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40 Meter BS and RCM Suspension Controller Test Plan

J. Heefner

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California Institute of Technology
LIGO Project - MS 51-33
Pasadena CA 91125
Phone (818) 395-2129
Fax (818) 304-9834
E-mail: info@ligo.caltech.edu

Massachusetts Institute of Technology
LIGO Project - MS 20B-145
Cambridge, MA 01239
Phone (617) 253-4824
Fax (617) 253-7014
E-mail: info@ligo.mit.edu

WWW: http://www.ligo.caltech.edu/

1 SUSPENSION CONTROLLER TESTS

The tests described below are to be used to verify the correct operation of the beam splitter and recycling mirror suspension controller. Due to the complexity of the module and the multiple input to output signal paths the tests verify operation of individual sections of the module and are progressive in nature. It is therefore extremely important that the tests be performed in the order shown below and any failure to perform be corrected and verified prior to proceeding. Measured gains within 2 dB of the nominal gains are considered to be acceptable.

In general the tests use a function generator set to produce a 1 Hz sine wave connected to a specified input and an oscilloscope connected to a specified monitor output to measure the response of the circuit. Gain is determined by using the oscilloscope to measure the input and output peak to peak voltages. All pots not specified for each test should be set to 0%.

The last set of tests (section 1.7. Transfer Function Verification) use an HP 3562 Dynamic Signal Analyzer to measure the frequency response of the module.

1.1. Input Matrix Verification

The table below is used to verify correct operation of the suspension controller input matrix. Using a function generator and oscilloscope the gain and polarity of each piece of the input matrix is verified. The function generator is connected to the input listed in column 1 of the table. The oscope is connected to the monitor listed in column 2. The frequency of the function generator should be set to 1 Hz and the amplitude set to approximately 1V peak to peak for all measurements. The designator “invert” in column 4 of the table refers to the input to output phase relationship and should be verified as part of the testing.

Table 1: Input Matrix Verification

Input	*Output Monitor*	*Pot # & Setting*	*Nominal Gain (1 Hz)*	*Actual Gain*
UL In	POS M	0: 100/50%	6 / 0 dB invert	
UL In	PIT M	4: 100/50%	6 / 0 dB invert	
UL In	YAW M	8: 100/50%	6 / 0 dB invert	
LL In	POS M	1: 100/50%	6 / 0 dB invert	
LL In	PIT M	5: 100/50%	6 / 0 dB	
LL In	YAW M	9: 100/50%	6 / 0 dB invert	
UR In	POS M	2: 100/50%	6 / 0 dB invert	
UR In	PIT M	6: 100/50%	6 / 0 dB invert	
UR In	YAW M	10: 100/50%	6 / 0 dB	
LR In	POS M	3: 100/50%	6 / 0 dB invert	

Table 1: Input Matrix Verification

Input	*Output Monitor*	*Pot # & Setting*	*Nominal Gain (1 Hz)*	*Actual Gain*
LR In	PIT M	7: 100/50%	6 / 0 dB	
LR In	YAW M	11: 100/50%	6 / 0 dB	
Side In	Side M	N/A	0 dB invert	

1.2. POS, PIT, YAW, Side Local Control Verification

The table below is used to verify the correct operation of the suspension controller POS, PIT, YAW and Side local control path. The function generator is connected to the input listed in column 1 of the table. As can be seen from the table the UL input is used to verify correct operation of the POS, PIT and YAW paths. It is therefore important that proper operation of the input matrix be verified prior to performing these tests. The function generator used should be set to 1 Hz and 1 mV peak to peak for the first 3 tests listed and 100 uV peak to peak for the last test (Side In to Side 2 M). In addition, the Local/Global and AC Enable control buttons for pitch and yaw should be set to “LOCAL” and “ENABLED”, respectively.

The designator “invert and non-invert” in column 4 of the table refers to the ability of the controller to flip the polarity of the signal on operator request. This function should be verified as part of the tests.

Table 2: POS, PIT, YAW Local Verification

Input	*Output Monitor*	*Pot # & Setting*	*Nominal Gain (1 Hz)*	*Actual Gain*
UL In	POS 2 M	0: 10% 28: 10/5%	72 / 66 dB invert & non-invert	
UL In	PIT 2 M	4: 10% 30: 100/50%	52 / 46 dB invert & non-invert	
UL In	YAW 2 M	8: 10% 32: 100/50%	52 / 46 dB invert & non-invert	
Side In	Side 2 M	29: 10/5%	76/ 70 dB invert & non-invert	

1.3. PIT and YAW Global AC Verification

The table below is used to verify the correct operation of the suspension controller PIT, and YAW global AC control path. The function generator is connected to the input listed in column 1 of the table. The function generator used should be set to 1 Hz and 100 mV peak to peak.In addition, the

Local/Global and AC Enable control buttons for pitch and yaw should be set to “GLOBAL” and “ENABLED”, respectively.

The designator “invert and non-invert” in column 4 of the table refers to the ability of the controller to flip the polarity of the signal on operator request. This function should be verified as part of the tests.

Table 3: PIT, YAW AC Global Verification

Input	*Output Monitor*	*Pot # & Setting*	*Nominal Gain (1 Hz)*	*Actual Gain*
PIT Global In	PIT 2 M	30: 100/50%	26 / 20 dB invert & non-invert	
YAW Global In	YAW 2 M	32: 100/50%	26 / 20 dB invert & non-invert	

1.4. PIT and YAW Global DC Verification

The table below is used to verify the correct operation of the suspension controller PIT, and YAW global DC control path. The function generator is connected to the input listed in column 1 of the table. The function generator used should be set to 1 Hz and 100 mV peak to peak. In addition, the DC Enable control button should be set to “ENABLED”.

The designator “invert and non-invert” in column 4 of the table refers to the ability of the controller to flip the polarity of the signal on operator request. This function should be verified as part of the tests.

Table 4: PIT, YAW DC Global Verification

Input	*Output Monitor*	*Pot # & Setting*	*Nominal Gain (1 Hz)*	*Actual Gain*
PIT Global In	PIT 2 M	31: 100/50%	23 / 17 dB invert & non-invert	
YAW Global In	YAW 2 M	33: 100/50%	23 / 17 dB invert & non-invert	

1.5. Output Matrix Verification

The table below is used to verify correct operation of the output matrix portion of the suspension controller. The function generator is connected to the input listed in column 1 of the table. The function generator used should be set to 1 Hz and 100 mV peak to peak. The POS, PIT, YAW and

Table 5: Output Matrix Verification

Input	*Output Monitor*	*Pot # & Setting*	*Nominal Gain (1 Hz)*	*Actual Gain*
POS T In	UL Coil M	12: 100/50%	14 / 8 dB Run Mode	
POS T In	LL Coil M	15: 100/50%	14 / 8 dB Run Mode	
POS T In	UR Coil M	18: 100/50%	14 / 8 dB Run Mode	
POS T In	LR Coil M	21: 100/50%	14 / 8 dB Run Mode	
PIT T In	UL Coil M	13: 100/50%	0 / -6 dB Run Mode	
PIT T In	LL Coil M	16: 100/50%	0 / -6 dB Run Mode	
PIT T In	UR Coil M	19: 100/50%	0 / -6 dB Run Mode	
PIT T In	LR Coil M	22: 100/50%	0 / -6 dB Run Mode	
YAW T In	UL Coil M	14: 100/50%	0 / -6 dB Run Mode	
YAW T In	LL Coil M	17: 100/50%	0 / -6 dB Run Mode	
YAW T In	UR Coil M	20: 100/50%	0 / -6 dB Run Mode	
YAW T In	LR Coil M	23: 100/50%	0 / -6 dB Run Mode	
Side T In	Side Coil M	N/A	30 dB Run Mode	

Side Test Enable Buttons should be set to “ENABLED” and the Coil Test Enable buttons set to “DISABLED” for the respective tests.

1.6. LSC Input Verification

The table below is used to verify correct operation of the LSC input portion of the suspension controller. The function generator is connected to the input listed in column 1 of the table. The function generator used should be set to 1 Hz and 100 mV peak to peak.

The designators “Run Mode” and “Acq Mode” in column 4 of the table refers to the ability of the operator to set the mode of operation for the output coil driver. This function should be verified as part of the tests

Table 6: LSC Input Verification

Input	*Output Monitor*	*Pot # & Setting*	*Nominal Gain (1 Hz)*	*Actual Gain*
LSC In	UL Coil M	24: 100/50%	22.8/ 16.8 dB invert Run Mode 2.8 / -3.2 Acq Mode	
LSC In	LL Coil M	25: 100/50%	22.8/ 16.8 dB invert Run Mode 2.8 / -3.2 Acq Mode	
LSC In	UR Coil M	26: 100/50%	22.8/ 16.8 dB invert Run Mode 2.8 / -3.2 Acq Mode	
LSC In	LR Coil M	27: 100/50%	22.8/ 16.8 dB invert Run Mode 2.8 / -3.2 Acq Mode	

1.7. Transfer Function Verification

The table below is used to verify the transfer function of each signal path of the controller. These tests use the HP 3562 dynamic signal analyzer to plot the frequency response of the circuit under test. Frequency response plots should be made for each measurement listed in the table. The gain at 1 Hz is listed in column 4 of the table as a reference and should be verified from the frequency response plots.

The source level of the dynamic signal analyzer should be set to 8 mVrms for all tests except the Side In to Side Coil M test, where the source level should be set to 4 mVrms. Frequency response should be plotted from 1 Hz to 100 Hz for the 6 tests in the table and 0.01Hz to 100 Hz for the last

2 tests. Ensure that the polarity control button for each channel is set to the “NOMINAL” position

Table 7: Transfer Function Verification

Input	*Output Monitor*	*Pot # & Setting*	*Nominal Gain (1 Hz)*	*Actual Gain*
UL In	UL Coil M via POS path	0: 10% 28: 10% 12: 10%	9.5 dB Run Mode	
UL In	UL Coil M via PIT AC Local path	4: 10% 30: 10% 13: 10%	-8 dB Run Mode	
UL In	UL Coil M via YAW AC Local path	8: 10% 32: 10% 14: 10%	-8 dB Run Mode	
UL In	LL Coil M via POS path	0: 10% 28: 10% 15: 10%	9.5 dB Run Mode	
UL In	UR Coil M via POS path	0: 10% 28: 10% 18: 10%	9.5 dB Run Mode	
UL In	LR Coil M via POS path	0: 10% 28: 10% 21: 10%	9.5 dB Run Mode	
Side In (4 mVrms source)	Side Coil M via Side path	29: 1% plus 20 dB atten. and 50 ohms on input	+16 dB Run Mode	
Global PIT AC Input	UL Coil M	30: 10% 13: 10%	-14 dB Run Mode	
Global YAW AC Input	UL Coil M	32: 10% 14: 10%	-14 dB Run Mode	
Global PIT DC In	UL Coil M	31: 10% 13: 100%	3 dB Run Mode	
Global YAW DC Input	UL Coil M	33: 10% 14: 100%	3 dB Run Mode	

and the filter control button is set to “NORMAL” for the tests.