

# LI-7500A CO<sub>2</sub>/H<sub>2</sub>O Analyzer

## Calibration Certificate

Serial Number 75H-2668

Date: 30 Jan 2017  
Code:32930

Technician \_\_\_\_\_  
Jerry F.

### CO<sub>2</sub> Calibration Values

A = 1.65536E2  
B = -8.01959E3  
C = 7.03085E7  
D = -2.45453E10  
E = 3.39997E12  
XS = 0.0011  
Z = -4.00000E-4  
+ SD1 = 0.0016  
SD2 = -0.0983  
SD3 = 2.0250

### H<sub>2</sub>O Calibration Values

A = 5.36955E3  
B = 4.73511E6  
C = -3.45696E8  
XS = -0.0009  
Z = 1.97000E-2  
+ SD1 = 0.0098  
SD2 = -0.0625  
SD3 = 2.3210

### \* Signal Strength

B = 1.662  
C = 3.827

\* Ver 6.5 and above

+ Ver 7.6 and above

### Zero/Span set on 31 Jan 2017

CO2 Zero = 0.9392  
CO2 Span = 1.0120 (at 749 ppm)  
CO2 Span2= 0.0000  
H2O Zero = 0.9039  
H2O Span = 1.0054 (at 12 C)  
H2O Span2= 0.0000  
CX= 42292.7, WX = 42379.4



CO2 Computations

Num	ppm	abs/kPa	mmol/m3/kPa	Coeffs	Predicted	Error	%Error	Temp	Drift at 370 ppm	%/C
1	0	0E0	0	1.65536E2	0	0	0.000	44C	0.652	-0.002
2	98.6	2.32069E-4	0.03732	-8.01959E3	0.03878	0.00146	3.924	31C	0.266	
3	197.7	4.3658E-4	0.07485	7.03085E7	0.07564	0.00079	1.054	16C	0.248	
4	299.3	6.22132E-4	0.11331	-2.45453E10	0.11314	-0.00017	-0.147	1C	0.472	
5	401.3	7.89346E-4	0.15192	3.39997E12	0.15116	-0.00076	-0.503	-10C	0.406	
6	499.6	9.35943E-4	0.18914		0.18818	-0.00095	-0.504	-23C	0.758	
7	605.8	1.08182E-3	0.22926	0.0016	0.22866	-0.00061	-0.265			
8	748.6	1.26087E-3	0.28335	-0.0983	0.28341	0.00006	0.021			
9	1003	1.54274E-3	0.37959	2.0248	0.38104	0.00145	0.383			
10	1511	2.00761E-3	0.57182		0.57233	0.00052	0.090			
11	2004	2.38304E-3	0.75837		0.75552	-0.00284	-0.375			
12	2506	2.71518E-3	0.94855		0.94311	-0.00544	-0.574			
13	3016	3.01607E-3	1.14187		1.14027	-0.00159	-0.140			
14	0	0E0	0		0	0	0.000			
15	98.6	2.40598E-4	0.03891		0.04026	0.00134	3.456			
16	197.7	4.51114E-4	0.07801		0.07848	0.00047	0.601			
17	299.3	6.41526E-4	0.11809		0.11749	-0.0006	-0.507			
18	401.3	8.12045E-4	0.15831		0.15696	-0.00135	-0.854			
19	499.6	9.61261E-4	0.19712		0.19543	-0.00169	-0.857			
20	605.8	1.10966E-3	0.23902		0.23754	-0.00148	-0.621			
21	748.6	1.29117E-3	0.2954		0.29438	-0.00102	-0.347			
22	1003	1.57584E-3	0.39575		0.39543	-0.00032	-0.080			
23	1511	2.04503E-3	0.59621		0.59368	-0.00253	-0.425			
24	2004	2.42158E-3	0.79073		0.78308	-0.00765	-0.968			
25	2506	2.75458E-3	0.98855		0.97814	-0.01041	-1.053			
26	3016	3.05526E-3	1.18993		1.18411	-0.00581	-0.489			
27	0	0E0	0		0	0	0.000			
28	98.6	2.52234E-4	0.0409		0.04227	0.00137	3.349			
29	197.7	4.7114E-4	0.08201		0.08242	0.00041	0.505			
30	299.3	6.67655E-4	0.12416		0.12341	-0.00075	-0.602			
31	401.3	8.43658E-4	0.16648		0.16512	-0.00136	-0.817			
32	499.6	9.96308E-4	0.20723		0.20554	-0.00169	-0.816			
33	605.8	1.1478E-3	0.25127		0.24976	-0.00151	-0.601			
34	748.6	1.33293E-3	0.31051		0.30947	-0.00104	-0.334			
35	1003	1.62282E-3	0.41602		0.41558	-0.00044	-0.106			
36	1511	2.09702E-3	0.6268		0.62251	-0.0043	-0.686			
37	2004	2.47727E-3	0.83123		0.82097	-0.01026	-1.234			
38	2506	2.81139E-3	1.0393		1.02569	-0.01362	-1.310			
39	3016	3.1134E-3	1.25099		1.24431	-0.00668	-0.534			
40	0	0E0	0		0	0	0.000			
41	98.6	2.65485E-4	0.04312		0.04459	0.00146	3.397			
42	197.7	4.93959E-4	0.08647		0.08697	0.0005	0.577			
43	299.3	6.97859E-4	0.13089		0.13037	-0.00052	-0.397			
44	401.3	8.79367E-4	0.17551		0.17452	-0.001	-0.569			
45	499.6	1.03671E-3	0.21849		0.21742	-0.00107	-0.489			
46	605.8	1.1922E-3	0.26492		0.26424	-0.00068	-0.256			
47	748.6	1.38145E-3	0.32739		0.32728	-0.00011	-0.033			
48	1003	1.6772E-3	0.43867		0.43915	0.00047	0.108			
49	1511	2.1586E-3	0.66078		0.6566	-0.00418	-0.632			
50	2004	2.54267E-3	0.87635		0.86528	-0.01107	-1.263			
51	2506	2.87911E-3	1.09584		1.08189	-0.01394	-1.272			
52	3016	3.18164E-3	1.3188		1.31463	-0.00417	-0.316			
53	0	0E0	0		0	0	0.000			
54	98.6	2.76254E-4	0.04512		0.04648	0.00136	3.009			
55	197.7	5.12563E-4	0.09047		0.09073	0.00027	0.294			
56	299.3	7.22886E-4	0.13693		0.13626	-0.00067	-0.490			
57	401.3	9.09282E-4	0.18359		0.18257	-0.00101	-0.552			
58	499.6	1.07091E-3	0.22856		0.22772	-0.00084	-0.367			
59	605.8	1.22969E-3	0.27718		0.27677	-0.00041	-0.147			
60	748.6	1.42257E-3	0.3425		0.34273	0.00023	0.066			
61	1003	1.72357E-3	0.45892		0.45967	0.00075	0.163			
62	1511	2.21154E-3	0.69127		0.68649	-0.00479	-0.692			

Num	ppm	abs/kPa	mmol/m3/kPa	Coeffs	Predicted	Error	%Error	Temp	Drift at 370 ppm	%/C
63	2004	2.59917E-3	0.91681		0.90437	-0.01244	-1.357			
64	2506	2.93906E-3	1.14651		1.13276	-0.01375	-1.199			
65	3016	3.24196E-3	1.37975		1.37848	-0.00126	-0.092			
66	0	0E0	0		0	0	0.000			
67	98.6	2.90323E-4	0.04746		0.04896	0.0015	3.163			
68	197.7	5.36585E-4	0.09516		0.09566	0.0005	0.527			
69	299.3	7.55667E-4	0.14406		0.14411	0.00005	0.036			
70	401.3	9.47224E-4	0.19316		0.19301	-0.00016	-0.081			
71	499.6	1.11366E-3	0.24044		0.24088	0.00044	0.185			
72	605.8	1.27646E-3	0.29155		0.29274	0.00119	0.407			
73	748.6	1.47455E-3	0.3603		0.36263	0.00234	0.648			
74	1003	1.78161E-3	0.48278		0.4858	0.00302	0.626			
75	1511	2.27707E-3	0.72726		0.72403	-0.00323	-0.444			
76	2004	2.66963E-3	0.96447		0.95393	-0.01054	-1.092			
77	2506	3.00965E-3	1.20602		1.19443	-0.01159	-0.961			
78	3016	3.31276E-3	1.45139		1.45614	0.00475	0.327			

ppm - CO2 tank value (umol/mol)

abs/kPa - zero corrected CO2 absorptance divided by pressure

umolCO2/m3/kPa - CO2 mole density divided by pressure

Coeffs - computed calibration coeffs (fit 5th order poly to previous 2 columns)

Predicted - predicted CO2 (umol/m3/kPa)

% Error - (Predicted - actual)/actual \* 100

At 370 - %Error at 370 ppm (based on curve fit of errors) for each temperature data set

%/C - Estimated span drift with temperature at 370 ppm.

H2O Measurements

Table with 22 columns: Type, Time, H2O(C), 610kPa, 610kPaSD, H2O(ppt), H2O(mm3), CO2Abs, H2OAbs, H2OSD, H2OSlp, T(Oven(C)), Pa(kPa), T(C), Press, F(s/m), Cooler, ChCooler, CO2Aw, CO2Awo, H2OAw, H2OAwo, SS, Diag. Contains 27 rows of measurement data.

H2O(C) - LI-610 Dewpoint generator set point

610kPa - Overpressure (kPa) in the LI-610

H2O(mm3) - Water mole density (mmol/m3) in the calibration tube. Includes overpressure correction.

H2OAbs - H2O absorbance (unfiltered)

H2OSD - Standard deviation of H2OAbs (100 samples over 10 seconds).

CO2Abs - CO2 absorbance (unfiltered)

T(Oven(C)) - Oven temperature

T(C) - IRGA's temperature measurement

Pa(kPa) - Atmospheric pressure, measured by Ruska 6200

Press - Atmospheric pressure measured by IRGA

F(l/m) - Flow through calibration tube, liters/min.

Cooler - Detector cooler voltage

AGC - Automatic gain control value (0-100%)

Diag - IRGA's diagnostic codes, plus 'C' for CO2 stability achieved, and 'H' for H2O stability achieved.

H2O Computations

Table with 11 columns: Num, ppt, abs/kPa, mmol/m3/kPa, Coeffs, Predicted, Error, %Error, Temp, Drift at 10 ppt, %/C. Contains 27 rows of computed values corresponding to the measurements above.

mmolH2O/mol - H2O concentration

abs/kPa - H2O absorbance divided by pressure

mmolH2O/m3/kPa - H2O mole density divided by pressure

Coeffs - computed calibration coeffs (fit 3rd order poly to previous 2 columns)

Predicted - predicted H2O (mmol/m3/kPa)

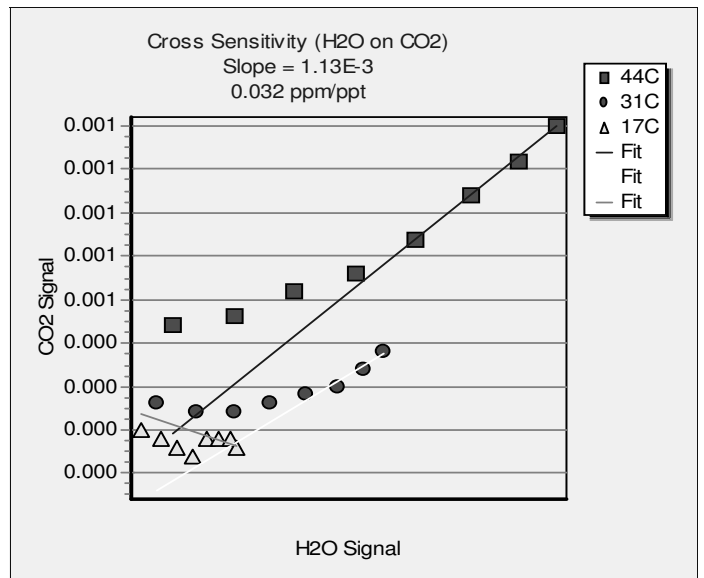
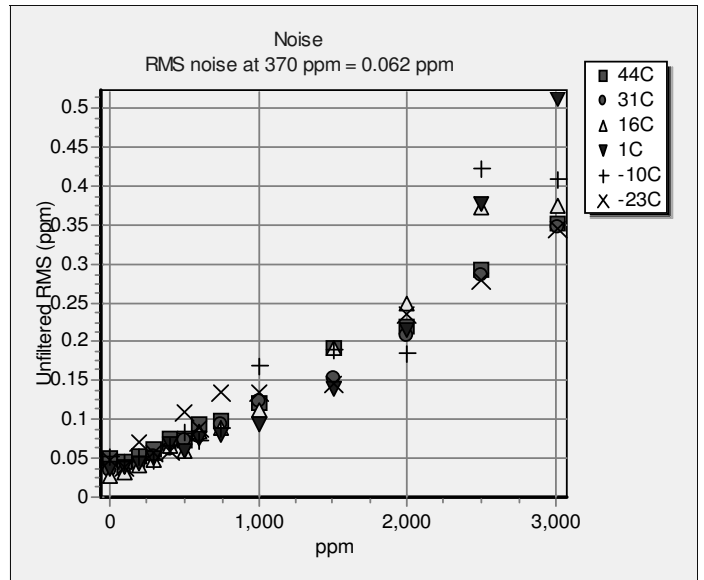
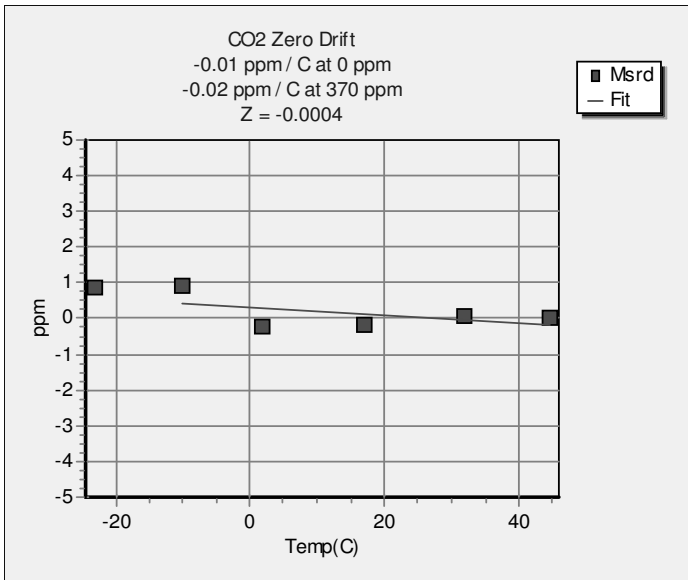
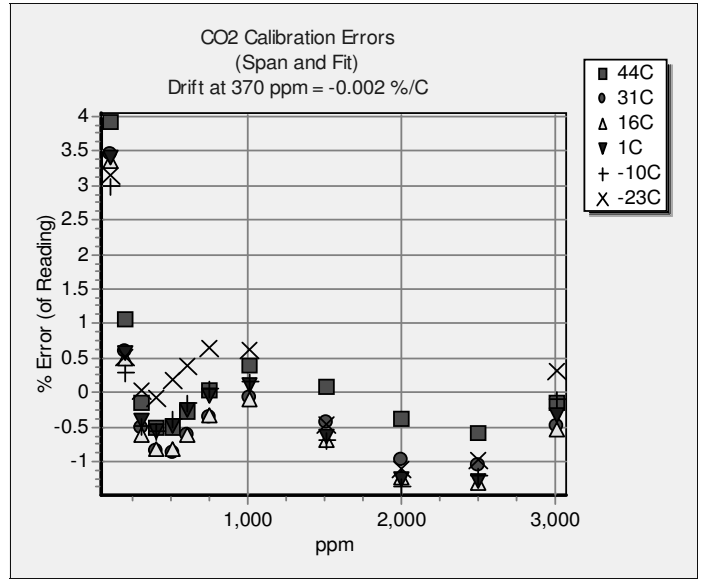
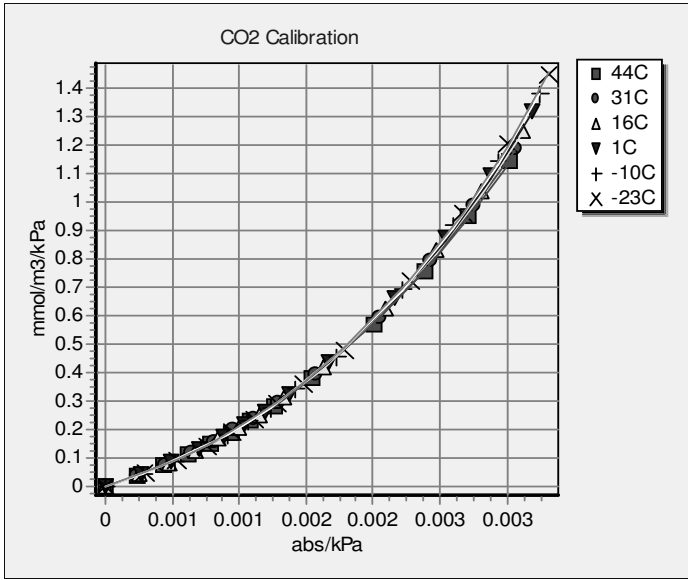
%Error - (Predicted - actual)/actual \* 100



LI-7500A 75H-2668 Calibrated 30 Jan 2017 / Checked 31 Jan 2017  
Calibration file: L:\MICHAEL\CALSV75H\2668\20170130.raw

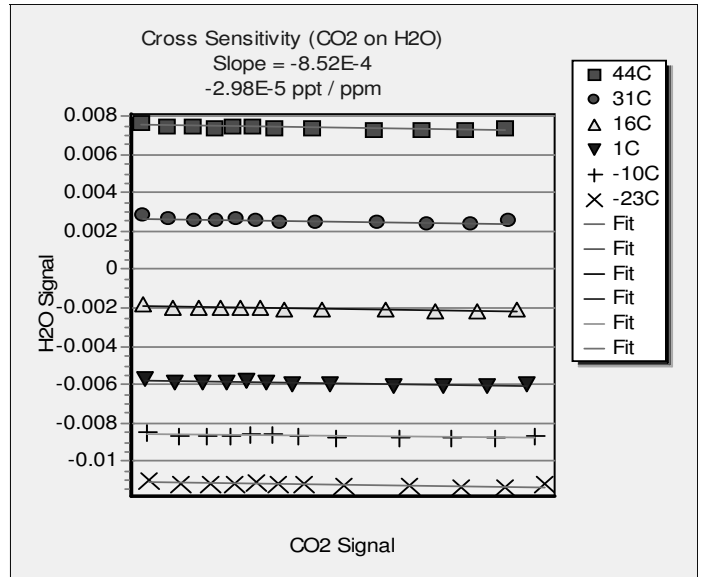
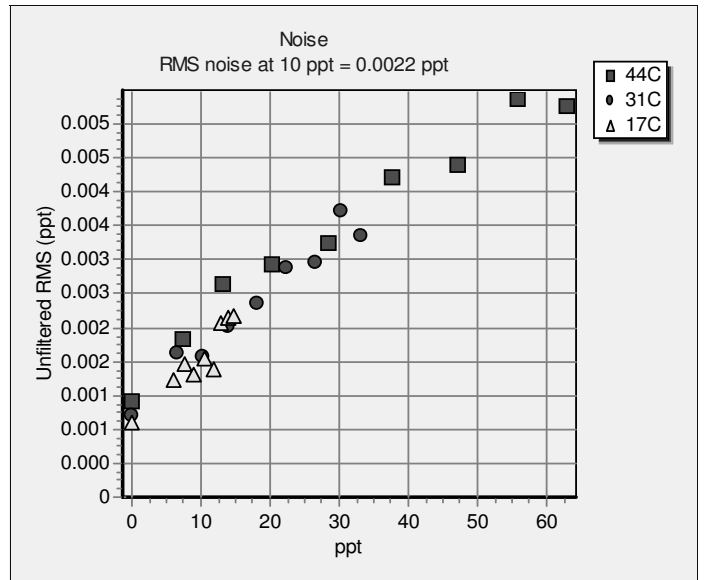
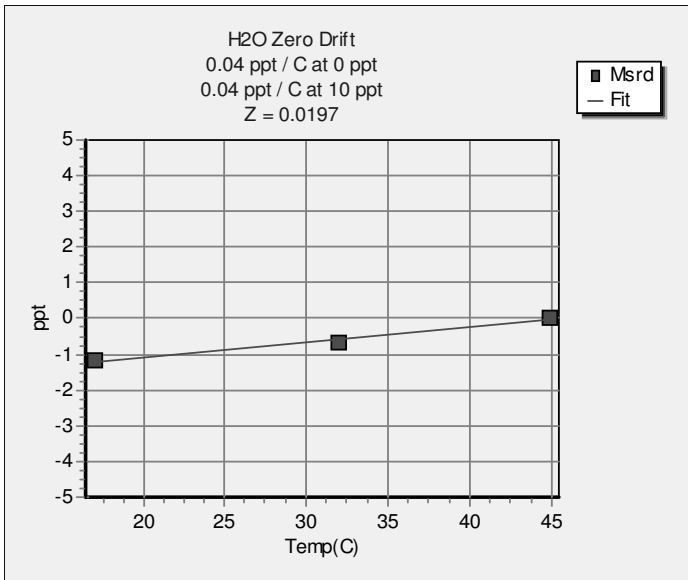
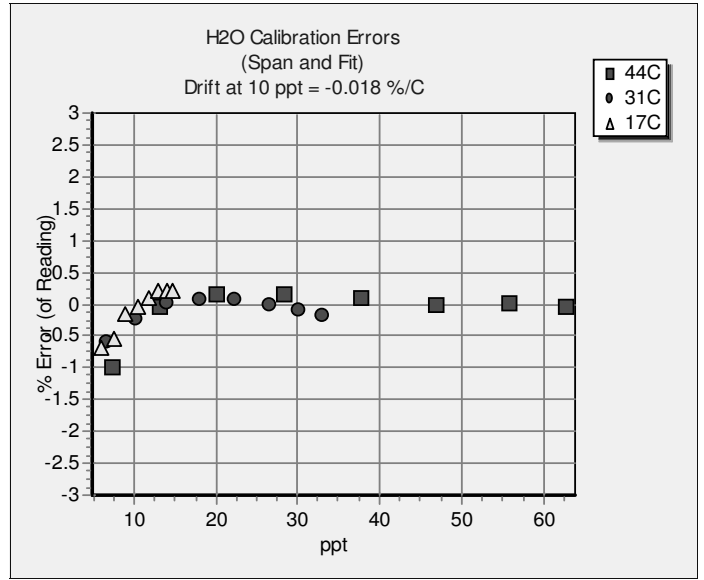
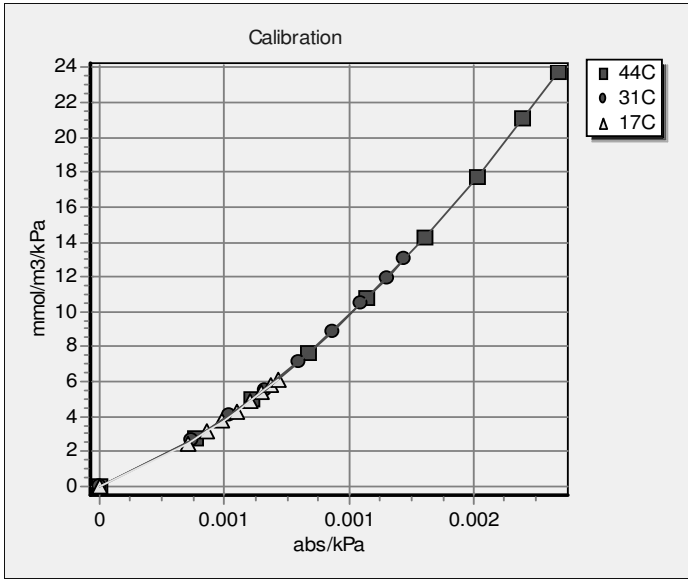
At 10 - Estimated % Error at 10 mmol/mol, based on a curve fit of the %Error values, for each temperature group  
%/C - Estimated span drift at 10 mmol/mol.

CO2 Calibration Plots





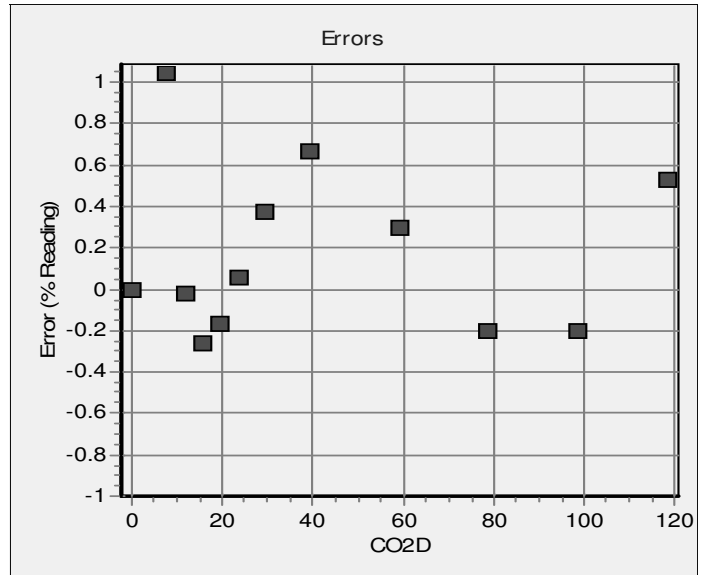
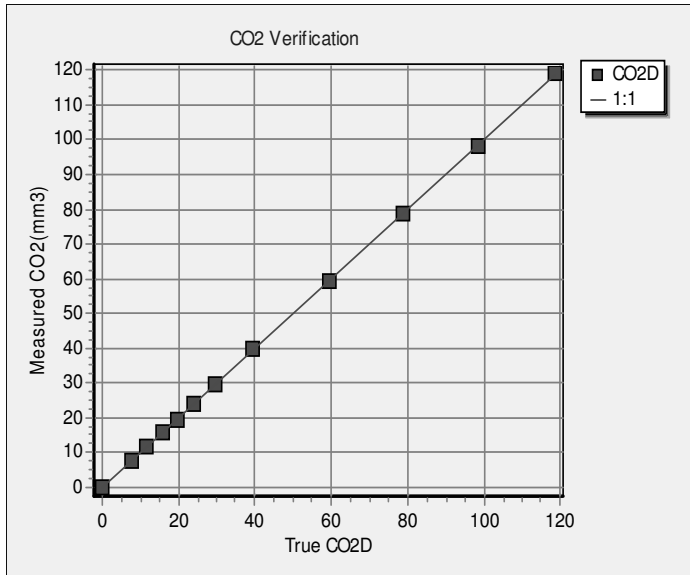
H2O Calibration Plots



CO2 Final Checkout. File = L:\MICHAEL\CALS\75H\2668\20170131.fc

Type	Time	CO2(ppm)	CO2(mm3)	CO2Abs	CO2SD	CO2Slp	H2OAbs	CO2D	CO2DSD	H2OD	H2ODSD	T(vent)(C)	Pa(kPa)	T(C)	Press	Fs(l/m)	Cooler	ChCooler	CO2Aw	CO2Awo	H2OAw	H2OAwo	SS	Diag	
1	CO2/75	07:42:23	0	0.000	0.00002	7.94E-6	-3.59E-5	-0.00006	0.004	1.33E-3	-0.3	4.31E-2	23.10	97.37	25.10	97.36	0.707	2.2228	1.6909	41848.8	39264.1	41515.4	39347.7	100.2	0x00ff
2	CO2/75	07:44:11	197.7	7.764	0.04441	7.20E-6	1.03E-5	-0.00004	7.845	1.40E-3	-0.2	4.94E-2	23.10	97.36	25.17	97.36	0.589	2.2206	1.6863	40010.3	39283.8	41539.5	39367.5	100.2	0x00ff
3	CO2/75	07:45:54	299.3	11.754	0.06304	7.01E-6	1.64E-5	-0.00006	11.751	1.56E-3	-0.3	4.27E-2	23.10	97.37	25.19	97.36	0.587	2.2189	1.6840	39238.7	39293.7	41552.8	39377.3	100.2	0x00ff
4	CO2/75	07:47:50	401.3	15.761	0.07973	6.89E-6	-1.53E-6	-0.00006	15.720	1.72E-3	-0.3	4.60E-2	23.00	97.36	25.14	97.35	0.569	2.2170	1.6814	38550.9	39306.9	41568.5	39390.3	100.2	0x00ff
5	CO2/75	07:49:27	499.6	19.622	0.09430	6.70E-6	-5.49E-6	0.00005	19.589	2.05E-3	0.3	3.84E-2	23.00	97.36	25.16	97.36	0.599	2.2159	1.6787	37938.9	39307.2	41565.7	39390.3	100.1	0x00ff
6	CO2/75	07:51:10	605.8	23.800	0.10873	8.28E-6	9.82E-6	-0.00001	23.813	2.71E-3	-0.1	4.13E-2	23.00	97.36	25.11	97.37	0.596	2.2144	1.6769	37341.0	39316.4	41579.5	39399.2	100.1	0x00ff
7	CO2/75	07:52:54	748.6	29.409	0.12637	7.60E-6	6.17E-6	-0.00006	29.520	2.98E-3	-0.3	4.64E-2	23.00	97.36	25.05	97.35	0.600	2.2131	1.6736	36613.1	39331.8	41599.5	39414.7	100.1	0x00ff
8	CO2/75	07:54:34	1003	39.416	0.15404	6.26E-6	7.23E-6	-0.00004	39.678	2.79E-3	-0.2	5.22E-2	23.00	97.36	25.02	97.37	0.576	2.2119	1.6727	35451.2	39335.4	41604.2	39417.9	100.1	0x00ff
9	CO2/75	07:56:31	1511	59.373	0.19938	6.60E-6	5.95E-6	-0.00004	59.547	4.97E-3	-0.2	4.05E-2	23.00	97.36	25.02	97.36	0.583	2.2108	1.6716	33539.6	39336.7	41608.3	39419.1	100.1	0x00ff
10	CO2/75	07:58:10	2004	78.753	0.23572	7.07E-6	1.50E-5	-0.00005	78.591	5.92E-3	-0.2	5.73E-2	23.00	97.36	24.99	97.36	0.618	2.2103	1.6688	32005.7	39338.4	41612.1	39420.7	100.1	0x00ff
11	CO2/75	07:59:47	2506	98.464	0.26775	7.29E-6	1.94E-5	-0.00004	98.263	8.58E-3	-0.2	4.72E-2	23.00	97.37	25.04	97.36	0.613	2.2095	1.6667	30656.8	39346.2	41621.5	39428.1	100.1	0x00ff
12	CO2/75	08:01:21	3016	118.531	0.29661	8.31E-6	1.34E-5	0.00012	119.156	1.29E-2	0.6	4.85E-2	23.00	97.37	25.03	97.38	0.616	2.2085	1.6651	29438.5	39351.5	41621.5	39432.8	100.1	0x00ff

CO2(ppm) - CO2 concentration (tank value)  
 CO2(mm3) - Actual value of CO2 mole density (mmol/m3)  
 CO2Abs - CO2 absorbance (unfiltered)  
 CO2D - Measured value of CO2 mole density (mmol/m3)  
 CO2DSD - Standard deviation of CO2D (100 samples over 10 seconds).  
 CErr - (CO2D - CO2(mm3))  
 H2OD - Measured value of H2O mole density (mmol/m3)  
 H2ODSD - Standard deviation of H2OD (100 samples over 10 seconds)  
 T(C) - IRGA's temperature measurement  
 Press - IRGA's pressure measurement  
 Pa(kPa) - Atmospheric pressure (measured by Ruska 6200)  
 Press - IRGA's pressure measurement (kPa)  
 F(l/m) - Flow through calibration tube, liters/min.  
 AGC - Automatic gain control value (0-100%)  
 Cooler - Detector cooler voltage  
 Diag - IRGA's diagnostic codes, plus 'C' indicates CO2 stability achieved, and 'H' indicates H2O stability achieved.



H2O Final Checkout. File = L:\MICHAEL\CALS\75H\2668\20170131.fc

Type	Time	H2O(C)	610kPa	610kPaSD	H2O(ppm)	H2O(mm3)	CO2Abs	H2OAbs	H2ODSD	H2O8Sp	CO2D	CO2DSD	H2OD	H2ODSD	TOvent(C)	Pat(kPa)	T(C)	Press	Flt(lm)	Cooler	ChCooler	CO2Aw	CO2Awo	H2OAw	H2OAwo	SS	Diag	
1	H2O/75	08:16:16	-99.00	0.01	5.2E-4	0.00	0.000	-0.00002	7.58E-6	-2.67E-5	0.015	1.35E-3	-0.1	4.07E-2	23.00	97.39	25.11	97.39	0.501	2.2060	1.6564	41974.4	39384.8	41659.6	39468.6	100.1	0x00ff	
2	H2O/75	08:34:10	11.99	17.15	3.7E-3	12.28	482.440	0.00008	0.05903	7.43E-6	-8.71E-6	0.014	1.39E-3	482.2	8.14E-2	23.30	97.42	25.32	97.44	0.226	2.2081	1.6551	41847.7	39620.0	39172.3	39444.8	100.1	0x00ff
3	H2O/75	08:39:35	11.99	17.52	3.7E-3	20.40	801.177	0.00009	0.08589	6.85E-6	-1.03E-5	0.016	1.09E-3	802.7	9.23E-2	23.30	97.42	25.39	97.43	0.226	2.2089	1.6555	41940.3	39357.2	38047.3	39438.8	100.1	0x00ff
4	H2O/75	08:44:48	14.99	17.44	1.7E-3	14.89	584.742	0.00007	0.06835	1.03E-5	-6.42E-5	0.011	1.21E-3	586.8	1.22E-1	23.30	97.42	25.41	97.43	0.226	2.2097	1.6566	41935.1	39349.9	38769.9	39431.9	100.1	0x00ff
5	H2O/75	08:49:53	9.98	17.30	2.1E-3	10.73	421.291	0.00006	0.05330	6.80E-6	-4.57E-5	0.010	1.20E-3	421.7	7.23E-2	23.30	97.42	25.47	97.43	0.226	2.2110	1.6581	41933.2	39347.2	39393.4	39429.6	100.1	0x00ff
6	H2O/75	08:54:35	5.00	17.20	1.5E-3	7.64	299.909	0.00003	0.04075	7.69E-6	-4.75E-5	0.005	1.24E-3	299.0	7.09E-2	23.40	97.43	25.56	97.44	0.226	2.2119	1.6587	41916.5	39329.6	39897.9	39412.7	100.1	0x00ff

H2O(C) - LI-610 Dewpoint generator set point  
 610kPa - Overpressure (kPa) in the LI-610  
 H2O(ppm) - True water concentration (mmol/mol)  
 H2O(mm3) - True water mole density (mmol/m3)  
 H2OAbs - H2O absorbance (unfiltered)  
 H2OD - Measured value of H2O mole density (mmol/m3)  
 H2ODSD - Standard deviation of H2OD (100 samples over 10 seconds)  
 H2O8Sp - (H2OD - H2O(mm3))  
 CO2D - Measured value of CO2 mole density (mmol/m3)  
 T(C) - IRGA's temperature measurement  
 Press - IRGA's pressure measurement  
 Pat(kPa) - Atmospheric pressure (measured by Ruska 6200)  
 Press - IRGA's pressure measurement (kPa)  
 Flt(lm) - Flow through calibration tube, liter/min.  
 AOC - Automatic gain control value (0-100%)  
 Cooler - Detector cooler voltage  
 Diag - IRGA's diagnostic codes, plus 'C' indicates CO2 stability achieved, and 'H' indicates H2O stability achieved.

