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Gravity Probe B Relativity Mission

# Test Procedure
**for**
# I8, I9 Probe Wiring Verification

| | |
|---|---|
| Prepared by: Bob Farley<br>TRE REE | Date |
| Approved by Paul Ehrensberger<br>IPT Leader | Date |
| Approved by J. Turneaure<br>Hardware Manager | Date |
| Approved by B. Taller<br>Quality Assurance | Date |

**[Rev. A incorporates changes per ECO 890.]**

This document consists of 17 pages.

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# I8, I9 Probe Wiring Verification Test

## 1. Scope

This procedure will be used to verify the Probe C wiring prior to installing the telescope detector modules in the flight system configuration. A special test box has been built to allow access to the I8 or I9 connections. A short test cable with a flight connector that mates with the internal probe Micro-D connectors at one end has a standard 37-socket D connector at the other end. A ribbon cable extension allows for convenient external probing.

## 2.

## List of Equipment Required

The following items are required to complete this test procedure.

| Reference | Description | Qty | |
|---|---|---|---|
| Item #1 | I8, I9 Verification Test Box | 1 | |
| Item #2 | Banana Plug Shorting Strips | 5 | |
| Item #3 | Stacking Banana Plug Patch cords, 8 or 12 inches long, B8 red or B12 red | 5 | |
| Item #4 | Stacking Banana Plug Patch cords, 36 or 48 inches long, B36 red or B48 red | 2 | |
| Item #5 | Stacking Banana Plug Patch cords, 36 or 48 inches long, B36 black or B48 black | 2 | |
| Item #6 | Banana Plug to Pee-Wee Clip, 36 inches long | 1 | |
| Item #7 | Fluke 87 Multimeter [Current Calibration Req'd.] | 1 | |
| Item #8 | Verification Cable for Flight 31-position Micro-D | 1 | |
| Item #9 | Verification cable extension | 1 | |
| Item #10 | Micro-tip test probe | 1 | |
| Item #11 | Kapton® tape | as req'd | |

## 3. List of Equipment Used

Please record the identification and calibration information for the equipment actually used in these measurements in the table below.

| Item | Name or Description | Manufacturer | Model Number | Serial or Property Number | Calibration Due Date |
|---|---|---|---|---|---|
| 7 | | | | | |
| | | | | | |
| | | | | | |

## 4.

## Authorized Personnel

This procedure shall be performed by any two of the following authorized personnel, or by any one of the following with an assistant to help with data recording:

Paul Ehrensberger, IPT Leader (SU)
Bob Farley, TRE REE (LMMS)
Gene Tam, Technician (LMMS)

## 5. Schematics and Diagrams

The schematic diagram of the I8, I9 Verification Test Box is shown in Figure 1. Note that the numbering reflects the mirror imaging of the vacuum feedthrough connectors, so that a standard series connector can be used on the test box. The test point layout, shown in Figure 2 mimics the pin layout of the 55-position connectors.

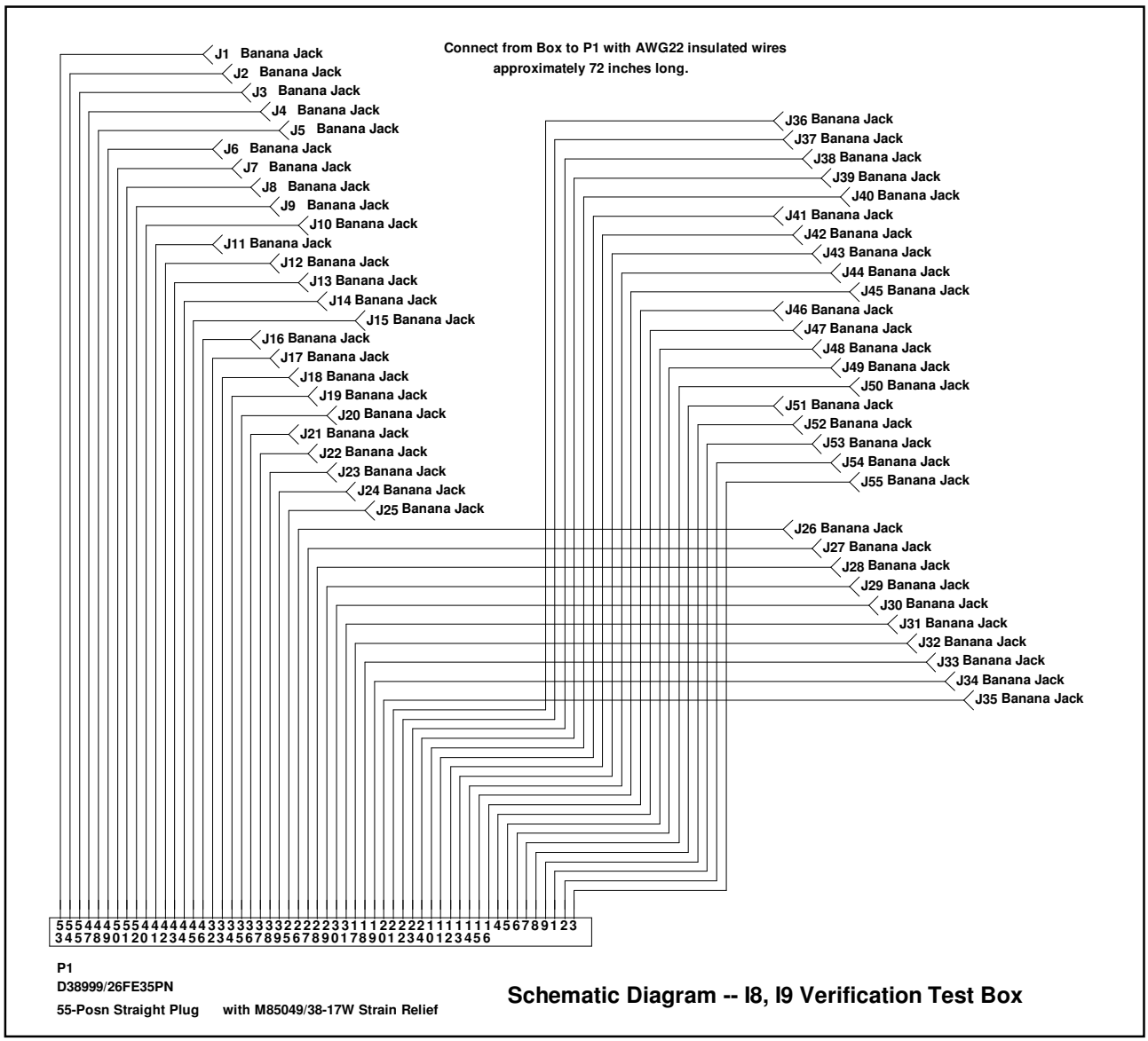


**Figure 1: Schematic of Item #1**

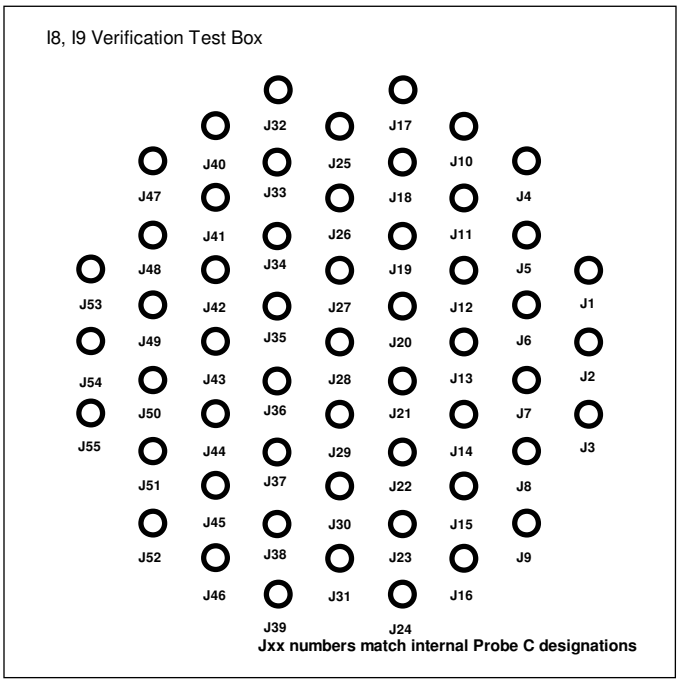


**Figure 2: Test Point Layout**

The schematic diagram for the 31-position Micro-D Connector Verification Test Cable is shown in Figure 3. Pins 1 through 31 of the 37 pin D connector are connected to corresponding pins 1 through 31 of the micro-D connector in order. A sketch of a banana plug shorting strip is shown in Figure 4.

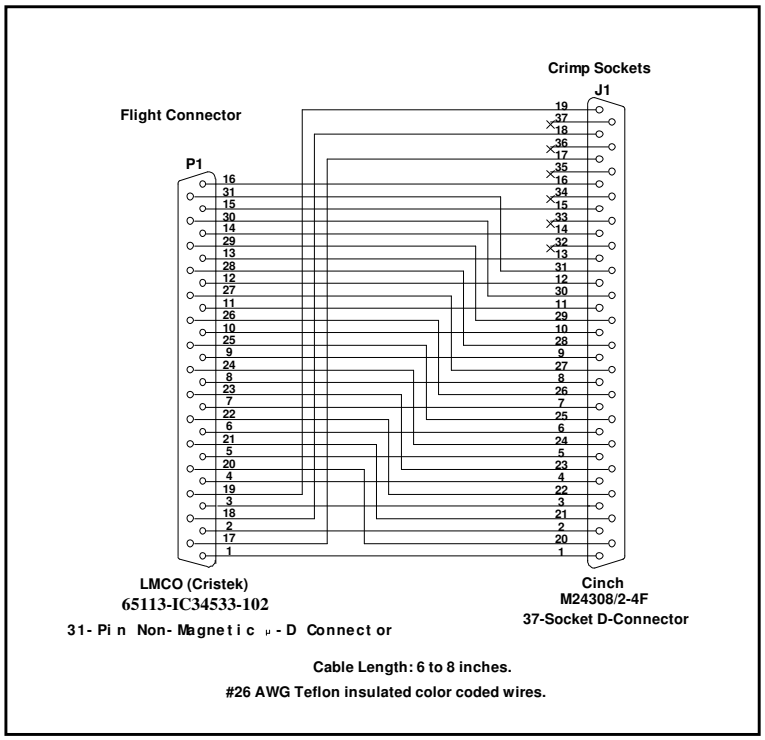


**Figure 3: Schematic of Item #8**

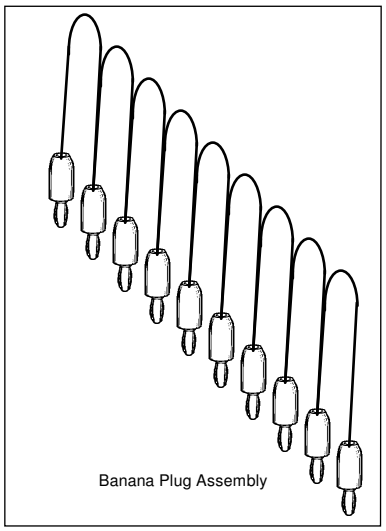


**Figure 4: Item #2**

# 6. Shorts Tests

Both I8 and I9 will be measured to detect shorts between conductors or to the probe structure.

## *6.1 Initial Setup for shorts tests*

Place one of the Item #3 patch cords between each of the indicated jack pairs on Item #1.

| Connect from | to |
|---|---|
| J10 | J11 |
| J20 | J21 |
| J30 | J31 |
| J40 | J41 |
| J50 | J51 |

Using one of Item #2 assemblies with white plugs, connect from the plug in J10 to the box connectors J9 through J1. Using an Item #2 assembly with red plugs, connect together J11 to J20, leaving the Item #3 patch cords in place. Similarly connect J21 through J30 with an Item #2 white plug assembly, and J31 through J40 with a red plug assembly. Using the Item #2 assembly with black plugs connect from J51 through J55. At this point, all of the banana jacks in Item #1 should be electrically connected together. Verify: (_____).

Connect Item #5 to a side hole in the stacking plug in J40, and clip the Pee-Wee clip to the probe case ground. Verify: (_____).

### *6.2 Check for I8 pins shorted to ground*

Connect the cable from the Item #1 test box to the connector saver on I8.

(_____)

Connect one terminal of the multimeter (item 7) to the string of banana plugs and set it to measure resistance. Remove the banana plug from J1 of the test box, and connect the second terminal of the meter to J1, and verify that that the resistance is greater than 10 megohms. Replace the original plug in J1, and then similarly measure J2, J3...through J55 one connection at a time. Note any low resistance reading, but proceed through the table.

I8 Shorts Verification

| Connection | Check | Note | Connection | Check | Note |
|---|---|---|---|---|---|
| J1 | | | J29 | | |
| J2 | | | J30 | | |
| J3 | | | J31 | | |
| J4 | | | J32 | | |
| J5 | | | J33 | | |
| J6 | | | J34 | | |
| J7 | | | J35 | | |
| J8 | | | J36 | | |
| J9 | | | J37 | | |
| J10 | | | J38 | | |
| J11 | | | J39 | | |
| J12 | | | J40 | | |
| J13 | | | J41 | | |
| J14 | | | J42 | | |
| J15 | | | J43 | | |
| J16 | | | J44 | | |
| J17 | | | J45 | | |
| J18 | | | J46 | | |
| J19 | | | J47 | | |
| J20 | | | J48 | | |
| J21 | | | J49 | | |
| J22 | | | J50 | | |
| J23 | | | J51 | | |
| J24 | | | J52 | | |
| J25 | | | J53 | | |
| J26 | | | J54 | | |
| J27 | | | J55 | | |
| J28 | | | | | |

**6.2.1**

**Investigate anomalies for I8 shorts**

All of the banana jacks on the Item #1 test box should now be connected together and to the probe case ground. If any of the jacks in the table above showed a low resistance, perform the following check. Remove the clip to the probe case ground. Connect the meter between the harness common and the jack in question as above, and note if the low resistance reading is still present. If the low value remains, it would indicate that the wire is shorted to another wire in the harness. Begin removing connections from the verification box one at a time until the low reading disappears. Note the location of the Jack that clears the short. Repeat for each of the anomalous low readings.

| Location of fault | To Probe Case? | Where, then | |
|---|---|---|---|
| J | | | |
| | | | |
| | | | |
| | | | |
| | | | |

### *6.3 Check for I9 pins shorted to ground*

Repeat the initial test setup, shorting together all of the jacks on the Item #1 test box as described in paragraph 0, including connecting the Pee-Wee clip to the probe ground.

(_____)

Connect the cable from the Item #1 test box to the connector saver on I9.

(_____)

Connect one terminal of the multimeter (item 7) to the string of banana plugs and set it to measure resistance. Remove the banana plug from J1 of the test box, and connect the second terminal of the meter to J1, and verify that that the resistance is greater than 10 megohms. Replace the original plug in J1, and then similarly measure J2, J3...through J55 one connection at a time. Note any low resistance reading, but proceed through the table.

I9 Shorts Verification

| Connection | Check | Note | Connection | Check | Note |
|---|---|---|---|---|---|
| J1 | | | J29 | | |
| J2 | | | J30 | | |
| J3 | | | J31 | | |
| J4 | | | J32 | | |
| J5 | | | J33 | | |
| J6 | | | J34 | | |
| J7 | | | J35 | | |
| J8 | | | J36 | | |
| J9 | | | J37 | | |
| J10 | | | J38 | | |
| J11 | | | J39 | | |
| J12 | | | J40 | | |
| J13 | | | J41 | | |
| J14 | | | J42 | | |
| J15 | | | J43 | | |
| J16 | | | J44 | | |
| J17 | | | J45 | | |
| J18 | | | J46 | | |
| J19 | | | J47 | | |
| J20 | | | J48 | | |
| J21 | | | J49 | | |
| J22 | | | J50 | | |
| J23 | | | J51 | | |
| J24 | | | J52 | | |
| J25 | | | J53 | | |
| J26 | | | J54 | | |
| J27 | | | J55 | | |
| J28 | | | | | |

**6.3.1**

**Investigate anomalies for I9 shorts**

All of the banana plugs and jacks should now be connected together and to the probe case ground. If any of the jacks in the table above showed a low resistance, perform the following check. Remove the clip to the probe case ground. Connect the meter between the harness common and the jack in question as above, and note if the low resistance reading is still present. If the low value remains, it would indicate that the wire is shorted to another wire in the harness. Begin removing connections from the verification box one at a time until the low reading disappears. Note the location of the Jack that clears the short. Repeat for each of the anomalous low readings.

| Location of fault | To Probe Case? | Where, then | |
|---|---|---|---|
| J | | | |
| | | | |
| | | | |
| | | | |
| | | | |

## 7. Continuity Tests

Remove all of the banana plugs from the Item #1 test box.

(_____)

### *7.1 I8 Continuity*

Connect the cable from the Item #1 test box to the connector saver on I8.

(_____)

**7.1.1**

**TB8A Micro-D Connections**

Connect the short Verification Cable, Item #8 to the probed micro-D connector TB8A. Connect the ribbon cable extension, Item #9 to the 37 position D connector of item 8. Temporarily secure the cables with Kapton® tape near the probe. Use the multimeter to verify continuity between each of the terminal pairs indicated in the table. Use a microtip test probe to contact the sockets of the 37-pin D-connector which is connected to pin for pin to the TB8A connector, and a banana lead to probe the jacks on the verification test box. Record the actual resistance readings on the data sheet. Flag any resistance reading greater than **250 ohms** as a potential fault.

| Extension cable from TB8A | I8,I9 Test Box connected to I8 | Resistance, Ohms | OK? |
|---|---|---|---|
| J2-1 | J32 | | |
| J2-2 | J26 | | |
| J2-3 | J41 | | |
| J2-4 | J5 | | |
| J2-5 | J1 | | |
| J2-6 | J13 | | |
| J2-7 | J2 | | |
| J2-8 | J7 | | |
| J2-9 | J14 | | |
| J2-10 | J9 | | |
| J2-11 | J24 | | |
| J2-12 | J28 | | |
| J2-13 | J22 | | |
| J2-14 | J30 | | |
| J2-17 | J40 | | |
| J2-18 | J33 | | |
| J2-19 | J47 | | |
| J2-20 | J12 | | |
| J2-21 | J6 | | |
| J2-22 | J20 | | |
| J2-23 | J3 | | |
| J2-24 | J8 | | |
| J2-25 | J15 | | |
| J2-26 | J16 | | |
| J2-27 | J21 | | |
| J2-28 | J29 | | |
| J2-29 | J23 | | |

**7.1.2**

**TB8B Micro-D Connections**

Move the Verification cable (Item #8) connector from TB8A to TB8B,. Measure and record the resistance for each of the terminal pairs indicated in the table as above.

| Extension cable from TB8B | I8,I9 Test Box connected to I8 | Resistance, Ohms | OK? |
|---|---|---|---|
| J2-1 | J25 | | |
| J2-2 | J10 | | |
| J2-3 | J4 | | |
| J2-4 | J42 | | |
| J2-6 | J43 | | |
| J2-7 | J49 | | |
| J2-8 | J39 | | |
| J2-9 | J37 | | |
| J2-10 | J44 | | |
| J2-11 | J46 | | |
| J2-12 | J50 | | |
| J2-13 | J55 | | |
| J2-17 | J17 | | |
| J2-18 | J18 | | |
| J2-19 | J11 | | |
| J2-20 | J53 | | |
| J2-21 | J35 | | |
| J2-22 | J54 | | |
| J2-23 | J31 | | |
| J2-24 | J38 | | |
| J2-25 | J36 | | |
| J2-26 | J45 | | |
| J2-27 | J52 | | |
| J2-28 | J51 | | |

***7.2***

### *I9 Continuity*

Connect the cable from the Item #1 test box to the connector saver on I9.

(_____)

### 7.2.1 TB9A Micro-D Connections

Connect the verification cable (Item #8) to TB9A, and secure with tape as required. Measure and record the resistance for each of the terminal pairs indicated in the table as above.

| Extension cable from TB9A | I8,I9 Test Box connected to I9 | Resistance, Ohms | OK? |
|---|---|---|---|
| J2-1 | J32 | | |
| J2-2 | J26 | | |
| J2-3 | J41 | | |
| J2-4 | J5 | | |
| J2-5 | J1 | | |
| J2-6 | J13 | | |
| J2-7 | J2 | | |
| J2-8 | J7 | | |
| J2-9 | J14 | | |
| J2-10 | J9 | | |
| J2-11 | J24 | | |
| J2-12 | J28 | | |
| J2-13 | J22 | | |
| J2-14 | J30 | | |
| J2-17 | J40 | | |
| J2-18 | J33 | | |
| J2-19 | J47 | | |
| J2-20 | J12 | | |
| J2-21 | J6 | | |
| J2-22 | J20 | | |
| J2-23 | J3 | | |
| J2-24 | J8 | | |
| J2-25 | J15 | | |
| J2-26 | J16 | | |
| J2-27 | J21 | | |
| J2-28 | J29 | | |
| J2-29 | J23 | | |

### 7.2.2

**TB9B Micro-D Connections**

Move the verification cable connector to TB9B. Measure and record the resistance for each of the terminal pairs indicated in the table

| Extension cable from TB9B | I8,I9 Test Box connected to I9 | Resistance, Ohms | OK? |
|---|---|---|---|
| J2-1 | J25 | | |
| J2-2 | J10 | | |
| J2-3 | J4 | | |
| J2-4 | J42 | | |
| J2-6 | J43 | | |
| J2-7 | J49 | | |
| J2-8 | J39 | | |
| J2-9 | J37 | | |
| J2-10 | J44 | | |
| J2-11 | J46 | | |
| J2-12 | J50 | | |
| J2-13 | J55 | | |
| J2-17 | J17 | | |
| J2-18 | J18 | | |
| J2-19 | J11 | | |
| J2-20 | J53 | | |
| J2-21 | J35 | | |
| J2-22 | J54 | | |
| J2-23 | J31 | | |
| J2-24 | J38 | | |
| J2-25 | J36 | | |
| J2-26 | J45 | | |
| J2-27 | J52 | | |
| J2-28 | J51 | | |

**8.**

## Completion of Procedure

The results obtained in the performance of this test procedure are acceptable.

Test Engineer_____ Date_____

IPT Leader_____ Date_____

This is to certify that the information obtained under this test procedure is as represented and the documentation is completed and correct.

Product Assurance_____ Date_____