



Technical Note

Operation of the SPIRE FTS
Ken King and Bruce Swinyard

Ref: SPIRE-RAL-NOT-002213
Issue: 1.0
Date: 5th November 2004
Page: 1 of 4

1. INTRODUCTION

This note gives an explanation of the way in which it is intended to operate the SPIRE spectrometer during normal operations. Only the fast scanning mode is described at present.

The information in this note is based on our understanding of the SMEC mechanism control described in the MCU/DCU Command List ICD (LAM/ELE/SPI/011011), Issue 4.0, 30th September 2004, which will be incorporated into the DRCU-DPU ICD. [Comments are welcome on any misunderstanding of the relevant documentation.](#)

2. SUBSYSTEM PARAMETERS

The following parameters are used in order to control the operation of the SMEC mechanism. The following table gives both the DRCU name (as used in the DRCU-DPU ICD) and the SPIRE name (as used in the instrument Data ICD, MIB and QLA).

DRCU Name	SPIRE Name	Description
STrajMode	SCANMODE	Mode of operation of the SMEC
STrajEndPosition	SCANEND	SMEC Movement End Position
STrajStartPosition	SCANSTART	SMEC Movement Start position
SmecStatus	SMECSTAT	SMEC Status word
SScanNumber	SCANS	Number of scans to perform
SScanSpeedForward	SCANFSPEED	Scan Forward speed
SScanSpeedReverse	SCANRSPEED	Scan Reverse speed

2.1 SMECSTAT

This parameter contains several pieces of information. Here they are allocated individual name. [\(These should be reflected in the Data ICD and MIB in the future\)](#)

2.1.1 SCANNO (bits 4-15)

The number of the current SMEC scan, when in SCAN mode. It starts at the value given by SCANS when the SCAN mode is executed and decrements by one as each scan is completed, until it reaches zero. At this point the set of requested scans has completed and the SMEC stops.

[We must assume that this value is set to zero at all other times \(i.e when not scanning\) otherwise it is difficult to identify the start of scanning.](#)

2.1.2 SCANDIR (bit 3)

This is set to zero when the SMEC is moving from SCANSTART to SCANEND and one when the SMEC is moving from SCANEND to SCANSTART.

2.1.3 SMECINIT (bit 2)

This is set to one when the SMEC position is initialise and zero when it is not, or the SMEC position has been lost by the MCU.



Technical Note

Operation of the SPIRE FTS
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Ref: SPIRE-RAL-NOT-002213
Issue: 1.0
Date: 5th November 2004
Page: 2 of 4

3. OPERATIONS OF THE SMEC MECHANISM

The SMEC has four operating modes:

3.1 HOLD

In this mode the SMEC remains at its current position, irrespective of the value of the other positional parameters – this allows, for example, the scan parameters to be modified without the SMEC moving.

This mode is obtained by the SetSTrajMode(0) DRCU command

3.2 MOVE

In this mode the SMEC moves to the position given by the SCANEND parameter

This mode is obtained by the SetSTrajMode(1) DRCU command

3.3 SCAN

In this mode the SMEC performs a set of scans between the end points (SCANSTART and SCANEND) in the following way:

1. The SMEC moves to SCANSTART from its current position (at what speed?)
2. The SMEC moves to SCANEND at the speed determined by SCANFSPEED. This is the first scan
3. The SMEC moves to SCANSTART at the speed determined by SCANRSPEED. This is the second scan.
4. Steps 2 and 3 are repeated until SCANS scans have been completed.
5. The SMEC remains at the position reached at the end of the final scan (This may be SCANSTART or SCANEND)

This mode is obtained by the SetSTrajMode(2) DRCU command

3.4 INIT

This mode resets the encoder counter to zero for the current position. As it is not possible to demand a negative position this mode should only be called when the SMEC is in a position less than the start position for SMEC movement. Normally this is set at the mechanical end stop.

This mode is obtained by the SetSTrajMode(4) DRCU command



Technical Note

Operation of the SPIRE FTS
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Ref: SPIRE-RAL-NOT-002213

Issue: 1.0

Date: 5th November 2004

Page: 3 of 4

4. OPERATIONS OF THE SPIRE SPECTROMETER

The SPIRE FTS will be operated using the following building blocks:

4.1 Initialise_FTS ()

Action	Command
Set SMEC to HOLD mode	SetSTrajMode, 0
Drive SMEC to mechanical end stop	SetStrajEndPosition,0
	SetSFeedForwardOffset, 0x0000
Wait 15 seconds	
Initialise step counter	SetSTrajMode, 4
Return to HOLD mode	SetSTrajMode, 0
Release SMEC to return to rest position (apply current = 0mA)	SetSFeedForwardOffset, 0x8000
Wait 15 seconds	

The position counter is initialised and the SMEC finishes at its rest position and in HOLD mode. This is the FTS_STBY State

4.2 FTS_REDY(Start)

This action sets the FTS to the scan start position ready to scan. It assumes the FTS is in the FTS_STBY state

Action	Command
Set SMEC to HOLD mode (just in case)	SetSTrajMode, 0
Set SMEC End position	SetStrajEndPosition, Posn
Move to Start	SetSTrajMode, 1
Wait to get to Start	
Hold at this position	SetSTrajMode, 0

4.3 FTS_STBY

This action sets the FTS to the rest position. It assumes the FTS is in the FTS_REDY state

Action	Command
Set SMEC to HOLD mode (just in case)	SetSTrajMode, 0
Release SMEC to return to rest position (apply current = 0mA)	SetSFeedForwardOffset, 0x8000
Wait to get to rest position	



Technical Note

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Ref: SPIRE-RAL-NOT-002213
Issue: 1.0
Date: 5th November 2004
Page: 4 of 4

4.4 Scan_FTS (Start, End, Nscans)

We assume that the FTS is already in the FTS_REDY state

Action	Command
Set SMEC to HOLD mode (just in case)	SetSTrajMode, 0
Set Scan Start and End positions	SetSTrajStartPosition, Start
	SetSTrajEndPosition, End
Set Scan Speeds (500um /s in both directions)	SetSScanSpeedForward, 0x1388
	SetSScanSpeedReverse, 0x1388
Set number of scans	SetSScanNumber, Nscans
Start Detector Science Sampling	
Start SMEC Science Sampling	
Start Scanning	SetSTrajMode, 2
Wait until end of scanning	
Stop SMEC Science Sampling	
Stop Detector Science Sampling	
Hold at this position	SetSTrajMode, 0

The FTS will stop in the FTS_REDY state

Notes:

- Provided Nscans is even the SMEC will finish at the Start position – this is the default.
- This building block may be repeated several time to build the required S/N. If another operation is required between sets of scans, the FTS will be returned to the STDBY state during this time
- At the start of the scanning, SCANO will change from zero to Nscans and decrement by one at the start of each new scan until it again reaches zero. The detector and SMEC science timelines will be continuous throughout the set of scans. For the SMEC Timeline product the value of SCANNO and SCANDIR should be provided for each SMEC sample.
- As the housekeeping data is generated only once per second, the SMEC and Detector science data should be marked ‘bad’ for the period between two housekeeping packets where the SCANNO has changed. (More sophisticated data processing may allow us to identify the scan change from the recorded SMEC positions, but this is not needed at this time).

The expected sequence of operations is thus:

1. Initialise_FTS
2. FTS_REDY
3. Scan_FTS..... repeated n times
4. FTS_STBY
5. Another operations
6. FTS_REDY
7. SCAN_FTS..... repeated n times
8. FTS_STBY
9. etc.....