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Swift Burst Alert Telescope (BAT)
Temperature Controller Test Procedure

410.4-PROC-0059

March 2002

Revision B

David D. Bloom

Code 565

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Swift BAT Temperature Controller Test Procedure

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This document defines the verification tests performed for the Swift Burst Alert Telescope (BAT) Detector Array and Loop Heat Pipe Heater Controller. It is an internal quality control record that is controlled by the Product Design Lead (PDL) for the Electrical System. Proposed changes to this document must be submitted to the PDL along with supportive material justifying the proposed change. Comments or questions concerning this document and proposed changes shall be addressed to:

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Revision History

Revision	Date	Approved by:	Remarks
-	11/29/01	Swift CM Office	Initial CM Release
A	3/20/02 3/21/02	D. Bloom Swift CM Office	Revised Sections 5.1.1, 5.1.2, 5.2.1, 5.2.2 and 5.3.2 Released Revision A
B	3/28/02	D. Bloom Swift CM Office	Revised Sections 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1 and 5.3.2 Released Revision B

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1 INTRODUCTION

1.1 Purpose

This document provides the detailed tests to be performed to verify the electrical, functional and environmental performance of the Temperature Controllers for the BAT instrument and the Swift mission. Where there are conflicts between this document and a referenced document, the information here takes precedence.

1.2 Definitions

For the purposes of this document, the following definitions are valid:

Component:	An electrical or electronic element which is part (or all) of the instrument subsystem, i.e., DM, BCDH, BVR, etc.
ICD:	Interface Control Document. This document specifies the information necessary to connect the subject subsystem or component to other components.
Subsystem:	Any component, group of components, box, or structure on the instrument, which is intended to perform a given function. For example: the Power subsystem is comprised of several components, which together perform the function of providing power to the instrument.
Instrument:	The entire assembly of the Array, the Power Box, and Image Processor
Observatory:	The entire payload of the launch vehicle, which is intended to operate as a system in orbit. This includes the instruments.

1.3 Abbreviations And Acronyms

BAT	Burst Alert Telescope
BOB	Break-out Box
EMC	Electro-Magnetic Conduction
EMI	Electro-Magnetic Interference
ETU	Engineering Test Unit
ESD	Electrostatic Discharge
DAC	Digital to Analog Converter
GSE	Ground Support Equipment
Hz	Hertz (cycles per second)
ICD	Interface Control Drawing (or Document)
MDM	
MHz	Mega Hertz (Million cycles per second)
MIL-STD	Military Standard
mW	Milli-watt
MAR	Mission Assurance Requirements (Document)
TC	Temperature Controller

2 APPLICABLE SPECIFICATIONS/ REQUIREMENTS

2.1 References

MIL-STD-461C	EMI/EMC Requirements
MIL-STD-462	EMI/EMC Testing
MIL-STD-463	EMI/EMC UNITS
MIL-STD-975M	NASA EEE PARTS
NASA-STD-8739	NASA Workmanship Standards
PPL-21	NASA GSFC Preferred Parts List (derating)
GSFC-Swift-Spec-002	Swift Mission Assurance Requirements
410.4-MGMT-005	BAT TCS Requirements
410.4-RQMT-0001	BAT Mechanical Requirements
410-PG-8730.3.1	Swift Quality Management Plan
410.4-PLAN-0011	BAT Contamination Plan
410.4-PLAN-0006	Swift BAT Parts Control Plan
BAT-ELEC-001	Swift Burst Alert Telescope (BAT) Electrical Specification
410.4-SPEC-0014	Swift Burst Alert Telescope (BAT) Temperature Controller Specification
410-4-ICD-0008	BAT Temperature Controller Interface Control Document
410.4-SPEC-0015	Swift Burst Alert Telescope (BAT) Temperature Controller Inverter Specification
410-4-ICD-0010	BAT Temperature Controller Inverter Interface Control Document

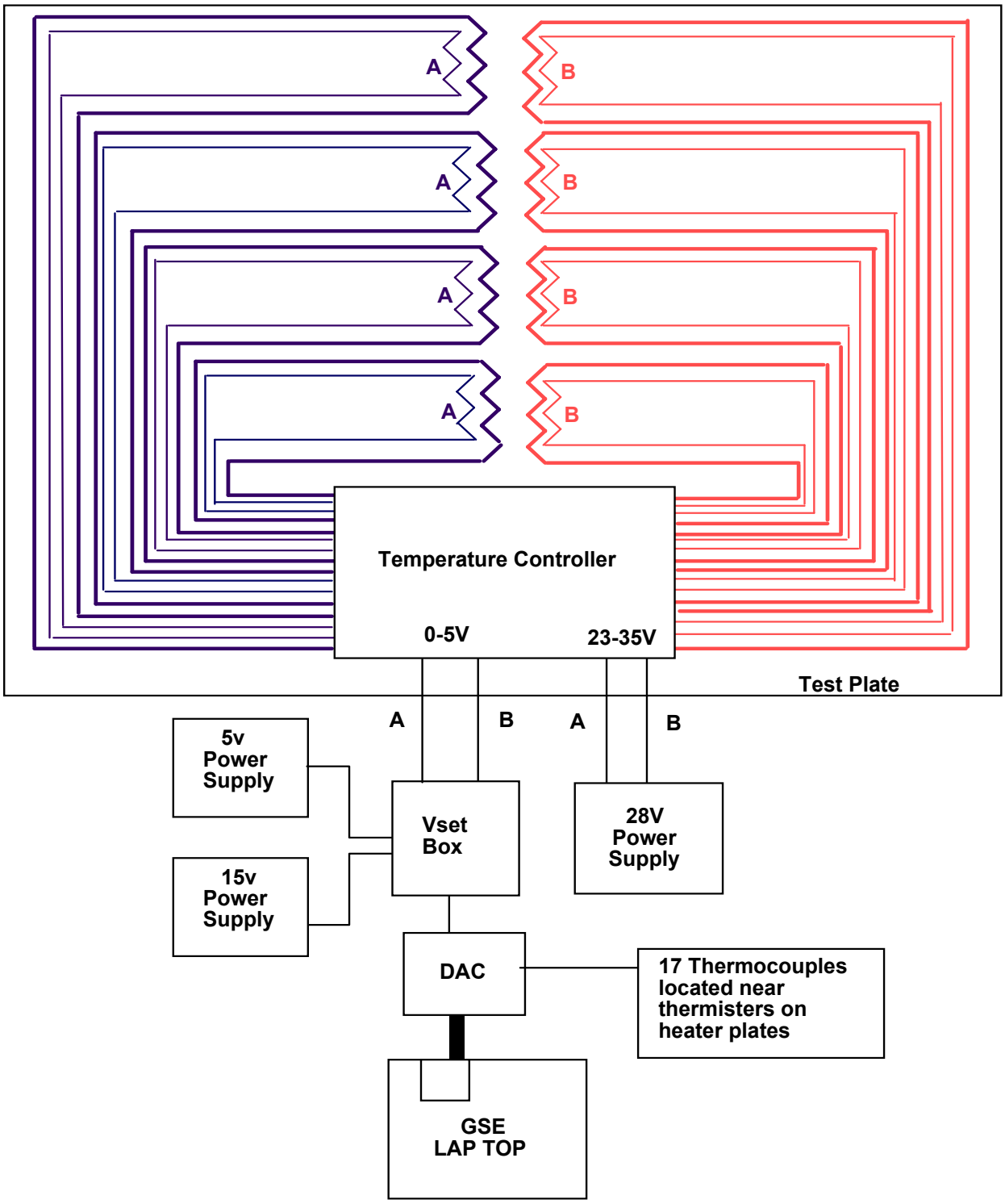
3 REQUIRED TEST EQUIPMENT

Swift BAT Temperature Controller GSE Heater Simulator
Swift BAT Temperature Controller GSE Laptop
Swift BAT Heater Vset Box
National Instruments SCB-68 DAC
9 Pin D BOB
25 PIN MDM BOB
Appropriate ESD Test Area and Equipment

Equipment Type	Manufacturer	Model #	Serial #	Calibration Date
HP E3630A or equivalent				
HP 6228B or equivalent				
FLUKE 87 Multimeter or equivalent				

4 GSE TEST SETUP

The following figure shows the basic GSE configuration for operating the Temperature Controller with Eight heaters, four primary and four secondary.


A
B
A
B
A
B
A
B
Temperature Controller
0-5V
23-35V
Test Plate
A
B
A
B
5v Power Supply
15v Power Supply
Vset Box
28V Power Supply
DAC
17 Thermocouples located near thermisters on heater plates
GSE LAP TOP

5 TEMPERATURE CONTROLLER ELECTRICAL CHECKS

The measurements performed in the following sections provide the electrical verification for the Swift BAT Temperature Controller (TC).

NOTE: If testing 3-channel inverter version disregard channel#4 checks.

5.1 Passive Resistance Checks

5.1.1 Temperature Controller Checks

Measure into the TC looking for resistances where applicable. Use the appropriate unpopulated BOB for the designated connector listed in the following tables.

CONN.	GSE/ FLT	SIGNAL +	PIN	SIGNAL -	PIN	CHECKOUT	R (Ω)	EXPECTED VALUES (Ω)
J1	FLT	Vset A	1	~~Chasis~~28VA RTN	~~GND~~8	1 to ~~GND~~8		~40~~26.7~~K
J1	FLT	Vset B	2	~~Chasis~~28VA RTN	~~GND~~8	2 to ~~GND~~8		~40~~26.7~~K
J1	FLT	Shield	3	~~Chasis~~28VA RTN	~~GND~~8	3 to ~~GND~~8		OL~~≤1~~
J1	FLT	28 VA	4	~~Chasis~~28VA RTN	~~GND~~8	4 to ~~GND~~8		1.48M~~~11M~~
J1	FLT	28 VB	5	~~Chasis~~28VA RTN	~~GND~~8	5 to ~~GND~~8		1.48M~~~11M~~
J1	FLT	Vset A RTN	6	~~Chasis~~28VA RTN	~~GND~~8	6 to ~~GND~~8		0.0~~≤1~~
J1	FLT	Vset B RTN	7	~~Chasis~~28VA RTN	~~GND~~8	7 to ~~GND~~8		0.0~~≤1~~
~~J1~~	~~FLT~~	~~28 VA RTN~~	~~8~~	~~Chasis~~28VA RTN	~~GND~~	~~8 to GND~~	-	~~≤1~~
J1	FLT	28 VB RTN	9	~~Chasis~~28VA RTN	~~GND~~8	9 to ~~GND~~8		0.0~~≤1~~
~~J1~~	~~FLT~~	~~28 VA~~	~~4~~	~~28 VA RTN~~	~~8~~	~~4 to 8~~	-	~~~26.7K~~
J1	FLT	28 VB	5	28 VB RTN	9	5 to 9		~1.48M~~26.7K~~
J1	FLT	Vset A	1	Vset A RTN	6	1 to 6		~40~~26.7~~K
J1	FLT	Vset B	2	Vset B RTN	7	2 to 7		~40~~26.7~~K
J1	FLT	Vset A	1	Shield	3	1 to 3		OL~~~26.7K~~
J1	FLT	Vset B	2	Shield	3	2 to 3		OL~~~26.7K~~
J1	FLT	28 VA	4	Shield	3	4 to 3		OL~~~26.7K~~
J1	FLT	28 VB	5	Shield	3	5 to 3		OL~~~26.7K~~

CHECKS TO PERFORM:
PIn-to-pin and pin-to-gnd
as indicated

CONN.	GSE/ FLT	SIGNAL +	PIN	SIGNAL -	PIN	CHECKOUT	R (Ω)	EXPECTED VALUES (Ω)
J2	FLT	Htr A4-	1	~~Chasis~~J1-28VA RTN	~~GND~~8	1 to ~~GND~~8		>2M~~~12.8M~~
J2	FLT	GND	2	~~Chasis~~J1-28VA RTN	~~GND~~8	2 to ~~GND~~8		0.0~~≤1~~
J2	FLT	28VB+	3	~~Chasis~~J1-28VA RTN	~~GND~~8	3 to ~~GND~~8		>2M~~~10.8M~~
J2	FLT	Htr A3-	4	~~Chasis~~J1-28VA RTN	~~GND~~8	4 to ~~GND~~8		>2M~~~12.8M~~
J2	FLT	GND	5	~~Chasis~~J2-28VA RTN	~~GND~~8	5 to ~~GND~~8		0.0~~≤1~~
J2	FLT	28VB+	6	~~Chasis~~J1-28VA RTN	~~GND~~8	6 to ~~GND~~8		>2M~~~10.8M~~
J2	FLT	Htr A2-	7	~~Chasis~~J1-28VA RTN	~~GND~~8	7 to ~~GND~~8		>2M~~~12.8M~~
J2	FLT	GND	8	~~Chasis~~J1-28VA RTN	~~GND~~8	8 to ~~GND~~8		0.0~~≤1~~
J2	FLT	28VB+	9	~~Chasis~~J1-28VA RTN	~~GND~~8	9 to ~~GND~~8		>2M~~~10.8M~~
J2	FLT	Htr A1-	10	~~Chasis~~J1-28VA RTN	~~GND~~8	10 to ~~GND~~8		>2M~~~12.8M~~
J2	FLT	GND	11	~~Chasis~~J1-28VA RTN	~~GND~~8	11 to ~~GND~~8		0.0~~≤1~~
J2	FLT	28VB+	12	~~Chasis~~J1-28VA RTN	~~GND~~8	12 to ~~GND~~8		>2M~~~10.8M~~
J2	FLT	N/U	13	~~Chasis~~J1-28VA RTN	~~GND~~8	13 to ~~GND~~8		OL
J2	FLT	Htr B4-	14	~~Chasis~~J1-28VA RTN	~~GND~~8	14 to ~~GND~~8		>2M~~~12.8M~~
J2	FLT	Therm A4+	15	~~Chasis~~J1-28VA RTN	~~GND~~8	15 to ~~GND~~8		~60K
J2	FLT	28VA+	16	~~Chasis~~J1-28VA RTN	~~GND~~8	16 to ~~GND~~8		>2M~~~10.8M~~
J2	FLT	Htr B3-	17	~~Chasis~~J1-28VA RTN	~~GND~~8	17 to ~~GND~~8		>2M~~~12.8M~~
J2	FLT	Therm A3+	18	~~Chasis~~J1-28VA RTN	~~GND~~8	18 to ~~GND~~8		~60K
J2	FLT	28VA+	19	~~Chasis~~J1-28VA RTN	~~GND~~8	19 to ~~GND~~8		>2M~~~10.8M~~
J2	FLT	Htr B2-	20	~~Chasis~~J1-28VA RTN	~~GND~~8	20 to ~~GND~~8		>2M~~~12.8M~~
J2	FLT	Therm A2+	21	~~Chasis~~J1-28VA RTN	~~GND~~8	21 to ~~GND~~8		~60K
J2	FLT	28VA+	22	~~Chasis~~J1-28VA RTN	~~GND~~8	22 to ~~GND~~8		>2M~~~10.8M~~
J2	FLT	Htr B1-	23	~~Chasis~~J1-28VA RTN	~~GND~~8	23 to ~~GND~~8		>2M~~~12.8M~~
J2	FLT	Therm A1+	24	~~Chasis~~J1-28VA RTN	~~GND~~8	24 to ~~GND~~8		~60K
J2	FLT	28VA+	25	~~Chasis~~J1-28VA RTN	~~GND~~8	25 to ~~GND~~8		>2M~~~10.8M~~

CHECKS TO PERFORM:

PIn-to-pin and pin-to-gnd

as indicated

CONN.	GSE/ FLT	SIGNAL +	PIN	SIGNAL -	PIN	CHECKOUT	R (Ω)	EXPECTED VALUES (Ω)
J2	FLT	28VA+	16	Htr A4-	1	16 to 1		1M
J2	FLT	28VA+	19	Htr A3-	4	19 to 4		1M
J2	FLT	28VA+	22	Htr A2-	7	22 to 7		1M
J2	FLT	28VA+	25	Htr A1-	10	25 to 10		1M
J2	FLT	28VB+	3	Htr B4-	14	3 to 14		1M
J2	FLT	28VB+	6	Htr B3-	17	6 to 17		1M
J2	FLT	28VB+	9	Htr B2-	20	9 to 20		1M
J2	FLT	28VB+	12	Htr B1-	23	12 to 23		1M
J2	FLT	Therm A4+	15	GND	2	15 to 2		60K
J2	FLT	Therm A3+	18	GND	5	18 to 5		60K
J2	FLT	Therm A2+	21	GND	8	21 to 8		60K
J2	FLT	Therm A1+	24	GND	11	24 to 11		60K

CHECKS TO PERFORM:
PIn-to-pin and pin-to-gnd
as indicated

CONN.	GSE/ FLT	SIGNAL +	PIN	SIGNAL -	PIN	CHECKOUT	R (Ω)	EXPECTED VALUES (Ω)
J3	FLT	Htr B4-	1	~~Chasis~~J1-28VB RTN	~~GND~~9	1 to ~~GND~~9		>2M~~~12.8M~~
J3	FLT	GND	2	~~Chasis~~J1-28VB RTN	~~GND~~9	2 to ~~GND~~9		0.0~~≤1~~
J3	FLT	28VA+	3	~~Chasis~~J1-28VB RTN	~~GND~~9	3 to ~~GND~~9		>2M~~~10.8M~~
J3	FLT	Htr B3-	4	~~Chasis~~J1-28VB RTN	~~GND~~9	4 to ~~GND~~9		>2M~~~12.8M~~
J3	FLT	GND	5	~~Chasis~~J1-28VB RTN	~~GND~~9	5 to ~~GND~~9		0.0~~≤1~~
J3	FLT	28VA+	6	~~Chasis~~J1-28VB RTN	~~GND~~9	6 to ~~GND~~9		>2M~~~10.8M~~
J3	FLT	Htr B2-	7	~~Chasis~~J1-28VB RTN	~~GND~~9	7 to ~~GND~~9		>2M~~~12.8M~~
J3	FLT	GND	8	~~Chasis~~J1-28VB RTN	~~GND~~9	8 to ~~GND~~9		0.0~~≤1~~
J3	FLT	28VA+	9	~~Chasis~~J1-28VB RTN	~~GND~~9	9 to ~~GND~~9		>2M~~~10.8M~~
J3	FLT	Htr B1-	10	~~Chasis~~J1-28VB RTN	~~GND~~9	10 to ~~GND~~9		>2M~~~12.8M~~
J3	FLT	GND	11	~~Chasis~~J1-28VB RTN	~~GND~~9	11 to ~~GND~~9		0.0~~≤1~~
J3	FLT	28VA+	12	~~Chasis~~J1-28VB RTN	~~GND~~9	12 to ~~GND~~9		>2M~~~10.8M~~
J3	FLT	N/U	13	~~Chasis~~J1-28VB RTN	~~GND~~9	13 to ~~GND~~9		OL
J3	FLT	Htr A4-	14	~~Chasis~~J1-28VB RTN	~~GND~~9	14 to ~~GND~~9		>2M~~~12.8M~~
J3	FLT	Therm B4+	15	~~Chasis~~J1-28VB RTN	~~GND~~9	15 to ~~GND~~9		~60K
J3	FLT	28VB+	16	~~Chasis~~J1-28VB RTN	~~GND~~9	16 to ~~GND~~9		>2M~~~10.8M~~
J3	FLT	Htr A3-	17	~~Chasis~~J1-28VB RTN	~~GND~~9	17 to ~~GND~~9		>2M~~~12.8M~~
J3	FLT	Therm B3+	18	~~Chasis~~J1-28VB RTN	~~GND~~9	1~~8~~ to ~~GND~~9		~60K
J3	FLT	28VB+	19	~~Chasis~~J1-28VB RTN	~~GND~~9	19 to ~~GND~~9		>2M~~~10.8M~~
J3	FLT	Htr A2-	20	~~Chasis~~J1-28VB RTN	~~GND~~9	20 to ~~GND~~9		>2M~~~12.8M~~
J3	FLT	Therm B2+	21	~~Chasis~~J1-28VB RTN	~~GND~~9	21 to ~~GND~~9		~60K
J3	FLT	28VB+	22	~~Chasis~~J1-28VB RTN	~~GND~~9	22 to ~~GND~~9		>2M~~~10.8M~~
J3	FLT	Htr A1-	23	~~Chasis~~J1-28VB RTN	~~GND~~9	23 to ~~GND~~9		>2M~~~12.8M~~
J3	FLT	Therm B1+	24	~~Chasis~~J1-28VB RTN	~~GND~~9	24 to ~~GND~~9		~60K
J3	FLT	28VB+	25	~~Chasis~~J1-28VB RTN	~~GND~~9	25 to ~~GND~~9		>2M~~~10.8M~~

CHECKS TO PERFORM:

PIn-to-pin and pin-to-gnd

as indicated

CONN.	GSE/ FLT	SIGNAL +	PIN	SIGNAL -	PIN	CHECKOUT	R (Ω)	EXPECTED VALUES (Ω)
J3	FLT	28VB+	16	Htr B4-	1	16 to 1		1M
J3	FLT	28VB+	19	Htr B3-	4	19 to 4		1M
J3	FLT	28VB+	22	Htr B2-	7	22 to 7		1M
J3	FLT	28VB+	25	Htr B1-	10	25 to 10		1M
J3	FLT	28VA+	3	Htr A4-	14	3 to 14		1M
J3	FLT	28VA+	6	Htr A3-	17	6 to 17		1M
J3	FLT	28VA+	9	Htr A2-	20	9 to 20		1M
J3	FLT	28VA+	12	Htr A1-	23	12 to 23		1M
J3	FLT	Therm B4+	15	GND	2	15 to 2		60K
J3	FLT	Therm B3+	18	GND	5	18 to 5		60K
J3	FLT	Therm B2+	21	GND	8	21 to 8		60K
J3	FLT	Therm B1+	24	GND	11	24 to 11		60K

CHECKS TO PERFORM:

PIn-to-pin and pin-to-gnd

as indicated

5.1.2 Temperature Controller GSE Checks

Measure into the GSE harness looking for resistances where applicable. Use the appropriate unpopulated BOB for the designated connector listed in the following tables.

CONN.	GSE/ FLT	SIGNAL +	PIN	SIGNAL -	PIN	CHECKOUT	R (Ω)	EXPECTED VALUES (Ω)
P1	GSE	Vset A	1	Chasis	GND	1 to GND		OL~~>10K~~
P1	GSE	Vset B	2	Chasis	GND	2 to GND		OL~~>10K~~
P1	GSE	Shield	3	Chasis	GND	3 to GND		OL~~>10K~~
P1	GSE	28 VA	4	Chasis	GND	4 to GND		>5~~10~~K
P1	GSE	28 VB	5	Chasis	GND	5 to GND		>5~~10~~K
P1	GSE	Vset A RTN	6	Chasis	GND	6 to GND		.1~~>10K~~
P1	GSE	Vset B RTN	7	Chasis	GND	7 to GND		.1~~>10K~~
P1	GSE	28 VA RTN	8	Chasis	GND	8 to GND		.1~~>10K~~
P1	GSE	28 VB RTN	9	Chasis	GND	9 to GND		.1~~>10K~~
P1	GSE	28 VA	4	28 VA RTN	8	4 to 8		>5~~10~~K
P1	GSE	28 VB	5	28 VB RTN	9	5 to 9		>5~~10~~K
P1	GSE	Vset A	1	Vset A RTN	6	1 to 6		OL~~>10K~~
P1	GSE	Vset B	2	Vset B RTN	7	2 to 7		OL~~>10K~~
P1	GSE	Vset A	1	Shield	3	1 to 3		OL~~>10K~~
P1	GSE	Vset B	2	Shield	3	2 to 3		OL~~>10K~~
P1	GSE	28 VA	4	Shield	3	4 to 3		OL~~>10K~~
P1	GSE	28 VB	5	Shield	3	5 to 3		OL~~>10K~~

CHECKS TO PERFORM:

PIn-to-pin and pin-to-gnd

as indicated

CONN.	GSE/ FLT	SIGNAL +	PIN	SIGNAL -	PIN	CHECKOUT	R (Ω)	EXPECTED VALUES (Ω)
P2	GSE	Htr A4-	1	Chasis	GND	1 to GND		~~>10K~~OL
P2	GSE	GND	2	Chasis	GND	2 to GND		~~>10K~~OL
P2	GSE	N/U	3	Chasis	GND	3 to GND		~~>10K~~OL
P2	GSE	Htr A3-	4	Chasis	GND	4 to GND		~~>10K~~OL
P2	GSE	GND	5	Chasis	GND	5 to GND		~~>10K~~OL
P2	GSE	N/U	6	Chasis	GND	6 to GND		~~>10K~~OL
P2	GSE	Htr A2-	7	Chasis	GND	7 to GND		~~>10K~~OL
P2	GSE	GND	8	Chasis	GND	8 to GND		~~>10K~~OL
P2	GSE	N/U	9	Chasis	GND	9 to GND		~~>10K~~OL
P2	GSE	Htr A1-	10	Chasis	GND	10 to GND		~~>10K~~OL
P2	GSE	GND	11	Chasis	GND	11 to GND		~~>10K~~OL
P2	GSE	N/U	12	Chasis	GND	12 to GND		~~>10K~~OL
P2	GSE	N/U	13	Chasis	GND	13 to GND		~~>10K~~OL
P2	GSE	N/U	14	Chasis	GND	14 to GND		~~>10K~~OL
P2	GSE	Therm A4+	15	Chasis	GND	15 to GND		~~>10K~~OL
P2	GSE	28VA+	16	Chasis	GND	16 to GND		~~>10K~~OL
P2	GSE	N/U	17	Chasis	GND	17 to GND		~~>10K~~OL
P2	GSE	Therm A3+	18	Chasis	GND	18 to GND		~~>10K~~OL
P2	GSE	28VA+	19	Chasis	GND	19 to GND		~~>10K~~OL
P2	GSE	N/U	20	Chasis	GND	20 to GND		~~>10K~~OL
P2	GSE	Therm A2+	21	Chasis	GND	21 to GND		~~>10K~~OL
P2	GSE	28VA+	22	Chasis	GND	22 to GND		~~>10K~~OL
P2	GSE	N/U	23	Chasis	GND	23 to GND		~~>10K~~OL
P2	GSE	Therm A1+	24	Chasis	GND	24 to GND		~~>10K~~OL
P2	GSE	28VA+	25	Chasis	GND	25 to GND		~~>10K~~OL

CHECKS TO PERFORM:
PIn-to-pin and pin-to-gnd
as indicated

CONN.	GSE/ FLT	SIGNAL +	PIN	SIGNAL -	PIN	CHECKOUT	R (Ω)	EXPECTED VALUES (Ω)
P2	GSE	28VA +	16	Htr A4-	1	16 to 1		~2.07K~~1892K~~
P2	GSE	28VA +	19	Htr A3-	4	19 to 4		~1.89K~~1892K~~
P2	GSE	28VA +	22	Htr A2-	7	22 to 7		~2.07K~~2.081K~~
P2	GSE	28VA +	25	Htr A1-	10	25 to 10		~2.07~~6~~
P2	GSE	Therm A4+	15	GND	2	15 to 2		~35~~42~~K
P2	GSE	Therm A3+	18	GND	5	18 to 5		~35~~42~~K
P2	GSE	Therm A2+	21	GND	8	21 to 8		~35~~42~~K
P2	GSE	Therm A1+	24	GND	11	24 to 11		~35~~42~~K

CHECKS TO PERFORM:

PIn-to-pin and pin-to-gnd

as indicated

CONN.	GSE/ FLT	SIGNAL +	PIN	SIGNAL -	PIN	CHECKOUT	R (Ω)	EXPECTED VALUES (Ω)
P3	GSE	Htr B~~A~~4-	1	Chasis	GND	1 to GND		~~>10K~~OL
P3	GSE	GND	2	Chasis	GND	2 to GND		~~>10K~~OL
P3	GSE	N/U	3	Chasis	GND	3 to GND		~~>10K~~OL
P3	GSE	Htr B~~A~~3-	4	Chasis	GND	4 to GND		~~>10K~~OL
P3	GSE	GND	5	Chasis	GND	5 to GND		~~>10K~~OL
P3	GSE	N/U	6	Chasis	GND	6 to GND		~~>10K~~OL
P3	GSE	Htr B~~A~~2-	7	Chasis	GND	7 to GND		~~>10K~~OL
P3	GSE	GND	8	Chasis	GND	8 to GND		~~>10K~~OL
P3	GSE	N/U	9	Chasis	GND	9 to GND		~~>10K~~OL
P3	GSE	Htr B~~A~~1-	10	Chasis	GND	10 to GND		~~>10K~~OL
P3	GSE	GND	11	Chasis	GND	11 to GND		~~>10K~~OL
P3	GSE	N/U	12	Chasis	GND	12 to GND		~~>10K~~OL
P3	GSE	N/U	13	Chasis	GND	13 to GND		~~>10K~~OL
P3	GSE	N/U	14	Chasis	GND	14 to GND		~~>10K~~OL
P3	GSE	Therm B~~A~~4+	15	Chasis	GND	15 to GND		~~>10K~~OL
P3	GSE	28VB~~A~~+	16	Chasis	GND	16 to GND		~~>10K~~OL
P3	GSE	N/U	17	Chasis	GND	17 to GND		~~>10K~~OL
P3	GSE	Therm B~~A~~3+	18	Chasis	GND	18 to GND		~~>10K~~OL
P3	GSE	28VB~~A~~+	19	Chasis	GND	19 to GND		~~>10K~~OL
P3	GSE	N/U	20	Chasis	GND	20 to GND		~~>10K~~OL
P3	GSE	Therm B~~A~~2+	21	Chasis	GND	21 to GND		~~>10K~~OL
P3	GSE	28VB~~A~~+	22	Chasis	GND	22 to GND		~~>10K~~OL
P3	GSE	N/U	23	Chasis	GND	23 to GND		~~>10K~~OL
P3	GSE	Therm B~~A~~1+	24	Chasis	GND	24 to GND		~~>10K~~OL
P3	GSE	28VB~~A~~+	25	Chasis	GND	25 to GND		~~>10K~~OL

CHECKS TO PERFORM:

PIn-to-pin and pin-to-gnd
as indicated

CONN.	GSE/ FLT	SIGNAL +	PIN	SIGNAL -	PIN	CHECKOUT	R (Ω)	EXPECTED VALUES (Ω)
P3	GSE	28VA+	16	Htr A4-	1	16 to 1		~2.08~~1892~~K
P3	GSE	28VA+	19	Htr A3-	4	19 to 4		~2.08~~1892~~K
P3	GSE	28VA+	22	Htr A2-	7	22 to 7		~2.08~~1892~~K
P3	GSE	28VA+	25	Htr A1-	10	25 to 10		~2.08~~1892~~K
P3	GSE	Therm A4+	15	GND	2	15 to 2		~35~~42~~K
P3	GSE	Therm A3+	18	GND	5	18 to 5		~35~~42~~K
P3	GSE	Therm A2+	21	GND	8	21 to 8		~35~~42~~K
P3	GSE	Therm A1+	24	GND	11	24 to 11		~35~~42~~K

CHECKS TO PERFORM:
PIn-to-pin and pin-to-gnd
as indicated

5.2 Power On Checks

5.2.1 Input

Mate the appropriate unpopulated BOB between the TC power input harness P1 and the TC input connector J1. Set the input voltage power supply to 28 volts and Vset power supply voltage to –10C from the GSE Labview window.~~5.0 volts~~. Measure the GSE input voltages for the designated connector listed in the following table. Turn off the input power supplies and populate the P1/J1 BOB.

CONN.	GSE/ FLT	SIGNAL +	PIN	SIGNAL -	PIN	CHECKOUT	Volts (DC)	EXPECTED VALUES (V)
P1	GSE	28 VA	4	28 VA RTN	8	4 to 8		~28.0
P1	GSE	28 VB	5	28 VB RTN	9	5 to 9		~28.0
P1	GSE	Vset A	1	Vset A RTN	6	1 to 6		≥0.0≤5.0
P1	GSE	Vset B	2	Vset B RTN	7	2 to 7		≥0.0≤5.0

5.2.2 Output

Mate the appropriate unpopulated BOB between the TC output harness P2 and the TC output connector J2. Set the input voltage power supply to 28 volts and Vset power supply voltage to 23C with the GSE Labview window.~~5.0 volts.~~ Measure the TC output voltages for the designated connector listed in the following table. Turn off the input power supplies.

CONN.	GSE/ FLT	SIGNAL +	PIN	SIGNAL -	PIN	CHECKOUT	Volts (DC)	EXPECTED VALUES (V)
J2	FLT	28VA+	16	Htr A4-	1	16 to 1		~28.0
J2	FLT	28VA+	19	Htr A3-	4	19 to 4		~28.0
J2	FLT	28VA+	22	Htr A2-	7	22 to 7		~28.0
J2	FLT	28VA+	25	Htr A1-	10	25 to 10		~28.0
J2	FLT	28VB+	3	Htr B4-	14	3 to 14		~28.0
J2	FLT	28VB+	6	Htr B3-	17	6 to 17		~28.0
J2	FLT	28VB+	9	Htr B2-	20	9 to 20		~28.0
J2	FLT	28VB+	12	Htr B1-	23	12 to 23		~28.0
J2	FLT	Therm A4+	15	GND	2	15 to 2		~3.6~~6.2~~+/-.2
J2	FLT	Therm A3+	18	GND	5	18 to 5		~3.6~~6.2~~+/-.2
J2	FLT	Therm A2+	21	GND	8	21 to 8		~3.6~~6.2~~+/-.2
J2	FLT	Therm A1+	24	GND	11	24 to 11		~3.6~~6.2~~+/-.2

CHECKS TO PERFORM:
PIn-to-pin and pin-to-gnd
as indicated

Mate the appropriate unpopulated BOB between the TC output harness P3 and the TC output connector J3. Set the input voltage power supply to 28 volts and Vset power supply voltage to 23C with the GSE Labview window~~5.0~~ volts. Measure the TC output voltages for the designated connector listed in the following table. Turn off the input power supplies.

CONN.	GSE/ FLT	SIGNAL +	PIN	SIGNAL -	PIN	CHECKOUT	Volts (DC)	EXPECTED VALUES (V)
J3	FLT	28VB+	16	Htr B4-	1	16 to 1		~28.0
J3	FLT	28VB+	19	Htr B3-	4	19 to 4		~28.0
J3	FLT	28VB+	22	Htr B2-	7	22 to 7		~28.0
J3	FLT	28VB+	25	Htr B1-	10	25 to 10		~28.0
J3	FLT	28VA+	3	Htr A4-	14	3 to 14		~28.0
J3	FLT	28VA+	6	Htr A3-	17	6 to 17		~28.0
J3	FLT	28VA+	9	Htr A2-	20	9 to 20		~28.0
J3	FLT	28VA+	12	Htr A1-	23	12 to 23		~28.0
J3	FLT	Therm B4+	15	GND	2	15 to 2		~3.6~~6.2~~+/-.2
J3	FLT	Therm B3+	18	GND	5	18 to 5		~3.6~~6.2~~+/-.2
J3	FLT	Therm B2+	21	GND	8	21 to 8		~3.6~~6.2~~+/-.2
J3	FLT	Therm B1+	24	GND	11	24 to 11		~3.6~~6.2~~+/-.2

CHECKS TO PERFORM:
PIn-to-pin and pin-to-gnd
as indicated

5.3 Electrical Verification

Mate the appropriate populated BOB between the TC power input harness P1 and the TC input connector J1. Also mate the appropriate populated BOB between the TC output harnesses P2 and P3 to the TC output connectors J2 and J3. Turn on the TC input power supply to 28 volts. Set the Vset voltage to 2 degrees from room temperature via the TC labview software. Monitor temperatures and verify they are within .25 degrees of the Vset. Complete the following sections with the TC controlling at the selected Vset.

5.3.1 10 Volt Reference

Using an voltmeter~~Oscilloscope~~ verify the 10 volt reference on the primary and secondary side is approximately 10 volts.~~-~~ Place the negative probe on pin 9 on connector J1. ~~-~~Place the positive probe at pin 1 on U2A Ref_A for the primary side and pin 1 U5A Ref_B for the secondary side.~~-~~ ~~Record the information to a picture file.~~

A-side_____
B-side_____

5.3.2 Timing Checks

Using an Oscilloscope verify each channel on the primary and secondary side is controlling. Load the TEK00003.SET setup file to configure the oscilloscope.~~-~~ Connect a probe to each of the primary heater channels at 28 Volt~~s~~ return, pin 1~~6~~,4~~19~~,7,~~22~~ and 10~~25~~ on the P2/J2 BOB. Record the turn on and turn off time for each channel to a picture file. The rise time should be approximately 1 millisecond and a fall time of.25 millisecond. Repeat the above procedure on the P3/J3 BOB. Record picture names below

Chan#1A_____ Chan#1B_____

Chan#2A_____ Chan#2B_____

Chan#3A_____ Chan#3B_____

Chan#4A_____ Chan#4B_____

NOTE: If testing 3-channel inverter version disregard channel#4 checks and verify channel #3 is inverted.

5.3.3 Switching Frequency

Using an Oscilloscope verify the switching frequency on the primary and secondary side is approximately 8.5 Hz. Load the TEK00001.SET setup file to configure the oscilloscope. Place the probe at pin 16 on U2D Ramp A for the primary side and pin 16 U5D Ramp B for the secondary side. Record the information to a picture file.

Side A_____

Side B_____

5.3.4 Noise

Using an Oscilloscope verify the noise on the primary and secondary side is no more than 12mV peak to peak. Place a probe at +28VA for the primary side and a probe at +28VB for the secondary side. Record the information to a picture file.

5.3.5 Power dissipation

Insert Multimeter to monitor current at the GSE 28 Volt Input Power. Step through voltages in table below adjusting the Vset to force all channels off or on.

Input Voltage Volts DC	All Channels OFF I		All Channels ON I	
	A	B	A	B
21.0				
22.0				
23.0				
24.0				
25.0				
26.0				
27.0				
28.0				
29.0				
30.0				
31.0				
32.0				
33.0				
34.0				
35.0				

6 FUNCTIONAL TESTING

6.1 Temperature Control Range and Accuracy

In order to test the full temperature control range requires a thermal chamber or thermal vacuum chamber. Please refer to the BAT Temperature Controller Thermal Test Procedure (410.4-PROC-0060) to complete this portion of testing.

7 ENVIRONMENTAL TESTING

With the exception of thermal cycling which is completed in section 6.1 the environmental qualification of the ETU Temperature Controller is completed at the block level.

8 QUALITY ASSURANCE

Design, fabrication, assembly, and test shall be in accordance with the Swift Mission Assurance Requirements Document, 410.4-SPEC-0001 (Also referenced as: GSFC-SWIFT-410-SPEC-0002) and the Swift Quality Management Plan, 410.4-PG-8730.3.1. The Swift BAT Parts Control Plan 410.4-PLAN-0006 will be implemented. All personnel working within 3 feet of hardware must be ESD certified and follow requirements of NASA-STD-8739.7