Calibrators

Software Interface Requirements

Draft

For approval

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Update history

Date	Version	Remarks
13th March 2001	1.0	Draft – Awaiting approval from IFSI

Table of Contents

1. Scope

This document specifies the software commands needed for operation of the photometer calibrator (PCAL) and spectrometer calibrator sources (SCAL-point, SCAL-flood).

2. Documents

2.1. Applicable documents

	Title	Author	Reference	Date
AD1	Calibrators electrical interface requirements	P.Hargrave	SPIRE-QMW-PRJ-……	13/03/01

2.2. Reference documents

	Title	Author	Reference	Date

2.3. Glossary

PCAL	Photometer CALibrator	DPU	Digital Processing Unit
SCAL	Spectrometer CALibrator		
DAC	Digital – Analogue Converter		
LUT	Look-Up Table		

3. Subsystem overview

3.1. Photometer Calibrator - PCAL

The purpose of the photometer calibrator is to provide a repeatable signal for monitoring of detector health and responsivity for ground testing and in-flight operation. It is NOT an absolute calibrator, but may be useful as part of the overall calibration scheme. The baseline design consists of a thermal source inside an integrating cavity, the body of which will be at 4K. The cavity will have a light pipe output with a 1-mm diameter aperture. The calibrator will be located behind the beam steering mirror (M4) at an image of the telescope secondary mirror. The fraction of M4 area obscured will be 0.2%. The limit on the calibrator aperture is set by the ratio of the telescope secondary to primary mirror diameters.

3.2. Spectrometer Calibrator - SCAL

The purpose of the spectrometer calibrator is to null the telescope emission by mimicking its spectrum and brightness in the second input port of the FTS. The telescope is assumed to be at 80-K with overall wavelength-independent emissivity $\varepsilon = 0.04$. The overall emissivity of the system is assumed to be uncertain by a factor of 2 (actual value will not be known before launch). The baseline design, shown in figure (1), is the use of a heated black plate, together with a "hot" source in an integrating cavity with light pipe, to uniformly illuminate the pupil. A neutral density filter may be used to dilute the emission. The calibrator will be located at the second input port to the FTS, at an image of the telescope pupil (diameter = 30 mm). Throughout this document, the heated plate will be referred to as SCAL-flood, and the "hot" PCAL type source shall be referred to as SCAL-point.

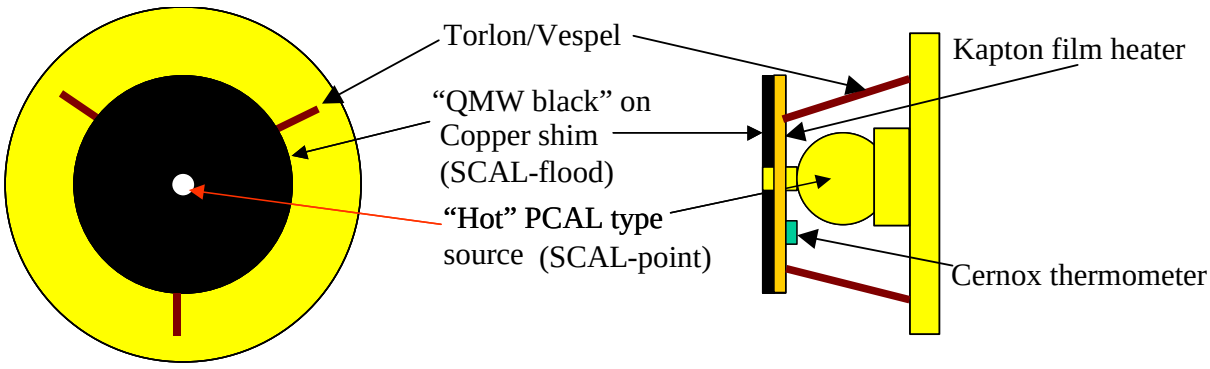

Figure 1 Schematic of spectrometer calibrator (SCAL)

4. Commands

This list of commands applies to both prime and redundant systems.

4.1. PCAL

Normal operation of PCAL will involve the application of a pre-determined sequence of commands based on an OBS script under DPU control. Envisaged frequency of operation is no more than once per hour for a period of ~10 seconds.

Command ID	Name	Description
PC1	On/Off	Switches PCAL drive circuit on/off
PC2	Current level	PCAL will be driven by a 12-bit DAC over the range 0 to 7mA. Therefore the software should allow for the commanding of 4096 current levels in the range 0 to 7mA.

4.2. SCAL Point

Normal operation of SCAL-point will involve the continuous application of a specified drive current for the duration of the "on" state.
However, SCAL-point may also be used as a stimulus to check the spectrometer detectors in a similar fashion to PCAL. Therefore provision should be made to allow for a pre-determined sequence of commands based on an OBS script under DPU control.

Command ID	Name	Description
SCP1	On/Off	Switches SCAL-point drive circuit on/off
SCP2	Current level	SCAL-point will be driven by a 12-bit DAC over the range 0 to 7mA. Therefore the software should allow for the commanding of 4096 current levels in the range 0 to 7mA.

4.3. SCAL Flood

Normal operation of SCAL-flood will involve the continuous application of a specified drive current for the duration of the "on" state.
A warm-up sequence of currents and time intervals may be necessary. This should be provided for by the use of an OBS script in the DPU.

PID control may prove necessary. This can adequately be achieved using software control. If this is implemented, then the PID may be left in continuous operation. The PID parameters will be specified by Cardiff.

Command ID	Name	Description
SCF1	On/Off	Switches SCAL-flood drive circuit on/off
SCF2	Current level	SCAL-flood will be driven by an 8-bit DAC over the range 0 to 9mA. Therefore the software should allow for the commanding of 256 current levels in the range 0 to 9mA.
SCF3	Time Interval	Time for which current is applied (used during warm-up sequence)

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Comments from Bruce – to be incorporated.

> On the software doc.
>
> PCAL:  The commanding scheme is that the DPU will command the
> calibration
> source to some given level.  All the timing for these
> operations is done by
> the DPU - the DRCU will essentially know nothing about
> timing.  The commands
> to be sent by the DPU/OBS are SET_LEVEL(nnn) and to switch
> the circuit ON
> and OFF - we must then script an OBS sequence that deals with
> the intervals
> etc (Sunil's job) - there is no "interval" command from the
> DPU to the DRCU.
>
> SCAL Flood:  I think you should default that there is a
> feedback loop (don't
> specify the type just the input and output params) for the
> control of SCAL
> flood - this way they can scope the OBS better as it has to deal
with
> reading some thermistor value and returning a current value
> after some TBD
> algrotihm has been applied.  They will need some estimate of
> the update time
> for this feedback loop - presumably Nyquist sampling of the
> response time of
> the termal source.
>
> SCAL Point:  This source may be used as a prime calibrator for the
> spectrometer - in which case it must be stabilised - again we
> could specify
> a feedback loop using the measured voltage and supplied
```

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> current to feedback
> and stabilise the "temperature" of the device  I think again
> that to scope
> the OBS we should specify that this what we are going to do
> so they know
> they need to read the voltage and feedback the current after some
TBD
> algorithm.  Again a feedback time is necessary same as above.
>
```