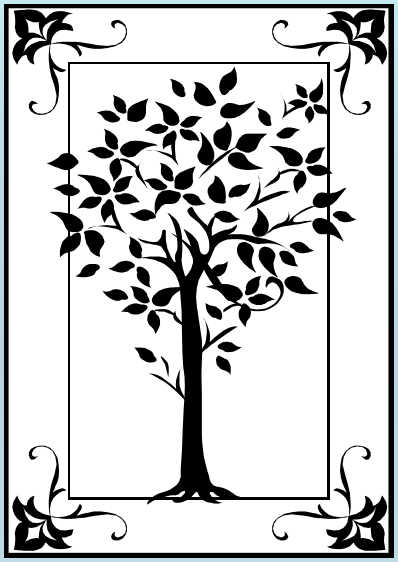
METADATA AND NUMERICAL DATA CAPTURE:
Uncertainties
(General Description)

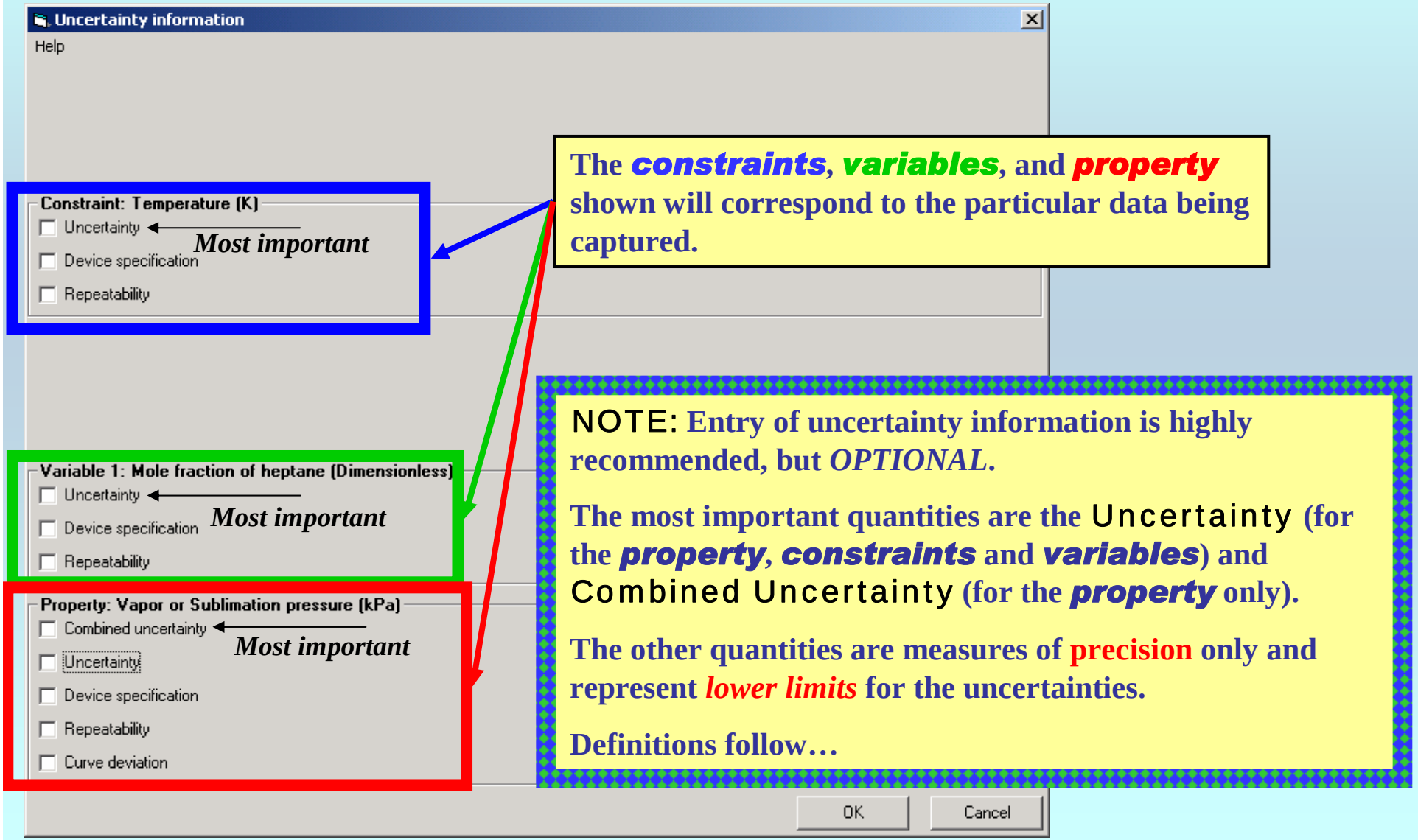
Guided **D**ata

Capture (GDC)



This tutorial describes
DATA CAPTURE:
for Uncertainties and Precisions
with the Guided Data Capture (GDC) software.

NOTE: **In GDC 3.0 all *uncertainty* and *precision* information is captured on one form, as shown below. The form appears after the property and metadata (phases, constraints, etc.) are specified.**



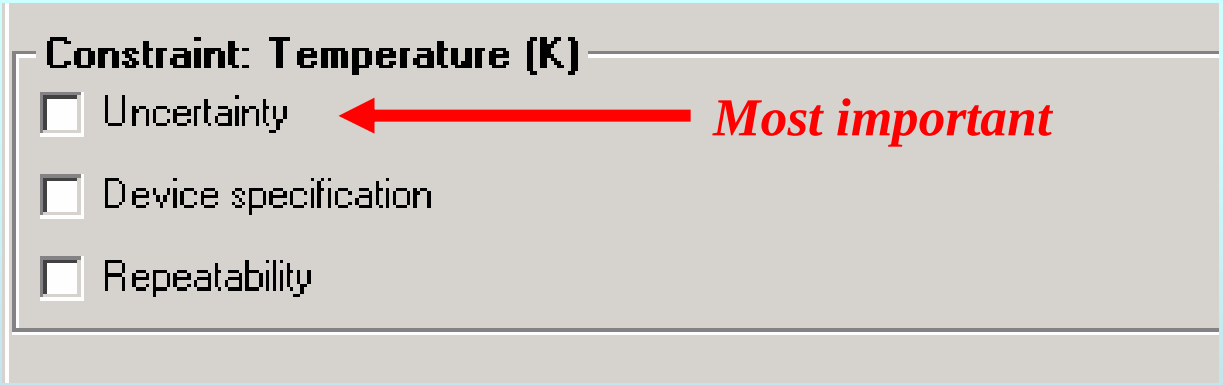
The *constraints*, *variables*, and *property* shown will correspond to the particular data being captured.

NOTE: **Entry of uncertainty information is highly recommended, but *OPTIONAL*.**

The most important quantities are the Uncertainty **(for the *property*, *constraints* and *variables*) and** Combined Uncertainty **(for the *property* only).**

The other quantities are measures of precision only and represent *lower limits* for the uncertainties.

Definitions follow…

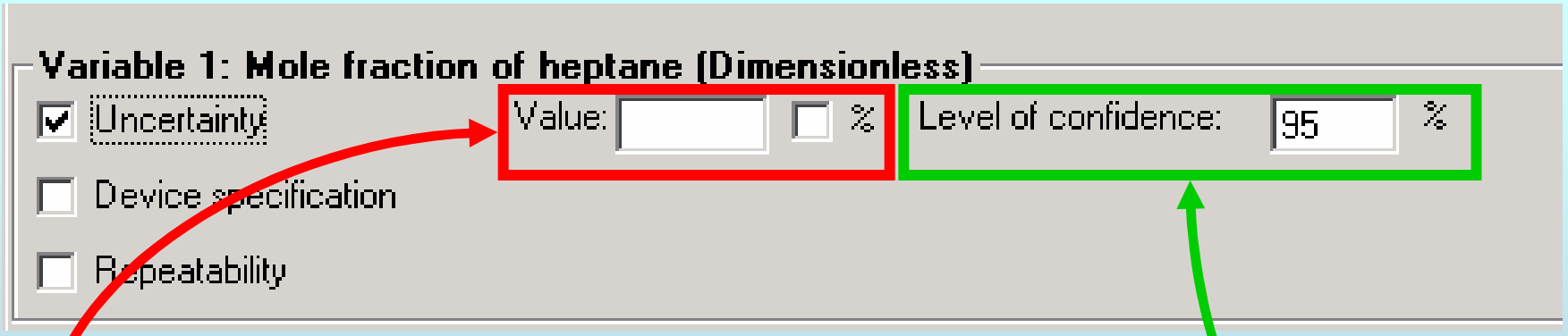


3 measures of uncertainty/precision are shown for each constraint, variable, and property.

The property has two additional quantities described later.

You can select to enter any or all of these. Additional fields associated with the quantity appear after selection. (Select by checking the ***check box*****)**

The following pages show each uncertainty/precision type.



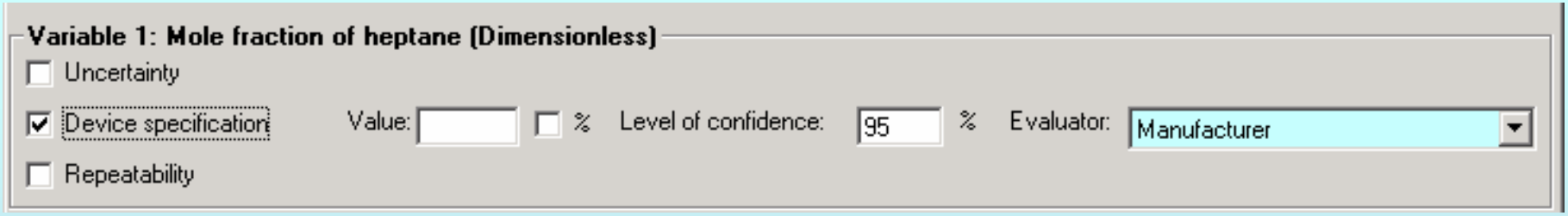
Uncertainty is the most important quantity for ***variables*** and ***constraints***. This quantity is the *Expanded Uncertainty* described in *J. Chem. Eng. Data*, 2003, 48, 1344.

It includes the uncertainty arising from all sources, but *does not include propagation of uncertainty from other constraints or variables*.

The ***Value*** for the *entire data set* can be entered as an *absolute value* or *percentage*. (Select the % check box for percentages)

The ***Level of confidence*** is assumed to be 95%, but you can changed this value, if necessary.

NOTE: If necessary, *Uncertainties* associated with *individual data points* can be entered in the *Data Table Form* which follows the *Uncertainty Info Form* in the GDC software.



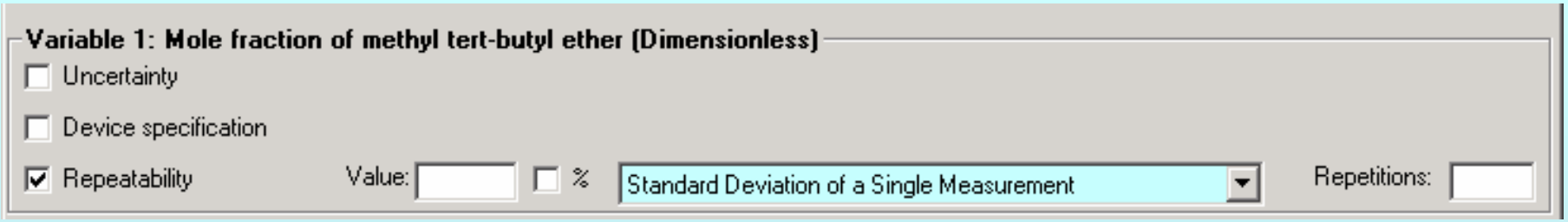
Device Specification is a type of precision.

***Device specification* allows reporting of *device calibration information*. This does not include uncertainties associated with use of the device in the experimental apparatus.**

For example, a thermometer could have a *Device Specification* value of 0.01 K (based on calibration), but the uncertainty in the temperature measurements might be much larger.

The *Device Specification* value is one measure of the *lower limit* for the uncertainty.

The *Level of confidence* is assumed to be 95%, but you can changed this value, if necessary.



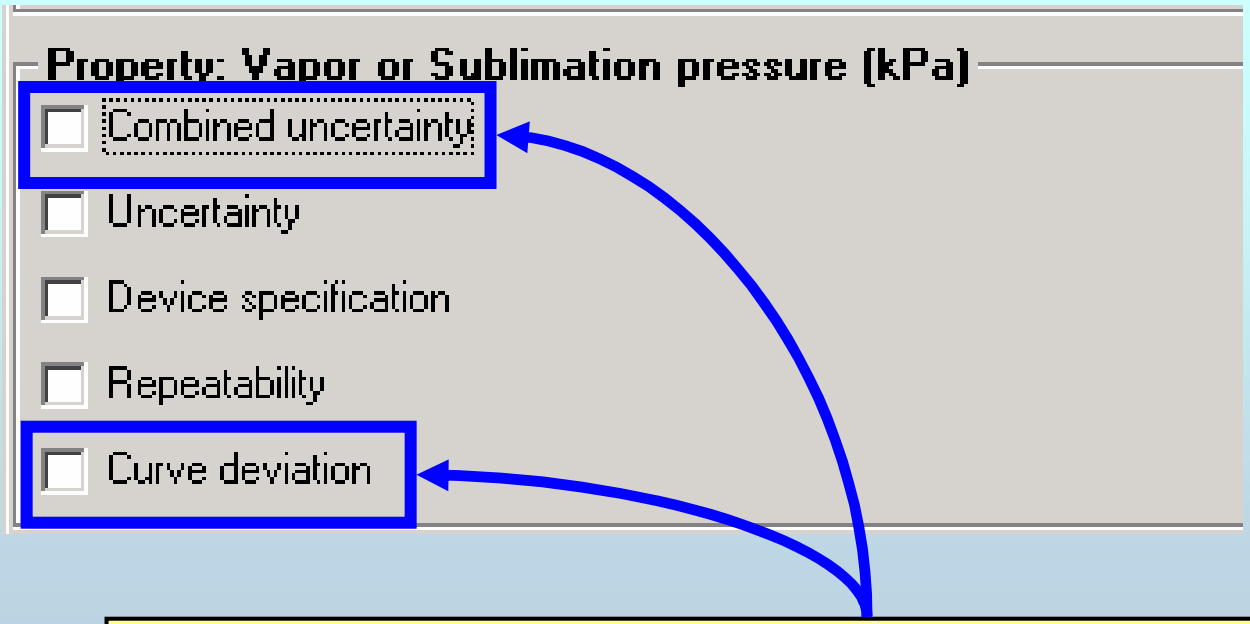
Repeatability **is another type of precision.**

Repeatability **is defined as:**
Closeness of the agreement between the results of successive measurements of the same measurand carried out under the same conditions of measurement.

Repeatability is expressed in GDC as: the *Standard Deviation of a Single Measurement* or the *Standard Deviation of the Mean*. (Mathematical formulations are given in the HELP file for the Uncertainty Information form.

The *Repeatability* value is another measure of the *lower limit* for the uncertainty.

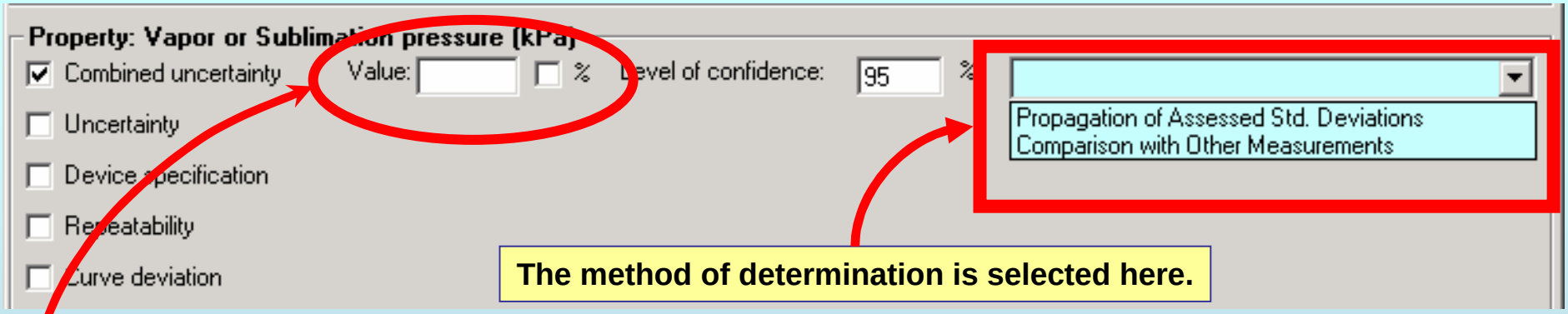
The *Level of confidence* is assumed to be 95%, but you can changed this value, if necessary.



The PROPERTY has 2 additional representations:

1) Combined Uncertainty: **This is like the *Uncertainty*, but it includes uncertainty *propagated* from the variables and constraints. This is the most important representation of uncertainty.**

2) Curve deviation: **This is another measure of the *lower limit* for the uncertainty**



•Combined Uncertainty **is the most important quantity for properties. This is the *Combined Expanded Uncertainty* described in *J. Chem. Eng. Data*, 2003, 48, *1344*.**

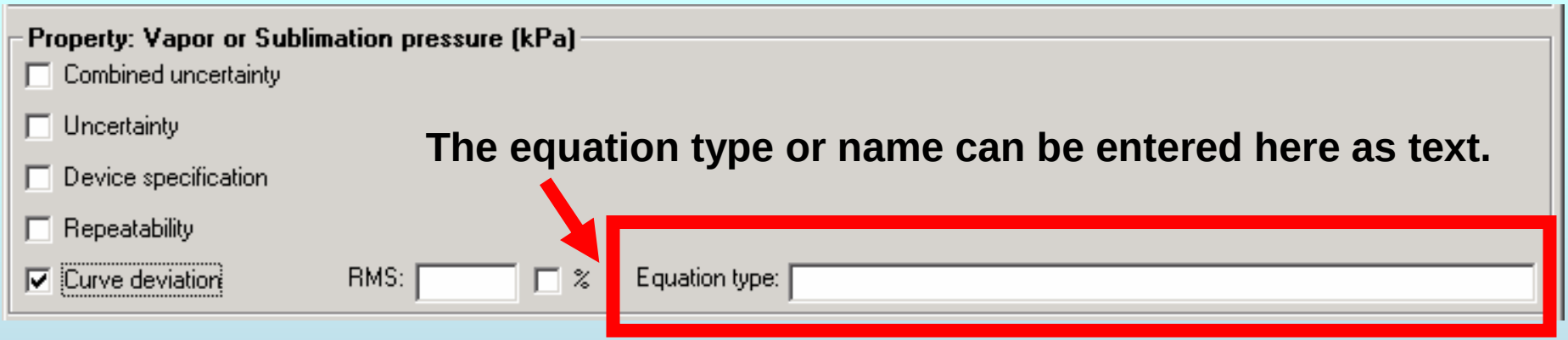
•This quantity includes the uncertainty arising from all sources, and includes propagation of uncertainty from the constraints or variables.

•The quantity can be entered as an *absolute value* or *percentage*. If necessary, *Combined Uncertainties* associated with individual data points can be entered in the *Data Table Form* which follows the *Uncertainty Info Form*. (Leave the *Value* field blank, if the uncertainties will be entered directly in the *Data Table Form*.)

•You should select how the values were determined from the indicated pull-down menu. (shown in the red box above)

•The *Level of confidence* is assumed to be 95%, but you can change this value, if necessary.

***NOTE*: If necessary, *Uncertainties* associated with *individual data points* can be entered in the *Data Table Form* which follows the *Uncertainty Info Form* in the GDC software.**



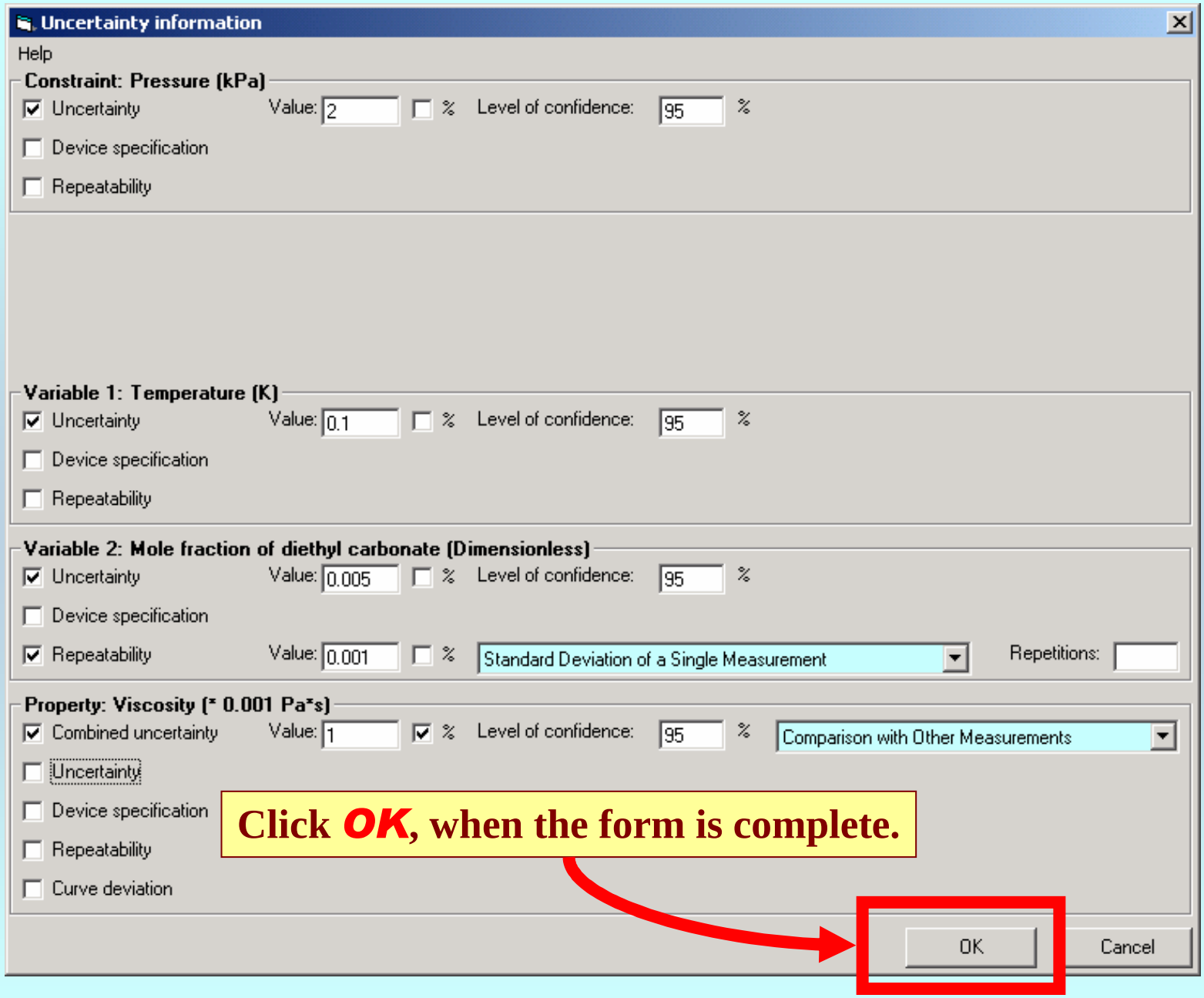
Curve deviation is another type of **precision**.

Curve deviation **is defined as:**
The root-mean-square deviation from a specified curve.

The *Curve deviation* value is another measure of the *lower limit* for the uncertainty.

The value can be expressed as an absolute value or percentage.

The *Level of confidence* is assumed to be 95%, but you can changed this value, if necessary.


Uncertainty information
Help
Constraint: Pressure (kPa)
Uncertainty
Value: 2
%
Level of confidence: 95 %
Device specification
Repeatability
Variable 1: Temperature (K)
Uncertainty
Value: 0.1
%
Level of confidence: 95 %
Device specification
Repeatability
Variable 2: Mole fraction of diethyl carbonate (Dimensionless)
Uncertainty
Value: 0.005
%
Level of confidence: 95 %
Device specification
Repeatability
Value: 0.001
%
Standard Deviation of a Single Measurement
Repetitions:
Property: Viscosity (* 0.001 Pa*s)
Combined uncertainty
Value: 1
%
Level of confidence: 95 %
Comparison with Other Measurements
Uncertainty
Device specification
Repeatability
Curve deviation
Click OK, when the form is complete.
OK
Cancel

All definitions are based on the following documents:

Definitions and descriptions of all quantities related to the expression of uncertainty in GDC conform to the;

***Guide to the Expression of Uncertainty in Measurement*, ISO (International Organization for Standardization), October, 1993.**

These ISO recommendations were adopted with minor editorial changes as the;

***U.S. Guide to the Expression of Uncertainty in Measurement*. (commonly referred to by its abbreviation; the *GUM*).**

The recommendations have been summarized in;

Guidelines for the Evaluation and Expression of Uncertainty in NIST Measurement Results

This final document is available via free download from the Internet *(http://physics.nist.gov/cuu/).*

A more complete discussion of the uncertainty terms used here is given in *J. Chem. Eng. Data*, 2003, 48, 1344-1359.

Note: This article provides much more detail than is necessary for use of GDC.

END

Continue with data capture...