|  |  |
| --- | --- |
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| Refer to: | LIGO-E1200086-v3 |
| Date: | March 5, 2014 |

Common Mode Summing Node Test Procedure

**Test Preparation**

Enter Name, Date, and Board Serial Number. Indicate if the board has passed or failed the test.

|  |  |  |  |
| --- | --- | --- | --- |
| **Test Engineer:** | **Board Serial Number:** | **Date:** | **Pass:** |
|  |  |  |  |

Required Test and Ancillary Equipment

* 2 – Summing Node Board D1300788-v1 Tester
* 1 – Tektronix AFG 3101 Signal Generator or equivalent
* 1 – Tektronix TDS 210 Oscilloscope or equivalent
* 1 – Fluke Multimeter or equivalent
* 1 – HP 4395A Network analyzer (1Hz to 10MHz) or equivalent
* 1 – Stanford Research Systems Signal Analyzer Model SR785
* 1 – GPIB to Cat5 adapter
* 1 – Cat5 cable
* 1 – Laptop CPU using Windows operating system
* 1 – Folder containing Test File Scripts
* 2 – DC Power Supplies (Five Channels Required. Continuous Supply Voltages: +/- 24VDC, +/- 17VDC, and +5VDC)
* 1 – 17VDC Power Cable
* 1 – 24VDC Power Cable
* 1 – 5VDC Power Cable (Banana Plug to Banana Plug Cable and Jumper)
* 1 – custom cable adapting the DB9 Monitor port on the D0901781 front panel into three BNCs. (Refer to Common Mode Board: DAQ, Number D040180 Rev E, Sheet 17 of 17 for DB9 pinout detail)
* 3 – BNC Female to Female Adapters (Barrels)
* 1 – BNC Tee Connector
* 3 – BNC Female to Double Stacking **Banana** Plugs
* 1 – BNC Male to Mini Grabber Test Leads Cable
* 2 – 50 ohm BNC terminations
* 4 – BNC Male to BNC Male Cables

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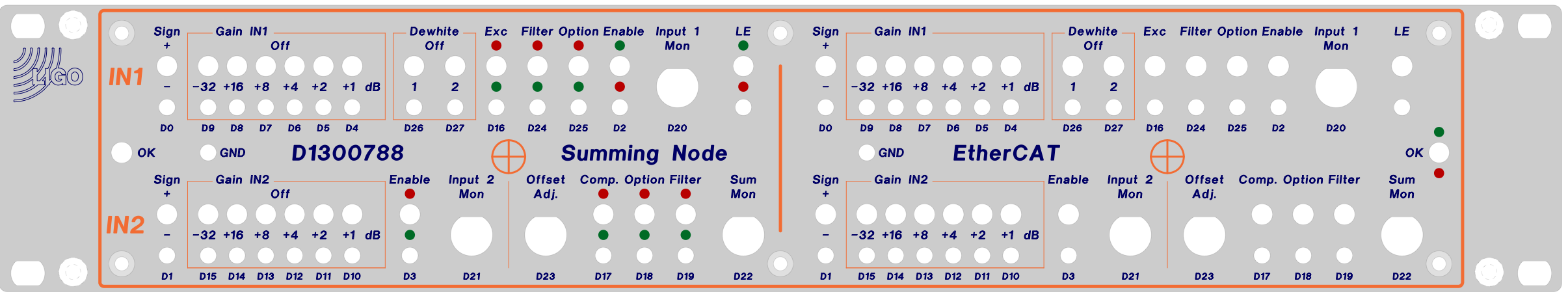
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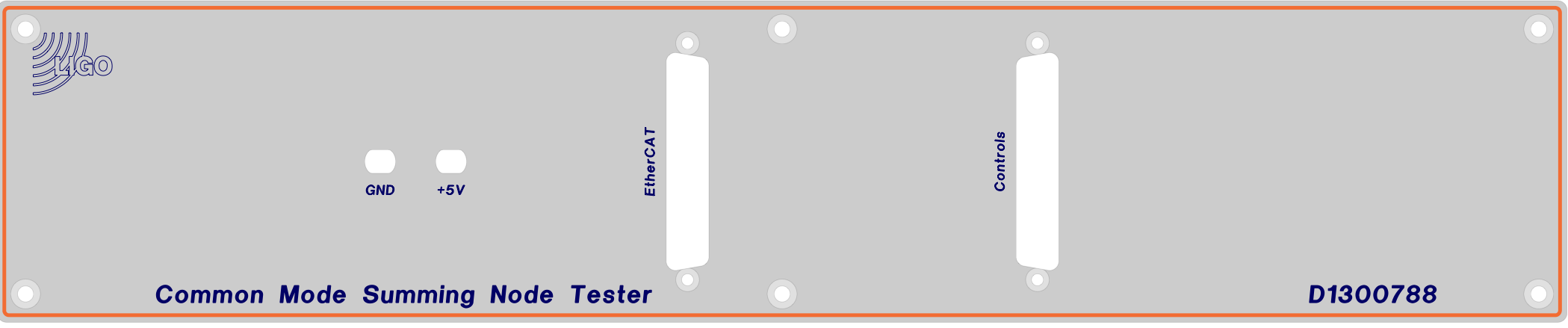
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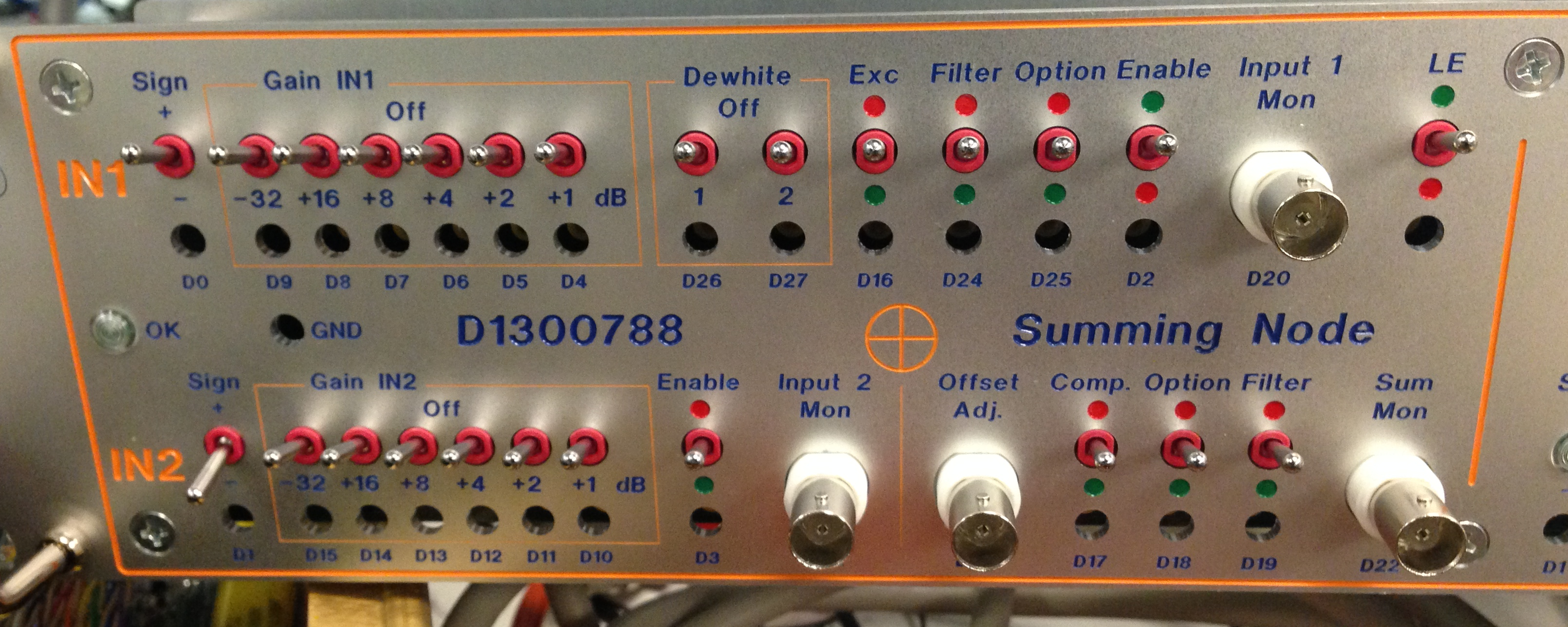
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|  |
| --- |
| **IMPORTANT NOTES:**  **1. On the Summing Node Tester (D1300789-v1) front panel, all switches must be returned to default positions after each test and/or step, unless otherwise instructed.**  **2. The default position for most switches is UP**  **The switch default positions are shown in Picture 1 below.**  **3. “Left” and “Right” indicate the PCB as viewed from the front of the Summing Node chassis.** |







**Picture 1**

**Front and Rear of Summing Node Tester**

# **Tests Part 1.**

# ***1) Power Board Voltage (Low Noise Power Circuit Board Assembly D0901846)***

**Connect** +/-17VDC and +/- 24VDC to the Common Mode Summing Node and +5VDC to the Summing Node Tester.

**Turn ON Power Supplies.**

On the Low Noise Power Circuit Board Assembly, **Connect** the positive multimeter test lead to the following test points and **Connect** the negative multimeter test lead to GRD.

**Record** the observed voltages in the data boxes below.

**Turn Off** Power Supplies.

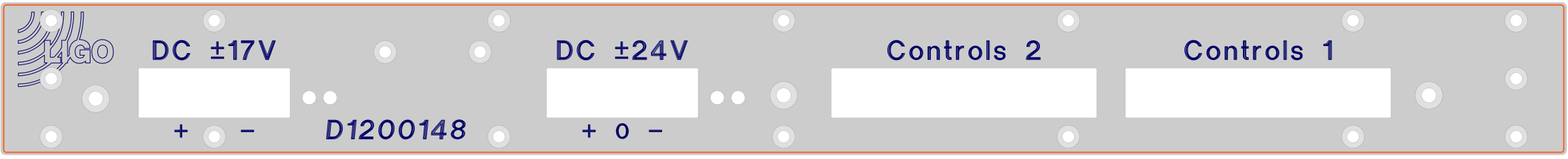
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **TP1** | **TP2** | **TP3** | **TP4** | **TP5** | **TP6** | **TP7** | **TP8** | **TP9** | **TP10** | **TP11** | **TP12** | **TP13** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| +17V | -17V | GND | GND | +5V | -15V | +24V | GND | -24V | GND | +15V | +VREF | -VREF |

\*\* Correct voltage indications are: TP14 ~3VDC and front panel OK light lit.

## *2) Power Supplies*

**Turn OFF Power Supplies**.

**Connect** 50 pin Control cables 1 and 2 to corresponding Control Mode Servo Tester and Summing Node rear jacks.

 **Picture 2**

**Rear of Common Mode Summing Node Board**

**Turn ON** Power Supplies

.

**Check** current draw from the ±17V power supply is between 0.3A and 0.6A.

On the front panel of Power Supplies, **Observe** and **Record** the amperage displayed.

|  |  |  |
| --- | --- | --- |
| **Power supply** | **Current (A)** | **Nominal (A)** |
| +24V |  | 0.02 |
| -24V |  | 0.02 |
| +17V |  | .45 |
| -17V |  | .45 |

*3) Oscillations*

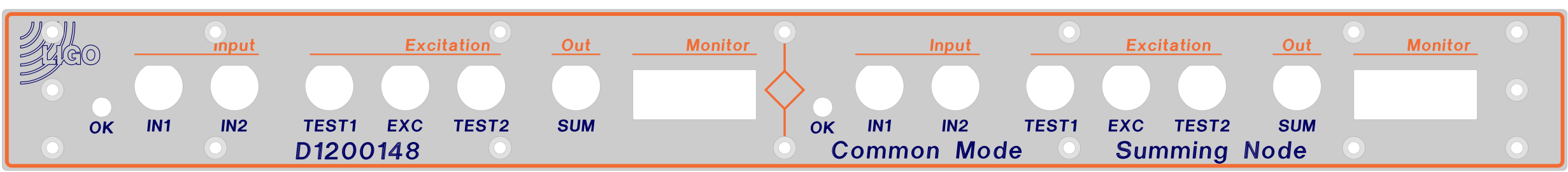
**Set** oscilloscope coupling to **AC Coupling**.

**Connect** oscilloscope probe to the following outputs. Ensure no oscillating waveforms are observed.

**Use** P2 pins 1+2 for I1MON P+N, pins 3+4 for I2MON P+N, pins 4+6 for SMON P+N.

**Connect** controls output to tester.

**Place** checkmark in corresponding box below each output.



**Picture 3**

**Front of Common Mode Summing Node Board**

*Right Front Panel Outputs:*

|  |  |  |  |
| --- | --- | --- | --- |
| **Outputs** | **SUM Out** | **Test 1** | **Test 2** |
| Check Box |  |  |  |
| **Outputs** | **I1MON** | **I2MON** | **SMON** |
| Check Box |  |  |  |

*Right Rear Panel Outputs:*

|  |  |  |  |
| --- | --- | --- | --- |
| **Outputs** | **D20 Input 1 Mon** | **D21 Input 2 Mon** | **D22 Sum Mon** |
| Check Box |  |  |  |

*Left Front Panel Outputs:*

|  |  |  |  |
| --- | --- | --- | --- |
| **Outputs** | **SUM Out** | **Test 1** | **Test 2** |
| Check Box |  |  |  |
| **Outputs** | **I1MON** | **I2MON** | **SMON** |
| Check Box |  |  |  |

*Left Rear Panel Outputs:*

|  |  |  |  |
| --- | --- | --- | --- |
| **Outputs** | **D20 Input 1 Mon** | **D21 Input 2 Mon** | **D22 Sum Mon** |
| Check Box |  |  |  |

***4) Check DC Bias***

**Check** DC Bias at the outputs and monitors. Pass if around 0 VDC

*Right:*

|  |  |  |
| --- | --- | --- |
| Input Mon 1 (D20) | VDC | Pass/Fail |
| Input Mon 2 (D21) | VDC | Pass/Fail |
| Sum Mon (D22) | VDC | Pass/Fail |
| Sum OUT | VDC | Pass/Fail |
| I1MON (P2) | VDC | Pass/Fail |
| I2MON (P2) | VDC | Pass/Fail |
| SMON (P2) | VDC | Pass/Fail |

*Left:*

|  |  |  |
| --- | --- | --- |
| Input Mon 1 (D20) | VDC | Pass/Fail |
| Input Mon 2 (D21) | VDC | Pass/Fail |
| Sum Mon (D22) | VDC | Pass/Fail |
| Sum OUT | VDC | Pass/Fail |
| I1MON (P2) | VDC | Pass/Fail |
| I2MON (P2) | VDC | Pass/Fail |
| SMON (P2) | VDC | Pass/Fail |

*5) Signal Gain*

Gain slider IN1:

**Connect** Input 1 Mon (or Test 1) to the oscilloscope.

**Connect** Function Generator Output to Common Mode Summing node IN1 jack.

**Set** Function Generator to frequency 10Hz, Sine wave, and an Amplitude of 1 Vpp.

**Inject** a 10Hz / 1Vpp Sine wave signal.

**Measure** the voltage at 0dB (all switches in default position) and **Record**.

Individually, **Toggle** each switch down (GND) and **Record** observed voltage. After each voltage observation, **Return** the switch to default position.

Continue to **Toggle** each switch, **Record** the observed voltage and **Return** each switch to default position.

\*\* Tolerance is + / - 1.059 V (+/-0.5dB).

*Right:*

|  |  |  |
| --- | --- | --- |
| **Binary input (Switch Setting)** | **Measured Vpp** | **Nominal Vpp** |
| —(0dB) |  | 1 |
| D4 (1dB) |  | 1.12 |
| D5 (2dB) |  | 1.26 |
| D6 (4dB) |  | 1.59 |
| D7 (8dB) |  | 2.51 |
| D8 (16dB) |  | 6.31 |
| D7 & D8 (24dB) |  | 15.9 |
| D9 (-32dB) |  | 0.025 |
| D9 & D7 (-24dB) |  | 0.063 |
| D9 & D8 (-16dB) |  | 0.159 |
| D9 & D8 & D7 (-8dB) |  | 0.398 |

*Left:*

|  |  |  |
| --- | --- | --- |
| **Binary input (Switch Setting)** | **Measured Vpp** | **Nominal Vpp** |
| —(0dB) |  | 1 |
| D4 (1dB) |  | 1.12 |
| D5 (2dB) |  | 1.26 |
| D6 (4dB) |  | 1.59 |
| D7 (8dB) |  | 2.51 |
| D8 (16dB) |  | 6.31 |
| D7 & D8 (24dB) |  | 15.9 |
| D9 (-32dB) |  | 0.025 |
| D9 & D7 (-24dB) |  | 0.063 |
| D9 & D8 (-16dB) |  | 0.159 |
| D9 & D8 & D7 (-8dB) |  | 0.398 |

Gain slider IN2:

**Connect** Input 2 Mon to an oscilloscope.

**Set** Function Generator to frequency 100Hz, Sine wave and an Amplitude of 1 Vpp.

**Connect** Function Generator Output to Common Mode Summing Node IN2 jack.

**Inject** a 100Hz / 1Vpp Sine wave signal into IN2.

**Measure** the voltage at 0dB (all switches in default position) and **Record**.

**Toggle** each switch individually **Down** (GND) and **Record** observed voltage. **Return** the switch to default position.

Continue to **Toggle** each switch, **Record** the observed voltage and **Return** each switch to default position.

\*\* Tolerance is + / - 1.059 V (+/-0.5dB).

*Right:*

|  |  |  |
| --- | --- | --- |
| **Binary Input (slider gain)** | **Measured Vpp** | **Nominal Vpp** |
| — (0dB) |  | 1 |
| D10 (1dB) |  | 1.12 |
| D11 (2dB) |  | 1.26 |
| D12 (4dB) |  | 1.59 |
| D13 (8dB) |  | 2.51 |
| D14 (16dB) |  | 6.31 |
| D13 & D14 (24dB) |  | 15.9 |
| D15 (-32dB) |  | 0.025 |
| D15 & D13 (-24dB) |  | 0.063 |
| D15 & D14 (-16dB) |  | 0.159 |
| D15 & D14 & D13 (-8dB) |  | 0.398 |

*Left:*

|  |  |  |
| --- | --- | --- |
| **Binary Input (slider gain)** | **Measured Vpp** | **Nominal Vpp** |
| — (0dB) |  | 1 |
| D10 (1dB) |  | 1.12 |
| D11 (2dB) |  | 1.26 |
| D12 (4dB) |  | 1.59 |
| D13 (8dB) |  | 2.51 |
| D14 (16dB) |  | 6.31 |
| D13 & D14 (24dB) |  | 15.9 |
| D15 (-32dB) |  | 0.025 |
| D15 & D13 (-24dB) |  | 0.063 |
| D15 & D14 (-16dB) |  | 0.159 |
| D15 & D14 & D13 (-8dB) |  | 0.398 |

*6) Crossbar switches*

**Inject** a 100Hz/1Vpp **Sine wave** to IN1. Individually, **Toggle** each Crossbar switches **Down**. Using an oscilloscope, **Record** the voltage states at each SUM Out. Voltage states are either **ON** or **OFF**.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Binary input** | **SUM Out Right** | **Nominal** | **SUM Out Left** | **Nominal** |
| Switches in Default Positions |  | On |  | On |
| D2 (input 1 disabled) |  | Off |  | Off |
| D3 (input 2 enabled, input 1 disabled) |  | Off |  | Off |

**Inject** a 100Hz/1Vpp **Sine wave** to IN2. **Record** the voltage states at each SUM Out 2 while toggling the switches **Down**. Voltages states are either **ON** or **OFF**.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Binary input** | **SUM Out Right** | **Nominal** | **SUM Out Left** | **Nominal** |
| Switches in Default Positions |  | Off |  | Off |
| D2 (input 1 disabled) |  | Off |  | Off |
| D3 (input 2 enabled, input 1 disabled) |  | On |  | On |

*7) Excitation:*

**Inject** a 100Hz/1Vpp **Sine wave** to IN1. **Measure** and **Record** the voltage at TEST1 and TEST2. \*\* Tolerance is +/-0.5dB.

*Right:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Binary input** | **TEST1** | **Nominal Vpp** | **TEST2** | **Nominal Vpp** |
| Switches in Default |  | 1.00 |  | -1.00 |

*Left:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Binary input** | **TEST1** | **Nominal Vpp** | **TEST2** | **Nominal Vpp** |
| Switches in Default |  | 1.00 |  | -1.00 |

**Inject** a 100Hz/1Vpp **Sine wave** to EXC. **Measure** and **Record** the voltage at TEST2 and Sum OUT while toggling the switches **Down**. \*\* Tolerance is +/-0.5dB.

*Right:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Binary input** | **TEST2** | **Nominal Vpp** | **SUM Out** | **Nominal Vpp** |
| Default |  | Off |  | Off |
| D16 (exc enable) |  | 1.00 |  | 1.00 |
| D16 & D26 (DW1) |  | 0.10 |  | 0.10 |
| D16 & D27 (DW2) |  | 0.10 |  | 0.10 |
| D16 & D26, 27 (DW1, 2) |  | 0.01 |  | 0.01 |

*Left:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Binary input** | **TEST2** | **Nominal Vpp** | **SUM Out** | **Nominal Vpp** |
| Default |  | Off |  | Off |
| D16 (exc enable) |  | 1.00 |  | 1.00 |
| D16 & D26 (DW1) |  | 0.10 |  | 0.10 |
| D16 & D27 (DW2) |  | 0.10 |  | 0.10 |
| D16 & D26, 27 (DW1, 2) |  | 0.01 |  | 0.01 |

*8) Filter/Option*

**Inject** a 100Hz/1Vpp **Sine wave** to IN1. **Measure** and **Record** the voltage at SUM Out while toggling the switches **Down**. \*\* Tolerance is +/-0.5dB.

*Right:*

|  |  |  |
| --- | --- | --- |
| **Binary input** | **SUM Out** | **Nominal Vpp** |
| — |  | 1.00 |
| D17 (SUM comp. enable) |  | 1.00 |
| D18 (SUM filter enable) |  | 1.00 |
| D19 (SUM option enable) |  | 0.00 |
| D24 (IN1 filter enable) |  | 1.00 |
| D25 (IN1 option enable) |  | 0.00 |

*Left:*

|  |  |  |
| --- | --- | --- |
| **Binary input** | **SUM Out** | **Nominal Vpp** |
| — |  | 1.00 |
| D17 (SUM comp. enable) |  | 1.00 |
| D18 (SUM filter enable) |  | 1.00 |
| D19 (SUM option enable) |  | 0.00 |
| D24 (IN1 filter enable) |  | 1.00 |
| D25 (IN1 option enable) |  | 0.00 |

Note: D18/D19 are mislabeled on tester.

*9) EPICS Readbacks*

**Inject** a 100Hz/1Vpp **Sine wave** to IN1 or IN2 and **Record** the observed voltage.

*Right:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **EPICS readback** | **1Hz** | **Nominal Vpp** | **100Hz** | **Nominal Vpp** |
| D20 (input mon 1) |  | -1.00 |  | 0.080 |
| D21 (input mon 2) |  | -1.00 |  | 0.080 |
| D22 (sum mon) |  | -1.00 |  | 0.080 |

*Left:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **EPICS readback** | **1Hz** | **Nominal Vpp** | **100Hz** | **Nominal Vpp** |
| D20 (input mon 1) |  | -1.00 |  | 0.080 |
| D21 (input mon 2) |  | -1.00 |  | 0.080 |
| D22 (sum mon) |  | -1.00 |  | 0.080 |

## Tests Part 2: SR785 Signal Analyzer Tests

|  |
| --- |
| **Important Notes: 1. Ensure all Summing Node Tester switches are in the default position. 2. Closely Read and follow all On-Screen prompts.** |

On a Windows operating system laptop, **Create** and **Save** a file called TEST\_DATA to C: drive. The path is C:\Test\_DATA\.

**Save** Test Scripts in TEST\_DATA.

**Connect** an SR785 Signal Analyzer to the laptop with a GPIB to Cat5 adapter.

From the DOS CMD window, **Type** cd.., Enter, **Type** cd.., Enter and **Type cd** SummingNode\_TEST\_DATA.

**Type** and **Run** 'setgpib.bat' and **Enter** the adapter's IP address (which should be labeled on the adapter).

**Reset** the SR785's settings with 'resetSR785.bat'. If the SR785 resets when the script is run, the SR785 is properly connected to the PC.

***10) Power Board Noise*** *(SR785PowerBoardNoise.bat)*

One pair of probes (MiniGrabbers) are required to check the noise levels at 140Hz on the low noise power board.

In the DOS CMD window, **Type** SR785PowerBoardNoise.

**Read** and **Follow** the On-Screen prompts for proper test equipment configuration and procedure.

**Record** the collected On-Screen data in the boxes below.

\*\* Test values must be less than the values indicated in the table below.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **TP11** | **< [nV/√Hz]** | **TP12** | **< [nV/√Hz]** | **TP13** | **< [nV/√Hz]** | **TP6** | **< [nV/√Hz]** |
|  | 30 |  | 20 |  | 30 |  | 30 |

# Note: TP11, TP12, TP13, TP6 indicate the noise performance of P15V, VREF, NREF, and N15V respectively, which are the voltages we are regulating.

# ***11) Monitor Channel Filtering*** *(SR785MonitorTFs.bat)*

In the DOS CMD window, **Type** SR785MonitorTFs

**Read** and **Follow** the On-Screen prompts for proper test equipment configuration and procedure.

**Measure** test transfer functions at 100Hz to 1Hz on IN1 to the indicated monitor channels on the tester and **Record** the data in the table below.

\*\* Tolerances for Lowpass filtering are +/-1dB and +/-5deg from nominal.

*Right:*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Boost #** | **@1Hz** | **Nominal** | **@10Hz** | **Nominal** | **@100Hz** | **Nominal** |
| Input Mon 1 (D20) |  | -0.1dB  173deg |  | -4.1dB  129deg |  | -22dB  95deg |
| Sum Mon (D22) |  | -0.1dB  173deg |  | -4.1dB  129deg |  | -22dB  95deg |

*Left:*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Boost #** | **@1Hz** | **Nominal** | **@10Hz** | **Nominal** | **@100Hz** | **Nominal** |
| Input Mon 1 (D20) |  | -0.1dB  173deg |  | -4.1dB  129deg |  | -22dB  95deg |
| Sum Mon (D22) |  | -0.1dB  173deg |  | -4.1dB  129deg |  | -22dB  95deg |

**Measure** test transfer functions at 100Hz to 1Hz on IN2 to the indicated monitor channels on the tester and **Record** the data in the table below.

**Toggle** D2 down (off), and **Toggle** D3 down (on).

\*\* Tolerances for Lowpass filtering are +/-1dB and +/-5deg from nominal.

*Right:*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Boost #** | **@1Hz** | **Nominal** | **@10Hz** | **Nominal** | **@100Hz** | **Nominal** |
| Input Mon 2 (D21) |  | -0.1dB  173deg |  | -4.1dB  129deg |  | -22dB  95deg |
| Sum Mon (D22) |  | -0.1dB  173deg |  | -4.1dB  129deg |  | -22dB  95deg |

*Left:*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Boost #** | **@1Hz** | **Nominal** | **@10Hz** | **Nominal** | **@100Hz** | **Nominal** |
| Input Mon 2 (D21) |  | -0.1dB  173deg |  | -4.1dB  129deg |  | -22dB  95deg |
| Sum Mon (D22) |  | -0.1dB  173deg |  | -4.1dB  129deg |  | -22dB  95deg |

**Return** all summing node tester switches to the default position.

***12) Adjustment Channel Filtering*** *(SR785AdjustmentTFs.bat)* \*\*NOT Applicable, unless input is connected.

**Type** SR785AdjustmentTFs

**Test** the transfer functions at 10kHz to 1Hz on the indicated adjustment channels on the tester to Sum Out. Verify filtering of at least -60dB at 100Hz and **Record** level below in the box below.

*Right:*

|  |  |
| --- | --- |
| **Default** |  |

*Left:*

|  |  |
| --- | --- |
| **Default** |  |

***13) Distortion*** *(SR785DistortionMeasurement.bat)*

**Type** SR785DistortionMeasurement.

**Inject** a 1kHz/Vrms sine wave into IN1. Use a spectrum analyzer to measure the harmonic components at Sum Out. One the SR785, **press** Marker to display the THD level. **Repeat** the measurement for IN2 (Toggle D2, D3 down). **Record** the measurements in the boxes below.

**Return** toggle switches to default position.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **INI Left** | **IN1 Right** | **SUM Out** | **IN2 Left** | **IN1 Right** | **SUM Out** |
| **Total Harmonic Distortion (THD)** |  |  | <-70dB |  |  | < -70dB |

***14) Noise Spectra*** *(SR785NoiseMeasurements.bat)*

**Type** resetSR785 and **Allow** the SR785 to reset. **Type** SR785NoiseMeasurements

**Terminate** IN1 and IN2 using 50 Ohm terminations. **Measure** the noise density at each SUM Out. **Record** the values at 100Hz, 1kHz, and 10kHz in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **SUM Out Left** | **< [nV/√Hz]** | **SUM Out Right** | **< [nV/√Hz]** |
| **100Hz** |  | 40 |  | 40 |
| **1kHz** |  | 30 |  | 30 |
| **10kHz** |  | 30 |  | 30 |

***15) Basic Transfer Functions*** *(SR785BasicTFs.bat)*

**Type** SR785BasicTFs

**Sweep** the frequency from 100kHz down to 1Hz with 100mV source amplitude and **Measure** the transfer function from IN1 to SUM Out, and from IN2 to SUM Out for each side. **Record** the values at 10Hz, 100Hz, 1kHz, and 10kHz in the table below.

\*\* Tolerances must be within 1dB and 5deg of nominal.

*Right:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SUM Out/IN1** | **dB** | **Nom** | **deg** | **Nom** |
| **1Hz** |  | 0.0dB |  | 180deg |
| **10Hz** |  | 0.0dB |  | 180deg |
| **100Hz** |  | 0.0dB |  | 180deg |
| **1kHz** |  | 0.0dB |  | 180deg |
| **10kHz** |  | 0.0dB |  | 175deg |

**Toggle** D2, D3 down

**Ensure** Sign “-“ for IN2 (swapped sign relative to IN1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SUM Out/IN2** | **dB** | **Nom** | **deg** | **Nom** |
| **1Hz** |  | 0.0dB |  | 180deg |
| **10Hz** |  | 0.0dB |  | 180deg |
| **100Hz** |  | 0.0dB |  | 180deg |
| **1kHz** |  | 0.0dB |  | 180deg |
| **10kHz** |  | 0.0dB |  | 175deg |

**Return** toggles switches to default positions

*Left:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SUM Out/IN1** | **dB** | **Nom** | **deg** | **Nom** |
| **1Hz** |  | 0.0dB |  | 180deg |
| **10Hz** |  | 0.0dB |  | 180deg |
| **100Hz** |  | 0.0dB |  | 180deg |
| **1kHz** |  | 0.0dB |  | 180deg |
| **10kHz** |  | 0.0dB |  | 175deg |

**Toggle** D2, D3 down

**Ensure** Sign “-“ for IN2 (swapped sign relative to IN1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SUM Out/IN2** | **dB** | **Nom** | **deg** | **Nom** |
| **1Hz** |  | 0.0dB |  | 180deg |
| **10Hz** |  | 0.0dB |  | 180deg |
| **100Hz** |  | 0.0dB |  | 180deg |
| **1kHz** |  | 0.0dB |  | 180deg |
| **10kHz** |  | 0.0dB |  | 175deg |

**Return** toggles switches to default positions.

***16) Transfer Functions of Boost Gain Stages******(****SR785BoostGainTFs.bat)*

**Type** SR785BoostGainTFs

|  |
| --- |
| Note: 1. Switch D9 must be **Down** (low) for **all** measurements.  2. All other switches are in default unless prompted otherwise |

\*\* Tolerances must be within 1dB and 5deg of nominal.

*Right:*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Boost #** | **@10Hz** | **Nom** | **@100Hz** | **Nom** | **@1kHz** | **Nom** |
| **Common Comp.**  **(D17)** |  | -32dB  180deg |  | -32dB  180deg |  | -32dB  180deg |

*Left:*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Boost #** | **@10Hz** | **Nom** | **@100Hz** | **Nom** | **@1kHz** | **Nom** |
| **Common Comp.**  **(D17)** |  | -32dB  180deg |  | -32dB  180deg |  | -32dB  180deg |

***17) Transfer Functions of DAQ Channels******(****SR785DAQTFs.bat****)***

**Type** SR785DAQTFs

**Measure** the transfer function from SR785 CH1 A to Monitor jack (DAQ channels). **Sweep** the frequency from 10kHz down to 1Hz at 1mV source amplitude. **Record** the values at 1Hz and 10kHz in the table below.

\*\* Tolerances must be within 1dB and 5deg of nominal.

Note: If you only have one PCB, you will need a breakout board to attach to P2 (see D1200151 for pin breakdown). If you have two PCBs, attach right front panel P2, P3 to left front panel P4, P2.

*Right:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **1Hz** | **Nominal** | **10kHz** | **Nominal** |
| **I1MON** |  | 5dB, 0deg |  | 46dB, 0deg |
| **I2MON** |  | 5dB, 0deg |  | 46dB, 0deg |
| **SMON w/ IN1** |  | 5dB, -170deg |  | 46dB, -180deg |
| **SMON w/ IN2** |  | 5dB, -170deg |  | 46dB, -180deg |

## *Left:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **1Hz** | **Nominal** | **10kHz** | **Nominal** |
| **I1MON** |  | 5dB, 0deg |  | 46dB, 0deg |
| **I2MON** |  | 5dB, 0deg |  | 46dB, 0deg |
| **SMON w/ IN1** |  | 5dB, -170deg |  | 46dB, -180deg |
| **SMON w/ IN2** |  | 5dB, -170deg |  | 46dB, -180deg |

***18) Transfer Functions Filters******(****SR78FilerTF.bat****)***

**Type** SR785FilterTF

**Measure** the transfer function from EXC to SUM Out with the dewhitening filters enabled from 7mHz to 1kHz with a source amplitude of 1V.

**Confirm** pole/zero at 1Hz/10Hz.

*Right:*

|  |  |
| --- | --- |
| Check box |  |

*Left:*

|  |  |
| --- | --- |
| Check box |  |

**Measure** the transfer function from IN1 to SUM Out with each filter on (D24, D18) from 1Hz to 100kHz with a source amplitude of 1V. **Ensure** unity gain.

*Right:*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Measured (dB)** | **Nominal (dB)** |  |
| **IN1 Filter (D24)** |  | 0 dB | Pass/Fail |
| **Sum Filter (D18)** |  | 0 dB | Pass/Fail |

*Left:*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Measured (dB)** | **Nominal (dB)** |  |
| **IN1 Filter (D24)** |  | 0 dB | Pass/Fail |
| **Sum Filter (D18)** |  | 0 dB | Pass/Fail |

## Tests Part 3: 4395A Network/Spectrum Analyzer

**Connect** the 4395A in a similar fashion to the SR785, with a GPIB to Cat5 adapter.

***19) High Frequency Transfer Function*** *(AG4395AHighFreqTF.bat)*

**Type** AG4395AHighFreqTF

Use a network analyzer to measure the transfer function from IN1/2 to Sum Out. Sweep the frequency from 10MHz down to 10kHz with –20dBm source. To remove cable delays first measure the transfer function against a BNC barrel and use as a reference. **Record** the displayed values at 100kHz, 300kHz and 1MHz in the table below. Nominal values are given.

\*\* Tolerances are within 1dB and 5deg of nominal.

*Right:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **SUM Out/IN1 [dB]** | **Nominal** | **SUM Out/IN1 [deg]** | **Nominal** |
| **100kHz** |  | -5dB |  | 170deg |
| **300kHz** |  | -5dB |  | 160deg |
| **1MHz** |  | -5dB |  | 130deg |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **SUM Out/IN2 [dB]** | **Nominal** | **SUM Out/IN2 [deg]** | **Nominal** |
| **100kHz** |  | -5dB |  | 170deg |
| **300kHz** |  | -5dB |  | 160deg |
| **1MHz** |  | -5dB |  | 130deg |

*Left:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **SUM Out/IN1 [dB]** | **Nominal** | **SUM Out/IN1 [deg]** | **Nominal** |
| **100kHz** |  | -5dB |  | 170deg |
| **300kHz** |  | -5dB |  | 160deg |
| **1MHz** |  | -5dB |  | 130deg |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **SUM Out/IN2 [dB]** | **Nominal** | **SUM Out/IN2 [deg]** | **Nominal** |
| **100kHz** |  | -5dB |  | 170deg |
| **300kHz** |  | -5dB |  | 160deg |
| **1MHz** |  | -5dB |  | 130deg |