

English Language Test Description

Contract Number: N00244-09-C-0054

For

Unit Under Test

UUT Nomenclature: DRIVERS DISPLAY MODULE LRU

UUT Part Number: 5429249

UUT Reference Designator: DDM LRU

From

Assault Amphibious Vehicle

AN/PSM-115

ATE (Automated Test Equipment) SYSTEM

AN/USM-657B(V)2 Third Echelon Test System (TETS)

AN/USM-717(V)2 Virtual Instrument Portable Equipment Repair / Tester (VIPER/T)

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ELTD REVISION SUMMARY

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1. Introduction

The Unit Under Test (UUT) for this English Language Test Description (ELTD) is the Drivers Display Module Line Replaceable Unit (LRU), Part Number 5429249. The LRU resides in the Assault Amphibious Vehicle (AAV) Weapon System.

1.1. Scope

An ELTD is a detailed supplementary document consisting of textual test descriptions with graphical representation of signal interconnectivity and a functional flow chart.

1.2. Purpose

The purpose of this document is to describe in English language the test descriptions for the TP_AAV_DDM_LRU to a level of detail used for maintenance purposes. The TP_AAV_DDM_LRU makes up part of the AN/PSM-115 Application Program Set (APS).

1.3. Content Arrangement

The document is laid out in the sequence the Test Program Set (TPS) would be executed when a 95 “Run All Mods” is entered in the main menu. A paragraph at the beginning of each module will describe the test description for that module. Each step will contain a description for that particular test followed by a graphical representation of the connections made from the receiver, through the Interface Test Adapter (ITA) and cable to the Drivers Display Module LRU. A Functional Flow Chart resides at the end of the document.

2. English Language Test Description (ELTD)

WEAPON SYSTEM: Assault Amphibious Vehicle (AAV)

UNIT UNDER TEST: 5429249

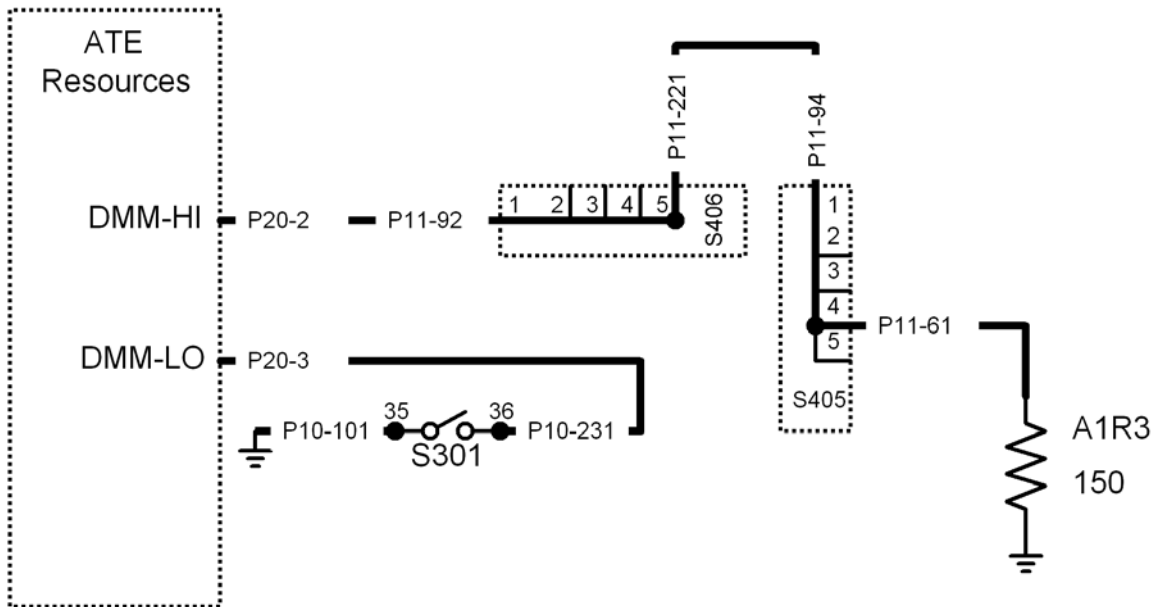
TEST PROGRAM SET: TP_AAV_DMM_LRU

SAFE TO TURN ON TESTS

Step 1 ITA Identification

Test step 1 verifies the correct ITA is installed by using the DMM to measure the resistance of ITA A1R3. The resistance should be from 149 ohms to 155 ohms.

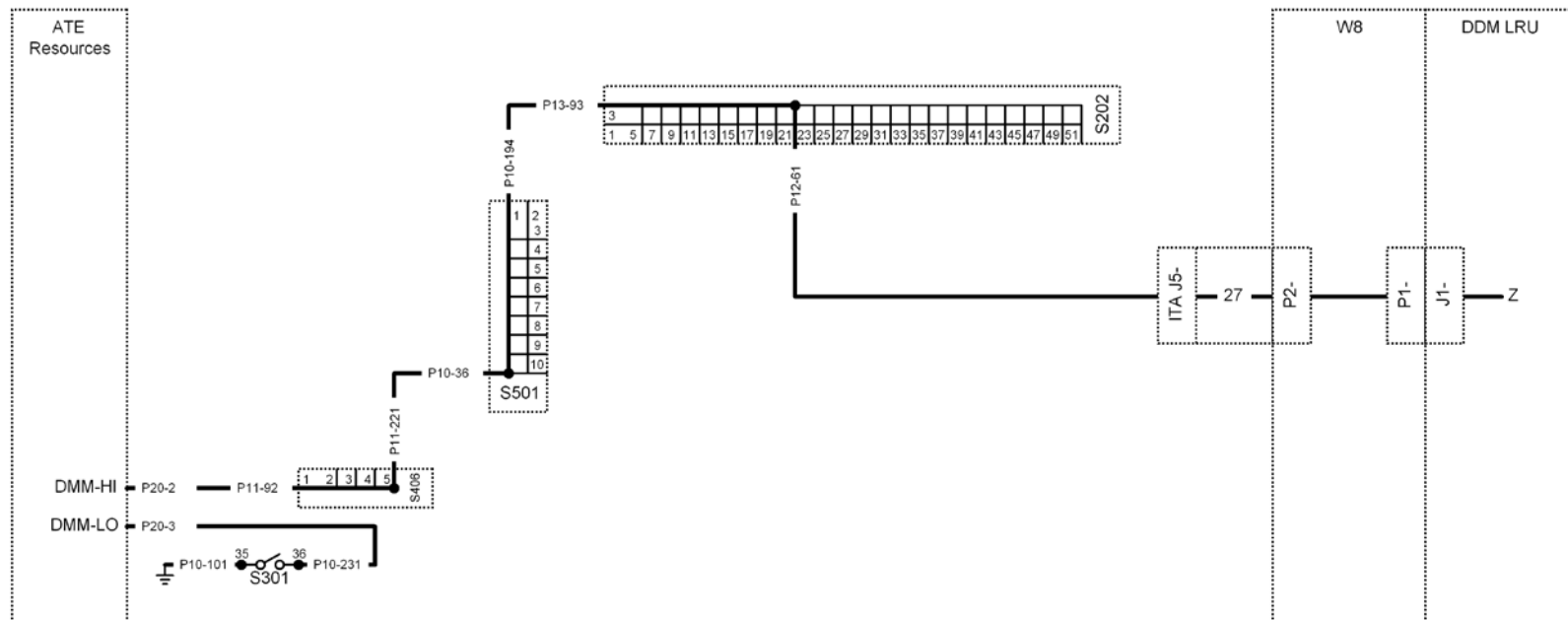
Connection Path as follows:



Step 2 UUT Identification

Test step 2 verifies the correct UUT is installed by using the DMM to measure the resistance of R9 and R10 between J1-Z and GND. The resistance should be less than 5000 ohms.

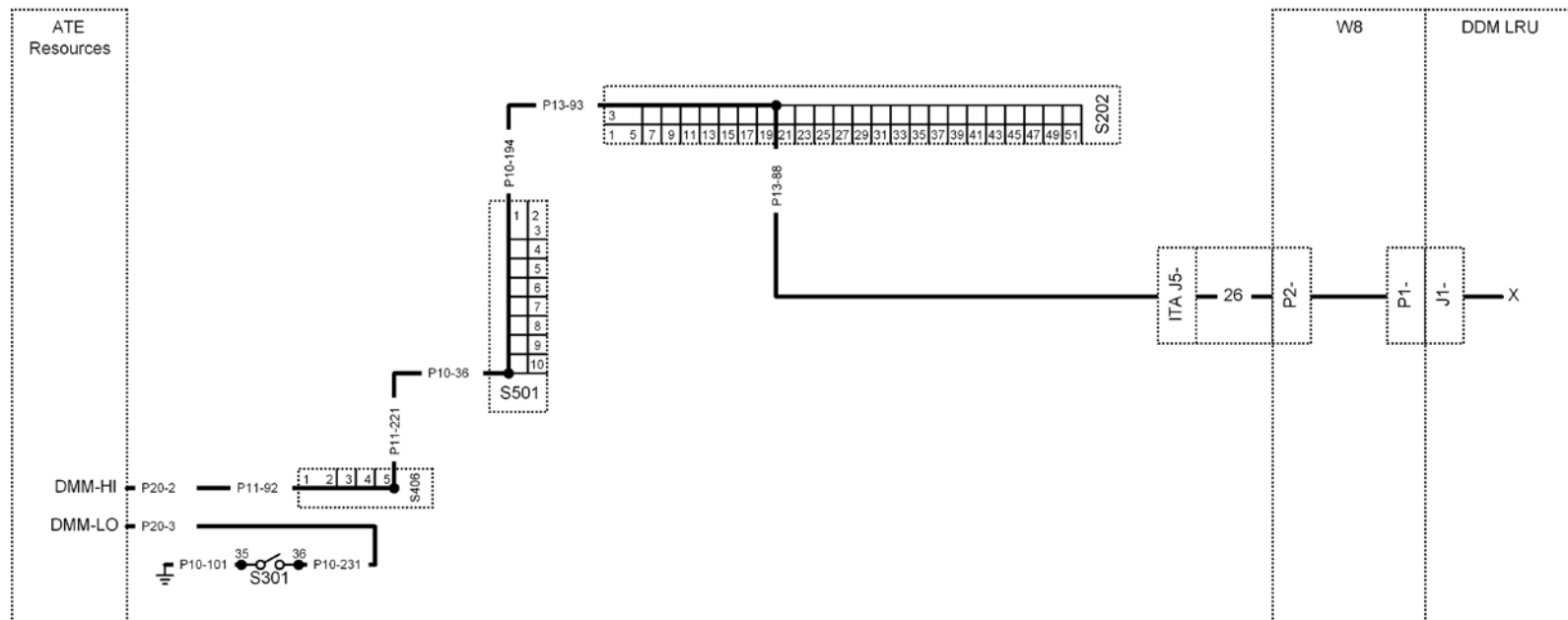
Connection Path as follows:



Step 3 UUT Identification

Test step 3 verifies the correct UUT is installed by using the DMM to measure the resistance of R65 between J1-X and GND. The resistance should be less than 65 ohms.

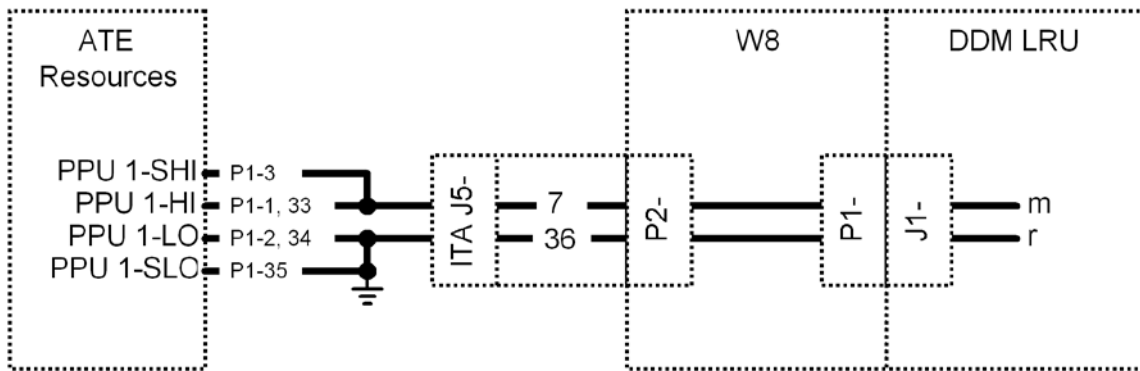
Connection Path as follows:



Step 4 +28 VDC Power STTO

Test step 4 verifies the +28 Vdc is safe to apply power by connecting PPU1 to the UUT but only applying 1.0 Vdc at 0.100 A. The PPU voltage read back is used to measure the voltage from J1-m to GND. The voltage should be greater than 0.925 Vdc. If an overload condition is present PPU4 will exceed its current limit and turn off before the measurement causing the test to fail.

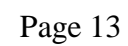
Connection Path as follows:



Step 5 T1 Center-Tap, C5, R51 (J1-f/ GND)

Test step 5 verifies the isolation transformer T1 center-tap Circuit resistance is correct by using the DMM to measure the resistance of T1 between J1-f and GND. The resistance should be between 800000 ohms and 1200000 ohms.

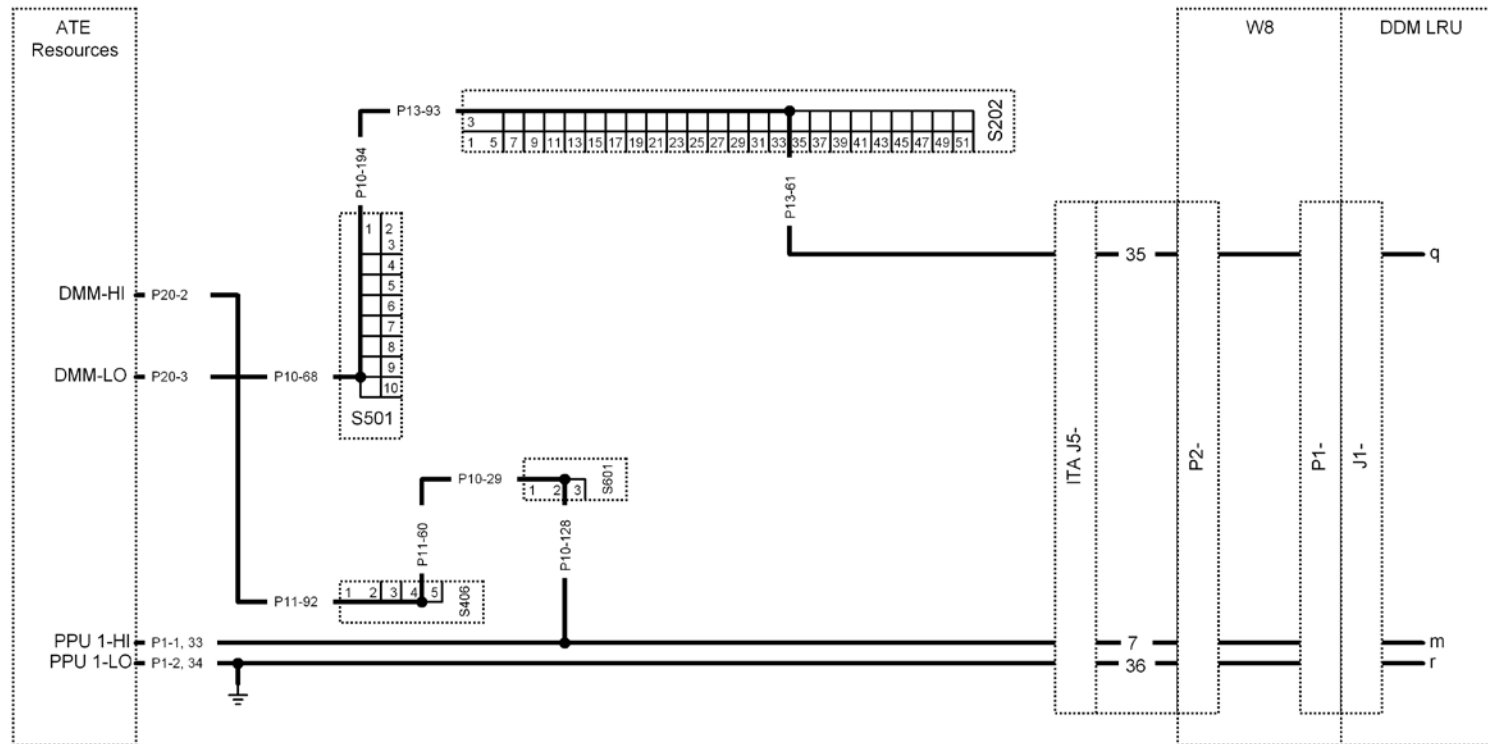
Connection Path as follows:



Step 6 R5 (J1-m/ J1-q)

Test step 6 verifies resistor R5 is in working order by using the DMM to measure the resistance of R5 between J1-m and J1-q. The resistance should be between 1900 ohms and 2100 ohms.

Connection Path as follows:



UUT POWER UP

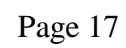
+28.0 Vdc at 2.0 A with a tolerance of ± 0.5 Vdc is required to power the UUT.

UUT POWER UP TESTS

Step 7 +28.0 VDC Power

Test step 7 verifies PPU1 can deliver +28.0 Vdc to the UUT by using the DMM to measure the voltage between J1-m and GND. The voltage should be from 27.5 Vdc to 28.5 Vdc. PPU1 remains connected to the UUT for the remainder of testing.

Connection Path as follows:



MODULE 1 PRESSURE CHANNEL CALIBRATION TESTS

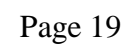
Module 1 tests the Transmission Oil Pressure, Engine Oil Pressure, and Engine Air Pressure circuitry by applying a specific current to drive the input to specific levels equivalent to functional activity. This requires adjustment routines for each level change as well as operator observations to verify the display is correct. The dimming circuitry and audio warning are each tested through voltage stimulus and voltage read back or operator observation.

Step 101 4mA, XMSN Oil Pressure at J1-V

Test steps 101 through 108 will verify that the circuit used to indicate transmission oil pressure is functioning correctly. Some of the steps will undergo an adjustment routine before a measurement is taken. This adjustment routine consists of the input current being changed using the DC function of the ARB. The divide by seven output from the ARB will be switched to the CCA input via J1-W. In conjunction with the ARB, the DMM will be connected as a current meter to verify that the correct current is being sourced by the ARB. The DMM will first verify the input current and then be switched to verify Voltage from the output. These tests will determine the functionality of OP-Amps and surrounding components. A read back procedure will be used to verify the current accuracy from the ARB via the DMM in current mode. This connection diagram is located in Appendix A titled ARB1 for test steps 101, 102, 103, 107, and 108.

Specifically test step 101 will apply +4.375 Vdc at J1-W via the ARB. The DMM will be used to measure an expected current of approximately 4 mA and the ARB input will be adjusted until a measurement is between 3.98 and 4.02 mA. Once the adjustment has been completed the adjusted voltage will be applied to J1-W via the ARB. The DMM will be used to measure the output at J1-V with a voltage between -0.003 Vdc and +0.015 Vdc.

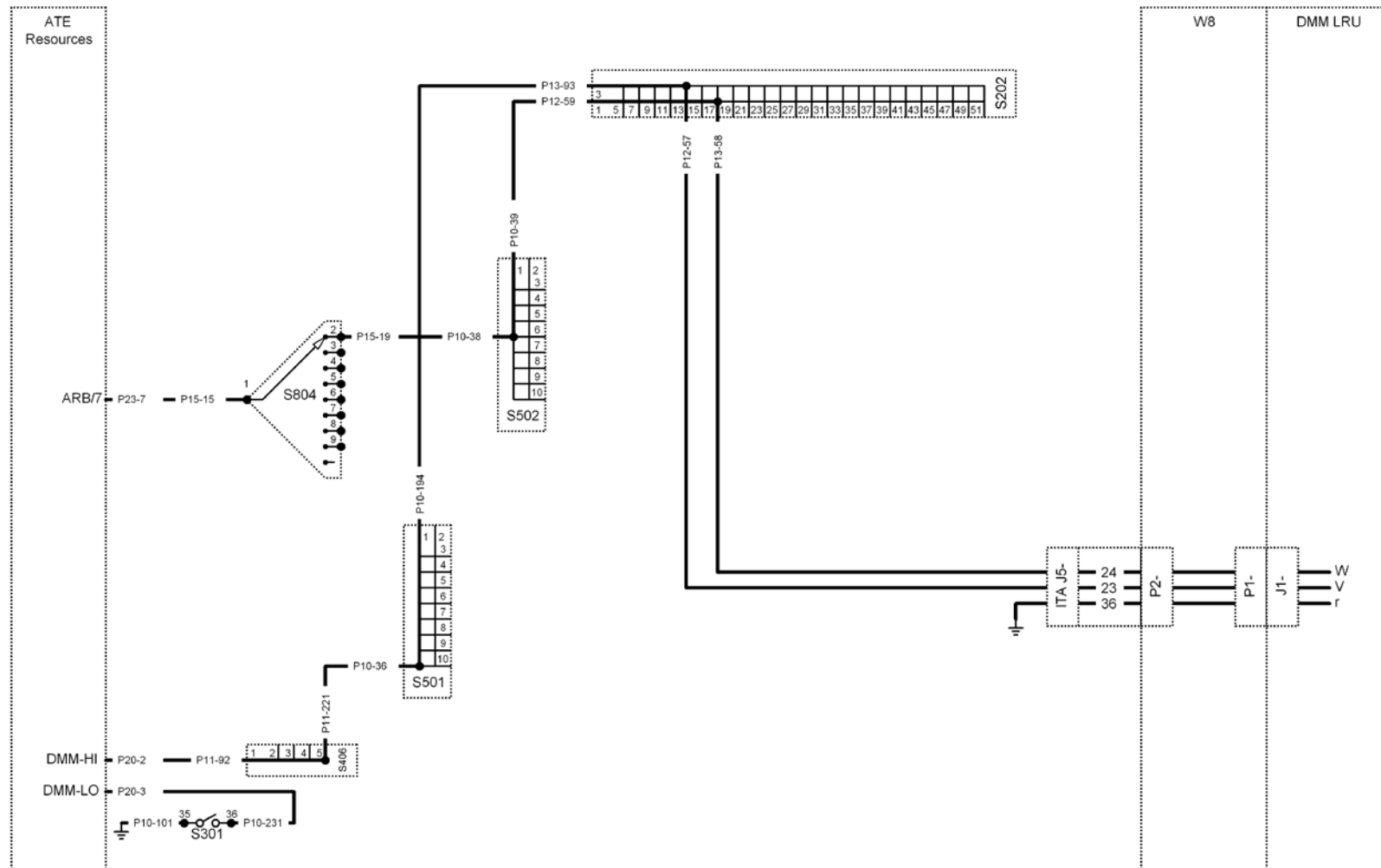
Connection Path as follows:



Step 102 11.68mA, XMSN Oil Pressure at J1-V

Test step 102 will apply +1.255 Vdc at J1-W via the ARB. The DMM will be used to measure an expected current of approximately 11.68 mA and the ARB input will be adjusted until a measurement is between 11.62 and 11.74 mA. Once the adjustment has been completed the adjusted voltage will be applied to J1-W via the ARB. The DMM will be used to measure the output at J1-V with a voltage between 0.0386 Vdc and 0.0414 Vdc.

Connection Path as follows:



Step 103 19.36mA, XMSN Oil Pressure at J1-V

Test step 103 will apply -1.86 Vdc at J1-W via the ARB. The DMM will be used to measure an expected current of approximately 19.36 mA and the ARB input will be adjusted until a measurement is between 19.26 and 19.46 mA. Once the adjustment has been completed the adjusted voltage will be applied to J1-W via the ARB. The DMM will be used to measure the output at J1-V with a voltage between 0.0772 Vdc and 0.0828 Vdc.

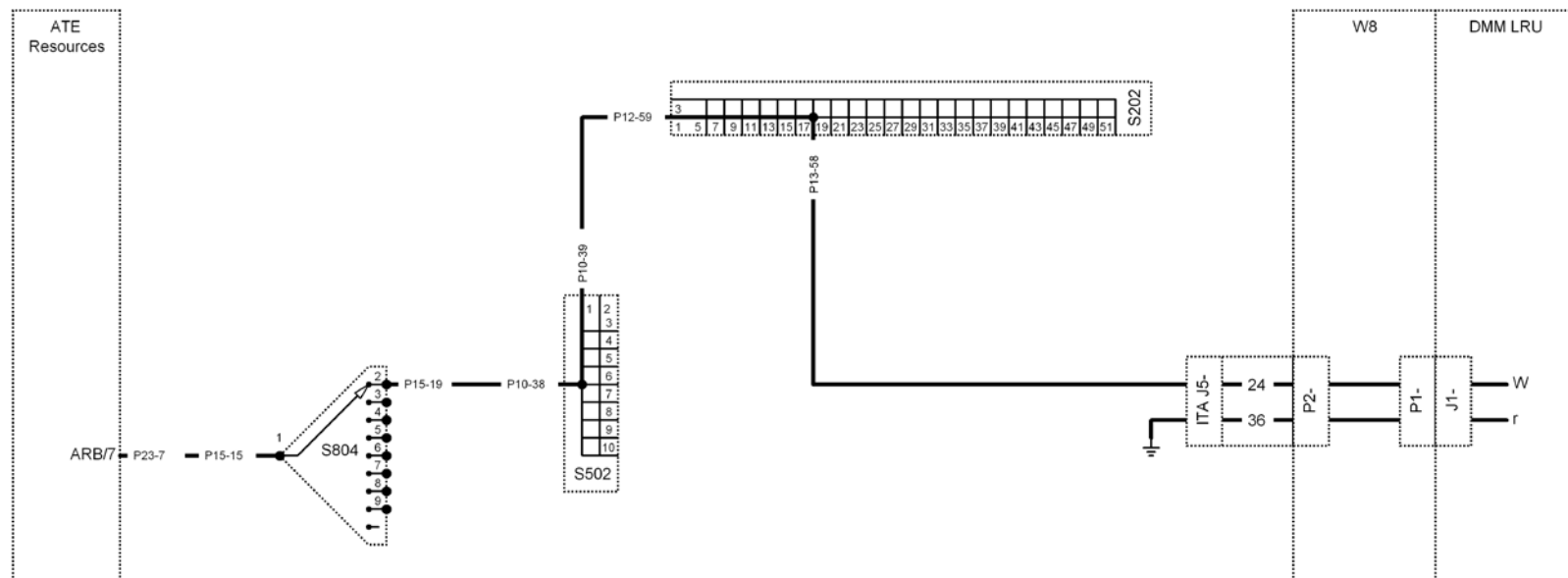
Connection Path as follows:



Step 104 Segments 0-15 at 4mA

Test step 104 will have the same adjusted voltage applied to J1-W via the ARB as test step 101. The operator will be asked to verify that the Transmission Oil Pressure Indicator is between a reading of 0 and 30, which corresponds to between 0 to 15 segments being lit for an approximate value of 0.

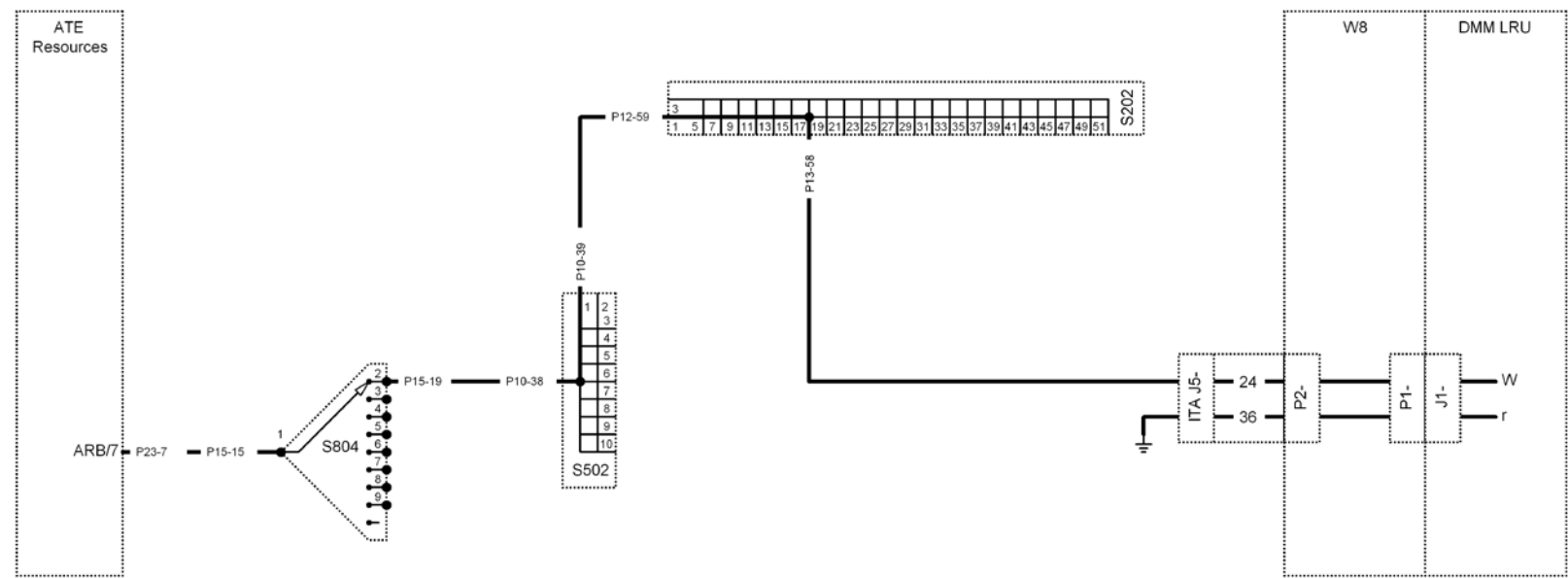
Connection Path as follows:



Step 105 Segments 85-115 at 11.68mA

Test step 105 will have the same adjusted voltage applied to J1-W via the ARB as test step 102. The operator will be asked to verify that the Transmission Oil Pressure Indicator is between a reading of 90 and 150, which corresponds to between 85 to 115 segments being lit for an approximate value of 120.

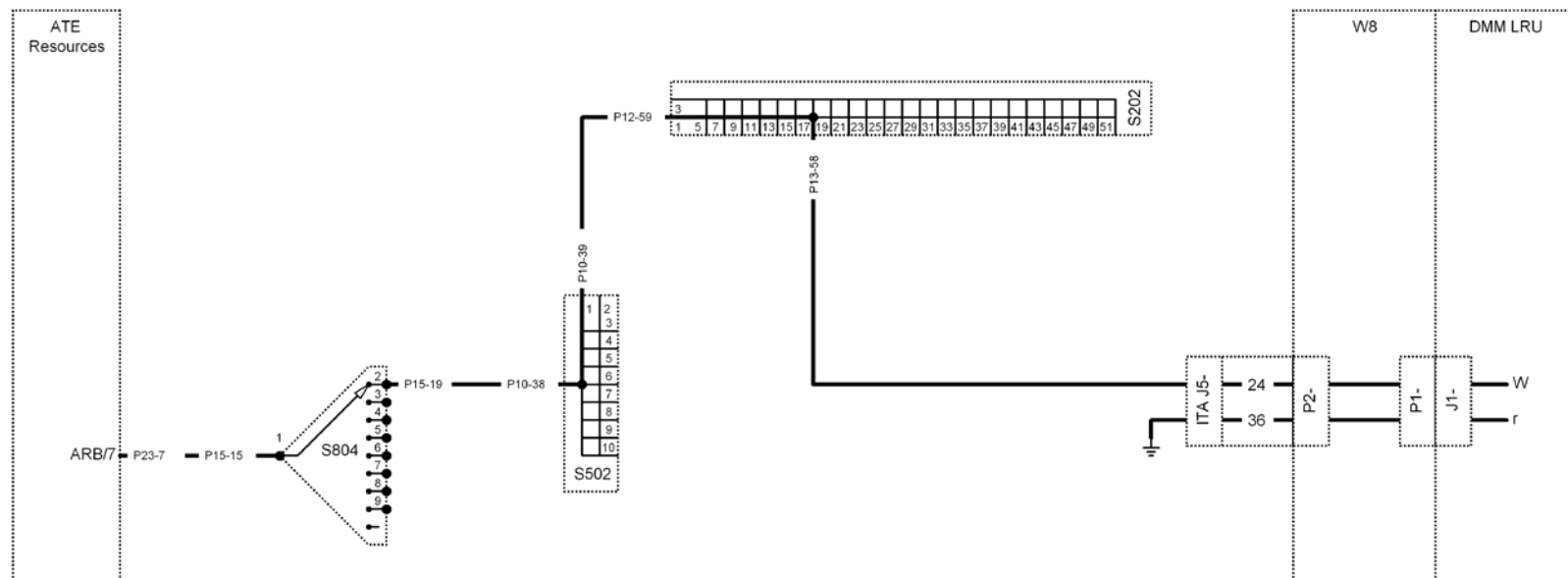
Connection Path as follows:



Step 106 Segments 185-200 at 19.36mA

Test step 106 will have the same adjusted voltage applied to J1-W via the ARB as test step 103. The operator will be asked to verify that the Transmission Oil Pressure Indicator is between a reading of 210 and 240, which corresponds to between 185 to 200 segments being lit for an approximate value of 240.

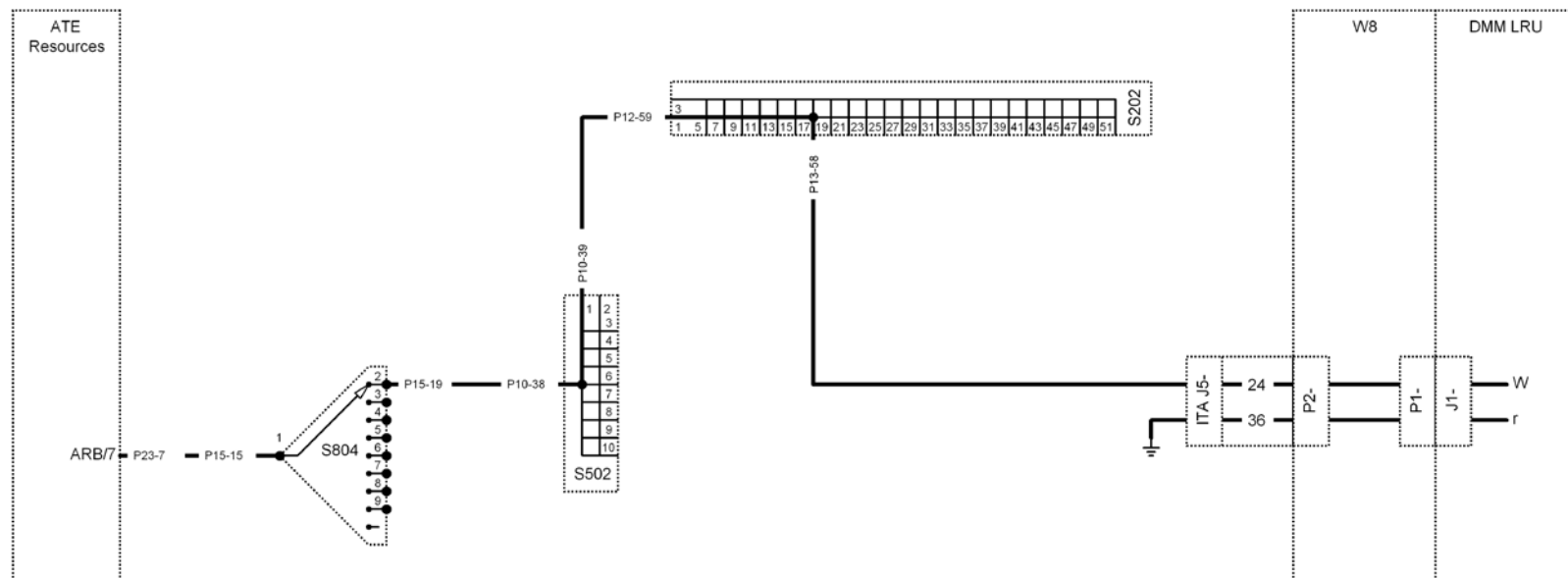
Connection Path as follows:



Step 107 XMSN Oil Pressure LED On

Test step 107 will apply 2.75 Vdc at J1-W via the ARB. The DMM will be used to measure an expected current of approximately 8.0 mA and the ARB input will be adjusted until a measurement is between 7.95 and 8.05 mA. Once the adjustment has been completed the adjusted voltage will be applied to J1-W via the ARB. The operator will be asked to verify that the Transmission Oil Pressure Indicator Warning Lights are blinking.

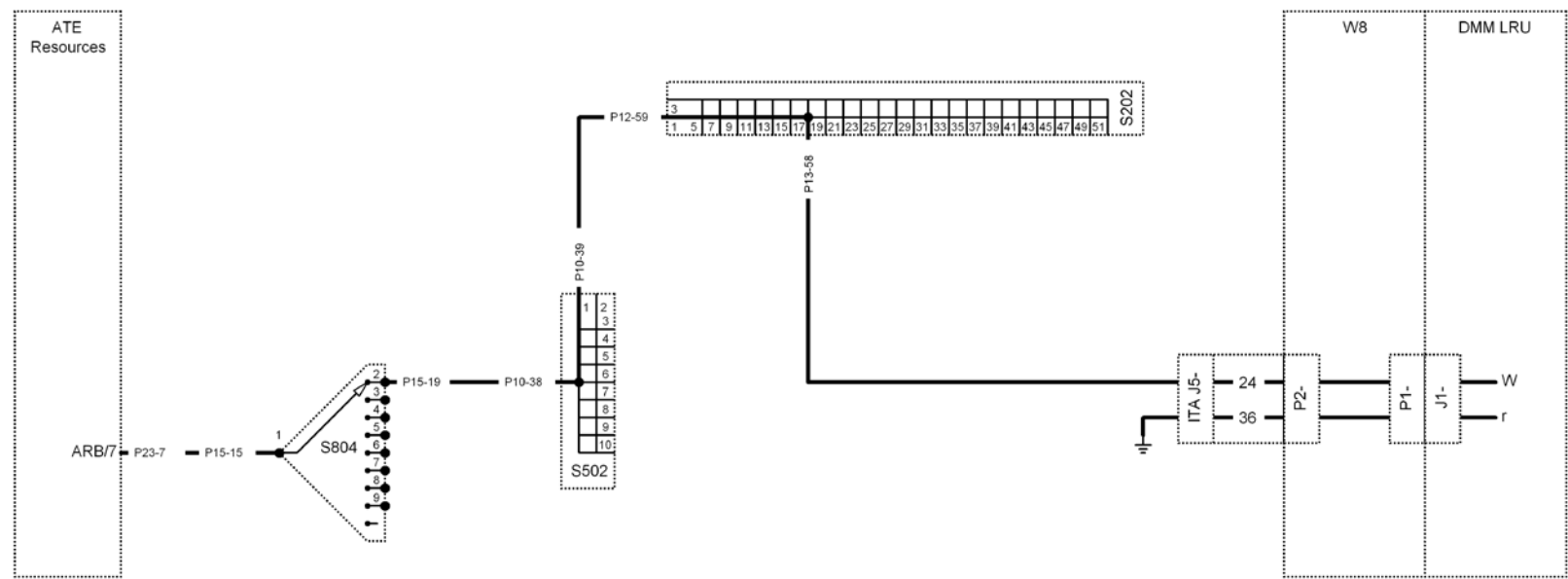
Connection Path as follows:



Step 108 XMSN Oil Pressure LED Off

Test step 108 will apply 1.125 Vdc at J1-W via the ARB. The DMM will be used to measure an expected current of approximately 12.0 mA and the ARB input will be adjusted until a measurement is between 11.95 and 12.05 mA. Once the adjustment has been completed the adjusted voltage will be applied to J1-W via the ARB. The operator will be asked to verify that the Transmission Oil Pressure Indicator Warning Lights are off.

Connection Path as follows:

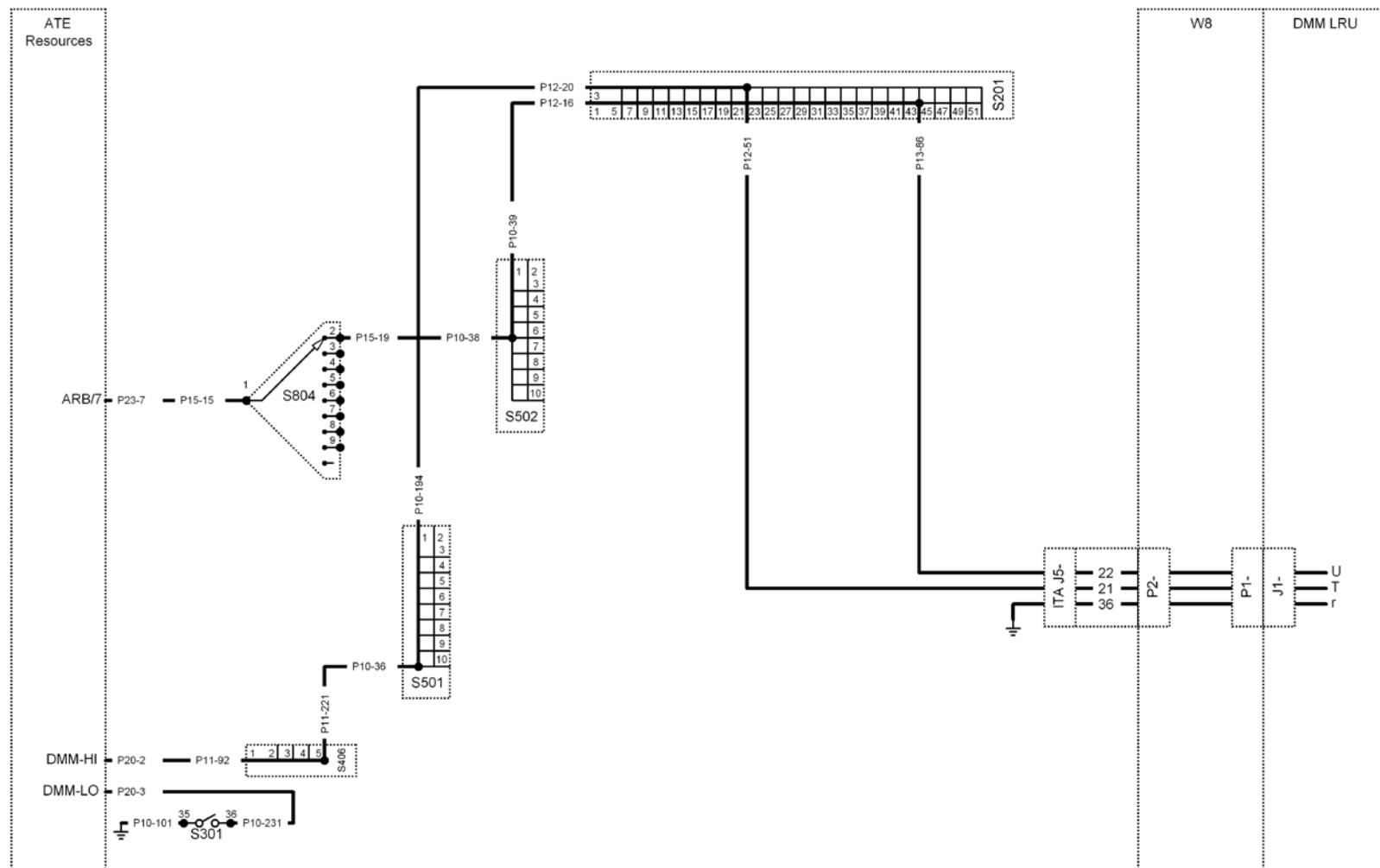


Step 109 4mA, Engine Oil Pressure at J1-T

Test steps 109 through 116 will verify that the circuit used to indicate engine oil pressure is functioning correctly. Some of the steps will undergo an adjustment routine before a measurement is taken. This adjustment routine consists of the input current being changed using the DC function of the ARB. The divide by seven output from the ARB will be switched to the CCA input via J1-U. In conjunction with the ARB, the DMM will be connected as a current meter to verify that the correct current is being sourced by the ARB. The DMM will first verify the input current and then be switched to verify Voltage from the output. These tests will determine the functionality of OP-Amps and surrounding components. A read back procedure will be used to verify the current accuracy from the ARB via the DMM in current mode. This connection diagram is located in Appendix A titled ARB2 for test steps 109, 110, 111, 115, and 116.

Specifically test step 109 will apply +4.305 Vdc at J1-U via the ARB. The DMM will be used to measure an expected current of approximately 4 mA and the ARB input will be adjusted until a measurement is between 3.98 and 4.02 mA. Once the adjustment has been completed the adjusted voltage will be applied to J1-U via the ARB. The DMM will be used to measure the output at J1-T with a voltage between -0.003 Vdc and +0.015 Vdc.

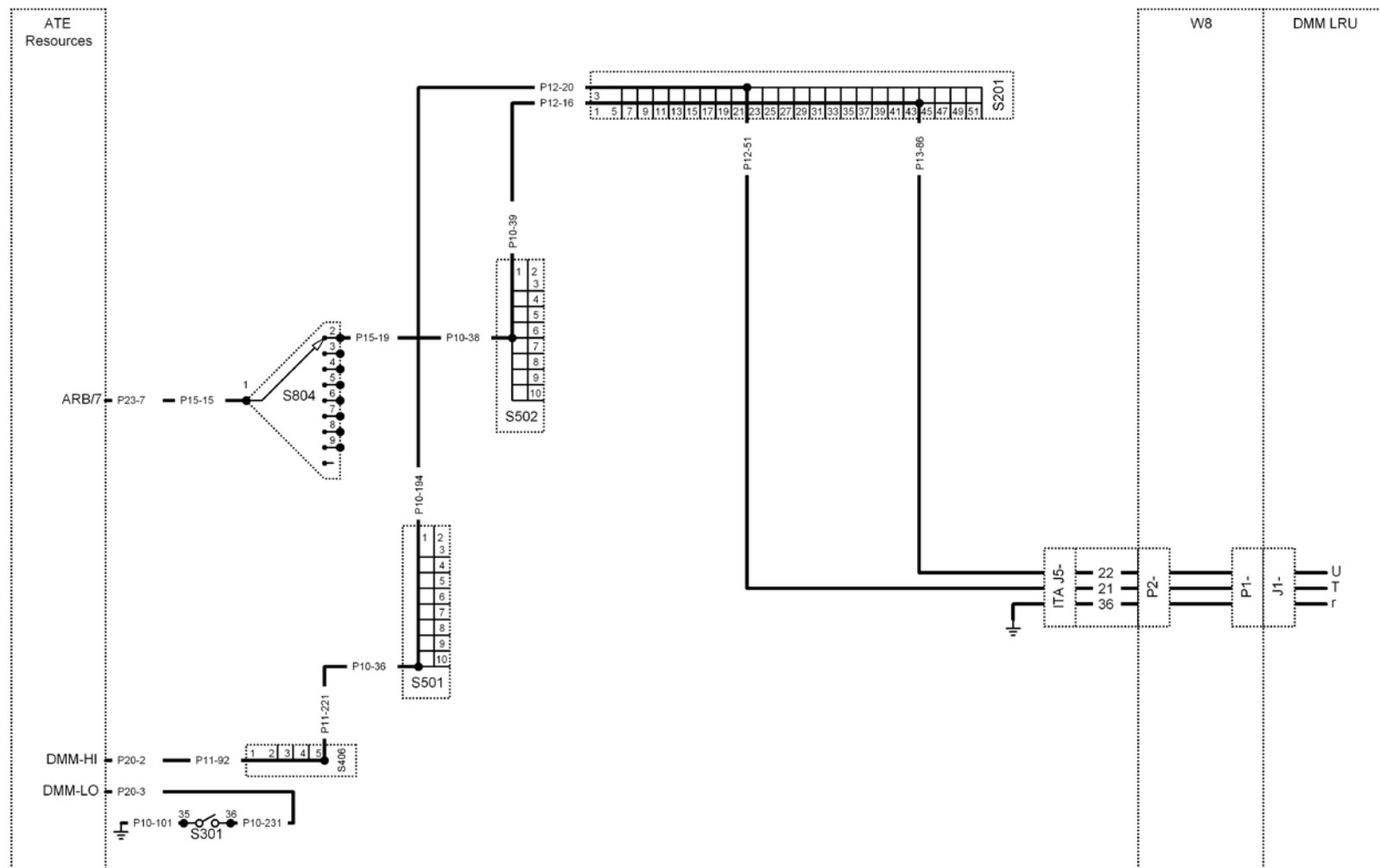
Connection Path as follows:



Step 110 10.40mA, Engine Oil Pressure at J1-T

Test step 110 will apply +1.6 Vdc at J1-U via the ARB. The DMM will be used to measure an expected current of approximately 10.4 mA and the ARB input will be adjusted until a measurement is between 10.35 and 10.45 mA. Once the adjustment has been completed the adjusted voltage will be applied to J1-U via the ARB. The DMM will be used to measure the output at J1-T with a voltage between 0.0347 Vdc and 0.0373 Vdc.

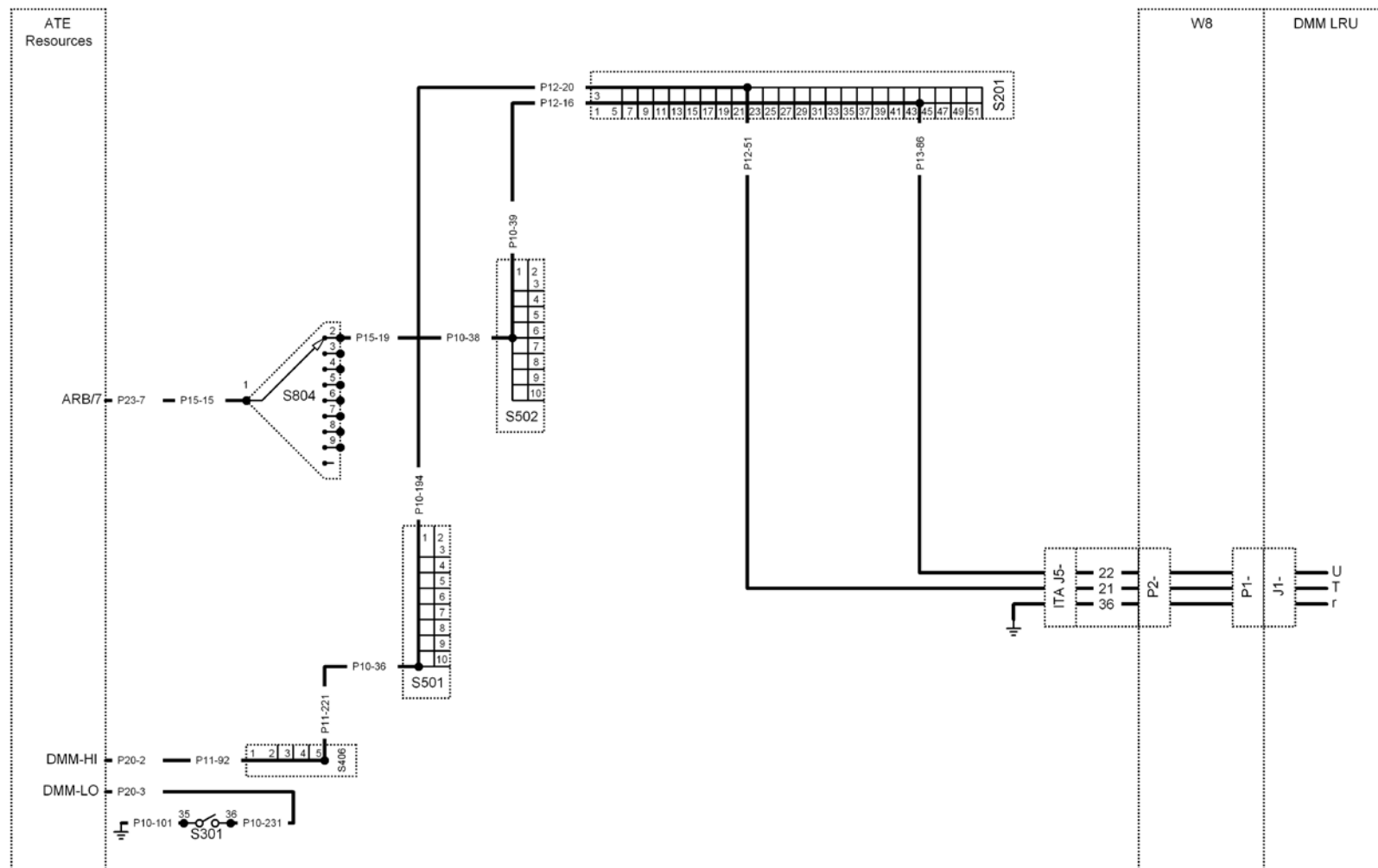
Connection Path as follows:



Step 111 16.80mA, Engine Oil Pressure at J1-T

Test step 111 will apply -1.11 Vdc at J1-U via the ARB. The DMM will be used to measure an expected current of approximately 16.8 mA and the ARB input will be adjusted until a measurement is between 16.72 and 16.88 mA. Once the adjustment has been completed the adjusted voltage will be applied to J1-U via the ARB. The DMM will be used to measure the output at J1-T with a voltage between 0.0698 Vdc and 0.0742 Vdc.

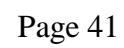
Connection Path as follows:



Step 112 Segments 0-15 at 4mA

Test step 112 will have the same adjusted voltage applied to J1-U via the ARB as test step 109. The operator will be asked to verify that the Engine Oil Pressure Indicator is between a reading of 0 and 10, which corresponds to between 0 to 15 segments being lit for an approximate value of 0.

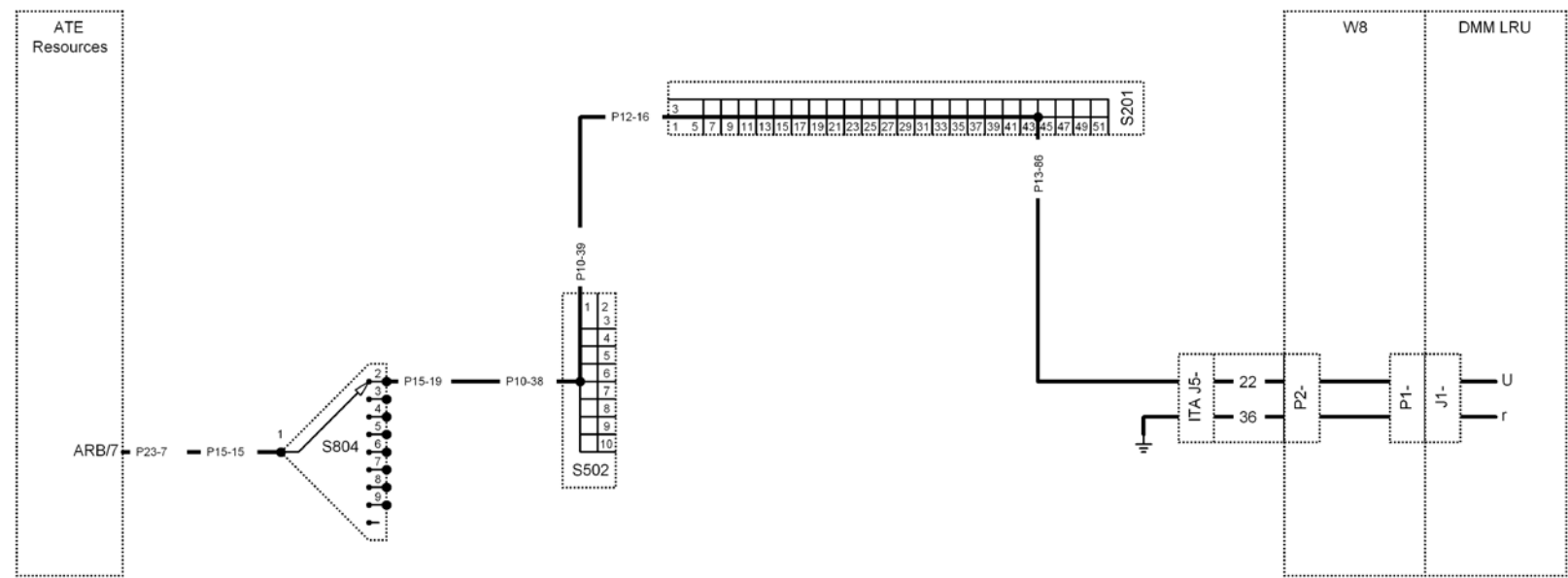
Connection Path as follows:



Step 113 Segments 85-115 at 10.40mA

Test step 113 will have the same adjusted voltage applied to J1-U via the ARB as test step 110. The operator will be asked to verify that the Engine Oil Pressure Indicator is between a reading of 30 and 50, which corresponds to between 85 to 115 segments being lit for an approximate value of 40.

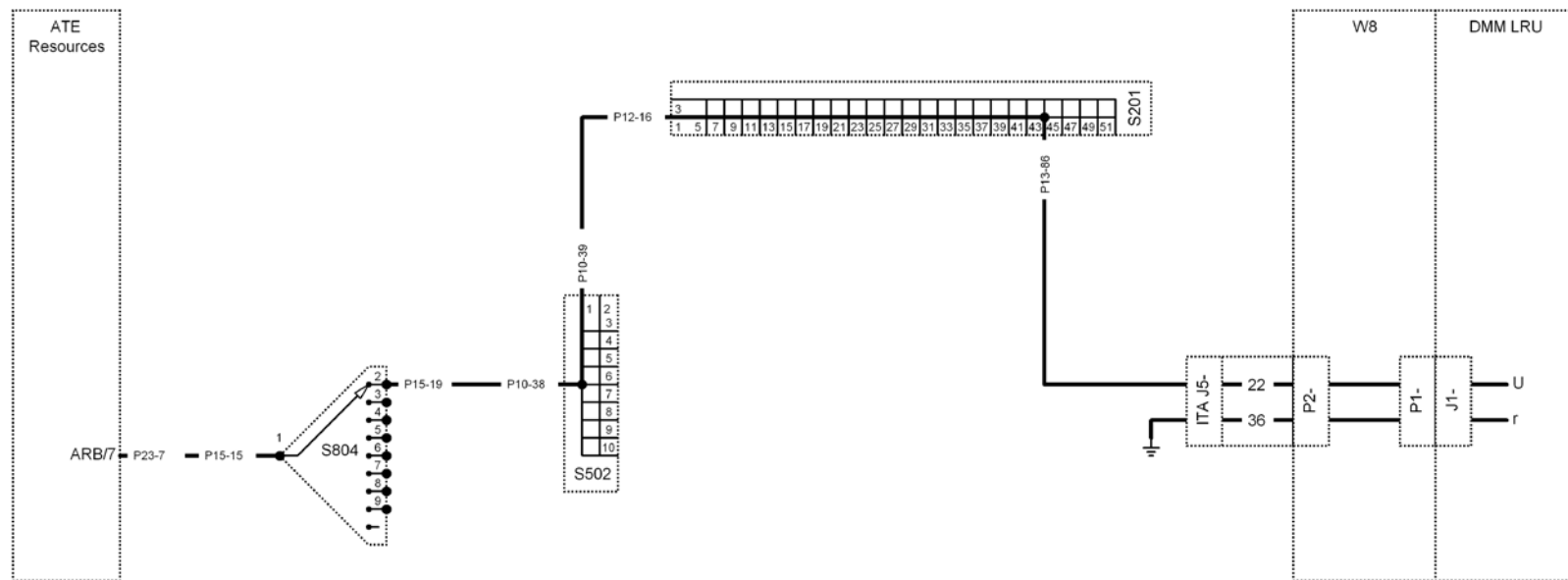
Connection Path as follows:



Step 114 Segments 185-200 at 16.80mA

Test step 114 will have the same adjusted voltage applied to J1-U via the ARB as test step 110. The operator will be asked to verify that the Engine Oil Pressure Indicator is between a reading of 70 and 80, which corresponds to between 185 to 200 segments being lit for an approximate value of 80.

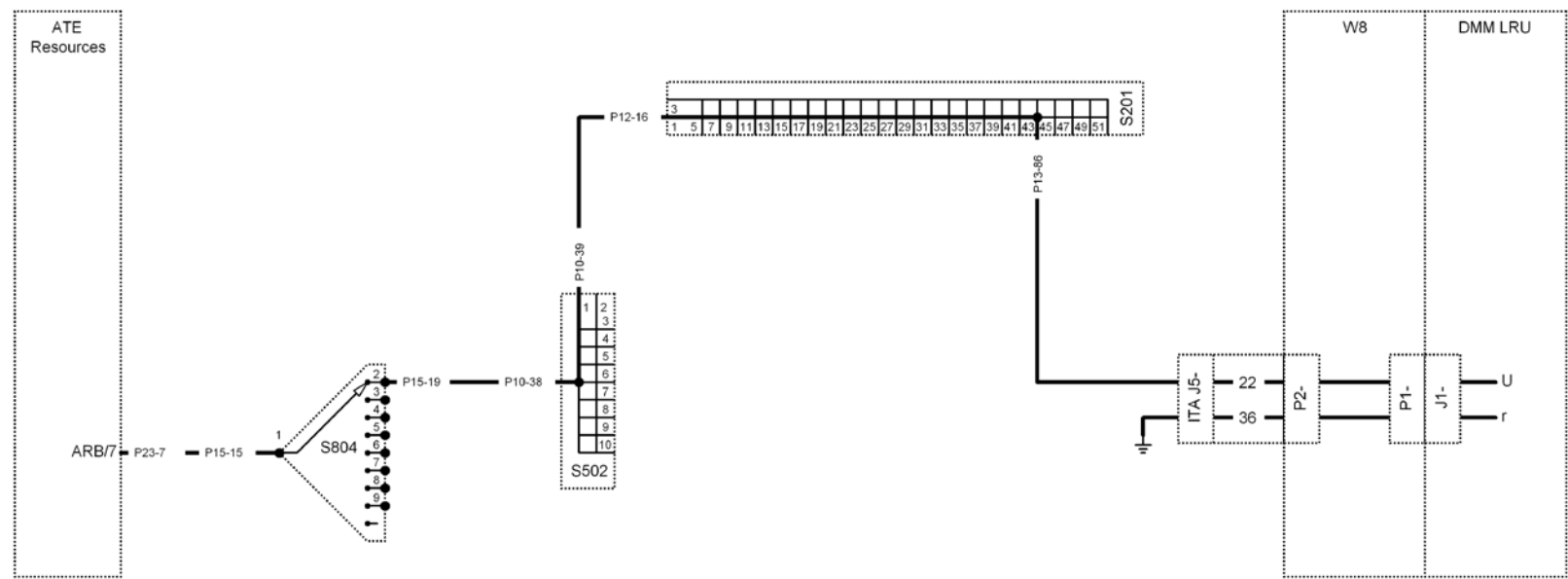
Connection Path as follows:



Step 115 Engine Oil Pressure LED On

Test step 115 will apply 4.305 Vdc at J1-U via the ARB. The DMM will be used to measure an expected current of approximately 4.0 mA and the ARB input will be adjusted until a measurement is between 3.98 and 4.02 mA. Once the adjustment has been completed the adjusted voltage will be applied to J1-U via the ARB. The operator will be asked to verify that the Engine Oil Pressure Indicator Warning Lights are blinking.

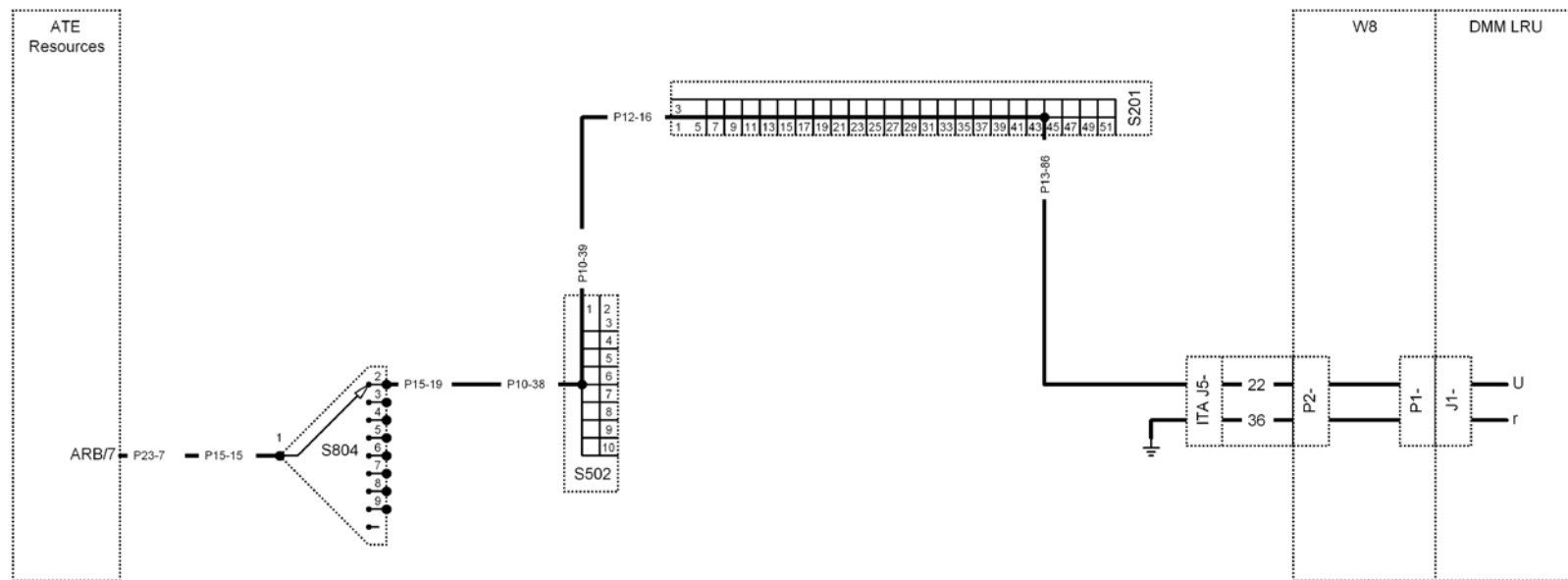
Connection Path as follows:



Step 116 Engine Oil Pressure LED Off

Test step 116 will apply 1.125 Vdc at J1-U via the ARB. The DMM will be used to measure an expected current of approximately 12.0 mA and the ARB input will be adjusted until a measurement is between 11.95 and 12.05 mA. Once the adjustment has been completed the adjusted voltage will be applied to J1-U via the ARB. The operator will be asked to verify that the Engine Oil Pressure Indicator Warning Lights are off.

Connection Path as follows:

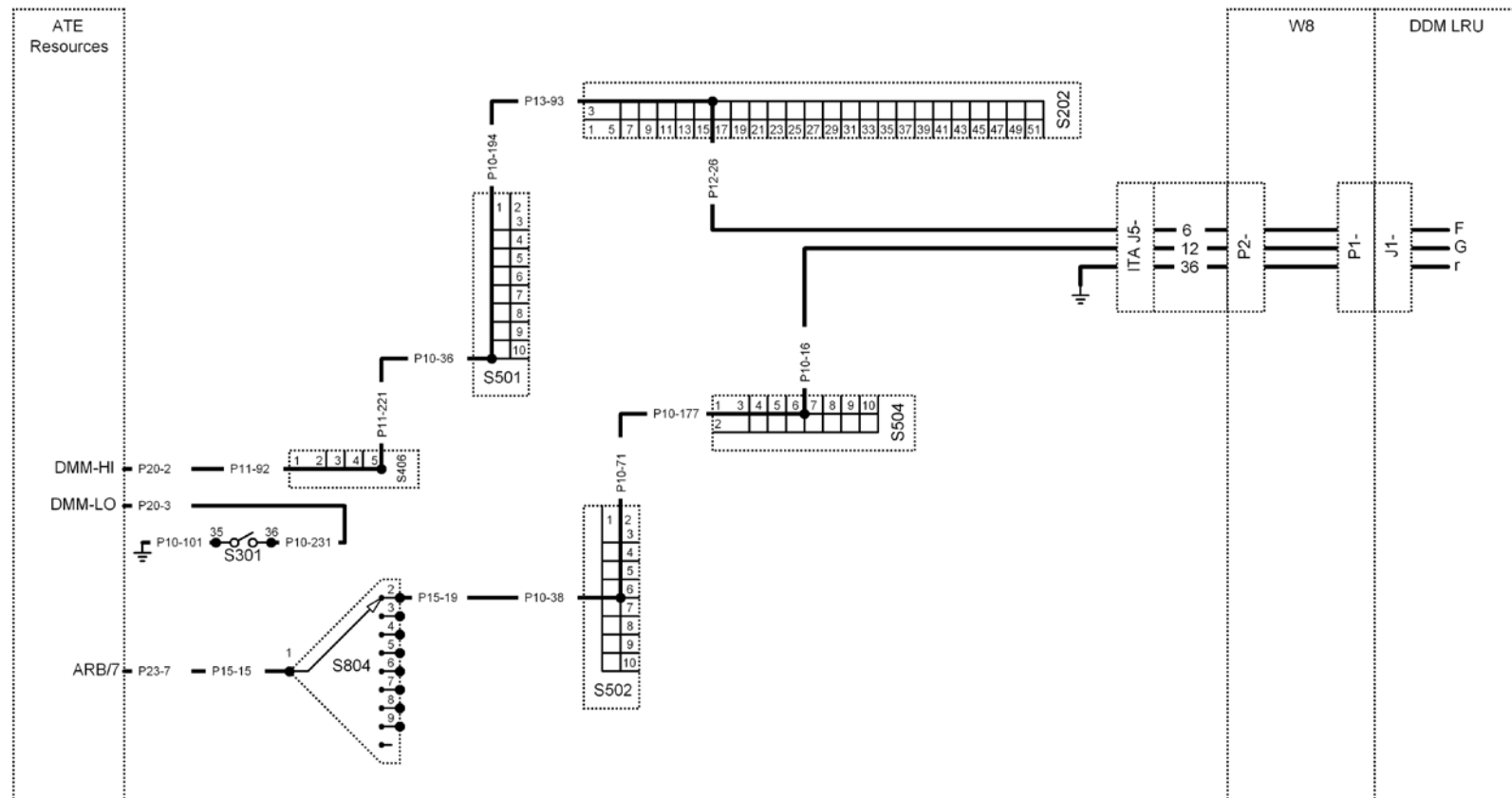


Step 117 4mA, Air Filter Pressure at J1-F

Test steps 117 through 124 will verify that the circuit used to indicate air filter restriction pressure is functioning correctly. Some of the steps will undergo an adjustment routine before a measurement is taken. This adjustment routine consists of the input current being changed using the DC function of the ARB. The divide by seven output from the ARB will be switched to the CCA input via J1-G. In conjunction with the ARB, the DMM will be connected as a current meter to verify that the correct current is being sourced by the ARB. The DMM will first verify the input current and then be switched to verify Voltage from the output. These tests will determine the functionality of OP-Amps and surrounding components. A read back procedure will be used to verify the current accuracy from the ARB via the DMM in current mode. This connection diagram is located in Appendix A titled ARB3 for test steps 117, 118, 119, 123, and 124.

Specifically test step 117 will apply +4.385 Vdc at J1-G via the ARB. The DMM will be used to measure an expected current of approximately 4 mA and the ARB input will be adjusted until a measurement is between 3.98 and 4.02 mA. Once the adjustment has been completed the adjusted voltage will be applied to J1-G via the ARB. The DMM will be used to measure the output at J1-F with a voltage between -0.003 Vdc and +0.015 Vdc.

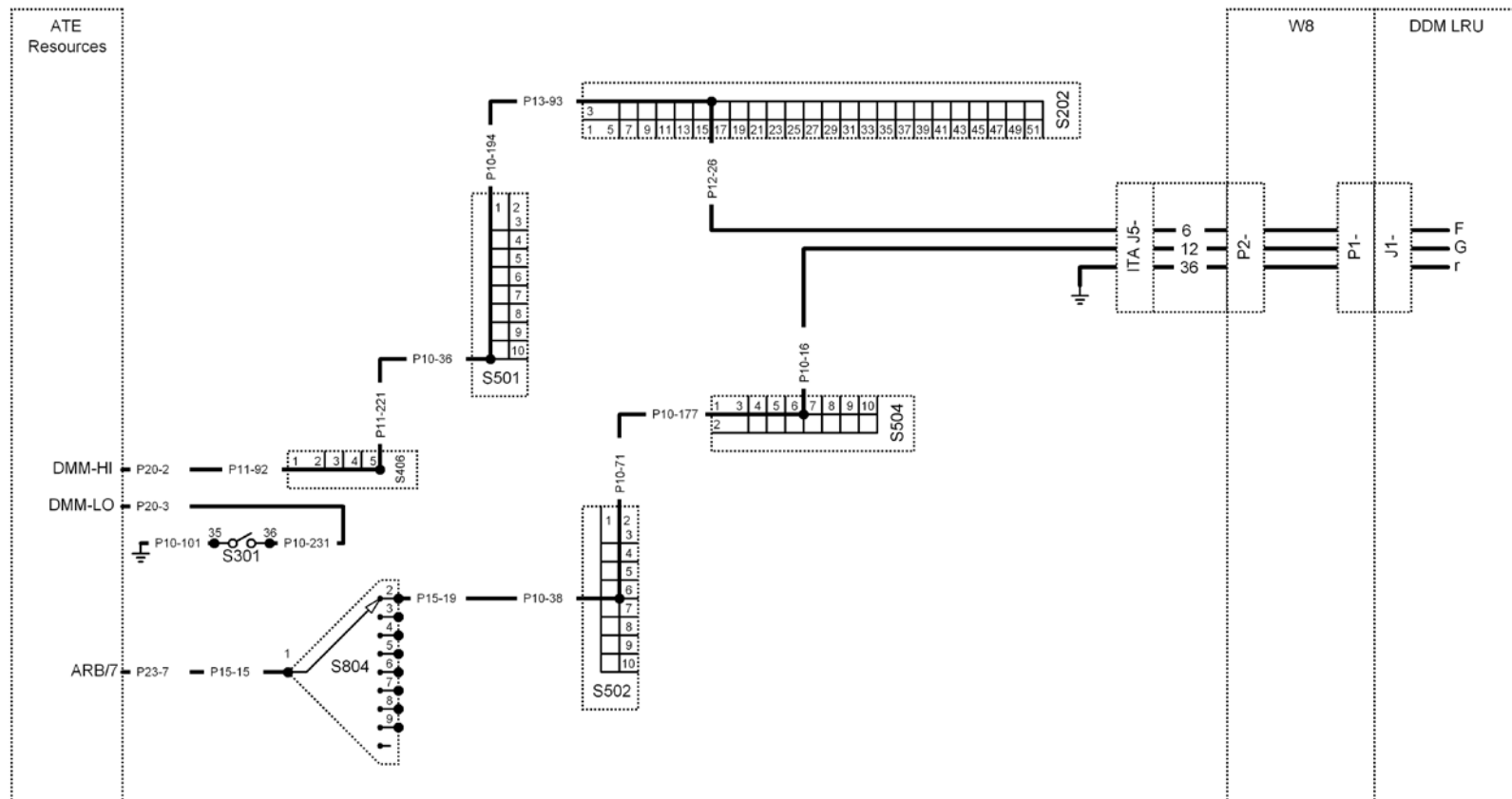
Connection Path as follows:



Step 118 12.00mA, Air Filter Pressure at J1-F

Test step 118 will apply +1.16 Vdc at J1-G via the ARB. The DMM will be used to measure an expected current of approximately 12 mA and the ARB input will be adjusted until a measurement is between 11.94 and 12.06 mA. Once the adjustment has been completed the adjusted voltage will be applied to J1-G via the ARB. The DMM will be used to measure the output at J1-F with a voltage between 0.0070 Vdc and 0.0075 Vdc.

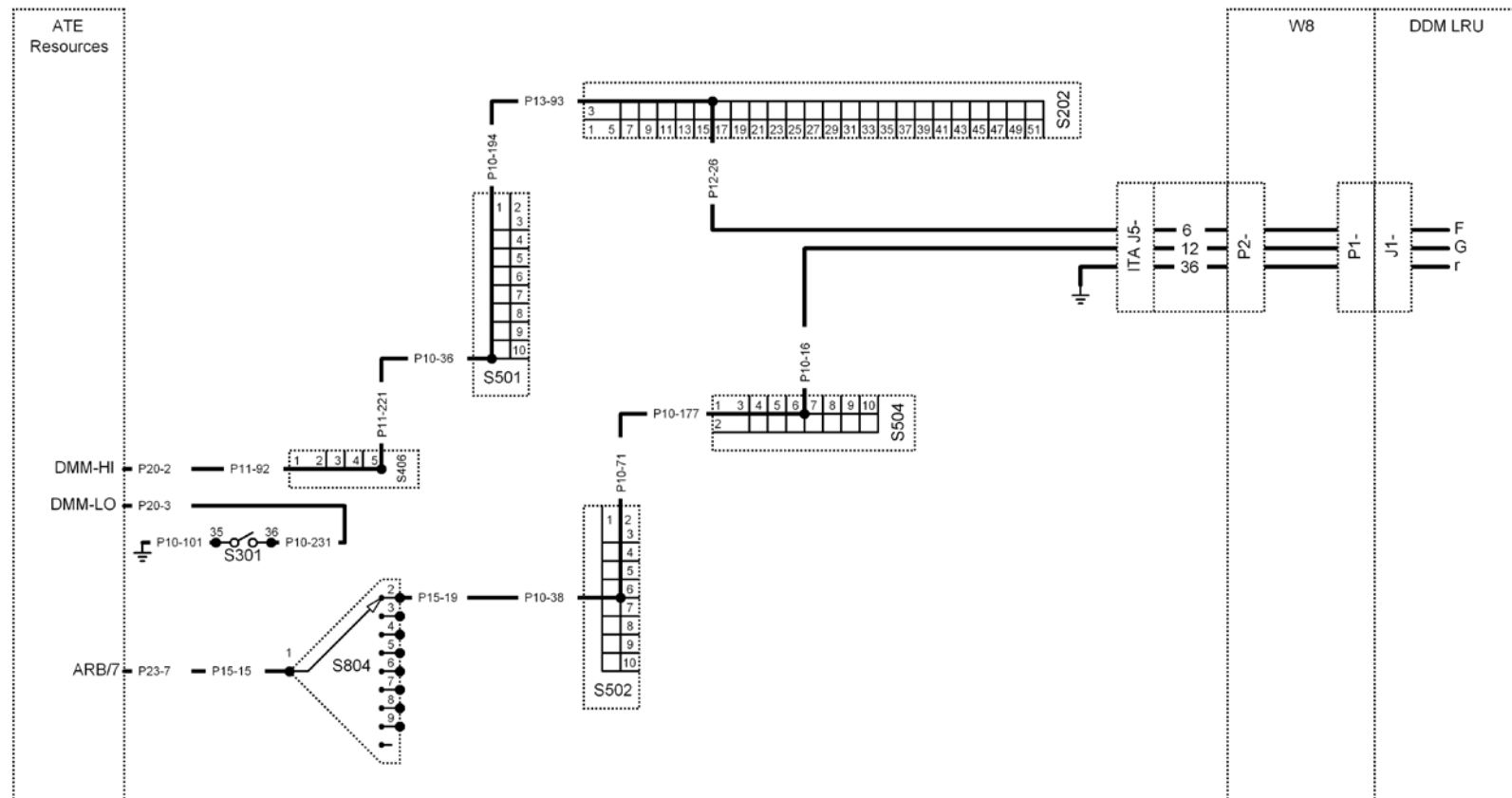
Connection Path as follows:



Step 119 20.00mA, Air Filter Pressure at J1-F

Test step 119 will apply -2.0615 Vdc at J1-G via the ARB. The DMM will be used to measure an expected current of approximately 20 mA and the ARB input will be adjusted until a measurement is between 19.9 and 20.1 mA. Once the adjustment has been completed the adjusted voltage will be applied to J1-G via the ARB. The DMM will be used to measure the output at J1-F with a voltage between 0.01410 Vdc and 0.01495 Vdc.

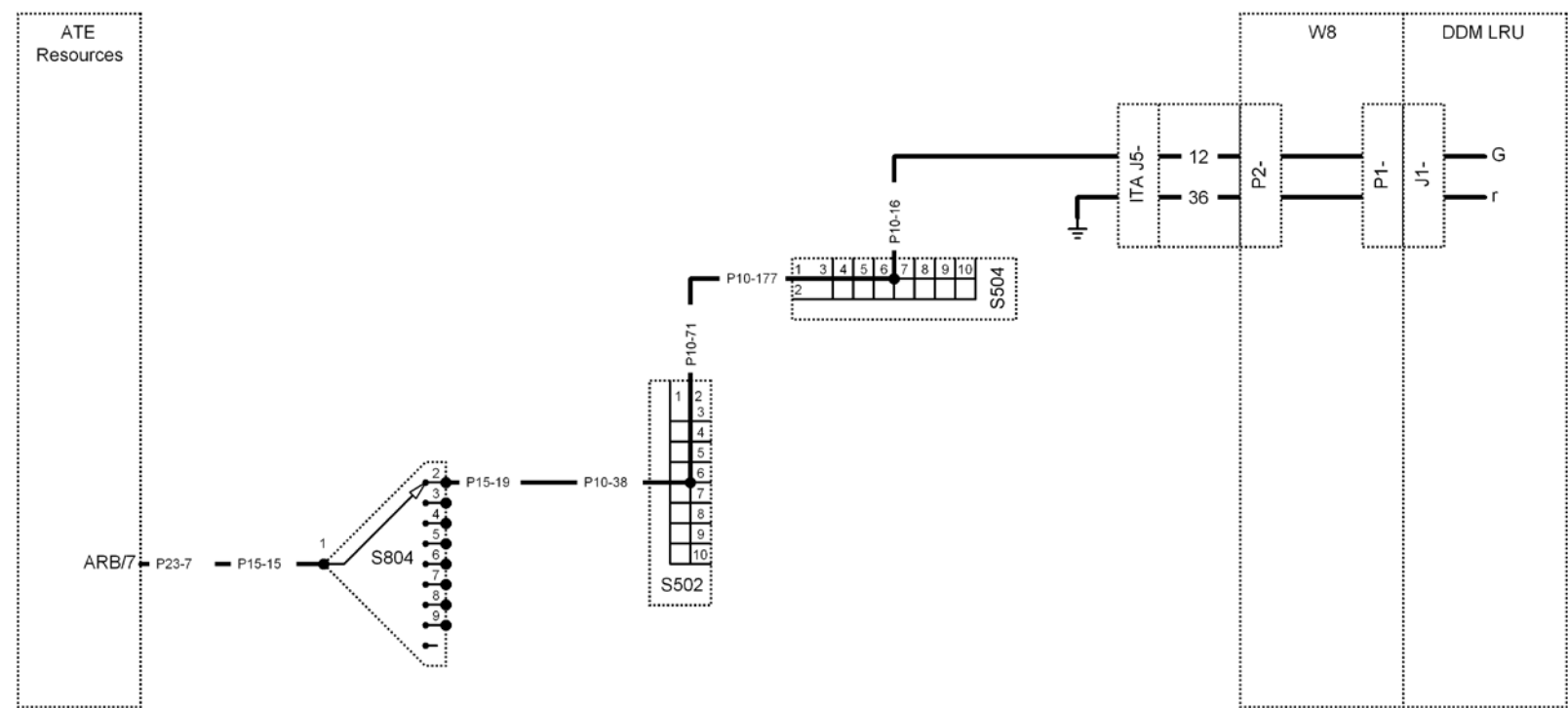
Connection Path as follows:



Step 120 Segments 0-15 at 4mA

Test step 120 will have the same adjusted voltage applied to J1-G via the ARB as test step 117. The operator will be asked to verify that the Air Filter Restriction Pressure Indicator is between a reading of 0 and 5, which corresponds to between 0 to 15 segments being lit for an approximate value of 0.

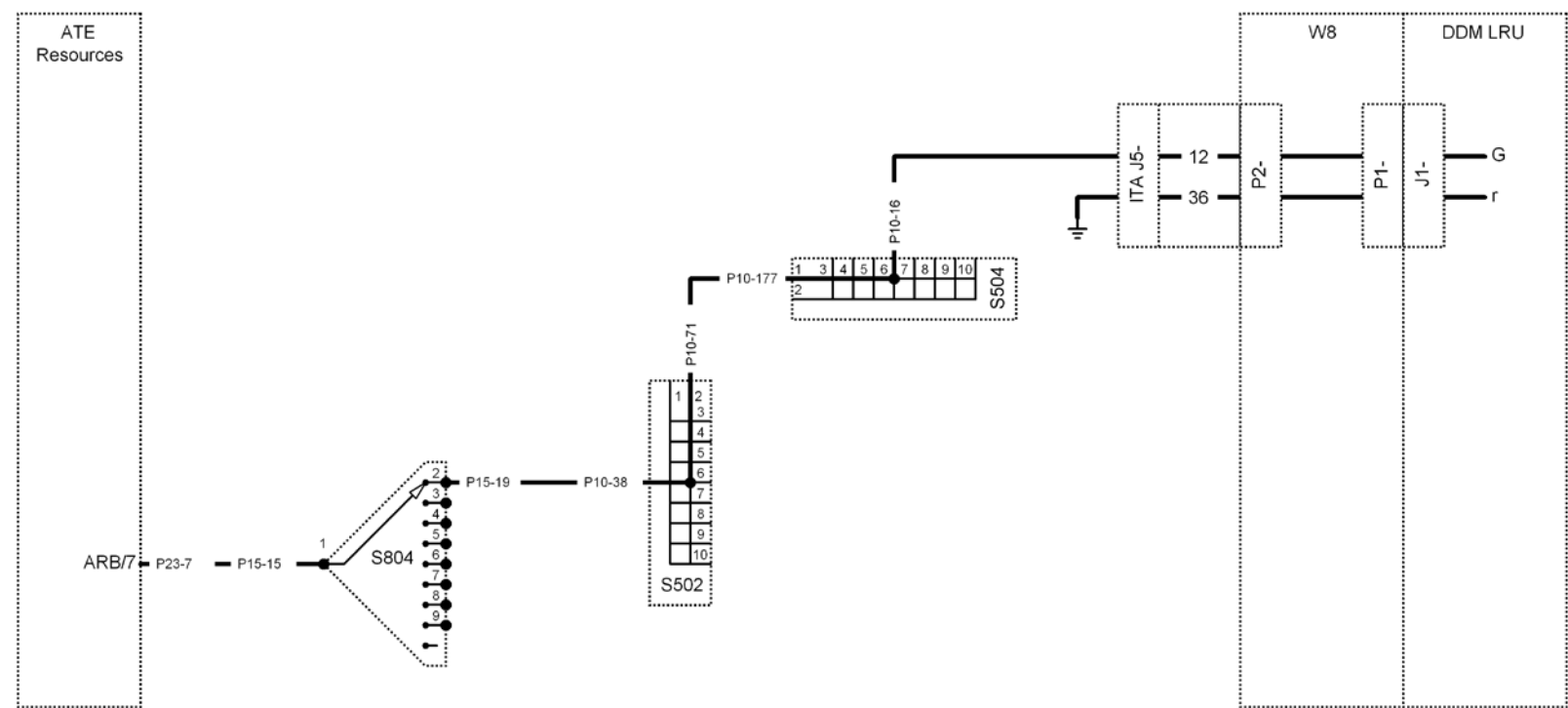
Connection Path as follows:



Step 121 Segments 85-115 at 12.00mA

Test step 121 will have the same adjusted voltage applied to J1-G via the ARB as test step 118. The operator will be asked to verify that the Air Filter Restriction Pressure Indicator is between a reading of 15 and 25, which corresponds to between 85 to 115 segments being lit for an approximate value of 20.

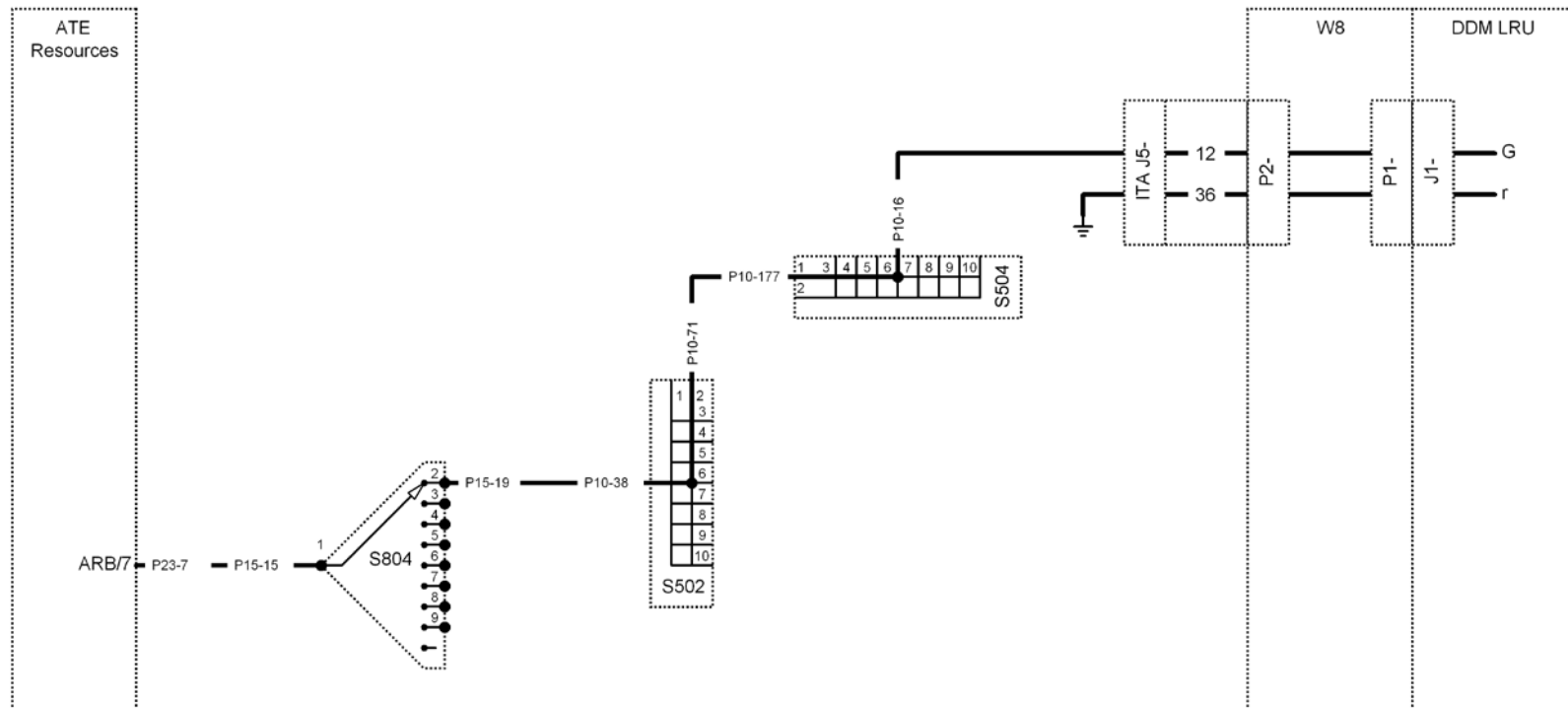
Connection Path as follows:



Step 122 Segments 185-200 at 20.00mA

Test step 122 will have the same adjusted voltage applied to J1-G via the ARB as test step 119. The operator will be asked to verify that the Air Filter Restriction Pressure Indicator is between a reading of 35 and 40, which corresponds to between 185 to 200 segments being lit for an approximate value of 40.

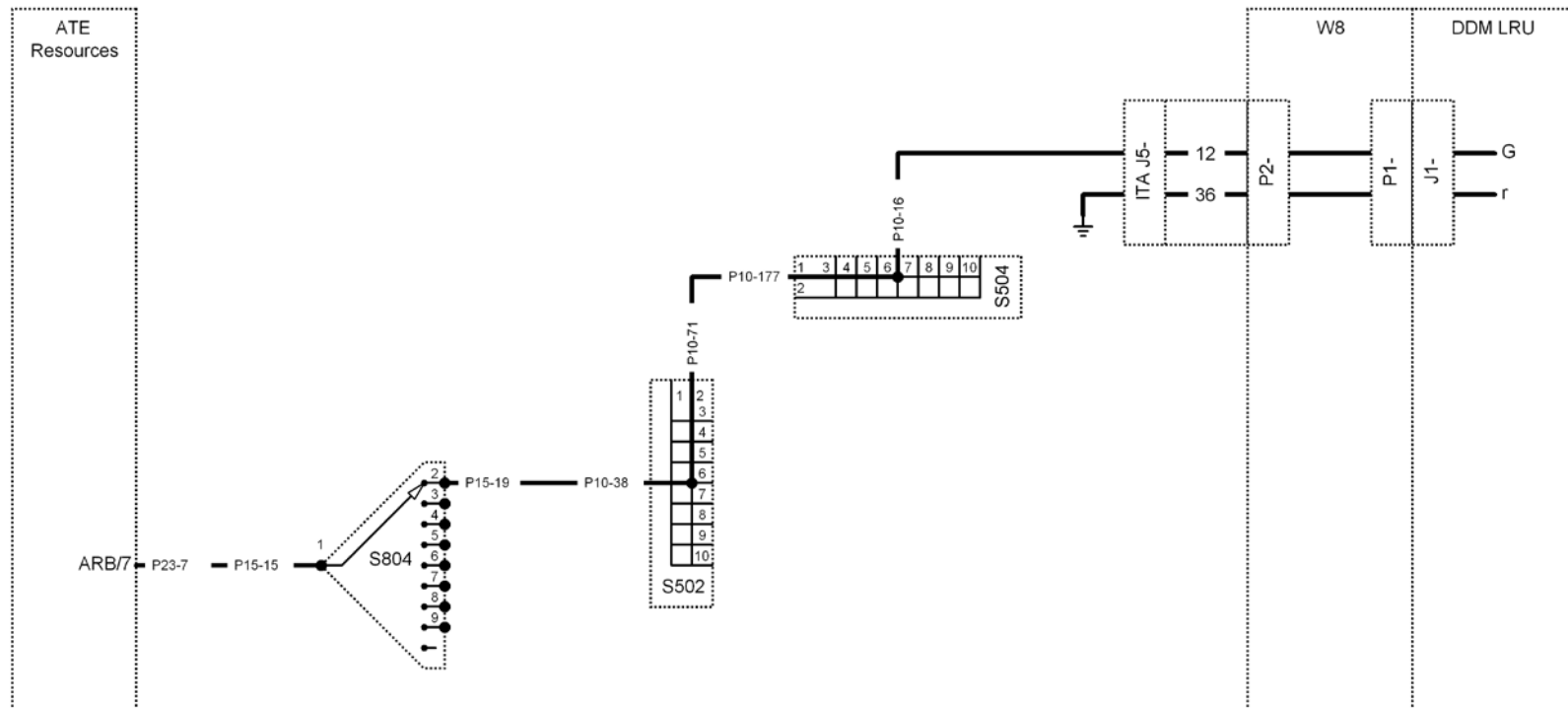
Connection Path as follows:



Step 123 Air Filter Pressure LED On

Test step 123 will apply 0.335 Vdc at J1-G via the ARB. The DMM will be used to measure an expected current of approximately 14 mA and the ARB input will be adjusted until a measurement is between 13.95 and 14.05 mA. Once the adjustment has been completed the adjusted voltage will be applied to J1-G via the ARB. The operator will be asked to verify that the Air Filter Restriction Pressure Indicator Warning Lights are blinking.

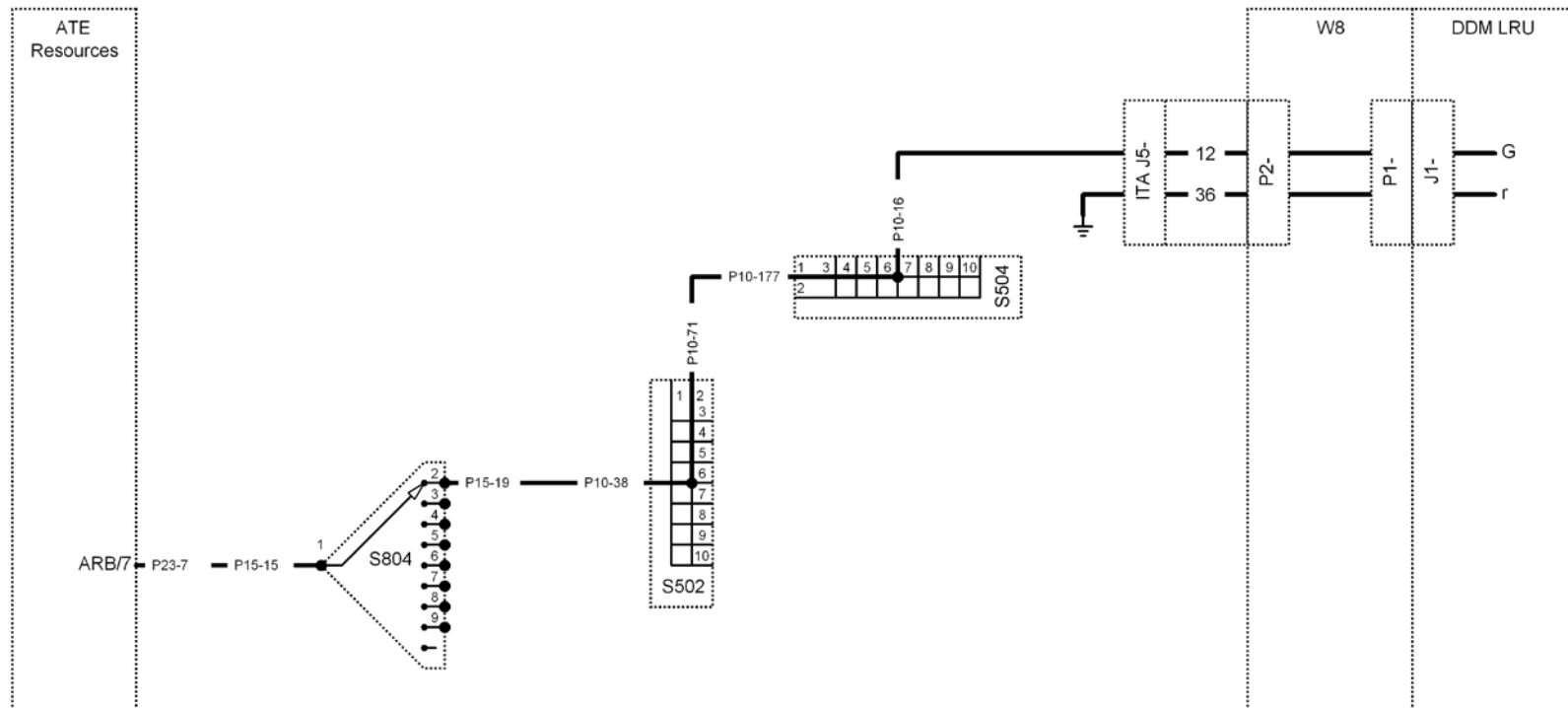
Connection Path as follows:



Step 124 Air Filter Pressure LED Off

Test step 124 will apply 4.385 Vdc at J1-G via the ARB. The DMM will be used to measure an expected current of approximately 4.0 mA and the ARB input will be adjusted until a measurement is between 3.98 and 4.02 mA. Once the adjustment has been completed the adjusted voltage will be applied to J1-G via the ARB. The operator will be asked to verify that the Air Filter Restriction Pressure Indicator Warning Lights are off.

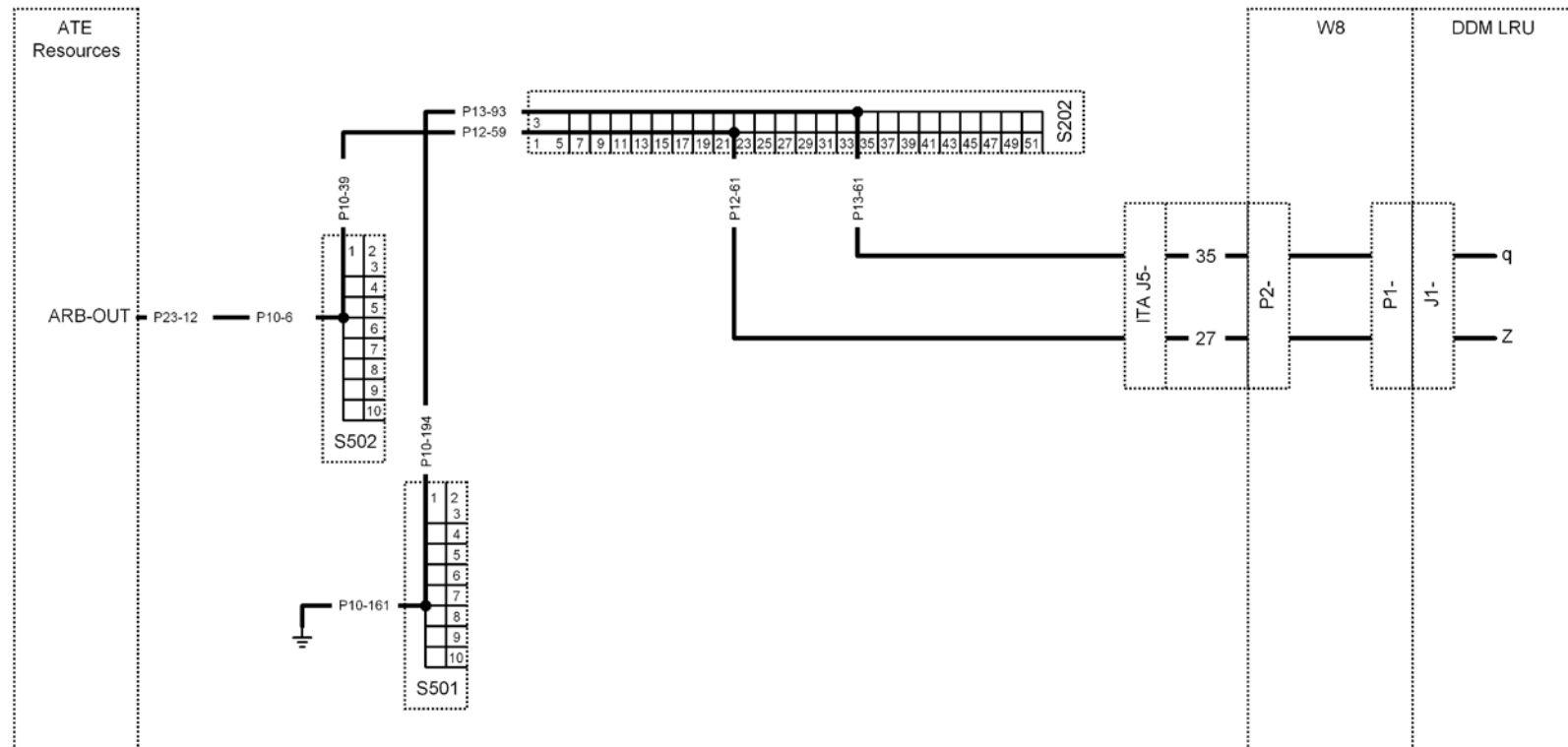
Connection Path as follows:



Step 125 Dimming Circuit J1-Z High

Test step 125 verifies that the bar graph display dimmer circuit is functioning correctly. The operator must manually verify the 50% brightness output of the bar graphs. This is accomplished by first providing a visual reference by lighting the bar graphs at 100% brightness. The operator is asked to note the brightness, and then the dimmer circuit is activated and the operator is asked to verify that the circuit has dimmed to approximately 50% of the initial brightness. If the bar graphs fail to light completely while the dimmer circuit is enabled, an in-line alignment procedure will be executed in which the operator will align R65 in an attempt to cause the bar graphs to light while the dimmer is enabled. If the in-line alignment is executed, the operator will be instructed to adjust R65 clockwise while the dimmer circuit is enabled to a point where the bar graph displays are "just on". From that point the operator will be asked to adjust R65 1 full turn in the clockwise direction. At this point the 50% brightness test is repeated. The operator is shown the 100% visual reference and then the dimmer circuit is enabled once again and the operator is asked to verify 50% brightness. J1-q is connected to ground briefly before the stimulus for this test is applied and the operator is instructed to verify the output, it is not connected for the entire duration of the test.

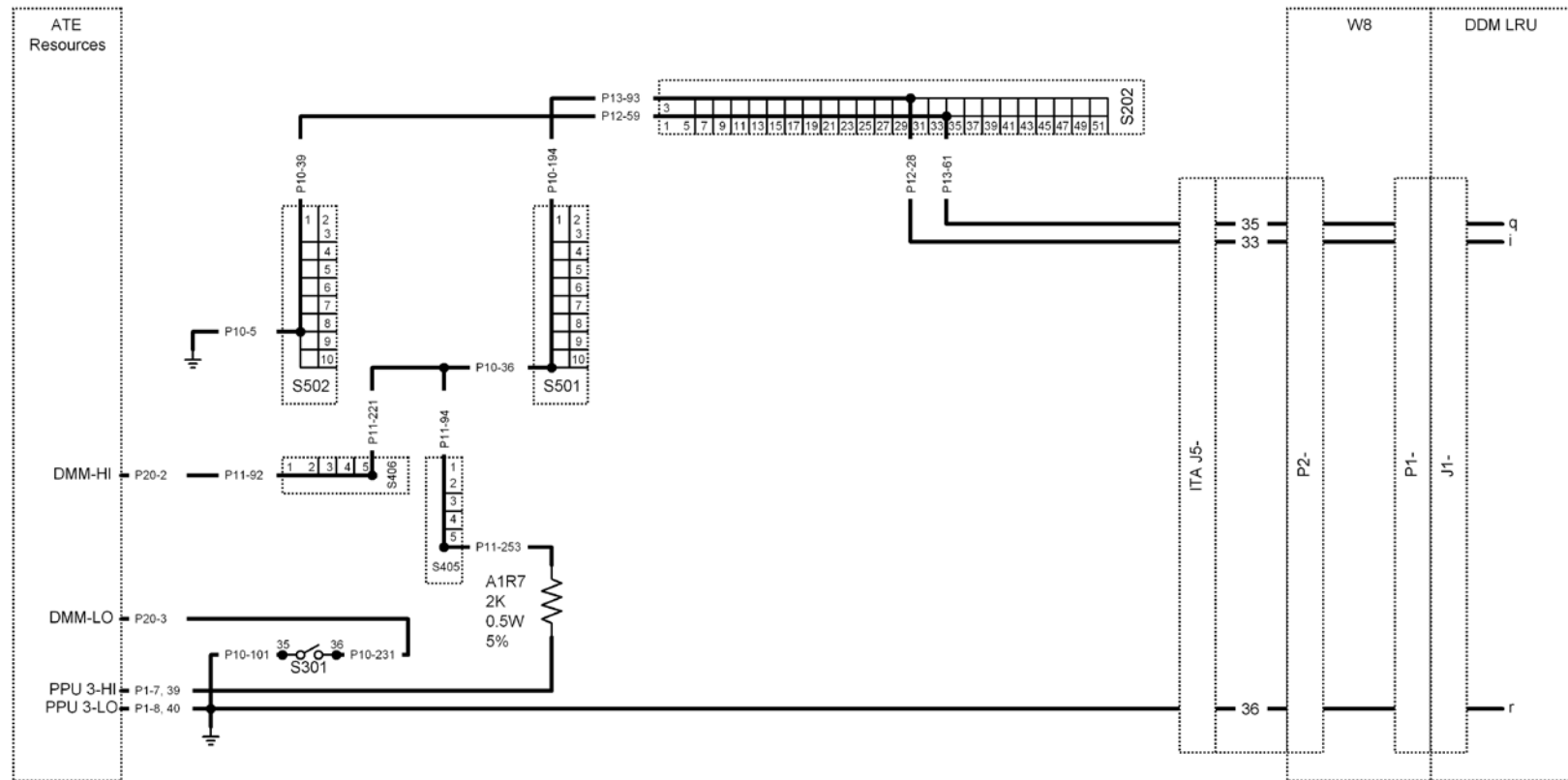
Connection Path as follows:



Step 126 Audio Warning (J1-i) On

Test step 126 verifies that the audio warning function is working correctly by applying +5.0 Vdc pull-up resistor at J1-i. The DMM will be used to measure the output at J1-i with a voltage between 1.2 Vdc and 5.5 Vdc.

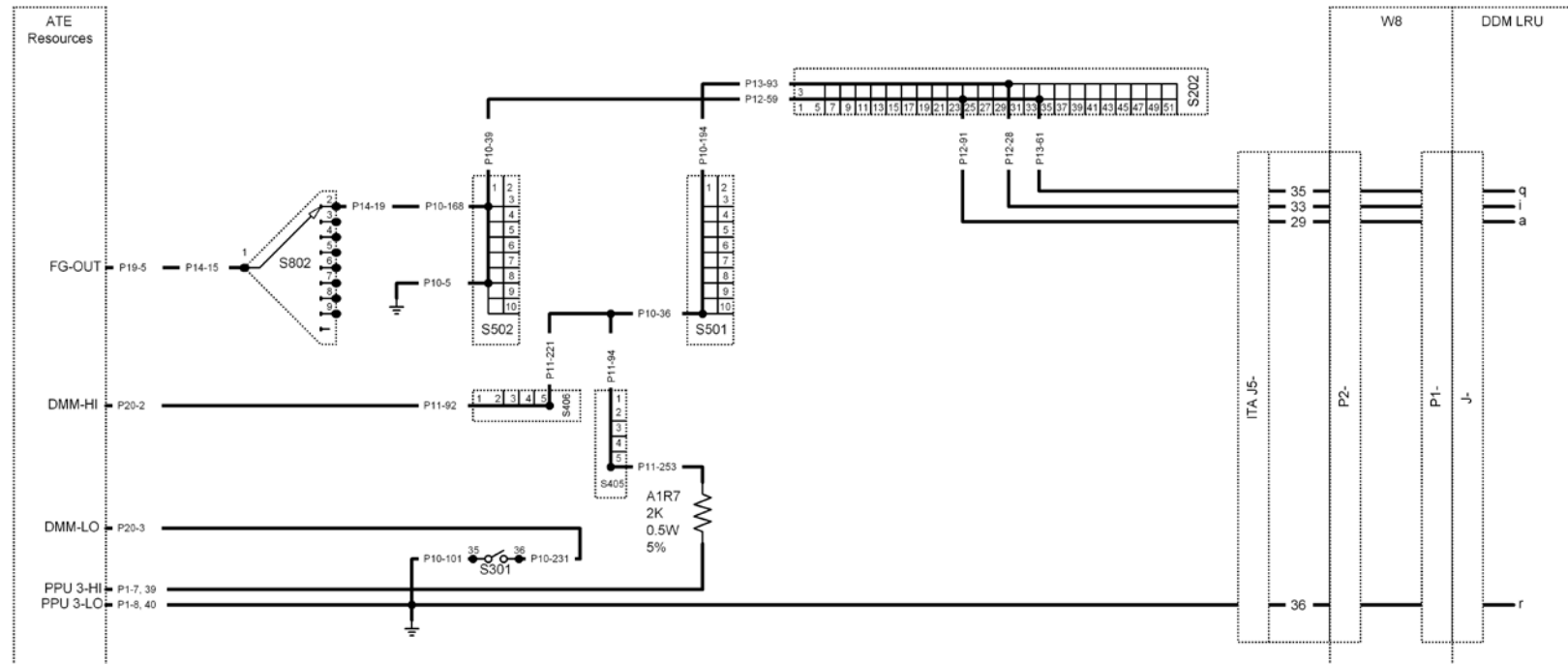
Connection Path as follows:



Step 127 Audio Warning (J1-i) Off

Test step 126 verifies that the audio warning function is working correctly by applying +5.0 Vdc pull-up resistor at J1-I as well as a +5.0 Vdc stimulus at J1-q via the ARB. The DMM will be used to measure the output at J1-i with a voltage between 0.01 Vdc and 1.2 Vdc.

Connection Path as follows:



MODULE 2 TEMPERATURE AND FUEL LEVEL CHANNEL TESTS

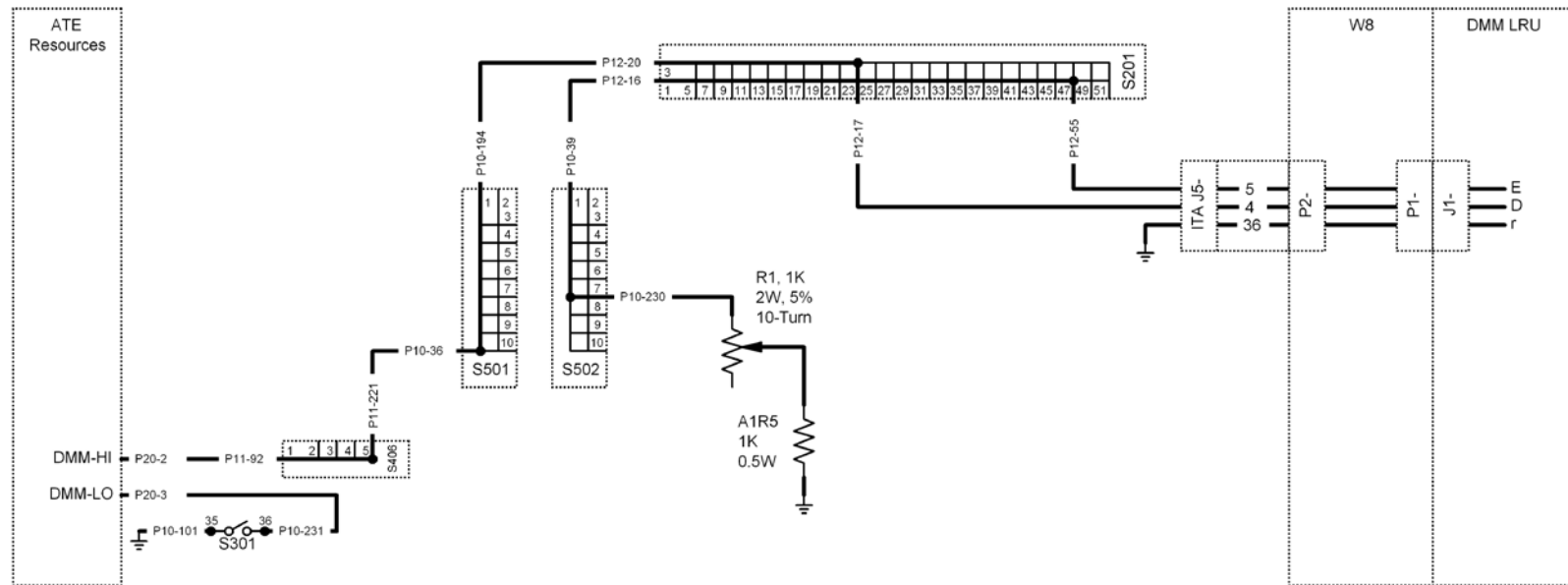
Module 2 tests the Transmission Oil Temperature, Engine Oil temperature, and Engine Coolant/Water Temperature circuitry by applying a specific resistance to drive the input voltage divider to specific levels equivalent to functional activity. The Fuel Level circuitry uses a voltage signal to simulate the same functionality as the resistance being applied to the input voltage divider. All of these require adjustment routines for each level change as well as operator observations to verify the display is correct.

Step 201 7.464mA, Engine Oil Temp at J1-D

Test steps 201 through 208 will verify that the circuit used to indicate engine oil temperature is functioning correctly. Starting with step 201, every step will undergo an adjustment routine before a measurement is taken. These adjustment routines consist of the resistance of potentiometer R1 being monitored by the DMM while the operator adjusts it to within the desired limits. This connection diagram is located in Appendix A titled ITAR1 and is used for steps 201 through 224.

Specifically test step 201 will use the DMM to monitor an expected resistance of approximately 1210 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1208 and 1212 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-E via switching. The DMM will be used to measure the output at J1-D with a voltage between 0.048 Vdc and 0.054 Vdc.

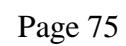
Connection Path as follows:



Step 202 6.271mA, Engine Oil Temp at J1-D

Test step 202 will use the DMM to monitor an expected resistance of approximately 1517 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1515 and 1519 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-E via switching. The DMM will be used to measure the output at J1-D with a voltage between 0.0738 Vdc and 0.0920 Vdc.

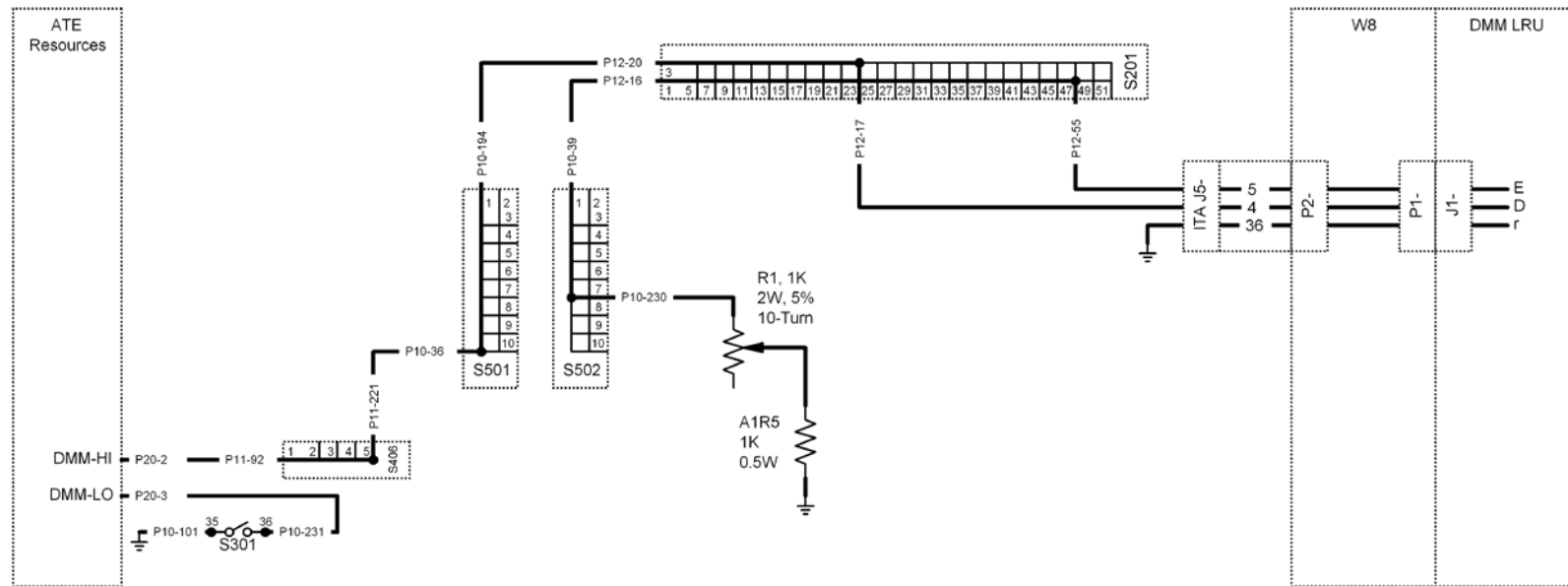
Connection Path as follows:



Step 203 5.402mA, Engine Oil Temp at J1-D

Test step 203 will use the DMM to monitor an expected resistance of approximately 1824 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1822 and 1826 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-E via switching. The DMM will be used to measure the output at J1-D with a voltage between 0.1004 Vdc and 0.1166 Vdc.

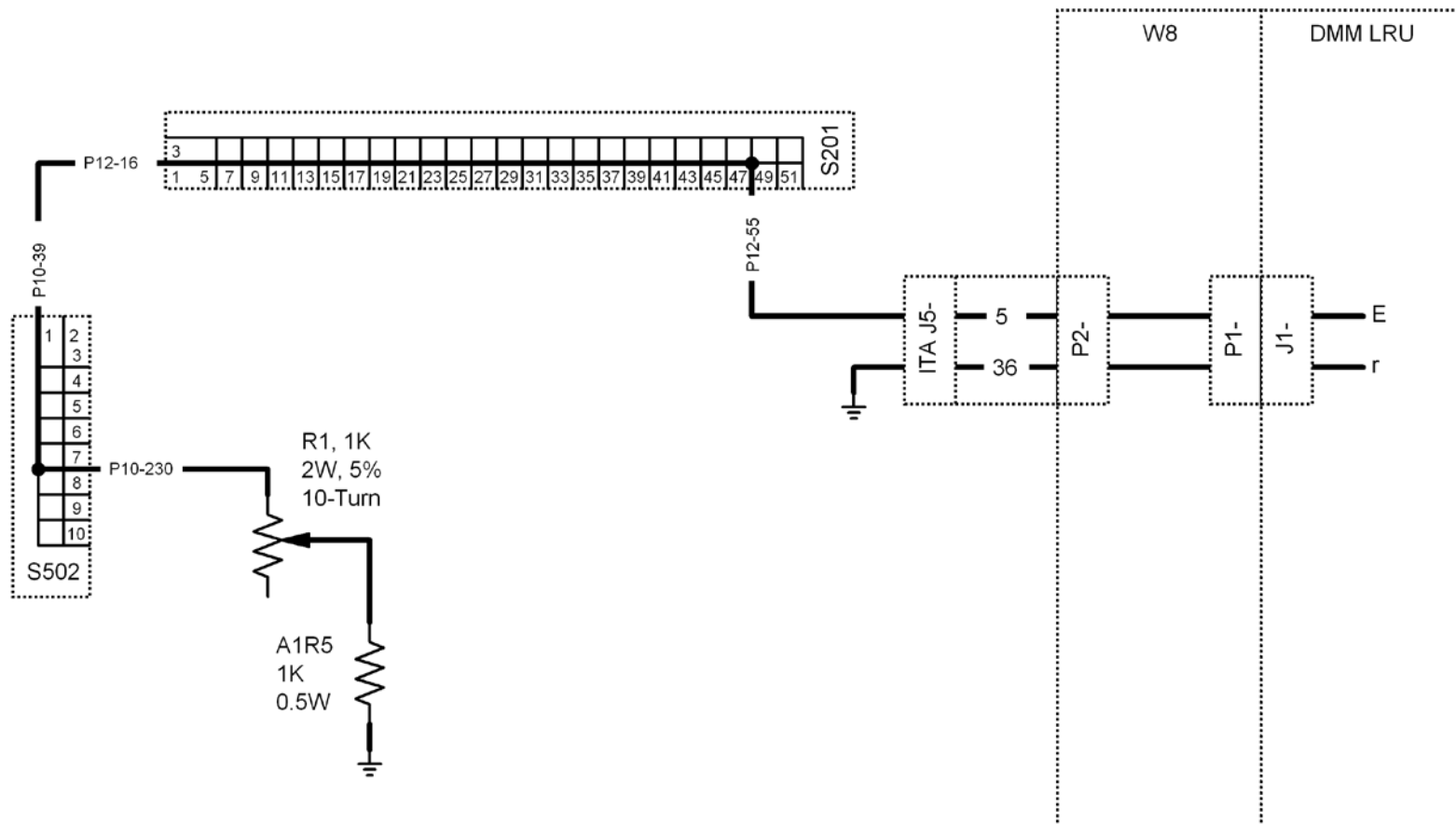
Connection Path as follows:



Step 204 Segments 0-15 at 7.464mA

Test step 204 will use the DMM to monitor an expected resistance of approximately 1210 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1208 and 1212 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-E via switching. The operator will be asked to verify that the Engine Oil Temperature Indicator is between a reading of 150 and 170, which corresponds to between 0 to 15 segments being lit for an approximate value of 150.

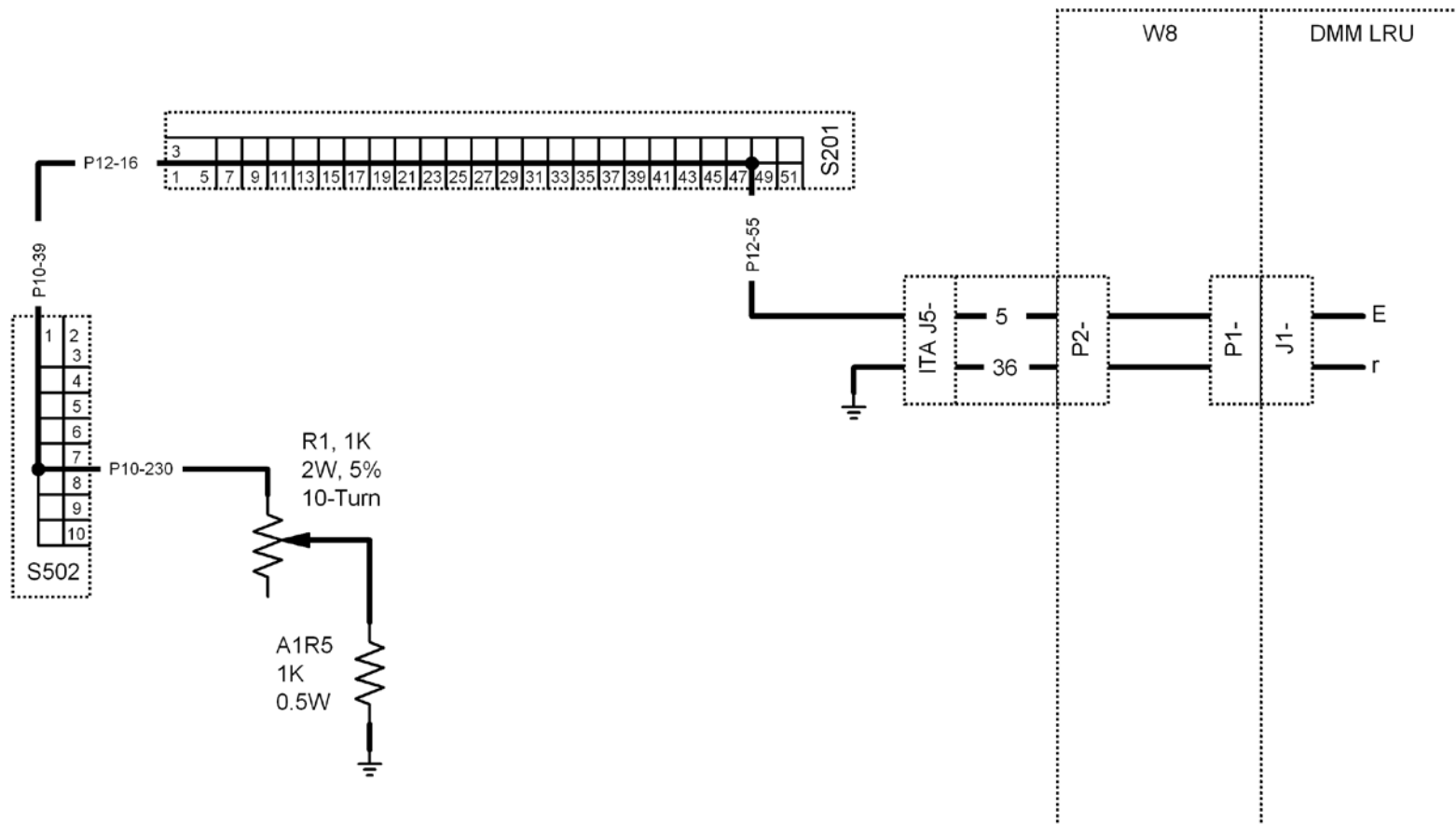
Connection Path as follows:



Step 205 Segments 85-115 at 6.271mA

Test step 205 will use the DMM to monitor an expected resistance of approximately 1517 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1515 and 1519 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-E via switching. The operator will be asked to verify that the Engine Oil Temperature Indicator is between a reading of 210 and 250, which corresponds to between 85 to 115 segments being lit for an approximate value of 230.

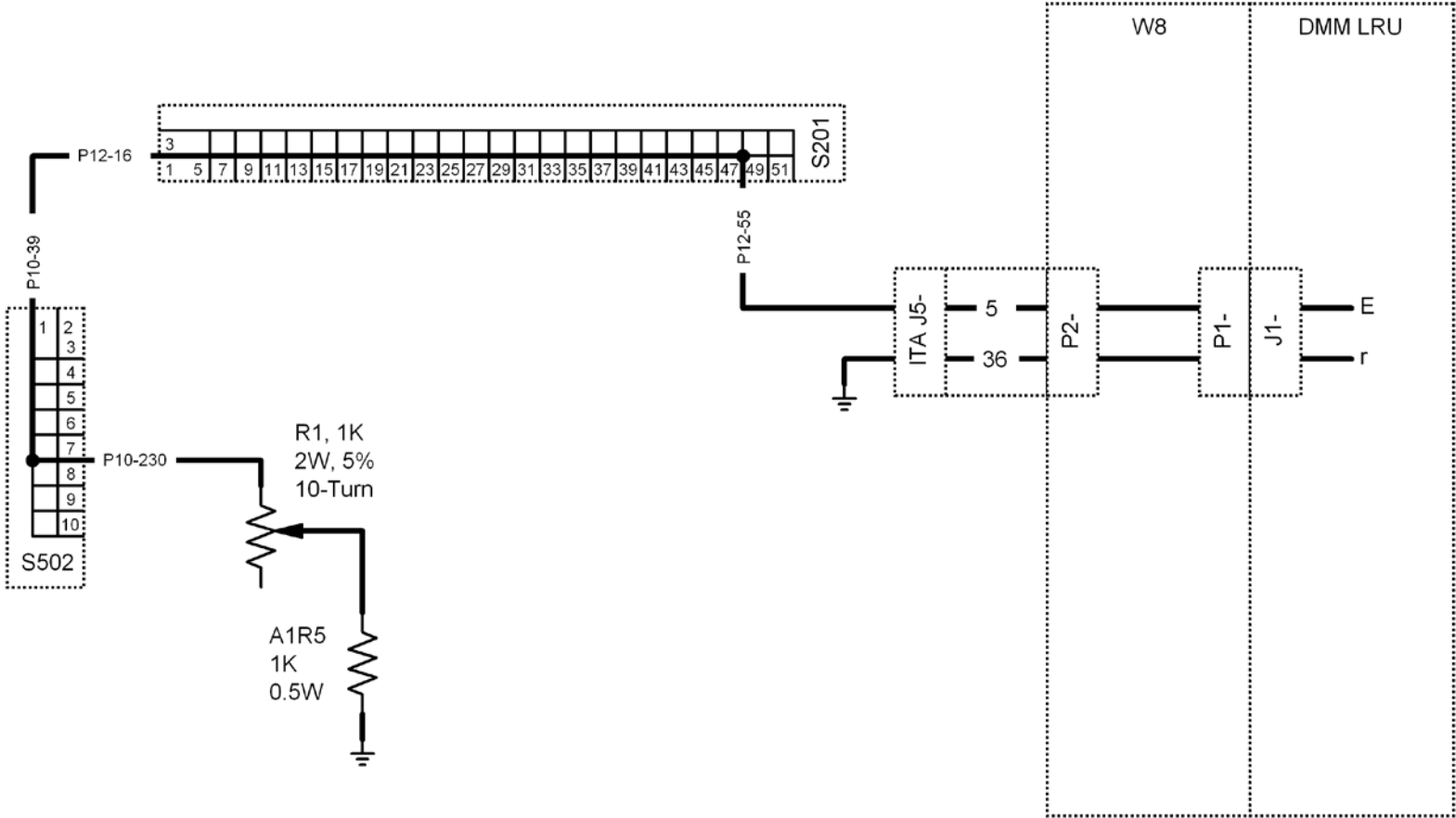
Connection Path as follows:



Step 206 Segments 185-200 at 5.402mA

Test step 206 will use the DMM to monitor an expected resistance of approximately 1824 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1822 and 1826 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-E via switching. The operator will be asked to verify that the Engine Oil Temperature Indicator is between a reading of 290 and 310, which corresponds to between 185 to 200 segments being lit for an approximate value of 310.

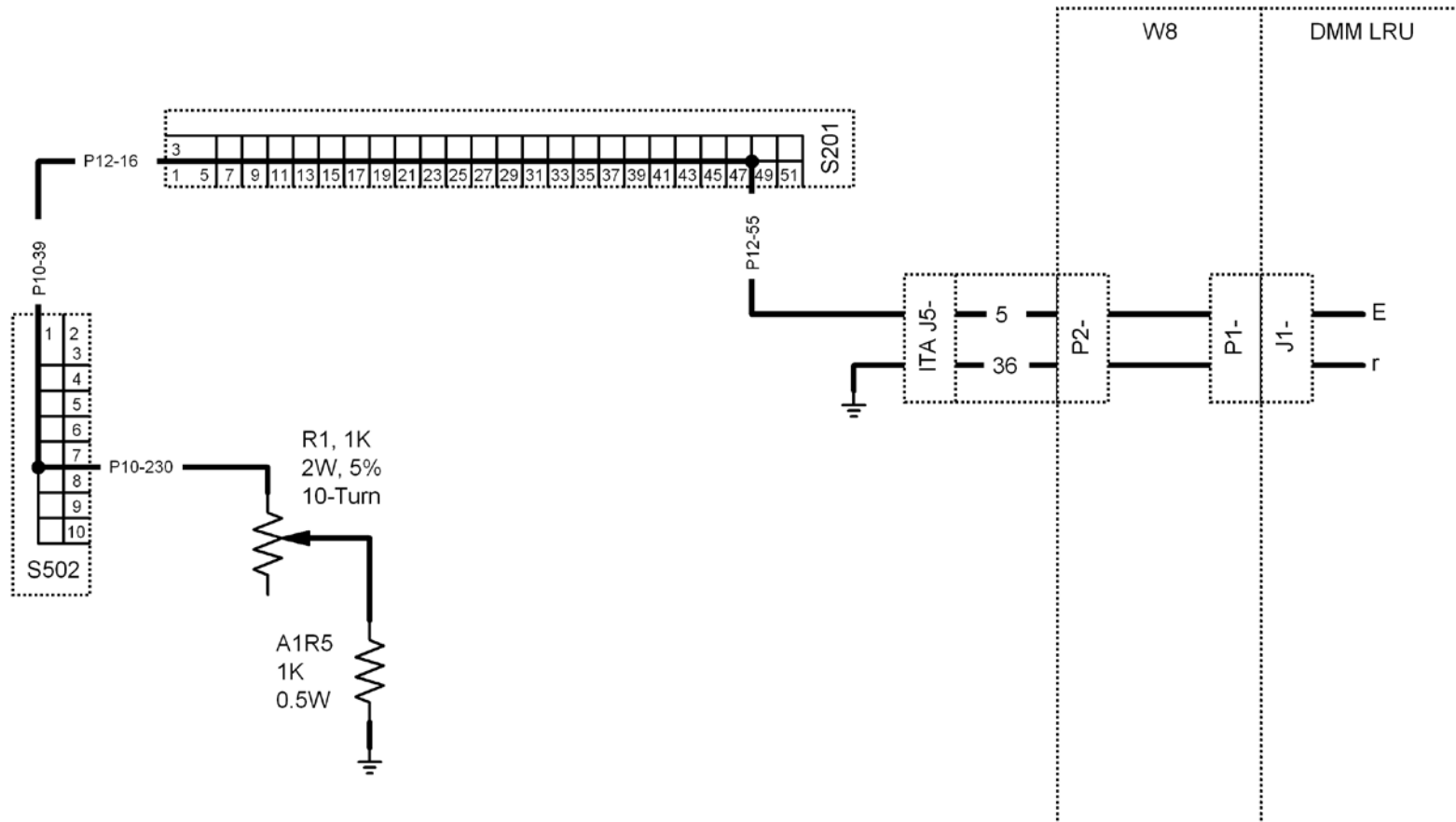
Connection Path as follows:



Step 207 Engine Oil Temp LED On

Test step 207 will use the DMM to monitor an expected resistance of approximately 1722 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1721 and 1723 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-E via switching. The operator will be asked to verify that the Engine Oil Temperature Indicator Warning Lights are blinking.

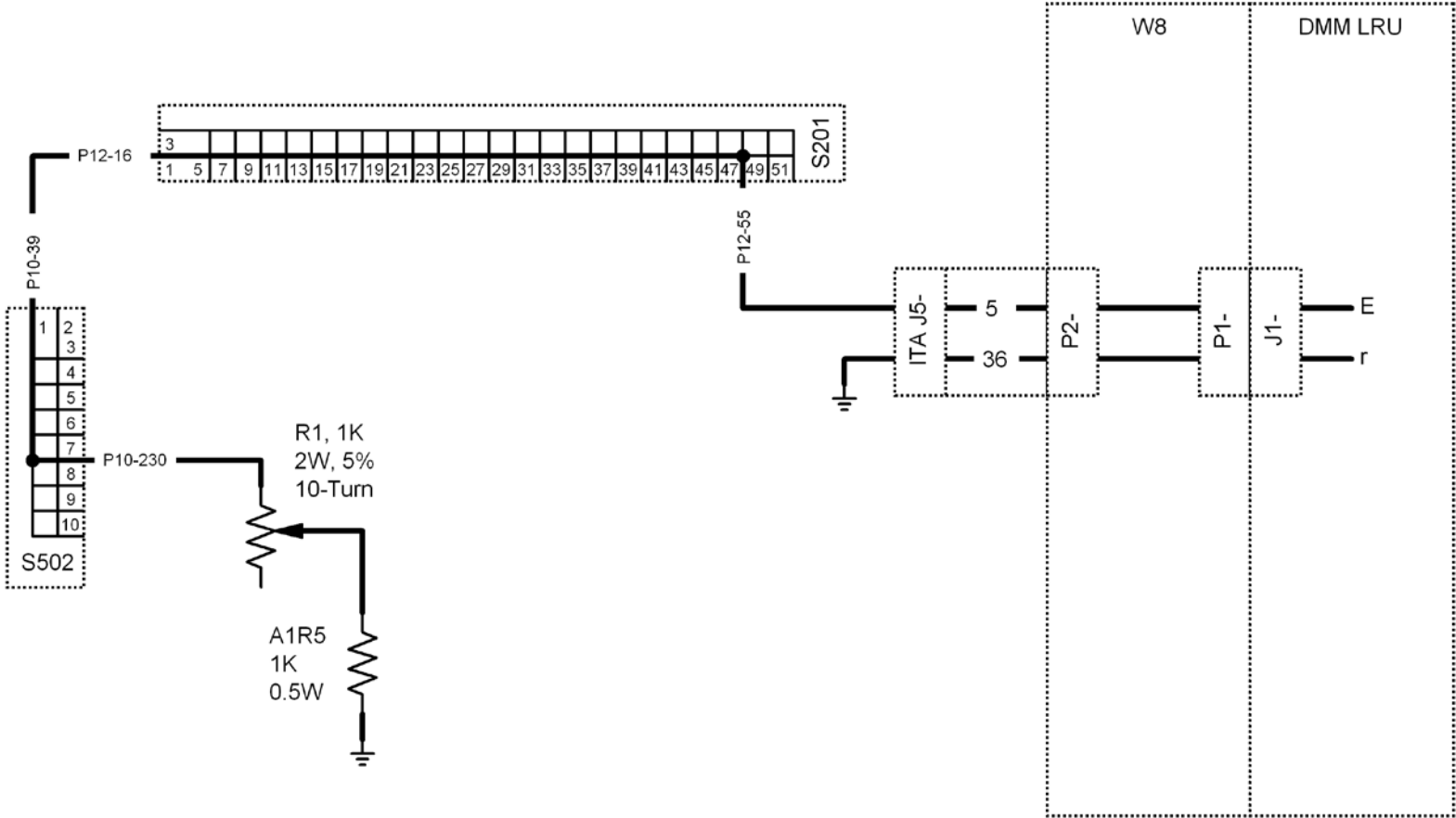
Connection Path as follows:



Step 208 Engine Oil Temp LED Off

Test step 208 will use the DMM to monitor an expected resistance of approximately 1630 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1629 and 1631 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-E via switching. The operator will be asked to verify that the Engine Oil Temperature Indicator Warning Lights are off.

Connection Path as follows:

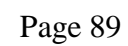


Step 209 7.464mA, XMSN Oil Temp at J1-B

Test steps 209 through 216 will verify that the circuit used to indicate transmission oil temperature is functioning correctly. Starting with step 201, every other step will undergo an adjustment routine before a measurement is taken. These adjustment routines consist of the resistance of potentiometer R1 being monitored by the DMM while the operator adjusts it to within the desired limits.

Specifically test step 209 will use the DMM to monitor an expected resistance of approximately 1210 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1208 and 1212 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-C via switching. The DMM will be used to measure the output at J1-B with a voltage between 0.048 Vdc and 0.067 Vdc.

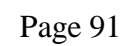
Connection Path as follows:



Step 210 6.271mA, XMSN Oil Temp at J1-B

Test step 210 will use the DMM to monitor an expected resistance of approximately 1517 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1515 and 1519 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-C via switching. The DMM will be used to measure the output at J1-B with a voltage between 0.0738 Vdc and 0.0920 Vdc.

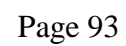
Connection Path as follows:



Step 211 5.402mA, XMSN Oil Temp at J1-B

Test step 211 will use the DMM to monitor an expected resistance of approximately 1824 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1822 and 1826 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-C via switching. The DMM will be used to measure the output at J1-B with a voltage between 0.1004 Vdc and 0.1166 Vdc.

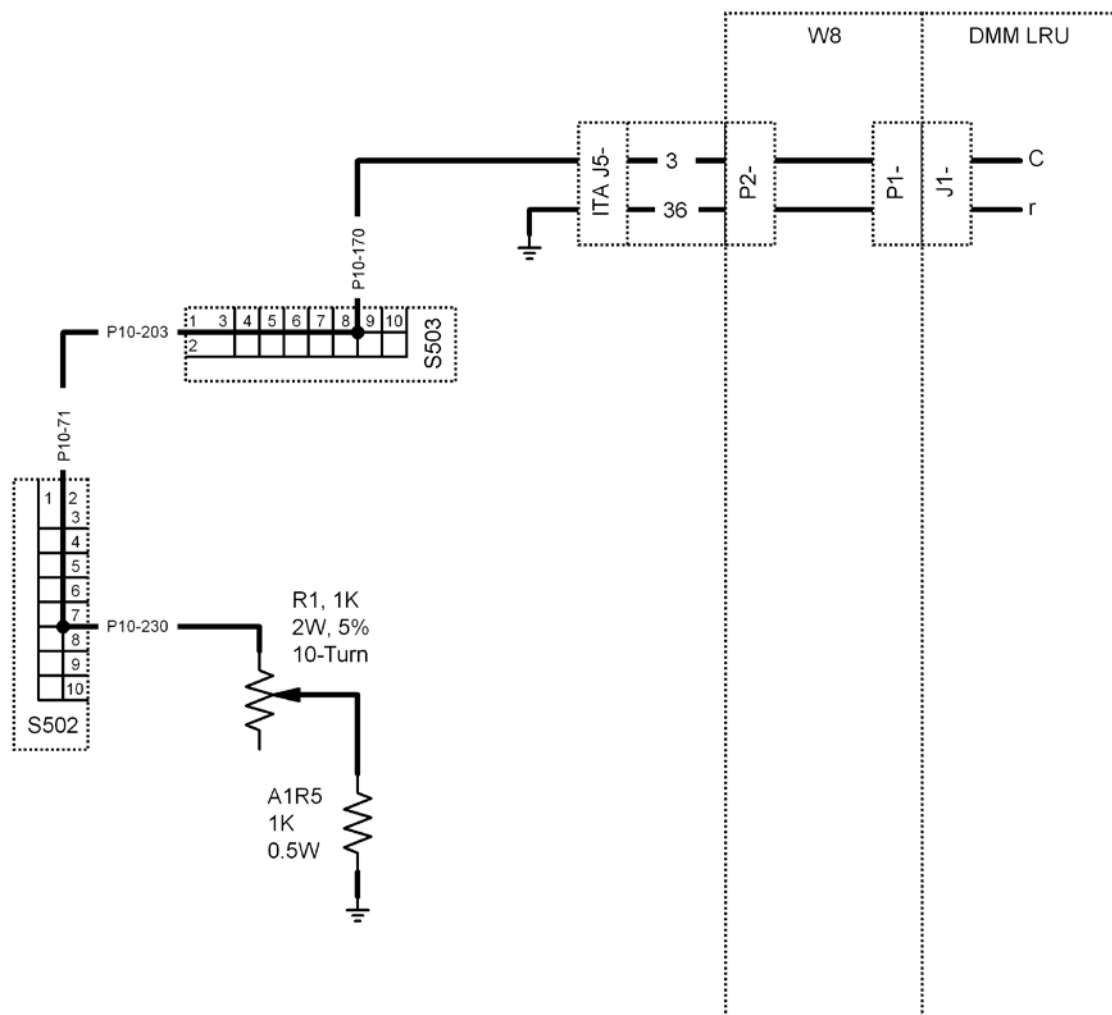
Connection Path as follows:



Step 212 Segments 0-15 at 7.464mA

Test step 212 will use the DMM to monitor an expected resistance of approximately 1210 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1208 and 1212 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-E via switching. The operator will be asked to verify that the Transmission Oil Temperature Indicator is between a reading of 150 and 170, which corresponds to between 0 to 15 segments being lit for an approximate value of 150.

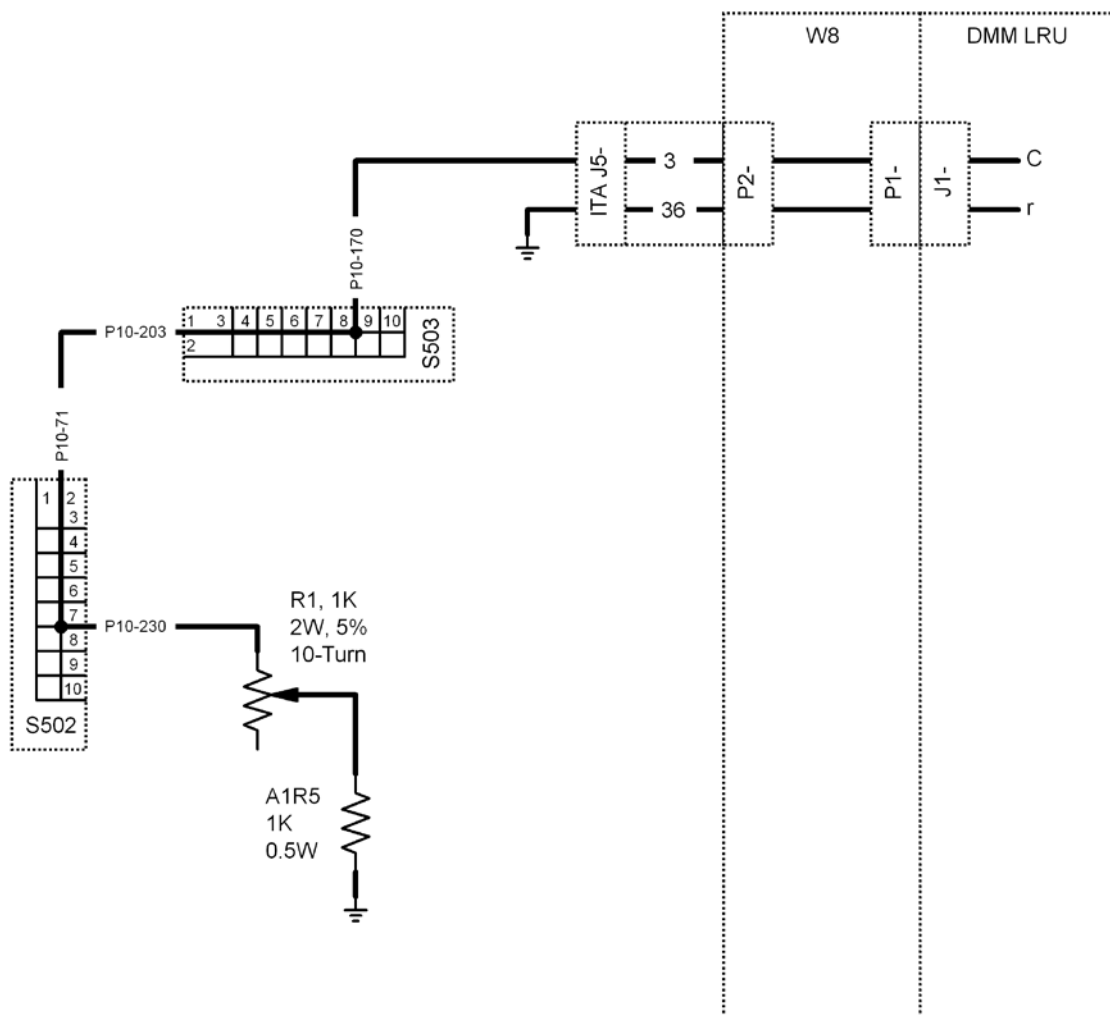
Connection Path as follows:



Step 213 Segments 85-115 at 6.271mA

Test step 213 will use the DMM to monitor an expected resistance of approximately 1517 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1515 and 1519 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-E via switching. The operator will be asked to verify that the Transmission Oil Temperature Indicator is between a reading of 210 and 250, which corresponds to between 85 to 115 segments being lit for an approximate value of 230.

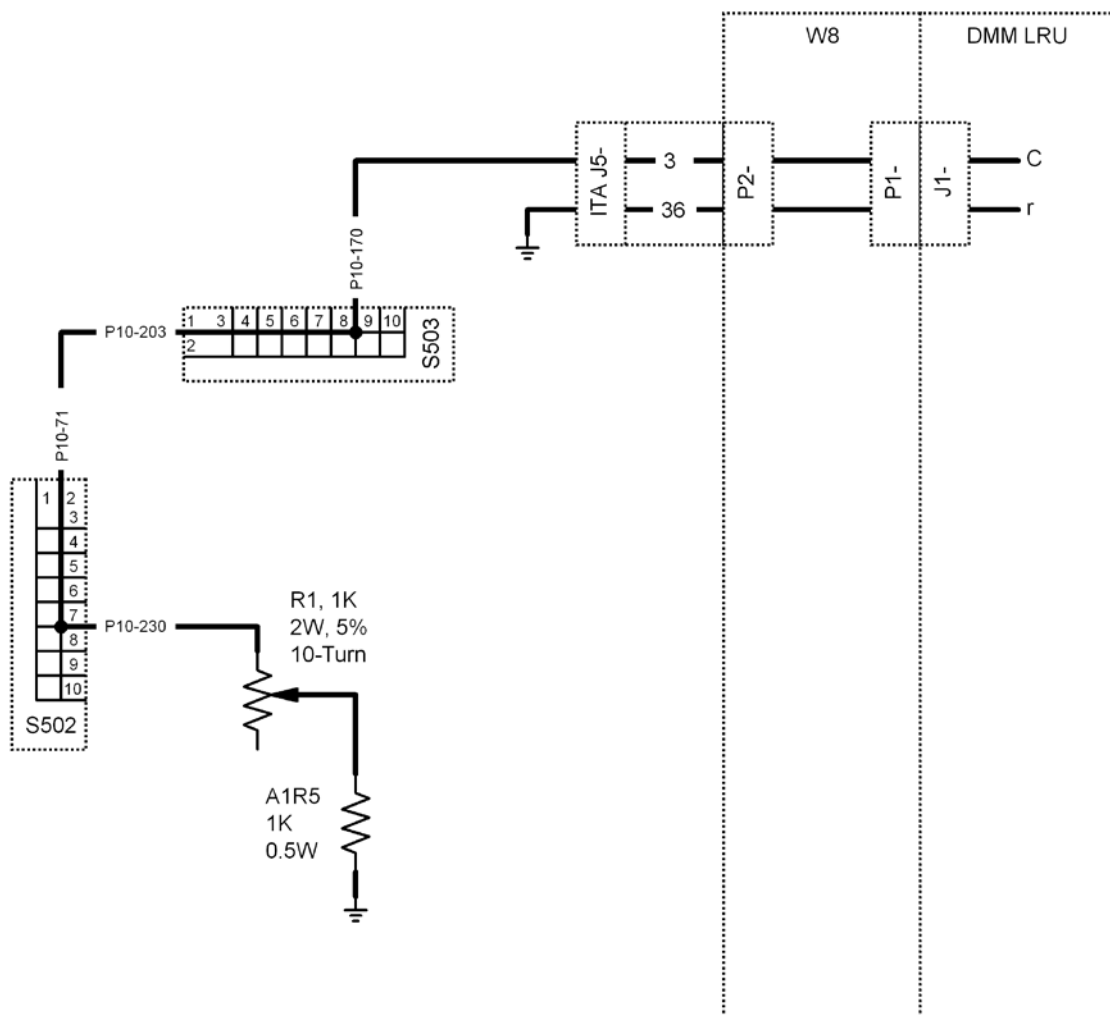
Connection Path as follows:



Step 214 Segments 185-200 at 5.402mA

Test step 214 will use the DMM to monitor an expected resistance of approximately 1824 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1822 and 1826 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-E via switching. The operator will be asked to verify that the Transmission Oil Temperature Indicator is between a reading of 290 and 310, which corresponds to between 185 to 200 segments being lit for an approximate value of 310.

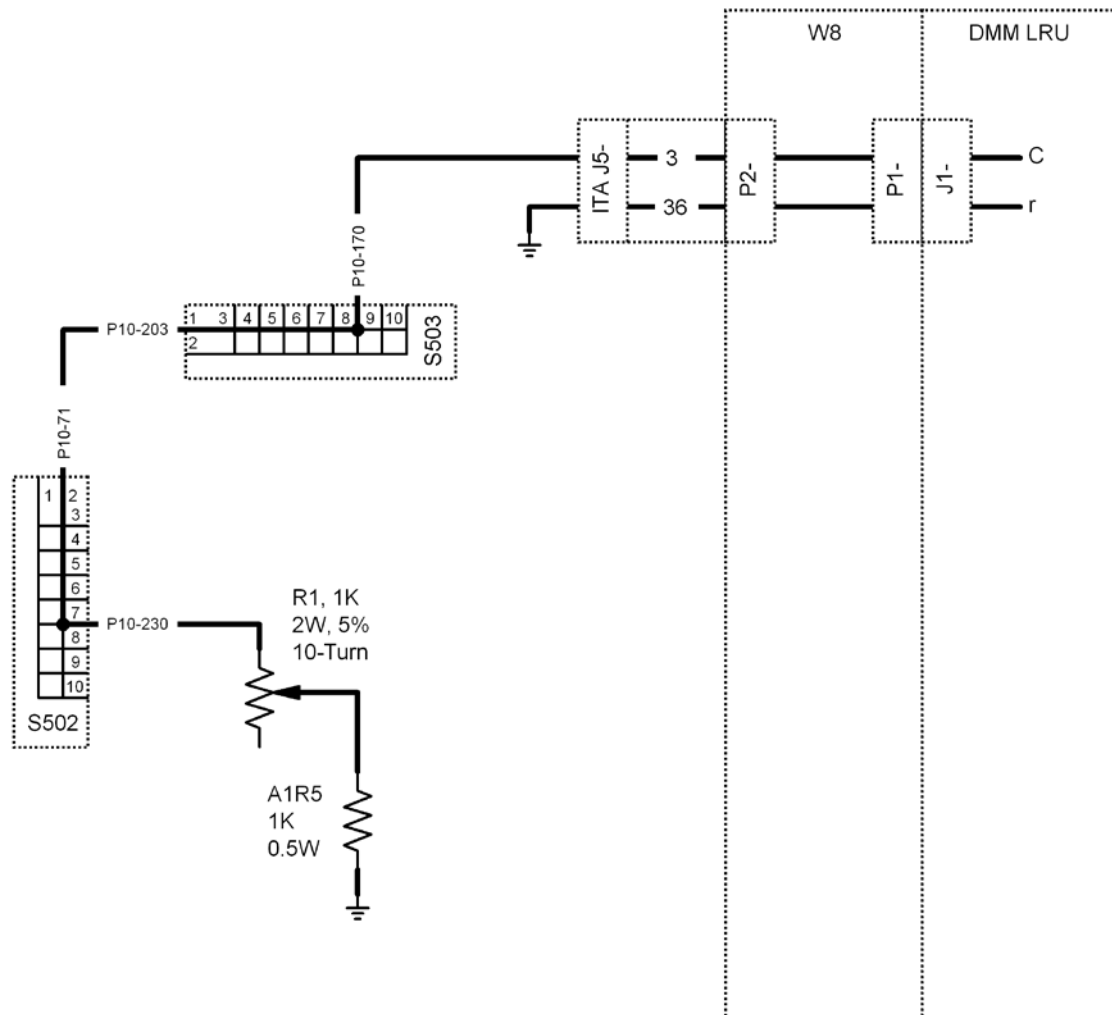
Connection Path as follows:



Step 215 XMSN Oil Temp LED On

Test step 215 will use the DMM to monitor an expected resistance of approximately 1722 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1721 and 1723 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-E via switching. The operator will be asked to verify that the Transmission Oil Temperature Indicator Warning Lights are blinking.

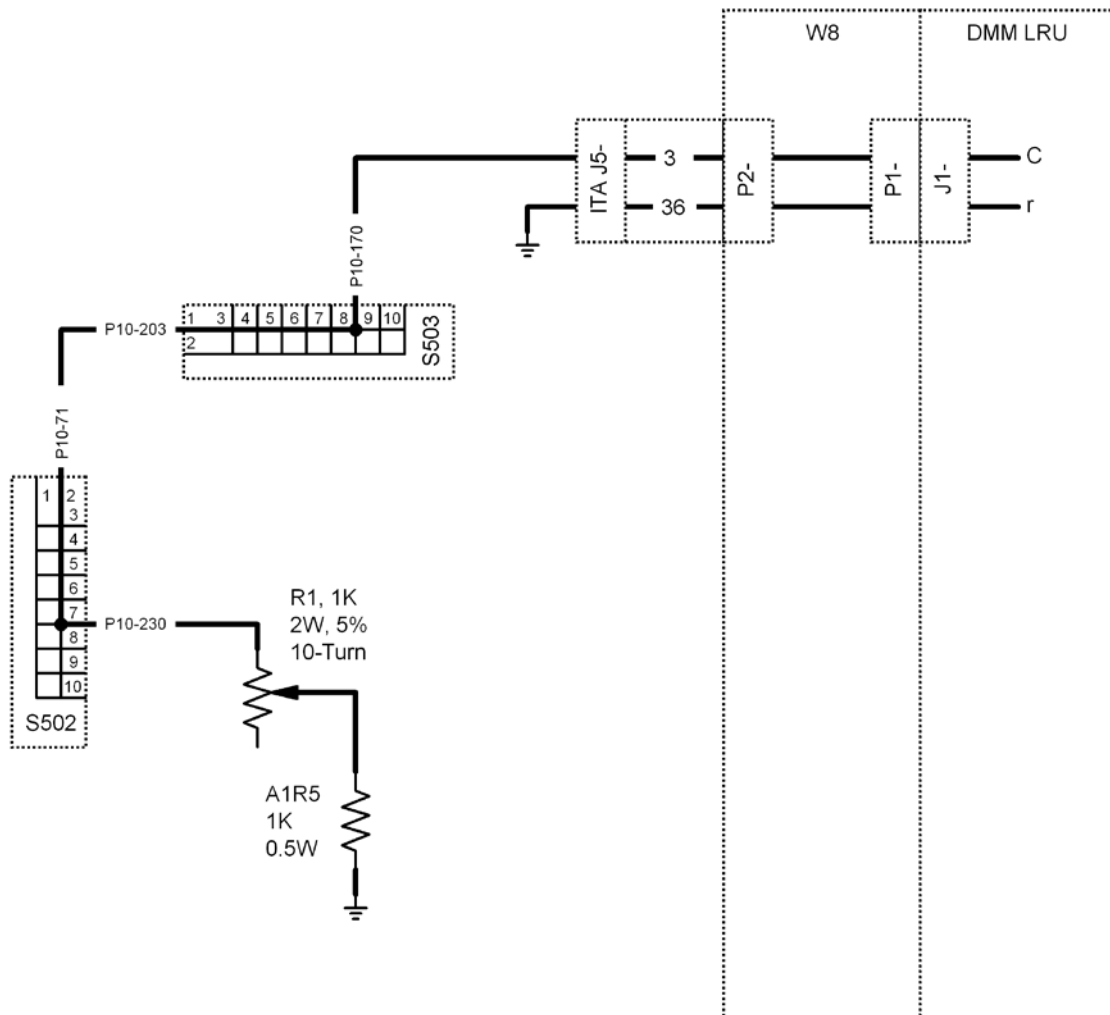
Connection Path as follows:



Step 216 XMSN Oil Temp LED Off

Test step 216 will use the DMM to monitor an expected resistance of approximately 1630 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1629 and 1631 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-E via switching. The operator will be asked to verify that the Transmission Oil Temperature Indicator Warning Lights are off.

Connection Path as follows:

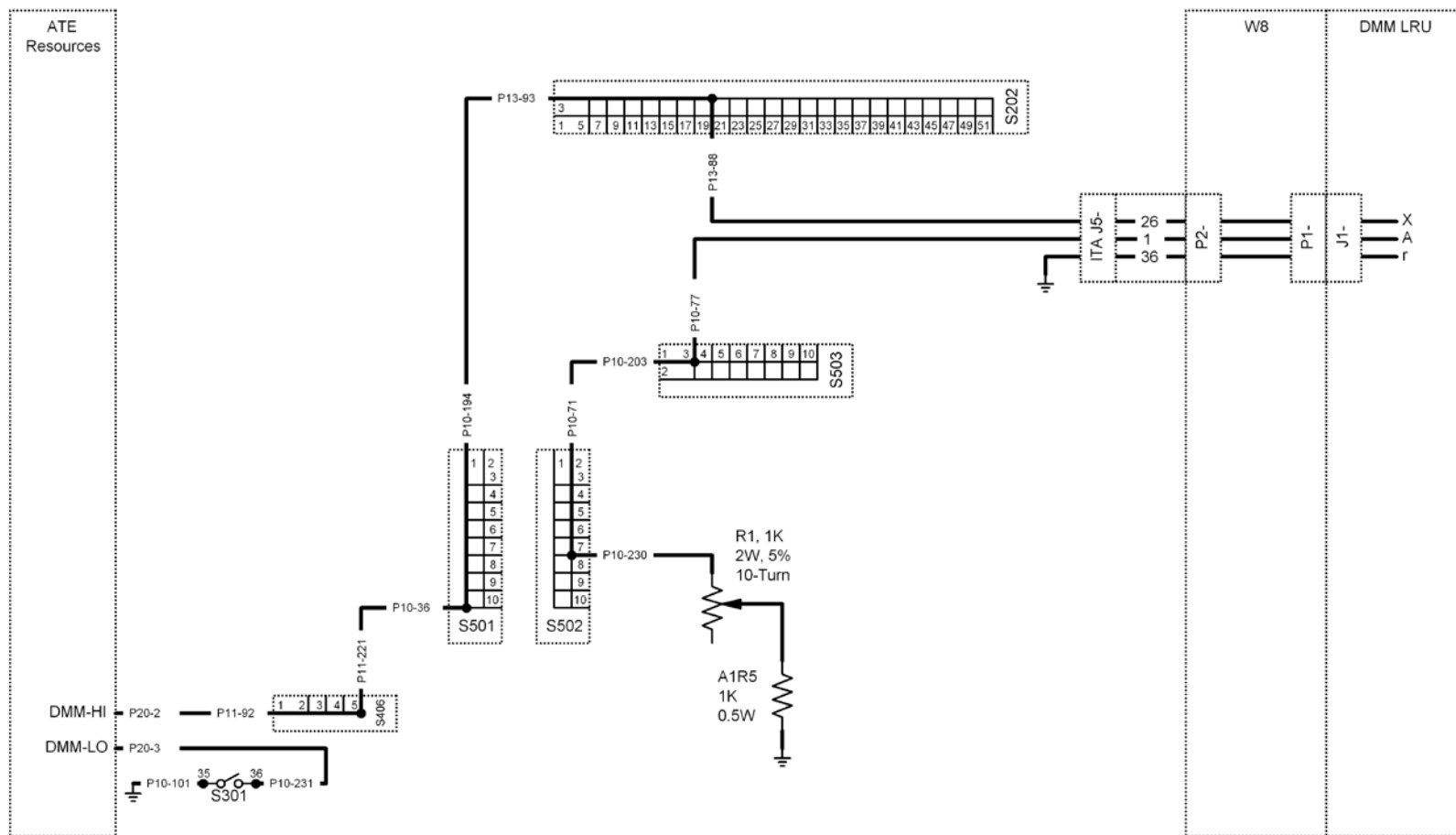


Step 217 7.464mA, Engine Coolant Temp at J1-X

Test steps 217 through 224 will verify that the circuit used to indicate engine coolant temperature is functioning correctly. Starting with step 217, every step will undergo an adjustment routine before a measurement is taken. These adjustment routines consist of the resistance of potentiometer R1 being monitored by the DMM while the operator adjusts it to within the desired limits.

Specifically test step 217 will use the DMM to monitor an expected resistance of approximately 1210 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1208 and 1212 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-A via switching. The DMM will be used to measure the output at J1-X with a voltage between 0.048 Vdc and 0.067 Vdc.

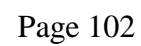
Connection Path as follows:



Step 218 6.676mA, Engine Coolant Temp at J1-X

Test step 218 will use the DMM to monitor an expected resistance of approximately 1399 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1397 and 1401 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-A via switching. The DMM will be used to measure the output at J1-X with a voltage between 0.643 Vdc and 0.820 Vdc.

Connection Path as follows:

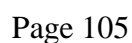


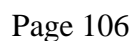
Step 219 6.043mA, Engine Coolant Temp at J1-X

Test step 219 will use the DMM to monitor an expected resistance of approximately 1588 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1586 and 1590 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-A via switching. The DMM will be used to measure the output at J1-X with a voltage between 0.0804 Vdc and 0.0963 Vdc.

Connection Path as follows:



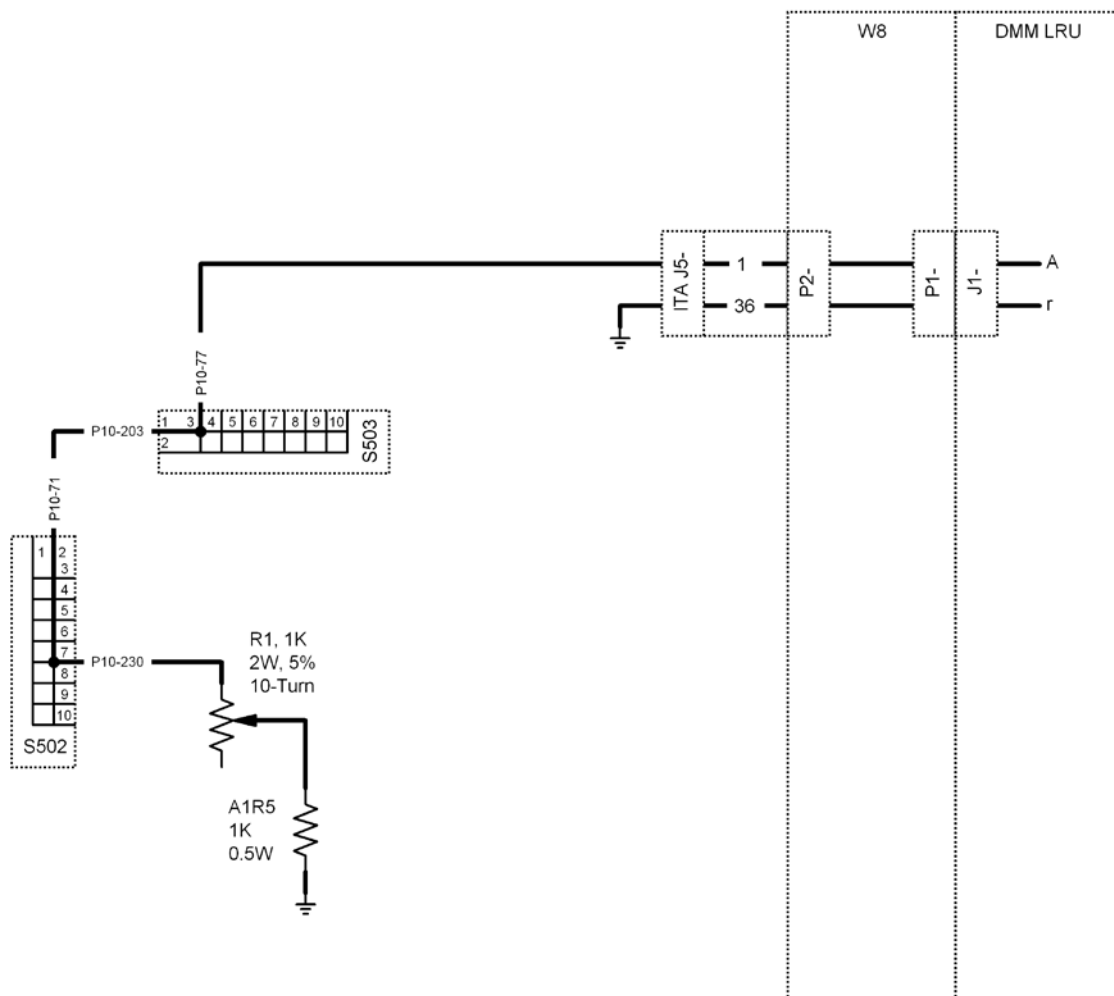




Step 222 Segments 185-200 at 6.043mA

Test step 222 will use the DMM to monitor an expected resistance of approximately 1588 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1586 and 1590 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-A via switching. The operator will be asked to verify that the Engine Water Temperature Indicator is between a reading of 237.5 and 250, which corresponds to between 185 to 200 segments being lit for an approximate value of 250.

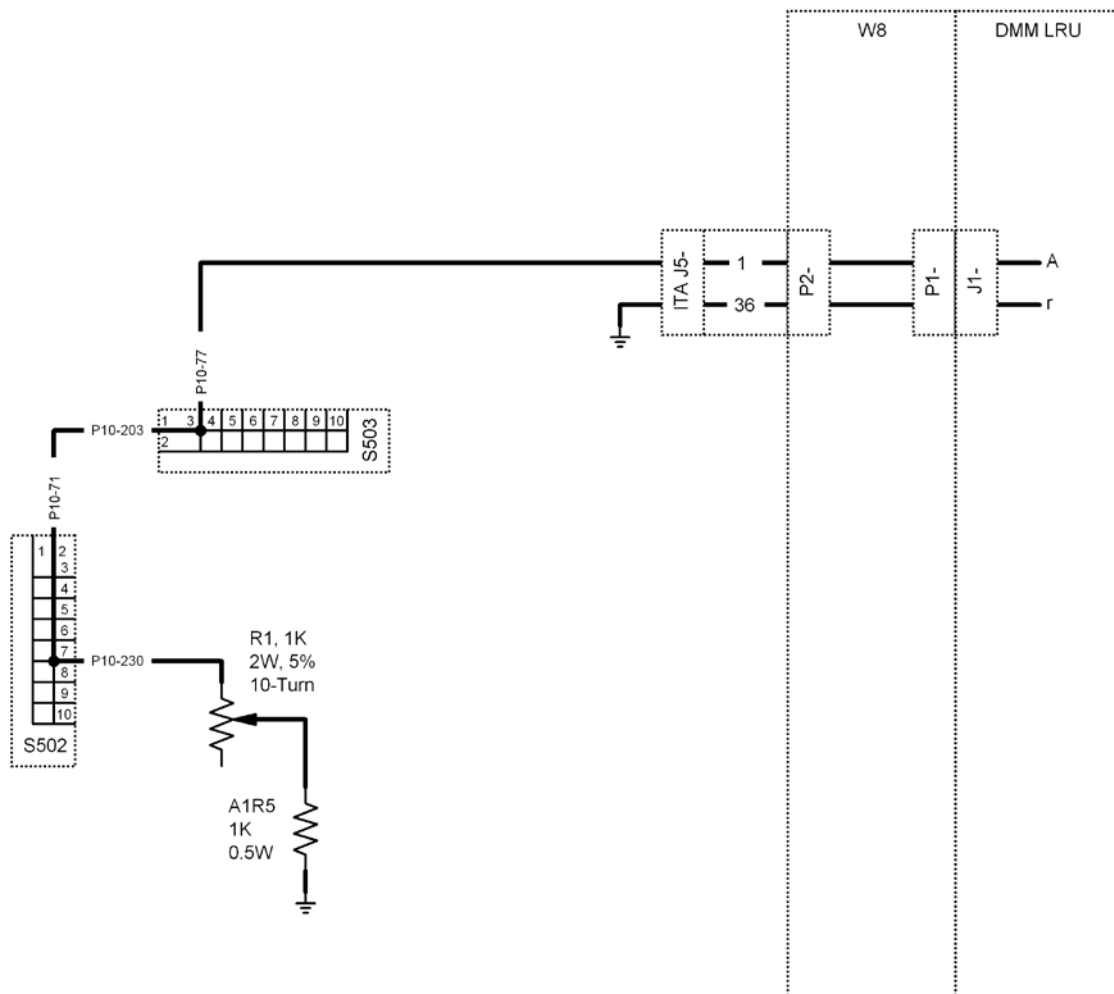
Connection Path as follows:



Step 223 Engine Coolant Temp LED On

Test step 223 will use the DMM to monitor an expected resistance of approximately 1471 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1470 and 1472 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-A via switching. The operator will be asked to verify that the Engine Water Temperature Indicator Warning Lights are blinking.

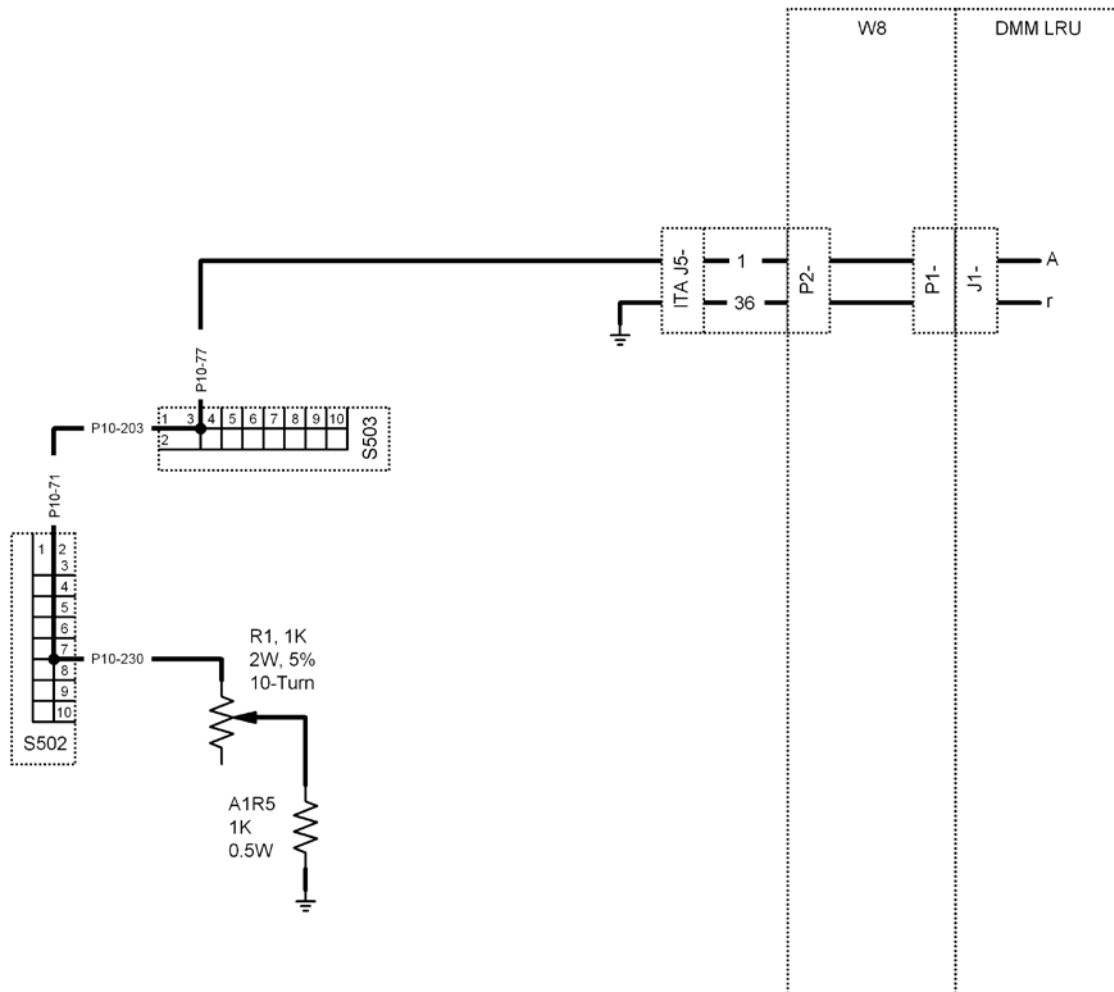
Connection Path as follows:



Step 224 Engine Coolant Temp LED Off

Test step 224 will use the DMM to monitor an expected resistance of approximately 1384 Ohms and the potentiometer will be adjusted by the operator until a measurement is between 1384 and 1385 Ohms. Once the adjustment has been completed the adjusted resistor will be applied to J1-A via switching. The operator will be asked to verify that the Engine Water Temperature Indicator Warning Lights are off.

Connection Path as follows:

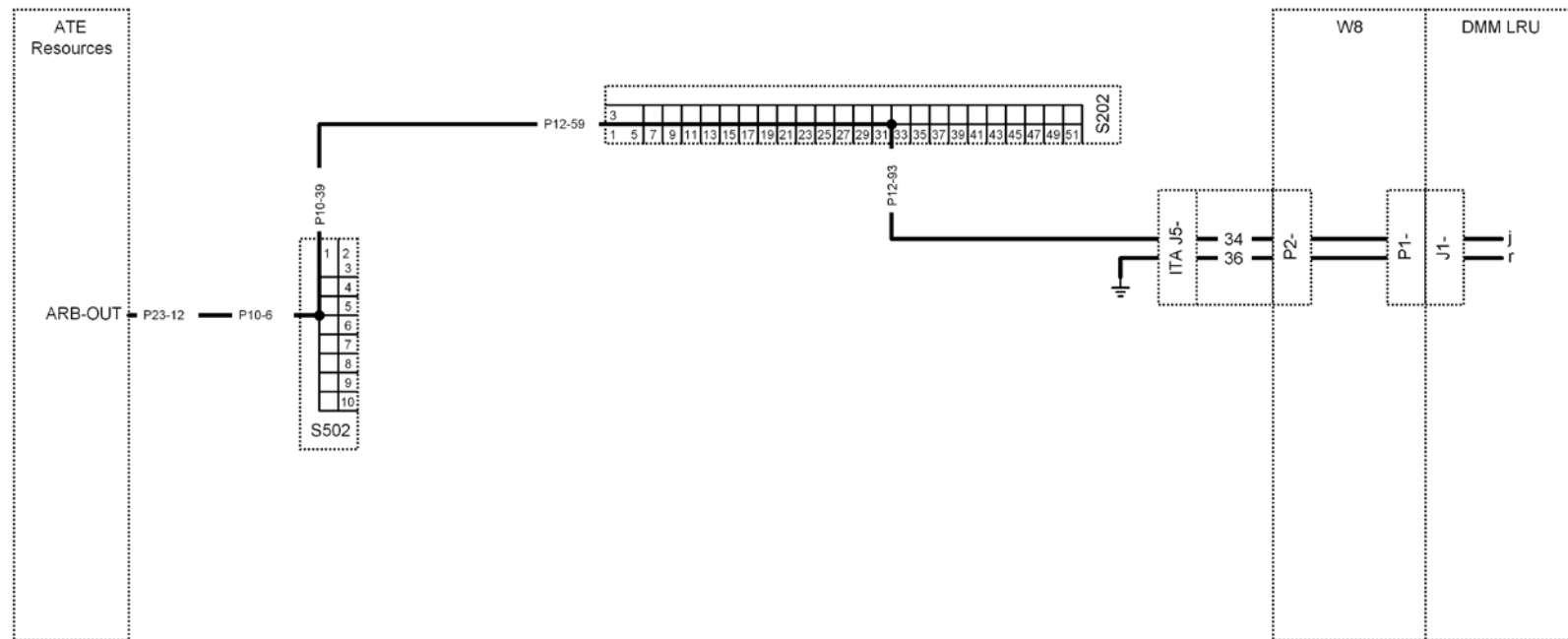


Step 225 Segments 0-15 at 25.831mA

Test steps 225 through 227 will verify that the circuit used to indicate fuel level is functioning correctly. Starting with step 225, every step will undergo an adjustment routine before a measurement is taken. These adjustment routines consist of the input voltage being changed using the DC function of the ARB. The output from the ARB will be switched to the CCA input via J1-j. In conjunction with the ARB, the DMM will be connected to verify that the correct voltage is being sourced by the ARB. The DMM will first verify the input voltage and then be switched to verify voltage from the output. This connection diagram is located in Appendix A titled ARB4 for test steps 225, 226, and 227.

Specifically test step 225 will apply -0.6465 Vdc at J1-j via the ARB. The DMM will be used to measure an expected voltage of approximately 0 Vdc and the ARB input will be adjusted until a measurement is between -0.01 and +0.01 Vdc. Once the adjustment has been completed the adjusted voltage will be applied to J1-j via the ARB. The operator will be asked to verify that the Fuel Level Indicator is between a reading of E and 1/8, which corresponds to between 0 to 15 segments being lit for an approximate value of E.

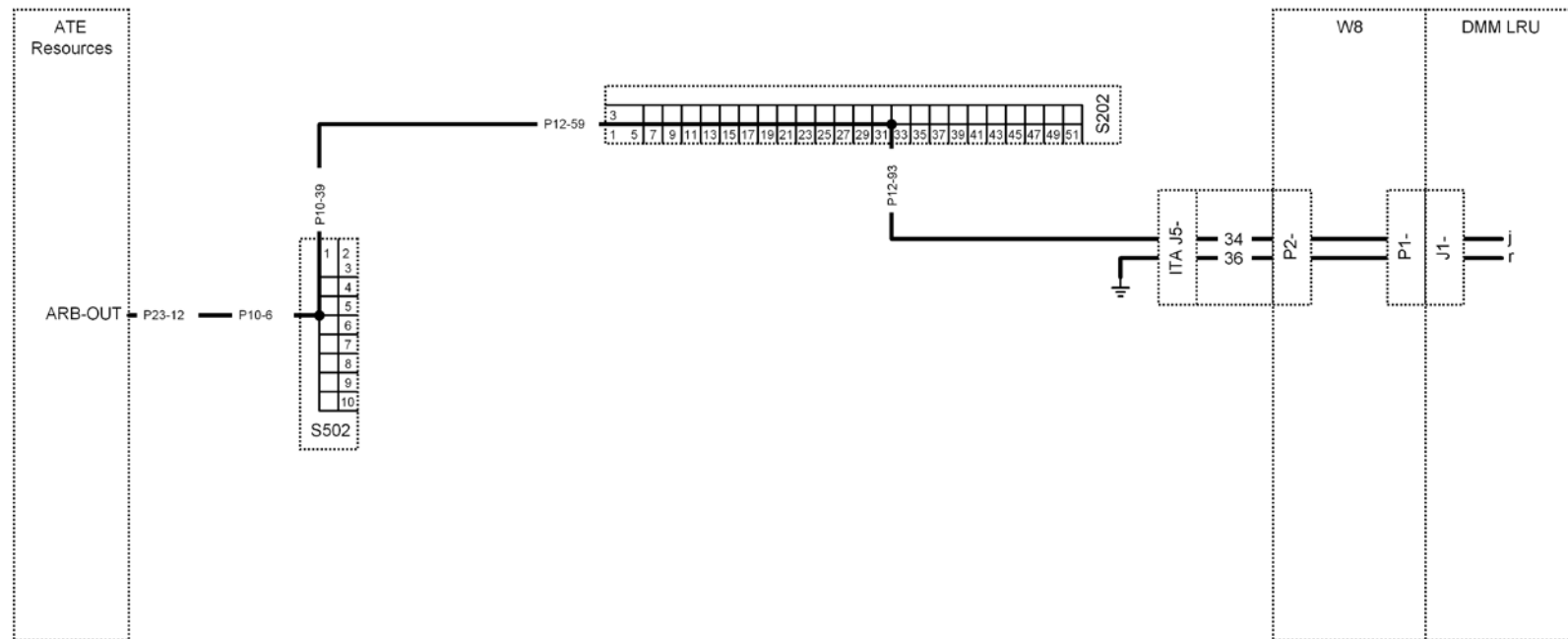
Connection Path as follows:



Step 226 Segments 85-115 at 25.037mA

Test step 226 will apply -0.4385 Vdc at J1-j via the ARB. The DMM will be used to measure an expected voltage of approximately 0.376 Vdc and the ARB input will be adjusted until a measurement is between 0.3736 Vdc and 0.3784 Vdc. Once the adjustment has been completed the adjusted voltage will be applied to J1-j via the ARB. The operator will be asked to verify that the Fuel Level Indicator is between a reading of 3/8 and 5/8, which corresponds to between 85 and 115 segments being lit for an approximate value of 1/2.

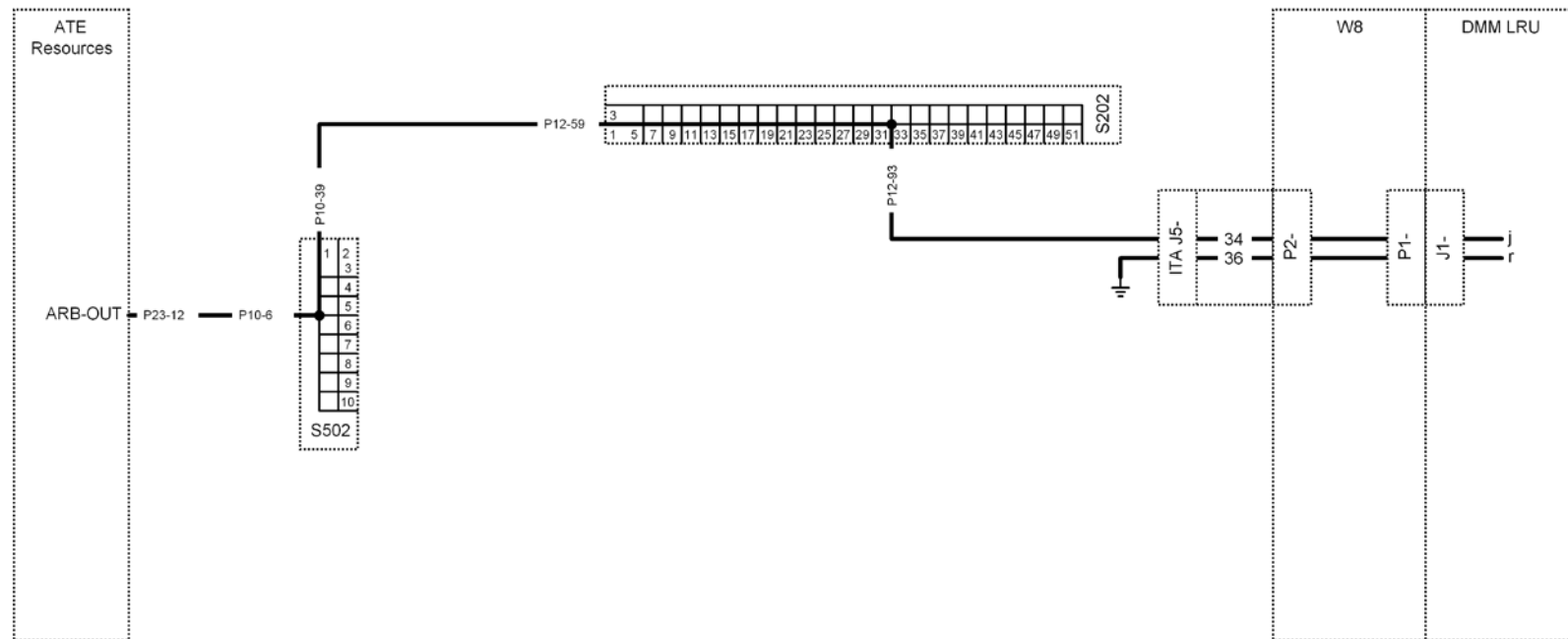
Connection Path as follows:



Step 227 Segments 185-200 at 24.277mA

Test step 227 will apply -0.2425 Vdc at J1-j via the ARB. The DMM will be used to measure an expected voltage of approximately 0.729 Vdc and the ARB input will be adjusted until a measurement is between 0.7267 Vdc and 0.7313 Vdc. Once the adjustment has been completed the adjusted voltage will be applied to J1-j via the ARB. The operator will be asked to verify that the Fuel Level Indicator is between a reading of 7/8 and F, which corresponds to between 185 and 200 segments being lit for an approximate value of F.

Connection Path as follows:



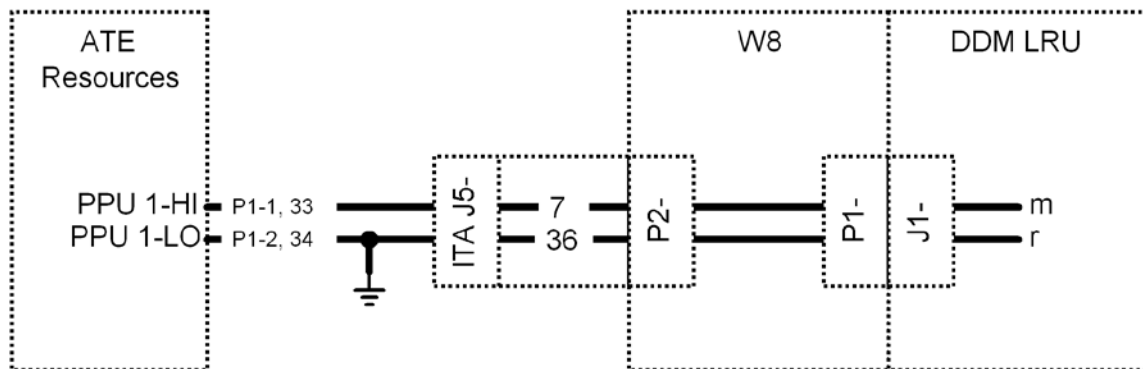
MODULE 3 VEHICLE VOLTAGE CHANNEL TESTS

Module 3 verifies that the circuit used to indicate battery voltage is functioning correctly by changing the supply voltage to different voltage levels and having the operator verify that the correct voltage levels, and warning when applicable, are displayed.

Step 301 Segments 35-65 at 21V

Test step 301 will change the PPU1 voltage to +21.0 Vdc. The operator will be asked to verify that the Battery Voltage Indicator is between a reading of 19.5 and 22.5, which corresponds to between 35 and 65 segments being lit for an approximate value of 21.

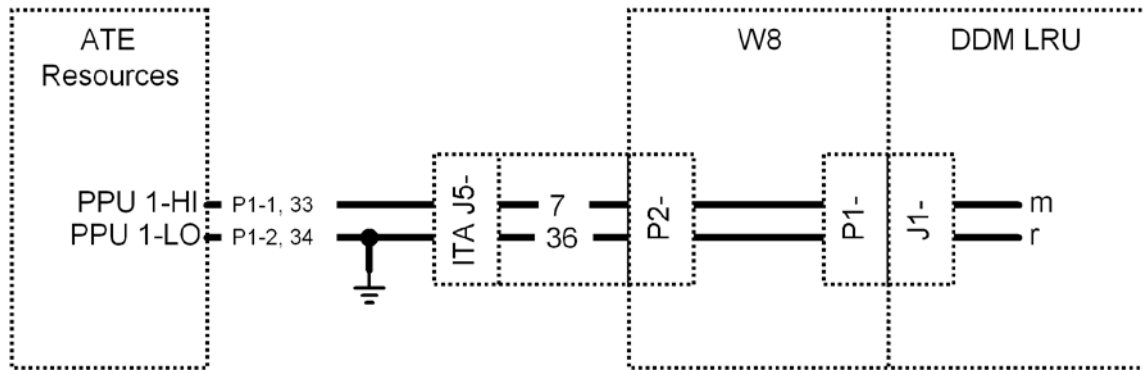
Connection Path as follows:



Step 302 Segments 85-115 at 24V

Test step 302 will change the PPU1 voltage to +24.0 Vdc. The operator will be asked to verify that the Battery Voltage Indicator is between a reading of 22.5 and 25.5, which corresponds to between 85 and 115 segments being lit for an approximate value of 24.

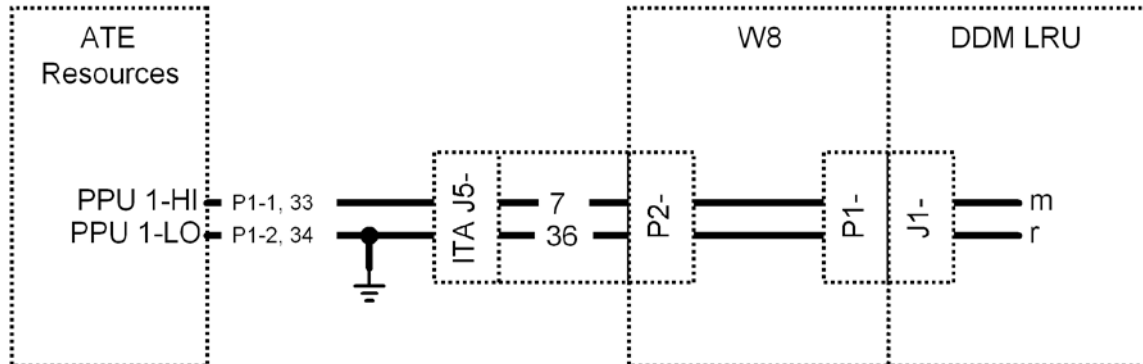
Connection Path as follows:



Step 303 Segments 135-165 at 27V

Test step 303 will change the PPU1 voltage to +27.0 Vdc. The operator will be asked to verify that the Battery Voltage Indicator is between a reading of 25.5 and 28.5, which corresponds to between 135 and 165 segments being lit for an approximate value of 27.

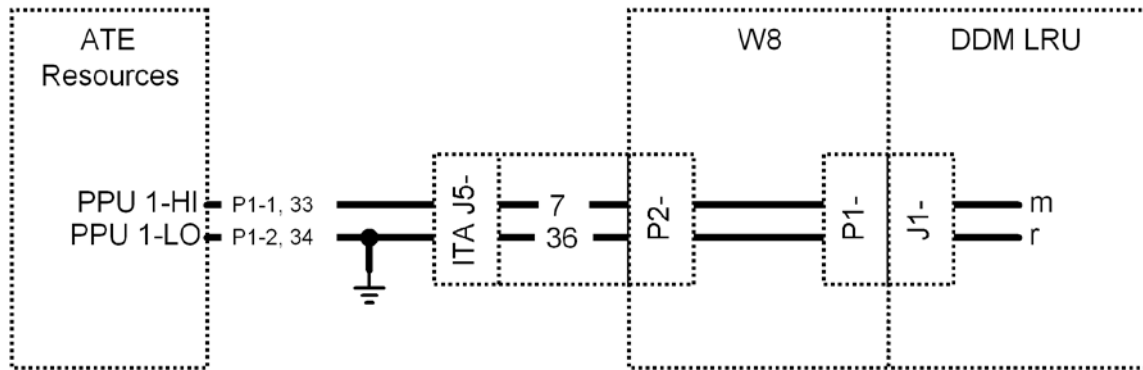
Connection Path as follows:



Step 304 Segments 185-200 at 30V

Test step 304 will change the PPU1 voltage to +30.0 Vdc. The operator will be asked to verify that the Battery Voltage Indicator is between a reading of 28.5 and 30, which corresponds to between 185 and 200 segments being lit for an approximate value of 30.

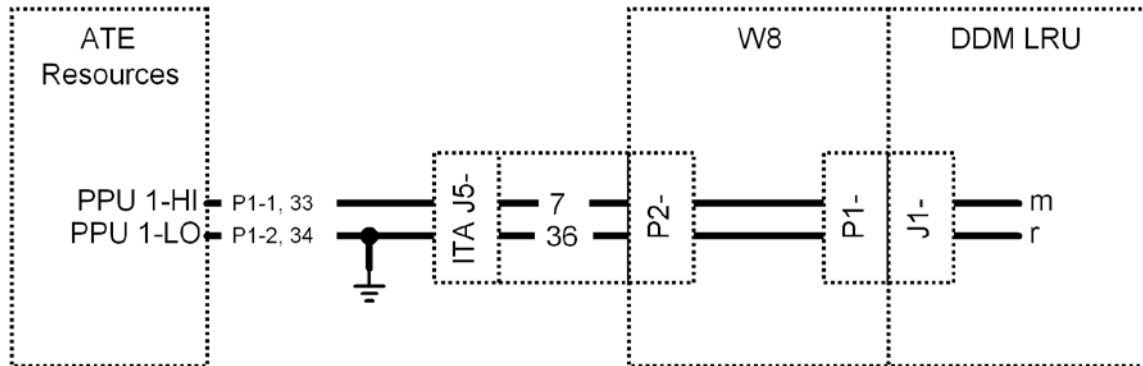
Connection Path as follows:



Step 305 28V-34V, Voltage Battery LED Blinking

Test step 305 will change the PPU1 voltage to +34.0 Vdc. The operator will be asked to verify that the Battery Voltage Warning Lights are blinking.

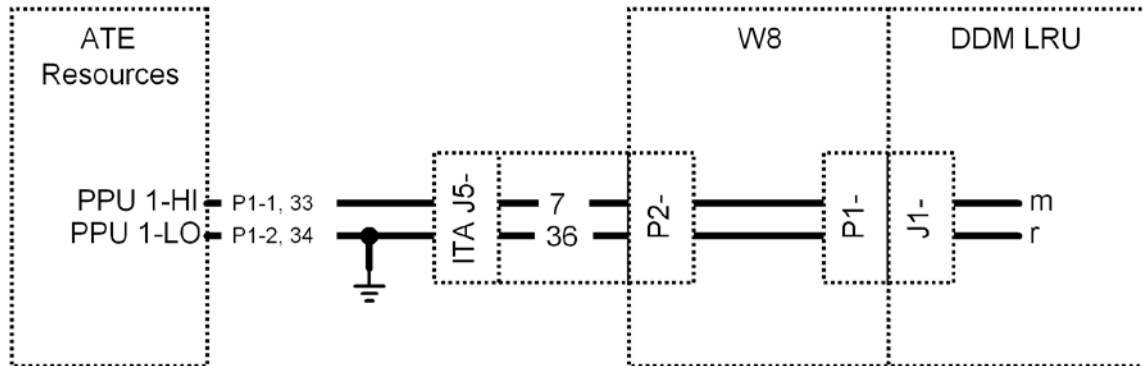
Connection Path as follows:



Step 306 34V-28V, Voltage Battery LED Off

Test step 306 will change the PPU1 voltage to +28.0 Vdc. The operator will be asked to verify that the Battery Voltage Warning Lights are off.

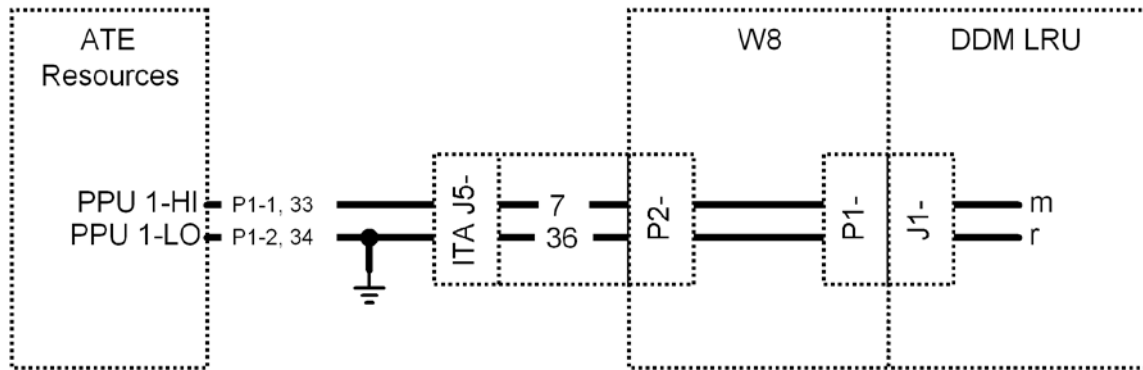
Connection Path as follows:



Step 307 24V-19V, Voltage Battery LED Blinking

Test step 307 will change the PPU1 voltage to +19.0 Vdc. The operator will be asked to verify that the Battery Voltage Warning Lights are blinking.

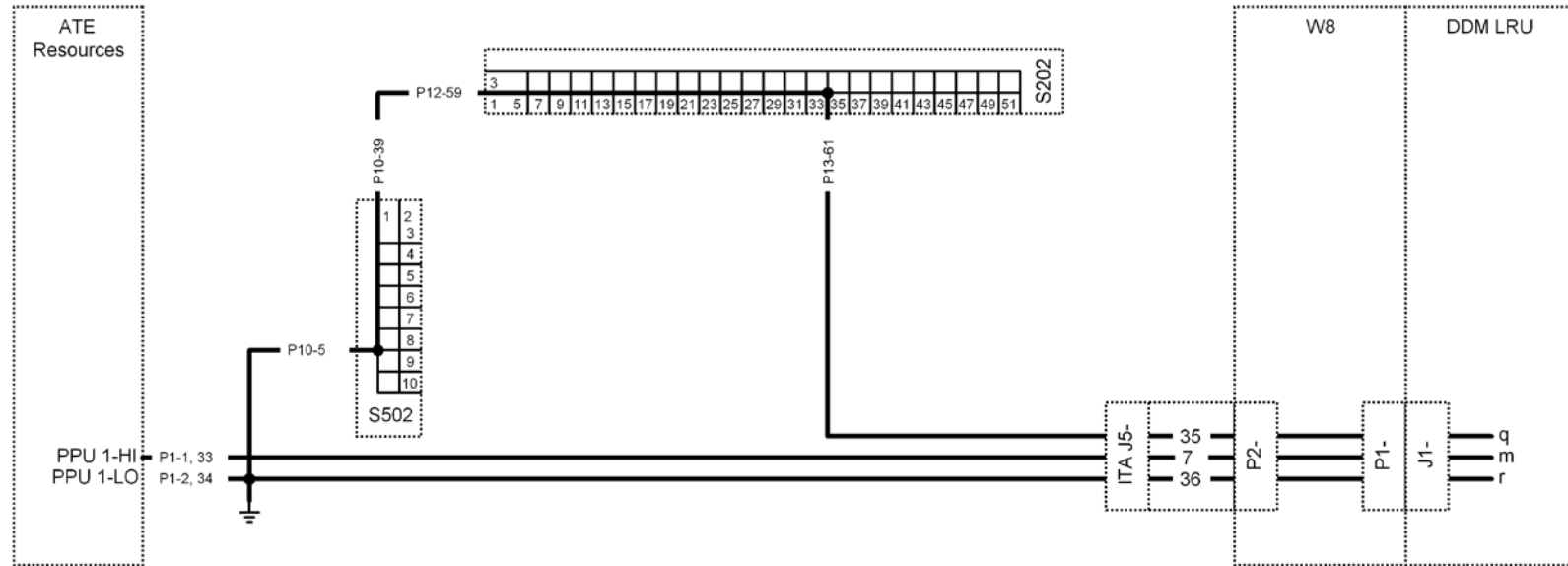
Connection Path as follows:



Step 308 24V-19V, Voltage Battery LED On

Test step 308 will hold the PPU1 voltage at +19.0 Vdc and will apply GND to J1-q. The operator will be asked to verify that the Battery Voltage Warning Lights are on solid and not blinking.

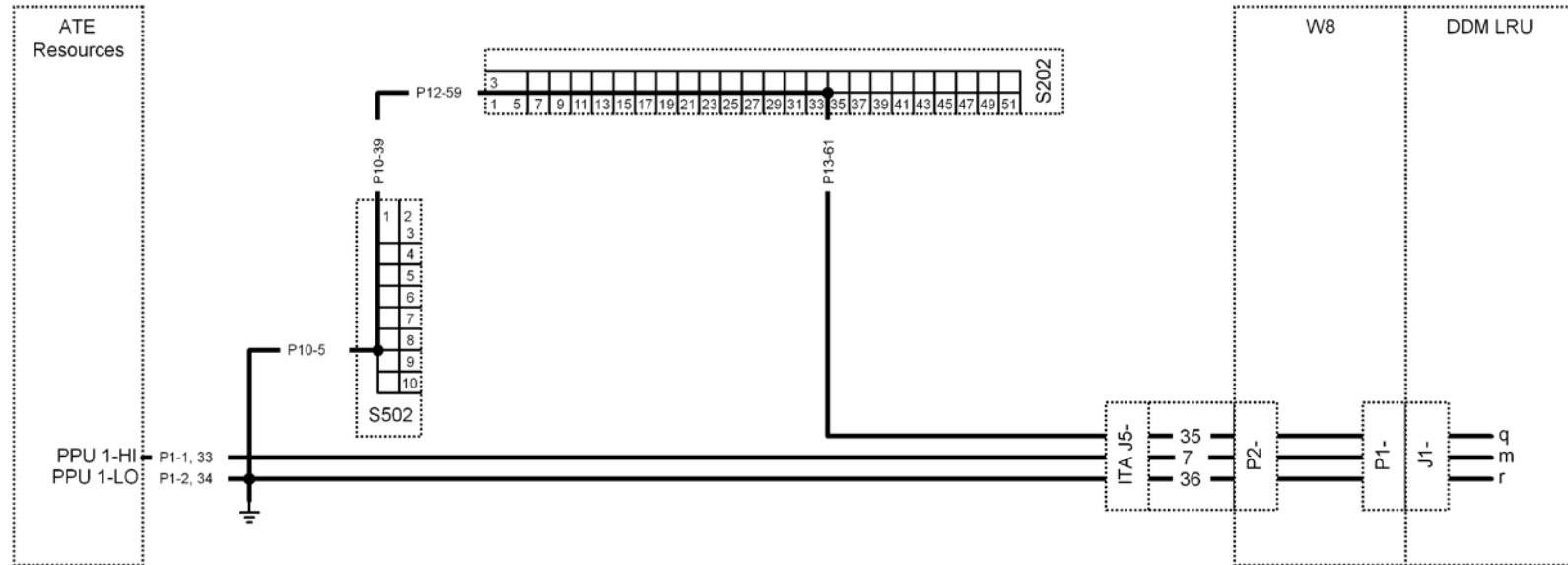
Connection Path as follows:



Step 309 19V-24V, Voltage Battery LED Off

Test step 309 will change the PPU1 voltage to +24.0 Vdc. The operator will be asked to verify that the Battery Voltage Warning Lights are off.

Connection Path as follows:



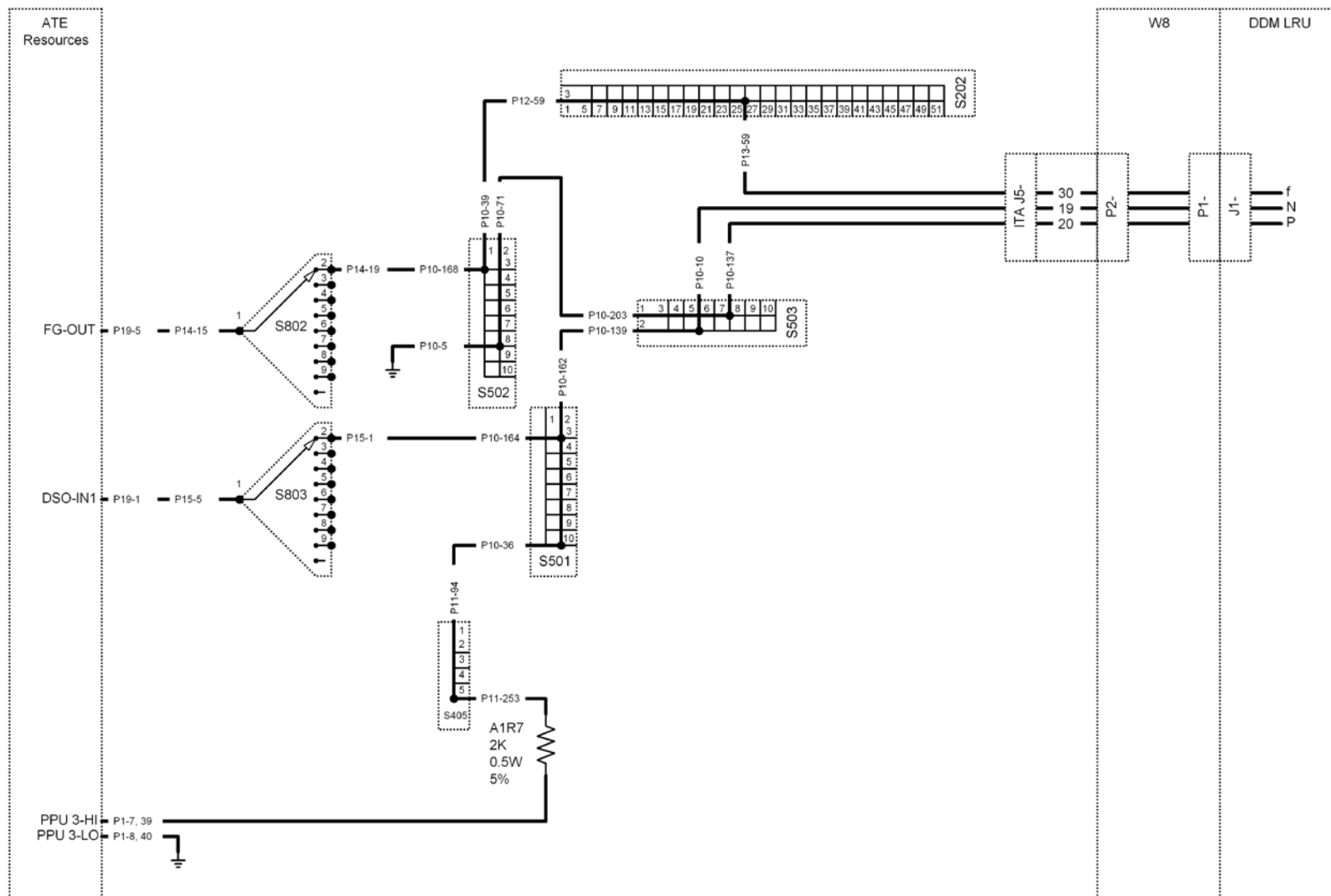
MODULE 4 ENGINE SPEED CIRCUIT TESTS

Module 4 will verify that the engine speed circuit is functioning correctly by measuring the amplitude, minimum, and pulse width of the output signal.

Step 401 Engine Speed Amplitude

Test step 401 will verify the engine speed amplitude is correct by applying a 20 Hz 500 mVpp square-wave signal to J1-f via the FG. A +28V (2 kohm) pull-up resistor will be applied to the open-collector output J1-N. The DSO will be used to measure the output at J1-N with a peak to peak voltage of greater than 27.0 Vpp.

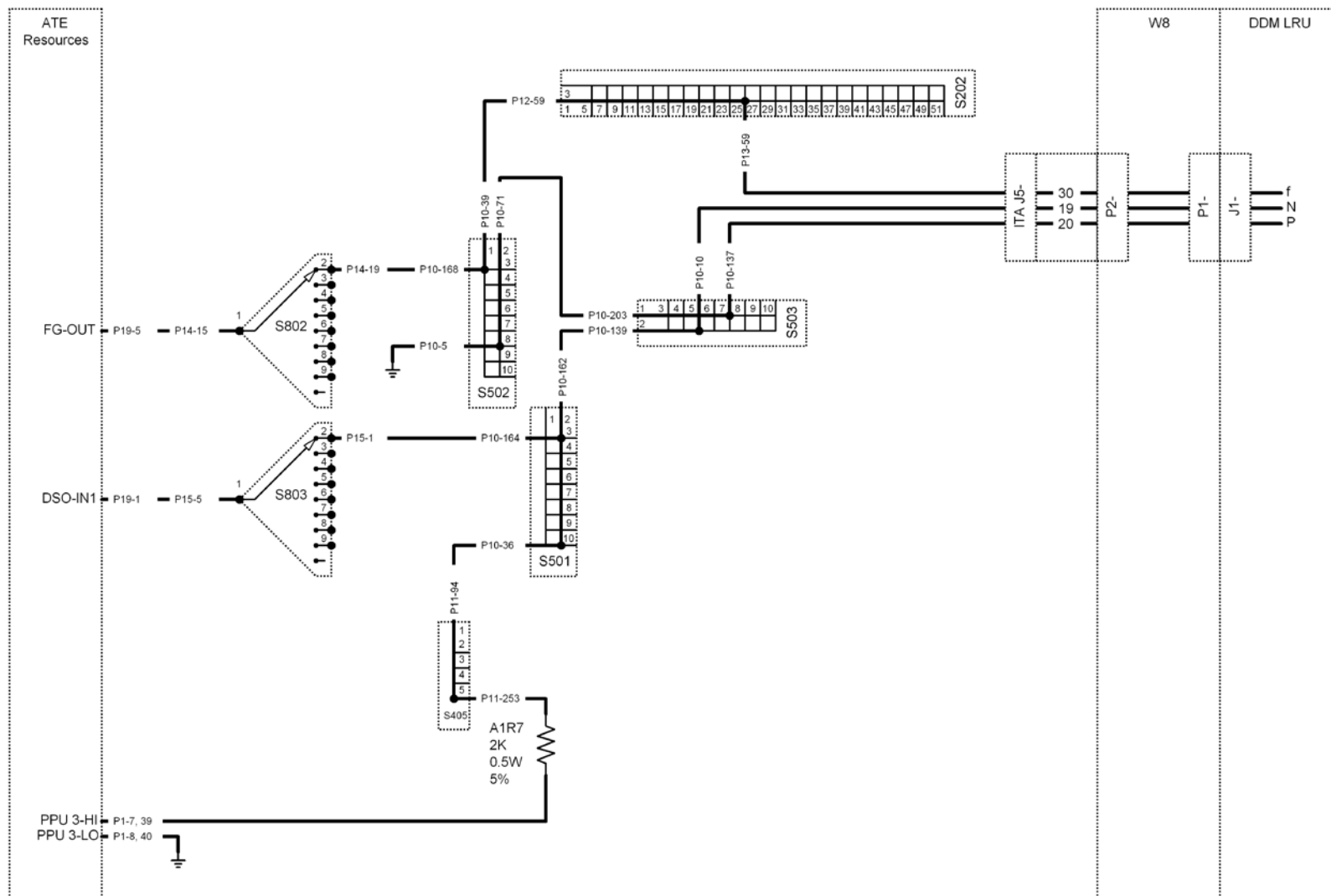
Connection Path as follows:



Step 402 Engine Speed Voltage-Min

Test step 402 will verify the engine speed minimum voltage is correct by applying a 20 Hz 500 mVpp square-wave signal to J1-f via the FG. A +28V (2 kohm) pull-up resistor will be applied to the open-collector output J1-N. The DSO will be used to measure the output at J1-N with a minimum peak voltage of less than 1.0 Vpk.

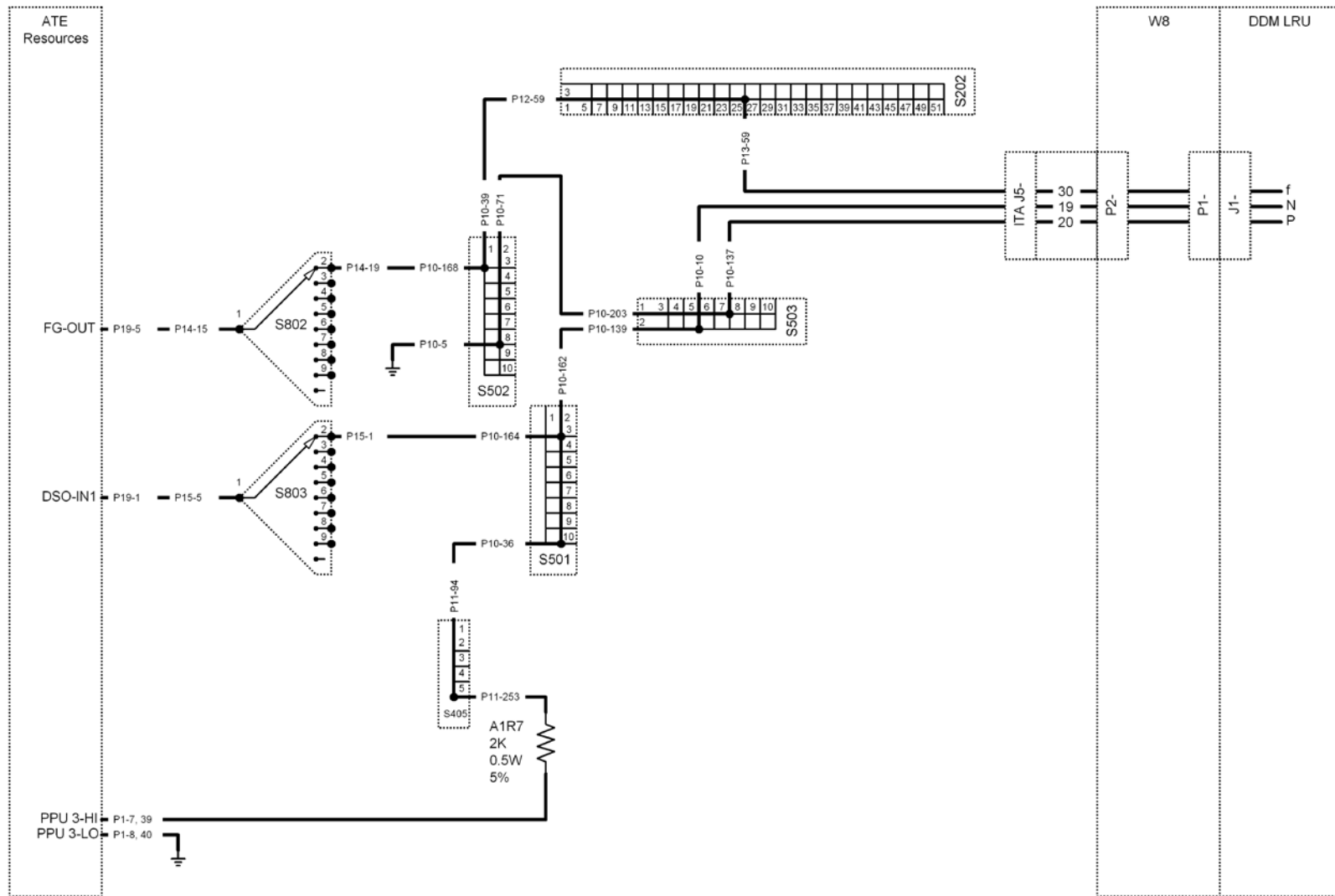
Connection Path as follows:



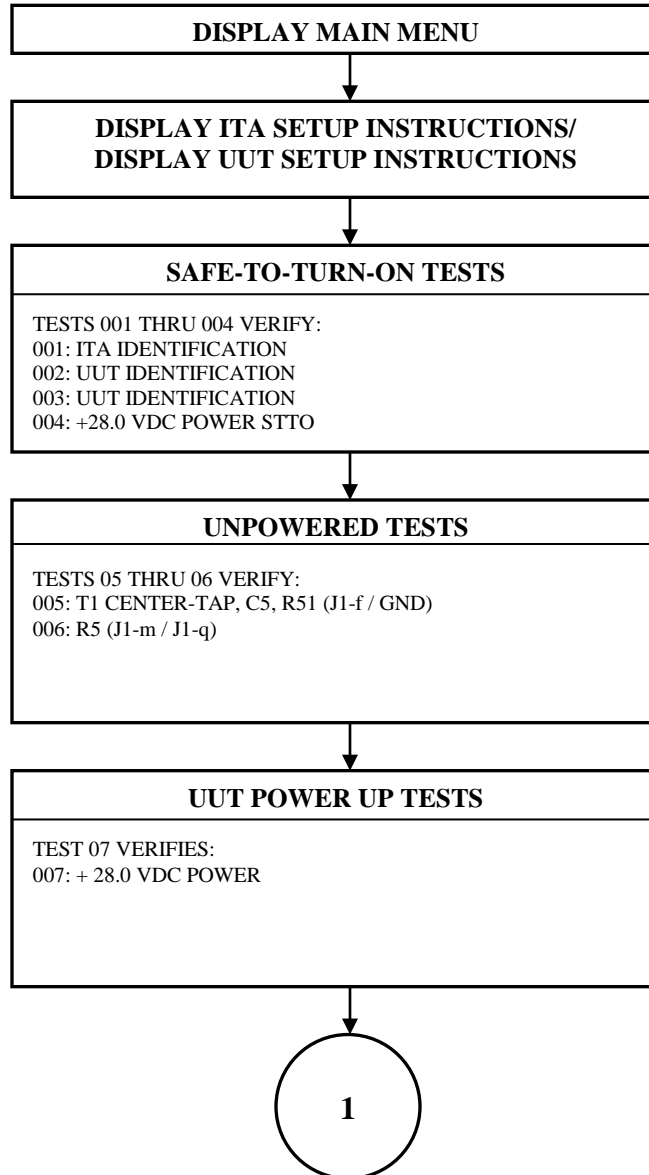
Step 403 Engine Speed Pulse

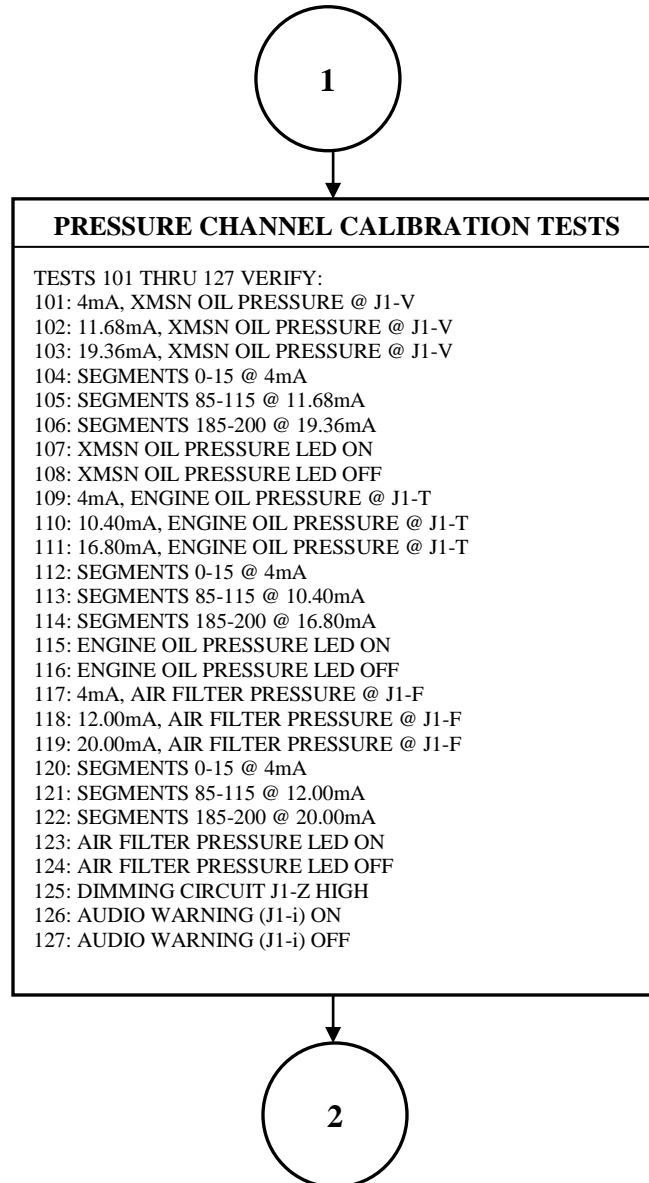
Test step 403 will verify the engine speed pulse is correct by applying a 20 Hz 500 mVpp square-wave signal to J1-f via the FG. A +28V (2 kohm) pull-up resistor will be applied to the open-collector output J1-N. The DSO will be used to measure the output at J1-N with a negative pulse width between 0.0049 sec and 0.0081 sec.

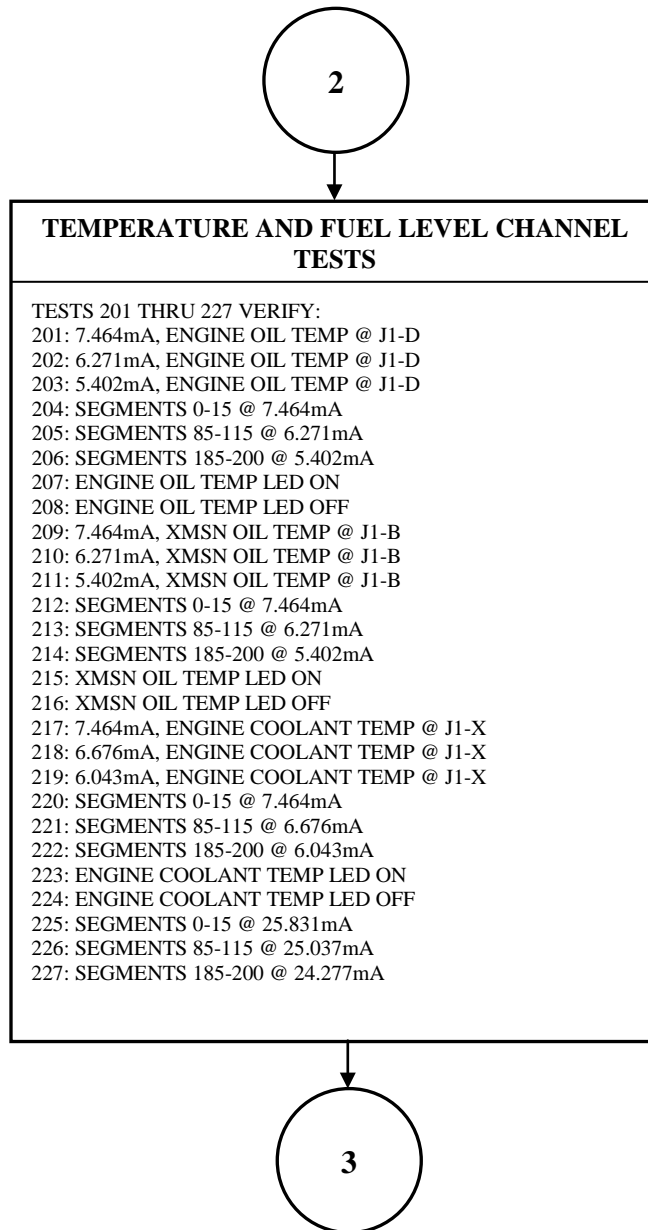
Connection Path as follows:

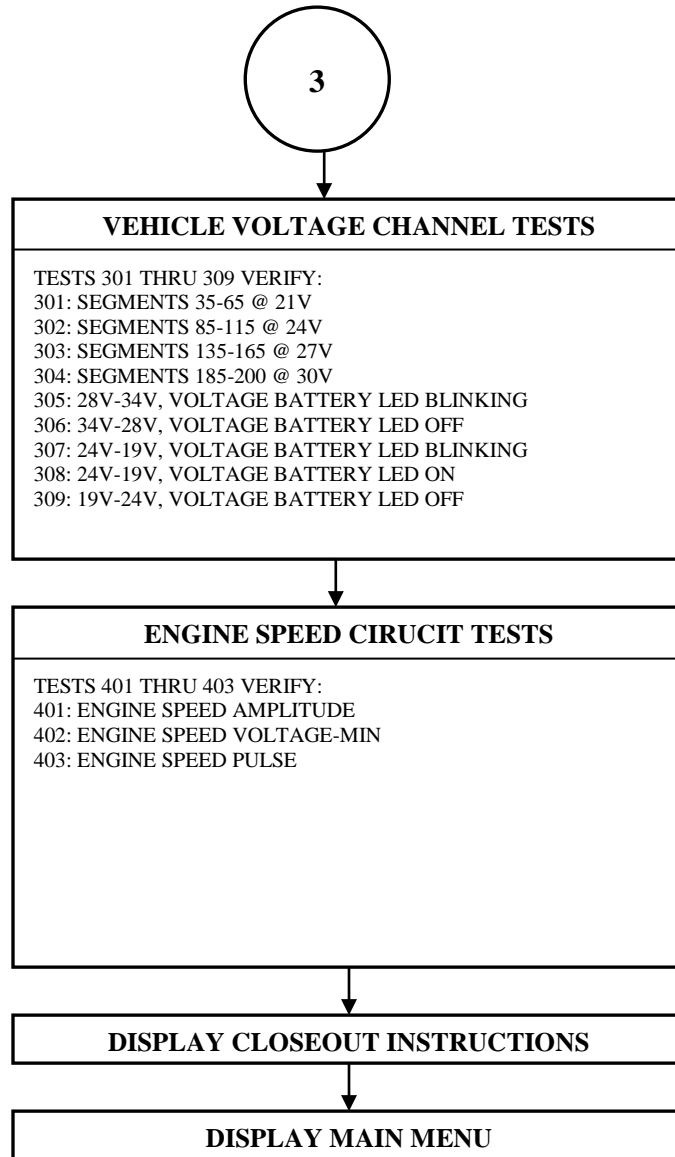


FUNCTIONAL FLOW CHART (FFC)

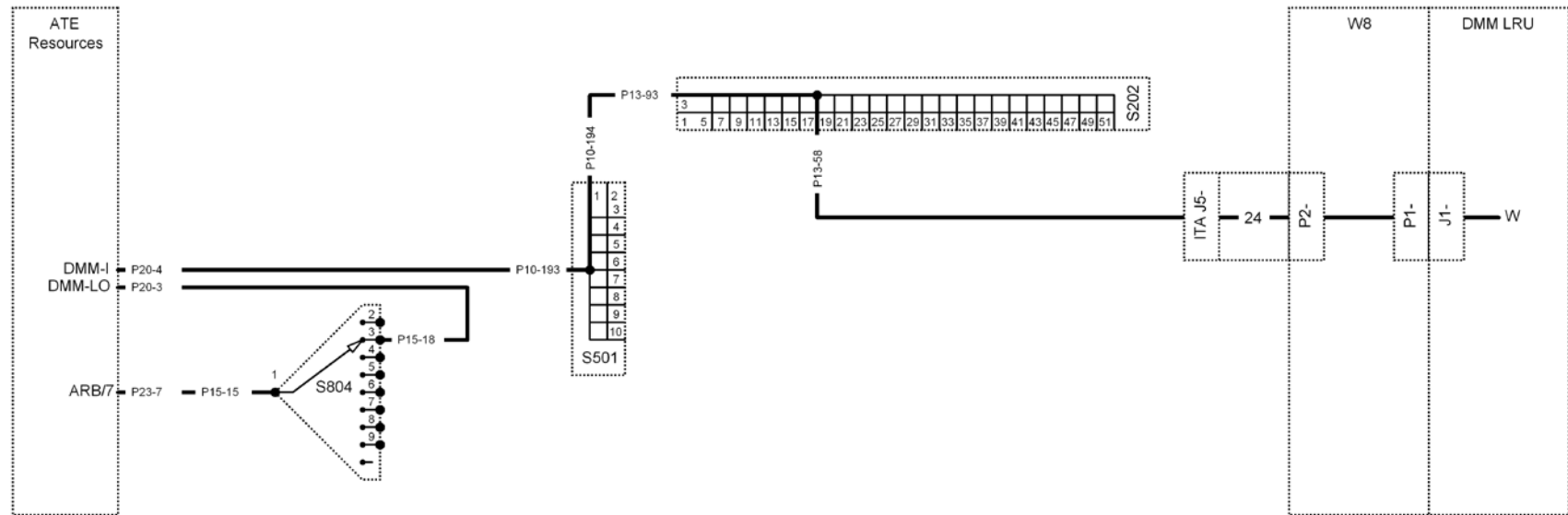




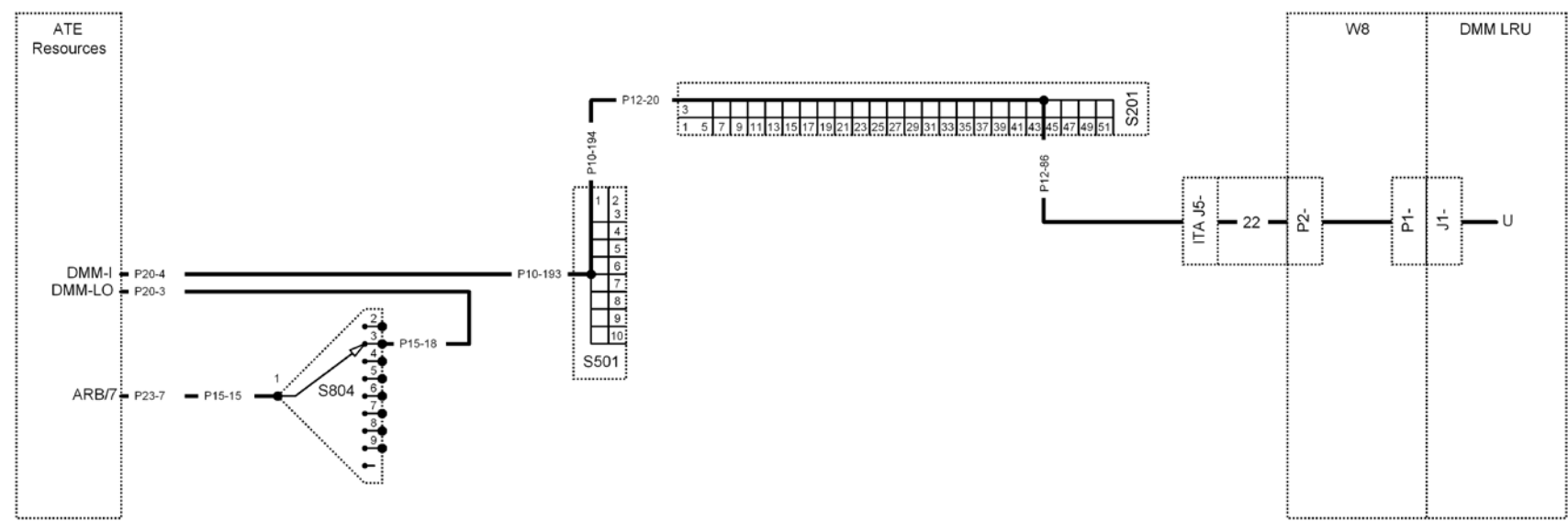




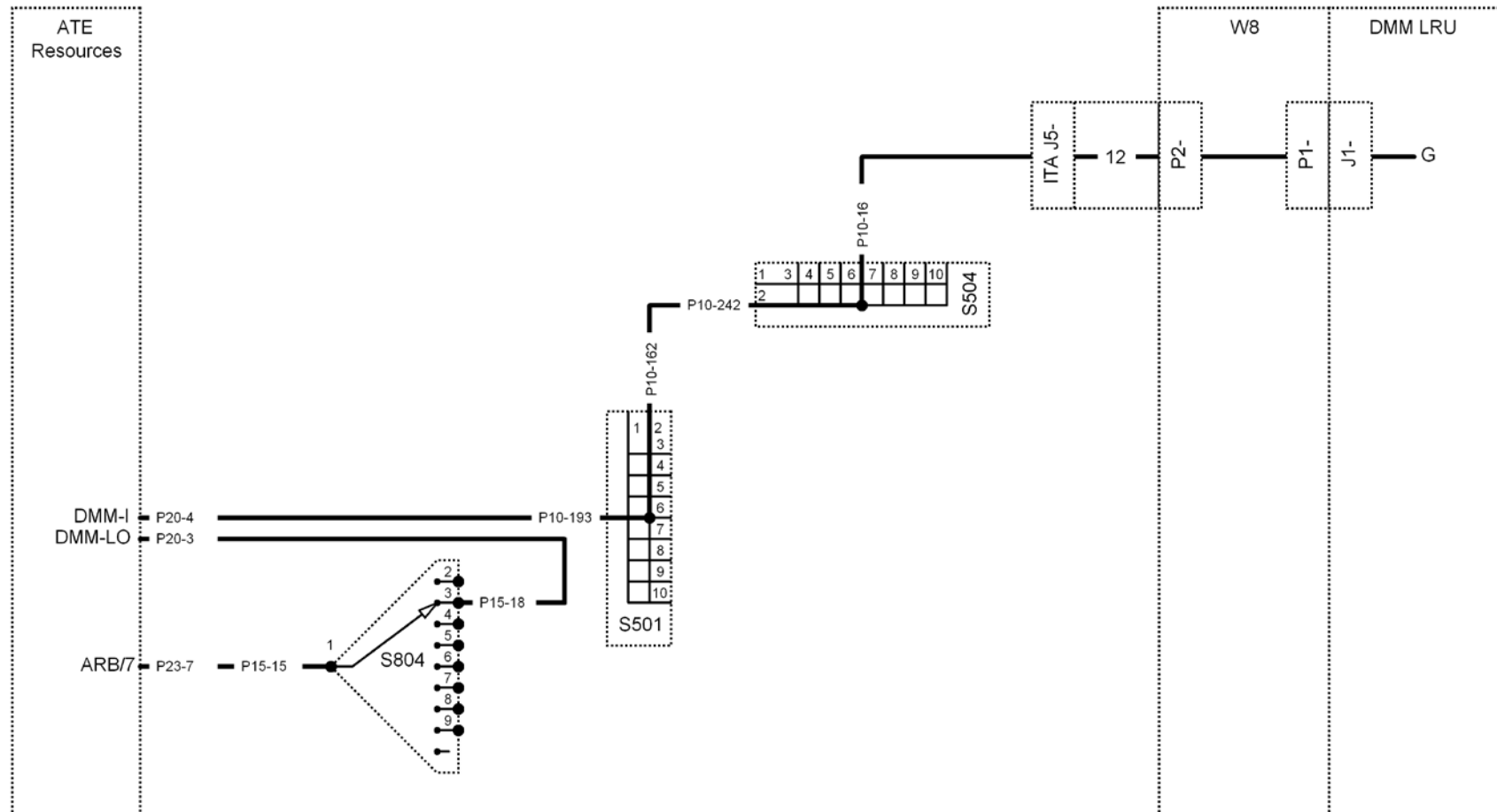
APPENDIX A



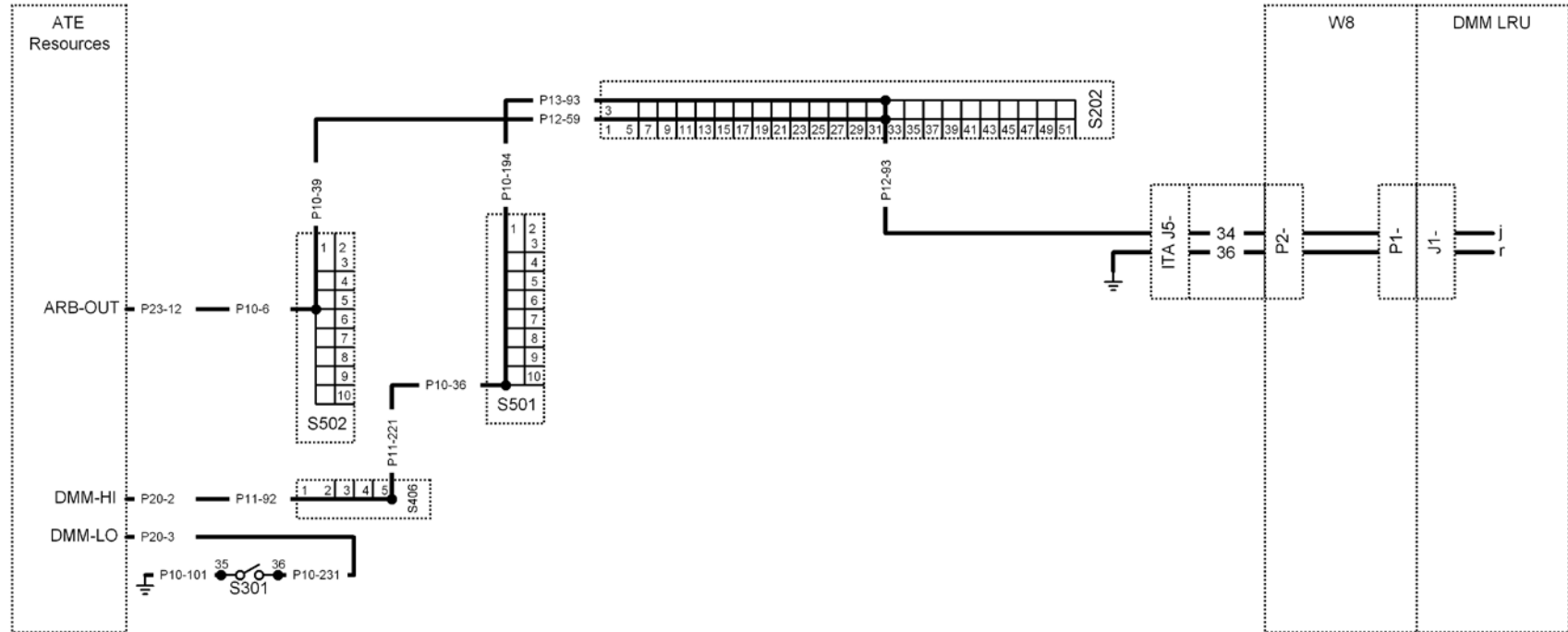
ARB1



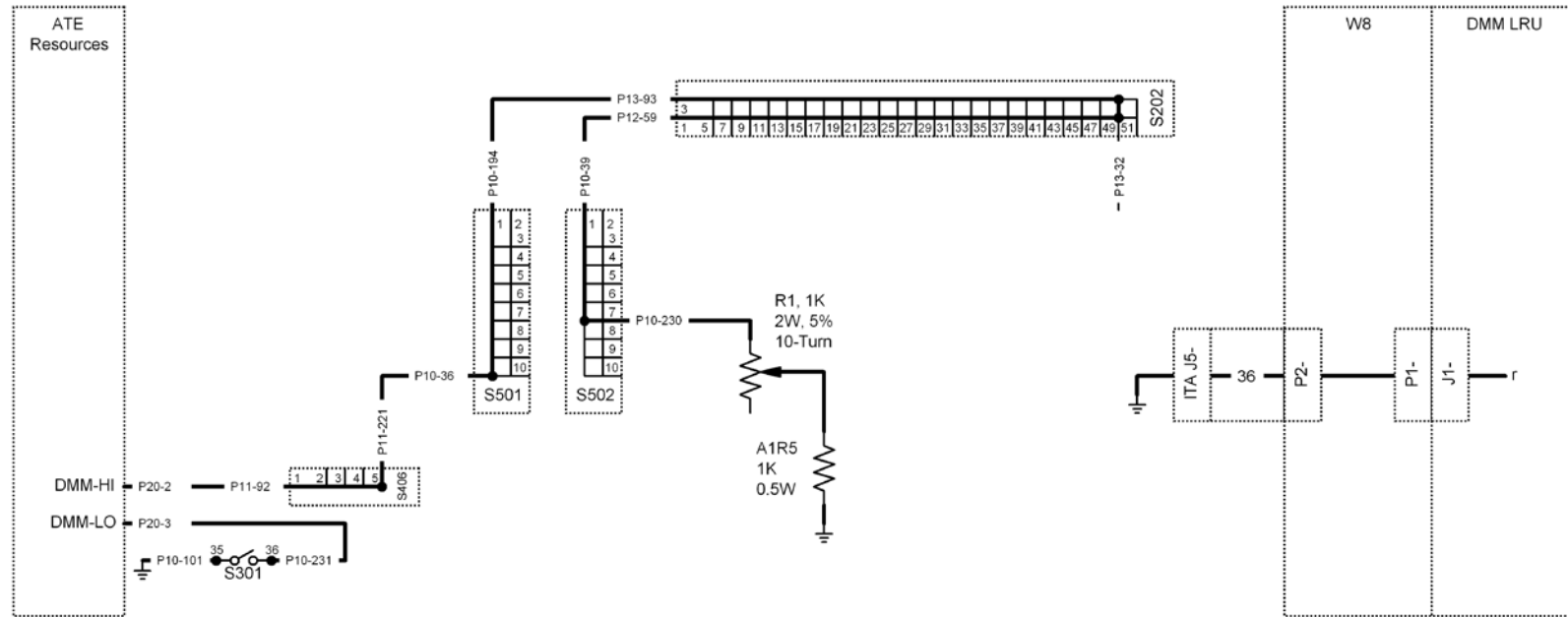
ARB2



ARB3



ARB4



ITAR1