# SCM interface document

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**Document change record**

| version | date | Description of change |
|---|---|---|
| 0.1 | October 23, 2003 | Initial draft |
| 1.0 | February 3, 2004 | - Updated mechanical interface drawings:<br>. preamplifier box - section 3.1<br>. Antenna – section 3.2<br>- Removed C2 signal in section1 and Table 2<br>Fixation bolts specification |
| 1.1 | February 10, 2004 | Renamed C1 to SCM_CAL to comply with DFB documentation, and added a description of the calibration operation. |
| 1.2 | Feb 12, 2004 | Duration of calibration |
| 1.3 | April 1, 2004 | Noise level update (section 1) |
| 1.4 | 2004.05.24 | Updates after the ECDR<br>• Signal dynamique<br>• Power update (EM measured)<br>• Boom harness shielding<br>• Interface drawings<br>• Scientific Measurement axis<br>• Editorial updates<br>Added: - Thermal test specs reference.<br>- Final pre-amp mass. |

**Acronyms**

DFB – Digital fields board
SCM – Search coil magnetometer
tbd - to be defined
tbc – to be confirmed

# Introduction

This document describes the electrical and mechanical interfaces of the Search Coil Magnetometer (SCM). The instrument consists of three coils that measure the x, y, and z components of the AC magnetic field, and a preamplifier. It has two mechanical interfaces with the spacecraft (the antenna on the boom, and the preamplifier on the spacecraft) and an electrical interface with the digital field board

# 1. Electrical Interface

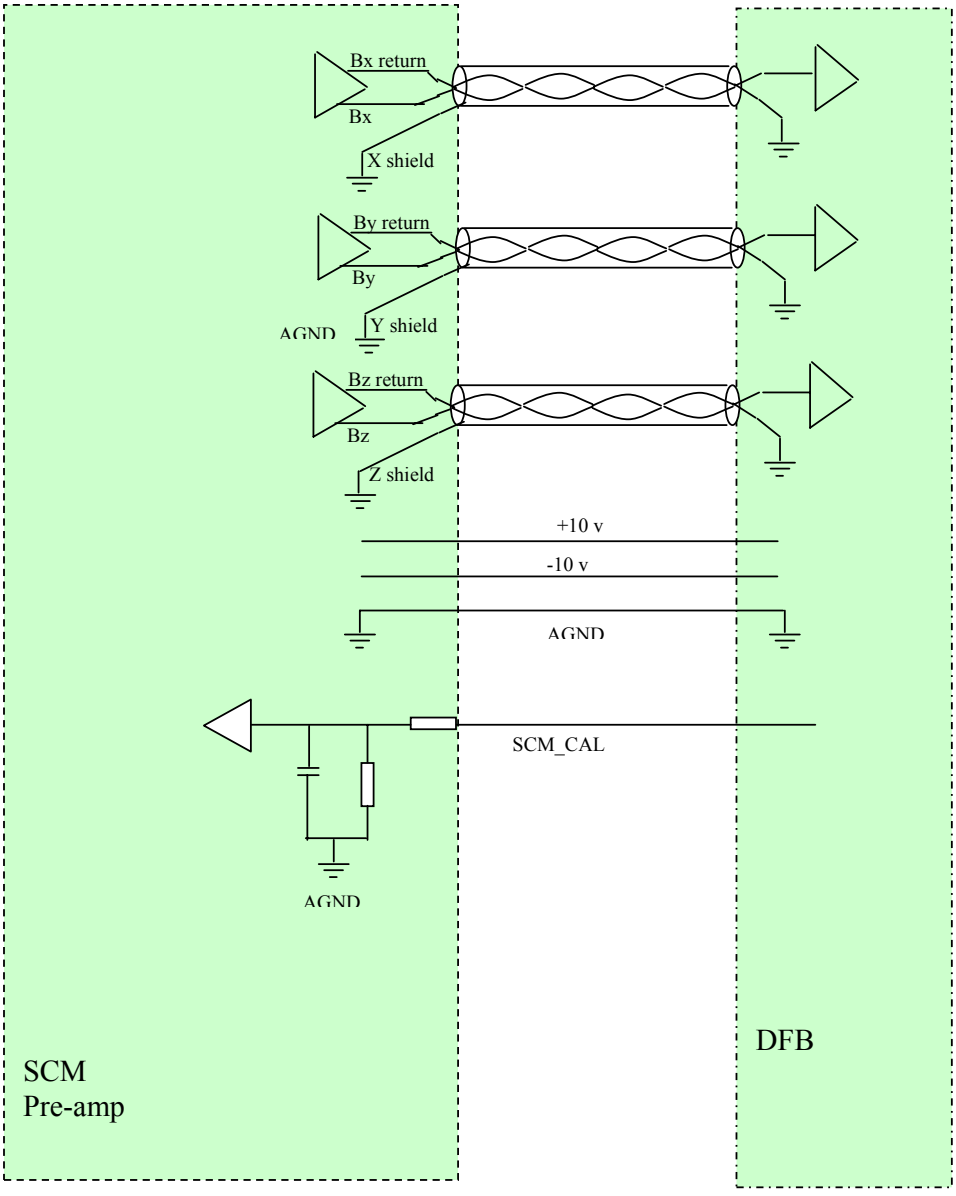


Fig. 1 Electrical Interface

Figure 1 shows the electrical interface between the SCM and the DFB. It consists of :
- Three differential analog signals are connected to the DFB through twisted shield pairs of wires. The shield is grounded in the SCM side. The characteristics of these lines are:
  - output impedances: 100 ohms
  - signal bandwidth: 100 mHz – 4 KHz
  - noise level: less than -100dBV/sqrt(Hz) +/-6dB at 1kHz.
    -70dBV/sqrt(Hz) +/-6dB at 1Hz
  - maximum signal level +/-5 V (10 Vpp)

- Three power lines: +10v, -10v, and AGND (0v)
  - SCM /EM consumes 4,1 mA on the +10 V and 4,5 mA on the –10 V (with Cal OFF)

- One digital signal SCM_CAL used to control the SCM calibration. This signal is normally low ( logic level 0). Whenever a calibration is needed, it is pulled high for a duration defined in the command (default 30 seconds, maximum 60 sec), and then back low. During calibration, a triangular wave is generated by the SCM preamplifier and applied to a feedback winding in each search coil. This signal is detected by the primary winding, and seen in Bx, By, and Bz data.

### *1.1 Wiring harness*

Tables 1 and 2 show the detailed interconnections of the cables. J01 of the preamplifier is connected to the antenna through a set of three shielded cables, each consisting of three twisted wires.
J02 is connected to the DFB. Cables consisting of two twisted shielded wires are used for Bx, By, and Bz signals. The power lines and CAL signals are connected through simple wires.

**Important: The signal ground is not connected to the instrument structure. This will be connected at the spacecraft level.**

List of connectors:
Antenna J01: Cannon SubD – 15P (male) on the antenna, 15S (female) on the cable.

Preamplifier J01: Cannon SubD – 15S on the P.A., 15P on the cable
J02: Cannon SubD – 15P on the P.A., 15S on the cable

DFB : microD 15 pin female on the DFB, male on the cable

| SCM antenna J01 | Signal designation | Cable n° | AWG | SCM Preamp J01 |
|---|---|---|---|---|
| 1 | Bx signal | 1 | 26 | 1 |
| 2 | Bx shld | 1 | shld | 2 |
| 3 | By signal | 2 | 26 | 3 |

| | | | | |
|---|---|---|---|---|
| 4 | By shld | 2 | shld | 4 |
| 5 | N.C. | | | N.C. |
| 6 | Bz signal | 3 | 26 | 6 |
| 7 | Bz shld. | 3 | shld | 7 |
| 8 | N.C. | | | N.C. |
| 9 | Bx return | 1 | 26 | 9 |
| 10 | Bx feedback | 1 | 26 | 10 |
| 11 | By return | 2 | 26 | 11 |
| 12 | By feedback | 2 | 26 | 12 |
| 13 | N.C. | | | N.C. |
| 14 | Bz return | 3 | 26 | 14 |
| 15 | Bz feedback | 3 | 26 | 15 |

Table 1 SCM antenna to Pre-amplifier cable

The cable will be covered by an overall shield, including the backshell of the connector at the PA side (J01). As the connector to the sensor is inside the thermal blanket, it is agreed that an overshield can be avoided at that extremity of the harness.

| J02 | Signal | Cable number | Wire AWG | DFB Connector |
|---|---|---|---|---|
| 1 | V+ | | s 26 | ** |
| 2 | V- | | s 26 | ** |
| 3 | Bx | 1 | tsp 26 | ** |
| 4 | Y shield | 2 | shield | N.C. |
| 5 | By return | 2 | tsp 26 | ** |
| 6 | Bz | 3 | tsp 26 | ** |
| 7 | SCM_CAL | | s 26 | ** |
| 8 | N.C. | | | N.C. |
| 9 | AGND | | s 26 | ** |
| 10 | Bx return | 1 | tsp 26 | ** |
| 11 | X shield | 1 | shield | N.C. |
| 12 | By | 2 | tsp 26 | ** |
| 13 | Z shield | 3 | shield | N.C. |
| 14 | Bz return | 3 | tsp 26 | ** |
| 15 | N.C. | | | N.C. |

Table 2 SCM Preamplifier to DFB cable

** TBD by UCB

Wire type: tsp: twisted shielded pair, s: single wire

# 2. Mechanical interface.

### *2.1 Preamplifier*

The preamplifier box must be located inside the spacecraft body to stay within a reasonable temperature range. It was agreed that it will be mounted on one side of the IDPU. It is fixed by four screws of M4 metric size (attachment holes = 4.3 mm).
Pre-amplifier mass (weighed): 200.25g

The interface drawing of the PA is given on Fig 2.

### *2.2 Antenna*

The antenna structure is fixed to the end of a boom on a dedicated bracket designed to allow a precise alignment of the sensor structure w.r.t. the spacecraft axis. The fixation is made by four screws of M5 metric size (attachment holes 5.3 mm).

The total mass of the sensor will be close to 600 g with a margin of the order of +/-3% for the moment (without MLI and attachment screws). A better evaluation should be available soon.

Calculated gravity center (mm): x = -13.322 y = 59.989 z = 31.321

The interface drawing of the Sensor is given on Fig 3 where the orientation of the measurement axis is also indicated.

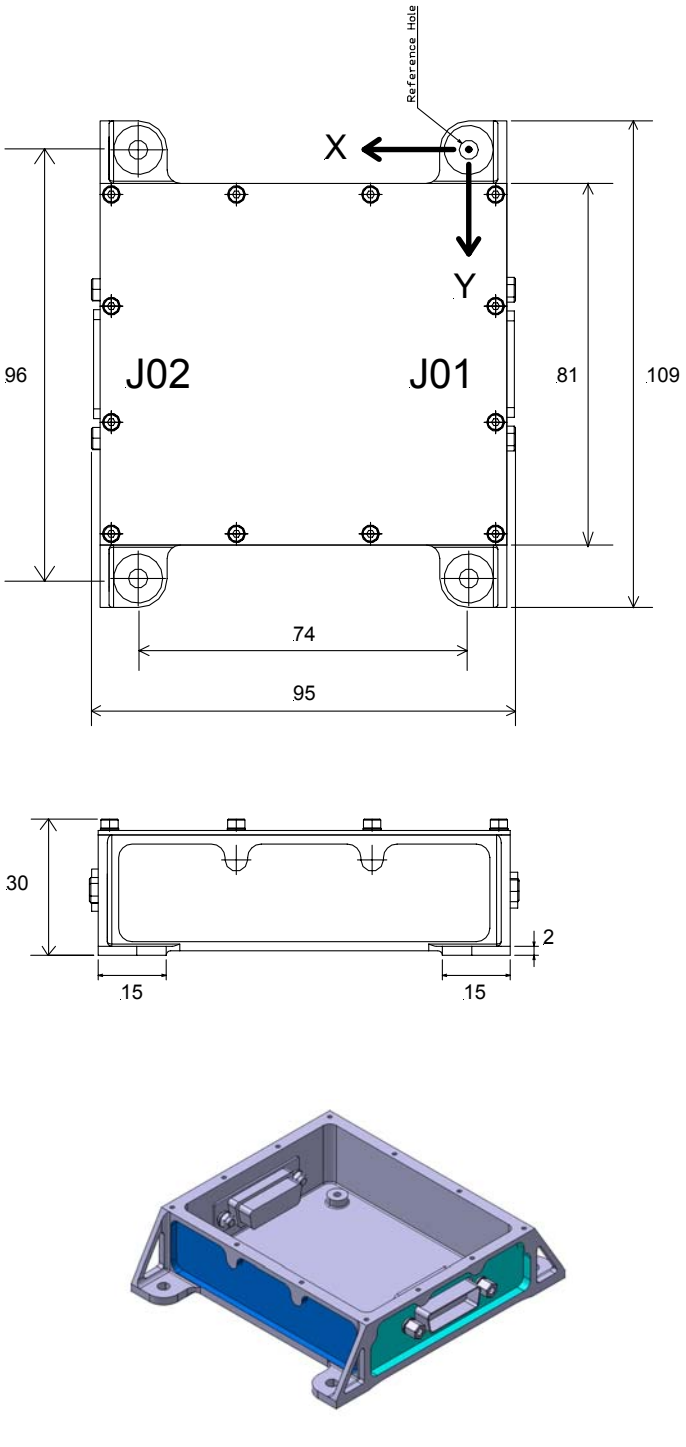


Fig 2 : SCM-PA Interface drawing
Dimensions in mm

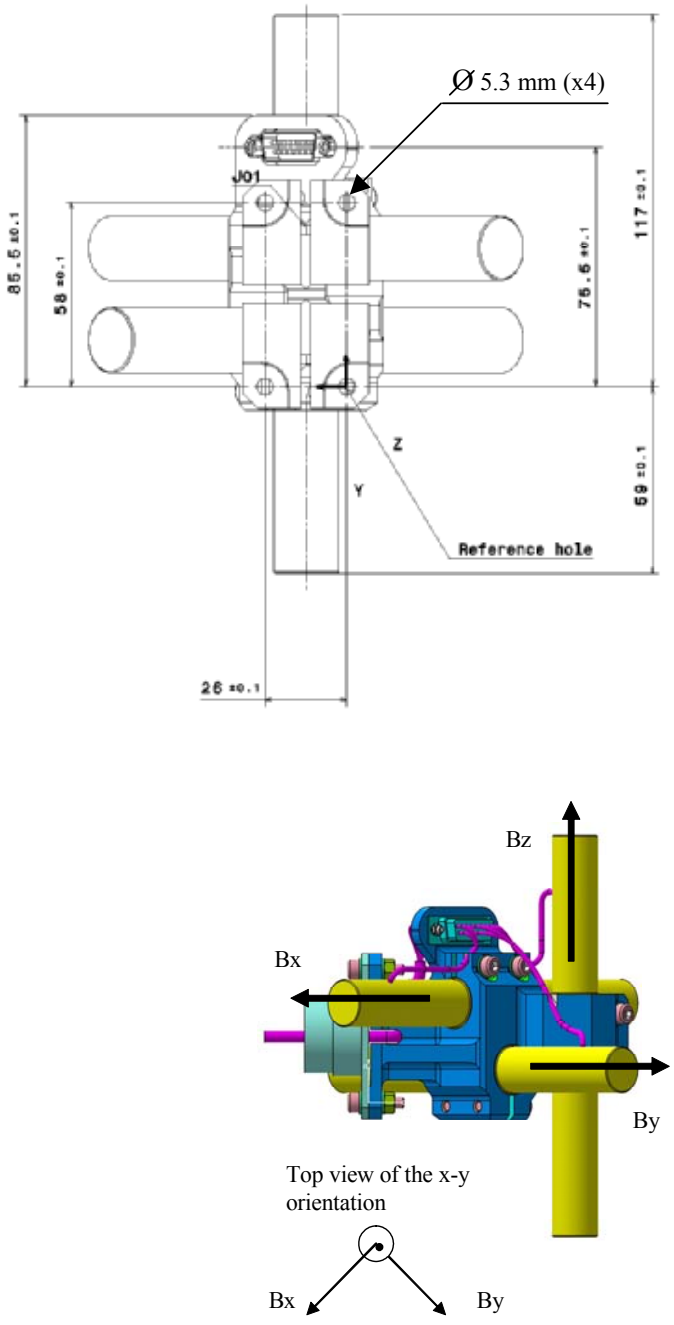


Fig 3: SCM-Sensor Interface drawing and magnetic measurement axis

# 4. Thermal test

Both the preamplifier and the antennas will be tested to the limits specified in the document ref. THM-SYS-005: “Instrument Payload Verification Plan and Environmental Test Specification”