cal equipment

Keithley 2001

Manufacturer	KEITHLEY INSTRUMENTS	Calibration date	July 14 2022
Model Number	Model 2001	Ambient Temperature	23.4 °C
Serial	0629860	Relative Humidity	45.0 %
ID Number	Mike	Pressure	1004.0 hPa
Notes	Test front V/R ports	Test type	Condition as received, before adjustment

Reference standard	Mfg	Model	Options	Serial / Unc	CEID	Calibration date	Due date
MFC	Fluke	5720A	03/HLK	E2E6	XC01	07/08/2022	07/08/2023
Amplifier	Fluke	5725A		5930005	XA01	07/08/2022	07/08/2023
DMM	HP	3458A	001,X02	X	XD3	07/14/2022	10/14/2022
DC STD	xDevs.com	792X[2]	9.9999802 VDC	±1.0 ppm	XD01	Process calibration	Process calibration
STDR	ESI	SR104	10000.0013 KΩ	±0.20 ppm	XR04	02/22/2022	02/22/2024
STDR	Ohm Labs	109-AF	1.000037 GΩ	±9 ppm	TCMR	07/05/2022	07/05/2023
ARB	Keysight	33622A				Source only	Source only

MFC last calibrated	7.0 days ago	MFC since DCV ZERO	1.0 days ago
MFC since WBFLAT	552.0 days ago	MFC since WBGAIN	158.0 days ago
MFC Confidence level	**24h 95% REL**	MFC Calibrate date	2022-07-08 00:00:00
MFC Calibrate date Zero	2022-07-14 00:00:00	Calibrate date WB Flatness	2021-10-09 00:00:00
Calibrate date WB Gain	2022-02-07 00:00:00	CAL CONST 6.5V reference voltage	6.95748135065
CAL CONST 13V reference voltage	13.8553055727	CAL CONST 22V range positive zero	398.17821
CAL CONST 22V range negative zero	398.17767	CAL CONST DAC Linearity	0.0
CAL CONST 10KOHM true output resistance	9999.820065	CAL CONST 10KOHM standard resistance	9998.7587624
CAL CONST, Zero calibration temperature	24.0	CAL CONST, All calibration temp	24.0
Booster type	VB5725,IB5725	Current output posts	AUX
Calibrate date 5725A AMP	1988-10-01 00:00:00	Calibrated days ago	2013-12-06 00:00:00

CAL CONST, Amp ACAL temperature	23.0	CAL CONST, Amp CalCheck temperature	23.0

This note is test MFC dummy text block for further use. Calibrator was warmed up >365 days. DMM was warmed up at least 24 hours.

Meter Info	KEITHLEY INSTRUMENTS INC.,MODEL 2001,0629860,B10 /A02	Test date start	14 July 2022 14:07
Test specification interval	**24 hour DUT spec**	Line frequency	110V 60 Hz
Next calibration date	03/19/02	Last calibration date	03/19/01
DUT temperature to cal	0.1	Last calibration temperature	+23.8

Service information

Last calibration temperature
+23.8
All CAL values
9.994200E-01,-2.615209E-04,1.000028E+01,-2.886275E-04,1.000056E+00,-6.488010E-06,1.000624E+01,5.254278E-05,9.998189E+01,4.966413E+02,5.588051E-03,5.080047E-03,3.556033E-03,6.604061E-03,5.588051E-03,1.380000E+02,1.140000E+02,2.432947E-04,1.000313E+00,1.000316E+00,1.000361E+00,1.000202E+00,1.028731E-01,1.000711E+00,1.200000E+02,1.390000E+02,1.385000E+02,1.160000E+02,1.000000E+00,5.000000E-01,2.000000E+00,1.411056E+00,-4.717220E-05,1.763604E+00,-3.311094E-06,-7.054145E-01,1.981577E-05,1.763378E+00,-8.331487E-07,7.053248E-01,1.036494E-03,1.412358E+00,-1.738336E-05,1.412210E+00,-1.737424E-05,1.409961E+00,-1.734657E-05,1.395577E+00,-1.716960E-05,1.409930E+00,-1.734618E-05,1.517331E+00,-9.868634E-03,1.430408E+00,-1.029610E-03,1.787791E+00,-1.015351E-04,1.967744E+00,-1.351222E-05,2.477408E+00,-5.633017E-06,2.272255E+00,-4.364244E-06,2.491312E+00,-4.687154E-06,3.937018E+00,2.314618E-02,1.574748E+00,2.313838E-03,1.517331E+00,3.783760E-05,1.430408E+00,3.567001E-05,1.787791E+00,3.593600E-06,1.967744E+00,3.955321E-06,2.477408E+00,4.979784E-06,7.054153E-01,9.999982E-01,15612,8745,12157,29498,29498,29495,29498,1351,6453,9.299595E-03,9.864712E-04,9.864712E-04,8.962568E-05,7.118748E-06,7.761471E-07,7.079016E-08,4.479543E-09,4.479543E-09
Reference
Direct MFC test, verification per-cal
DUT Condition
Test before calibration

Test procedure : $Id: k2001.py | Rev 861 | 2018/08/28 10:57:10 tin_fpga $

Source procedure : $Id: f5720b.py | Rev 2391 | 2022/07/13 12:16:28 tin_sl $

Main DC Voltage ranges performance test.
Checks zero offset and +/-FS calibration on all ranges
The following test for the offset voltage specification using MFC 0V source in 4-wire ext sense mode as reference.
DCV gain range points verify gain of the DC voltage function, using uncorrected 24-hour MFC output. DC voltage offset of DUT is nulled before FS tests.

Test Description	Expected Value	Measured Value	Measurement Uncertainty	Lower Limit	Upper Limit	Deviation	DUT Spec	Test Status
Short 0 mVDC	0.0000000E+00	**-1.76 µV**	0.50 µV	-1.700 µV	1.700 µV	N/A	1.20 µV	FAIL

Short 0.0 VDC	0.0000000E+00	**-1.60 µV**	0.50 µV	-4.500 µV	4.500 µV	N/A	4.00 µV	PASS
Short 00.0 VDC	0.0000000E+00	**-41.00 µV**	0.50 µV	-80.500 µV	80.500 µV	N/A	80.00 µV	PASS
Short 000.0 VDC	0.0000000E+00	**0.00 µV**	0.50 µV	-600.500 µV	600.500 µV	N/A	0.60 mV	PASS
Short 0000.0 VDC	0.0000000E+00	**-300.00 µV**	0.50 µV	-6000.500 µV	6000.500 µV	N/A	6.00 mV	PASS

DCV Test	0.1V-1000V	DUT	Source unc.	Low Limit	Hi limit	Measured	24h spec	Result
0.2 VDC (0.20 Range)	0.2000000	**0.20000234**	7.27 ppm	0.19999535	0.20000465	11.725 ppm	16.00 ppm	PASS 50.39 %
-0.2 VDC (0.20 Range)	-0.2000000	**-0.20000236**	7.27 ppm	-0.20000465	-0.19999535	11.800 ppm	16.00 ppm	PASS 50.71 %
0.1 VDC (2.00 Range)	0.1000000	**0.10000162**	7.27 ppm	0.099998373	0.10000163	16.167 ppm	9.00 ppm	PASS 99.36 %
1.0 VDC (2.00 Range)	1.0000000	**1.0000132**	3.86 ppm	0.99998714	1.0000129	13.183 ppm	9.00 ppm	FAIL 102.51 %
2.0 VDC (2.00 Range)	2.0000000	**2.000025**	3.86 ppm	1.9999743	2.0000257	12.492 ppm	9.00 ppm	PASS 97.14 %
-0.1 VDC (2.00 Range)	-0.1000000	**-0.10000133**	7.27 ppm	-0.10000163	-0.099998373	13.333 ppm	9.00 ppm	PASS 81.95 %
-1.0 VDC (2.00 Range)	-1.0000000	**-1.0000131**	3.86 ppm	-1.0000129	-0.99998714	13.067 ppm	9.00 ppm	FAIL 101.61 %
-2.0 VDC (2.00 Range)	-2.0000000	**-2.0000254**	3.86 ppm	-2.0000257	-1.9999743	12.675 ppm	9.00 ppm	PASS 98.56 %
1.0 VDC (20.00 Range)	1.0000000	**0.99997783**	3.86 ppm	0.99998514	1.0000149	-22.167 ppm	11.00 ppm	FAIL 149.17 %
10.0 VDC (20.00 Range)	10.0000000	**10.000091**	2.77 ppm	9.9998623	10.000138	9.133 ppm	11.00 ppm	PASS 66.33 %
20.0 VDC (20.00 Range)	20.0000000	**20.000212**	2.73 ppm	19.999725	20.000275	10.592 ppm	11.00 ppm	PASS 77.14 %
-1.0 VDC (20.00 Range)	-1.0000000	**-1.000047**	3.86 ppm	-1.0000149	-0.99998514	47.000 ppm	11.00 ppm	FAIL 316.29 %
-10.0 VDC (20.00 Range)	-10.0000000	**-10.000165**	2.77 ppm	-10.000138	-9.9998623	16.550 ppm	11.00 ppm	FAIL 120.19 %
-20.0 VDC (20.00 Range)	-20.0000000	**-20.000274**	2.73 ppm	-20.000275	-19.999725	13.683 ppm	11.00 ppm	PASS 99.66 %
10 VDC (200.00 Range)	10.0000000	**10.000142**	2.77 ppm	9.9998123	10.000188	14.167 ppm	16.00 ppm	PASS 75.48 %
100 VDC (200.00 Range)	100.0000000	**100.00149**	3.73 ppm	99.998027	100.00197	14.900 ppm	16.00 ppm	PASS 75.52 %
200 VDC (200.00 Range)	200.0000000	**200.00319**	3.73 ppm	199.99605	200.00395	15.942 ppm	16.00 ppm	PASS 80.80 %
-10 VDC (200.00 Range)	-10.0000000	**-10.000105**	2.77 ppm	-10.000188	-9.9998123	10.500 ppm	16.00 ppm	PASS 55.94 %
-100 VDC (200.00 Range)	-100.0000000	**-100.00138**	3.73 ppm	-100.00197	-99.998027	13.817 ppm	16.00 ppm	PASS 70.03 %
-200 VDC (200.00 Range)	-200.0000000	**-200.00301**	3.73 ppm	-200.00395	-199.99605	15.058 ppm	16.00 ppm	PASS 76.32 %
100 VDC (1000.00 Range)	100.0000000	**100.00113**	3.73 ppm	99.997327	100.00267	11.333 ppm	23.00 ppm	PASS 42.40 %
200 VDC (1000.00 Range)	200.0000000	**200.0027**	3.73 ppm	199.99465	200.00535	13.500 ppm	23.00 ppm	PASS 50.51 %
1000 VDC (1000.00 Range)	1000.0000000	**1000.0341**	5.45 ppm	999.96905	1000.0309	34.150 ppm	23.00 ppm	FAIL 110.34 %
-100 VDC (1000.00 Range)	-100.0000000	**-100.00205**	3.73 ppm	-100.00267	-99.997327	20.500 ppm	23.00 ppm	PASS 76.69 %
-200 VDC (1000.00 Range)	-200.0000000	**-200.0033**	3.73 ppm	-200.00535	-199.99465	16.500 ppm	23.00 ppm	PASS 61.73 %
-1000 VDC (1000.00 Range)	-1000.0000000	**-1000.0329**	5.45 ppm	-1000.0309	-999.96905	32.867 ppm	23.00 ppm	FAIL 126.65 %

4W test procedure for all test points that verify Gain of the OHMF function. 4-wire kelvin connection is used between DMM and MFC. 1GΩ resistance range is tested using the external standard, as MFC unable to provide this range value.

OHM Test	1 Ohm to 1 GOhm	DUT	Source unc.	Low Limit	Hi limit	Measured	24h spec	Result
1 Ω	0.9997689	**0.99981819**	85.0 ppm	9.9964793E-01	9.9988987E-01	49.299 ppm	36.0 ppm	PASS 40.74 %

1.9 Ω	1.8997939	**1.8998807**	85.0 ppm	1.8995640E+00	1.9000238E+00	45.683 ppm	36.0 ppm	PASS 37.75 %
10 Ω	10.000591	**10.000883**	23.0 ppm	1.0000001E+01	1.0001181E+01	29.223 ppm	36.0 ppm	PASS 49.53 %
19 Ω	19.000192	**19.000745**	23.0 ppm	1.8999071E+01	1.9001313E+01	29.102 ppm	36.0 ppm	PASS 49.32 %
100 Ω	99.99593	**99.997762**	10.0 ppm	9.9991830E+01	1.0000003E+02	18.317 ppm	31.0 ppm	PASS 44.68 %
190 Ω	189.99194	**189.99532**	10.0 ppm	1.8998415E+02	1.8999973E+02	17.790 ppm	31.0 ppm	PASS 43.39 %
1.0 kΩ	1000.021	**1000.0429**	8.0 ppm	9.9998700E+02	1.0000550E+03	21.933 ppm	26.0 ppm	PASS 64.51 %
1.9 kΩ	1899.88	**1899.9149**	8.0 ppm	1.8998154E+03	1.8999446E+03	18.378 ppm	26.0 ppm	PASS 54.05 %
10 kΩ	9999.8	**9999.9702**	8.0 ppm	9.9994900E+03	1.0000110E+04	17.017 ppm	23.0 ppm	PASS 54.89 %
19 kΩ	18999.277	**18999.604**	9.0 ppm	1.8998669E+04	1.8999885E+04	17.220 ppm	23.0 ppm	PASS 53.81 %
100 kΩ	99994.76	**99951.075**	9.0 ppm	9.9991410E+04	9.9998110E+04	-436.873 ppm	24.5 ppm	FAIL 1304.10 %
190 kΩ	189989.18	**189905.74**	9.0 ppm	1.8998282E+05	1.8999554E+05	-439.200 ppm	24.5 ppm	FAIL 1311.05 %
1.0 MΩ	999983.7	**999888.62**	16.0 ppm	9.9991320E+05	1.0000542E+06	-95.085 ppm	54.5 ppm	FAIL 134.87 %
1.9 MΩ	1899982.1	**1899791.5**	17.0 ppm	1.8998463E+06	1.9001179E+06	-100.336 ppm	54.5 ppm	FAIL 140.33 %
10 MΩ	9999118	**9997694.9**	33.0 ppm	9.9971432E+06	1.0001093E+07	-142.325 ppm	164.5 ppm	PASS 72.06 %
19 MΩ	18998781	**18995236**	43.0 ppm	1.8994839E+07	1.9002723E+07	-186.571 ppm	164.5 ppm	PASS 89.91 %
100 MΩ	1.0000499E+08	**99961395**	100.0 ppm	9.9684974E+07	1.0032501E+08	-435.928 ppm	3100.0 ppm	PASS 13.62 %

4W and 2W Zero test procedure for all test points that verify Zero offset of the OHMF function. 4-wire kelvin connection is used between DMM and MFC. 1GΩ resistance range is tested using the external standard, as MFC unable to provide this range value.

OHM ZERO 4W	DUT	Source unc.	Low Limit	Hi limit	Measured	24h spec	Result
20R Ω	**Range 0.0000233 Ω**	1.400e-04 Ω	-0.00014	0.00014	N/A	3.6000e-05 Ω	PASS
200R Ω	**Range 0.0000633 Ω**	1.400e-03 Ω	-0.0014	0.0014	N/A	2.3000e-05 Ω	PASS
2K Ω	**Range 0.0000333 Ω**	8.000e-03 Ω	-0.008	0.008	N/A	2.3000e-05 Ω	PASS
20K Ω	**Range 0.0000000 Ω**	8.000e-02 Ω	-0.08	0.08	N/A	2.3000e-05 Ω	PASS
200K Ω	**Range 0.0083333 Ω**	9.000e-01 Ω	-0.9	0.9	N/A	2.3000e-05 Ω	PASS
OHM ZERO 2W	**DUT**	**Source unc.**	**Low Limit**	**Hi limit**	**Measured**	**24h spec**	**Result**
20R Ω	**Range 0.3727922 Ω**	6.140e-03 Ω	-0.00614	0.00614	N/A	3.6000e-05 Ω	FAIL
200R Ω	**Range 0.3438083 Ω**	7.400e-03 Ω	-0.0074	0.0074	N/A	2.3000e-05 Ω	FAIL
2K Ω	**Range 0.3313167 Ω**	1.400e-02 Ω	-0.014	0.014	N/A	2.3000e-05 Ω	FAIL
20K Ω	**Range 0.3043333 Ω**	8.000e-02 Ω	-0.08	0.08	N/A	2.3000e-05 Ω	FAIL
200K Ω	**Range 0.0950000 Ω**	9.000e-01 Ω	-0.9	0.9	N/A	2.3000e-05 Ω	PASS
2M Ω	**Range -1.8312500 Ω**	9.000e+00 Ω	-9	9	N/A	2.3000e-05 Ω	PASS
20M Ω	**Range -23.1875000 Ω**	9.000e+01 Ω	-90	90	N/A	2.3000e-05 Ω	PASS
200M Ω	**Range -748.7500000 Ω**	2.000e+04 Ω	-20000.0	20000.0	N/A	2.3000e-05 Ω	PASS
1G Ω	**Range -2012.5000000 Ω**	1.000e+05 Ω	-100000	100000	N/A	2.3000e-05 Ω	PASS

Procedure for all test points in the AC performance verification for ANAlog mode. AC-measurements does not suffer from TEMF offsets, test connection can be made using shielded leads terminated with dual banana plugs. MFC main AC output is used as reference source

ACV ANA Test	1V-10V	DUT	w/Guardband	Low Limit	Hi limit	Units	Measured	24h spec	Result
1.0 VAC @ 50.0 kHz	1.0	**0.9996223**	0.0129 %	0.99672091	1.00327909	VAC	-0.0378 %	0.3150 %	PASS 11.52 %
1.0 VAC @ 1.0 MHz	1.0	**0.9987348**	0.2500 %	0.989	1.011	VAC	-0.1265 %	0.8500 %	PASS 11.50 %
10 VAC @ 100 Hz	10	**9.995333**	73.18	9.9947682	10.0052318	VAC	-466.700 ppm	450.0 ppm	PASS 89.20 %
10 VAC @ 400 Hz	10	**9.996756**	73.18	9.9947682	10.0052318	VAC	-324.400 ppm	450.0 ppm	PASS 62.01 %
10 VAC @ 1.0 kHz	10	**9.996655**	73.18	9.9947682	10.0052318	VAC	-334.500 ppm	450.0 ppm	PASS 63.94 %
10 VAC @ 50.0 kHz	10	**10.00092**	0.0129 %	9.9672091	10.0327909	VAC	0.0092 %	0.3150 %	PASS 2.81 %
10 VAC @ 1.0 MHz	10	**10.128196**	0.3000 %	9.76	10.24	VAC	1.2820 %	2.1000 %	PASS 53.42 %

Procedure for all test points in the AC performance verification for SYNCronous mode. This is highest AC accuracy test. AC-measurements does not suffer from TEMF offsets, test connection can be made using shielded leads terminated with dual banana plugs. MFC main AC output is used as reference source

ACV SYNC Test	DUT	w/Guardband	Low Limit	Hi limit	Measured	24h spec	Result, % spec
0.02 V AC+DC @ 10 Hz	**0.019998**	0.0312 %	0.019907	0.020093	-0.0100 %	0.4325 %	PASS 2.16 %
0.02 V AC+DC @ 20 Hz	**0.019999**	0.0312 %	0.019907	0.020093	-0.0050 %	0.4325 %	PASS 1.08 %
0.02 V AC+DC @ 50 Hz	**0.020001**	0.0312 %	0.019907	0.020093	0.0050 %	0.4325 %	PASS 1.08 %
0.02 V AC+DC @ 60 Hz	**0.020002**	0.0312 %	0.019907	0.020093	0.0100 %	0.4325 %	PASS 2.16 %
0.02 V AC+DC @ 100 Hz	**0.02**	0.0312 %	0.019907	0.020093	0.0000 %	0.4325 %	PASS 0.00 %
0.02 V AC+DC @ 1.0 kHz	**0.019997**	0.0312 %	0.019907	0.020093	-0.0150 %	0.4325 %	PASS 3.23 %
0.02 V AC+DC @ 6.25 kHz	**0.02**	0.0312 %	0.019907	0.020093	0.0000 %	0.4325 %	PASS 0.00 %
0.02 V AC+DC @ 10.0 kHz	**0.020001**	0.0312 %	0.019907	0.020093	0.0050 %	0.4325 %	PASS 1.08 %
0.02 V AC+DC @ 20.0 kHz	**0.020002**	0.0312 %	0.019907	0.020093	0.0100 %	0.4325 %	PASS 2.16 %
0.02 V AC+DC @ 50.0 kHz	**0.020002**	0.0447 %	0.019905	0.020095	0.0100 %	0.4325 %	PASS 2.10 %
0.02 V AC+DC @ 100.0 kHz	**0.019984**	0.0773 %	0.019828	0.020172	-0.0800 %	0.7825 %	PASS 9.30 %
0.02 V AC+DC @ 200.0 kHz	**0.019948**	0.1500 %	0.019800	0.020200	-0.2600 %	0.8500 %	PASS 26.00 %
0.02 V AC+DC @ 300.0 kHz	**0.019941**	0.1500 %	0.019800	0.020200	-0.2950 %	0.8500 %	PASS 29.50 %
0.02 V AC+DC @ 500.0 kHz	**0.019966**	0.2500 %	0.019530	0.020470	-0.1700 %	2.1000 %	PASS 7.23 %
0.02 V AC+DC @ 1.0 MHz	**0.020205**	0.4000 %	0.019500	0.020500	1.0250 %	2.1000 %	PASS 41.00 %
0.2 V AC+DC @ 10 Hz	**0.199966**	0.0121 %	0.199866	0.200134	-0.0170 %	0.0550 %	PASS 25.32 %
0.2 V AC+DC @ 20 Hz	**0.199982**	0.0121 %	0.199866	0.200134	-0.0090 %	0.0550 %	PASS 13.41 %
0.2 V AC+DC @ 50 Hz	**0.199986**	0.0121 %	0.199886	0.200114	-0.0070 %	0.0450 %	PASS 12.25 %
0.2 V AC+DC @ 60 Hz	**0.199985**	0.0121 %	0.199886	0.200114	-0.0075 %	0.0450 %	PASS 13.13 %
0.2 V AC+DC @ 100 Hz	**0.199983**	0.0121 %	0.199886	0.200114	-0.0085 %	0.0450 %	PASS 14.88 %
0.2 V AC+DC @ 1.0 kHz	**0.199992**	0.0121 %	0.199886	0.200114	-0.0040 %	0.0450 %	PASS 7.00 %
0.2 V AC+DC @ 6.25 kHz	**0.2**	0.0121 %	0.199886	0.200114	0.0000 %	0.0450 %	PASS 0.00 %
0.2 V AC+DC @ 10.0 kHz	**0.200002**	0.0121 %	0.199886	0.200114	0.0010 %	0.0450 %	PASS 1.75 %
0.2 V AC+DC @ 20.0 kHz	**0.200002**	0.0121 %	0.199886	0.200114	0.0010 %	0.0450 %	PASS 1.75 %

0.2 V AC+DC @ 50.0 kHz	**0.199961**	0.0256 %	0.199319	0.200681	-0.0195 %	0.3150 %	PASS 5.72 %
0.2 V AC+DC @ 100.0 kHz	**0.199738**	0.0591 %	0.198332	0.201668	-0.1310 %	0.7750 %	PASS 15.71 %
0.2 V AC+DC @ 200.0 kHz	**0.199087**	0.0964 %	0.198107	0.201893	-0.4565 %	0.8500 %	PASS 48.24 %
0.2 V AC+DC @ 300.0 kHz	**0.198602**	0.0964 %	0.198107	0.201893	-0.6990 %	0.8500 %	PASS 73.86 %
0.2 V AC+DC @ 500.0 kHz	**0.198163**	0.1500 %	0.198000	0.202000	-0.9185 %	0.8500 %	PASS 91.85 %
0.2 V AC+DC @ 1.0 MHz	**0.197898**	0.3000 %	0.197700	0.202300	-1.0510 %	0.8500 %	PASS 91.39 %
2.0 V AC+DC @ 10 Hz	**2.00008**	0.0050 %	1.998801	2.001199	0.0040 %	0.0550 %	PASS 6.67 %
2.0 V AC+DC @ 20 Hz	**2.00024**	0.0050 %	1.998801	2.001199	0.0120 %	0.0550 %	PASS 20.02 %
2.0 V AC+DC @ 50 Hz	**2.00032**	0.0050 %	1.999001	2.000999	0.0160 %	0.0450 %	PASS 32.03 %
2.0 V AC+DC @ 60 Hz	**2.00029**	0.0050 %	1.999001	2.000999	0.0145 %	0.0450 %	PASS 29.03 %
2.0 V AC+DC @ 100 Hz	**2.00031**	0.0050 %	1.999001	2.000999	0.0155 %	0.0450 %	PASS 31.03 %
2.0 V AC+DC @ 1.0 kHz	**2.00031**	0.0050 %	1.999001	2.000999	0.0155 %	0.0450 %	PASS 31.03 %
2.0 V AC+DC @ 6.25 kHz	**2.00036**	0.0050 %	1.998901	2.001099	0.0180 %	0.0500 %	PASS 32.75 %
2.0 V AC+DC @ 10.0 kHz	**2.00038**	0.0050 %	1.998901	2.001099	0.0190 %	0.0500 %	PASS 34.57 %
2.0 V AC+DC @ 20.0 kHz	**2.00035**	0.0050 %	1.998901	2.001099	0.0175 %	0.0500 %	PASS 31.84 %
2.0 V AC+DC @ 50.0 kHz	**1.99983**	0.0085 %	1.993529	2.006471	-0.0085 %	0.3150 %	PASS 2.63 %
2.0 V AC+DC @ 100.0 kHz	**1.99766**	0.0138 %	1.984224	2.015776	-0.1170 %	0.7750 %	PASS 14.83 %
2.0 V AC+DC @ 200.0 kHz	**1.99169**	0.0425 %	1.982149	2.017851	-0.4155 %	0.8500 %	PASS 46.55 %
2.0 V AC+DC @ 300.0 kHz	**1.98775**	0.0425 %	1.982149	2.017851	-0.6125 %	0.8500 %	PASS 68.62 %
2.0 V AC+DC @ 500.0 kHz	**1.98699**	0.1100 %	1.955800	2.044200	-0.6505 %	2.1000 %	PASS 29.43 %
2.0 V AC+DC @ 1.0 MHz	**1.9918**	0.1800 %	1.954400	2.045600	-0.4100 %	2.1000 %	PASS 17.98 %
20 V AC+DC @ 10 Hz	**19.9981**	0.0048 %	19.986036	20.013964	-0.0095 %	0.0650 %	PASS 13.61 %
20 V AC+DC @ 20 Hz	**19.9991**	0.0048 %	19.986036	20.013964	-0.0045 %	0.0650 %	PASS 6.45 %
20 V AC+DC @ 50 Hz	**20**	0.0048 %	19.988036	20.011964	0.0000 %	0.0550 %	PASS 0.00 %
20 V AC+DC @ 60 Hz	**20.0001**	0.0048 %	19.988036	20.011964	0.0005 %	0.0550 %	PASS 0.84 %
20 V AC+DC @ 100 Hz	**19.9996**	0.0048 %	19.988036	20.011964	-0.0020 %	0.0550 %	PASS 3.34 %
20 V AC+DC @ 1.0 kHz	**19.9982**	0.0048 %	19.988036	20.011964	-0.0090 %	0.0550 %	PASS 15.05 %
20 V AC+DC @ 6.25 kHz	**19.9966**	0.0048 %	19.980036	20.019964	-0.0170 %	0.0950 %	PASS 17.03 %
20 V AC+DC @ 10.0 kHz	**19.9977**	0.0048 %	19.980036	20.019964	-0.0115 %	0.0950 %	PASS 11.52 %
20 V AC+DC @ 20.0 kHz	**20.001**	0.0048 %	19.980036	20.019964	0.0050 %	0.0950 %	PASS 5.01 %
20 V AC+DC @ 50.0 kHz	**20.0046**	0.0085 %	19.935291	20.064709	0.0230 %	0.3150 %	PASS 7.11 %
20 V AC+DC @ 100.0 kHz	**19.9976**	0.0121 %	19.932573	20.067427	-0.0120 %	0.3250 %	PASS 3.56 %
20 V AC+DC @ 200.0 kHz	**19.9738**	0.0336 %	19.803273	20.196727	-0.1310 %	0.9500 %	PASS 13.32 %
20 V AC+DC @ 300.0 kHz	**19.973**	0.0336 %	19.803273	20.196727	-0.1350 %	0.9500 %	PASS 13.72 %
20 V AC+DC @ 500.0 kHz	**20.0034**	0.1100 %	19.138000	20.862000	0.0170 %	4.2000 %	PASS 0.39 %
20 V AC+DC @ 1.0 MHz	**20.1694**	0.1700 %	19.126000	20.874000	0.8470 %	4.2000 %	PASS 19.38 %
200.0 V AC+DC @ 100 Hz	**200.032**	0.0060 %	199.877964	200.122036	0.0160 %	0.0550 %	PASS 26.20 %

200.0 V AC+DC @ 1.0 kHz	**200.011**	0.0060 %	199.877964	200.122036	0.0055 %	0.0550 %	PASS 9.01 %
200.0 V AC+DC @ 6.25 kHz	**200**	0.0060 %	199.797964	200.202036	0.0000 %	0.0950 %	PASS 0.00 %
200.0 V AC+DC @ 10.0 kHz	**200.015**	0.0060 %	199.797964	200.202036	0.0075 %	0.0950 %	PASS 7.42 %
200.0 V AC+DC @ 20.0 kHz	**200.047**	0.0060 %	199.797964	200.202036	0.0235 %	0.0950 %	PASS 23.25 %
700.0 V AC+DC @ 100 Hz	**699.8**	0.0074 %	699.283452	700.716548	-0.0286 %	0.0950 %	PASS 27.86 %
700.0 V AC+DC @ 1.0 kHz	**699.77**	0.0074 %	699.283452	700.716548	-0.0329 %	0.0950 %	PASS 32.04 %

Procedure for all test points that verify Gain of the DC current DCI function. Both +/-FS points are tested.
2-wire connection at LO and DCI is used between DMM and MFC.
DCI gain range points verify gain of the DC current function, using corrected 24-hour MFC output.

DCI Test	100nA-1A	DUT	Source unc.	Low Limit	Hi limit	Measured	24h spec	Result
Zero 00 µADC	0	**-3E-10**						INFO
10 µADC	1E-05	**1.000092E-05**	71.82 ppm	9.998402E-06	1.00016E-05	92.000 ppm	88 ppm	PASS 57.56 %
20 µADC	2E-05	**2.000227E-05**	71.82 ppm	1.99968E-05	2.00032E-05	113.500 ppm	88 ppm	PASS 71.02 %
-10 µADC	-1E-05	**-1.000149E-05**	71.82 ppm	-1.00016E-05	-9.998402E-06	149.000 ppm	88 ppm	PASS 93.23 %
20 µADC	-2E-05	**-2.000284E-05**	71.82 ppm	-2.00032E-05	-1.99968E-05	142.000 ppm	88 ppm	PASS 88.85 %
Zero 000 µADC	0	**-3.1E-10**						INFO
100 µADC	0.0001	**0.00010001265**	71.82 ppm	9.998402E-05	0.000100016	126.500 ppm	88 ppm	PASS 79.15 %
200 µADC	0.0002	**0.00020002549**	71.82 ppm	0.000199968	0.000200032	127.450 ppm	88 ppm	PASS 79.75 %
-100 µADC	-0.0001	**-0.00010001348**	71.82 ppm	-0.000100016	-9.998402E-05	134.800 ppm	88 ppm	PASS 84.34 %
-200 µADC	-0.0002	**-0.00020002625**	71.82 ppm	-0.000200032	-0.000199968	131.250 ppm	88 ppm	PASS 82.12 %
Zero mADC	0	**-1E-09**						INFO
-1.0 mADC	0.001	**0.0010001371**	33.64 ppm	0.0009998824	0.001000118	137.100 ppm	84 ppm	FAIL 116.54 %
2.0 mADC	0.002	**0.0020002797**	33.64 ppm	0.001999765	0.002000235	139.850 ppm	84 ppm	FAIL 118.88 %
-1.0 mADC	-0.001	**-0.0010001517**	33.64 ppm	-0.001000118	-0.0009998824	151.700 ppm	84 ppm	FAIL 128.95 %
-2.0 mADC	-0.002	**-0.0020002963**	33.64 ppm	-0.002000235	-0.001999765	148.150 ppm	84 ppm	FAIL 125.94 %
Zero 00 mADC	0	**-6E-09**						INFO
10 mADC	0.01	**0.010002242**	32.27 ppm	0.009998827	0.01000117	224.200 ppm	85 ppm	FAIL 191.18 %
20 mADC	0.02	**0.020004487**	32.27 ppm	0.01999765	0.02000235	224.350 ppm	85 ppm	FAIL 191.31 %
-10 mADC	-0.01	**-0.010002322**	32.27 ppm	-0.01000117	-0.009998827	232.200 ppm	85 ppm	FAIL 198.00 %
-20 mADC	-0.02	**-0.020004594**	32.27 ppm	-0.02000235	-0.01999765	229.700 ppm	85 ppm	FAIL 195.87 %
Zero 000 mADC	0	**-1.3E-07**						INFO
100 mADC	0.1	**0.0999873**	53.32 ppm	0.09998307	0.1000169	-127.000 ppm	116 ppm	PASS 75.01 %
200 mADC	0.2	**0.19996693**	53.32 ppm	0.1999661	0.2000339	-165.350 ppm	116 ppm	PASS 97.66 %
-100 mADC	-0.1	**-0.09998852**	53.32 ppm	-0.1000169	-0.09998307	-114.800 ppm	116 ppm	PASS 67.80 %
-200 mADC	-0.2	**-0.19996914**	53.32 ppm	-0.2000339	-0.1999661	-154.300 ppm	116 ppm	PASS 91.13 %
Zero ADC	0	**-2E-06**						INFO

1.0 ADC	1	**0.9999559**	115.22 ppm	0.9993648	1.000635	-44.100 ppm	520 ppm	PASS 6.94 %
2.0 ADC	2	**1.9996609**	115.22 ppm	1.99873	2.00127	-169.550 ppm	520 ppm	PASS 26.69 %
-1.0 ADC	-1	**-0.9998997**	115.22 ppm	-1.000635	-0.9993648	-100.300 ppm	520 ppm	PASS 15.79 %
-2.0 ADC	-2	**-1.9996606**	115.22 ppm	-2.00127	-1.99873	-169.700 ppm	520 ppm	PASS 26.72 %

Procedure for all test points that verify Gain of the AC Current ACI function. Three frequency band points are tested, 50 Hz, 60 Hz and 1 kHz. 2-wire connection at LO and DCI is used between DMM and MFC.

ACI Test	200µA-2A	DUT	Source unc.	Low Limit	Hi limit	Measured	24h spec	Result, % spec
50 µA AC @ 50 Hz	5e-05	**5.01263E-05**	0.0165 %	4.99467275e-05	5.00532725e-05	2526.000 ppm	0.0900 %	FAIL 237.08 %
100 µA AC @ 50 Hz	0.0001	**0.0001000719**	0.0165 %	9.9893455e-05	0.000100106545	719.000 ppm	0.0900 %	PASS 67.48 %
150 µA AC @ 50 Hz	0.00015	**0.0001500268**	0.0165 %	0.0001498401825	0.0001501598175	178.667 ppm	0.0900 %	PASS 16.77 %
200 µA AC @ 50 Hz	0.0002	**0.0001999843**	0.0165 %	0.00019978691	0.00020021309	-78.500 ppm	0.0900 %	PASS 7.37 %
1.0 mA AC @ 50 Hz	0.001	**0.0009997053**	0.0138 %	0.00099896182	0.00100103818	-294.700 ppm	0.0900 %	PASS 28.39 %
2.0 mA AC @ 50 Hz	0.002	**0.001999932**	0.0138 %	0.00199792364	0.00200207636	-34.000 ppm	0.0900 %	PASS 3.27 %
10 mA AC @ 50 Hz	0.01	**0.009997984**	0.0138 %	0.0099896182	0.0100103818	-201.600 ppm	0.0900 %	PASS 19.42 %
20 mA AC @ 50 Hz	0.02	**0.020001072**	0.0138 %	0.0199792364	0.0200207636	53.600 ppm	0.0900 %	PASS 5.16 %
100 mA AC @ 50 Hz	0.1	**0.09993846**	0.0134 %	0.099896636	0.100103364	-615.400 ppm	0.0900 %	PASS 59.54 %
200 mA AC @ 50 Hz	0.2	**0.19992428**	0.0134 %	0.199793272	0.200206728	-378.600 ppm	0.0900 %	PASS 36.63 %
1.0 A AC @ 50 Hz	1.0	**0.9995111**	0.0308 %	0.99879182	1.00120818	-488.900 ppm	0.0900 %	PASS 40.47 %
2.0 A AC @ 50 Hz	2.0	**1.9994065**	0.0308 %	1.99758364	2.00241636	-296.750 ppm	0.0900 %	PASS 24.56 %
50 µA AC @ 60 Hz	5e-05	**5.00279E-05**	0.0165 %	4.99467275e-05	5.00532725e-05	558.000 ppm	0.0900 %	PASS 52.37 %
100 µA AC @ 60 Hz	0.0001	**9.99637E-05**	0.0165 %	9.9893455e-05	0.000100106545	-363.000 ppm	0.0900 %	PASS 34.07 %
150 µA AC @ 60 Hz	0.00015	**0.0001500178**	0.0165 %	0.0001498401825	0.0001501598175	118.667 ppm	0.0900 %	PASS 11.14 %
200 µA AC @ 60 Hz	0.0002	**0.0001999077**	0.0165 %	0.00019978691	0.00020021309	-461.500 ppm	0.0900 %	PASS 43.32 %
1.0 mA AC @ 60 Hz	0.001	**0.0009996725**	0.0138 %	0.00099896182	0.00100103818	-327.500 ppm	0.0900 %	PASS 31.55 %
2.0 mA AC @ 60 Hz	0.002	**0.0020000697**	0.0138 %	0.00199792364	0.00200207636	34.850 ppm	0.0900 %	PASS 3.36 %
10 mA AC @ 60 Hz	0.01	**0.009997992**	0.0138 %	0.0099896182	0.0100103818	-200.800 ppm	0.0900 %	PASS 19.34 %
20 mA AC @ 60 Hz	0.02	**0.020003557**	0.0138 %	0.0199792364	0.0200207636	177.850 ppm	0.0900 %	PASS 17.13 %
100 mA AC @ 60 Hz	0.1	**0.09993967**	0.0134 %	0.099896636	0.100103364	-603.300 ppm	0.0900 %	PASS 58.37 %
200 mA AC @ 60 Hz	0.2	**0.19993498**	0.0134 %	0.199793272	0.200206728	-325.100 ppm	0.0900 %	PASS 31.45 %
1.0 A AC @ 60 Hz	1.0	**0.9997117**	0.0308 %	0.99879182	1.00120818	-288.300 ppm	0.0900 %	PASS 23.86 %
2.0 A AC @ 60 Hz	2.0	**1.9994463**	0.0308 %	1.99758364	2.00241636	-276.850 ppm	0.0900 %	PASS 22.91 %
50 µA AC @ 1.0 kHz	5e-05	**5.01282E-05**	0.0165 %	4.99467275e-05	5.00532725e-05	2564.000 ppm	0.0900 %	FAIL 240.65 %
100 µA AC @ 1.0 kHz	0.0001	**0.0001000822**	0.0165 %	9.9893455e-05	0.000100106545	822.000 ppm	0.0900 %	PASS 77.15 %
150 µA AC @ 1.0 kHz	0.00015	**0.0001500427**	0.0165 %	0.0001498401825	0.0001501598175	284.667 ppm	0.0900 %	PASS 26.72 %
200 µA AC @ 1.0 kHz	0.0002	**0.0002000075**	0.0165 %	0.00019978691	0.00020021309	37.500 ppm	0.0900 %	PASS 3.52 %

1.0 mA AC @ 1.0 kHz	0.001	**0.0009998367**	0.0138 %	0.00099896182	0.00100103818	-163.300 ppm	0.0900 %	PASS 15.73 %
2.0 mA AC @ 1.0 kHz	0.002	**0.0020001861**	0.0138 %	0.00199792364	0.00200207636	93.050 ppm	0.0900 %	PASS 8.96 %
10 mA AC @ 1.0 kHz	0.01	**0.009999823**	0.0138 %	0.0099896182	0.0100103818	-17.700 ppm	0.0900 %	PASS 1.70 %
20 mA AC @ 1.0 kHz	0.02	**0.020004647**	0.0138 %	0.0199792364	0.0200207636	232.350 ppm	0.0900 %	PASS 22.38 %
100 mA AC @ 1.0 kHz	0.1	**0.09995974**	0.0134 %	0.099896636	0.100103364	-402.600 ppm	0.0900 %	PASS 38.95 %
200 mA AC @ 1.0 kHz	0.2	**0.19996558**	0.0134 %	0.199793272	0.200206728	-172.100 ppm	0.0900 %	PASS 16.65 %
1.0 A AC @ 1.0 kHz	1.0	**0.9997324**	0.0308 %	0.99879182	1.00120818	-267.600 ppm	0.0900 %	PASS 22.15 %
2.0 A AC @ 1.0 kHz	2.0	**1.9997389**	0.0308 %	1.99758364	2.00241636	-130.550 ppm	0.0900 %	PASS 10.81 %
50 µA AC @ 10.0 kHz	5e-05	**5.01327E-05**	1400	4.986e-05	5.014e-05	0.2654 %	1400.0 ppm	PASS 94.79 %
100 µA AC @ 10.0 kHz	0.0001	**0.0001001696**	0.1400 %	9.972e-05	0.00010028	0.1696 %	0.1400 %	PASS 60.57 %
150 µA AC @ 10.0 kHz	0.00015	**0.0001501767**	0.1400 %	0.00014958	0.00015042	0.1178 %	0.1400 %	PASS 42.07 %
200 µA AC @ 10.0 kHz	0.0002	**0.0002001675**	0.1400 %	0.00019944	0.00020056	0.0837 %	0.1400 %	PASS 29.91 %
1.0 mA AC @ 10.0 kHz	0.001	**0.0009999645**	0.1400 %	0.0009972	0.0010028	-0.0035 %	0.1400 %	PASS 1.27 %
2.0 mA AC @ 10.0 kHz	0.002	**0.0020001638**	0.1400 %	0.0019944	0.0020056	0.0082 %	0.1400 %	PASS 2.92 %
10 mA AC @ 10.0 kHz	0.01	**0.010000085**	0.1300 %	0.009973	0.010027	0.0009 %	0.1400 %	PASS 0.31 %
20 mA AC @ 10.0 kHz	0.02	**0.020002682**	0.1300 %	0.019946	0.020054	0.0134 %	0.1400 %	PASS 4.97 %
100 mA AC @ 10.0 kHz	0.1	**0.10000342**	0.1100 %	0.09975	0.10025	0.0034 %	0.1400 %	PASS 1.37 %
200 mA AC @ 10.0 kHz	0.2	**0.20002356**	0.1100 %	0.1995	0.2005	0.0118 %	0.1400 %	PASS 4.71 %
1.0 A AC @ 10.0 kHz	1.0	**0.9975977**	0.6100 %	0.9925	1.0075	-0.2402 %	0.1400 %	PASS 32.03 %
2.0 A AC @ 10.0 kHz	2.0	**1.9916789**	0.6100 %	1.985	2.015	-0.4161 %	0.1400 %	PASS 55.47 %

Test completed

Test date	14 July 2022 19:28

Lab temperature maintained +23°C ±2°C

Internal use only

Not validated