SPIRE INSTRUMENT

DETECTOR READOUT & CONTROL UNIT

GROUNDING SCHEME

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List of Acronyms

ADC	Analog to Digital Converter
AMUX	Analog Multiplexer
BSM	Beam Steering Mirror
DAC	Digital to Analog Converter
DCE	Detector Control Electronics
DCU	Detector Control Unit
DMUX	Digital Multiplexer
DPU	Data Processing Unit
DRCU	Detector Readout & Control Unit
FPU	Focal Plane Unit
FTS	Fourier Transform Spectrometer
JFET	Junction Field Effect Transistor
LIA	Lock-in amplifier
LPF	Low Pass Filter
MCE	Mechanisms Control Electronics
MCU	Mechanisms Control Unit
NA	Not Applicable
NC	Not connected
OEP	Optical Encoder Preamplifier
PDU	Power Distribution Unit
PSU	Power Supply Unit
S/S	Sub-System
S/W	Software
SCE	Sub-system Control Electronics
SCU	Sub-system Control Unit
SMEC	Spectrometer Mechanism Control
SMPS	Switching Mode Power Supply
SNR	Signal over Noise Ratio
TBC	To Be Confirmed
TBD	To Be Defined
TBW	To Be Written
WIH	Warm Interconnect Harnesses

Table of Contents

1. Introduction

1.1. Purpose

The purpose of this document is to provide a description of the DRCU grounding scheme and to list relevant design constraints.

1.2. Scope

The scope of this document includes the DCU and the FCU units of the DRCU as well as the power distribution harness between the PSU and the sub-systems..

1.3. Reference Documents

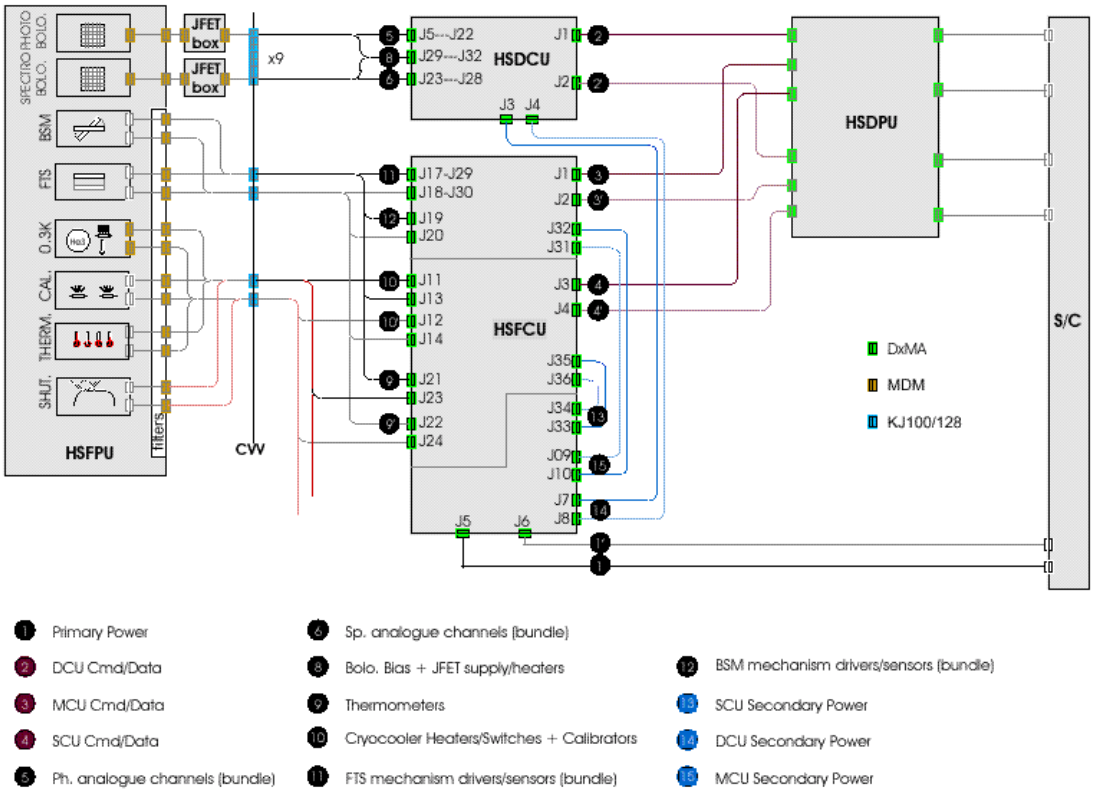
RD1	Introduction to EMC techniques for HERSCHEL instrumentation	Sap-SPIRE-DS-0000-02
RD2		

1.4. Applicable Documents

AD1	Herschel/Planck IID part A	SCI-PT-IIDA-04624
AD2	SPIRE grounding	No ref.
AD3		

2. Description of the DRCU

The DRCU is a unit of the SPIRE instrument located on the SVM along with the DPU and other warm electronics units. For mechanical, thermal and electrical reasons the DRCU has been rapidly split into too mechanically independent box which are the DCU and the FCU respectively the Detector Control Unit and the FPU Control Unit. The FCU being itself composed of 3 subunits: the MCU for Mechanical Control Unit, the SCU for Subsystem Control Unit and the PSU for Power Supply Unit. Then globally the DRCU interface with the FPU via the CVV feedthrough connectors with the DPU for command/data exchange and with the S/C for primary supplying as shown bellow.



2.1. DCU

The DCU encompasses all the function required to operate the photometer and spectrometer bolometers located in inside the HERSCHEL CVV. It comprises 360 quasi-identical analog channels associated to multiplexers and analog to digital converters, and bolometer/JFET biases generators. Additionally it provides support for command reception and decoding, and digitised data transmission. The power supply of this unit is externally provided by specific outputs of the PSU. In order to meet the performance specification linear post-regulators provide analog channels with high stability and low noise supplies from PSU output lines.

2.2. FCU

2.2.1. MCU

The MCU encompasses all the control functions for the SMEC and the BSM mechanism. It comprises a DSP based multi-axes controller and analog electronics to interfaces with the actuator and sensors located inside the HERSCHEL CVV. MCU functions are configurable by means of a command interface and trajectory housekeeping are reported. The power supply of this unit is externally provided by specific outputs of the PSU.

2.2.2. SCU

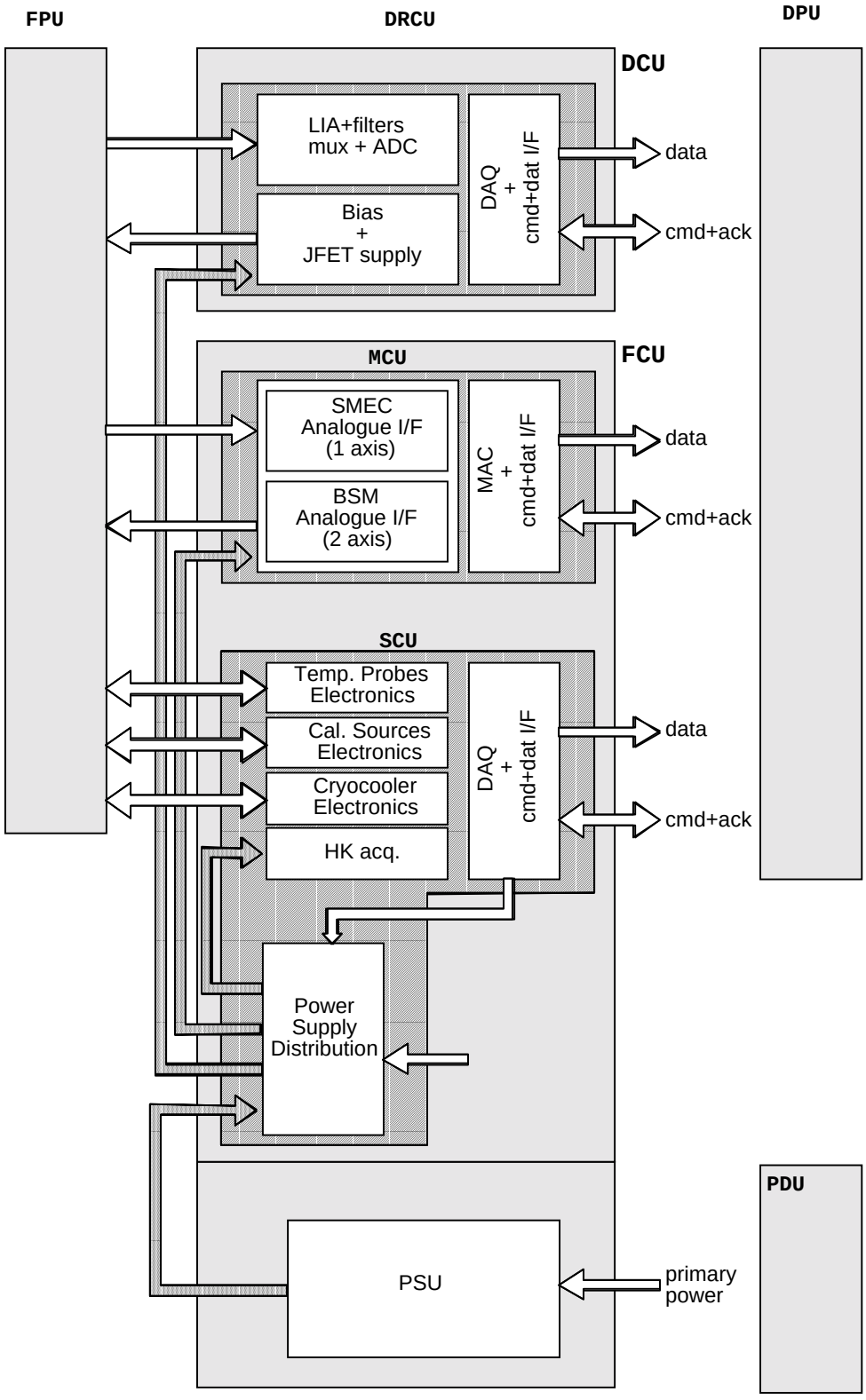
The SCU encompasses the low-level control functions for the other elements of the FPU. It includes the calibration sources, the temperature measurement sensors and the cryo-cooler heaters controls. All the analog parameters might be adjusted during operation by means of an command interface. It also perform housekeeping reporting and enables PSU to be remotely controlled by implementing on/off commands.

2.2.3. PSU

The PSU comprises all DC/DC converters (and additional filters) for supplying separately the previously described sub-systems. It also feature partial on/off capability (analog electonics switching between photometer and spectrometer, and MCU switching).

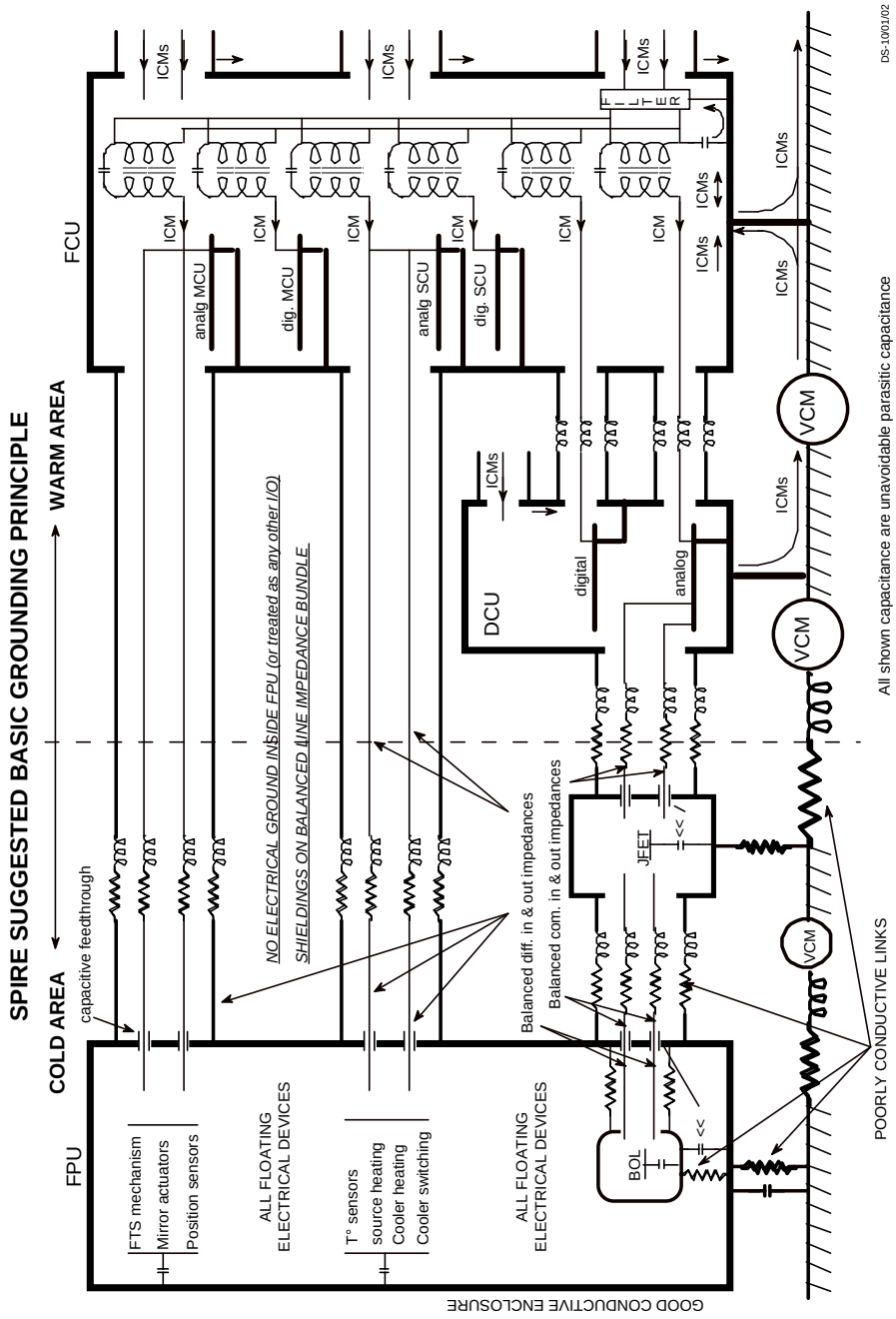
2.3. Block Diagram

A block diagram of the DRCU is depicted by the following figure:



3. Grounding Concept

The following grounding scheme for the DRCU is proposed on the basis of reducing common mode injected current from internal or external noise sources (other units, power devices, digital devices, …). Return path for such source shall be as short as possible before contaminating sensitive devices and to propagate to the FPU; chassis being the path with the lowest possible impedance.
This concept is developed in RD1 and is illustrated bellow:



4. Design Constraints

The concept illustrated before shall be properly implemented for best results. Then design constraints could be defined:

- low-level amplifiers shall share the same reference to the chassis than the common mode voltage,
- printed circuit board supporting low level amplifiers shall be connected to the chassis near the input connector location,
- when digital and analog functions (ADC, DAC, …) share the same board a large ground plane (for the lowest impedance) is mandatory to limit common mode effect,
- peripheral surface contact between chassis and ground plane shall be implemented
- digital input stage shall referenced to the chassis as shortly as possible,
- unit to mounting plane shall have the lowest possible impedance (conductive filler is mandatory for good surface contact).