



# Software Applications

## Uncertainty Calculation Module Details

### **Abstract**

This document lists the uncertainty calculation modules available for use in KELTON™  
UNCERTAINTYPLUS™ and UNCERTAINTYLIVE™

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## 1.0 Revision Control

Rev	Issue date	Description	Prep.	App.
1	27/01/17	Format Document	MH	JON
1.1	27/07/17	Revised Module List	JS	MH
1.2	28/11/17	Reformatted	KW	JON
1.3	22/12/17	Revised Module List	JS	JON
1.4	10/09/18	Updated in accordance with Brand Guidelines	KW	JON
1.5	30/10/19	Updated to include new Modules	PK	JON
1.6	17/02/20	Updated to include checkbox instructions	KW	JON
1.7	23/09/20	Updated to include new module	PK	KW
1.8	26/04/2021	Updated to include new Modules	PK	JON

## 2.0 Using the 'Fill & Sign' Command

When in Adobe Acrobat Reader open the Tools pane, expand the Forms section, and then click Edit. Expand the Tasks section, and then select Check Box from the Add New Field pull-down menu. Position the cursor where you want the check box to appear. Place a 'tick box' in the right hand column next to the modules required and return the updated pdf to [sales@kelton.co.uk](mailto:sales@kelton.co.uk)

## 3.0 Coriolis Meter Modules

Module no.	Title	Module Description	Module Required
UN-101	Gas Coriolis (Calc Dens, Calc Std Dens, Calc CV)	Calculates the uncertainty in mass, standard volume and energy flowrates for a gas flow through a Coriolis meter. Standard density, CV and their respective uncertainties are calculated from the gas composition. Coriolis meter flowrate uncertainty is determined using the technical specification for the Coriolis meter selected from the integrated meter selection tool.	

Module no.	Title	Module Description	Module Required
UN-102	Gas Coriolis (basic)	Calculates the uncertainty in mass flowrate for a gas flow through a Coriolis meter. Coriolis meter flowrate uncertainty is determined using the technical specification for the Coriolis meter selected from the integrated meter selection tool.	
UN-110	Liquid Coriolis (basic)	Calculates the uncertainty in mass and standard volume flowrates for a liquid flow through a Coriolis meter. Standard density and its uncertainty are manual inputs. Coriolis meter flowrate uncertainty is determined using the technical specification for the Coriolis meter selected from the integrated meter selection tool.	
UN-112	Liquid Coriolis (Density based water cut meter, no prover)	Coriolis meter flowrate uncertainty is determined using the technical specification for the Coriolis meter selected from the integrated meter selection tool. Water cut is determined from known standard densities of water and oil in addition to line density of the oil-water mixture. Pressure, temperature and measured density uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool. The module replicates the “Net Oil” calculations to determine the “Net Oil” and “Water” mass flowrates and determines the associated uncertainties in these outputs. The “Net Oil” calculation require standard density inputs for both the oil and water phases, and uses the relevant standards for Ctl and Cpl to convert these densities to line conditions.	
UN-113	Liquid Coriolis (Water cut meter, prover)	Calculates the uncertainty in mass and standard volume flowrate for a liquid flow through a Coriolis meter with an online prover and/or master meter. Meter observed volume flowrate uncertainties are determined from proving statistics as per API MPMS 4.2. Pressure, temperature and measured density uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-114	Liquid Coriolis (Water cut meter, no prover)	As per module UN-113, without prover/master meter configuration and is designed for stand-alone Coriolis meters. Coriolis meter flowrate uncertainty is determined using the technical specification for the Coriolis meter selected from the integrated meter selection tool. Pressure, temperature and measured density uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-115	Liquid Coriolis (Sample based water cut, prover)	As per module UN-113, with sample-based water cut uncertainty calculated as per ISO 3171 method. Coriolis meter flowrate uncertainties are determined from proving statistics as per API MPMS 4.2. Pressure, temperature and measured density uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	

Module no.	Title	Module Description	Module Required
UN-118	Liquid Coriolis (Water cut Meter, Proved as a Volume Meter)	As per module UN-113 but with addition of Coriolis meter density accuracy term for a Coriolis meter being proved as a volumetric meter. Coriolis meter flowrate uncertainties are determined from proving statistics as per API MPMS 4.2. Pressure, temperature and measured density uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-119	UN119 Liquid Coriolis (Sample based water cut, no prover)	Calculates the uncertainty in mass and standard volume flowrates for a liquid flow through a Coriolis meter. Standard density and its uncertainty are manual inputs. Coriolis meter flowrate uncertainty is determined using the technical specification for the Coriolis meter selected from the integrated meter selection tool. Sample-based water cut uncertainty calculated as per ISO 3171 method.	
UN-120	UN120 Liquid Coriolis (Water cut from manual sample, no prover, Net oil from lab data)	Calculates the uncertainty in mass and standard volume flowrates for a liquid flow through a Coriolis meter. Standard density and its uncertainty are manual inputs. Coriolis meter flowrate uncertainty is determined using the technical specification for the Coriolis meter selected from the integrated meter selection tool. Sample-based water cut uncertainty calculated as per ISO 3171 method. Net oil volume and mass calculations calculated using % mass water cut, wet mass and wet standard volume flowrates, emulsion and water standard densities and salinity correction. Uncertainties for all these values are used to calculate net oil uncertainties.	
UN-121	Liquid Coriolis Meter Net Oil (Water cut meter, Inferred mass proving)	Calculates the uncertainty in mass and standard volume flowrates for a liquid flow through a Coriolis meter. This calculation considers the uncertainty in measured line density in order to calculate the uncertainty in prover mass converted from base volume.	

## 4.0 Ultrasonic Meter Modules

Module no.	Title	Module Description	Module Required
UN-201	Gas USM (Calculated density, VCF and ECF)	Calculates the uncertainty in observed volume, mass, standard volume and energy flowrate for a gas USM. USM flowrate uncertainties are determined from an assessment of the meter calibration performance, installation and on-going performance/usage parameters. Density, standard density and CV calculations and their uncertainties are performed using user-selectable calculations. Pressure and temperature uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-202	Gas USM (Measured density)	Calculates the uncertainty in observed volume, mass, standard volume and energy flowrate for a gas USM. USM flowrate uncertainties are determined from an assessment of the meter calibration performance, installation and on-going performance/usage parameters. Density is determined from measurement and its uncertainty determined from the technical specifications of the densitometer used. Standard density and CV calculations and their uncertainties are performed using user-selectable calculations and the gas composition data. Pressure and temperature uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-204	Flare Gas USM (Calculated density from MW)	Calculates the uncertainty in observed volume, mass and standard volume flowrates for a USM used for flaring. USM flowrate uncertainties are determined from an assessment of the meter calibration performance, installation and on-going performance/usage parameters. Density is derived from molecular weight and its uncertainty gained from this relationship. Pressure and temperature uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-414	Liquid USM (Water cut meter, no prover)	Calculates the uncertainty in observed volume, mass and standard volume flowrate for a liquid flow through a USM. USM flowrate uncertainties are determined from an assessment of the meter calibration performance, installation and on-going performance/usage parameters. Line and standard densities and their uncertainties are performed by user-selected density referral calculations. Pressure, temperature, measured density and water cut uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	

Module no.	Title	Module Description	Module Required
UN-416	Liquid USM (Sample based water cut, no prover)	Calculates the uncertainty in observed volume, mass and standard volume flowrate for a liquid flow through a USM. USM flowrate uncertainties are determined from an assessment of the meter calibration performance, installation and on-going performance/usage parameters. Line and standard densities and their uncertainties are performed by user-selected density referral calculations. Water cut is determined by sample and analysis. Pressure, temperature and measured density uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-417	Liquid USM (No pressure, temperature or density measurement)	Calculates the uncertainty in observed volume, mass and standard volume flowrate for a liquid flow through a USM. Line density, VCF and their uncertainties are performed by user-selected density referral calculations. Overall observed volume uncertainty is calculated as a function of the following uncertainty components; calibration, repeatability, linearity, process effects, drift, installation effects, pulse count and computation.	

## 5.0 Turbine/PD Meter Modules

Module no.	Title	Module Description	Module Required
UN-211	Gas Turbine	Calculates the uncertainty in observed volume, mass, standard volume and energy flowrate for a gas turbine meter. Meter flowrate uncertainties are determined from an assessment of the meter calibration performance, installation and on-going performance/usage parameters. Density, standard density and CV calculations and their uncertainties are performed using user-selectable calculations. Pressure and temperature uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-212	Gas Turbine (AGA7 PTZ)	Calculates the uncertainty in observed volume and standard volume flowrate for a gas turbine meter. Observed volume flowrate uncertainty are determined from an assessment of the meter calibration performance, installation and on-going performance/usage parameters. VCF is calculated as per AGA Report No. 7 and its uncertainty is used to determine the uncertainty in standard volume flowrate. Pressure and temperature uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool. Uncertainty in line and standard density can be entered by the user.	
UN-213	Gas Turbine (Basic)	Calculates the uncertainty in observed volume, standard volume and mass flowrate for a gas turbine meter. Meter flowrate uncertainties are determined from an assessment of the meter calibration performance, installation and on-going performance/usage parameters. Pressure and temperature uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-401	Liquid Turbine (Density based water cut, prover)	Calculates the uncertainty in observed volume, mass and standard volume flowrate for a liquid flow through a turbine with an online prover and/or master meter. Meter observed volume flowrate uncertainties are determined from proving statistics as per API MPMS 4.2. Line and standard densities and their uncertainties are performed by user-selected density referral calculations. Pressure, temperature and measured density uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool. The module replicates the "Net Oil" calculations to determine the "Net Oil" and "Water" mass flowrates and determines the associated uncertainties in these outputs. The "Net Oil" calculation require standard density inputs for both the oil and water phases, and uses the relevant standards for Ctl and Cpl to convert these densities to line conditions.	



Module no.	Title	Module Description	Module Required
UN-403	Liquid Turbine (Water cut meter, prover)	Calculates the uncertainty in observed volume, mass and standard volume flowrate for a liquid flow through a turbine meter with an online prover and/or master meter. Meter observed volume flowrate uncertainties are determined from proving statistics as per API MPMS 4.2. Line and standard densities and their uncertainties are performed by user-selected density referral calculations. Pressure, temperature, measured density and water cut uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-404	Liquid Turbine (Water cut meter, no prover)	As per module UN-403, without prover/master meter configuration.	
UN-405	Liquid Turbine (Sample based water cut, prover)	Calculates the uncertainty in observed volume, mass and standard volume flowrate for a liquid flow through a turbine meter with an online prover and/or master meter. Meter observed volume flowrate uncertainties are determined from proving statistics as per API MPMS 4.2. Line and standard densities and their uncertainties are performed by user-selected density referral calculations. Water cut is determined by sample and analysis. Pressure, temperature and measured density uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-406	Liquid Turbine (Sample based water cut, no prover)	As per module UN-405, without prover/master meter configuration.	
UN-431	Positive Displacement Meter with Oil Prover	Calculates the uncertainty in observed volume, mass and standard volume flowrate for a liquid flow through a PD meter with an online prover and/or master meter. Meter observed volume flowrate uncertainties are determined from proving statistics as per API MPMS 4.2. Standard densities and associated uncertainty calculated by user-selected density referral calculations. Pressure, temperature and measured density uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	

## 6.0 Vortex Meter Modules

Module no.	Title	Module Description	Module Required
UN-221	Gas Vortex (Calculated density, VCF and ECF)	Calculates the uncertainty in observed volume, mass, standard volume and energy flowrate for a gas vortex meter. Meter flowrate uncertainties are determined from an assessment of the meter calibration performance, installation and on-going performance/usage parameters. Density, standard density and CV calculations and their uncertainties are performed using user-selectable calculations. Pressure and temperature uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-423	Liquid Vortex (Water cut meter)	Calculates the uncertainty in observed volume, mass and standard volume flowrate for a liquid flow through a vortex meter. Line and standard densities and their uncertainties are performed by user-selected density referral calculations. Pressure, temperature, measured density and water cut uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-807	Water Vortex	Calculates the uncertainty in Gross volume. Overall uncertainty is calculated as a function of the following uncertainty components; calibration, drift, repeatability, installation effects, computation, pipe diameter and accuracy. Accuracy is determined from meter type, output type (pulse/analog) and velocity.	

## 7.0 Orifice Plate Meters

Module no.	Title	Module Description	Module Required
UN-301	Gas Orifice (Calc Dens, Calc Std Dens, Calc CV)	Calculates the uncertainty in mass, standard volume and energy flowrate for a gas orifice meter run. Mass flowrate, density, standard density and CV calculations and their uncertainties are performed using user-selectable calculations. Pressure, temperature and differential pressure uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-302	Gas Orifice (NX-19 density)	As per module UN-301, except this module has been modified to use NX-19 as opposed to a full compositional analysis.	

Module no.	Title	Module Description	Module Required
UN-303	Liquid Orifice	Calculates the uncertainty in mass and standard volume flowrate for a liquid orifice meter run. Mass flowrate, density and standard density calculations and their uncertainties are performed using user-selectable calculations based on the density measured using a densitometer. Pressure, temperature, differential pressure and density uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-304	Liquid Orifice (Water cut meter)	As per module UN-303 with the addition of the calculation of 'wet' and 'dry' flowrate uncertainty where the water content is user entered or measured using a water cut meter.	
UN-305	Wet Gas Orifice (Calc Dens, Calc Std Dens, Calc CV)	Calculates the uncertainty in the corrected gas mass flowrate from an orifice plate encountering a wet gas flow using the wet gas correction described in ISO TR 12748. Mass uncertainty is based on "dry gas" uncertainty (as per Module 301) in addition to wet gas parameters and their uncertainties. Standard density and energy flowrate uncertainties are also estimated from this corrected gas mass flowrate. Pressure, temperature and differential pressure uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-306	Gas Orifice (Measured density)	Calculates the uncertainty in mass, standard volume and energy flowrate for a gas orifice meter run. Mass flowrate, standard density and CV calculations and their uncertainties are performed using user-selectable calculations. Pressure, temperature, differential pressure and density uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-307	Gas Orifice (User entered density)	Calculates the uncertainty in mass and standard volume flowrate for a gas orifice meter run. Mass flowrate and its uncertainty are performed using user-selectable calculations. Pressure, temperature and differential pressure uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool. Uncertainty in line and standard density can be entered by the user.	
UN-308	Liquid Orifice (User entered density)	Calculates the uncertainty in mass and standard volume flowrate for a liquid orifice meter run. Mass flowrate and its uncertainty are performed using user-selectable calculations. Pressure, temperature and differential pressure uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool. Uncertainty in line and standard density can be entered by the user.	

## 8.0 Cone Meter Modules

Module no.	Title	Module Description	Module Required
UN-116	Gas Cone Meter	Calculates the uncertainty in mass, standard volume and energy flowrate for a gas cone meter. Mass flowrate, density, standard density and CV calculations and their uncertainties are performed using user-selectable calculations. Pressure, temperature and differential pressure uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	

## 9.0 Venturi Meter Modules

Module no.	Title	Module Description	Module Required
UN-321	Gas Venturi (Calc Dens, Calc Std Dens, Calc CV)	Calculates the uncertainty in mass, standard volume and energy flowrate for a gas Venturi meter run. Mass flowrate, density, standard density and CV calculations and their uncertainties are performed using user-selectable calculations. Pressure, temperature and differential pressure uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-322	Wet Gas Venturi (Calc Dens, Calc Std Dens, Calc CV)	Calculates the uncertainty in the corrected gas mass flowrate from a Venturi encountering a wet gas flow, using a “Chisholm De Leeuw” based wet gas correction. Mass uncertainty is based on “dry gas” uncertainty (as per Module 321) in addition to wet gas parameters and their uncertainty. Standard density and energy flowrate uncertainties are also estimated from this corrected gas mass flowrate. Pressure, temperature and differential pressure uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	
UN-323	Liquid Venturi	Calculates the uncertainty in mass and standard volume flowrate for a liquid Venturi meter run. Pressure, temperature, and density uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool. Standard density uncertainty is determined dependent on user entered calculation choice.	
UN-324	Gas Venturi (Measured density)	Calculates the uncertainty in mass, standard volume and energy flowrate for a gas Venturi meter run. Mass flowrate, standard density and CV calculations and their uncertainties are performed using user-selectable calculations. Pressure, temperature, differential pressure and density uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool.	

## 10.0 Electromagnetic Flow Meter Modules

Module no.	Title	Module Description	Module Required
UN-501	Water Electromagnetic Flow Meter	Calculates the uncertainty in volume flowrate for an electromagnetic flow meter measuring water. Water density and its uncertainty are entered by the user to also obtain mass flow uncertainty.	

## 11.0 Thermal Mass Meter Modules

Module no.	Title	Module Description	Module Required
UN-801	Thermal Mass Meter	Calculates the uncertainty in mass, standard volume and energy flowrate through a thermal mass meter. A wide selection of thermal mass meter manufacturers and models are available and technical specification for these meters is used to determine primary element uncertainty. Pressure and temperature uncertainties are determined using the technical specification for the transmitters selected from the integrated transmitter selection tool. Calculates gas composition uncertainty per component and applies this to calculation of uncertainty in calculated values of line density, standard density and calorific value.	

## 12.0 GC Module

Module no.	Title	Module Description	Module Required
UN-004	Gas Chromatograph	Calculates the uncertainty in Standard Density and Calorific Value based on the composition uncertainty. Various standards can be used to calculate standard density and CV and the associated uncertainties for these values.	