	8B	02	07	PASS THROUGH GATE FAILURE Unable to raise pass through gate.	All
B	8B	03	07	PASS THROUGH FULL An attempt was made to use a pass through that is occupied. Move cartridge from pass through and retry command.	All
B	8B	04	07	PASS THROUGH EMPTY An attempt was made to move a cartridge from an empty pass through. Place the desired cartridge on the pass through. Retry command.	All
4	8B	05	07	PASS THROUGH CURRENT FEEDBACK FAILURE The pass through is jammed. Determine and remove the cause of obstruction.	All
B	8B	07	07	NO CARTRIDGE ON PASS THROUGH No cartridge was detected on pass through during self test. Place a cartridge on the pass through. Retry command.	Diag
B	8B	08	07	CALIBRATE PASS THROUGH SENSORS The registration sensor on the pass through did not detect the cartridge correctly.	All
4	8B	30	07	PASS THROUGH MOTOR OR SENSOR FAILURE During PTM self test (vis diagnostic port only), a cartridge is passed between sensors on the PTM. This error is returned if any of the PTM sensors do not transition. This could occur due to a faulty sensor or motor.	Diag
B	8C	01	07	IOD TIMEOUT The Inport/Outport Device failed to move the cartridge from the INPORT within a time-out period.	All
B	8C	02	07	IOD OUTPORT FULL The cartridge OUTPORT is full. Open the outport door and remove the cartridges.Retry command.	All
B	8C	03	07	IOD INPORT FULL A cartridge is present in the INPORT at selftest start-up. Remove the cartridge. Retry command.	Diag
B	8C	04	07	IOD INPORT EMPTY An attempt was made to move a cartridge from an empty INPORT. Place the desired cartridge in the INPORT. Retry command.	All

Sense Key	ASC	ASCQ	ASL	Description Recovery/Explanation	Host Interface
4	8C	05	07	IOD CURRENT FEEDBACK FAILURE The IOD INPORT is jammed. Determine and remove the cause of obstruction.	All
B	8C	06	07	IOD INPORT DOOR IS OPEN The INPORT door on the IOD is open. Close INPORT door. Retry command.	All
B	8C	07	07	IOD INPORT REGISTRATION A cartridge is detected in the INPORT but it is improperly registered. Reseat the cartridge. Retry command.	All
B	8D	01	07	STEPPER MOTOR TPU TIMEOUT CPU failure. Retry command. If failure repeats, power cycle unit. Use diagnostic host to self test stepper.	All
B	8D	02	07	STEPPER MOTOR MOVE TIMEOUT CPU failure. Retry command. If failure repeats, power cycle unit. Use diagnostic host to self test stepper.	All
4	8D	05	07	STEPPER MOTOR HARDWARE ERROR Stepper was unable to reach destination (open or close). Retry command. If failure repeats use diagnostic host to self test stepper.	All
4	8D	03	07	STEPPER MOTOR TPU RAM ERROR CPU failure. Retry command. If failure repeats, power cycle unit. Use diagnostic host to self test stepper.	All
4	8D	04	07	STEPPER MOTOR TPU REGISTER ERROR CPU failure. Retry command. If failure repeats, power cycle unit. Use diagnostic host to self test stepper.	All
4	8D	06	07	STEPPER MOTOR CURRENT FEEDBACK TEST FAILURE Unable to sense current feedback from stepper motor controller. Use diagnostic host to self test stepper.	All
4	8E	01	07	FLASH MEMORY UNABLE TO IDENTIFY Replace flash memory on CPU.	Diag
4	8E	02	07	FLASH MEMORY UNABLE TO ERASE Replace flash memory on CPU.	Diag
4	8E	03	07	FLASH MEMORY UNABLE TO PROGRAM Replace flash memory on CPU.	Diag
B	8F	00	07	LIBRARY UNIT COMMAND TIMED OUT Verify communications to Library Unit still exist by issuing another command	SCSI EIA/TIA

Sense Key	ASC	ASCQ	ASL	Description Recovery/Explanation	Host Interface
B	8B	80	07	PTM DOOR OPEN ERROR The PTM cannot complete an operation because a unit door is open. Close all doors. Retry operation.	SCSI EIA/TIA
B	8B	81	07	PTM DOOR STOPPED ERROR The PTM cannot complete an operation because another unit has stopped operating. Retry operation.	SCSI EIA/TIA
B	8B	82	07	PTM LIGHT CURTAIN ERROR The PTM cannot complete an operation because a light is broken. Visually inspect system for obstructions. If obstruction exists remove source of obstruction. If obstruction does not exist check light curtain sensor. Retry operation.	SCSI EIA/TIA
B	8B	83	07	PTM UNIT OFFLINE ERROR The PTM cannot complete an operation because a unit is off-line. Check the STOP button. Retry command. Check the ONLINE/STANDBY button on the status panel. Press the ONLINE/STANDBY button to the ONLINE position. Retry operation.	SCSI EIA/TIA
B	8B	84	07	PTM LIGHT CURTAIN ERROR The PTM cannot complete an operation because of an over-temperature condition. Visually inspect system. If an over-temperature condition exists, power-down the library and notify Field Service. If over-temperature condition does not exist, check sensors. Retry operation.	SCSI EIA/TIA
B	8B	85	07	PTM CONCURRENT The PTM cannot complete an operation because another PTM is operating. Retry operation.	SCSI EIA/TIA

Appendix D: Control Panel Codes

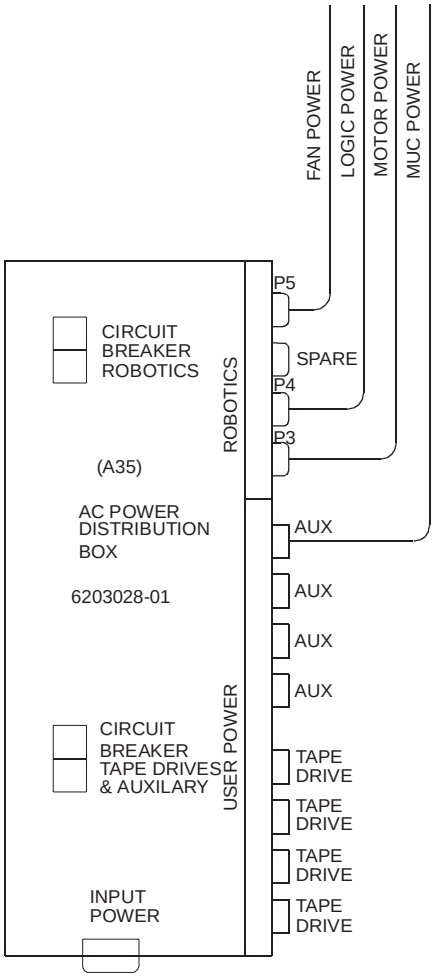
The Control Panel communicates error and status information using display codes. The display codes and their descriptions are listed in Table D-1.

Table D-1: Front Control Panel Status Codes

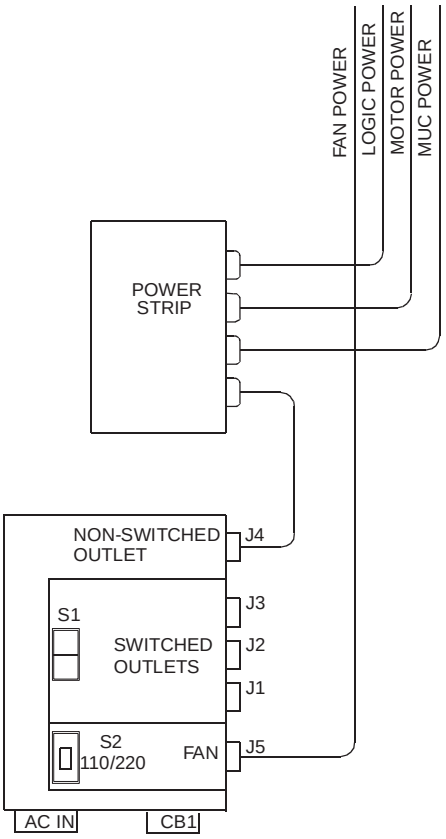
Code	Code Description
00	System online and ready to accept host commands.
01	System offline and ready to accept diagnostic commands.
2a	STOP button depressed.
2b	Door open (front or back).
2C	System performing power-up sequence.
2d	System is initializing actuators and taking inventory.
2f	Low Power Error
3a	Error occurred during initialization of actuator prior to coming online.
3b	Error occurred during actuator self-test prior to coming online.
3C	Inventory failed.
4a	Extension home failed.
4b	Extension test failed.
4C	Carriage A/D failed.
4d	Carriage diagnostic test failed.
5a	Vertical home failed.
5b	Vertical test failed.
6a	Carousel home failed.
6b	Carousel test failed.
6C	Carousel A/D test failed.
6d	Carousel digital test failed.

Code	Code Description
7a	Gripper home failed.
7b	Gripper test failed.
8b	Light curtain test failed.
8C	Light curtain broken.
d0-dF	Downloading (one digit increments every sixteen S-Records received).
E0	Downloader ready.
E1	Downloader complete.
EA	Can’t identify flash memory.
Eb	Can’t erase flash memory.
EC	Can’t program flash memory.
F0-F7	Carousel is on face indicated (0-7).
FF	MPU firmware at location U3 & U4 missing or defective

Appendix E: Interconnect Diagrams

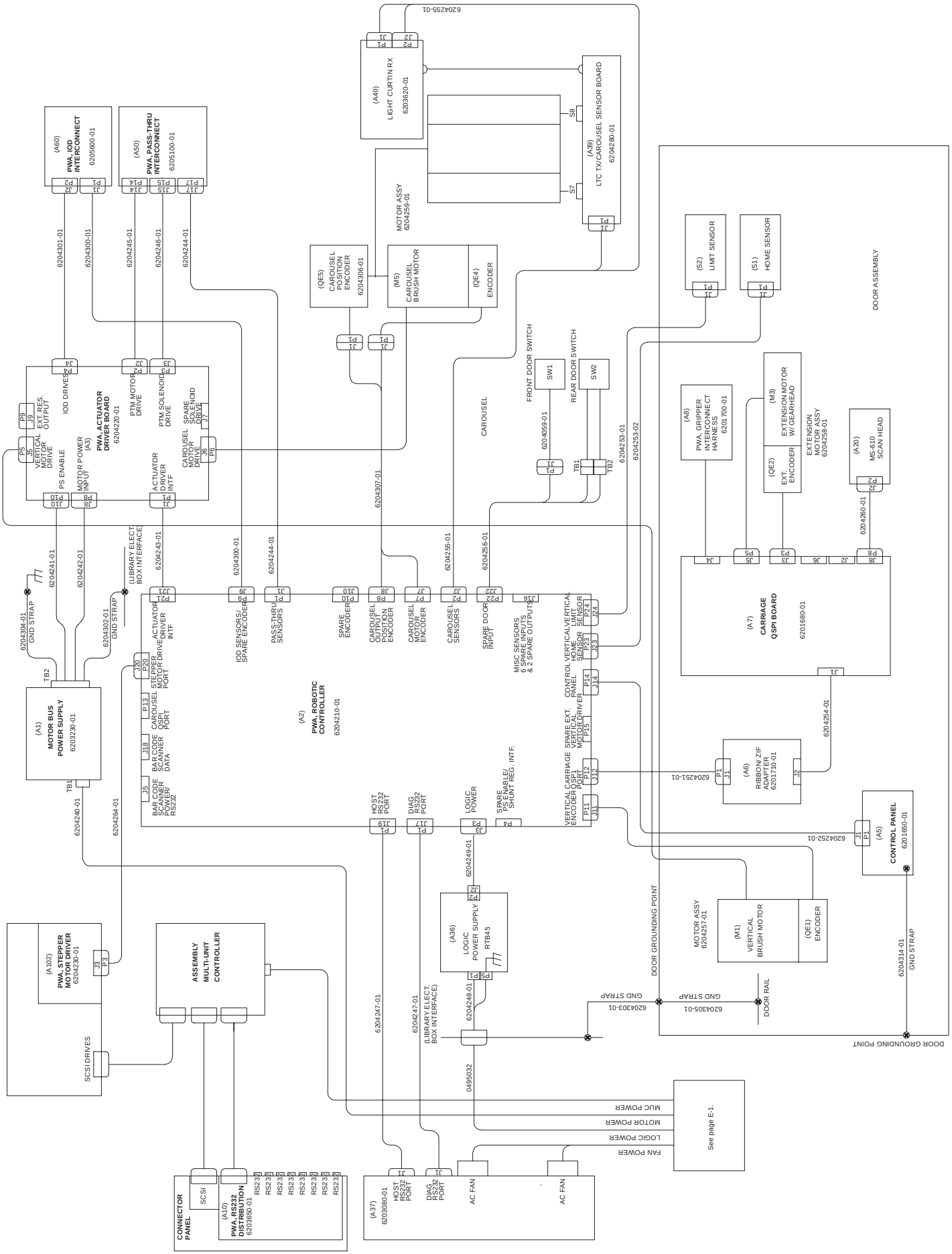


AC POWER DISTRIBUTION



AC POWER DISTRIBUTION

	POWER BOX	PTM	IOD	STEPPER
6200200-01	6203028-01	OPTIONAL	OPTIONAL	N/A
6200201-01	6203028-01	0	0	N/A
6200202-01	6203235-01	0	0	N/A
6200203-01	6203240-01	STANDARD	STANDARD	STANDARD
6200204-01	6203028-01	0	0	N/A
6200205-01	--	0	0	N/A
6200206-01	6203235-01	0	0	STANDARD
62002XX-01	-	-	-	-
62002XX-01	-	-	-	-
62002XX-01	-	-	-	-


(A2)
PWA, ROBOTIC CONTROLLER
6204210-01
(A1)
MOTOR BUS POWER SUPPLY
6203230-01
(A7)
CARRIAGE QSPI BOARD
6201680-01
(A5)
CONTROL PANEL
6201660-01
(A6)
RIBBON Z IF ADAPTER
6201710-01
(A36)
LOGIC POWER SUPPLY
(A37)
6203080-01
(A10)
PWA, RS232 DISTRIBUTION
6203680-01
(A102)
PWA, STEPPER MOTOR DRIVER
6204230-01
ASSEMBLY MULTI-UNIT CONTROLLER
CONNECTOR PANEL
SCSI DRIVES
(A60)
PWA, IOD INTERCONNECT
6205600-01
(A50)
PWA, PASS-THRU INTERCONNECT
6205100-01
(A40)
LIGHT CURTIN RX
6203620-01
(A39)
LTC TX/CAROUSEL SENSOR BOARD
6204280-01
MOTOR ASSY
6204259-01
(QE5)
CAROUSEL POSITION ENCODER
6204306-01
(M5)
CAROUSEL BRUSH MOTOR
(QE4)
ENCODER
CAROUSEL
FRONT DOOR SWITCH
REAR DOOR SWITCH
SW1
SW2
6204059-01
6204253-01
6204253-02
(S2)
LIMIT SENSOR
(S1)
HOME SENSOR
DOOR ASSEMBLY
(A8)
PWA, GRIPPER INTERCONNECT HARNESS
6203 700-01
(M3)
EXTENSION MOTOR W/ GEARHEAD
EXTENSION MOTOR ASSY
6204258-01
(QE2)
EXT. ENCODER
(A20)
MS-610
SCAN HEAD
6204260-01
6204301-01
6204300-01
6204245-01
6204246-01
6204244-01
6204307-01
6204255-01
6204256-01
6204241-01
6204242-01
6204243-01
6204302-01
6204304-01
GND STRAP
(LIBRARY ELECT BOX INTERFACE)
6204240-01
6204264-01
6204254-01
6204251-01
6204252-01
6204249-01
6204247-01
6204248-01
0495032
6204303-01
6204305-01
GND STRAP
DOOR RAIL
DOOR GROUNDING POINT
6204314-01
GND STRAP
MOTOR ASSY
6204257-01
(M1)
VERTICAL BRUSH MOTOR
(QE1)
ENCODER
IOD DRIVES
PTM MOTOR DRIVE
PTM SOLENOID DRIVE
SPARE SOLENOID DRIVE
CAROUSEL MOTOR DRIVE
EXT. RES. OUTPUT
VERTICAL MOTOR DRIVE
PS ENABLE
MOTOR POWER INPUT
PWA, ACTUATOR DRIVER BOARD
6204220-01
ACTUATOR DRIVER INTF
IOD SENSORS/ SPARE ENCODER
PASS-THRU SENSORS
SPARE ENCODER
CAROUSEL OUTPUT POSITION ENCODER
CAROUSEL MOTOR ENCODER
CAROUSEL SENSORS
SPARE DOOR INPUT
MISC SENSORS FROM IOD'S & 2 SPARE OUTPUTS
CONTROL VERTICAL HOME SENSOR
CONTROL VERTICAL LIMIT SENSOR
CONTROL PANEL
SPARE EXT. VERTICAL MOTOR DRIVER
VERTICAL CARRIAGE ENCODER
ACTUATOR DRIVER INTF
STEPPER MOTOR DRIVE PORT
CAROUSEL QSPI PORT
BAR CODE SCANNER QSPI PORT
BAR CODE SCANNER INTERFACE RS232
HOST RS232 PORT
DIAG RS232 PORT
LOGIC POWER
SPARE PS ENABLE/ SHUNT REG. INTF.
SCSI
RS232
AC FAN
AC FAN
FAN POWER
LOGIC POWER
MOTOR POWER
MUC POWER
See page E-1.

Appendix F: Cartridge Bin Numbers

Table F-1: Cartridge bin numbers

	FACE 0	FACE 1	FACE 2	FACE 3	FACE 4	FACE 5	FACE 6	FACE 7
BINPACK # 1	0	33	66	99	132	165	198	231
	1	34	67	100	133	166	199	232
	2	35	68	101	134	167	200	233
	3	36	69	102	135	168	201	234
	4	37	70	103	136	169	202	235
	5	38	71	104	137	170	203	236
	6	39	72	105	138	171	204	237
	7	40	73	106	139	172	205	238
	8	41	74	107	140	173	206	239
	9	42	75	108	141	174	207	240
	10	43	76	109	142	175	208	241
BINPACK # 2	11	44	77	110	143	176	209	242
	12	45	78	111	144	177	210	243
	13	46	79	112	145	178	211	244
	14	47	80	113	146	179	212	245
	15	48	81	114	147	180	213	246
	16	49	82	115	148	181	214	247
	17	50	83	116	149	182	215	248
	18	51	84	117	150	183	216	249
	19	52	85	118	151	184	217	250
	20	53	86	119	152	185	218	251
	21	54	87	120	153	186	219	252
BINPACK # 3	22	55	88	121	154	187	220	253
	23	56	89	122	155	188	221	254
	24	57	90	123	156	189	222	255
	25	58	91	124	157	190	223	256
	26	59	92	125	158	191	224	257
	27	60	93	126	159	192	225	258
	28	61	94	127	160	193	226	259
	29	62	95	128	161	194	227	260
	30	63	96	129	162	195	228	261
	31	64	97	130	163	196	229	262
	32	65	98	131	164	197	230	263

Glossary

TL820 library	An automated library system developed for storing and handling DLT cartridges.
alignment	In the context of this manual, alignment refers to the mechanical adjustments required for successful operation of the TL820 library.
alignment toolkit	A set of alignment aids available to authorized field service personnel.
auto-clean	This term refers to the Automatic Drive Cleaning feature. Two modes of drive cleaning support are available on library units with a Model Number of 6200213: Host Initiated and Fully Automatic. In Host Initiated Cleaning Mode, drive cleaning is enabled by your System Administrator at the host computer. Although the library unit will internally track cleaning cartridge movement and use, the library unit provides no cleaning support in this mode. The host is responsible for all cleaning functions such as detecting when a drive requires cleaning, tracking and selecting cleaning cartridges, initiating media movement of the cleaning cartridge to the drive and determining when a cleaning cartridge has been “used up”. Drive cleaning in the Fully Automatic Cleaning Mode is also enabled by your System Administrator at the host computer. However, in this mode, the library unit monitors each drive’s status to determine when a drive requires cleaning and initiates action when that determination is made. In this case, the library unit selects an available cleaning cartridge, handles media movement of the cleaning cartridge to and from the drive and supervises the cleaning operation in the drive. The library unit tracks cleaning cartridges within the library, monitors cleaning cartridge use and determines when a cleaning cartridge has been “used up”. A“used up” cleaning cartridge is exported from the library under controll of the library. ***NOTE:*** ***The library is shipped with Automatic Drive Cleaning disabled. You, as the FSE, can enable automatic cleaning while using the Diagnostic Software Package. However, when the library power is cycled, the feature is disabled.***
automated cartridge library	A robotic storage and retrieval system for cartridges.

barcode	In the context of this manual, the machine-readable label on DLT cartridges.
barcode decoder	The portion of the barcode scanner which decodes the barcode and is mounted in the rear of the cabinet.
barcode scan head	The portion of the barcode scanner which senses the barcode and is mounted on the vertical carriage. See barcode decoder.
binpack	A removable rack that stores up to eleven DLT cartridges inside an TL820 library. It attaches to the carousel inside an TL820 library.
calibration	In the context of this manual, calibration refers to the software measurements and configuration required for successful operation of the TL820 library.
carousel	The eight-sided rotating prism in the center of the library which holds binpacks with DLT cartridges.
carousel belt	The drive belt connecting the carousel motor/gearbox to the carousel.
carousel face	One side of the eight-sided carousel.
control panel	The panel containing the display, fault light, and control buttons on the front door of the TL820 library.
door interconnect board	The electronics board located on the front door to which the cables crossing the hinge are connected.
EIA/TIA-574	A serial communications cabling and protocol standard for nine-pin connectors, sometimes referred to as RS-232.
electronics module	The metal frame holding the optional SCSI adapter and control electronics and all the electronics attached to it.
extension axis assembly	Mounted onto the vertical axis, the extension axis assembly consists of the gripper assembly and the horizontal axis on which the gripper assembly is mounted.
extension axis belt	The drive belt connecting the extension motor/gearbox to the gripper.
FCC Class A	Standard established by the U.S. Federal Communications Commission governing electromagnetic emissions.
FSE	Field Service Engineer
gripper assembly	The assembly which mounts on the extension axis and grips cartridges; sometimes called the gripper.
host	Host computer.
host computer	The computer which issues high-level pick and place commands to control the TL820 library.

IOD	The Inport/Outport Device, located at the cutout on either side of the TL820 library, allows insertion and removal of single cartridges into and out of the library.
LED	Light Emitting Diode.
library	A single TL820 cabinet and the robotics therein.
mounting kit	Kits supplied with TL820 librarys for installing tape drive systems in the unit.
MTBF	Mean Time Between Failures.
MTTR	Mean Time To Repair.
MUC	The Multi-Unit Controller is an option that serves two functions. It is a SCSI adapter and it permits the library host computer to control up to five attached basic or expansion TL820 librarys.
online	Ready for communication with a host computer.
PC	Personal Computer.
pick	The act of removing a cartridge from one location in preparation for placing it in another location.
place	The act of placing a cartridge in a location after it has been picked from another location.
power distribution box	A box located in the left rear of the TL820 cabinet which contains receptacles for providing power to the various components of the library and switches for turning the power on and off.
PTM	The Pass-Through Mechanism is the motor-driven, high-speed conveyor that transports cartridges between adjacent librarys in a multi-unit TL820 tape library. It is used in conjunction with the IOD when importing or exporting single cartridges.
PROM	Programmable Read-Only Memory.
rear connector panel	Located at the bottom rear of the cabinet, the rear connector panel contains the fans and the connectors for attaching external cabling to the library.
SCSI	Small Computer System Interface communications standard for attaching peripheral equipment to computers.
tape drive	The mechanism that reads and writes data from and to a tape.

tape drive alignment cartridge	An alignment aid in the general form of a DLT cartridge which has flanges to keep it from being stuck in a drive.
UL	Underwriters Laboratories.
vertical belt	The drive belt connecting the vertical motor to the vertical axis assembly.
vertical carriage assembly	The crossbar and linear bearings mounted onto the vertical rails and everything mounted on the crossbar.
ZIF connector	A Zero Insertion Force connector used for electrical wiring.

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