# IMPORTANT

# Engineering Bulletin #104
# M00352 (AKA T-LIMIT-T) Limit Board Installation & Adjustment on Microflite Plus, Ultra, and Ultra 2000 Controllers Using Analog Tachometers or Digital Encoders (LIMITOT Software)


## Motion Control Engineering

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**O. Thompson M00352 Limit Board**

The O. Thompson M00352 Limit board is designed to comply with the latest version of ANSI and Canadian elevator codes. It performs the NTS (Normal Terminal

Stopping, ANSI Rule 209.2) function by clamping the speed reference signal from the MPU or the speed board to the drive or regulator. It performs the ETS (Emergency Terminal Stopping, ANSI Rule 209.4b) function by opening a series of contacts in the elevator's safety circuit.

The M00352 Limit board uses a processor to monitor car speed and the status of the hoistway limit switches. If the car speed exceeds that which is safe for an approach to the top or bottom terminal floor, the Limit board will perform a clamping operation, slowing the car speed to a safe level. If the car fails to respond, or the response is not fast enough to prevent the car from striking the buffer, the Limit board will open the safety circuit, removing power from the brake and hoist motor. This will stop the car close to the terminal floor, allowing the passengers (if any) to get off the car.

The following is an explanation on installation and adjustment of the board. The board can be installed in one of two ways. If you have an existing installation using an analog tachometer, and do not wish to activate the speed clamping function, follow the procedure that is outlined for an existing installation. (This procedure is also outlined in Bulletin 116, which is limited to analog tachometer installations.) If you wish to activate the clamping, follow the procedure for a new installation using a digital encoder. On jobs using digital encoders the board will automatically detect if the speed reference is present and if not, will not clamp the reference, but rather open the fault circuitry.

## Limit Board Mounting (Existing Controllers – Analog Tachometers)

The mounting holes on the new board are positioned such that the new board will use the existing mounting holes on most controllers.

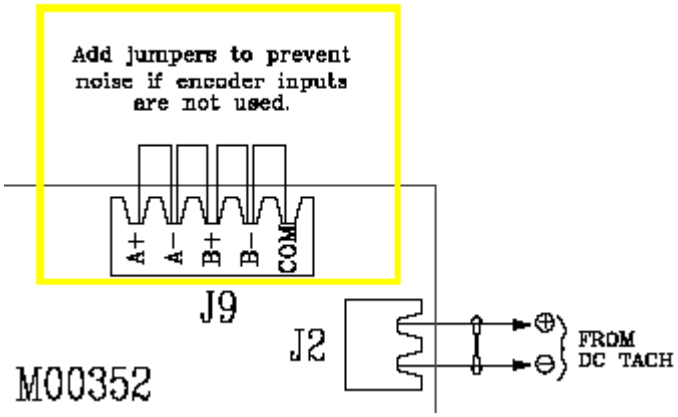
Position the Limit board so that it is aligned with the existing mounting holes on the right side. Install the mounting screws and stand-offs, securing the new board to the controller.

## Limit Board Wiring (Existing Controllers – Analog Tachometers)

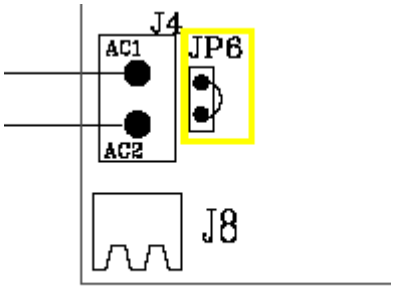
Before the Limit board can be adjusted, it must be wired correctly. The board was designed so that the wiring from the existing board will connect to the new board. You may, however, have to re-route or lengthen the wires that connect to some of the terminals. Due to the smaller size of the new board, some of the terminals have been relocated about 5 inches away. Refer to Figure 1 below for the correct terminals.

**Attention:** When replacing the M00118 limit board, you must invert the wires going into the J2 connector on the new limit board. In other words, on the M00118 board the TACH – input is at the top and the TACH + is at the bottom, whereas on the M00352 (AKA T-LIMIT-T) board, the TACH + input is at the top of connector J2 and the TACH- input is at the bottom.

When a DC tachometer is used the encoder inputs need to be connected to the common on the J9 connector to avoid noise problems.




Make sure there is a jumper on JP6.



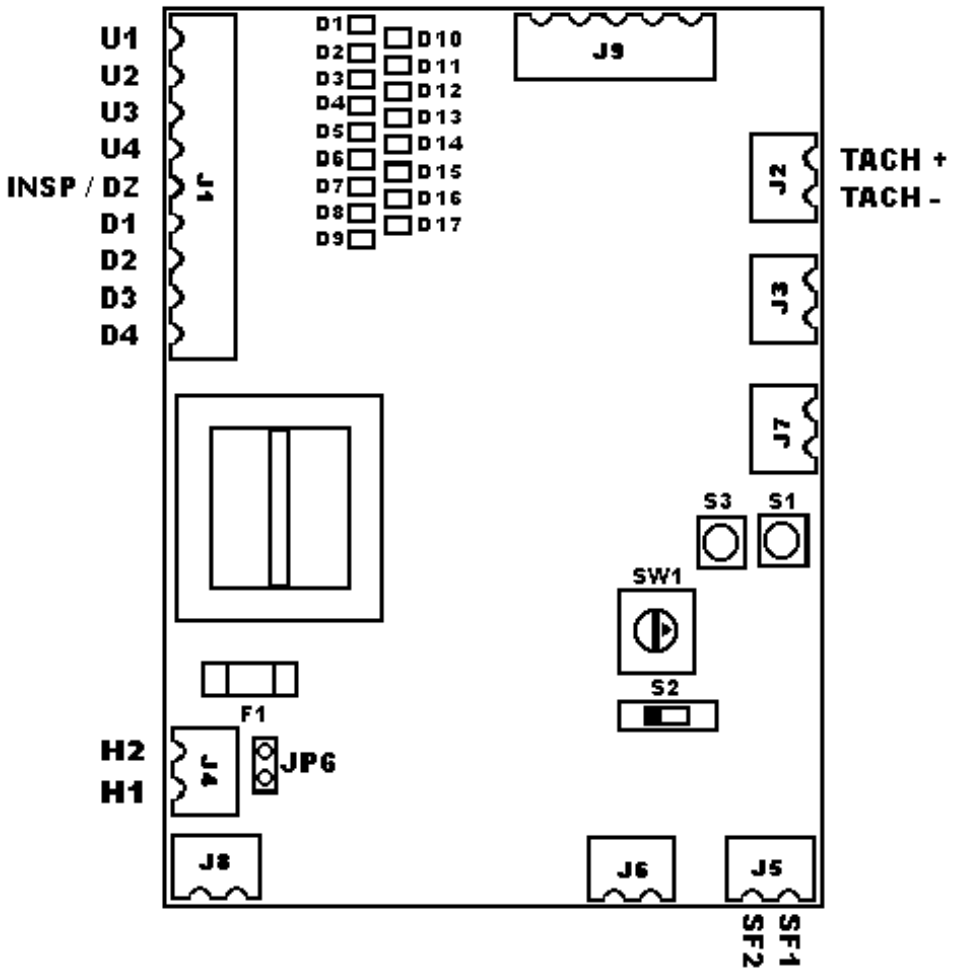



Figure 1

**Please Note:** Not all limit switch input terminals may be used on your application. If there were no wires on the existing board on U1, U2, U3, D1, D2, or D3, nothing should be connected to the new board. If AC2 is the power supply to the limit switches, then AC1 is common. Put jumper JP6 in place on the Limit board. If the jumper is not present, terminals J8-1 and J8-2 must be wired to the low side of the line supplying the switches.

## Limit Board Set Up (Existing Controllers – Analog Tachometers)

Before the Limit board is adjusted, it is necessary to program the car speed. Locate the rotary switch "SW1" on the board. Using the chart below, locate the contract speed of the car. SW1 will be set based on the car speed. If the contract speed of the car is not divisible by 100 (for example, 350 FPM), S2 will be used to add 50 FPM to the programmed car speed.

| Car Speed | SW1 | Car Speed | SW1 | Car Speed | SW1 |
|---|---|---|---|---|---|
| 100 | 1 | 600 | 6 | 1100 | B |
| 200 | 2 | 700 | 7 | 1200 | C |
| 300 | 3 | 800 | 8 | 1300 | D |
| 400 | 4 | 900 | 9 | 1400 | E |
| 500 | 5 | 1000 | A | 1500 | F |

Set SW1 to the value specified above. If 50 FPM needs to be added, place S2 in the right most position. If not, S2 must remain in the left most position. If the SW1 or S2 settings have been modified while the board was powered up, you must cycle power to the board.

The Limit board requires a learn procedure for calibration. With the car on inspection, place it somewhere near the center of the hoistway, away from all terminal floor slowdown switches. Prior to doing the learn procedure the inspection speed must be set up to its highest possible setting, as allowed by the inspection speed potentiometer adjustment (e.g. Ultra 2000). Confirm that all of the switches are turned on by checking the LED on the board. Use the chart below to determine which LED corresponds to which limit.

| Limit | LED | Limit | LED |
|---|---|---|---|
| U1 | D1 | D1 | D5 |
| U2 | D2 | D2 | D6 |
| U3 | D3 | D3 | D7 |
| U4 | D4 | D4 | D8 |

LED D9 should be turned off. It will come on when the car is on Automatic operation with the doors closed. Due to the circuit, when placing some controllers on

inspection operation, while the door is closed, LED D9 will not turn off. If this is the case on your controller, disconnect the INSP/DZ wire (pin 5 on connector J1) for the time being.

To place the board in the learn mode, press S3 and then press and release S1. Release S3. LED D25 (DIAGNOSTIC LED) will be blinking rapidly (on 1/8 second, off 1/8 second). Also, the D10, D11, and D17 LED's will be lit.

Run the car up and down on inspection. Confirm that the car speed does not exceed 100 FPM.

Run the car up on inspection about 5 feet. With the car running, press and release S3. D10 will turn off.

Run the car down on inspection about 5 feet. With the car running, press and release S3. D11 will turn off. D25 will now be on continuously, indicating that the inspection learn procedure was done correctly, and the board is in normal operation.

Lower the inspection speed back to its original, desired setting. If you had to disconnect the INSP/DZ wire (pin 5 on connector J1), please reconnect it at this time.

**Attention:** The high-speed learn trip must be done following the inspection learn and not the other way around. If you have to redo the inspection learn, then please make sure to also follow it by a high-speed learn. If your inspection learn has already been completed and there is no need to redo it, you can repeat the high-speed learn trip as many times as needed, without having to redo the inspection learn.

Next, the Limit board must be set up for high-speed operation.

Bring the car to the lowest landing door zone on inspection operation. Disable the doors, and place the car on Automatic operation. Make sure that LED D9 is turned on when the doors are closed. **Cycle power to the board, else the high speed learn will most likely not complete successfully, and will have to be repeated.** Press and hold S3. Press and release S1. Release S3. D25 (DIAGNOSTIC LED) will begin blinking rapidly (on 1/8 second, off 1/8 second), and D10 and D11 will be illuminated.

Do a high-speed run to the top floor. After the car stops, D10 will turn off.

Do a high-speed run to the bottom floor. After the car stops, D11 will turn off, and D25 will be on continuously, indicating that the high speed learn procedure was completed successfully, and the Limit board is in normal operation.

The Limit board set up is now complete.

## Limit Board Testing (Existing Controllers – Analog Tachometers)

**BEFORE THE BOARD IS TESTED, IT MAY BE NECESSARY TO PREVENT THE CAR SAFETY AND/OR COUNTERWEIGHT SAFETY FROM APPLYING.** To do this, disable the safety devices by tying the safety arm down so it will not apply if the car or counterweight strikes the buffer.

If the customer is not doing this then they are running the risk that the mechanical safety could apply, and if it is the type that requires the car to be moved up to reset, they may be in a position where the car cannot be moved. In this situation, releasing the mechanical safety can be quite a problem.

To confirm that the board will function correctly, remove the J1 connector. Run the car in the up direction on automatic. As soon as the car speed reaches about 100 – 150 FPM, the Limit board will trip, stopping the car. Repeat the test with the car running in the down direction. Re-connect the J1 connector.

With the car on door disable operation start the car from the lower part of the shaft and place a car call one floor (two floors away for high-speed cars) away from the top landing. When the car reaches full speed, pull the up limit wires from J1 connector, one at a time, starting with the limit farthest away from the terminal. Make sure that the board trips and self-resets 3 seconds after the car comes to a stop. LEDs D10 – D13 will show the limit status when the board tripped for the direction the car was running in. LEDs D14 and D15 will indicate that the car was moving in the up, respectively the down direction when the trip occurred. Repeat the test in the down direction.

With all the limits made, run the car at full speed and pull out the tachometer connector J2, prior to the car breaking any limits. Shortly after the car breaks the first limit, the board will trip on a non-resettable failure. LED D16 will turn on. Reconnect the tachometer input and reset the limit board. Repeat the same test in the opposite direction. Reconnect the tachometer input, reset the limit board and run the car to the middle of the shaft.

With all the limits made, run the car to the first stop after just past the first limit the up direction. After the car comes to a stop, remove the tachometer input and run the car to the top floor. The board will trip on a non-resettable failure after the last limit breaks. . Reconnect the tachometer input, reset the limit board and run the car to the middle of the shaft. Repeat the test in the down direction. Reconnect the tachometer input, reset the limit board and run the car to the middle of the shaft.

Enable door operation on the controller and run the car. Observe how LED D9 turns off any time the car opens up the door and turns on when the car moves out of the door zone. Make sure that the board does not trip when the door opens. If the board

trips only when the door opens it is recommended that the set-up learn procedure, both inspection and high-speed, be repeated.

**RE-ENABLE THE SAFETIES DISABLED AT THE BEGINNING OF THIS TEST.** Cycle power to the controller and the car can be returned to service.

## Limit Board Wiring (New Controllers – Digital Encoders)

Before the Limit board can be adjusted, it must be wired correctly. The new Limit board incorporates features which were not available on previous boards. Specifically, the new board does not need an analog speed feedback signal. You can wire the output from a rotary encoder into the Limit board for the speed feedback. This signal will be wired in to terminals A+, A-, B+, B- and COM. Wire directly from the corresponding terminals on the drive to the Limit board.

The new Limit board also incorporates Speed Reference clamping to clamp the speed signal to the drive. This is done to attempt to slow the car down to bring it in to the terminal floor before opening the safety circuit. The Speed Reference input to the Limit board (Speed Ref In + and Speed Ref In -) must be connected to the output of the MPU or D/A board. The output from the Limit board (Speed Ref Out + and Speed Ref Out -) is then connected to any required relay circuitry, and then to the drive or regulator.

Refer to Figure 2 on the following page for proper connections to the Limit board.

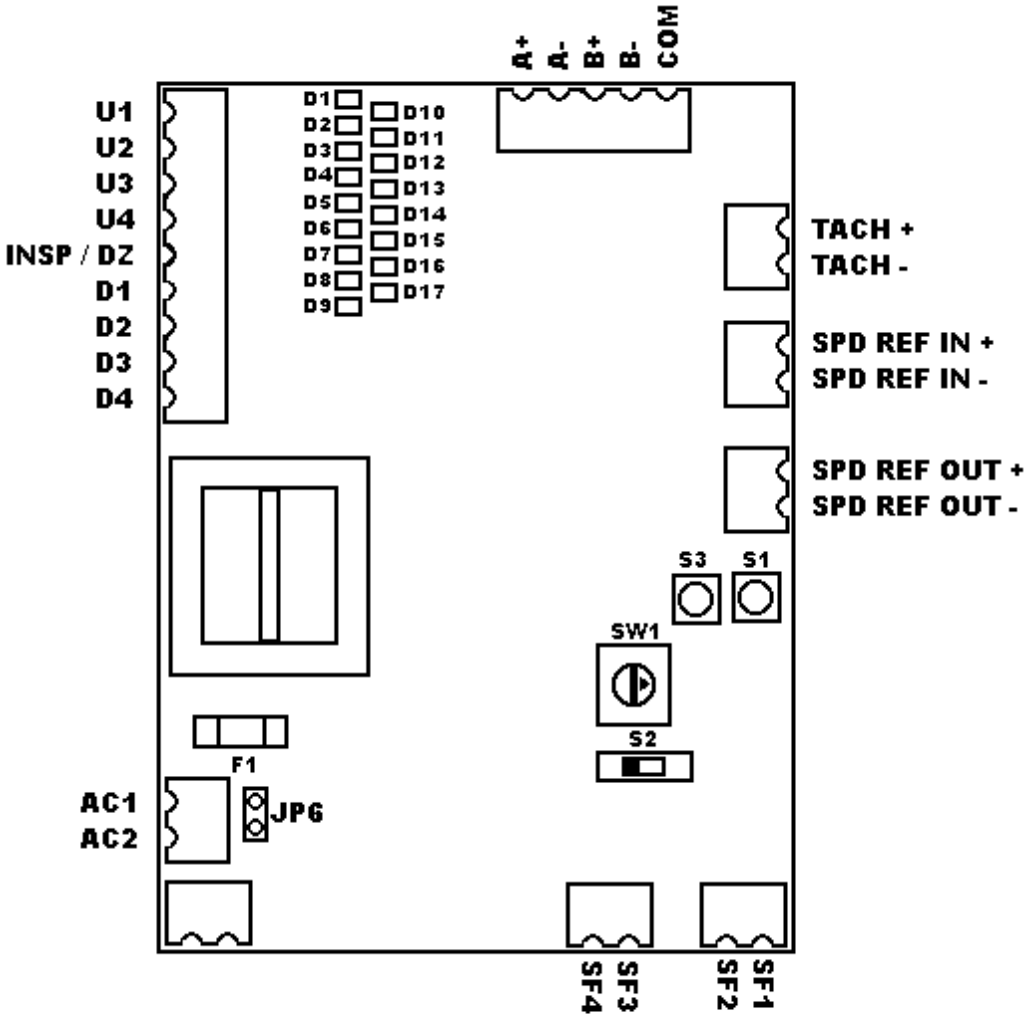
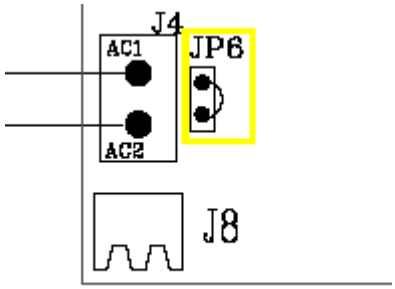



**Figure 2**

**Please Note:** Not all limit switch input terminals may be used on your application. Jumper JP6 ties terminal AC1 to limit switch common.

Make sure there is a jumper on JP6.



There are two contacts that are wired into the safety circuit, SF1 & 2, and SF3 & 4. These contacts are on two different relays. These contacts are wired into the safety circuit at different points to drop the brake and remove power from the hoist motor in the event the speed reference clamping does not slow the car enough to prevent it from striking the buffer. Wire SF1 and SF2 at the end of the safety circuit, just before the SAF relay. Wire SF3 and SF4 at the beginning of the safety circuit, just after the overload and / or reverse phase relay.

## Limit Board Set Up (New Controllers - Digital Encoders)

The set up and adjustment procedure on the Limit board is much the same for new and old controllers. There are, however, differences between testing a new controller and an old one.

Before the Limit board is adjusted, it is necessary to program the car speed. Locate the rotary switch "SW1" on the board. Using the chart below, locate the contract speed of the car. SW1 will be set based on the car speed. If the contract speed of the car is not divisible by 100 (for example, 350 FPM), S2 will be used to add 50 FPM to the programmed car speed.

| Car Speed | SW1 | Car Speed | SW1 | Car Speed | SW1 |
|---|---|---|---|---|---|
| 100 | 1 | 600 | 6 | 1100 | B |
| 200 | 2 | 700 | 7 | 1200 | C |
| 300 | 3 | 800 | 8 | 1300 | D |
| 400 | 4 | 900 | 9 | 1400 | E |
| 500 | 5 | 1000 | A | 1500 | F |

Set SW1 to the value specified above. If 50 FPM needs to be added, place S2 in the right most position. If not, S2 must remain in the left most position. If the SW1 or S2 settings have been modified while the board was powered up, you must cycle power to the board.

The Limit board requires a learn procedure for calibration. With the car on inspection, place it somewhere near the center of the hoistway, away from all terminal floor slowdown switches. Prior to doing the learn procedure the inspection speed must be set up to its highest possible setting, as allowed by the inspection speed potentiometer adjustment (e.g. Ultra 2000). Confirm that all of the switches are turned on by checking the LED on the board. Use the chart below to determine which LED corresponds to which limit.

| Limit | LED | Limit | LED |
|---|---|---|---|
| U1 | D1 | D1 | D5 |
| U2 | D2 | D2 | D6 |
| U3 | D3 | D3 | D7 |
| U4 | D4 | D4 | D8 |

LED D9 should be turned off. It will come on when the car is on Automatic operation with the doors closed. . Due to the circuit, when placing some controllers on inspection operation, while the door is closed, LED D9 will not turn off. If this is the case on your controller, disconnect the INSP/DZ wire (pin 5 on connector J1) for the time being.

To place the board in the learn mode, press S3 and then press and release S1. Release S3. LED D25 (DIAGNOSTIC LED) will be blinking rapidly (on 1/8 second, off 1/8 second). Also, the D10, D11, and D17 LED's will be lit.

Run the car up and down on inspection. Confirm that the car speed does not exceed 100 FPM.

Run the car up on inspection about 5 feet. With the car running, press and release S3. D10 will turn off.

Run the car down on inspection about 5 feet. With the car running, press and release S3. D11 will turn off. D25 will now be on continuously, indicating that the inspection learn procedure was done correctly, and the board is in normal operation.

Lower the inspection speed back to its original, desired setting. If you had to disconnect the INSP/DZ wire (pin 5 on connector J1), please reconnect it at this time.

**Attention:** The high-speed learn trip must be done following the inspection learn and not the other way around. If you have to redo the inspection learn, then please make sure to also follow it by a high-speed learn. If your inspection learn has already been completed and there is no need to redo it, you can repeat the high-speed learn trip as many times as needed, without having to redo the inspection learn.

Next, the Limit board must be set up for high-speed operation.

Bring the car to the lowest landing door zone on inspection operation. Disable the doors, and place the car on Automatic operation. Make sure that LED D9 is turned on when the doors are closed. **Cycle power to the board, else the high speed learn will most likely not complete successfully, and will have to be repeated.** Press and hold S3. Press and release S1. Release S3. D25 (DIAGNOSTIC LED) will

begin blinking rapidly (on 1/8 second, off 1/8 second), and D10 and D11 will be illuminated.

Do a high-speed run to the top floor. After the car stops, D10 will turn off.
If D14 illuminates, the Limit board has detected that the car did not go into slow down before the first limit switch opened. **The Limit board will not function properly until the limit switches are moved.**

Do a high-speed run to the bottom floor. After the car stops, D11 will turn off, and D25 will be on continuously, indicating that the high speed learn procedure was completed successfully, and the Limit board is in normal operation.
Again, if D14 illuminates, the car is moving at high speed when the first limit switch opened. If the controller is any thing other than a Series 90, relocate the limit switches closer to the terminal floor.

The Limit board set up is now complete.

## Limit Board Testing (New Controllers – Digital Encoders)

**BEFORE THE BOARD IS TESTED, IT MAY BE NECESSARY TO PREVENT THE CAR SAFETY AND/OR COUNTERWEIGHT SAFETY FROM APPLYING.** To do this, disable the safety devices by tying the safety arm down so it will not apply if the car or counterweight strikes the buffer.

If the customer is not doing this then they are running the risk that the mechanical safety could apply, and if it is the type that requires the car to be moved up to reset, they may be in a position where the car cannot be moved. In this situation, releasing the mechanical safety can be quite a problem.

To confirm that the board will function correctly, it is necessary to remove the wire on the input connected to the first limit switch the car will encounter in the up direction. The wire must be removed while the car is in flight. On most applications, the limit switch will be U1 or U2.

Place the car at the lowest landing. Loosen the connector for the wire from the first limit switch which the car passes in the up direction. Make sure that the LED on the board for the limit switch stays on. Run the car up at contract speed. While the car is running, remove the wire. The car speed should immediately begin ramping down to approximately 10% of contract speed. Also, as the board performs the speed clamping, D25 will blink at the rate of 2 seconds on, and 2 seconds off. The car should continue at 10% speed until it reaches a floor and is directed to stop and open its doors by the MPU.

Next, remove the J1 connector. Place a temporary jumper from Speed Ref In + to Speed Ref Out +. Place another temporary jumper from Speed Ref In – to Speed Ref Out -. Run the car in the up direction on automatic. As soon as the car speed reaches

about 100 – 150 FPM, the Limit board will trip, stopping the car. Open the main line disconnect. Re-connect the J1 connector. Remove the jumpers on the Speed Ref Input and Output.
**RE-ENABLE THE SAFETIES DISABLED AT THE BEGINNING OF THIS TEST.**
Restore power to the controller, and the car can be placed in service.

**Limit Board LED Indicators**

The LED's on the Limit board are divided into two columns. The first column, D1 - D9 are limit input diagnostic LED's. They each correspond to a specific limit switch input.

**D1** Up Limit 1
**D2** Up Limit 2
**D3** Up Limit 3
**D4** Up Limit 4
**D5** Down Limit 1
**D6** Down Limit 2
**D7** Down Limit 3
**D8** Down Limit 4
**D9** Inspection Operation / Door Open

The LED will be illuminated when the limit switch is closed. The limits will open as the car passes them traveling toward the terminal floor. D9, Inspection Operation / Door Open, turns off to indicate that car is on inspection, or the gate switch or door locks are open.

LED's D10 - D17 are diagnostic or fault indicators. On normal operation, all the LED's will be off, with the exception of D10 and D11. These LED's indicate the direction of the car's motion, up or down.

## Normal Operation

On normal operation, if a fault has not occurred, LED D10 will turn on when the car runs up and LED D11 will turn on when the car runs down. Sometimes when running on very low inspection speeds, it is possible to notice a flicker on these LEDs.

On normal operation, if a fault has occurred, the board will save the last fault. It will indicate the direction the car was traveling and which limit switch opened to initiate the slowdown into the terminal floor. The LED's are:

**D10** Status of Up/Down Limit 1 Trip during Trip
**D11** Status of Up/Down Limit 2 Trip during Trip
**D12** Status of Up/Down Limit 3 Trip during Trip
**D13** Status of Up/Down Limit 4 Trip during Trip
**D14** Up Direction Detected during Trip
**D15** Down Direction Detected during Trip
**D16** Tachometer/Encoder Speed Feedback Failure
**D17** Not Used

LED D14 or D15 will indicate the car's direction of travel, and D10 - D13 will indicate which limit opened to initiate the trip. Both D14 and D15 LEDs on indicate that the board detected no up and down slowdown limits at all, while LED D9 was turned off (car not on inspection and door not opening). D16 indicates that the board has lost the speed feedback input, preventing the board from being able to monitor the speed of the car. LED25 will blink (1/2 second on, ½ second off) while the board is tripped. The Tachometer Speed Feedback Failure is not self-resettable. The other faults, specifically all limits missing (both D14 and D15 turn on), or the up/down overspeed faults (D14 on, respectively D15 on), self-reset 3 seconds after the car has come to a complete stop, as long as there are no more than 5 trips within a 1.5 minute time interval.

## Set Up Mode

While the board is in set up mode, D10 - D17 indicate the status of various functions the board monitors.

**D10** Learn Up
**D11** Learn Down
**D12** Not Used
**D13** Not Used
**D14** Limit Opening at High Speed during Set Up
**D15** Encoder Input Present
**D16** Pattern Clamping Enabled (in other words, Speed reference detected)
**D17** Car on Inspection

D10 and D11 indicate that the learn up or learn down operations have not been completed. They will turn off after these operations have been performed.

D14 indicates that the car had not gone into slow down when the first limit switch opened. The limit switches need to be moved closer to the floor for proper operation of the board.

D15 indicates that an encoder has been detected for the speed feedback.

D16 indicates that the Limit board has detected that the speed reference input is present, and pattern clamping will be enabled.

D17 indicates that the car is on inspection operation.

D25 blinks rapidly (1/8 second on, 1/8 second off), indicating that the board is in set-up (learn) mode.

If you have any questions about this or any other O. Thompson device, please contact our Technical Support Department at (718) 417-3131.