



**Project Document**

**TFCS Acceptance  
Test Plan and procedures**

**Ref:** SPIRE-RAL-  
DOC-002281

**Issue:** 1.0

**Date:** 25/01/2005

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PREPARED BY:	Samuel Ronayette (U of L/RAL)	
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J.Payne  
S. Sidher  
D.Smith  
K. King

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FIGURES

TABLES

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## Glossary

CBB	Cold Black Body
CQM	Cryogenic Qualification Model
EGSE	Electrical Ground Support Equipment
FIR	Far Infrared
FTS	Fourier Transform Spectrometer
ICD	Interface Control Document
PFM	Proto-Flight Model
SPIRE	SPectrometer and Infrared REceiver
TFCS	Test Facility Control System
VI	Virtual Instrument

## 1. INTRODUCTION

### 1.1 Scope

This document describes the test to be performed on the Test Facility Control System (TFCS) in order to verify that it meet the requirements specified in RD 1. The tests concern the software only and the assumption is made that the hardware commanded by the TFCS functions properly.

### 1.2 Structure of Document

User requirements are summarized in the table section 2. Then, a test plan is described. The procedures of each test are given in the last section of this document.

### 1.3 Documents

Applicable Documents

	Title	Author	Reference	Date
AD 1	TFCS Requirements	Dave Smith	SPIRE-RAL-NOT-001172 1.0	Jan 2005

## 2. USER REQUIREMENTS

Section (AD1)	Requirement No.	ID	Description
5.1. System	5.1.1	1	All functions of the TFCS will be performed from a single Pentium III PC running Windows NT-4.
	5.1.2	2	The TFCS PC shall have sufficient expansion slots to incorporate <ul style="list-style-type: none"><li>• A GPIB, IEEE-488 interface card</li><li>• 2 (TBC) National Instruments data acquisition cards.</li><li>• TBD additional serial ports.</li></ul>
	5.1.3	3	The TFCS PC shall have a network link to the SPIRE EGSE.
	5.1.4	4	The TFCS shall be configured so that it can either be controlled as a stand-alone system or remotely from SCOS-2000.
	5.1.5	5	The TFCS shall be time synchronised to the SPIRE EGSE.
	5.1.6	6	The TFCS software shall be written in LabVIEW 6i™.



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5.2. Data Logging	5.2.1	7	All TFCS Data must be recorded to a file
	5.2.2	8	It shall be possible to stop and restart data logging at any time.
	5.2.3	9	A new log file shall be generated whenever logging restarts.
	5.2.4	10	Existing log files must not be overwritten when logging is started/restarted.
	5.2.5	11	It shall be possible to concatenate data from several log-files.
5.3. Display	5.3.1	12	The temperatures, vacuum pressures and cryogen levels, cold-blackbody parameters, telescope simulator parameters shall be displayed for real-time and archived data for the full SPIRE test period.
	5.3.2	13	The display will be configurable by the user to show data from parameters of interest over a selected time range. The configuration settings shall include as a minimum: <ul style="list-style-type: none"> <li>• The parameters to be displayed</li> <li>• Graphical or Text output</li> <li>• The output format (precision, linestyle, colour)</li> <li>• Display type (Linear or Logarithmic)</li> <li>• Time/Date range</li> <li>• Time/Date resolution</li> <li>• Parameter range</li> <li>• Parameter resolution</li> <li>• Alarm limits</li> </ul>
	5.3.3	14	It shall be possible to call up displays independently of whether the TFCS is operating as a stand-alone system, or from the TFCS.
	5.3.4	15	The configurations of the displays shall be saved to an editable text file so that a particular display format can be reused.
	5.3.5	16	It shall be possible to produce an electronic copy of the display (i.e. pdf file)
	5.3.6	17	It shall be possible to play back data through display system.
	5.3.7	18	Temperature data will be compiled into a data packet for transmission to the rest of the EGSE systems. ??? (c.f. 5.5.1)
5.4. Monitoring.	5.4.1	19	It shall be possible for the user to define upper and lower alarm settings.
	5.4.2	20	The TFCS shall monitor all parameters and check for out of limits conditions.
	5.4.3	21	An audible alarm shall be triggered in the case of a parameter being out of limits.
5.5. EGSE Interface.	5.5.1	22	The data from all of the TFCS subsystems will be incorporated into telemetry packets to be sent to the SPIRE EGSE by the packet router. The format and content of the telemetry packets will be defined in the TFCS TM/TC Packet ICD
	5.5.2	23	Telecommands issued by SCOS-2000 to the TFCS subsystems will be sent via the packet router. The format and content of the telecommand packets will be defined in the TFCS TM/TC Packet ICD
6.1.1.3. Logging Requirements.	6.1.1.3.1	24	The temperatures of all the thermometers listed in table 1 of AD1 shall be automatically recorded by the TFCS. The update rate will be every 16 seconds (TBC) for all sensors.
	6.1.1.3.2	25	All temperatures shall be logged and monitored continuously throughout the tests.
	6.1.1.3.3	26	No other process on the TFCS may interrupt temperature logging unless a specific instruction has been sent.
6.1.2.2. Cryogen Data Logging.	6.1.2.2.1	27	The level sensors will be polled every 16 seconds (TBC)
	6.1.2.2.2	28	No other process on the TFCS may interrupt the level logging and monitoring unless a specific instruction has been sent.



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	6.1.2.2.3	29	The liquid nitrogen and helium levels shall be logged and monitored continuously throughout the tests.
6.1.3.2. Software.	6.1.3.2.1	30	The pressure gauges will be polled every second (TBC).
	6.1.3.2.2	31	No other process on the TFCS may interrupt the pressure monitoring unless a specific instruction has been sent.
	6.1.3.2.3	32	The pressure readings shall be logged and monitored continuously throughout the tests except when the SPIRE instrument is switched on.
	6.1.3.2.4	33	It shall be possible to disable the pressure monitoring without affecting the overall logging system (i.e. temperature, levels...). When the pressure monitoring is disabled the pressure gauges must be switched off.
	6.1.3.2.5	34	It shall be possible to reactivate the pressure gauges and monitoring without having to restart the overall logging system.
	6.1.3.2.6	35	The rate of change of vacuum pressure shall be calculated and displayed.
6.1.5.1 Telemetry.	6.1.5.1.1	36	The parameters listed in Table 5 (AD1) Shall be transmitted to SCOS-2000
6.1.5.2. Telecommands.	6.1.5.2.1	37	All the commands in Table 5 (AD1) to be sent from SCOS-2000 to control the cryostat
6.1.5.3. Events.	6.1.5.3.1	38	All the events in Table 6 (AD1) to be sent to SCOS-2000
6.2.1 CBB Software Requirements	6.2.1.2	40	It shall be possible to set the cold-blackbody heater power, flip mirror position and heat shunt position from the SPIRE EGSE
	6.2.1.3	41	No other process on the TFCS may interrupt the cold-blackbody control and monitoring unless a specific instruction has been sent
	6.2.1.4	42	The temperatures, heater power, mirror and heat shunt positions shall be logged and monitored continuously throughout the tests
6.2.2.1 Telemetry	6.2.2.1.1	43	The parameters listed in Table 7 (AD1) shall be transmitted to SCOS-2000 as telemetry packets
6.2.2.2. Telecommands.	6.2.2.2.1	44	The commands in Table 8 (AD1) are to be sent from SCOS-2000 to the TFCS to control the cold-blackbody
6.2.2.3. Events.	6.2.2.3.1	45	The events in Table 9 (AD1) are to be sent to SCOS-2000
6.3.2.1. Telescope Control Software Requirements	6.3.2.1.1	46	It shall be possible to move the image of a point source by the telescope simulator to a given detector position Y, Z
	6.3.2.1.2	47	It shall be possible to scan the image of a point source across a range of SPIRE detectors.
	6.3.2.1.4	48	It shall be possible to reset the co-ordinates of the actuator positions to a defined setting (e.g. zero mm)
	6.3.2.1.5	49	It shall be possible to remotely switch-on/off the motors.
6.3.2.2. Display.	6.3.2.2.1	50	The TFCS shall provide a real-time display of the commanded and actual positions of the actuators.
	6.3.2.2.2	51	The TFCS shall indicate the commanded pixel co-ordinates
	6.3.2.2.3	52	The TFCS shall indicate the status of the motors (On/Off).
	6.3.2.2.5	54	An audible alarm shall sound if an actuator end-stop has been reached
6.3.3.1. Telemetry.	6.3.3.1.1	55	Refer to AD1 for telemetry information
6.3.3.2. Commands	6.3.3.2.1	56	Refer to AD1 for telecommand information
6.3.3.3. Events.	6.3.3.3.1	57	Refer to AD1 for Events to be sent to SCOS-2000
6.4.2 EGSE temp		58	
6.5 HBB		59	The TFCS shall be able to set and monitor the temperature of the hot blackbody.



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6.6 Weather station		60	The TFCS shall monitor the temperature, p ressure and relative humidity within the telescope simulator enclosure
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**3. TEST PLAN**

Test	Requirement(s) covered
Cryostat temperature Display	12, 14, 24
EGSE temperatures display	14, 58
Cryogen Level display	12, 14, 27
Pressure display	12, 14, 30, 34, 35
CBB temperature Display	12, 14
Weather station display	14, 60
Data logging	7, 8, 9, 10, 11, 25, 26, 28, 29, 31, 32, 33, 41, 42
Playback display	17, 25, 26, 28, 29, 31, 32, 33
Alarm limits	19, 20, 21, 54
CBB control	40
Telescope Simulator control	46, 47, 48, 49, 50, 51, 52
HBB control	14, 59
Telemetry	3, 5, 22, 36, 38, 43, 45, 55, 57
Commands	3, 4, 23, 37, 44, 56

Note: Requirements 1,2,3 and 6 are met by design, there is no specific test related to these requirements.

**4. HARDWARE SET-UP**

In order to perform those tests, the following equipment in the lab must be switched on:

- Hot Black Body
- Motion Controller (but leave motors OFF)
- Lakeshore unit (DC units and AC bridge)
- Cold black body electronics (plugged to cold black body itself if possible)
- Cryogen level sensor
- Pressure gauge
- Weather station (make sure all sensors and Ethernet cable are plugged in)

**5. TESTS PROCEDURES**

For all the following tests, you need first to run the TFCS on the TFCS machine in the SPIRE lab:  
 Start menu -> Programs -> Spire tfcs -> TFCS

**5.1 Subsystems logging and control**



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**5.1.1 Cryostat temperatures display**

1. Click on the button “temperature”. Temperature front panel appears
2. Wait for the initialisation of the lakeshore units to finish
3. Check that all the 31 values of the thermometers appear on the digital display (sensor unit or digital display). Click toggle button to select temperatures. Check that sensors are in expected range (290K +/- 10 K). Record values in table below.
4. Tick all the checkboxes associated with each temperature and check that they all appear on the graph
5. Leave it running and verify that the display is updated every ~15 sec

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.1.1.1	Temperatures display starts	-	-		
5.1.1.3	Cryostat temperatures:				
	Temp 1	290 +/- 10 K			
	Temp 2	290 +/- 10 K			
	Temp 3	290 +/- 10 K			
	Temp 4	290 +/- 10 K			
	Temp 5	290 +/- 10 K			
	Temp 6	290 +/- 10 K			
	Temp 7	290 +/- 10 K			
	Temp 8	290 +/- 10 K			
	Temp 9	290 +/- 10 K			
	Temp 10	290 +/- 10 K			
	Temp 11	290 +/- 10 K			
	Temp 12	290 +/- 10 K			
	Temp 13	290 +/- 10 K			
	Temp 14	290 +/- 10 K			
	Temp 15	290 +/- 10 K			
	Temp 16	290 +/- 10 K			
	Temp 17	290 +/- 10 K			
	Temp 18	290 +/- 10 K			
	Temp 19	290 +/- 10 K			
	Temp 20	290 +/- 10 K			
	Temp 21	290 +/- 10 K			
	Temp 22	290 +/- 10 K			
	Temp 23	290 +/- 10 K			
	Temp 24	290 +/- 10 K			
	Temp 25	290 +/- 10 K			
	Temp 26	290 +/- 10 K			
	Temp 27	290 +/- 10 K			
	Temp 28	290 +/- 10 K			
	Temp 29	290 +/- 10 K			
	Temp 30	290 +/- 10 K			
	Temp 31	290 +/- 10 K			
5.1.1.4	Temperatures appears on graph	-	-		
5.1.1.5	Display is updated	-	-		





**5.1.2 EGSE temperatures display**

1. Click on the button “Extra temperature”. Extra Temperature display front panel appears
2. Wait for the initialisation of the lakeshore units to finish
3. Check that all the 13 values of the thermometers (Ohm) appear on the digital display and are in expected range (290K +/- 10 K) – see table to fill in at the end of this document
4. Tick all the checkboxes associated with each temperature and check that they all appear on the graph
5. Leave it running and verify that the display is updated every ~15 sec

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.1.2.1	Temperatures display starts	-	-		
5.1.2.3	Instrument temperatures:				
	Temp 1	290 +/- 10 K			
	Temp 2	290 +/- 10 K			
	Temp 3	290 +/- 10 K			
	Temp 4	290 +/- 10 K			
	Temp 5	290 +/- 10 K			
	Temp 6	290 +/- 10 K			
	Temp 7	290 +/- 10 K			
	Temp 8	290 +/- 10 K			
	Temp 9	290 +/- 10 K			
	Temp 10	290 +/- 10 K			
	Temp 11	290 +/- 10 K			
	Temp 12	290 +/- 10 K			
	Temp 13	290 +/- 10 K			
	Temp 14	-			
	Temp 15	-			
	Temp 16	-			
5.1.2.4	Temperatures appears on graph	-	-		
5.1.2.5	Display is updated	-	-		



### 5.1.3 Cryogen Level display

1. Click the button “cryogen” on the TFCS front panel. Cryogen level front panel appears
2. Click on “begin monitoring” on the level monitoring front panel
3. Check that the “low Alarm”, “low”, “high”, “high alarm” levels are read successively every ~5 sec and that values are as expected, by comparing with the reading on the front panel of the level sensor in the lab (reading will be 0 until vessel is filled with LN2). Record values.

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.1.3.1	Cryogen level display starts	-	-		
5.1.3.3	Parameters values				
	Low alarm				
	Low				
	High				
	High alarm				

### 5.1.4 Pressure display

1. Click the button “pres sure” on the TFCS front panel. Pressure front panel appears
2. Click on “begin monitoring” on the pressure monitoring front panel
3. Check that pressure are read every ~15 sec and are as expected ( $\sim 10^3$  mbar and same reading on the unit in the lab). Record values
4. Check that values on “change rate” display are sensible
5. Stop the pressure monitoring (button “quit”)
6. Restart it (step 1 to 3)

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.1.4.1	Pressure display starts	-	-		
5.1.4.3	Parameters values				
	Pirani gauge				
	Full range gauge				
5.1.4.4	Change rate is OK	-	-		
5.1.4.5	Pressure display stops	-	-		
5.1.4.6	Pressure display restart	-	-		



**5.1.5 Weather Station display**

1. Click the button “weather” on the TFCS front panel. Weather station front panel appears
2. Check that communication is established (error code =0 on weather station front panel – if not, check TCP/IP connection)
3. Check digital displays for Temp1, Temp2, Temp3, pressure, rel. humidity 1 and rel. humidity 2. Record values.
4. Check that they appear on the graphical display. With the menu, change the graphical display to pressure, temperature, or relative humidity.

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.1.5.1	Weather station displays starts	-	-		
5.1.5.2	Communication is OK	-	-		
5.1.5.3	Parameters values				
	Temp1				
	Temp2				
	Temp3				
	R.H. 1				
	R.H. 2				
	Atm. pressure				
5.1.5.4	Data appear on graph	-	-		

**5.1.6 Data logging**

1. Open folder D:\TFCS Archive\
2. Find latest \*.tfc file and check that it is updated every 15 seconds (and increases in size by ~1 kB at each update)
3. Click the button “convert data file”
4. Select the latest .tfc log file created and press the “continue” button to write the data into a .txt file
5. Edit the .txt file written (Notepad, WordPad, Excel) and check that all the parameters have been logged properly (better to open with Excel)

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.1.6.2	.tfc file is created and updated				
5.1.6.4	Data are in txt file as expected	-	-		



**5.1.7 Play back Data display**

1. If test Data logging is successful: click on the button “Playback data”
2. Select the “view temperatures” and “display data from the last 1 day(s)”and press “go”
3. Verify that the data recorded in the past appeared on the graph
4. Check that the most recent data are the same as that on the real time display
5. Repeat for other parameters (pressure, cryogen level, weather)

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.1.7.3	Temperatures history appears				
5.1.7.4	Correct set of data is played back				
5.1.7.5	Pressure history is ok				
	Cryo level history is ok				
	Weather history is ok				

**5.1.8 Alarm limits**

1. On TFCS front panel, click the button “set alarm limits”
2. Make sure cryogen level, pressure, cryostat temperatures, telescope simulator parameters, cold black body parameters and hot black body parameters are being logged
3. Tick some check boxes
4. Check that an audible sound alarm goes off if at least one parameter is out of range (change the low-high range if necessary)
5. Check that the alarm stops if the checkbox corresponding to the parameter(s) out of range is not ticked
6. Note that it is possible to save the configuration (low limit, high limits, checkboxes)

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.1.8.4	Alarm is heard				
5.1.8.5	Alarm stops				



### 5.1.9 CBB control and display

1. From TFCS front panel, click on “Cold BB “ to open the cold black body control and monitoring program
2. Check digital display for thermometers T1, T2, T3 and T4 (Ohm and Kelvin). Check that values are as expected and record it
3. Check that the temperature are displayed on the graph
4. Check that temperatures are read every ~15 sec
5. Switch the state of the mirror to “view CBB” or “view room”
6. Check that the green LED indicates that the mirror is travelling, then that it is open or closed
7. If the CBB is visible (i.e. not in the cryostat closed), check that the mirror has moved

**Following steps (5 to 7) can only be performed at Liquid Helium temperatures:**

8. If the CBB is cold, set a target temperature greater than 4.2 K. Check that the applied power goes above 0 and that the CBB reaches the required temperature (this may take several minutes)
9. Close heat shunt. If the CBB is “warm” (~40K) and in cooling down (applied power = 0), check that closing the heat shunt significantly increases the cooling rate.
10. Re-open heat shunt

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.1.9.1	CBB display starts				
5.1.9.2	Parameters values				
	T1				
	T2				
	T3				
	T4				
5.1.9.3	Temperatures appear on graph				
5.1.9.4	Display is updated				
5.1.9.6 5.1.9.7	Mirrors has moved and VI indicates it				
5.1.9.8	Power is applied – target temperature is reached				
5.1.9.9	Heat shunt is closed				
5.1.9.10	Heat shunt is open				



### 5.1.10 Telescope simulator control

1. Start the telescope simulator control VI from the TFCS front panel
2. Switch on motors. Check that the green LED goes ON on the VI front panel and on the motion controller front panel in the lab
3. Set a Y, Z position to reach (e.g Y=+10 mm, Z=-95 mm). Press the button “engage Y, Z”
4. Check that the actuators have moved, by looking at the actual (measured) positions of the actuators
5. Check that the requested position and actual positions are similar
6. Send the telescope simulator to the extreme values of SPIRE’s FoV: +40 and -80 mm in Y, -115 and -65 mm in Z
7. Check that requested and actual positions are still the same and that the motors remain ON (hitting a hardware limit causes the motors to go OFF)
8. In the lab, check that the actuators and tip/tilt platforms remain in contact
9. Re-set the actuator position to the centre by pressing the button “move to centre”
10. Check that actuators position are 0
11. Switch motors OFF

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.1.10.1	Telescope simulator control starts				
5.1.10.2	Motors are switched on				
5.1.10.4	Mirrors have moved				
5.1.10.5	Position is as requested				
5.1.10.7	Full range scan is OK				
5.1.10.8	Hardware follows				
5.1.10.10	Actuators are re-centred				
5.1.10.11	Motors are off				



### 5.1.11 HBB control

1. Start the Hot black body control VI from the TFCS front panel
2. Set a target temperature (e.g. 200 deg C)
3. Check that the set point temperature increases up to the requested one, and that the measured temperature follows
4. Set the target temperature back to room temperature

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.1.11.1	HBB display starts				
5.1.11.3	Temperature is set as requested				
	Set point temperature				
	Measured temperature				

## 5.2 Interface with EGSE

### 5.2.1 Telemetry

1. Connect the TFCS to the router: click “connect to router”, IP 130.246.32.25, port number 9877-> connect, name\_client: “TFCS”-> send command, then add\_client with APID: 7F4->send command->close without sending
2. From TFCS front panel, run the following VIs: cryostat temperature, extra temperatures, telescope simulator, HBB, weather station, CBB, pressure, cryogen level
3. On SCOS display check that the values of the parameters appear, are correct and are updated every second. The relevant SCOS displays are: TFCS BB parameters, TFCS cryostat parameters, Instrument temperatures, TFCS Tel Sim, Weather Station parameters.
4. Check that the time in the TFCS packets is the same than the rest of the EGSE

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.2.1.1	TFCS is connected to router				
5.2.1.3	Parameters appear on SCOS display and are similar to the ones on TFCS display				
5.2.1.4	Time synchronisation is OK				



**5.2.2 Commands**

1. Connect the TFCS to the router: click “connect to router”, IP 130.246.32.25, port number 9877-> connect, name\_client: “TFCS”-> send command, then add\_client with APID: 7F4->send command->close without sending.

**Then send the following commands from SCOS and check each time that the TFCS does the action required:**

2. **Temperature, cryogen and pressure monitoring:**

ACTION	COMMAND	ACTIVITY
2.1. Start cryostat temperatures monitoring	T_logging_control	activate temp log
2.2. Stop cryostat temperatures monitoring	T_logging_control	deactivate temp log
2.3. Start cryogen level monitoring	T_logging_control	activate cryo log
2.4. Stop cryogen level monitoring	T_logging_control	deactivate cryo log
2.5. Start pressure monitoring	T_logging_control	activate press log
2.6. Stop pressure monitoring	T_logging_control	deactivate press log
2.7. Start extra Temperature monitoring	T_logging_control	activate instr log
2.8. Stop extra temperature monitoring	T_logging_control	deactivate instr log
2.9. Check that commands have been accepted	(check SCOS command history display)	

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.2.2.1	TFCS is connected to router	-	-		
5.2.2.2.1	Cryostat temperature display starts	-	-		
5.2.2.2.2	Cryostat temperature display stops	-	-		
5.2.2.2.3	Cryo level display starts	-	-		
5.2.2.2.4	Cryo level display stops	-	-		
5.2.2.2.5	Pressure display starts	-	-		
5.2.2.2.6	Pressure display stops	-	-		
5.2.2.2.7	Extra temp display starts	-	-		
5.2.2.2.8	Extra temp display stops	-	-		
5.2.2.2.9	Commands are accepted	-	-		





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**3. CBB control and monitoring:**

ACTION	COMMAND	ACTIVITY
3.1. Start CBB monitoring	T_flip_mirror	Activate log
3.2. Open flip mirror	T_flip_mirror	View CBB
3.3. Close flip mirror	T_flip_mirror	View ext
3.4. Set target temperature to 10K	T_Set_CBB_temp	-
3.5. Set target temperature to 4K	T_Set_CBB_temp	-
3.6. Open heat shunt	T_flip_mirror	Open heat shunt
3.7. Close heat shunt	T_flip_mirror	Close heat shunt
3.8. Stop CBB monitoring	T_flip_mirror	Deactivate log
3.9. Check that commands have been accepted	(check SCOS command history display)	

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.2.2.3.1	CBB display starts				
5.2.2.3.2	Mirror opens				
5.2.2.3.3	Mirror closes				
5.2.2.3.4	Temperature goes up				
5.2.2.3.5	Temperatures goes down				
5.2.2.3.6	Heat shunt opens				
5.2.2.3.7	Heat shunt closes				
5.2.2.3.8	CBB display stops				
5.2.2.2.9	Commands are accepted	-	-		



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**4. Telescope simulator (T/S) control and monitoring**

ACTION	COMMAND	ACTIVITY
4.1. Start T/S monitoring	T_telescope_Func	Activate log
4.2. Switch motors ON	T_telescope_Func	Activate MM4006
4.3. Move T/S to e.g. X=+5, Y=-5 and Z=-85 mm	T_move_to_det_pos	-
4.4. Move axis 1 by e.g. +1mm	T_set_actuator_pos	-
4.5. Repeat step 4.4 for axis 2, 3, 4, and 5	T_set_actuator_pos	-
4.6. Centre actuators	T_telescope_Func	Centre actuators
4.7. Switch motors OFF (= deactivate MM4006)	T_telescope_Func	Deactivate mm4006
4.8. Stop Telescope simulator monitoring	T_telescope_Func	Deactivate log
4.9. Check that commands have been accepted	(check SCOS command history display)	

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.2.2.4.1	T/S display starts				
5.2.2.4.2	Motors are switched ON				
5.2.2.4.3	T/S moves				
5.2.2.4.4	Axis 1 moves				
5.2.2.4.5	Axis 2 moves				
	Axis 3 moves				
	Axis 4 moves				
	Axis 5 moves				
5.2.2.4.6	Actuators moves to centre position				
5.2.2.4.7	Motors are switched OFF				
5.2.2.4.8	T.S display stops				
5.2.2.2.9	Commands are accepted	-	-		



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**5. Hot Black body control and monitoring**

ACTION	COMMAND	ACTIVITY
5.1. Start HBB monitoring	T_logging_control	Activate HBB
5.2. Set a target temperature to e.g. 200 deg C	T_Set_HBB_temp	-
5.3. Wait for set point temperature to reach the target	T_Set_HBB_temp	-
5.4. Stop HBB monitoring	T_logging_control	Deactivate HBB
5.5. Check that commands have been accepted	(check SCOS command history display)	

Test ref.	Parameter / action to check	Parameter value expected	Parameter values read	Pass or fail	Comment
5.2.2.5.1	HBB display starts				
5.2.2.5.3	Temperatures reaches target				
5.2.2.5.4	HBB display stops				
5.2.2.2.9	Commands are accepted	-	-		