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**DISTRIBUTION**

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## Change of Record

| Issue Change | Section | Reason for |
| --- | --- | --- |

## Contents

## Applicable Documents

AD1   SPIRE-RAL-NOT-000622   Telescope Simulator Optical Design,   Issue: 3.0

AD2   SPIRE-RAL-NOT-000734   Set-up and alignment procedure for the Telescope Simulator Imaging Mirror,   Issue: 2.0

AD3   SPIRE-RAL-NOT-001172   Test Facility Control System Requirements,   Draft: 0.4

AD4   SPIRE_RAL_NOT_001710 Motion Controller Software Design Specification

AD5    SPIRE_RAL_NOT_001712 Motion Controller Global Software Procedures

# 1    List of Acronyms

AZ              Azimuth
EL              Elevation
DSS             Data Socket Server
FA              Focus Adjustment
FOV             Field of View
GV              Global Variable
MC              Motion Controller
MM4006          Model of Newport Motion Controller
PC              Personal Computer
RAL             Rutherford Appleton Laboratory
SCOS (Space Craft Operating System)
SPIRE           Spectral and Photometric Imaging Receiver
TBC             To Be Confirmed
TBD             To Be Determined
TFCS            Test Facility Control System
Tel.Sim.        Telescope Simulator Control System
VI              Virtual Instrument
ZOM             Zemax Optical Model

# 2    Scope of Document

This document specifies the procedures for the running of SPIRE Test Facility Motion Controller Software and its interface to the SCOS

The Motion Controller Software has been developed using Labview 6i™ to comply with the EGSE interface development and includes all the user requirements and software functions that were required to carry out testing.

# 3 Introduction

This Telescope Simulator Control Software was designed to control the Newport Motion Controller box for automated FOV scan control of the SPIRE Instrument. It was designed in LabVIEW 6i[TM] and interfaces with the Newport unit via an IEEE-GPIB connection.

The (Yesa, Zesa) coordinate system tables ("TelSim_Scan Table_v3.xls") that the software uses to scan the instrument's test field combined Spectrometer and Photometer FOV were designed by Marc Ferlet and contain conversions from the desired test beam positions in the field of view to specific axis positions to allow accurate testing.

The Software interfaces with these (Yesa, Zesa) coordinate system table via C code node in the LabVIEW coding which uses a DLL (dynamic Link Library) to search through the table, find the closest point to the desired input value and interpolates to find the correct 5 axes positions. This DLL was developed and implemented by Dave Smith.

# 4 Procedure

1) Make sure the Newport Motion Controller box is powered and is turned on with the front panel of the box active, not in Stand-by mode. Axes 1-4 with there current positions should be listed on the Motion Controller's Display screen.

2) If the mains power has been cut off to the Motion Controller and it was not left in Stand-by mode, the port number and communication mode of the box may have reset. These need to be checked. The port should be set to 10 and the communication mode to IEEE. Please contact Marc Ferlet if this occurs.

3) Once the Motion Controller box is powered up and initialised, the Telescope Simulator Control Software needs to be opened on the TFCS PC The control interface is called Motion Controller Master and can be found in:

    D:/Motion Controller IEEE/Motion Controller Master_ELS

    This folder (D:/Motion Controller IEEE) also contains the library of sub-vi's that are contained within the top level control under Motion Controller_ELS.

4) Once the Front panel of the Telescope Simulator Control Software has launched, check that the correct port number is set on the front panel in the grey box in the top left hand side of the window. It should be set to:

    GPIB0::10::INSTR

5) To run the command software, you need to press the grey box with a white arrow in it in the top left hand corner on the LabVIEW task bar. This will command the Newport Motion Controller box into IEEE remote mode and the PC now has full control. This can be checked by looking at the display screen on the front of the Newport unit which should now have a banner across the screen displaying the message "IEEE Remote Mode".

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6) The Mode indicator button should read "Local" for the Front panel to have control. If it reads "Remote", this means that the Global Variable has control of the Newport unit so check who is using it before continuing. If you have permission to override there remote access then the "Get Control" button below the Indicator can be pressed which will then place the control on the Front panel and the Global will not be able to command unless they then replace the mode control to Remote.

7) The first command that will need to be sent is the Turn Motor On command. This can be engaged by pushing the "Motor On/Off" button in which should engage the green light on the button. The button should remain down to keep the motor on and if it is lifted, it will turn the motor off. The "Motor On/Off" button must be down for the axes to be moved.

8) To start a set of testing, all axes will probably need to be set in there home positions which has been pre set as zero on every axis. This zero or home for the axes places the test beam at the centre of the field of view of the Photometer of the SPIRE Instrument. The "Move Actuators Home" button in the top right hand corner of the window will place all the axes in there home positions.

9) To move the 5 axes to a specific position in the field of view of the instrument all that is needed is the (Yesa, Zesa) coordinate position. Input the position required in each box in turn in the middle left of the window and when you have entered to desired destination, push "Engage YZ". This command will execute a DLL to interpolate through the coordinate tables and place the axes in the correct positions.

10) To send a command to the Newport Motion Controller box which is not hard wired into the Front panel, the Engage Command string can be used which is located in the middle right hand side of the window. The Newport unit has two character short code for each command which can be sent from this string. Axis numbers and Displacement amounts can also be included in these commands. The procedure for using this function is:

   ➢ Type the appropriate two character short code into the "Command" string box.

   ➢ If an axis number is needed, selected the correct one from the "Axes" box and press the "Include Axis Number" button on which the indicating light should turn green. The button should remain down. If no specific axis is needed, then the command will be sent to all axes if it involves motion.

   ➢ If a displacement in needed, type in the desired value into the "Displacement" box and press the "Include Displacement" button on which the indicating light should turn green. The button should remain down.

   ➢ Once all the desired parts of the command have been included, press the "Engage Command" button. This will send the command and the green indicator light will light up, then the "Include Displacement" and "Include Axis Number" buttons should return to there upright positions and the green indicator lights on all the buttons will go out.

   ➢ The Read Return will only display a message from the Newport unit if the command sent specifically requested it.

> ➤ See Appendix 1 for a short table of relevant commands but all possible two character short codes can be found in the Newport Motion Controller box manual with full explanations of there uses.

11) On the middle left hand side of the window is a menu which has 3 built in commands, which are regularly used, which do not require the two character short codes. This contains a "Displace by" command, a "Move to Absolute position" command and a "Move Home" command. This can only be used to modify a single axis at a time as it does not include an opt out for the axis number or the displacement value. Once the correct variables have been selected, press the "Engage move" button and the command will be sent. The indicating button will go green and then the button will return to its upright position and the green light will go out.

12) The Read Return function, located at the bottom left hand side of the window, is where specific command should be entered to return information form the Newport unit. The specific two character code should be input into the "Request Data" box. If information is only required for one axis then an axis number can be included by selecting the correct one from the "Axis Number" box and then pressing down the "Include Axis" button, on which the indicator light should turn green. Once all required parts of the command have been included, press the "Read Return" button and the command will be sent. The indicating button will go green and then the button will return to its upright position and the green light will go out on all the buttons.

13) Located on the middle right hand side of the window are the "Requested Positions" and "Actual Positions" tables. These indicate where the actuators where commanded to go in the "Requested Positions" table and reads back from the Newport unit the "Actual Positions" that the axes are located at. This is to compare the axes positions and check the are performing correctly.

14) On the bottom right hand side of the window are the Global Variable's indicators. These can not be edited from the Front panel but are there for monitoring purposes, if the Telescope Simulator Control Software is being run from a remote location. [reference global variable tech note] This will be indicated by the "Mode" indicating button which will be displaying "Remote" instead of local.

15) Once all the desired commands have been executed, it is time to stop the program running. Firstly, the "Motor On/Off" button needs to be pressed again to bring it up so the indicating light goes dark and the motor has been turned off.

16) Then, to stop the program running, the "Port Close" button is pressed. This will cut off communication with the Newport Motion Controller box and this can be checked by observing the Newport unit's display screen which should no longer have the "IEEE Remote Mode" banner across it but now should display Axes 1 to 4 with there respective axis positions.

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17) If any incorrect commands are sent to the Newport unit during the course of testing, there is an "Emergency Stop" button. This not only ends the run of the Telescope Simulator Software but also sends a command to halt motion on all axes. This is to prevent damage to any part of the Telescope Simulator especially the mirrors and the actuators. If pressed the button indicator light will come on and end the run of the program and the will pop back up.

18) To run the testing sequence again once the "Emergency Stop" has been engaged, return to point 5) of this tech note and Run through the sequence again.

# 5    Adaptations

The conversion tables may be adjusted during the course of testing and so the DLL must be updated. The sub vi containing the C code interface node can be found in the Control Master Library in:

D:/Motion Controller IEEE/Motion Controller_ELS/TelSim_Table_DLSmith.vi

The actual DLL file is stored in:

D:/Motion Controller IEEE/ TelSim_Table.dll

This is where the new copy of the DLL must be stored. An updated version of the interface table will also have to be stored in this folder. See Dave Smith with any problems.

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**Appendix 1)**

A screen dump of the Front panel of the Telescope Simulator Control Software.
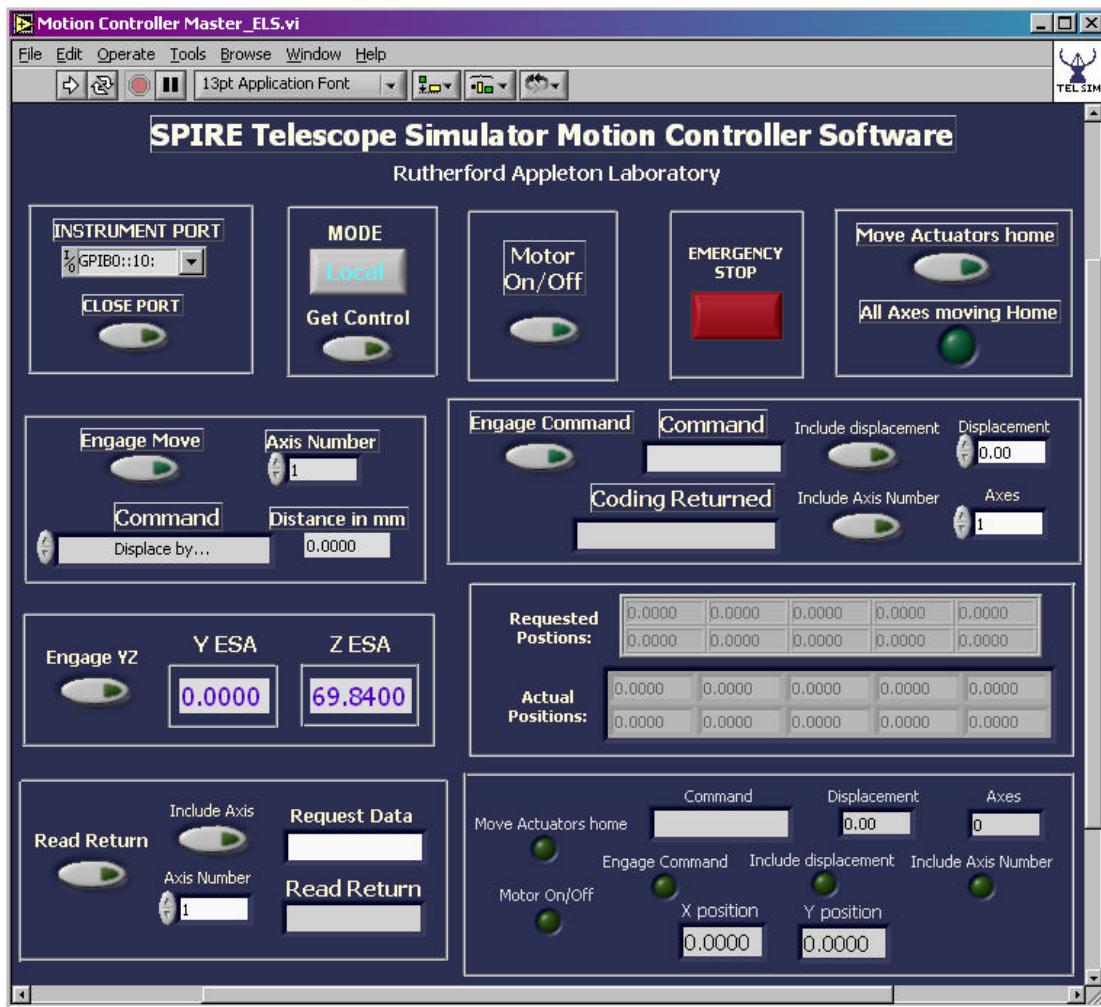
**Appendix 2)**

Table of two Character short code commands for the Newport Motion Controller box. (A full list of commands is available in the Newport MM4006 Manual)

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| Axes number | Short code | Value | Description |
|---|---|---|---|
| | **\*IDN?** | | Identity of Controller (should read: MM4006 Newport Motion Controller) |
| | **MF** | | Motor Off |
| | **MO** | | Motor On |
| [xx] | **DH** | | Define Home |
| [xx] | **OR** | [nn] | Search for Home |
| xx | **PA** | nn | Move to Absolute Position |
| xx | **PR** | nn | Move to Relative Position |
| [xx] | **ST** | | Stop Motion |
| [xx] | **ZP** | | Zero Position |
| [xx] | **TP** | | Read Actual Position |
| xx | **TL** | | Read Left Travel Limit |
| xx | **TR** | | Read Right Travel Limit |
| [xx] | **MS** | | Read Motor Status |
| | **TS** | | Read Controller status |