

OCTOBER 25, 2023

The Power of Expressions

AVEVA™ Historian & AVEVA™ Insight

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Search Results
3 matches

3 TAGS
All Tags

Mixed data

2 TAGS
I/sec :

Numeric data

1 TAGS
I/min :

Numeric data

Mixed data

4/11/2022 11:53:08 am - 4/11/2022 2:08:08 pm



InletFlow (l/sec) : InletFlow.SP (l/sec) : OutletFlow (l/min) :

30D 7D 3D YESTERDAY TODAY 1H CUSTOM

Specific Use Cases Targeted

Simple Engineering

- Pump Efficiency
- Find process lag based on flow rate
- Compensate for a process lag

Logical Expressions

- Simple comparisons
- Time “true”
- “True” for min/max time

Exception Handling

- Substitute bad/stale values
- Find last good value

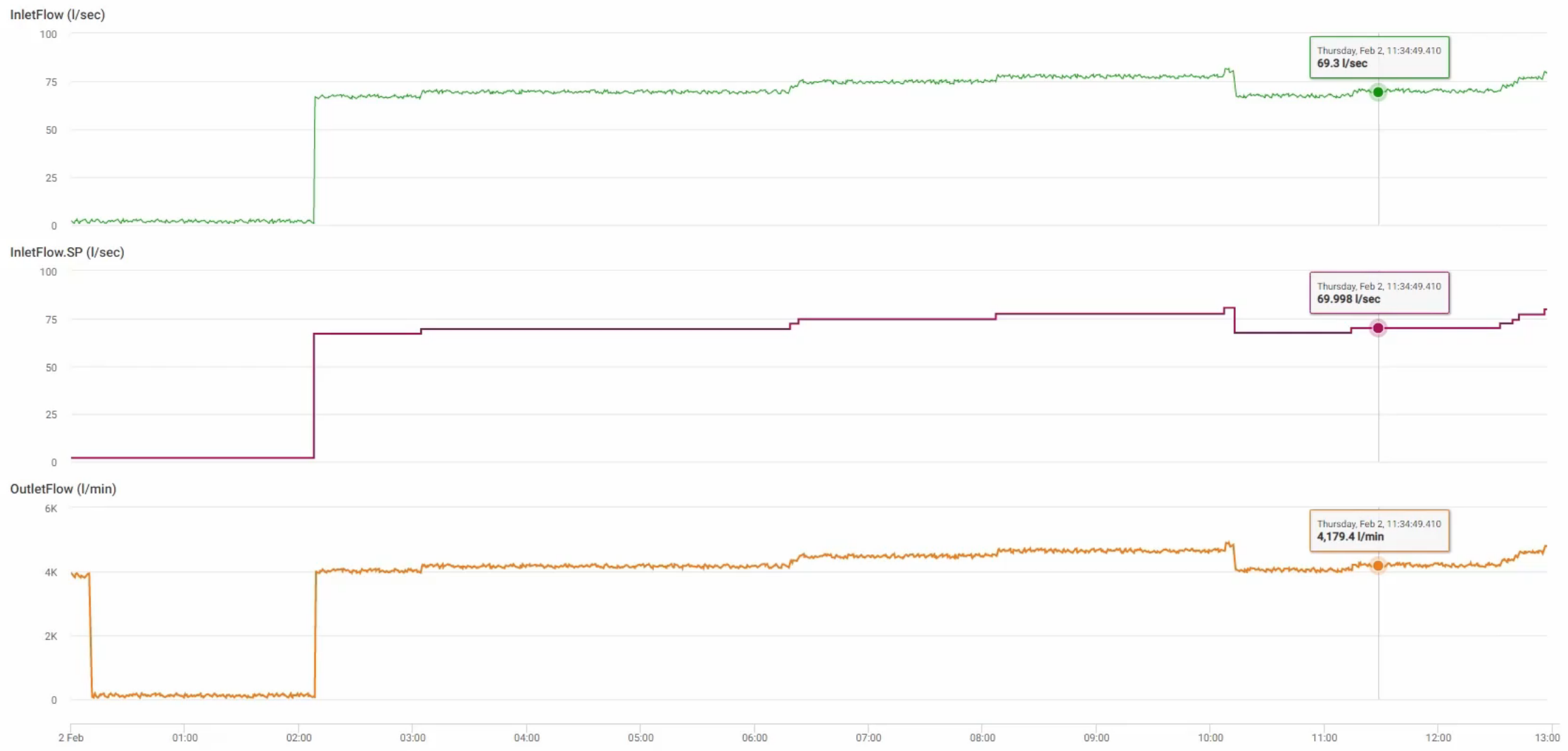
- Home
- Alerts
- Alarms
- Assets
- Lists
- Content**
- Dashboards
- Equipment Efficiency
- Strategize
- OEE Analysis
- Administration
- Classic Look

Content001

📍 Cursor 📄 Data ⚙️ Settings 💾 Save

< 02/02/2023 12:00:00 am - 02/02/2023 1:04:08 pm >

🔍 📍 📄 ⬇️ 🗨️ 🔔



30D 7D 3D YESTERDAY **TODAY** 12H 1H CUSTOM

Designing Calculations

Questions

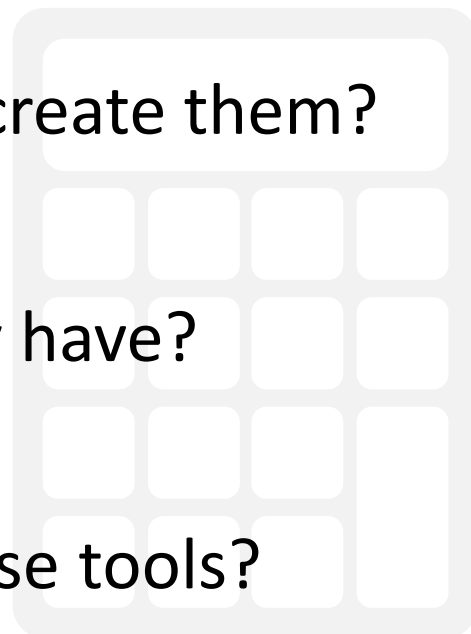
1. Who should be allowed to create them?
2. What relevant skills do they have?
3. Why not use general-purpose tools?

My Answers

All users
(not just administrators)

Excel
(not C#, C++, SQL)

Time-series,
Industrial distinctives
(not the same as accounting & IT)



Time-series & Industrial Distinctives

Time-Series

1. Date/time syntax is tedious
2. Time units are complex
3. Time zones
4. Daylight savings
5. Sample rates
6. Latency

Industrial

1. Volume of data
2. Data quality
3. Production vs. calendar days
4. Rates vs. quantity
5. Boolean information



Unit Conversion

What is the value range of the results of this expression?

`SysTimeSec` + `SysTimeMin`
0-59 seconds 0-59 minutes

- ✗ ~~a. 0 - 118~~
 - ✓ b. 0 - 3599 seconds
- ?

Unit Conversion

Might be confusing, but consider this:

$$\begin{array}{cc} \text{FI101.PV} + \text{FI202.PV} & \\ 0-35.0 & 0-0.58 \\ \text{liters/minute} & \text{liters/second} \end{array}$$

Result will be in units of first tag:

$$0-70.0 \quad \text{liters/minute}$$

Alternative puts burden on user to convert:

$$\begin{array}{l} \text{FI101.PV} + \text{FI202.PV} \quad \cancel{/ 60.0} \quad \times \\ \text{FI101.PV} + \text{FI202.PV} \quad * 60.0 \quad \checkmark \end{array}$$

Ad Hoc Expressions

Arithmetic

+
-
/
*
^
%

Units

UOM
CASTUOM

Scalar

SIGN
ABS
SQRT
LOG
ROUND
TRUNCATE

AND
OR
NOT

IF
IFBAD
IFLONGER
IFSHORTER

Statistics

AVERAGE
AVERAGES
TOTAL
TOTALS
MIN
MAX

COUNT
COUNTALL

Time Series

TIMESHIFT
DURATION
PREV
PREVGOOD

New in Historian 2023

R2

Statistics

AVERAGE(M21.Temp, 1 hour)

Returns time-weighted average

TOTAL(M21.FlowOut > 54.0, 15 minute)

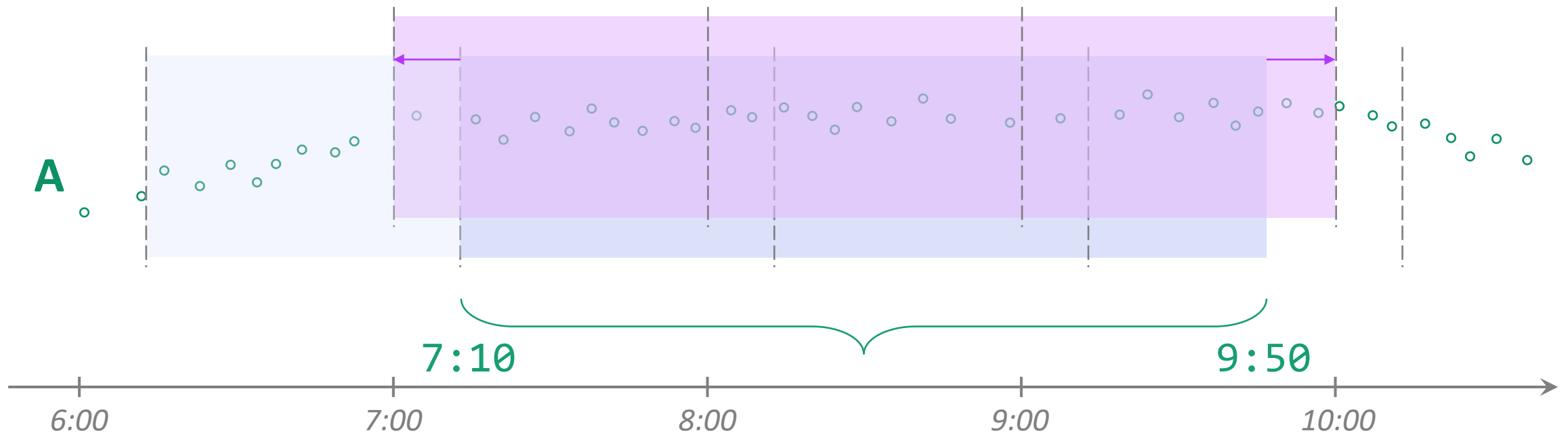
Returns a time-weighted “integral”, converting a rate to a quantity

METER(CasePacker10.Cases, 1 day)

Returns “counter” retrieval value, considering “rollover” settings

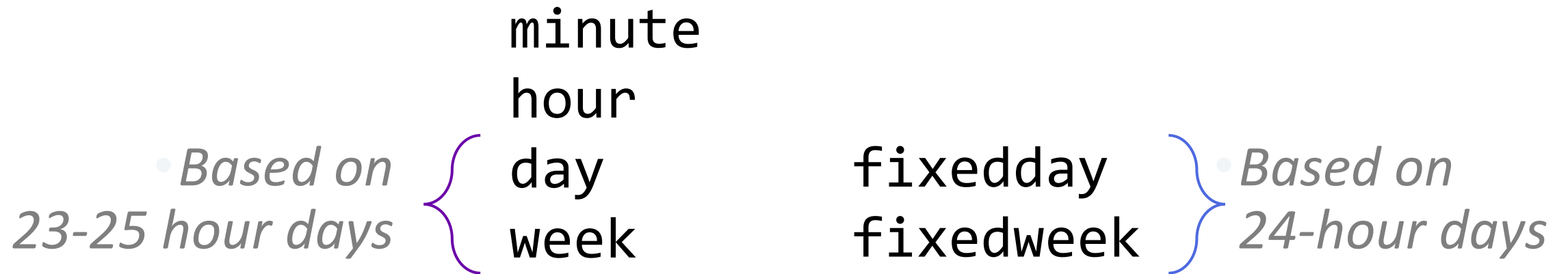
Aggregate Periods

```
AVERAGE( A, 1 hour )  
...FROM History WHERE wwRetrievalMode='AVG'  
AND wwResolution=3600000...
```



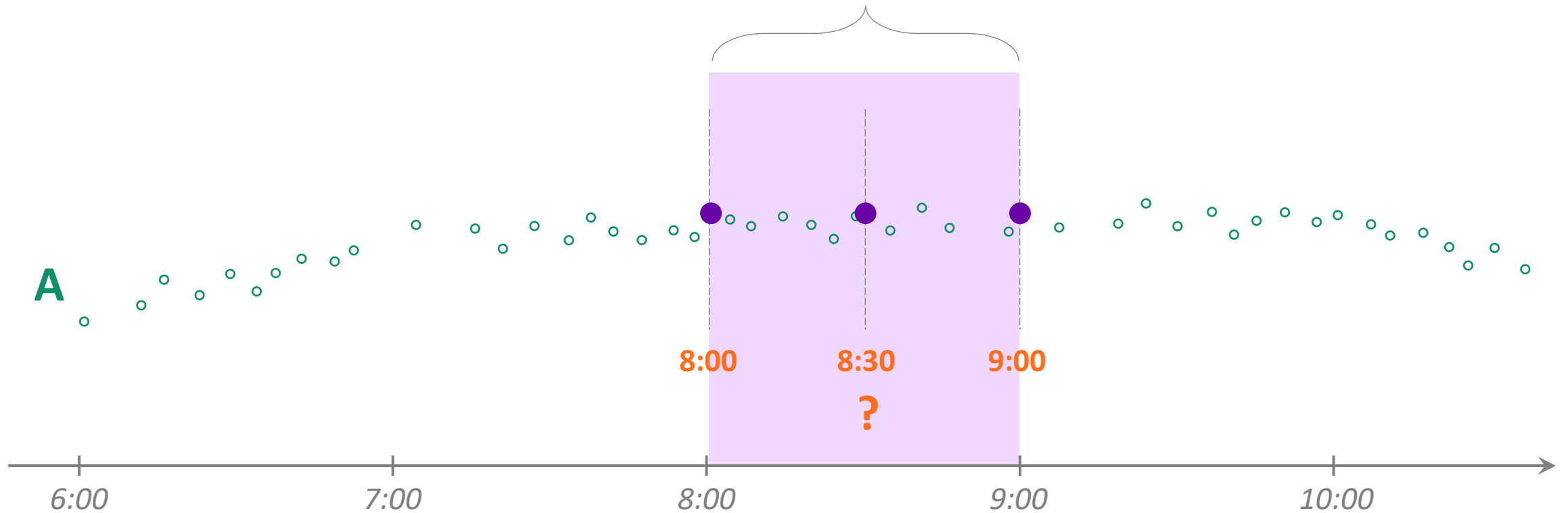
Named Periods

AVERAGE(M21.Temp, 1 hour)



Aggregate Time Stamps

AVERAGE(A, 1 hour)



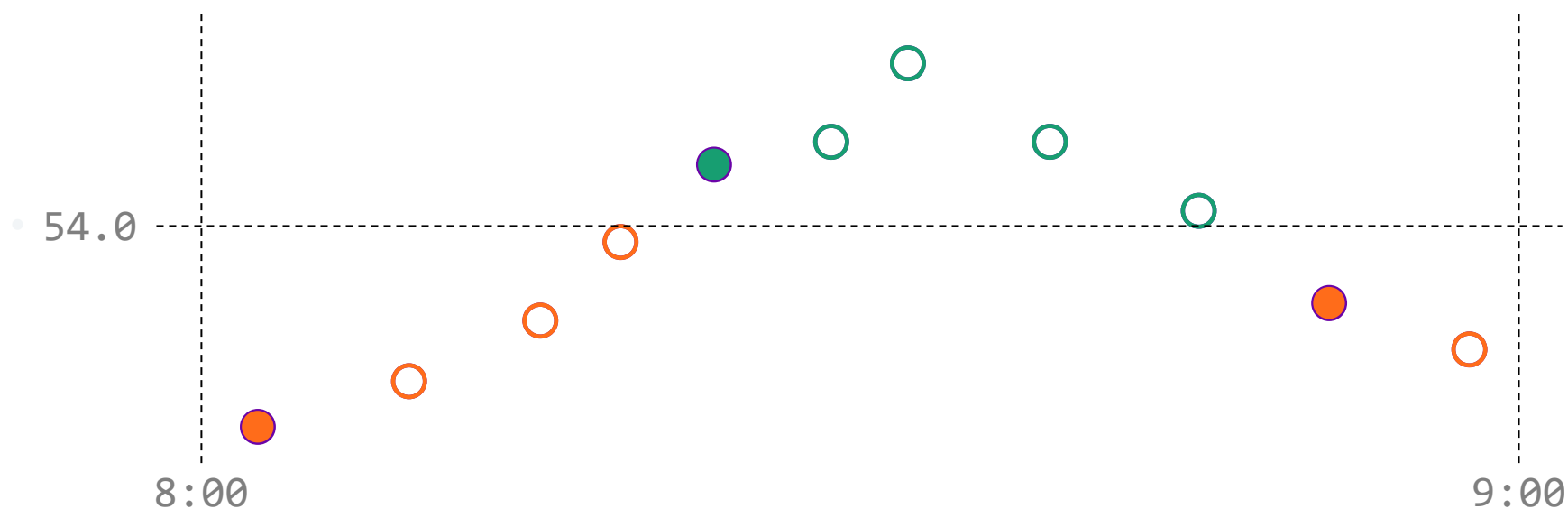
COUNT vs COUNTALL

`M21.Temp > 54.0`

`COUNT(M21.Temp > 54.0, 1 hour)`

- Only returns logical changes (**filled** points)
- Works similar to `wwEdgeDetection='both'`

- Only counts **filled green** points (e.g. "1")



`COUNTALL(M21.Temp > 54.0, 1 hour)`

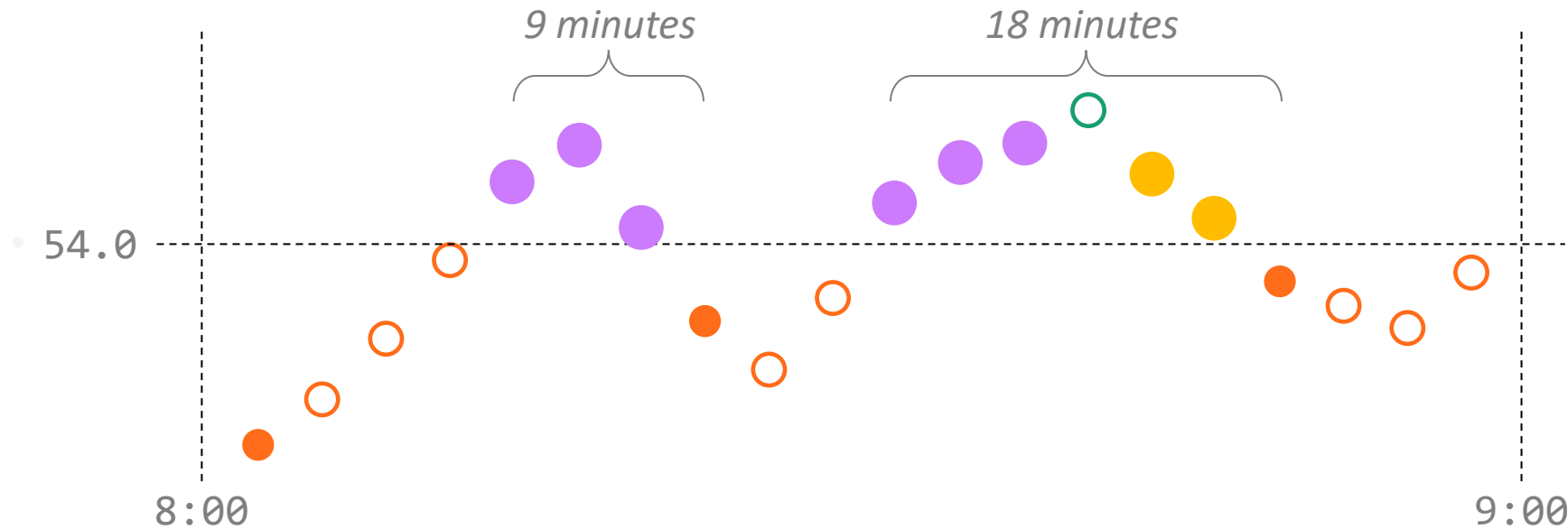
- Counts **all green** points (e.g. "5")

Considering Duration

$M21.Temp > 54.0$

- Only returns logical changes (**filled** points)
- Works similar to `wwEdgeDetection='both'`

`IFLONGER($M21.Temp > 54.0$, 10 minute)` • Returns value for **yellow** points



`IFSHORTER($M21.Temp > 54.0$, 10 minute)` Returns value for **purple** points

IFLONGER & IFSHORTER

IFLONGER(M21.Temp > 54.0, 5 minute)

Returns TRUE or FALSE

IFLONGER(M21.Temp > 54.0, 5 minute, 27.0)

Returns 27.0 or *null*

IFLONGER(M21.Temp > 54.0, 5 minute, 27.0, 3.14)

Returns 27.0 or 3.14



Auto
 Move Up
 Scale Up
 Original
 Single Tag Scale

Auto
 Move Up
 Scale Up
 Original
 All Tags Scale

Highlight
 Previous
 Next
 Delete
 Tag

Trend
 Stacked
 Single
 Scatter
 Layout

Add Annotation
 Notes

In
 Out
 Zoom

Selection
 Select All
 Configure

Properties

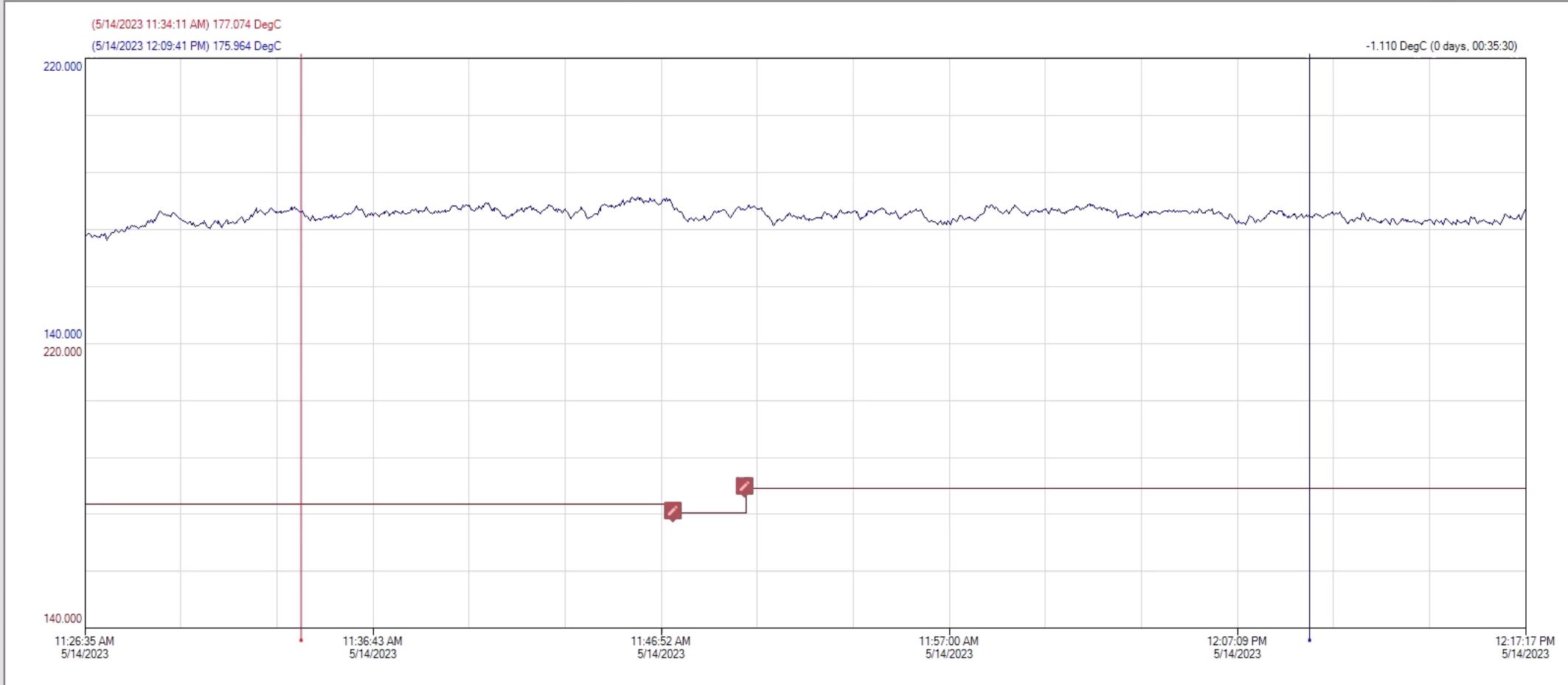
Tag Picker

- Servers
- LOCALHOST
 - Public Groups
 - All Analog Summary Tags
 - All Analog Tags
 - All Discrete Tags
 - All Event Tags
 - All State Summary Tags
 - All String Tags
 - InTouch Nodes
 - Replication Sources
 - System Status Tags
 - Wylie
 - Private Groups

Tags

Tag Name	Description
B100.Temperature	Combined flow/pressure se
B100.Temperature.SP	Target temperature
B150._AbnormalShift	Current anomaly applied
B150._AbnormalStep	Number of cycles remaining
B150._Correlation	Ratio of Pressure/Tempera.
B150._Move	Per cycle shift in temperatu
B150.Pressure	Combined flow/pressure se
B150.Temperature	Combined flow/pressure se
B150.Temperature.SP	Target temperature
B200._AbnormalShift	Current anomaly applied
B200._AbnormalStep	Number of cycles remaining
B200._Correlation	Ratio of Pressure/Tempera.
B200._Move	Per cycle shift in temperatu
B200.Pressure	Combined flow/pressure se
B200.Temperature	Combined flow/pressure se
B200.Temperature.SP	Target temperature
B250._AbnormalShift	Current anomaly applied
B250._AbnormalStep	Number of cycles remaining
B250._Correlation	Ratio of Pressure/Tempera.
B250._Move	Per cycle shift in temperatu
B250.Pressure	Comb flow/pressure se
B250.Temperature	Combined flow/pressure se
B250.Temperature.SP	Target temperature
B300.Pressure	Combined flow/pressure se
B300.Temperature	Combined flow/pressure se
Backwash.Status	Enter attribute description
Blending.AlarmDSCntT...	The Area represents a plan
Blending.AlarmOnCnt...	The Area represents a plan

5/14/2023 11:26:35 AM [00] 00:50:42.565 5/14/2023 12:17:17 PM



LOCALHOST:B150.Temperature [BestFit - 00:00:00:10.377]

Tag Name	Description	Number	Server	Display Units	Original Units	Color	Minimum	Maximum	IO Address	Time Offset	Source Tag	Source Server	Value at X1	Value at X2
<input checked="" type="checkbox"/> B150.Temperature	Combined flow/pressure...	1	LOCALH...	DegC	DegC	Blue	140.000	220.000	\\SVR22\InSQL_MDA...	0:00:00.000			177.074	175.964
<input checked="" type="checkbox"/> B150.Temperature.SP	Target temperature	2	LOCALH...	DegC	DegC	Red	140.000	220.000	\\SVR22\InSQL_MDA...	0:00:00.000			174.900	179.500

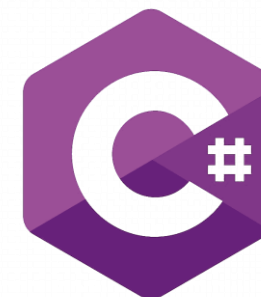
API Support for Expressions



- “wwExpression” column
- Only in “History” view



- “Expression” property
- Only on “ProcessValues” endpoint
- Only in “POST” queries



- “Expression” property
- Only on “HistoryQuery”

- Up to 10 tags per expression
- Retrieval Modes: Full, Delta, Best Fit, Cyclic

Engineering Unit Labels

The screenshot displays the 'Attributes' tab for a variable named 'Flow.PV'. The properties are as follows:

- Name:** Flow.PV
- Description:** Actual flow rate
- Data type:** Float
- Writeability:** User writeable
- Initial value:** 0.0
- Eng units:** (Empty field)

A callout box with a question mark lists the following engineering units: lpm, L/min, and l/min. A purple line points from this callout to the 'Eng units' field in the IDE.

Making Sense Of Engineering Units

String Labels

Label
m ³ /sec
l/s
L/sec
lpm
L/min
l/min
gps
gal/sec
g/m
<u>gpm</u>

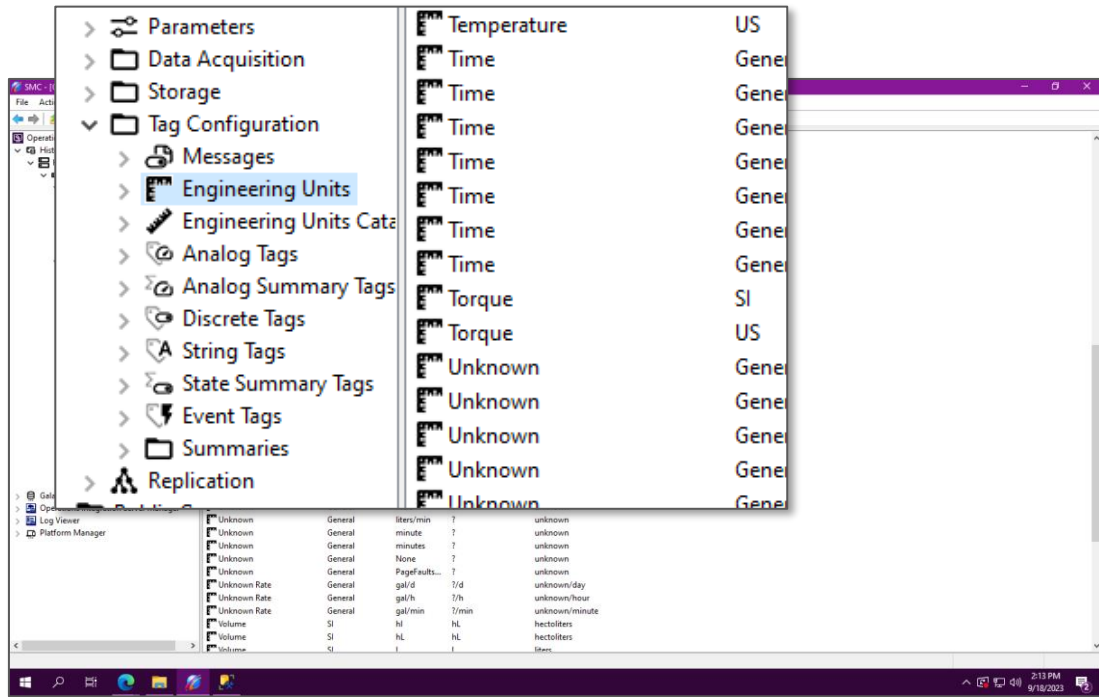
Formal Definition

“Catalog” or “Canonical Unit”

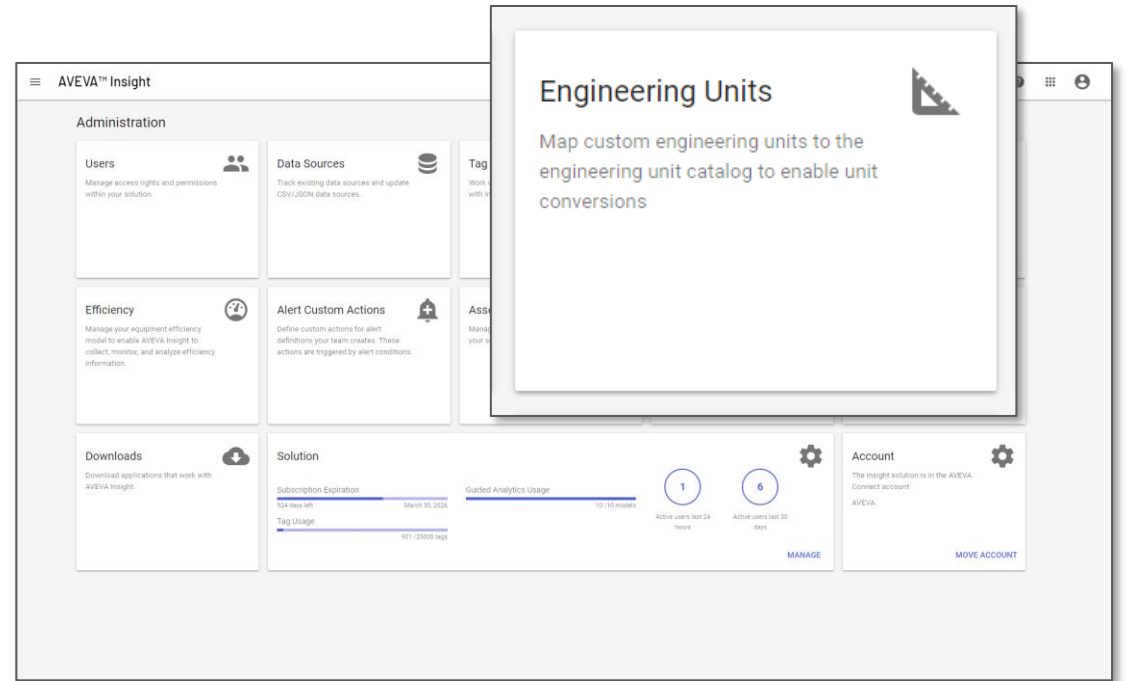
Unit	Symbol	Scale Factor
cubic meters/second	m ³ /s	<i>base</i>
liters/second	L/s	0.00100000000000
liters/minute	L/min	0.00001666666667
gallons/second	gal/s	0.0037854117840
gallons/minute	gal/min	0.0000630901964

all of the above are
Volumetric Flow
“Dimension”

Mapping Engineering Units



On-Premises: AVEVA Historian



Online: AVEVA Insight

Feedback On Implicit Unit Conversion

The image compares two versions of the AVEVA Historian Client Web interface for building an expression. The 'Classic' interface (left) shows the expression `M21.FlowIn - M21.FlowOut` with a dropdown menu for units, where `l/min` is selected. The 'Modern' interface (right) shows the same expression with a tooltip that explicitly states 'Returns l/sec' and provides a unit selection menu with 'l/sec' as the default. The Modern interface also features a time range selector with options like 30D, 7D, 3D, YESTERDAY, TODAY, 12H, 1H, and CUSTOM, along with 'Cancel' and 'Save expression' buttons.

Classic

AVEVA Historian Client Web

`fx M21.FlowIn - M21.FlowOut`

`l/sec` `l/min`

Modern

AVEVA Historian Client Web

Build an expression

`l/sec` `l/min`

`M21.FlowIn - M21.FlowOut`

Returns `l/sec`

30D 7D 3D YESTERDAY TODAY 12H 1H CUSTOM

Cancel Save expression

Expression Feedback Examples

Build an expression

gps l/min
LRP201.InletFlow - LRP101.OutletFlow

Returns **gps**

Implicit unit conversion

Units not understood

Build an expression

L/min DegC
SP101.Flow.PV - SP101.Temp

 **DegC** is not directly compatible

Build an expression

m3
LRP101.PipeVolume / LRP101.DoesNotExist

Error

 Tag not found LRP101.DoesNotExist

Units Of Measure (UOM)

L/s

M21.FlowIn

Sets units
without applying
any conversion

Result Units

→ L/s

L/s
CASTUOM(M21.FlowIn * 30, liters)

→ liters

L/s

M21.FlowIn

Applies
conversion to
produced units

CASTUOM(30, minutes)

→ liters

L/s

UOM(M21.FlowIn

minutes

* CASTUOM(30, minutes), m3)

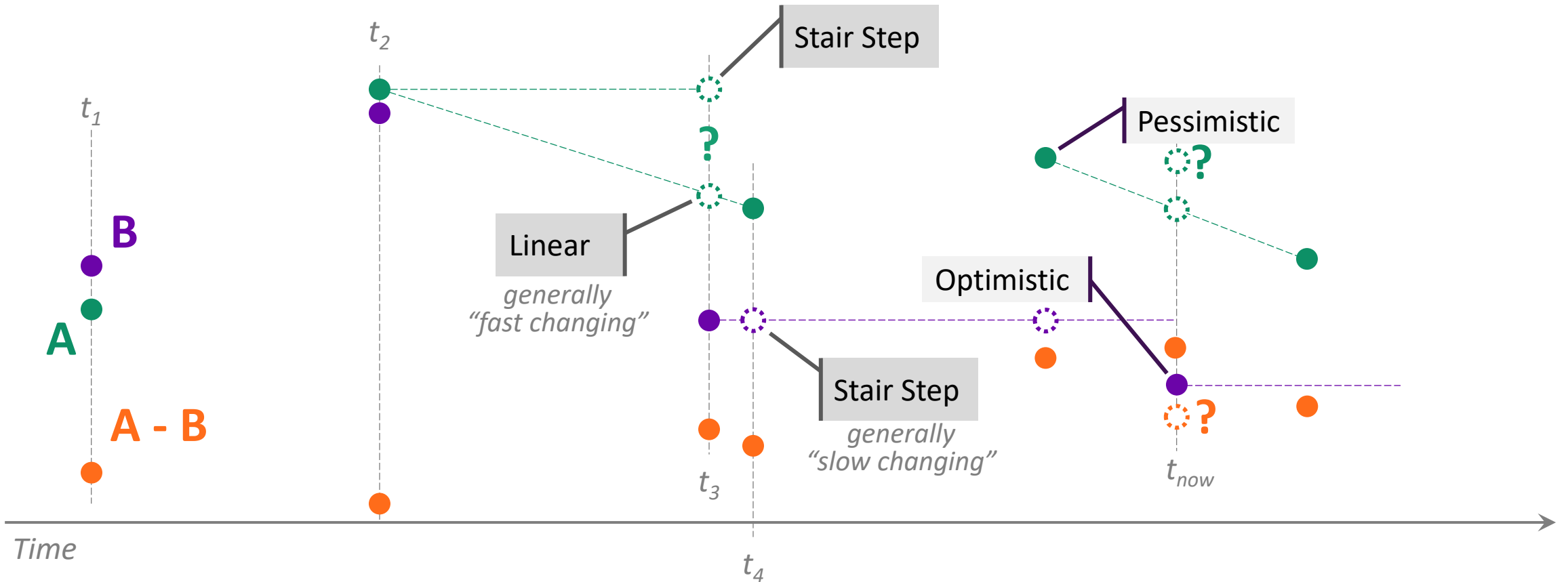
→ m³

Performance Considerations

- Every stored values is processed: No benefit from auto-summary
- Consider data rate, not just results & retrieval mode

- Expressions with multiple tags can compound the volume of data
- Values injected when values aren't time-aligned

Aligning Sample Times



Questions?

Please wait for the microphone.
State your name and company.



Please remember to...

Navigate to this session in the mobile app to complete the survey.



The Power of Expressions

Thank you!

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