CalLab SOLUTIONS
Fusing Software With Metrology

Measurement Information Infrastructure
&
Metrology.NET® Taxonomy Standard

From Cal Lab Solutions, Inc.

KEYSIGHT TECHNOLOGIES
Solutions Partner

METROLOGY.NET

Huge Disconnect in Uncertainty

We copy results from our Excel calculations into the Word document we send to the Accreditation body to get back a PDF document.

Accreditated Capabilities are 100% disconnected from:

- **our original uncertainty calculations, and**
- **our daily calibration product.**

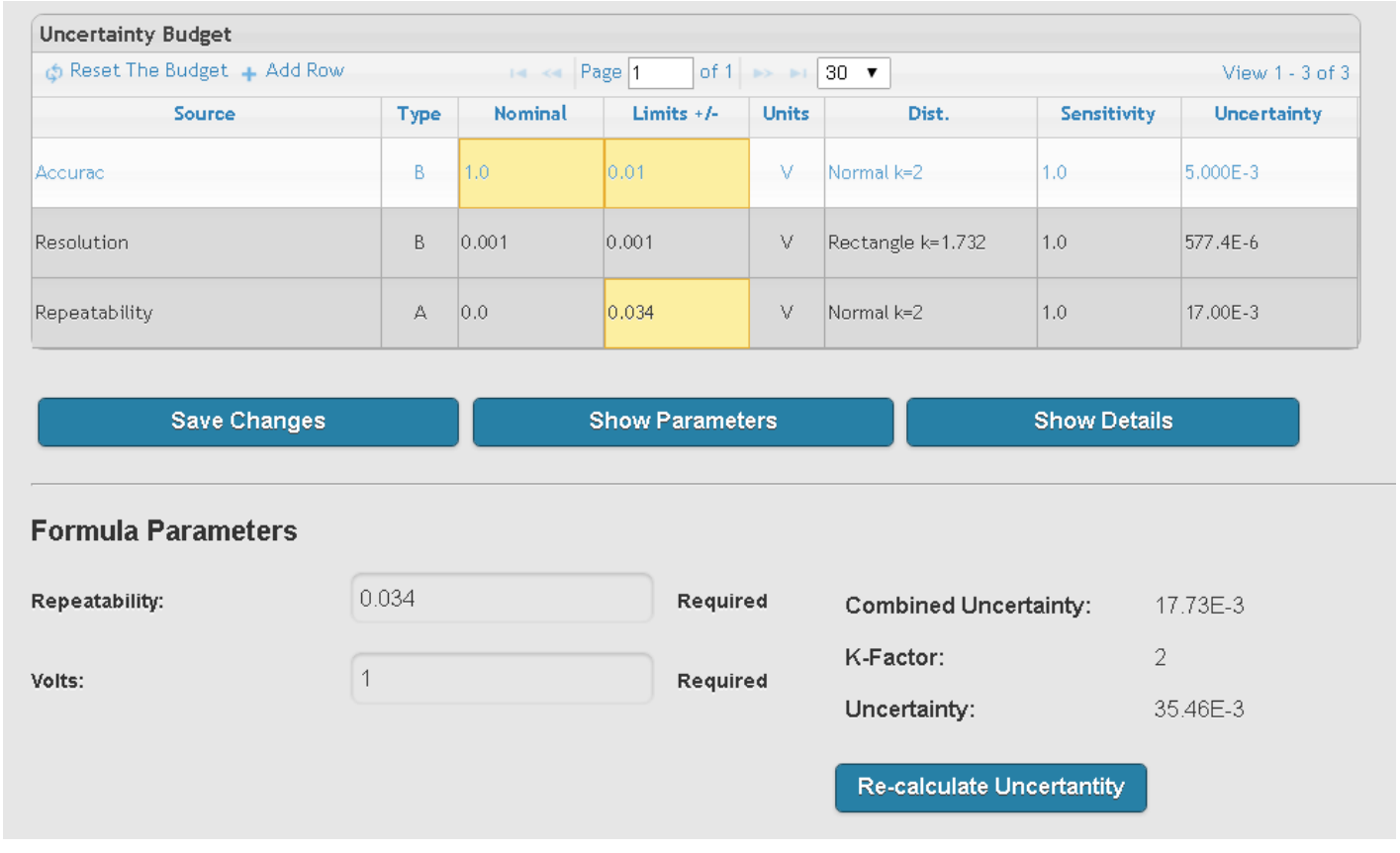
What is needed is a way to tie all this data together!

Measurement Uncertainties in Excel

			Value			Scaling			Standard Unc	
Sym	Contributor	A/B	Nominal	Limits	Units	Distribution	Divisor	Sensitivity	Value	Units
cell	Uncertainty of the Cell	B		3.00E-06	V	Normal	2	0.01	15.00E-9	V
DMMtran	DMM 10V Transfer Accuracy	B		10.0E-6	V	Normal	2	0.01	50.00E-9	V
DmmRng	DMM 24Hr Range (Opt 002)	B		30.0E-9	V	Normal	2	1	15.00E-9	V
LinRdg	5720 Reading Lineraity	B		100.0E-9	V	Normal	2	1	50.00E-9	V
LinRng	5720 Range Lineraity	B		200.0E-9	V	Normal	2	1	100.00E-9	V
StbRdg	5720 Reading Stability	B		30.0E-9	V	Normal	2	1	15.00E-9	V
StbRng	5720 Range Stability	B		300.0E-9	V	Normal	2	1	150.00E-9	V
Res	UUT Resolution	B		100.0E-9	V	Rectangle	1.732	1	57.74E-9	V
std	Measurement Repeatability	A		000.0E+0	V	Normal	2	1	000.00E+0	V
env	Environment	A		0.00E+00	V	Normal	2	1	000.00E+0	V
								Combined Standard Uncertainty :	203.74E-9	V
								Coverage Factor k :	2	
								Expanded Uncertainty :	407.47E-9	V

Divisor and Distribution	Type
6 = 2.449 Triangle	B
3 = 1.732 Rectangle	B
2 = 1.414 U-Shaped	B
1 = 1.000 Sigma	A
2 = 2.000 Normal (k=2)	A/B
3 = 3.000 Normal (k=3)	B

Uncertainties in Metrology.NET



Uncertainty Budget

Reset The Budget + Add Row Page 1 of 1 30 View 1 - 3 of 3

Source	Type	Nominal	Limits +/-	Units	Dist.	Sensitivity	Uncertainty
Accurac	B	1.0	0.01	V	Normal k=2	1.0	5.000E-3
Resolution	B	0.001	0.001	V	Rectangle k=1.732	1.0	577.4E-6
Repeatability	A	0.0	0.034	V	Normal k=2	1.0	17.00E-3

Save Changes Show Parameters Show Details

Formula Parameters

Repeatability: 0.034 **Required**

Volts: 1 **Required**

Combined Uncertainty: 17.73E-3

K-Factor: 2

Uncertainty: 35.46E-3

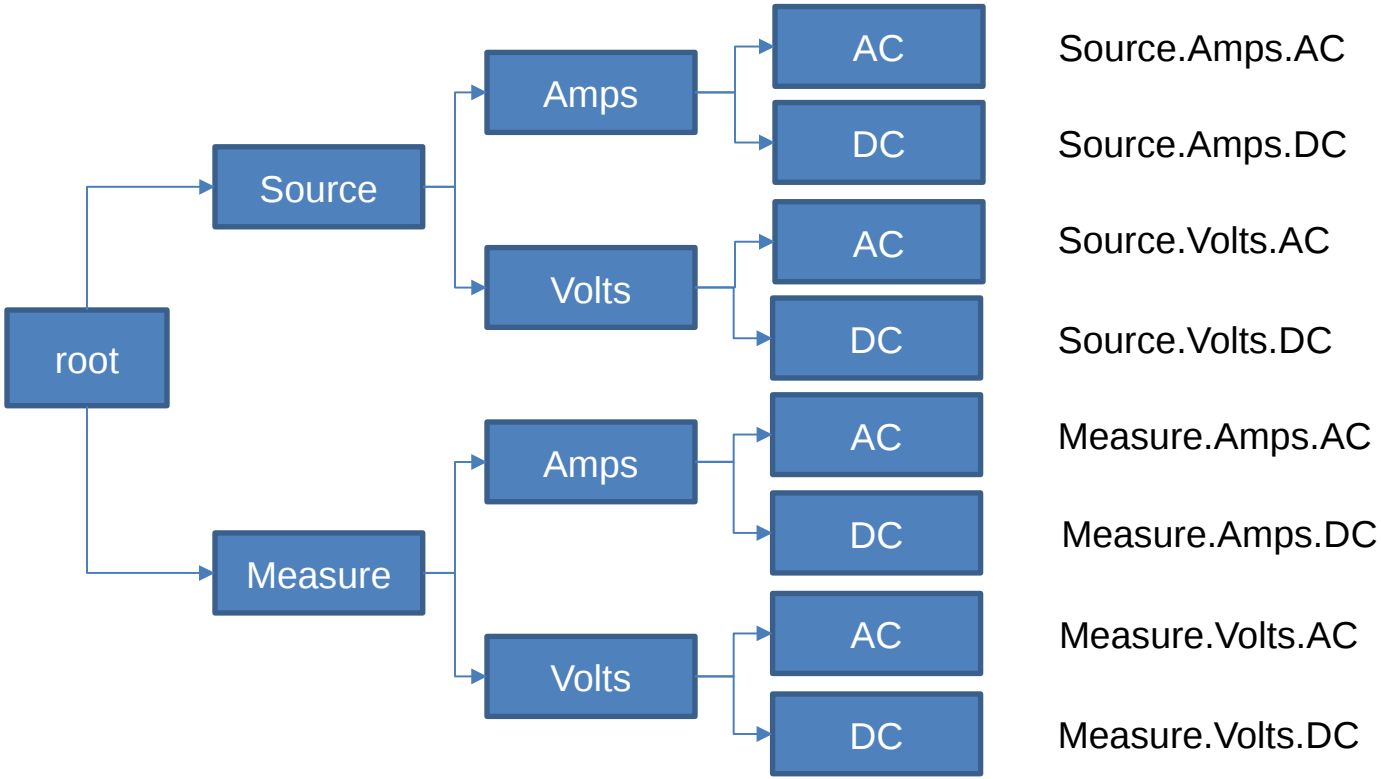
Re-calculate Uncertantity

Scope Of Accreditation

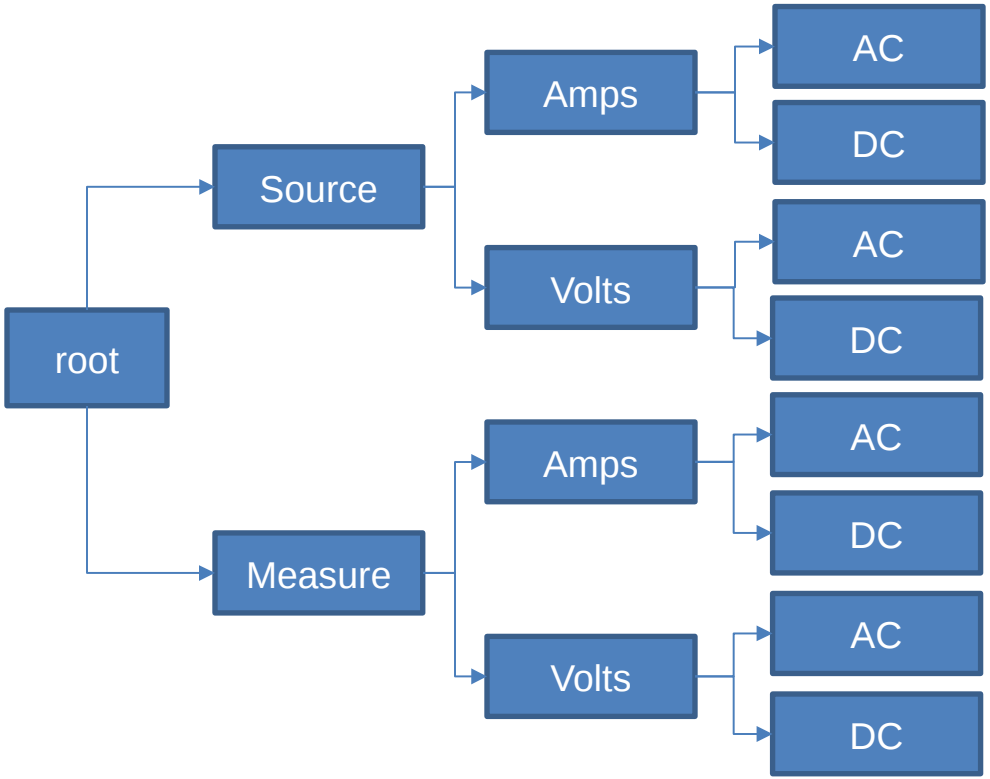
III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2] (±)	Comments
DC Voltage – Generate	(0 to 220) mV (220 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1000) V	4.2 µV/V + 0.4 µV 2.3 µV/V + 0.7 µV 1.1 µV/V + 2.5 µV 1.1 µV/V + 4 µV 2.2 µV/V + 40 µV 3.2 µV/V + 400 µV	Fluke 5720
DC Voltage – Generate, Fixed Points	1.018 V 10 V	0.060 µV/V 0.050 µV/V	Fluke 732B
DC Voltage – Measure	(0 to 10) V	46 nV	Josephson Voltage System (JVS)
Fixed Points	100 mV 1 V 10 V 100 V 1000 V	3.0 µV/V 2.0 µV/V 1.0 µV/V 2.0 µV/V 3.0 µV/V	Fluke 732B with voltage divider and nullmeter

Metrology Taxonomy



Metrology Taxonomy



Source.Amps.AC

Source.Amps.DC

Source.Volts.AC

Source.Volts.DC

Measure.Amps.AC

Measure.Amps.DC

Measure.Volts.AC

Measure.Volts.DC

(Implementation)

(Implementation)

(Implementation)

(Implementation)

(Implementation)

(Implementation)

(Implementation)

(Implementation)

Scope Of Accreditation

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2] (±)	Comments
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DC Voltage – Generate, Fixed Points	1.018 V 10 V	0.060 µV/V 0.050 µV/V	Fluke 732B
DC Voltage – Measure	(0 to 10) V	46 nV	Josephson Voltage System (JVS)
Fixed Points	100 mV 1 V 10 V 100 V 1000 V	3.0 µV/V 2.0 µV/V 1.0 µV/V 2.0 µV/V 3.0 µV/V	Fluke 732B with voltage divider and nullmeter

Source.Volts.DC (Fluke 5720A)

Source.Volts.DC (Fluke 732B)

Measure.Volts.DC (JVS)

Measure.Volts.DC (Fluke 732A)

Measurement Uncertainties in Excel

Source.Volts.DC (Fluke 5720A Ref with 10 V Cell & 3458A)

			Value			Scaling			Standard Unc	
Sym	Contributor	A/B	Nominal	Limits	Units	Distribution	Divisor	Sensitivity	Value	Units
cell	Uncertainty of the Cell	B		3.00E-06	V	Normal	2	0.01	15.00E-9	V
DMMtran	DMM 10V Transfer Accuracy	B		10.0E-6	V	Normal	2	0.01	50.00E-9	V
DmmRng	DMM 24Hr Range (Opt 002)	B		30.0E-9	V	Normal	2	1	15.00E-9	V
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Divisor and Distribution	Type
6 = 2.449 Triangle	B
3 = 1.732 Rectangle	B
2 = 1.414 U-Shaped	B
1 = 1.000 Sigma	A
2 = 2.000 Normal (k=2)	A/B
3 = 3.000 Normal (k=3)	B

Uncertainties in Metrology.NET

Measure.Volts.DC (HP 34401A)

Uncertainty Budget

Reset The Budget | Add Row | Page 1 of 1 | 30 | View 1 - 3 of 3

Source	Type	Nominal	Limits +/-	Units	Dist.	Sensitivity	Uncertainty
Accurac	B	1.0	0.01	V	Normal k=2	1.0	5.000E-3
Resolution	B	0.001	0.001	V	Rectangle k=1.732	1.0	577.4E-6
Repeatability	A	0.0	0.034	V	Normal k=2	1.0	17.00E-3

Save Changes | Show Parameters | Show Details

Formula Parameters

Repeatability: 0.034 Required

Volts: 1 Required

Combined Uncertainty: 17.73E-3

K-Factor: 2

Uncertainty: 35.46E-3

Re-calculate Uncertantity

Find Specific Calculation

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2] (±)	Comments
DC Voltage – Generate	(0 to 220) mV (220 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1000) V	4.2 µV/V + 0.4 µV 2.3 µV/V + 0.7 µV 1.1 µV/V + 2.5 µV 1.1 µV/V + 4 µV 2.2 µV/V + 40 µV 3.2 µV/V + 400 µV	

Source.Volts.DC (Fluke 5720A)

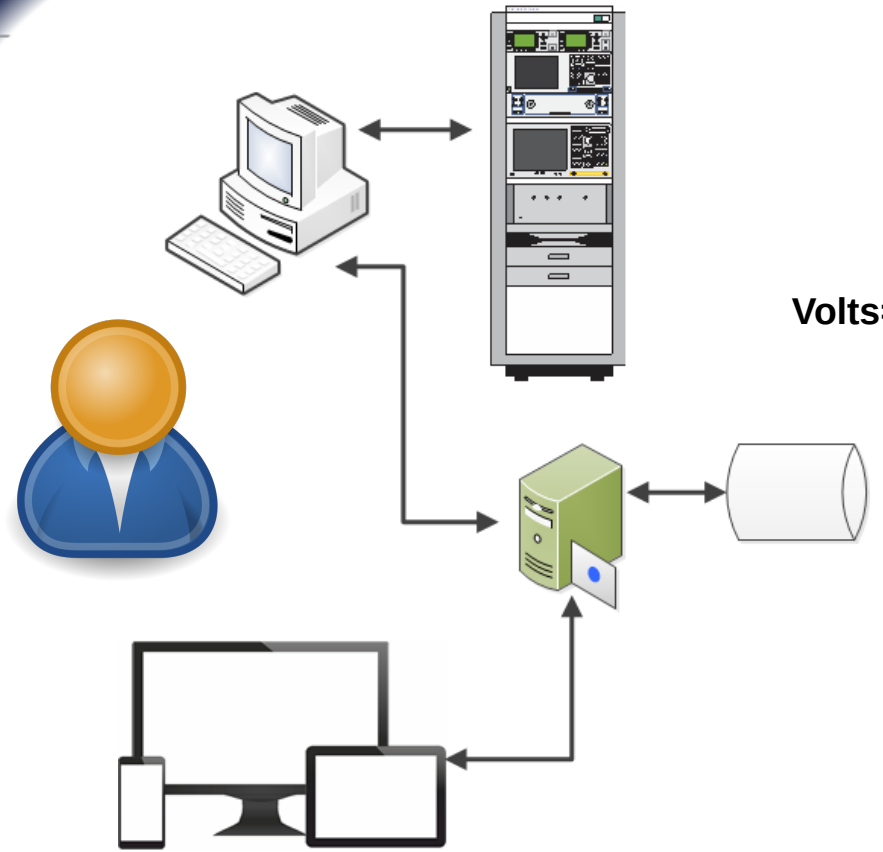
Volts =

-220e-3 to +220e-3
-2.2 to +2.2
-11 to +11
-22 to +22
-220 to +220
-1000 to +1000

NOTE: This SOA tells me they can't source voltage below 0 Volts.

** This is not machine readable

Metrology.NET Uncertainty Check



Volts= 10

Run Live Calculations

Source.Volts.DC (Fluke 5720A)

Check Scope of Accreditation

Source.Volts.DC (Fluke 5720A)

Metrology.NET Taxanomy Standard

Naming Convention starting with [Source] or [Measure] and progressing from general to more specific sub-category.

Each sub-category would be seperated by “.” periods

Each specific leaf on the taxanomy tree would contain the specific required and optional input paramaters. For example: Source.Volts.DC would require Volts.

The specific implementation of the taxonomy definition would be contained in parentheses “( )”.

Source.Volts.DC (Fluke 5720A)

Volts=

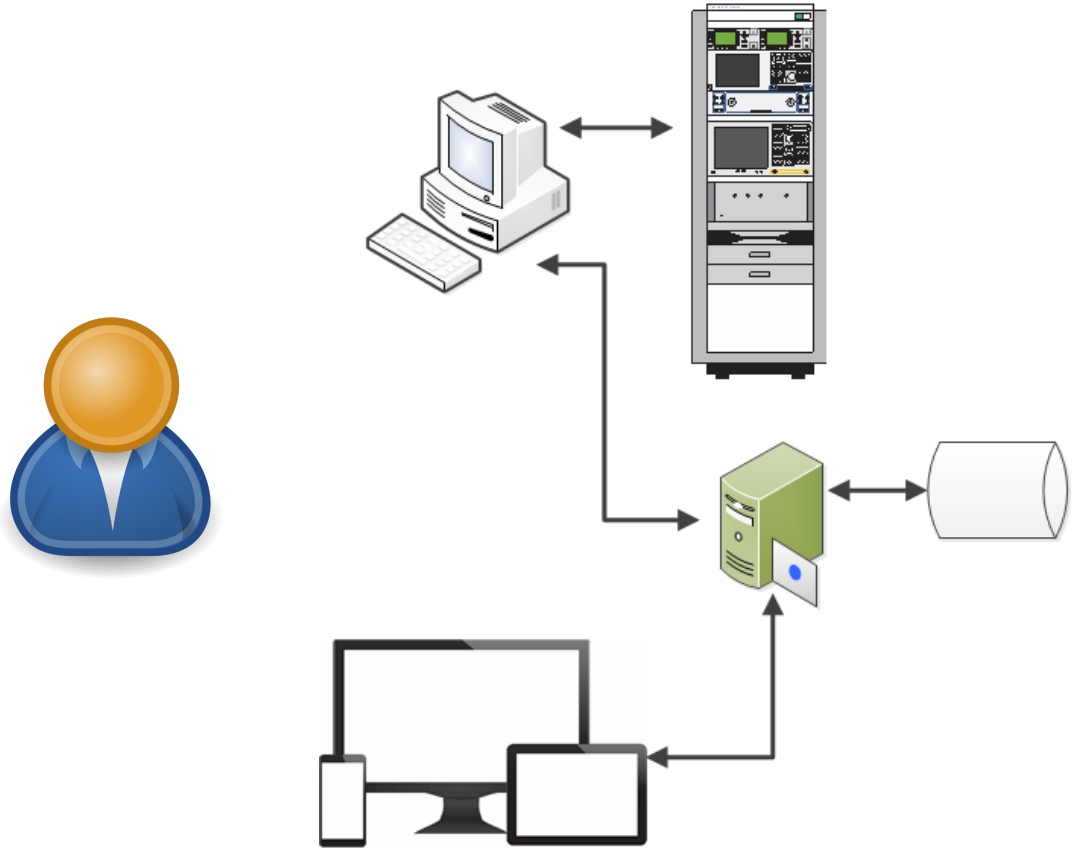
Measure.Volts.AC (HP 3458A)

Volts=

Frequency=

Questions

Overview of Metrology.NET®



Data Point Centric Automation
w/ Detailed Test Point Metadata

Standardized Communications using REST & JSON (or XML)

System-of-Metrology-Systems

Any Programming Language

Any Database

Any Operating System

Any Browser (PC or Mobile)

Any Reporting Tool