

TSI® FMS 5 SOFTWARE EXPRESSION AND FUNCTIONS ALLOWED IN CALCULATED DRIVER

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Description

Often when receiving User Requirements (URS) for an FMS System it is requested to be able to make computation between some of the configured Sample Points as this can reduce drastically the physical installation of duplicated sensors.

Per example; you can have pressure sensors installed in each cleanroom measuring the pressure against the atmosphere. But to protect those rooms from contamination of less adjacent clean spaces, it is required to measure the differential pressure between each adjacent room and to keep it in the range of 5 Pa to 20 Pa. This can be done by installing other pressure sensors where the positive and negative tubes are connected in both cleanrooms. The other way is to compute between each Pressure sensors with reference to the atm.

Many other examples exist, like doors interlocking, for which Calculated Sample Point are needed in an FMS System.

This type of computation can be done in FMS 5 by creating new Calculated Sample Points by using the “*Calculated Driver.*” Be aware that these Calculated Sample Points are taken into account for the total number of Sample Points in the FMS 5 License Key.



Requirements

- FMS version 5.1.0 or above must installed.
- All Sample Points that are part of the calculation of a Calculated Sample Point must already be configured.
- A maximum of **15** Calculated Units can be configured per Monitor and for each Calculated Unit a maximum of **15** Sample Points can be created. This is a total of 225 calculated sample points per Monitor.
- It is extremely important for the Expressions and Functions described below that the syntax is respected as shown.

Assumptions

The Communication Channels, Units and Sample Points part of a calculation expression are already configured within FMS 5. The configuration example shown in this note will use the following consideration:

- Unit Name: **UCalculated_1**
- SP Room Pressure 3: **P_003**
- SP Room Pressure 4: **P_004**
- Calculated Sample Point Name: **Calculated_SP**
- Calculated Expression: **P_003 - P_004 (A-B)**

Expressions Allowed

The following table shows all the different expressions that can be used in a Calculated Sample Point.

Variables A & B can be either a Sample Point Name or a numeric value.

Expression	Description
(A^B) A^B	A raised to the power B
$(A*B)$ $A*B$	Multiplication
(A/n) A/n	A divided by a numerical value (n) Expression (A/B) will not work and will cause the Monitor to restart.
$(A+B)$ $A+B$	Addition
$(A-B)$ $A-B$	Subtraction
$(A=B)$ $A=B$	Comparison between A and B, if the condition is met stored value will be 1 else 0
$A<B$	Comparison between A and B, if the condition is met stored value will be 1 else 0
$A>B$	Comparison between A and B, if the condition is met stored value will be 1 else 0
$(A<=B)$ $(A>=B)$	These expressions will not work and will cause the Monitor to restart.

Functions Allowed

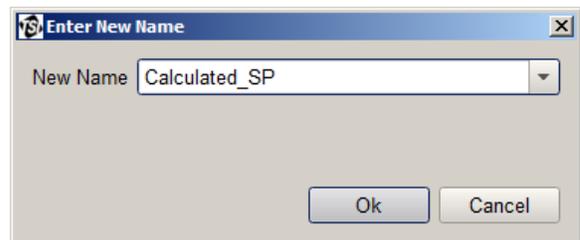
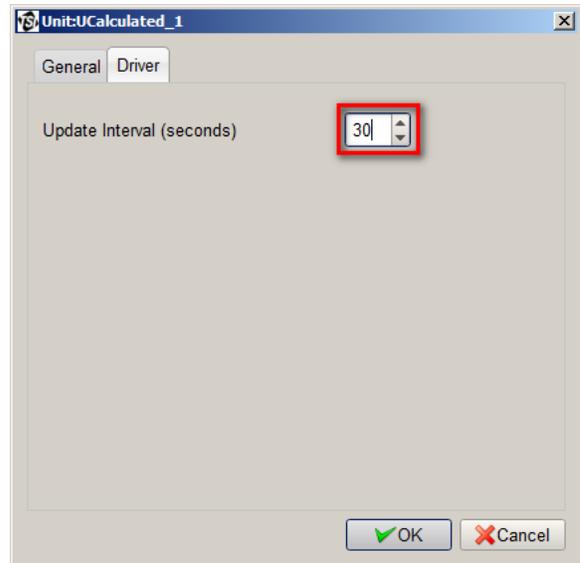
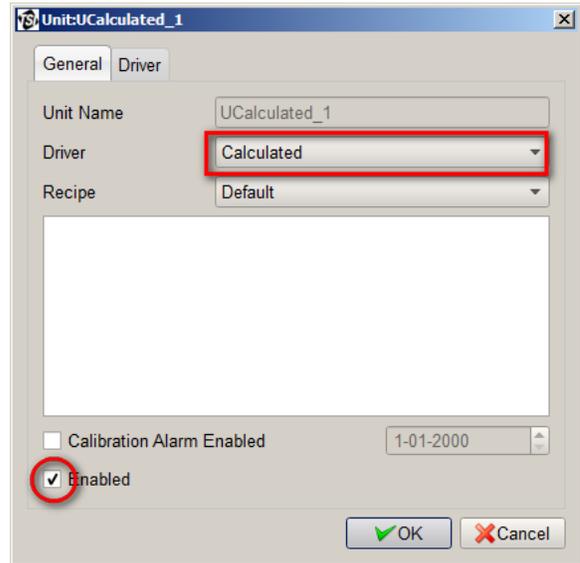
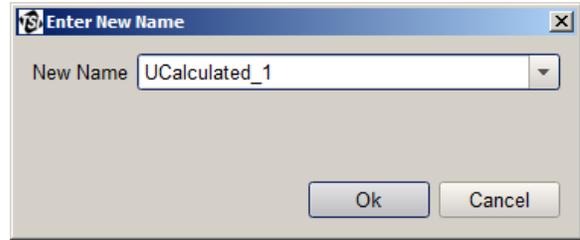
The following table shows all the different functions that can be used in a calculated Sample Point.

Variables A & B can also be replaced by one of the expression listed in the previous table.

Function	Description
abs(A)	Absolute value of A. With real numbers, if A is negative, returns -A otherwise returns A.
ceil(A)	Ceiling of A. Returns the smallest integer not smaller than A. Rounds up to the next higher integer. E.g. -2.9, -2.5 and -2.1 are rounded to -2.0, and 2.9, 2.5 and 2.1 are rounded to 3.0.
exp(A)	Exponential of A. Returns the value of e raised to the power A where e is the base of the natural logarithm, which is equal to 2.71828182846.
if(A,B,C)	If int(A) differs from 0, the return value of this function is B, else C. Only the parameter which needs to be evaluated is evaluated, the other parameter is skipped.
int(A)	Rounds A to the closest integer. Equidistant values are rounded away from zero. E.g. -2.9 and -2.5 are rounded to -3.0; -2.1 is rounded to -2.0, and 2.9 and 2.5 are rounded to 3.0; 2.1 is rounded to 2.0.
log(A)	Natural (base e) logarithm of A. If during the evaluation the value of A is equal to 0 then the message "Evaluation Failed" will be stored.
log10(A)	Base 10 logarithm of A. If during the evaluation the value of A is equal to 0 then the message "Evaluation Failed" will be stored.
max(A,B)	If $A > B$, the result is A, else B. If the condition is met stored value will be A else B
min(A,B)	If $A < B$, the result is A, else B. If the condition is met stored value will be A else B
sqrt(A)	Square root of A.
cos(A)	Cosine of A. Returns the cosine of the angle A, where A is measured in radians.
cosh(A)	Same as cos() but for hyperbolic cosine.
sin(A)	Sine of A. Returns the sine of the angle A, where A is measured in radians.
sinh(A)	Same as sin() but for hyperbolic sine.
cot(A)	If during the evaluation the value of A is equal to 0 then the message "Evaluation Failed" will be stored.
tan(A)	Tangent of A. Returns the tangent of the angle A, where A is measured in radians.
tanh(A)	Same as tan() but for hyperbolic tangent.

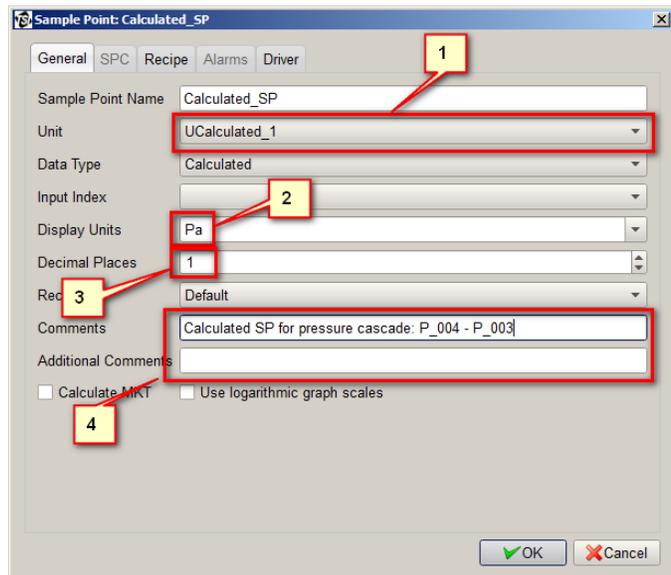
How to Create a Calculated Sample Point in FMS

1. In FMS 5 Configuration create a new Unit named **UCalculated_1**.
2. Click **Ok**.
3. Select the **Calculated** driver from the drop-down list "**Driver**".
4. Check **Enabled**.
5. Go to "**Driver**" tab and select the "**Update Interval...**" you want to set.
6. Click **OK**.
7. In FMS 5 Configuration, create a Sample Point Name named **Calculated_SP**.
8. Click **Ok**.



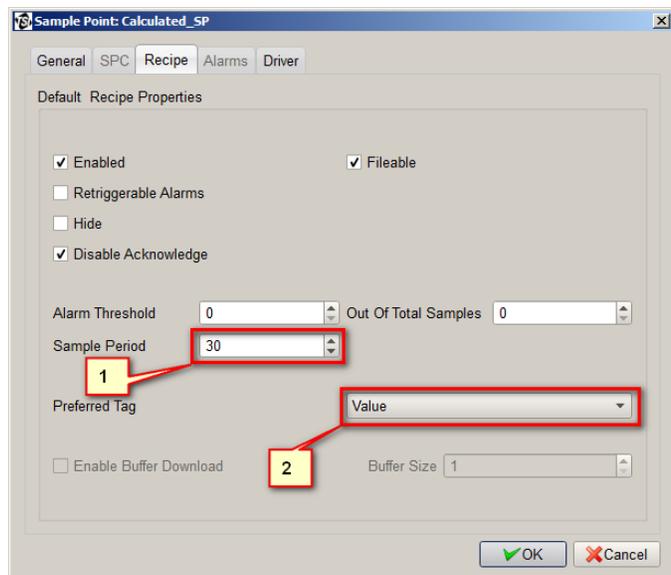
9. Set the newly created Sample Point as follows:

- ① Select the associated Unit from the “Unit” drop-down list.
- ② Enter the “Display Units” you want.
- ③ Enter or select the number of “Decimal Places” required (max 4).
- ④ It is recommended to enter any “Comments” for this calculated Sample Point.



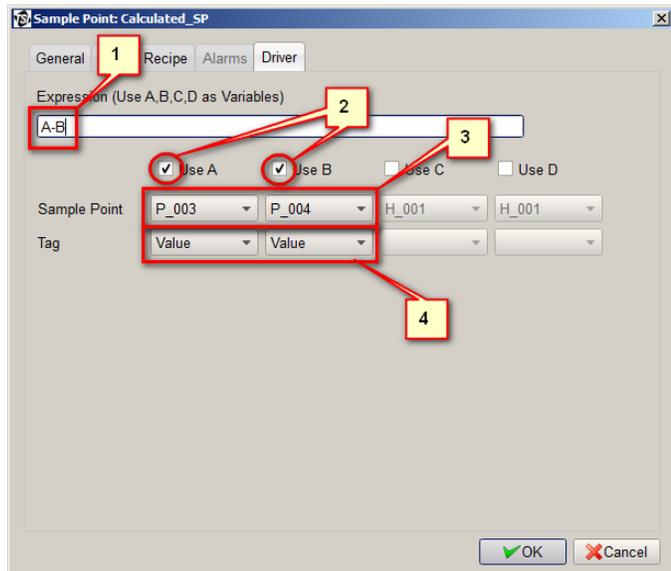
10. Go to “Recipe” tab and configure the properties as follows:

- ① Select the “Sample Period” you want to set.
- ② For the “Preferred tag” select “Value” from the drop-down list.



11. Go to “Driver” tab and do as follows:

- ① Enter the “Expression” you want to apply for this calculated Sample Points.
- ② Check the variable(s) you will use in the expression.
- ③ For each variable(s) select from the drop-down list “Sample Point” the Sample Points required.
- ④ For each selected above select the “tag” you want for the calculation.



12. When finished click **OK**.

13. FMS Monitor will restart, when finished verify the correct result for your calculation.



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