GRAVITY PROBE B

PROCEDURE FOR

PAYLOAD VERIFICATION

Procedure for TRE Heater Operation

P0871

August 3, 2001

Prepared by: *Bob Farley*

Approvals:

Program Responsibility	Signature	Date
Bob Farley TRE REE		
M. Taber Payload Test Director		
Richard Whelan GP-B System Engineering		
D. Ross GP-B Quality Assurance		
Rob Brumley GP-B Payload Technical Manager		

NOTES:

Level of QA required during performance of this procedure:

__4__ Stanford QA Representative

All redlines must be approved by QA

Revision Record:

Rev	Rev Date	ECO #	Summary Description
-	03 August 2001	na	Original issue

Acronyms and Abbreviations:

Acronym / Abbreviation	**Meaning**
GSE	Ground Support Equipment
TRE	Telescope Readout Electronics
na	not applicable

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1. Scope

This procedure exercises the Detector modules to provide heat outputs in support of another test procedure. The JFET circuits of the DMA are not powered in this procedure. Only the silicon diode thermometer and the heater resistor are used.

This procedure assumes that both TREs will be used to power four detector module

assemblies (DMAs). If only one TRE is used, it can power two DMAs, one X-axis and one Y-axis unit. Please note the configuration used in the appropriate locations throughout this procedure.

This procedure ☐ Does ☒ Does not provide formal verification of GP-B trquirements.
This procedure ☐ Does ☒ Does not include constraints and restrictions for the Payload.

2. Safety Requirements

2.1 Potential Hazards

2.1.1 The electronic systems are subject to damage by electrostatic discharge.

2.1.2 Connectors are subject to wear or damage during mating.

2.2 Mitigation of hazards

2.2.1 Connection and disconnection shall be performed only when the equipment involved is in a powered-down state.

2.2.2 Connector savers are to be used on the TRE and tophat connectors.

Note: The mating and demating of all flight connectors must be recorded in a log. This procedure does not require removal or replacement of connector savers onto the flight connectors--they should already be in place.

2.2.3 Connectors shall be inspected for contamination and for bent, damaged, or recessed pins prior to mating.

2.2.4 Grounded wrist straps are to be worn prior to removal of connector caps or covers and during mating/demating operations.

2.2.5 ESD-protective caps or covers are to be immediately installed after demating of connectors.

2.3 Injuries

3. Quality Assurance

3.1 QA Notification

QA to notify ONR 24 hours prior to beginning of testing.

Person Contacted: _____ Date and Time: _____

3.2 Red-line Authority

Authority to red-line (make minor changes during execution) this procedure is given solely to the PTD or his designate and shall be approved by the QA Representative. Additionally, approval by the Hardware Manager shall be required if, in the judgment of the PTD or QA Representative, experiment functionality may be affected.

3.3 Discrepancies

Testing shall be conducted on a formal basis to approved and released procedures. The QA program office shall be notified of the start of this procedure. A Quality Assurance Representative, designated by D. Ross shall be present during the procedure and shall review any discrepancies noted and approve their disposition. Upon completion of this procedure, the QA Program Engineer, D. Ross or her designate, will certify concurrence that the effort was performed and accomplished in accordance with the prescribed instructions by signing and dating in the designated place(s) in this document. Discrepancies will be recorded in a D-log or as a DR per Quality Plan P0108.

4. Test Personnel

4.1 Personnel Requirements

4.1.1 A TRE GSE test set operator familiar with executing the TRE test set..

4.1.2 This test is to be conducted under the direction of certified technical personnel.

4.2 Qualified Personnel

4.2.1 Operators
John Goebel, Bob Farley.

4.2.2 Test conductors
John Goebel, Bob Farley.

5. Requirements

5.1 Hardware Required

5.1.1 Commercial test equipment

Manufacturer	Model	Serial Number	Calibr. Exp. Date

5.1.2 Mechanical/Electrical Special test equipment

Description	Part No.	Rev. no.	Serial No.	Certification Date
TRE Ground Support Equipment Rack	na		Unit #1	5/26/99

5.1.3 Tools

5.1.4 Custom

Description	Model number	No. Req'd

5.2 Software Required

5.2.1 Flight Software

Flight Software Name	Version No.

5.2.2 CSTOL Scripts

CSTOL Script Name		Version No.

5.2.3 SPC Scripts

SPC Script Name	Version No.
N/A	

5.2.4 Test Support Software

Test Software Name	Version No.
SQD362.exe. (supports two TREs).	V3.62

5.3 Procedures or Op Orders Required

Procedure Name	Procedure No.

5.4 Equipment Pretest Requirements

5.5 Configuration Requirements

5.5.1 Probe is installed in the dewar. Probe pressure not critical to this procedure. TRE mounted on dewar, with cables connected to tophat. TREs are connected to the GSE Test Set.

5.5.2 Dewar and probe are cooled with liquid helium.

5.5.3 The TREs shall have been connected to the tophat I8 and I9 connectors prior to the initiation of this procedure.

5.6 Verification / Success Criteria

The success criteria are to complete the procedure.

5.7 Constraints and Restrictions

Execution of this procedure does not violate any known constraints or restrictions.

6. Reference Documents

Number	Title
P0391	Help for Using the TRE Support Systems (GSE TestRacks) Simplified Instructions

7. Operations

7.1 TRE Installation Verification

7.1.1 Verify that LMMS 8A01948GSE-101 cables are installed between the TRE units and the TRE GSE Test Rack. Note which TRE serial number is connected to side A or side B of the Test Rack and enter the information in the table below.

7.1.2 Verify that Cable 8A01288-101 connects TRE-A to Tophat connector I9.

7.1.3 Verify that Cable 8A01287-101 connects TRE-B to Tophat connector I8.

7.1.4 If any of these connections are missing, install the cables as indicated above to satisfy the connectivity.

TRE Assembly **8A00918-101**	GSE Rack Connection A or B	Tophat Connector	Initial and Date	QA Verification
TRE S/N001	Side _____	I ____		
TRE S/N002	Side _____	I ____		

7.2 TRE Power-on

7.2.1 Power the GSE Test Rack and boot the computer. Change to directory **SQD3** and run program named SQD362.exe. Select MON A in the main menu, and step through the four selections in the Global menu to enable both A and B commands.

7.2.2 Power on the A Side TRE using the switch on the A side power supply.

7.2.3 Check the A-Side housekeeping display for both X and Y axes. Power supply voltages and Reference voltages should be within 5% of nominal values.

QA Witness_____ Date:_____

7.2.4 Navigate to the Main Menu and select MON B.

7.2.5 Power on the B Side TRE using the switch on the B side power supply.

7.2.6 Check the B-Side housekeeping display for both X and Y axes. Power supply voltages and Reference voltages should be within 5% of nominal values.

QA Witness_____ Date:_____

7.3 TRE Setup for 2 mw Heating using both TREs

7.3.1 Heat the detector platforms to approximately 57 K using local closed loop mode. Execute the following for the X- and Y-Axes on both A-Side and B-Side.

7.3.1.1 In the Main Menu, select MON A or MON B as appropriate.

7.3.1.2 Select Commands, and the appropriate Axis menu.

7.3.1.3 Heat platform to 57 K using the following commands.

7.3.1.3.1 Set DTEMP to 087Ch.

7.3.1.3.2 Set HEAT to 0007h.

7.3.1.3.3 Set CONTROL to 0080h.

7.3.2 When all four axes have been setup, monitor the temperature displayed and verify that it is increasing toward 57 K. Record the time.

All platforms are heating at _____

7.3.3 After five minutes, Change the thermal control to provide a constant power into the probe

7.3.3.1.1 Set HEAT to 0462h.

7.3.3.1.2 Set CONTROL to 0000h.

7.3.3.1.3 The heater voltage should be approximately 2.74 volts.

7.3.3.1.4 Retain these settings until requested to change by the test director.

7.3.4 Prior to changing to a new condition, record the Servo Error for each axis.

	A-side, X-Axis	A-side, Y-Axis	B-side, X-Axis	B-side, Y-Axis
Servo Error (volts)				
Initials & Date				

QA Witness_____ Date:_____

7.4 TRE Setup for 4 mw Heating using both TREs

7.4.1 Heat the detector platforms to approximately 79 K using local closed loop mode. Execute the following for the X- and Y-Axes on both A-Side and B-Side.

7.4.1.1 In the Main Menu, select MON A or MON B as appropriate.

7.4.1.2 Select Commands, and the appropriate Axis menu.

7.4.1.3 Heat platform to 79 K using the following commands.

7.4.1.3.1 Set DTEMP to 0833h.

7.4.1.3.2 Set HEAT to 0007h.

7.4.1.3.3 Set CONTROL to 0080h.

7.4.2 When all four axes have been setup, monitor the temperature displayed and verify that it is increasing toward 79 K. Record the time.

All platforms are heating at _____

7.4.3 After five minutes, Change the thermal control to provide a constant power into the probe

7.4.3.1.1 Set HEAT to 00632h.

7.4.3.1.2 Set CONTROL to 0000h.

7.4.3.1.3 The heater voltage should be approximately 3.87 volts.

7.4.3.1.4 Retain these settings until requested to change by the test director.

7.4.4 Prior to changing to a new condition, record the Servo Error for each axis.

	A-side, X-Axis	A-side, Y-Axis	B-side, X-Axis	B-side, Y-Axis
Servo Error (volts)				
Initials & Date				

QA Witness_____ Date:_____

7.5 TRE Setup for 8 mw Heating using both TREs

7.5.1 Heat the detector platforms to approximately 107 K using local closed loop mode. Execute the following for the X- and Y-Axes on both A-Side and B-Side.

7.5.1.1 In the Main Menu, select MON A or MON B as appropriate.

7.5.1.2 Select Commands, and the appropriate Axis menu.

7.5.1.3 Heat platform to 107 K using the following commands.

7.5.1.3.1 Set DTEMP to 07CDh.

7.5.1.3.2 Set HEAT to 0007h.

7.5.1.3.3 Set CONTROL to 0080h.

7.5.2 When all four axes have been setup, monitor the temperature displayed and verify that it is increasing toward 107 K. Record the time.

All platforms are heating at _____

7.5.3 After five minutes, Change the thermal control to provide a constant power into the probe

7.5.3.1.1 Set HEAT to 008C4h.

7.5.3.1.2 Set CONTROL to 0000h.

7.5.3.1.3 The heater voltage should be approximately 5.48 volts.

7.5.3.1.4 Retain these settings until requested to change by the test director.

7.5.4 Prior to changing to a new condition, record the Servo Error for each axis.

	A-side, X-Axis	**A-side, Y-Axis**	**B-side, X-Axis**	**B-side, Y-Axis**
Servo Error (volts)				
Initials & Date				

QA Witness_____ Date:_____

7.6 TRE Setup for arbitrary heater power level

The operational requirement for platform power dissipation is 6 mw total, however each platform can be made to dissipate nearly 6 mw if the heater voltage is set to its maximum value. If the test director desires higher values of power dissipation for a particular experiment, the heater setting can be calculated as follows:

7.6.1 Divide the total power desired by 2 or 4 to get the power for each DMA.

7.6.2 The heater resistance in each DMA is 15,000 ohms. Calculate the required heater voltage by taking the square root of the product of power and resistance.

$$V = \sqrt{R \times P}$$

7.6.3 The 12 bit heater DAC is scaled for a range from zero to 10 volts. Calculate the command value by dividing the voltage by 10 and multiplying by 4096. This number can be entered as a decimal value, or it can be converted to hexadecimal and entered as a hex value. $$HEAT = \frac{V}{10} \times 4096$$

7.6.4 Enter the same value into the HEAT register for each of the four DMAs, X-axis, Y-axis for A-side and B-side.

7.6.5 Record the HEAT command value used. _____

QA witness _____

7.7 Completion of testing

7.7.1 If no further testing of the TRE / DPA is needed, return the CONTROL and HEAT registers to 0000h for all of the axes and verify completion in the table below.

Axis	A-side, X-Axis	A-side, Y-Axis	B-side, X-Axis	B-side, Y Axis
CONTROL	0000h	0000h	0000h	0000h
HEAT	0000h	0000h	0000h	0000h
Initial & date				

7.7.2 Turn off the TRE power supplies in the test rack.

QA Witness_____ Date:_____

7.7.3 When testing is completed, transfer any data files made to a Jaz cartridge, so they can be archived on the Payload Server.

8. Procedure Completion

Completed by: _____

QA Witnessed by: _____

Date: _____

Time: _____

PTD_____ Date _____

Quality Manager_____ Date _____