

Certificate of Calibration

Certificate Number: 20190802-65413



Manufacturer: **IET Labs, Inc.**
Model: **1413-9700**
Description: **Precision Decade Capacitor**
Serial Number: **N3-19311233**
Customer Designation:

IET Item ID # 54425

IET Labs, Inc. hereby certifies that the above-referenced instrument meets or exceeds its published specifications. IET Labs, Inc. hereby certifies that its measurement and calibration procedures are compliant with DIS10012, ISO9001, ISO/IEC17025, ANSI/NCSL Z540-1-1994, and MIL-STD-45662A. The calibration and measurement procedures are defined in Quality Policy Manual QM-100 and associated procedures. The calibration and measurement procedures use primary or secondary standards whose calibration is traceable, through NIST or other National Standards Institutes, to the International System of Units (SI) or to accepted intrinsic standards of measurement, or whose accuracy have been determined by ratio-type calibration techniques. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. Except where noted, IET Labs maintains at least a 4:1 Test Uncertainty Ratio. The reported data is valid only at the time of test and does not take into account the effects of voltage/current, humidity, long-term drift, transportation or other factors that may affect the stability of the tested device.

- Condition Received**
- New unit
 - Out of tolerance
 - Physical Damage (see Details of Damage)
 - Met manufacturer's specifications
 - Inoperative
- Condition Returned**
- Calibrated/Certified to manufacturer's specifications
 - Repaired
 - Other (see Condition Returned Notes)

Calibration Procedure The instrument listed above was calibrated by IET Labs, according to Calibration Procedure 1413-TP, Rev E2.

Decision Rules RDS (Root Difference Square) rule: PASS if MEASURED value <= Test limit <(Specification Limit^2 - Measurement Uncertainty^2)^0.5
This gives a PFA (Probability of False Accept) of < 0.6%.

A PASS* indicates the MEASURED value is ≥Test Limits and <Specification Limits.

For TL = SL this gives a PFA of <1% at a TUR of 4:1.

The user should determine conformity, when PASS* is indicated based upon the desired rule of; RDS in which case PASS* is a FAIL or TL = SL in which case PASS* is a PASS.

Measurement Uncertainty Measurement Uncertainty was calculated in accordance with the principles of "ISO Guide to the Expression of Uncertainty in Measurement (GUM)". The expanded uncertainty at 95% confidence level and a coverage factor of k=2 is listed below.

1 pF through 10 µF, at 1 kHz	0.02%		2000 µF, at 100 Hz	0.16%
10 µF through 300 µF, at 100 Hz	0.04%		3000 µF, at 100 Hz	0.22%
400 µF, at 100 Hz	0.06%		4000 µF, at 100 Hz	0.28%
500 µF, at 100 Hz	0.07%		5000 µF, at 100 Hz	0.34%
600 µF, at 100 Hz	0.08%		6000 µF, at 100 Hz	0.40%
700 µF, at 100 Hz	0.09%		7000 µF, at 100 Hz	0.46%
800 µF, at 100 Hz	0.11%		8000 µF, at 100 Hz	0.52%
900 µF, at 100 Hz	0.12%		9000 µF, at 100 Hz	0.58%
1000 µF, at 100 Hz	0.13%		10000 µF, at 100 Hz	0.64%

Associated 'D' is not an accredited parameter.

Associated Test Reports *Report #* *Date* *Test Description*

114149 13-Aug-2019 As Built



IET LABS, INC.

Standards • Decades • Strobes • Sound Level Meters • Bridges

formerly manufactured by **GenRad**

(516) 334-5959 • (800) 899-8438

Long Island, NY • Email: info@ietlabs.com

www.ietlabs.com

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Model: **1413-9700**

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IET Item ID # 54425

Standards And Tools Used

<i>Manufacturer</i>	<i>Model</i>	<i>Description</i>	<i>Serial Number</i>	<i>Cal Date</i>	<i>Due Date</i>
GenRad	1689-9700	Precision RLC Digibridge	8390012006	12-Sep-2018	12-Sep-2019

Calibration Facility: IET Labs, Inc. 1202 VFW Parkway West Roxbury, MA 02132	Calibration Date:	13-Aug-19	<hr/> Authorized Signature RDG
	Next Recommended Calibration Date:		



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Test Report Number: 114149

TestDataRpt_0002

Test Description: As Built

Environmental Conditions: Temp (Deg C): 23.12 **Test Date:** 13-Aug-2019 **Test Version:** 6.3
 RH (%): 35.0 **Tech:** RDG

Test Conditions:	SPECIFICATION LIMITS	TEST LIMITS
Schedule @:	<100.000 fF	<75.000 fF
Schedule A:	±(0.0500% + 500.000 fF) @ 1.00 kHz, 1.00 Vac Dissipation Factor <0.002000 [Df]	±(0.0400% + 400.000 fF) @ 1.00 kHz, 1.00 Vac Dissipation Factor <0.002000 [Df]
Schedule B:	±(0.0500% + 500.000 fF) @ 1.00 kHz, 1.00 Vac Dissipation Factor <0.001000 [Df]	±(0.0400% + 400.000 fF) @ 1.00 kHz, 1.00 Vac Dissipation Factor <0.001000 [Df]
Schedule C:	±(0.0500% + 500.000 fF) @ 1.00 kHz, 1.00 Vac Dissipation Factor <0.000500 [Df]	±(0.0400% + 400.000 fF) @ 1.00 kHz, 1.00 Vac Dissipation Factor <0.000500 [Df]
Schedule D:	±(0.0500% + 500.000 fF) @ 1.00 kHz, 1.00 Vac Dissipation Factor <0.000300 [Df]	±(0.0400% + 400.000 fF) @ 1.00 kHz, 1.00 Vac Dissipation Factor <0.000300 [Df]
Schedule E:	±(0.0500% + 500.000 fF) @ 1.00 kHz, 1.00 Vac Dissipation Factor <0.000400 [Df]	±(0.0400% + 400.000 fF) @ 1.00 kHz, 1.00 Vac Dissipation Factor <0.000400 [Df]

COLUMN LEGEND - SCH: Schedule applied for particular measurement.
 NOMINAL: Expected/ideal value.
 READING: Value reported by the measurement equipment.
 LOWER LIM: The minimum acceptable value.
 MEASURED: Represents the calibrated value. If ZERO SUBTRACTION is specified in Schedule, this is the reading minus the measured ZERO.
 UPPER LIM: The maximum acceptable value.
 P/F: PASS or FAIL; Pass if MEASURED is >=LOWER LIM. AND <=UPPER LIM., otherwise FAIL.
 % ERROR: Percent error between the NOMINAL and the MEASURED values.
 =[(MEASURED-NOMINAL)/NOMINAL]*100
 ABS. ERROR: Absolute error between the NOMINAL and MEASURED values.
 =(MEASURED-NOMINAL)

Series: 141x - GenRad
 Model: 1413-9700

SCH	NOMINAL (F)	READING (F)	LOWER LIM (F)	MEASURED (F)	UPPER LIM (F)	% ERROR	ABS.ERROR	P/F
@	0.0000	25.4500f	0.0000	25.4500f	100.0000f	+25.4500%	+25.450f	PASS



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SCH	NOMINAL (F)	READING (F)	LOWER LIM (F)	MEASURED (F)	UPPER LIM [(F)	% ERROR	ABS.ERROR]	P/F
A	1.0000p	1.0066p [Associated 'D']	499.50f -Inf	1.0066p -0.004786	1.5005p [0.002000	+0.6600%	+6.600f]	PASS PASS
A	2.0000p	1.9987p [Associated 'D']	1.4990p -Inf	1.9987p -0.002639	2.5010p [0.002000	-0.0650%	-1.300f]	PASS PASS
A	3.0000p	3.0139p [Associated 'D']	2.4985p -Inf	3.0139p -0.001238	3.5015p [0.002000	+0.4633%	+13.900f]	PASS PASS
A	4.0000p	4.1001p [Associated 'D']	3.4980p -Inf	4.1001p -0.001479	4.5020p [0.002000	+2.5025%	+100.100f]	PASS PASS
A	5.0000p	4.9489p [Associated 'D']	4.4975p -Inf	4.9489p -0.001332	5.5025p [0.002000	-1.0220%	-51.100f]	PASS PASS
A	6.0000p	6.1780p [Associated 'D']	5.4970p -Inf	6.1780p -0.000653	6.5030p [0.002000	+2.9667%	+178.000f]	PASS PASS
A	7.0000p	6.9487p [Associated 'D']	6.4965p -Inf	6.9487p -0.000799	7.5035p [0.002000	-0.7329%	-51.300f]	PASS PASS
A	8.0000p	8.2063p [Associated 'D']	7.4960p -Inf	8.2063p -0.000186	8.5040p [0.002000	+2.5788%	+206.300f]	PASS PASS
A	9.0000p	9.0559p [Associated 'D']	8.4955p -Inf	9.0559p -0.000795	9.5045p [0.002000	+0.6211%	+55.900f]	PASS PASS
A	10.000p	10.323p [Associated 'D']	9.4950p -Inf	10.323p 0.000054	10.505p [0.002000	+3.2300%	+323.000f]	PASS PASS
A	10.000p	9.9231p [Associated 'D']	9.4950p -Inf	9.9231p -0.000557	10.505p [0.002000	-0.7690%	-76.900f]	PASS PASS
A	20.000p	19.990p [Associated 'D']	19.490p -Inf	19.990p -0.000318	20.510p [0.002000	-0.0500%	-10.000f]	PASS PASS
A	30.000p	29.918p [Associated 'D']	29.485p -Inf	29.918p -0.000050	30.515p [0.002000	-0.2733%	-82.000f]	PASS PASS
A	40.000p	39.938p [Associated 'D']	39.480p -Inf	39.938p -0.000031	40.520p [0.002000	-0.1550%	-62.000f]	PASS PASS
A	50.000p	50.003p [Associated 'D']	49.475p -Inf	50.003p 0.000930	50.525p [0.002000	+0.0060%	+3.000f]	PASS PASS
A	60.000p	60.388p [Associated 'D']	59.470p -Inf	60.388p 0.000824	60.530p [0.002000	+0.6467%	+388.000f]	PASS PASS
A	70.000p	69.988p [Associated 'D']	69.465p -Inf	69.988p 0.000732	70.535p [0.002000	-0.0171%	-12.000f]	PASS PASS
A	80.000p	80.385p [Associated 'D']	79.460p -Inf	80.385p 0.000648	80.540p [0.002000	+0.4813%	+385.000f]	PASS PASS
A	90.000p	89.995p [Associated 'D']	89.455p -Inf	89.995p 0.000612	90.545p [0.002000	-0.0056%	-5.000f]	PASS PASS
A	100.00p	100.40p [Associated 'D']	99.450p -Inf	100.40p 0.000585	100.55p [0.002000	+0.4000%	+400.000f]	PASS PASS



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TestDataRpt_0002

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A	100.00p [Associated 'D']	99.997p	99.450p -Inf	99.997p 0.000578	100.55p [0.002000	-0.0030%	-3.000f]	PASS PASS
B	200.00p [Associated 'D']	199.80p	199.40p -Inf	199.80p 0.000257	200.60p [0.001000	-0.1000%	-200.000f]	PASS PASS
B	300.00p [Associated 'D']	299.77p	299.35p -Inf	299.77p 0.000391	300.65p [0.001000	-0.0767%	-230.000f]	PASS PASS
B	400.00p [Associated 'D']	399.98p	399.30p -Inf	399.98p 0.000234	400.70p [0.001000	-0.0050%	-20.000f]	PASS PASS
B	500.00p [Associated 'D']	499.62p	499.25p -Inf	499.62p 0.000147	500.75p [0.001000	-0.0760%	-380.000f]	PASS PASS
B	600.00p [Associated 'D']	599.60p	599.20p -Inf	599.60p 0.000237	600.80p [0.001000	-0.0667%	-400.000f]	PASS PASS
B	700.00p [Associated 'D']	699.39p	699.15p -Inf	699.39p 0.000186	700.85p [0.001000	-0.0871%	-610.000f]	PASS PASS
B	800.00p [Associated 'D']	799.38p	799.10p -Inf	799.38p 0.000247	800.90p [0.001000	-0.0775%	-620.000f]	PASS PASS
B	900.00p [Associated 'D']	899.58p	899.05p -Inf	899.58p 0.000195	900.95p [0.001000	-0.0467%	-420.000f]	PASS PASS
B	1.0000n [Associated 'D']	999.55p	999.00p -Inf	999.55p 0.000236	1.0010n [0.001000	-0.0450%	-450.000f]	PASS PASS
B	1.0000n [Associated 'D']	999.66p	999.00p -Inf	999.66p 0.000130	1.0010n [0.001000	-0.0340%	-340.000f]	PASS PASS
C	2.0000n [Associated 'D']	1.9994n	1.9985n -Inf	1.9994n 0.000110	2.0015n [0.000500	-0.0300%	-600.000f]	PASS PASS
D	3.0000n [Associated 'D']	2.9990n	2.9980n -Inf	2.9990n 0.000126	3.0020n [0.000300	-0.0333%	-1.000p]	PASS PASS
D	4.0000n [Associated 'D']	3.9983n	3.9975n -Inf	3.9983n 0.000137	4.0025n [0.000300	-0.0425%	-1.700p]	PASS PASS
D	5.0000n [Associated 'D']	4.9993n	4.9970n -Inf	4.9993n 0.000105	5.0030n [0.000300	-0.0140%	-700.000f]	PASS PASS
D	6.0000n [Associated 'D']	5.9989n	5.9965n -Inf	5.9989n 0.000103	6.0035n [0.000300	-0.0183%	-1.100p]	PASS PASS
D	7.0000n [Associated 'D']	6.9994n	6.9960n -Inf	6.9994n 0.000090	7.0040n [0.000300	-0.0086%	-600.000f]	PASS PASS
D	8.0000n [Associated 'D']	7.9991n	7.9955n -Inf	7.9991n 0.000093	8.0045n [0.000300	-0.0112%	-900.000f]	PASS PASS
D	9.0000n [Associated 'D']	8.9985n	8.9950n -Inf	8.9985n 0.000103	9.0050n [0.000300	-0.0167%	-1.500p]	PASS PASS
D	10.000n [Associated 'D']	9.9981n	9.9945n -Inf	9.9981n 0.000114	10.005n [0.000300	-0.0190%	-1.900p]	PASS PASS



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D	10.000n [Associated 'D']	9.9985n	9.9945n -Inf	9.9985n 0.000161	10.005n [0.000300	-0.0150%	-1.500p]	PASS PASS
D	20.000n [Associated 'D']	19.997n	19.990n -Inf	19.997n 0.000090	20.010n [0.000300	-0.0150%	-3.000p]	PASS PASS
D	30.000n [Associated 'D']	29.994n	29.985n -Inf	29.994n 0.000123	30.016n [0.000300	-0.0200%	-6.000p]	PASS PASS
D	40.000n [Associated 'D']	39.990n	39.980n -Inf	39.990n 0.000113	40.020n [0.000300	-0.0250%	-10.000p]	PASS PASS
D	50.000n [Associated 'D']	49.994n	49.974n -Inf	49.994n 0.000147	50.026n [0.000300	-0.0120%	-6.000p]	PASS PASS
D	60.000n [Associated 'D']	59.992n	59.970n -Inf	59.992n 0.000164	60.031n [0.000300	-0.0133%	-8.000p]	PASS PASS
D	70.000n [Associated 'D']	69.990n	69.965n -Inf	69.990n 0.000143	70.036n [0.000300	-0.0143%	-10.000p]	PASS PASS
D	80.000n [Associated 'D']	79.987n	79.959n -Inf	79.987n 0.000153	80.041n [0.000300	-0.0163%	-13.000p]	PASS PASS
D	90.000n [Associated 'D']	89.982n	89.954n -Inf	89.982n 0.000157	90.045n [0.000300	-0.0200%	-18.000p]	PASS PASS
D	100.00n [Associated 'D']	99.990n	99.949n -Inf	99.990n 0.000088	100.05n [0.000300	-0.0100%	-10.000p]	PASS PASS
E	100.00n [Associated 'D']	100.00n	99.949n -Inf	100.00n 0.000042	100.05n [0.000400	+0.0000%	+0.000]	PASS PASS
E	200.00n [Associated 'D']	199.99n	199.90n -Inf	199.99n 0.000082	200.10n [0.000400	-0.0050%	-10.000p]	PASS PASS
E	300.00n [Associated 'D']	299.98n	299.85n -Inf	299.98n 0.000086	300.15n [0.000400	-0.0067%	-20.000p]	PASS PASS
E	400.00n [Associated 'D']	399.96n	399.80n -Inf	399.96n 0.000114	400.20n [0.000400	-0.0100%	-40.000p]	PASS PASS
E	500.00n [Associated 'D']	499.98n	499.75n -Inf	499.98n 0.000184	500.25n [0.000400	-0.0040%	-20.000p]	PASS PASS
E	600.00n [Associated 'D']	599.97n	599.70n -Inf	599.97n 0.000186	600.30n [0.000400	-0.0050%	-30.000p]	PASS PASS
E	700.00n [Associated 'D']	699.95n	699.65n -Inf	699.95n 0.000182	700.35n [0.000400	-0.0071%	-50.000p]	PASS PASS
E	800.00n [Associated 'D']	799.95n	799.60n -Inf	799.95n 0.000194	800.40n [0.000400	-0.0062%	-50.000p]	PASS PASS
E	900.00n [Associated 'D']	899.92n	899.55n -Inf	899.92n 0.000208	900.45n [0.000400	-0.0089%	-80.000p]	PASS PASS
E	1.0000u [Associated 'D']	999.92n	999.50n -Inf	999.92n 0.000209	1.0005u [0.000400	-0.0080%	-80.000p]	PASS PASS

No Failures Recorded.



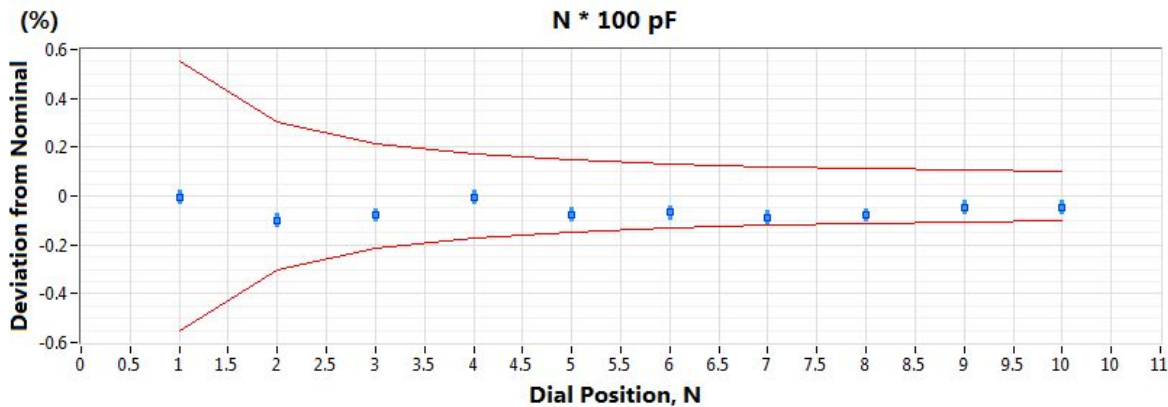
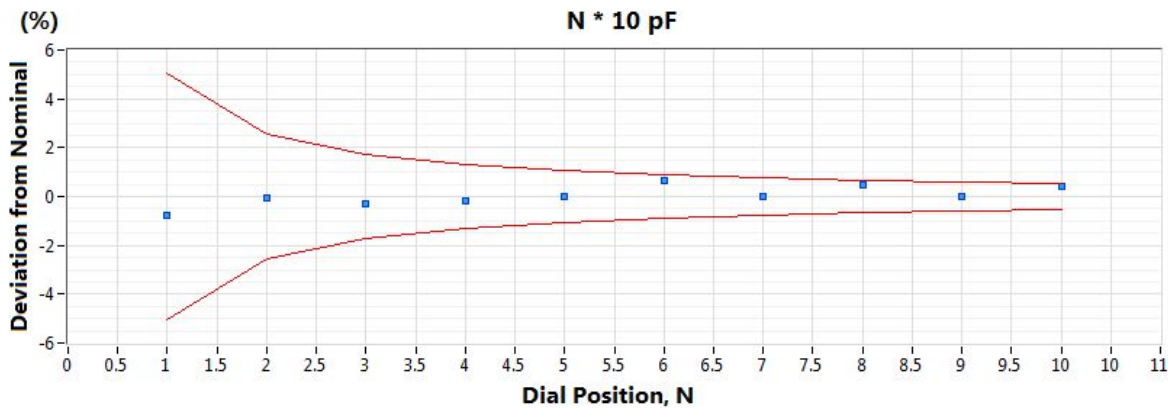
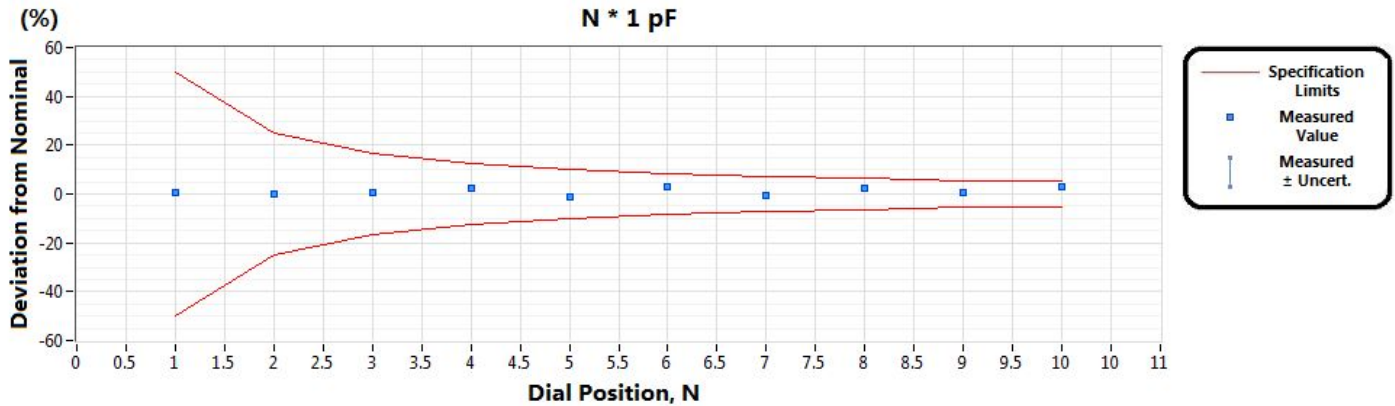
Appendix to Certificate

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