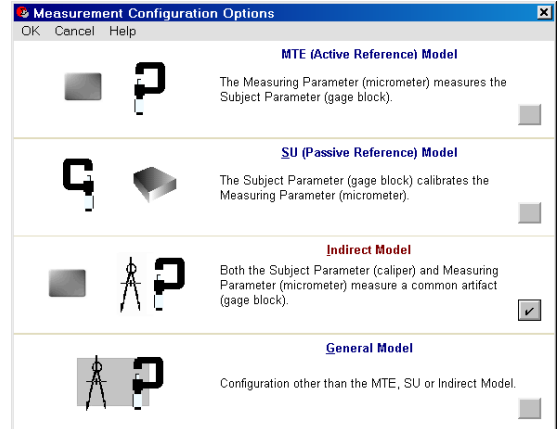




**Abundant On-Screen Information**

- The **Analysis Guide Screen** provides a tree-view presentation of uncertainty analysis concepts and methods, program features, operating procedures, analysis examples and other topics.
- **Interactive analysis procedure checklists** provide a short, structured walk-through of the basic steps in estimating uncertainty for typical measurements.
- Major screens and worksheets contain **detailed procedures with hypertext links** to program functions.
- All screens and worksheets contain context sensitive **Info buttons**.
- All screens and worksheets have access to a full-featured **Help function** with index, content, and search capabilities for over 650 topics.

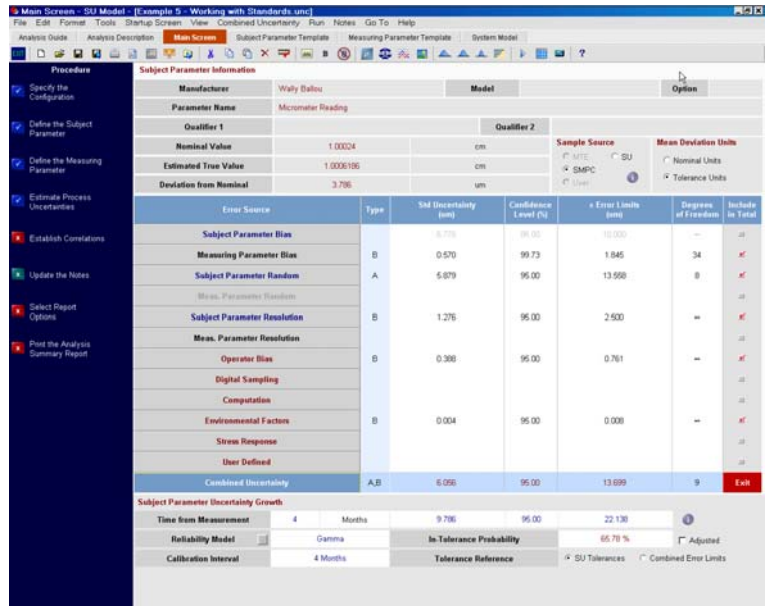


**Measurement Configuration Options**

- Users can choose from a list of measurement configurations via the **Measurement Configurations Screen**.
- Selecting a measurement configuration instructs UncertaintyAnalyzer to de-activate screens and worksheets that are not required for the analysis.
- Selecting a measurement configuration also instructs UncertaintyAnalyzer to activate special analysis screens, where appropriate.

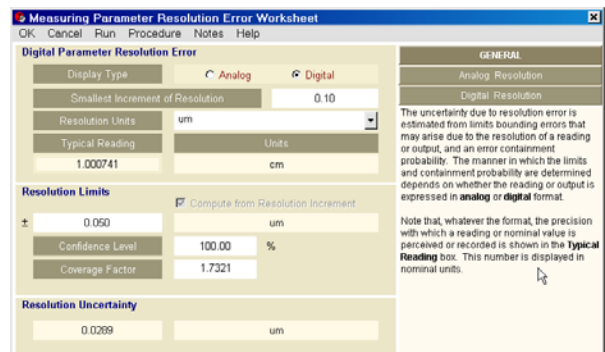
**Analysis of Direct Measurements**

- Every aspect of the uncertainty analysis process can be accessed via the **Main Screen**.
- Main Screen menu and tool bars, analysis procedure checklist, and measurement process error list provide quick access to drill-down analysis screens and worksheets.
- Information about the subject parameter being analyzed, the measurement process uncertainties, and the overall combined uncertainty are all summarized on the Main Screen.



**Drill-down Worksheets for Analyzing Measurement Process Errors**

- **Parameter Bias Uncertainty Worksheets** for estimating uncertainty due to measuring and/or subject parameter bias.
- **Measurement Data Entry Worksheets** for estimating uncertainty due to measuring and/or subject parameter random (repeatability) error.
- **Parameter Resolution Error Worksheets** for estimating uncertainty due to measuring and/or subject parameter resolution error.
- **Operator Bias Uncertainty Worksheet** for estimating uncertainty due to operator bias.
- **Digital Sampling Uncertainty Worksheet** for estimating uncertainty due to analog to digital and/or digital to analog signal conversion.
- **Computation Error Uncertainty Worksheet** for estimating uncertainty due to computation error.
- **Environmental Factors Uncertainty Worksheet** for estimating uncertainty due to environmental factors.
- **Stress Response Uncertainty Worksheet** for estimating uncertainty due to shipping and handling stress.
- **User Defined Error Worksheet** for estimating uncertainty due to other user defined errors.





**Notes Pages for All Analysis Levels**

- All worksheets and screens contain built-in notes pages for storing images and text.
- Notes pages are saved with each analysis.
- Notes pages can also be saved externally as rich text format files.

**Analysis Description Screen**

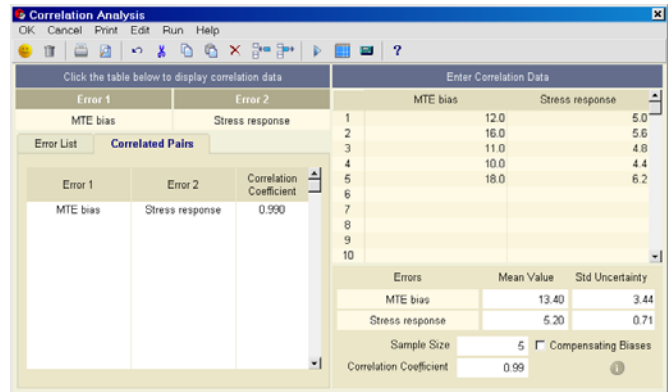
- The **Analysis Description Screen** provides a separate screen for entering text and graphics information that describe the overall analysis, measurement process, etc.
- This screen also provides easy access to other notes pages.
- The screen contents are automatically saved with each analysis.
- Analysis descriptions can also be saved as external rich text format files.

**Data Importing**

- The **Data Import Profile Screen** can be used to import data from delimited text, html, Excel, Lotus, Access, or dBase file formats.
- The Data Import Profile Screen allows the user to view the data prior to importing into UncertaintyAnalyzer.
- The Windows Copy & Paste functions are also supported.

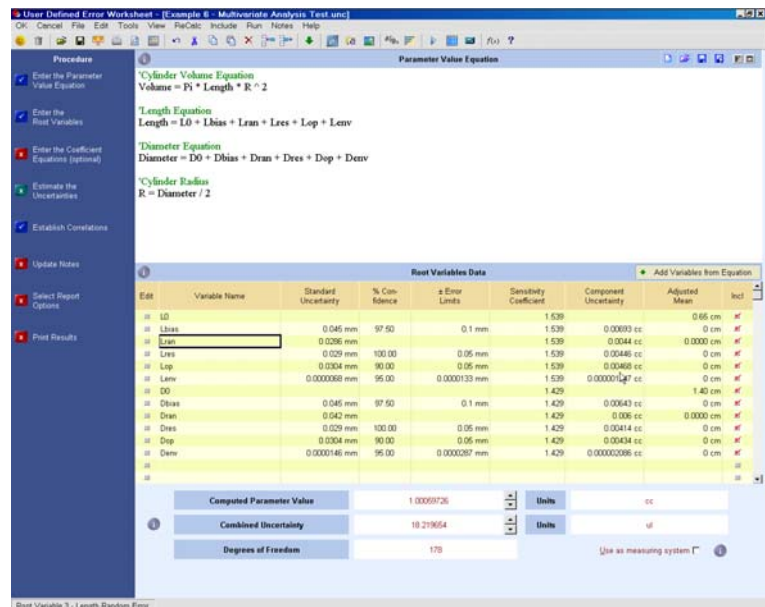
**Correlation of Error Sources**

- All error sources are assumed to be uncorrelated unless otherwise specified by the user.
- The **Correlation Analysis Screen** assists the user in establishing correlations between error sources.
- Correlation coefficients can be entered directly or computed from data pairs.
- Correlation coefficients are automatically included in the computation of the total, combined uncertainty.



**Analysis of Multivariate Measurements**

- The **User Defined Error Worksheet** is the primary screen for analyzing uncertainties for multivariate measurements.
- The model equation for computing the parameter value of interest can contain up to 1,000 root variables or quantities and an unlimited number of nested variables, each defined by a separate equation.
- Root variables and associated uncertainties are analyzed via the Error Source Uncertainty Worksheets.
- Sensitivity coefficients for root variables are automatically computed via numerical partial differentiation of the model equation..
- The user has the option of entering sensitivity coefficient equations in lieu of automatic partial differentiation.
- All equations are entered in the extremely versatile and non-proprietary VB Script format.
- Equation variables are automatically added to the Root Variables Data table by simply clicking a button.

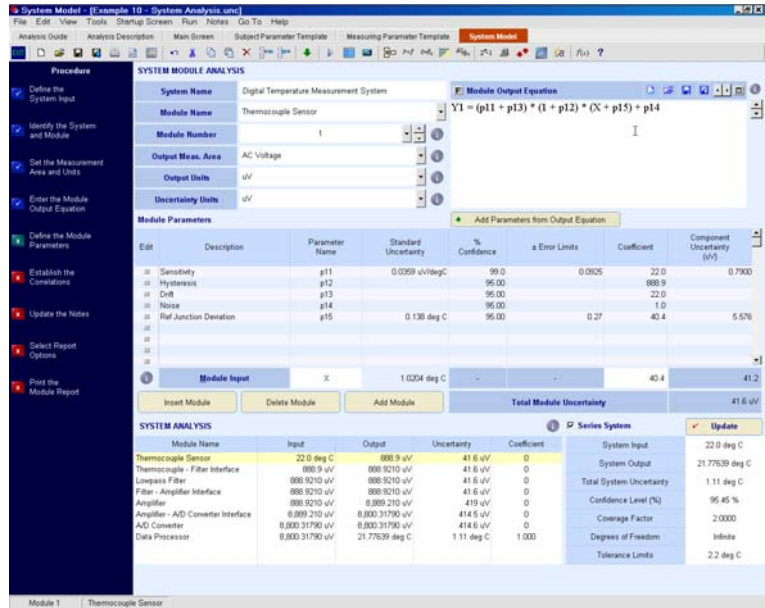


- The program automatically checks for discrepancies between the variable names listed in the Root Variables Data table and those used in the equations. Listed root variables not found in the equations are highlighted in bold red text.



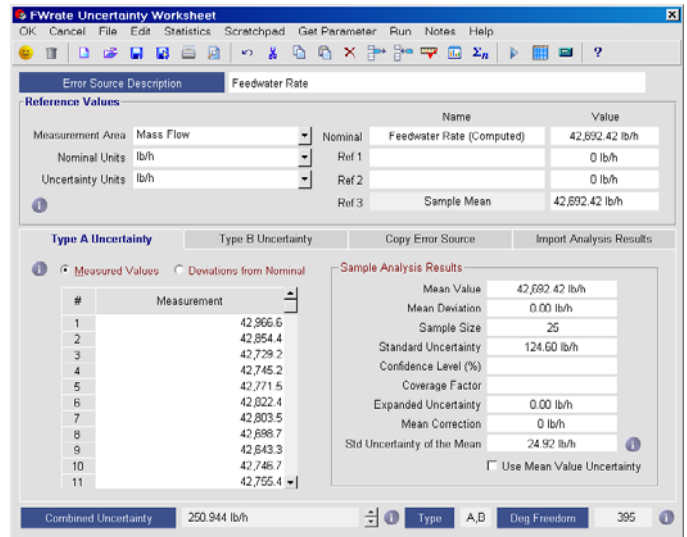
### Analysis of Measurement Systems

- The **System Model Screen** is used to analyze uncertainties for linear measurement systems.
- Measurement Systems can contain up to 10 component modules arranged in series.
- Each module can be analyzed as a multivariate measurement comprised of up to 30 root variables.
- Uncertainties for each module are computed, summarized and propagated through the measurement system.
- Module Output Equation parameters are automatically added to Parameter Data table by simply clicking a button.
- The program automatically checks for discrepancies between the parameter names listed in the Parameter Data table and those used in the Module Output equations. Listed Parameter names that are not found in the equations are highlighted in bold red text.



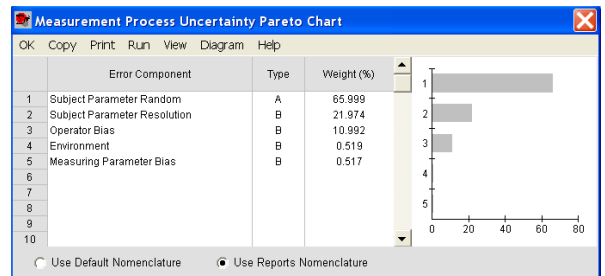
### Analysis of Type A, Type B and Type A,B Estimates

- The uncertainty estimate type is automatically determined based on user data entry.
- Degrees of freedom are computed for all estimate types.
- Type B error limits can be computed as a linear or root-sum-square (RSS) combination of a fixed value, % of nominal or reading, % of full scale, and % of range or other components.
- Worksheet contents can be saved as an external file (\*.esu) that can then be imported to other analyses.
- The **Copy Error Source** function also allows users to copy information from one Error Source Uncertainty Worksheet to another to reduce duplication of data entry in cases where two or more error sources are similar.
- The **Import Analysis Results** function allows users to import results from other UncertaintyAnalyzer files. This option provides more flexibility in building analyses for complex measurement processes.



### Charts and Plots

- Parameter bias distribution plots are automatically displayed on the Parameter Bias Uncertainty Worksheets.
- Process error distribution plots can also be displayed via the Main Screen.
- A histogram plot of sampled data can be displayed on the Measurement Data Entry Worksheets.
- The Pareto Chart Screen displays a bar chart depicting the relative contributions of Type A, Type B, and Type A,B process uncertainties to the total, combined uncertainty.



### Comprehensive Analysis Reports

- The **Report Options Screen** can be used to tailor reports to display the desired information.
- A variety of reporting levels are available including summary reports and "drill-down" reports for complete communication of analysis results.
- Notes, charts and plots can be selected for inclusion on report pages.
- The **Print Preview Screen** provides navigation through reports pages prior to printing.
- Analysis reports can be saved in Rich Text or HTML file formats via the Print Preview Screen.
- Analysis reports can also be copied and pasted as images in Word, Excel, PowerPoint or other external application.

### Advanced Features

- Uncertainty Growth Projection** for the subject parameter under evaluation can be computed via the **Reliability Model Worksheet**.
- The **SMPC Analysis Screen** can be used to obtain the best estimates of both the subject parameter and measuring parameter values using Bayesian methods.
- Screens for computing **Statistics for Selected Cells** (i.e., sample subset), **Normality Testing** and **Outlier Removal Testing** can be accessed via the Tools menu of the Measurement Data Entry Worksheets.
- The built-in **Type B Degrees of Freedom Calculator** provides a useful tool for estimate the degrees of freedom for heuristic (i.e., non-statistical) uncertainty estimates.
- The built-in **Measurement Units Database** contains over eighty measurement areas and several hundred units in compliance with NIST Special Publication 811.
- The built-in **Instrument Database** can be used for storing and retrieving instrument and parameter specifications.
- The **SpecMaster Worksheet** provides a powerful tool for determining tolerances for parameters with complex specifications.
- External Windows applications can be run from within UncertaintyAnalyzer via the **Run External Application Screen**.
- UncertaintyAnalyzer also fully integrates with other ISG applications for enhanced measurement analysis capability.



### Best Uncertainty - Micrometer Calibration

Integrated Sciences Group - Bak-O

11-Jan-2005

#### Submitted:

Howard Castrup  
Owner, ISG  
11/19/04

#### Approved:

Suzanne Grison  
VP Engineering, ISG  
11/22/14

File Name: Example 5 - Working with Standards.unc

#### Unit Under Test

Manufacturer: Wally Ballou  
Parameter Name: Micrometer Reading  
Nominal Value: 1.00024 cm  
Estimated True Value: 1.0007413 cm  
Estimated Parameter Bias: 5.013 um ± 9 um with 95.00% Confidence  
Estimated Value Based On: SMPC Computed

#### Measuring Unit

Parameter Name: Gage Block Dimension

### Analysis Results

#### Measurement Process Uncertainty Summary:

Uncertainty Source	Standard Uncertainty (um)	Confidence Level	Deg. Freedom	Confidence Limits (um)	Type	Distribution
Measuring Parameter Bias	0.570	99.73	34	1.845	B	Student's t
UUT Parameter Repeatability	5.879	95.00	8	13.558	A	Student's t
UUT Parameter Resolution	1.276	95.00	infinite	2.500	B	Normal
Operator Bias	0.388	95.00	infinite	0.761	B	Normal
Environmental Factors	0.004	95.00	infinite	0.008	B	Normal
<b>Combined Uncertainty</b>	<b>6.056</b>	<b>95.00</b>	<b>9</b>	<b>13.699</b>	<b>A,B</b>	<b>Student's t</b>

#### Pareto Diagram:

Rank	Error Component	Type	Weight (%)
1	UUT Parameter Repeatability	A	72.432
2	UUT Parameter Resolution	B	15.714
3	Measuring Parameter Bias	B	7.022
4	Operator Bias	B	4.783
5	Environment	B	0.049

