



56 Volt Electric Zero Turn Troubleshooting Guide

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light up pg 2

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No start/ VCM lights up
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Do not page straight through this document. This document is interactive.
Follow a procedure, then return to the flow chart you are following.



No Power/VCM does not light up

Check all connectors

[Install the 20 pin service tool](#)
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Does the contactor click on?

Replace VCM

[Test for voltage at PDM pg 23](#)

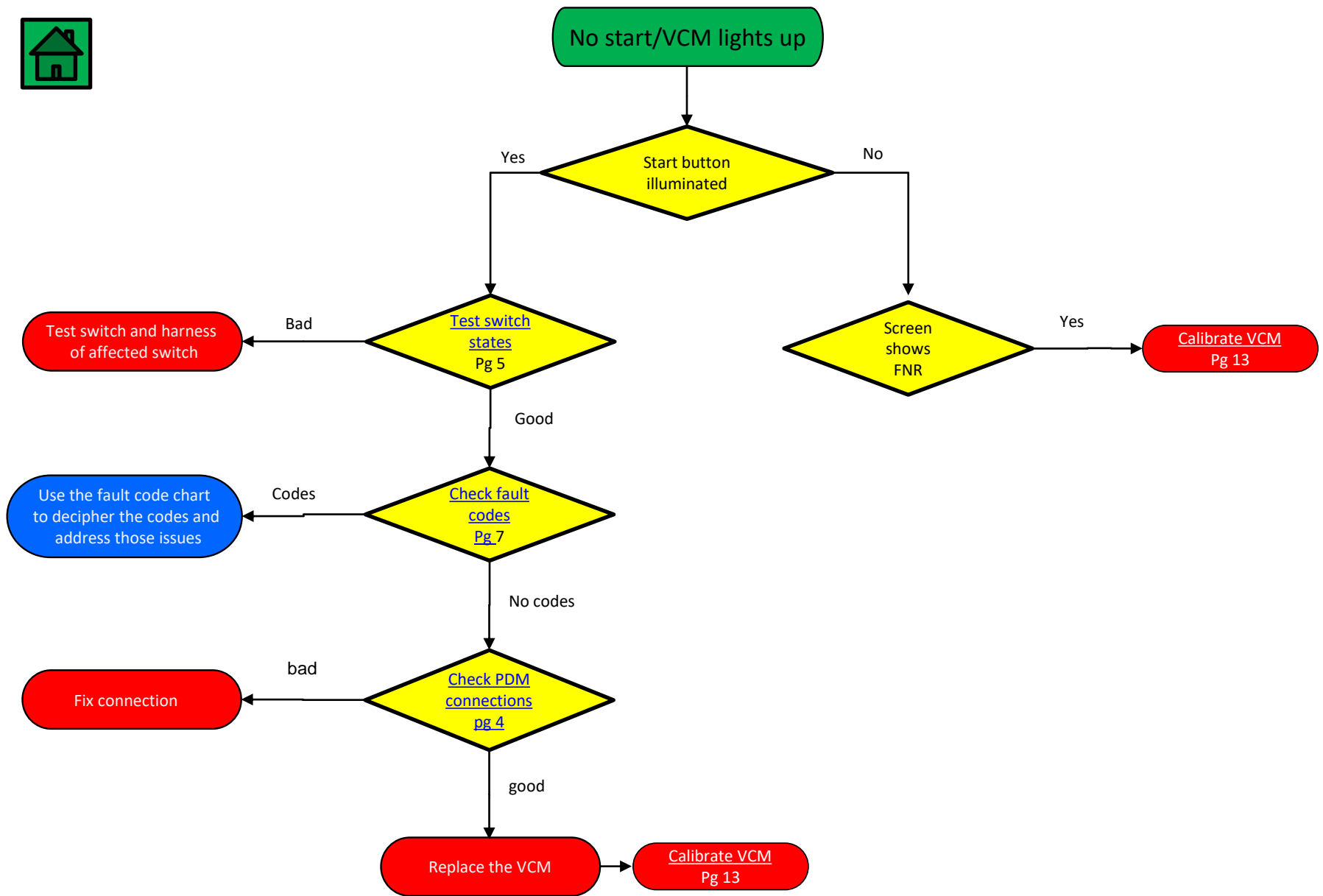
Voltage greater than 42 volts?

[Test for contactor activate voltage](#)
Pg 19

[Test battery](#)
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Click a diamond to go to that test.

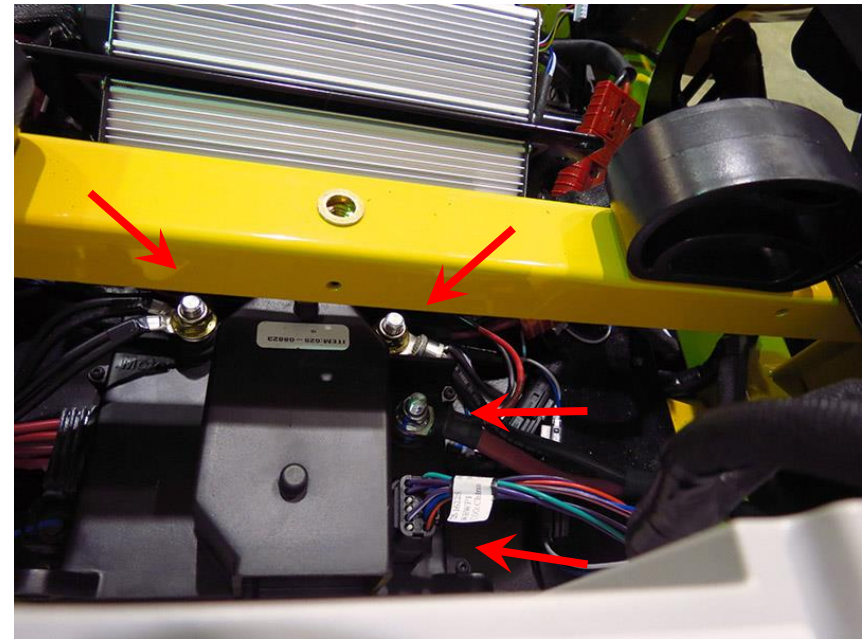






Check PDM connections

1. Open the hood.
 2. Check the 4 connectors.
 - The battery cover was removed for the photograph.
- If all connections are good, but the mower does not start replace the VCM.
 - If there is a faulty connection, fix the connection and try to start the mower again.



Flow Chart

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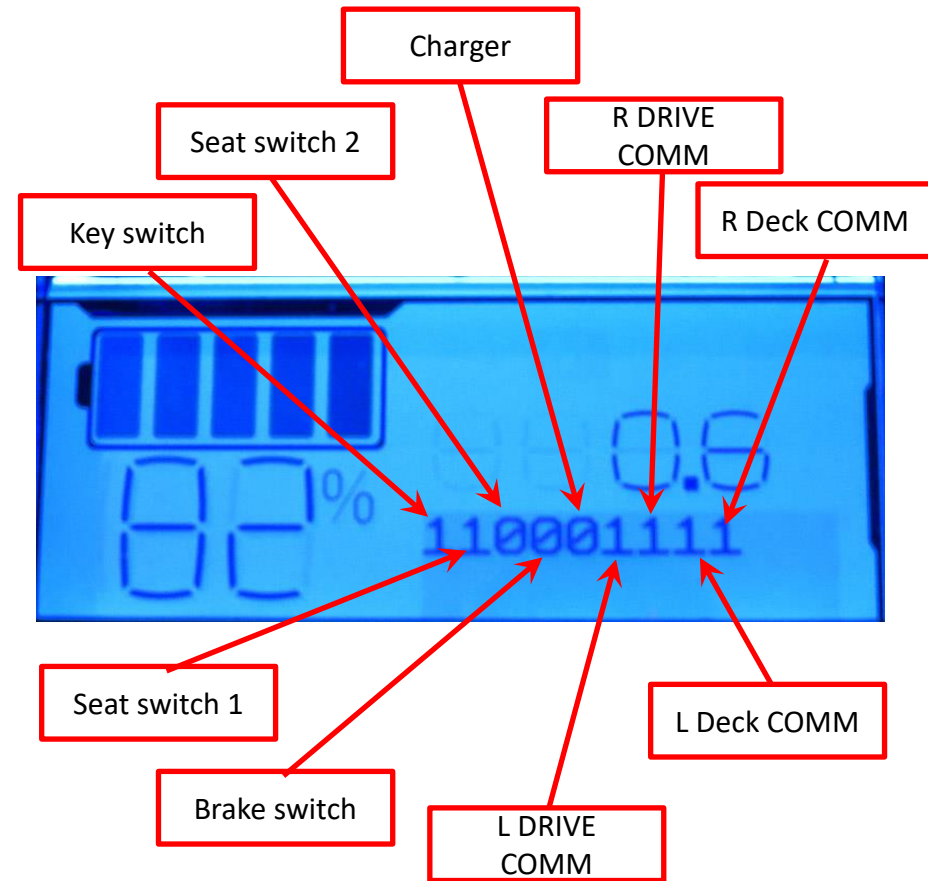
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Switch Faults

Switch faults are fairly easy to diagnosis.

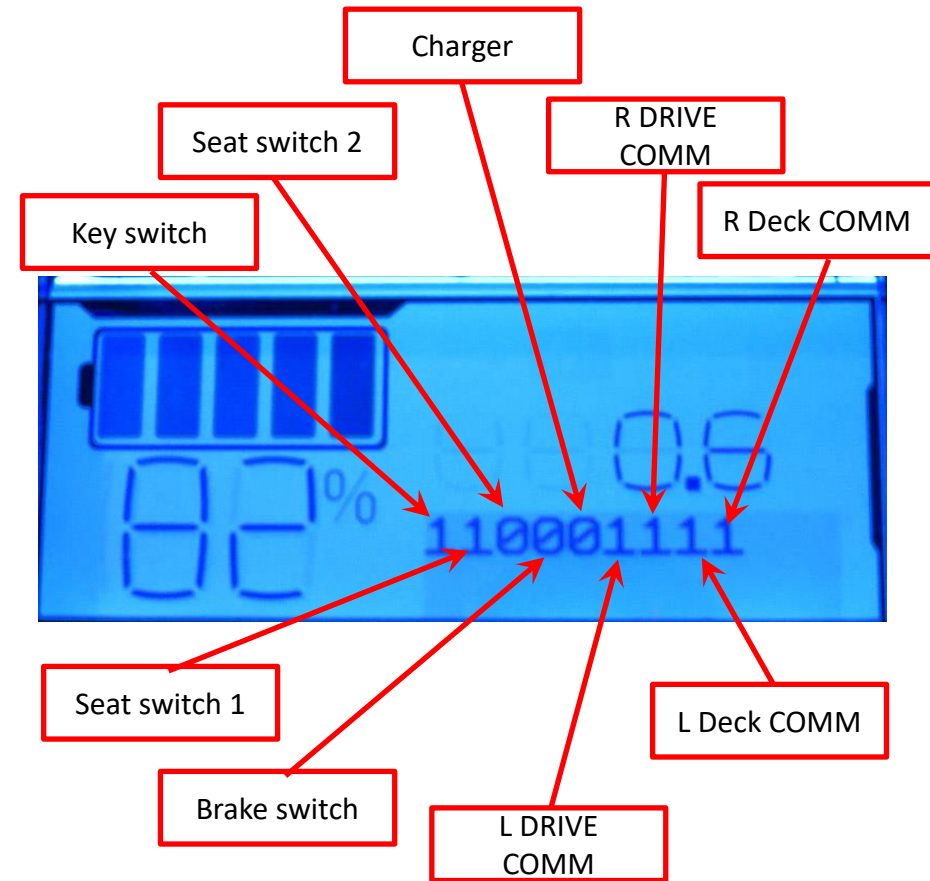
1. Put the VCM in diagnostic mode.
2. Operate the switches while watching the screen.
3. The long number at the top of the screen is the input state of all of the switches.
 - Each digit represents a different switch.
 - “0” = switch is open.
 - “1” = switch is closed.





Switch Faults

4. If the digit doesn't change or match the switches state, disconnect the switch and test the switch with a multimeter. If the switch does not operate correctly, replace the switch.
5. If the switch operates correctly, test the harness and all connection.



Flow Chart

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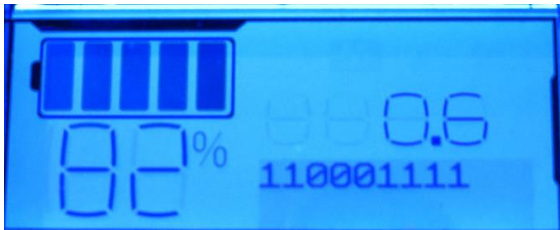
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Diagnostic Mode

To enter diagnostic mode:

1. Press and hold the Eco mode and Start buttons simultaneously for 7seconds.
2. The first screen displayed is the inputs screen



Input screen





Diagnostic Mode

1. Press the headlight button to scroll to the TPS input screen.
2. This screen displays the TPS input signals.



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Diagnostic Mode

1. Press the headlight button to scroll to the TPS input screen.
2. This screen displays the TPS input signals.
3. Press the headlight button to scroll to the software screen.
4. This screen displays the software versions.





Diagnostic Mode

3. Press the headlight button to scroll to the Hardware screen.
4. This screen displays the VCM and battery hardware versions.



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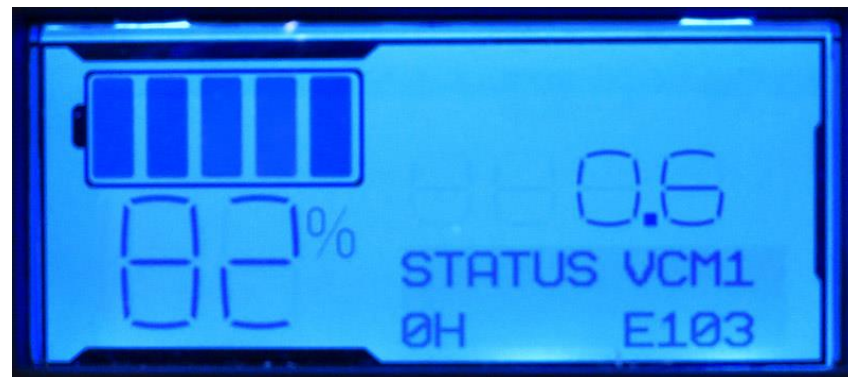
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Diagnostic Mode

5. Press the headlight button to scroll to the Live Faults screens.
6. The first screen is the VCM1 screen.
7. Press the cruise button to scroll through the live fault banks.





Diagnostic Mode

8. Press the headlight button to scroll to the Historical Faults screens.
9. The first screen is the historical VCM1 screen.
10. Each bank will store up to 10 codes
11. Press the cruise button to scroll through the historical fault banks.



No start
Flow Chart

Battery no charge
Flow Chart

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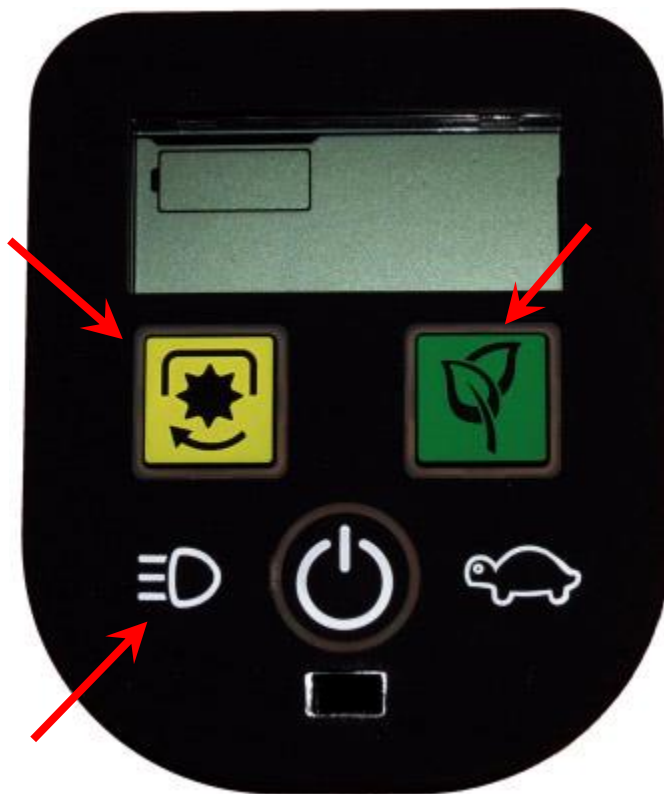
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TPS calibration

- IMPORTANT: Brake must be released.
- Insert the key
- For the left side, press and hold ECO mode and HEADLIGHT for 7 seconds.
- For the right side, press and hold PTO and HEADLIGHT for 7 seconds.
- Let go of Headlight and ECO mode buttons
- NOTE: New VCMs will be in calibration mode until they are calibrated for the first time.
- NOTE: If the VCM will not accept calibration inputs, check the brake switch circuit for a short.





TPS calibration

- NOTE: Calibration must be done in this order.
- Move the lap bar forward until it hits a hard stop.
- Press the LSPD button.
- Release the lap bar.





TPS calibration

- With the lap bar in a neutral position and not touching it, press the start button.



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TPS calibration

- Pull the lap bar back until it hits a hard stop.
- Press the PTO button.
- The screen will switch to the start screen, indication that the calibration is saved.
- NOTE: If you hold the button for more than 7 seconds, you will get an error code.
- Release the lap bar.
- Repeat on the other side.
- Test drive the mower in a safe area before returning it to service.



Home

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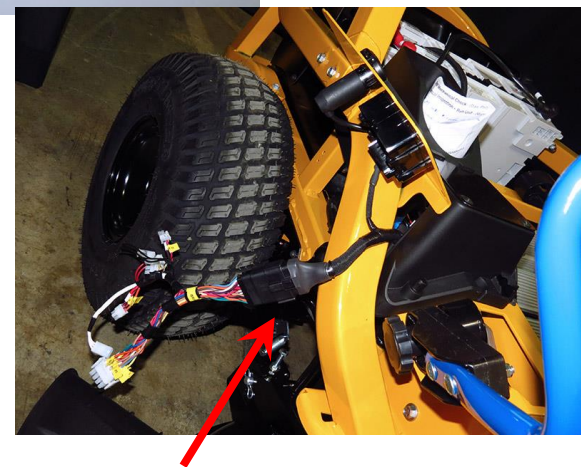
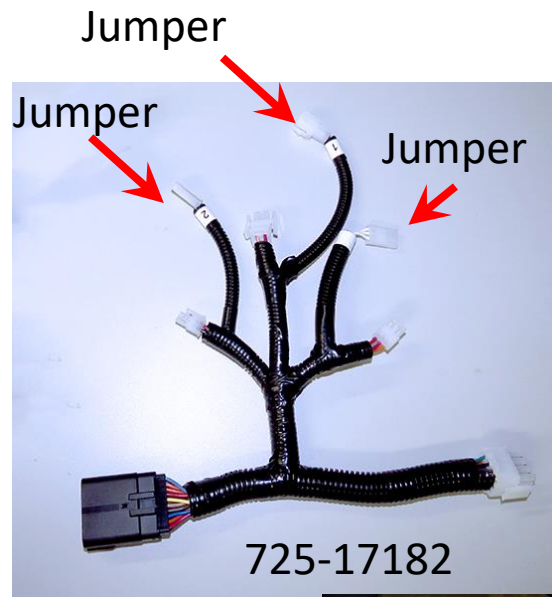
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Install the 20-pin Service Tool

- Remove the key
- Gain access to the VCM
- Disconnect the VCM's 20-pin connector.
- Open all of the service tool's jumpers
- Connect the service tool 725-17182 to the 20-pin harness connection



No Power
Flow Chart

Pre-charge
Flow Chart

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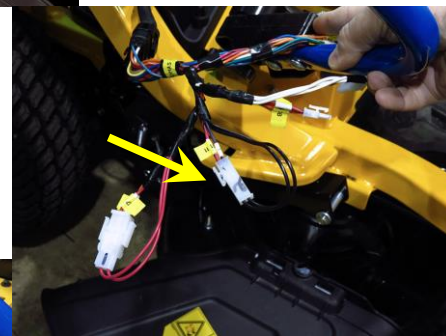
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Power On Test

- Connect the service tool's jumper #1.
- Connect the service tool's jumper #2.
- Wait a couple of seconds, then connect the service tool's jumper #3.
- You should hear the contactor click on.
- Disconnect jumper #2



Flow Chart

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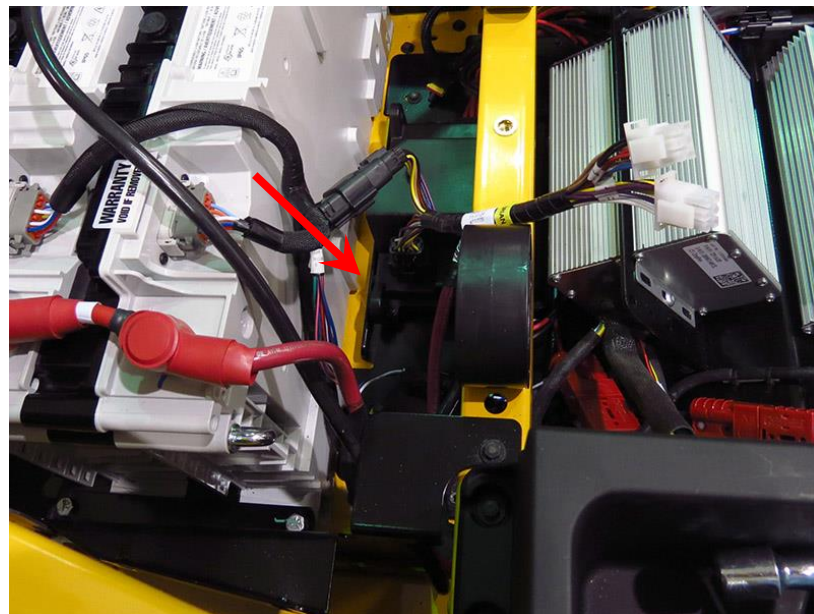
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Test for Contactor Activate Voltage

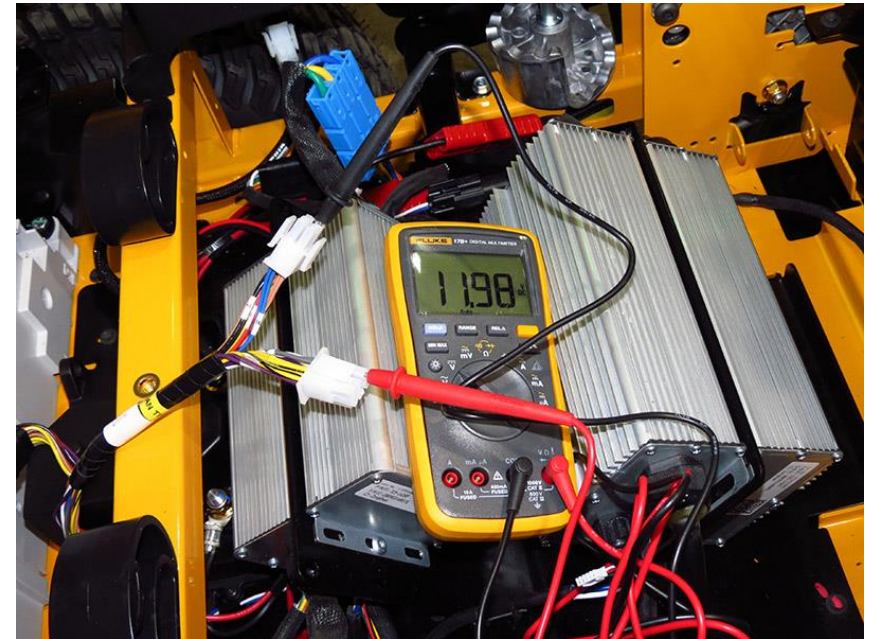
- Install the 12-pin break out adaptor 725-06084 at the PDM.
- Set DMM to measure DC volts.
- Place negative probe in pin 1 of the 12-pin break out adaptor 725-06084.
- Place positive probe in pin 6 of the 12-pin break out adaptor 725-06084.





Test for Contactor Activate Voltage

- Connect the 20-pin service tool's jumper #1.
- DMM should read ~12 volts.
- Yes – continue
- No – Check for voltage from the battery to the PDM.





Test for Contactor Activate Voltage

- Move the positive probe in pin 4 of the 12-pin break out adaptor 725-06084.
- Connect the service tool's jumper #2.
- Wait a couple of seconds, then connect the service tool's jumper #3.
- DMM should read ~12 volts.
 - If it reads ~12 volts, continue.
 - If it reads ~0 V, check the harness and connectors.





Test for Contactor Activate Voltage

- Leave the jumpers connected and move the DMM's probes.
- Back probe the red wire in the power connector of each controller with the positive probe of a DMM.
- Back probe the black wire in the power connector of each controller with the negative probe of a DMM.
- If any of the controllers do not read close to battery voltage, replace the PDM.



[Flow Chart](#)

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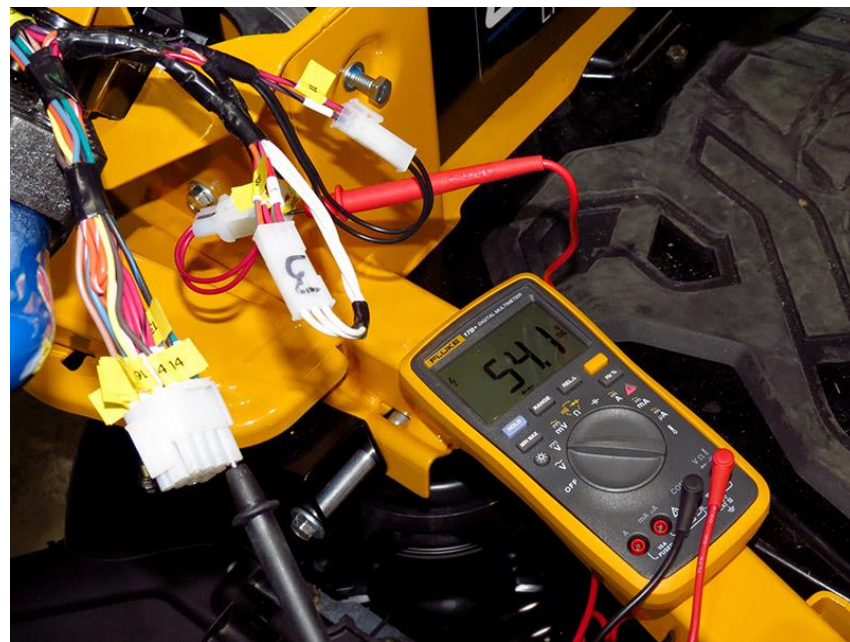
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Test for Voltage at PDM

- Place negative probe in pin 1 of the 20-pin connector of the service tool.
- Back probe the orange wire with a white trace of jumper 1 (pin #19) of the service tool with the positive probe.
- Connect jumper #1.
- DMM should read greater than 42 volts.

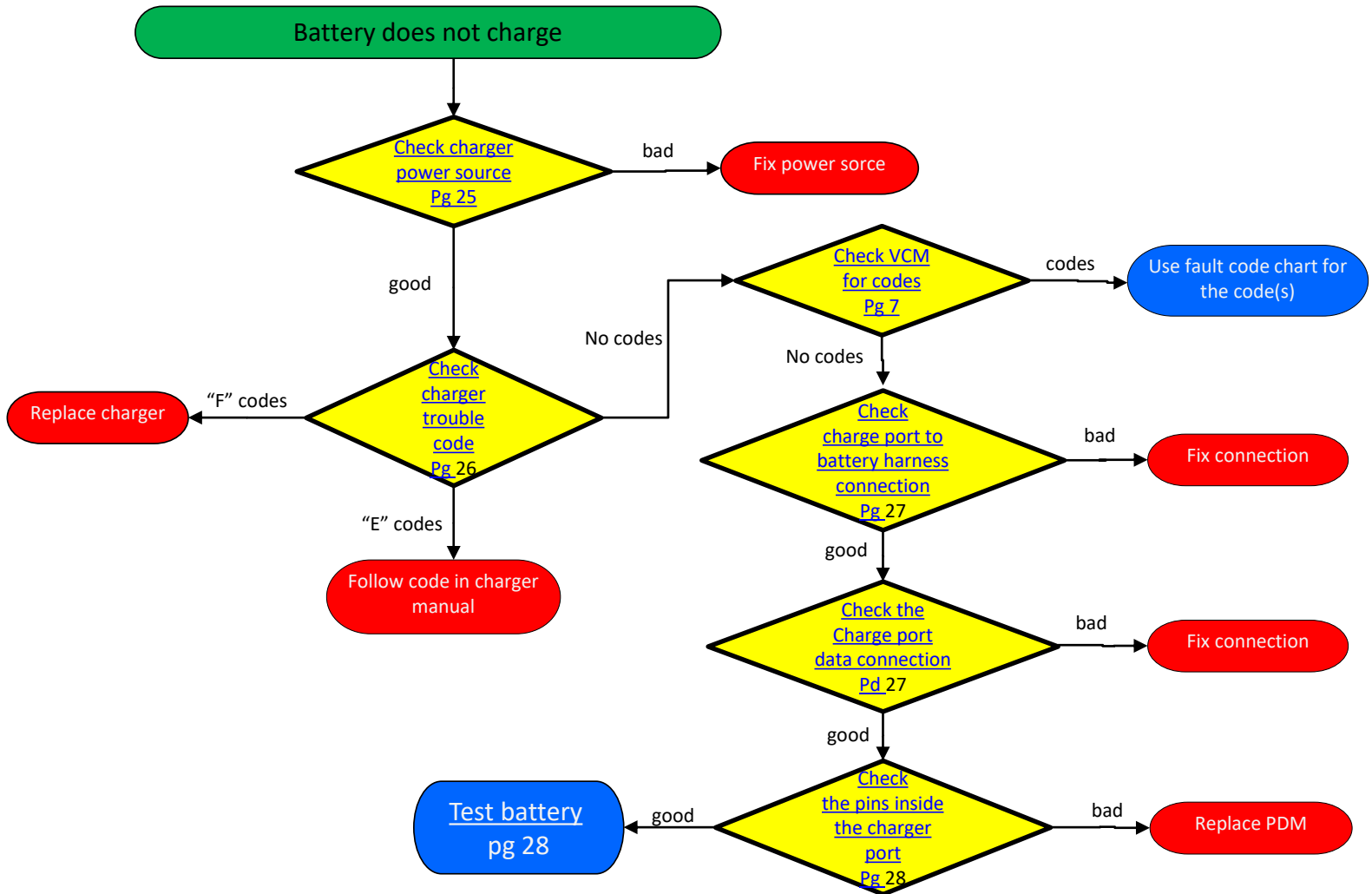


Flow Chart

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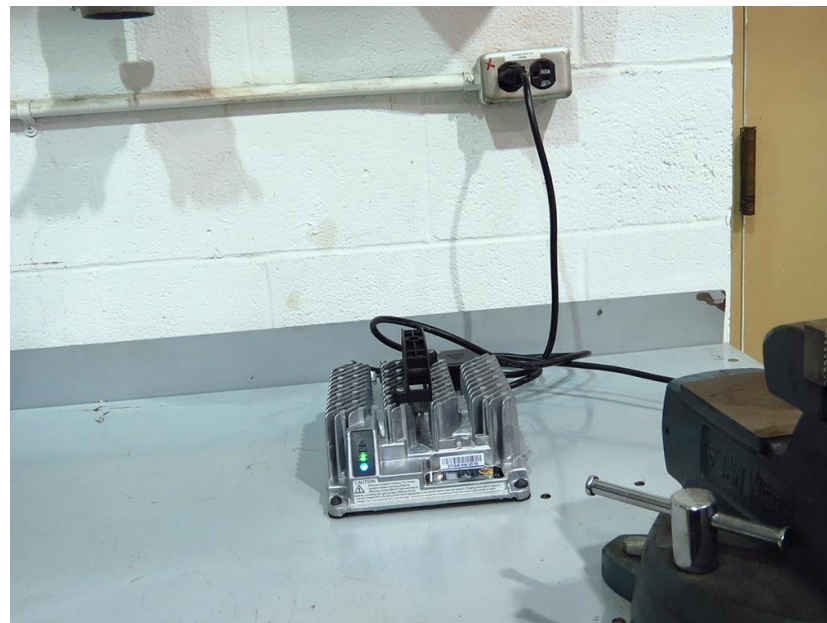
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Check Charger Power supply

- Make sure the charger is connected to the tractor.
- Make sure the power supply is plugged into an adequate power source.
- Note: Loose/worn wall outlets can cause charger faults.



Flow Chart

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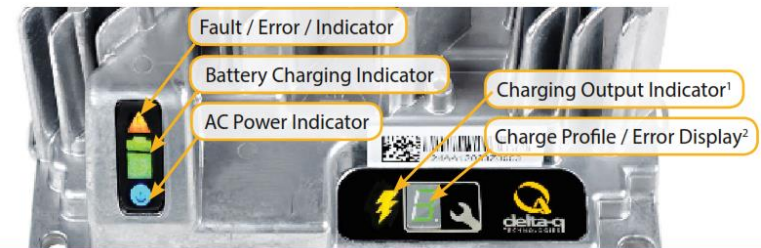
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Charger Trouble Codes

- Check the charger's display for any trouble codes.
- The meaning of the codes can be found in the owner's manual or by clicking [here](#).



	Flashing amber = External error condition - caution See display panel for details		Solid blue = AC power available
	Solid red = Charger fault See display panel for details		Flashing green = Low state of charge
			Solid green = High state of charge
			Flashing green = High state of charge
			Solid green = charge completed

Flow Chart

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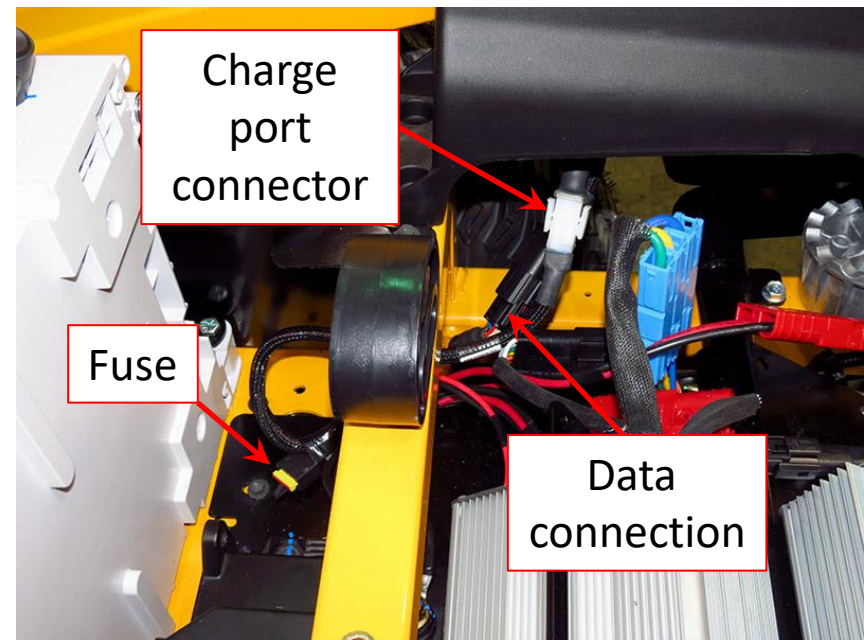
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Check Fuse and Connections

- Check the fuse
- Check the charge port to battery connection
- Check the charge port data connection



Flow Chart

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Check the Charger Port

- Check the pins inside the charger connection and the charger for:
 - Burns
 - Pits
 - Scaling
 - Damage
 - Pins pushed back



No charger
Flow Chart

E004/ Charger error
Flow Chart

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Test HPD Battery Module

1. Connect the 725P12545 tester/jumper to the battery.
2. Leave the rocker switch in the center position until the blue LED turns off.



725P12545



Test HPD Battery Module

3. Insert the probes of your multimeter into the 2 pin connector on the tester.
4. Leave the rocker switch in the center position until the voltage drains down below 1 volt.





Test HPD Battery Module

5. Move the rocker switch to position 1 to test the battery in master mode.
 - If the voltage is between 42V and 56V, go to the next step.
 - If the voltage is between 21v and 42v, charge the battery.
 - If the voltage is less than 21v, replace the battery.





Test HPD Battery Module

6. Move the rocker switch to the center position, until the voltage is below 1 V.
7. Move the rocker switch to position 2 to test the battery in salve mode.
 - If the voltage is between 42V and 56V, go to the next step.
 - If the voltage is between 21v and 42v, charge the battery.
 - If the voltage is less than 21v, replace the battery.

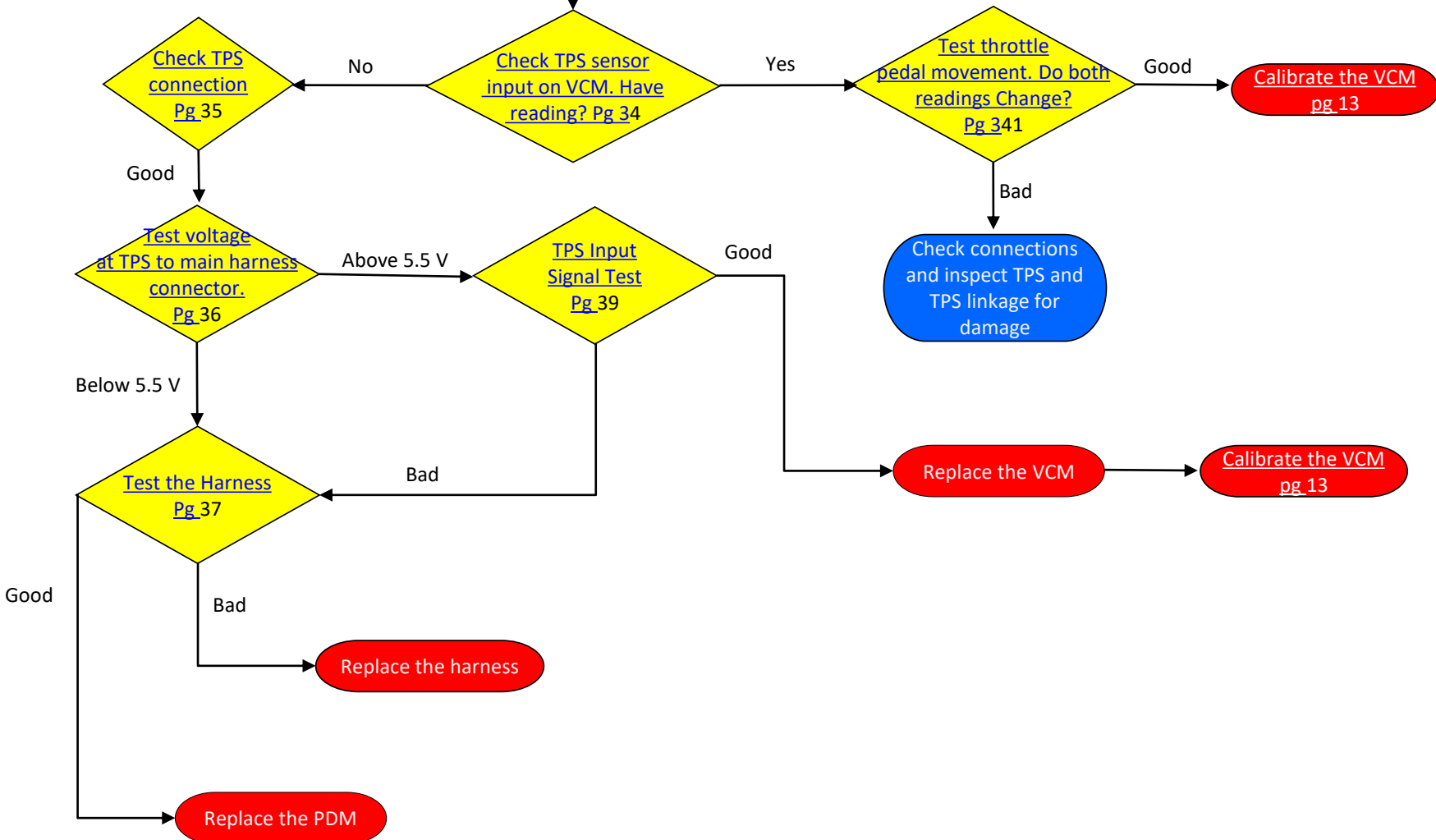


No power
Flow Chart

Battery no charge
Flow Chart



Throttle Position Sensor (TPS) faults





Throttle Position Sensor (TPS) faults

To troubleshoot the TPS:

1. Hold down the Reverse Caution Mode and the Start buttons simultaneously for 7 seconds to enter the diagnostic screens.
- If one or both of the sensors reads “0”, the VCM can not see that sensor(s) because it is either disconnected or the harness is damaged.
 - Move drive pedal to make sure readings change.



Left TPS

Right TPS

Flow Chart

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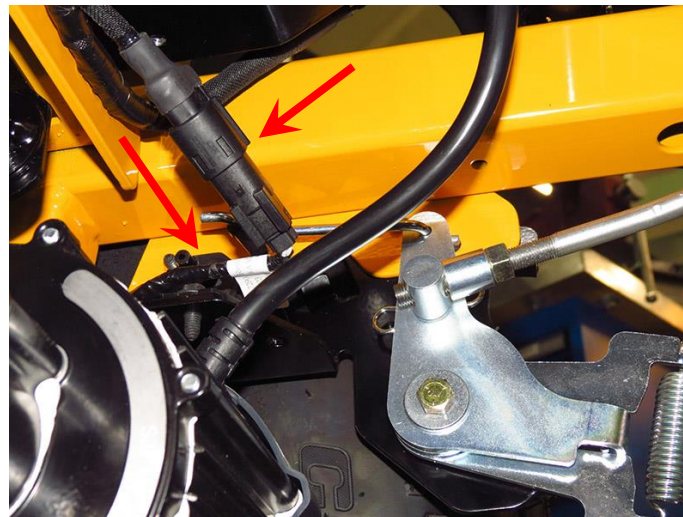
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Check the TPS sensor Connections

- The TPS are mounted by the transmissions.
- If the unit is on a lift, the connector can be accessed without removing the deck.



Flow Chart

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TPS Voltage Test

1. Disconnect the TPS sensor harness from the main harness.
2. Set a DMM to read DC voltage.
3. Measure the voltage across pins 1 and 2 of the main harness connector.

NOTE: Standard DMM probes will not fit in the connectors. Paper clips or probe adaptors can be used to extend the probes into the connectors.

- If the DMM should read 4.7 to 5.5 volts, the sensor has proper power and return circuits.



[Flow Chart](#)



TPS Harness Test

1. Disconnect the 20 pin connector from the VCM and connect it to the 20 pin break out adapter 725-17194 to the main harness only.
2. Disconnect the 12 pin connector at the PDM and connect the 12 break out adapter 725-06084 to the main harness only
3. Check for continuity between pin 1, on the main harness side of each TPS connector and the pin 1 port of the 20 pin break out adaptor, if no continuity, replace the harness.





TPS Harness Test

4. Check for continuity between pin 2, on the main harness side of each TPS connector and the pin 7 port of the 12 pin break out adaptor, at if no continuity, replace the harness. If there is continuity continue.
5. Check for continuity between:
 - Pin 3 of Left TPS & pin 12 of 20 pin connector
 - Pin 4 of Left TPS & pin 2 of 20 pin connector
 - Pin 3 of right TPS & pin 13 of 20 pin connector
 - Pin 4 of right TPS & pin 3 of 20 pin connector
 - Replace harness if any of the checks fail.



Flow Chart

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TPS Input Signal Test

1. Install the 20-pin break out adapter 725-17194.
2. Place negative probe of DMM in port 1 of the 20-pin break out adapter.
3. For the left TPS, place the positive probe in port 12 of the 20-pin break out adapter.
4. Move the drive pedals while observing the DMM.
 - The DC voltage reading on the DMM should fluctuate with the movement of the drive pedals.





TPS Input Signal Test

5. Place the positive probe in port 2 of the 20-pin break out adapter and repeat step 4. The readings should fluctuate in the opposite direction of the previous readings.
6. For the right TPS, place the positive probe in port 13 of the 20-pin break out adapter.
7. Move the drive pedals while observing the DMM.
 - The DC voltage reading on the DMM should fluctuate with the movement of the drive pedals.
8. Place the positive probe in port 3 of the 20-pin break out adapter and repeat step 4. The readings should fluctuate in the opposite direction of the previous readings.



[Flow Chart](#)

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Move Drive Pedals

- Fully depress the forward drive pedal while observing the display.
- If neither of the sensor values change there is a mechanical failure of the TPS. Inspect the TPS linkage and the TPS lever.

NOTE: The TPS lever is susceptible to damage from over travel when the travel stop bolt is removed from the pedal assembly.

- If only one sensor value changes:
 - Inspect the TPS harness connections.
 - Check the main harness for damage.
 - Replace the TPS assembly.
- Both sensor values change:
 - Operate the drive pedals fully forward and fully reverse while observing the display:
 - If both sensors change proportionally, recalibrate the TPS.



Left TPS

Right TPS

Flow Chart

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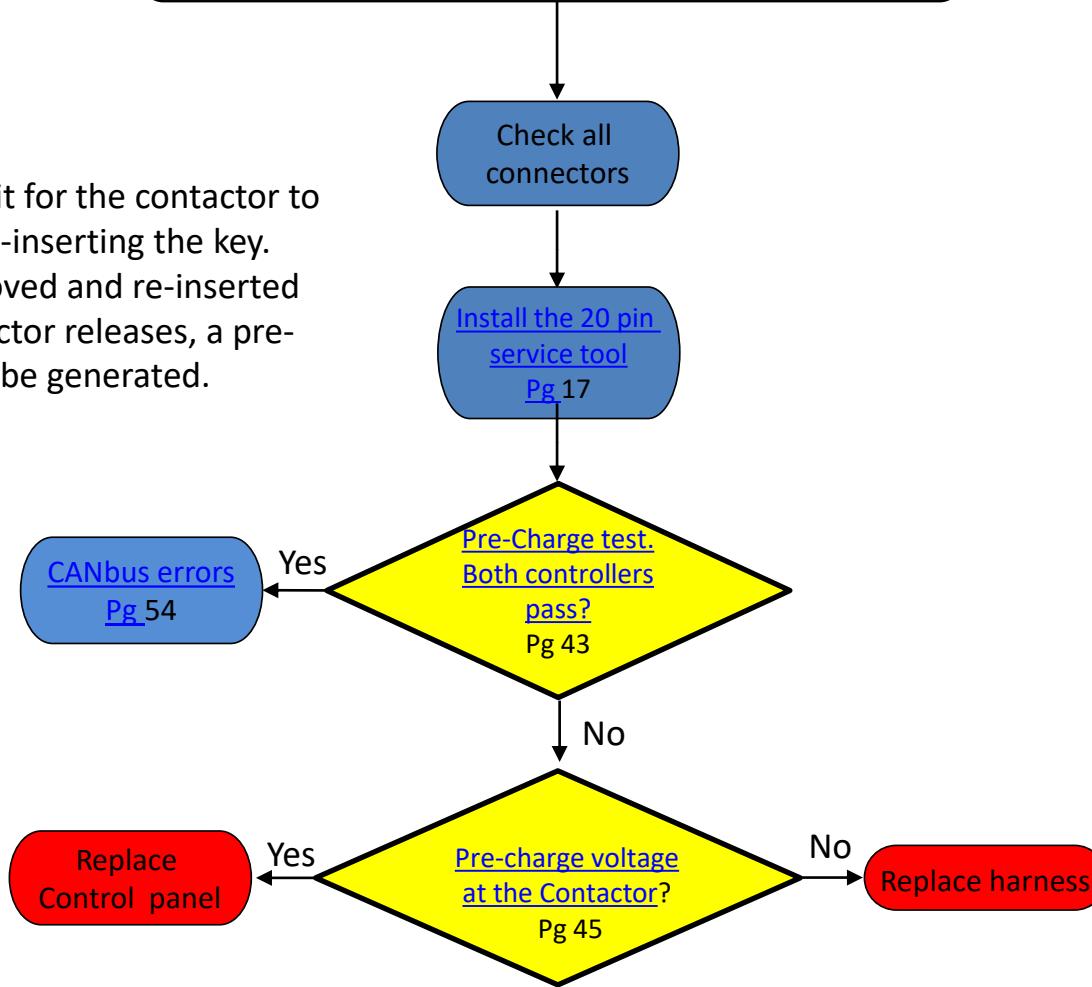
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Pre-charge Failure Fault

Note: Always wait for the contactor to release before re-inserting the key. If the key is removed and re-inserted before the contactor releases, a pre-charge error can be generated.





Test for Pre-charge voltage at Controllers

- Install the 20 pin service tool 725-17182
- Set DMM to measure DC volts.
- Back probe the black wire in the large red connector at of each controller, with the negative probe of a DMM.
- Back probe the red wire in the large red connector at of each controller, with the positive probe of a DMM.





Test for Pre-charge voltage at Controllers

- Connect jumper 1 of the 20 pin service tool.
- Connect jumper 2 of the 20 pin service tool.
- The DMM reading should be greater than 35 volts.
- Repeat at each controller.

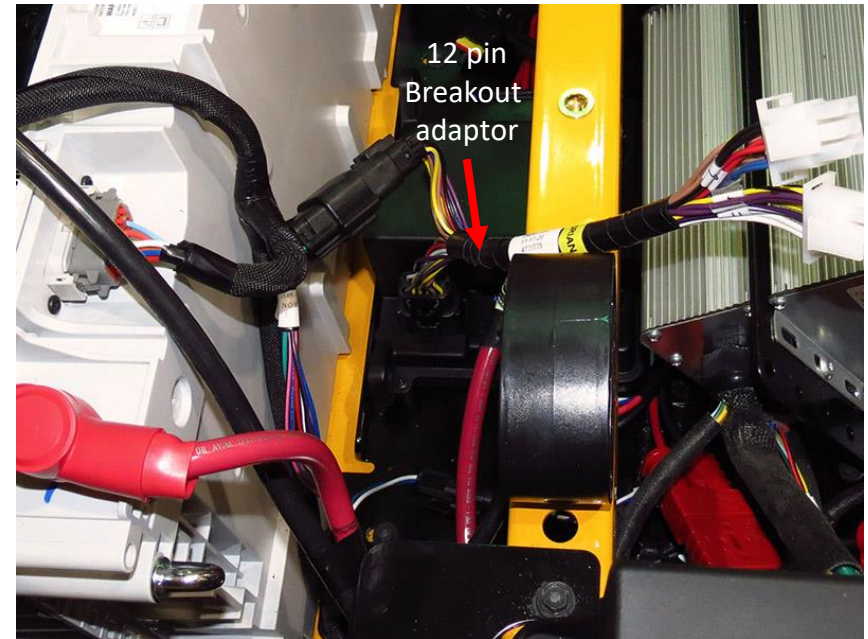


[Flow Chart](#)



Test for Pre-charge voltage at Contactor

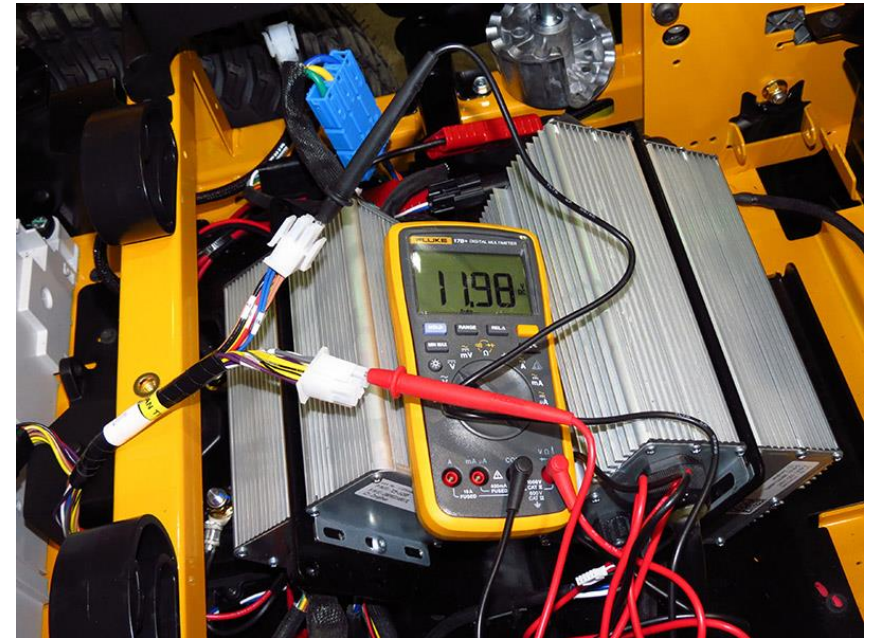
- Remove the key.
- Disconnect the jumpers of the 20-pin service tool.
- Install the 12-pin breakout adaptor between the contactor and the harness.
- Set DMM to measure DC volts.
- Insert the positive probe into pin 8 of the 12-pin breakout tool.



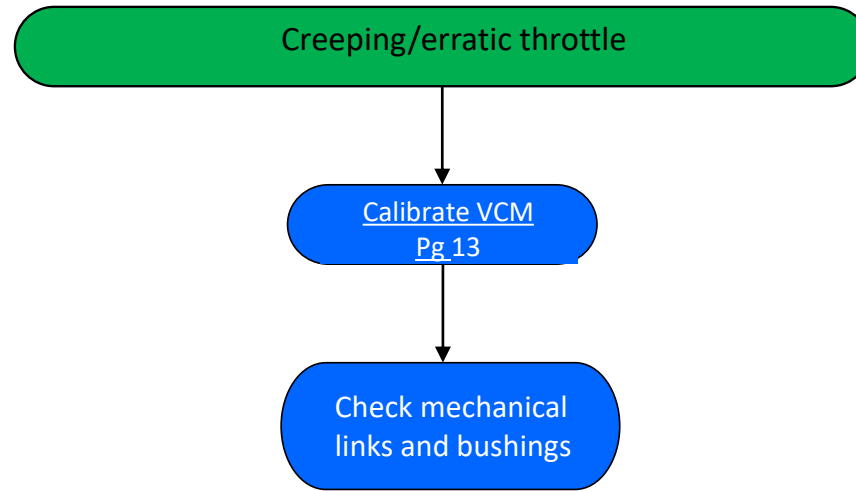


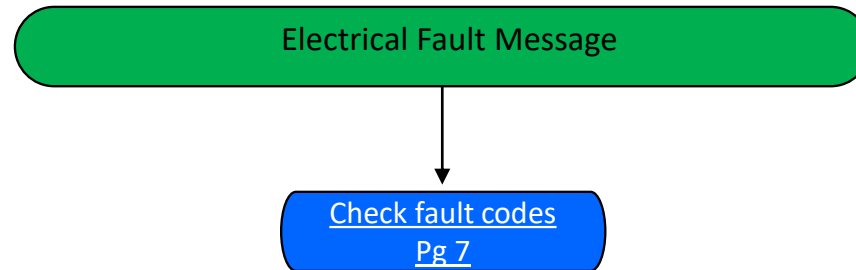
Test for Pre-charge voltage at Contactor

- Insert the negative probe into pin 1 of the 12-pin breakout tool.
- Connect the service tool's jumper #1.
- Connect the service tool's jumper #2.
- DMM should read approximately 12 volts.



[Flow Chart](#)







Motor Faults

To troubleshoot motor faults:

NOTE: When troubleshooting the motors, drive or deck, the procedures are basically the same.

1. Inspect the motor:
 - For a deck motor fault, sharpen the blades and remove any debris from motor.
 - NOTE: If there are any signs of impact damage on a blade, check the motor for a bent shaft.
 - For a drive motor fault, check and adjust the brake pads





Drive Motor

If the VCM shows a drive motor fault:

1. Remove any debris from motor.
2. Check and adjust the brake pads.
3. Check the connections at the controller.
4. If everything checks out ok, replace the motor.
5. **Do Not** try to bench test the motor,



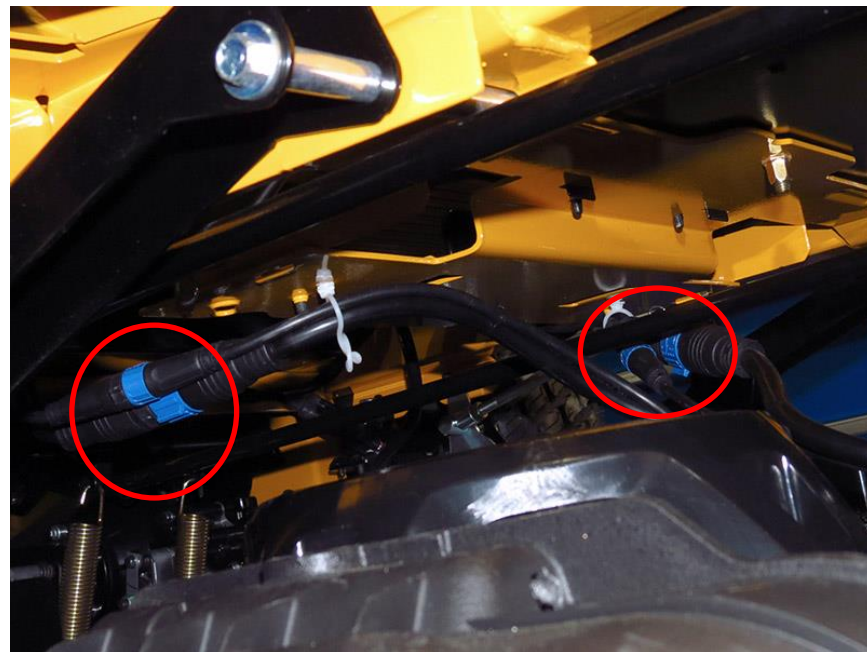


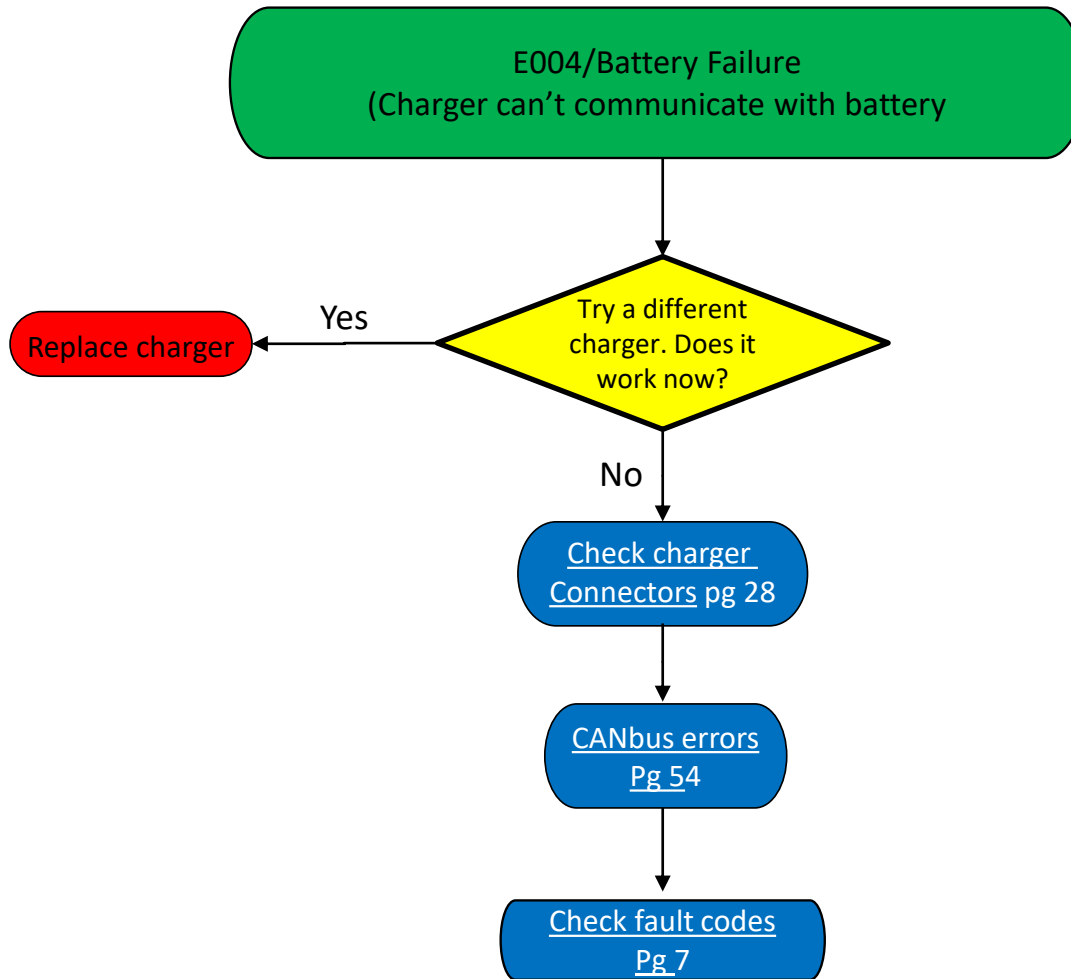
Deck Motor

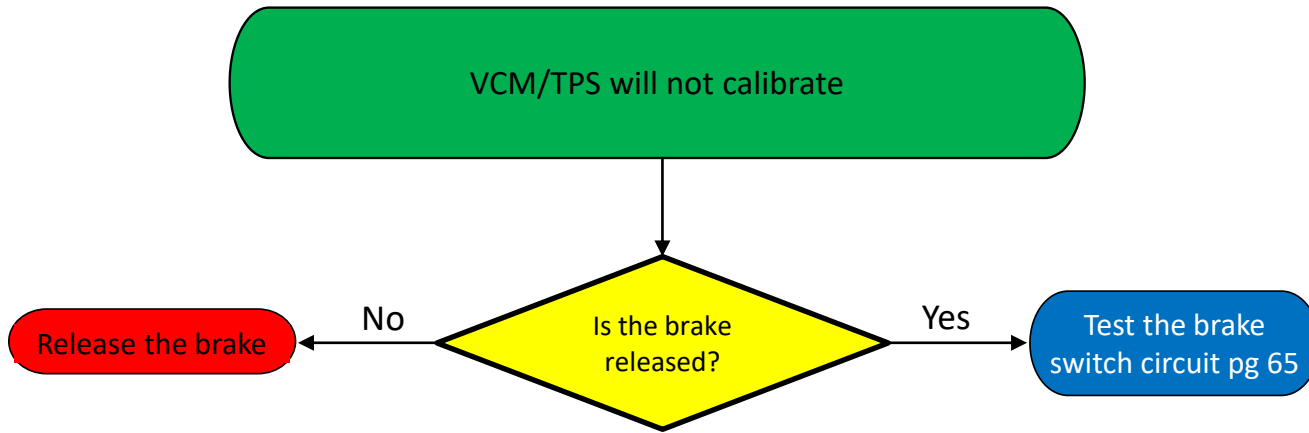
If the VCM shows a deck motor fault:

1. Remove any debris from motor.
2. Check the connections at the controller.
3. Disconnect and remove the deck.
4. Check the continuity of the harness between the deck motor connectors at the bottom of the control panel and where they connect to the contactor.
5. If everything checks out ok, replace the motor.

6. Do Not try to bench test the motor,

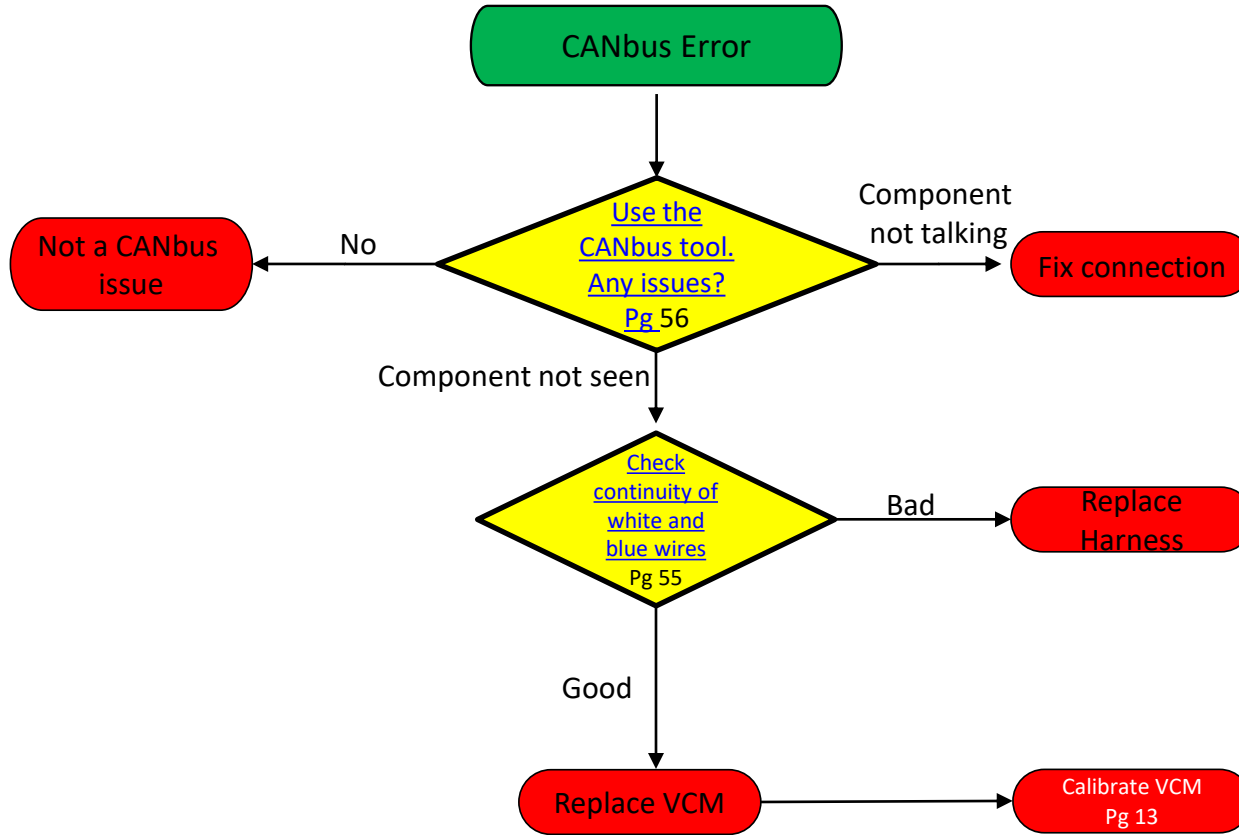








Click a diamond to go to that test.





Test CANbus Wires

- Test the continuity of the white wire between:
 - Pin 10 of the VCM's 20 pin connector, pin 2 of the 12 pin BMS connector, pin 4 of the BMS connector of battery 1 and the white wire at each controller.
- Test the continuity of the blue wire between:
 - Pin 20 of the VCM's 20 pin connector, pin 1 of the 12 pin BMS connector and the blue wire at each controller.

CANbus Chart

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CANbus Tool

Use a CAN bus analyzer to see which nodes are active on the network.

MTD offers a loaner tool,
P/N 753-11181



CANbus Chart

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CANbus Tool

- Attach the proper adaptor cable to the tool.
- The adaptor cable tees in between the charge port connector and the main harness.





CANbus Tool

- Turn the tool on by pressing the dial.
- Note: The tool can be powered by the power supply or 4 AA batteries (not included).



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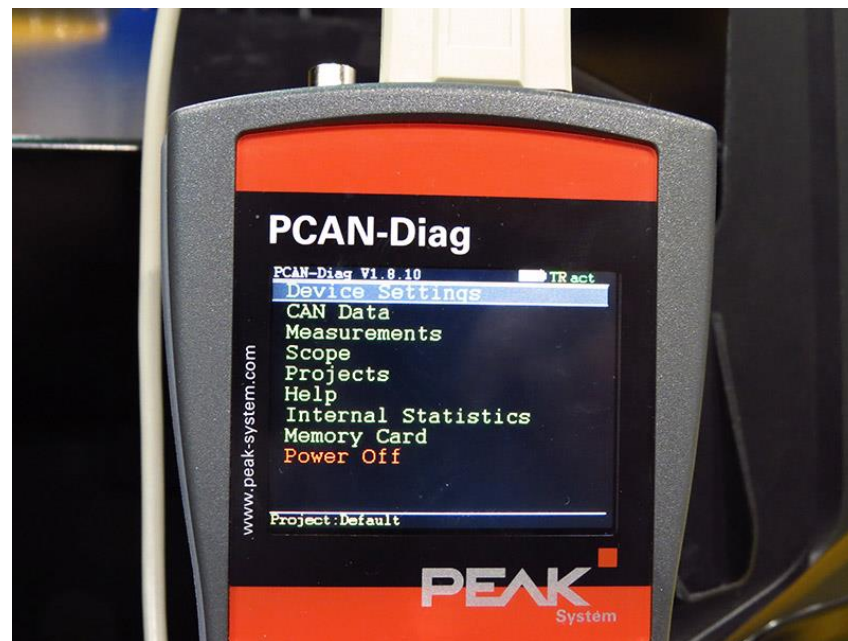
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CANbus Tool

- Turn the tool on by pressing the dial.
- Scroll to device settings. Press the dial.



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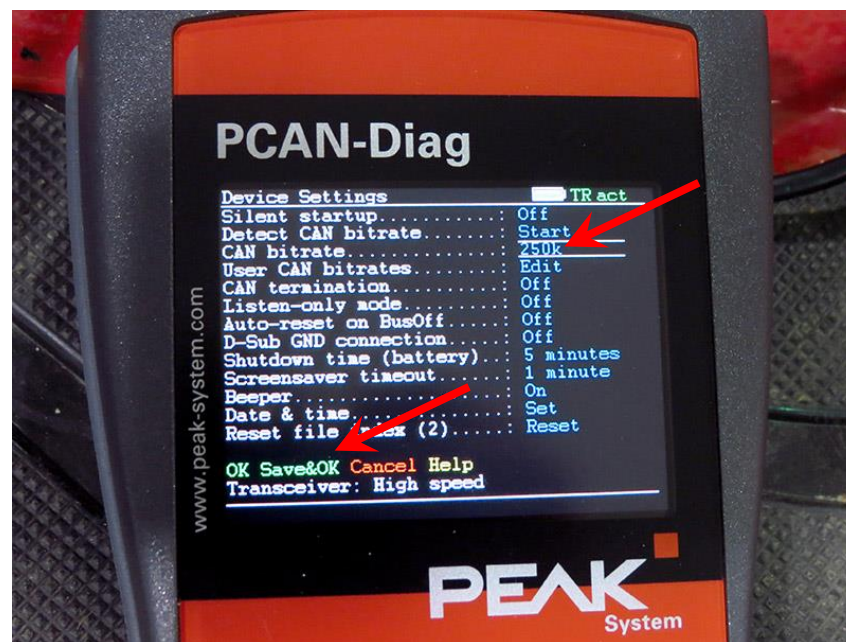
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CANbus Tool

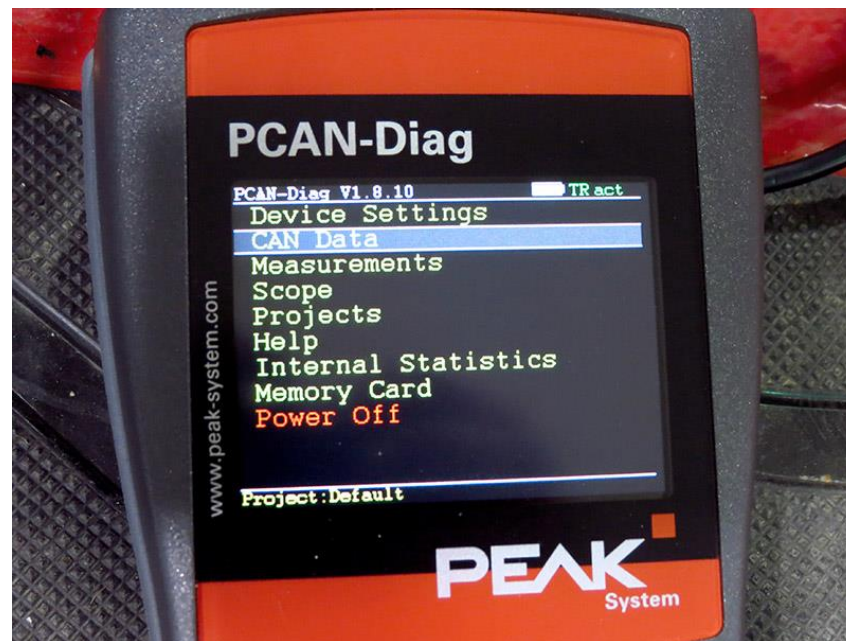
- Turn the tool on by pressing the dial.
- Scroll to device settings. Press the dial.
- Scroll to the CAN bitrates.
- Make sure it is at 250k, then save and exit.





CANbus Tool

- Scroll to CAN Data.
Press the dial.



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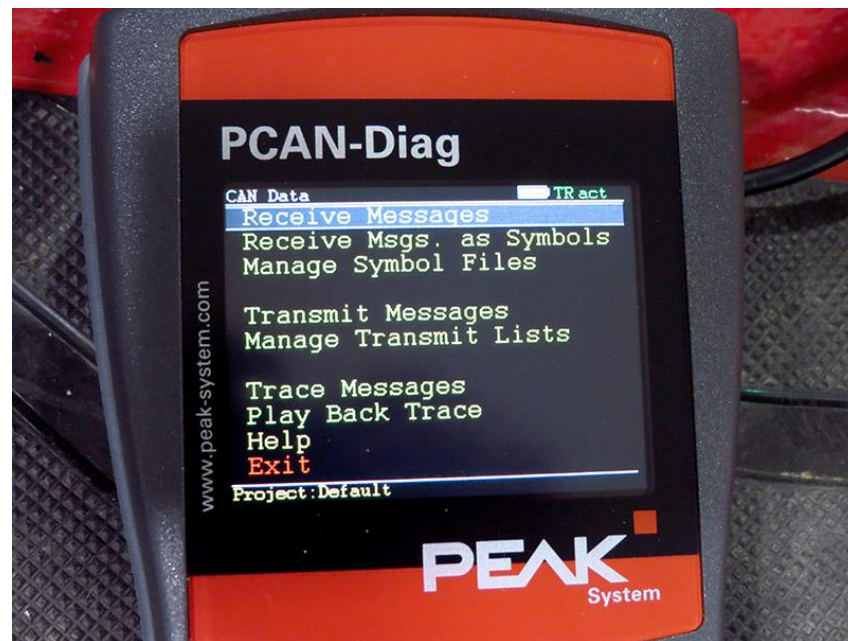
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CANbus Tool

- Scroll to CAN Data.
Press the dial.
- Scroll to Receive Messages. Press the dial.



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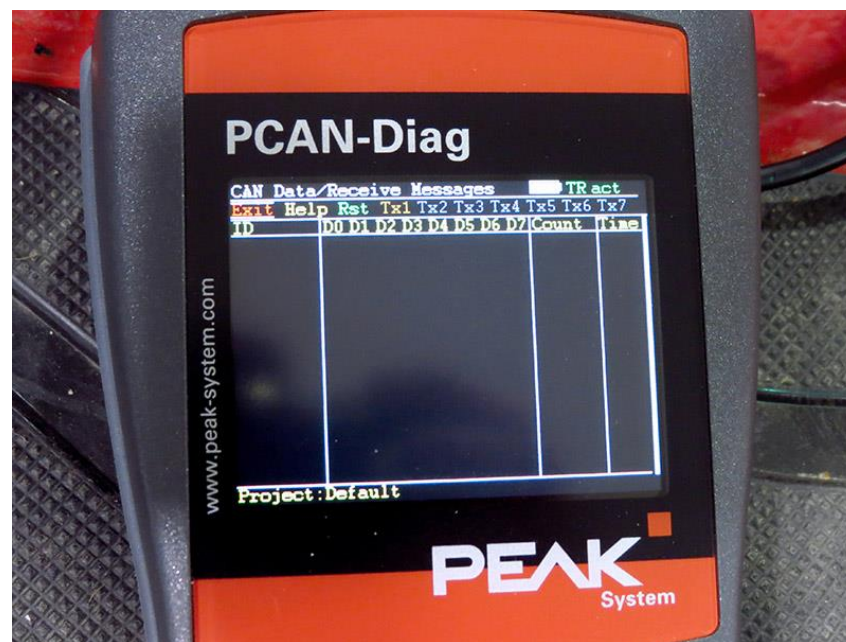
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CANbus Tool

- Scroll to CAN Data.
Press the dial.
- Scroll to Receive Messages. Press the dial.
- Turn the mower on.
- * The data fields will be empty until the mower turns on.

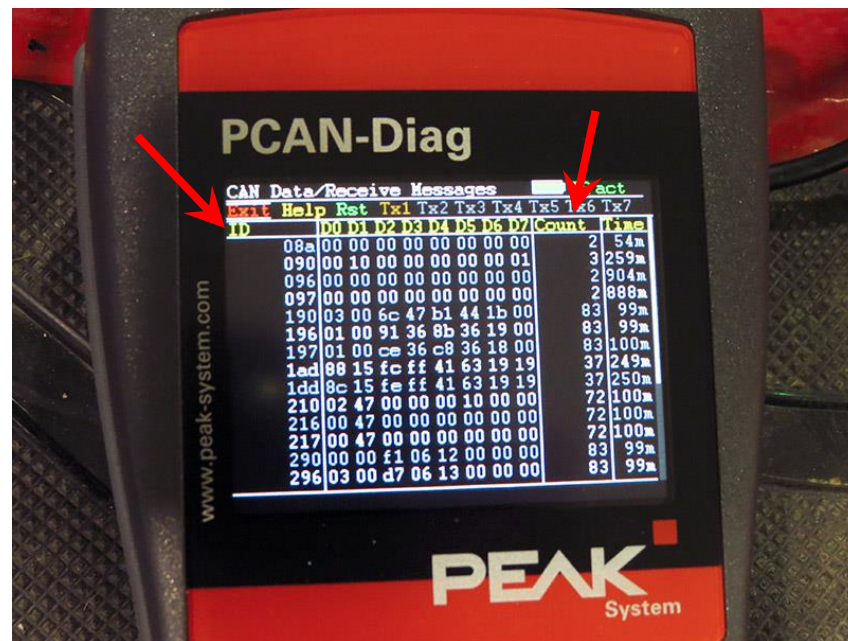




CANbus Tool

- Verify that all of the required IDs are present and are counting.
- Missing IDs indicate that node can not communicate with the network.
- Check the connection. if good, replace the component.

Click for CANbus ID list

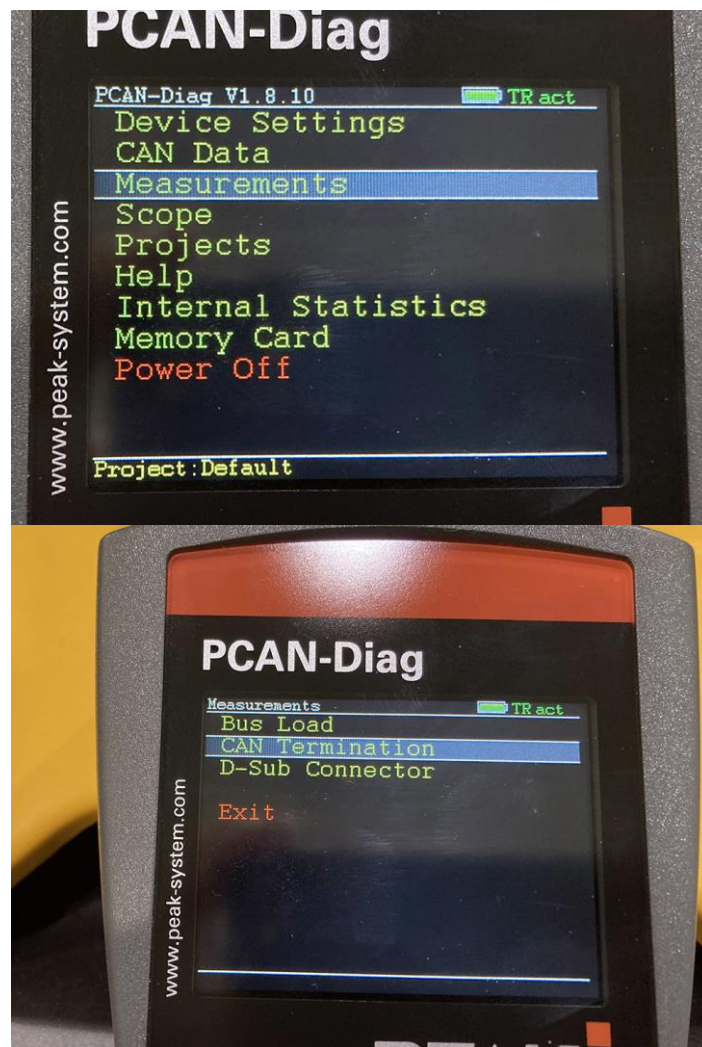




CANbus Tool

Check the termination resistance values.

- Go to the main menu and select measurements.
- Select CAN termination



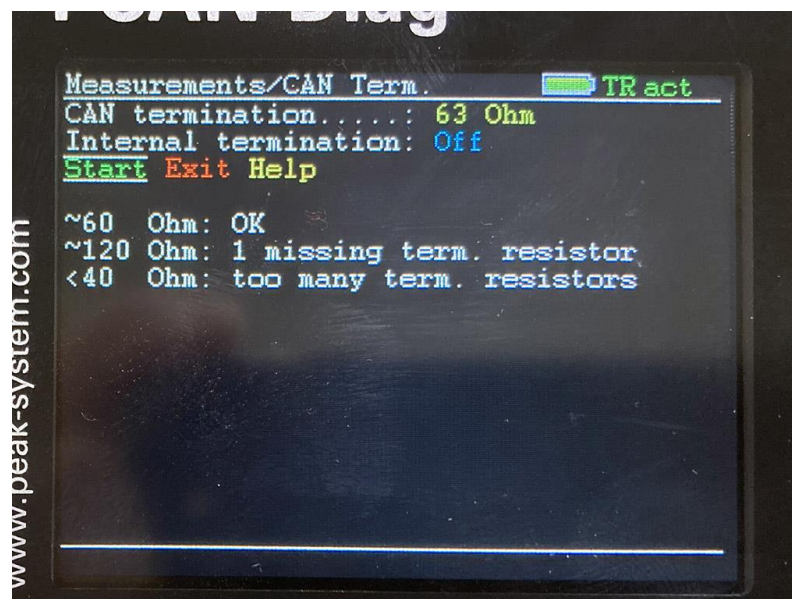


CANbus Tool

The CAN termination should be around 60 Ohms.

If it does not:

- Unplug CAN connections, 1 at a time and recheck the measurement, then re-connect.
- When the reading returns to 60 Ohms, you found the bad CAN termination.





CANbus Tool

- Turn off the mower.
- Scroll to exit and press the dial.
- Select power off to turn the tool off.
- Disconnect the adaptor from the mower.



CANbus Chart

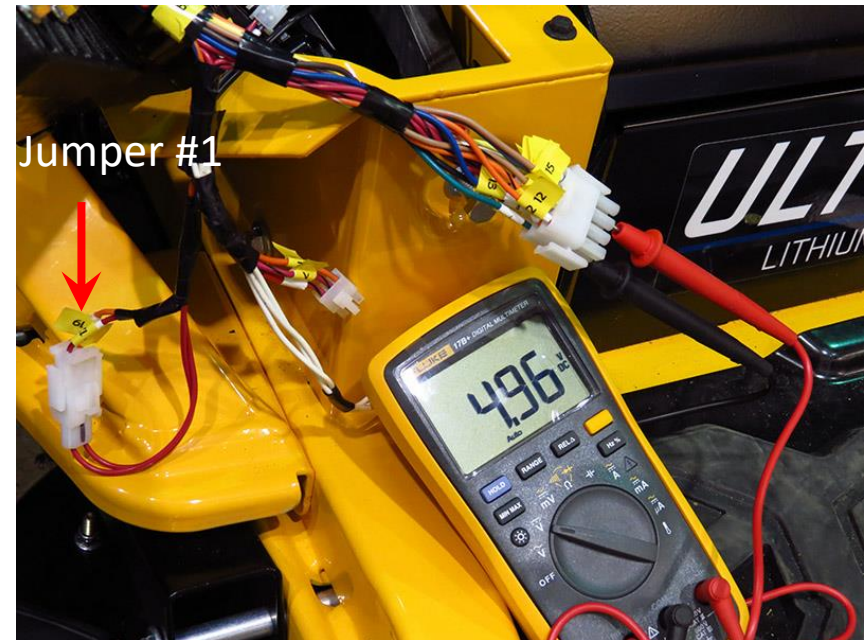
Cub Cadet

CRAFTSMAN

TROY-BILT

Test the Brake Switch Circuit

- [Install the 20-pin service tool.](#)
- Set DMM to the DC volts scale.
- Insert the negative probe into the pin 1 port.
- Insert the positive probe into the pin 15 port.



Test the Brake Switch Circuit

- Connect jumper #1.
- The DMM should read Approx. 5 volts (may take a couple of seconds to get there).
- If it does not, test the brake switch and connection.



Flow Chart