

Reference Load

VERIFICATION OF HARMONIC AND FLICKER MEASUREMENT



Reference Load

- ✓ Simulates a non-linear load with a defined set of harmonic current components up to the 40th harmonic similar to the IEC/EN 61000-3-2 class A limits
- ✓ Simulates a flicker load with a defined flicker level of $P_{ST} = 1.0$
- ✓ Simulation accuracy better than $\pm 3\%$
- ✓ Reference load can be used as a calibration load

The relating standards:*

IEC/EN 61000-3-2
IEC/EN 61000-3-3
IEC/EN 61000-3-11
IEC/EN 61000-3-12
IEC/EN 60146-1-1
IEC/EN 61000-2-2
IEC/EN 61000-4-8
IEC/EN 61000-4-11
IEC/EN 61000-4-13
IEC/EN 61000-4-14
IEC/EN 61000-4-17
IEC/EN 61000-4-27
IEC/EN 61000-4-28
IEC/EN 61000-4-29
IEC/EN 61000-4-34
IEC/EN 61131-2
IEC/EN 61496-1
IEC/EN 61800-3
IEC/EN 62040-2
RTCA DO-160
SEMI F47-0706
IEC TR 61547-1
German. Lloyd

** The Reference Load can be used for certain tests within these standards. Additional equipment might be required. For detailed information, please contact sales@spitzenberger.de.*

HARMONIC CURRENT AND FLICKER LOAD

REFERENCE LOAD FUNCTIONAL PRINCIPLE

The Reference Load simulates a non-linear load with defined harmonic current components up to the 40th harmonics and a defined flicker load.

In combination with an APS series amplifier and an AIS series analyser it can be used as a calibration load. The SPS TestManager software supports the AIS series analyser with harmonics and flicker measurements, including a detailed measurement report.

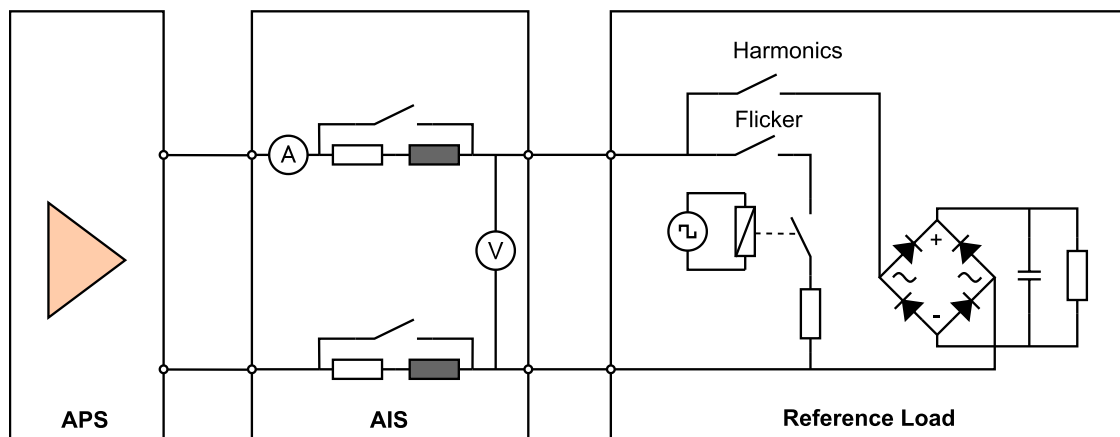


Fig. 1: Reference Load principle schematic

TECHNICAL DATA – REFERENCE LOAD

REFERENCE LOAD		
Input	<i>Input voltage (RMS)</i>	230 V
	<i>Connector type</i>	4 mm laboratory sockets
Harmonics		
	<i>Measurement value</i>	see measurement table
	<i>Accuracy</i>	± 3 %
Flicker		
		1200 changes per minute
	<i>Measurement value</i>	see measurement table
	<i>Accuracy</i>	± 3 %
Ambient temperature		
+10 °C up to +40 °C		
Storage temperature		
-25 °C up to +60 °C		
Relative humidity		
non condensing, max. 80 % for temperature < 31 °C, decreasing linearly to 50 % at 40 °C		
Ingress protection		
IP20		
Power supply (±10 %, 50/60 Hz)		
230 V		
Line protection, connection		
0.5 A, Schuko		
Housing		
plug-in unit or desktop, light grey (RAL 7035)		
<i>Reference Load</i>		
19", 3 U		
<i>approx. dimensions (H x W x D)</i>		
133 x 483 x 450 mm		
Weight (approx.)		
20 kg		

HARMONICS MEASUREMENT - EXAMPLE DATA

Maximum RMS current and corresponding values in time window 335:

U_{hrms_s}	230.043 V	$THVG_s$	0.109 V	$POHV_{g_s}$	0.049 V
U_{hAC_s}	230.043 V	$THDG_{u_s}$	0.047 %	$PWHV_{g_s}$	0.296 V
I_{hrms_s}	3.338 A	$THCG_s$	1.487 A	$POHC_{g_s}$	0.265 A
I_{hAC_s}	3.338 A	$THDG_{i_s}$	49.767 %	$PWHC_{g_s}$	1.716 A
P_{h_s}	594.624 W	S_{h_s}	767.783 VA	λ_{AC_s}	0.774
P_{hAC_s}	594.624 W	S_{hAC_s}	767.783 VA	CoS_{ϕ_s}	0.865
P_{f_s}	594.686 W				

Test conditions: IEC 61000-3-2 Edition 5.1 2020-07; 50 Hz; Phase: L1; Range: 20 A

Time window: 200 ms; $I_{avg} = 3.34$ A

Harmonic currents < 0.6 % of I_{avg} or < 0.005 A are NOT DISREGARDED for $THDG_{i_s}$, $THCG_s$, $POHC_{g_s}$, $PWHC_{g_s}$

Validated limit class: Class A; Grouping = on

No impedances set.

HARMONIC ANALYSIS: Test failed

Generator check pass.

Tobs = entire measurement; $POHC(C.3)$ avg.: =0.2645 A, Limit: = 0.2514 A

Ha	Entire measurement: 150 s = 750 time windows							Average		Result
	Maximum [A]	Window	Limit: Class A [A]	Margin in MaxWin [%]	100 to 150 %	150 to 200 %	Exceeded	Value [A]	Exceeded	
DC	0.0024	695	---	---	0	0	0	0.0023	0	✓
1	2.9880	403	---	---	0	0	0	2.9879	0	✓
2	0.0001	625	1.0800	-100.0	0	0	0	0.0001	0	✓
3	1.2420	1	2.3000	-46.0	0	0	0	1.2419	0	✓
4	0.0001	694	0.4300	-100.0	0	0	0	0.0001	0	✓
5	0.4918	697	1.1400	-56.9	0	0	0	0.4918	0	✓
6	0.0001	623	0.3000	-100.0	0	0	0	0.0001	0	✓
7	0.3587	28	0.7700	-53.4	0	0	0	0.3587	0	✓
8	0.0001	115	0.2300	-99.9	0	0	0	0.0001	0	✓
9	0.2954	128	0.4000	-26.2	0	0	0	0.2954	0	✓
10	0.0002	407	0.1840	-99.9	0	0	0	0.0002	0	✓
11	0.2025	109	0.3300	-38.6	0	0	0	0.2025	0	✓
12	0.0002	572	0.1533	-99.9	0	0	0	0.0002	0	✓
13	0.2012	8	0.2100	-4.2	0	0	0	0.2012	0	✓
14	0.0002	319	0.1314	-99.8	0	0	0	0.0002	0	✓
15	0.1508	100	0.1500	0.5	750	0	0	0.1507	1	✗
16	0.0002	116	0.1150	-99.8	0	0	0	0.0002	0	✓
17	0.1447	183	0.1324	9.4	750	0	0	0.1447	1	✗
18	0.0002	14	0.1022	-99.8	0	0	0	0.0002	0	✓
19	0.1263	643	0.1184	6.7	750	0	0	0.1263	1	✗
20	0.0002	428	0.0920	-99.7	0	0	0	0.0002	0	✓
21	0.1101	20	0.1071	2.8	750	0	0	0.1101	1	✗
22	0.0001	321	0.0836	-99.9	0	0	0	0.0001	0	✓
23	0.1075	38	0.0978	9.9	750	0	0	0.1075	1	✗
24	0.0002	406	0.0767	-99.7	0	0	0	0.0002	0	✓
25	0.0908	380	0.0900	0.9	750	0	0	0.0908	1	✗
26	0.0004	679	0.0708	-99.5	0	0	0	0.0003	0	✓
27	0.0905	126	0.0833	8.6	750	0	0	0.0905	1	✗
28	0.0003	416	0.0657	-99.5	0	0	0	0.0003	0	✓
29	0.0805	95	0.0776	3.8	750	0	0	0.0805	1	✗
30	0.0002	623	0.0613	-99.8	0	0	0	0.0001	0	✓
31	0.0765	237	0.0726	5.3	750	0	0	0.0764	1	✗
32	0.0001	531	0.0575	-99.8	0	0	0	0.0001	0	✓
33	0.0729	75	0.0682	7.0	750	0	0	0.0729	1	✗
34	0.0001	623	0.0541	-99.8	0	0	0	0.0001	0	✓
35	0.0661	217	0.0643	2.8	750	0	0	0.0661	1	✗
36	0.0001	533	0.0511	-99.7	0	0	0	0.0001	0	✓
37	0.0657	229	0.0608	8.0	750	0	0	0.0657	1	✗
38	0.0001	548	0.0484	-99.7	0	0	0	0.0001	0	✓
39	0.0596	646	0.0577	3.3	750	0	0	0.0596	1	✗
40	0.0001	525	0.0460	-99.8	0	0	0	0.0001	0	✓

Value exceeded

Avg. Value < 0.6 % of I_{avg} or < 0.005 A

FLICKER MEASUREMENT - EXAMPLE DATA

Test conditions: IEC 61000-3-3 Edition 3.2 2021-03; 230.04 V; 50 Hz; Phase: L 1
IEC 61000-4-15 Edition 2.0 2010-08; Obs: 10 x 60.0 s; $Z_{\text{test}} = (0.4000 + j0.2500) \Omega$
 $R_A + jX_A = (0.2400 + j0.1500) \Omega$; $R_N + jX_N = (0.1600 + j0.1000) \Omega$

Flicker / d(t) limit = 3.3 %: Test failed!
Max. permitted impedance $Z_{\text{max}} = (0.3850 + j0.2406) \Omega$; $|Z_{\text{max}}| = 0.4540 \Omega$

Time	$P_{\text{inst,max}}$	P_{st}	Sliding P_{lt}	T_{max} [s]	d_{max} [%]	d_c [%]	Result
10:06:53	2.0745	1.0259	1.0259	0.000	0.000	0.000	✗
10:07:53	2.0792	1.0256	1.0256	0.000	0.000	0.000	✗
10:08:53	2.0738	1.0257	1.0257	0.000	0.000	0.000	✗
10:09:52	2.0738	1.0257	1.0257	0.000	0.000	0.000	✗
10:10:52	2.0737	1.0257	1.0257	0.000	0.000	0.000	✗
10:11:53	2.0743	1.0256	1.0256	0.000	0.000	0.000	✗
10:12:53	2.0737	1.0257	1.0257	0.000	0.000	0.000	✗
10:13:53	2.0734	1.0256	1.0256	0.000	0.000	0.000	✗
10:14:52	2.0736	1.0256	1.0256	0.000	0.000	0.000	✗
10:15:52	2.0731	1.0254	1.0254	0.000	0.000	0.000	✗
Limits:		1.0000	0.6500	0.500	4.000	3.300	
P_{lt} : 1.0256							
Evaluated: P_{st}							

Flicker: Source test passed!

Time	$P_{\text{inst,max}}$	P_{st}	Sliding P_{lt}	T_{max} [s]	d_{max} [%]	d_c [%]	Result
10:06:53	0.0003	0.0112	--,---	0.000	0.000	0.000	✓
10:07:53	0.0003	0.0112	--,---	0.000	0.000	0.000	✓
10:08:53	0.0003	0.0112	--,---	0.000	0.000	0.000	✓
10:09:52	0.0003	0.0111	--,---	0.000	0.000	0.000	✓
10:10:52	0.0003	0.0111	--,---	0.000	0.000	0.000	✓
10:11:53	0.0003	0.0111	--,---	0.000	0.000	0.000	✓
10:12:53	0.0003	0.0111	--,---	0.000	0.000	0.000	✓
10:13:53	0.0003	0.0111	--,---	0.000	0.000	0.000	✓
10:14:52	0.0003	0.0111	--,---	0.000	0.000	0.000	✓
10:15:52	0.0003	0.0111	--,---	0.000	0.000	0.000	✓
P_{lt} : 0.0111							
Evaluated: $P_{\text{st}} \leq 0.4$ $d_{\text{max}} < 20\%$ $d_{\text{max EUT}}$							