TECH TIPS

Diagnostics of

Genie / Sauer Danfoss Joystick Controllers

Deutsch type connection

Genie
Sauer Danfoss
Controller
Part #s
101173
101174
101175

Tools needed:
Multi-meter
Small Screwdriver
Harness Adaptor 119613
Jumper Wires w/clips
Three 1.5 volt AA or AAA Batteries
Appropriate three battery holder
Miscellaneous electronic components
Small Soldering Iron and Solder

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Tech Tips Safety Rules

Danger

Failure to obey the instructions and safety rules in the appropriate Operator's Manual and Service Manual for your machine will result in death or serious injury. Many of the hazards identified in the operator's manual are also safety hazards when maintenance and repair procedures are performed.

Do Not Perform Maintenance Unless:

- You are trained and qualified to perform maintenance on this machine.
- You read, understand and obey:
  - manufacturer's instructions and safety rules
  - employer's safety rules and worksite regulations
  - applicable governmental regulations
- You have the appropriate tools, lifting equipment and a suitable workshop.

The information contained in this tech tip is a supplement to the service manual. Consult the appropriate service manual of your machine for safety rules and hazards.

Introduction

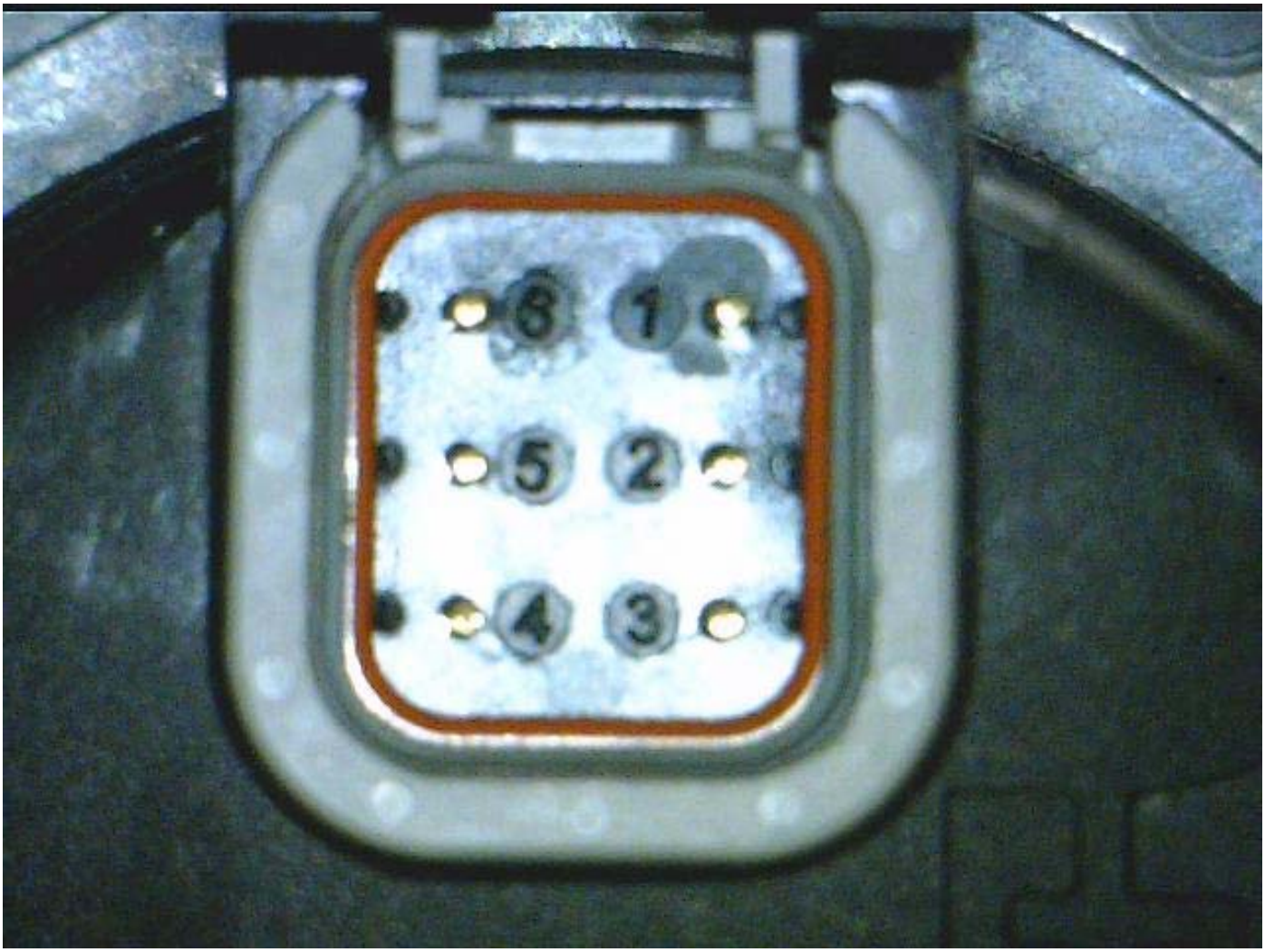
From Left to Right:
101173... Dual-Axis with Proportional Rocker Controller used on Z135 Units
101174… Dual-Axis Proportional Controller used on ALC 500 and ALC 1000 Units
101175… Single-Axis Proportional Controller used on ALC 500 and ALC 1000 Units.

The focus of this Tech Tip is to obtain a rapid diagnosis for a proportional controller installed on a Genie Aerial product utilizing the ALC500 and ALC1000 Sauer Danfoss Control Systems.

The intent is to display the analog outputs of the controller so the unknown condition of a controller can be determined before installation or for verification of a “faulty controller” fault code from the ALC500 or ALC1000 diagnostic system.

Familiarization

Start with familiarization of the controller layout and pin locations.



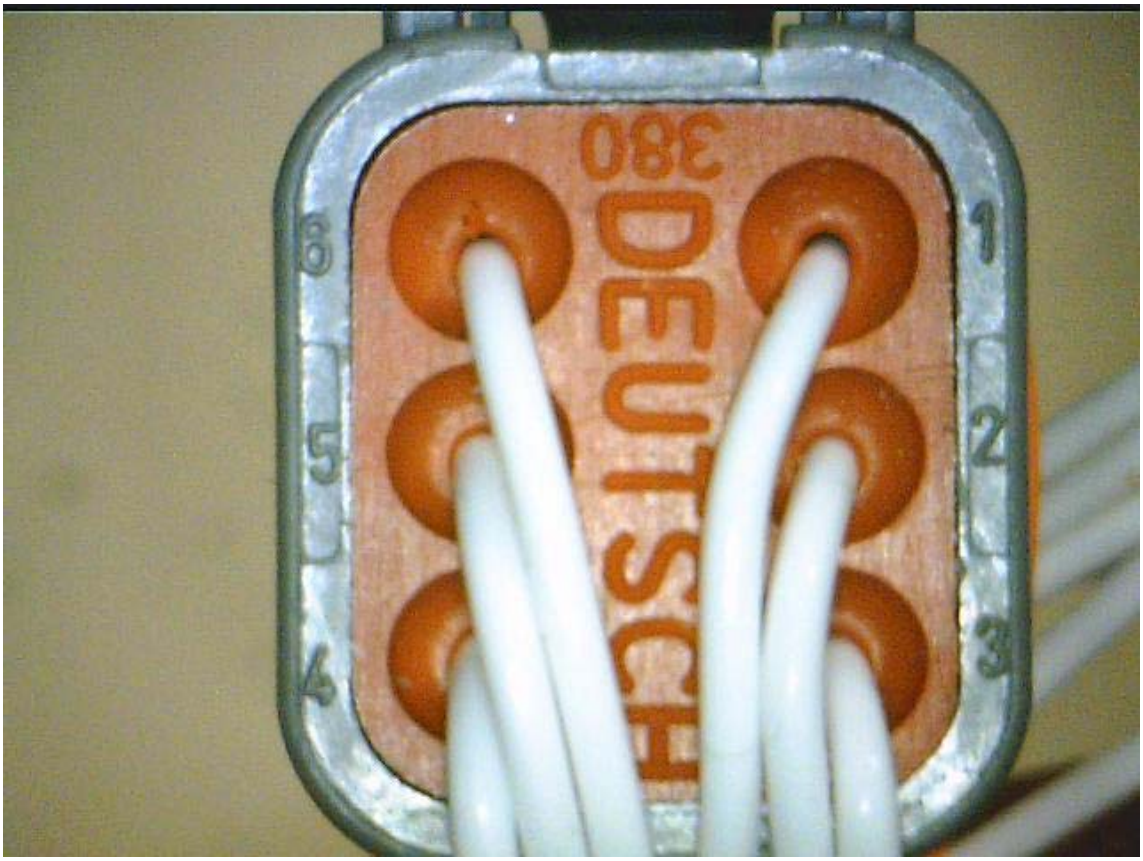
This is a photo of the JS1000 controller socket.

Notice the male pins.

Note that Pin 1 is at the top right and also note the clockwise arrangement of the remainder of the pins.

Analog connections:

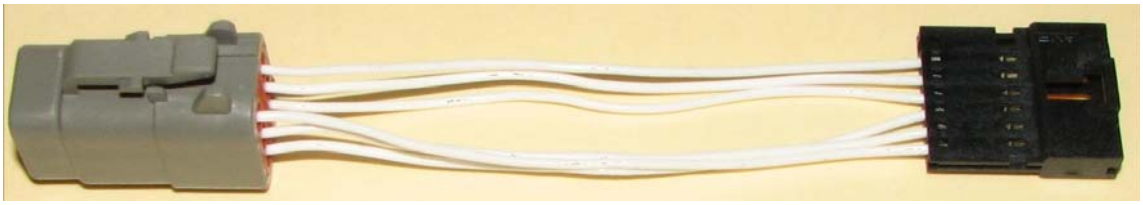
Pin 1 is GROUND IN
Pin 2 is 5 volts DC Power IN
Pin 3 is X OUT
Pin 4 is Y OUT
Pin 5 is Proportional Rocker OUT if equipped
Pin 6 is Ground Return



The Deutsch Connector that is inserted into the socket of the JS1000 Controller

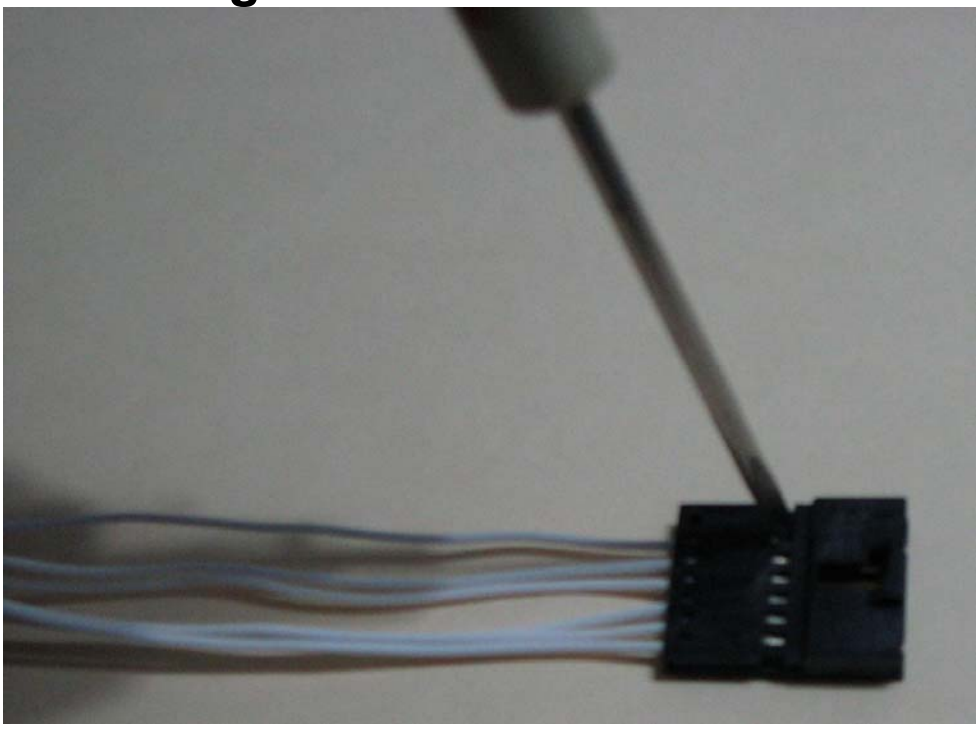
Again note the pin numbers.

Genie Part # 119613

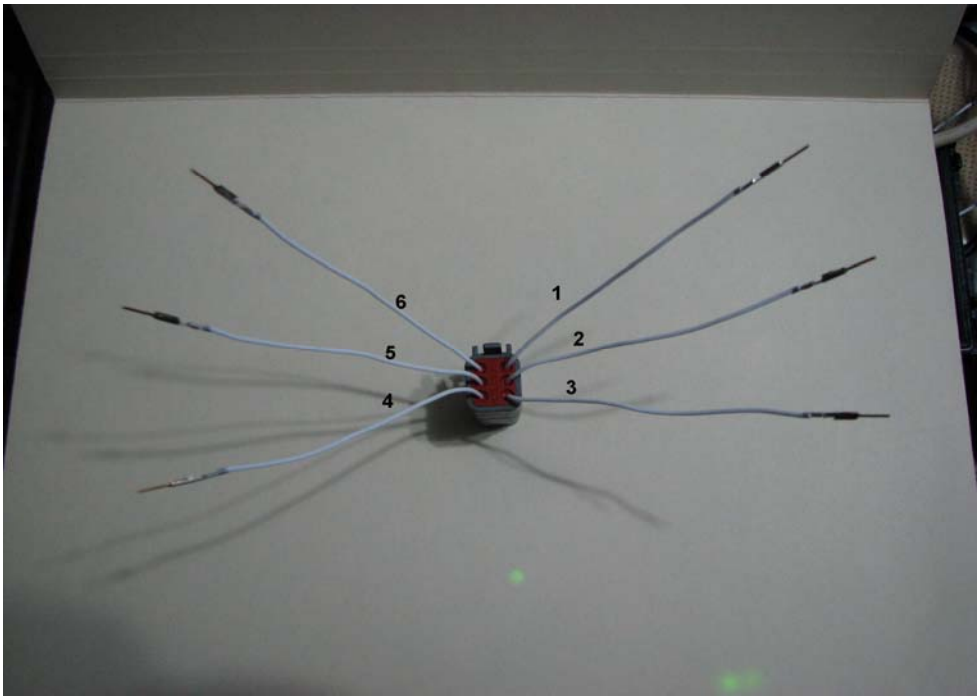


This is an adaptor used to bridge this version of controllers to earlier models that used the AMP Spade type joysticks that did not have the Deutsch connector.
It will be used in this Tech Tip as an interface for use with a Voltmeter and as a connection for a diagnostic tool that will be explained in detail later.

Removing the connector end from harness 119613



Remove the flat spade-like connector by gently pressing the retaining tab of each pin with a small slotted head screwdriver while pulling on the wire of that pin.
This part can be reproduced with parts from a used harness or individual wires with female pins to install on the pins in the socket of the JS1000 Controller.

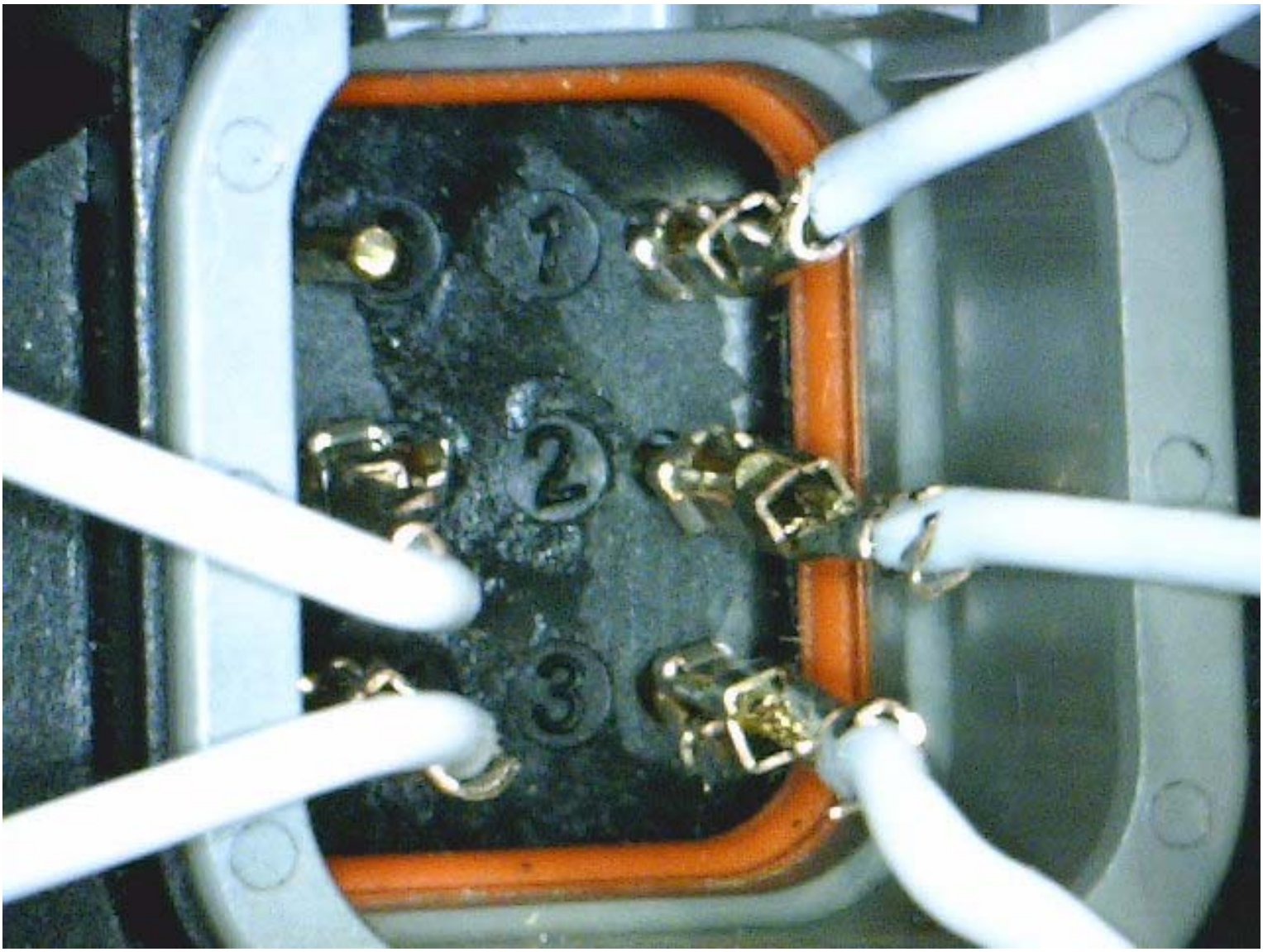


This is the portion of the harness that will be used to diagnose the controller.

TECH TIPS

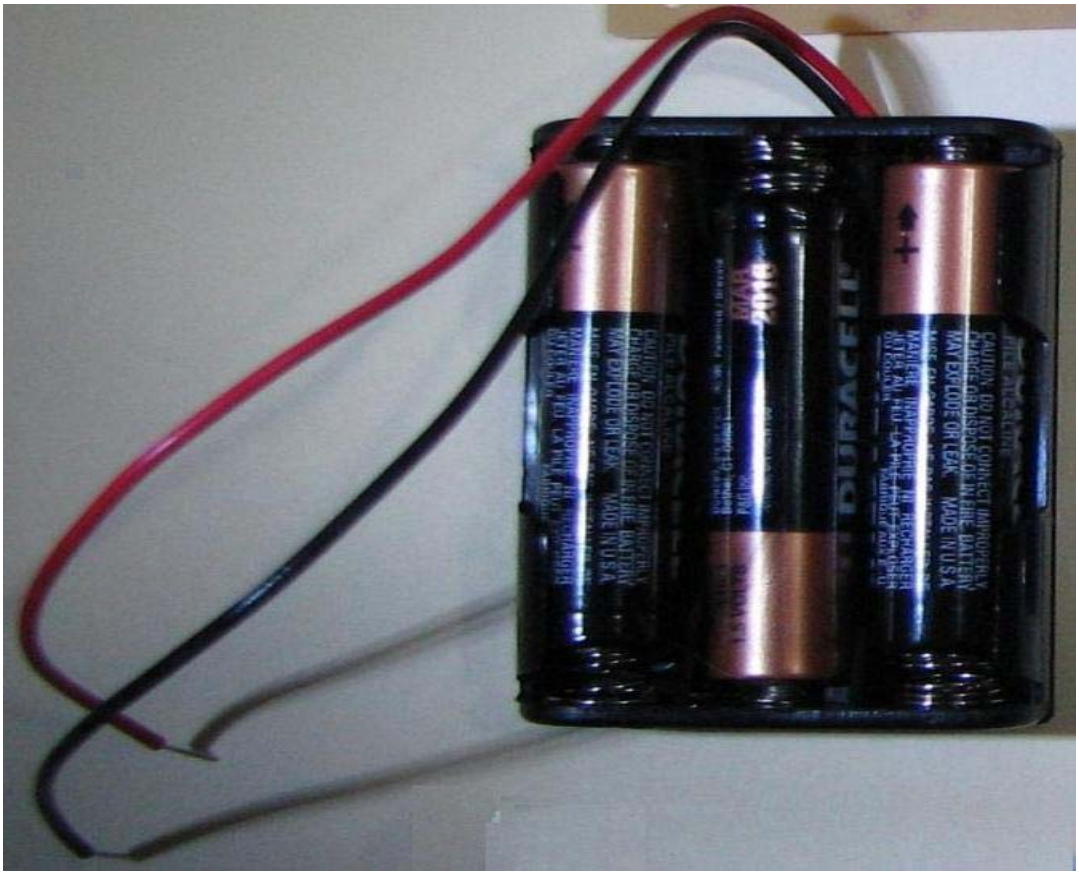
119613 Adaptor Harness – Available from Genie Parts Department

For diagnostic purposes, this part can be reproduced with parts from a used harness or individual wires with female pins to install on the pins in the socket of the JS1000 Controller.



Individual Wires with Female Terminal Ends Installed.
Be sure that bare exposed terminal ends do not contact each other and that they have a firm snug fit to prevent coming loose and shorting.

Power Source:



A three “AA” or “AAA” battery holder and three batteries will be used to power the controller for testing.

The holder is available at any electronics or hobby store at an inexpensive cost.

The input voltage for the controller must not exceed 5 volts DC.

The three batteries will deliver approximately 4.8 volts when they are at full charge.

We will use the value of 4.5 volts to represent used but serviceable batteries. If the voltage of the applied power supply is higher than 4.5 volts, the results will be a bit higher. Likewise, if the supply voltage is lower than 4.5 volts, the results will be a bit lower.

For testing purposes, voltage needed for testing will need to fall in the range of 3.8 volts to 5 volts DC.

Always verify voltage of the power supply before any diagnostic testing.

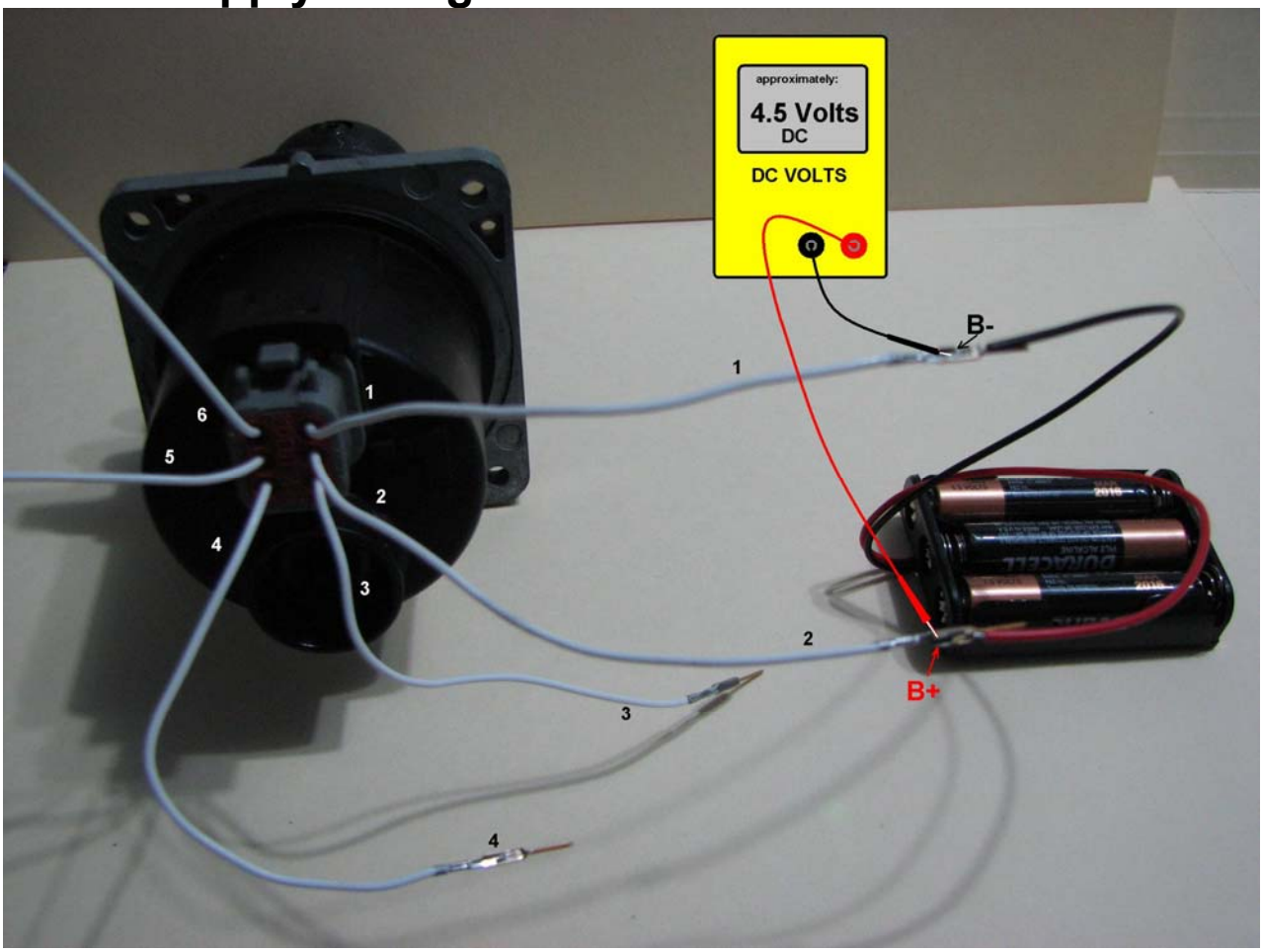
If a “wall wart” type (AC to DC converter) power supply is used, be sure the output is regulated.

Plug the wall wart in and check the output with a voltmeter. If the output is more than 5.0 volts, do not use it for testing these controllers.

101175 Controller:

STEP 1: (also: **Steps 1 and 8 for 101174)**

Power Supply Voltage Measurement:



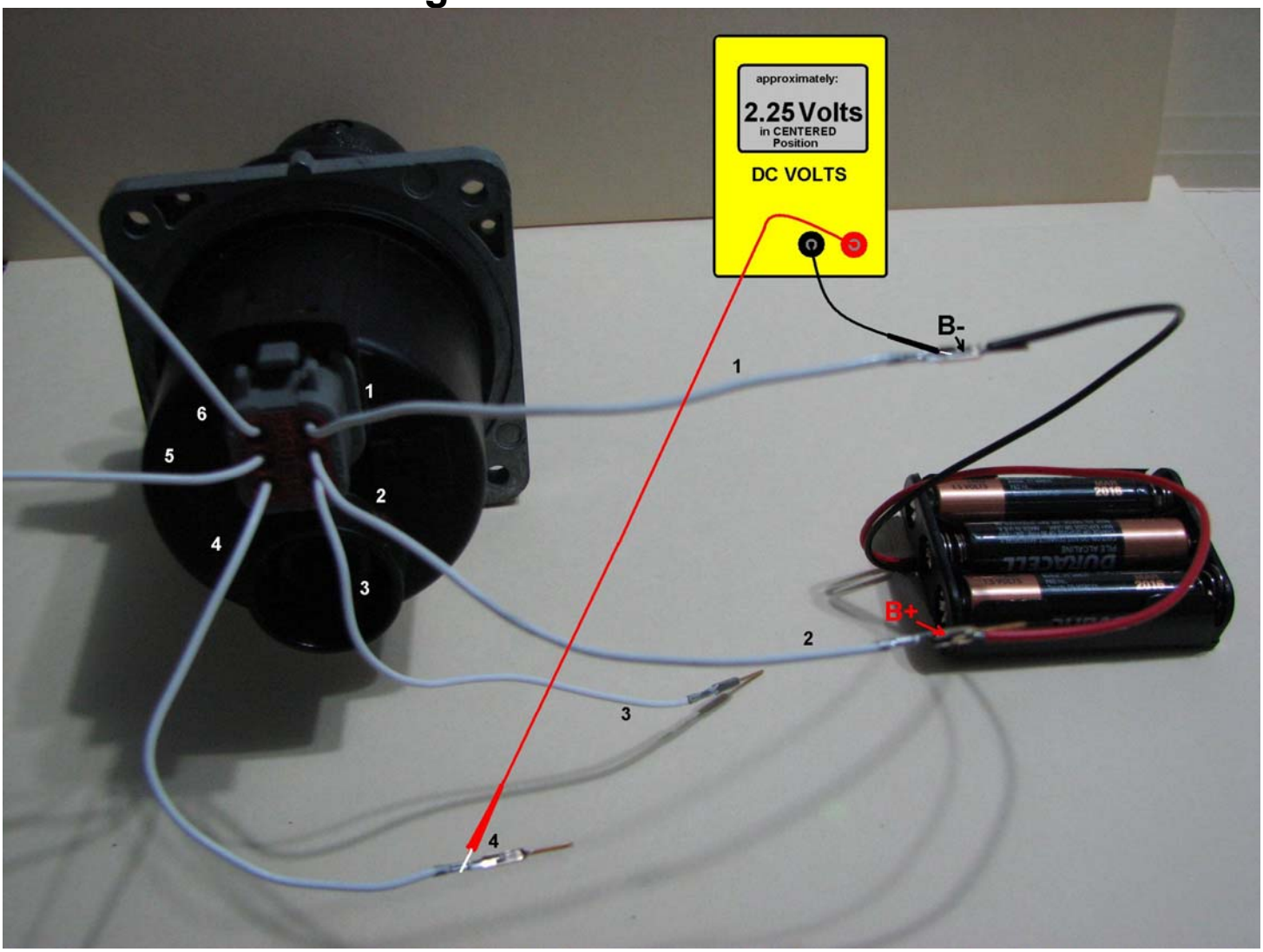
The voltmeter representation is showing in this case a 4.5 volt DC power source available. It is important to verify enough voltage is available when conducting diagnostics. Do not exceed 5.0 volts.

This photo shows Pins 1 and 2 connected to Battery Minus and Battery Plus respectively. No other leads are connected.

The controller in the photo is Part Number **101175.**
It is a Single Axis Joystick that is used on **Genie Models**:
After Serial Number:
Z45 31328, **Z51** 383, **Z60** 7227, **Z80** 1167, **Z135**,
S40/45 12510, **S60/65/HC** 14782, **S80/85** 5520
S100/105 420, **S120/125** 1617.

Step 2: (also: **Steps 2 and 9 for 101174)**

Center Position Voltage Measurement:



On the Single Axis controllers (101175), only the number 1, 2 and 4 terminals are used.
1 is the Ground Input
2 is the Power Plus Input (3.8 volts to 5 volts)
4 is the Output for the Y axis.

When Pin 4 is connected to the voltmeter, the reading should be approximately half that of the voltage applied to pin 2.
In this case the reading will be approximately 2.25 volts.

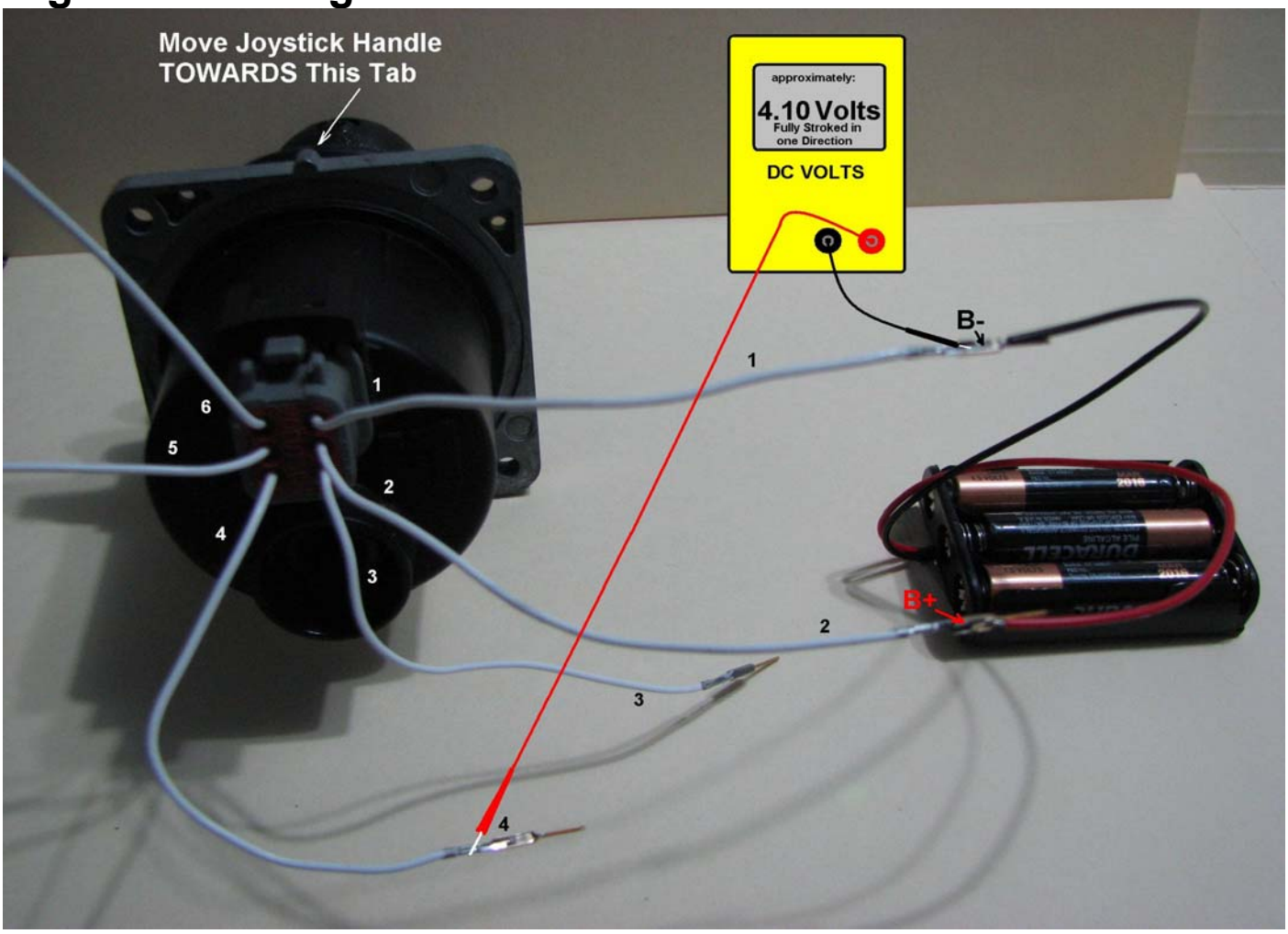
If the power supply is 5.0 volts, the reading here will be approximately 2.5 volts. If 4.0 volts is the input at pin 2, the output here would be approximately 2.0 volts.

This same relationship holds true for the remainder of testing.

(Step 9) Pin 3 is for the X-Axis on 101174. The Positive lead from the voltmeter will be on Pin 3 for step 9. Pin 4 will not be connected for X-Axis test.

Step 3: (also: **Steps 3 and 10 for 101174)**

High-Side Voltage Measurement:



Positioning the Socket or TAB at 12:00 O'clock will make it easier to reference directions later. Reference will be from the bottom as in this photo.

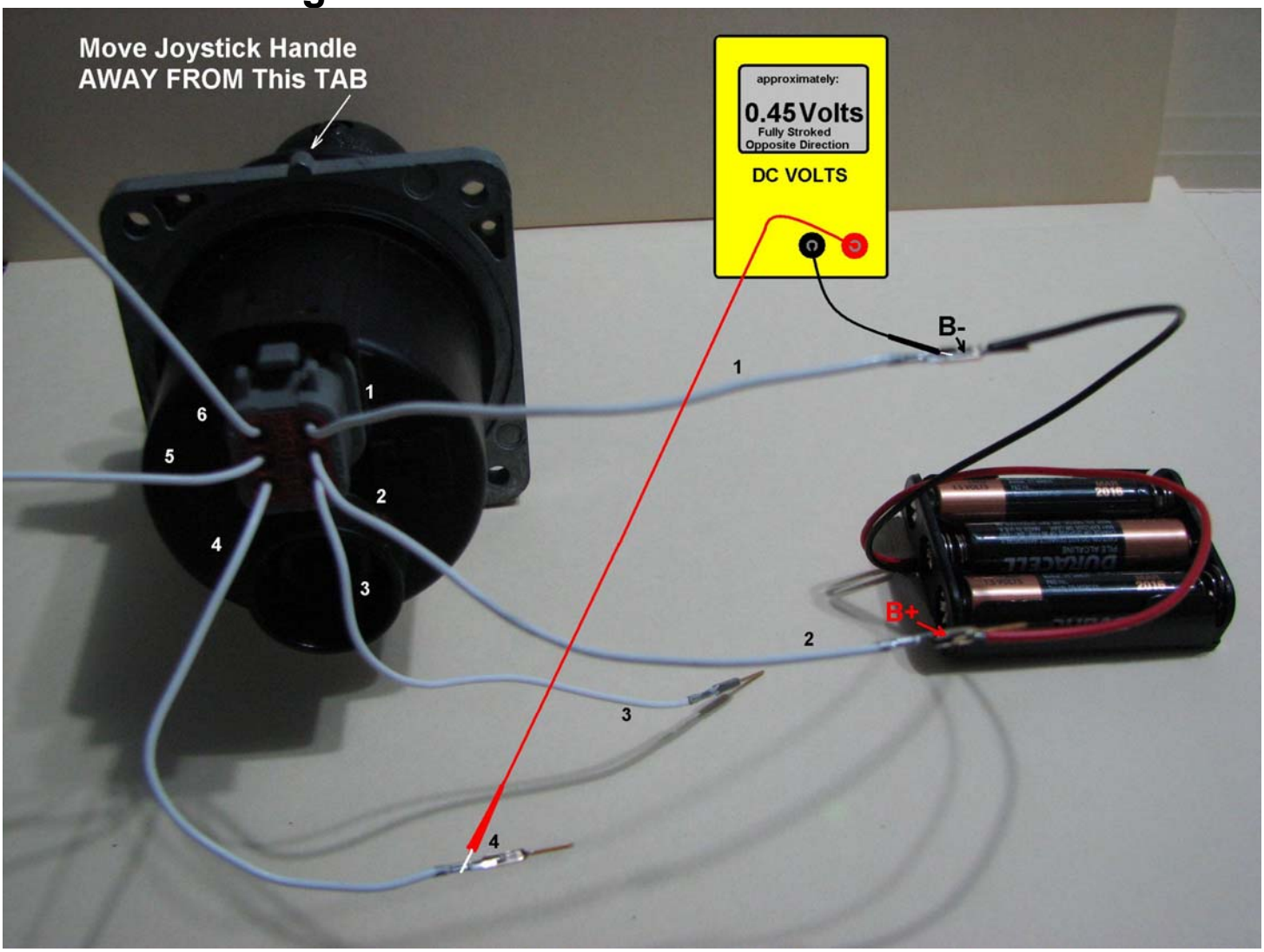
Moving The Joystick Handle **Towards** the TAB (12:00 O'clock) located on the controller housing we will see the voltage **increase** to approximately 0.40 to 0.50 volts less than the Power Supply voltage (4.5 volts) at full deflection of the joystick handle. In this case about 4.10 volts*. Again, a 5.0 volt supply would be about 4.6 volts and a 4.0 volt supply will be about 3.6 volts.*

The **increasing** voltage as the handle is moved should be a smooth and linear proportional voltage **increase**. If the voltage change is erratic, choppy or interrupted, the signal to the control circuit (ALC500 or ALC1000) will reflect the same and the control board will be confused and go into a fault mode.

(Step 10) 101174 Controller: Facing the controller from the bottom, move the Joystick Handle to the 9:00 o'clock position (High-Side). Reading will be approximately the same as Step 3. The Positive lead from the voltmeter will be on Pin 3 for step 10. Pin 4 will not be connected for X-Axis test.

Step 4: (also: Steps 4 and 11 for 101174)

Low-Side Voltage Measurement:



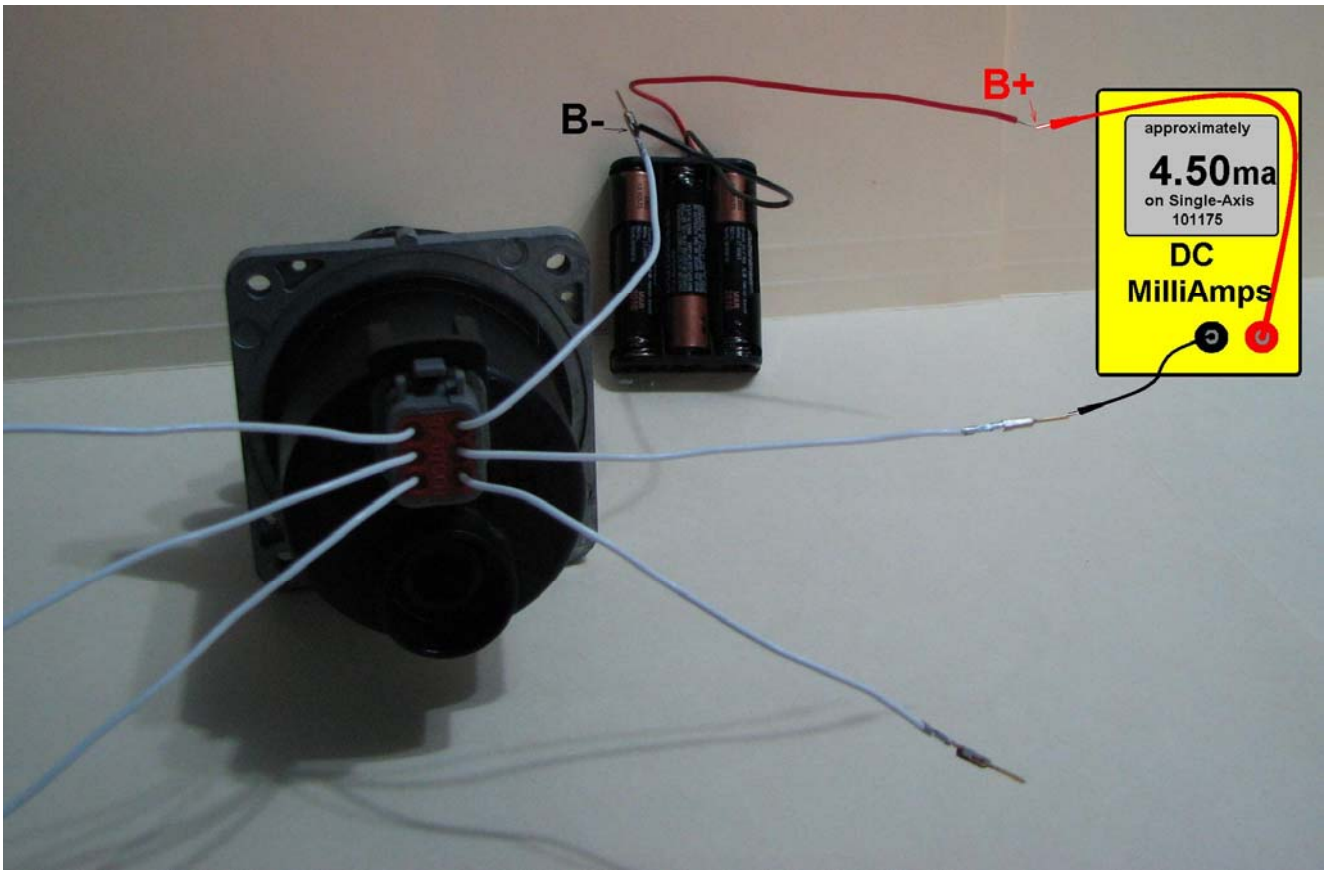
Moving The Joystick Handle **Away** (6:00 O'clock) from the TAB located on the controller housing we will see the voltage **decrease** to approximately 0.40 to 0.50 volts **Above** the Minus Supply (0.00 volts) at full deflection of the joystick handle. This will be a voltage reading of from 0.40 to 0.50 volts throughout the accepted input range of 3.8 to 5.0 volts at pins 1 and 2.

The **decreasing** voltage as the handle is moved should be a smooth and linear proportional voltage **decrease**. If the voltage change is erratic, choppy or interrupted, the signal to the control circuit (ALC500 or ALC1000) will reflect the same and the control board will be confused and go into a fault mode.

(Step 11) 101174 Controller: Facing the controller from the bottom, move the Joystick Handle to the 3:00 o'clock position (Low-Side). Reading will be approximately the same as Step 4. The Positive lead from the voltmeter will be on Pin 3 for step 11. Pin 4 will not be connected for X-Axis test.

Step 5: (also: **Steps 5 and 12 for 101174)**

Static State Current Measurement:



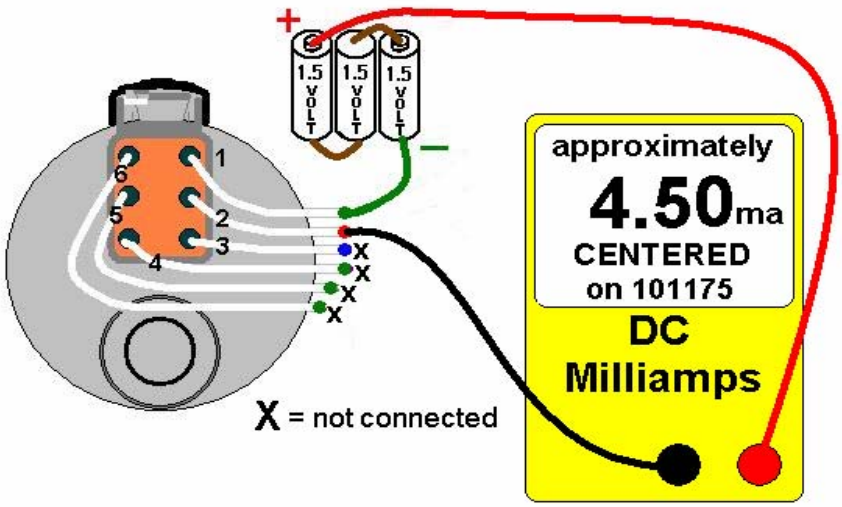
Set the Multimeter to read MilliAmp DC Current.
The Meter connections are as follows:
Positive Lead of Current Meter connected to Battery Positive
Negative Lead of Current Meter connected to Joystick Pin # 2
Negative Lead from Battery Pack connected to Joystick Pin # 1.
This puts the current meter in series with the power supply and the Joystick controller. No other pins of the joystick will be connected.
The current in the Hall Effect Circuits will be displayed.
On the Single-Axis **101175** controller the current will be approximately **4.50 milliamps**. For reference here, the current values at this static state are different for each of the three different controllers outlined in this Tech Tip.

101175: Single-Axis will be approximately 4.50ma.
101174: Dual-Axis will be approximately 8.50ma.
101173: Dual Axis w/ Proportional Rocker will be approximately 15.50ma

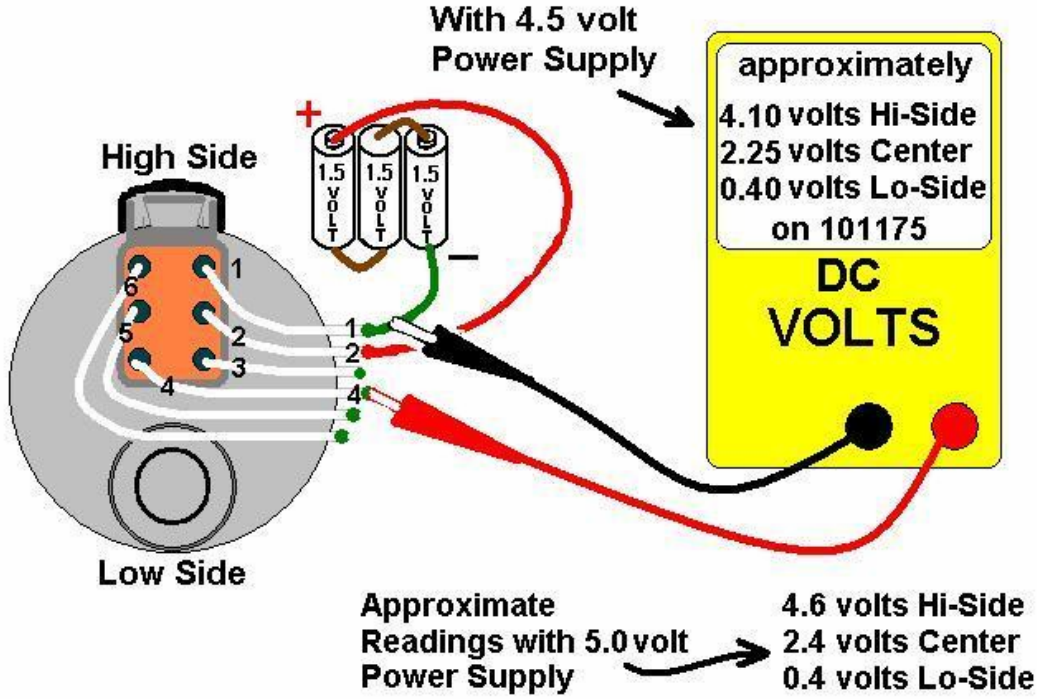
(Steps 5 and 12 of 101174 will be approximately 8.50 milliamps)

Pictorial of Current Measurement Circuit:

101175 = 4.50ma
101174 = 8.50ma
101173 = 15.50ma

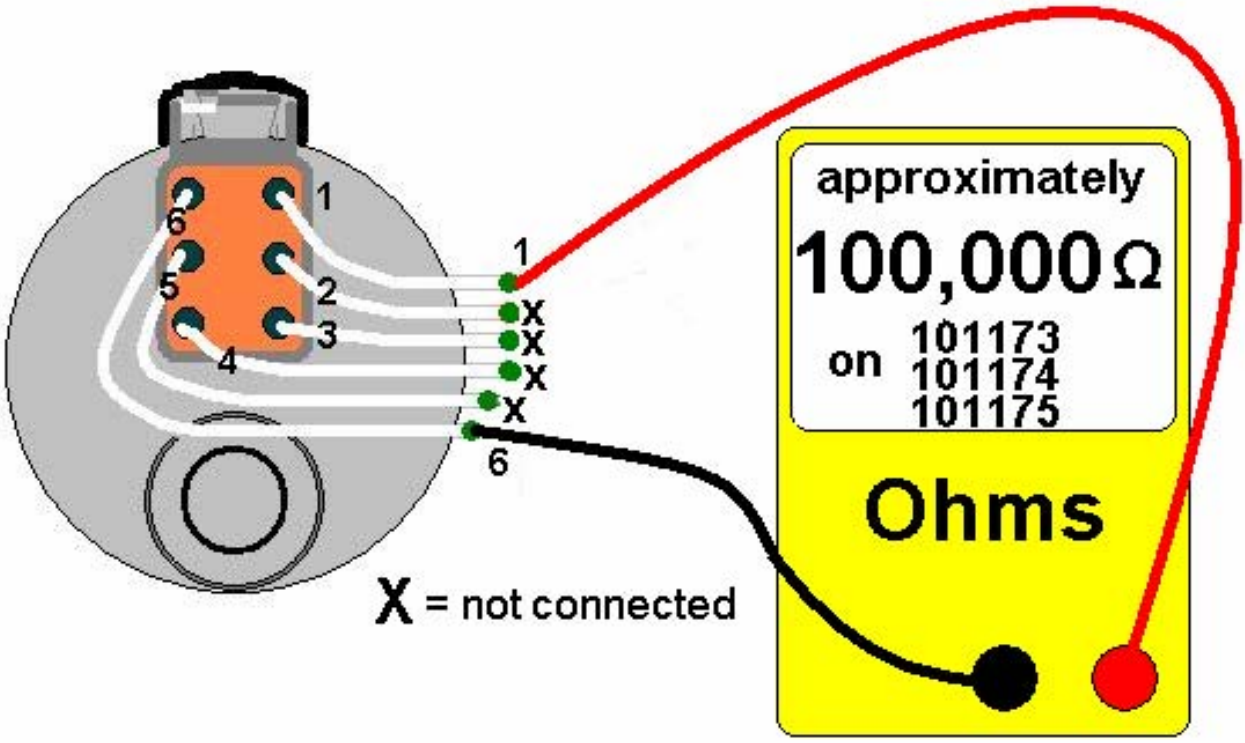


Simple Voltage Circuit Diagram:



Step 6: (also: **Step 13 for 101174)**

Resistance Measurement for Ground Return Circuit:



No power applied.
The Resistance between pin 1 and pin 6 for the Ground Return will not be continuity.
It will be approximately 99,000Ωs to 101,000Ωs for the Sauer Danfoss Controllers included in this Tech Tip.
It must not have a “shorted” or “open” reading.

(Step 13 is identical to Step 6)

End 101175 Diagnostic

101174 Controller:

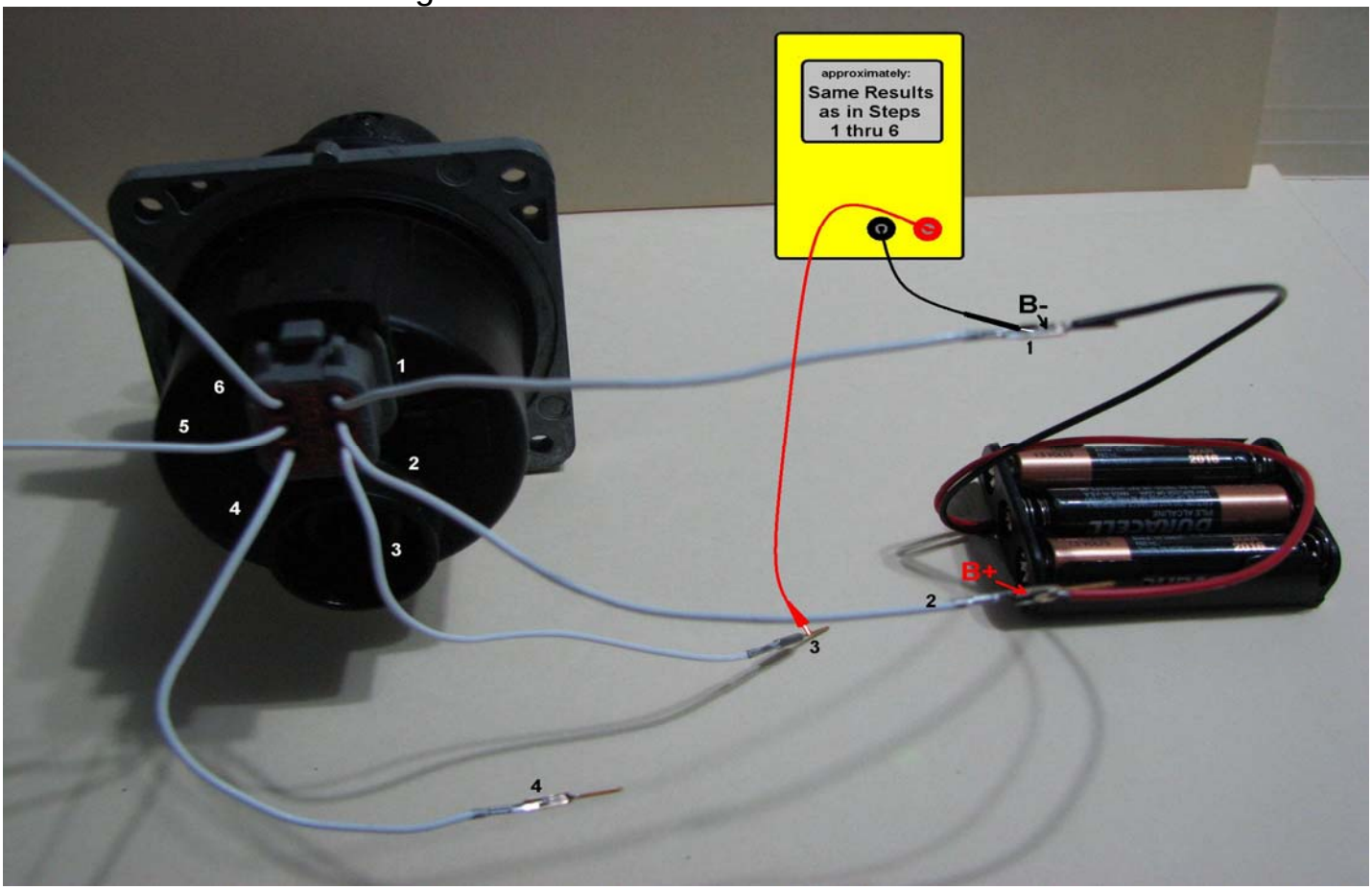
Used on Genie Models AFTER Serial Numbers:
Z45 31328**, Z51** 383**, Z60** 7227**, Z80** 1167**, Z135,**
S40/45 12510, **S60/65/HC** 14782, **S80/85** 5520,
S100/105 420, **S120/125** 1617.

Step 7:

This diagnostic is for Controller Part Number 101174.
Dual-Axis Proportional Controller

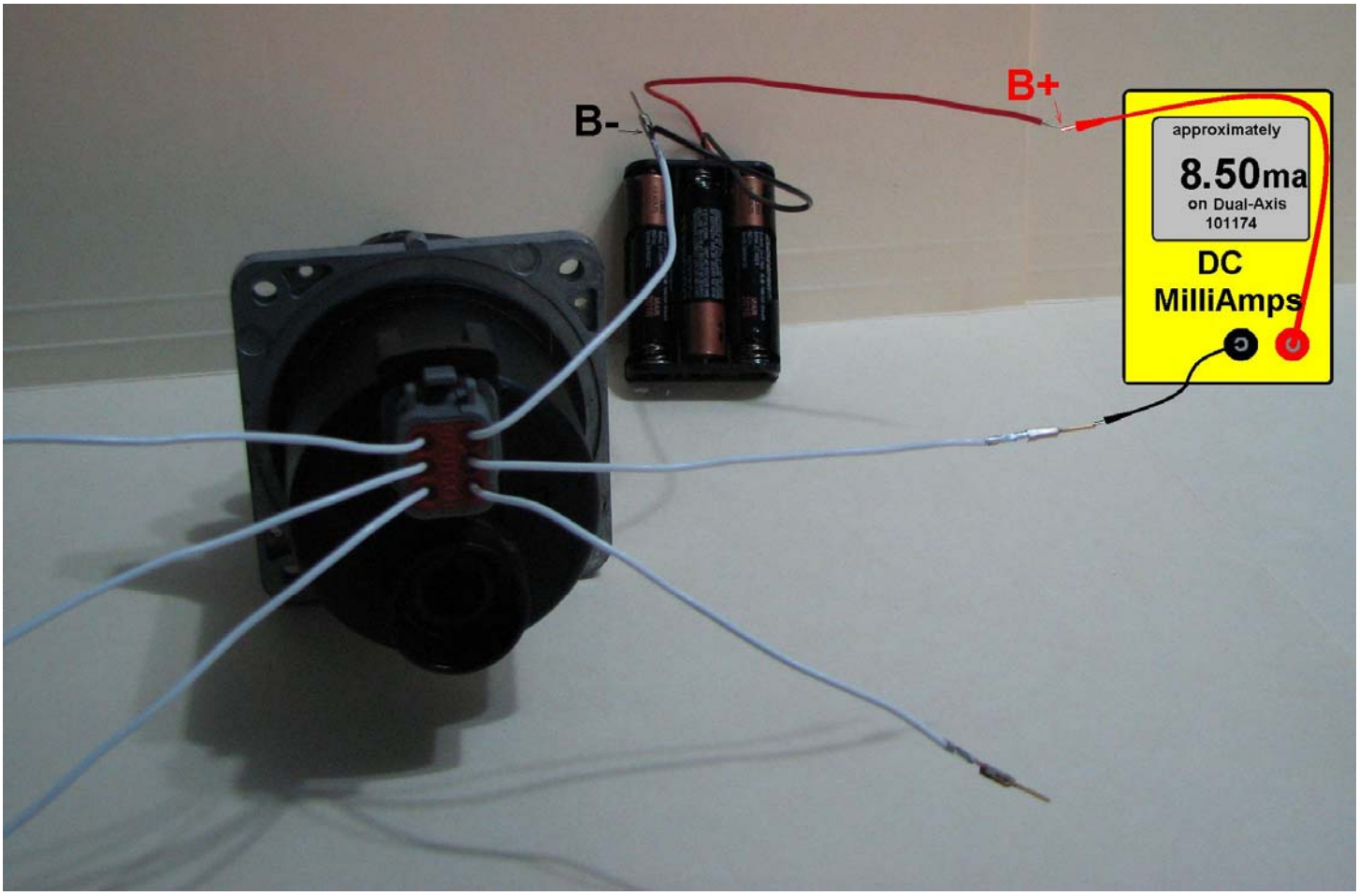
Return now to steps 1 thru 6 for the Y-Axis of the 101174 controller using PIN #4 as in steps 1 thru 6.
Steps 8 thru 13 are for the X-Axis measurements of Controller 101174.
Use Pin 3 for testing X-Axis of 101174.

Diagnosis of X-Axis is similar to that of the Y-Axis except using PIN # 3 of the Deutsch Connector. Perform Steps 8 thru 13 using Pin 3 instead of PIN 4. Results will be similar to the Y-Axis testing.



TECH TIPS

Static State Current Measurement for 101174:

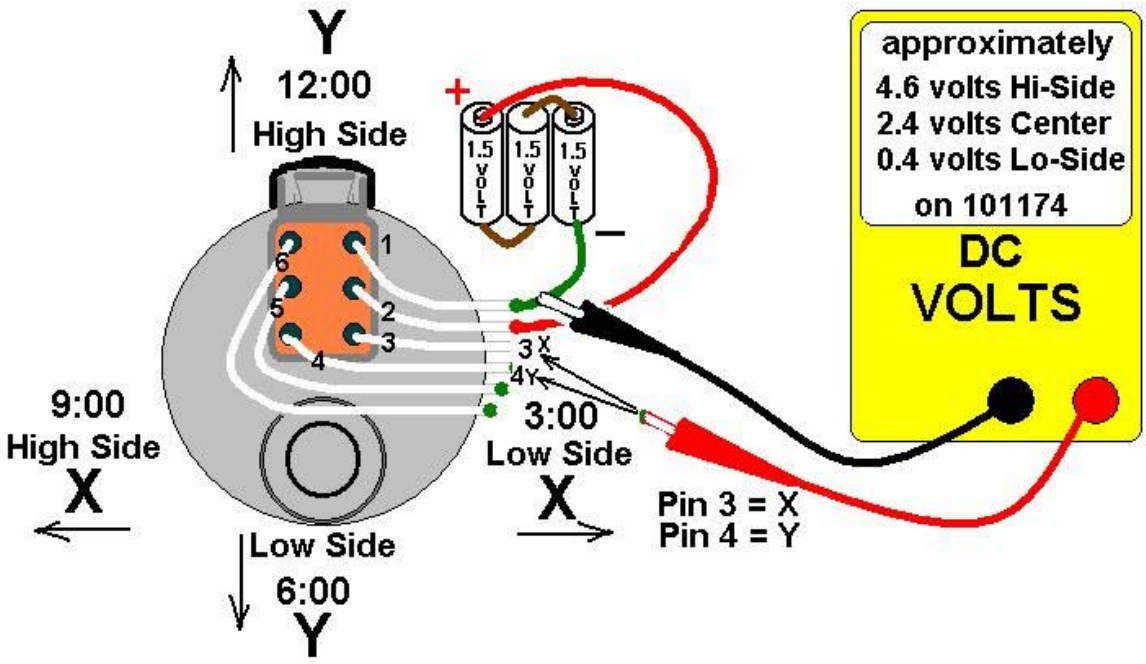


Set the Multimeter to read MilliAmp DC Current.
The Meter connections are as follows:
Positive Lead of Current Meter connected to Battery Positive
Negative Lead of Current Meter connected to Joystick Pin # 2
Negative Lead from Battery Pack connected to Joystick Pin # 1.
This puts the current meter in series with the power supply and the Joystick controller.
No other pins of the joystick will be connected.
The current in the Hall Effect Circuits will be displayed.
On the Dual-Axis **101174** controller the current will be approximately **8.50 milliamps**.

For reference here, the current values at this static state are different for each of the three different controllers outlined in this Tech Tip.

101175: Single-Axis will be approximately 4.50ma.
101174: Dual-Axis will be approximately 8.50ma.
101173: Dual Axis w/ Proportional Rocker will be approximately 15.50ma

When a 5.0 volt potential is applied across inputs Pin 1 and Pin 2:
This illustration points out the expected approximate results.



Looking at the controller from the bottom side, moving the joystick handle towards the 12:00 o'clock position will result with increasing voltage.
This is the Y-Axis High Side. Pin 4 is used.

Moving the joystick handle down towards the 6:00 o'clock position will result with decreasing voltage.
This is the Y-Axis Low-Side. Pin 4 is used.

Likewise:
Moving the joystick handle towards the 9:00 o'clock position will result with increasing voltage.
This is the X-Axis High Side. Pin 3 is used.

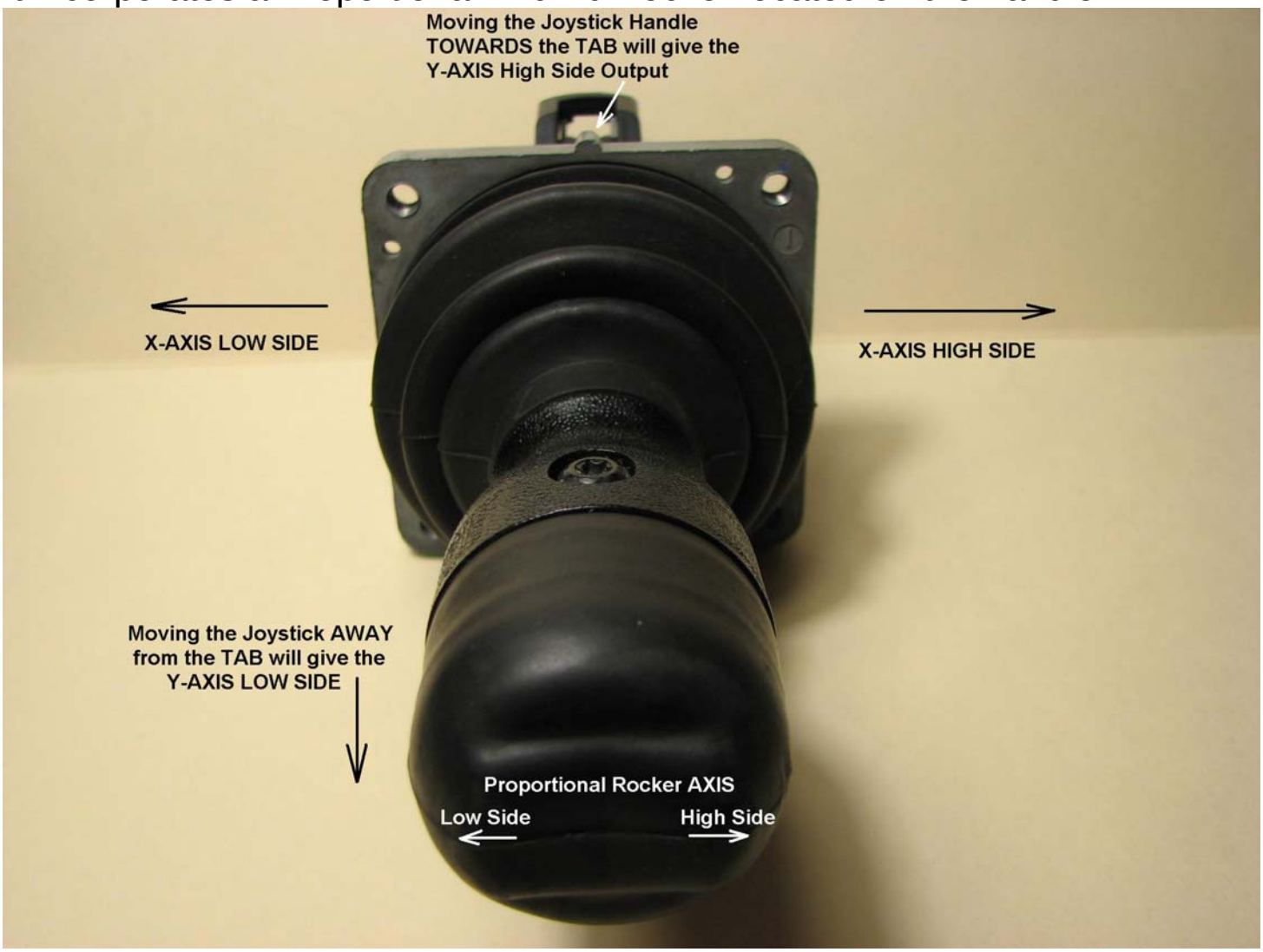
Moving the joystick handle towards the 3:00 o'clock position will result with decreasing voltage.
This is the X-Axis Low-Side. Pin 3 is used.

End 101174 Diagnostic

101173 Controller:

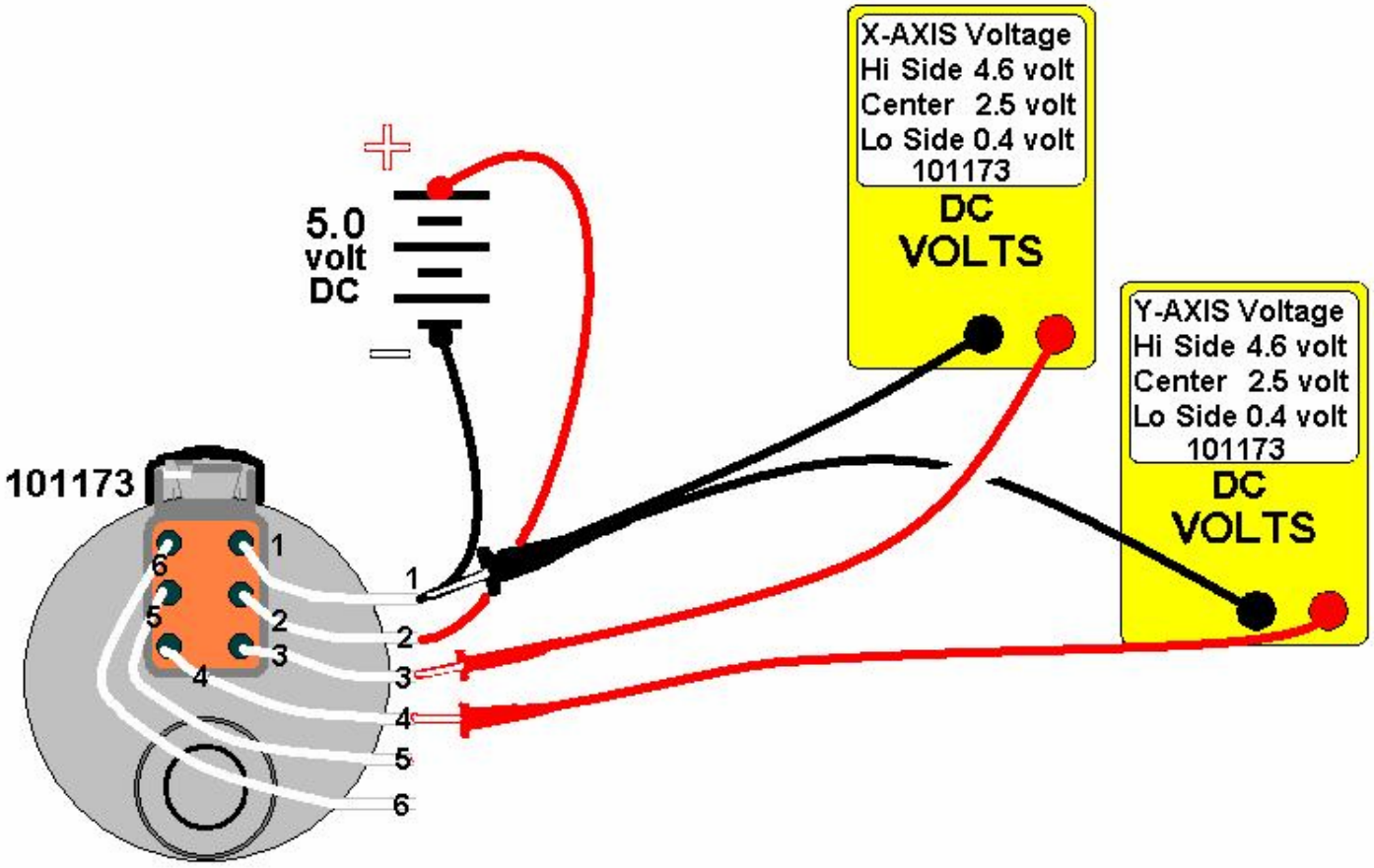
Dual-Axis with Proportional Thumb Rocker.
Used on Z135 for:
Primary Up/Down-Turntable Rotate-Primary Extend/Retract
And:
Jib Boom Up/Down-Platform Rotate-Jib Extend/Retract

IMPORTANT INFORMATION:
The 101173 Controller is different than the 101174 and 101175 in that It incorporates a Proportional Thumb Rocker located on the handle.



TECH TIPS

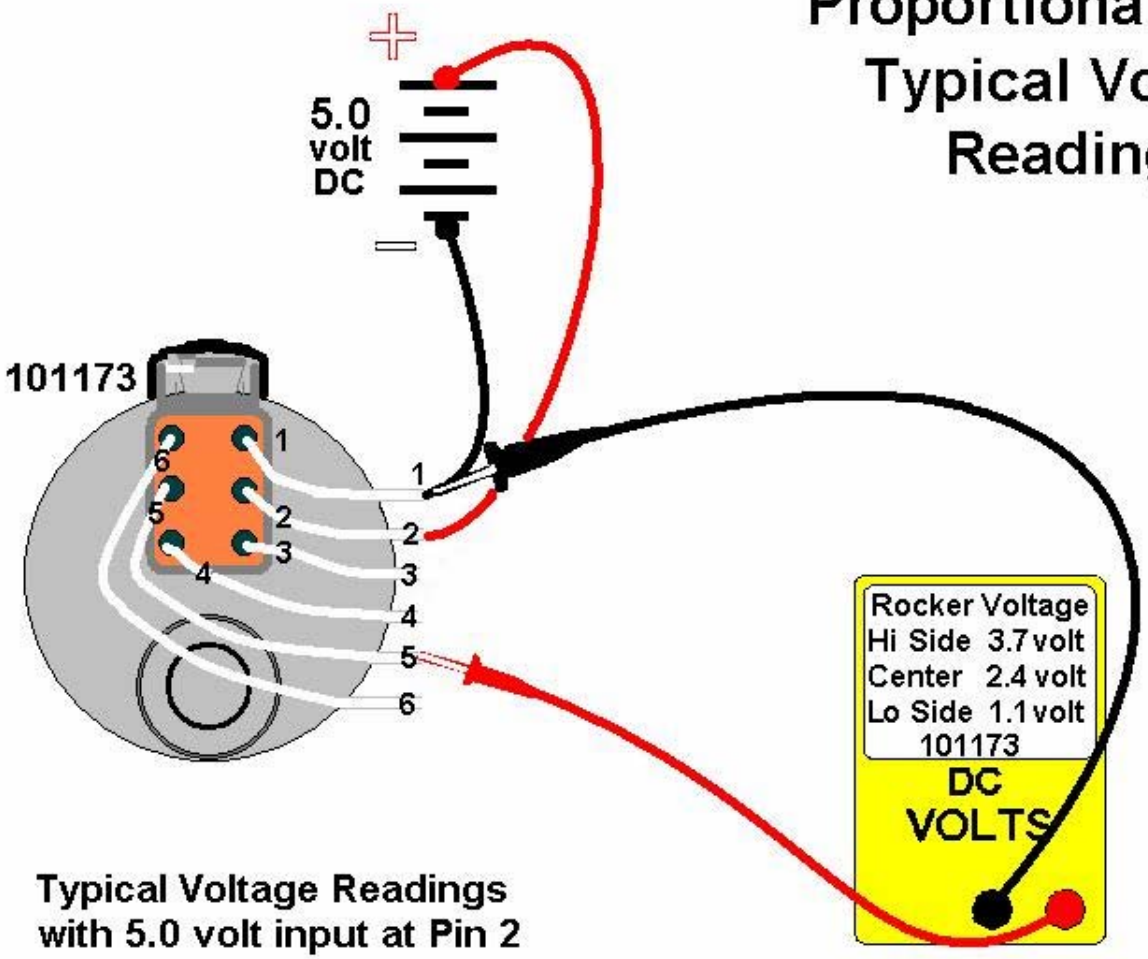
Testing the Y-Axis and X-Axis of the **101173** Controller will be performed using the same procedure used when testing the 101174 Controller.
Refer to Steps 1 through 13 for these tests.



Typical Voltage Readings with 5.0 volt input at Pin 2

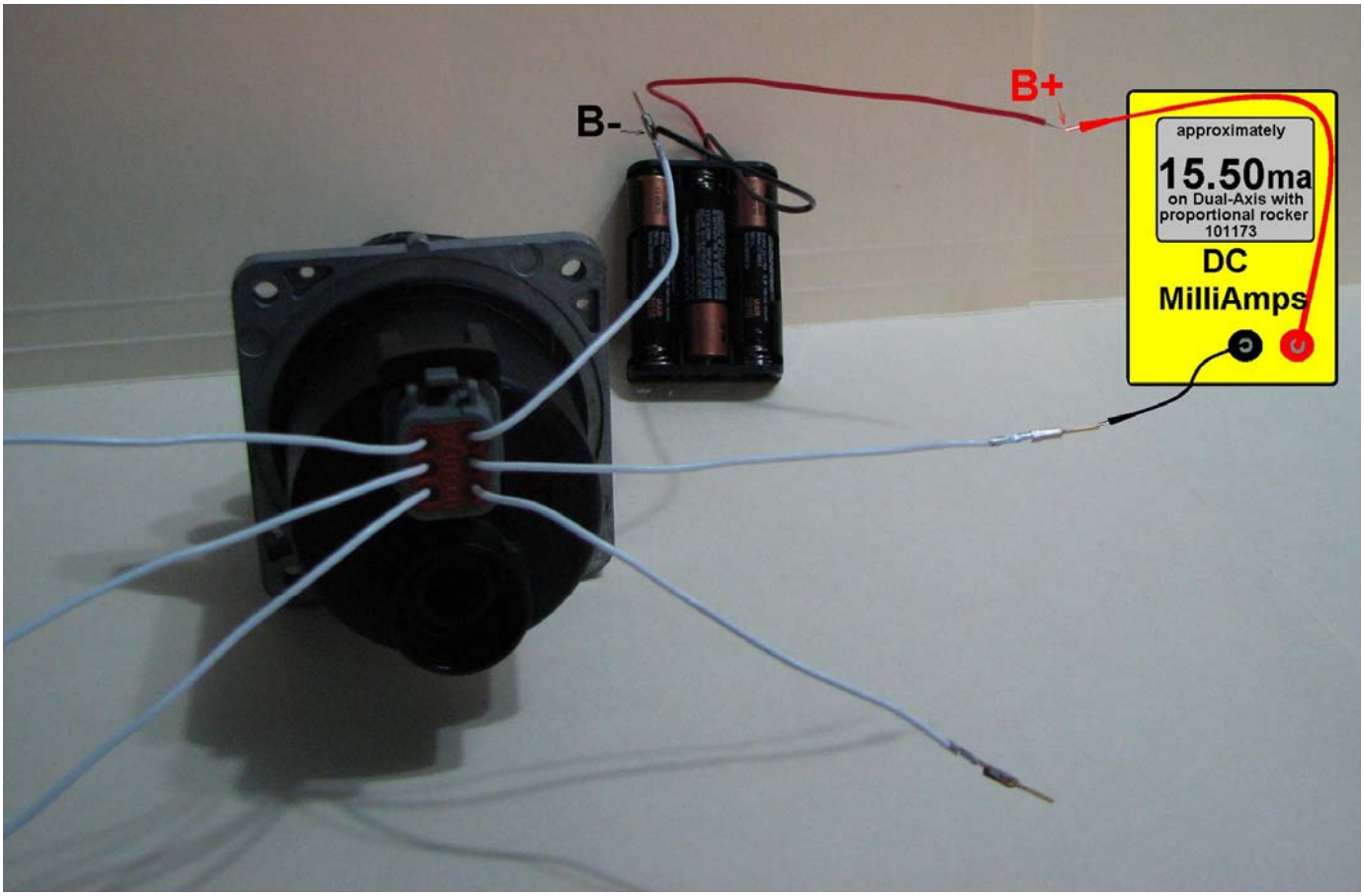
X-AXIS and Y-AXIS Voltage Readings

Proportional Rocker Typical Voltage Readings



Typical Voltage Readings with 5.0 volt input at Pin 2

Static State Current Measurement for 101173:



Set the Multimeter to read MilliAmp DC Current.
The Meter connections are as follows:
Positive Lead of Current Meter connected to Battery Positive
Negative Lead of Current Meter connected to Joystick Pin # 2
Negative Lead from Battery Pack connected to Joystick Pin # 1.
This puts the current meter in series with the power supply and the Joystick controller.
No other pins of the joystick will be connected.
The current in the Hall Effect Circuits will be displayed.
On the Dual-Axis with Proportional Rocker **101173** controller the current will be approximately **15.50 milliamps**.

For reference here, the current values at this static state are different for each of the three different controllers outlined in this Tech Tip.

101175: Single-Axis will be approximately 4.50ma.
101174: Dual-Axis will be approximately 8.50ma.
101173: Dual Axis w/ Proportional Rocker will be approximately 15.50ma

End 101173 Diagnostic

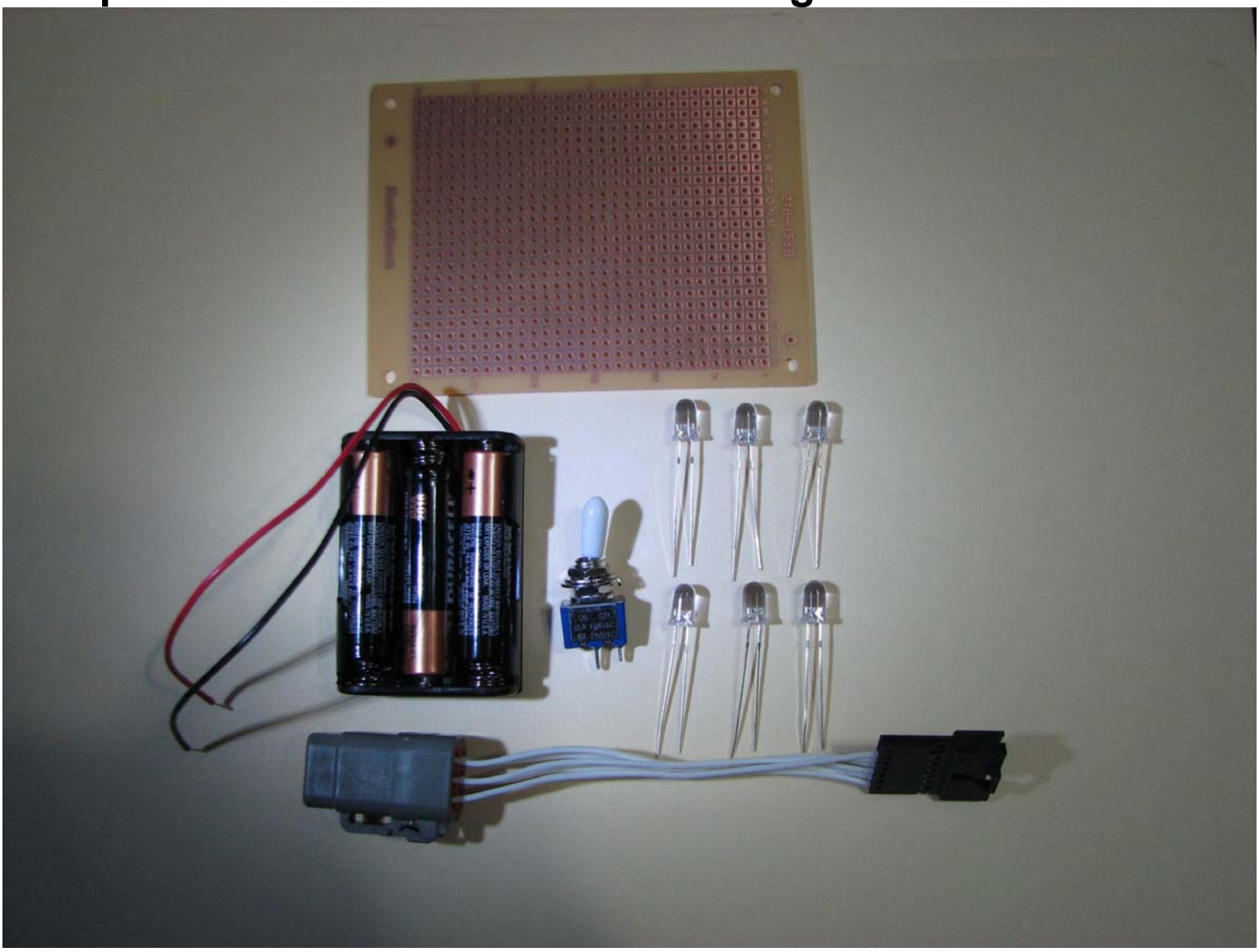
Diagnostic Tool Project

Note the orientation of the controllers in the Z135 Platform Control Box.

The two 101173 (Dual-Axis with Proportional Rocker) controllers on the left are turned 90 degrees Counter-Clockwise with relationship to the other two Controllers (101175 and 101174). This is to facilitate the orientation of the Proportional Rocker on the Joystick to reflect the actual movements of the functions they control. Primary Boom Extend-Retract and Jib Boom Extend-Retract.

The Diagnostic Tool we will be assembling will replicate the characteristics of the 101173 as it is used in the Z135.
The Diagnostic Tool can, however, be used on all the controllers covered in this Tech Tip.

Components Needed to Assemble Diagnostic Tool:



These Parts are readily available at electronics stores.

- Three AA or AAA Batteries and a Battery Holder
- Six Light Emitting Diodes Must be 4.7 to 5.0 volts Max Forward Voltage.
- Single Pole-Single Throw Toggle Switch
- Component PC Board – 750 Solder-Ringed Holes size will suffice

Available from Genie Parts Department

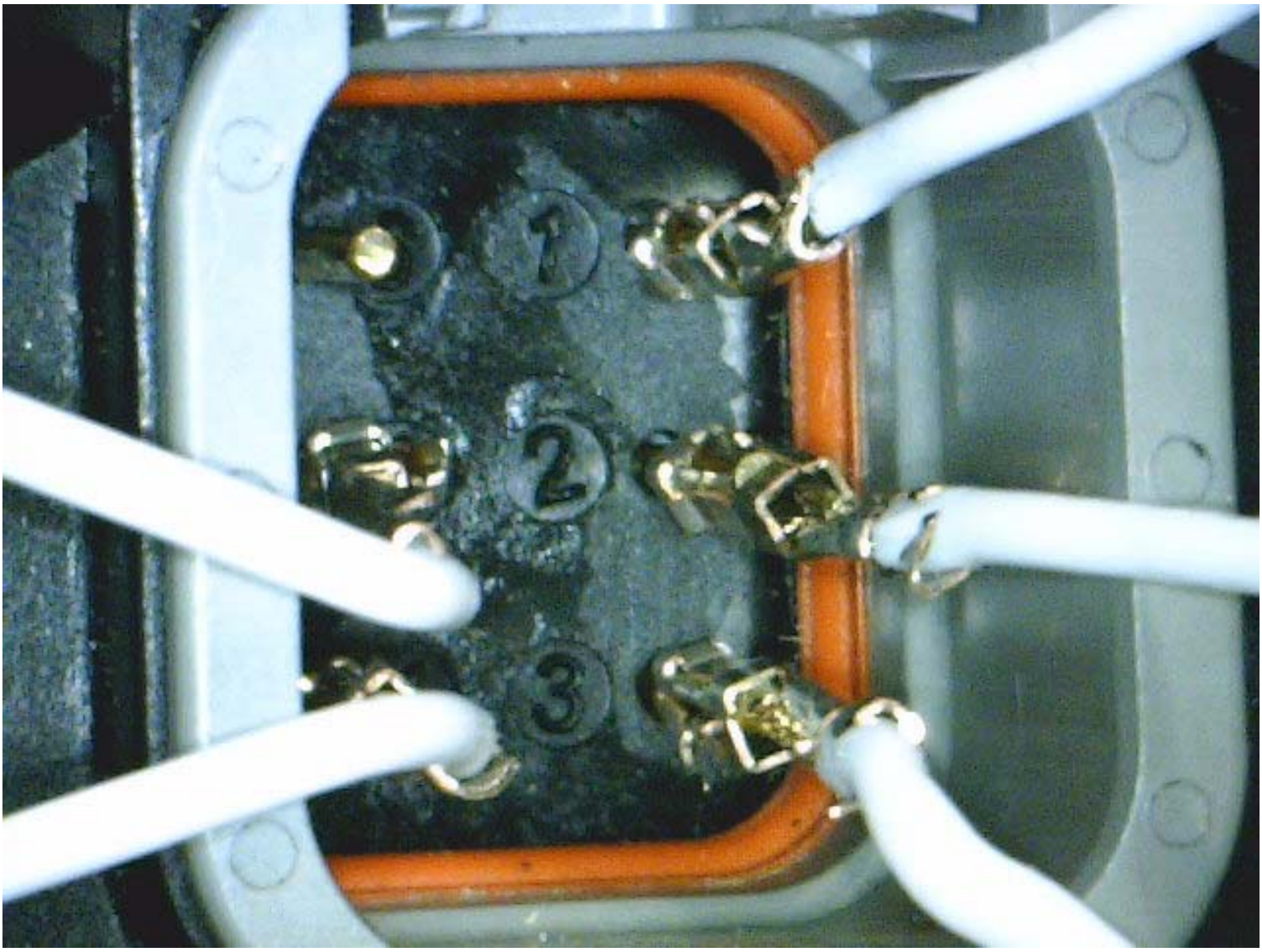
- 119613 Adaptor Harness

A small Soldering Iron will be needed to assemble the Diagnostic Tool.

TECH TIPS

119613 Adaptor Harness – Available from Genie Parts Department

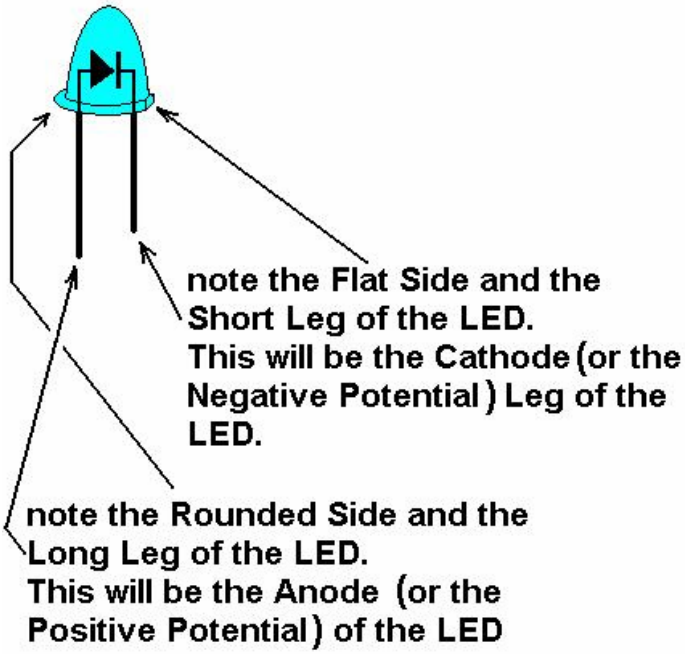
For diagnostic purposes, this part can be reproduced with parts from a used harness or individual wires with female pins to install on the pins in the socket of the JS1000 Controller.

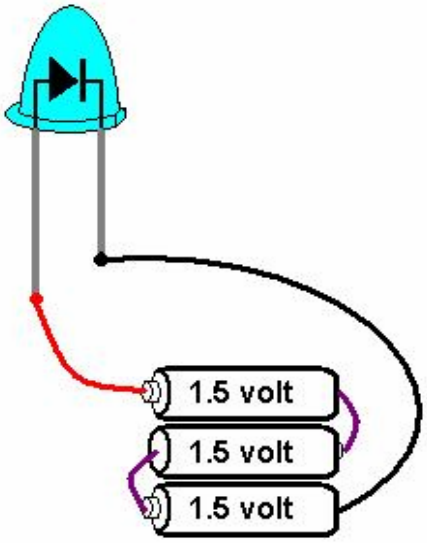


Individual Wires with Female Terminal Ends Installed.

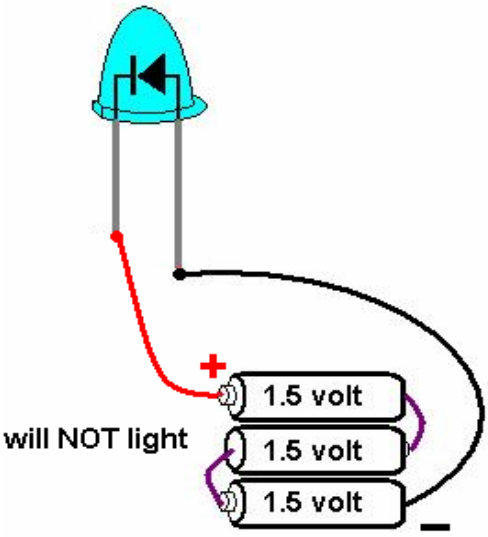
Step A:
Checking the LEDs:

Check the LEDs **before** soldering onto circuit board





This is correct and should light.

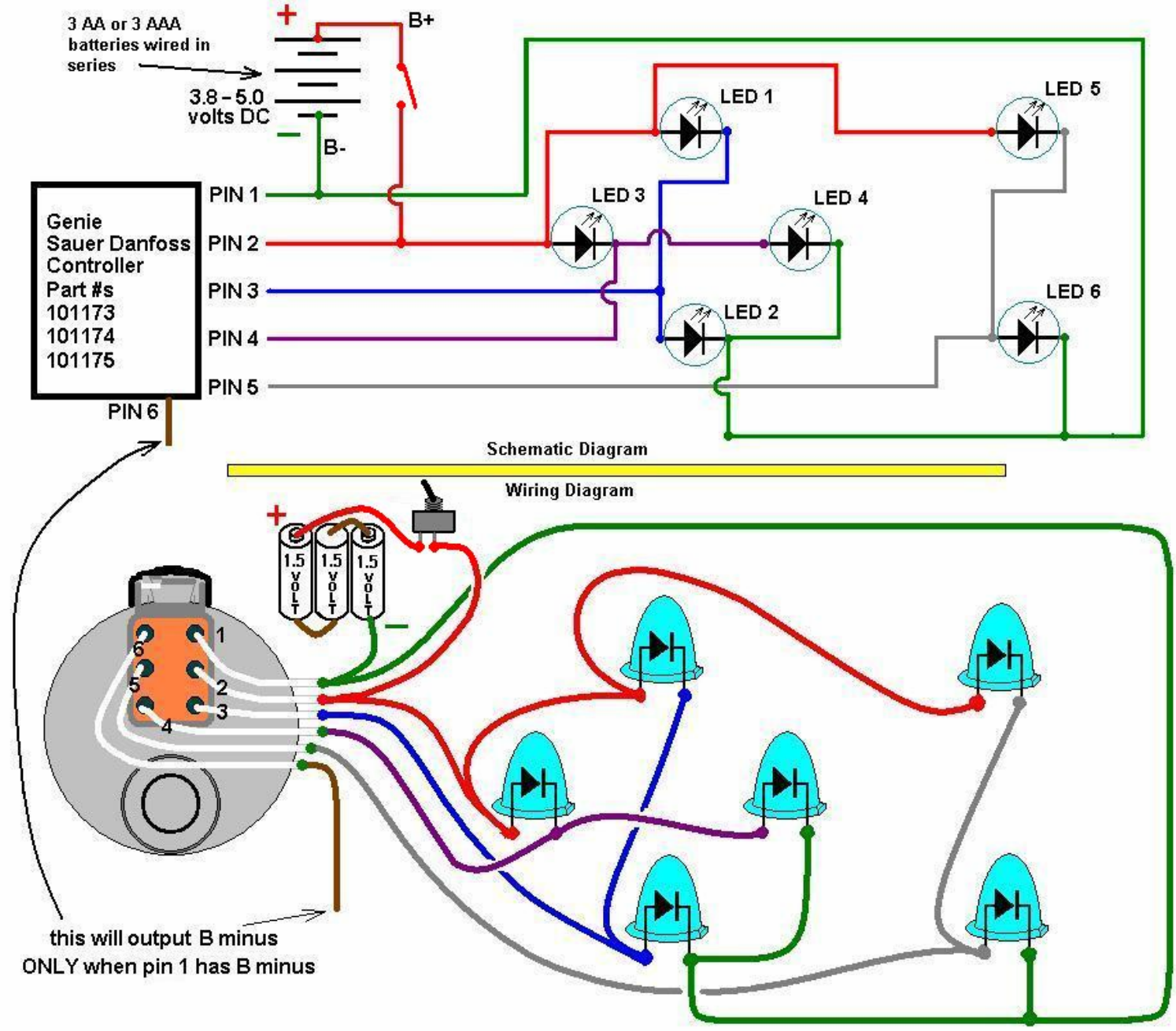


This is incorrect and will NOT light.

Remember that the LEDs need to be 4.7 to 5.0 volts Max Forward Voltage. They will burn out immediately if a lesser value is used.

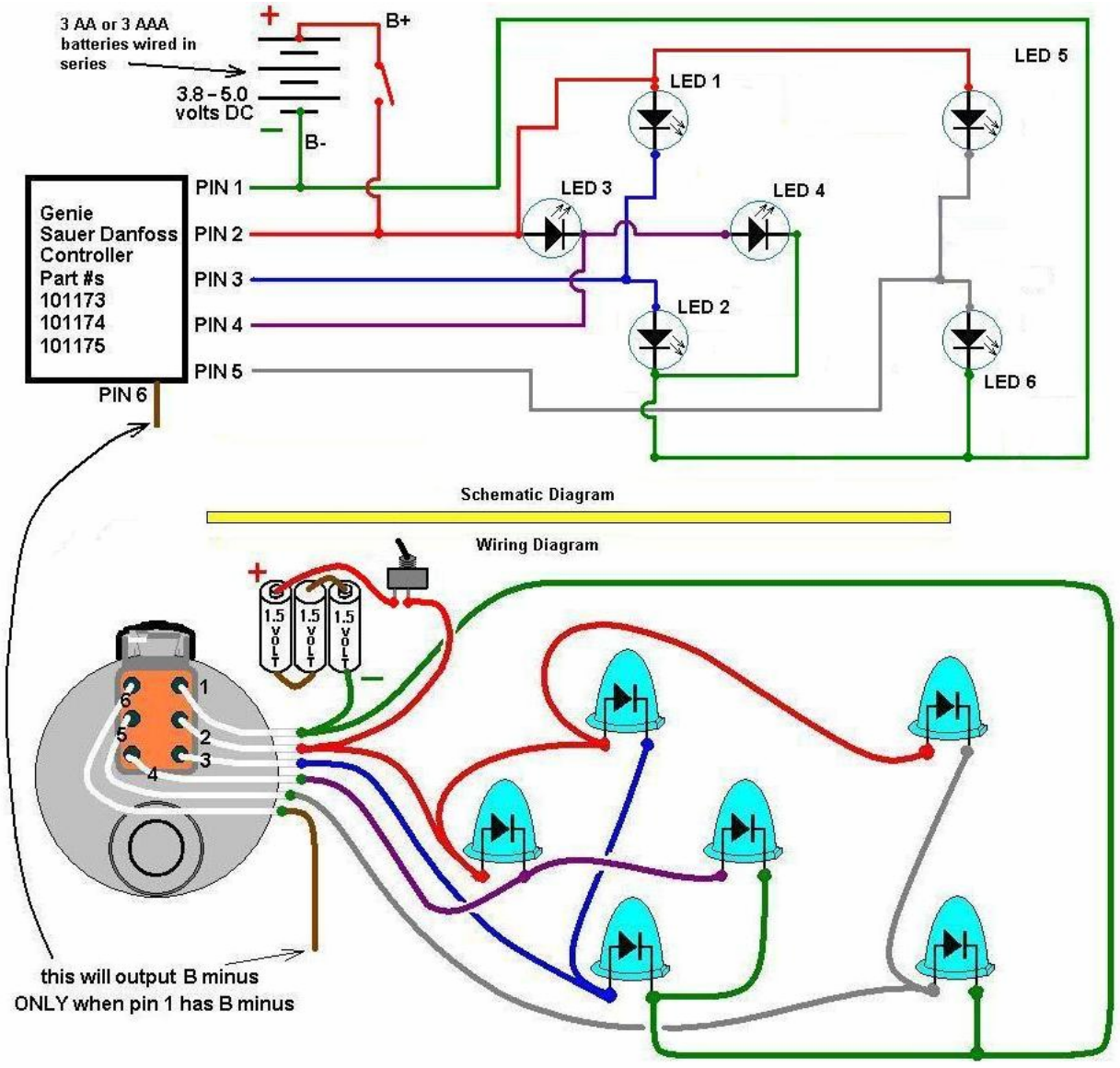
TECH TIPS

Schematic and Wiring Diagram for Diagnostic Tool



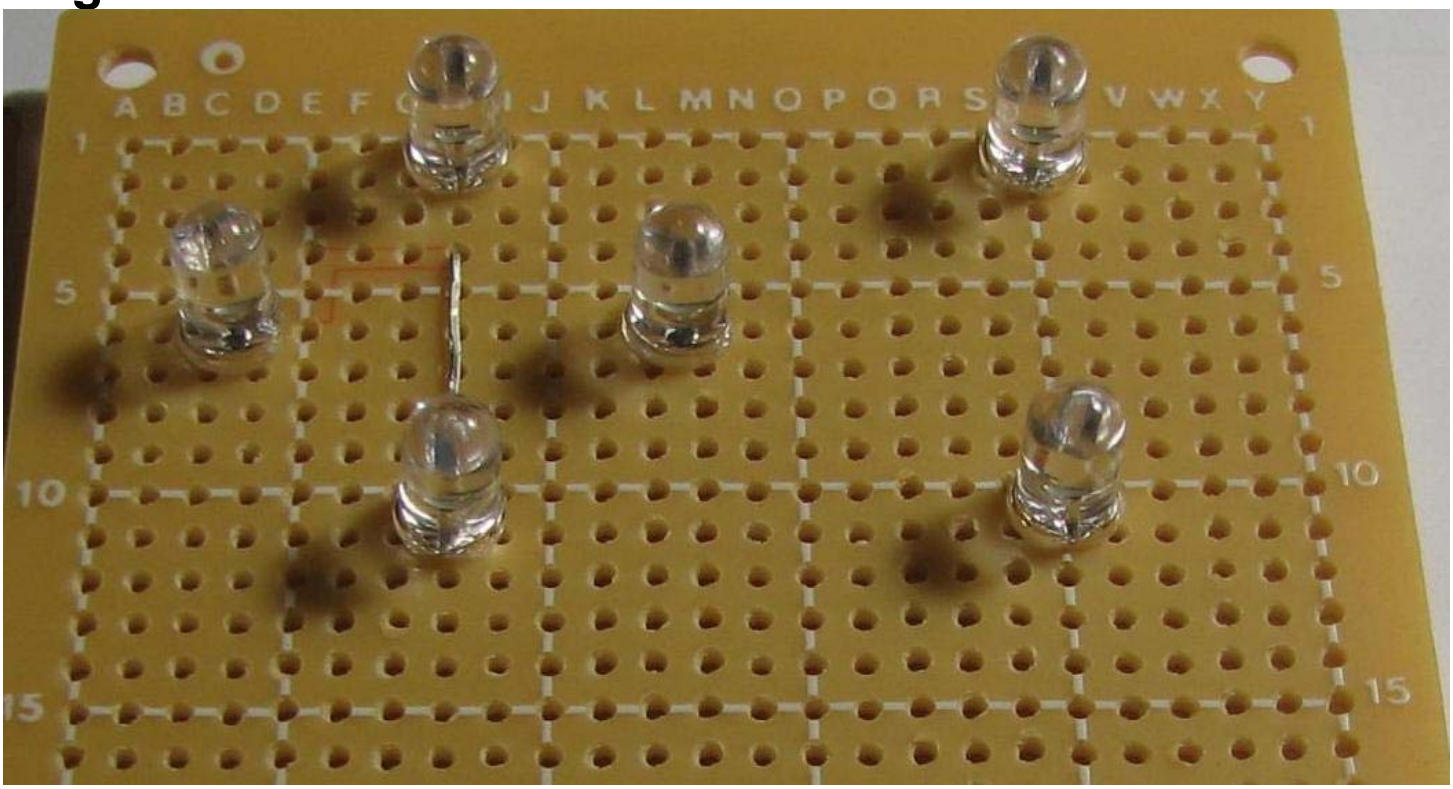
Remember that the LEDs need to be 4.7 to 5.0 volts Max Forward Voltage. They will burn out immediately if a lesser value is used.

Schematic and Wiring Diagram for Diagnostic Tool

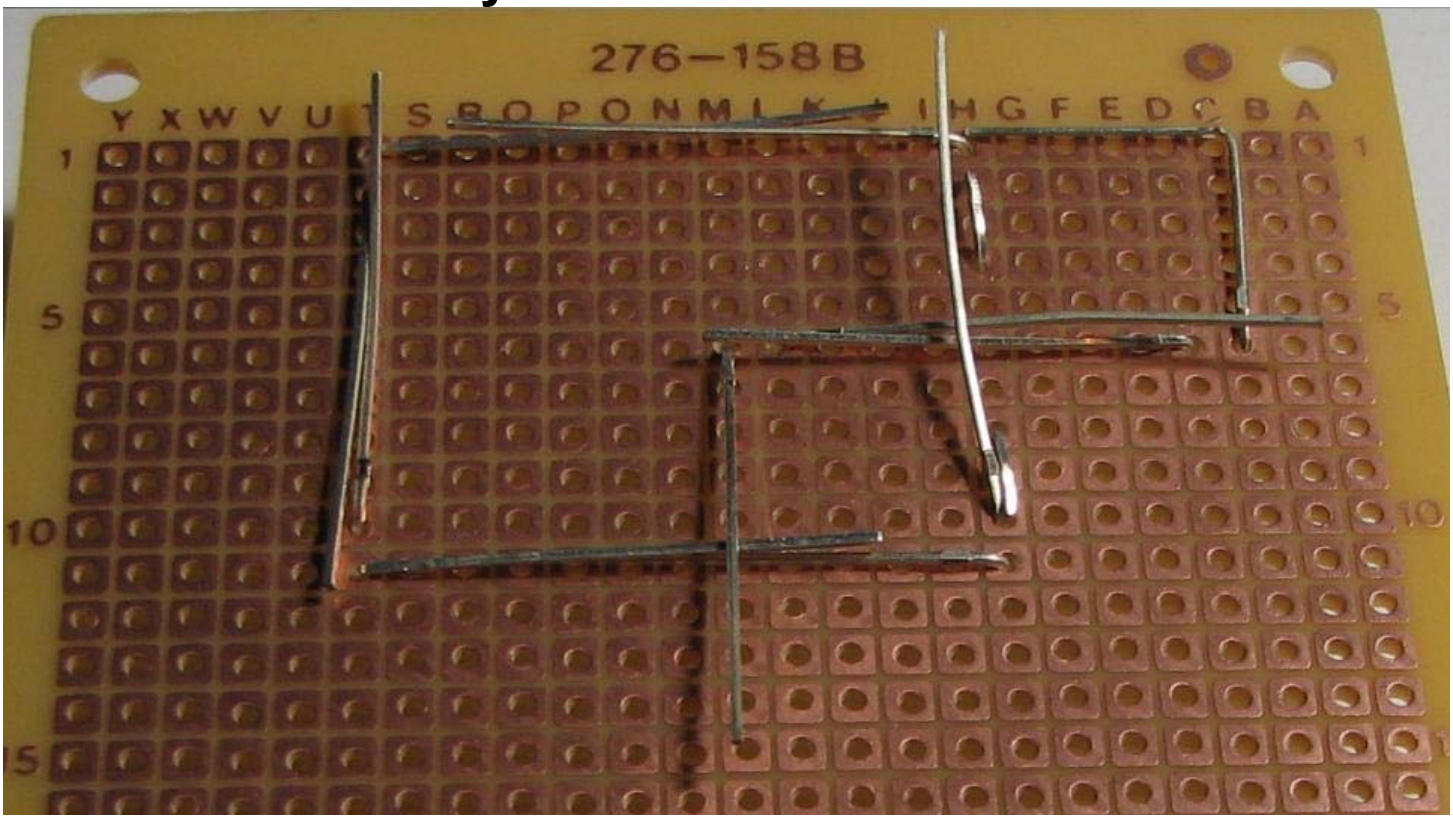


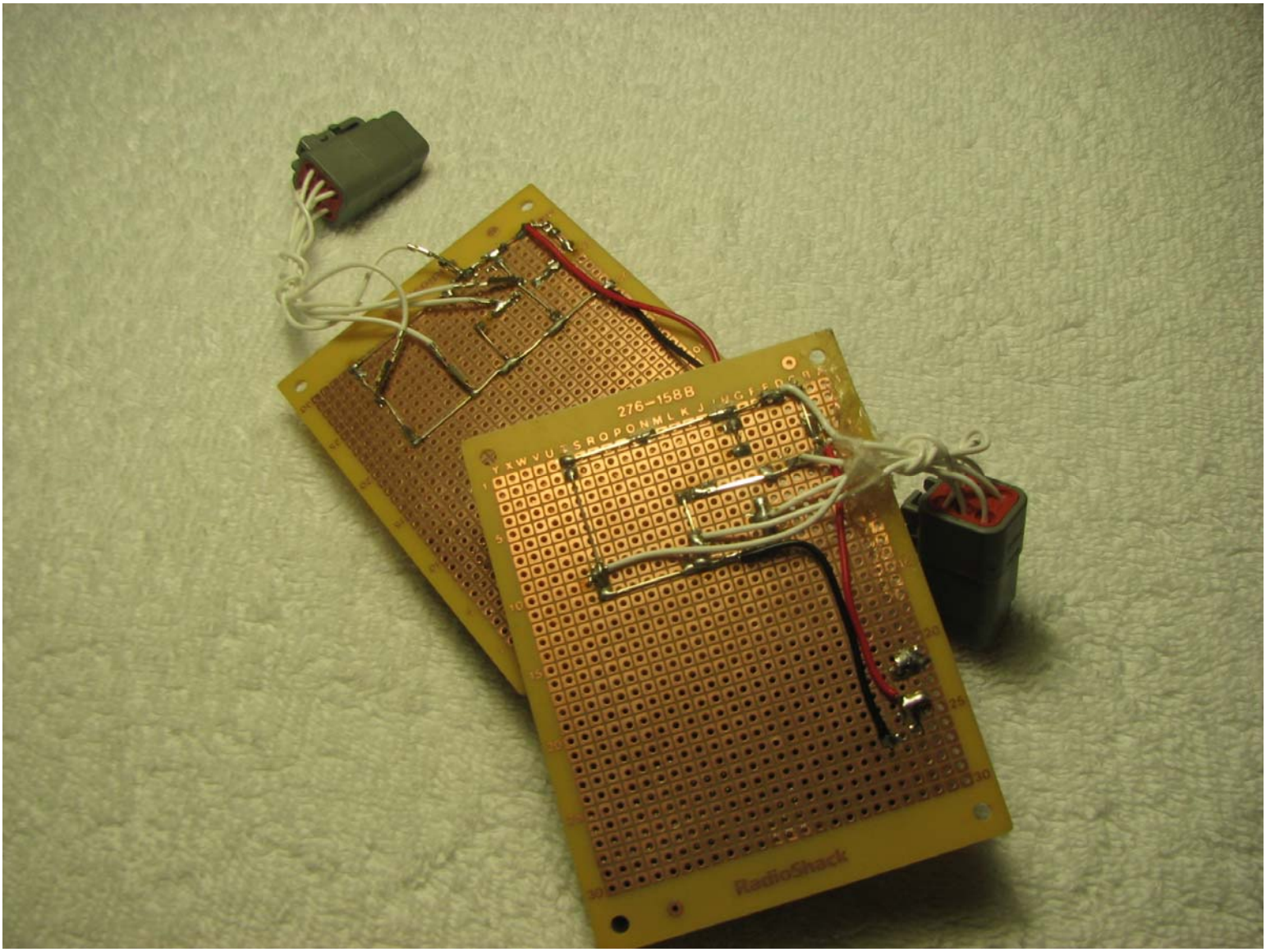
TECH TIPS

Align LEDs to desired locations



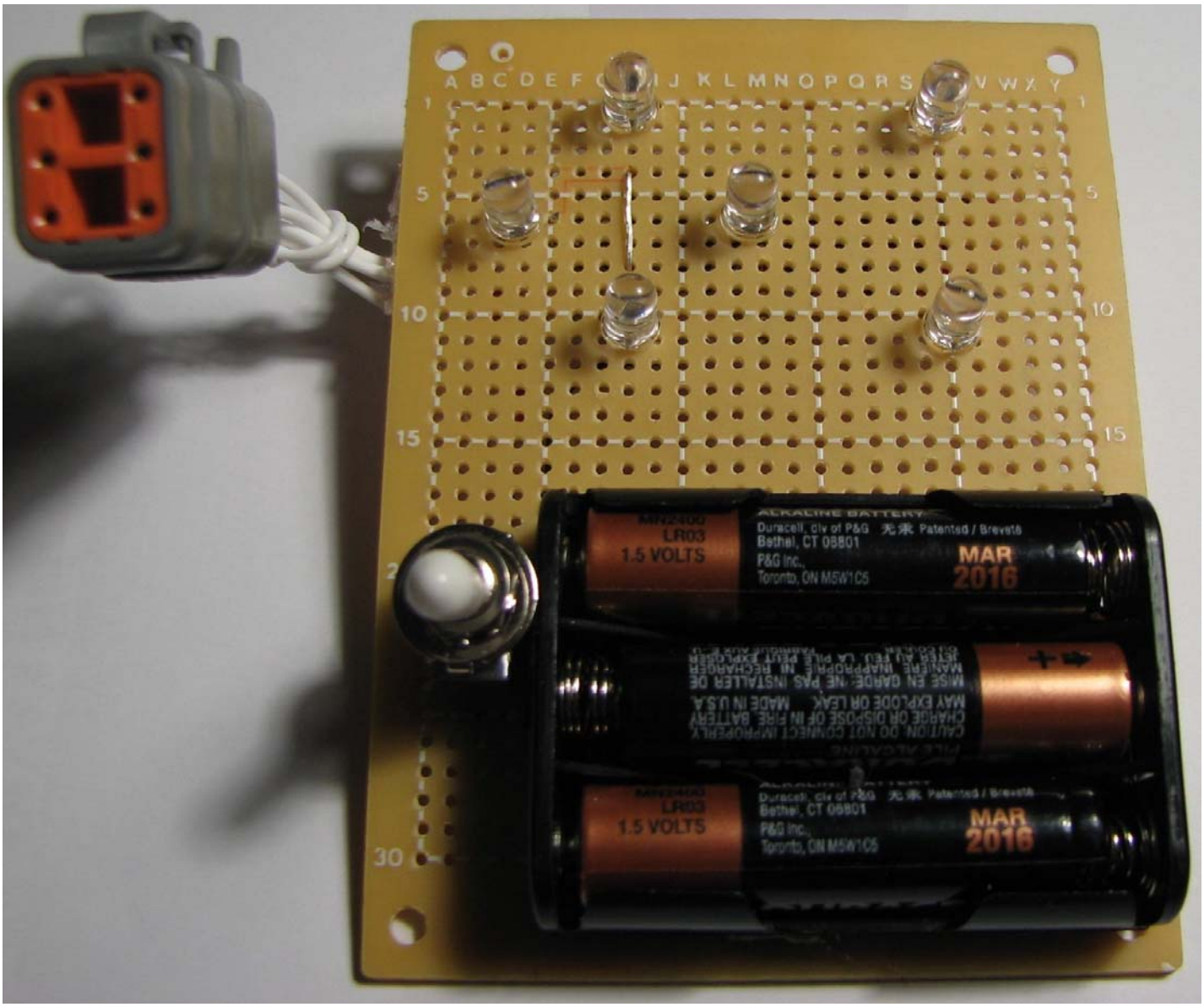
The LED Leads may be used instead of wires





Soldered boards

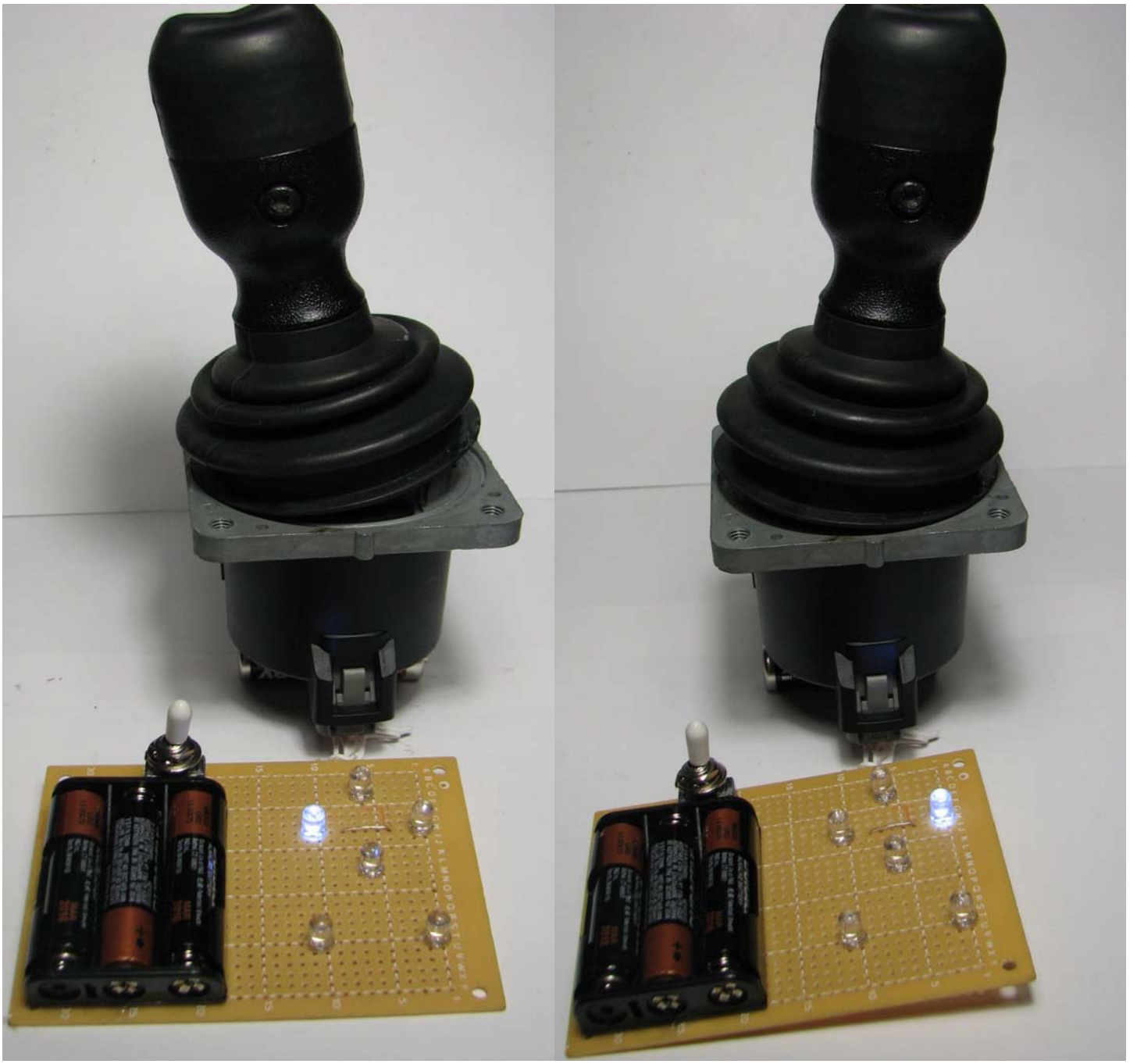
The boards may be assembled into a project box or other suitable enclosure. They can also simply be coated with an insulating epoxy or other coating.



Finished Project

The Switch is used to maintain longer Battery Life.
Although the LEDs do not illuminate when the Joystick is in the Neutral Position, there is still current flowing through the circuit.
If a switch is not used, disconnect power from the circuit to assure maximum battery life.
Test the diagnostic tool throughout all the function positions.

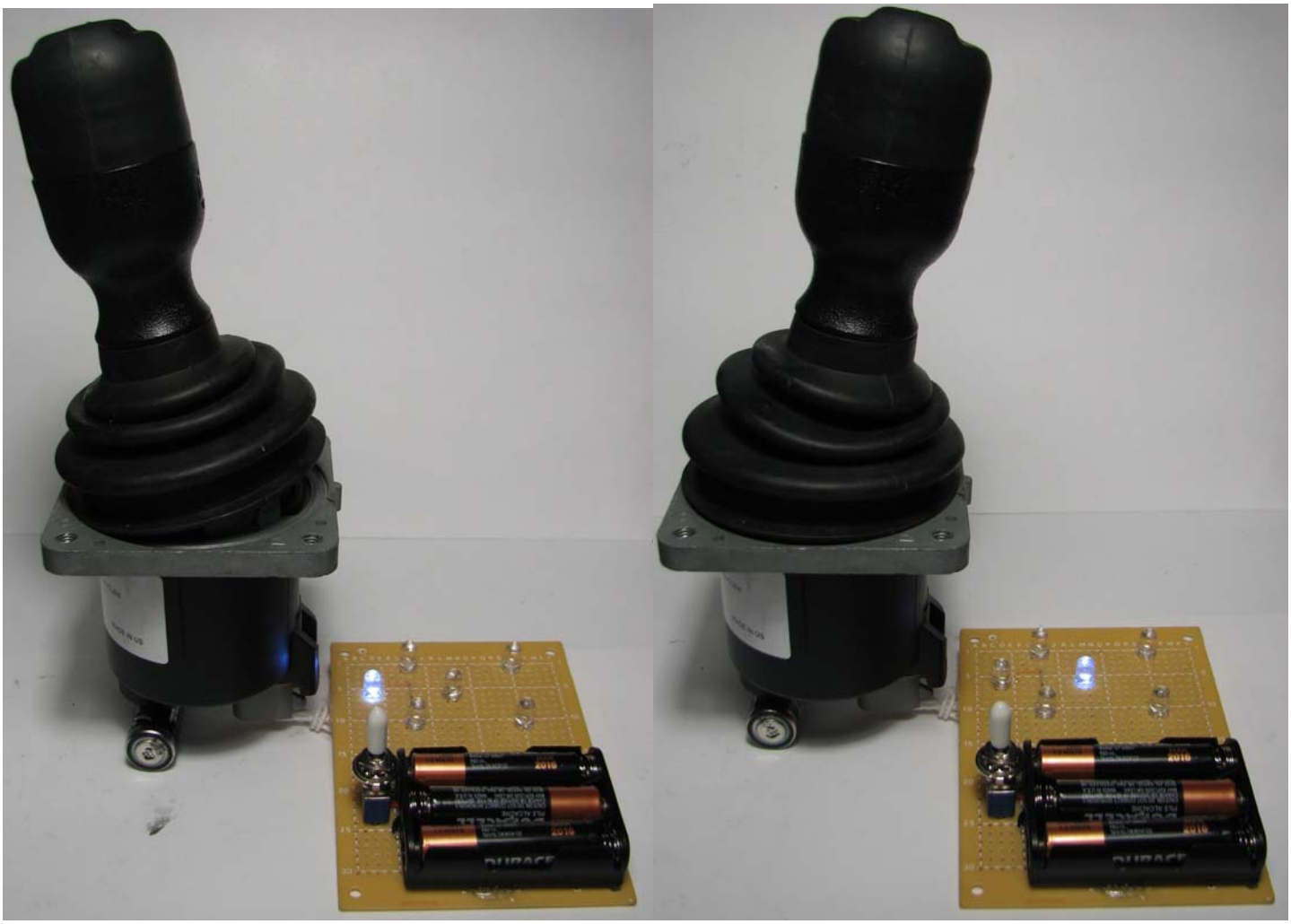
TECH TIPS



Boom Down **Boom Up**

As the controller is stroked off center, the LED representing that direction will illuminate dimly.
The more the Joystick is moved the brighter the LED will light.
The brilliance change should be smooth and linear throughout the range of the Joystick.

TECH TIPS



Rotate Left **Rotate Right**

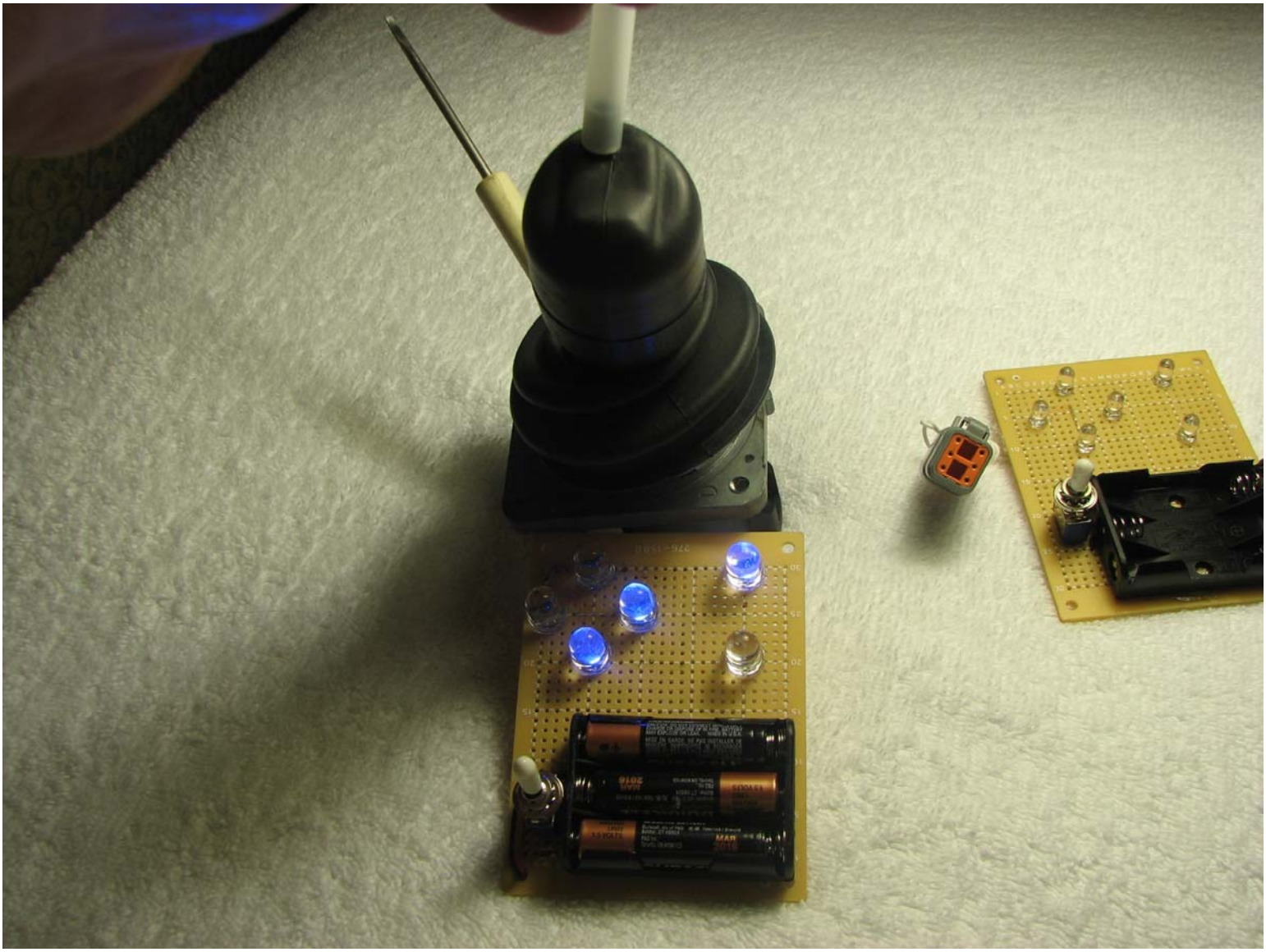
As the controller is stroked off center, the LED representing that direction will illuminate dimly.
The more the Joystick is moved the brighter the LED will light.
The brilliance change should be smooth and linear throughout the range of the Joystick.

TECH TIPS

Boom Out

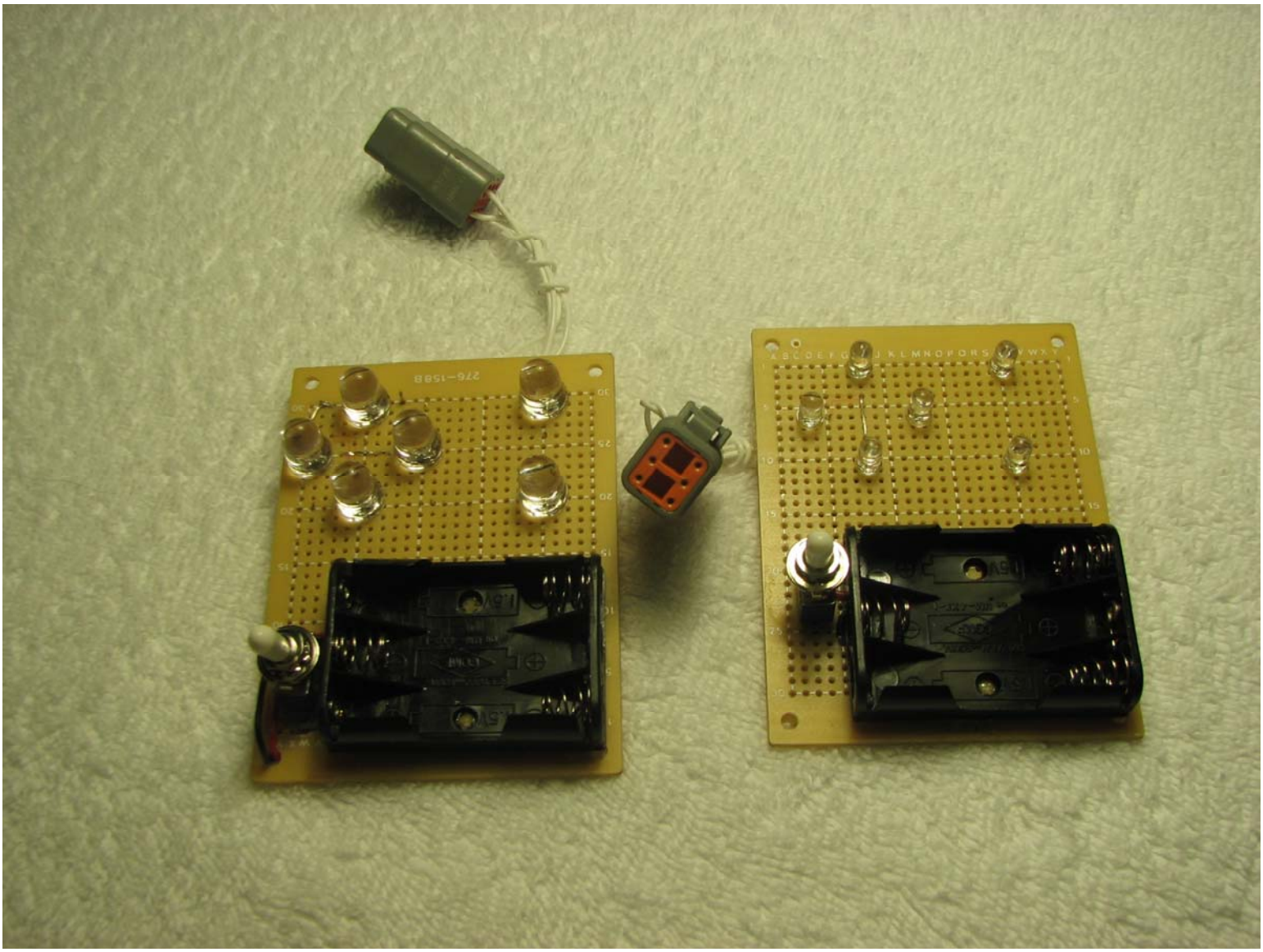
Boom In

As the Proportional Rocker is pressed off center, the LED representing that direction will illuminate dimly.
The more the Rocker is moved the brighter the LED will light.
The brilliance change should be smooth and linear throughout the range of the Rocker.



Three Directions Activated Simultaneously

Remember that the further the Joystick is stroked and the Rocker pressed, the brighter the LEDs will light.



Different LED styles and sizes may be used but the Forward Voltage Rating must be 4.7 to 5.0 volts. This is a typical value readily available at any electronic store.

And one last reminder:
Be sure to turn switch OFF or remove batteries when not in use to prevent battery drain.

TECH TIPS

This Tech Tip should give the technician an accurate diagnosis of the Sauer Danfoss controllers (with Deutsch connectors) used on the ALC500 and ALC1000 Control Systems.

The values depicted here will be very close to what you will see if the controller is in working condition.

If the Diagnostic Test Tool is used, when the power is turned on and the Joystick and Rocker are in the Center Position, NO LEDs should be illuminating. If ALL the LEDs are glowing when the Joystick is Centered, it is because their Max Forward Voltage rating is lower than the Power Supply Voltage.

If there are further questions pertaining to Bench Testing this type of controller, please contact Genie Service Department.

Terex AWP / Genie Lift
800-536-1800