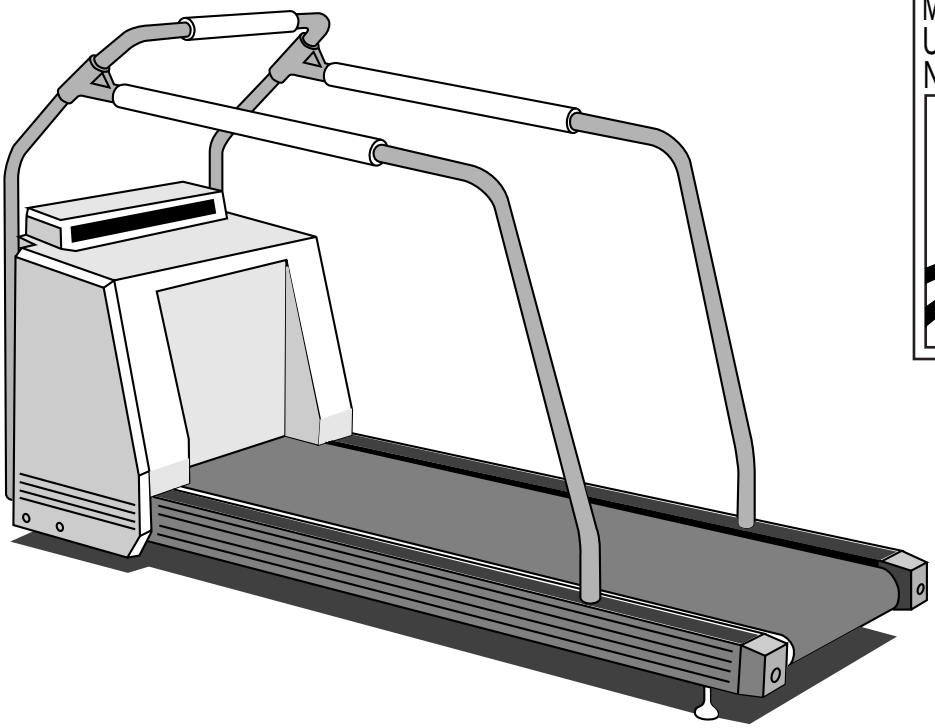
Series 2000 Treadmill

field service manual

PN 409110-004 Revision D



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Appendices

1 Introduction

Manual Information

Revision History

Each page of the document has the document part number followed by a revision letter at the bottom of the page. This letter identifies the document's update level. The latest letter of the alphabet corresponds to the most current revision of the document.

The revision history of this document is summarized in the table below.

Table 1-1. Revision History PN 409110-004

Revision	Date	Comment
A	30 January 1997	Initial release of manual. This manual covers the Y% product code (Thor controller). This replaces the -003 and includes RS232 port. There are two parts lists chapters for CE and non-CE.
B	21 February 1997	Changed page 2-8 due to product label correction of the fuse. F2 is 0.5ASB.
C	6 June 1997	Added "Intended Use" and recommendations on use of rails and emergency stop switch from American Heart Association.
D	22 July 1998	Removed CE page, updated parts lists and technical specifications.

Manual Purpose

This manual supplies technical information for service representatives and technical personnel so they can maintain the equipment at the assembly and subassembly level. It is intended to function primarily as a guide for maintenance and electrical repairs considered field repairable. The manual includes: maintenance and troubleshooting guides, parts lists, illustrations of assembly parts, and some schematics.

Conventions

These are the conventions used in this manual.

Safety Messages

DANGER safety messages indicate an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.

WARNING safety messages indicate a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.

CAUTION safety messages indicate a potentially hazardous situation which, if not avoided may result in minor or moderate injury.

NOTE messages provide additional user information.

Definitions

- Items shown in Black text are keys on the keyboard, text to be entered, or hardware items such as buttons or switches on the equipment.
- Items shown in *Italicized* text are software terms which identify menu items, buttons, or options in various windows.
- To perform an operation which appears with a plus (+)sign between the names of two keys, you press and hold the first key while pressing the second key once. This is called a keystroke combination.

  For example, “Press Ctrl+Esc” means to press and hold down the Ctrl key while pressing the Esc key.
- When instructions are given for typing a precise text string with one or more spaces, the point where the spacebar must be pressed is indicated as: <Space>. The purpose of the < > brackets is to ensure you press the spacebar when required.
- Enter means to press the “Enter” or “Return” key on the keyboard. Do not type “enter”.

Safety Information

Responsibility of the Manufacturer

Marquette Medical Systems, is responsible for the effects of safety, reliability, and performance only if:

- Assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by Marquette.
- The electrical installation of the relevant room complies with the requirements of the appropriate regulations.
- The equipment is used in accordance with the instructions for use.

General

To ensure patient safety, use only parts and accessories manufactured or recommended by Marquette Medical Systems.

Contact Marquette Medical Systems for information before connecting any devices to this equipment that are not recommended in this manual.

The use of ACCESSORY equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include:

- use of the accessory in the PATIENT VICINITY; and
- evidence that the safety certification of the ACCESSORY has been performed in accordance to the appropriate IEC 601-1 and/or IEC 601-1-1 harmonized national standard.

Equipment Symbols

The following symbols appear on the equipment.

This symbol means that you must pay attention to the documents delivered with this equipment. It calls attention to the things to which you must pay special attention during operation and when the equipment is operated in conjunction with other equipment.

In Europe, this symbol means dangerous or high voltage. In the United States, this symbol represents the caution notice below:

⚠ CAUTION

To reduce the risk of electric shock, do NOT remove cover (or back). Refer servicing to qualified personnel.

M15287-16A

Type B equipment. Type B equipment is suitable for intentional external and internal application to the patient, excluding direct conductive connection to the patient's heart.

Alternating current (AC)

Equipotential (This is the ground lug.)

Protective earth (ground)

M13495, M13504, M13864, M13571, M13574, M13573

Warnings and Cautions

DANGER

Do NOT use in the presence of flammable anesthetics.

M15287-1B

WARNING

Total system leakage current must not exceed 300 microamperes.

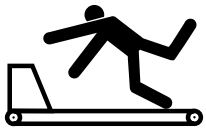
M15287-76A

WARNING

Replace only with the same type and rating of fuse.

M15287-2B

WARNING



Wait until treadmill belt is moving before placing feet on belt.

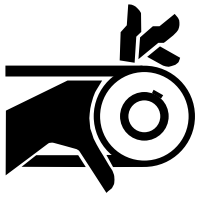
M15287-11B

WARNING

This is Class I equipment. The mains plug must be connected to an appropriate power supply.

M15287-5C

WARNING



Keep hands, hair, jewelry, and loose clothing away from moving parts.

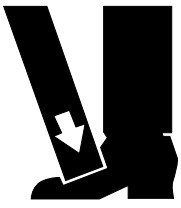
M15287-26B

WARNING

Keep leakage current within acceptable limits when connecting auxiliary equipment to this device.

M15287-7C

WARNING



Do not place feet under treadmill during elevation changes. Otherwise, serious injury could result.

M15287-36A

WARNING

Do NOT contact unit or patient during defibrillation.

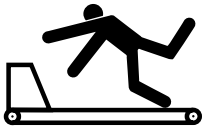
M15287-8C

WARNING

Route the AC power cable away from moving parts.

M15287-64A

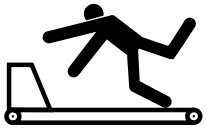
⚠WARNING



Verify proper operation of the stop switch assembly, pn 88380-006, every month.

M15287-065A

⚠WARNING



Operate the treadmill with 6 feet of clearance at the rear (end opposite the motor).

M15287-066A

Service Information

Service Requirements

Refer equipment servicing to Marquette Medical Systems' authorized service personnel only. Any unauthorized attempt to repair equipment under warranty voids that warranty.

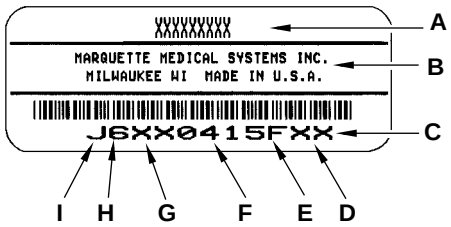
It is the user's responsibility to report the need for service to Marquette Medical Systems or to one of their authorized agents.

Failure on the part of the responsible individual, hospital, or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.

Regular maintenance, irrespective of usage, is essential to ensure that the Series 2000 treadmill will always be functional when required.

Equipment Identification

Every Marquette Medical Systems device has a unique serial number for identification. The serial number appears on the product label on the base of each unit.



MD1113-022B

Table 1-2. Equipment Identifications

Item	Name	Description
A	name of device	Series 2000 treadmill
B	manufacturer	Marquette Medical Systems
C	serial number	Unique identifier
D	device characteristics	One or two letters that further describe the unit, for example: P = prototype not conforming to marketing specification; R = refurbished equipment; S = special product documented under Specials part numbers; U = upgraded unit
E	division	F = Cardiology G = Monitoring J = GW Labs
F	product sequence number	Manufacturing number (of total units manufactured.)
G	product code	Two-character product descriptor Y5 = Treadmill
H	year manufactured	6 = 1996, 7 = 1997, 8 = 1998, (and so on)
I	month manufactured	A = January, B = February, C = March, D = April, E = May, F = June, G = July, H = August, J = September, K = October, L = November, M = December

2 Equipment Overview

General Description

Standard features include the emergency stop switch, a full handrail set, and a long, 60-inch walking surface. Designed for simplified serviceability, the Series 2000 Treadmill has fewer moving parts than other treadmills, built-in self-calibration, and easy-to-replace assemblies.

Intended Use

The Series 2000 Treadmill is intended for use with any one of the several Marquette Medical Systems exercise testing systems or the MTC-1 (manual treadmill controller) for administering a controlled exercise load during a diagnostic stress test.

The emergency stop switch is intended for emergency situations where immediately stopping the treadmill is required to deliver appropriate emergency care to the patient or health care provider, as implied by the American Heart Association “Guidelines for Clinical Exercise Testing Laboratories” (1995). It is not intended for routinely stopping the treadmill.

Motor Drive System

The 3 HP, brushless, DC motor is controlled by a separate control box, and it connects directly to the front roller with a drive belt. An 11-pound flywheel, attached to the motor’s drive shaft, keeps “footfall” variance to a minimum. An “adjustment plate” between the motor and the treadmill frame contains two bolts for adjusting the drive belt tension.

The increase of horsepower raises the weight capacity from 350 lbs. for previous treadmills to 450 lbs.

Elevation System

The elevation system uses a rack and pinion operation to raise and lower the treadmill rather than jack screws and chains. The elevation motor attaches to a small gearbox that connects to the pinion shaft.

The upper- and lower-limit switches ride along one of the pinion “legs,” making them easy to reach and adjust. Replacing the elevation motor only requires the removal of the three mounting bolts and detaching the motor from the pinion shaft coupling.

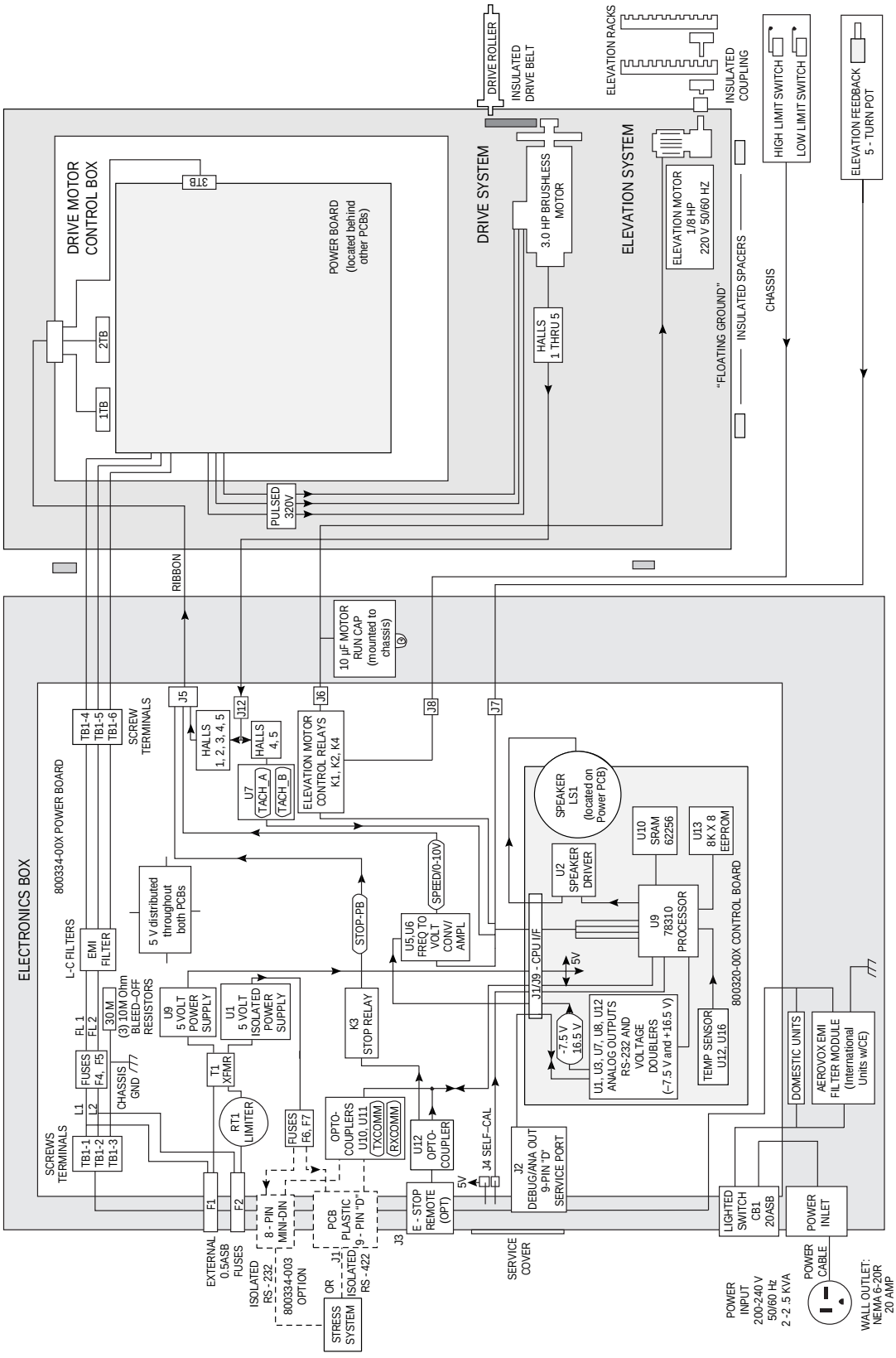
Bed Assembly

The one-piece bed assembly, with side rails and struts welded together, enables quick parts replacement for field service personnel.

Electronic Assembly

An isolated “electronics box” contains the power supply PCB and the control PCB. The box is instantly accessible with the shroud removed and can be replaced as a complete assembly.

Block Diagram



MD1129-007E

Preparation for Use

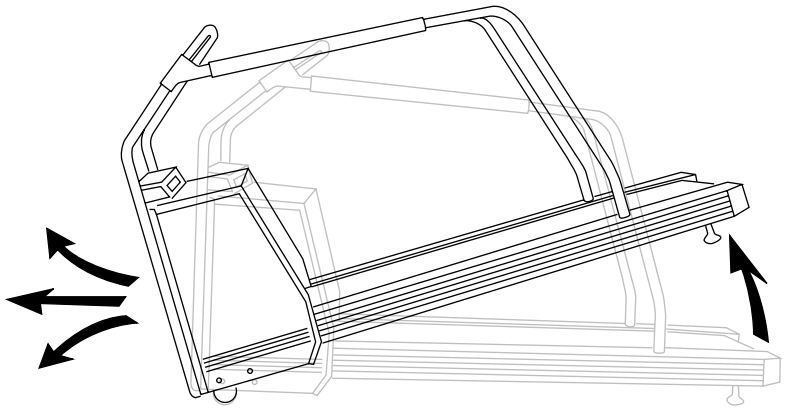
Safe Handling Guidelines

The Series 2000 Treadmill ships preset with an approximate 2% grade. This slight elevation provides for free wheel movement and prevents the shroud from scraping the floor.

If you are moving the treadmill after it has been in operation, use the controlling equipment to set the grade to approximately 7%. Then remove power and disconnect all cables to the treadmill before moving the unit.

Follow the steps below to move the treadmill. We recommend that two people work together since the treadmill may be too heavy for some individuals to lift and lower safely.

1. Lift the end of the bed assembly to about knee height, keeping knees bent and backs straight as you lift.
2. Rotate the treadmill in the direction you want to go (the treadmill will pivot on its wheels) and push forward.
3. When you have maneuvered the treadmill into its new location, gently lower the end of the bed assembly to the floor.



MD1128-022

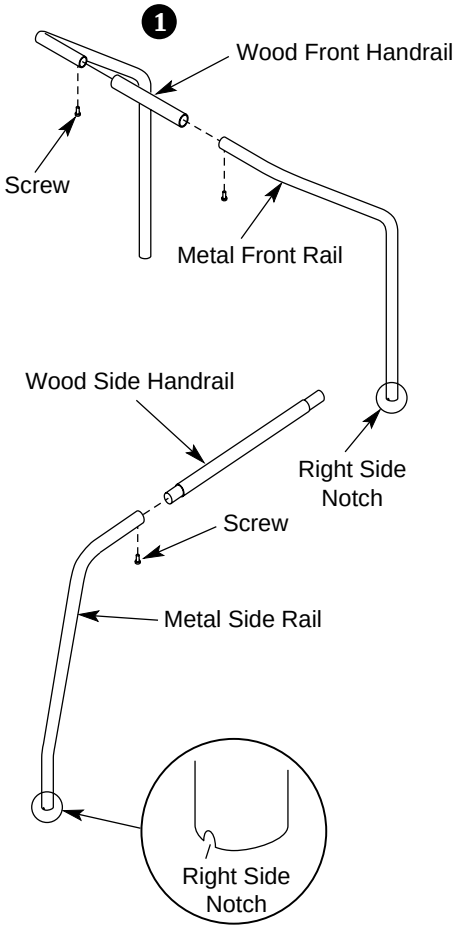
Equipment Assembly

The Series 2000 Treadmill ships completely assembled except for the handle set and the emergency stop switch. Attach the handle set and emergency stop switch before applying power to the unit.

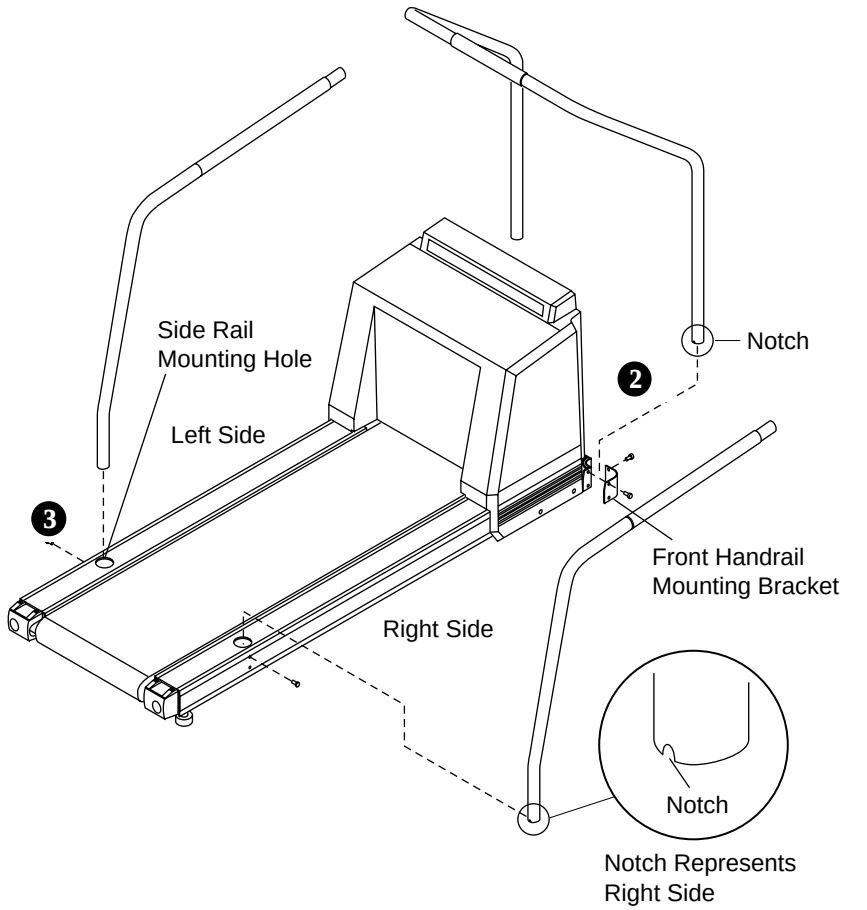
> **NOTE**
>
> As recommended by the American Heart Association Exercise Standards (Special Report, Vol 82, No 6), the treadmill should have front and side rails installed for patients to steady themselves. An emergency stop switch must be visible and readily accessible.

Handle Set

1. Insert the wood front handrail into the metal side rails, then align the predrilled holes and screw in the two Phillips screws on both sides. Assemble the optional side rails in the same way.
2. Place the assembled front handrail into the metal mounting brackets on the front corners of the shroud. Using the supplied Allen wrench and four bolts, secure the handrail to the brackets.
3. Place the assembled side rails into the side mounting holes and screw in the two bolts on each side.

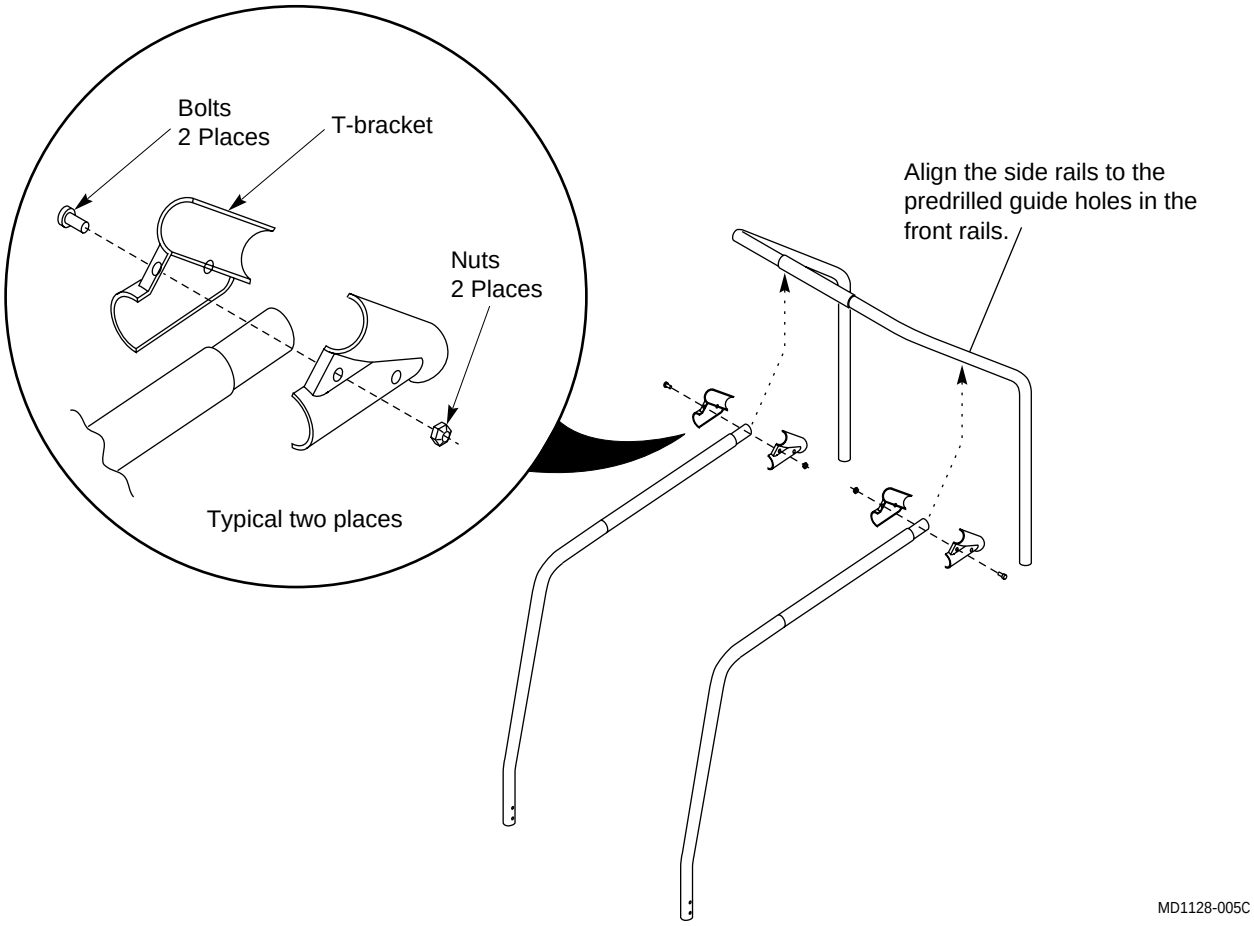


MD1128-003C



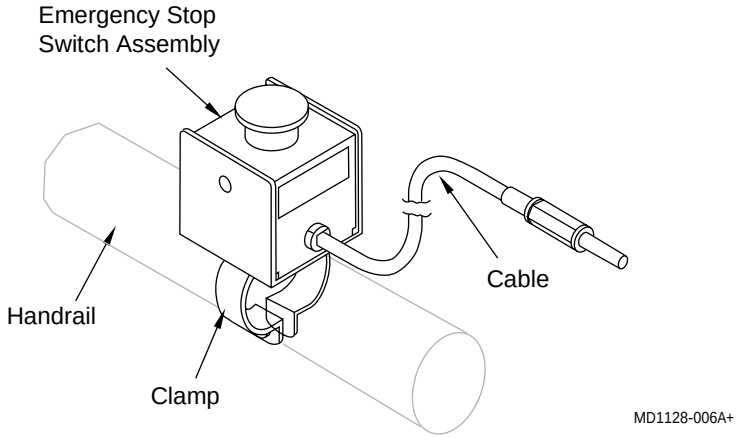
MD1128-004B

4. Attach the side rails to the front rail with the mated T-brackets. Tighten the two T-bracket bolts with the Allen wrench.



Emergency Stop Switch

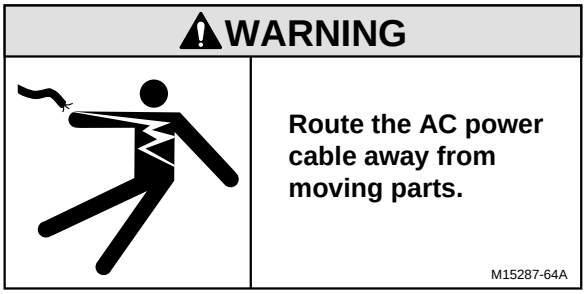
1. Attach the two clamp pieces to the assembled, latching emergency stop switch.

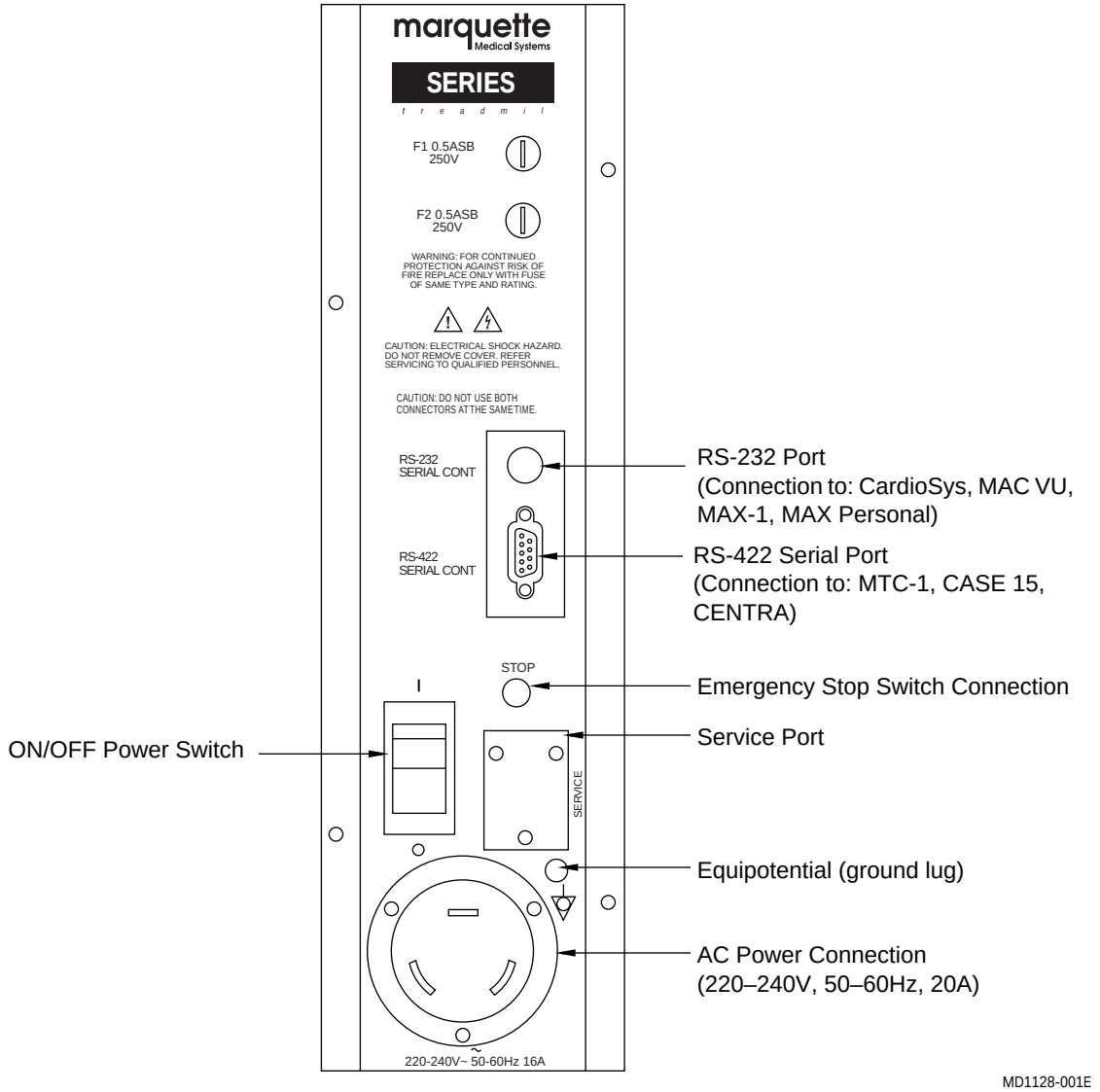


2. Position the clamps around the treadmill front handrail and secure with the supplied screw and nut.
3. Connect the cable from the emergency stop switch to the mating connector on the treadmill's rear connector panel.
4. Use the cord clips to attach the cable along the front handrail.

Connector Locations

The illustration below shows the various input connectors on the rear panel of the treadmill. Attach the appropriate controller cable from the stress system or MTC-1 and the AC power cable.





Operating Instructions

Electrical Safety Tests

The electrical safety of this installation is the responsibility of the customer, not Marquette Medical Systems. In hospitals, contact your in-house biomedical technician, electrician, or technically qualified personnel. Outside of hospitals, contact your hospital affiliation for these services. Otherwise, contact Marquette Medical Systems and open a customer-billable service call.

Before using the treadmill, perform the tests listed below.

- AC line voltage test to verify the power outlet is properly wired.
- Ground continuity test to verify all exposed metal is properly grounded.
- Leakage tests to verify the equipment passes all applicable leakage tests.

Your in-house biomedical technician, electrician, or technically qualified personnel can find instructions for performing these tests in chapter 3, “Maintenance.”

Operating Controls

The treadmill has two operating controls, the power switch and the emergency stop switch. The power switch is located on the rear panel, and the emergency stop switch is on the front handrail.

Power Switch

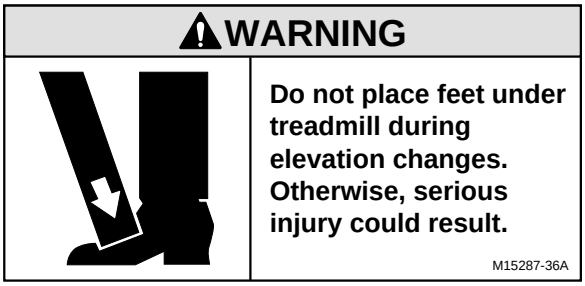
The power switch controls the AC power to the treadmill. The on position (1) applies power. The off position (0) removes power.

Emergency Stop Switch

The emergency stop switch is a safety device for use in emergency situations to stop the treadmill. Press the “STOP” push-button and the treadmill promptly stops but the belt will not lock, allowing for removal of foreign objects. To release the emergency stop switch, turn the push-button 1/4-turn in either direction.

Controlling the Treadmill

- Turn the power switch on (1).
- Use the controlling equipment to start the treadmill, adjust the treadmill speed and grade, proceed through the exercise phases, terminate the exercise session, and turn off the treadmill.



Emergency Stop Switch Check

- With the belt moving at a relatively high speed, press the emergency stop switch. The treadmill belt will stop promptly but the belt will not lock, allowing for removal of foreign objects. To release the switch, turn the button 1/4-inch turn in either direction.
- Use the controlling equipment to terminate the exercise session and turn off the treadmill.

3 Maintenance

Introduction

Recommended Maintenance

A regular equipment maintenance program helps prevent unnecessary equipment and power failures and also reduces possible health hazards. This chapter contains instructions for the following recommended maintenance:

- Inspecting and cleaning the unit
- Power source integrity test
- Leakage safety tests
- Resistance measurements
- Self-calibration
- Belt tracking adjustments

Inspection Report

To help you establish a systematic maintenance routine, Marquette Medical Systems recommends that, every six months, you perform the maintenance checks and test procedures on the "Preventive Maintenance Inspection Report," included at the end of this chapter. (Make extra copies of the report form to use as an inspection check-off list.)

> **NOTE**
>
> Unless you have an Equipment Maintenance Contract, Marquette Medical Systems does not in any manner assume the responsibility for performing the recommended maintenance procedures. The sole responsibility rests with the individual or institution using the equipment. Marquette Medical Systems service personnel may, at their discretion, follow the procedures provided in this manual as a guide during visits to the equipment site.

Required Tools and Supplies

To maintain and repair the treadmill, you will need the following:

- Standard hand tools
- DVOM
- Leakage current tester PN MT-1216-01 (for 120 V), PN MT-1216-02 (for 240 V), or equivalent
- Anti-septic cleaner
- Dust remover (compressed air)

Inspection and Cleaning

Visual Inspection

Regularly inspect the AC power cord and all other cords and cables for fraying or other damage. Perform safety tests on any repaired line cords.

Inspect all plugs, cables and connectors for bent prongs or pins. Verify that all cords, socketed components, and connectors are securely seated.

Inspect the following for excessive wear or damage:

- Walking belt
- Drive belt
- Handrail and hardware

Test the stop switch assembly monthly.

Exterior Cleaning

Turn the treadmill system off. Clean the exterior surfaces with a clean, soft cloth and a mild dishwashing detergent diluted in water. Wring out the excess water from the cloth and take care not to drip solutions on the keyboard or writer assembly. (Use anti-septic cleaner on the handrails and walking belt.) Avoid contact with open vents, plugs or connectors. Dry the surfaces with a clean cloth or paper towel.

Interior Cleaning

Complete any pre-service procedures prior to opening the unit or performing any interior cleaning. Clean the unit as needed, but at least once per month.

Domestic Electrical Safety Tests

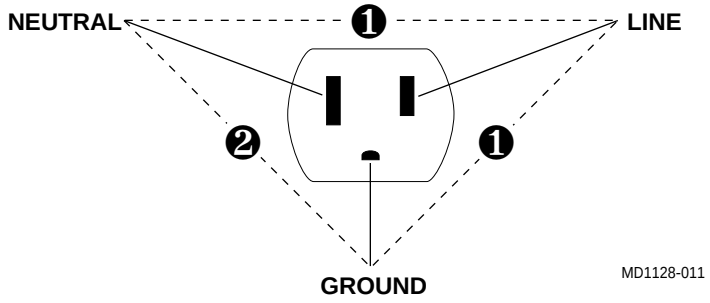
AC Line Voltage Test

This test verifies that the domestic wall outlet supplying power to the equipment is properly wired. For international wiring tests, refer to the internal standards agencies of that particular country.

120 VAC, 50/60 Hz

Use a digital voltmeter to check the voltages of the 120-volt AC wall outlet (dedicated circuit recommended). If the measurements are significantly out of range, have a qualified electrician repair the outlet. The voltage measurements should be as follows:

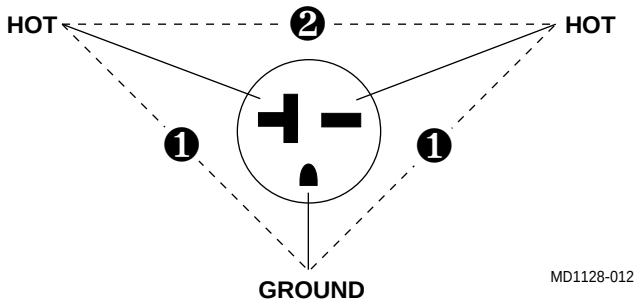
1. 120 VAC (± 10 VAC) between the line contact and neutral and between the line contact and ground.
2. Less than 3 VAC between neutral and ground.



240 VAC, 50/60 Hz

Use a digital voltmeter, set to measure at least 300 VAC, to check the voltages of the NEMA 6-20R, AC wall outlet (dedicated circuit recommended). If the measurements are significantly out of range, have a qualified electrician repair the outlet. The voltage measurements should be as follows:

1. 120 VAC (± 10 VAC) between either “hot” contact and ground.
2. 210 to 230 VAC between the two “hot” contacts.



Leakage Tests

The leakage tests are safety tests to ensure that the equipment poses no electrical health hazards. Use the table below to determine which tests apply to the unit under test and the maximum allowable leakage currents. For international leakage limits, refer to the internal standards agencies of that particular country.

If the unit under test fails the leakage tests, do not allow the customer to use the equipment. Call Tech Support for assistance. (See the "How to Reach Us" page in the front of the manual.)

Marquette Medical Systems recommends that you perform these tests:

- Before applying power for the first time
- Every 6 months as part of routine maintenance
- Whenever internal assemblies are serviced

NOTE

The accuracy of the leakage tests depends on a properly-wired wall outlet. Do not proceed until you verify the integrity of the power source.

⚠ WARNING

Total system leakage current must not exceed 300 microamperes.

M15287-76A

Table 3-1. Leakage Tests and Maximum Allowable Leakage Currents

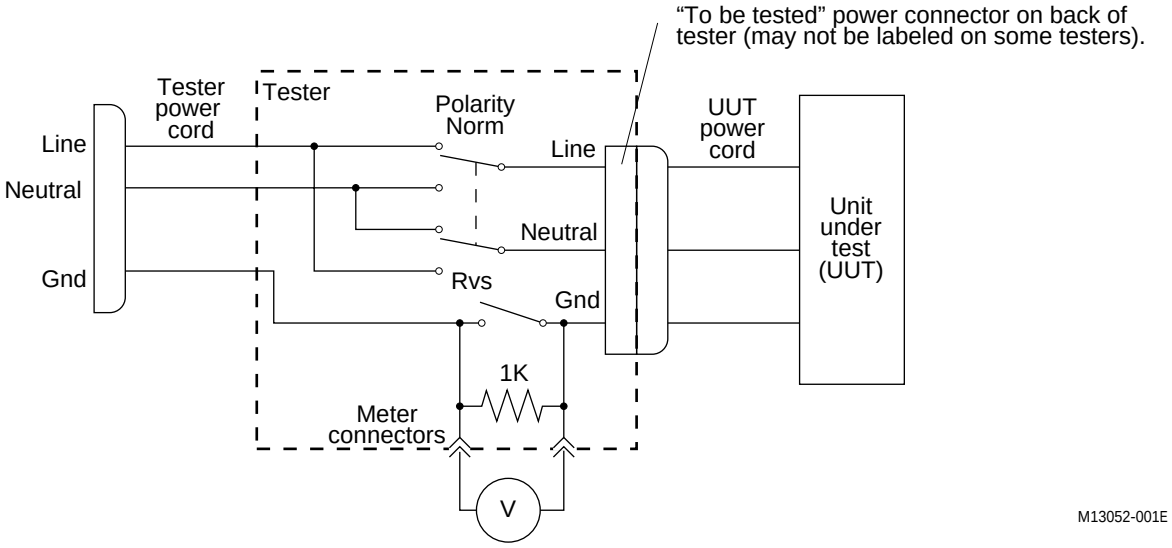
	Test	Applies To	Maximum Current (µA)
1	Ground-wire-leakage-to-ground	MAX-1 stress system	300
2	Chassis-leakage-to-ground	MAX-1 stress system	300
3	Patient-cable-leakage-to-ground	Acquisition module	10
4	Patient-cable-leakage-into-patient-leads-from-120 V ac	Acquisition module	20

Leakage Test Diagrams

These diagrams show only a representation of how a typical leakage current tester functions. Follow the instructions provided with the leakage current tester that you use.

Test #1

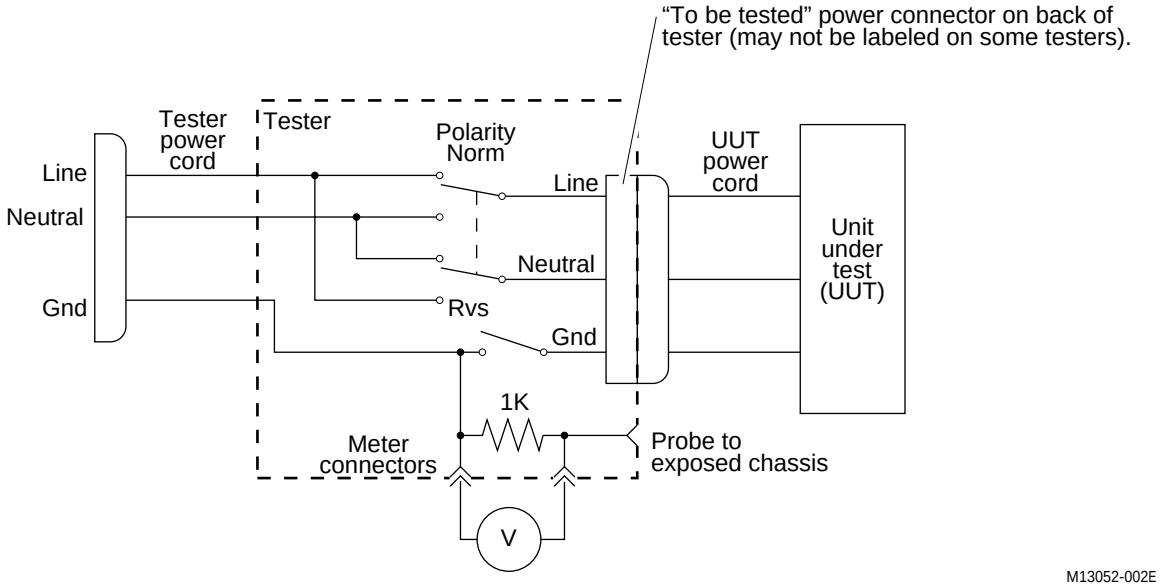
Ground-Wire-Leakage-to-Ground



Test #2

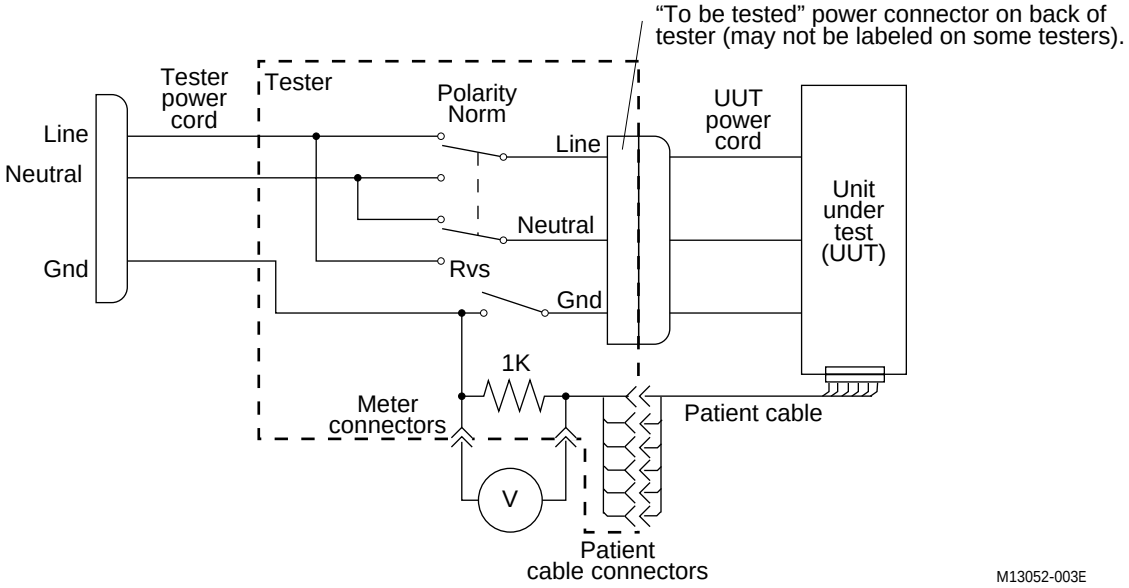
Chassis-Leakage-to-Ground (Exposed Chassis)

Apply line voltage to the UUT chassis for this test.



Test #3

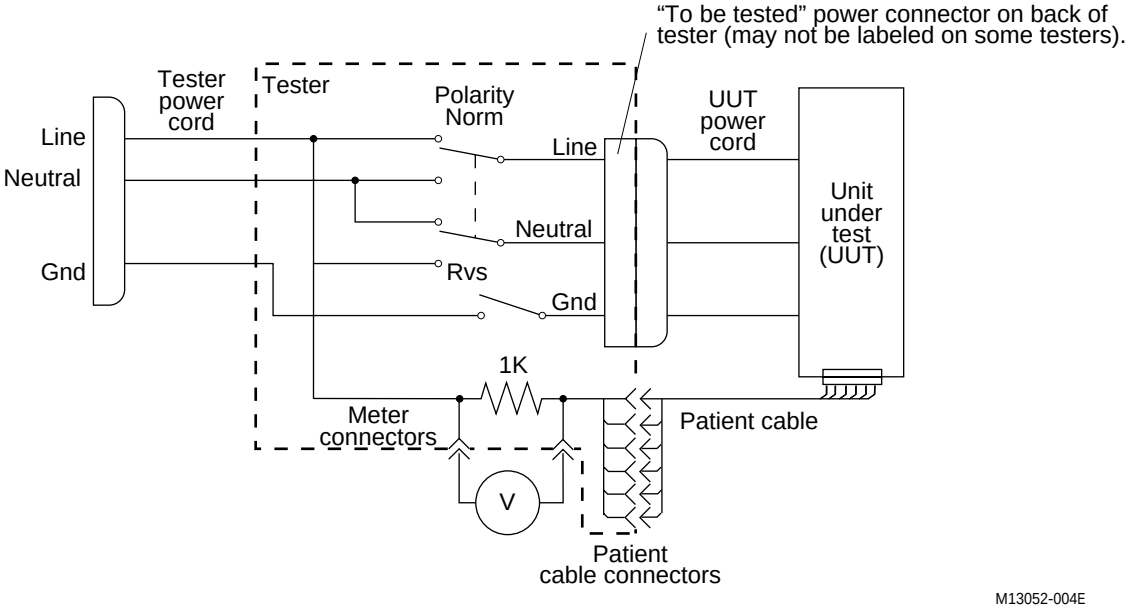
Patient-Cable-Leakage-to-Ground



Test #4

Patient Cable-Leakage-into-Patient Leads-from 120 VAC

During this test, line voltage is applied to the patient cable connectors. To prevent erroneous readings, don not allow the leadwires to contact conductive materials such as metal handles, and do not place the leadwires on the floor.

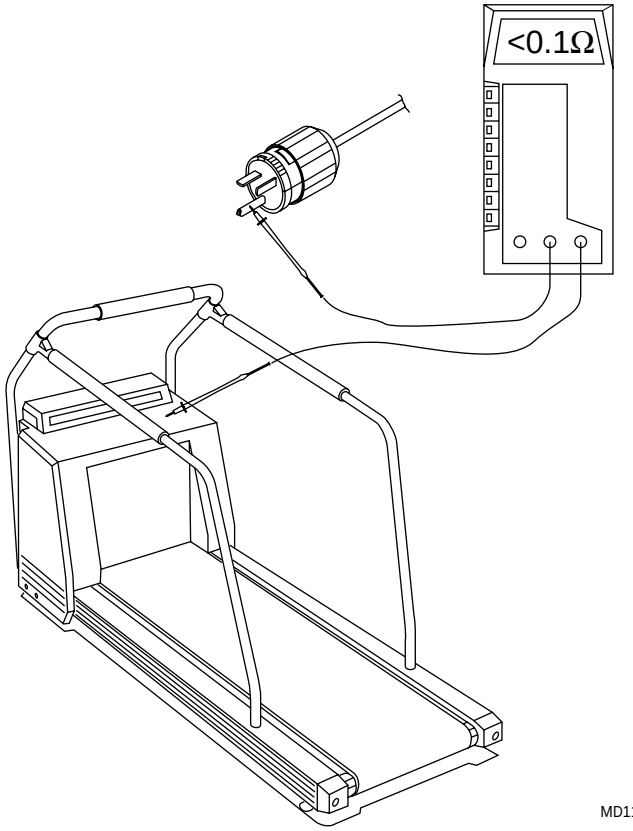


Ground Continuity Test

This test verifies that there is continuity (less than 100 mΩ resistance) between all the exposed metal surfaces, which have the potential to become energized, and the ground prong on the mains AC power cord. If the metal surfaces are anodized or painted, scrape off a small area in an inconspicuous area on the aluminum casting for the probe to make direct contact with the metal.

Use a digital multimeter to check all the metal surfaces of the equipment as illustrated below. Make adjustments for any resistance in the test leads.

If the measurements are significantly out of range, check for breaks in the power cord or in the internal connections within the unit.



MD1128-007A+

Self-Calibration

When to Calibrate

Marquette Medical Systems recommends that you activate the self-calibration feature every time you replace a major assembly or a circuit board.

Activating Self-Calibration

To activate the Series 2000 Treadmill self-calibration feature, do the following:

1. Remove the plate covering the service port on the rear panel of the treadmill.
2. Remove controlling device (MAX-1, CASE, CENTRA, MTC-1) cable or turn off the controlling device.
3. Below the service port are two prongs (pins). Place a screwdriver between the two self-calibration prongs to short the circuit and activate the self-calibration software.

   The software calibrates the speed and grade from the minimum points to the maximum points.

Belt Tracking Adjustments

When to Adjust

The treadmill walking-belt tension is set at the factory. However, you should test the belt tracking every time the treadmill is moved. Run the treadmill for several minutes with no one exercising. If the belt tracks to one side or the other, then you must adjust the belt tracking.

It is not unusual for the treadmill belt to move slightly off center while a person with a heavy gait is exercising. A properly adjusted belt recenters itself when the person steps off the treadmill. If the belt does not recenter, check the treadmill level and adjust the belt tracking as described.

Check Treadmill Level

1. Use the controlling equipment to set the treadmill elevation to 0.0%.
2. Check the treadmill level with a carpenter's level.
3. If the treadmill is uneven, adjust the feet at the rear of the treadmill until it is stable.

   For stability, use one shim of the right thickness (rather than several thin shims) to achieve the proper level.

   If necessary, use longer shims to accommodate the maximum treadmill elevation. The treadmill wheels must not roll off the shims. Verify that the shim lengths exceed the wheel movement when the treadmill is fully elevated.
4. If you cannot level the treadmill safely with shims, move the treadmill to another location.

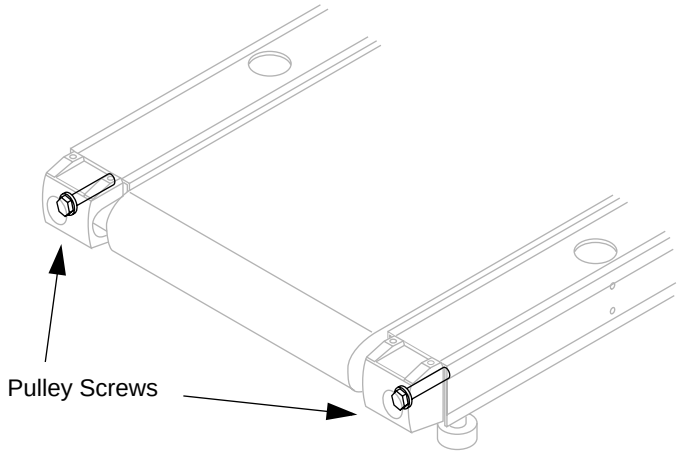
Adjust Pulley Screws

1. Use the controlling equipment to set the belt speed to 4 or 5 miles per hour (7 or 8 kilometers per hour).
2. To correct a belt that tracks to the right, turn the right pulley adjustment screw CLOCKWISE in 1/8-turn increments until the belt tracks in the center. Wait 2 or 3 minutes between each 1/8-turn to allow the belt position to stabilize.

   To correct a belt that tracks to the left, turn the left pulley adjustment screw CLOCKWISE in 1/8-turn increments until the belt tracks in the center. Wait 2 or 3 minutes between each 1/8-turn to allow the belt position to stabilize.

> **NOTE**
>
> Make adjustments to the pulley screws in small increments. Over-adjustments and repeated tightening of the screws can cause too much tension on the belt.

3. If either adjustment in step 2 results in an over-adjustment of the belt tracking, loosen the pulley screw that was tightened and wait several minutes for the treadmill belt position to stabilize. Then tighten the other pulley adjustment screw.



MD1129-016B

Miscellaneous Maintenance Forms

Marquette Medical Systems recommends that every six months you perform the maintenance checks and test procedures on the "Preventive Maintenance Inspection Report" (see following page). These maintenance procedures can be performed more often if indicated.

Series T2000 Treadmill

Preventive Maintenance Inspection Report

Customer_____ Customer Number_____ Date_____

FE _____ FE ID_____ Call Number_____

Equipment Serial Number_____ Software Revision _____

Configuration (✓)

___ Emergency Stop Switch installed

Tools

1. Leakage tester
2. Multimeter
3. Standard hand tools
4. Service Manual (p/n 409110-001)
5. ESD Mat and Wrist Strap

Visual Inspection (✓)

Inspect the following for excess wear and/or any visual signs of damage.

1. ___ Walking belt
2. ___ Interface cable
3. ___ Connectors
4. ___ AC power cord
5. ___ Handrail hardware
6. ___ Drive belt

Cleaning (✓)

1. ___ Handrails
2. ___ Shroud
3. ___ Walking belt

Calibration (✓)

1. ___ Speed calibration (2 mph = 10 revolutions in 38 seconds +/- 2 seconds)
2. ___ Grade calibration (@ 10% +/- .75 inches)

Electrical Safety Checks (✓)

Refer to PM Application Form XPMAPP-001-4 class B for leakage standards for specific voltages.

1. ___ Wall Receptacle Test
2. ___ Ground Continuity (Impedence of protected connection)Test(≤ .1Ω or ≤.2Ω w/power cord)

3. Leakage

	Open		**Closed**	
	Normal	Reversed	Normal	Reversed
Ground(Earth) wire leakage to ground test	___	___	NA	NA
Chassis(Enclosure) leakage to ground test	___	___	___	___

Checkout Procedure (✓)

1. Perform the applicable checkout procedure(s) listed below using the FRU Checkout Procedure document, after a major assembly is replaced.

1.____ Increase and decrease speed from minimum to maximum using controlling unit(MAX-1, CASE 15, etc.) to verify operation.
2.____ Raise and lower elevation from 0% to 25% using controlling unit(MAX-1, CASE 15, etc.) to verify operation.
3.____ Depress emergency stop switch(if installed) while unit running at 3 m.p.h. to confirm operation.
4.____ Monitor walking belt tracking at 3 m.p.h. Adjust, if necessary, using procedure in Field Service manual.
5.____ Verify speed calibration, 2 m.p.h. = 10 revolutions in 38 seconds.
6.____ Verify elevation calibration. Adjust, if necessary, using calibration procedure in Field Service manual.
7.____ Monitor drive belt for slipping, squeaking and mis-alignment. Adjust, if necessary, using procedure in Field Service manual.
8.____ Perform Self-Calibration procedure. Refer to Field Service Manual for details.

Comments

Briefly describe all repairs/adjustments made and list all parts replaced:

_____

_____

Additional comments:

_____

_____

FRU Checkout Procedure

FRU Description*	Tools	Visual Inspection	Cleaning	Calibration	Electrical Safety Tests	Checkout Procedure
Drive Controller Box(Thor)	1,4	-	-	1	3	1,3,8
Control(CPU) Pcb	1,4	-	-	1,2	3	1,3,8
Power Pcb	1,4	-	-	1,2	2	1,3,8
Drive Belt	-	-	-	-	-	1,7
Walking Belt	-	-	-	-	-	1,4
Walking Board	-	-	-	-	-	1,4
3 HP Speed Motor	4	-	-	1	3	1,5,8
Elevation Motor	4	-	-	2	3	2,6,8
Front Roller	4	-	-	-	-	1,4,5,7
Rear Roller	4	-	-	-	-	1,4,5,7
Software	-	-	-	-	-	1,2,8
Hardware Upgrades (Including Firmware)	Perform complete PM					
Supplies	Perform applicable Checkout Procedure(s)					
Non-Listed FRU's	Perform complete PM					
No Parts Replaced	Perform applicable Checkout Procedure(s)					
* The FRU Checkout procedure for any listed FRU also applies to it's internal PCB's and parts.						

4 Troubleshooting

Power PCB Theory

General Description

The 800334-002 power board and the 800320-001 control board function together as part of the electronics box to control the Series 2000 Treadmill. The power board contains the following:

- Mains components
- Isolation transformer
- Elevation and drive interface circuitry
- Speaker (for error codes)
- Serial control links

The serial control links receive inputs from a stress system controller along with feedback from the treadmill sensors, send the inputs to the control board, and then receive the control signals for the drive and elevation motors.

Power Distribution/ Isolation

The power board receives 185 V to 265 VAC power (nominal 220V). The isolation transformer supplies 5 V to both the isolated communication link and the control board.

Bypass caps are distributed across the board to minimize EMI and power supply noise. All other supplies are created on the 800320-001 control board.

STOP Circuitry

When the belt is moving, pushing the normally-closed STOP switch activates (and latches) the dynamic braking on the drive system. This takes place as soon as the stop relay K3 is released. The K3 relay also can be released with a processor RESET* or when the +5 voltage drops too low.

When a stop occurs, the 4538 timer and frequency-to-voltage converter disables the output speed (0-10 .3V) for 2.2 seconds and signals the processor that a stop occurred, even if the switch was only momentarily depressed.

Frequency-to-Voltage Converter/Amplifier

The 4538 receives variable frequency (0–2 kHz) pulses from the processor timer and converts them to 470 µs pulses. The 470 µs pulses are applied to a low-pass filter/integrator (output 0–5 volt) and passed through a noninverting op amp (Gain=2) to produce a 0–10.3 volt drive signal. The drive signal is sent to the drive system as an analog-requested speed voltage. The circuitry can be disabled for 2.2 seconds by a system RESET*, a BRAKE* signal, or by releasing the stop relay. This permits the watchdog timer to maintain a zero-speed command to the drive during system power-up and guarantees a zero-speed command during stop conditions.

Start/Stop Circuitry

When COAST* and BRAKE* are not active (low), the START pulse command can engage the drive system. These signals are level converted from CMOS/TTL (0–5 V) levels to (-15 V–0 V) logic by the 74HC14 drivers and level shifting transistors. The 750-ohm resistors limit the maximum current to 27 mA (+5V -(-15V) /750) and the typical current to 5.7 mA (+5V - (0.7V) /750). The diodes limit the output voltage to 0.7 volts. These drivers are connected to the opto-couplers within the drive system.

The COAST* and BRAKE* signals override the START pulse.

Elevation Relays

A direction control and an enable relay control the elevation motor. A change in direction should only occur when the elevation motor is stopped. The enable relay is disabled by the normally-closed limit switches at the end of travel to prevent damage to the motor. The LIMIT* signal goes low when a limit switch is activated in a particular direction.

Drive Connector

Inputs from the brushless motor hall sensor and the control signals are combined to provide signals to run the drive system. The drive system provides fault output, which is reset by pulsing the COAST* signal.

Hall Feedback

Five hall sensors monitor the position and speed of the drive motor. The drive control uses the three primary sensors (HALL1, HALL2, HALL3) to commutate the three-phases of the DC motor. The other two hall sensors (HALL4 & HALL5) provide speed and direction feedback by quadrature to the drive and to the control. HALL1and HALL3 provide about 4 pulses per revolution and HALL4 and HALL5 provide about 30 pulses per revolution. The higher frequency HALL4 and HALL5 signals maintain better speed regulation at low motor speeds.

These 5-volt hall signals are squared-up by 74HC14, which is protected by filter caps, limiting resistors, and Zener diodes.

Power Inlet, Drive Power Outlet, and Mains

The power comes in on the terminal block, gets fused and filtered, and is distributed to the isolation transformer and out to the drive system. Externally accessible 0.5ASB fuses are provided for the control portion of the circuitry. The 20 Amp internal fuses are for the drive section and are intended to protect the wiring from major faults within the drive system. Spacings for creepage and isolation are critical in this whole section.

Control Board Connector

The control board connector provides 0.5-inches of stand-off spacing for the rear entry connector on the 800320-001 board.

Elevation Sensor

The elevation sensor is a 5-turn pot that is coupled to the elevation rack. The voltage on pin 2 should be proportional to elevation. That is, low voltage should be low elevation, increasing voltage should indicate increasing elevation. During self-calibration, the offset and gain remain in software memory. Initially, the limit switch positions are the reference for self-calibration. Once the offset and gain are adjusted, the pot position determines the elevation.

Isolation Transformer

The isolation transformer provides isolation for two secondaries. The 220 VAC primary is stepped down and isolated from the two 12 VCT secondaries. Each of the secondaries provide unregulated power for a 5-volt switching supply.

Power Supplies

There are two identical power supplies. One is for the control power, the other is for the isolated serial link. The isolated serial link supply provides a maximum of 2 amps of 5-volt power to operate a manual controller.

Unregulated power comes from the center-tapped isolation transformer, through the full-wave bridge to the switching regulator. The switching regulator is a step-down, buck PWM-type that switches at about 100 KHz. It also has an internal current limit of 4 amps. The 5-volt regulators are configured to produce about 5.1 volts.

Isolated Serial Link

This circuitry provides an isolated, RS-422/232 link back to the controlling system. It also provides up to 2 amps of 5 V power for an external manual controller.

Debug/Serial Link

The debug/serial link connector is covered by a removable plastic plate. This connector sends/receives the analog outputs, the manual analog inputs, and the RS-232 (debug) signals.

> **NOTE**
>
> These outputs are accessed through the SERVICE connector and are referenced to DIGITAL ground which is NOT connected to CHASSIS ground. Analog isolation amplifiers may be required to protect externally connected equipment.

ESD and EMI Compatibility

The I/O connectors on the power board have current-limiting resistors, Zener diodes, or filtering capacitors wherever possible to prevent EMI from escaping the board. These components also limit rise-time and voltages which may come from ESD or other noise sources.

Power Supply Requirements

Table 4-1. Output Requirements

Voltage	Nominal Voltage	Test Range	Maximum Current	Ripple P-P
+5 V	+5.1 VDC ±5%	0.0–3.0 A	4.0 A	0.5 V
+5 V–ISO	+5.1 VDC ±5%	0.0–2.0 A	4.0 A	0.5 V

Table 4-2. J2 Debug/Analog Control					
PIN #	NAME	TYPE	IN/OUT	FREQ	COMMENT
J2-1	SPEEDV	ANA	OUT	DC	Current Speed 1V/5MPH (±2% TOLERANCE)
J2-2	TXSERVICE (NOT WORKING)	232	OUT	10KHZ	RS-232 DEBUG T
J2-3	RXSERVICE (NOT WORKING)	232	IN	10KHZ	RS-232 DEBUG RX
J2-4	MANELEV	ANA	IN	5HZ	MAN ELEV IN 0-5V (RATIOMETRIC)
J2-5	GND	GND	COM	DC	Digital Ground
J2-6	MANSPD	ANA	IN	5HZ	MAN SPEED IN 0-5V (RATIOMETRIC)
J2-7	MANRUN	CMOS	IN	LEVEL	Signal to Start MAN CNTRL
J2-8	+5V	PWR	OUT	DC	+5V POWER OUT 250ma
J2-9	GRADEV	ANA	OUT	5HZ	Current Grade 1V/5% (±2% TOLERANCE)

Table 4-3. J5 Drive Connector					
PIN #	NAME	TYPE	IN/OUT	FREQ.	COMMENTS
J5-1	SHLD-GND	GND	COM	DC	Digital Ground
J5-2	STARTPB	-15V	OUT	PULSE	Drive Start Pulse
J5-3	DRVGND	GND	COM	DC	Digital Ground
J5-4	STOPPB	-15V	OUT	PULSE	Drive Stop (Brake) Pulse
J5-5	ESTOPPB	-15V	OUT	PULSE	Drive EStop (Coast) Pulse
J5-6	SPEED/010V	ANA	OUT	5HZ	Speed command
J5-7	FAULT*	OC5V	IN	LEVEL	Drive Fault output
J5-8	HALL1	OC5V	OUT	10KHZ	Hall sensor 1
J5-9	HALL2	OC5V	OUT	10KHZ	Hall sensor 2
J5-10	HALL3	OC5V	OUT	10KHZ	Hall sensor 3
J5-11	DRV5V	PWR	PWR	DC	Hall sensor power
J5-12	TEMP1	15V	I/O	LEVEL	OverTemp cutout

Table 4-3. J5 Drive Connector (Continued)					
J5-13	TEMP2	15V	I/O	LEVEL	OverTemp cutout
J5-14	HALL5	OC5V	OUT	10KHZ	Hall sensor 5 /Tach B
J5-15	HALL4	OC5V	OUT	10KHZ	hall sensor 4/Tach A
J5-16	SHLD-GND	GND	COM	DC	Digital Ground

Table 4-4. J6 Elevation Motor						
PIN	NAME	TYPE	IN/OUT	FREQ.	COMMENTS	COLOR
J6-1	220VUP	PWR	OUT	50/60	MOTOR RUN CAP	BLK
J6-2	NC		NC		NOT CONNECTED	
J6-3	220VDN	PWR	OUT	50/60	MOTOR RUN CAP	BLK
J6-4	220VUP	PWR	OUT	50/60	MOTOR BLAC	BLK
J6-5	NC		NC		NOT CONNECTED	
J6-6	220VDN	PWR	OUT	50/60	MOTOR RED	RED
J6-7	NC		NC		NOT CONNECTED	
J6-8	NC		NC		NOT CONNECTED	
J6-9	NC		NC		NOT CONNECTED	
J6-10	20VELEV	PWR	OUT	50/60	MOTOR BLUE	BLU
J6-11	NC		NC		NOT CONNECTED	
J6-12	MOT20AGND	GND	COM	DC	MOTOR BROWN	BRN

Table 4-5. J7 Elevation Feedback						
PIN #	NAME	TYPE	IN/OUT	FREQ.	COMMENTS	COLOR
J71	+5V	PWR	OUT	DC	SENSOR SUPPLY	RED
J72	ELEVFB	ANA	IN	5HZ	SENSOR OUTPUT 05V	GRN
J73	GND	GND	COM	DC	Digital Ground	BLK

Table 4-6. J9 CPU Board Interface–I/O and Power					
PIN #	NAME	TYPE	IN/OUT	FREQ.	COMMENTS
J9-1	GND	GND	COM	DC	Digital Ground
J9-2	+5V	PWR	OUT	DC	+5V SUPPLY
J9-3	GND	GND	COM	DC	Digital Ground
J9-4	+5V	PWR	OUT	DC	+5V SUPPLY
J9-5	START	CMOS	IN	PULSE	Belt START pulse (latched)
J9-6	BRAKE*	CMOS	IN	PULSE	Belt (FAST) STOP pulse
J9-7	UP/DOWN*	CMOS	IN	LEVEL	Elevation Direction
J9-8	COAST*	CMOS	IN	PULSE	Belt COAST & FAULT RESET
J9-9	EN-ELEV	CMOS	IN	LEVEL	Elevation Motor RUN
J9-10	DRIVE-EN	CMOS	IN	LEVEL	NOT USED
J9-11	SETSPEED	CMOS	IN	2KHZ	0-2 KHZ DRIVE SPEED CMD
J9-12	RESET*	CMOS	IN	LEVEL	CPU RESET signal
J9-13	TXCOMM	CMOS	IN	10KHZ	RS422 TX signal
J9-14	GND	GND	COM	DC	Digital Ground
J9-15	RXCOMM	CMOS	OUT	10KHZ	RS422 RX signal
J9-16	GND	GND	COM	DC	Digital Ground
J9-17	TACH-A	CMOS	OUT	10KH	QUAD-DRV SPEED & DIR FB
J9-18	GND	GND	COM	DC	Digital Ground
J9-19	TACH-B	CMOS	OUT	10KHZ	QUAD-DRV SPEED & DIR FB
J9-20	GND	GND	COM	DC	Digital Ground
J9-21	LIMIT*	CMOS	OUT	LEVEL	Elev Limit Switch reached
J9-22	GND	GND	COM	DC	Digital Ground
J9-23	ESTOPSW	CMOS	OUT	LEVE	ESTOP SWITCH/ RELAY active
J9-24	SPEAKER	ANA	IN	10KHZ	To 8-ohm Speaker
J9-25	ESTOPTRP	CMOS	OUT	PULSE	ESTOP/POWER insanity 1sho
J9-26	SPEAKER	ANA	IN	10KHZ	To 8-ohm Speaker

Table 4-6. J9 CPU Board Interface–I/O and Power (Continued)					
J9-27	SELF-CAL	CMOS	OUT	LEVEL	Signal to Start SELFCAL
J9-28	TXSERVICE	232	IN	10KHZ	RS232 DEBUG TX
J9-29	MANRUN	CMOS	OUT	LEVEL	Signal to Start MAN CNTRL
J9-30	RXSERVICE	232	OUT	10KHZ	RS232 DEBUG RX
J9-31	FAULT*	CMOS	OUT	LEVEL	BELT DRIVE FAULT
J9-32	GND	GND	COM	DC	Signal Ground
J9-33	GND	GND	COM	DC	Signal Ground
J9-34	-7.5V	PWR	IN	DC	Power for OP AMP
J9-35	GND	GND	COM	DC	Signal Ground
J9-36	+16.5V	PWR	IN	DC	Power for OP AMP
J9-37	GND	GND	COM	DC	Signal Ground
J9-38	GRADEV	ANA	IN	5HZ	Current Grade 1V/5% (2%)
J9-39	GND	GND	COM	DC	Signal Ground
J9-40	SPEEDV	ANA	IN	5HZ	Current Speed 1V/5MPH (2%)
J9-41	GND	GND	COM	DC	Signal Ground
J9-42	MANELE	ANA	OUT	5HZ	MAN GRADE IN 0-5V (RATIO)
J9-43	GND	GND	COM	DC	Signal Ground
J9-44	MANSPD	ANA	OUT	5HZ	MAN SPEED IN 0-5V (RATIO)
J9-45	GND	GND	COM	DC	Signal Ground
J9-46	ELEVFB	ANA	OUT	5HZ	ELEV POSITION FB (RATIO)
J9-47	GND	GND	COM	DC	Signal Ground
J9-48	+5V	PWR	OUT	DC	+5V SUPPLY
J9-49	GND	GND	COM	DC	Signal Ground
J9-50	+5V	PWR	OUT	DC	+5V SUPPLY

Table 4-7. J12 Hall Sensor Interface						
PIN #	NAME	TYPE	IN/OUT	FREQ.	COMMENTS	COLOR
J12-1	DRVGND	GND	COM	DC	Digital Ground	BLK
J12-2	DRV5V	PWR	PWR	DC	Hall sensor power	RED
J12-3	HALL3	OC5V	IN	10KHZ	Hall sensor 3	ORG
J12-4	HALL2	OC5V	IN	10KHZ	Hall sensor 2	YEL
J12-5	HALL4	OC5V	IN	10KHZ	Hall sensor 4 /Tach A	GRN
J12-6	HALL5	OC5V	IN	10KHZ	Hall sensor 5/ Tach B	BLU
J12-7	HALL1	OC5V	IN	10KHZ	Hall sensor 1	WHT
J12-1	SHLD	GND	COM	DC	Digital Ground	SHLD

Precautions

The Board must be powered before signals are applied to it.

The circuitry is static sensitive as are all HC, AC, and MOS ICs. Therefore, when removing or installing boards, the power should be off.

The circuit board should not be supplied with a VCC over 5.5 volts on the +5V supply. The power sections should not be supplied with voltages over 265VAC.

Initial Board Conditions

Apply power supply conditions as stated in Table 4-1, “Output Requirements.”

Control PCB Theory

General Description

The 800320-001 control board and the 800334-002 power board function together to control the Series 2000 Treadmill. The control board contains the following:

- Micro-controller CPU circuitry (78310)
- Memory (EEROM code/calibration/history data, SRAM)
- Temperature sensor
- Speaker driver
- Some of the I/O circuitry

The I/O circuity receives inputs from a stress system controller along with feedback from the treadmill sensors to control the elevation and drive systems located on the 800334-002 power board.

Power Distribution

The control board receives 5 volts of power from the power board. Bypass caps distributed across the board minimize EMI and power supply noise. Other analog supplies are created from the 5-volt supply to the board with voltage doublers.

Clock Generator

A 12 MHz crystal provides the processor clock. Sharp clock edges are controlled by the 100-ohm series termination resistors to minimize EMI.

Reset Generator

The Reset/Watchdog generator resets the CPU under any one of three conditions:

- Upon receipt of a “BREAK” signal over the RS-422 port, the 100 K/0.33µF RC will discharge, creating the PBRESET* and RESET* signal.
- If the 5 V (±5%) supply falls below 4.5 V, RESET* is activated.
- If the CPU fails to reset the watchdog timer for 1.2 seconds, the RESET* is activated. The software has the watchdog control software “threaded” through its task-switcher to help guarantee that all processor tasks are running.

Temperature Sensor

The processor monitors temperature and saves peak temperature in EEROM data storage for use by field service. The sensor outputs 10 mV/Deg C. The op amp provides a gain of 4.92.

The 78310 A/D converter produces the following outputs

- In hardware: A/D value = Temp(Deg C) * 10mV/DegC * GAIN * 256(max A/D counts) / VREF
- In software: Readout Temp = (A/D value) * 4 / 10

For example:

At 25 Deg C ==>

A/D value = 25 * 0.01 * 4.92 * 256 / 5.1 = 62 (Dec)

Readout Temp = 62 * 4 / 10 = 24.8

At 100 Deg C ==>

A/D value = 100 * 0.01 * 4.92 * 256 / 5.1 = 247 (Dec)

Readout Temp = 247 * 4 / 10 = 98.8

Processor Circuitry

The 78310 runs at 12 Mhz. Its code is stored in the 8K X 8 EEROM. It can be reprogrammed through the RS-422 serial port. The code must be initially installed by the manufacturing test fixtures. The 78310 accesses memory through its multiplexed address/data bus. An 8-bit address latch (HC573) separates the address from the data. An EP330 decodes the proper chip select from the address. The EP330 can select the SRAM, the EEROM, or a UART (unused) at the appropriate address. It also generates the special WRITE gate signals to write to EEROM.

The processor handles all the I/O, including one serial channel, 4 analog inputs, and digital inputs and outputs, to control the treadmill grade and speed.

Analog Inputs

Elevation feedback (from the pot), manual speed, and manual elevation analog inputs are designed to take ratiometric voltages referenced to +5 VREF as inputs to the processor.

Speaker Output

One of the timer outputs is used to create sound through the AC-coupled audio amplifier. A 2.5 V pseudo-ground is built using one-half of the op amp. The other half is configured as an AC-coupled bandpass amplifier referenced to the 2.5 V pseudo-ground.

Analog Outputs

Two analog outputs are derived from the two PWM (pulse-width modulation) output channels. The 8-bit register for the PWM pulses are used to control an analog switch which provides precise 1.235 V pulses to an integrator. The output of the integrator is buffered through two op amps (gain=4.17 ±2%).

Output voltage = (PWM-value) * 1.235 * 4.17 / 255

PWM	Output	
0	0.000 V	±20mV typical unadjusted offset
1	0.02020 V	~20mV resolution
255	5.15 V	±2% typical unadjusted gain error

These outputs are used to provide two treadmill analog outputs:

GRADE at 1 volt per 5% grade and SPEED at 1 volt per 5 MPH.

> **NOTE**
>
> These outputs are accessed through the SERVICE connector and are referenced to DIGITAL ground which is NOT connected to CHASSIS ground. Analog isolation amplifiers may be required to protect externally connected equipment.

Analog Supplies

The +16.5 V and –7.5 V supplies for the analog output and RS-232 circuitry are supplied by the +5 V supply. Capacitor voltage doublers and inverters are used to get these unregulated supplies from the LT1133 and the 7660.

Supplies

The EMI filter inductor normally has about a 100 to 200 mV voltage drop across it (load dependent). +5 VREF is typically at about 5.1 VDC. The +5V supply is typically at about 4.9 to 5.0 VDC.

ESD and EMI Compatibility

The one and only connector on this PCB has current limiting resistors and filtering capacitors on almost every signal to prevent EMI from escaping this board. These components also limit rise-time and voltages which may come from ESD or other noise sources.

Brushless DC Drive Theory

General Description

A brushless DC motor consists of permanent magnets that create a static magnetic field and electromagnets that, when energized, provide motion. The magnets attach to a shaft to form a rotor with an even number of magnetic poles. One or more electromagnets are wound on a laminated steel stator to form the motor phases. Typically, brushless DC motors have four, six, or eight magnetic poles with three winding phases.

With multiple motor phases, there is always one of the phases that can be energized to provide rotational torque—regardless of the rotor position with respect to the stator. Energizing the phases in the proper sequence and polarity provides constant unidirectional torque. Transistors have replaced brushes to accomplish phase switching. Sensors determine the rotor position and turn on the correct motor phase. These position sensors are typically Hall-effect devices because of their low cost and immunity from environmental conditions.

Phases and Power Switches

The most common arrangement of phases and power switches is the three-phase, Y-connected windings with six power switches. Each phase consists of two windings in series, spaced 120 electrical degrees apart. Each phase can be energized in either direction by turning on two of the six power devices. This arrangement of switches and motor windings is identical to an AC motor drive. The number of electrical cycles per mechanical revolution is equal to the number of rotor poles divided by two.

Motor Torque

To control motor torque, it is necessary to control the current through the motor windings since torque is directly proportional to motor current. Rapidly switching the power devices on and off limits the effective voltage applied to the motor winding. Using a feedback loop, a voltage command controls the motor current. This is called the current loop or inner loop of the drive.

Motor Speed

Control of motor torque is only half of the motor control process, since the ultimate goal of a motor drive is to provide an adjustable motor speed. The simplest speed control loop consist of a summing junction to determine the difference between the desired motor speed and the actual motor speed, along with a gain block that feeds into the current loop. The current loop may be considered a single block with voltage as an input and motor current as an output. The overall feedback loop is called the velocity loop or outer loop of the drive. While this system controls motor speed, it cannot control the exact motor speed since some error signal is required to drive the current loop. The actual motor speed is dependent on the speed command, the load, the error gain, and the characteristics of the motor itself.

Adding an integrator to the error amplifier allows exact speed control. Any speed error results in an output from the integrator that builds with time and causes an output to the current loop. This loop, therefore, will seek zero speed error. This is the type of velocity loop used in the Marquette Series 2000 Treadmill drive.

Drive Motor Control Box Description

Power Board

The treadmill drive motor control consists of two PC boards and a power IGBT module. The power board is located on the heat sink and contains the input bridge rectifier, the DC bus capacitors, the logic power supplies, and the IGBT gate drivers. The IGBT module attaches to the heat sink in the center of the power board.

> **NOTE**
>
> All the circuitry on this board is referenced to the common of the DC bus which puts it at or near line potential.

Control Board

The control board is located on the cover above the power board. This board contains the logic to decode the motor hall sensors, the current loop, the velocity loop, and five status LEDs.

> **NOTE**
>
> This board is at line potential with the exception of the small area between the terminal block and the row of opto-isolators.

LED Functions

Over-Temperature

This LED lights if the heat sink thermostat opens.

Fault

This LED lights when a fault condition occurs. The following conditions can cause a fault: AC line under voltage, AC line over voltage, motor over current, power supplies low, heat sink over temperature, auxiliary temperature switch open, motor stalled, or personality module missing. Once a fault occurs, you cannot start the drive until you correct the fault and open the ESTOP switch.

Ilimit (Current Limit)

This LED lights when the controller is supplying maximum current to the motor. Although it usually remains off, it may flash with a heavy load. If this LED is on continuously, check the drive and belt. If the motor stalls for more than 5 seconds with the current limit LED on, the drive will fault-out.

Power (Power Supplies OK)

This LED lights when the main ± 15-volt power supplies are within the required range.

Tach loss

This LED lights to indicate the tachometer circuits in the motor are not active.

User Inputs/Outputs

User inputs and outputs are available at the 15-pin, D-connector located at the top of the drive. See figure for a list of the functions and pin numbers. Signal functions are as follows:

HALL1, HALL2, HALL3

These signals originate from the commutation hall sensors in the DC motor and are used to decode the rotor position so that the correct phase is energized. They are 5-volt, square waves, displaced 90 electrical degrees apart. You can check the signals with a voltmeter while slowly rotating the motor by hand and verifying the +5 volt and near-zero volt levels.

HALL4, HALL5

These signals originate from the auxiliary hall sensors in the DC motor, and they supply a tachometer signal to the drive for speed regulation. These are 5-volt, square waves, displaced approximately 90 degrees from each other. You can check the signals with a voltmeter while slowly rotating the motor by hand and verifying the +5 volt and near-zero volt levels.

+5ISOL

This signal is the power for the motor hall sensor.

GNDISOL

This is the common for all of the user I/O.

VIN

This is a 0–10.3 volt signal that controls the speed of the drive.

START

This is a normally-open switch input. Connecting this input to GNDISOL starts the drive unless there is a fault condition or the STOP or ESTOP contacts are open. The signal is pulled down to –15V ISOL.

STOP

This is a normally-closed switch input. Opening this switch signals the drive to power to a stop with full braking. The drive brakes until it reaches zero speed unless a fault occurs or the ESTOP switch is open. The signal is pulled down to –15V ISOL.

ESTOP

This is a normally-closed switch input. Opening this switch signals the drive to coast to a stop. This also clears any faults that have been latched unless the fault condition still exists. The signal is pulled down to –15V ISOL.

$\overline{\text{FAULT}}$

This is an open collector output that is pulled low when a fault condition is latched.

TEMP1, TEMP2

These terminals can be connected to an external thermal switch such as the motor over-temperature switch. The switch should be normally closed. Opening the contact causes a fault condition.

D-connector Inputs/Outputs

D- Connector Pin #	Signal Name
1	--
2	GNDISOL
3	ESTOP
4	$\overline{\text{FAULT}}$
5	HALL2
6	+5ISOL
7	TEMP2
8	HALL5
9	START
10	STOP
11	VIN
12	HALL1
13	HALL3
14	TEMP1
15	HALL4

Electrical Requirements

The two black wires that exit the side of the enclosure supply power to the drive. The power source should be single phase, 208/240 VAC. If the line voltage dips below 170 VAC or exceeds 264 VAC, the drive faults.

Maximum input current is 16A.

Fuses should be KTKR 20 only. Substituting a different fuse type may cause a fire or safety hazard.

The orange wire from the side of the enclosure is connected to the sheet metal enclosure and should be connected to the designated terminal on the power terminal block. Do not connect this wire to the treadmill frame which would cause a safety hazard.

The motor wires exit through the flexible conduit on the left side of the enclosure. These wires carry the pulsed 320 V to the motor. Be sure to observe proper phasing when connecting these wires. The drive will not operate with incorrect phasing.

> **NOTE**
>
> If the motor is disconnected, do not let the motor wires short to each other or any other point. If it rotates, the motor will function as a generator, and it may be damaged or cause a shock hazard. The ground strap from the flexible conduit should be connected to the motor frame. Make sure this connection is secure.

General Fault Isolation

Visual Inspection

A thorough visual inspection of the equipment can save time. Small things—disconnected cables, foreign debris on circuit boards, missing hardware, loose component—can frequently cause symptoms and equipment failures that may appear to be unrelated and difficult to track.

Take the time to make all of the recommended visual checks (refer to the visual inspection chart on the next page) before starting any detailed troubleshooting procedures.

> **NOTE**
>
> Before performing any maintenance or repair on the equipment, take precautions against electrostatic discharge damage. See "Controlling Electrostatic Discharge" in chapter 3.

> **NOTE**
>
> Solder multilayer and surface mount PCB assemblies at your own risk! Improper repair methods can damage the PCB assemblies even further. Only qualified service personnel with the proper equipment should attempt to repair PCBs.

Power Down

Set the treadmill's power switch to off (0). Disconnect the power cord from the AC wall outlet.

⚠WARNING

Unplug unit before performing the following procedure.

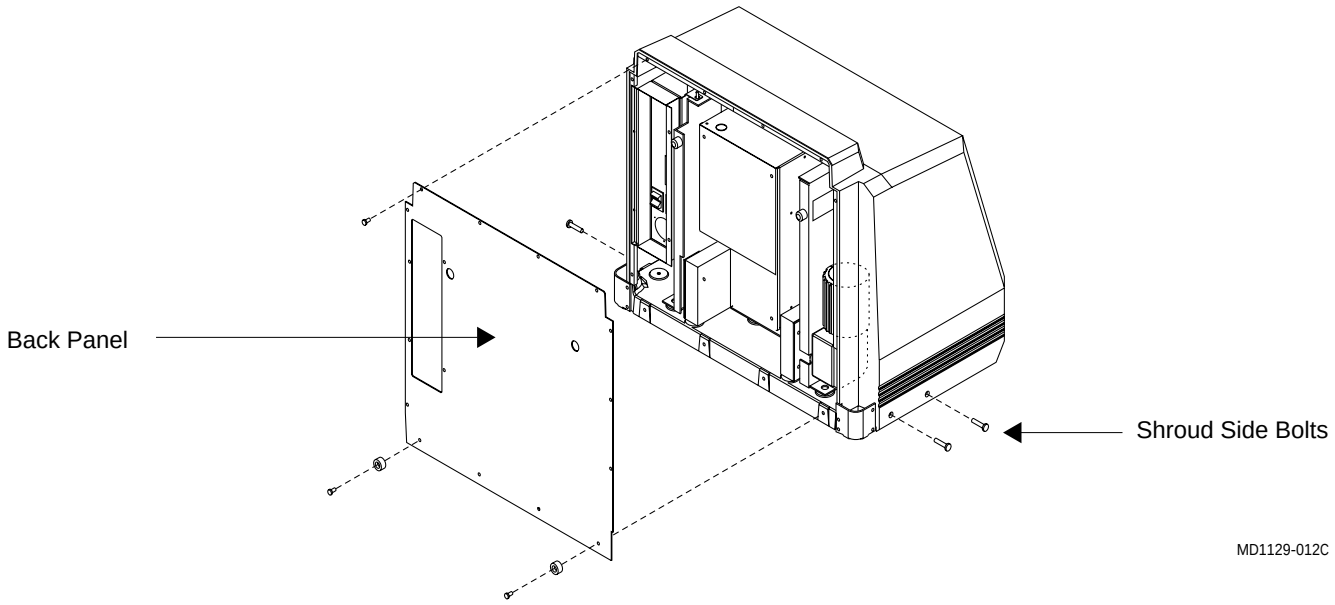
M15287-28B

Table 4-8. Visual Inspection List	
Area	Look for the following problems:
I/O Connectors and Cables	• Fraying or other damage.• Bent prongs or pins. • Cracked housing.• Loose screws in plugs.
Fuses	• Type and rating. Replace as necessary.
Interface Cables	• Excessive tension or wear.• Loose connection. • Strain reliefs out of place.
Circuit Boards	• Moisture, dust, or debris (top and bottom).• Loose or missing components. • Burn damage or smell of over-heated• Socketed components not firmly seated. components.• PCB not seated properly in edge connectors. • Solder problems: cracks, splashes on board, incomplete feed through, prior modifications or repairs.
Ground Wires/Wiring	• Loose wires or ground strap connections.• Faulty wiring. • Wires pinched or in vulnerable position.
Mounting Hardware	• Loose or missing screws or other hardware, especially fasteners used as connections to ground planes on PCBs.
Power Source	• Faulty wiring, especially AC outlet.• Circuit not dedicated to system. (Power source problems can cause static discharge, resetting problems, and noise.)

Shroud Removal

To remove the treadmill shroud for the internal visual inspection or for service:

- Disconnect the power cord from the rear connector panel.
- Remove the screws on the back panel of the shroud and remove the back panel.
- Remove the 2 bolts on each side of the shroud.
- Lift off the shroud from the front.



Parts Locations

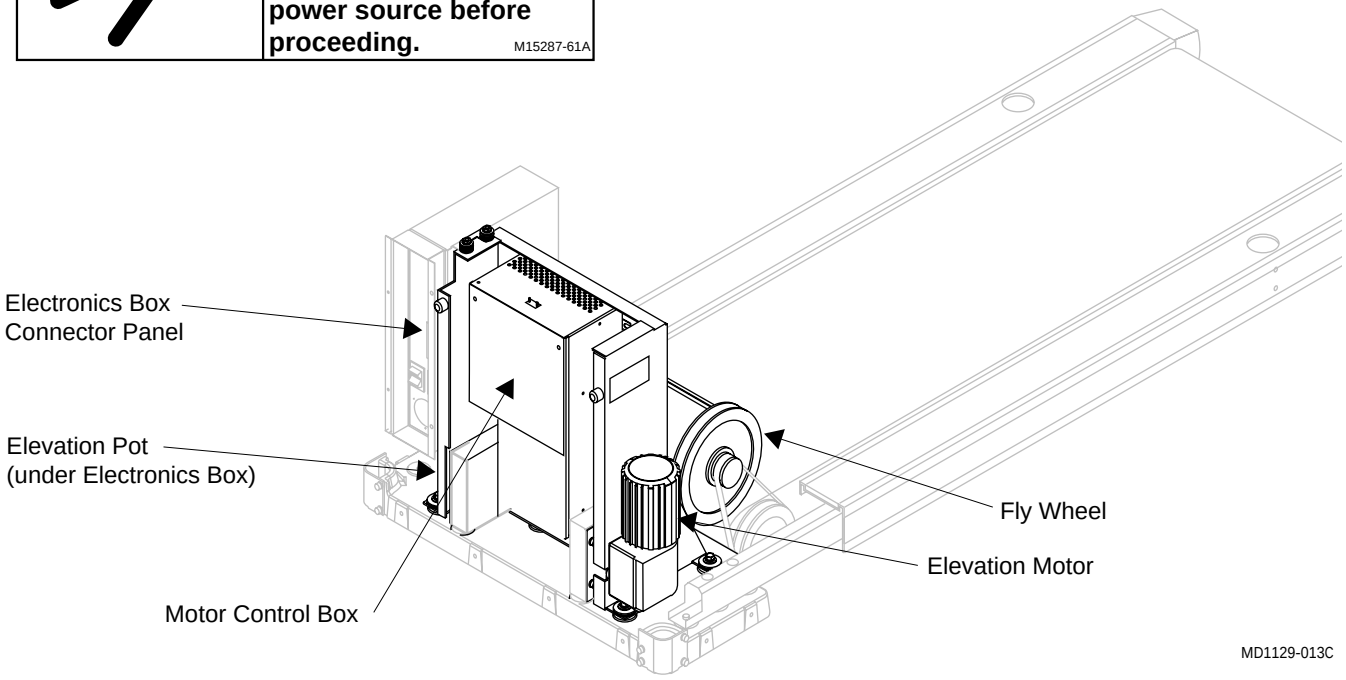
⚠WARNING

Electrical shock hazard between chassis ground and isolated (“floating”) ground when power is applied. Unplug unit from power source before proceeding.

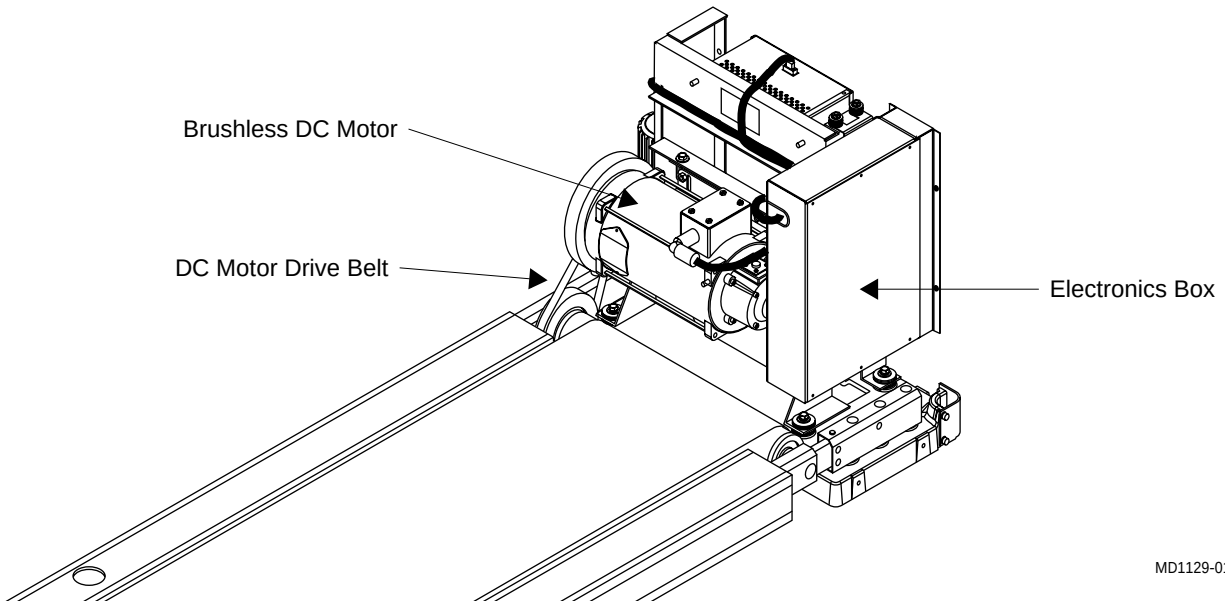
M15287-61A

chassis ground

isolated ground



MD1129-013C

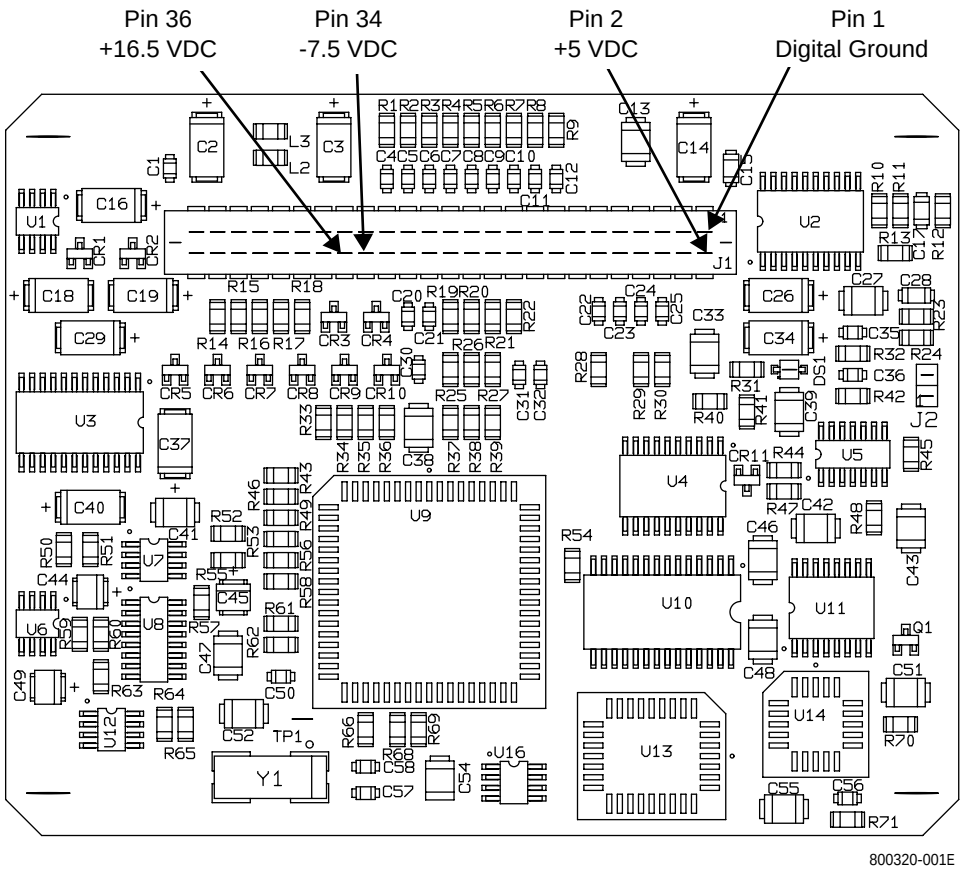


MD1129-014C

Power Supply Voltage Checks

With the power on, remove the side panel on the electronics box to measure the system's supply voltages as follows:

- On the control board, PN 800320-001, check the voltages on pins 2, 34, and 36 in reference to digital ground (see illustration). The control board is mounted on the power board.
- On the power board, PN 800334-002, check for +5 V-ISO across diode VR5.



Speaker Check

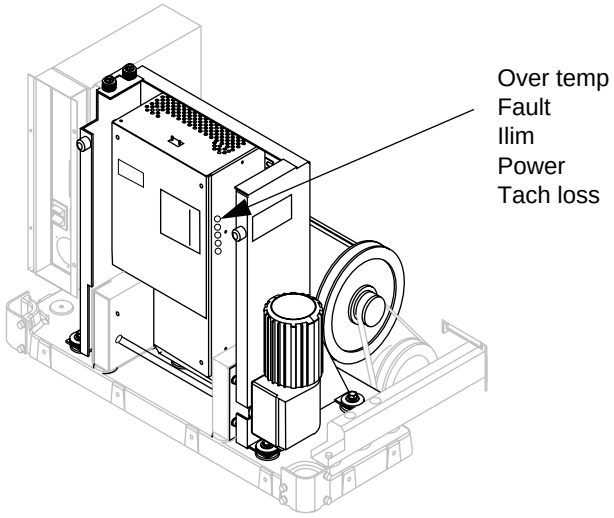
With the shroud removed, listen for the speaker output during power-up. There should be 2 short beeps to indicate "system OK".

Service Port

The self-diagnostic software is not available at this time.

Drive Control Fault LEDs

Use a hand-held mirror to view fault indicator LEDs.

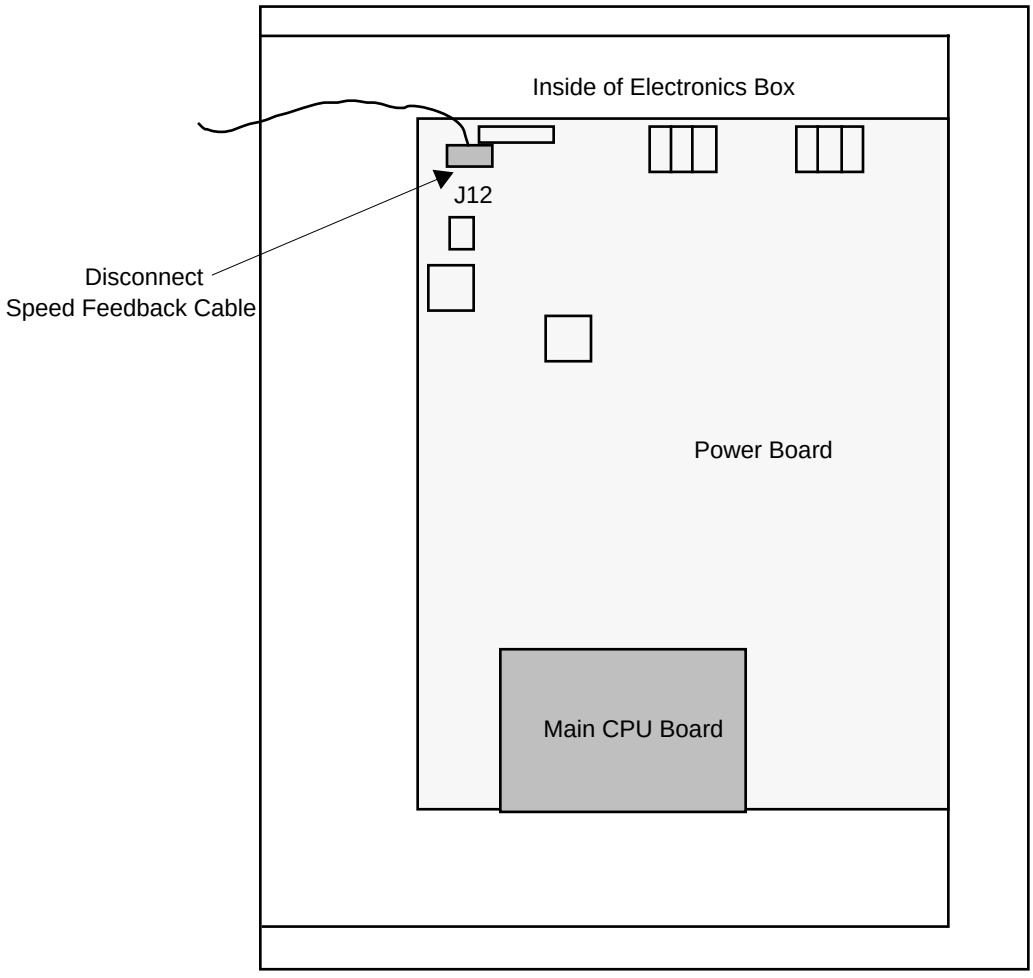


MD1129-023A

DC Motor Replacement

Replacement Instructions

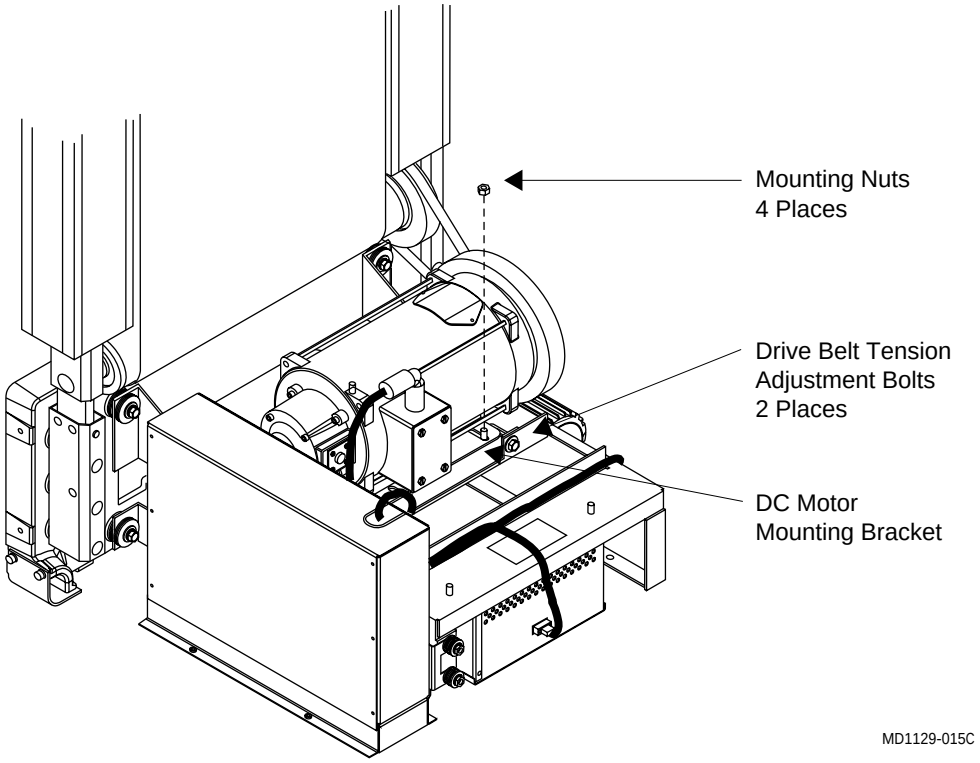
1. Turn the power switch off, disconnect the power cord from the wall outlet, and remove the shroud.
2. Unscrew the 6 screws on the electronics box side panel and remove the panel.
3. Disconnect the speed feedback cable from the power board, illustrated below.



MD1128-008C

4. Cut and remove all tie wraps on the speed feedback cable back to the motor.
5. Remove 4 screws from power cable access box on top of motor.
6. Cut but-splice connectors, unscrew ground strap, remove conduit lockdown nut. Remove conduit cable from access box.

7. Lift the treadmill up on end. This treadmill position offers the best access for replacing the DC motor.
8. Use a 1/2-inch wrench to remove the 4 nuts that hold the motor in place (2 each side).

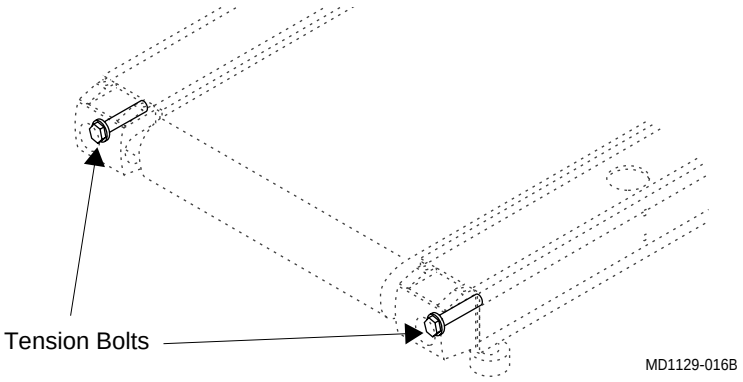


9. Remove the 2 drive belt tension adjustment bolts.
10. Remove the DC motor mounting bracket.
11. Swap motors and re-assemble in reverse order. Remember to replace the tie wraps.
12. Adjust the drive belt tension and tracking. See “Motor Drive Belt Replacement and Adjustments” in this chapter.
13. Activate the self-calibration feature as instructed in chapter 3, “Maintenance.”

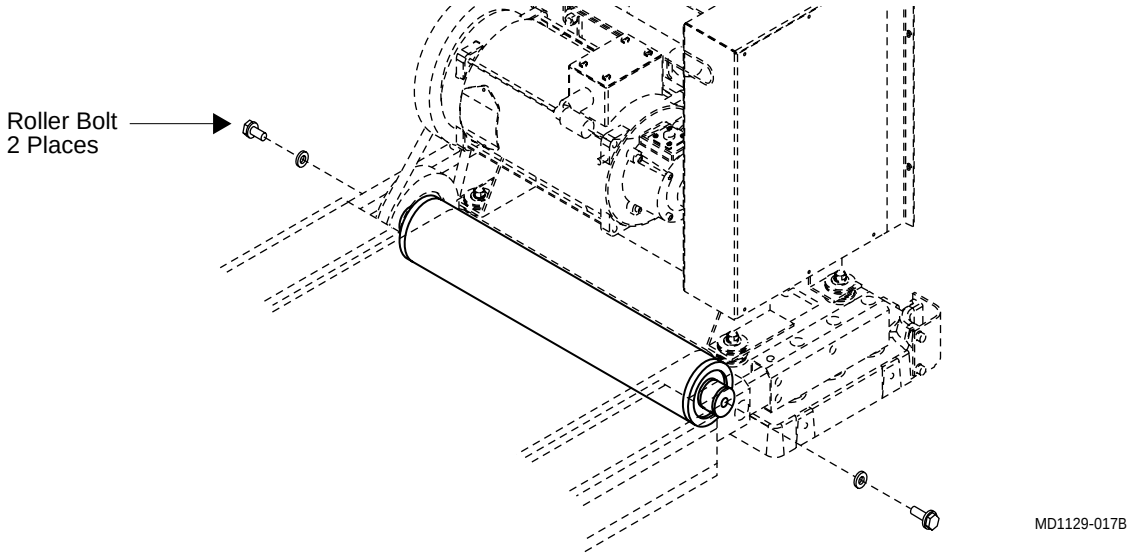
Front Roller Replacement

Replacement Instructions

1. Turn the power switch off, disconnect the power cord from the wall outlet, and remove the shroud.
2. Loosen the walking belt tension bolts on the end of the treadmill.



3. On the drive-belt side of the treadmill, locate the roller bolt access hole. Remove the 9/16-inch bolt (one of two that hold the roller in position).

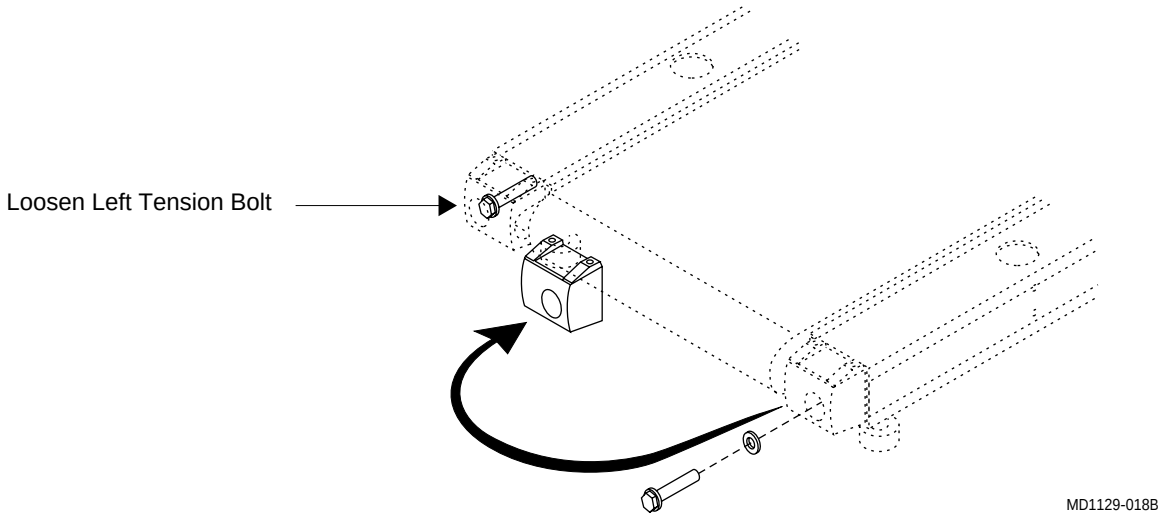


4. While supporting the free end of the roller, remove the 9/16-inch bolt on the opposite side of the treadmill.
5. Lift the roller up and slide it out of the belt.
6. Install the new roller in reverse order, then adjust the walking belt tension.
7. Activate the self-calibration feature as instructed in chapter 3, “Maintenance.”

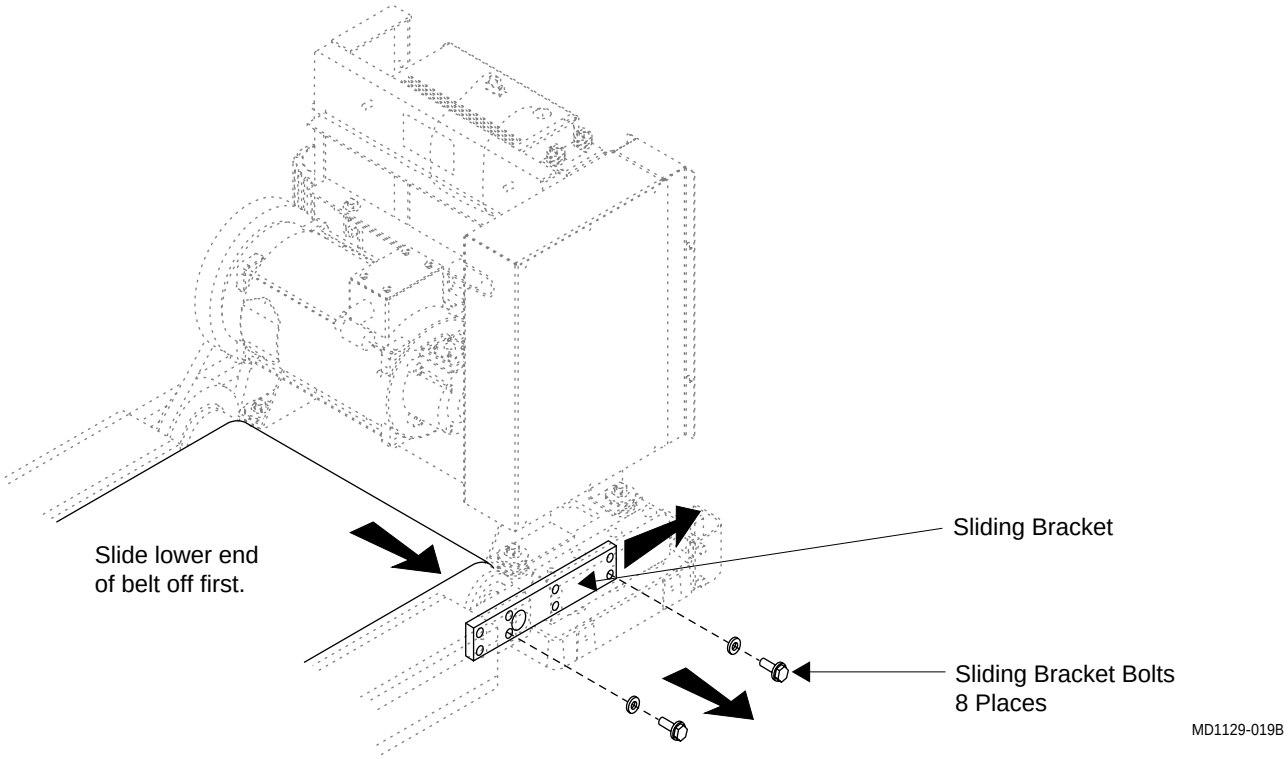
Walking Belt and Board Replacement

Walking Belt Replacement Instructions

1. Turn the power switch off, disconnect the power cord from the wall outlet, and remove the shroud. You do not have to remove the roller to replace the belt.
2. Remove the right end cap from the end of the treadmill and loosen the tension bolt on the left end cap.
3. Lift up the left side of the treadmill and place the end cap that you just removed under the left foot.



4. On the front right side of the treadmill, remove the eight, 1/2-inch bolts that hold the frame's sliding bracket in place.



5. Slide the bracket into the frame.
6. Slide the belt off the walking board, lower end first.
7. Replace the belt in reverse order.

> **NOTE**
>
> The wax material on the walking board acts as a lubricant for the belt. We recommend that you replace the board every time you put on a new belt to ensure the belt absorbs the required amount of lubricant.

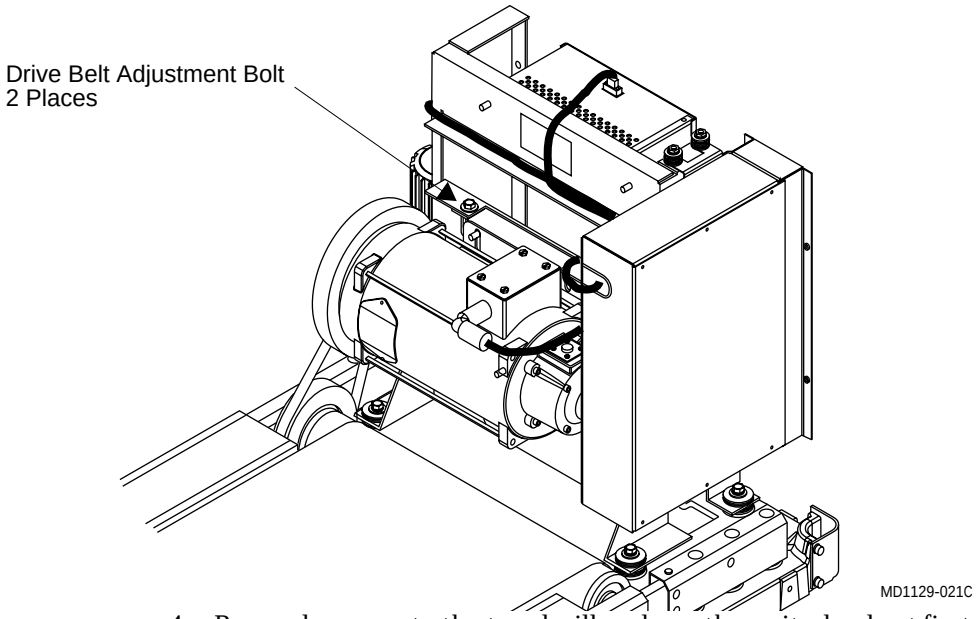
Walking Board Replacement Instructions

1. Remove the walking belt as instructed in the previous steps.
2. Remove the eight, 5/32-inch Allen-head, counter-sunk screws on from the top of the walking board. (There are no nuts on the underside of the board.)
3. Secure the new walking board to the bed assembly with the 8 screws.
4. Replace the walking belt and adjust the tension.
5. Activate the self-calibration feature as instructed in chapter 3, “Maintenance.”

Motor Drive Belt Replacement and Adjustments

Tension Adjustments

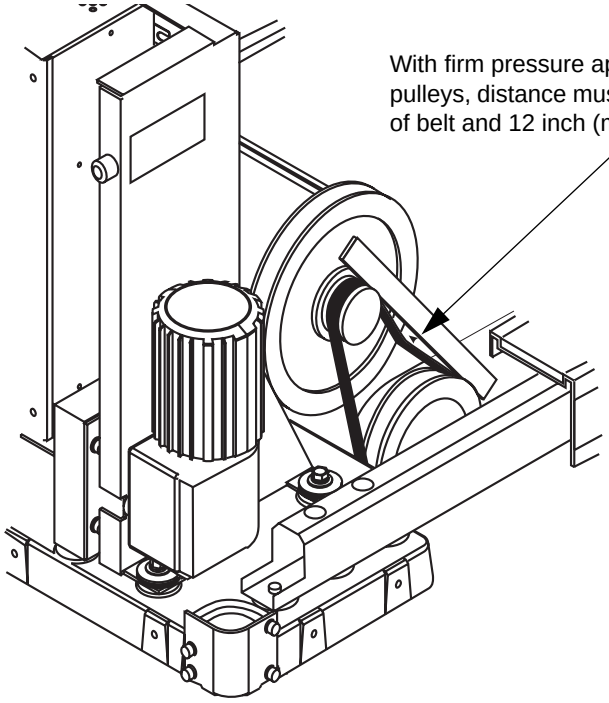
1. Turn the power switch off, disconnect the power cord from the wall outlet, and remove the shroud.
2. To replace the drive belt, first remove the front roller as instructed in this chapter under “Front Roller Replacement.” Slide the old belt off, put a new belt on the sprockets, and replace the front roller.
3. There are two belt-tension adjustment bolts above the DC motor. Tighten these 1/2-inch bolts to make a course adjustment to the drive belt tension (clockwise to tighten).



4. Re-apply power to the treadmill and run the unit, slowly at first, to check the belt tension and tracking.

5. Fine tune the belt tension with the adjustment bolts so that you can push in the belt approximately 1/2-inch on one side.

> **NOTE**
>
> Excessive tension will cause undue stress on the motor shaft.



6. Activate the self-calibration feature as instructed in chapter 3, “Maintenance.”

Tracking Adjustments

The motor is mounted at a very slight angle so that the belt meshes quietly with the sprockets. Because of this design, the belt will always track to one side of the top sprocket. However, you may have to make slight adjustments to the top sprocket’s 3/32-inch Allen screws to align the top sprocket with the lower sprocket so the belt tracks evenly on the lower sprocket.

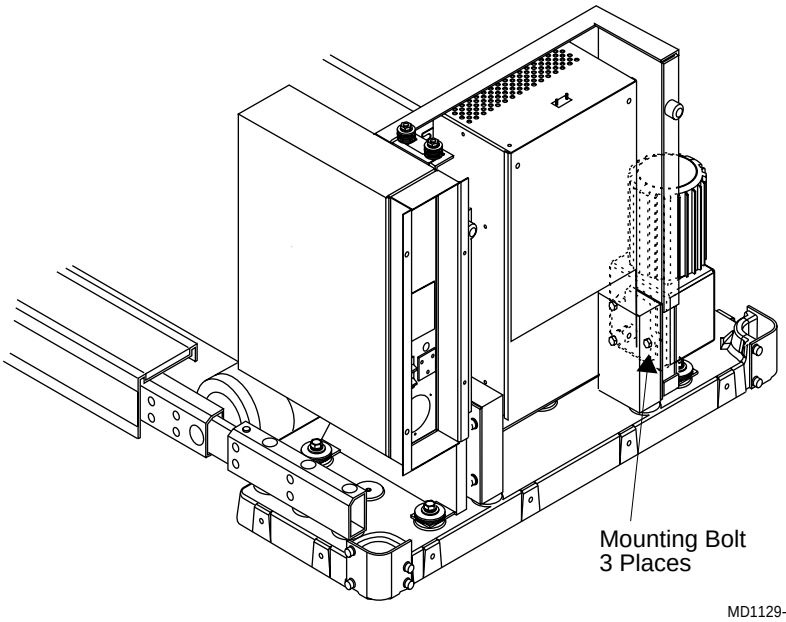
Elevation Motor Replacement

Replacement Instructions

1. Turn the power switch off, disconnect the power cord from the wall outlet, and remove the shroud.
2. Disconnect the elevation motor power cable and remove all tie wraps on the cable.
3. Place the treadmill on its side so the elevation motor is on top.

> **NOTE**
>
> The elevation motor supports the treadmill. To prevent the treadmill from falling, only replace the elevation motor with the treadmill on its side.

4. Remove the two visible mounting bolts on the elevation motor.

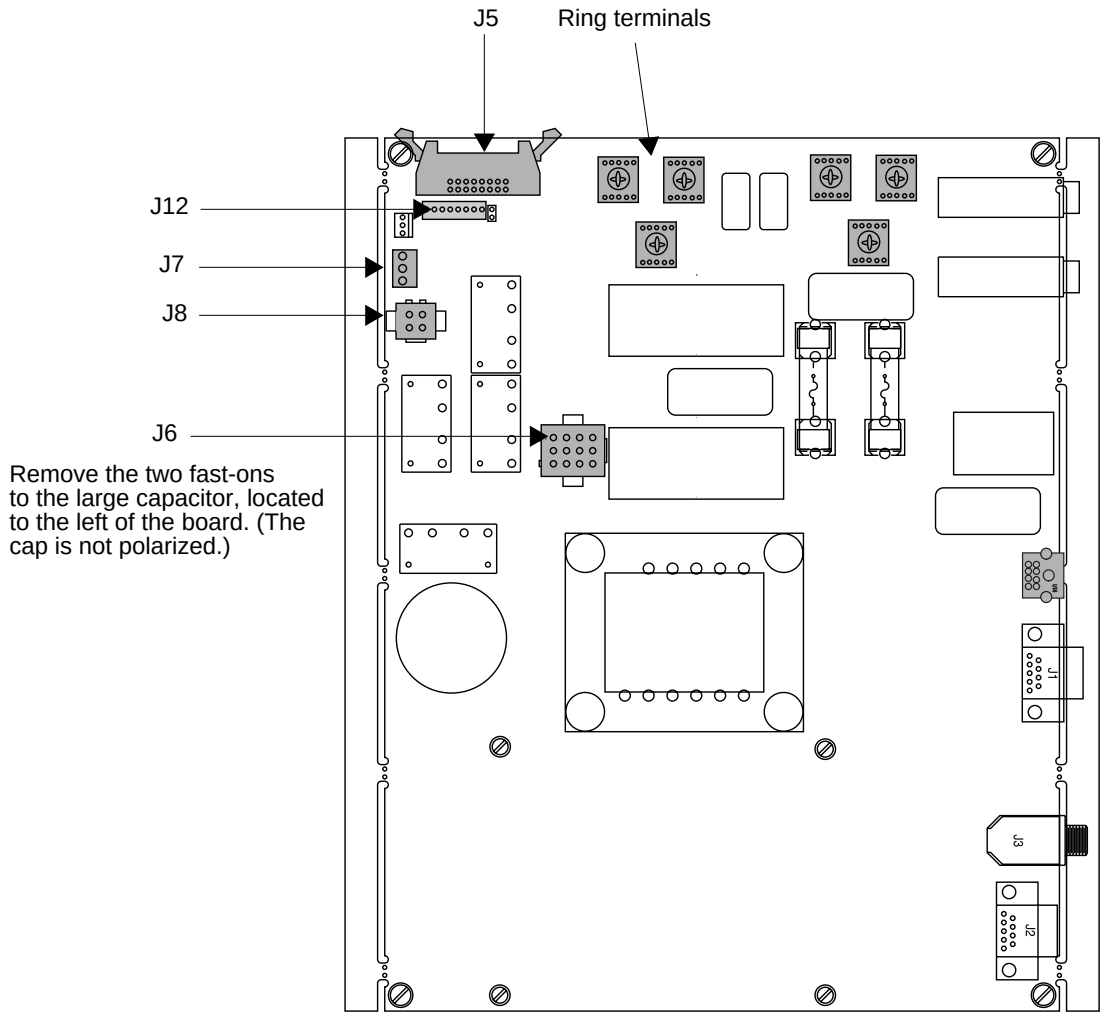


5. Remove the third mounting bolt behind the rubber coupling. If the treadmill stopped at 0% elevation, you may have to remove the wheel to reach the third mounting bolt.
6. Remove the elevation motor from its coupling and replace with a new motor in reverse order.
7. Replace the tie wraps and activate the self-calibration feature as instructed in chapter 3, “Maintenance.”

Electronics Box Replacement

Replacement Instructions

1. Turn the power switch off, disconnect the power cord from the wall outlet, and remove the shroud.
2. Unscrew the 6 screws on the electronics box side panel and remove the panel.
3. Disconnect the power ring terminals and communication connectors from the PCB, as illustrated, and the ground clip (E2) from the electronics box.

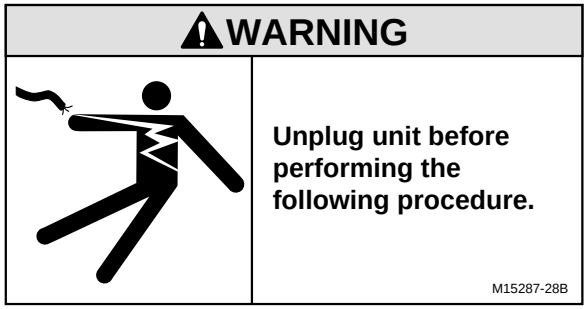


4. Remove the two, 3/8-inch nuts on both the top and bottom of the box.
5. Pull the electronics box out and replace it with a new box in reverse order.
6. Activate the self-calibration feature as instructed in chapter 3, “Maintenance.”

Drive Motor Control Box Replacement

Replacement Instructions

1. Turn the power switch off, disconnect the power cord from the wall outlet, and remove the shroud.
2. Unscrew 6 screws on the electronics box side panel and remove the panel.



3. Disconnect the L1 BLK, L2 BLK and GND ORG power ring terminals from the power pcb assembly.
4. Disconnect the communication cable from the top of the drive motor control box.
5. Remove the 4 screws from power cable access box on top of motor.
6. Cut butt-splice connectors, unscrew ground strap, remove conduit lock down nut. Remove conduit cable from access box
7. Remove the 2 mounting nuts on top of the motor control box and the 2 mounting nuts on the bottom of the box.
8. Pull the motor control box out and replace it with a new box in reverse order.
9. Activate the self-calibration feature as instructed in chapter 3, “Maintenance.”

5A Parts Lists and Drawings for Configuration without CE

Ordering Parts

Introduction

This chapter contains the current parts lists, drawings, some schematics, and any kits for the standard treadmill configurations available at the time of the manual release date. The upper-level parts list appears first, followed by the assembly parts. The upper-level parts list specifies all the items that ship with the equipment such as upgrade kits, software disks, power cords, and manuals.

These parts lists and drawings supply enough detail for you to order parts for the assemblies considered field serviceable. See chapter 6 for component-level drawings and part numbers. To order parts, contact Service Parts at the address or telephone number on the page, “How to Reach Us...,” provided at the beginning of the manual.

Field Replaceable Units For Product CodeY5 (non-CE)

The following items may not be assigned separate manufacturing part numbers because they are normally part of a larger assembly. Since they are considered field replaceable units (FRUs), they have specific service part numbers so they can be ordered and replaced by service technicians

> **NOTE**
>
> Verify part numbers before ordering service parts. See the tech memo series for this product for changes or additions to this list.

Table 5A-1. Field Replaceable Units

Item	Part Number
WALKING BELT	3602-006
WALKING BOARD	56944-009
DRIVE BELT	408913-001
DRIVE MOTOR 3.0 H.P.	408893-002
DRIVE MOTOR CONTROLLER	408891-002
ELEVATION MOTOR	408890-001
POWER PCB	800334-002
CONTROL PCB	800320-001

Upper-Level Assembly Rev R

Item	Description	Part Number	Qty
1	2000 TRDML W/FULL HNDL DOM	900444-001	1
2	2000 TRDML W/FULL HNDL INTL	900444-002	1
3	2000 TRDML W/EMI FULL HNDL DOM	900444-003	1
4	2000 TRDML W/EMI FULL HNDL INT	900444-004	1
5	CABLE TRDML/CASE INTCON	80690-001	1
7	MTC-1 REHAB/STRESS MPH T2000	9563-501	1
8	MTC-1 REHAB/STRESS KPH T2000	9563-502	1
9	MTC-1 EXER MPH T2000	9563-503	1
10	MTC-1 EXER KPH T2000	9563-504	1
11	MTC-I FIELD SERVICE CE	407143-003	1
12	T2000 FIELD SERVICE	409110-004	1
23	CAB 8P MINI DIN 20FT	400073-001	1
25	REWORK 2000 TRDML, W/FULL HNDL	900444-001R	1
26	REWORK 2000 TRDML W/FULL HNDL	900444-002R	1
27	REWORK T2000 EMI FULL HNDL DOM	900444-003R	1
28	REWORK 2000 TRDML W/EMI FH INT	900444-004R	1
39	REWORK MTC-1 REHAP/STRESS MPH	9563-501R	1
40	RWK MTC-1 REHAB/STRESS KPH	9563-502R	1
41	REWORK MTC-1 EXER MPH T2000	9563-503R	1
42	RWK MTC-1 EXER KPH T2000	9563-504R	1
43	CABLE TREADMILL TO STRESS SYS	700609-001	1

Full Handrail Kit 900433-001G

Item	Description	Part Number	Qty
1	SOCKET ALLEN 3/16 HEX	400056-001	1
2	HANDLE-T	400093-001	1
3	SCREW SKT 1/4-20 X 3/4	407236-001	2
4	SCREW SKT 1/4-20 X 1.63	407236-002	2
10	BOX MAILER 11.75L 11.00W 2.88H	9924-101	2
11	KIT TEE HANDLE LH-RH	408912-003	2
13	NUT ESNA 1/4-20	4521-311	4
19	KIT HANDRAIL FULL-PACKAGING	412562-001	1

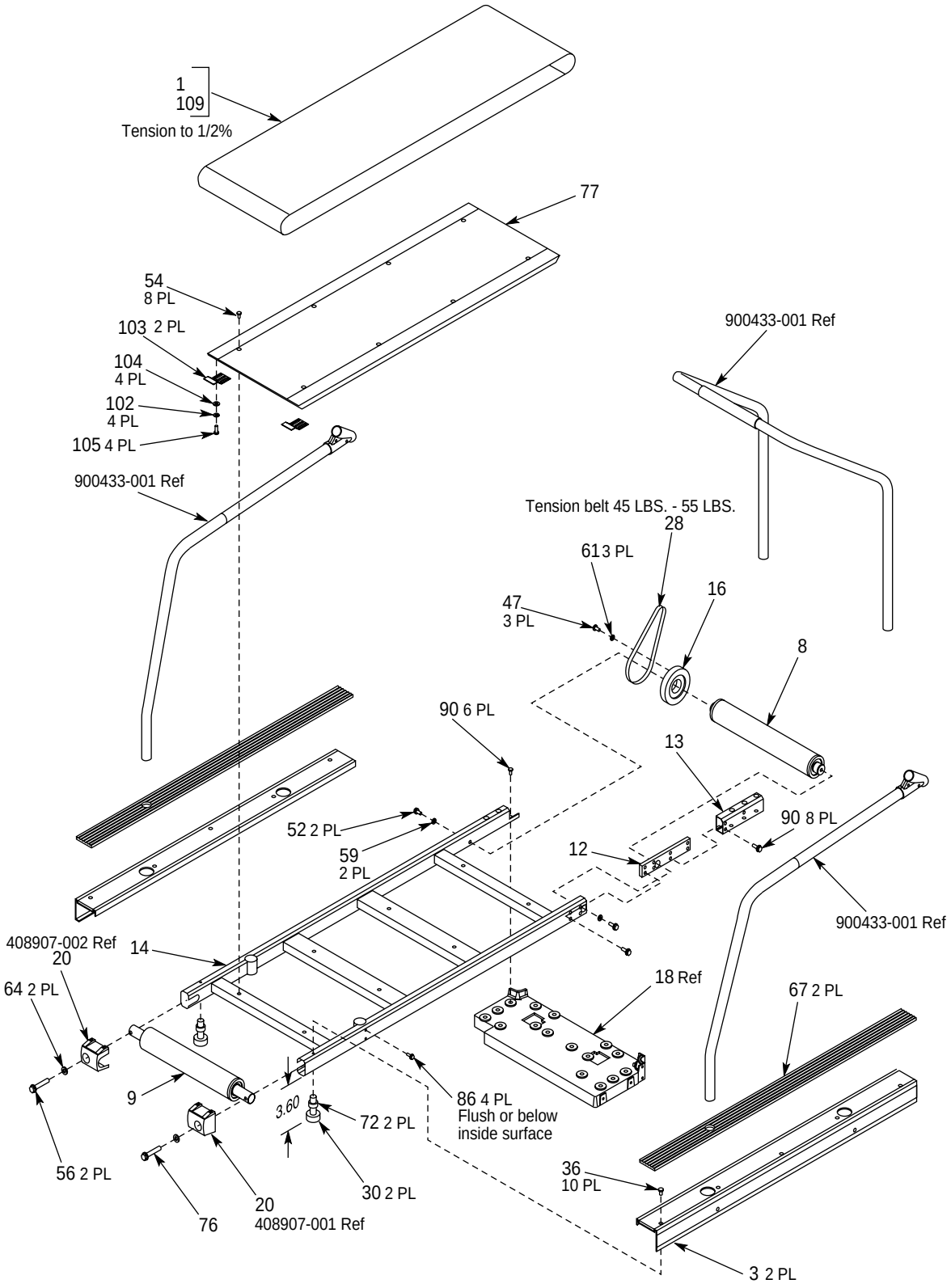
Treadmill Assembly 900367-001T

Item	Description	Part Number	Qty
1	BELT WALKING 1800/1900/2000	3602-006	1
2	SCREW SKT 1/4-20 X 1.00L	407236-003	8
3	EXTRUSION SIDE RAIL T2000	413690-001	2
4	MOTOR ELEVATION 185-265V .13HP	408890-001	1
6	MOTOR 3HP 4000 RPM DC-QUIET	408893-002	1
7	CLAMP HANDRAIL TERM TO BASE	408894-001	2
8	ROLLER ASSEMBLY FRONT	408895-001	1
9	ROLLER ASSEMBLY REAR	408896-001	1
10	RACK STL 10P 14.5 DEG PRESS	408897-001	1
11	GEAR PINION 11T 10P	408898-001	2
12	BRACKET HEAD TO FRAME	408899-001	1
13	SUPPORT FRAME TO CASTING	408900-001	1
14	WELD FRAME TREADMILL T2000	413689-001	1
15	SPROCKET 25T 5MM P .62 BORE	408902-001	1
16	SPROCKET 90T 5MM P	408903-001	1
17	FLYWHEEL 8.00DIA X 1.00W	408904-001	1
18	BASE HEAD CASTING	408905-001	1
19	TOWER FABRICATION	408906-002	1
20	KIT END CAP LH-RH	408907-003	1
21	ELEVATION BLOCK RH	408908-001	1
22	ELEVATION BLOCK LH	408908-002	1
23	SHROUD TMILL-2000	408909-001	1
24	ENDPLATE ELEVATION BLOCK	408910-001	1
25	ENDPLATE SW MTG ELEVATION BL	408910-002	1
26	SPACER DELRIN TWR MNT	408911-001	12
27	SPACER DELRIN EBOX MNT	408911-002	8
28	BELT DRIVE 5MM P 20MM W	408913-001	1
29	BSHG 1.0 OD X .625 ID X .50 W	408914-001	2
30	FOOT FRAME	408915-001	2
31	FOOT HEAD	408915-002	2
32	PIN DOWEL .2502D X 1.000L	408916-001	2
33	SW LEVER SPST NO 3A 250VAC	408918-001	2
34	LABEL BLANK 2 X 3/4	404525-001	1
35	KEY WOODRUFF 3/16 X 5/8	408920-001	2
36	SCR TRILOBE PH FLTHD #10X.50	408921-001	10
37	TUBE TYGON 3/16ID X 5/16OD	408922-001	0.06
38	REAR PANEL TREADMILL 2000	408924-001	1
39	SHAFT ELEVATION	408925-001	1
40	COUPLING ISOLATION ELE MTR	408926-101	1

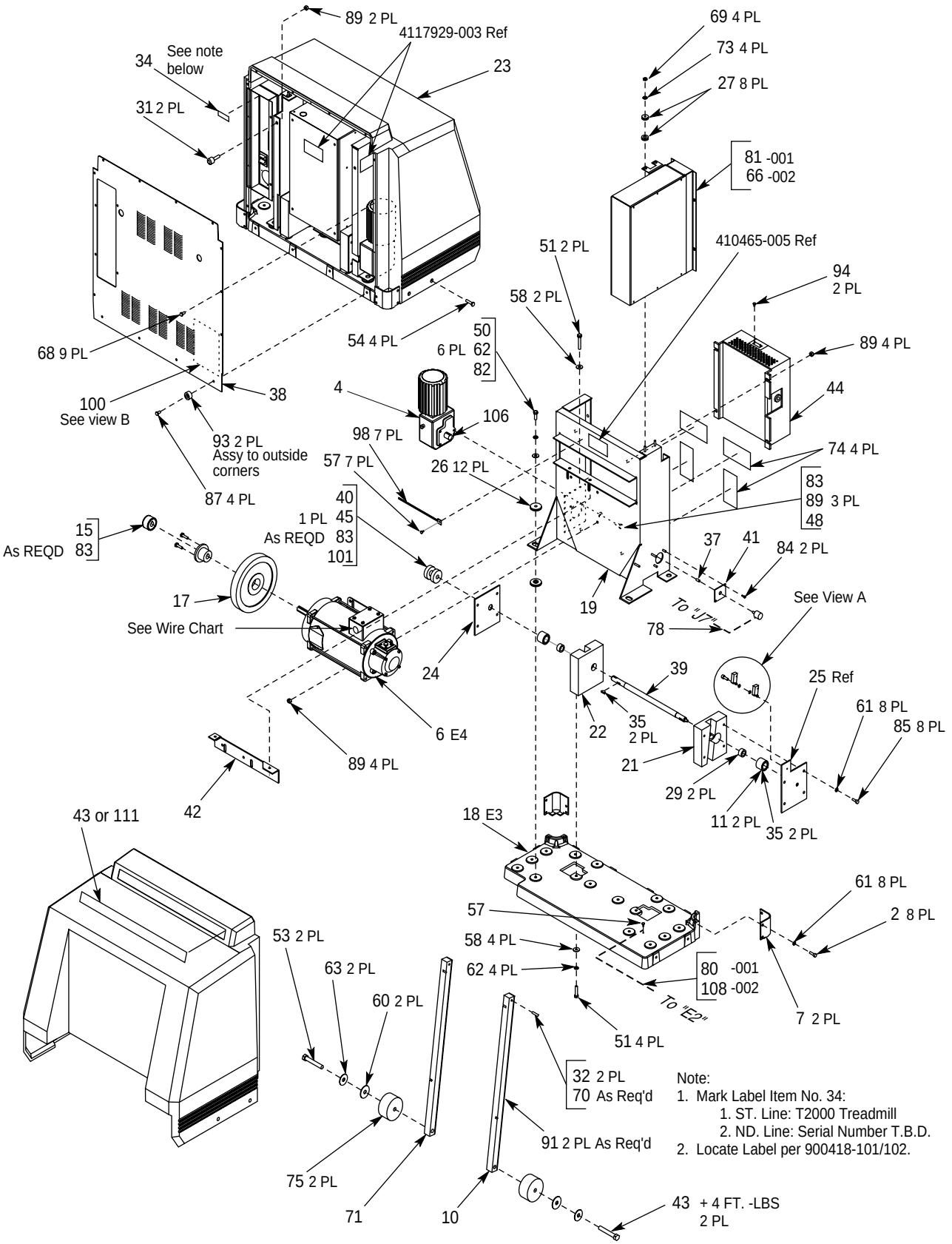
Item	Description	Part Number	Qty
41	PANEL POT ISO FROM TOWER	408929-001	1
42	BRKT DRIVE MTR MOUNTING	408931-001	1
43	LABEL 2000T SHROUD	410465-001	1
44	CONTROL BOX DRIVE MOTOR CE MRK	408891-002	1
45	KEY 3/16 X 3/16 X 7/16	410625-001	1
47	SCREW GR8 1/4-20 X .88	45002-114	3
48	STUD FULL THREAD GR	411746-001	3
50	SCREW HX G8 5/16X1.5	45002-224	6
51	SCR HEX HD 5/16-18 X 2.00	45002-549	2
52	SCREW GR 8 3/8-16 X 3/4LONG	45002-312	2
53	SCREW GR8 1/2-13X 3	45002-548	2
54	SCREW SKT 82FLH 1/4-20X1.25BLK	45019-120	12
55	SCREW PH 4-40X 1 1/4L	4502-440	2
56	SCREW HEX HD 3/8-16X3.50L BLK	45027-362	2
57	SCREW SELF TAPPING 8-32X.32	45070-612	8
58	WASHER FLAT STL 5/16	45076-012	6
59	WASHER SPLIT BLACK .375 I.D.	45090-001	2
60	WASHER FLAT STL 1/2	45076-015	2
61	WASHER LK SR STL 1/4	45076-111	19
62	WASHER LK SR STL5/16	45076-112	10
63	WASHER LK SR STL 1/2	45076-115	2
64	WASHER FLAT HDN 3/8	45076-213	2
65	WASHER FLAT SS #4	4520-004	4
67	TREAD RUBBER W/HOLE	408888-001	2
68	SCREW PH GREY W/WSHR 8-32X.38L	45021-806	13
69	NUT HEX ESNA 10-24	4521-310	4
70	ADHESIVE,BLACK MAX	4851-058	0.01
71	RACK STL 10P 14.5DEG W/O NOTCH	408897-002	1
72	NUT JAM 3/4-10 UNC	4546-003	2
73	WASHER BELLEVILLE .56X.19X.028	4550-031	4
74	DAMPENER SOUND 3.00LG TRDML	58520-003	4
75	WHEEL 3.25OD	4704-001	2
76	GREASE LUBRIPLATE	4850-017	0.01
77	BOARD WALKING W/WAX	56944-009	1
78	HARN ELEV POT TO PCB P7	700337-001	1
79	HARN ELEV LIMIT SW TO PCB P8	700338-002	1
80	WIRE 14GA GN/Y 8IN LONG	80306-075	1
81	ASSY ELEC BOX W/O EMI/RFI	900418-101	1
82	WSHR FL STL.321IDX1.06ODX.105	45053-002	6
83	CEMENT LOCTITE 242	4851-003	0.01
84	SCREW SEMS PH 6-32X1/2	45000-608	2
85	SCREW GRB 1/4-20 X .62	45002-110	8

Item	Description	Part Number	Qty
86	1/4-20X5/8 SKTCAP SCREW W/NYL	45023-212	4
87	SCREW SEMS PH 1/4-20 .625L	45000-710	4
88	HARN EBOX TO CNTRLR RBN 16 PIN	700337-002	1
89	NUT 5/16-18 FLANGED LOCKING	410686-001	13
90	SCREW HEX 5/16-18 FLANGED LK	410686-002	14
91	GREASE SYNTHETIC WITH TEFLON	410748-001	0.06
93	BUMPER PLASTIC 1.00 OD	410746-001	2
94	SCREW SEMS PH PHIL 4-40 X.312L	45000-405	2
95	SPLICE CE 22-14	4533-201	1
96	SPLICE CE 16-10	4533-202	3
97	TERMINAL INS RING#10	4531-410	1
98	CABLE CLAMP 7.43LG X .187W	4535-102	7
99	CODE T2000 V001E	410114-003	0
100	DAMPENER SOUND 5.00 X 7.00	58520-004	1
101	SCREW SET CPP 8-32X1/4	4518-808	2
102	WASHER LOCK SPLIT #10	4520-910	4
103	SHIELD PINCH POINT 2000	57071-007	2
104	WASHER FLAT SS #10	4520-010	4
105	SCREW PH WOOD #10 X .62L	408714-003	4
106	ADHESIVE LOCKTITE 262	4851-069	0.10
112	LABEL UL CLASSIFIED	408230-009	1
113	LABEL UL CLASSIFIED CANADA	408230-010	1

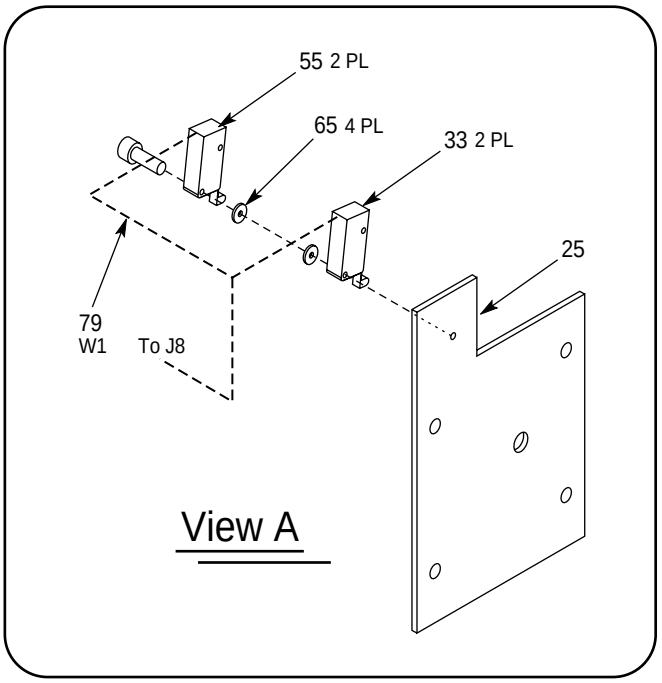
1 of 4

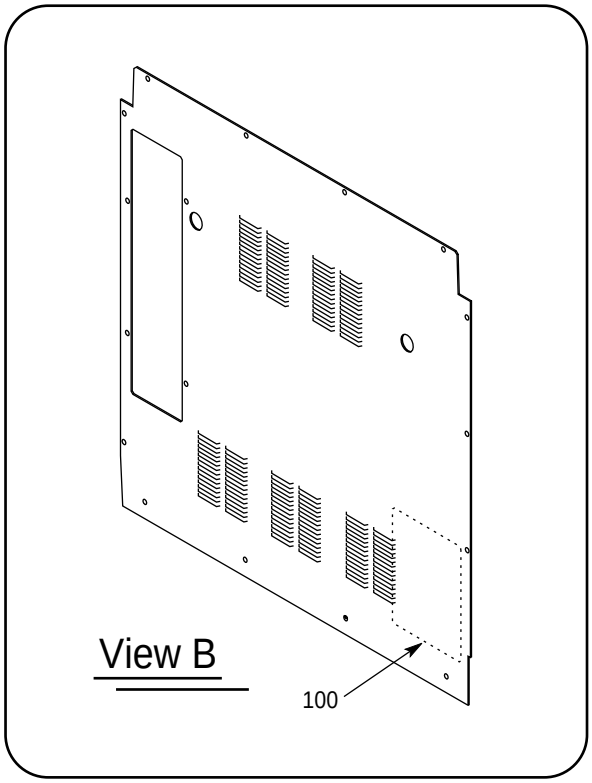

1
109
Tension to 1/2%
77
54
8 PL
103 2 PL
104
4 PL
102
4 PL
105 4 PL
900433-001 Ref
900433-001 Ref
Tension belt 45 LBS. - 55 LBS.
28
61 3 PL
47
3 PL
16
8
90 6 PL
13
52 2 PL
59
2 PL
12
90 8 PL
900433-001 Ref
408907-002 Ref
14
20
64 2 PL
18 Ref
67 2 PL
9
3.60
72 2 PL
86 4 PL
Flush or below
inside surface
56 2 PL
76
20
408907-001 Ref
30 2 PL
36
10 PL
3 2 PL

2 of 4


89 2 PL
4117929-003 Ref
34 See note below
23
31 2 PL
69 4 PL
73 4 PL
27 8 PL
81 -001
66 -002
410465-005 Ref
51 2 PL
58 2 PL
94 2 PL
54 4 PL
50
6 PL 62
82
89 4 PL
68 9 PL
4
106
44
100 See view B
38
98 7 PL
74 4 PL
93 2 PL Assy to outside corners
57 7 PL
26 12 PL
83
89 3 PL
48
87 4 PL
40
1 PL 45
As REQD 83
101
37
41
84 2 PL
15
As REQD 83
19
TO "J1"
See View A
17
78
See Wire Chart
24
39
25 Ref
61 8 PL
85 8 PL
22
35 2 PL
6 E4
21
89 4 PL
29 2 PL
42
11 2 PL
35 2 PL
43 or 111
18 E3
61 8 PL
57
2 8 PL
53 2 PL
58 4 PL
63 2 PL
62 4 PL
80 -001
108 -002
60 2 PL
TO "E2"
7 2 PL
51 4 PL
32 2 PL
70 As Req'd
Note:
1. Mark Label Item No. 34:
1. ST. Line: T2000 Treadmill
2. ND. Line: Serial Number T.B.D.
2. Locate Label per 900418-101/102.
91 2 PL As Req'd
75 2 PL
71
10
43 + 4 FT. -LBS 2 PL

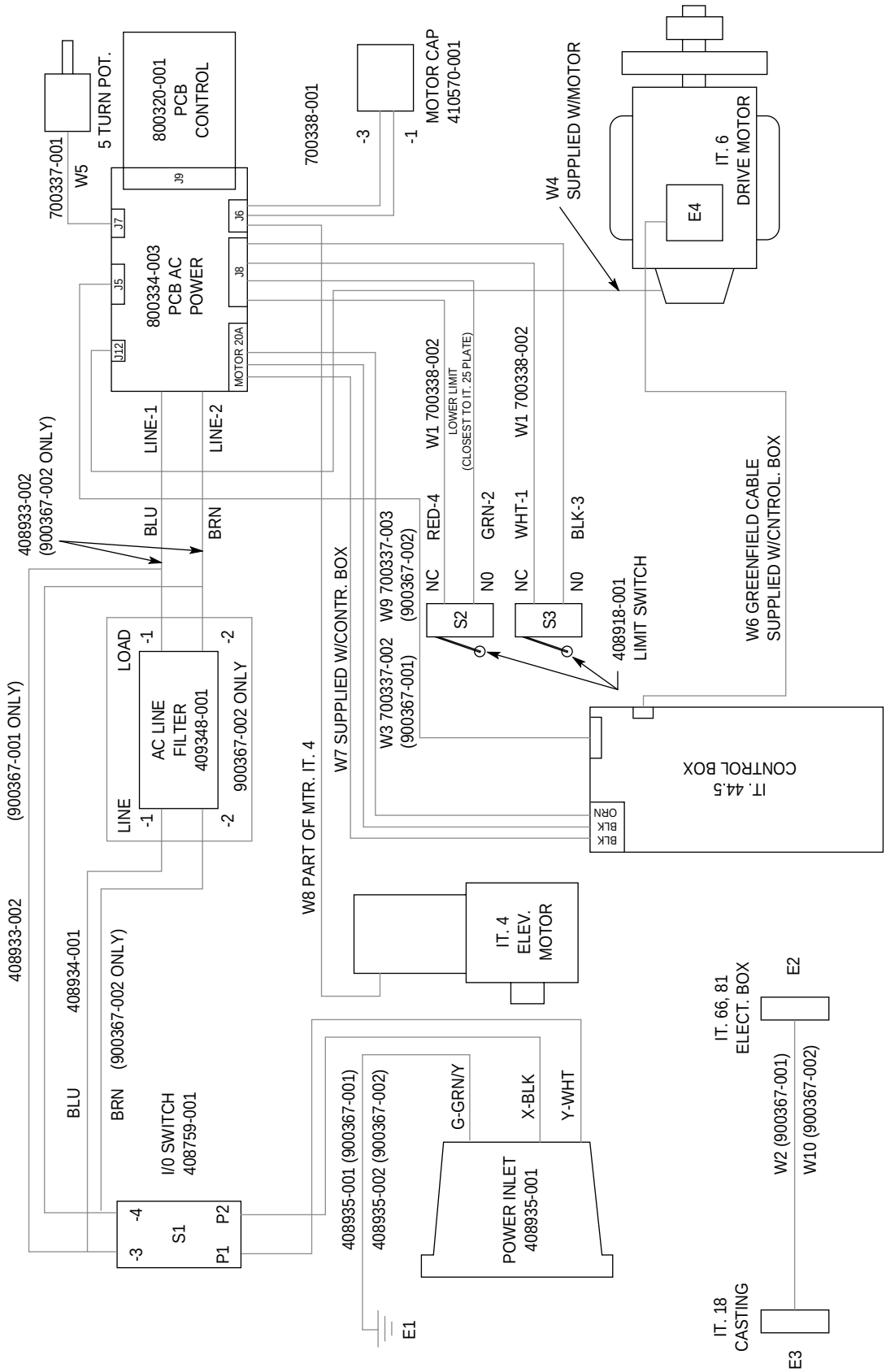
3 of 4





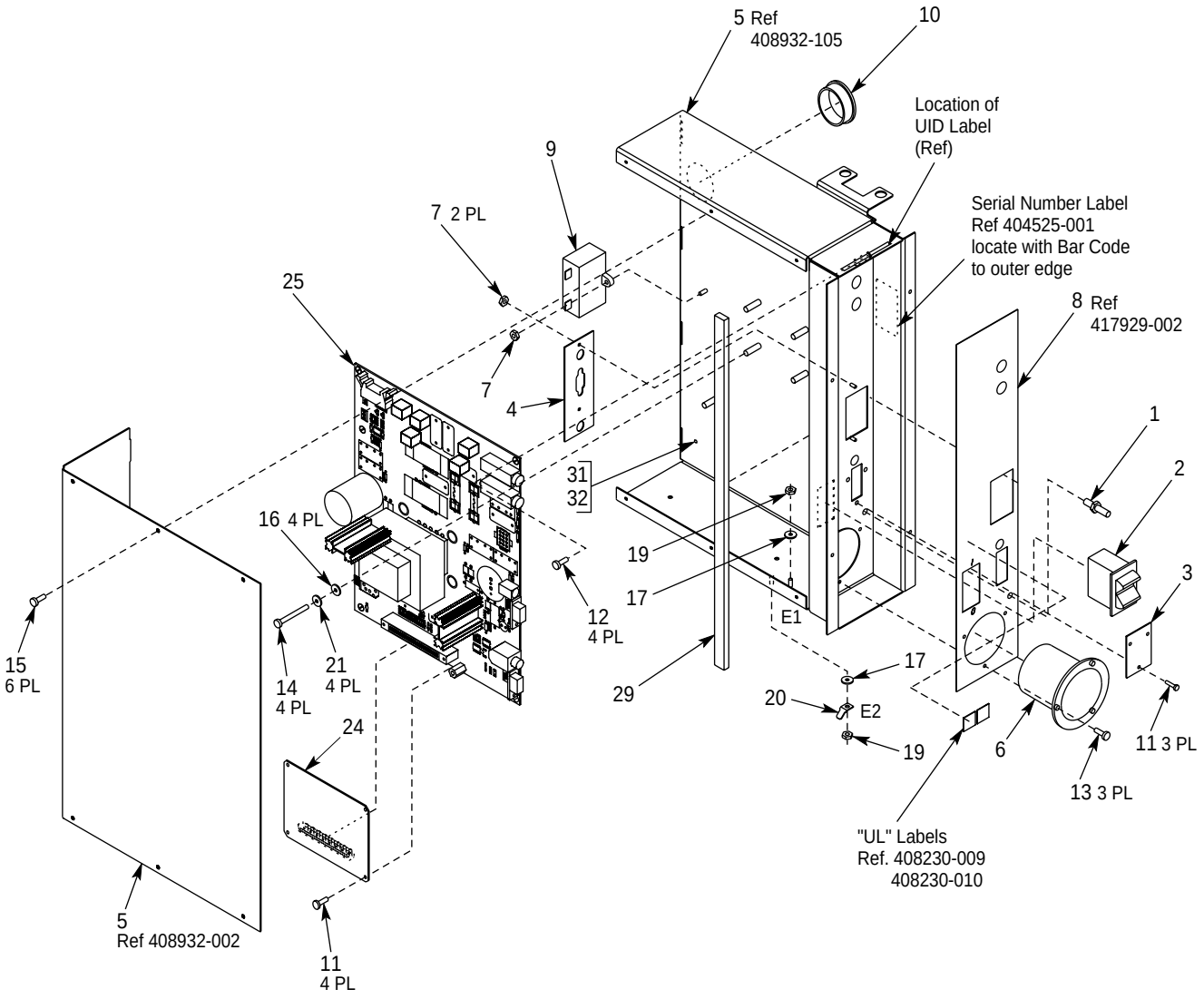
Lead Ident.	ITEM NO.	From		To	
		Circuit Point	ITEM NO.	Circuit Point	ITEM NO.
W5	78	– – –	78	J7	81, 66
W1	79	S2, S3	33	J8	81, 66
W2	80	E2	81	E3	18
W3	88	J5	81	J10	5
W4	6	MOTOR	6	J12	81, 66
W6-1	44	CNTRL-1	96	MOTOR-1	6
W6-2	44	CNTRL-2	96	MOTOR-2	6
W6-3	44	CNTRL-3	96	MOTOR-3	6
W6-4	6	CNTRL-BLU	95	CNTRL-BLU	6
W6-5	44	CNTRL-GND	97	E4	6
W7-1	44	BLK-L1	44	L1-MTR 20A	81, 66
W7-2	44	BLK-L2	44	L2-MTR 20A	81, 66
W7-3	44	ORG-GND	44	GND	81, 66
W8	4	MOTOR	4	J6	81, 66
W9	107	J5	66	J10	44
W10	108	E2	66	E3	18

4 of 4


700337-001
W5
5 TURN POT.
800320-001
PCB
CONTROL
J9
700338-001
-3
-1
MOTOR CAP
410570-001
W4
SUPPLIED W/MOTOR
IT. 6
DRIVE MOTOR
E4
J7
J6
J5
J8
J12
MOTOR 20A
800334-003
PCB AC
POWER
LINE-1
LINE-2
408933-002
(900367-002 ONLY)
BLU
BRN
W1 700338-002
LOWER LIMIT
(CLOSEST TO IT. 25 PLATE)
RED-4
GRN-2
WHT-1
BLK-3
NC
NO
NC
NO
S2
S3
W9 700337-003
(900367-002)
W3 700337-002
(900367-001)
408918-001
LIMIT SWITCH
W6 GREENFIELD CABLE
SUPPLIED W/CNTROL. BOX
(900367-001 ONLY)
LOAD
LINE
-1
-2
AC LINE
FILTER
409348-001
900367-002 ONLY
W7 SUPPLIED W/CONTR. BOX
W8 PART OF MTR. IT. 4
IT. 44.5
CONTROL BOX
BLK
BLK
ORN
408933-002
408934-001
(900367-002 ONLY)
BLU
BRN
I/O SWITCH
408759-001
S1
-3
-4
P1
P2
IT. 4
ELEV.
MOTOR
408935-001 (900367-001)
408935-002 (900367-002)
G-GRN/Y
X-BLK
Y-WHT
POWER INLET
408935-001
E1
IT. 66, 81
ELECT. BOX
E2
W2 (900367-001)
W10 (900367-002)
IT. 18
CASTING
E3

Electronics Box Assembly 900418-101B

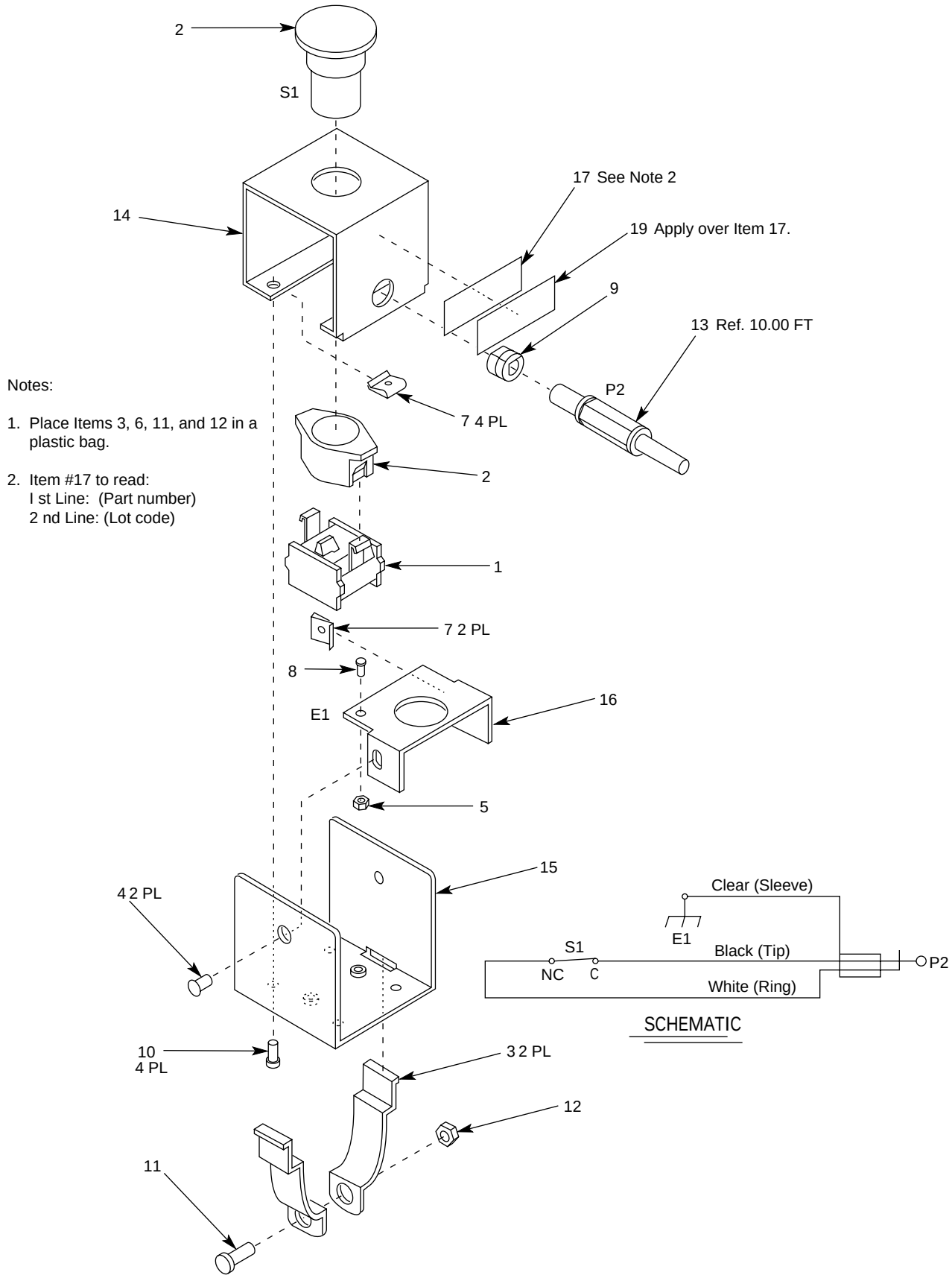
Item	Description	Part Number	Qty
1	PLUG MC EQUIPOTENTIAL	400040-001	1
2	SWITCH CKT BRKR 240V 20A	408759-001	1
3	PANEL SVC ACCESS TMILL-2000	408927-001	1
4	PANEL RFI/EMI SHIELD 9-PIN D	408928-101	1
5	KIT ELECTRONICS BOX	408932-106	1
6	HARN PWR INPUT OUTLET-FILTER	408935-001	1
7	NUT ESNA 4-40	4521-304	3
8	LABEL SET 2000T ELECTRNCS BOX	417929-001	1
9	CAP MOTOR 10UF 10% 250VAC	410570-001	1
10	GROMMET SNAP-IN 1.31 ID	410666-001	1
11	SCREW SEMS PH 4-40 X 1/4	45000-404	7
12	SCREW SEMS PH 6-32X1/2	45000-608	4
13	SCREW SEMS PH 8-32 X .50L	45000-808	3
14	SCREW PH 6-32X 2 1/2L	4502-680	4
15	SCREW TT PH 6-32X1/4	45040-604	6
16	WASHER FLAT SS #6	4520-006	4
17	WASHER LOCK EXTT #6	4520-306	2
19	NUT HEX KEPS 6-32	4521-706	2
20	TERMINAL FASTON .250M 45 BLADE	4534-901	1
21	WASHER LOCK INTT #6	4520-206	4
24	PCB 2000 TRDML CONTROLLER	800320-001	1
25	PCB T2000 PWR EMI RS232	800334-003	1
26	CLAMP CORD MEDIUM	4528-006	3
27	HARN SWITCH TO PCB/FLTR W/RING	408933-002	1
28	HARN ELEV CAP PCB P6 PIN 1/3	700338-001	1
29	TAPE FOAM URETHANE 1/4X1/2W	4819-016	1.33
31	SCREW SELF TAPPING 8-32X.32	45070-612	1
32	CABLE CLAMP 7.43LG X .187W	4535-102	1



Lead Ident	Item No	From		To	
		Circuit Point	Item No	Circuit Point	Item No
W1-1	6	X-BLK	6	S1-P2 BLK	2
W1-2	6	Y-WHT	6	S1-P1 WHT	2
W1-3	6	G-GR/Y	6	E1 GR/Y	5
W3-1	27	Line-L2 BRN	25	S1-4 BRN	2
W3-2	27	Line-L1 BLU	25	S1-3 BLU	2
W4-1	28	CAP	9	J6-1	25
W4-2	28	CAP	9	J6-3	25

Stop Switch Assembly 88380-006B

Item	Description	Part Number	Qty
1	SWITCH SPST NC	1668-001	1
2	ACTUATOR EMER PB	1668-101	1
3	CLAMP EMERGENCY STOP T-2000	402183-003	2
4	SCREW FH 6-32X.38 R	45009-606	2
5	NUT HEX KEPS 4-40	4521-704	1
6	CLAMP CORD MEDIUM	4528-006	6
7	NUT SPRING TYPE T-U 6-32	4529-016	6
8	STUD CPTV PMP 4-40 X 5/16	4557-003	1
9	STRAIN RELIEF 1/2D 5N-4	4582-112	1
10	SCREW BLK PH 6-32 X 3/8	4641-606	4
11	SCREW BLK PH 10-32 X 5/8	4641-910	1
12	NUT HEX ES 10-32	4644-310	1
13	CABLE, 3 COND P/P 10FT	5512-002	1
14	BRACKET EMER SW	56984-001	1
15	COVER REAR EMERGENCY SWITCH	56985-002	1
16	BRACKET SWITCH	56998-001	1
17	LABEL BLANK 2 X 3/4	404525-001	1
18	EMRGNCY STP SWTCH INSTL INS	404061-001	1
19	LABEL CLEAR OVERLAMINATE	413608-001	1



Notes:

1. Place Items 3, 6, 11, and 12 in a plastic bag.

2. Item #17 to read:
   I st Line: (Part number)
   2 nd Line: (Lot code)

5B Parts Lists and Drawings for Configuration with CE

Ordering Parts

Introduction

This chapter contains the current parts lists, drawings, some schematics, and any kits for the standard treadmill configurations available at the time of the manual release date. The upper-level parts list appears first, followed by the assembly parts. The upper-level parts list specifies all the items that ship with the equipment such as upgrade kits, software disks, power cords, and manuals.

These parts lists and drawings supply enough detail for you to order parts for the assemblies considered field serviceable. See chapter 6 for component-level drawings and part numbers. To order parts, contact Service Parts at the address or telephone number on the page, “How to Reach Us...,” provided at the beginning of the manual.

Field Replaceable Units for Product Code Y5 w/CE

The following items may not be assigned separate manufacturing part numbers because they are normally part of a larger assembly. Since they are considered field replaceable units (FRUs), they have specific service part numbers so they can be ordered and replaced by service technicians.

> **NOTE**
>
> Verify part numbers before ordering service parts. See the tech memo series for this product for changes or additions to this list.

Table 5B-1. Field Replaceable Units

Item	Part Number
WALKING BELT	3602-009
WALKING BOARD	56944-009
DRIVE BELT	408913-001
DRIVE MOTOR 3.0 H.P.	408893-002
DRIVE MOTOR CONTROLLER	408891-002
ELEVATION MOTOR	408890-001
POWER PCB	800334-002
CONTROL PCB	800320-001
CE LABEL	408230-008
EMI E-BOX GROUND WIRE HARNESS W10	411810-003
E-BOX TO CONTROLLER W/CHOKE HARNESS W9	700337-003
SOUND DAMPENER MATERIAL	58520-003
POWER INPUT HARNESS	408935-002
HARNESS SWITCH TO EMI FILTER	408934-001
HARNESS SWITCH TO PCB	408933-002
AC LINE FILTER	409348-001

Upper-Level Assembly Rev R

Item	Description	Part Number	Qty
1	2000 TRDML W/FULL HNDL DOM	900444-001	1
2	2000 TRDML W/FULL HNDL INTL	900444-002	1
3	2000 TRDML W/EMI FULL HNDL DOM	900444-003	1
4	2000 TRDML W/EMI FULL HNDL INT	900444-004	1
5	CABLE TRDML/CASE INTCON	80690-001	1
7	MTC-1 REHAB/STRESS MPH T2000	9563-501	1
8	MTC-1 REHAB/STRESS KPH T2000	9563-502	1
9	MTC-1 EXER MPH T2000	9563-503	1
10	MTC-1 EXER KPH T2000	9563-504	1
11	MTC-I FIELD SERVICE CE	407143-003	1
12	T2000 FIELD SERVICE	409110-004	1
23	CAB 8P MINI DIN 20FT	400073-001	1
25	REWORK 2000 TRDML, W/FULL HNDL	900444-001R	1
26	REWORK 2000 TRDML W/FULL HNDL	900444-002R	1
27	REWORK T2000 EMI FULL HNDL DOM	900444-003R	1
28	REWORK 2000 TRDML W/EMI FH INT	900444-004R	1
39	REWORK MTC-1 REHAP/STRESS MPH	9563-501R	1
40	RWK MTC-1 REHAB/STRESS KPH	9563-502R	1
41	REWORK MTC-1 EXER MPH T2000	9563-503R	1
42	RWK MTC-1 EXER KPH T2000	9563-504R	1
43	CABLE TREADMILL TO STRESS SYS	700609-001	1

50/60 Hz Full Handle Assembly 900444-00XG

Item	Description	Part Number	Qty
1	2000 TRDML W/FULL HNDL DOM	900444-001	0
2	2000 TRDML W/FULL HNDL INTL	900444-002	0
3	2000 TRDML W/EMI FULL HNDL DOM	900444-003	0
4	2000 TRDML W/EMI FULL HNDL INT	900444-004	0
5	2000 TRDML FULL HNDL GERMAN	900444-005	1
6	2000 TRDML W/EMI FULL HNDL GRM	900444-006	1
7	2000 TRDML FULL HNDL SWED	900444-007	1
8	2000 TRDML W/EMI FULL HNDL SWE	900444-008	1

Full Handrail Kit 900433-001G

Item	Description	Part Number	Qty
1	SOCKET ALLEN 3/16 HEX	400056-001	1
2	HANDLE-T	400093-001	1
3	SCREW SKT 1/4-20 X 3/4	407236-001	2
4	SCREW SKT 1/4-20 X 1.63	407236-002	2
10	BOX MAILER 11.75L 11.00W 2.88H	9924-101	2
11	KIT TEE HANDLE LH-RH	408912-003	2
13	NUT ESNA 1/4-20	4521-311	4
19	KIT HANDRAIL FULL-PACKAGING	412562-001	1

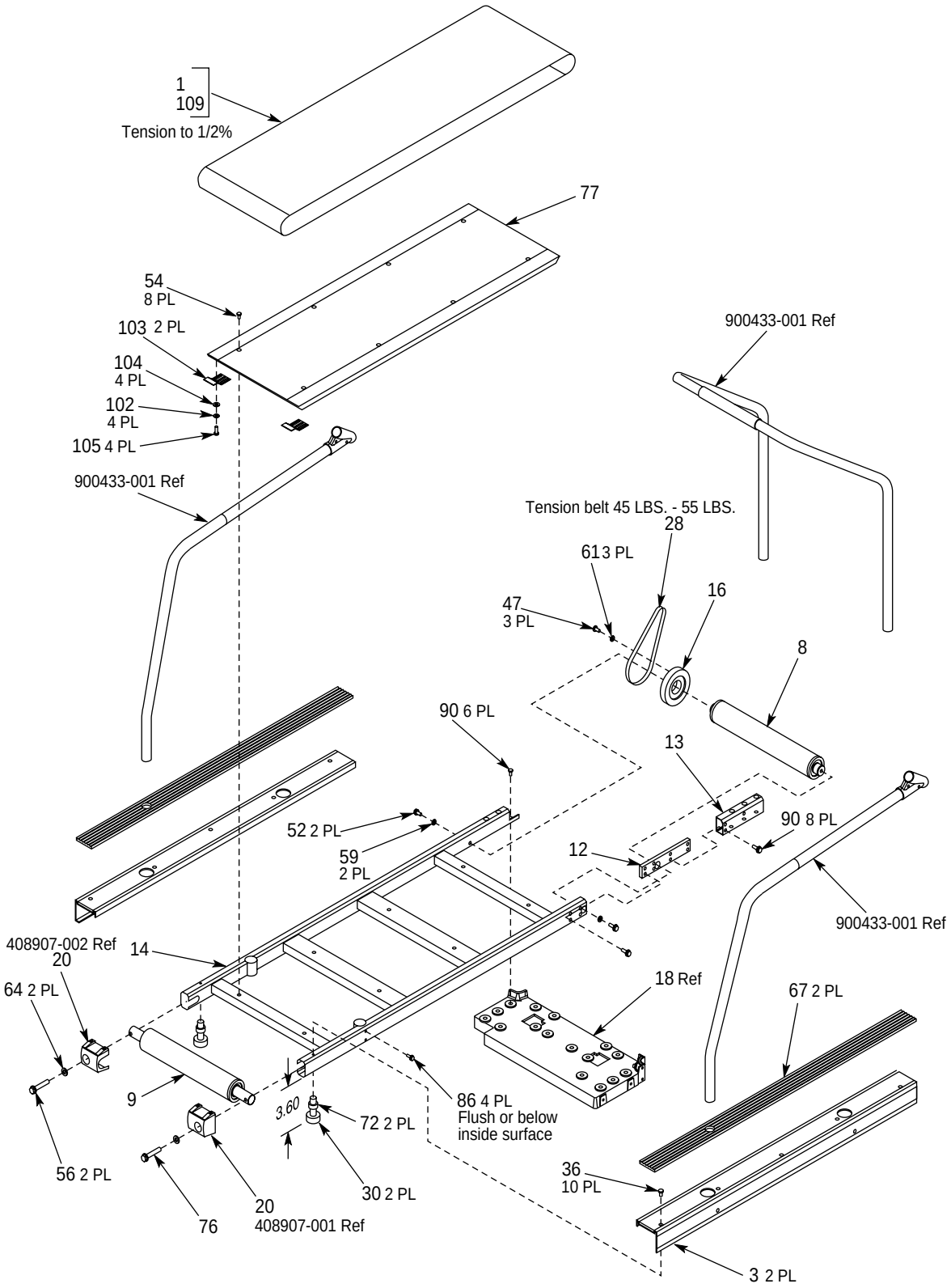
Treadmill Assembly w/CE 900367-002T

Item	Description	Part Number	Qty
2	SCREW SKT 1/4-20 X 1.00L	407236-003	8
3	EXTRUSION SIDE RAIL T2000	413690-001	2
4	MOTOR ELEVATION 185-265V .13HP	408890-001	1
6	MOTOR 3HP 4000 RPM DC-QUIET	408893-002	1
7	CLAMP HANDRAIL TERM TO BASE	408894-001	2
8	ROLLER ASSEMBLY FRONT	408895-001	1
9	ROLLER ASSEMBLY REAR	408896-001	1
10	RACK STL 10P 14.5 DEG PRESS	408897-001	1
11	GEAR PINION 11T 10P	408898-001	2
12	BRACKET HEAD TO FRAME	408899-001	1
13	SUPPORT FRAME TO CASTING	408900-001	1
14	WELD FRAME TREADMILL T2000	413689-001	1
15	SPROCKET 25T 5MM P .62 BORE	408902-001	1
16	SPROCKET 90T 5MM P	408903-001	1
17	FLYWHEEL 8.00DIA X 1.00W	408904-001	1
18	BASE HEAD CASTING	408905-001	1
19	TOWER FABRICATION	408906-002	1
20	KIT END CAP LH-RH	408907-003	1
21	ELEVATION BLOCK RH	408908-001	1
22	ELEVATION BLOCK LH	408908-002	1
23	SHROUD TMILL-2000	408909-001	1
24	ENDPLATE ELEVATION BLOCK	408910-001	1
25	ENDPLATE SW MTG ELEVATION BL	408910-002	1
26	SPACER DELRIN TWR MNT	408911-001	12
27	SPACER DELRIN EBOX MNT	408911-002	8
28	BELT DRIVE 5MM P 20MM W	408913-001	1
29	BSHG 1.0 OD X .625 ID X .50 W	408914-001	2
30	FOOT FRAME	408915-001	2
31	FOOT HEAD	408915-002	2
32	PIN DOWEL .2502D X 1.000L	408916-001	2
33	SW LEVER SPST NO 3A 250VAC	408918-001	2
34	LABEL BLANK 2 X 3/4	404525-001	1
35	KEY WOODRUFF 3/16 X 5/8	408920-001	2
36	SCR TRILOBE PH FLTHD #10X.50	408921-001	10
37	TUBE TYGON 3/16ID X 5/16OD	408922-001	0.06
38	REAR PANEL TREADMILL 2000	408924-001	1
39	SHAFT ELEVATION	408925-001	1
40	COUPLING ISOLATION ELE MTR	408926-101	1
41	PANEL POT ISO FROM TOWER	408929-001	1

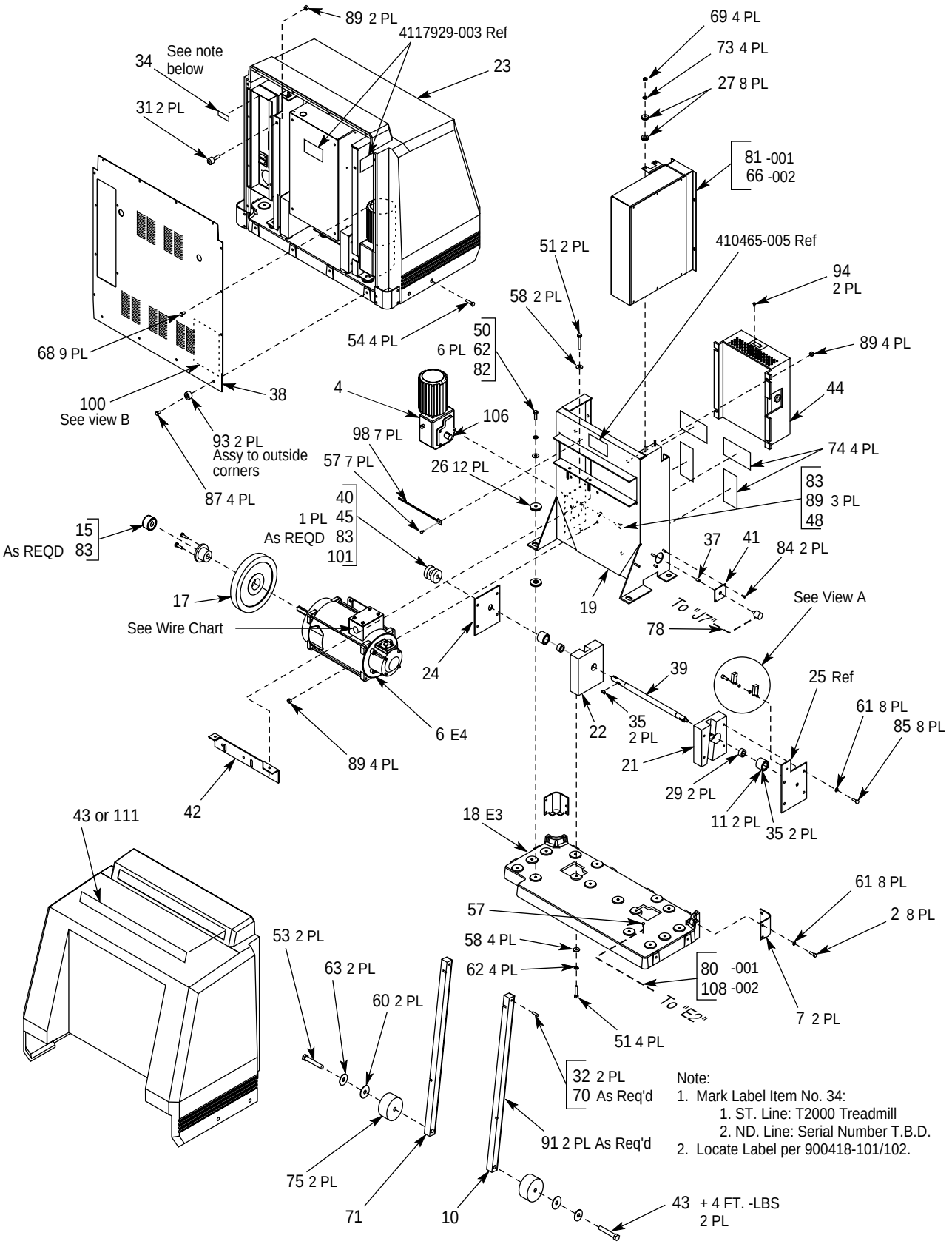
Item	Description	Part Number	Qty
42	BRKT DRIVE MTR MOUNTING	408931-001	1
43	LABEL 2000T SHROUD	410465-001	1
44	CONTROL BOX DRIVE MOTOR CE MRK	408891-002	1
45	KEY 3/16 X 3/16 X 7/16	410625-001	1
47	SCREW GR8 1/4-20 X .88	45002-114	3
48	STUD FULL THREAD GR	411746-001	3
50	SCREW HX G8 5/16X1.5	45002-224	6
51	SCR HEX HD 5/16-18 X 2.00	45002-549	2
52	SCREW GR 8 3/8-16 X 3/4LONG	45002-312	2
53	SCREW GR8 1/2-13X 3	45002-548	2
54	SCREW SKT 82FLH 1/4-20X1.25BLK	45019-120	12
55	SCREW PH 4-40X 1 1/4L	4502-440	2
56	SCREW HEX HD 3/8-16X3.50L BLK	45027-362	2
57	SCREW SELF TAPPING 8-32X.32	45070-612	8
58	WASHER FLAT STL 5/16	45076-012	6
59	WASHER SPLIT BLACK .375 I.D.	45090-001	2
60	WASHER FLAT STL 1/2	45076-015	2
61	WASHER LK SR STL 1/4	45076-111	19
62	WASHER LK SR STL5/16	45076-112	10
63	WASHER LK SR STL 1/2	45076-115	2
64	WASHER FLAT HDN 3/8	45076-213	2
65	WASHER FLAT SS #4	4520-004	4
66	ASSY ELECTRONICS BOX EMI/RFI	900418-102	1
67	TREAD RUBBER W/HOLE	408888-001	2
68	SCREW PH GREY W/WSHR 8-32X.38L	45021-806	13
69	NUT HEX ESNA 10-24	4521-310	4
70	ADHESIVE,BLACK MAX	4851-058	0.01
71	RACK STL 10P 14.5DEG W/O NOTCH	408897-002	1
72	NUT JAM 3/4-10 UNC	4546-003	2
73	WASHER BELLEVILLE .56X.19X.028	4550-031	4
74	DAMPENER SOUND 3.00LG TRDML	58520-003	4
75	WHEEL 3.25OD	4704-001	2
76	GREASE LUBRIPLATE	4850-017	0
77	BOARD WALKING W/WAX	56944-009	1
78	HARN ELEV POT TO PCB P7	700337-001	1
79	HARN ELEV LIMIT SW TO PCB P8	700338-002	1
82	WSHR FL STL.321IDX1.06ODX.105	45053-002	6
83	CEMENT LOCTITE 242	4851-003	0
84	SCREW SEMS PH 6-32X1/2	45000-608	2
85	SCREW GRB 1/4-20 X .62	45002-110	8
86	1/4-20X5/8 SKTCAP SCREW W/NYL	45023-212	4
87	SCREW SEMS PH 1/4-20 .625L	45000-710	4

Item	Description	Part Number	Qty
89	NUT 5/16-18 FLANGED LOCKING	410686-001	13
90	SCREW HEX 5/16-18 FLANGED LK	410686-002	14
91	GREASE SYNTHETIC WITH TEFLON	410748-001	0.06
93	BUMPER PLASTIC 1.00 OD	410746-001	2
94	SCREW SEMS PH PHIL 4-40 X.312L	45000-405	2
95	SPLICE CE 22-14	4533-201	1
96	SPLICE CE 16-10	4533-202	3
97	TERMINAL INS RING#10	4531-410	1
98	CABLE CLAMP 7.43LG X .187W	4535-102	7
99	CODE T2000 V001E	410114-003	0
100	DAMPENER SOUND 5.00 X 7.00	58520-004	1
101	SCREW SET CPP 8-32X1/4	4518-808	2
102	WASHER LOCK SPLIT #10	4520-910	4
103	SHIELD PINCH POINT 2000	57071-007	2
104	WASHER FLAT SS #10	4520-010	4
105	SCREW PH WOOD #10 X .62L	408714-003	4
106	ADHESIVE LOCKTITE 262	4851-069	0.10
107	HARN EBOX TO CNTLR W/CHOKE	700337-003	1
108	ASSY T2000 EMI E-BOX GRND	411810-003	1
109	BELT WALKING T2000 EMI	3602-009	1
110	LABEL CE MARK	408230-008	1
112	LABEL UL CLASSIFIED	408230-009	1
113	LABEL UL CLASSIFIED CANADA	408230-010	1

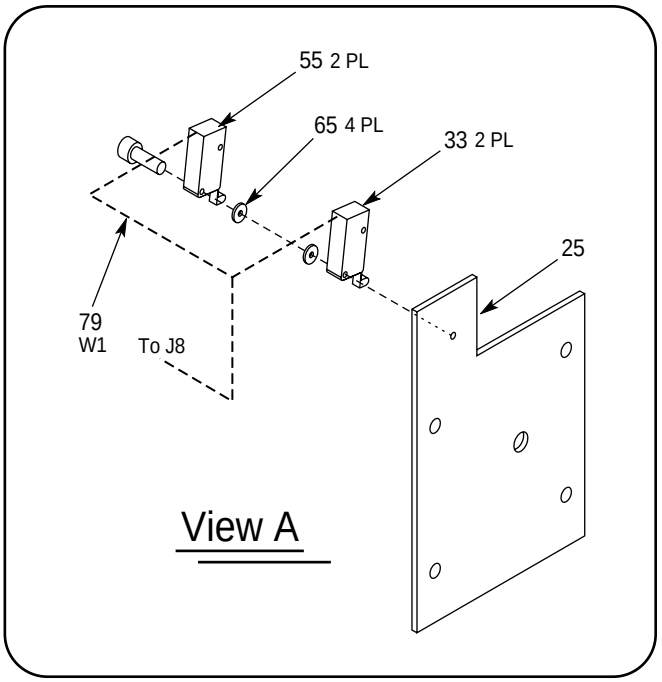
1 of 4

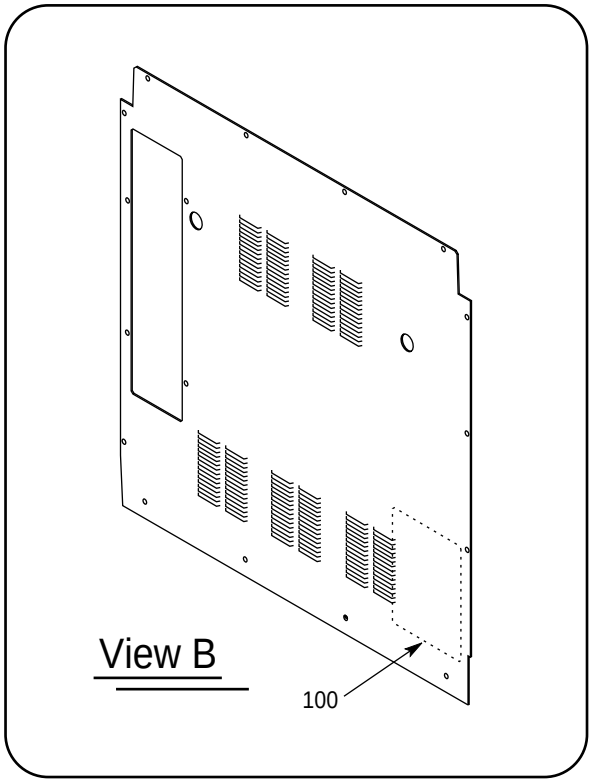

1
109
Tension to 1/2%
77
54
8 PL
103 2 PL
104
4 PL
102
4 PL
105 4 PL
900433-001 Ref
900433-001 Ref
Tension belt 45 LBS. - 55 LBS.
28
61 3 PL
47
3 PL
16
8
90 6 PL
13
52 2 PL
59
2 PL
90 8 PL
12
900433-001 Ref
408907-002 Ref
14
20
64 2 PL
18 Ref
67 2 PL
9
3.60
72 2 PL
86 4 PL
Flush or below
inside surface
56 2 PL
76
20
408907-001 Ref
30 2 PL
36
10 PL
3 2 PL

2 of 4


89 2 PL
4117929-003 Ref
34 See note below
23
31 2 PL
69 4 PL
73 4 PL
27 8 PL
81 -001
66 -002
51 2 PL
410465-005 Ref
94 2 PL
58 2 PL
50 6 PL 62 82
54 4 PL
68 9 PL
89 4 PL
44
4
106
100 See view B
38
98 7 PL
74 4 PL
93 2 PL Assy to outside corners
57 7 PL
26 12 PL
83 89 3 PL 48
87 4 PL
40 1 PL 45 As REQD 83 101
15 As REQD 83
37
41
84 2 PL
17
19
TO "J1"
78
See View A
See Wire Chart
24
39
25 Ref
61 8 PL
85 8 PL
22
35 2 PL
6 E4
89 4 PL
21
29 2 PL
42
11 2 PL
35 2 PL
43 or 111
18 E3
61 8 PL
57
2 8 PL
53 2 PL
58 4 PL
63 2 PL
62 4 PL
80 -001
108 -002
60 2 PL
TO "E2"
7 2 PL
51 4 PL
32 2 PL
70 As Req'd
Note:
1. Mark Label Item No. 34:
1. ST. Line: T2000 Treadmill
2. ND. Line: Serial Number T.B.D.
2. Locate Label per 900418-101/102.
91 2 PL As Req'd
75 2 PL
71
10
43 + 4 FT. -LBS 2 PL

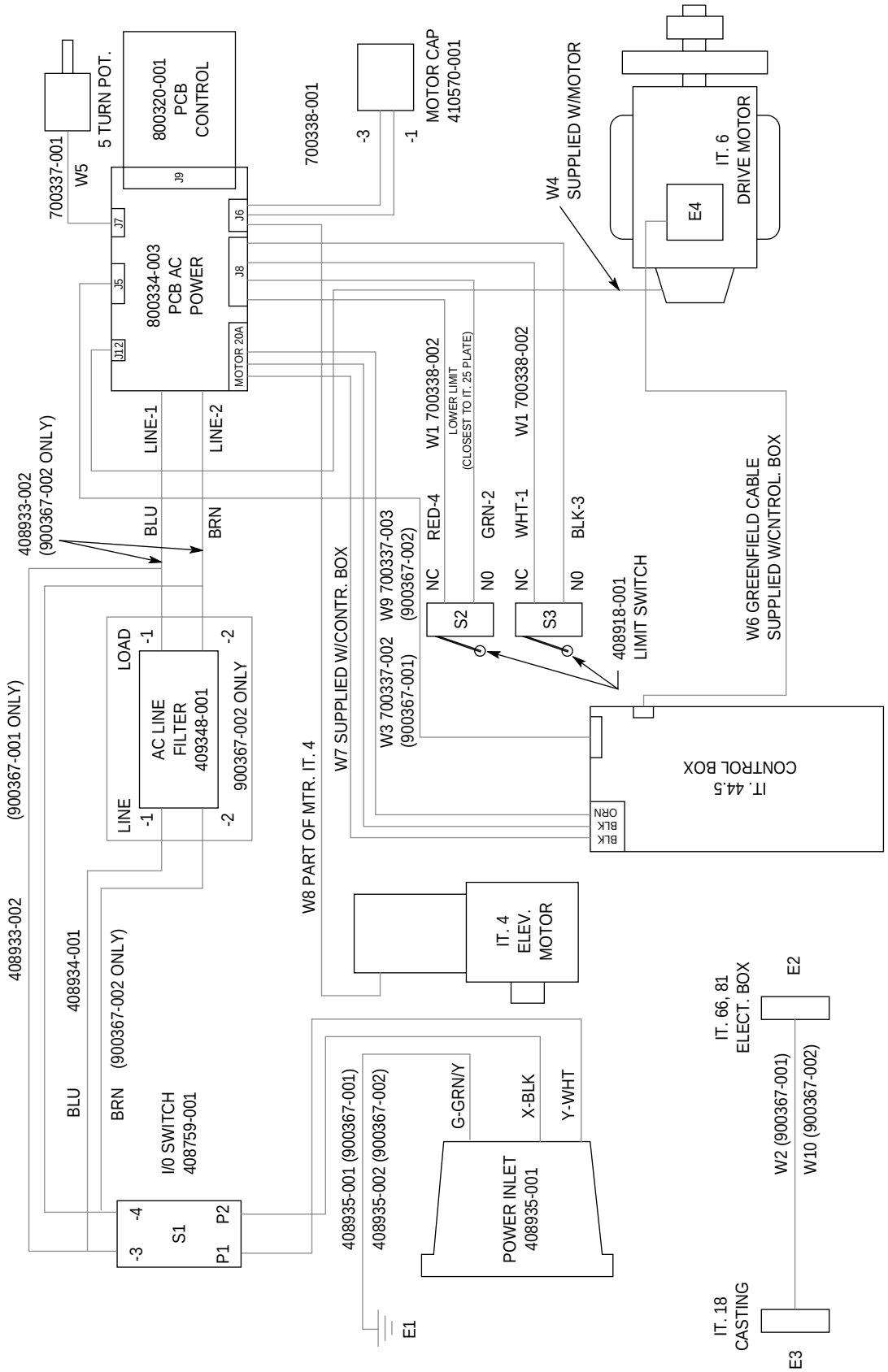
3 of 4





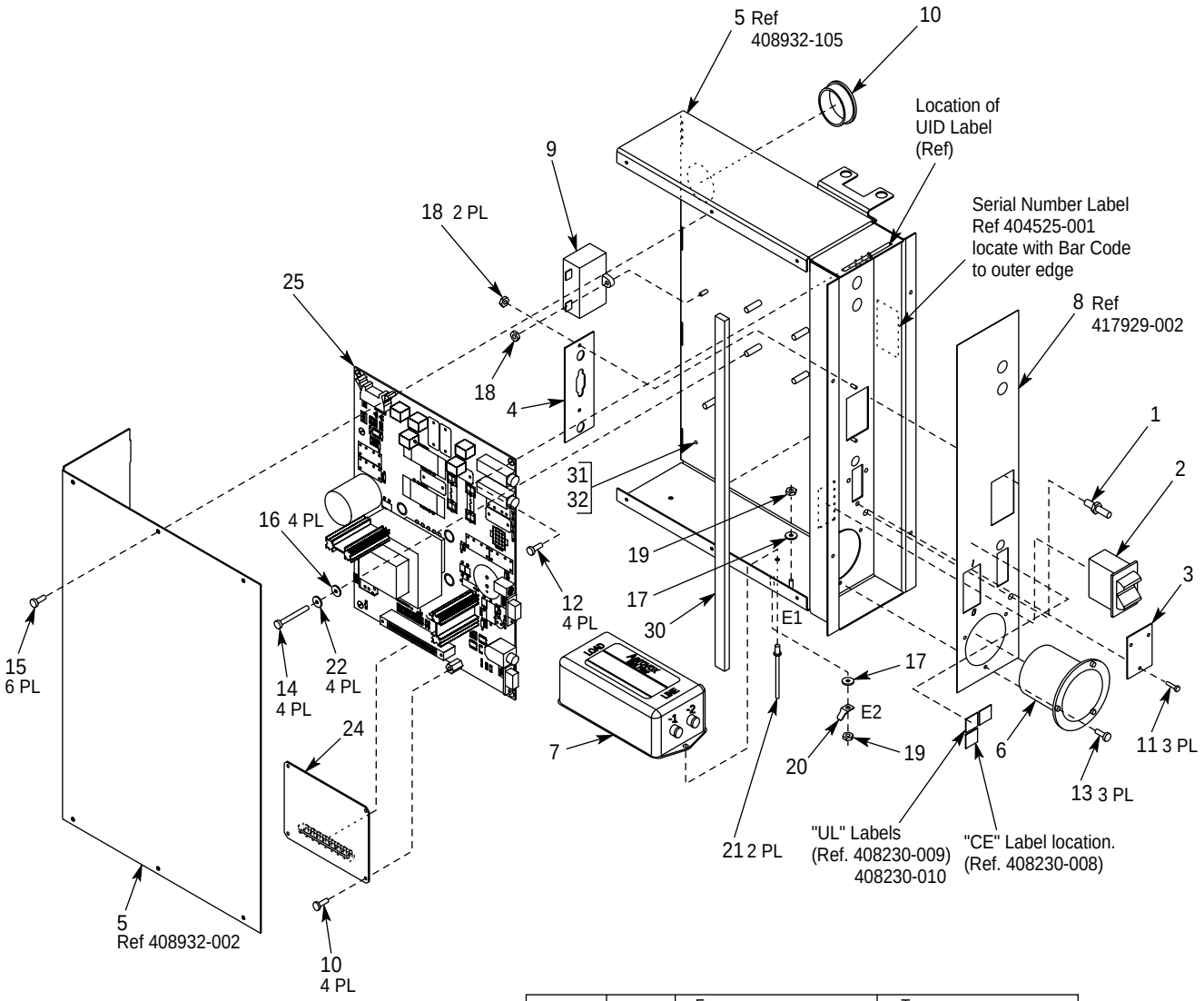
Lead Ident.	ITEM NO.	From		To	
		Circuit Point	ITEM NO.	Circuit Point	ITEM NO.
W5	78	– – –	78	J7	81, 66
W1	79	S2, S3	33	J8	81, 66
W2	80	E2	81	E3	18
W3	88	J5	81	J10	5
W4	6	MOTOR	6	J12	81, 66
W6-1	44	CNTRL-1	96	MOTOR-1	6
W6-2	44	CNTRL-2	96	MOTOR-2	6
W6-3	44	CNTRL-3	96	MOTOR-3	6
W6-4	6	CNTRL-BLU	95	CNTRL-BLU	6
W6-5	44	CNTRL-GND	97	E4	6
W7-1	44	BLK-L1	44	L1-MTR 20A	81, 66
W7-2	44	BLK-L2	44	L2-MTR 20A	81, 66
W7-3	44	ORG-GND	44	GND	81, 66
W8	4	MOTOR	4	J6	81, 66
W9	107	J5	66	J10	44
W10	108	E2	66	E3	18

4 of 4


700337-001
W5
5 TURN POT.
800320-001
PCB
CONTROL
J9
J7
J6
J5
J8
J12
MOTOR 20A
800334-003
PCB AC
POWER
700338-001
-3
-1
MOTOR CAP
410570-001
W4
SUPPLIED W/MOTOR
E4
IT. 6
DRIVE MOTOR
LINE-1
LINE-2
408933-002
(900367-002 ONLY)
BLU
BRN
W1 700338-002
LOWER LIMIT
(CLOSEST TO IT. 25 PLATE)
RED-4
GRN-2
WHT-1
BLK-3
W1 700338-002
W9 700337-003
(900367-002)
NC
NO
NC
NO
S2
S3
408918-001
LIMIT SWITCH
W6 GREENFIELD CABLE
SUPPLIED W/CNTROL. BOX
LOAD
-1
-2
LINE
-1
-2
AC LINE
FILTER
409348-001
900367-002 ONLY
(900367-001 ONLY)
W3 700337-002
(900367-001)
W7 SUPPLIED W/CONTR. BOX
W8 PART OF MTR. IT. 4
IT. 44.5
CONTROL BOX
BLK
BLK
ORN
408933-002
408934-001
BLU
BRN
(900367-002 ONLY)
I/O SWITCH
408759-001
IT. 4
ELEV.
MOTOR
-3
-4
S1
P2
P1
408935-001 (900367-001)
408935-002 (900367-002)
G-GRN/Y
X-BLK
Y-WHT
POWER INLET
408935-001
E1
IT. 66, 81
ELECT. BOX
E2
W2 (900367-001)
W10 (900367-002)
IT. 18
CASTING
E3

Electronics Box Assembly w/CE 900418-102B

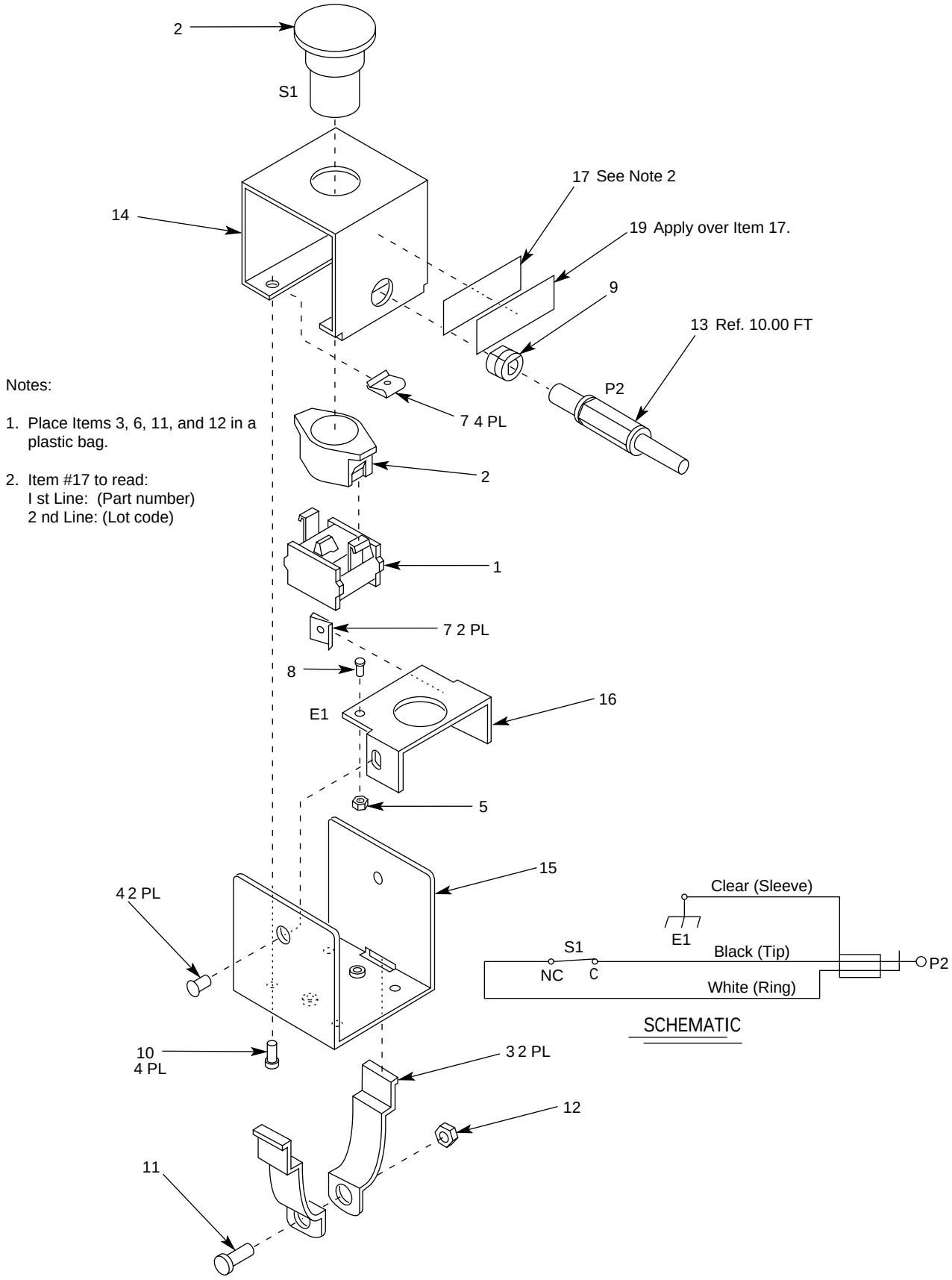
Item	Description	Part Number	Qty
1	PLUG MC EQUIPOTENTIAL	400040-001	1
2	SWITCH CKT BRKR 240V 20A	408759-001	1
3	PANEL SVC ACCESS TMILL-2000	408927-001	1
4	PANEL RFI/EMI SHIELD 9-PIN D	408928-101	1
5	KIT ELECTRONICS BOX	408932-106	1
6	HARN PWR INPUT W/CHOKE TO FLTR	408935-002	1
7	AC LINE FILTER 250V 20A	409348-001	1
8	LABEL SET 2000T ELECTRNCS BOX	417929-001	1
9	CAP MOTOR 10UF 10% 250VAC	410570-001	1
10	GROMMET SNAP-IN 1.31 ID	410666-001	1
11	SCREW SEMS PH 4-40 X 1/4	45000-404	7
12	SCREW SEMS PH 6-32X1/2	45000-608	4
13	SCREW SEMS PH 8-32 X .50L	45000-808	3
14	SCREW PH 6-32X 2 1/2L	4502-680	4
15	SCREW TT PH 6-32X1/4	45040-604	6
16	WASHER FLAT SS #6	4520-006	4
17	WASHER LOCK EXTT #6	4520-306	2
18	NUT ESNA 4-40	4521-304	3
19	NUT HEX KEPS 6-32	4521-706	2
20	TERMINAL FASTON .250M 45 BLADE	4534-901	1
21	RIVET BLIND 5/32 0-.250	4590-154	2
22	WASHER LOCK INTT #6	4520-206	4
23	CLAMP CORD MEDIUM	4528-006	3
24	PCB 2000 TRDML CONTROLLER	800320-001	1
25	PCB T2000 PWR EMI RS232	800334-003	1
26	HARN SWITCH TO EMI FILTER	408934-001	1
27	HARN SWITCH TO PCB/FLTR W/RING	408933-002	1
28	HARN ELEV CAP PCB P6 PIN 1/3	700338-001	1
30	TAPE FOAM URETHANE 1/4X1/2W	4819-016	1.33
31	SCREW SELF TAPPING 8-32X.32	45070-612	1
32	CABLE CLAMP 7.43LG X .187W	4535-102	1



Lead Ident	Item No	From		To	
		Circuit Point	Item No	Circuit Point	Item No
W1-1	6	X-BLK	6	S1-P2 BLK	2
W1-2	6	Y-WHT	6	S1-P1 WHT	2
W1-3	6	G-GR/Y	6	E1 GR/Y	5
W2-1	26	Line-L2	7	S1-3 BLU	2
W2-2	26	Line-L1	7	S1-4 BRN	2
W3-1	27	Line-L1 BLU	25	Load - 1	7
W3-2	27	Line-L2 BRN	25	Load - 2	7
W4-1	28	CAP	9	J6-1	25
W4-2	28	CAP	9	J6-3	25

Stop Switch Assembly 88380-006B

Item	Description	Part Number	Qty
1	SWITCH SPST NC	1668-001	1
2	ACTUATOR EMER PB	1668-101	1
3	CLAMP EMERGENCY STOP T-2000	402183-003	2
4	SCREW FH 6-32X.38 R	45009-606	2
5	NUT HEX KEPS 4-40	4521-704	1
6	CLAMP CORD MEDIUM	4528-006	6
7	NUT SPRING TYPE T-U 6-32	4529-016	6
8	STUD CPTV PMP 4-40 X 5/16	4557-003	1
9	STRAIN RELIEF 1/2D 5N-4	4582-112	1
10	SCREW BLK PH 6-32 X 3/8	4641-606	4
11	SCREW BLK PH 10-32 X 5/8	4641-910	1
12	NUT HEX ES 10-32	4644-310	1
13	CABLE, 3 COND P/P 10FT	5512-002	1
14	BRACKET EMER SW	56984-001	1
15	COVER REAR EMERGENCY SWITCH	56985-002	1
16	BRACKET SWITCH	56998-001	1
17	LABEL BLANK 2 X 3/4	404525-001	1
18	EMRGNCY STP SWTCH INSTL INS	404061-001	1
19	LABEL CLEAR OVERLAMINATE	413608-001	1



Notes:

1. Place Items 3, 6, 11, and 12 in a plastic bag.

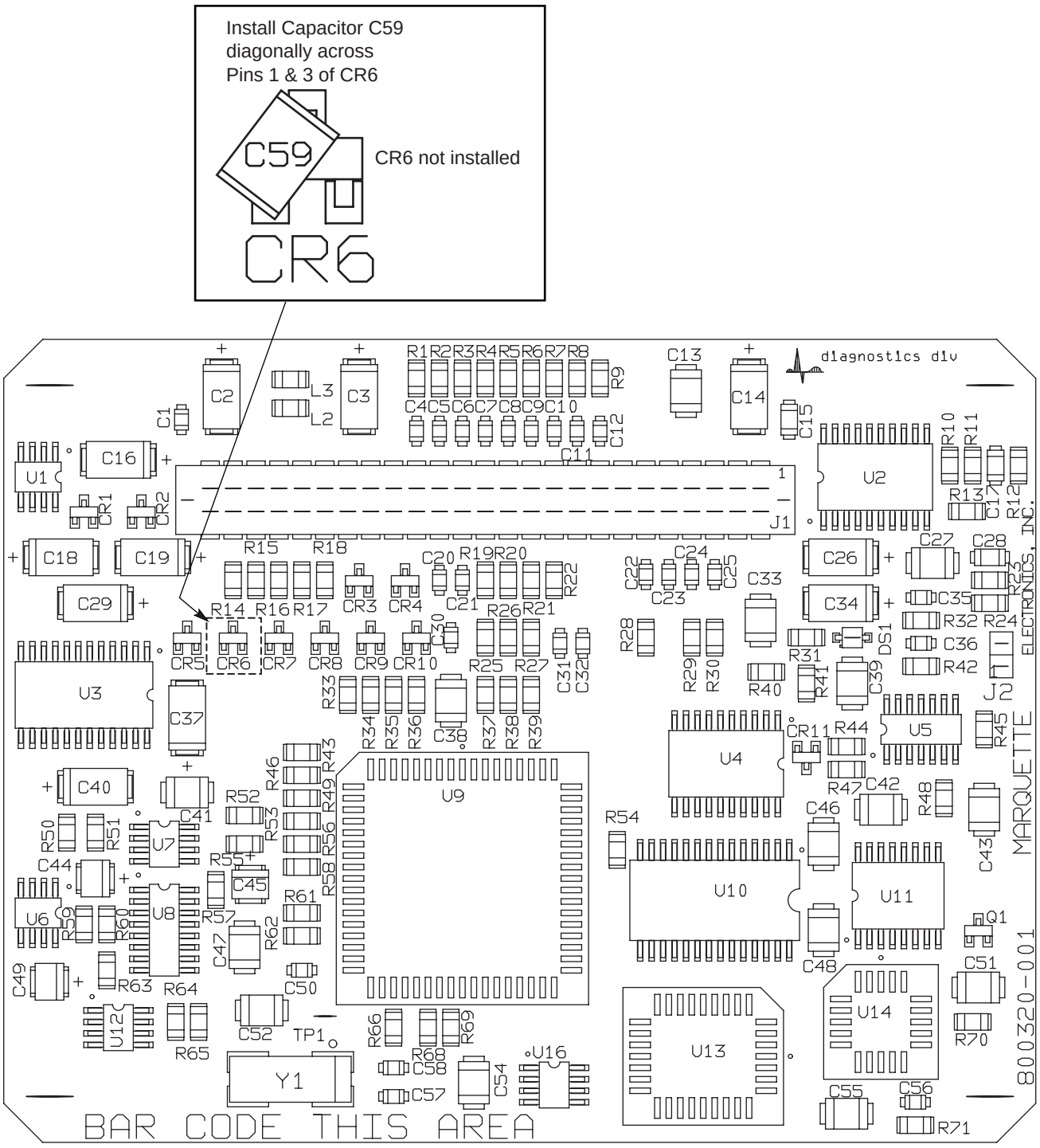
2. Item #17 to read:
   I st Line: (Part number)
   2 nd Line: (Lot code)

6 PCB Assemblies

Control PCB 800320-001H

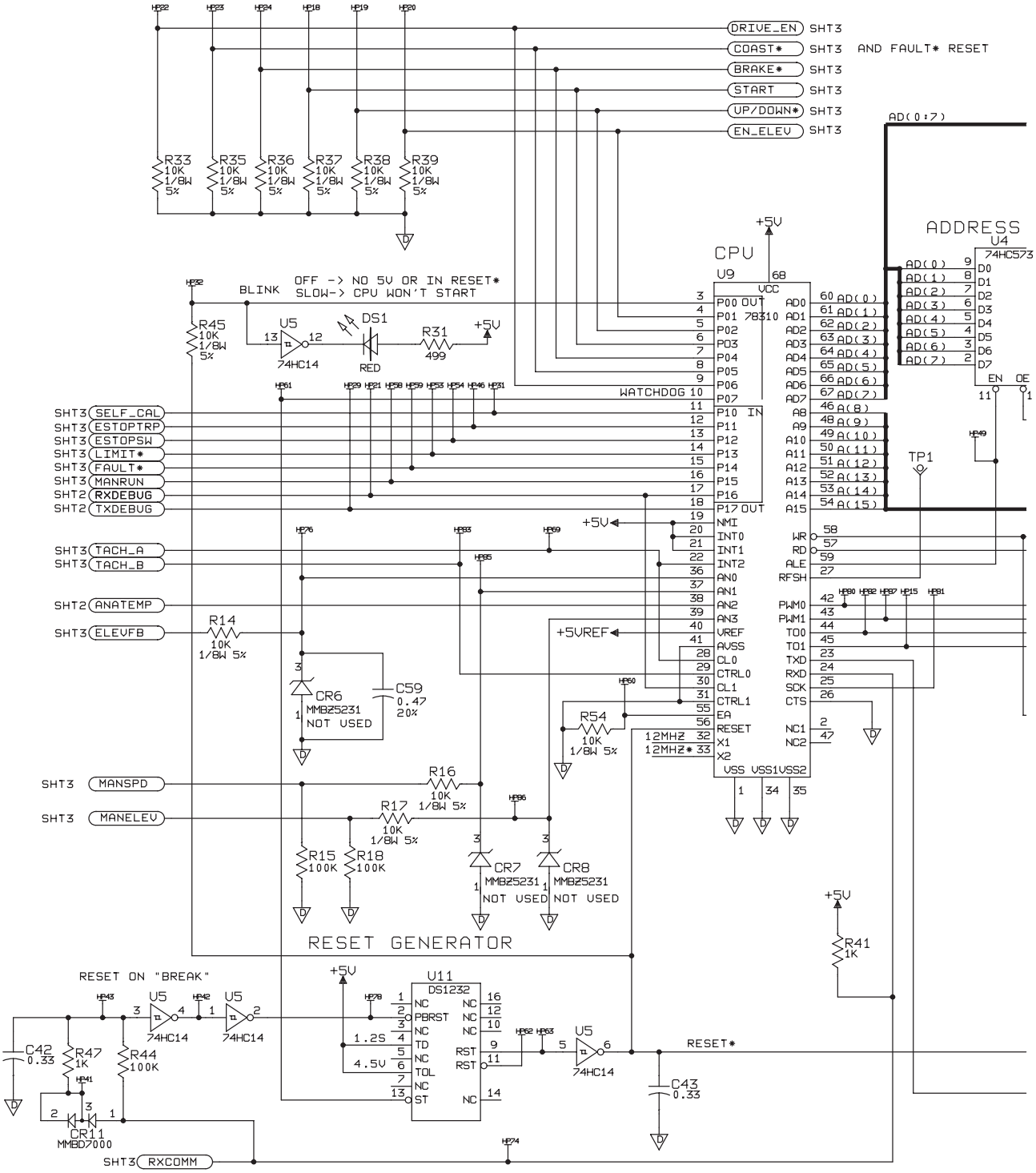
Item	Description	Part Number	Qty
1	RES SM CER 100 5% 1/8W	1081-101	22
2	RES SM CER 10K 5% 1/8W	1081-103	14
3	RES SM CHIP 68K 5% 1/8W	1081-491	1
4	RES SM CER 100K 1% 1/8W	1082-100	8
5	RES SM CER 4.99K 1% 1/8W	1082-101	2
6	RES SM CER 1K 1% 1/8W	1082-103	6
7	RES SM CER 10.0K 1% 1/8W	1082-104	1
8	RES SM CHIP 47.5K 1% 1/8W	1082-757	10
9	RES SM CHIP 15K 1% 1/8W	1082-857	2
10	RES SM CHIP 499 1% 1/8W	1082-867	1
11	RES SM CER 39.2K 1% 1/8W	1082-881	1
12	RES SM CER 32.4K 1% 1/8W	1082-324	1
13	CAP SM TANT 47UF 20% 10V	405585-001	4
14	CAP SM CER COG .01UF 5% 50V	1181-103	1
15	CAP SM CER COG 220PF 5% 100V	1181-221	1
16	CAP SM CER COG 470PF 5% 100V	1181-471	22
17	CAP SM CER X7R .33UF 20% 50V	1186-334	14
18	CAP SM CER X7R .1UF 50V	1187-104	3
19	CRYSTAL SM 12.000MHZ MA506	413773-001	1
21	DIODE SM SERIES PR D7000	2013-201	4
22	DIODE SM REF LM385 1.2V SO-8	2015-386	1
23	TRANSISTOR SM PNP T3906	2511-101	1
24	IC SM RS232 5RCV/3DRV LT1133	3023-133	1
25	IC SM HC 74HC14	3038-014	1
27	IC FLAT PACK VOLT CONV 7660CSA	3142-002	1
28	IC SM OP AMP LM358	3144-358	2
29	IC MICROCOMPUTER CMOS PD78310	3155-004	1
30	IC SM PWR MONITOR DS1232S	3168-001	1
31	IC SM CMOS RAM 62256FLP	3202-256	1
32	IC SM EPROM X28C64 32PLCC	400626-002	1
33	IC SM HC 74HC573	401971-001	1
34	CAP SM TANT 1.0UF 10% 35V	403907-001	3
35	DIODE ZENER SM 16.8V	403937-001	4
36	IC SM CMOS 4053	404002-001	1
37	IC SM AMPL L2726 SOL20	404495-001	1
38	CAP SM TANT 10UF 10% 35V	406884-013	7
39	DIODE ZENER SM 5V1	406918-001	0
40	CONN HDR SM B/ENTRY 50P .1X.1	409056-001	1
41	PAL T2000 78310 DECODE V2.0	410113-002	1

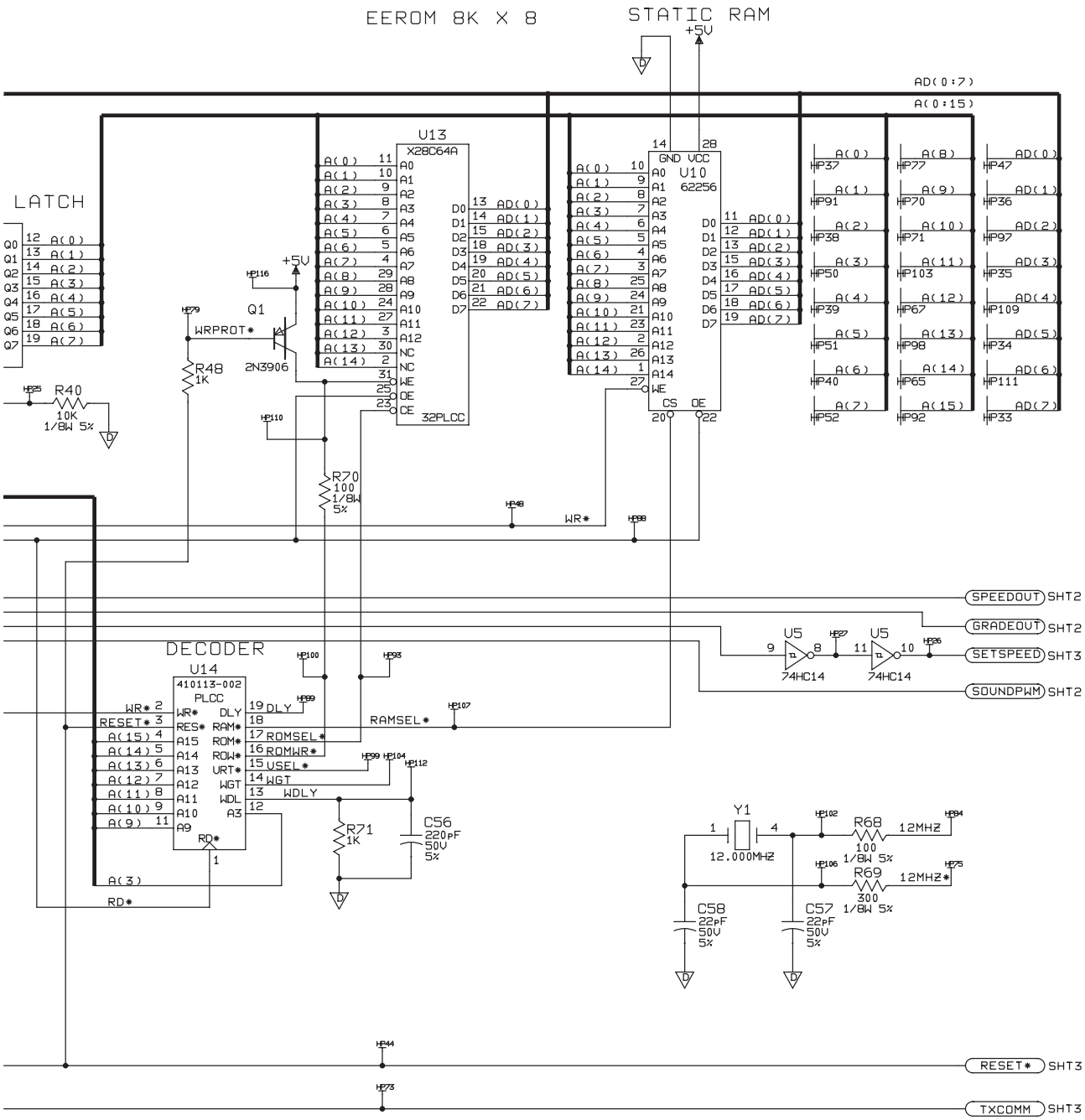
Item	Description	Part Number	Qty
42	IC SM TEMP SENSOR LM35DM	410121-001	1
43	CKT BD 2000 TRDMILL CONTROL	800321-001	1
44	SCHEM 2000 TREADMILL CONTROL	SD800320-001	0
45	RES SM CHIP 300 5% 1/8W	1081-497	1
46	CAP SM CER COG 22PF 5% 100V	1181-220	2
47	BEAD SM 1206 600@100 200MA	408746-001	2
48	CAP SM CER Z5U .47UF 20% 50V	407860-001	1


Install Capacitor C59
diagonally across
Pins 1 & 3 of CR6
C59
CR6 not installed
CR6
diagnostics div
MARQUETTE ELECTRONICS, INC.
800320-001
BAR CODE THIS AREA

Control PCB Schematic SD800320-001G

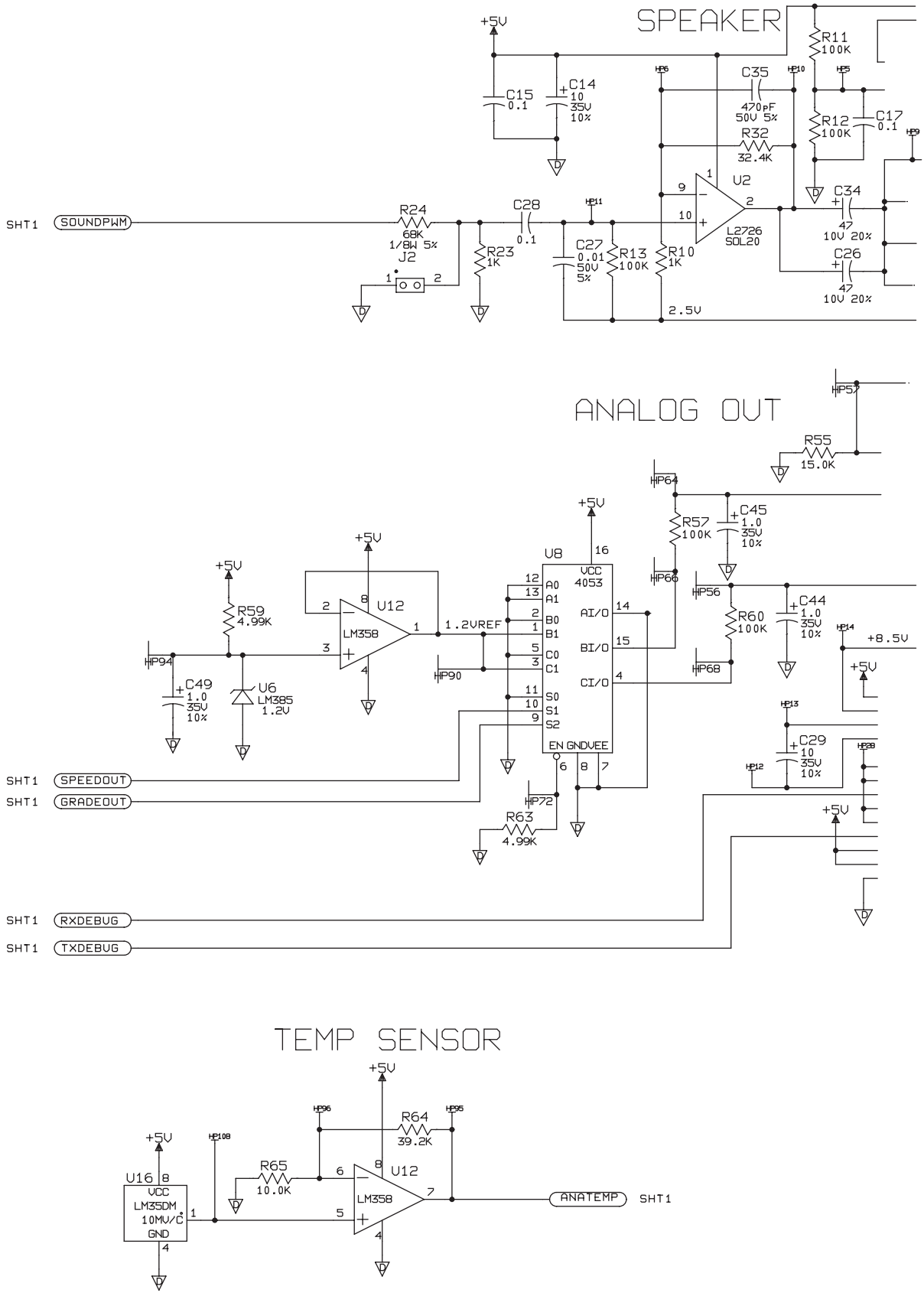
1 of 3

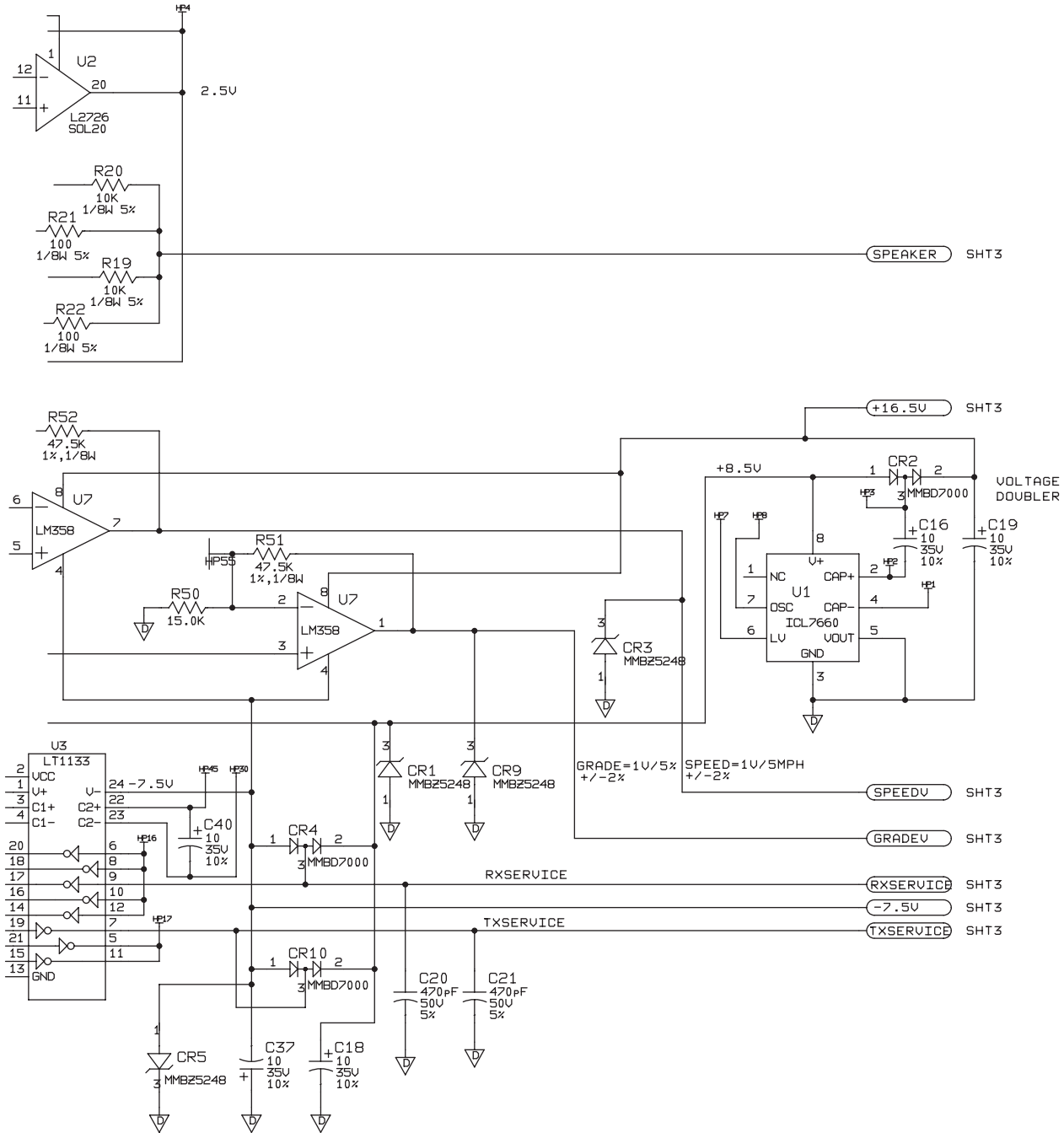




NOT INSTALLED: DS1 (LED), W1(JUMPER)

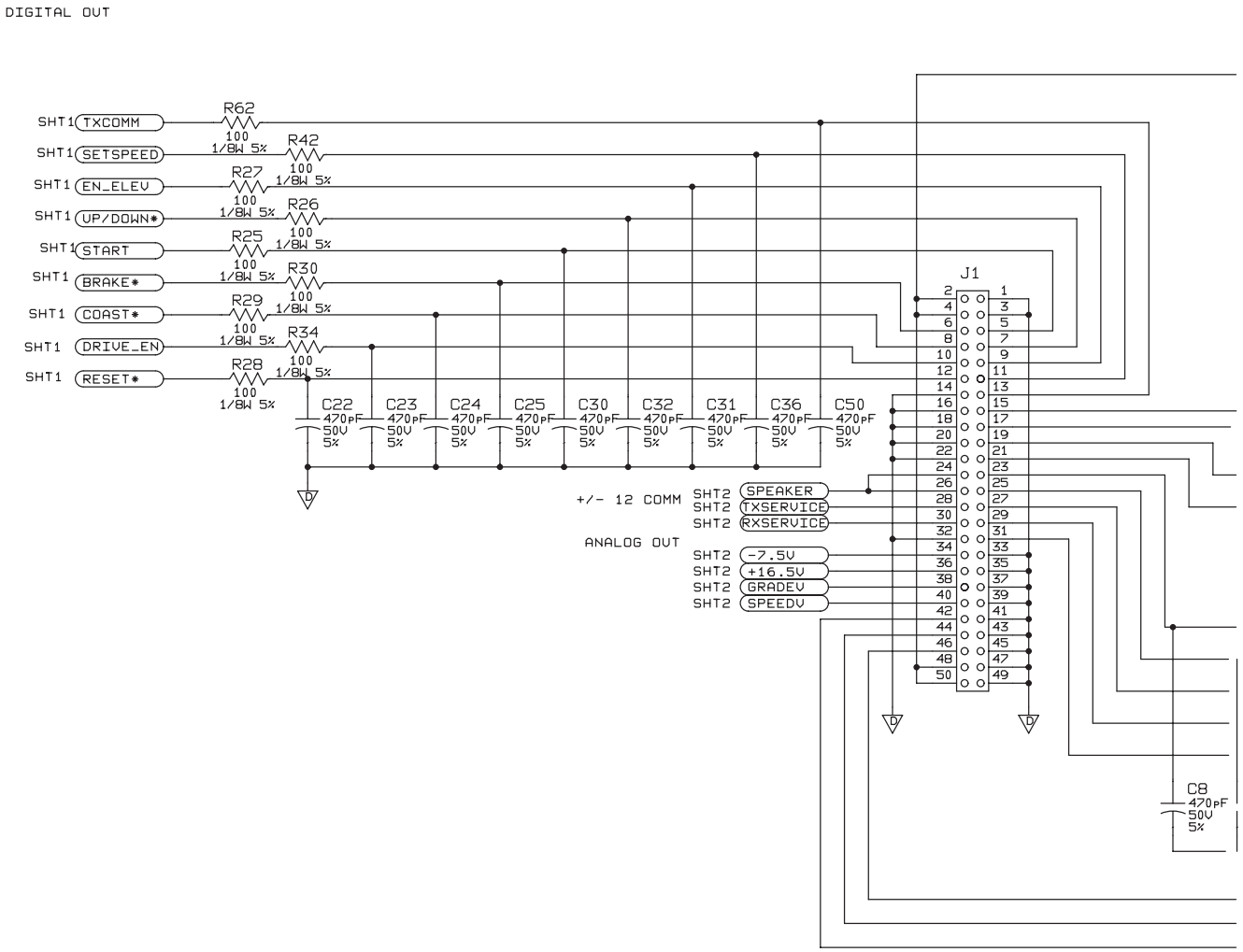
2 of 3

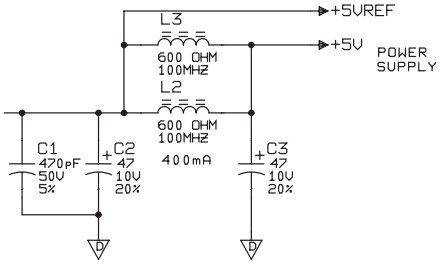

SPEAKER
+5V
C15
0.1
C14
10
35V
10%
R11
100K
C35
470pF
50V 5%
R12
100K
C17
0.1
R32
32.4K
U2
L2726
SOL20
C34
47
10V 20%
C26
47
10V 20%
SHT1
SOUNDPWM
R24
68K
1/8W 5%
J2
C28
0.1
R23
1K
C27
0.01
50V
5%
R13
100K
R10
1K
2.5V
ANALOG OUT
R55
15.0K
R57
100K
C45
1.0
35V
10%
U8
VCC
4053
EN GNDVEE
AI/O
BI/O
CI/O
A0
A1
B0
B1
C0
C1
S0
S1
S2
U12
LM358
1.2VREF
R59
4.99K
C49
1.0
35V
10%
U6
LM385
1.2V
R60
100K
C44
1.0
35V
10%
+8.5V
C29
10
35V
10%
R63
4.99K
SHT1
SPEEDOUT
SHT1
GRADEOUT
SHT1
RXDEBUG
SHT1
TXDEBUG
TEMP SENSOR
R64
39.2K
R65
10.0K
U16
LM35DM
10MV/C°
GND
ANATEMP
SHT1



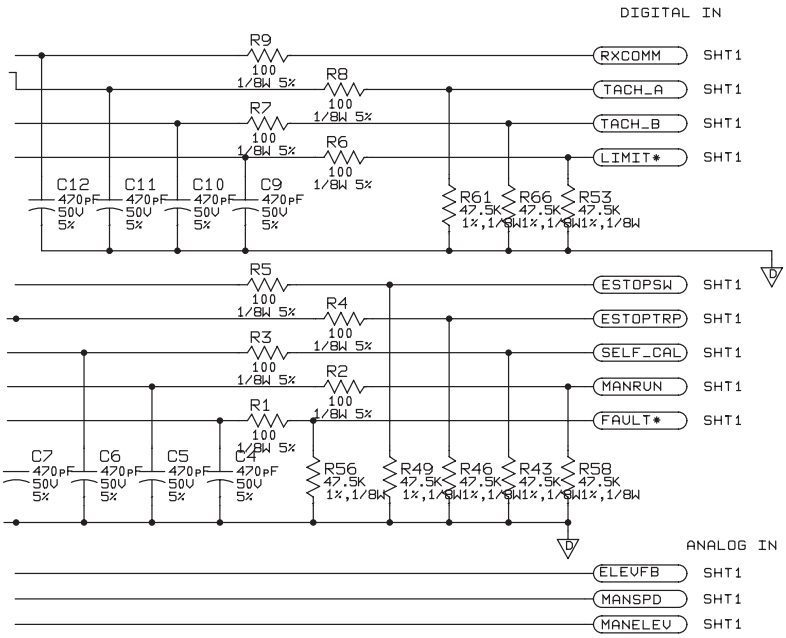
RS-232 I/F(SERVICE)

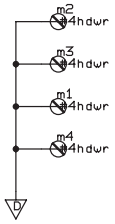
3 of 3


DIGITAL OUT
SHT1 TXCOMM
SHT1 SETSPEED
SHT1 EN_ELEV
SHT1 UP/DOWN*
SHT1 START
SHT1 BRAKE*
SHT1 COAST*
SHT1 DRIVE_EN
SHT1 RESET*
R62
R42
R27
R26
R25
R30
R29
R34
R28
100
1/8W 5%
C22
C23
C24
C25
C30
C32
C31
C36
C50
470pF
50V
5%
+/- 12 COMM
SHT2 SPEAKER
SHT2 TXSERVICE
SHT2 RXSERVICE
ANALOG OUT
SHT2 -7.5V
SHT2 +16.5V
SHT2 GRADEV
SHT2 SPEEDV
J1
C8



IC POWER/GROUND/BYPASS CHART								
IC		SHEET	VCC		GND		BYPASS	
U14	EP320	1	+5V		D		C51	0.33
U16	LM35DM	2	+5V		D		C54	0.33
U12	LM358	2	+5V		D		C52	0.33
U5	74HC14	1	+5V		D		C39	0.33
U5	4053	2	+5V		D		C47	0.33
U13	EEPROM	1	+5V		D		C55	0.33
U7	LM358	2	+5V		D		C41	0.33
U2	L2726	2	+5V		D		C13	0.33
U11	DS1232	1	+5V		D		C46	0.33
U10	62256	1	+5V		D		C48	0.33
U4	74HC573	1	+5V		D		C33	0.33
U9	78310	1	+5V		D		C38	0.33



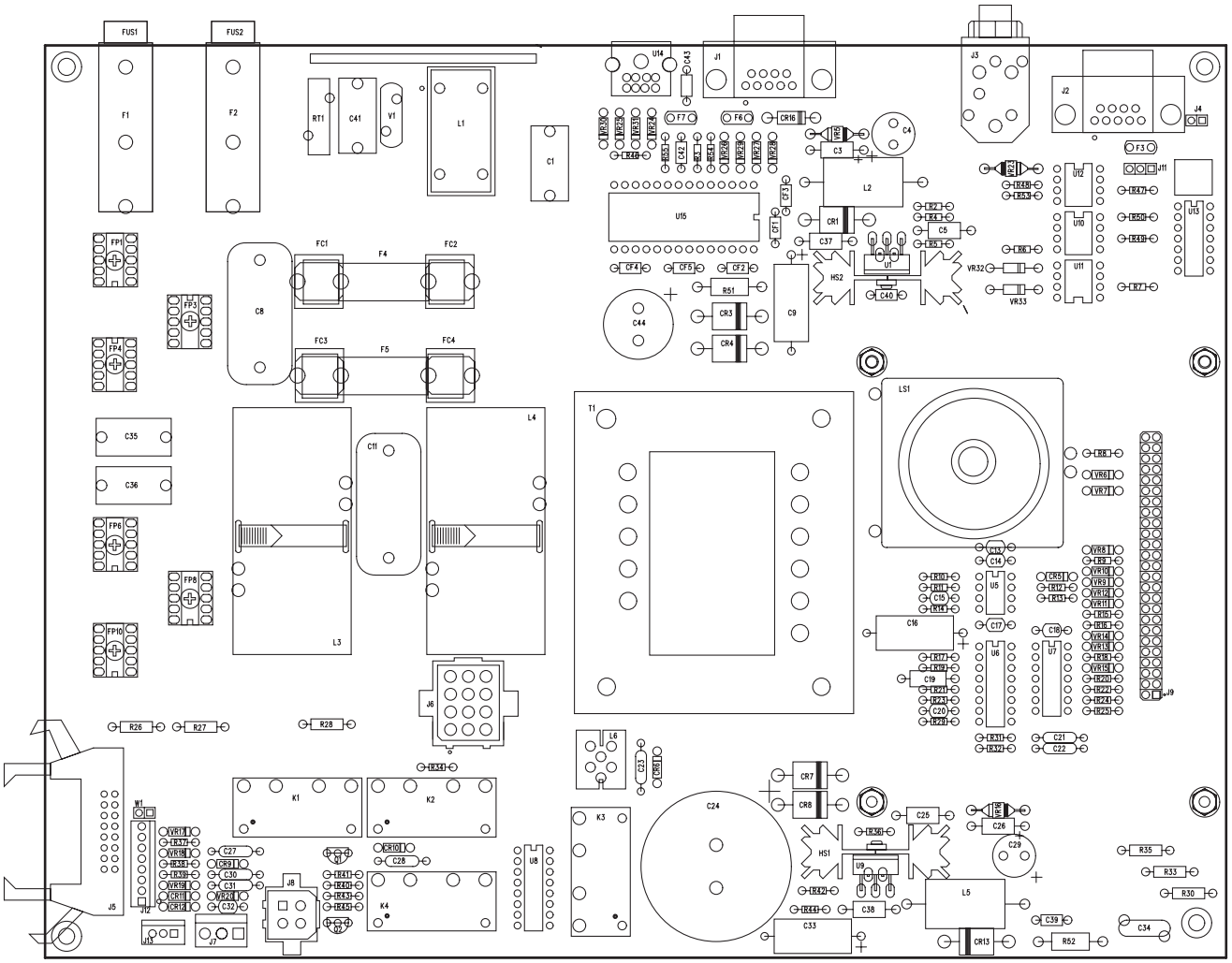


Power PCB 800334-003A

Item	Description	Part Number	Qty
1	10M 0,33W<250PPM VR25	100/21012/106	6
2	RES COMP 10 5% 1/2W	1002-100	2
3	RES MINI MF 47.5 1% 1/4W	1023-065	2
4	RES MINI MF 100 1% 1/4W	1023-096	2
5	RES MINI MF 499 1% 1/4W	1023-162	3
6	RES MINI MF 750 1% 1/4W	1023-179	9
7	RES MINI MF 2.49K 1% 1/4W	1023-229	2
8	RES MINI MF 3.01K 1% 1/4W	1023-237	2
9	RES MINI MF 3.92K 1% 1/4W	1023-248	2
10	RES MINI MF 10.0K 1% 1/4W	1023-287	14
11	RES MINI MF 10.5K OHMS 1% 1/4W	1023-289	1
12	RES MINI MF 20.0K 1% 1/4W	1023-316	2
13	RES MINI MF 100K 1% 1/4W	1023-383	4
14	RES MINI MF 750K 1% 1/4W	1023-467	1
15	RES MINI MF 1M 1% 1/4W	1023-479	2
16	VARISTOR 250VAC V250LA20A	1075-250	1
17	CAP CER RAM .33UF 50V +80/-20%	1110-334	7
18	CAP TANT 1.0UF 10% 35V	1224-105	2
19	CAP TANT 10UF 10% 35V	1224-106	2
20	CAP TANT 22UF 10% 35V	1224-226	1
21	CAP AL R 1000UF 20% 50V	1253-102	1
22	CAP AL R 330UF 20% 25V	1259-331	2
23	CAP CER COG 470PF 10% 50V	1281-471	2
24	CAP CER COG 4700PF 10% 50V	1281-472	1
25	CAP CER X7R .01UF 10% 50V	1282-103	2
26	CAP CER X7R .1UF 10% 50V	1282-104	4
27	CAP CER COG .001UF AX 5% 50V	1283-102	7
28	CAP CER Z5U .1UF +80/–20% 50V	1287-104	5
29	XFMR PWR ISO UL2601 7V 185-265	1401-221	1
30	IND CHOKE 47UH 4.0A	1441-014	2
31	SPEAKER 8 OHM .2W	1663-004	1
32	HLDR FUSE 3AG HORIZ PC MT	1740-101	2
33	JACK 1/4 PH 3 COND R ANGLE PCB	1769-101	1
34	POST .025SQ .320H	1778-604	2
35	CONN PC PIN HEADER MR 4M	1785-504	1
36	CONN PC PIN HEADER MR 12M	1785-512	1
37	CONN 90 RIB EJCTR - 16P	1824-016	1
38	HEADER MTA-156 W/LOCKS VERT 3P	1850-103	1
39	HDR MTA .100CTR W/LOCKS 8P	1868-208	1
40	CONN MINI CIR DIN PC MT 8P	1876-402	1

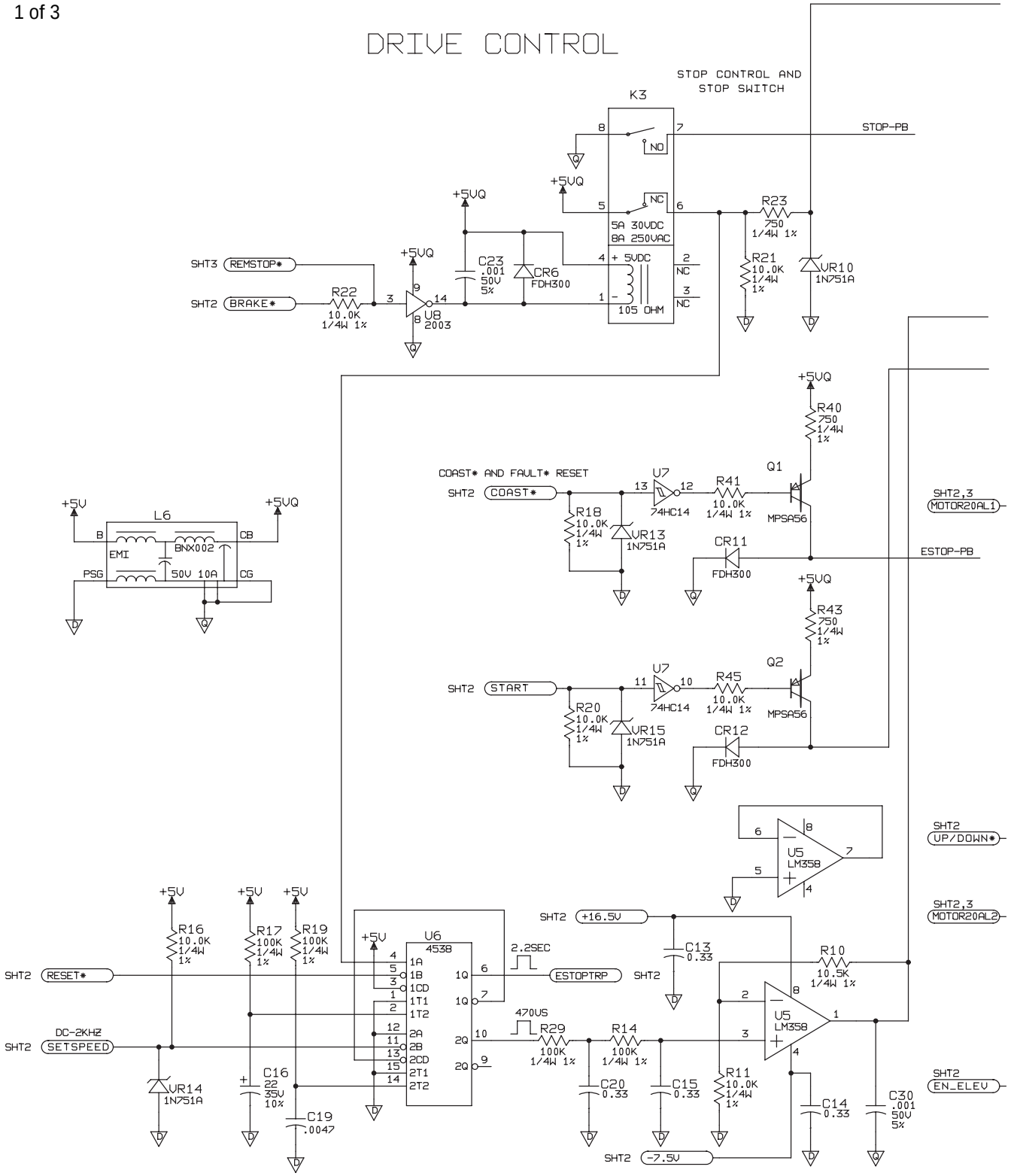
Item	Description	Part Number	Qty
41	FUSE 3AG 1/2A SB	1910-012	2
42	PROTECTOR CURRENT PTC 500 mA	1913-050	3
43	DIODE ZENER 500mW 5.1V 1N751A	2000-751	14
44	DIODE ZENER 500MW 5.6V 1N752A	2000-752	2
45	DIODE ZENER 18V 500MW 1N967B	2000-967	8
46	DIODE 500W TVS505	2002-505	3
47	DIODE LL FDH300	2003-001	6
48	DIODE SCHOTTKY 3A 40V 1N5822	2050-822	6
49	DIODE REC 1A 400V 1N4004	2401-100	1
50	TRANSISTOR NTWK DARL NPN 2003A	2599-001	1
51	TRANSISTOR PNP MPS-A56	2652-002	2
52	HEATSINK EXTRUDED W/PINS	2812-120	2
53	IC CMOS 4538	3001-538	1
54	IC HCMOS 74HC05	3019-005	1
55	IC HCMOS 74HC14	3019-014	1
56	IC AMPL DIP LM358	3102-358	1
57	IC SW REG LT1074CT	3129-074	2
58	IC OPTOCOUPLER CNW136	3151-036	3
59	INSULATOR SILICONE TO-220	3961-002	2
60	CAP AL RAD 10000UF +/-20% 50V	400079-001	2
61	FILTER EMI 50VDC	402151-001	1
62	RELAY 5A 1NO/1NC 5V PCB	404549-002	4
63	CAP CER DHR12 470PF 20% 7.5KV	405282-001	1
64	THERMISTOR NTC 10 OHM 5 AMP	406067-002	1
65	CAP MPE .047UF 20% 250VAC	406247-001	2
66	INDUCTOR TOROID 300UH 20A RMS	408116-001	2
67	FUSE CLIP 13/32 DIA FUSE PCB	408282-001	4
68	CONN RCPT D RA 94V 9P W/RIVETS	408845-001	2
69	SPACER XFMR POWER BOARD	408923-001	1
70	HEADER 50P 0.500 STANDOFF	410162-001	1
71	CAP MPE 0.068UF 20% 250VAC	410406-001	4
72	FUSE 13/32 KTK-15 FAST	411682-001	2
73	CHOKE COMMON MODE LINE 9A	415494-001	1
74	IC DIP 485/232 XCVR LTC1334CNW	417042-001	1
75	SCREW SEMS PH 6-32 X 1/4	45000-604	5
76	SCREW PH 4-40 X 3/8	4502-412	2
77	TERMINAL PWR LUG 10P	45139-001	5
78	NUT HEX KEPS 4-40	4521-704	6
79	TIE WRAP 8.00LG X .187W	4535-002	2
80	SPACER M/F 4-40 X 0.50	4656-408	4
81	CKT BD T2000 PWR EMI RS232	800335-003	1
82	SCH T2000 TMIL PWREMI RS232	SD800334-003	0
83	SCREW SEMS PH 6-32X1/4	45000-604	5

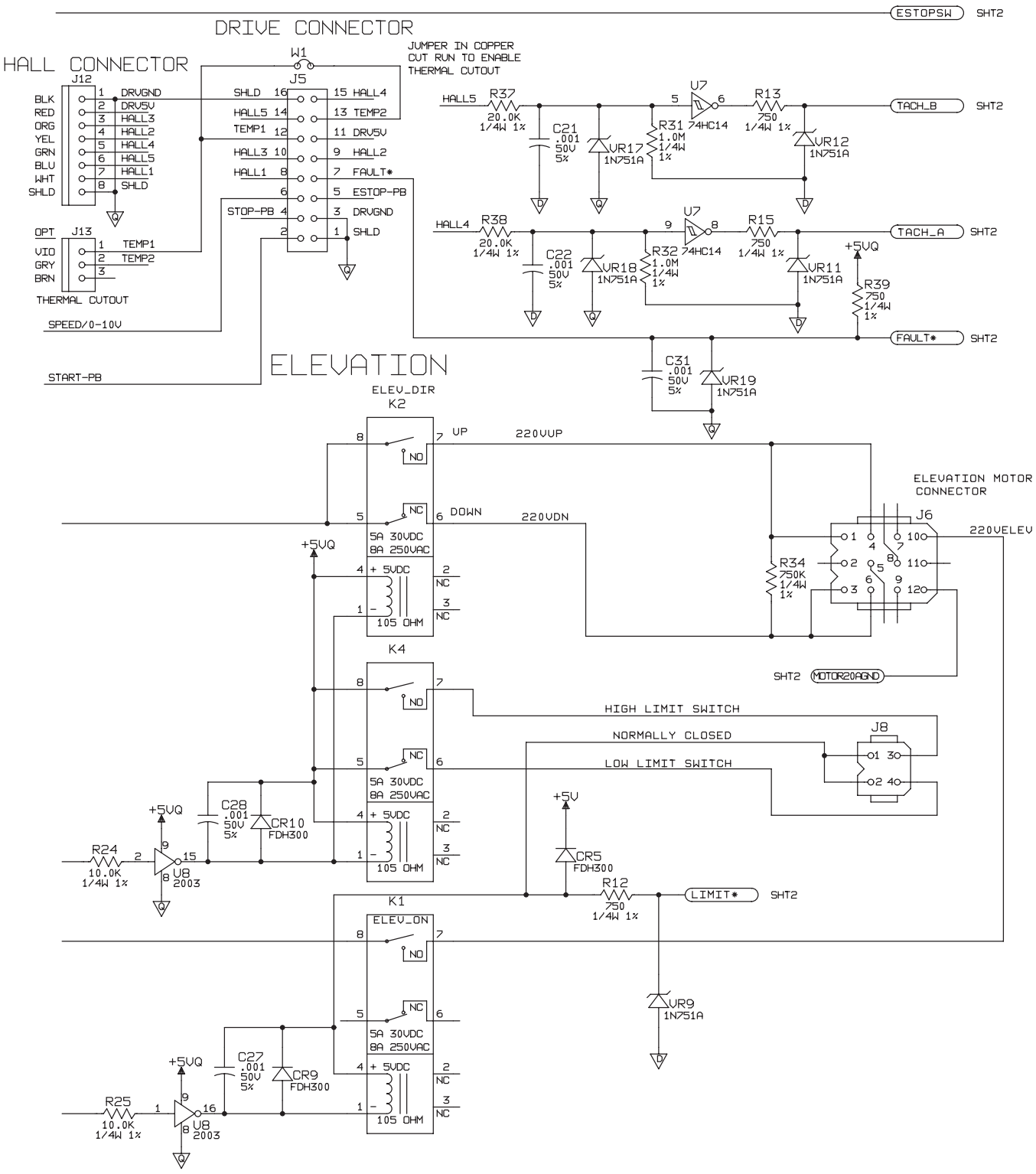
Component (Top) Side View



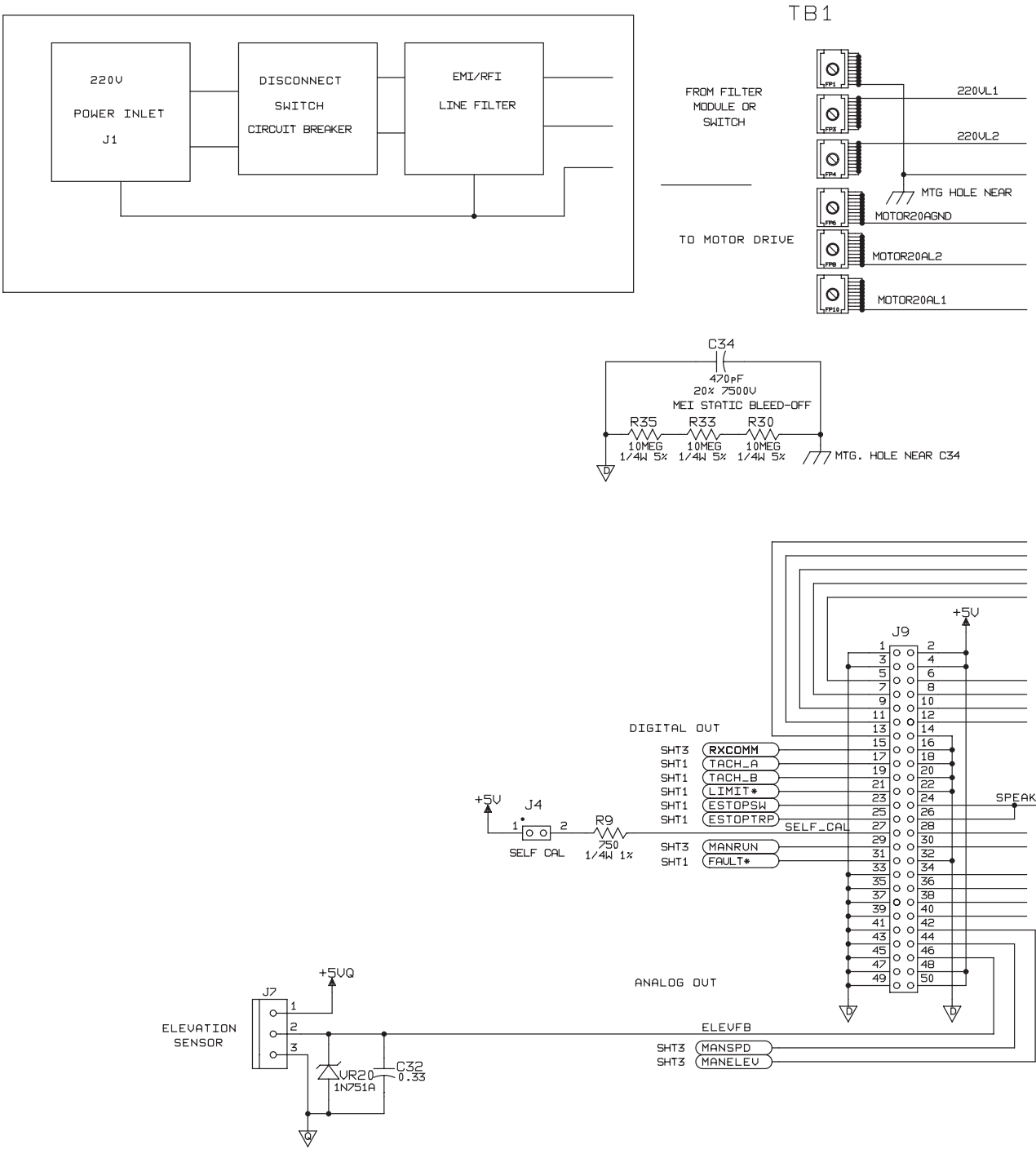
Power PCB Schematic SD800334-003A

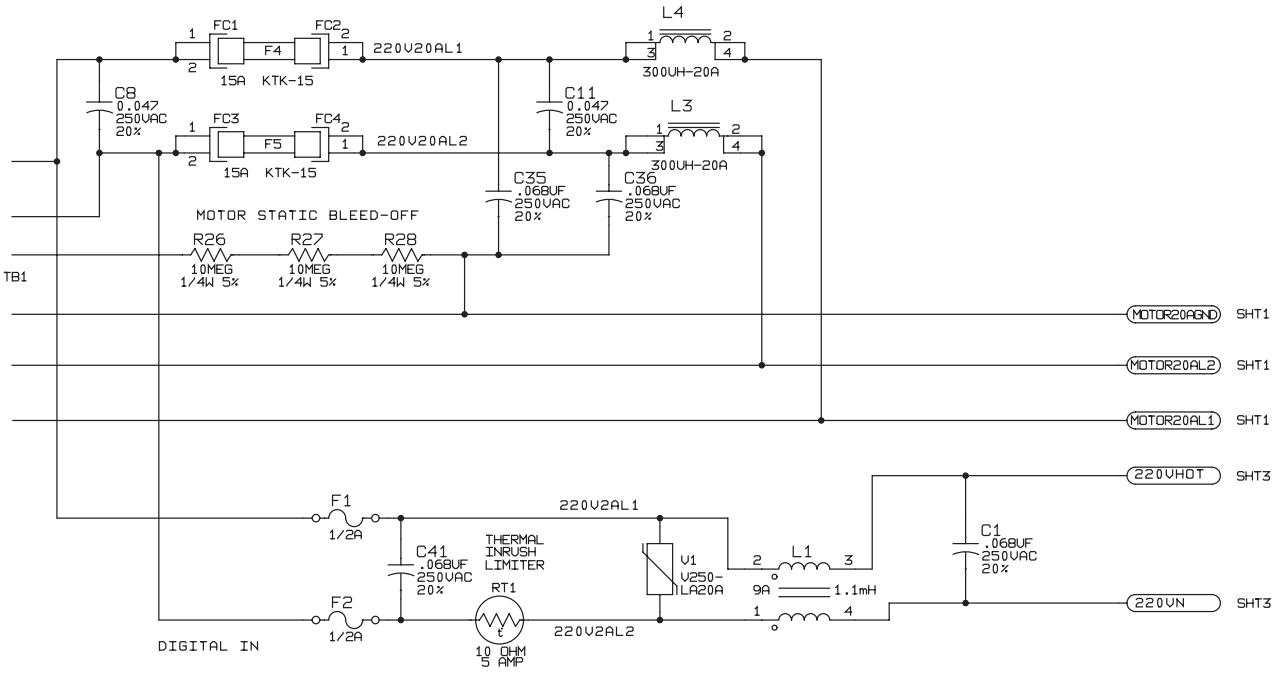
1 of 3

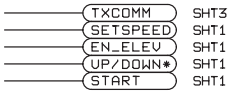



DRIVE CONNECTOR
HALL CONNECTOR
J12
BLK
RED
ORG
YEL
GRN
BLU
WHT
SHLD
DRVGND
DRV5V
HALL3
HALL2
HALL4
HALL5
HALL1
SHLD
OPT
J13
VIO
GRY
BRN
TEMP1
TEMP2
THERMAL CUTOUT
SPEED/0-10V
START-PB
W1
JUMPER IN COPPER
CUT RUN TO ENABLE
THERMAL CUTOUT
J5
SHLD
HALL5
TEMP1
HALL3
HALL1
STOP-PB
HALL4
TEMP2
DRV5V
HALL2
FAULT*
ESTOP-PB
DRVGND
SHLD
ESTOPSW
SHT2
HALL5
R37
20.0K
1/4W 1%
C21
.001
50V
5%
VR17
1N751A
U7
74HC14
R31
1.0M
1/4W
1%
R13
750
1/4W 1%
VR12
1N751A
TACH_B
HALL4
R38
20.0K
1/4W 1%
C22
.001
50V
5%
VR18
1N751A
R32
1.0M
1/4W
1%
R15
750
1/4W 1%
VR11
1N751A
+5VQ
R39
750
1/4W
1%
TACH_A
FAULT*
C31
.001
50V
5%
VR19
1N751A
ELEVATION
ELEV_DIR
K2
UP
220VUP
DOWN
220VDN
NO
NC
5A 30VDC
8A 250VAC
+ 5VDC
105 OHM
ELEVATION MOTOR
CONNECTOR
J6
220VELEV
R34
750K
1/4W
1%
MOTOR20AGND
K4
HIGH LIMIT SWITCH
NORMALLY CLOSED
LOW LIMIT SWITCH
J8
+5VQ
C28
.001
50V
5%
CR10
FDH300
R24
10.0K
1/4W 1%
U8
2003
+5V
CR5
FDH300
R12
750
1/4W 1%
LIMIT*
K1
ELEV_ON
VR9
1N751A
C27
.001
50V
5%
CR9
FDH300
R25
10.0K
1/4W 1%

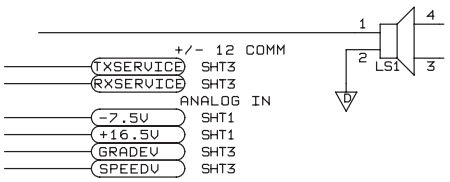
2 of 3

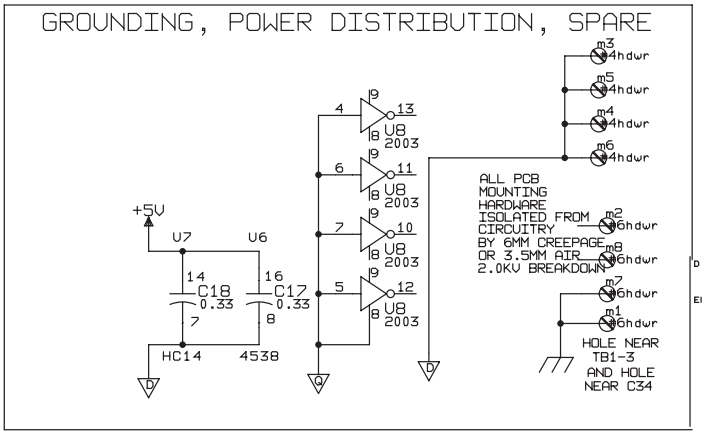

220V
POWER INLET
J1
DISCONNECT
SWITCH
CIRCUIT BREAKER
EMI/RFI
LINE FILTER
TB1
FROM FILTER
MODULE OR
SWITCH
220VL1
220VL2
MTG HOLE NEAR
MOTOR20AGND
TO MOTOR DRIVE
MOTOR20AL2
MOTOR20AL1
C34
470pF
20% 7500V
MEI STATIC BLEED-OFF
R35
10MEG
1/4W 5%
R33
10MEG
1/4W 5%
R30
10MEG
1/4W 5%
MTG. HOLE NEAR C34
+5V
J9
DIGITAL OUT
SHT3 RXCOMM
SHT1 TACH_A
SHT1 TACH_B
SHT1 LIMIT*
SHT1 ESTOPSW
SHT1 ESTOPTRP
SELF_CAL
SPEAKER
+5V
J4
SELF CAL
R9
750
1/4W 1%
SHT3 MANRUN
SHT1 FAULT*
+5VQ
J7
ELEVATION
SENSOR
VR20
1N751A
C32
0.33
ANALOG OUT
ELEVFB
SHT3 MANSPD
SHT3 MANELEV


FC1
FC2
F4
15A KTK-15
220V20AL1
L4
300UH-20A
C8
0.047
250VAC
20%
C11
0.047
250VAC
20%
FC3
FC4
F5
15A KTK-15
220V20AL2
L3
300UH-20A
C35
.068UF
250VAC
20%
C36
.068UF
250VAC
20%
MOTOR STATIC BLEED-OFF
R26
R27
R28
10MEG
1/4W 5%
TB1
MOTOR20AGND SHT1
MOTOR20AL2 SHT1
MOTOR20AL1 SHT1
220VHOT SHT3
F1
1/2A
220V2AL1
C41
.068UF
250VAC
20%
THERMAL
INRUSH
LIMITER
RT1
10 OHM
5 AMP
V1
V250-
LA20A
L1
9A
1.1mH
C1
.068UF
250VAC
20%
F2
1/2A
220V2AL2
220VN SHT3
DIGITAL IN

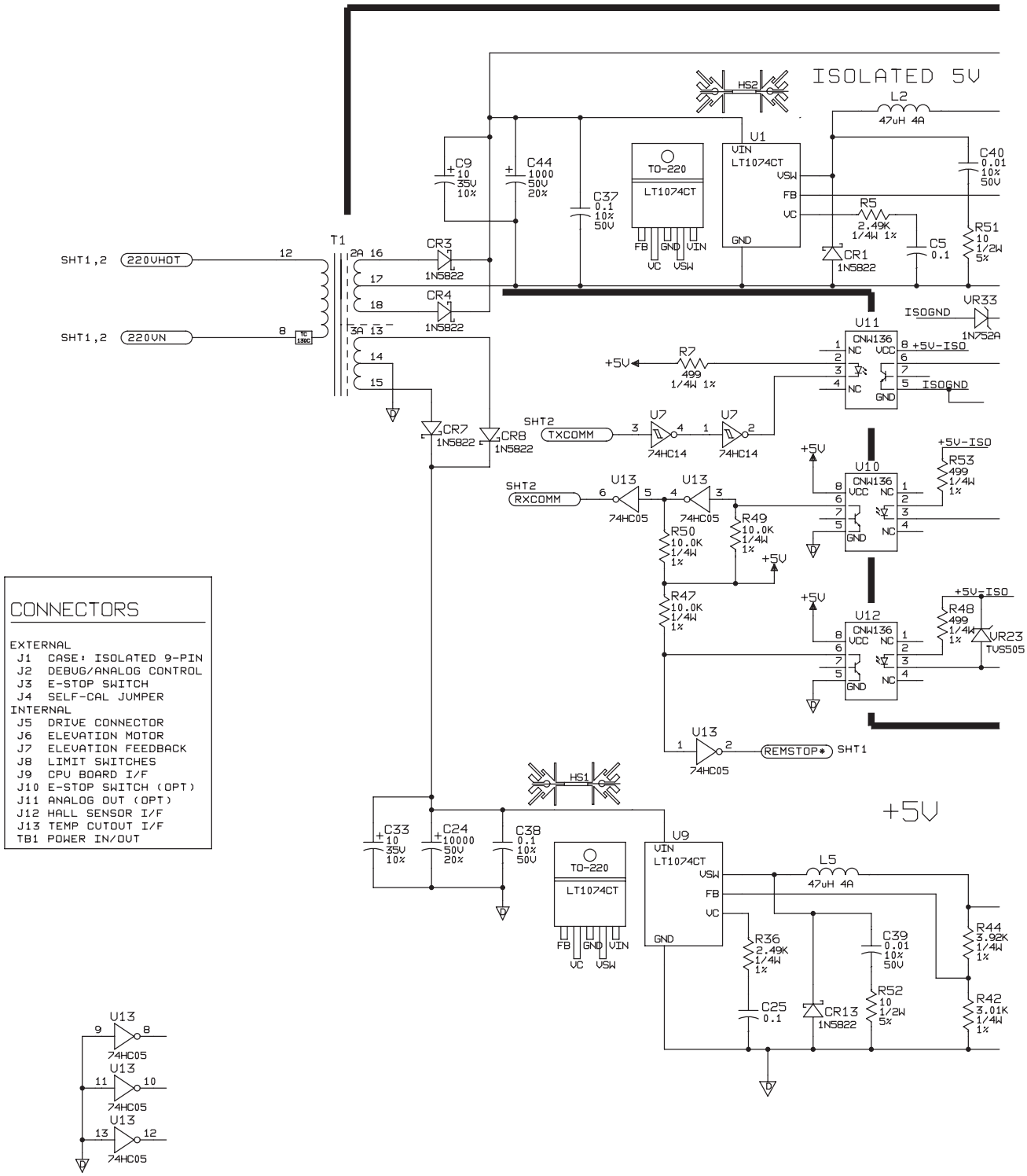

TXCOMM SHT3
SETSPEED SHT1
EN_ELEV SHT1
UP/DOWN* SHT1
START SHT1

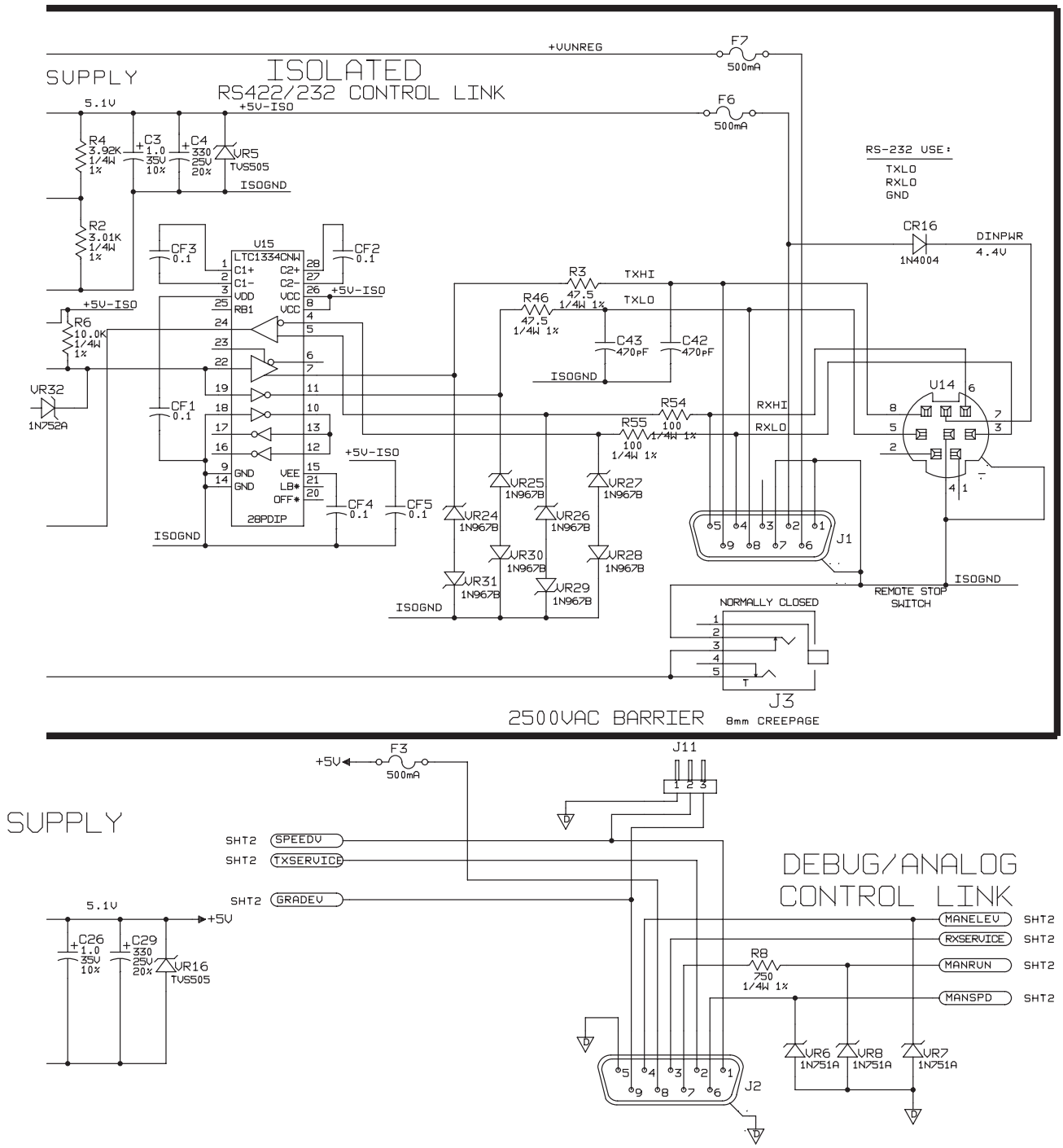

BRAKE* SHT1
COAST* SHT1
DRIVE_EN NOT USED
RESET* SHT1


+/- 12 COMM
LS1
TXSERVICE SHT3
RXSERVICE SHT3
ANALOG IN
-7.5V SHT1
+16.5V SHT1
GRADEV SHT3
SPEEDV SHT3


GROUNDING, POWER DISTRIBUTION, SPARE
U8
2003
+5V
U7
U6
C18
0.33
C17
0.33
HC14
4538
ALL PCB
MOUNTING
HARDWARE
ISOLATED FROM
CIRCUITRY
BY 6MM CREEPAGE
OR 3.5MM AIR
2.0KV BREAKDOWN
HOLE NEAR
TB1-3
AND HOLE
NEAR C34

3 of 3


ISOLATED 5V
CONNECTORS
EXTERNAL
J1 CASE: ISOLATED 9-PIN
J2 DEBUG/ANALOG CONTROL
J3 E-STOP SWITCH
J4 SELF-CAL JUMPER
INTERNAL
J5 DRIVE CONNECTOR
J6 ELEVATION MOTOR
J7 ELEVATION FEEDBACK
J8 LIMIT SWITCHES
J9 CPU BOARD I/F
J10 E-STOP SWITCH (OPT)
J11 ANALOG OUT (OPT)
J12 HALL SENSOR I/F
J13 TEMP CUTOUT I/F
TB1 POWER IN/OUT
SHT1,2 220VHOT
SHT1,2 220VN
T1
CR3
CR4
CR7
CR8
1N5822
1N752A
U1
U7
U9
U10
U11
U12
U13
74HC14
74HC05
LT1074CT
TO-220
CNW136
TXCOMM
RXCOMM
REMSTOP*
SHT1
SHT2
+5V
+5V-ISO
ISOGND
HS1
HS2
L2
L5
47uH 4A
TVS505


SUPPLY
ISOLATED
RS422/232 CONTROL LINK
+VUNREG
F7
500mA
F6
500mA
5.1V
+5V-ISO
R4
3.92K
1/4W
1%
C3
1.0
35V
10%
C4
330
25V
20%
VR5
TVS505
ISOGND
R2
3.01K
1/4W
1%
CF3
0.1
V15
LTC1334CNW
CF2
0.1
C1+
C1-
VDD
RB1
C2+
C2-
VCC
VCC
R6
10.0K
1/4W
1%
VR32
1N752A
CF1
0.1
GND
GND
VEE
LB*
OFF*
28PDIP
CF4
0.1
CF5
0.1
R3
47.5
1/4W 1%
TXHI
R46
47.5
1/4W 1%
TXLO
C43
470pF
C42
470pF
R54
100
1/4W 1%
RXHI
R55
100
1/4W 1%
RXLO
VR25
1N967B
VR27
1N967B
VR24
1N967B
VR26
1N967B
VR30
1N967B
VR28
1N967B
VR31
1N967B
VR29
1N967B
RS-232 USE:
TXLO
RXLO
GND
CR16
1N4004
DINPWR
4.4V
U14
J1
REMOTE STOP
SWITCH
NORMALLY CLOSED
J3
2500VAC BARRIER
8mm CREEPAGE
SUPPLY
F3
500mA
+5V
J11
SHT2
SPEEDV
SHT2
TXSERVICE
SHT2
GRADEV
5.1V
C26
1.0
35V
10%
C29
330
25V
20%
VR16
TVS505
DEBUG/ANALOG
CONTROL LINK
MANELEV
RXSERVICE
MANRUN
MANSPD
R8
750
1/4W 1%
VR6
1N751A
VR8
1N751A
VR7
1N751A
J2

Appendix A: Abbreviations

Standard Abbreviations

A

A	ampere
A-ang	antianginal
A-arh	antiarrhythmic
A-coa	anticoagulants
A-hyp	antihypertensive
A1 - A4	auxiliary leadwires
AAMI	American Association of Medical Instrumentation
ABP	ambulatory blood pressure
ac, AC	alternating current
ACLS	Advanced Cardiac Life Support
A/D	analog-to-digital
Adj	adjustable
AG	automotive glass
Ah	ampere hours
AHA	American Heart Association
Al	aluminum
AllRam	all RAM
AllSec	all sector
AllTrk	all track
ALT	alternate
Alt-Off	alternate offset
am, AM	acquisition module, ante meridiem
AM-1	acquisition module-1
AM-1M	acquisition module-1 modified
AM-2	acquisition module-2
AM-3	acquisition module-3
AM-4	acquisition module-4
amp	ampere
Ampl	amplifier
AMU	ambulatory monitoring unit
ANA	analog
ANLG	analog
AnsrTone	answer tone
A/O	Analog Output
ASCII	American Standard Code for Information Interchange
ASSY	assembly
Attn	attention
AUG	August
AUST	Australian
AUSTRALN	Australian
Auto	automatic
AutoRhym	automatic rhythm
AUX	auxiliary
aVF	augmented left leg lead
avg	average
aVL	augmented left arm lead
aVR	augmented right arm lead
AWG	American Wire Gage

B

Bd	board, baud
BDGH	binding head
BetaB	beta blockers
BKSP	backspace
BLK	black
BLU	blue
Blvd	boulevard
BP	blood pressure
BPM	beats per minute
BRIT	Britain
BRN	brown
BSI	British Standards Institute
Btu	British thermal unit

C

CalcBlk	calcium blockers
CAPOC	Computer Assisted Practice of Cardiology
CASE	Computer Aided System for Exercise
Catoprl	Catopril
Cauc	Caucasian
Cer	ceramic
CFM	cubic feet/minute
CGR	computer graphic record
Ch, CH	channel
C/L	center line
CLK	clock signal
Clonid	Clonidine
cm	centimeter
cm^2	square centimeters
Cmd	command number
CMMR	common mode rejection ratio
CMOS	complementary metal-oxide semiconductor
c/o	in care of
COM1	communications port 1
COM2	communications port 2
ComLink	communications link
Comp	composition
Confrmd	confirmed
Cont, CONT	Continental, continued
Coumadn	Coumadin
CPR	cardiopulmonary resuscitation
CPU	central processing unit
CR	diode

CRC	cyclic redundancy check
CRD	cord
crt, CRT	cathode ray tube
CSA	Canadian Standards Association
CTRL	control

D

D/A	digital to analog
DA	damping relay
dac, DAC	digital-to-analog converter
DAN	Danish
Dat/Tim	date/time
dBm	decibel (referenced to 1 milliwatt into 600 ohms)
dc, DC	direct current
DD	double density, day
DDD	Digital Diagnostic Diskette
DEC	Digital Equipment Corporation, December
Del	delete
DEMO	demonstration
DES	designation
DevId	device identification
Diag	diagnostic
Digital	Digitalis
Digitox	Digitoxin
Digox	digoxin
Digoxin	Digoxin-Lanoxin
DIP	dual in-line package
Dirctry	directory
Diurt	diuretics
DOB	date of birth
DOS	disk operating system
DP	diametral pitch
DPST	double-pole, single-throw
DRAM	dynamic RAM
DR/DT	digital recording/digital transmission
DSKTP	desktop
Dysopyr	Dysopyramide

E

E	enable, vector electrode site, vector lead
ecg, Ecg, ECG	electrocardiogram
ECO	Engineering Change Order
EDIC	Electrocardiograph Digital Information Center
EEPROM	electrically erasable programmable ROM
e.g.	for example
EGA	enhanced graphics adapter
EMF	electromotive force
EMI	electromagnetic interference
ENG	English
EOF	end of file
EPIC	Electronic Patient Information Chart
EPLD	electrically programmable logic device
EPROM	eraseable, programmable, read-only memory
ESD	electrostatic discharge
etc, etc.	et cetera
EURO	Europe, European
EXP	Expanded

F

F	fuse, Farad, female
F1-F5	function keys 1 through 5
Fax	facsimile
FCC	Federal Communications Commission
FE	front end
FILH	fillister head
FLH	flat head
FLRAM	flash RAM
FR	French
FrntEnd	front end
FSK	frequency shift keying
ft	foot, feet
Furosem	Furosemide

G

g	gram, acceleration due to gravity
GB	Great Britain
GERM	German, Germany
GND	ground, digital ground (dc common)
GRN	green
GRY	gray

H

H	high, vector electrode site, vector lead
HDLC	high-level data link control
Hex, HEX	hexagon, hexadecimal
HH	hour
HiRes	high-resolution
Hr	hour
Hydral	Hydralazine
Hz	Hertz (cycles per second)

I

I	on, input, vector electrode site
I, II, III	limb leads
IC	integrated circuit
ID	identification
i.e.	that is
IEC	International Electrotechnical Commission
in	inch
IN	input
inc, inc., INC	incorporated
Info	information
Ins	insert

I/O	input/output
I/P	input
ISA	industry standard architecture
Isosorb	Isosorbide
IT	Italian, Italy

J

JAN	January
JIS	Japan Industrial Standards

K

k, K	kilo, 1000, 1024
Kb, KB	kilobyte
kg, Kg	kilogram
kHz, KHz	kilohertz
kV, KV	kilovolt
Kyb	keyboard

L

L	line
L1	level one
L2	level two
LA	left arm
lb	pound
LCD	liquid crystal display
Lcl Line	local line
Ld Grps	lead groups
LED	light-emitting diode
LH	left hand
Lidoca	Lidocaine
LL	left leg
Loc	location
LocPc	Local MAC PC
LogRetry	log retry
Ltd	limited

M

m	meter
M	megabyte, metric, vector electrode site, vector lead, male
mA	milliamperes
MAC	Microcomputer Augmented Cardiograph
mains voltage	voltage of a supply mains between 2 line conductors of a polyphase system or voltage between the line conductor and the neutral of a single-phase system
max	maximum
Measure	measurements
Med	medications
MEM	memory
MF	metal film
MHz	megahertz
min	minutes, minimum
Misc	miscellaneous
mm	millimeter
MM	minute
MMM	month
mm/mV	millimeter per millivolt
mm/s	millimeter per second
MMS	Marquette Medical Systems
Modem	modulator/demodulator
MOS	metal oxide semiconductor
MPE	metallized polycarbonate expitaxial
ms	milliseconds
MS-DOS	Microsoft Disk Operating System
MTBF	mean time between failures
mtg	mounting
MTR	MOTOR
MUSE	Marquette Universal System for Electrocardiography
mux	multiplexer
mV	millivolt
mVR	minus (inverted) aVR

N

N	neutral
n/a	not available
NA	not applicable
NC	no connection
Nitrate	nitrates
NLQ	near letter quality
NMI	non-maskable interrupt
NMOS	N-channel metal-oxide semiconductor
No	number
NO	normally open
norm	normal
nS	nanoseconds
NSR	Normal Sinus Rhythm

O

O	off, original
OE	other errors
OEM	original equipment manufacturer
OH	off-hook relay
OneSec	one sector
ORG	orange
Orig	original
OUT	output
oz	ounce

P

P	P wave (section of the ECG waveform)
p-p	peak-to-peak
PA	P wave amplitude
Params	parameters
Passwds	passwords

PatData	patient data
PatInfo	patient information
PATN	patient
PC	printed circuit, personal computer
PCB	printed circuit board
pF	picofarad
Pgm	program
PgmId	program identification
Phenoth	Phenothiazide
Phenytn	Phenytoin
PID	patient identification digit
PLCC	plastic leadless chip carrier
PM	power module
pm, PM	post meridiem, preventive maintenance
PM-2	Power Module-2
PM-3	Power Module-3
pn, PN	part number
PNH	pan head
PPA	P wave amplitude
PR	ECG signal interval
Pro-Off	progressive offset
Procain	Procainamide
PROM	programmable read-only memory
Propran	Propranolol
PSK	phase shift keying
PSU	power supply unit
Psych	psychotropic
PUP	pull-up signal
PVC	polyvinyl chloride
PWM	pulse-width modulation
PWR	power
PWR CRD	power cord

Q

Q	transistor
QA	quality assurance, Q wave amplitude
QAD	Quality Assurance Deviation
QAM	quadrature amplitude modulation (phase and amplitude modulation)
QC	quality control
QD	Q wave duration
QRS	QRS complex (portion of ECG waveform), interval of ventricular depolarization
QT	QRS interval
QTC	QRS interval
QTY	quantity
Quinid	Quinidine

R

R	resistor, red, reset
RA	right angle, right arm or R wave amplitude
RAM	random access memory
RC	resistor capacitor
RD	R wave duration
Ref	reference, refresh
REN	Ringer Equivalence Number
Reserp	Reserpine
REV	revision
RevdBy	reviewed by
RevXmit	reverse transmission
rf	radio frequency
RFI	radio frequency interference
RGB	red, green, blue
RI	ring indicate
RL	right leg
RMR	Rhythm and Morphology Report
ROM	read only memory
RPA	R wave amplitude
RPD	R wave duration
rpt, Rpt	report
RTC	real time clock
RTI	relative to patient input
RTN	return
RVS	reverse
R/W	read/write

S

12SL	12 simultaneous leads
s, S	second, select, switch
SA	s wave amplitude
SB	slow-blow
SCL	safe current limits
SD	schematic diagram, S wave duration
SE	serial input/output errors
sec	second
sec.s	seconds
SEER	Solid-state Electronic ECG Recorder
SING	Singapore
SP	Spanish
SPA	S wave amplitude
SPDT	single-pole, double-throw
SRAM	static RAM
ST-T	ST-T wave (section of the ECG waveform)
standrd, Standrd	standard
STD	standard
STE	ST segment displacement at the end
STJ	ST segment displacement at the J point
STM	ST segment displacement at the mid-point between STJ and STE
stmts, Stmts	statements
supply mains	permanently installed power source
SVT	power cord type; 300 V
sw, SW	switch, software
SW	Swedish, Sweden

T

T Tone	touch tone
TA	T wave amplitude
Tant	tantalum
TDML	treadmill
TE	timeout errors
Tech	technical
Thiazid	Thiazide
TM	trademark
Tot	total
TP	test point
TPA	T' wave amplitude
TRAM	Transport Remote Acquisition Monitor
Tricyli	Tricylic antidepressant
TTL	transistor-transistor logic, TTL levels
TVS	transient voltage suppressor

U

UE	undefined errors
uF	microfarad
UL	Underwriters' Laboratory, Inc
Unconf	unconfirmed
UUT	unit-under-test

V

v, V	volt, volts
V1-V6	precordial leads
V123	V1, V2, V3
V3R	precordial lead
V456	V4, V5, V6
V4R	precordial lead
V ac	volts, alternating current
V dc	voltage, direct current
VA	volt-amperes
Var	variable
VDE	Verband Deutscher Elektrotechniker (German regulatory agency)
Vent.	ventricular
VF	ventricular fibrillation
VGA	video graphics array
VIA	versatile interface adapter
VIO	violet
Volt	voltage
VRAM	video RAM
vs	versus

W

w/	with
W	watt
Warfar	Warfarin
WHT	white
WI	Wisconsin

X

x	by (as in "8-1/2 x 11")
XCV	transceiver
X,Y,Z	orthogonal leads

Y

Y	year, yellow
yr	year
yrs	years
YY	year

Symbols

↑	SHIFTed or alternate function
µ	micro
µF	microfarad
µs, µsec	microsecond
68K	68000
&	and
#	number
°C	degrees Celsius
°F	degrees Fahrenheit
Ω	Ohm, ohm
%	percent
®	registered
>	greater than
<	less than
±	plus or minus
*	An asterisk after a signal name indicates the signal is active at its relatively lower potential, or "active-low." Signals without the asterisk suffix are active at their relatively higher potential, or "active-high."
12SL	12 simultaneous leads

Appendix B: Technical Description

Technical Specifications

Table B-1. Performance Specifications	
Item	Specification
Maximum Rated Load	182 kg (450 lbs)
Drive Motor	3.0 HP, brushless, DC motor
Elevation Motor	0.13 HP
Belt Speed Range	0.0 to 22.5 km/h (0 to 13.5 mph) at 220V, @ 50/60 Hz continuously variable, zero mph start-up
Belt Speed Tolerance	±0.16km/h (±0.1mph)
Belt Speed Acceleration/Deceleration	Approximately 0.8 km/sec (0.5 mph/sec)
Elevation Range	0.0 to 25.0% grade, continuously variable
Elevation Range Increase/Decrease	1.14%/sec. @ 60 Hz
Manual Treadmill Controller (Optional)	Functions: On, Off, Up, Down, Fast, Slow, Automatic Protocol Selection, Elapsed Time, Distance Traveled Automatic Protocols: 15 exercise and 15 rehabilitation (includes Bruce, Naughton, Balke II, Ellestad, Low Performance)
Maximum Leakage Current	100 µA, chassis to ground
Interface	Either RS-232 port or RS-422 serial port, 9600 baud
Mode of Operation	Continuous
Degree of protection against ingress of water	Ordinary

Table B-2. Physical Specifications	
Item	Specification
Weight	181.4 kg (400 lb)
Walking Area	45.7 cm x 152.4 cm (18 in x 60 in)
Floor Space Required	73.7 cm x 195.6 cm (29 in x 77 in)
Walking Surface Height	14.0 cm (5.5 in)
Handrail Height Above Walking Surface	Front: 101.6 cm (40 in) Side: Maximum 88.9 cm (35 in) descending at 5° angle to 81.3 cm (32 in)

Table B-3. Power/Environmental Specifications	
Item	Specification
Power Requirements	200 to 265 VAC, 60 Hz, single phase, 20 A, NEMA 6-20 R wall socket (dedicated circuit recommended)
Power Consumption	1540 watts, 16 A

Table B-4. Safety	
Item	Description
Certification	UL classified CSA certified
Type of Protection Against Electrical Shock	Class 1
Degree of Protection Against Ingress of Liquids	Ordinary
Handling of Disposable Supplies and Other Consumables	■ Use only parts and accessories manufactured or recommended by Marquette. ■ Follow manufacturer's instructions for use for disposable/consumable product. ■ Follow local environmental guidelines concerning the disposal of hazardous materials (e.g. lead acid batteries).
Patient Mode of Operation	Continuous
Patient Leakage Current	Not applicable
Degree of Protection Against Electrical Shock	Not applicable
Maintenance Frequency	■ Test the stop switch assembly monthly. ■ Recommended user daily visual inspection and cleaning. ■ Recommended six-month routine maintenance checks and test procedures performed by qualified technical personnel.
Repair Guidelines	Calibration instructions, equipment descriptions, and all other service information to repair those parts of the equipment designated as field repairable by qualified technical personnel is available in the service manual. Upon request, Marquette will provide circuit diagrams and component parts lists for printed circuit boards deemed repairable by qualified technical personnel.

Table B-5. Environmental	
Item	Description
Operating Conditions	
Ambient temperature	10°C to 40°C (50°F to 104°F)
Relative humidity	20% to 90%
Atmosphere pressure	525 mmHg to 795 mmHg (20.7 to 31.3 in Hg)
Storage Conditions	
Temperature range	–40°C to 70°C (–40°F to 160°F)
Relative humidity	15% to 95%
Atmosphere pressure	500 hPa to 1060 hPa (375 mmHg to 795 mmHg)