

Current Accuracy - Example 1

PCBA 5010-4 Hardware Version 2 : Temperature compensated current control

Table 1: Unit 26 - Firmware version 2.00

Test Current Setting (mA) Unit 28	Measured Current (mA) Channel 1	Measured Current (mA) Channel 2	Measured Current (mA) Channel 3	Measured Current (mA) Channel 4	Specified Error (mA) 0.1% + 2mA
100	99.50	99.75	100.25	99.25	2.1
-100	-100.00	-100.50	-99.00	-99.25	2.1
500	499.50	499.75	500.25	499.25	2.5
-500	-500.25	-501.25	-499.50	-499.50	2.5
2,000	1,998.00	1,999.50	2,000.75	1,999.50	4.0
-2,000	-1,998.25	-2,001.25	-1,999.00	-1,998.25	4.0
4,000	3,996.25	4,000.00	4,001.25	3,999.75	6.0
-4,000	-3,996.25	-4,001.50	-3,998.75	-3,997.00	6.0
6,000	5,996.00	6,000.00	6,002.25	6,000.00	8.0
-6,000	-5,995.75	-6,003.00	-5,998.75	-5,996.75	8.0
8,000	8,000.00	7,999.50	7,999.50	8,000.00	10.0
-8,000	-8,000.75	-8,000.50	-8,000.00	-8,000.75	10.0
10,000	10,009.25	9,999.50	10,003.00	10,008.50	12.0
-10,000	-10,011.25	-9,999.50	-9,999.25	-10,008.50	12.0

- Notes:
- 1) Battery used for testing was lead acid AGM, 12.0V, 50Ahr.
 - 2) Recorded values indicate temperature stablized steady state current for each setting.
 - 3) Measurements performed in 24 degree Celsius ambient air temperture using Tektronix DMM4040 voltmeter accross +/-0.05% 40 milli-ohm constantan shunt.

Current Accuracy - Example 2

PCBA 5010-4 Hardware Version 2 : Temperature compensated current control

Table 2: Unit 28 - Firmware version 2.00

Test Current Setting (mA)	Measured Current (mA) Channel 1	Measured Current (mA) Channel 2	Measured Current (mA) Channel 3	Measured Current (mA) Channel 4	Specified Error (mA) 0.1% + 2mA
100	99.50	99.50	100.25	99.25	2.1
-100	-99.75	-100.00	-100.00	-100.00	2.1
500	499.25	499.75	499.75	499.75	2.5
-500	-499.75	-501.00	-501.00	-501.00	2.5
2,000	1,997.25	1,999.75	2,001.00	1,999.50	4.0
-2,000	-1,998.00	-2,000.50	-2,000.75	-1,999.75	4.0
4,000	3,995.00	4,000.75	4,001.00	3,999.75	6.0
-4,000	-3,996.00	-4,000.00	-4,000.50	-3,998.50	6.0
6,000	5,994.00	6,000.00	6,001.75	6,000.00	8.0
-6,000	-5,995.25	-5,999.25	-6,000.25	-5,998.50	8.0
8,000	7,999.50	7,999.75	8,000.00	8,000.00	10.0
-8,000	-8,000.00	-8,000.00	-8,000.25	-8,000.00	10.0
10,000	10,006.25	9,996.50	9,997.75	10,001.25	12.0
-10,000	-10,007.00	-9,996.75	-9,993.75	-9,999.00	12.0

- Notes:
- 1) Battery used for testing was lead acid AGM, 12.0V, 50Ahr.
 - 2) Recorded values indicate temperature stablized steady state current for each setting.
 - 3) Measurements performed in 24 degree Celsius ambient air temperture using Tektronix DMM4040 voltmeter accross +/-0.05% 40 milli-ohm constantan shunt.

Current Accuracy - Example 3

PCBA 5010-4 Hardware Version 1 : Software compensated current control

Table 3: Unit 8 - Firmware version 1.50

Test Current Setting (mA) Unit 20	Measured Current (mA) Channel 1	Measured Current (mA) Channel 2	Measured Current (mA) Channel 3	Measured Current (mA) Channel 4	Specified Error (mA) 0.1% + 10mA
100	101.25	96.75	98.00	98.75	10.1
-100	-100.25	-101.00	-101.75	-101.00	10.1
500	501.75	497.75	499.00	500.00	10.5
-500	-500.50	-502.25	-503.50	-502.25	10.5
2,000	1,998.50	1,996.75	1,998.00	1,998.00	12.0
-2,000	-1,998.50	-2,001.00	-2,004.00	-2,002.50	12.0
4,000	3,991.00	3,990.00	3,990.75	3,990.75	14.0
-4,000	-3,992.00	-3,993.75	-3,997.50	-3,997.00	14.0
6,000	5,994.00	5,989.25	5,988.50	5,990.00	16.0
-6,000	-5,995.00	-5,992.25	-5,993.50	-5,995.25	16.0
8,000	8,001.75	7,990.50	7,988.25	7,993.75	18.0
-8,000	-8,000.25	-7,990.00	-7,988.50	-7,994.00	18.0
10,000	10,011.75	9,995.25	9,986.25	9,993.00	20.0
-10,000	-10,007.50	-9,988.00	-9,982.50	-9,986.50	20.0

- Notes:
- 1) Battery used for testing was lead acid AGM, 12.0V, 50Ahr.
 - 2) Recorded values indicate temperature stabilized steady state current for each setting.
 - 3) Measurements performed in 24 degree Celsius ambient air temperature using Tektronix DMM4040 voltmeter across +/-0.05% 40 milli-ohm constantan shunt.

Current Accuracy - Example 4

PCBA 5010-4 Hardware Version 1 : Software compensated current control

Table 4: Unit 12 - Firmware version 1.50

Test Current Setting (mA) Unit 20	Measured Current (mA) Channel 1	Measured Current (mA) Channel 2	Measured Current (mA) Channel 3	Measured Current (mA) Channel 4	Specified Error (mA) 0.1% + 10mA
100	100.75	96.75	97.00	100.75	10.1
-100	-102.00	-102.00	-101.00	-101.50	10.1
500	501.75	499.00	499.50	503.75	10.5
-500	503.00	-503.75	-504.50	-504.00	10.5
2,000	1,999.00	1,998.50	2,000.25	2,005.50	12.0
-2,000	2,003.00	-2,005.00	-2,010.00	-2,005.50	12.0
4,000	3,992.25	3,993.75	3,995.50	3,998.50	14.0
-4,000	3,998.00	-4,000.00	-4,006.50	-3,999.00	14.0
6,000	5,996.50	5,993.75	5,994.50	5,997.00	16.0
-6,000	6,000.00	-5,996.25	-6,003.25	-5,996.50	16.0
8,000	8,003.00	7,993.00	7,987.50	7,994.75	18.0
-8,000	8,002.50	-7,991.25	-7,987.50	-7,994.75	18.0
10,000	10,013.25	10,001.00	9,994.75	9,990.75	20.0
-10,000	10,004.00	-9,985.75	-9,980.50	-9,987.75	20.0

- Notes:
- 1) Battery used for testing was lead acid AGM, 12.0V, 50Ahr.
 - 2) Recorded values indicate temperature stabilized steady state current for each setting.
 - 3) Measurements performed in 24 degree Celsius ambient air temperature using Tektronix DMM4040 voltmeter across +/-0.05% 40 milli-ohm constantan shunt.

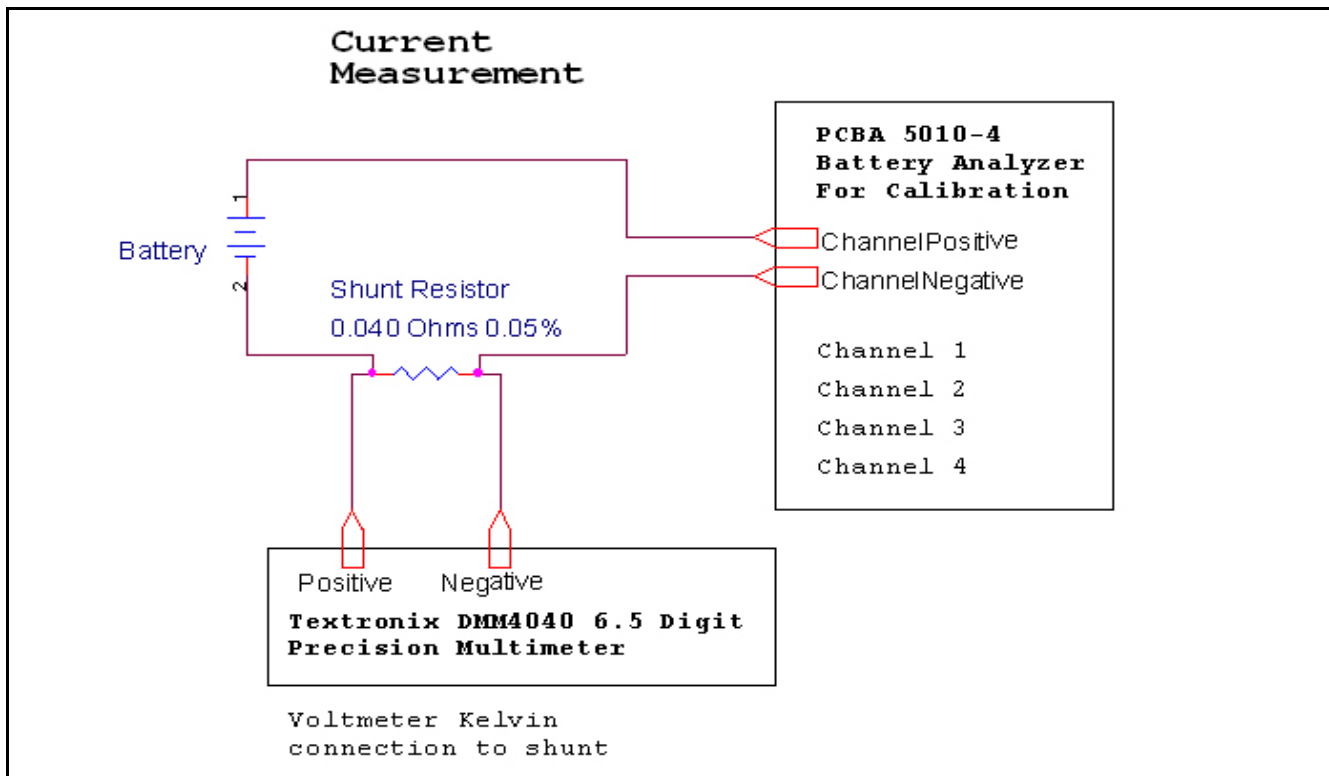


Diagram 1 - Current Accuracy Test Setup

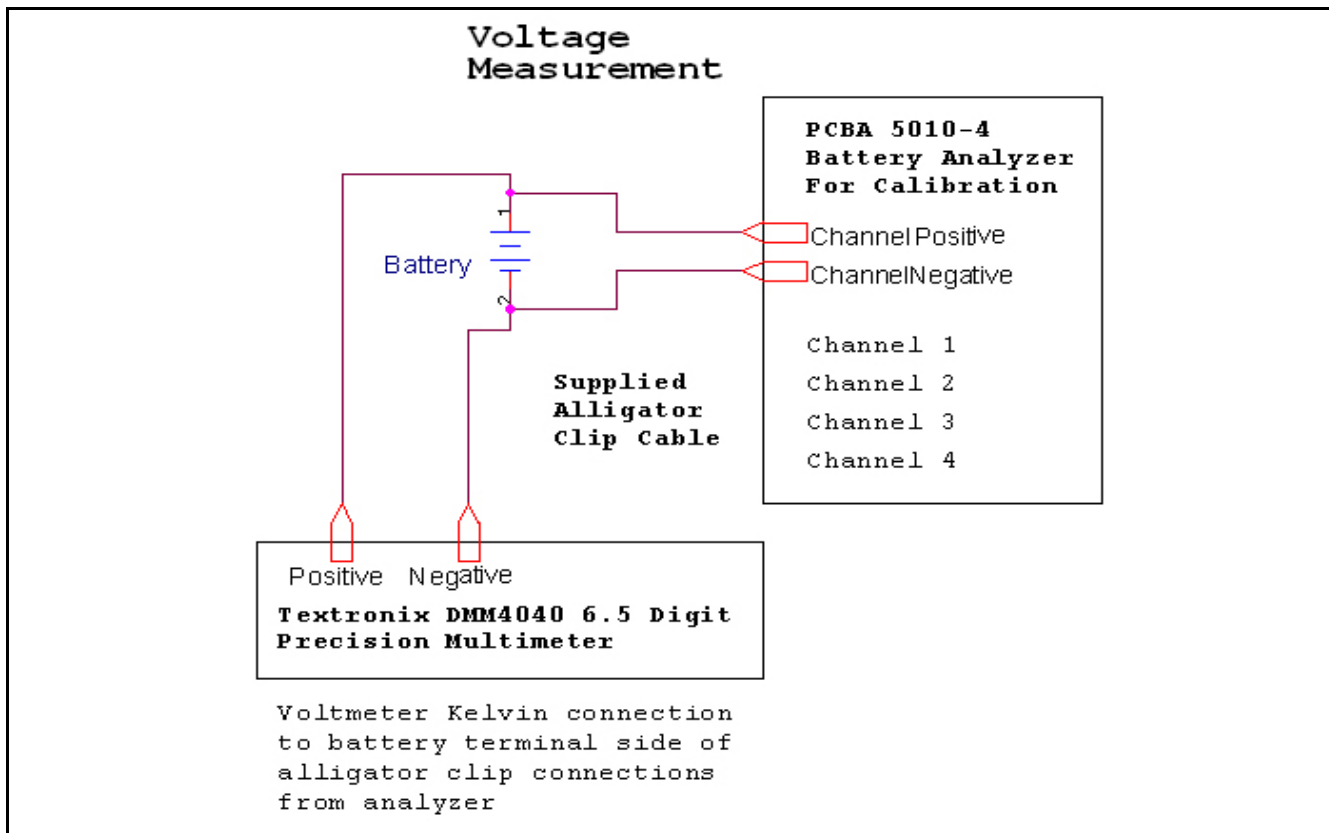


Diagram 2 - Voltage Accuracy Test Setup

Voltage Accuracy - 1.2 Volt Sample

PCBA 5010-4 Hardware Version 2, Firmware Version 2.01

Table 5 - Unit 37 - Specified Error (0.1% + 10mV) = 11mV

Current Setting (mA)	Channel 1			Channel 2			Channel 3			Channel 4		
	PCBA	Meter	Error mV	PCBA	Meter	Error mV	PCBA	Meter	Error mV	PCBA	Meter	Error mV
100	1.240	1.243	-3	1.304	1.306	-2	1.335	1.337	-2	1.356	1.357	-1
-100	1.236	1.237	-1	1.305	1.304	1	1.336	1.336	0	1.356	1.356	0
500	1.247	1.250	-3	1.306	1.308	-2	1.335	1.338	-3	1.355	1.358	-3
-500	1.208	1.210	-2	1.302	1.301	1	1.334	1.334	0	1.354	1.353	1
2,000	1.296	1.300	-4	1.320	1.324	-4	1.345	1.350	-5	1.364	1.367	-3
-2,000	1.220	1.220	0	1.297	1.295	2	1.328	1.325	3	1.349	1.345	4
4,000	1.325	1.330	-5	1.334	1.340	-6	1.354	1.360	-6	1.370	1.375	-5
-4,000	1.250	1.250	0	1.296	1.290	6	1.315	1.310	5	1.335	1.330	5
6,000	1.360	1.365	-5	1.374	1.380	-6	1.387	1.395	-8	1.406	1.410	-4
-6,000	1.271	1.270	1	1.306	1.300	6	1.327	1.320	7	1.334	1.330	4
8,000	1.383	1.385	-2	1.398	1.400	-2	1.409	1.415	-6	1.421	1.420	1
-8,000	1.253	1.250	3	1.305	1.300	5	1.326	1.320	6	1.305	1.300	5
10,000	1.398	1.400	-2	1.417	1.420	-3	1.430	1.435	-5	1.446	1.445	1
-10,000	1.302	1.300	2	1.303	1.300	3	1.324	1.320	4	1.331	1.330	1

- Notes:
- 1) Battery used for testing was Nickel Cadmium 1.
 - 2) Meter measurements taken using Tektronix DM4040 voltmeter.
 - 3) Results similar for hardware version 1, firmware version 1.50

Voltage Accuracy - 3.6 Volt Sample

PCBA 5010-4 Hardware Version 2, Firmware Version 2.01

Table 6 - Unit 37 - Specified Error (0.1% + 10mV) = 14mV

Current Setting (mA)	Channel 1			Channel 2			Channel 3			Channel 4		
	PCBA	Meter	Error mV	PCBA	Meter	Error mV	PCBA	Meter	Error mV	PCBA	Meter	Error mV
100	3.933	3.927	6	3.871	3.867	4	3.817	3.812	5	3.791	3.787	4
-100	3.928	3.920	8	3.869	3.863	6	3.817	3.809	8	3.790	3.784	6
500	3.942	3.937	5	3.878	3.874	4	3.821	3.817	4	3.797	3.792	5
-500	3.929	3.923	6	3.867	3.860	7	3.810	3.802	8	3.785	3.777	8
2,000	3.968	3.965	3	3.896	3.895	1	3.843	3.845	-2	3.819	3.818	1
-2,000	3.898	3.890	8	3.843	3.835	8	3.782	3.770	12	3.766	3.755	11
4,000	4.013	4.010	3	3.890	3.890	0	3.847	3.850	-3	3.852	3.850	2
-4,000	3.858	3.850	8	3.768	3.757	11	3.724	3.710	14	3.705	3.693	12
6,000	3.995	3.990	5	3.972	3.970	2	3.927	3.931	-4	3.912	3.910	2
-6,000	3.782	3.775	7	3.715	3.705	10	3.697	3.685	12	3.683	3.670	13
8,000	4.097	4.090	7	3.925	3.920	5	3.902	3.900	2	3.907	3.900	7
-8,000	3.701	3.695	6	3.625	3.620	5	3.612	3.600	12	3.609	3.600	9
10,000	4.033	4.030	3	4.004	4.000	4	4.001	4.000	1	4.007	4.000	7
-10,000	3.679	3.670	9	3.633	3.630	3	3.608	3.600	8	3.602	3.600	2

- Notes:
- 1) Battery used for testing was Lithium Polymer, Cobalt Oxide, 3.6V, 14Ahr
 - 2) Meter measurements taken using Tektronix DM4040 voltmeter.
 - 3) Results similar for hardware version 1, firmware version 1.50

Voltage Accuracy - 12.0 Volt Sample

PCBA 5010-4 Hardware Version 2, Firmware Version 2.01

Table 7 - Unit 37 - Specified Error (0.1% + 10mV) = 22mV

Current Setting (mA)	Channel 1			Channel 2			Channel 3			Channel 4		
	PCBA	Meter	Error mV	PCBA	Meter	Error mV	PCBA	Meter	Error mV	PCBA	Meter	Error mV
100	12.557	12.540	17	12.475	12.470	5	12.456	12.450	6	12.384	12.380	4
-100	12.334	12.310	24	12.517	12.500	17	12.410	12.398	12	12.421	12.410	11
500	12.588	12.580	8	12.512	12.510	2	12.492	12.490	2	12.436	12.435	1
-500	12.297	12.280	17	12.477	12.460	17	12.373	12.365	8	12.389	12.380	9
2,000	12.698	12.687	11	12.627	12.625	2	12.593	12.595	-2	12.541	12.540	1
-2,000	12.172	12.150	22	12.262	12.240	22	12.264	12.250	14	12.292	12.280	12
4,000	12.846	12.835	11	12.766	12.763	3	12.728	12.730	-2	12.678	12.677	1
-4,000	12.033	12.010	23	12.025	12.000	25	12.119	12.100	19	12.115	12.100	15
6,000	12.971	12.960	11	12.891	12.888	3	12.852	12.852	0	12.801	12.800	1
-6,000	11.914	11.890	24	11.855	11.830	25	11.893	11.870	23	11.931	11.910	21
8,000	13.067	13.050	17	12.996	12.988	8	12.964	12.962	2	12.906	12.900	6
-8,000	11.802	11.780	22	11.736	11.715	21	11.695	11.675	20	11.752	11.735	17
10,000	13.090	13.080	10	13.009	13.000	9	13.016	13.015	1	12.907	12.900	7
-10,000	11.688	11.665	23	11.586	11.570	16	11.525	11.510	15	11.541	11.530	11

- Notes:
- 1) Battery used for testing was lead acid AGM, 12.0V, 50Ahr.
 - 2) Meter measurements taken using Tektronix DM4040 voltmeter.
 - 3) Results similar for hardware version 1, firmware version 1.50

Voltage Accuracy - 24.0 Volt Sample

PCBA 5010-4 Hardware Version 2, Firmware Version 2.01

Table 8 - Unit 37 - Specified Error (0.1% + 10mV) = 34mV

Current Setting (mA)	Channel 1			Channel 2			Channel 3			Channel 4		
	PCBA	Meter	Error mV	PCBA	Meter	Error mV	PCBA	Meter	Error mV	PCBA	Meter	Error mV
100	25.460	25.450	10	25.410	25.420	-10	25.433	25.450	-17	25.400	25.407	-7
-100	24.800	24.770	30	25.300	25.290	10	25.206	25.195	11	25.306	25.300	6
500	25.588	25.600	-12	25.550	25.570	-20	25.568	25.600	-32	25.533	25.550	-17
-500	24.677	24.670	7	25.146	25.140	6	25.094	25.100	-6	25.144	25.140	4
2,000	26.161	26.170	-9	26.140	26.160	-20	26.170	26.200	-30	25.818	25.835	-17
-2,000	24.418	24.395	23	24.844	24.830	14	24.809	24.800	9	24.806	24.790	16
4,000	26.743	26.750	-7	26.730	26.750	-20	26.498	26.530	-32	26.302	26.320	-18
-4,000	24.172	24.150	22	24.517	24.500	17	24.494	24.480	14	24.519	24.500	19
6,000	27.087	27.100	-13	27.183	27.200	-17	26.772	26.800	-28	26.592	26.610	-18
-6,000	23.918	23.900	18	24.223	24.200	23	24.161	24.140	21	24.173	24.150	23
8,000	27.297	27.300	-3	27.343	27.350	-7	27.080	27.100	-20	26.677	26.680	-3
-8,000	23.610	23.600	10	23.615	23.600	15	23.613	23.600	13	23.798	23.780	18

- Notes:
- 1) Battery used for testing was AGM, 12.0V, 50Ahr in series with SLA 12.0V, 14Ahr
 - 2) Meter measurements taken using Tektronix DM4040 voltmeter.
 - 3) Results similar for hardware version 1, firmware version 1.50

Voltage Accuracy - 36.0 Volt Sample

PCBA 5010-4 Hardware Version 2, Firmware Version 2.01

Table 9 - Unit 37 - Specified Error (0.1% + 10mV) = 46mV

Current Setting (mA)	Channel 1			Channel 2			Channel 3			Channel 4		
	PCBA	Meter	Error mV	PCBA	Meter	Error mV	PCBA	Meter	Error mV	PCBA	Meter	Error mV
100	38.040	38.044	-4	38.074	38.100	-26	38.014	38.050	-36	38.177	38.200	-23
-100	37.828	37.835	-7	37.885	37.885	0	37.750	37.760	-10	37.874	37.880	-6
500	38.287	38.318	-31	38.315	38.350	-35	38.180	38.230	-50	38.367	38.400	-33
-500	37.630	37.650	-20	37.643	37.650	-7	37.610	37.640	-30	37.676	37.690	-14
2,000	38.909	38.940	-31	38.767	38.804	-37	38.795	38.840	-45	38.920	38.950	-30
-2,000	37.184	37.190	-6	36.826	36.820	6	36.986	37.000	-14	37.100	37.100	0
4,000	39.265	39.300	-35	39.238	39.275	-37	39.340	39.380	-40	39.320	39.344	-24
-4,000	36.594	36.600	-6	36.255	36.250	5	36.264	36.270	-6	36.436	36.430	6
6,000	39.520	39.556	-36	39.441	39.460	-19	39.525	39.560	-35	39.418	39.430	-12
-6,000	36.000	36.012	-12	35.938	35.930	8	35.900	35.900	0	35.982	35.970	12

- Notes:
- 1) Battery used for testing was SLA, AGM, 12.0V, 50Ahr in series with two SLA 12.0V, 14Ahr
 - 2) Meter measurements taken using Tektronix DM4040 voltmeter.
 - 3) Results similar for hardware version 1, firmware version 1.50