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| Author: | Dani Atkinson / Daniel Sigg |
| Refer to: | LIGO-E1100429-v3 |
| Date: | April 29, 2011 |

Common Mode Servo Board Test Procedure

**Test Preparation**

Enter Name, Date, Revision, Board Serial Number and board to be tested: common mode board (CM), mode cleaner board (**MC**) or an acquisition light system board (ALS).

|  |  |  |
| --- | --- | --- |
| **Test Engineer** | **Date** | **Pass** |
|  |  |  |
| **Board** | **Board Serial Number** |  |
| **D040180 rev. E** | **CM or ALS or MC** |  |

Required Test and Ancillary Equipment

* 1 - Common Mode Board D1003364 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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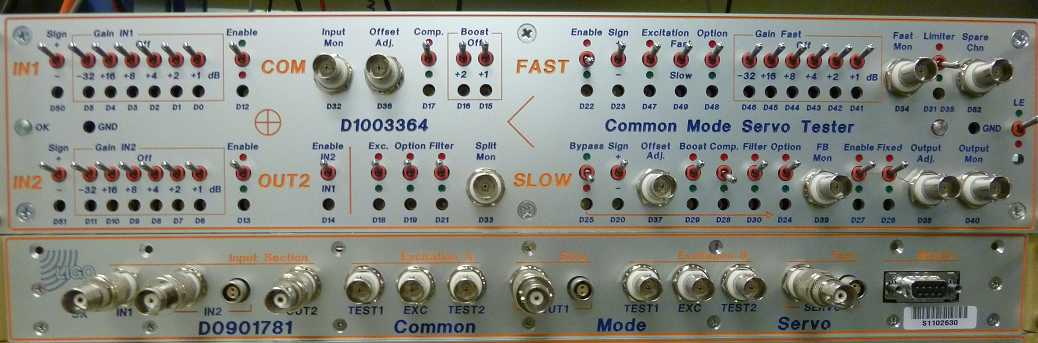
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| --- |
| **IMPORTANT NOTES:**  **1. On the Common Mode Servo Tester (D1003364) front panel, all switches must be returned to default positions after each test and/or step, unless otherwise instructed.**  **2. The default position for most switches is UP, with the exception of switches D22, D25, D28, and D31, which are DOWN.**  **The switch default positions are shown in Picture 1 below.** |

**Picture 1**

**Front of D0901781 Common Mode Servo and D1003364 Common Mode Servo Tester in default configuration.**

|  |
| --- |
| **NOTE: Common Mode Servo ALS and MC Variants**  **1. Unless otherwise marked, nominal values listed are for all boards. Where the ALS and/or MC boards vary from the CM board, those values will be green for ALS or red for MC.** |

# **Tests Part 1.**

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

**Connect** +/-17VDC and +/- 24VDC to the Common Mode Servo and +5VDC to the Common Mode Servo 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.

## Power Supplies

**Turn OFF Power Supplies**.

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

**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** | **Nominal** |
| +24V |  | 0.02 |
| -24V |  | 0.02 |
| +17V |  | .45 |
| -17V |  | .45 |

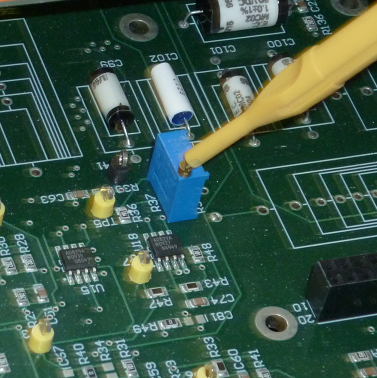
Oscillations

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

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

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Outputs** | **OUT1** | **OUT2** | **SERVO** | **A:TST1** | **A:TST2** | **B:TST1** | **B:TST2** |
| CheckBox |  |  |  |  |  |  |  |
| **Outputs** | D32 Input Mon | D33 Split Mon | D34 Fast Mon | D39  Slow FB Mon | D40  Output Mon |  |  |
| CheckBox |  |  |  |  |  |  |  |
| **Outputs** | IMON | FMON | SMON |  |  |  |  |
| CheckBox |  |  |  |  |  |  |  |

**Adjust DC Bias**

**Set** Oscilloscope coupling to DC Coupling.

**Connect** Input Mon (D32) and Offset Adj. (D36) to the oscilloscope.

**Ground** IN1 using a BNC 50 ohm termination.

**Adjust** DC bias (R54) for zero volts observed at Input Mon (D32) ensure D32 remains zero when D36 is removed.

**Connect** FB Mon (D39) and Offset Adj. (D37) to oscilloscope.

Picture 2

**Adjust** R137 to zero volts observed at FB Mon (D39) when D37 is removed.

**Connect** OUT1 to oscilloscope.

**Turn ON** D15 (switch down).

**Adjust** R54 for zero volts observed.

**Return** D15 to default position.

**Turn ON** D16 (switch down).

**Adjust** R54 for zero volts observed.

**Turn ON** D15 and D16.

**Adjust** R54 for zero volts observed at OUT1.

**Return** switches to default positions.

**Record** observations below.

|  |  |
| --- | --- |
| Zero D32 via R54. | VDC |
| Zero D39 via R137. | VDC |
| Zero OUT1 via R54 with D15 enabled. | VDC |
| Zero OUT1 via R54 with D16 enabled. | VDC |
| Zero OUT1 via R54 with both D15 and D16 enabled. | VDC |

Signal Gain

Gain slider A (Gain IN1):

**Toggle** switch D14 **Down** (IN1 position).

**Connect** OUT2 to the oscilloscope.

**Connect** Function Generator Output to Common Mode Servo IN1 jack.

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

**Inject** a 100Hz / 1Vpp **Sine wav**e 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.

**Return** D14 to the default position.

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

|  |  |  |
| --- | --- | --- |
| **Binary input (Switch Setting)** | **Measured Vpp** | **Nominal Vpp** |
| —(0dB) |  | 1 |
| D0 (1dB) |  | 1.12 |
| D1 (2dB) |  | 1.26 |
| D2 (4dB) |  | 1.59 |
| D3 (8dB) |  | 2.51 |
| D4 (16dB) |  | 6.31 |
| D3 & D4 (24dB) |  | 15.9 |
| D5 (-32dB) |  | 0.025 |
| D5 & D3 (-24dB) |  | 0.063 |
| D5 & D4 (-16dB) |  | 0.159 |
| D5 & D3 & D4 (-8dB) |  | 0.398 |

Gain slider B (Gain IN2):

**Toggle** switch D13 down (D14 is in the default position IN2).

**Connect** OUT2 to an oscilloscope.

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

**Connect** Function Generator Output to Common Mode Servo 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.

**Return** D13 to the default position.

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

|  |  |  |
| --- | --- | --- |
| **Binary Input (slider gain)** | **Measured Vpp** | **Nominal Vpp** |
| — |  | 1 |
| D6 (1dB) |  | 1.12 |
| D7 (2dB) |  | 1.26 |
| D8 (4dB) |  | 1.59 |
| D9 (8dB) |  | 2.51 |
| D10 (16dB) |  | 6.31 |
| D9 & D10 (24dB) |  | 15.9 |
| D11 (-32dB) |  | 0.025 |
| D11 & D9 (-24dB) |  | 0.063 |
| D11 & D10 (-16dB) |  | 0.159 |
| D11 & D9 & D10 (-8dB) |  | 0.398 |

Crossbar switches

**Inject** a 100Hz/1Vpp **Sine wave** to IN1. Individually, **Toggle** each Crossbar switches **Down**. Using an oscilloscope, **Record** the voltage states at OUT1 and OUT2. Voltage states are either **ON** or **OFF**.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Binary input** | **OUT1** | **Nominal** | **OUT2** | **Nominal** |
| Switches in Default Positions |  | On |  | Off |
| D12 (input 1 disabled) |  | Off |  | Off |
| D13 (input 2 enabled) |  | On |  | Off |
| D14 (output switch) |  | On |  | On |

**Inject** a 100Hz/1Vpp **Sine wave** to IN2. **Record** the voltage states at OUT1 and OUT2 while toggling the switches **Down**. Voltages states are either **ON** or **OFF**.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Binary input** | **OUT1** | **Nominal** | **OUT2** | **Nominal** |
| Switches in Default Positions |  | Off |  | On |
| D12 (input 1 disabled) |  | Off |  | On |
| D13 (input 2 enabled) |  | On |  | On |
| D14 (output switch) |  | Off |  | Off |

Excitation A

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

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

**Inject** a 100Hz/1Vpp **Sine wave** to A:EXC. **Measure** and **Record** the voltage at A:TEST2 and OUT1 while toggling the switches **Down**. \*\* Tolerance is +/-0.5dB. (Red = MC)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Binary input** | **A:TEST2** | **Nominal Vpp** | **OUT1** | **Nominal Vpp** |
| Default |  | Off |  | Off |
| D18 (com exc enable) |  | -0.10 |  | 0.10 / 0.50 |
| D18 & D19 (com option) |  | -0.10 |  | Off |

Split

**Inject** a 100Hz/1Vpp **Sine wave** to IN1. **Measure** and **Record** the voltage at OUT1 and SERVO while toggling the switches **Down**. \*\* Tolerance is +/-0.5dB.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Binary input** | **OUT1** | **Nominal Vpp** | **SERVO** | **Nominal Vpp** |
| — |  | -1.00 |  | -1.00 |
| Lift D22 (disable fast) |  | -1.00 |  | Off |
| D21 (common filter) |  | -1.00 |  | -1.00 |
| D23 (fast polarity) |  | -1.00 |  | +1.00 |
| D20 (slow polarity) |  | 1.00 |  | -1.00 |
| D24 (slow option) |  | Off |  | -1.00 |
| Lift D28 (slow comp) |  | 3.98 (phase offset) |  | -1.00 |
| D29 (slow boost) |  | 4.12 (phase offset) |  | -1.00 |
| D30 (slow filter) |  | -1.00 |  | -1.00 |
| D25 (slow bypass) |  | 1.00 |  | -1.00 |
| D27 (slow offset enable) |  | 1.00 (change offset with slow offset D38) |  | -1.00 |
| D27 and D26 (slow 5V offset) |  | 1.00 (5 V offset) |  | -1.00 |

Latching

**Inject** a 100Hz/1Vpp **Sine wave** to IN1. **Toggle Down** LE switch (P1/11 latch enable).

**Measure** and **Record** the voltage at SERVO.

**Toggle** D12 **Down** (IN1 1 enable) and make sure the signal at the output stays on all the time.

**Return** LE switch and D12 switch to default positions.

|  |  |
| --- | --- |
| **SERVO** | **Vpp** |
| **Check** |  |

Excitation B

**Inject** a 100Hz/1Vpp **Sine wave** to IN1. **Measure** the voltage at B:TEST1 and B:TEST2 while toggling the switches **Down**. Tolerance is +/-0.5dB.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Binary input** | **B:TEST1** | **Nominal Vpp** | **B:TEST2** | **Nominal Vpp** |
| — |  | -1.00 |  | 1.00 |
| Lift D22 |  | Off |  | Off |
| D49 (fast/slow) and lift D22 |  | -1.00 |  | 1.00 |

**Inject** a 100Hz/1Vpp **Sine wave** to B:EXC. **Measure** the voltage at OUT1 and SERVO while toggling the switches **Down**. Tolerance is +/-0.5dB.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Binary input** | **OUT1** | **Nominal Vpp** | **SERVO** | **Nominal Vpp** |
| — |  | Off |  | Off |
| D47 (exc. enable) |  | Off |  | 0.10 |
| D47 & D48 (fast option) |  | Off |  | Off |
| D47 & D49 |  | 0.10 |  | Off |
| D47, D49, & D24 |  | Off |  | Off |

Limiter

**Inject** a 100Hz/10Vpp **Sine wave** to IN1. **Measure** the voltage at SERVO while toggling switch D31/35 **UP** (on the tester, red is on and green is off for this switch). The measured voltage should be within 25% of the nominal value.

|  |  |  |
| --- | --- | --- |
| **Binary input** | **Measured Vpp** | **Nominal Vpp** |
| - |  | 20.0 Vpp |
| D31 (fast limiter) |  | 6.6 Vpp |

Gain slider C

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

|  |  |  |
| --- | --- | --- |
| **Binary input (slider gain)** | **Measured Vpp** | **Nominal Vpp** |
| — |  | 1 |
| D41 (1dB) |  | 1.12 |
| D42 (2dB) |  | 1.26 |
| D43 (4dB) |  | 1.59 |
| D44 (8dB) |  | 2.51 |
| D45 (16dB) |  | 6.31 |
| D44 & D45 (24dB) |  | 15.9 |
| D46 (-32dB) |  | 0.025 |
| D46 & D44 (-24dB) |  | 0.063 |
| D46 & D45 (-16dB) |  | 0.159 |
| D46 & D45 & D44 (-8dB) |  | 0.398 |

EPICS Readbacks

**Inject** a 1Hz/1Vpp **Sine wave** to IN1. **Observe** analog outputs for a peak to peak value and **Record** the observed voltage.

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

\*\*The voltage tolerance is 1 dB (6dB for D34) of the nominal value.

(Red = MC) (Green = ALS)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **EPICS readback** | **1Hz** | **Nominal Vpp** | **100Hz** | **Nominal Vpp** |
| D32 (input mon) |  | -1.00 |  | 0.080 |
| D33 (split mon) |  | -1.00 |  | 0.080 |
| D34 (fast mon) |  | -0.4 / **7.5 / 7.5** |  | 0.80 |
| D39 (slow FB mon) |  | 1.00 |  |  |
| D40 (output mon) |  | -1.00 |  |  |

Limit indicator

**Inject** a 0.1Hz/10Vpp **Square wave** to IN1. **Observe** D35 Indicator Light (limit indicator) is **ON** and **Record** the observed voltage. Compare with the nominal response; see Appendix A6.

|  |  |
| --- | --- |
| **D35 Indicator Light Check** |  |
| **Voltage** |  |

**Inject** a 100Hz **Sine wave** to IN1. Increase injected signal amplitude from 0.0V, in 0.1V steps, until D35 Indicator Light goes from high (**ON**) to low (**OFF**). **Record** the observed voltage.

|  |  |  |
| --- | --- | --- |
| **Binary input** | **Measured [Vpp]** | **Nominal [Vpp]** |
| — |  | Approx. 6.0 Vpp |

## Tests Part 2: SR785 Signal Analyzer Tests

|  |
| --- |
| **Important Notes: 1. Ensure all Common Mode Servo 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** 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.

**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.

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

# **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.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Boost #** | **@1Hz** | **Nominal** | **@10Hz** | **Nominal** | **@100Hz** | **Nominal** |
| Input Mon (D32) |  | -0.1dB  173deg |  | -4.1dB  129deg |  | -22dB  95deg |
| Split Mon (D33) |  | -0.1dB  173deg |  | -4.1dB  129deg |  | -22dB  95deg |
| Fast Mon (D34) (CM) |  | -8.8dB  150deg |  | 10.5dB  5deg |  | -2.5dB  -79deg |
| D34 (MC/ALS) |  | 19.9dB  -7deg |  | 15.9dB  -51deg |  | -2.0dB  -85deg |
| FB Mon (D39) |  | -0.1dB  -7deg |  | -4.1dB  -51deg |  | -22dB  -85deg |
| Output Mon (D40) |  | -0.1dB  173deg |  | -4.1dB  129deg |  | -22dB  95deg |

**Return** all Common Mode Servo Tester switches to the default position.

**Adjustment Channel Filtering** (SR785AdjustmentTFs.bat)

**Type** SR785AdjustmentTFs

**Test** the transfer functions at 10kHz to 1Hz on the indicated adjustment channels on the tester to OUT1. **Toggle Down** D27 when testing D38. Verify filtering of at least -60dB at 100Hz for each channel and **Record** levels below in the boxes below.

**Return** switch D27 to default position.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Offset Adj.(D36)** |  | **Offset Adj. (D37)** |  | **Output Adj. (D38)** |  |

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

**Type** SR785DistortionMeasurement

**Inject** a 1kHz/1Vrms sine wave to IN1. Use a spectrum analyzer (SR785) to measure the harmonic components at SERVO; see Appendix A7. On the SR785, **Press** Marker to display THD level. **Repeat** the measurement for IN2 (D13 on). **Record** the measurements in the boxes below.

**Return D13** to the default position.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **IN1** | **SERVO** | **IN2** | **SERVO** |
| **Total Harmonic Distortion (THD)** |  | <-70dB |  | <-70dB |

**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 OUT1, OUT2 and SERVO. **Record** the values at 100Hz, 1kHz, 10kHz and 100kHz in the table below. See Appendix A1 for typical examples.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Frequency** | **OUT1** | **< [nV/√Hz]** | **OUT2** | **< [nV/√Hz]** | **SERVO** | **< [nV/√Hz]** |
| **10Hz** |  |  |  |  |  |  |
| **100Hz** |  | 40 |  | 30 |  | 50 |
| **1kHz** |  | 30 |  | 30 |  | 40 |
| **10kHz** |  | 30 |  | 30 |  | 40 |
| **100kHz** |  | 30 |  | 30 |  | 40 |

**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 OUT1, from IN1 to SERVO and from IN2 to OUT2. **Record** the values at 10Hz, 100Hz, 1kHz, 10kHz and 100kHz in the table below. See Appendix A2 for typical examples.

\*\* Tolerances must be within 1dB and 5deg of nominal. See Appendix A2 for typical examples.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **OUT1/IN1** | **dB** | **Nom (CM MC ALS)** | **deg** | **Nom (CM MC ALS)** |
| **1Hz** |  | 0.0dB 14.0dB 0.0dB |  | 180deg 180deg 180deg |
| **10Hz** |  | 0.0dB 14.0dB 0.0dB |  | 180deg 180deg 179deg |
| **100Hz** |  | 0.0dB 14.0dB -0.2dB |  | 180deg 177deg 169deg |
| **1kHz** |  | 0.0dB 13.0dB -7.0dB |  | 180deg 153deg 117deg |
| **10kHz** |  | 0.0dB -0.2dB -26.0dB |  | 175deg 102deg 94deg |
| **100kHz** |  | -3.0dB -20.0dB -46.0dB |  | 130deg 86deg 85deg |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SERVO/IN1** | **dB** | **Nom (CM MC ALS)** | **deg** | **Nom (CM MC ALS)** |
| **1Hz** |  | -28.3dB 0.0dB 0.0dB |  | -23deg -180deg 180deg |
| **10Hz** |  | -1.9dB 0.0dB 0.0dB |  | -127deg -180deg 180deg |
| **100Hz** |  | 0.0dB 0.0dB 0.0dB |  | -174deg -180deg 180deg |
| **1kHz** |  | 0.0dB 0.0dB 0.0dB |  | -180deg -180deg 180deg |
| **10kHz** |  | 0.0dB 0.1dB 0.0dB |  | 89deg -177deg 89deg |
| **100kHz** |  | 0.0dB 3.0dB 0.0dB |  | 81deg -170deg 81deg |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **OUT2/IN2** | **dB** | **Nom (CM MC ALS)** | **deg** | **Nom (CM MC ALS)** |
| **1Hz** |  | 0.0dB 0.0dB 0.0dB |  | 180deg 180deg 180deg |
| **10Hz** |  | 0.0dB 0.0dB 0.0dB |  | 180deg 180deg 180deg |
| **100Hz** |  | 0.0dB 0.0dB 0.0dB |  | 180deg 180deg 180deg |
| **1kHz** |  | 0.0dB 0.0dB 0.0dB |  | 180deg 180deg 180deg |
| **10kHz** |  | 0.0dB 0.0dB 0.0dB |  | 180deg 180deg 180deg |
| **100kHz** |  | 0.0dB 0.0dB 0.0dB |  | 177deg 177deg 177deg |

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

**Type** SR785BoostGainTFs

|  |
| --- |
| Note: 1. Switch D5 must be **Down** (low) for **all** measurements.  2. All other switches are in default unless prompted otherwise |

It is also possible to measure these boost stages by using TP3, TP8, TP9, TP10 and TP11A. See Appendix A4 for typical examples.

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Boost #** | **@10Hz** | **Nom** | **@100Hz** | **Nom** | **@1kHz** | **Nom** |
| **Common Comp.**  **(D17)** |  | 39.7dB  -14deg |  | 31.4dB  -67deg |  | 12.3dB  -74deg |
| **1. (D15)** |  | 26.3dB  -1deg |  | 26.3dB  -5deg |  | 23.4dB  -42deg |
| **2. (D16)** |  | 26.3dB  -1deg |  | 26.3dB  -5deg |  | 23.4dB  -42deg |
| **3. (D15+D16)** |  | 23.5dB  -2deg |  | 23.1dB  -17deg |  | 12.9dB  -61deg |
| **Lift D28**  **(slow comp)** |  | 31.3dB  -68deg |  | 11.9dB  -88deg |  | -8.1dB  -90deg |
| **D29 (slow boost)** |  | 31.4dB  -67deg |  | 12.3dB  -74deg |  | 0.6dB  -22deg |

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

**Type** SR785DAQTFs

**Measure** the transfer function from SR785 CH1 A to D0901781 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. See Appendix A5 for typical examples.

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **1Hz** | **Nominal** | **10kHz** | **Nominal** |
| **IMON** |  | 26dB, 0deg |  | 26dB, 0deg |
| **FMON** |  | –dB, –deg |  | 46dB, -180deg |
| **SMON** |  | -26dB, 0deg |  | 26dB, -12deg |

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

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

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

**Type** AG4395AHighFreqTF

Use a network analyzer to measure the transfer function from IN1 to SERVO. 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 for CM. See Appendix A3 for typical examples.

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **SERVO/IN1 [dB]** | **Nominal** | **SERVO/IN1 [deg]** | **Nominal** |
| **100kHz** |  | 0dB |  | 170deg |
| **300kHz** |  | 0dB |  | 150deg |
| **1MHz** |  | 2dB |  | 75deg |