Prepared by: E.M. Llewellyn-Samuel

DISTRIBUTION

RAL M. Ferlet
T. Lim
A. Matheson
D. Smith
B. Swinyard

Change of Record

Issue	Section	Reason for Change

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

Reference Documents

RD1 SPIRE-RAL-NOT-001172 Test Facility Control System Requirements, Draft: 0.4

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
SPIRE	Spectral and Photometric Imaging Receiver
TFCS	Test Facility Control System
Tel.Sim.	Telescope Simulator Control System
VI	Virtual Instrument
ZOM	Zemax Optical Model
TBC	To Be Confirmed
TBD	To Be Defined

2 Scope of Document

This document specifies the requirements for the SPIRE Test Facility Motion Controller Software including both user requirements and software needs.

The Motion Controller Software is to be developed using Labview 6i™ to comply with the EGSE interface development and should include all the user requirements and software functions that are required. It covers the interfaces required with other software packages and how some of these interactions may be achieved.

3 Introduction

The main requirement of the Motion Controller Software is to position the telescope Simulator mirrors so that they can allow scanning of a point source, with the F=8.68 beam (as in the case of Herschel's Telescope) over the instrument FOV for calibration purposes. [AD1]

2 actuators for 2-axis scanning (elevation and azimuthal) in the back of F2 and F3 using linear actuators and a translation stage under F1 and F2 for focal adjustments, all linked to the Motion Controller, MC. The MC remotely controls the axes via the PC using Labview 6i ™ via the IEEE link.

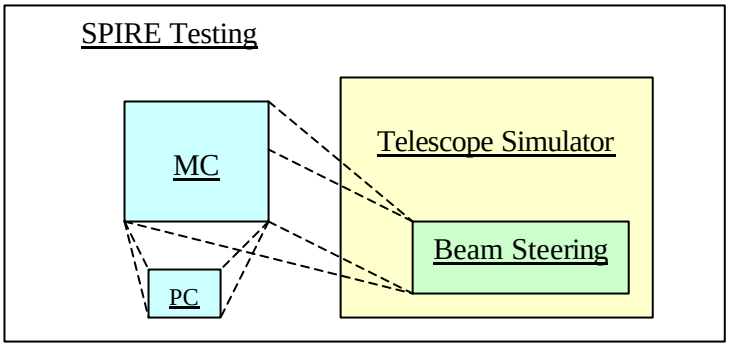


Figure 1: The Structure of the Testing

The MC Software will also be required to interface with the TFCS to exchange data e.g. mirror positions and be commanded by the TFCS. It will also have to interface with the Zemax Look-up tables

to move the mirrors in unison to exact pre calculated positions taking the focus between f2 and f3 into account so every angle of the instruments FOV can be reached. [AD2]

4 Test Facility Control System Requirements

The extract below is taken from The Test Facility Control System Requirements Technical Note [RD1] where the basic software requirements are set out.

4.1 Software User Requirements

4.1.1 Control

It shall be possible to move the image of a point source by the telescope simulator to a given detector position x,y.

It shall be possible to scan the image of a point source across a range of SPIRE detectors.

It shall be possible to automatically find the centre of movement of the telescope simulator actuators.

It shall be possible to reset the co-ordinates of the actuator positions to a defined setting (e.g. zero mm)

It shall be possible to remotely switch-on/off the Newport MM4006 controller.

4.1.2 Display

The TFCS shall provide a real-time display of the commanded and actual positions of the actuators.

The TFCS shall indicate the commanded and estimated pixel co-ordinates.

The TFCS shall indicate the status of the Newport MM4006 controller.

The TFCS shall indicate the scanning mode:

- Move to detector x,y
- Scan from x1,y1 to x2,y2
- Centering actuators.

An audible alarm, eventually replaced or supported by a visual display, shall warn users if an actuator end-stop has been reached.

4.2 EGSE Interface

4.2.1. Telemetry

Ref:	Parameter Name
1	Date
2	Time
3	Fold Mirror 2 Commanded Azimuth
4	Fold Mirror 2 Measured Azimuth
5	Fold Mirror 2 Commanded Elevation
6	Fold Mirror 2 Measured Elevation
7	Fold Mirror 3 Commanded Azimuth
8	Fold Mirror 3 Measured Azimuth
9	Fold Mirror 3 Commanded Elevation
10	Fold Mirror 3 Measured Elevation
11	Translation Stage Commanded Position
12	Translation Stage Measured Position

4.2.2 Commands

Ref:	Commands	Parameters
1	Switch On/Off MM4006 controller	ON/OFF
2	Center actuators	
3	Set actuator position	Actuator no. Position (mm)
4	Move to detector position x,y	x y

5	Scan from detector x1,y1 to x2,y2	x1 y1 x2 y2

5 Motion Controller Software Set requirements

5.1 Communication

The Motion Controller will be commanded using Labview 6i™ Software.

The MC is connected to the PC using GPIB/IEEE-488 channel. The IEEE port does not need to be configured in the standard way as the MC is set up so it can accept commands from the front panel input or from the remote mode through the IEEE (after pre-set on the front panel instead of RS-232.)

Pre-written software in Labview 6i™ was available from the Newport™ website to control this series of MC but contained encrypted sections written in C which could not be accessed and therefore could not be properly debugged to configure to the specific requirements of the Tel Sim. When a basic VI was rewritten using the VISA configuration, the MC responds to commands with correct command returns.

5.2 Function Requirements

There are both user and software set requirements that must be incorporated into the design of the MC Control software.

The user requirements include:

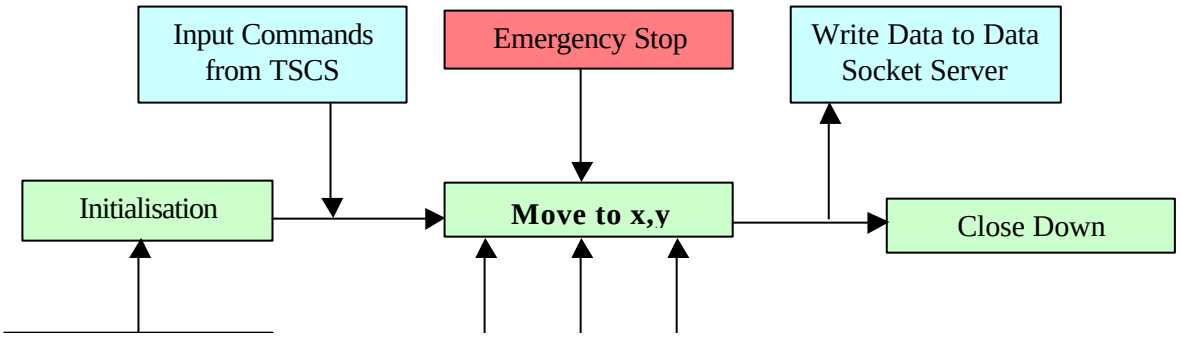
5.2.1 Configure and open the port
5.2.2 Move the mirrors to home
5.2.3 Move mirrors to set position
5.2.4 Send a Command

5.2.5 Receive a Command
5.2.6 Acquire mirror position on an axis
5.2.7 Set the Motor On or Off
5.2.8 Stop Motion
5.2.9 Emergency Stop
5.2.10 Warning Alerts of Errors

The Software also has additional Requirements:

5.2.11 Receive commands from TFCS
5.2.12 Receive AZ and EL positions from TFCS (translate into linear displacement of actuators)
5.2.13 Send Data to the TFCS
5.2.14 Mirror positions input from Zemax look-up table
5.2.15 Focus adjustments input from Zemax look-up table

The diagram below sets out the interactions needed within the Labview 6i™ program to control the required parameters of the MC.



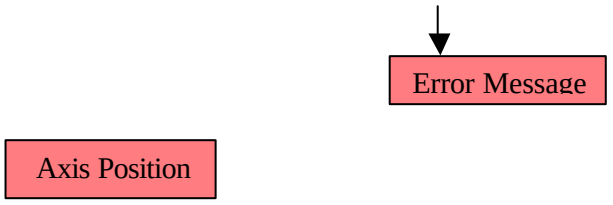


Figure 2: Requirements of Motion Controller Software

5.3 Interfaces

5.3.1 The MC software will have to interface with a look up table for focus/mirror position constructed using the Zemax Optical Model. How this achieved is TBD.

5.3.2 The MC software needs to interact with the Telescope Simulator software to send and receive data between the two. This was going to be achieved using a Global variable packet data transfer which has subsequently changed to Data Socket Server as this is contained within the PC and many types of data can be interfaced simultaneously without having to be bundled into a cluster for data transfer.

6 Status of Development

6.1 Present Issues Identified

6.1.1 Length of IEEE cable needs to be limited to a maximum length of 4 meters as a greater distance may cause communication problems between the MC and PC.

6.1.2 Testing is needed to observe how the motion controller and the Labview 6i™ software interact to exchange data regarding how many axis are installed/present in the system and how Labview 6i™ recognises the motion actuator present at that axis (i.e: Linear focal motion stage on fifth axis). How this is achieved is TBC.

6.1.3 For testing purposes, the MC is the only instrument at present that is connected to the IEEE port on the test PC in the Laboratory. It is currently set as the default instrument address (2) but the TFCS has already been configured for instrument addresses 1-6. Therefore, the MC instrument address will have to be changed (to 10?) so there is not a conflict of commanding when the system is up and running. This problem needs to be rectified by testing that the Labview 6i™ software with accept a different address, other than the default, and communicate correctly with the MC.