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**Lyndon B. Johnson Space Center**  
**Houston, Texas 77058**

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Interface Definition Document  
for the  
Human Research Facility  
Joint Excursion System (JES)

LS-71104-2

# PROJECT DOCUMENT APPROVAL SHEET

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for the  
Human Research Facility  
Joint Excursion System (JES)

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for the  
Human Research Facility (HRF)  
Joint Excursion System (JES)

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## ACRONYMS AND ABBREVIATIONS

|      |                                    |
|------|------------------------------------|
| ADAS | Ambulatory Data Acquisition System |
| cm   | centimeter                         |
| DC   | Direct Current                     |
| ft   | foot                               |
| g    | gravity                            |
| HRF  | Human Research Facility            |
| ID   | Identification                     |
| IDD  | Interface Definition Document      |
| JES  | Joint Excursion System             |
| SRD  | System Requirements Document       |
| V    | Volts                              |
| W    | Watts                              |

## 1.0 INTRODUCTION

### 1.1 PURPOSE

This Interface Definition Document (IDD) defines the interfaces that are provided by the Human Research Facility (HRF) Joint Excursion System (JES). This document also controls the connections between the JES and the Ambulatory Data Acquisition System (ADAS) as well as other hardware.

### 1.2 SCOPE

This document includes the interfaces for Sensors, Command and Data Handling, Software, Electrical Power, Audio and Video, Mechanical, Thermal, Vacuum, Nitrogen, Mass and Volume, and Structural Environment.

### 1.3 VERSION

After the JES has been configured for flight, tested, and accepted, this document will be updated to an “as-built” version. If designing to this document, it is suggested that the HRF group be contacted for verification of information provide herein.

## 2.0 APPLICABLE DOCUMENTS

| <u>Document Number</u> | <u>Rev.</u> | <u>Document Title</u>   |
|------------------------|-------------|---|
| LS-71104-1             |             | Joint Excursion System (JES) System Requirements Document (SRD) |

## 3.0 HARDWARE DESCRIPTIONS

### 3.1 JOINT EXCURSION SYSTEM DISPLAY ASSEMBLY

The JES Display Assembly is a small portable device that is used to calibrate and display the output of a sensor. The Display Assembly displays voltage from the sensors as angles.

Part numbers and descriptions are as follows:

| Item Name                  | Part Number     |
|----------------------------|-----------------|
| HRF JES Angle Display Unit | SEG46117981-301 |

### 3.2 JOINT EXCURSION SYSTEM SENSORS

The JES Sensors are used to measure the angle of specific joints.

Part numbers and descriptions are as follows:

| Item Name                | Part Number     |
|--------------------------|-----------------|
| HRF JES Ankle Goniometer | SEG46118316-301 |
| HRF JES Knee Goniometer  | SEG46118315-301 |
| HRF JES Hip Goniometer   | SEG46118314-301 |

### 3.3 JOINT EXCURSION SYSTEM CALIBRATION TEMPLATE ASSEMBLY

The JES Calibration Template Assembly is used to calibrate or zero a JES Sensor at a known angle. A 45 degree template will be used for knee and hip joint calibration. A 90 degree template will be used for ankle joint calibration.

Part numbers and descriptions are as follows:

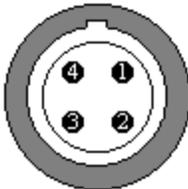
| Item Name                        | Part Number     |
|----------------------------------|-----------------|
| HRF JES Calibration Template 45° | SDG46118328-301 |
| HRF JES Calibration Template 90° | SDG46118330-301 |

## 4.0 JOINT EXCURSION SYSTEM INTERFACES

### 4.1 DIAGRAMS OF JOINT EXCURSION SYSTEM DISPLAY ASSEMBLY CONNECTOR INTERFACES

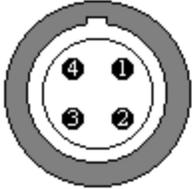
#### 4.1.1 J1 Channel 1 Connector

The J1 connector provides the sensor input for Channel 1.

| FRONT VIEW  | CONNECTOR INFORMATION   |       |                 |      |
|---|-------------------------|-------|-----------------|------|
|   | Pin #                   | ID    | Description     | Type |
|  | 1                       | 0V    | Return          | DC   |
|   | 2                       | L/C + | Positive Signal | DC   |
|   | 3                       | L/C - | Negative Signal | DC   |
|   | 4                       | +5V   | Supply          | DC   |
| Part Number   | LEMO P/N EGG.0B.304.CLN |       |                 |      |
| Mating Part Number  | LEMO P/N FGG.0B.304.CLL |       |                 |      |

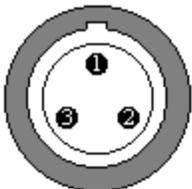
#### 4.1.2 J2 Channel 2 Connector

The J2 connector provides the sensor input for Channel 2.

| FRONT VIEW  | CONNECTOR INFORMATION   |       |                 |      |
|---|-------------------------|-------|-----------------|------|
|   | Pin #                   | ID    | Description     | Type |
|  | 1                       | 0V    | Return          | DC   |
|   | 2                       | L/C + | Positive Signal | DC   |
|   | 3                       | L/C - | Negative Signal | DC   |
|   | 4                       | +5V   | Supply          | DC   |
| Part Number   | LEMO P/N EGG.0B.304.CLN |       |                 |      |
| Mating Part Number  | LEMO P/N FGG.0B.304.CLL |       |                 |      |

#### 4.1.3 J3 Analog Output Connector

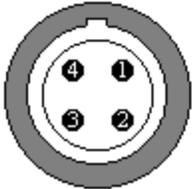
The J3 connector provides the analog signal of both channels for output to a recording device.

| FRONT VIEW  | CONNECTOR INFORMATION   |     |                  |      |
|---|-------------------------|-----|------------------|------|
|   | Pin #                   | ID  | Description      | Type |
|  | 1                       | AO1 | Channel 1 Signal | DC   |
|   | 2                       | AO2 | Channel 2 Signal | DC   |
|   | 3                       | GND | Signal Return    | DC   |
|   |                         |     |                  |      |
| Part Number   | LEMO P/N EGG.0B.303.CLL |     |                  |      |
| Mating Part Number  | LEMO P/N FGG.0B.303.CLL |     |                  |      |

## 4.2 DIAGRAMS OF JOINT EXCURSION SYSTEM SENSOR ASSEMBLY CONNECTOR INTERFACES

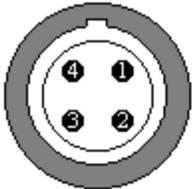
### 4.2.1 J1 Connector

The J1 connector is the Flexion/Extension angle data from the sensor.

| FRONT VIEW  | CONNECTOR INFORMATION   |       |                 |      |
|---|-------------------------|-------|-----------------|------|
|   | Pin #                   | ID    | Description     | Type |
|  | 1                       | 0V    | Return          | DC   |
|   | 2                       | L/C + | Positive Signal | DC   |
|   | 3                       | L/C - | Negative Signal | DC   |
|   | 4                       | +5V   | Supply          | DC   |
| Part Number   | LEMO P/N EGG.00.304.CLN |       |                 |      |
| Mating Part Number  | LEMO P/N FGG.00.304.CLL |       |                 |      |

### 4.2.2 J2 Connector

The J2 connector is the Abduction/Adduction angle data from the sensor.

| FRONT VIEW  | CONNECTOR INFORMATION   |       |                 |      |
|---|-------------------------|-------|-----------------|------|
|   | Pin #                   | ID    | Description     | Type |
|  | 1                       | 0V    | Return          | DC   |
|   | 2                       | L/C + | Positive Signal | DC   |
|   | 3                       | L/C - | Negative Signal | DC   |
|   | 4                       | +5V   | Supply          | DC   |
| Part Number   | LEMO P/N EGG.00.304.CLN |       |                 |      |
| Mating Part Number  | LEMO P/N FGG.00.304.CLL |       |                 |      |

## 4.3 COMMAND AND DATA HANDLING INTERFACES

Not applicable.

The JES hardware does not have Command and Data Handling interfaces.

## 4.4 SOFTWARE INTERFACES

Not applicable.

The JES hardware does not have any Software or Software interfaces.

#### 4.5 ELECTRICAL POWER INTERFACES

A single standard alkaline 9V battery powers the JES Display Assembly. The battery door located on the back of the JES Display Assembly can be opened to change out the battery. The battery clip is a standard 9V battery clip. A low battery light will illuminate when the battery voltage drops below operational voltage.

#### 4.6 AUDIO/VIDEO INTERFACES

Not applicable.

The JES hardware does not contain an audio or video interface.

#### 4.7 MECHANICAL INTERFACES

System hardware for JES shall fit in one allocated 4-panel unit drawer. The system shall be packed in foam pre-flight in its stowage configuration.

#### 4.8 THERMAL INTERFACES

##### 4.8.1 Avionics Air Cooling

The JES, under normal operating conditions, generates approximately 0.2 Watts of power. The waste heat is removed from the unit using convection through the environmental air.

##### 4.8.2 Water Cooling

Not applicable.

The JES does not contain an interface to a water-cooling system.

#### 4.9 VACUUM INTERFACES

Not applicable.

The JES hardware does not contain an interface to a vacuum.

#### 4.10 NITROGEN INTERFACES

Not applicable.

The JES hardware does not contain an interface to nitrogen.

#### 4.11 MASS/VOLUME INTERFACES

The JES hardware shall have total mass and volume properties as follows:

Mass Properties for JES Part Numbers

| Item Name                        | Part Number     | Mass (g) |
|----------------------------------|-----------------|----------|
| HRF JES Angle Display Unit       | SEG46117981-301 | 210 g    |
| HRF JES Ankle Goniometer         | SEG46118316-301 | 30 g     |
| HRF JES Knee Goniometer          | SEG46118315-301 | 30 g     |
| HRF JES Hip Goniometer           | SEG46118314-301 | 40 g     |
| HRF JES Calibration Template 45° | SDG46118328-301 | 180 g    |
| HRF JES Calibration Template 90° | SDG46118330-301 | 150 g    |

Dimension Properties for JES Part Numbers

| Item Name                        | Part Number     | Height (cm) | Width (cm) | Length (cm) |
|----------------------------------|-----------------|-------------|------------|-------------|
| HRF JES Angle Display Unit       | SEG46117981-301 | 2.35        | 7.1        | 11.43       |
| HRF JES Ankle Goniometer         | SEG46118316-301 | 1.08        | 1.90       | 19.83       |
| HRF JES Knee Goniometer          | SEG46118315-301 | 1.08        | 1.90       | 25.7        |
| HRF JES Hip Goniometer           | SEG46118314-301 | 1.08        | 1.90       | 26.2        |
| HRF JES Calibration Template 45° | SDG46118328-301 | .96         | 2.88       | 32.14       |
| HRF JES Calibration Template 90° | SDG46118330-301 | .96         | 2.88       | 14.43       |

Volume Properties for JES Part Numbers

| Item Name                        | Part Number     | Volume(cm <sup>3</sup> ) | Volume(ft <sup>3</sup> ) |
|----------------------------------|-----------------|--------------------------|--------------------------|
| HRF JES Angle Display Unit       | SEG46117981-301 | 190.70                   | 0.00673                  |
| HRF JES Ankle Goniometer         | SEG46118316-301 | 40.70                    | 0.00144                  |
| HRF JES Knee Goniometer          | SEG46118315-301 | 52.73                    | 0.00186                  |
| HRF JES Hip Goniometer           | SEG46118314-301 | 53.77                    | 0.00189                  |
| HRF JES Calibration Template 45° | SDG46118328-301 | 88.86                    | 0.00313                  |
| HRF JES Calibration Template 90° | SDG46118330-301 | 39.89                    | 0.00141                  |

#### 4.12 Structural Environment

The JES shall be stowed in locker while not in use. The structural environment shall be limited to a kick force of 14 pounds.

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