



TREADMILL BASE ELECTRONICS – DC MOTOR TECHNICAL CERTIFICATION TRAINING

Field Engineering | 2010

LifeFitness
WHAT WE LIVE FOR

Course Objectives

- » Topics to be covered include:
 - ♦ Major components identified
 - ♦ Common Issues/Trouble-shooting tips

Treadmill Models – (Mid-line)

T9 consumer



Serial numbers

91Ti
90T
T9i mid-line



Treadmill Models - Consumer



F3



T3

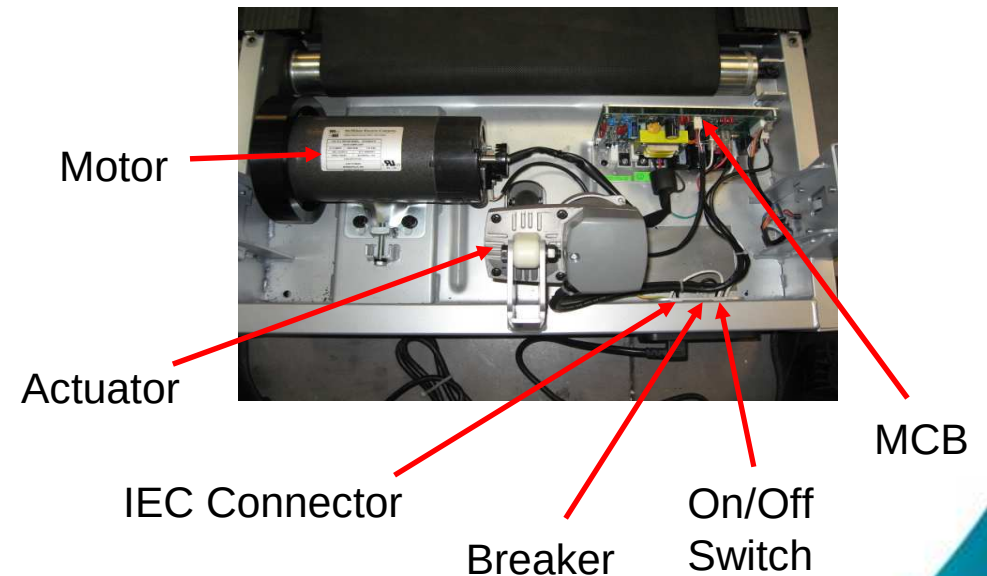
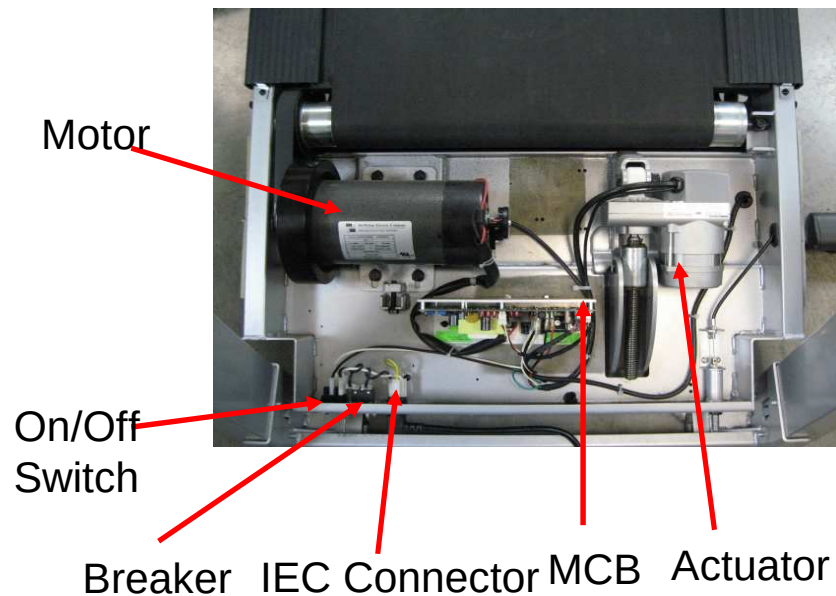


T5-0, T5-5, T7-0

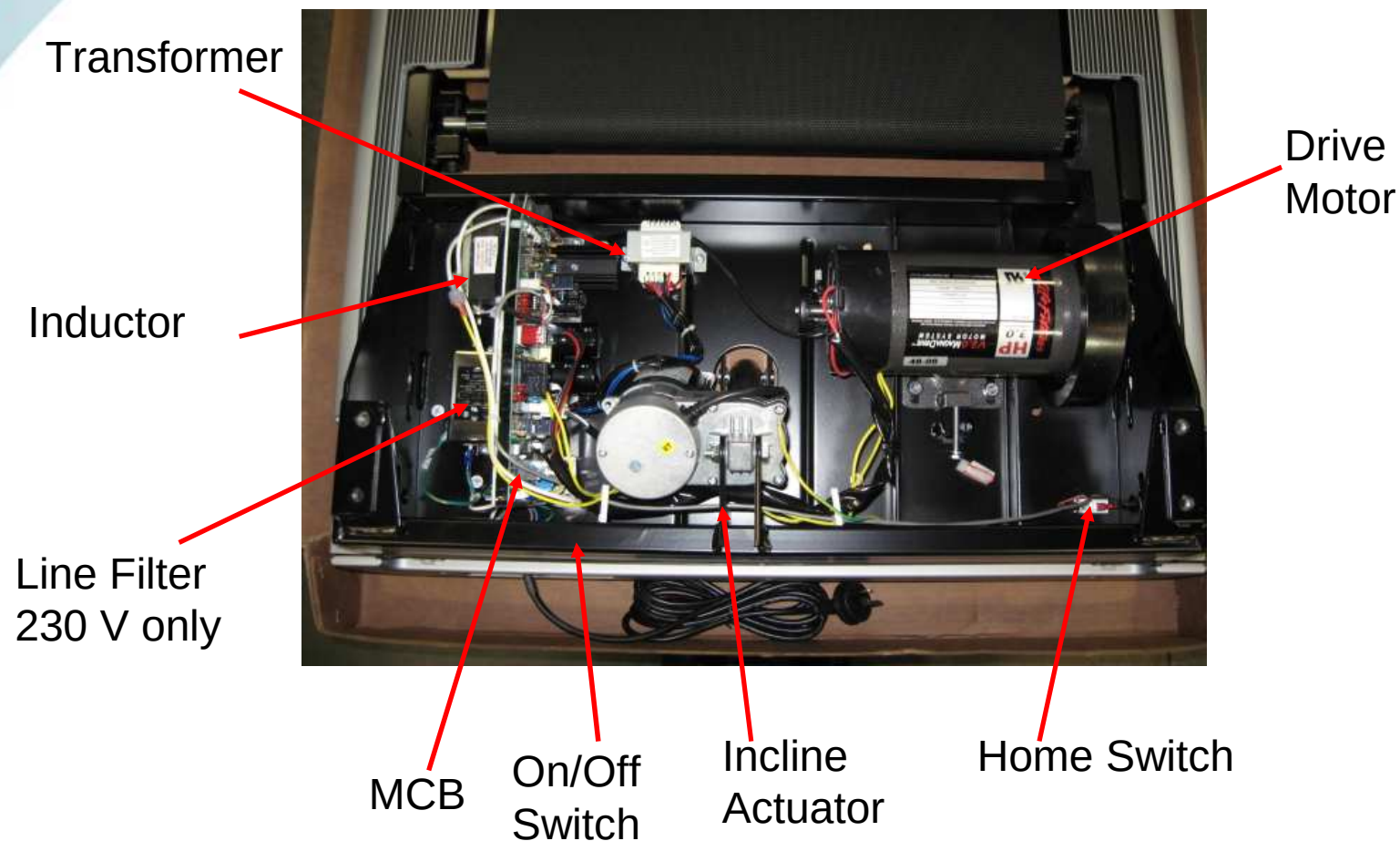
T3 and F3 Motor Pan's (Consumer)

F3

T3



T5.0/T5.5/T7.0 Motor Pan's (Consumer)

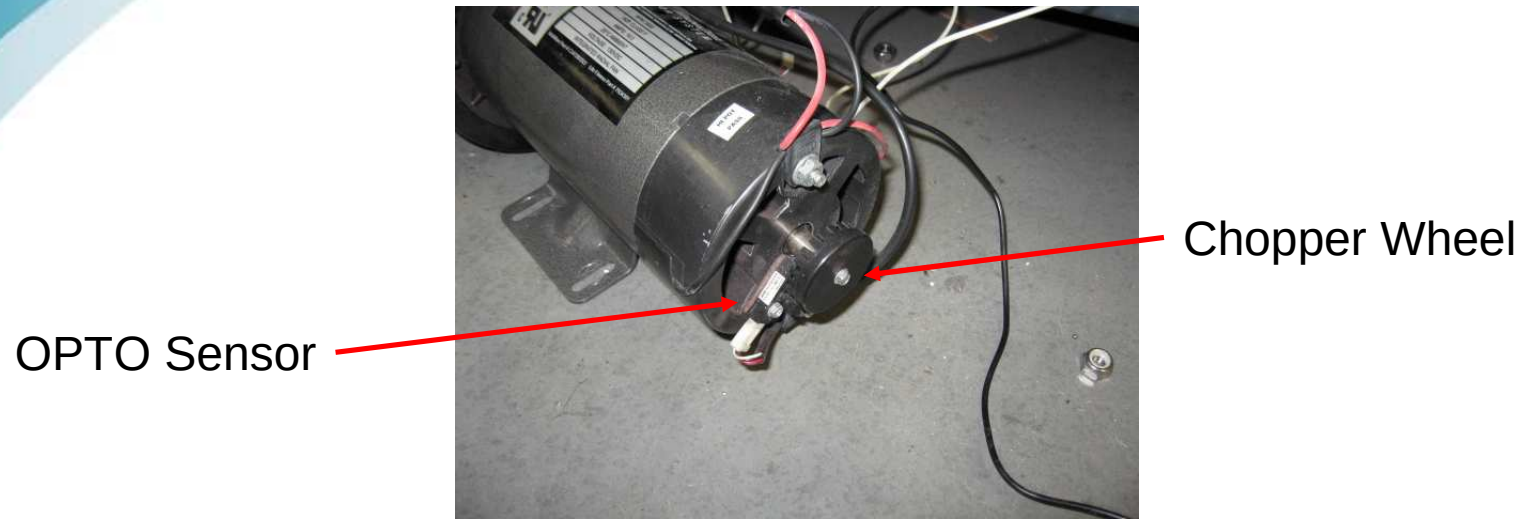


Drive Motors

Drive Motors - DC

- » Main Function is to drive the Treadmill Walking Belt.
- » Drive motors are DC motors
- » Used on Consumer Models and Mid Line
- » These motors require an Opto Sensor and Chopper wheel to determine speed of the motor.

Consumer T3/F3 - 3 HP DC Motor



- » Opto Sensor and Chopper Wheel are required for this motor. They determine the Motor speed.
- » The Chopper Wheel is mechanically attached to the motor drive shaft.
- » The Opto Sensor is positioned so the chopper wheel teeth pass through it.

Incline/Lift Actuators

Incline/Lift Actuators

- » Incline Actuators are all AC motors.
- » Main Function is to drive the raise (or lower) the Treadmill Deck.
 - > Incline specified as a %.
 - > Ranges shown in the User Manuals.
 - > 97 Series Treadmills have a Negative Incline (Decline) – up to (-3%).
 - > Incline Actuators use the Home switch to determine starting position.
- » Incline Actuators have internal limit switches (top and bottom).
 - ♦ Internal limit switches are there for safety and should not activate in normal operation.
 - ♦ With Internal limit activated, still allows activation in opposite direction – so Treadmill is still functional.

Incline Actuator and control

» How does it function?

- ◆ Works with AC voltage (either 120 VAC or 220 VAC) that comes from the Motor controller
- ◆ Must always find Home (zero % incline) before it allows further operation.
- ◆ Set up on a timing function: the up or down ON-time duration directly correlated to the incline desired.
- ◆ Has internal limits or stops (top and bottom). These are factory set before being installed. No calibration needed.
Note: This is why it is IMPORTANT **not** to turn the lift screw or nut prior to installing.

F3/T3 Actuator difference

- » The F3/T3 Actuator has a Potentiometer in it.
 - ♦ The motor controller uses the Potentiometer feedback from the actuator to determine the position of the actuator at all times.
 - ♦ This is one reason why units are 'Calibrated' once a part is replaced
 - ♦ Motors come with the Potentiometer set at the minimum incline, so nut position on the screw thread is very important when installing.
 - ♦ Diagnostics have a calibration for the incline actuator.

Motor Controllers

Motor Controllers

- » This is the brains of the Treadmill Base.
- » Communicates with the Console or not.
- » Interfaces to the various Base components.
- » Controls and regulates the speed of the striding belt.
- » Many different Motor Controllers made at LF. Parts List identify the different part numbers.
- » The **DSP** (Digital Signal Processor) Motor Controllers **cannot be used with DC motors.**

DC Motor Controller LED's - Mid Line

» Service LED's

LED 1 Main Loop

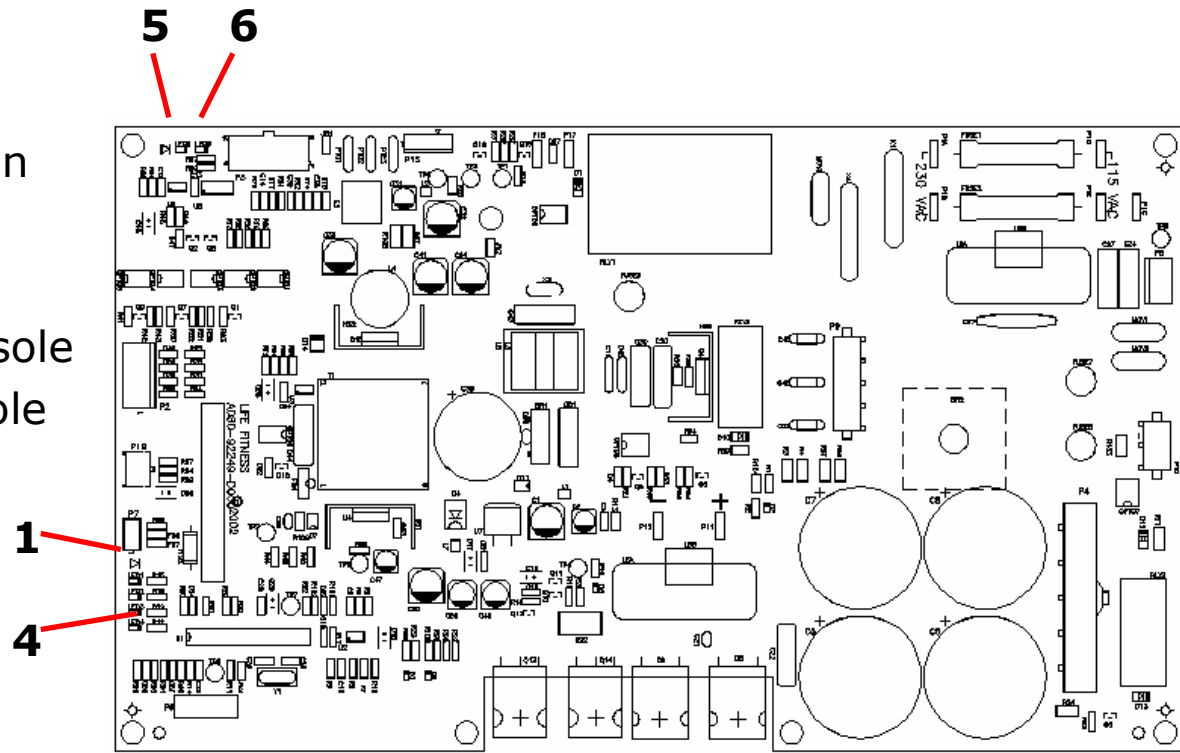
LED 2 Communication

LED 3 Home Switch

LED 4 RPM / Opto

LED 5 +12 VDC Console

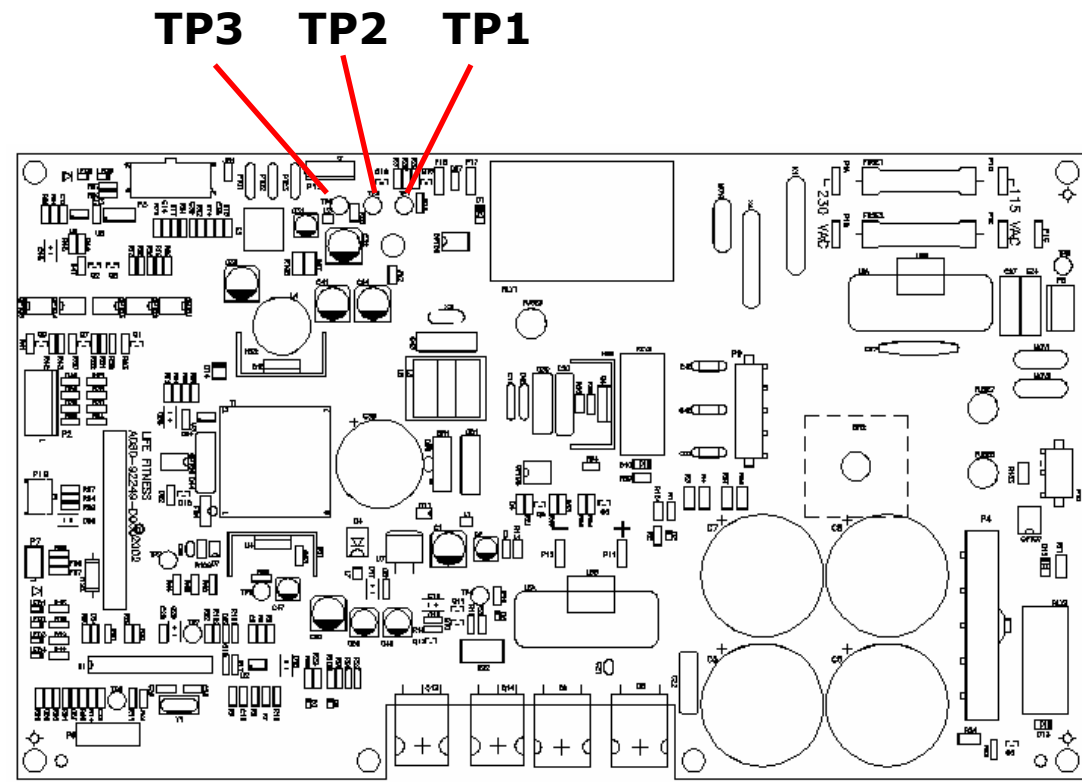
LED 6 +8 VDC Console



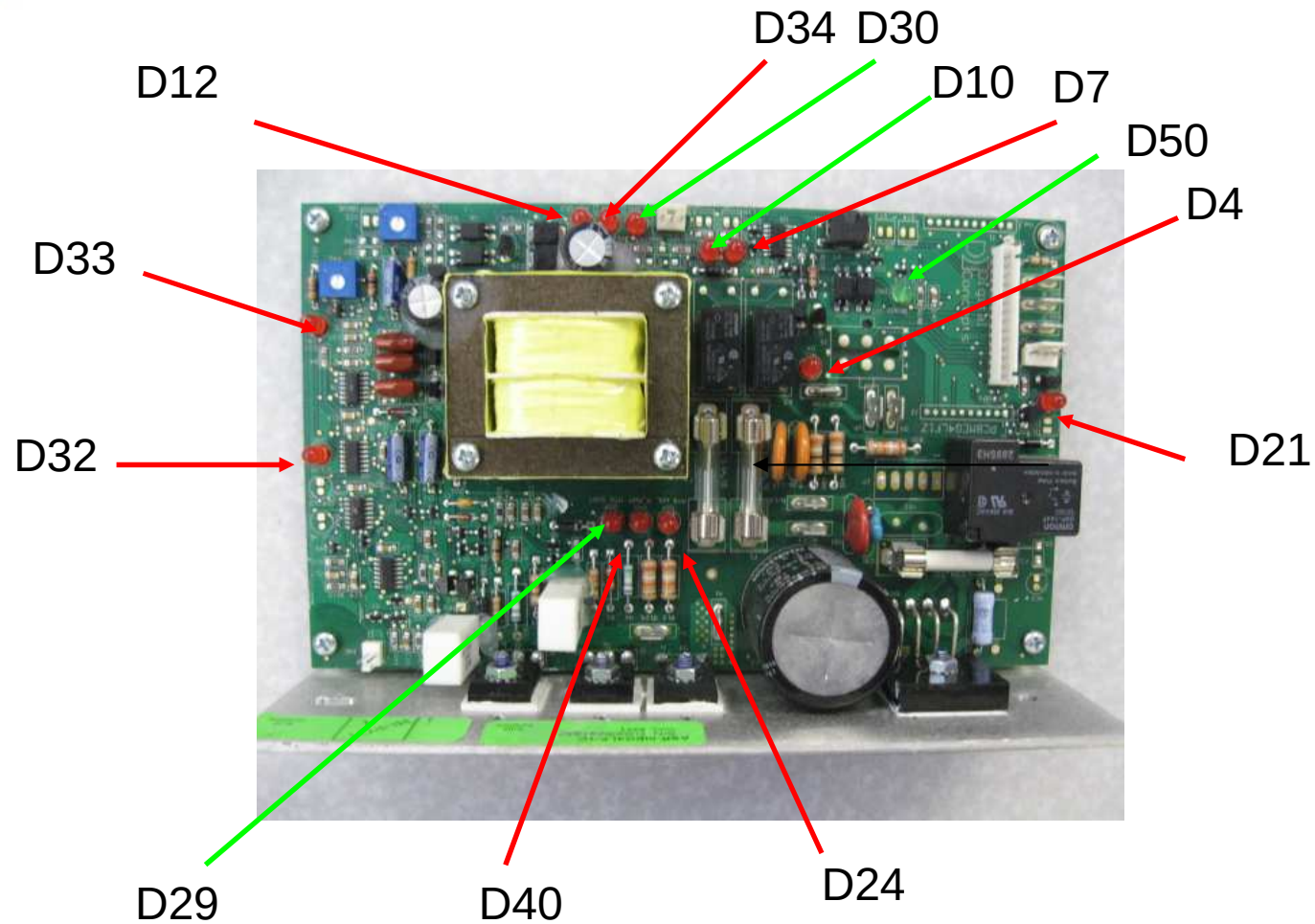
DC motors, motor controller

DC MCB Test Points - Mid Line

- » If “NO” LED’s are “on” then verify if power is coming out of the motor controller
- » Test Points – measure voltage:
- » TP1 Ground for Console
- » TP2 +8VDC Console
- » TP3 +12VDC Console
- » How does this help you?



T3/F3 MCB LED Indicators



T3/F3 MCB LED Descriptions

Label on board	Name	Description
D33	18V	Turns on when the transformer secondary that is attached to power ground outputs power. This indicates that the low voltage transformer is working and implies that the "hot side" control electronics are active.
D4	AC1	AC power is at the primary to the transformer.
D7	DOWN	Current is flowing in the elevation control circuit to allow for the down relay controlling the elevation motor to activate.
D32	I LIM	Turns on when the current flowing through the motor reaches the circuit set maximum. This indicates that the system is loaded to or beyond its capacity.
D40	M_PWM	Turns on when the power FET is conducting. The LED will seem to become brighter as the PWM at the power FET approaches 100% because it is flashing at a greater rate than the human eye can see.
D29	MTR SHRT	Turns on when excessive current passes through the FET. This LED implies that there is a short in the motor or motor wiring.
D24	MTR VOL	Turns on dimly when power is first applied and becomes brighter as the large capacitor charges. When the LED is bright this indicates that the motor controller is ready to power the motor.
D12	PWM	Turns on when the incoming PWM signal is logical high with a duty cycle of less than 99%. The LED will seem to become brighter as the incoming PWM approaches 99% because it is flashing at a greater rate than the human eye can see.
D50	READY	This is a green LED. This LED will light when the treadmill is in the horizontal position. When the treadmill is folded the LED will be off.

T3/F3 MCB LED Descriptions cont...

D21	RELAY	Turns on when the console commands the relay to turn on. This indicates that power is present at the relays to energize them. It implies that the motor controller and the console are communicating
D30	SPD	Flashes each time the speed sensor is triggered. This indicates that the speed sensor is working and communicating with the motor controller. This also indicates that the signal has been converted to a TTL output. This does not indicate that the console is receiving the speed feedback.
D10	UP	Current is flowing in the elevation control circuit to allow for the up relay controlling the elevation motor to activate.
D34	VCON	Turns on when the voltage regulator on the transformer secondary attached to Chassis Ground that supplies the console outputs power. This indicates that the low voltage transformer is working and implies that there is enough power to turn the console on and that the "cold" side electronics is active.

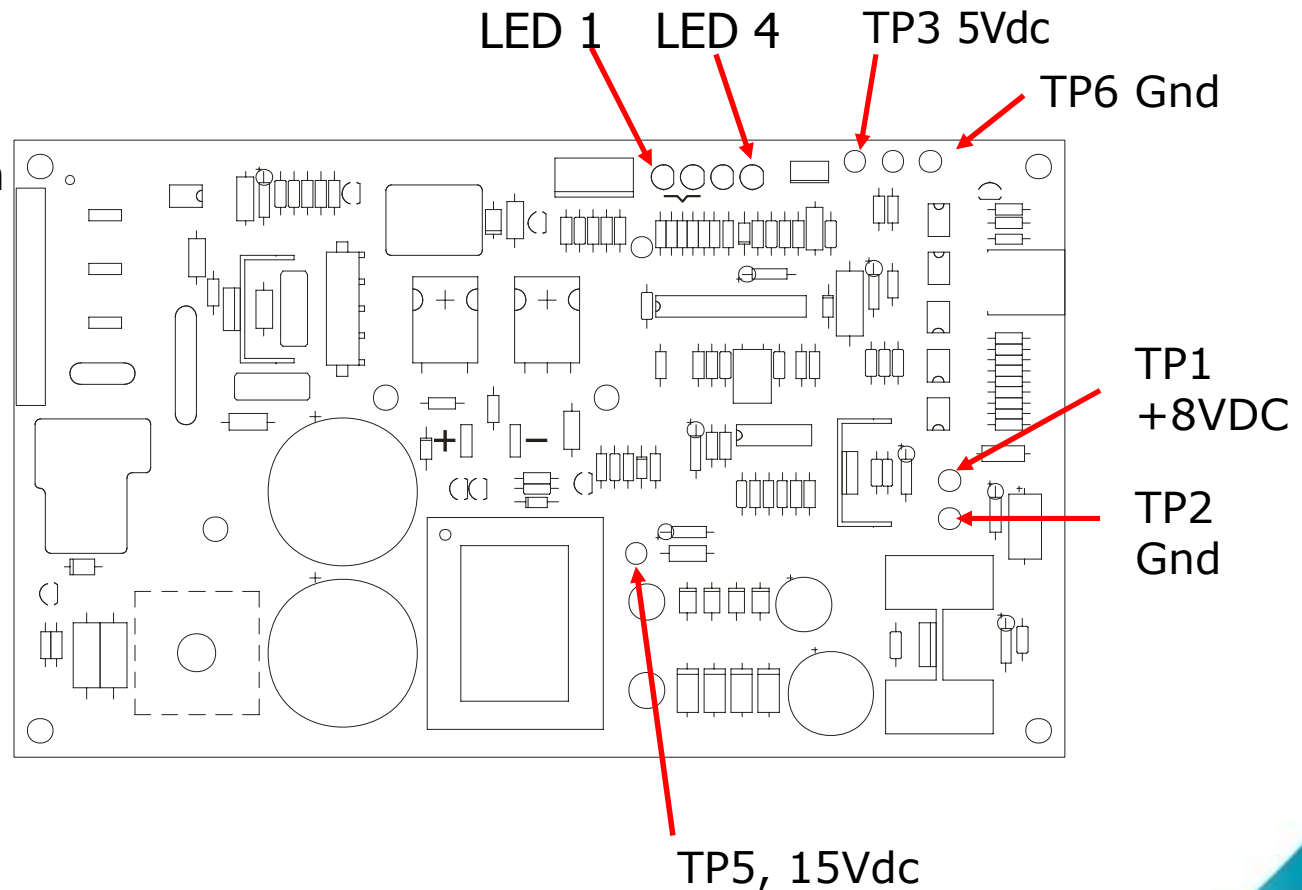
DC MC for T3.5/T7i, T3.0/T5i, T3

» LED identification:

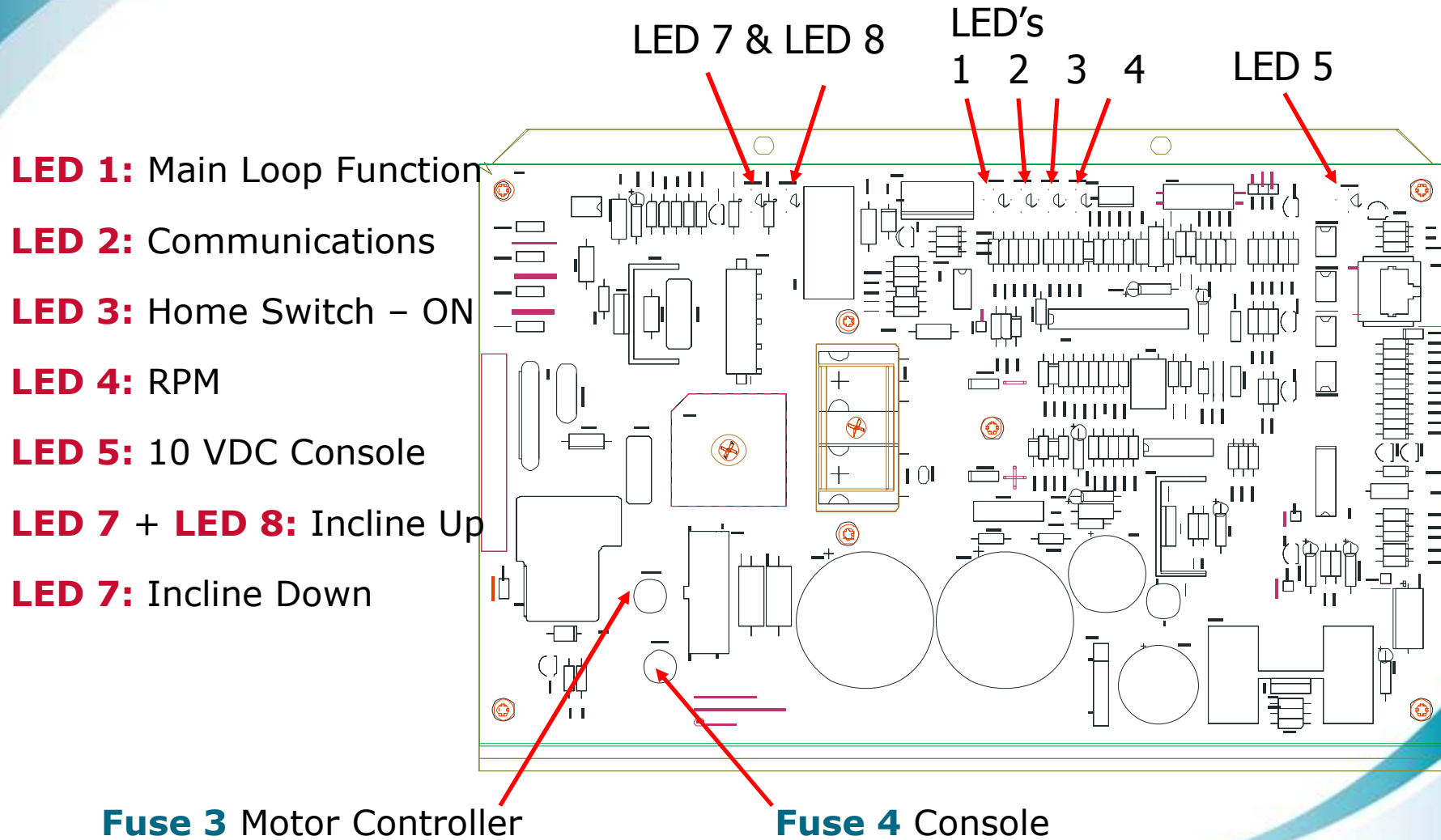
- » LED 1: Communication (Main Loop)
- » LED 2: Communication
- » LED 3: Home Switch
- » LED 4: RPM Sensor

» Test Points for measurement:

- » TP 1: +8Vdc (Console)
- » TP 3: +5Vdc (Drive)
- » TP 5 +15Vdc (Drive)
- » TP 2,6: Gnd

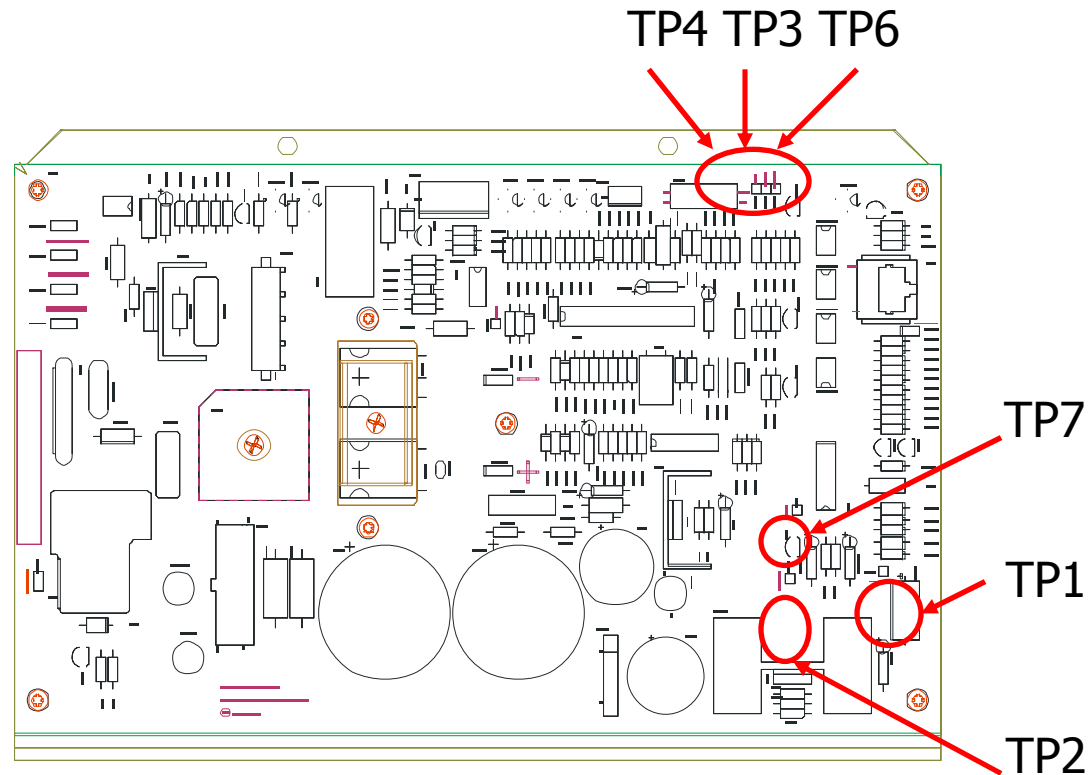


DC MCB for T7.0/T5.5/T5.0 - LED's

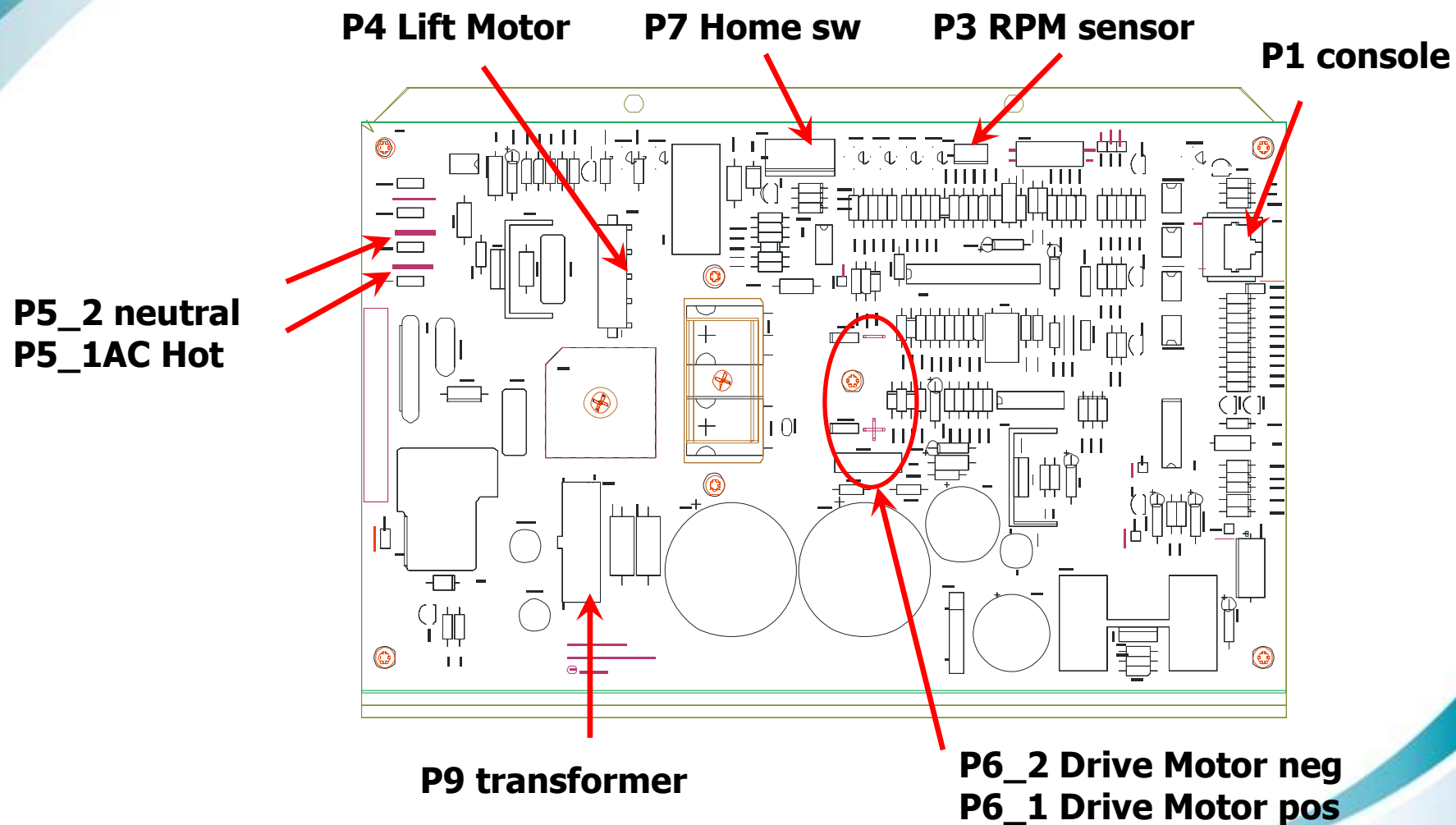


DC MCB for T7.0/T5.5/T.5.0 - Test Points

- » Console voltage
 - ◆ TP1 = + 10Vdc,
 - ◆ TP2 = Ground
- » Console voltage
 - ◆ TP7 = + 5Vdc
 - ◆ TP2 = Ground
- » MC Processor
 - ◆ TP3 = + 5Vdc
 - ◆ TP6 = Ground
- » MC Drive Voltage
 - ◆ TP4 = + 15Vdc
 - ◆ TP6 = Ground



T5.0/T5.5/T7 MCB Cable Connections



Service Information & Tips

Troubleshooting Tips

- » General Tip: Check all cables and connectors prior to replacing any Electronic parts (Circuit Boards, motors, etc.).
 - ◆ Cables can be pinched, damaged
 - ◆ Connectors can have broken/bent pins, pins pushing out the back of the housing, etc.

T3/F3 Treads – Need Calibration

- » When any of these components are changed, need to run Calibration within Diagnostics (Advanced/Basic Consoles)
 - ◆ Lift Actuator
 - ◆ Display Console
 - ◆ Motor Controller
 - ◆ Drive Motor

- » If Error Codes are seen during calibration, check for:
 - ◆ Pinched cables during assembly
 - ◆ Bent pins at cable connections

Common Issues

Consumer Model Errors

»Symptom

»Below errors Displayed at the start of a workout

»F3/T3 – **SPEED STALL**

»T5.0 – **START UP ERROR**

»T5.5/T7.0 – **MOTOR DISABLED**

»Models

♦F3, T3, T5.0, T5.5, T7.0

»Possible Causes

♦Bad OPTO

♦Loose cable connection at the OPTO sensor or where it connects to the MCB

»Probable Solutions

♦Replace faulty components

F3/T3 – “Emergency Stop Key” Error

»Symptom

- ♦“Emergency Stop Key” message displayed (even when key is present) immediately after customer installation

»Models

- ♦F3 & T3

»Possible Causes

- ♦Not connecting all the console cables during installation.
- ♦Activity zone cable is missed.

»Probable Solutions

- ♦Check for missing cables. Confirm all 3 cables between Base and Console are properly connected.
- ♦Re-install cables
- ♦Verify no bent pins within cable connectors

T5.0/T7.0 – “Please Wait” Error

»Symptom

- ◆“Please Wait” message displayed

»Models

- ◆T5.0/T5.5/T7.0

»Possible Causes

- ◆Bad Home Switch.
- ◆Bad Home Switch cable.

»Probable Solutions

- ◆Check cables for proper connections and pinch points.
- ◆Change Home Switch or Cable

Motor Controller Errors T5.5, T7.0

STARTUP ERROR - no speed was detected when the belt is first starting

RUNNING ERROR - no speed is detected after the belt successfully started

BELT MOVING ERROR - a significant speed is detected when the belt is expected to be stopped

OVERSPEED ERROR - the belt is running significantly faster than the speed commanded

LOW VOLTAGE ERROR - the bus voltage dropped below a predetermined value

DRIVE TRANSISTOR ERROR a possible shorted drive transistor is detected, this can also occur if a motor has intermittent brush contact

MOTOR DISABLED –inspect cable connection between the drive motor and controller

Error Codes T5.0

Malfunction	Probable Cause	Corrective Action
Motor Comm Error	Console lost communication with motor controller.	Check connections and continuity on main harness using multi-meter.
Start up error	Belt was commanded to move and the opto has not seen any movement or the belts movement was interrupted prior to it reaching its commanded speed	Verify opto operation in Diagnostics, Motor Test Mode, Section 2. Verify DC voltage at connector P6 pins 1 and 2. Verify that LED 4 on the Motor Controller flashes as the motor moves.
Running error	Belts movement was interrupted or lost opto after reaching its commanded speed.	Check opto connections. Verify opto operations in Diagnostics, Motor Test Mode, Section 2, and that LED4 flashes as motor moves.
Belt Moving error	Belt movement detected prior to receiving a command.	Make sure user is not pushing belt manually. If unit is moving without command, replace the motor controller.
Overspeed Error	Belt movement is exceeding command by 3 Mph.	Verify opto operation in Diagnostics, Motor Test Mode, Section 2. Replace motor controller if actual speed exceeds target speed.
FET Stuck On Error	A short has been detected on the Driver transistor component of the motor controller.	Replace The motor controller.
Low Voltage Error	Customers Electrical Supply	Verify customer has proper outlet and power requirements

Summary – Treadmill Base Electronics

- ◆ When do we need to calibrate a T3 or F3 unit?
- ◆ Does a DC motor need a speed sensor?
- ◆ Is the incline motor a DC motor?
- ◆ Can cables cause an “emergency stop key” error message?

Questions





THANK YOU!

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