Metrology Process Studio (MPS)

Release Notes
Version 2.0

Overview

This document describes new features, enhancements, and error corrections included in this version of MPS.

MPS 2.0 has a greatly expanded test point uncertainty modeling system with both improvements to existing tools and the addition of many new tools to assist you in creating and managing more sophisticated test point uncertainty models. The new "Uncertainty Analysis Editor" form also has features to document your uncertainty analysis.

MPS 2.0 still has all the same uncertainty modeling features that were present in MPS 1.0. MPS 2.0 still automatically creates and manages uncertainty budgets for quantitative test points that use MetSpec Instruments as calibration standards. The features that automatically manage uncertainty budgets work the same way in MPS 2.0 as they did in MPS 1.0. Except for manually added uncertainty budget items, you are not required to do anything differently in MPS 2.0 unless you want to use its new tools and features. For manually added budget items in MPS 2.0, you now enter an error limit, select an error limit distribution and MPS will automatically calculate the k=1 uncertainty for the budget item. You can now also override the error limit distribution MPS assigns to its automatically added uncertainty budget items.

These new features are described in the “New Features (Major)” section of this document.

The application has been rebranded to “MOX” from “MetBench,” although some minor elements of the software retain the term “MetBench,” such as the system database name (“MetBench_MPS”) and default file system directories used when saving application files (“..\Documents\MetBench”). These were retained to minimize impact on users of the new version of the application.

A new update of the MetSpec application, with some new features and error corrections, is also being released along with MPS version 2.0. While this is not a major update of the MetSpec application, its version number was advanced to 2.0 along with

this major update of MPS 2.0. This also delineates the application's rebranding to "MOX." All MPS and MetSpec 1.x versions were "MetBench." Starting with version 2.0 they are "MOX."

Upgrades

- **SQL Scripts**: This update requires SQL scripts to update your existing MetBench_MPS database. See the instructions in your update package.

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1. System Requirements

The following are minimum system requirements for this version of CPM:

Operating System: Windows 7 or greater

Database Server: MS SQL Server 2012 or greater

2. Critical Changes

None

3. New Features (Major)

1. Major expansion of the MPS uncertainty modelling system
Description: MPS 2.0 has a greatly expanded test point uncertainty modeling system with both improvements to existing tools and the addition of many new tools to assist you in creating and managing more sophisticated test point uncertainty models. The new "Uncertainty Analysis Editor" form also has features to document your uncertainty analysis. MPS 2.0 still has all the same uncertainty modeling features that were present in MPS 1.0. MPS still automatically creates and manages uncertainty budgets for quantitative test points that use MetSpec instruments as calibration standards. The features that automatically manage uncertainty budgets work the same way in MPS 2.0 as they did in MPS 1.0. Except for manually added uncertainty budget items, you are not required to do anything differently in MPS 2.0 unless you want to use its new tools and features. For manually added budget items in MPS 2.0, you now enter an error limit and select an error limit distribution and MPS will automatically calculate the k=1 uncertainty for the budget item. You can now also override the error limit distribution MPS assigns to its automatically added uncertainty budget items. **What happens to my MPS 1.0 uncertainty models?** MPS 2.0 is reverse compatible with the uncertainty modeling system of MPS 1.0. Your existing data sheets' test point uncertainty models will automatically be updated when an MPS 1.0 data sheet is loaded into MPS 2.0. As MPS 2.0 now features error limits and selectable distributions for budget items, MPS 2.0 will use its knowledge of the distributions used in MPS 1.0 to convert these budget items. MPS 2.0 will take your existing k=1 uncertainties in the existing uncertainty budget items and assign the distribution MPS 1.0 would have used and then automatically calculate the error limit from the k=1 value and the distribution. In MPS 2.0, when you manually add budget items, you enter the error limit, select a distribution, and MPS calculates the k=1 value for you. MPS 1.0 did this internally with automatically added budget items, such as with MetSpec Instrument Ranges and the Measurement Resolution. MPS 1.0 used the following rules to determine which distribution it would use to calculate the k=1 uncertainty value for these automatically added budget items: • **Measurement Resolution (Type B)**: The "Rectangular (Resolution)" (k = √12) distribution was always used. • **Standard Deviation of Samples (Type A):** The "Standard" (k = 1) distribution was always used. • **Assigned Standards [MetSpec Instrument Ranges] (Type B)**: The "Normal" Distribution was used with a probability specified in the "[Measurement Uncty].[In Tolerance Probability]"

master configuration option. If the "[Measurement Uncty].[Use MetSpec Confidence]" master configuration option is True ("1"), then the MetSpec Instrument Confidence value is used if it is > 0.

MPS 2.0 calculates the error limits for these automatically added budget items the same way MPS 1.0 did and uses the same rules to set the error limit distributions, so there is nothing special it must do. It just recalculates them as it always did, and you end up with the same k=1 values in MPS 2.0 that you got in MPS 1.0.

For manually added budget items in MPS 1.0, you provided the k=1 uncertainty values. This is a little trickier because MPS has no idea what distribution you used to determine your k=1 value for these manual budget items. MPS 2.0 will assign and use the following distributions to calculate the error limit values for these items.

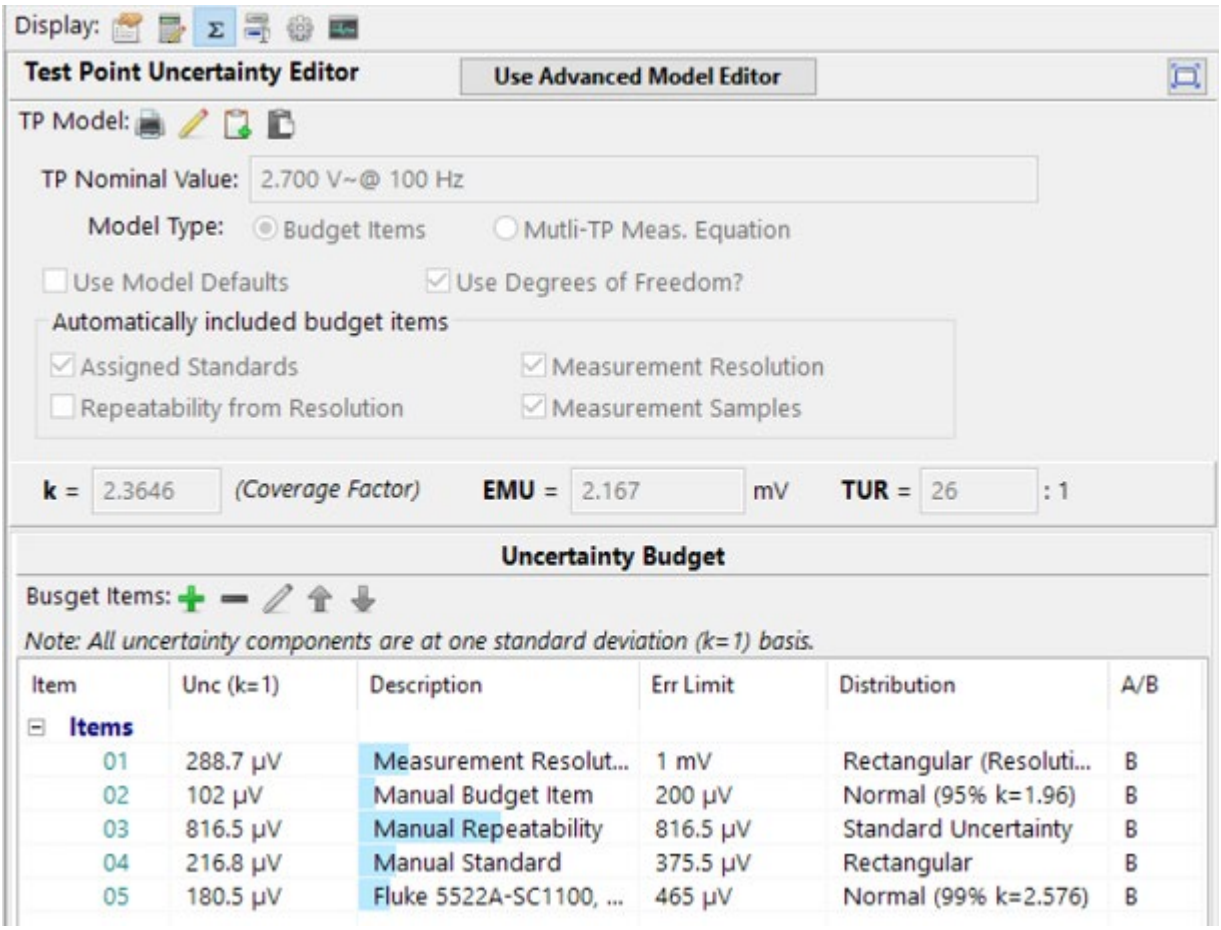
- **Type A Budget Items**: MPS 2.0 will assign the "Standard" (k = 1) distribution
- **Type B Budget Items**: MPS 2.0 will assign the "Rectangular" (k = √3) distribution

Once MPS 2.0 sets the manual budget item's distribution, it will calculate the error limit from the MPS 1.0 k=1 uncertainty value. While you will end up with the same k=1 uncertainty value for these manual budget items, the distribution displayed might be incorrect. The error limit will be correctly calculated, but may be based on the wrong distribution. As MPS 1.0 did not document the distribution used to derive the k=1 value for manually added budget items, there is nothing else that MPS 2.0 can do to convert them. The default distributions chosen for type A and B were just based on an assumption about the most commonly used distribution for manually added budget items of each type.

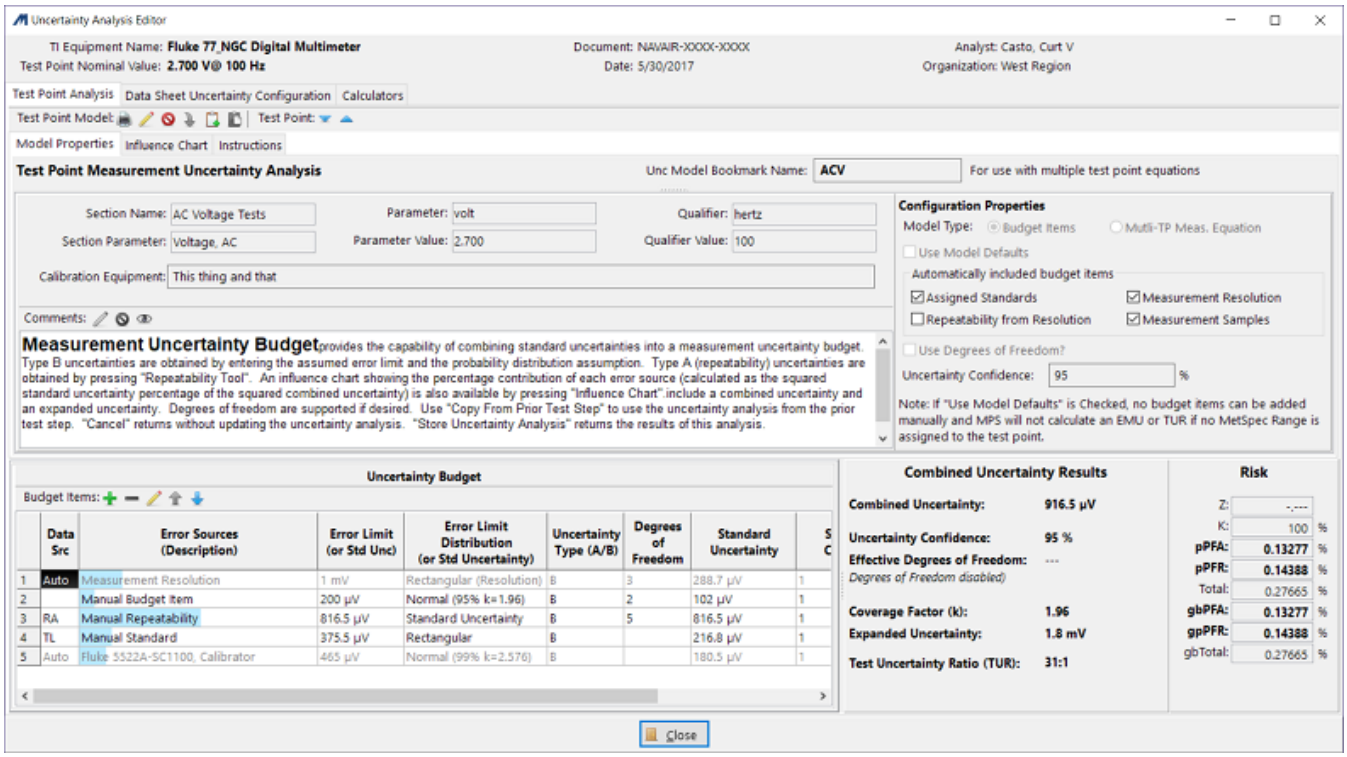
Two Primary Model Editing Tools

There are two model editing tools that can be used to create uncertainty models for test points:

- **Test Point Uncertainty Editor**: MPS 2.0 still has the "Test Point Uncertainty Editor" that you are familiar with from MPS 1.0, but new features have been added to it. You can still use this tool to view and manage uncertainty budgets when you don't need the more advanced model documentation and detail viewing features of the advanced model editor. This is still probably the best tool to use for rapid data sheet development for most working level M&TE.



- **Uncertainty Analysis Editor**: This is a new and much more sophisticated tool for creating, viewing, and documenting uncertainty models and analysis. This tool has all the features of the familiar "Test Point Uncertainty Editor," but also enables you to document the model/analysis and view more details about the test point uncertainty models summary result and risk calculations.



The Enhanced "Test Point Uncertainty Editor" form

The "Test Point Uncertainty Editor" form has the following new features:

Note: The new features are described briefly here but will be described in more detail later.

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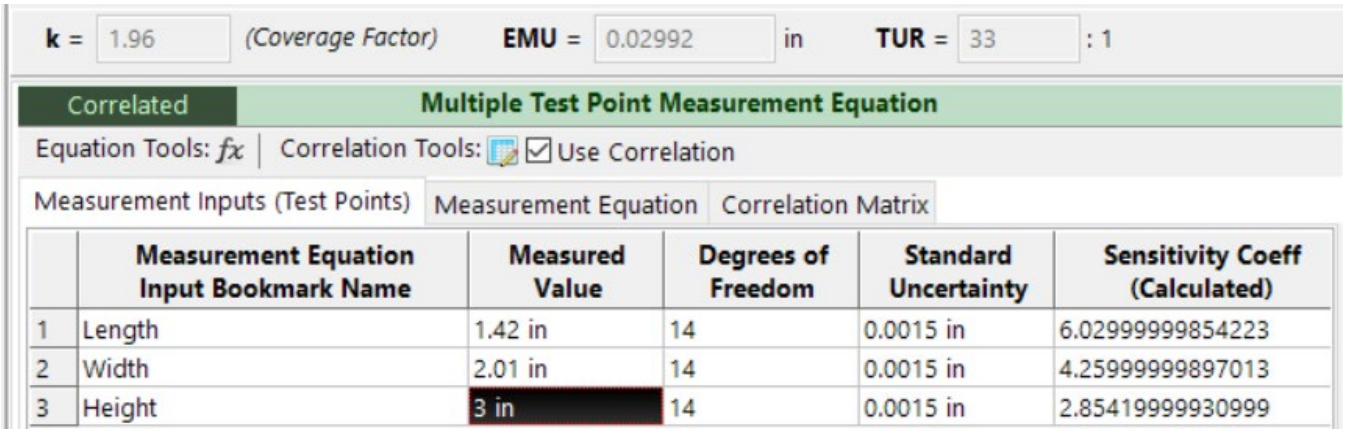
: Click this button to display the new “Uncertainty Analysis Editor” form for advanced uncertainty model editing. The button is located near the top of the “Uncertainty Analysis Editor” form you have been using in MPS 1.0.
- 
: Click this “Print an analysis report for the currently selected test points or data sheet” button to have MPS display/print an RTF (Rich Text Formatted) report with uncertainty model details for either the currently selected test points or the entire data sheet. This feature is described in detail in a separate section of this document.
- **Model Type**: MPS 2.0 supports two types of uncertainty models:
    - **Budget Items**: This is the normal type of uncertainty model that includes a list of budget items that contribute to the test points’ uncertainty model. This feature is described in detail in a separate section of this document.
    - **Multi-TP Meas. Equation**: This model type uses data from multiple other test points, along with a measurement equation, to compute the data for this test point. This model combines the uncertainty models of the other test points, automatically calculates sensitivity coefficients, and uses an optional correlation matrix for the

composite uncertainty model. This feature is described in detail in a separate section of this document.

- **Use Degrees of Freedom**: MPS 2.0 supports the optional use of degrees of freedom.

- **Repeatability from Resolution**: This is a new, optional automatically assigned budget item. If checked, a pseudo "Repeatability" budget item is added. This creates a budget item exactly like the automatically added "Measurement Resolution" budget item, except that the description label is "Repeatability." Use this item when you want to automatically add a repeatability budget item but have no actual repeatability data. Note: MPS 2.0 also has a new "Repeatability Analysis Tool" to create a real repeatability budget item using actual sample data. This feature is described in detail in a separate section of this document.
- **Budget Items Grid Enhancements**: The budget items grid is displayed when the "Budget Items" model type is in use and has the following new features:
    - No longer has separate tree nodes for type A and B items.
    - Includes the following new fields: "Error Limit," "Error Limit Distribution," and "A/B."
    - The "Description" field also is a virtual Influence chart. The relative influence of each budget item is indicated by a blue bar behind the description text. The description field is used for this as it is simply the widest grid cell (field) and provides the most resolution for the influence bars. The left edge of the cell is 0%, and the right edge is 100%.
- **Multiple Test Point Measurement Equation Grid**: This new grid is displayed instead of the budget items grid when the "Multi-TP Meas. Equation" model type is in use. This feature is described in detail in a separate section of this document.



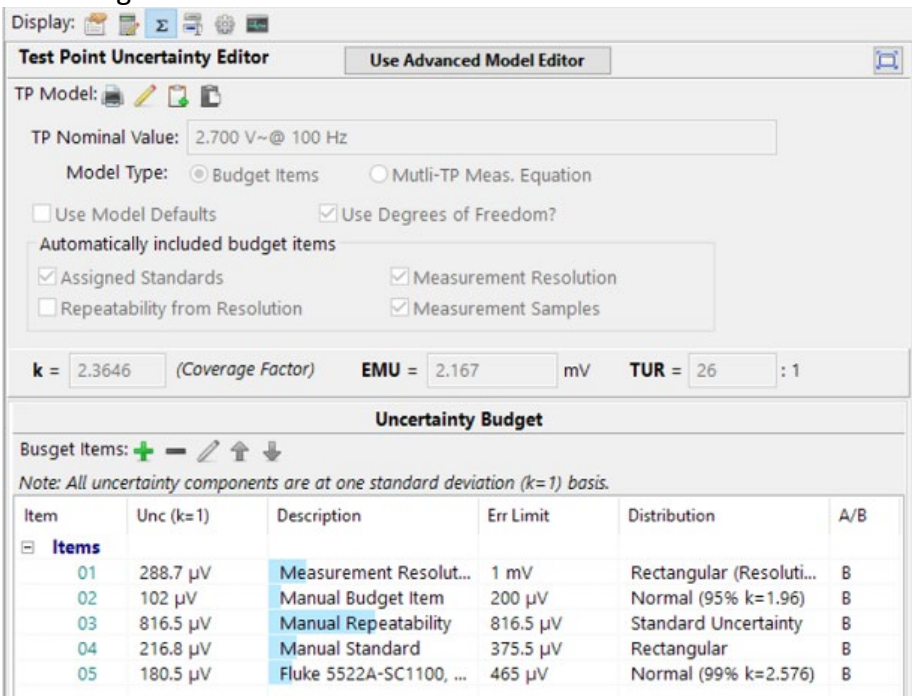
	Measurement Equation Input Bookmark Name	Measured Value	Degrees of Freedom	Standard Uncertainty	Sensitivity Coeff (Calculated)
1	Length	1.42 in	14	0.0015 in	6.02999999854223
2	Width	2.01 in	14	0.0015 in	4.25999999897013
3	Height	3 in	14	0.0015 in	2.85419999930999

Which tool should I use?

Two different model editing/viewing tools can be used to create uncertainty models for test points:

- **Test Point Uncertainty Editor**: This is the tool that you are familiar with from MPS 1.0, but new features have been added to it. Use this tool when you don't need the more advanced model documentation and detail viewing features of the advanced model editor. This form is probably the best tool to use for rapid creation/viewing of basic uncertainty budgets. This is

especially true when using MetSpec Instruments for calibration standards and MPS' automatic uncertainty modeling features.

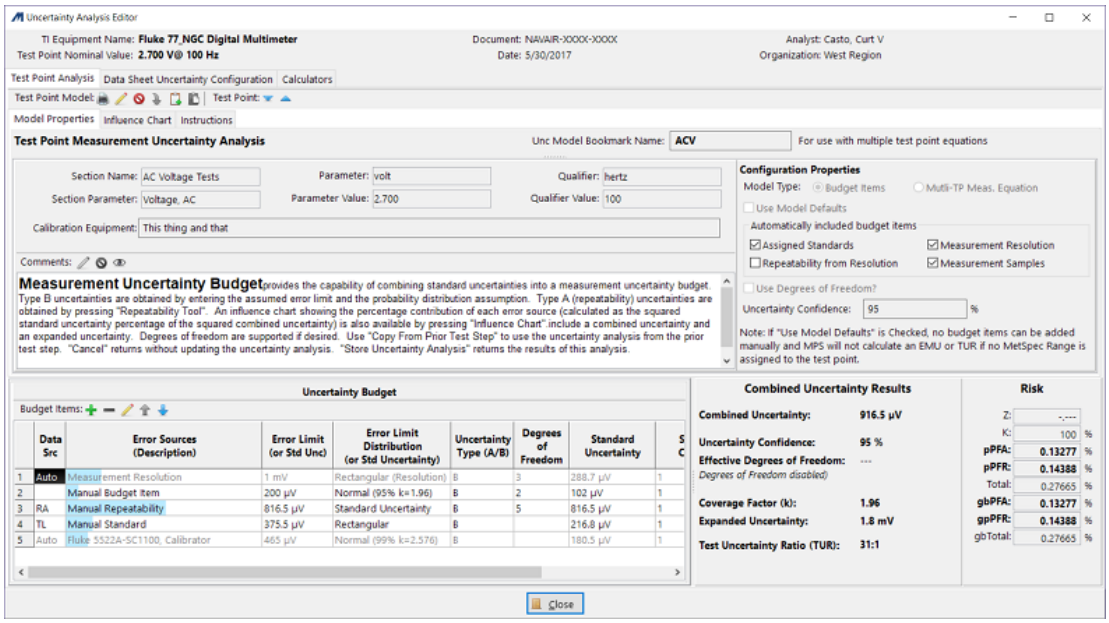


- **Uncertainty Analysis Editor**: This is a much more sophisticated tool for creating, viewing, and documenting uncertainty models and analysis. This tool has all the features of the "Test Point Uncertainty Editor" form, but also enables you to document the analysis and view more details about the test point uncertainty model's summary result and risk calculations.

    - This tool is a pop-up form that is displayed by clicking the 

button on the top of the "Test Point Uncertainty Editor" form.
    - While this form is displayed, you can still navigate to other test points by either clicking the form's 

buttons or pressing the ALT + UP or ALT + DOWN keyboard keys.



The case for using both tools together

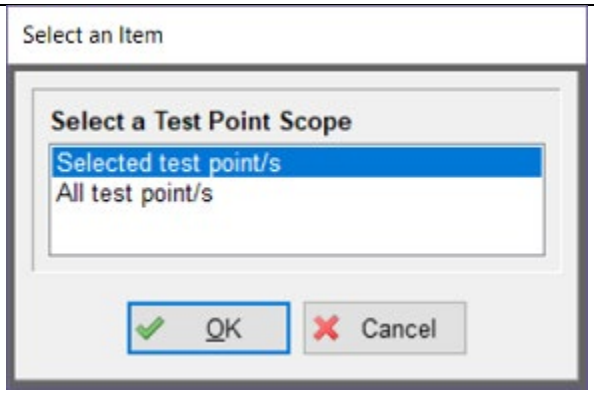
The choice is not necessarily one or the other. You can use the “Test Point Uncertainty Editor” tool to rapidly develop basic uncertainty budgets, and you can also use it as a viewer/editor for uncertainty models created with the "Uncertainty Analysis Editor" form. You only must use the "Uncertainty Analysis Editor" form for editing uncertainty analysis documentation or when you want to view a more complete picture of the uncertainty analysis for test points.

2. Displaying and printing Uncertainty Analysis Reports

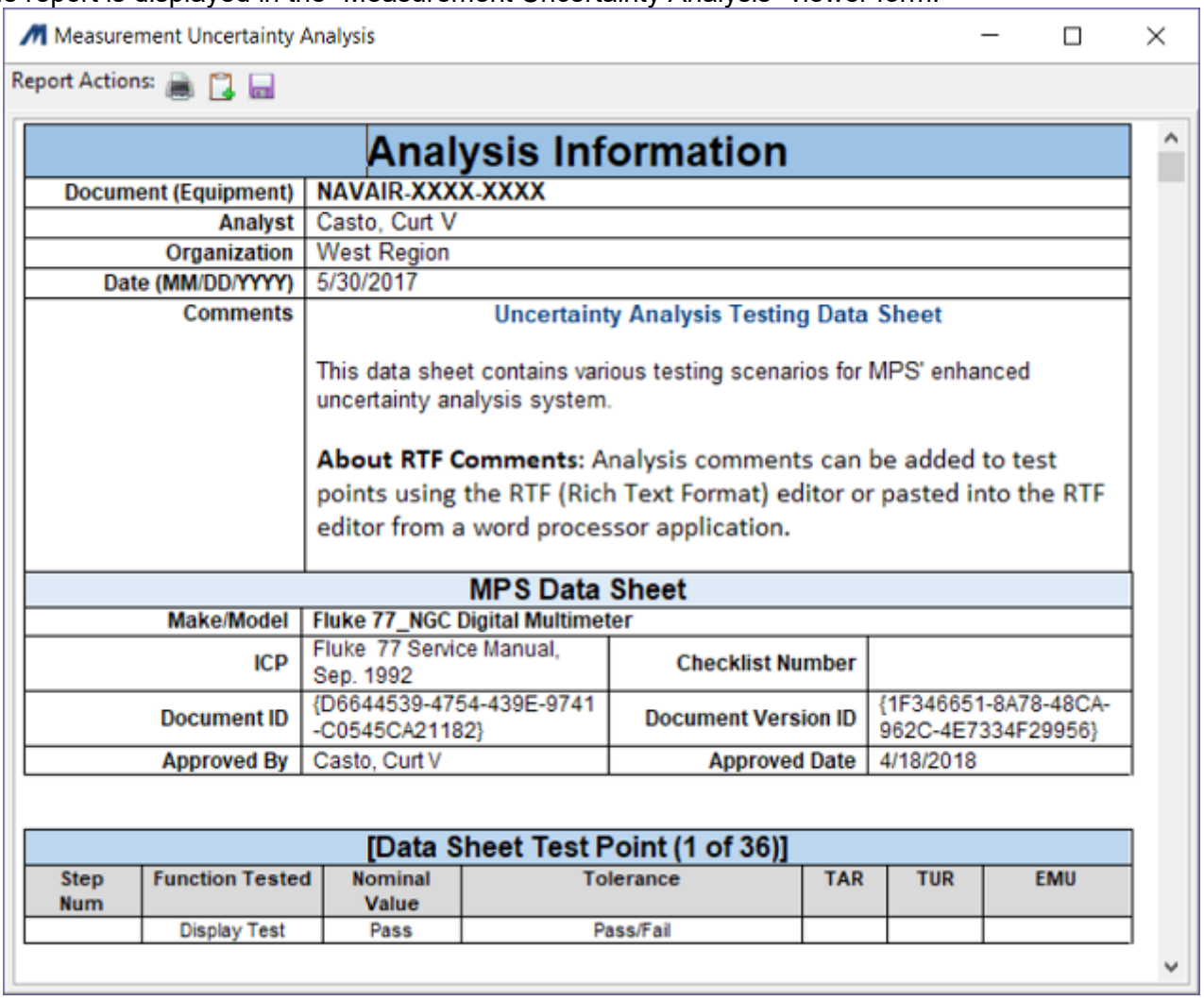
Description:

MPS has a built in Uncertainty Analysis Reporting system that generates uncertainty analysis documentation for either currently selected test points or the entire data sheet. The report is generated in RTF (Rich Text Format) to allow you to copy all or a portion of the report to the MS Windows clipboard and then paste that into a word processing application such as MS Word.

The report can be displayed/printed from either the “Test Point Uncertainty Editor” or "Uncertainty Analysis Editor" forms. Both forms have a  button that can be clicked to generate the report. When the button is clicked, a pop-up form will give you the option to generate the report for the currently selected test points or the entire data sheet:



The report is displayed in the "Measurement Uncertainty Analysis" viewer form.



Report Content Examples

Note: The information displayed in these examples is from a software testing data sheet and contains budget items and other settings intended to test various aspects of the MPS uncertainty modeling and analysis systems. This data sheet is used for these examples as it also illustrates a wide variety of model types, budget items, error limit distributions, etc. This data is used here for illustration purposes

and is not intended to reflect the actual model or analysis content for a real-world calibration of a specific item of M&TE.

Data Sheet Header Example

Whether printing selected test points or the entire data sheet, the report always begins with the data sheet header section. The following is an example of what this section looks like:

Analysis Information			
Document (Equipment)	NAVAIR-XXXX-XXXX		
Analyst	Casto, Curt V		
Organization	West Region		
Date (MM/DD/YYYY)	5/30/2017		
Comments	Uncertainty Analysis Testing Data Sheet This data sheet contains various testing scenarios for MPS' enhanced uncertainty analysis system. **About RTF Comments:** Analysis comments can be added to test points using the RTF (Rich Text Format) editor or pasted into the RTF editor from a word processor application.		
MPS Data Sheet			
Make/Model	Fluke 77_NGC Digital Multimeter		
ICP	Fluke 77 Service Manual, Sep. 1992	Checklist Number	
Document ID	{D6644539-4754-439E-9741-C0545CA21182}	Document Version ID	{1F346651-8A78-48CA-962C-4E7334F29956}
Approved By	Casto, Curt V	Approved Date	4/18/2018

Test Point with no uncertainty model example

Each test point section begins with a display of the data sheet test point and is followed by the uncertainty information. Test points that do not have an uncertainty model include only the test point information.

Example of a test point that has no uncertainty model:

[Data Sheet Test Point (1 of 36)]						
Step Num	Function Tested	Nominal Value	Tolerance	TAR	TUR	EMU
	Display Test	Pass	Pass/Fail			

This "Pass/Fail" test point is non quantitative and has no uncertainty model

"Budget Items" uncertainty model type (manual and automatic budget items) example

Example of a test point configured to use the "Budget Items" uncertainty model type. This example includes both automatically and manually added budget items.

Note: The manually added item descriptions begin with the word "Manual" for illustration purposes in this example.

[Data Sheet Test Point (13 of 36)]						
Step Num	Function Tested	Nominal Value	Tolerance	TAR	TUR	EMU
	3.2 V AC Range	2.700 V @ 100 Hz	2.644 to 2.756 V	120:1	26:1	± 2.2 mV

Test Point Measurement Uncertainty Analysis	
Calibration Equipment	Fluke 55XX or 57XX meter calibrators
Comments	***Note**: Budget items included in this test point's uncertainty model are for MPS system testing only. They do not necessarily apply to the actual calibration procedure used to calibrate the TI.*

Uncertainty Budget						
	Error Sources (Description)	Error Limit (or Std Unc)	Error Limit Distribution (or Std Uncertainty)	Uncertainty Type (A/B)	Degrees of Freedom	Standard Uncertainty
1	Measurement Resolution	1 mV	Rectangular (Resolution)	B	3	288.7 µV
2	Manual Budget Item	200 µV	Normal (95% k=1.96)	B	2	102 µV
3	Manual Repeatability	816.5 µV	Standard Uncertainty	B	5	816.5 µV
4	Manual Standard	375.5 µV	Rectangular	B		216.8 µV
5	Fluke 5522A-SC1100, Calibrator	465 µV	Normal (99% k=2.576)	B		180.5 µV
6	Repeatability	1 mV	Rectangular (Resolution)	A		288.7 µV

Measurement Equation (Additive)		Combined Uncertainty
V = True + e(Measurement Resolution) + e(Manual Budget Item) + e(Manual Repeatability) + e(Manual Standard) + e(Fluke 5522A-SC1100, Calibrator) + e(Repeatability)		960.9 µV

Combined Uncertainty Results	
Combined Uncertainty	960.9 µV
Uncertainty Confidence	95 %
Effective Degrees of freedom	9
Coverage Factor (k)	2.2622
Expanded Uncertainty	2.2 mV

Measurement Risk				
Risk Type	PFA	PFR	Total Risk	GB Multiplier
Design Tolerance (Normal)	0.15933%	0.1756%	0.33493%	

The Fluke calibrator in this example uses a 99% probability in the "Normal" distribution because MPS was configured to use MetSpec Instrument specification confidence and that is the spec confidence setting for the instrument in the MetSpec spec sheet. *Note: If the MPS Master Configuration option "[Measurement Uncty].[*Use MetSpec Confidence*]" is True, and the MetSpec Instrument has a Spec Confidence value > 0, The MetSpec Confidence is used as the "Normal" distribution probability.*

"Budget Items" uncertainty model type (Guard Band) example

Example of a test point configured to use the "Budget Items" uncertainty model type. This example displays guard band information in the "Measurement Risk" section of the test point analysis.

[Data Sheet Test Point (15 of 36)]						
Step Num	Function Tested	Nominal Value	Tolerance	TAR	TUR	EMU
	750 V AC Range	750.0000 V @ 100 Hz	749.4650 to 750.5350 V g: 749.4802 to 750.5198 V	2.3:1	3.0:1	± 180 mV

Test Point Measurement Uncertainty Analysis	
Calibration Equipment	
Comments	

Uncertainty Budget						
	Error Sources (Description)	Error Limit (or Std Unc)	Error Limit Distribution (or Std Uncertainty)	Uncertainty Type (A/B)	Degrees of Freedom	Standard Uncertainty
1	Measurement Resolution	100 µV	Rectangular (Resolution)	B	5	28.9 µV
2	Fluke 5522A-SC1100, Calibrator	235 mV	Normal (99% k=2.576)	B		91.2 mV

Measurement Equation (Additive)		Combined Uncertainty
V = True + e(Measurement Resolution) + e(Fluke 5522A-SC1100, Calibrator)		91.2 mV

Combined Uncertainty Results	
Combined Uncertainty	91.2 mV
Uncertainty Confidence	95 %
Effective Degrees of freedom	498810646242407
Coverage Factor (k)	1.96
Expanded Uncertainty	180 mV

Measurement Risk				
Risk Type	PFA	PFR	Total Risk	GB Multiplier
Design Tolerance (Normal)	0.97717%	2.21183%	3.189%	
Guard Banded (Method: Z540.3)	0.8006%	2.77899%	3.57959%	97.17698%

Guard banded risk information is displayed in the "Measurement Risk" section

"Multiple Test Point Measurement Equation" uncertainty model type (Uses Correlation) example
When using a "Multiple Test Point Measurement Equation," the test points that will provide the inputs to the equation each have a unique "Uncertainty Bookmark Name" assigned. The bookmark name will also be the variable name, which is used to represent the measured value of the test point within the measurement equation. Sensitivity coefficients (partial derivatives) are automatically calculated based on the measurement equation. The use of a correlation matrix is optional.
Example of a "Volume" test point configured to use the "Multi-TP Meas. Equation" uncertainty model type. The equation uses three other test points that have been assigned "Length," "Width," and "Height" Uncertainty Bookmark Names. The measurement equation used to obtain the "Volume" measured value is "`{Length} * {Width} * {Height}`". (See: "Model Type: Multi-TP Meas. Equation Editing section of this document" for information about this uncertainty model type):
Note: This example uses an optional correlation matrix. Two of the correlations in the example use the MPS "Measurement Equation Variable Correlation Analysis" tool to obtain their correlation value. The third correlation value is just a manually entered value. You can either use the tool or just manually enter values; it's your decision.

[Data Sheet Test Point (36 of 36)]

Step Num	Function Tested	Nominal Value	Tolerance	TAR	TUR	EMU
	Volume	9.000 in	8.000 to 10.000 in		33:1	± 0.03 in

Test Point Measurement Uncertainty Analysis

Calibration Equipment	
Comments	

Measurement Equation Inputs

	Measurement Equation Input Variable	Measured Value	Degrees of Freedom	Standard Uncertainty	Sensitivity Coefficient (Calculated)
1	Length	1.42 in	14	0.0015 in	6.02999999854223
2	Width	2.01 in	14	0.0015 in	4.25999999897013
3	Height	3 in	14	0.0015 in	2.85419999930999

Measurement Equation Description		Combined Uncertainty
Measurement = {Length} * {Width} * {Height}		0.015 in

Combined Uncertainty Results

Combined Uncertainty	0.015 in
Uncertainty Confidence	95 %
Effective Degrees of freedom	
Coverage Factor (k)	1.96
Expanded Uncertainty	0.03 in

Measurement Risk

Risk Type	PFA	PFR	Total Risk	GB Multiplier
Design Tolerance (Normal)	0.12449%	0.13421%	0.2587%	

Measurement Equation Correlation Matrix

Measurement Equation Input Variable	Var	1	2	3	4	5	6	7	8	9	10	11	12
Length	1	1.00											
Width	2	0.16 (A)	1.00										
Height	3	0.36 (A)	0.99 (M)	1.00									

Measurement Equation Correlation Analysis (Matrix Cell = R2:C1)

Input Variable 1			Input Variable 2			
Width			Length			
	Error Sources (Description)	Standard Uncertainty		Error Sources (Description)	Standard Uncertainty	Correlation
1	Measurement Resolution	288.7 µin	1	Measurement Resolution	288.7 µin	1
2	Repeatability	0.001 in	2	Repeatability	0.001 in	0.25
3	Cal Std	100 µin	3	Cal Std	100 µin	0.5
4	Operator Error	0.001 in	4	Operator Error	0.001 in	
5	Environment	282.8 µin	5	Environment	282.8 µin	
	Combined Uncertainty	0.0015 in		Combined Uncertainty	0.0015 in	
				Combined Correlation Between Variable 1 and Variable 2		0.16

Measurement Equation Correlation Analysis (Matrix Cell = R3:C1)

Input Variable 1			Input Variable 2			
Height			Length			
	Error Sources (Description)	Standard Uncertainty		Error Sources (Description)	Standard Uncertainty	Correlation
1	Measurement Resolution	288.7 µin	1	Measurement Resolution	288.7 µin	
2	Repeatability	0.001 in	2	Repeatability	0.001 in	
3	Cal Std	100 µin	3	Cal Std	100 µin	
4	Operator Error	0.001 in	4	Operator Error	0.001 in	0.75
5	Environment	282.8 µin	5	Environment	282.8 µin	0.5
	Combined Uncertainty	0.0015 in		Combined Uncertainty	0.0015 in	
				Combined Correlation Between Variable 1 and Variable 2		0.36

The "Measurement Equation Correlation Matrix" shows two of the correlations with the "(A)" symbol and one with the "(M)" symbol. The "(A)" symbol indicates that that the value is calculated result of a Correlation **A**nalysis and the "(M)" symbol indicates that the value was manually entered by the analyst. Therefore, only two "Measurement Equation Correlation Analysis" sections are displayed below the matrix.

3. Model Type: “Budget Items” editing

Description:

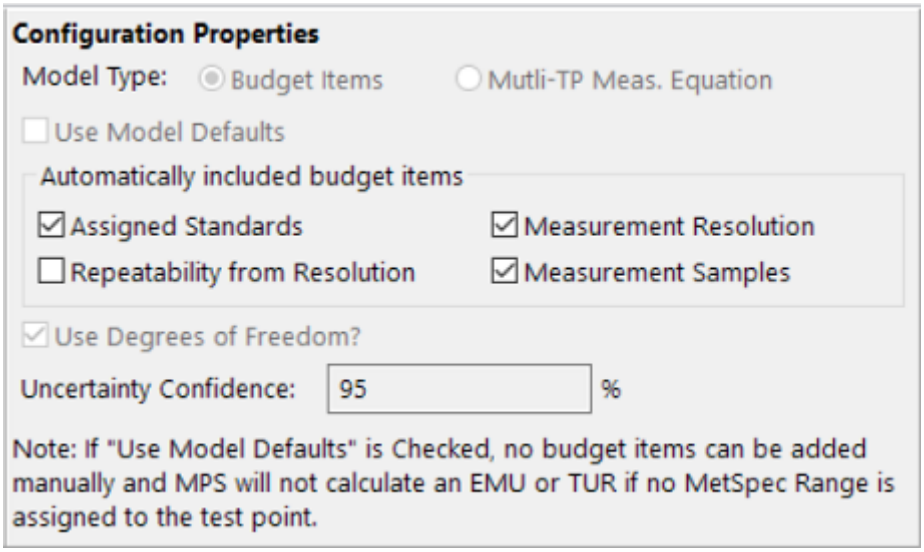
This is the common test point uncertainty model type that is comprised of one or more budget items. Each budget item will have a description, error limit, error limit distribution, and other optional properties. MPS will automatically calculate the standard (k=1) uncertainty for each budget item from its error limit and error limit distribution.

When manually adding budget items In MPS 1.0, you had to calculate the k=1 uncertainty yourself and enter the k=1 value. In MPS 2.0, you enter the error limit, select the applicable error limit distribution, and MPS will calculate the k=1 uncertainty for you. You can now also override the default error limit distribution MPS assigns to its automatically created budget items, such as calibration standard ranges and measurement uncertainty. If you override the error limit distribution, MPS will recalculate the k=1 uncertainty of the automatically added budget item using the selected error limit distribution. See the “Major expansion of the MPS uncertainty modelling system” (item #1 in this section of the document) for information about how MPS 2.0 will automatically transform your legacy data sheet budget items to the MPS 2.0 “Budget Items” format.

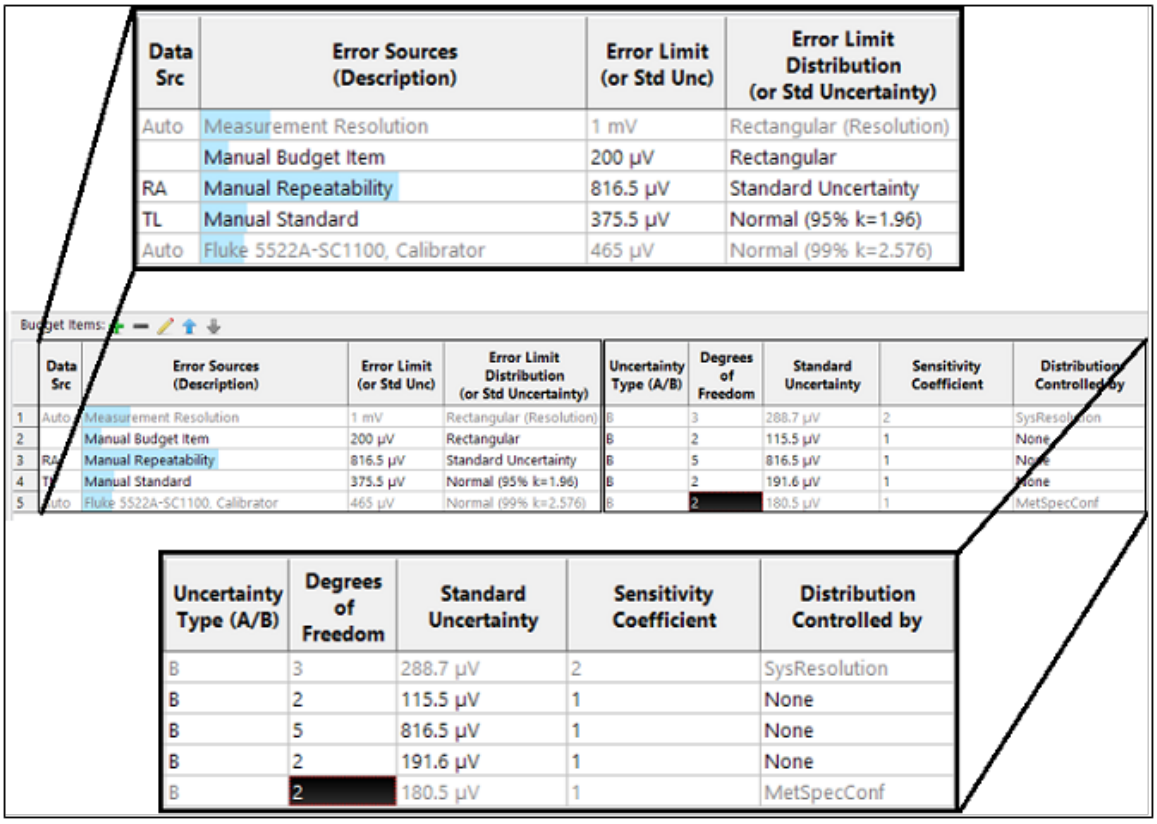
Configuring the test point uncertainty model's properties

You can configure properties for each test point uncertainty model to control behaviors, such as:

- Letting MPS have full control over the uncertainty model, using default settings for the behavior control items included on this panel (form section).
- Automatically adding MPS managed budget items for "Assigned Standards," "Measurement Resolution," "Repeatability from Resolution," and "Measurement Samples" (added to calibration measurement uncertainty models only).
    - "Repeatability from Resolution" is a new option in MPS 2.0. When selected, a type "B" budget item will be automatically created by MPS for "Repeatability" using the test point's measurement resolution as the error limit and “Rectangular (Resolution)” (k = √12) error limit distribution.
        - *Note: This creates a budget item exactly like the automatically added “Measurement Resolution” budget item, except that the description label is “Repeatability.” Use this item when you want to automatically add a repeatability budget item but have no actual repeatability data.*
        - *Note: Use the “*Repeatability Analysis Tool*” (described later in a separate section of this document) to create a real repeatability budget item using actual repeatability data.*
- The optional use of degrees of freedom.
- Overriding the default Uncertainty Confidence.



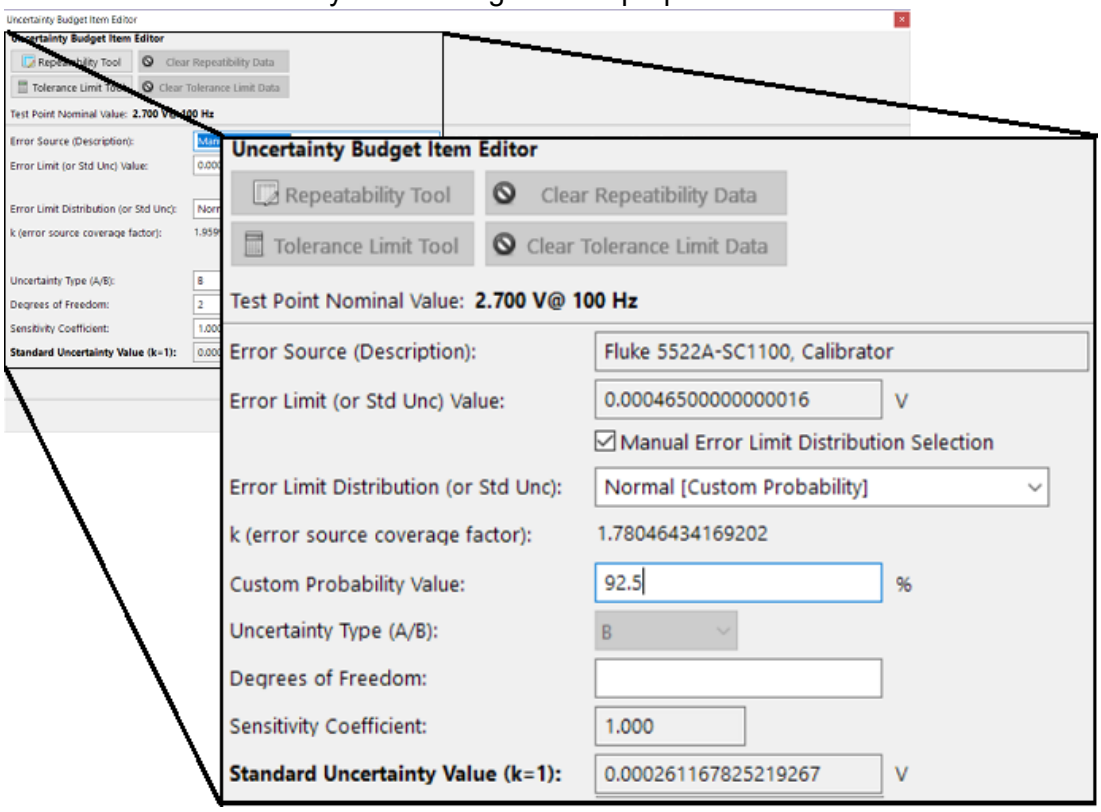
Budget Items



Note: The budget items displayed in this example illustrate a wide variety of budget item types, distributions, data sources, etc. The data used here is for illustration purposes and is not intended to reflect the actual model or analysis content for a real-world calibration of a specific item of M&TE.

Uncertainty Budget Item Editor form

This form replaces the old budget item editor form in MPS 1.0 and has many new features. Use this form to edit an uncertainty model budget item's properties.

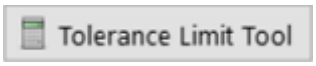


Note: The form is shown editing an automatically added "Assigned Standard" budget item. This displays all the form's editing GUI objects, but several are shown disabled. Most of the disabled objects would be enabled when editing a manually added budget item.

Test Point Analysis Documentation

Note: There are editing feature restrictions when editing a budget item automatically created by MPS. See the "Editing budget items automatically created and managed by MPS" section below for details about these restrictions.

GUI Element	Type	Description
Repeatability Tool	Button	Use the Repeatability Analysis Tool. See the separate section of this document that describes the "Repeatability Analysis Tool" for more information about using this tool. *Note: The Repeatability Analysis data is saved with the budget item and can be viewed or edited anytime in the future.*

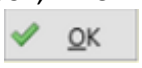
	Button	Clear any Repeatability Analysis data currently saved with the budget item. *Note: This button is only enabled when a budget item has saved Repeatability Analysis data.*
	Button	Use the Tolerance Limit Tool. See the separate section of this document that describes the "Tolerance Limit Tool" for more information about using this tool. *Note: The Tolerance Limit data is saved with the budget item and can be viewed or edited anytime in the future.*
	Button	Clear any Tolerance Limit data currently saved with the budget item. *Note: This button is only enabled when a budget item has saved Tolerance Limit data.*
Test Point Nominal Value	Label	Displays the currently selected test point's Nominal Value parameters. *Note: This label is the test point's Nominal Value display text.*
Error Source (Description)	Editor	Enter a description (label) that Identifies the error source (e.g., Repeatability, Resolution).
Error Limit (or Std Unc) Value	Editor	Enter the maximum error source or the standard uncertainty value.
Manual Error Limit Distribution Selection	Check Box	Disable automatic selection of the error limit distribution for an automatically created "Assigned Standards" budget item. When this feature is checked, the editing features for selecting an error limit distribution are enabled. *Note: This item is only visible when editing an "Assigned Standards" automatically created budget item.*
Error Limit Distribution (or Std Unc)	Pick List	Choose the probability distribution for the error source or select standard uncertainty.
k (error source coverage factor)	Label	The coverage factor associated with the selected distribution (Uncty = Error Limit / k).
Custom Probability Value	Editor	Enter a probability value when the "Normal [Custom Probability]" error limit distribution is selected. When this feature is used, MPS will display the distribution as "Normal (x% k=y)," where "x" is the value entered into this field and "y" is the k value calculated from "x" for a normal distribution. *Note: This item is only visible when the "Normal [Custom Probability]" error limit distribution is selected.*

Uncertainty Type (A/B)	Pick List	Identify whether the uncertainty calculation is Type A or B (optional).
Degrees of Freedom	Editor	Enter the degrees of freedom (Optional). *Note: The degrees of freedom can be obtained from the Repeatability Tool when its use is applicable.*
Sensitivity Coefficient	Editor	Enter a sensitivity coefficient value. (Default value is one). The k=1 uncertainty value of the budget item is multiplied by the sensitivity coefficient when calculating the combined uncertainty value for the test point.
Standard Uncertainty Value (k=1)	Label	Calculated based on the error limit and error distribution.
	Button	Click this button to accept edits and disable editing features. *Note: This button is displayed in a yellow bar at the bottom of the tab page that is only visible when editing features are enabled.*
	Button	Click this button to cancel edits and disable editing features. *Note: This button is displayed in a yellow bar at the bottom of the tab page that is only visible when editing features are enabled.*

Editing budget items automatically created and managed by MPS

You can now edit a limited number of budget item properties for budget items automatically created and managed by MPS. This section will describe the properties you can edit by automatically created budget item type.

Note: If you uncheck the test point uncertainty model property, to automatically create one of these types of automatically created budget items, and later check that option again, any changes previously made to the test point budget items of that type will be lost. The same applies for any MetSpec ranges assigned to test points. If you delete and re-add the assignment, any changes you made are lost. The reason for losing your property overrides is that the budget item has been destroyed (deleted) along with your property overrides. When they are subsequently recreated by MPS, there are no user overrides.

- "**Assigned Standards**" (MetSpec Range):
  - Error Limit Distribution: You can check the "Manual Error Limit Distribution Selection" check box to override the distribution that MPS automatically applies. If this item is checked, you can select the error limit distribution as you would with a manually created budget item. If you uncheck the "Manual Error Limit Distribution Selection" check box, MPS will restore its automatically chosen distribution when you click the form's  button to accept edits.

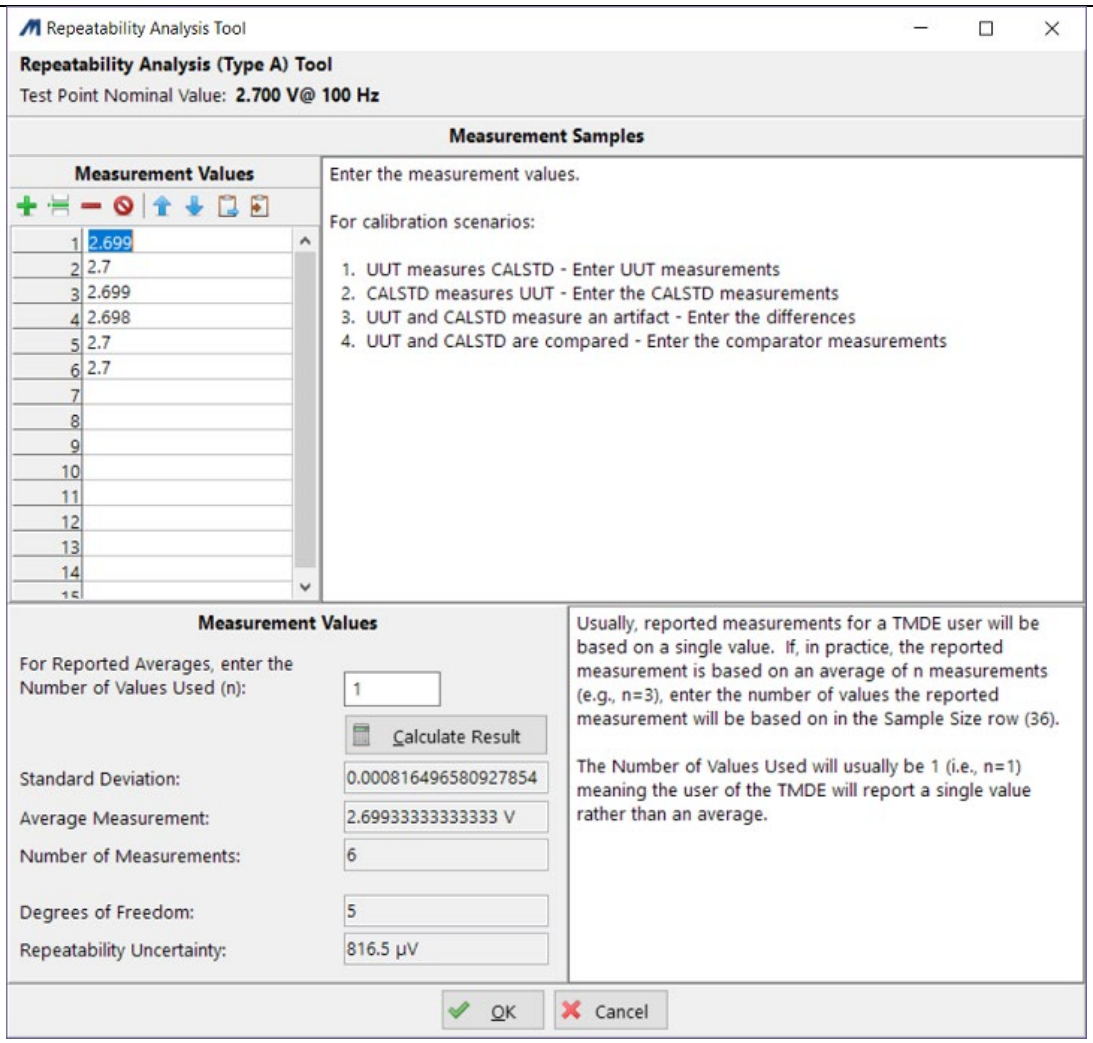
    - Degrees of Freedom: MPS cannot automatically determine the degrees of freedom for an automatically created budget item, so it is always up to you to set this value if using degrees of freedom.
- "**Repeatability from Resolution**" and "**Measurement Resolution**":
    - Sensitivity Coefficient: MPS defaults this value to one, but you can enter whatever value you like.
    - Degrees of Freedom: MPS cannot automatically determine the degrees of freedom for an automatically created budget item, so it is always up to you to set this value if using degrees of freedom.
- "**Measurement Samples**": There are no properties that you can set for these items because they do not exist until a measurement is made while executing a calibration.

4. Repeatability Analysis Tools

Description:

The new Repeatability Analysis Tool estimates repeatability uncertainty.

This tool can be displayed by clicking the "Repeatability Tool" button on the new Uncertainty Budget Item Editor form.



How this tool calculates the Repeatability Uncertainty

The Sample Standard Deviation and The Standard Uncertainty

- The standard uncertainty is not the same as the sample standard deviation
- Sample Standard Deviation

$$s = \sqrt{\sum_{i=1}^{n} \frac{\left(x_i - \bar{x}\right)^2}{\left(n-1\right)}}$$

- The standard uncertainty characterizes the variability in the measurement error probability distribution (k=1)
- The sample standard deviation is used to estimate the repeatability part of the standard uncertainty

Repeatability Uncertainty for Averaged Measurements

- Repeatability Error Source when the measurement is averaged

- Calculate Sample Standard Deviation

$$s = \sqrt{\sum_{i=1}^{n} \frac{\left(x_i - \bar{x}\right)^2}{\left(n-1\right)}}$$

- Repeatability Uncertainty for Mean
  (Uses sample standard deviation of the mean)

$$u_{Repeatability} = s/\sqrt{n}$$

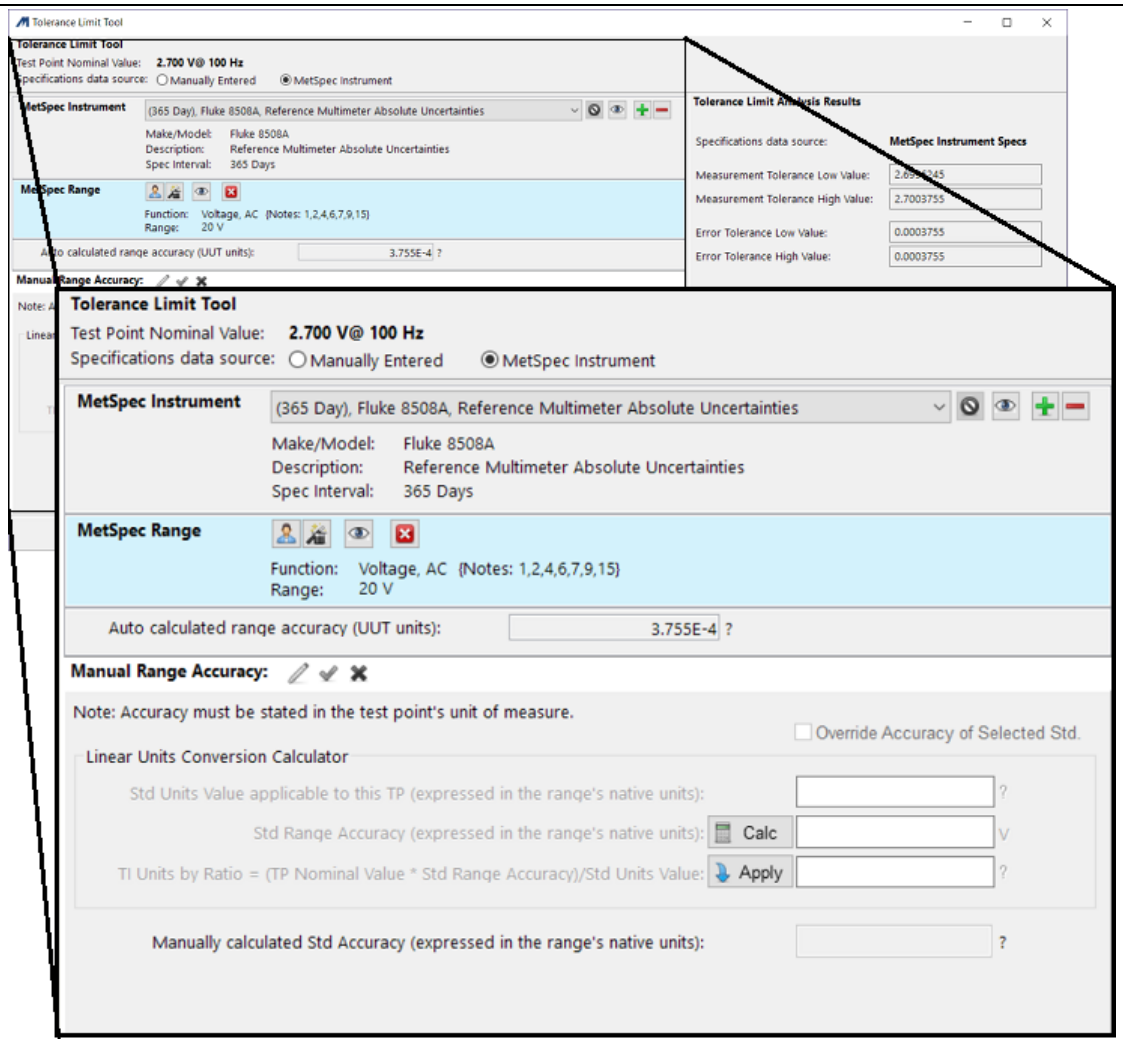
5. Tolerance Limit Tool

Description:
This tool is used to calculate an error limit for a manually added budget item using an instrument's specifications. This can be useful for adding uncertainty budget items for instruments that will not be added as MetSpec Calibration Standard Instruments. The tool allows you to provide the specifications in one of two ways:

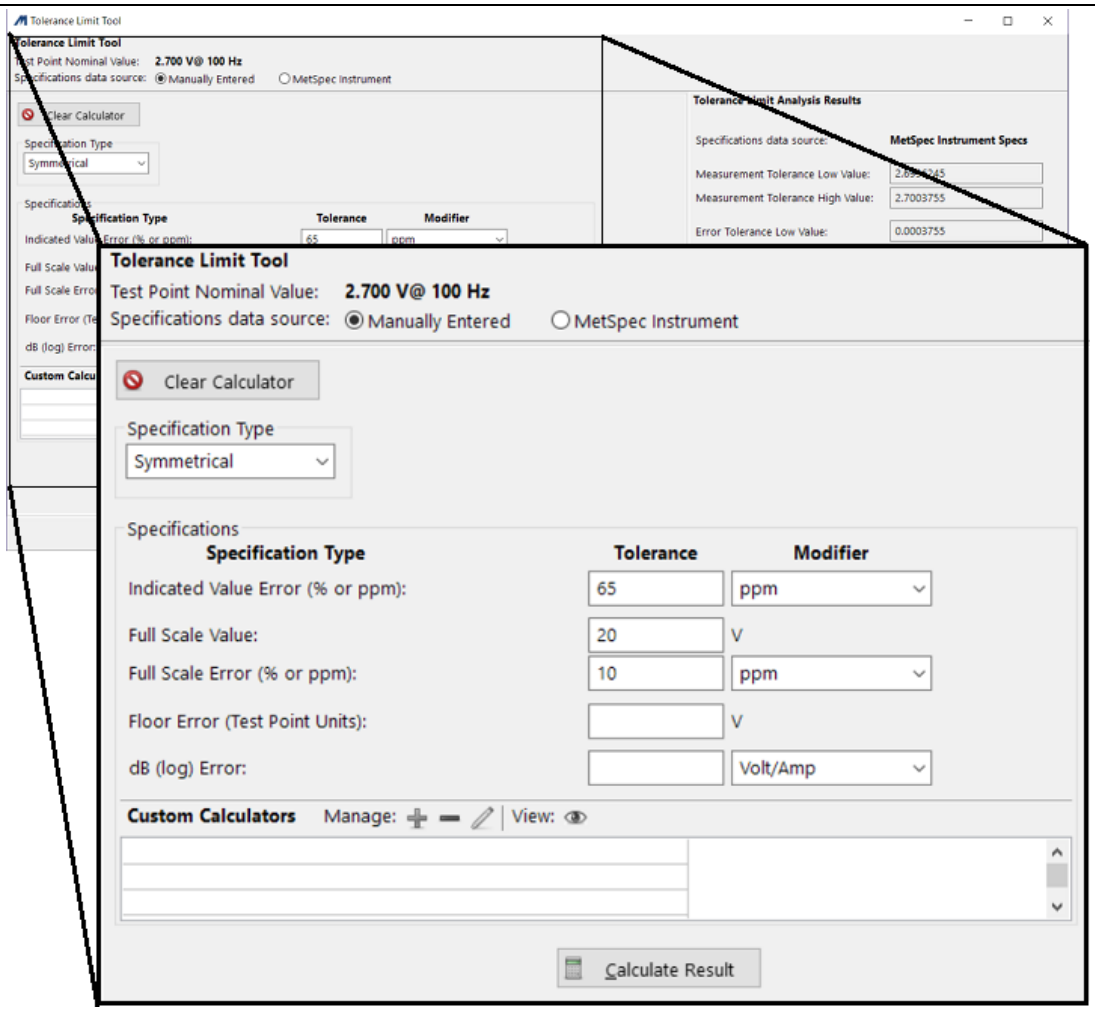
- **Manually Entered**: Enter specification components, such as % or ppm of indicated value, % or ppm of full scale, floor error, and dB (log) error. Entering specifications manually is similar to entering specifications in the MPS "Test Point Builder" form.
- **MetSpec Instrument**: Select a MetSpec Instrument and Range. This is similar to, but not the same as, assigning MetSpec Instruments to the data sheet and MetSpec Ranges to test points as calibration standards, for the TI (Test Instrument) calibration. This feature allows you to use MetSpec Instruments directly with uncertainty budget items that are not directly used in the TI calibration. MPS maintains a separate list of MetSpec Instruments that are used directly in uncertainty budget items (not used for range assignment to calibration test points). This sounds confusing, but an example might be if you wanted to include a budget item for an instrument that is used to calibrate one of the calibration standards that is used to calibrate the TI. If you are still confused, just suffice it to know that these MetSpec Instruments are independent of the MetSpec Instruments normally assigned to the data sheet as calibration standards, and you can use them directly with uncertainty budget items. If you use them for this purpose is entirely up to you.

The form has two data source modes that represent the two specification data sources described above. The two modes are "Manually Entered" and "MetSpec Instrument."

"MetSpec Instrument" Data Source Mode:



"Manually Entered" Data Source Mode:



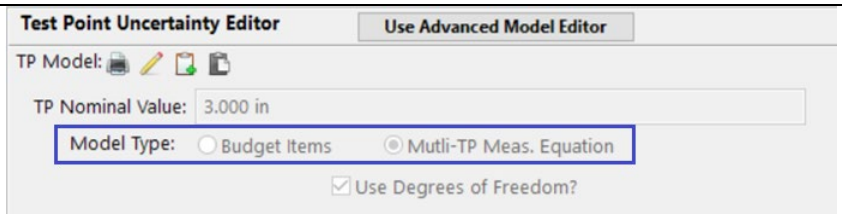
6. Model Type: "Multi-TP Meas. Equation" Editing

Description:

MPS 1.0 only had one uncertainty model type, which was based on a list of uncertainty budget items that were added to the uncertainty model either automatically or manually by the user. This is still the default uncertainty model type for MPS. MPS 2.0 supports two uncertainty model types:

- **Budget Items**: This is the uncertainty model type that you are already familiar with from MPS 1.0 that has a list of Type "A" and "B" uncertainty budget items.
- **Muti-TP Meas. Equation**: The new Multiple Test Point Equation (MTPE) facilitates combining multiple other test points with a measurement equation to calculate the measured values for the MTPE test point. This is described in detail below.

The uncertainty model type can be selected as shown in the following image:



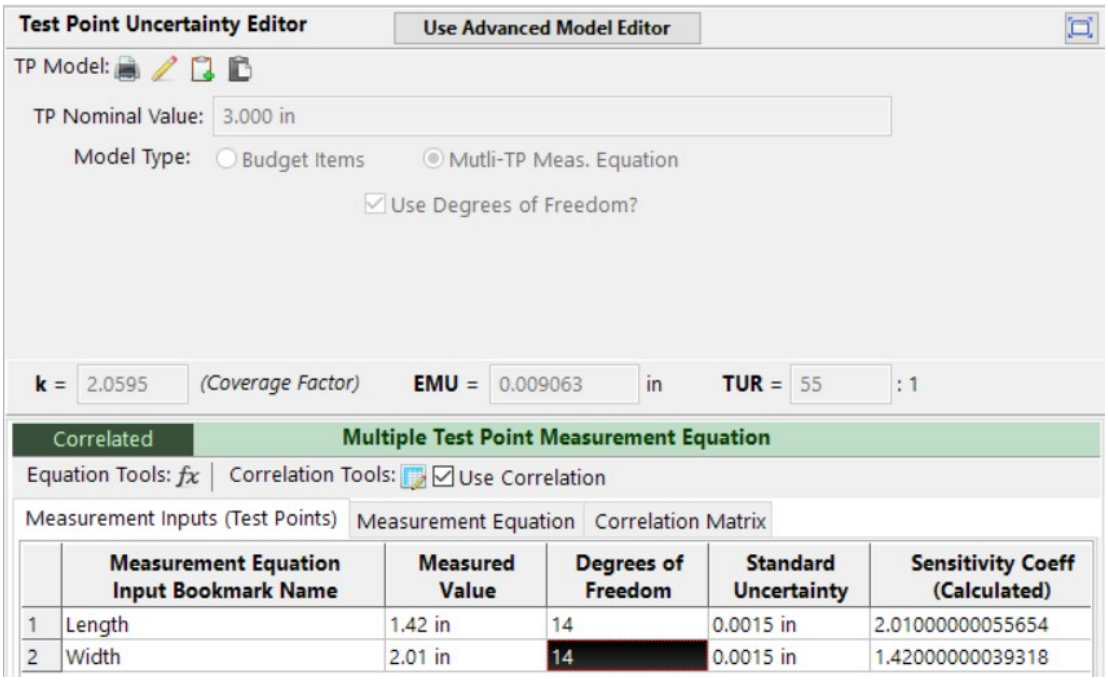
Multiple Test Point Equation (MTPE) description

MPS 2.0 supports the use of Multiple Test Point Equation (MTPE) for test points whose measured value is obtained by performing an equation that combines measured values from two or more other test points. For instance, you could have an "Area" test point that uses the "Length" and "Width" test point's measured values and the equation: "Area = Length * Width".

When calibrations are performed, the measured values for these test points are automatically calculated and assigned when a measured value is present in all test points that are inputs to the MPTE measurement equation.

Uncertainty calculations are fully dynamic. When the uncertainty model of one of the input test points is changed, the uncertainty, correlation input variable analyses, input sensitivity coefficients, etc. are automatically recalculated.

As with all other test point uncertainty models, the uncertainty model (input uncertainty models) may differ between "As Found" and "As left" measurements based on factors such as the calibration standards used.



	Measurement Equation Input Bookmark Name	Measured Value	Degrees of Freedom	Standard Uncertainty	Sensitivity Coeff (Calculated)
1	Length	1.42 in	14	0.0015 in	2.01000000055654
2	Width	2.01 in	14	0.0015 in	1.42000000039318

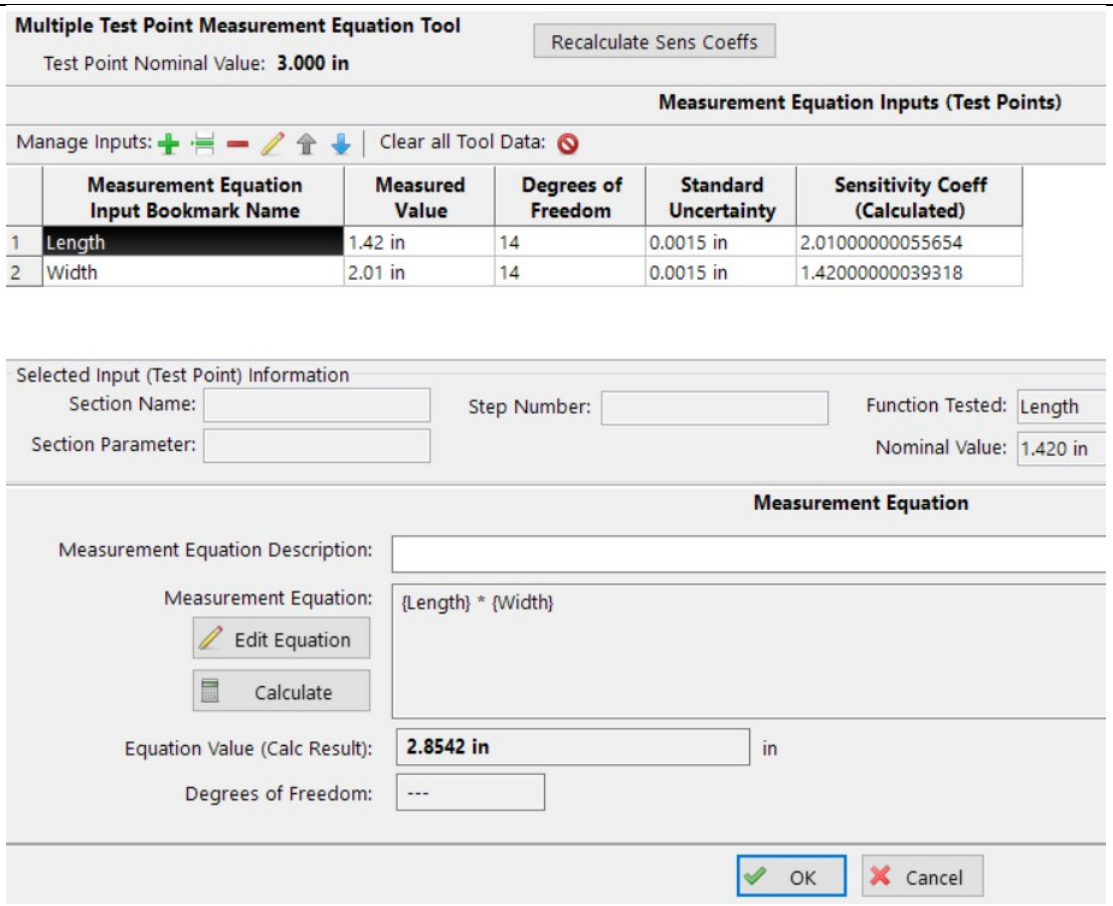
- Test points that will be used as inputs to MTPEs must be assigned a unique "Uncertainty Model Bookmark Name" in the "Uncertainty Analysis Editor" form (Advanced Uncertainty Model Editor) before they can be used as inputs to an MTPE.
    - The bookmark name assigned will also be used as the variable name in the equation editor. The value assigned to this variable when the equation is executed, is based on context:

- **Test Point (design) context**: This value defaults to the first Nominal Value parameter but may be overridden in the form used to manage input test points to the equation.
- **Measurement (calibration) context**: When a measurement is processed (equation executed) by MPS, the applicable Measured Values of the input test points are used as the variable values in the equation.

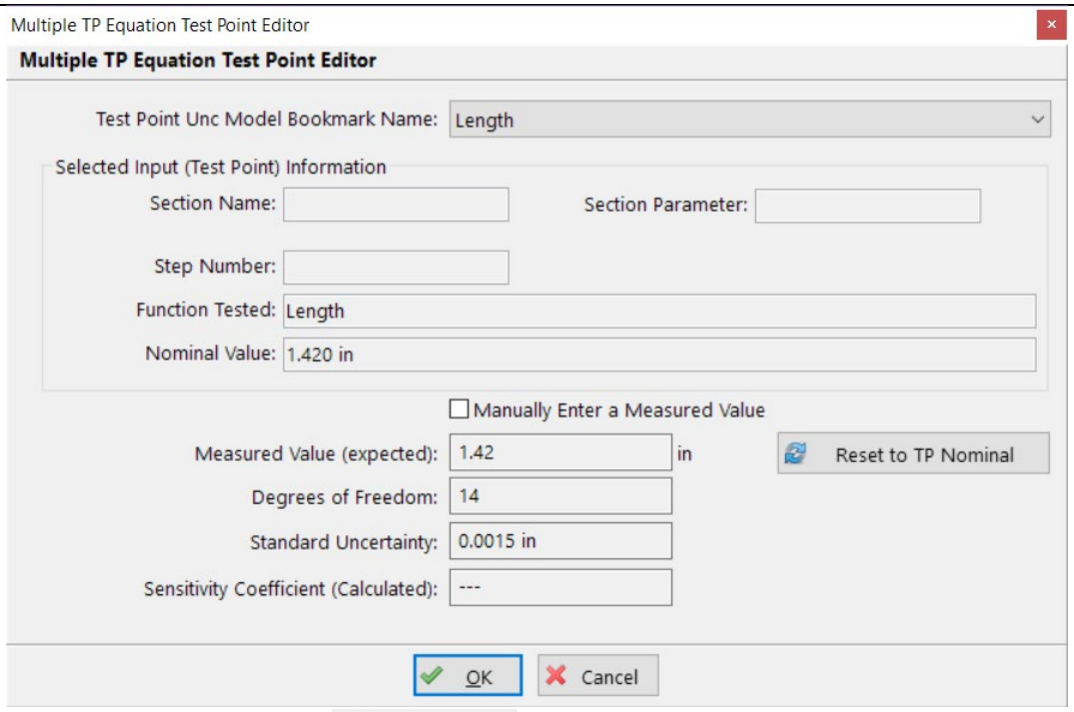
- Automatically calculates the partial derivative-based sensitivity coefficients of the contributing test points and the measurement equation used.
- Supports a Correlation Matrix and has correlation analysis tools to help correlate the uncertainty budget items of the test point's uncertainty models that are used in the MTPE.

How to create a MPTE test point:

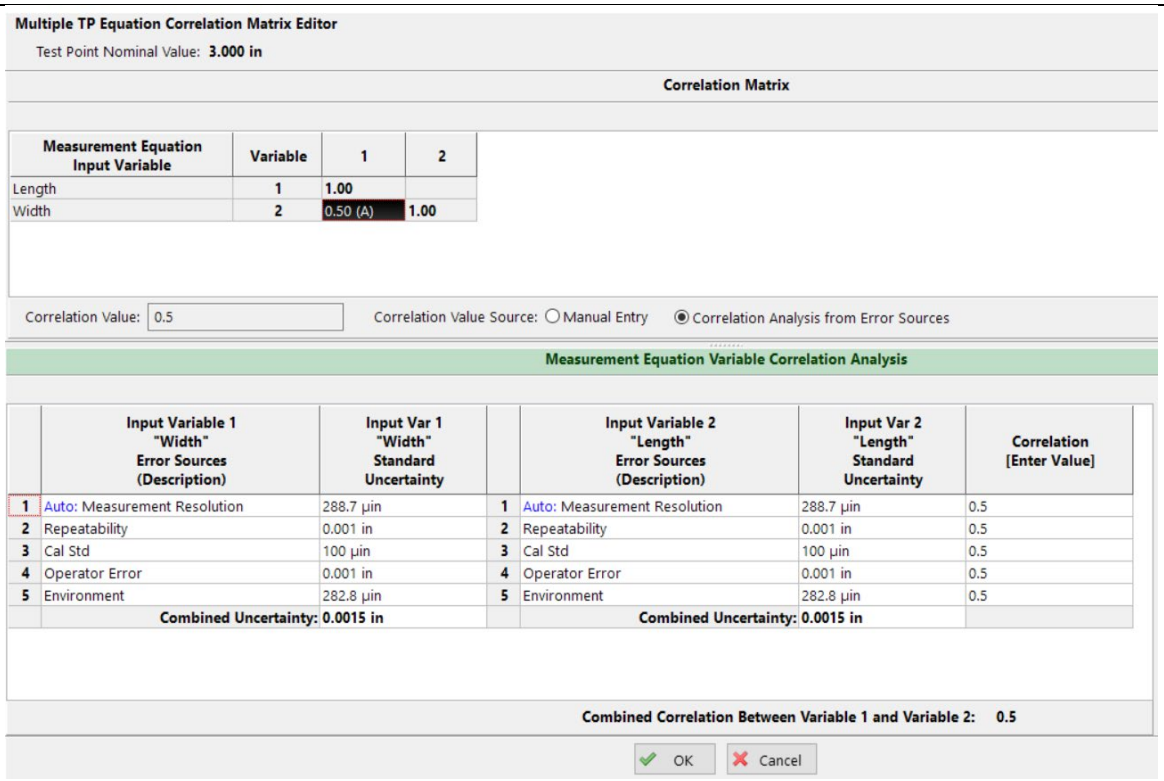
1. Create the input test points using the Test Point Builder.
    a. Input test points must use the "Budget Items" (normal) uncertainty model type.
2. Configure the uncertainty budget items of the input test points in the normal manner. This can be any combination of automatically or manually created budget items.
3. Assign a unique "Uncertainty Model Bookmark Name" in the "Uncertainty Analysis Editor" form (Advanced Uncertainty Model Editor) for each of the input test points to make them available for selection in the MTPE Equation editor. This bookmark name will also be the name of the variable in the equation editor that represents the input's value.
4. Create the MTPE test point using the Test Point Builder as you would any other test point.
5. Set this test point's Uncertainty Model Type to "Multi-TP Meas. Equation." Setting this model type causes MPS to change the features of the uncertainty model display/editor forms to support MTPE display/editing instead of "Budget Items."
6. Use the fx button to edit the Measurement Equation:



7. Use the Manage Inputs: buttons to add/manage input test points to the Measurement Equation:



8. After adding Inputs, use the Edit Equation button to edit the Measurement Equation. The common MPS equation editor form is displayed and will include a variable for each input (Uncertainty Model Bookmark Name). Edit and accept the equation.
9. Click the Calculate button to have MPS execute the equation and calculate sensitivity coefficients for each of the inputs. Sensitivity coefficients are calculated from the equation.
10. If you wish to use correlation, check the Use Correlation checkbox and then click the button to use the Correlation Matrix Editor to either manually assign correlation values or use the Variable Correlation Analysis tool to perform the analysis for the item currently selected in the displayed correlation matrix:



Note: There is a master/child relationship between the correlation matrix grid (top half of the form) and the correlation analysis tool (bottom half of the form). When you select a cell in the correlation matrix grid, the correlation analysis is displayed for the applicable pair of inputs.

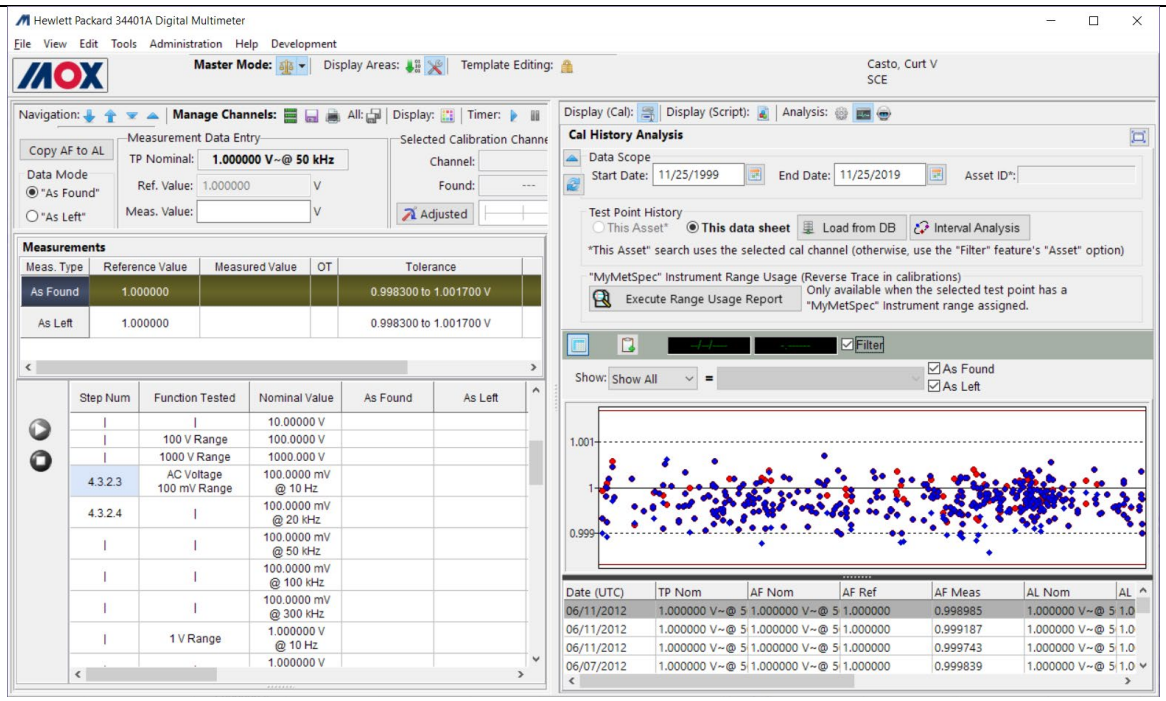
11. You can decide to use either manually estimated correlation values or use the correlation analysis tool to calculate them by selecting one of the following:


. If you choose "Manual Entry," you simply type in the matrix item value. Otherwise, the result of the correlation analysis tool is automatically applied.
12. Using the correlation analysis tool: MPS automatically populates the correlation analysis tool with all the budget items from input variable 1 (left side item). MPS will then populate the input variable 2 budget items that it is able to automatically match to items in input variable 1. You can then override MPS' choices by selecting a different input variable 2 item for each input variable 1 item or clear (none applicable) any of the input variable 2 selections. Entering correlation values for each input variable 1 and 2 budget items pair (left and right side) is entirely up to you.

7. Calibration Interval and other analysis tools that use MPS and CMS calibration history data

Description:

Whether in the "Calibration" or the "Design" MPS Master Mode, you can display and analyze calibration history data for the currently loaded data sheet and its test points. When one or more calibration channels are in use, a "This Asset" option is available to use only history data from the currently selected calibration channel (asset ID).



- The data displayed in the "Cal History Analysis" chart and grid are for the currently selected test point in the MPS master data sheet grid. The data displayed changes as you select different test points in the MPS master data sheet grid.
- The data can be filtered by date range, asset ID, and calibration technician.
- 

An interval analysis report can be displayed that includes analyses for both the data sheet as a whole and an independent analysis for each test point. This includes both interval and end of period reliability. The report can also optionally include measurement history:

Calibration Interval Analysis

for

Hewlett Packard 34401A, Digital Multimeter
Asset ID: 001908
From: 11/25/1999 to: 11/25/2019

Configuration Parameters

Note: These parameters are set in the MPS Maaster configurations and may differ from those set in the Staistics Miner application

Reliability Target: 85 %	Min Allowed Interval: 0 Days	Min Allowed Interval: 70 %
OOT Rate Target: 15 %	Max Allowed Interval: 360 Days	Max Inrwval Extension: 20 %

Note: Only calibrations with a calibration interval > 0 days are used in interval analysis.

Instrument Summary

Average Interval: 512 Days	Number In Tolerance 6	Observed Reliability: 100 %
Longest Interval: 720 Days	Number OOT: 0	Observed OOT Rate: 0 %
Number of Tests: 6		**Recommended Interval: 20 %**
Apparent Reliability: 87.5 %	Upper EoP Conf. Limit: 6	Avg. tests per year: 0.713
	Lower EoP Conf. Limit: 81.819 %	Consecutive successes: 6

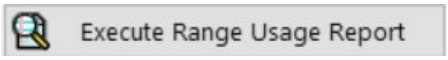
Test Point Detail

Step #	Function Tested	Nominal Value	Calibration Tolerance
4.3.1.3	DC Voltage 100 mV Range	0.0000 mV	-0.0035 to 0.0035 mV

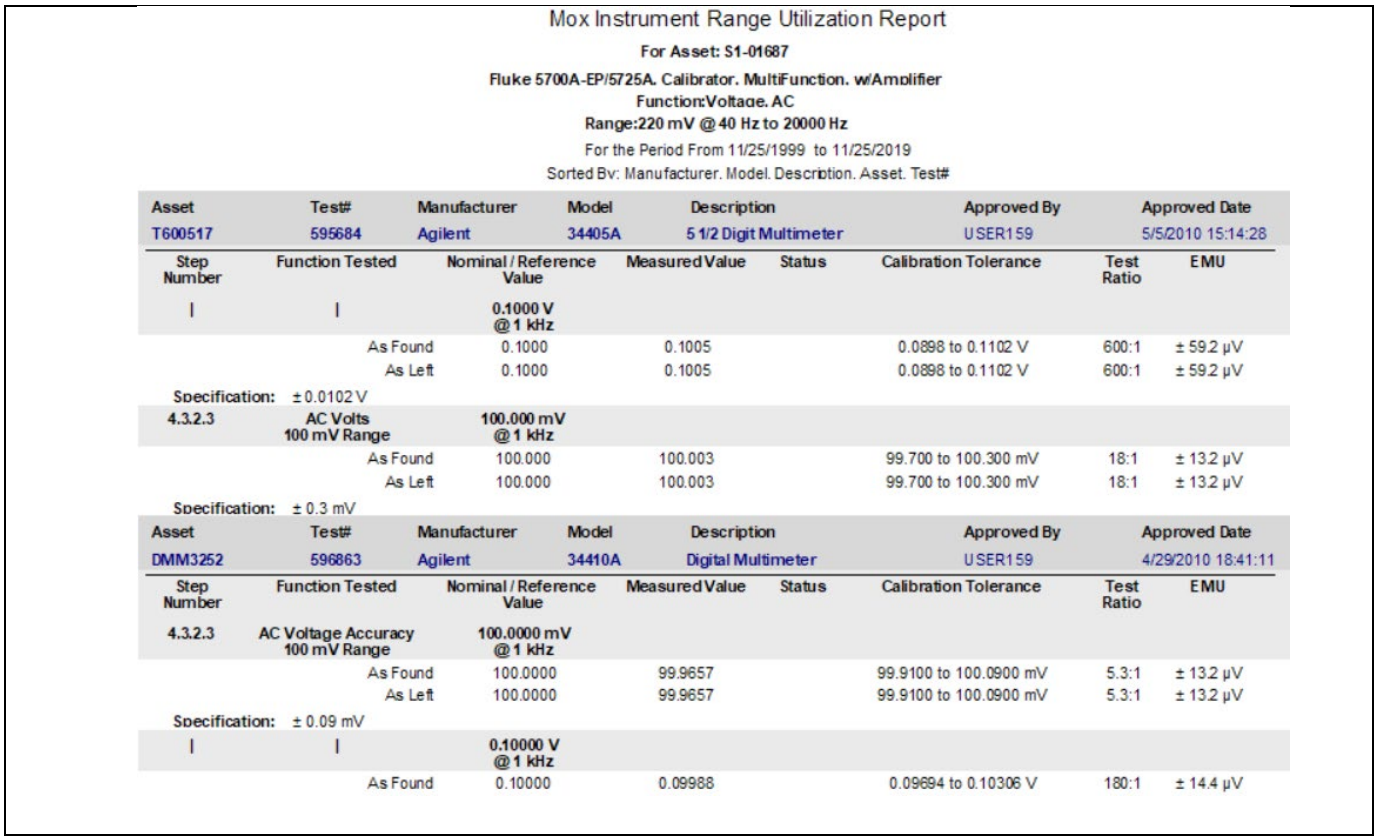
Average Interval: 512 Days	Number In Tolerance 6	Observed Reliability: 100 %
Longest Interval: 720 Days	Number OOT: 0	Observed OOT Rate: 0 %
Number of Tests: 6 Days		**Recommended Interval: 360 Days**
Apparent Reliability: 87.5 %	Upper EoP Conf. Limit: 100 %	Avg. tests per year: 0.713
	Lower EoP Conf. Limit: 81.819 %	Consecutive successes: 6

As Found Measurements

Cal Date	Test Number	Interval	As Found Value	OOT	As Found Tolerance	EMU
1/4/2012	655176	720	0.0001		-0.0035 to 0.0035 mV	± 0.39 µV
12/30/2010	607667	720	-0.0007		-0.0035 to 0.0035 mV	± 0.39 µV
12/31/2008	564814	540	-0.0001		-0.0035 to 0.0035 mV	± 0.39 µV
2/9/2007	524449	365	0.0011		-0.0035 to 0.0035 mV	± 0.39 µV
7/12/2005	488661	365	0.0004		-0.0035 to 0.0035 mV	± 0.39 µV
3/11/2004	405658	365	-0.0001		-0.0035 to 0.0035 mV	± 0.39 µV

- 

If the currently selected test point has a “MyMetSpec” instrument range assigned, you can display a reverse traceability report that shows utilization of the assigned “MyMetSpec” instrument and range as a calibration standard in other MPS calibrations. This is very helpful for doing reverse traceability assessments when you view a calibration document in MPS for a calibration standard. Select a failed (out of tolerance) test point and execute this report. The report will be filtered on the calibration standard’s applicable asset ID and date range (typically the date range from the last calibration until the next calibration):



Mox Instrument Range Utilization Report

For Asset: S1-01687

Fluke 5700A-EP/5725A. Calibrator. MultiFunction. w/Amplifier
Function:Voltage. AC
Range:220 mV @ 40 Hz to 20000 Hz

For the Period From 11/25/1999 to 11/25/2019

Sorted By: Manufacturer. Model. Description. Asset. Test#

Asset	Test#	Manufacturer	Model	Description	Approved By	Approved Date
T600517	595684	Agilent	34405A	5 1/2 Digit Multimeter	USER159	5/5/2010 15:14:28

Step Number	Function Tested	Nominal / Reference Value	Measured Value	Status	Calibration Tolerance	Test Ratio	EMU
|	|	0.1000 V @ 1 kHz				
	As Found	0.1000	0.1005		0.0898 to 0.1102 V	600:1	± 59.2 µV
	As Left	0.1000	0.1005		0.0898 to 0.1102 V	600:1	± 59.2 µV
Specification:	± 0.0102 V						
4.3.2.3	AC Volts 100 mV Range	100.000 mV @ 1 kHz					
	As Found	100.000	100.003		99.700 to 100.300 mV	18:1	± 13.2 µV
	As Left	100.000	100.003		99.700 to 100.300 mV	18:1	± 13.2 µV
Specification:	± 0.3 mV						

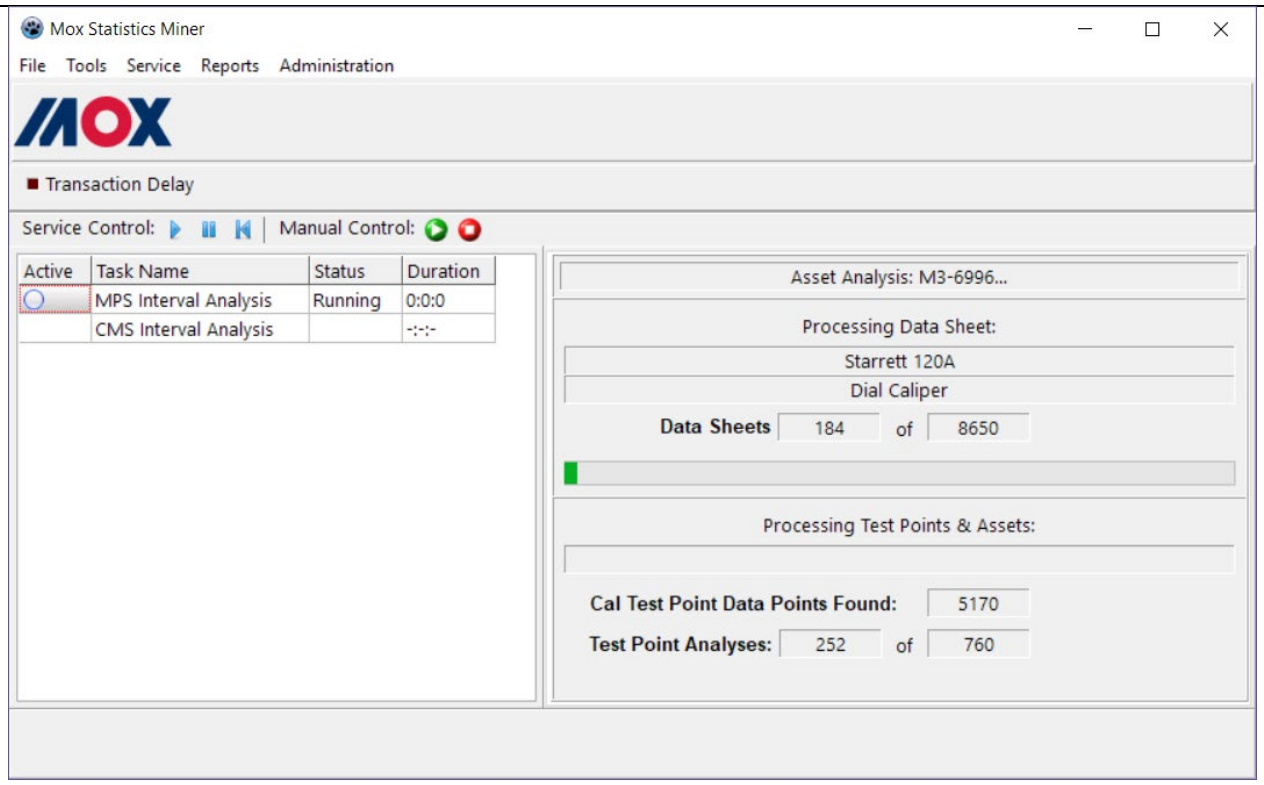
Asset	Test#	Manufacturer	Model	Description	Approved By	Approved Date
DMM3252	596863	Agilent	34410A	Digital Multimeter	USER159	4/29/2010 18:41:11

Step Number	Function Tested	Nominal / Reference Value	Measured Value	Status	Calibration Tolerance	Test Ratio	EMU
4.3.2.3	AC Voltage Accuracy 100 mV Range	100.0000 mV @ 1 kHz					
	As Found	100.0000	99.9657		99.9100 to 100.0900 mV	5.3:1	± 13.2 µV
	As Left	100.0000	99.9657		99.9100 to 100.0900 mV	5.3:1	± 13.2 µV
Specification:	± 0.09 mV						
|	|	0.10000 V @ 1 kHz				
	As Found	0.10000	0.09988		0.09694 to 0.10306 V	180:1	± 14.4 µV

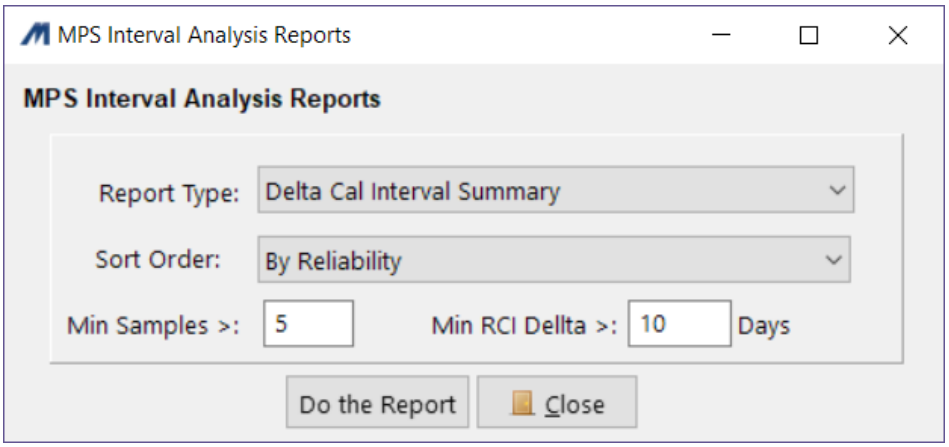
8. "MOX Statistics Miner" application

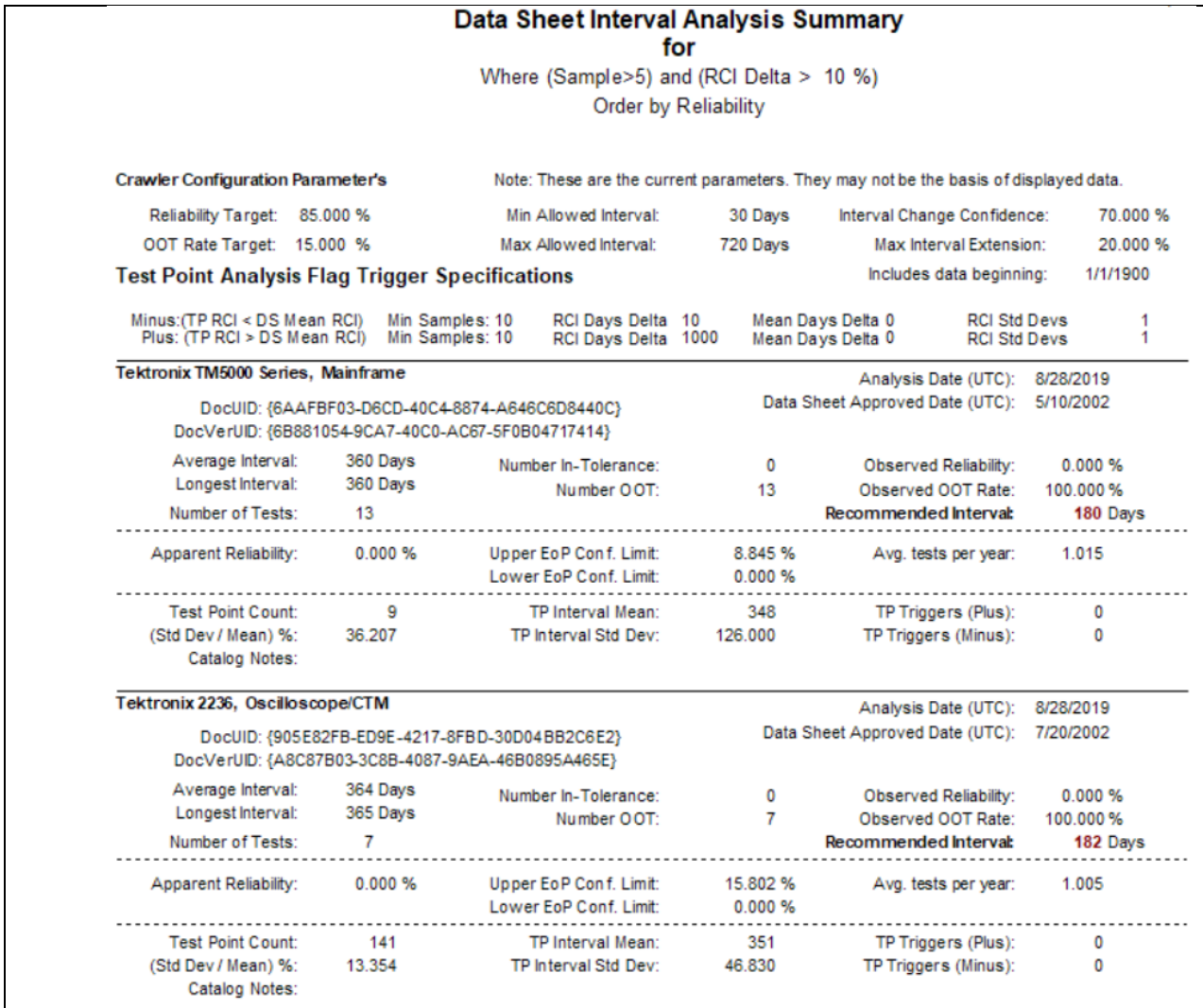
Description:

"MOX Statistics Miner" application. This application performs calibration interval analyses for all MPS Data Sheets and CMS Make/Models. The application generates summary analysis data records and stores them in the MPS and CMS database.



The summary data can be viewed from reports within either the MOX Statistics Miner or MPS applications. The report system has options that allow you to select multiple ways of looking at the data such as: by equipment reliability, recommended interval changes, data sheets with one or a few test points that are resulting in shortened calibration intervals, etc.





Data Sheet Interval Analysis Summary
for
Where (Sample>5) and (RCI Delta > 10 %)
Order by Reliability

Crawler Configuration Parameter's Note: These are the current parameters. They may not be the basis of displayed data.

Reliability Target:	85.000 %	Min Allowed Interval:	30 Days	Interval Change Confidence:	70.000 %
OOT Rate Target:	15.000 %	Max Allowed Interval:	720 Days	Max Interval Extension:	20.000 %

Test Point Analysis Flag Trigger Specifications Includes data beginning: 1/1/1900

Minus:(TP RCI < DS Mean RCI)	Min Samples: 10	RCI Days Delta	10	Mean Days Delta	0	RCI Std Devs	1
Plus: (TP RCI > DS Mean RCI)	Min Samples: 10	RCI Days Delta	1000	Mean Days Delta	0	RCI Std Devs	1

Tektronix TM5000 Series, Mainframe

Analysis Date (UTC): 8/28/2019
Data Sheet Approved Date (UTC): 5/10/2002
DocUID: {6AAFBF03-D6CD-40C4-8874-A646C6D8440C}
DocVerUID: {6B881054-9CA7-40C0-AC67-5F0B04717414}

Average Interval:	360 Days	Number In-Tolerance:	0	Observed Reliability:	0.000 %
Longest Interval:	360 Days	Number OOT:	13	Observed OOT Rate:	100.000 %
Number of Tests:	13			**Recommended Interval:**	**180** Days
Apparent Reliability:	0.000 %	Upper EoP Conf. Limit:	8.845 %	Avg. tests per year:	1.015
		Lower EoP Conf. Limit:	0.000 %		
Test Point Count:	9	TP Interval Mean:	348	TP Triggers (Plus):	0
(Std Dev / Mean) %:	36.207	TP Interval Std Dev:	126.000	TP Triggers (Minus):	0
Catalog Notes:					

Tektronix 2236, Oscilloscope/CTM

Analysis Date (UTC): 8/28/2019
Data Sheet Approved Date (UTC): 7/20/2002
DocUID: {905E82FB-ED9E-4217-8FBD-30D04BB2C6E2}
DocVerUID: {A8C87B03-3C8B-4087-9AEA-46B0895A465E}

Average Interval:	364 Days	Number In-Tolerance:	0	Observed Reliability:	0.000 %
Longest Interval:	365 Days	Number OOT:	7	Observed OOT Rate:	100.000 %
Number of Tests:	7			**Recommended Interval:**	**182** Days
Apparent Reliability:	0.000 %	Upper EoP Conf. Limit:	15.802 %	Avg. tests per year:	1.005
		Lower EoP Conf. Limit:	0.000 %		
Test Point Count:	141	TP Interval Mean:	351	TP Triggers (Plus):	0
(Std Dev / Mean) %:	13.354	TP Interval Std Dev:	46.830	TP Triggers (Minus):	0
Catalog Notes:					

The summary analyses are stored in the system databases for all the following grouping types of their included analysis data (each grouping listed has a separate table that stores its summary analysis results):

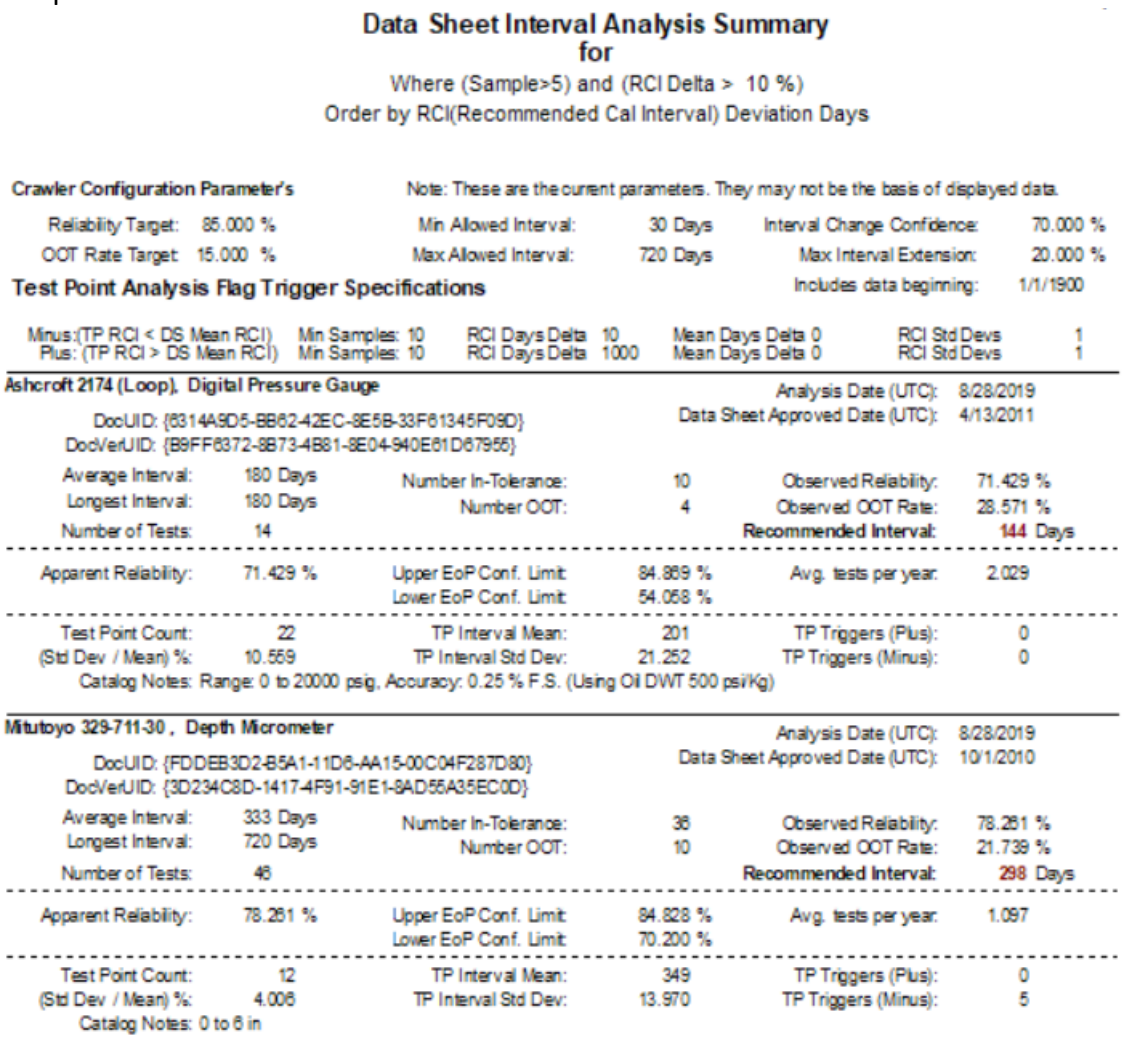
- CMS Make/Models
  - All CMS calibrations for the make/model
  - All CMS calibrations for the combination of each customer and make/model
  - All CMS calibrations for the combination of each asset and make/model
- MPS Data Sheets

  Note: The following groupings have analyses for both the data sheet as a whole and a separate analysis summary table and records for each test point in the data sheet.
  - All MPS calibrations for the data sheet
  - All MPS calibrations for the combination of each asset and data sheet

9. Interval Analysis Reports

Description:

Reports of interval analyses performed by the MOX Statistics Miner and stored in the system database can be displayed from within the MPS application. These reports can be accessed from the MPS main menu's "Tools," "Interval Analysis Reports" menu. You can choose to view reports MPS data reports or CMS data reports.



Data Sheet Interval Analysis Summary
for
Where (Sample>5) and (RCI Delta > 10 %)
Order by RCI(Recommended Cal Interval) Deviation Days

Crawler Configuration Parameter's Note: These are the current parameters. They may not be the basis of displayed data.

Reliability Target:	85.000 %	Min Allowed Interval:	30 Days	Interval Change Confidence:	70.000 %
OOT Rate Target:	15.000 %	Max Allowed Interval:	720 Days	Max Interval Extension:	20.000 %

Test Point Analysis Flag Trigger Specifications Includes data beginning: 1/1/1900

Minus:(TP RCI < DS Mean RCI)	Min Samples: 10	RCI Days Delta	10	Mean Days Delta	0	RCI Std Devs	1
Plus: (TP RCI > DS Mean RCI)	Min Samples: 10	RCI Days Delta	1000	Mean Days Delta	0	RCI Std Devs	1

Ashcroft 2174 (Loop), Digital Pressure Gauge Analysis Date (UTC): 8/28/2019
DocUID: {6314A9D5-BB62-42EC-8E5B-33F61345F09D} Data Sheet Approved Date (UTC): 4/13/2011
DocVerUID: {B9FF6372-8B73-4B81-8E04-940E61D67955}

Average Interval:	180 Days	Number In-Tolerance:	10	Observed Reliability:	71.429 %
Longest Interval:	180 Days	Number OOT:	4	Observed OOT Rate:	28.571 %
Number of Tests:	14			Recommended Interval:	144 Days
Apparent Reliability:	71.429 %	Upper EoP Conf. Limit:	84.869 %	Avg. tests per year:	2.029
		Lower EoP Conf. Limit:	54.058 %		
Test Point Count:	22	TP Interval Mean:	201	TP Triggers (Plus):	0
(Std Dev / Mean) %:	10.559	TP Interval Std Dev:	21.252	TP Triggers (Minus):	0

Catalog Notes: Range: 0 to 20000 psig, Accuracy: 0.25 % F.S. (Using Oil DWT 500 psi/Kg)

Mitutoyo 329-711-30 , Depth Micrometer Analysis Date (UTC): 8/28/2019
DocUID: {FDDEB3D2-B5A1-11D6-AA15-00C04F287D80} Data Sheet Approved Date (UTC): 10/1/2010
DocVerUID: {3D234C8D-1417-4F91-91E1-9AD55A35EC0D}

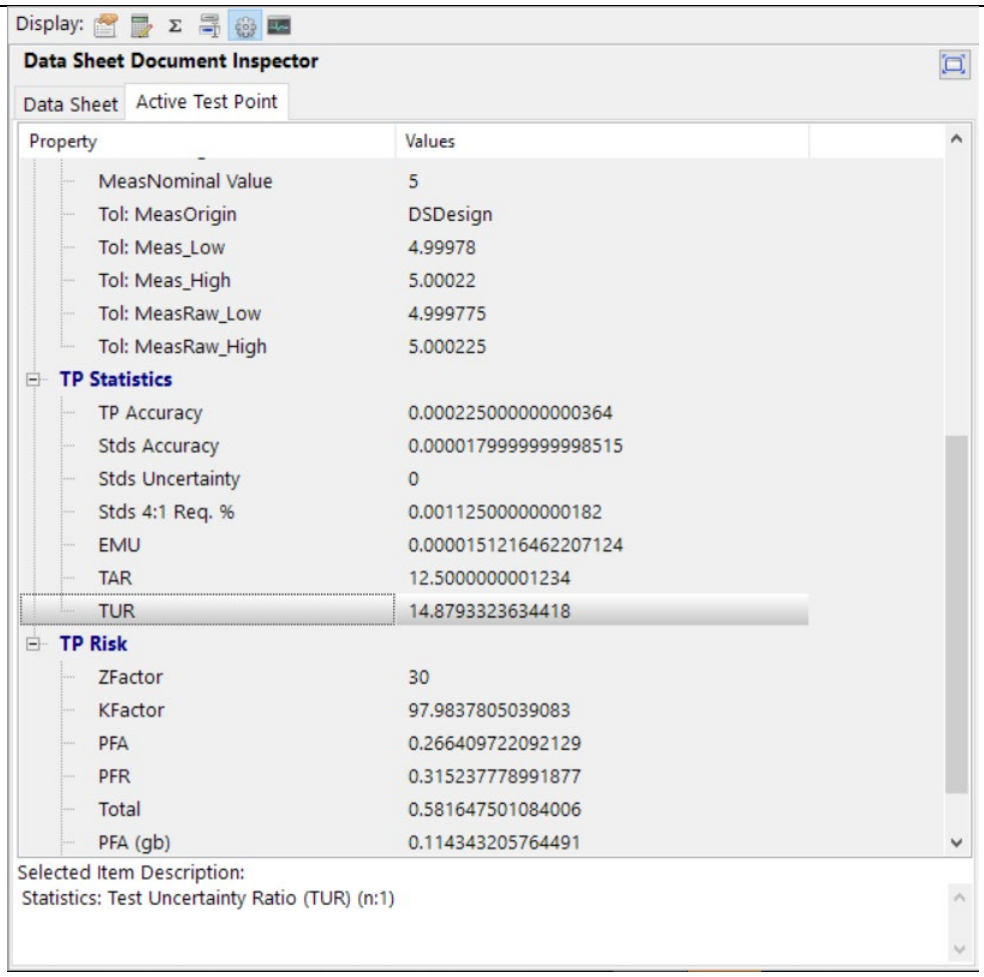
Average Interval:	333 Days	Number In-Tolerance:	36	Observed Reliability:	78.261 %
Longest Interval:	720 Days	Number OOT:	10	Observed OOT Rate:	21.739 %
Number of Tests:	46			Recommended Interval:	298 Days
Apparent Reliability:	78.261 %	Upper EoP Conf. Limit:	84.828 %	Avg. tests per year:	1.097
		Lower EoP Conf. Limit:	70.200 %		
Test Point Count:	12	TP Interval Mean:	349	TP Triggers (Plus):	0
(Std Dev / Mean) %:	4.006	TP Interval Std Dev:	13.970	TP Triggers (Minus):	5

Catalog Notes: 0 to 6 in

10. Data Sheet Document Inspector

Description:

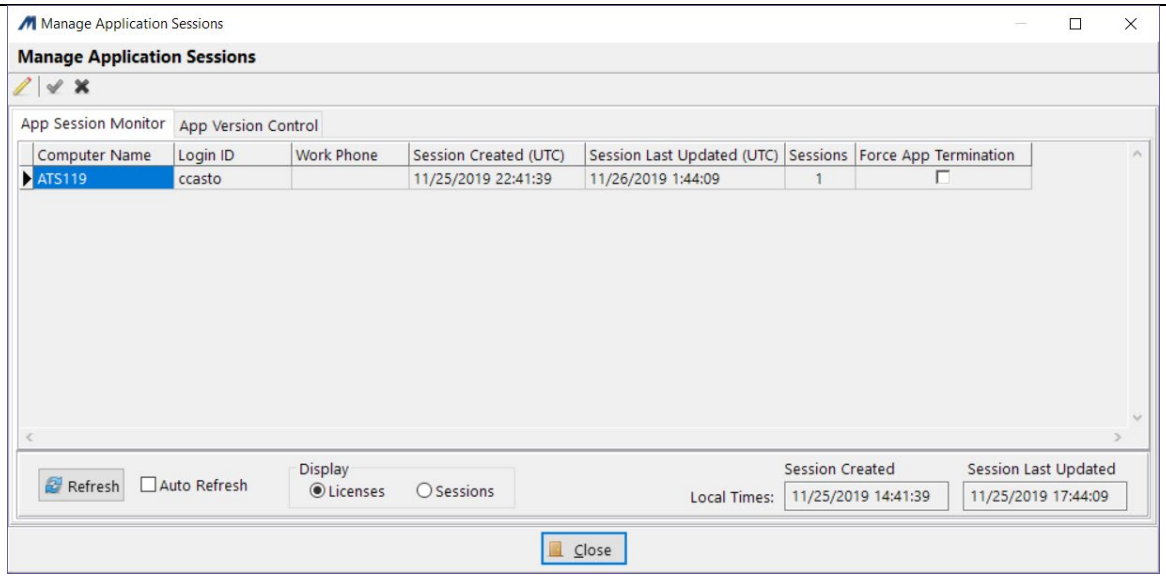
The new Data Sheet Document Inspector allows you to view and, in very few cases, edit document properties of the data sheet or active (currently selected) test point:



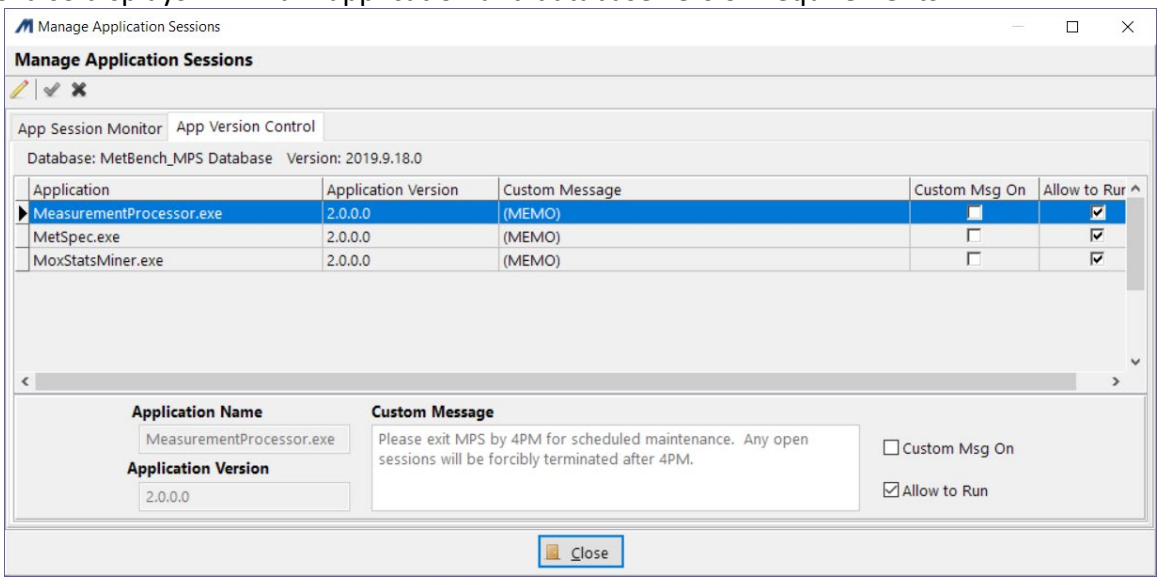
11. Application License and Sessions Manager

Description:

This tool can be used by anyone who is currently logged into MPS and MetSpec to see (read only) how many user licenses are currently in use. Additional features are available for system administrators to help notify users of an upcoming maintenance outage, terminate specific current user sessions, and set a flag to prevent new sessions from starting (running):



The tool also displays minimum application and database version requirements

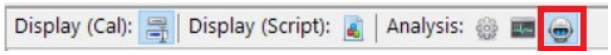


12. Editing assigned calibration standards while in the MPS "Calibration" master mode

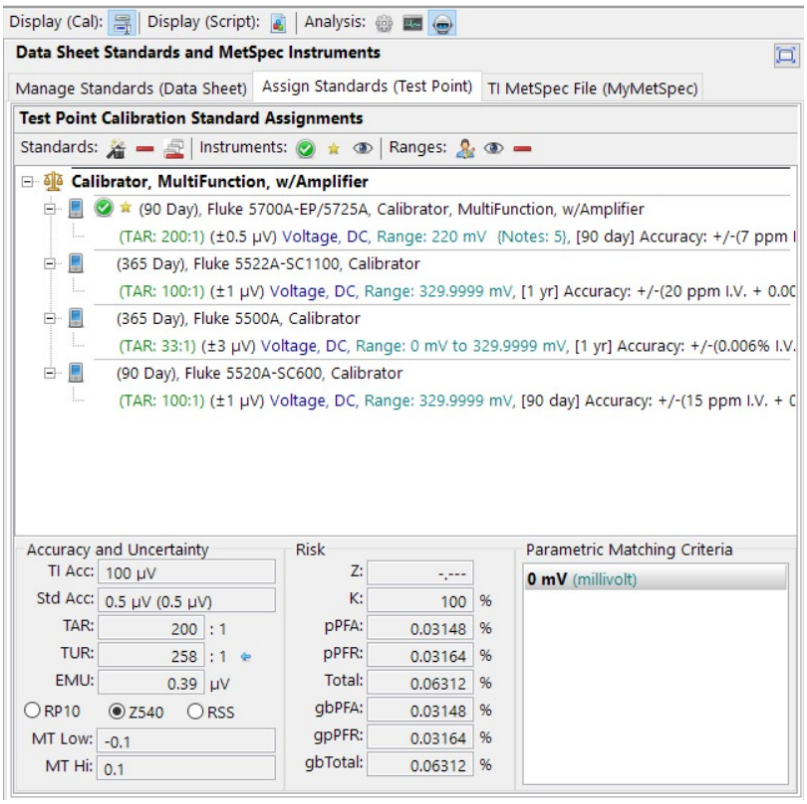
Description:

A new "[Calibrations].[Allow Calibration Standards Editing]" master configuration option has been added to optionally allow users to add, remove, or edit calibration standards assigned to the data sheet or MetSpec Ranges assigned to test points while performing a calibration. The default setting for this new configuration is False (not allowed). You must set this configuration to True to enable calibration standards editing during a calibration. If the feature is enabled, MPS does not have to be in the master edit mode to manage the standards while MPS is in its "Calibration" master mode. This

means that changes to the standards configuration will be considered as an allowable modification of the approved data sheet and MPS will accept calibrations performed with the data sheet.

When the feature is enabled, a  button appears on the right side of the calibration tool's workspace tool buttons bar: 

The editor is exactly the same as the "Data Sheet Standards and MetSpec Instruments" form that used to manage calibration standards and MetSpec instrument range assignments when in the MPS "Design" master mode.



4. New Features (Minor)

1. "MyMetSpec" Enhancements
Description: When a MetSpec Instrument is assigned to a data sheet as its "MyMetSpec" instrument (The MetSpec spec sheet that is the source of, or mirrors, the data sheet's test point specifications), the following new features are present in MPS 2.0:

- The header fields of the MetSpec Instrument (Model, Manufacturer, Description, spec interval, etc.) are automatically applied to the data sheet header if these fields are currently empty (blank) when selecting the MetSpec Instrument. If the fields are not blank, an option is displayed that offers to replace these fields' content. Both the form used to assign a "MyMetSpec" instrument to the data sheet and the form that is used to edit the data sheet header have a button to update these fields from the assigned "MyMetSpec" instrument.
- The Test Point builder now supports custom calculators in "MyMetSpec" Range Specifications. If MPS does not already have the applicable custom calculator assigned to the data sheet, it will now be added. The Test Point Builder will then add a reference to the custom calculator, so it will be included in the new test point created with the Test Point Builder. MPS 1.0 (and MudCats CPM for that matter) could not use custom calculators in "MyMetSpec" Range Specifications.

2. The Auto Assign MetSpec Calibration Instrument Ranges wizard now supports multiple test point selection

Description:
Previously, you could only use the Auto Assign Standard Ranges wizard to assign ranges to either one currently selected test point or the entire data sheet. In addition, you can now multiple select a contiguous (sequential) range of test points before clicking on the wizard feature to auto assign to that group of test points. This is very useful when you want to use the feature for a subset of the data sheet's test points.

5. Error Corrections

These items have been identified as errors in the application and have been corrected in this version.

1. Script Commands that read and write other script commands to/from script procedures and variables

Description:
When using the "Utils.ProcCmndsToVar" or "DS.TPCommandsToVar" commands to save a script procedure's commands to a variable and then using one of the "DS.VarToTPCommands," "Utils_VarToProcCmnds," or "Utils.CreateATEObject" commands to load the script procedure's commands from a variable, an error message may be displayed.

Resolution:
There was a formatting inconsistency between script commands that save a script procedure's commands to a variable and commands that load the script procedure's commands from a variable. This has been corrected to ensure the same formatting is used for all these commands.

2. "Sys.ExecCommandGroup" command was not setting the "Unit Global" command group.

Description:
The "Sys.ExecCommandGroup" command was not actually setting the "Unit Global" command group when the "[Unit Global]" constant was specified as the "CmndGroupType" parameter value.

Resolution:
This has been corrected.

3. Audit Report "File Name" field and Sort Order

Description:
There is a "File Name" field in the sort options selection list, but selecting it results in an error when the report is executed. Also, the report is not always sorted in the order specified by the sequence of sort options selected, depending on which fields are included in the sort field selections.

Resolution:
The error that resulted from selecting the "File Name" field was caused by the database field name being incorrect when the item is added to the SQL WHERE clause. This was corrected, but the field is not actually included in the report, so this field option was removed from the selection lists. There is no point sorting on a field that is not displayed in the report.

The source code that builds the composite SQL WHERE clause from the selection options was modified to ensure that they are added to the WHERE clause in the order of appearance in the four sort field drop down lists. The "Sort 1" drop down list is first, "Sort 2" is second, etc.