

SPIRE-AST-DOC-002441

Title: **EQM-SPIRE Warm Units Integration with IDAS**

CI-No: 153 200

|                        |                                    |       |                 |
|------------------------|------------------------------------|-------|-----------------|
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| Issue | Date   | Sheet | Description of Change | Release |
|-------|--------|-------|-----------------------|---------|
| 1     | 9.5.05 | All   | Initial issue         |         |

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## 1 Scope

This procedure details the general rules and necessary steps to be followed during the electrical integration and test of the Herschel SPIRE Warm Units.

An overview of the SPIRE Warm Units on the SVM Panel is given below.

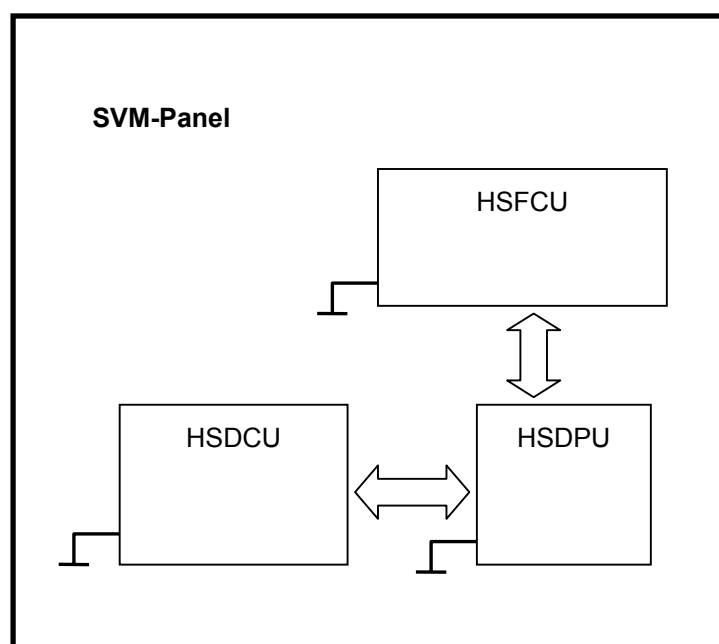


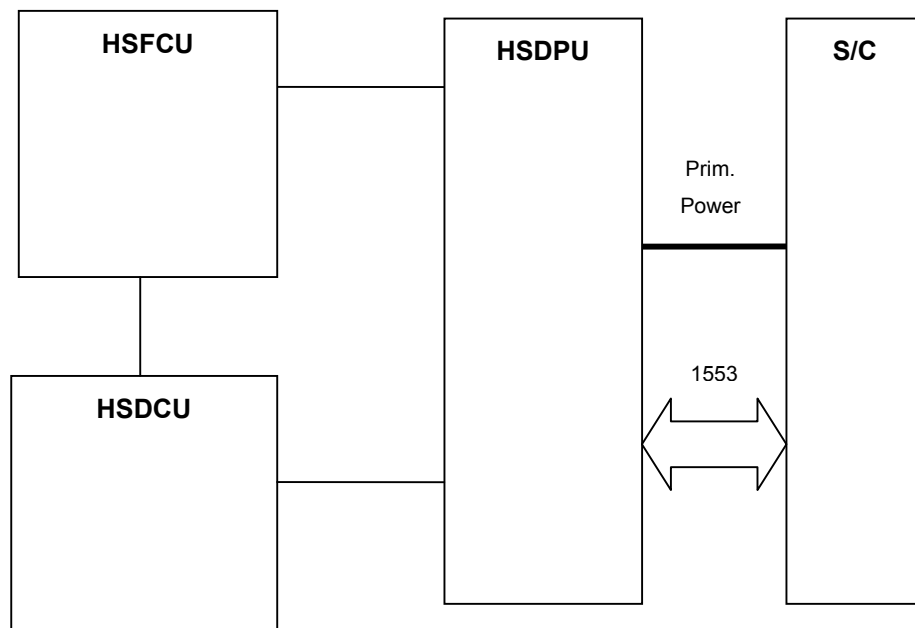
Figure 1.0-1: SPIRE Warm Units on SVM Panel

## 2 Objective

### 2.1 General Overview

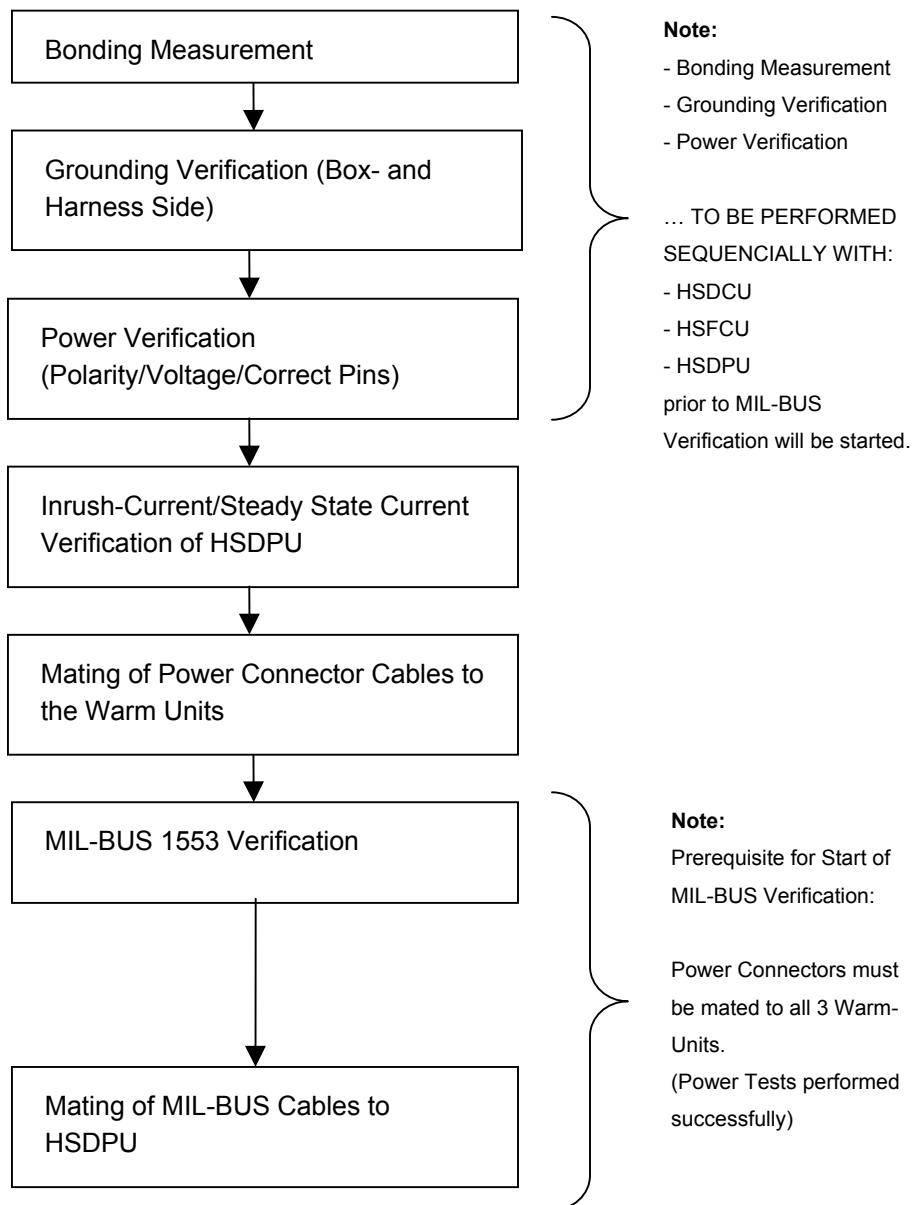
The purpose of this integration steps is to install and test the relevant electrical interfaces of the SPIRE Warm Units and to mate the harness connectors to the units. A block diagram of the SPIRE QM Warm Units is given in Fig. 2.1-1 below.

The mechanical integration of the SPIRE Warm Units and the interconnection harness onto the EQM SVM simulator is described within the procedure for Herschel EQM SVM Simulator Integration, doc. No. HP-2-ASED-PR-0031 (RD1).



**Figure 2.1-1: Blockdiagram of the Herschel SPIRE QM Warm Units (TBC)**

**2.2 Main Test Flow for Integration and Test of SPIRE Warm Units  
(Measurements to be performed with IDAS)**



## 2.3 Integration and Test Flow Description

Following electrical tests will be performed for each SPIRE Warm Unit:

### 2.3.1 Bonding Test between Box Housing and SVM Panel

Purpose:

To verify the bonding resistance between the housing of the mounted box structure and SVM-panel GND.

Required bonding resistance:

$R < 2.5 \text{ m}\Omega$

Prerequisite: A grounding diagram should be available to verify the correct bonding between used electronics units and grounding point. (see para. 4.2.1.6)

Note: For verification of the Grounding Diagram, it is proposed to measure the resistance of:

- DCU-, FCU-and DPU-housing to SVM panel GND
- SVM panel GND to measurement GND
- PLM SCOE int. GND rail to facility GND
- CDMU-DFE rack int. GND rail to facility GND
- IDAS rack int. GND rail to measurement GND

Used equipment:

Bonding Measurement Bridge (Milliohm meter).

Measurement to be performed:

Manually.

### 2.3.2 Bonding Resistance Tests between Box Ground Pins and Ground at Warm-Unit-Side

Purpose:

To verify the bonding resistance between grounded connector pins and ground when grounding of this pins is required. (e.g. power return pins at Warm Unit or at harness conn.)

Used equipment:

IDAS.

Measurement to be performed:

Automatically by using IDAS and proper test-steps.

IDAS will perform this test by connecting an ohmmeter with 1 to 10 mA measurement current between the required connector pins and ground. Measurement will be activated by proper measurement program steps.



### 2.3.3 *Insulation Resistance Tests between (Box-Connector) Power return Pins and Ground - at PLM SCOE-Side*

Purpose:

To verify the insulation resistance between insulated connector pins and ground when insulation of this pins is required. (e.g. power return pins at Warm Unit or at harness conn.)

Required Insulation Resistance:

$R \geq 1 \text{ MOhm}$

Used Equipment:

Ohm-Meter

Measurement to be performed:

Manually

### 2.3.4 *Power Voltage Test*

Purpose:

To verify the correct voltage and the correct polarity at the required connector pins prior to mating of the harness connectors to the Warm-Units. (see para. 4.2.1.1/2)

Used Equipment:

Multimeter

Measurement to be performed:

Manually

### 2.3.5 *Inrush Current Test*

Purpose:

To measure the inrush current of the HSDPU, when the power is switched on and the power connector is mated [to the HSDPU via IDAS T-Adaptor or break out box](#).

To measure the voltage and the steady state current of the HSDPU.

(see para. 4.2.1.1)

Used Equipment:

IDAS and current probe or DVM and scope with current probe

Measurement to be performed:

Automatically by using IDAS and programmed test steps or by using a scope with current probe.

A current vs. time diagram will be provided.

**Note:**

**After successful performance of the bonding-, voltage- and inrush current-verification, the power connectors will be connected to the relevant Warm Unit acc. to para. 4.2.1.7. The power verification has to be performed , before the MIL-BUS verification will be started.**

### **2.3.6 MIL-BUS 1553 Verification**

Purpose:

To measure the electrical characteristics of the MIL-Bus 1553 like voltage, rise time , fall time, measurement of ratio between A-voltage and B-voltage. (see para. 4.2.1.3/4)

Used Equipment:

IDAS and integrated scope

**Note:**

**After successful performance verification of the MIL-Bus 1553, the MIL-Bus connectors will be mated to the Warm Unit acc. to para 4.2.1.7.**

### 3 Documents/Drawings

#### 3.1 Applicable Documents

| No. | Document Name | Document Number             | Issue/Revision |
|-----|---------------|-----------------------------|----------------|
| AD1 | PA-Plan       | HP-2-ASED-PL-0007           | 2-1            |
| AD2 | SPIRE-ICD     | SCI-PT-IIDB/SPIRE-<br>02124 | 3-3            |
| AD3 |               |                             |                |
| AD4 |               |                             |                |
| AD5 |               |                             |                |
| AD6 |               |                             |                |
| AD7 |               |                             |                |
| AD8 |               |                             |                |

#### 3.2 Reference Documents

| No. | Document Name                 | Document Number      | Issue/Revision |
|-----|-------------------------------|----------------------|----------------|
| RD1 | EQM SVM Simulator Integration | HP-2-ASED-PR-0031    | 1; tbi         |
| RD2 | EGSE Configuration Procedure  | HP-2-ASED-PR-0035    | 1; tbi         |
| RD3 | SPIRE Harness Definition      | SPIRE-RAL-PRJ-000608 | 1.2            |
| RD4 | SPIRE ESD Requirements        | SPIRE-RAL-NOT-002028 | -              |
| RD5 |                               |                      |                |

**3.3 Other Documents**

NA

## 4 Configuration and Requirements

### 4.1 PLM Configuration

The Warm -Units are mounted at the EQM-SVM Panel acc. to RD1, the S/C Harness is prepared but not connected.

The grounding has to be performed acc. to para. 4.2.1.6

### 4.2 Test Setup

EGSE configuration during tests:

The used EGSE is composed of two main parts:

- PLM-SCOE (for power excitation)
- CDMU-DFE (for data handling)

IDAS-5 Configuration during tests:

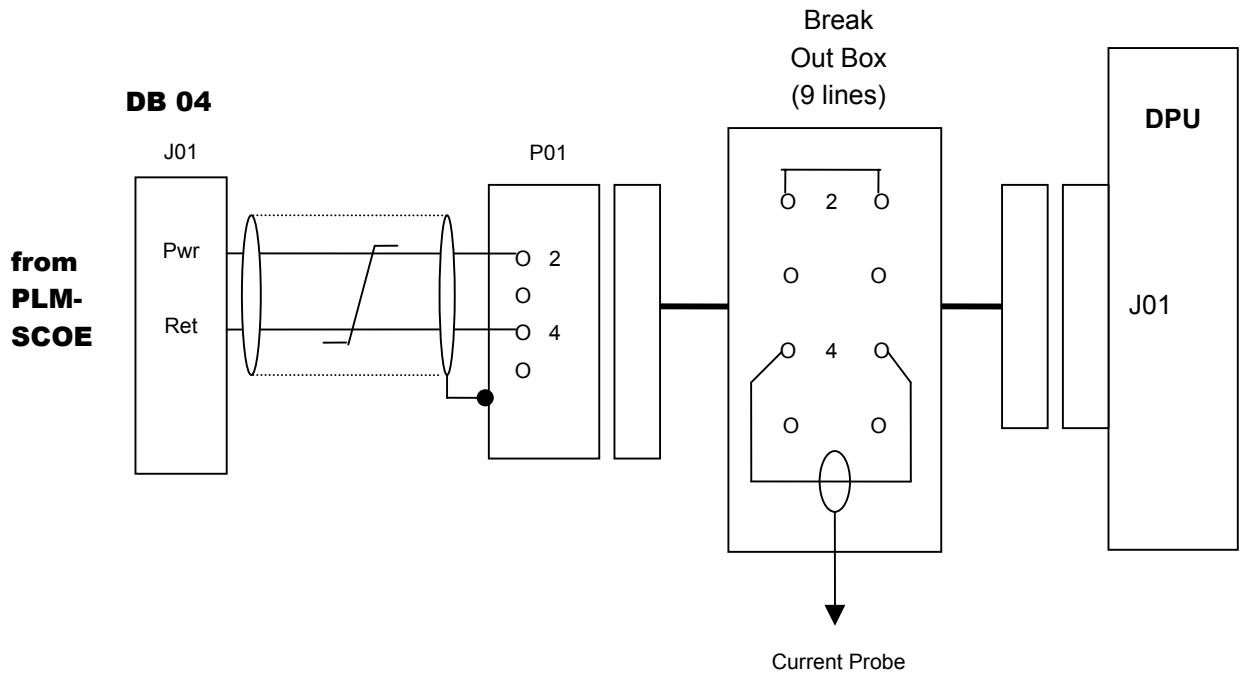
IDAS-5 Test Heads are connected via proper Testadapters to the relevant

"Unit under Test" - Connectors. For current measurements (Inrush and Steady-State) a current probe will be used.

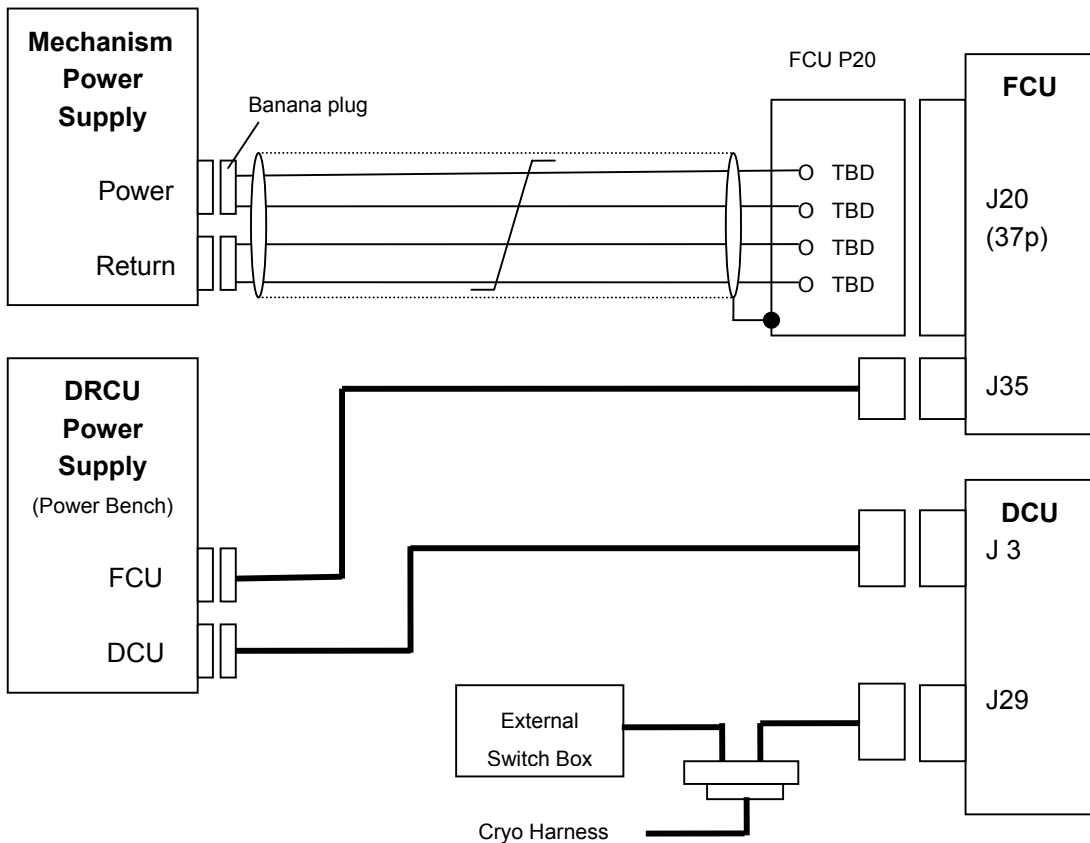
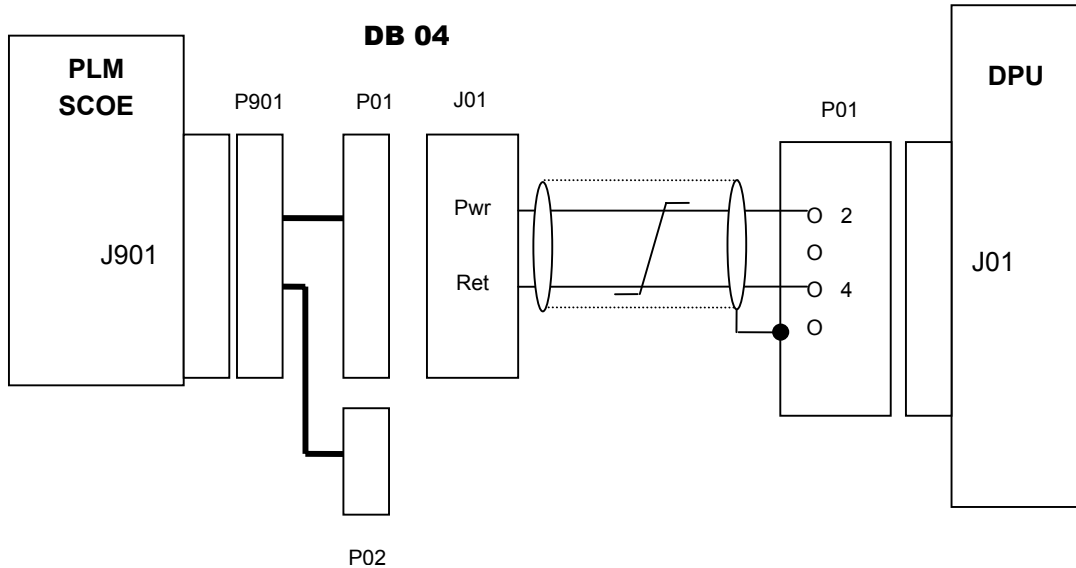
The IDAS-Rack must be grounded acc. to para. 4.2.1.6.

### 4.2.1 Block Diagram of the Test Setup

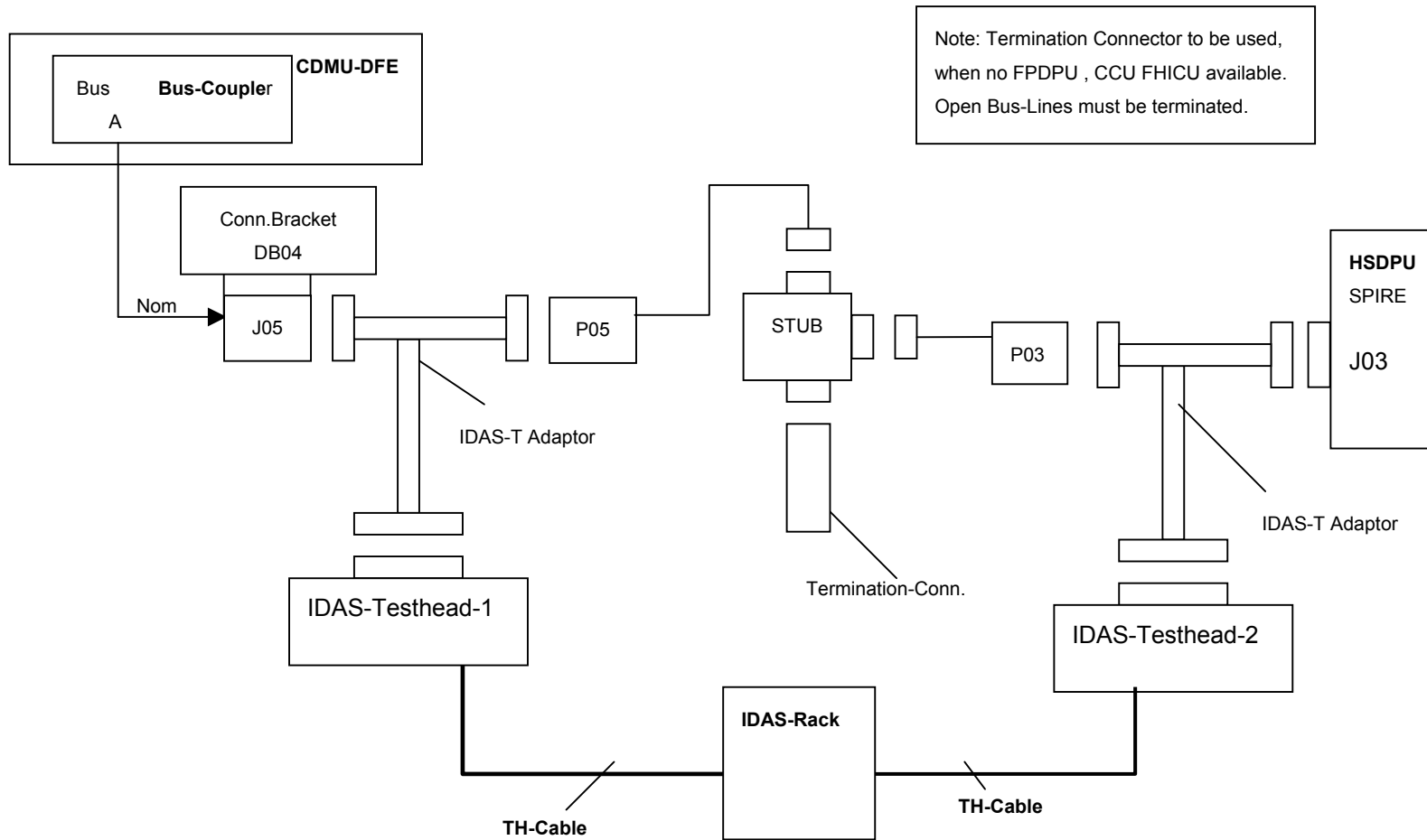
#### 4.2.1.1 Electrical Test Setup for Power Verification



4.2.1.2 Power Excitation of SPIRE Warm Units after Verification of I/F's

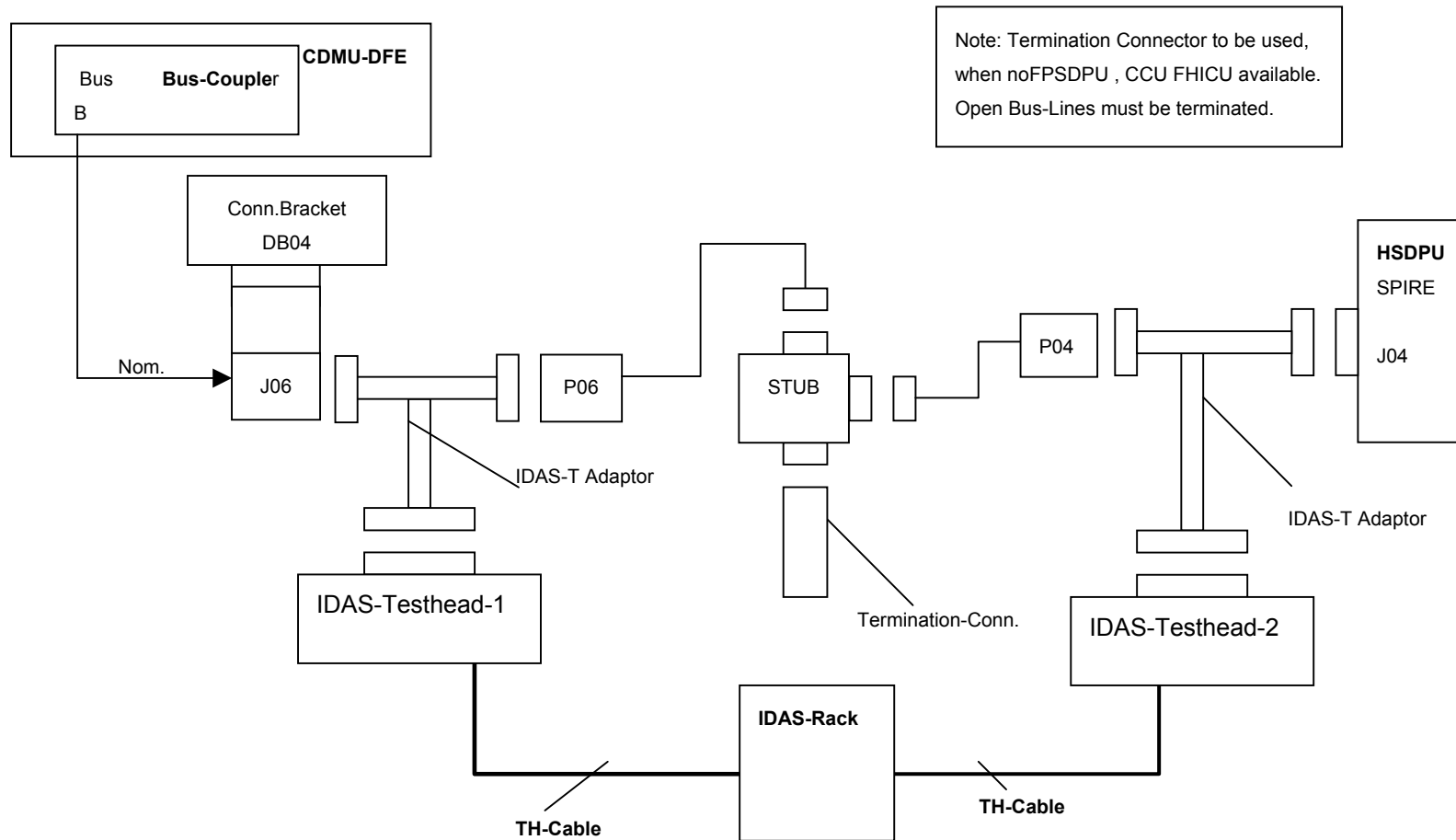


4.2.1.3 Electrical Test-set up for SPIRE MIL-Bus A Verification (Prime)





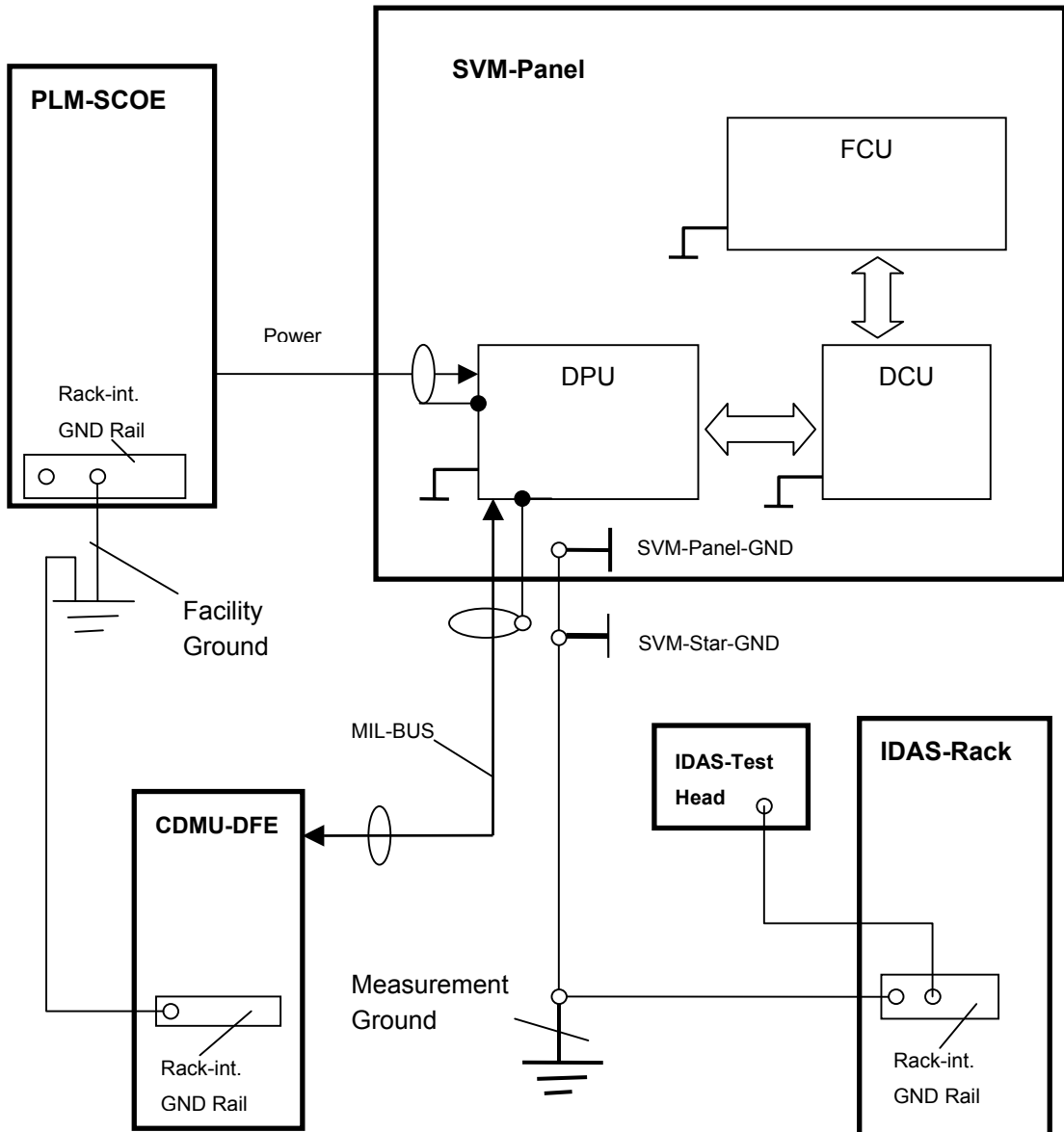
4.2.1.4 Electrical Test-set up for SPIRE MIL-Bus B Verification (Prime)



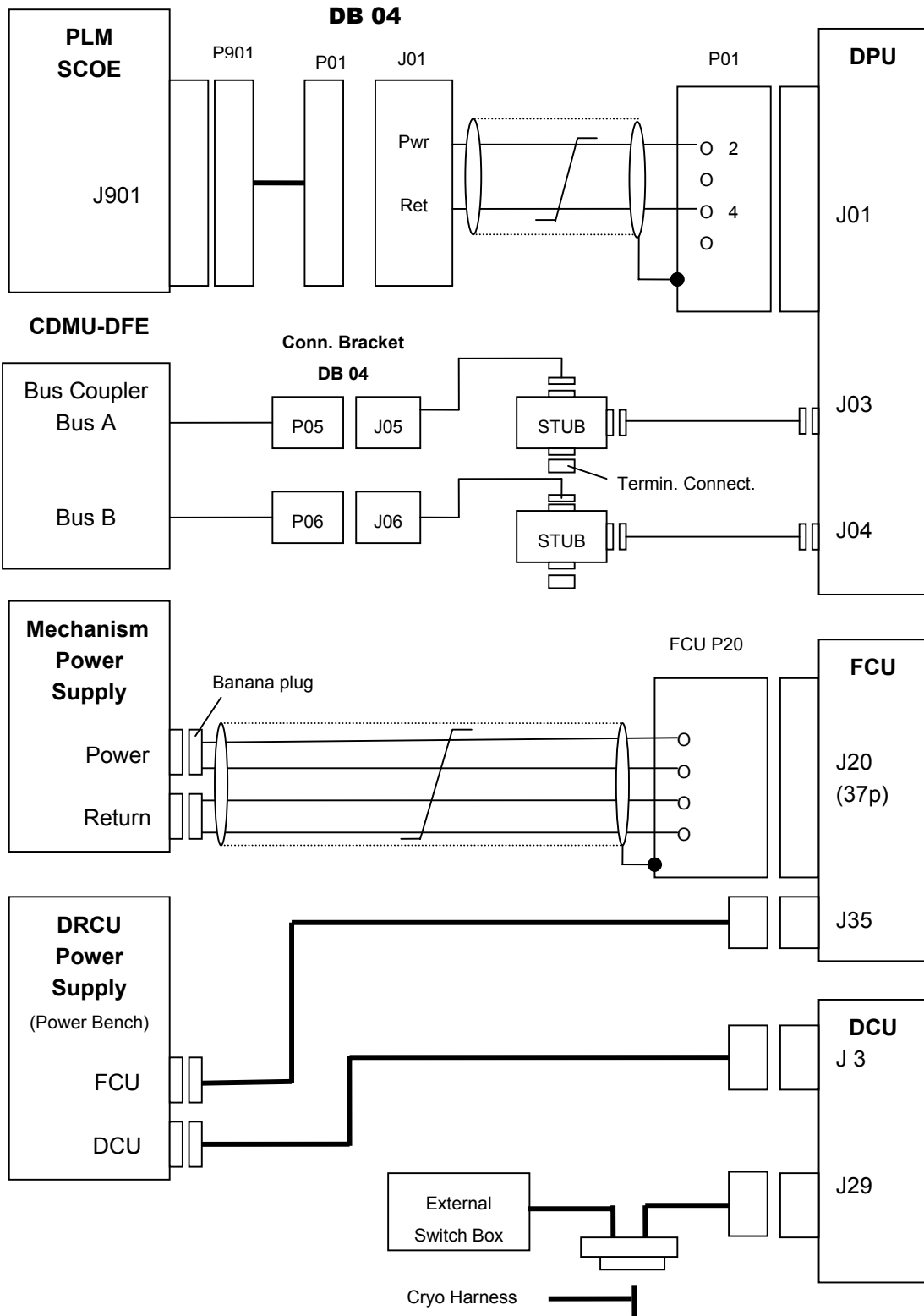
4.2.1.5 Electrical Test set-up for Synch Signal Verification

NA

4.2.1.6 Grounding scheme for SPIRE-Warm Units Test-set up



**4.2.1.7 Block Diagram of the Electrical Setup after Test Completion  
(SPIRE Configuration only)**



**4.2.2 Environment of the test set-up**

The tests shall be performed in CI.100 000 Clean Room

#### **4.2.3 ESD constraints**

During handling and connection at the Warm Units, ESC precautions acc. to RD4 have to be applied, e.g. personnel must be grounded.

The SVM must be grounded acc. to para 4.2.1.6.

#### **4.2.4 QA Requirements**

In general the PA Plan shall be followed (see AD1).

Quality Assurance will be a major part of AIT activities in order to ensure that all activities are performed in a controlled manner and documented in accordance with the corresponding requirements.

The main AIT-QA tasks are as follows:

- assurance that activities are performed in accordance with released procedures
- release of hardware for integration/testing
- witnessing of all AIT activities and environmental conditions
- performance of visual inspections
- application of non-conformance reporting system and relevant logbooks
- preparation and performance of KIP's/MIP's/TRP's and PTR's
- to assure that materials/parts/units etc. are traceable
- hazard identification and tracking.

#### **4.2.5 Documentation Requirements**

All data, results and possible special events received during this test have to be entered into the integration report

- **Sequence Diary**

The obtained records shall be marked with

- date of the test
- title of the procedure
- identification number of procedure
- test article identification number

Each activity and operation has to be entered in the logsheet.

- **Summary of Deviation**

In the event that the specimen exhibits any major failure or deviations from the requirement set forth in this procedure, testing shall be discontinued and a NCR shall be raised. Testing shall be continued only upon authorisation of Product Assurance and Project engineering acc. to the NCR decision.

- **Post Test Documentation**

After performance of the activities the summary sheets must be filled-in.

A copy of the filled-in summary sheets (see para 7.0) has to be incorporated to the summary report for the integration. After end of integration a test report shall be written.

## 5 Conditions

### 5.1 Personnel

| Responsibility          | Name / Organization |
|-------------------------|---------------------|
| Test Manager            |                     |
| Test Engineer           |                     |
| EGSE Operator           |                     |
| Support Engineer        |                     |
| PA Responsible          |                     |
| Customer Representative |                     |
|                         |                     |
|                         |                     |
|                         |                     |

### 5.2 Environmental

| Environmental    | Nominal    | Actual | P | N |
|------------------|------------|--------|---|---|
| Clean Room Class | 100 000    |        |   |   |
| Temperature      | (22±3) °C  |        |   |   |
| Rel. Humidity    | 40....60 % |        |   |   |
| Pressure         | ambient    |        |   |   |

Note: Clean room class acc. to Federal Standard 209 E

### 5.3 GSE Equipment and Tools

#### 5.3.1 EGSE

| Test Equipment List  |               |           |                    |            |             |
|----------------------|---------------|-----------|--------------------|------------|-------------|
| Item                 | Manuf.        | Model No. | SN No.             | Invent No. | Next Calib. |
| PLM-SCOE             | Sat. Services | -         | CI3A 2210-SE840/30 | NA         | NA          |
| CDMU-DFE             | Sat. Services | -         | CI3A 2200-SE841/01 | NA         | NA          |
| Bonding Meas. Bridge |               |           |                    |            |             |
| Scope                | Tektronix     | TDS 754A  |                    |            |             |
| Current Probe        | Tektronix     | TCP 202   |                    |            |             |
| Multimeter           |               |           |                    |            |             |

| EGSE Command Sequence | Description           | Single Actions |
|-----------------------|-----------------------|----------------|
| Switch ON PLM-SCOE    | Switch ON Power       | TBD            |
| Switch ON CDMU-DFEE   | Control Data Handling | TBD            |
|                       |                       |                |
|                       |                       |                |
|                       |                       |                |



### 5.3.2 IDAS

The IDAS-5 with two test heads and Scope and Current Probe shall be available for performance of this test.

| Test Equipment List |         |           |        |            |             |
|---------------------|---------|-----------|--------|------------|-------------|
| Item                | Manuf.  | Model No. | SN No. | Invent No. | Next Calib. |
| IDAS-Rack           | ASTRIUM |           |        |            |             |
| Scope               |         |           |        |            |             |
| Current-Probe       |         |           |        |            |             |
| Probe-Amplifier     |         |           |        |            |             |
| Test-Head 1         | ASTRIUM |           |        |            |             |
| Test-Head 2         | ASTRIUM |           |        |            |             |

### 5.3.3 Special Equipment for IDAS:

Test Adaptors for following connector-types shall be available:

- Connector : DEMA 9s/9p

### 5.3.4 IDAS Software Status

The actual IDAS Software Status is: **IDAS5.V4.6.0.exe**

## 6 Verification Requirements and Step by Step Procedure

### 6.1 Verification Requirements/Tolerances

#### 6.1.1 *Bonding Verification*

Bonding Resistance:  $R < 2.5 \text{ mOhm}$  between mounted box housing and SVM-Panel-GND.

#### 6.1.2 *Grounding Verification:*

Grounding Resistance:  $R \leq 100 \text{ mOHM}$  between setup and facility/measurement ground.

(Grounding Diagram of SPIRE-Warm Units Test Setup: see para 4.2.1.6)

### 6.1.3 Voltage/Current Verification:

- **DPU: LCL class I** acc. to SCI-PT-IIDA-04624, issue 3.3, Tables 5.9.5-3/5

Bus-Voltage: 26.....29 V

Inrush Current:  $\leq 2.25$  A

Steady State Current:  $\leq 1$  A

Pin Allocation: Conn.J01 -Prim.Power: Pin 2 ; Return: Pin 4  
(see para 4.2.1.1)

### 6.1.4 MIL-BUS 1553 Verification

- A- Voltage P-P: 4-6V

- B-Voltage P-P: 19-25V

- Polarity measurmts: to verify polarity before stub and at DPU-Connector is correct

- MIL BUS Verification with:

...Rise-Time: 80-300 nsec

...Fall-Time: 80-300 nsec

...Ratio-Measurement between A-Bus Voltage and B- Bus Voltage

- Pin Allocation: HSDPU - J03: BUS A (+) Prime: Pin 2 ; BUS A (-) Prime: Pin 6

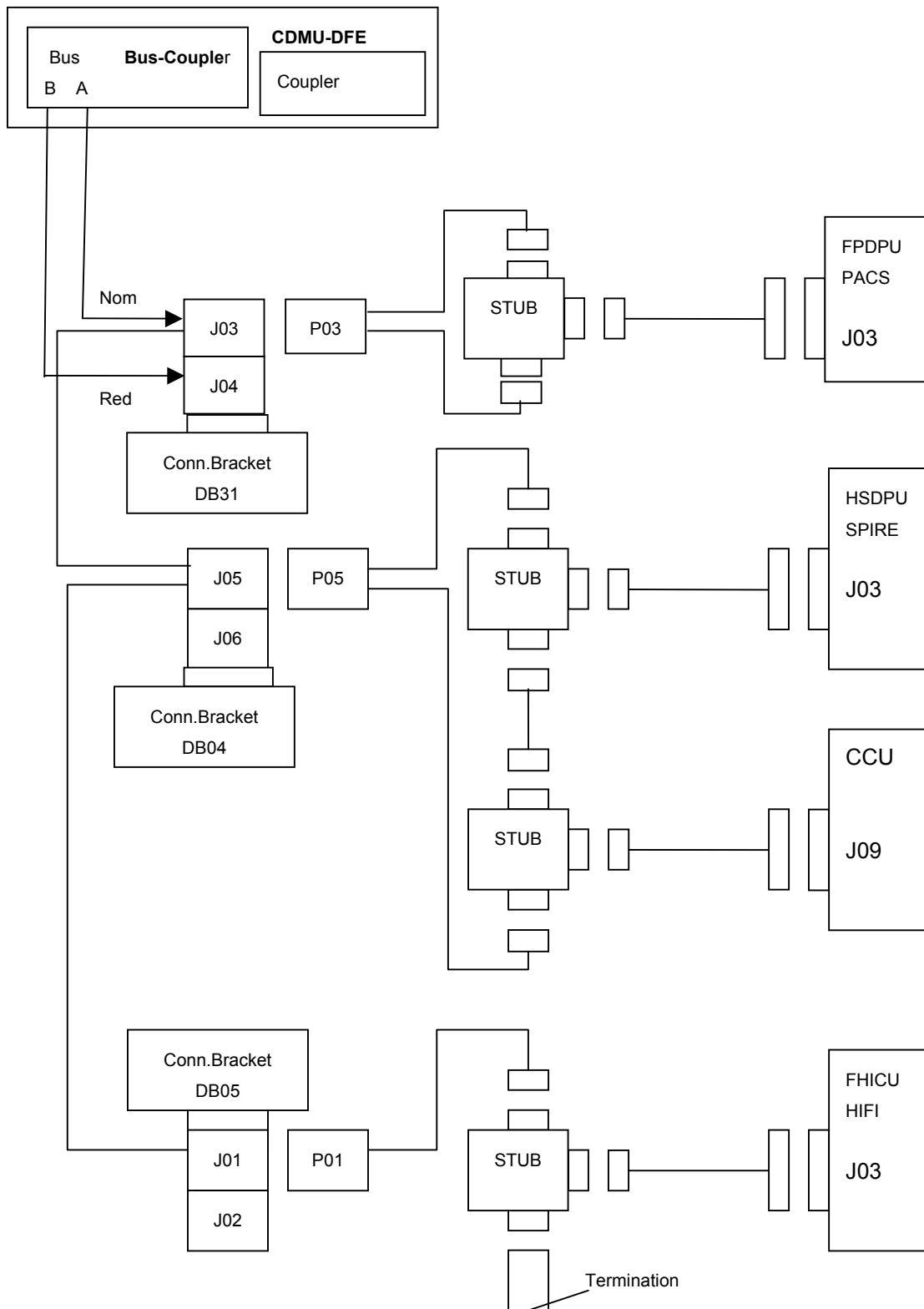
HSDPU - J04: BUS B (+) Prime: Pin 2 ; BUS B (-) Prime: Pin 6

(see annex 1, para 8.1.1/2)

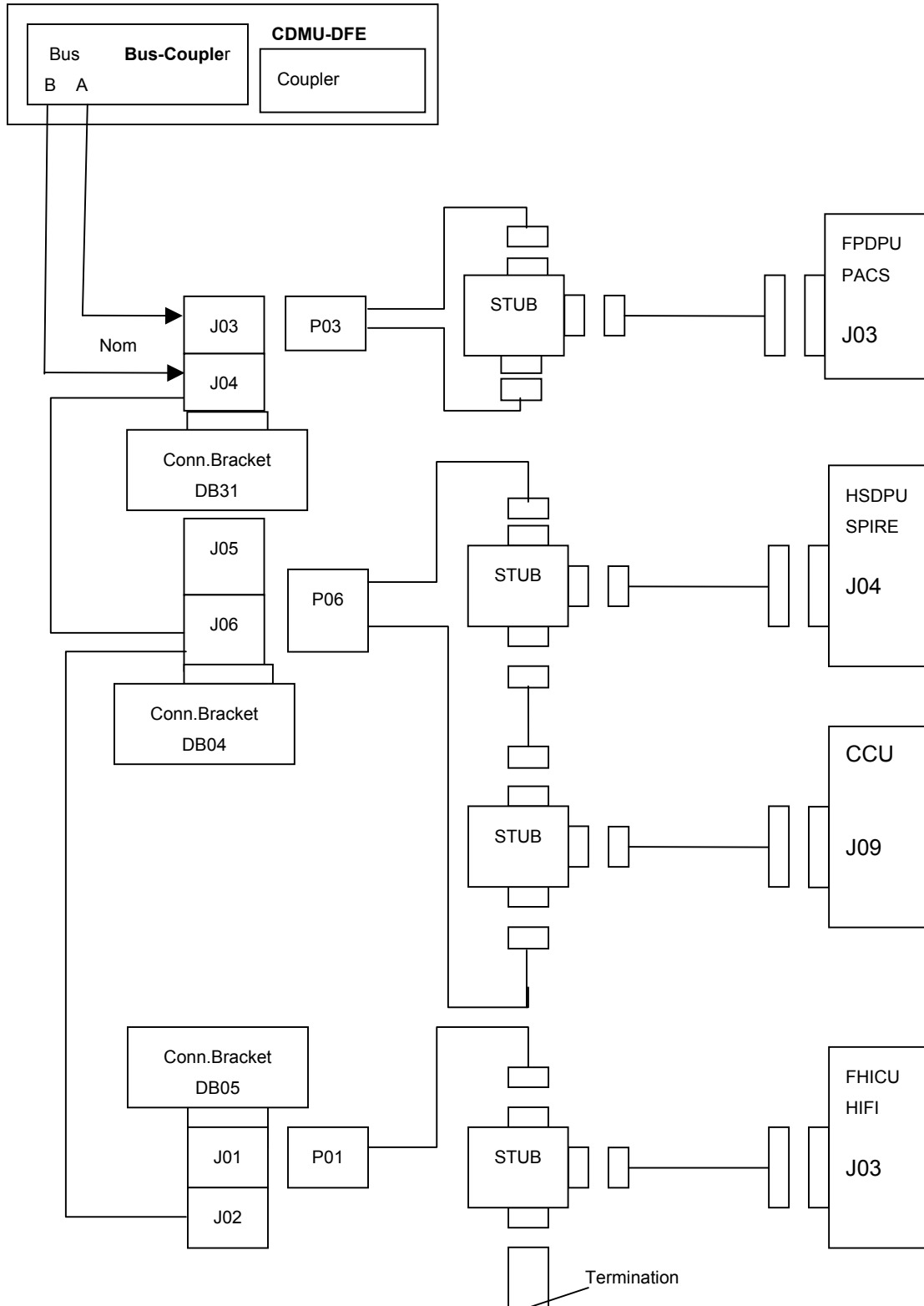
**Note:** The Herschel EQM-SVM system configuration of the MIL-Bus 1553 is given in chapter 6.1.5

If the MIL-Bus system set-up is not completely available according to 6.1.5, the correct termination of the MIL-Bus with termination connectors must be provided acc. to para. 4.2.1.3 and 4.2.1.4.

6.1.5 MIL-BUS 1553A Structure (Nominal) at EQM-SVM Warm Units



6.1.6 MIL-BUS 1553B Structure (Nominal) at EQM-SVM Warm Units



## 6.2 Step by Step Procedure

| Step         | ACTIVITY  | Required value                         | Actual value | Date | AIT Sign | QA Sign | Remarks / NCR No |
|--------------|---|--|--------------|------|----------|---------|------------------|
| <b>6.1.0</b> | <b>Bonding Measurement</b>  |  |              |      |          |         |                  |
| 6.1.1        | Measure acc. to a four-point measurement the resistance between:<br>- HSDPU and SVM panel GND<br>- HSFCU and SVM panel GND<br>- HSDCU and SVM panel GND | ≤ 2.5 mOHM<br>≤ 2.5 mOHM<br>≤ 2.5 mOHM |              |      |          |         |                  |
| <b>6.2.0</b> | <b>Grounding Verification</b>   |  |              |      |          |         |                  |
| 6.2.1        | Check the grounding of SVM star GND   | ≤ 100 mOHM                             |              |      |          |         |                  |
| 6.2.2        | Check the grounding of PLM-SCOE   | ≤ 100 mOHM                             |              |      |          |         |                  |
| 6.2.3        | Check the grounding of CDMU-DFE   | ≤ 100 mOHM                             |              |      |          |         |                  |
| <b>6.3.0</b> | <b>Insulation Resistance Test</b>   |  |              |      |          |         |                  |
| 6.3.1        | Measure the resistance between HSDPU/J01, pin4 and SVM panel GND  | ≥ 1 MOHM                               |              |      |          |         |                  |

| Step         | ACTIVITY   | Required value    | Actual value | Date | AIT Sign | QA Sign | Remarks / NCR No |
|--------------|--|-------------------|--------------|------|----------|---------|------------------|
| <b>6.4.0</b> | <b>Power Verification</b>  |                   |              |      |          |         |                  |
| 6.4.1        | Prepare the test setup acc. to para 4.2.1.1  |                   |              |      |          |         |                  |
| 6.4.2        | Check the voltage of DPU:<br>- between pin 2 (pwr) and pin 4 (ret)   | (28±1) VDC        |              |      |          |         |                  |
| 6.4.3        | Check the supply voltage of FCU (ext. power supply)  | (28±1) VDC        |              |      |          |         |                  |
| 6.4.4        | Measure the inrush/steady state current:<br><br>- mate connector DPU-P01<br>- switch ON power at PLM-SCOE and record the current<br>- evaluate the inrush current<br>- evaluate the steady state current | ≤ 2.25 A<br>≤ 1 A |              |      |          |         |                  |
| 6.4.5        | Complete the primary power cabling acc. to para 4.2.1.2:<br>- verify that PLM-SCOE and ext. power supply OFF<br>- remove the break out boxes<br>- mate DPU-P01 to DPU-J01<br>- mate FCU-P20 to FCU-J20   |                   |              |      |          |         |                  |

| Step  | ACTIVITY   | Required value | Actual value | Date | AIT Sign | QA Sign | Remarks / NCR No |
|-------|--|----------------|--------------|------|----------|---------|------------------|
| 6.5.0 | <b>MIL-BUS 1553 A/B Verification</b><br><br>This step by step procedure will be created by using IDAS. (see following pages 31-38) |                |              |      |          |         |                  |
| 6.6.0 | <b>Complete Set-up for Functional Test</b><br>Establish final connection and verify set-up as given in chapter 4.2.1.7             |                |              |      |          |         |                  |



**HERSCHEL****6 . 4 Mil-Bus Polarity Measurements preparation**

Sheet: 31

| St-No | Test-Step Description  | C-St. | Meas. Type | Parameter | Phys. Unit | Min.Value | Max. Value | actual Value | P/N |
|-------|--|-------|------------|-----------|------------|-----------|------------|--------------|-----|
| 0. 1  | MIL-BUS 1553 Verification  | NO    |            |           |            |           |            |              |     |
| 0. 2  | MIL BUS Verification between EQM SPIRE-DPU (Warm Unit) and Connector Bracket DB04 - Conn.J05/J06 for Nominal BUS A&B | NO    |            |           |            |           |            |              |     |
| 0. 3  | Verify the MIL-BUS set up for SPIRE Warm Unit Integration acc. to Sketch 6.1.5.                                      | NO    |            |           |            |           |            |              |     |
| 0. 5  | Prepare test set-up acc. to Sketch 4.2.1.3.  | NO    |            |           |            |           |            |              |     |
| 0. 6  | Prerequisite for MIL-BUS Verification: Power Verification passed.  | NO    |            |           |            |           |            |              |     |
| 0. 7  | All Mil-Bus connectors of the complete S/C Mil-Bus harness must be open.   | NO    |            |           |            |           |            |              |     |
| 0. 8  | Prepare EGSE for transmit Command Word   | NO    |            |           |            |           |            |              |     |
| 0. 9  | Connect IDAS-5 Testhead-1 via the T-Adapter 9d to Connector Bracket DB04- between J05 and P05                        | NO    |            |           |            |           |            |              |     |
| 0. 10 | Connect Testhead-1-GND to box structure (bonding stud of unit)   | NO    |            |           |            |           |            |              |     |

**HERSCHEL****6 . 4 Mil-Bus Polarity Measurements preparation**

Sheet: 32

| St-No | Test-Step Description   | C-St. | Meas. Type | Parameter     | Phys. Unit | Min.Value | Max. Value | actual Value | P/N |
|-------|---|-------|------------|---------------|------------|-----------|------------|--------------|-----|
| 0. 11 | Connect IDAS-5 Testhead-2 via adapter No.9d to Harness Spire Connector J03                                |       | NO         |               |            |           |            |              |     |
| 0. 12 | Connect Testhead-2-GND to box structure (bonding stud of unit)  |       | NO         |               |            |           |            |              |     |
| 0. 13 | Verify Mil-Bus Polarity by Sending a Command word/ Transmit   |       | PM         |               |            |           |            |              |     |
|       | CMD via Nominal Bus   |       | 053.100    | A-Voltage-pos | _Volt      |           | 1          | 30           |     |
|       | Testhead-1: DB04-J05  |       | 053.100    | B-Voltage-pos | _Volt      |           | 1          | 30           |     |
|       | 02  |       | 053.100    | TRIGGERLEVEL  | _Volt      |           | 0          | 2            |     |
|       | 06  |       | 053.100    | TRIGGERSLOPE  | _Pos       |           | 1          | 1            |     |
|       | Testhead-2: SPIRE-J03   |       |            |               |            |           |            |              |     |
|       | 02  |       |            |               |            |           |            |              |     |
|       | 06  |       |            |               |            |           |            |              |     |
| 0. 14 | Stop the Mil-Bus CMD  |       | NO         |               |            |           |            |              |     |
| 0. 15 | Disconnect IDAS Testheads with T-Adaptors from DB04 and NO from SPIRE-DPU-J03 and connect DB04-J05 to P05 |       | NO         |               |            |           |            |              |     |

**HERSCHEL**

**6 . 4 Mil-Bus Polarity Measurements preparation**

Sheet: 33

| St-No | Test-Step Description  | C-St. | Meas. Type | Parameter | Phys. Unit | Min.Value | Max. Value    | actual Value | P/N  |
|-------|--|-------|------------|-----------|------------|-----------|---------------|--------------|------|
| 1. 0  | Measurement of Bus B   |       |            |           | NO         |           |               |              |      |
| 1. 1  | Configure the EGSE to Bus B  |       |            |           | NO         |           |               |              |      |
| 1. 2  | Connect IDAS-5 Testhead-1 via the T-Adapter 9d to Connector Bracket DB04- between J06 and P06 -connect Testhead to Gnd         |       |            |           | NO         |           |               |              |      |
| 1. 3  | Connect IDAS-5 Testhead-2 via adapter No.9d to Unit- Harness Spire J04 Connector - connect Testhead to Gnd. Box not connected. |       |            |           | NO         |           |               |              |      |
| 1. 4  | Verify Mil-Bus Polarity by Sending a Command word/ Transmit  |       |            |           | PM         |           |               |              |      |
|       |  |       |            |           |            | 053.100   | A-Voltage-pos | _Volt        | 1 30 |
|       | CMD via redundant Bus  |       |            |           |            | 053.100   | B-Voltage-pos | _Volt        | 1 30 |
|       | Testhead-1: DB04-J06   |       |            |           |            | 053.100   | TRIGGERLEVEL  | _Volt        | 0 2  |
|       | 02   |       |            |           |            | 053.100   | TRIGGERSLOPE  | _Pos         | 1 1  |
|       | 06   |       |            |           |            |           |               |              |      |
|       | Testhead-2: SPIRE-J04  |       |            |           |            |           |               |              |      |
|       | 02   |       |            |           |            |           |               |              |      |
|       | 06   |       |            |           |            |           |               |              |      |

**HERSCHEL****6 . 4 Mil-Bus Polarity Measurements preparation**

Sheet: 34

| St-No | Test-Step Description  | C-St. | Meas. Type | Parameter | Phys. Unit | Min.Value | Max. Value | actual Value | P/N |
|-------|--|-------|------------|-----------|------------|-----------|------------|--------------|-----|
| 1. 5  | Stop the Mil-Bus CMD   |       |            |           | NO         |           |            |              |     |
| 1. 6  | Disconnect Testhead 2 and T-Adaptor from Connector SPIRE J04   |       |            |           | NO         |           |            |              |     |
| 1. 7  | Disconnect Testhead 1 and T-Adaptor from Connector DB04- J06/P06   |       |            |           | NO         |           |            |              |     |
| 2. 0  | Test-Conditions/Declarations:<br>In this test the Mil-Bus signals Bus A/B will be measured.                  |       |            |           | NO         |           |            |              |     |
| 2. 1  | Measurement of Nominal BUS A   |       |            |           | NO         |           |            |              |     |
| 2. 2  | Verify Box Power is ON   |       |            |           | NO         |           |            |              |     |
| 2. 3  | Connect IDAS-5 Testhead-1 via the T-Adapter 9d to Connector Bracket DB04-J05 - between connector J05 and P05 |       |            |           | NO         |           |            |              |     |
| 2. 4  | Connect Testhead-1-GND to box structure (bonding stud of unit)   |       |            |           | NO         |           |            |              |     |
| 2. 5  | Connect IDAS-5 Testhead-2 via adapter No.9d between SPIRE J03 and P03  |       |            |           | NO         |           |            |              |     |

## HERSCHEL

## 6 . 4 Mil-Bus Verification

Sheet: 35

| St-No | Test-Step Description   | C-St. | Meas. Type | Parameter | Phys. Unit | Min.Value | Max. Value      | Actual Value | P/N    |
|-------|---|-------|------------|-----------|------------|-----------|-----------------|--------------|--------|
| 2. 6  | Connect Testhead-2-GND to box structure (bonding stud of unit)              |       |            |           | NO         |           |                 |              |        |
| 2. 7  | Verify Mil-Bus by Sending a Status Word Check from receiver via Nominal Bus |       |            |           | NO         |           |                 |              |        |
| 2. 8  | Verify Mil-Bus Signal BC to RT  |       |            |           | PM         | 055.100   | A-VOLT P-P      | _Volt        | 19 25  |
|       |   |       |            |           |            | 055.100   | A-RISE TIME     | nsec         | 80 300 |
|       |   |       |            |           |            | 055.100   | A-FALL TIME     | nsec         | 80 300 |
|       | Testhead-1: DB04-J05  |       |            |           |            | 055.100   | B-VOLT P-P      | _Volt        | 4 6    |
|       | 02  |       |            |           |            | 055.100   | B-RISE TIME     | nsec         | 80 300 |
|       | 06  |       |            |           |            | 055.100   | B-FALL TIME     | nsec         | 80 300 |
|       | Testhead-2: SPIRE-J03   |       |            |           |            | 055.100   | VOLT-A / VOLT-B | %            | 4 6    |
|       | 02  |       |            |           |            | 055.100   | TRIGGERLEVEL    | _Volt        | 1 5    |
|       | 06  |       |            |           |            | 055.100   | TRIGGERSLOPE    | _Pos         | 1 1    |
| 2. 9  | Verify Mil-Bus Signal RT to BC  |       |            |           | PM         | 055.200   | A-VOLT P-P      | _Volt        | 4 6    |
|       |   |       |            |           |            | 055.200   | A-RISE TIME     | nsec         | 80 300 |
|       |   |       |            |           |            | 055.200   | A-FALL TIME     | nsec         | 80 300 |
|       | Testhead-1: DB04-J05  |       |            |           |            | 055.200   | B-VOLT P-P      | _Volt        | 19 25  |
|       | 02  |       |            |           |            | 055.200   | B-RISE TIME     | nsec         | 80 300 |
|       | 06  |       |            |           |            | 055.200   | B-FALL TIME     | nsec         | 80 300 |
|       | Testhead-2: SPIRE-J03   |       |            |           |            | 055.200   | VOLT-A / VOLT-B | %            | 4 6    |
|       | 02  |       |            |           |            | 055.200   | TRIGGERLEVEL    | _Volt        | 1 5    |
|       | 06  |       |            |           |            | 055.200   | TRIGGERSLOPE    | _Pos         | 0 0    |

## HERSCHEL

## 6 . 4 Mil-Bus Verification

Sheet: 36

| St-No | Test-Step Description   | C-St. | Meas. Type | Parameter | Phys. Unit | Min.Value | Max. Value | Actual Value | P/N |
|-------|---|-------|------------|-----------|------------|-----------|------------|--------------|-----|
| 2. 10 | Stop the Mil-Bus CMD  |       |            |           |            |           |            |              |     |
| 2. 11 | Disconnect Testhead 1 from DB04-J05/P05   |       |            |           |            |           |            |              |     |
| 2. 12 | Disconnect Testhead 2 from Spire-J03/P03  |       |            |           |            |           |            |              |     |
| 2. 13 | Connect Connector DB04-J05 to P05   |       |            |           |            |           |            |              |     |
| 3. 0  | Measurement of Nominal BUS B  |       |            |           |            |           |            |              |     |
| 3. 1  | Connect IDAS-5 Testhead-1 via the T-Adapter 9d to Connector Bracket DB04-J06- between J06 and P06 - connect Testhead to Gnd   |       |            |           |            |           |            |              |     |
| 3. 2  | Connect IDAS-5 Testhead-2 via adapter No.9d between Unit- NO Harness Spire J04 - and Box -Connector SPIRE-J04 - connect Testhead to Gnd. Box is connected to MIL-Bus. |       |            |           |            |           |            |              |     |
| 3. 3  | Verify Mil-Bus by Sending a Status Word check to receiver via NO redundant Bus  |       |            |           |            |           |            |              |     |

## HERSCHEL

## 6 . 4 Mil-Bus Verification

Sheet: 37

| St-No | Test-Step Description          | C-St. | Meas. Type | Parameter | Phys. Unit | Min.Value | Max. Value      | Actual Value | P/N |     |
|-------|--------------------------------|-------|------------|-----------|------------|-----------|-----------------|--------------|-----|-----|
| 3. 4  | Verify Mil-Bus Signal BC to RT |       |            |           | PM         | 055.100   | A-VOLT P-P      | _Volt        | 19  | 25  |
|       |                                |       |            |           |            | 055.100   | A-RISE TIME     | nsec         | 80  | 300 |
|       |                                |       |            |           |            | 055.100   | A-FALL TIME     | nsec         | 80  | 300 |
|       |                                |       |            |           |            | 055.100   | B-VOLT P-P      | _Volt        | 4   | 6   |
|       |                                |       |            |           |            | 055.100   | B-RISE TIME     | nsec         | 80  | 300 |
|       |                                |       |            |           |            | 055.100   | B-FALL TIME     | nsec         | 80  | 300 |
|       |                                |       |            |           |            | 055.100   | VOLT-A / VOLT-B | %            | 4   | 6   |
|       |                                |       |            |           |            | 055.100   | TRIGGERLEVEL    | _Volt        | 1   | 5   |
|       |                                |       |            |           |            | 055.100   | TRIGGERSLOPE    | _Pos         | 1   | 1   |
|       |                                |       |            |           |            | 055.100   |                 |              |     |     |
| 3. 5  | Verify Mil-Bus Signal RT to BC |       |            |           | PM         | 055.200   | A-VOLT P-P      | _Volt        | 4   | 6   |
|       |                                |       |            |           |            | 055.200   | A-RISE TIME     | nsec         | 80  | 300 |
|       |                                |       |            |           |            | 055.200   | A-FALL TIME     | nsec         | 80  | 300 |
|       |                                |       |            |           |            | 055.200   | B-VOLT P-P      | _Volt        | 19  | 25  |
|       |                                |       |            |           |            | 055.200   | B-RISE TIME     | nsec         | 80  | 300 |
|       |                                |       |            |           |            | 055.200   | B-FALL TIME     | nsec         | 80  | 300 |
|       |                                |       |            |           |            | 055.200   | VOLT-A / VOLT-B | %            | 4   | 6   |
|       |                                |       |            |           |            | 055.200   | TRIGGERLEVEL    | _Volt        | 1   | 5   |
|       |                                |       |            |           |            | 055.200   | TRIGGERSLOPE    | _Pos         | 0   | 0   |
|       |                                |       |            |           |            | 055.200   |                 |              |     |     |

**HERSCHEL**

**6 . 4 Mil-Bus Verification**

Sheet: 38

| St-No | Test-Step Description  | C-St. | Meas. Type | Parameter | Phys. Unit | Min.Value | Max. Value | Actual Value | P/N |
|-------|--|-------|------------|-----------|------------|-----------|------------|--------------|-----|
| 3. 6  | End of MIL BUS Measurements                                  |       |            |           | NO         |           |            |              |     |
| 3. 7  | Disconnect Testhead 1 and T-Adaptor from Conn-Bracket DB04   |       |            |           | NO         |           |            |              |     |
| 3. 8  | Connect DB04 Connector J06 to P06                            |       |            |           | NO         |           |            |              |     |
| 3. 9  | Disconnect Testhead 2 and T-Adaptor from Connector SPIRE-J04 |       |            |           | NO         |           |            |              |     |
| 3. 10 | Connect SPIRE Connector J04 to P04 and J03 to P03            |       |            |           | NO         |           |            |              |     |
| 3. 11 | End of SPIRE MIL BUS Verification                            |       |            |           | NO         |           |            |              |     |



## 7 Summary Sheets

### 7.1 Procedure Variation Summary

|                   |                   |                  |      |
|-------------------|-------------------|------------------|------|
|                   | Test Change       | Curr. No.:       |      |
|                   |                   | Date             |      |
|                   |                   | Page             | of   |
| Test designation  | Test Procedure    | Issue            | Rev. |
| Test step changed | Reason for Change |                  |      |
|                   |                   |                  |      |
| Prepared by:      | Resp. Test Leader | Project Engineer |      |
| PA/QA             | Prime             | Customer         |      |

7.2 Non Conformance Report (NCR) Summary

| NCR - No. | NCR - Title | Date | Open<br>Closed | PA<br>sig. |
|-----------|-------------|------|----------------|------------|
|           |             |      |                |            |

7.3 Sign-off Sheet

|                    | Date | Signature |
|--------------------|------|-----------|
| Test Manager       |      |           |
| Operator           |      |           |
| PA Responsible     |      |           |
| ESA Representative |      |           |
|                    |      |           |
|                    |      |           |



7.4 Sequence Diary - performed steps

| Date: /Time | Procedure Steps performed | Remarks/ NCRs | Name/Sign |
|-------------|---------------------------|---------------|-----------|
|             |                           |               |           |
|             |                           |               |           |
|             |                           |               |           |
|             |                           |               |           |
|             |                           |               |           |
|             |                           |               |           |
|             |                           |               |           |
|             |                           |               |           |
|             |                           |               |           |
|             |                           |               |           |
|             |                           |               |           |
|             |                           |               |           |
|             |                           |               |           |
|             |                           |               |           |
|             |                           |               |           |

8 Annex

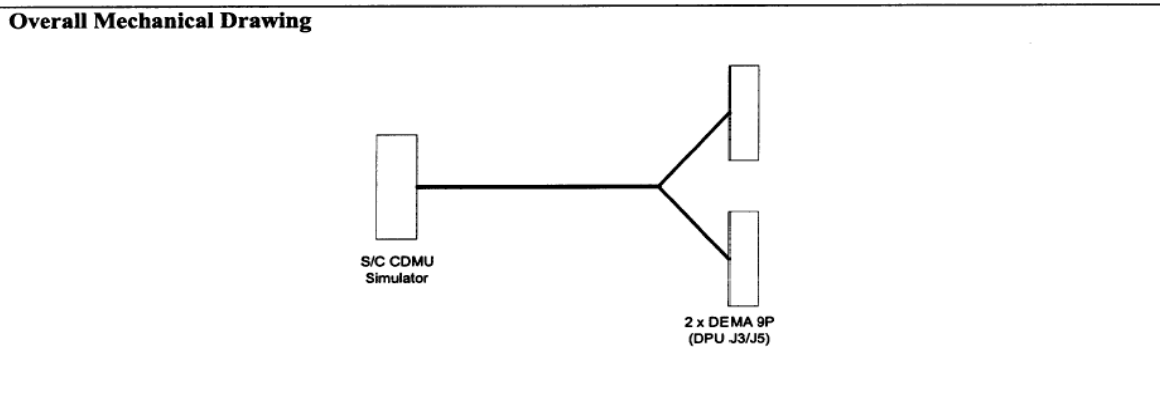
8.1 Annex 1 - Pinlists of Warm Units

8.1.1 Pin Allocation of MIL-Bus A

|   |   |   |   |
|---|---|---|---|
|  |  | <p><b>SPIRE HARNESS DEFINITION DOCUMENT</b></p> | <p>Doc: SPIRE-RAL-PRJ-000608<br/>                 Issue: 1.1<br/>                 Date: 05/03/03<br/>                 Page 205 of 228</p> |
|---|---|---|---|

4.7 Test Harnesses

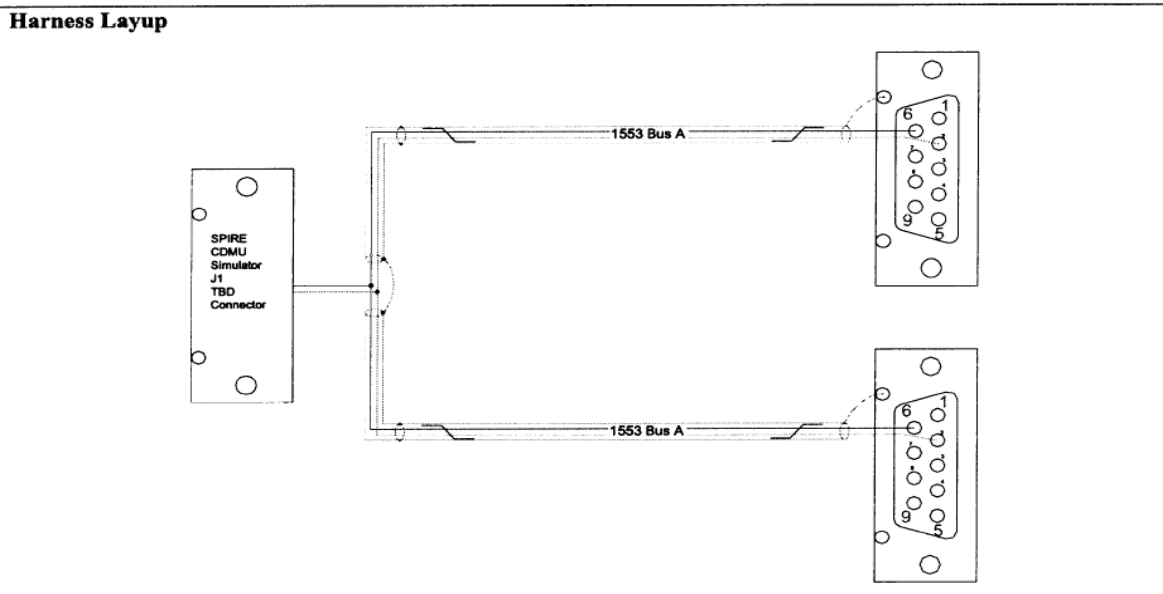
4.7.1 T1 1553 Bus A





**Connector/Backshell Details**

DEMA 9 P + Glenair 550 - T - 039 - M - 1 - TBD - H - 0 - TBD to DPUJ3  
 DEMA 9 P + Glenair 550 - T - 039 - M - 1 - TBD - H - 0 - TBD to DPUJ5

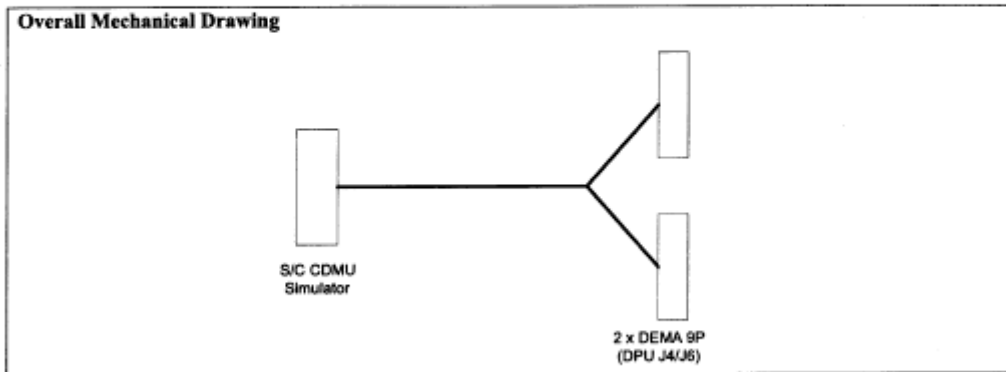
**Harness Layup**



8.1.2 Pin Allocation of MIL-Bus B

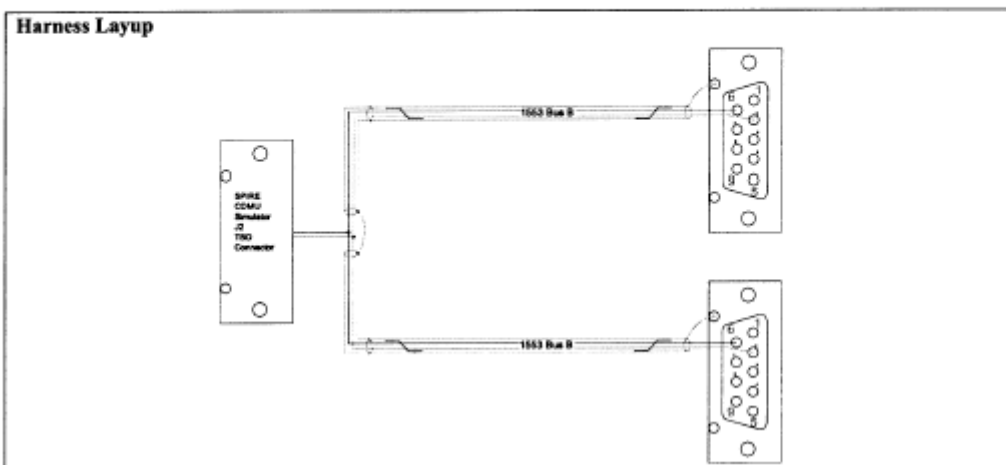
|   |   |  |  |
|---|---|--|--|
|  |  | <p align="center"><b>SPIRE HARNESS DEFINITION<br/>DOCUMENT</b></p> | <p>Doc: SPIRE-RAL-PRJ-000608<br/>Issue: 1.1<br/>Date: 05/03/03<br/>Page 206 of 228</p> |
|---|---|--|--|

4.7.2 T2 1553 Bus B



**Connector/Backshell Details**

|          |   |             |   |         |   |       |   |     |   |       |   |     |    |       |
|----------|---|-------------|---|---------|---|-------|---|-----|---|-------|---|-----|----|-------|
| DEMA 9 P | + | Glenair 550 | - | T - 039 | - | M - 1 | - | TBD | - | H - 0 | - | TBD | to | DPUJ4 |
| DEMA 9 P | + | Glenair 550 | - | T - 039 | - | M - 1 | - | TBD | - | H - 0 | - | TBD | to | DPUJ6 |



END OF DOCUMENT

|   | Name                    | Dep./Comp.   |   | Name                               | Dep./Comp. |
|---|-------------------------|--------------|---|------------------------------------|------------|
| X | Alberti von Mathias Dr. | AOE22        |   | Wagner Klaus                       | AOE22      |
| X | Barlage Bernhard        | AED11        | X | Wietbrock Walter                   | AET12      |
| X | Bayer Thomas            | AOA52        |   | Wöhler Hans                        | AOE22      |
|   | Fehringer Alexander     | AOE13        |   |                                    |            |
|   | Geiger Hermann          | AOA52        |   |                                    |            |
| X | Gerner Willi            | AED11        |   |                                    |            |
| X | Grasl Andreas           | OTN/AET52    |   |                                    |            |
|   | Grasshoff Brigitte      | AET12        |   |                                    |            |
|   | Hauser Armin            | AOE22        |   |                                    |            |
| X | Hendry David            | Terma Resid. | X | Alcatel                            | ASP        |
|   | Hinger Jürgen           | AOE22        | X | ESA/ESTEC                          | ESA        |
| X | Hohn Rüdiger            | AED65        |   |                                    |            |
|   | Huber Johann            | AOA52        |   | <b>Instruments:</b>                |            |
| X | Hund Walter             | ASE442       |   | MPE (PACS)                         | MPE        |
| X | Idler Siegmund          | AED432       | X | RAL (SPIRE)                        | RAL        |
| X | Ilse Stijn              | Terma Resid. |   | SRON (HIFI)                        | SRON       |
|   | Ivány von András        | FAE22        |   |                                    |            |
|   | Jahn Gerd Dr.           | AOE22        |   | <b>Subcontractors:</b>             |            |
| X | Kalde Clemens           | APE3         |   | Air Liquide, Space Department      | AIR        |
| X | Kameter Rudolf          | OTN/AET52    |   | Air Liquide, Space Department      | AIRS       |
|   | Kettner Bernhard        | AET42        |   | Air Liquide, Orbital System        | AIRT       |
| X | Knoblauch August        | AET32        |   | Alcatel Bell Space                 | ABSP       |
| X | Koelle Markus           | AOA53        |   | Astrium Sub-Subsyst. & Equipment   | ASSE       |
| X | Kroeker Jürgen          | AED65        |   | Austrian Aerospace                 | AAE        |
|   | Kunz Oliver Dr.         | AOE22        |   | Austrian Aerospace                 | AAEM       |
| X | Lamprecht Ernst         | OTN/ASI21    |   | APCO Technologies S. A.            | APCO       |
| X | Lang Jürgen             | ASE442       |   | Bieri Engineering B. V.            | BIER       |
| X | Langfermann Michael     | AOA51        |   | BOC Edwards                        | BOCE       |
| X | Mack Paul               | OTN/AET52    |   | Dutch Space Solar Arrays           | DSSA       |
|   | Müller Jörg             | AOA52        |   | EADS CASA Espacio                  | CASA       |
| X | Pastorino Michel        | ASPI Resid.  |   | EADS CASA Espacio                  | ECAS       |
|   | Peltz Heinz-Willi       | AOE13        |   | EADS Space Transportation          | ASIP       |
|   | Pietroboni Karin        | AED65        |   | Eurocopter                         | ECD        |
|   | Platzer Wilhelm         | AED22        |   | European Test Services             | ETS        |
|   | Rebholz Reinhold        | AOA51        |   | HTS AG Zürich                      | HTSZ       |
|   | Reuß Friedhelm          | AED62        |   | Linde                              | LIND       |
| X | Rühe Wolfgang           | AED65        |   | Patria New Technologies Oy         | PANT       |
| X | Runge Axel              | OTN/AET52    |   | Phoenix, Volkmarsen                | PHOE       |
|   | Sachsse Bernt           | AED21        |   | Prototech AS                       | PROT       |
| X | Schink Dietmar          | AED44        |   | QMC Instruments Ltd.               | QMC        |
| X | Schlosser Christian     | OTN/AET52    |   | Rembe, Brilon                      | REMB       |
|   | Schmidt Rudolf          | FAE22        |   | Rosemount Aerospace GmbH           | ROSE       |
|   | Schweickert Gunn        | AOE22        |   | RYMSA, Radiación y Microondas S.A. | RYM        |
| X | Sonn Nico               | AOE51        |   | SENER Ingeniería SA                | SEN        |
|   | Steininger Eric         | AED44        |   | Stöhr, Königsbrunn                 | STOE       |
| X | Stritter Rene           | AED11        |   | Terma A/S, Herlev                  | TER        |
|   | Thörmer Klaus-Horst Dr. | OTN/AED65    |   |                                    |            |