



*Shift*Worx

MATH EXPRESSIONS Quick Start Guide



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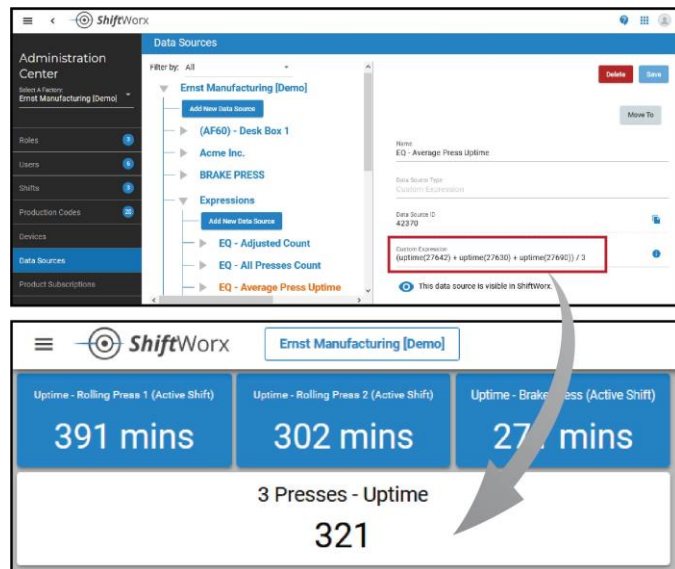
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Mathematical Expressions

ShiftWorx supports the capability to perform mathematical functions using machine inputs, and parameters that are stored within the application. These expressions are saved as a Data Source and can then be referenced using KPIs in real time.

Typically, these functions enable you to calculate values for:

- Uptime
- Downtime
- Count
- Last Value
- Time Range



Overview — How to Configure and Reference Expressions

In order to configure and use mathematical expressions, you must have an Administrator account and access the Administration Center. You will need to:

1. Create a **Data Source** for the expression.
2. Apply a Name and add the **Custom Expression** with the necessary Data Source Identifiers (DSIDs) within brackets and **Save**.
3. Insert a KPI into a Layout with the following options:
 - a. Define **All KPI Types — Custom Expression**.
 - b. Select your **Custom Expression** as a Data Source.
4. **Save** and **Exit Design Mode**.

Data Source Identifiers


Numbers within brackets (12345) and (67890) represent the Data Source ID (DSID) as a number. **DSIDs** can be located within the **Administration Center** by selecting **Data Sources** and selecting the appropriate **Machine > Input >** and **Data Primitive** for count; or state for time-based calculations. Each **Data Primitive** has a unique Identifier (DSID) that can be referenced to generate math results.

Examples

Below are a several examples of expressions and contexts for when to use.

Name	Expression	When To Use
Average Uptime	$(\text{uptime}(12345) + \text{uptime}(67890)) / 2$	Use this expression when you want an average value for one or more machines and then divide by the total number of machines.
Average Uptime or Downtime converted to Hours	$\text{uptime}(12345) * 0.016667$ $\text{downtime}(12345) * 0.016667$	Use these expressions when you want to convert minutes to hours. Hrs = Mins x 1/60 or Hrs = Min x 0.016667
Adjusted Count	$\text{count}(12345) - \text{count}(67890)$	Use this expression when you want to determine pieces without defects. For example, Adjusted Count = Total Part Count – Defect Count

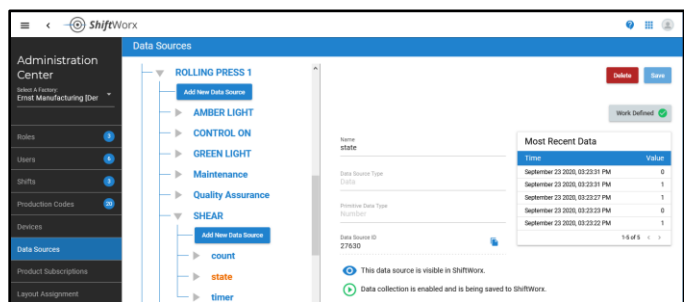
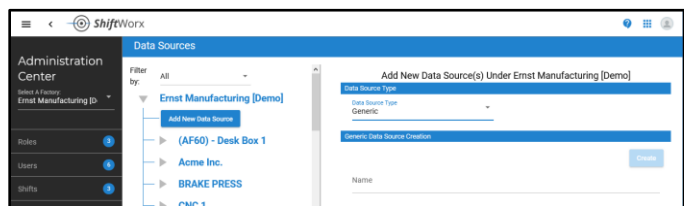
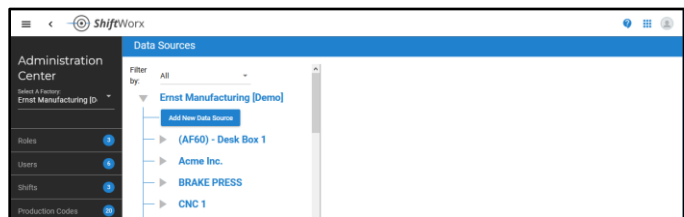
Count Summary	$\text{count}(24662) + \text{count}(24626) + \text{count}(24674) + \text{count}(24638)$	Use this expression to determine the summary count for multiple machines.
Average Time/ Cycle (Minutes/Cycle)	$\text{time_range()} / \text{count}(67890)$	Use this expression to determine your production rate as minutes per cycle. In this example, the time_range function represents the time range defined by the KPI in minutes. Cycle Time = Time (mins) ÷ Part Count
Average Time/ Cycle (Seconds/Cycle)	$60 * \text{time_range()} / \text{count}(67890)$	Use this expression to determine your production rate as seconds per cycle.
Counts Per Minute	$\text{count}(12345) / \text{time_range()} / 60$	Use this expression when you want calculate parts/min.
First Pass Yield	$100 * ((\text{count}(27629) - \text{count}(42380)) / \text{count}(27629))$	Use this expression when you want to calculate the First Pass Yield (FPY) by dividing good units by the total number of units produced and multiply by 100 to obtain a percentage. For example, FPY = $100 * ((\text{Total Count} - \text{Defect Count}) \div \text{Total Count})$


NOTE: Replace all numbers within brackets with the desired Data Source ID (DSID) for the data primitive you want to reference. For example, $(\text{uptime}(27642) + \text{uptime}(27630)) / 2$. You can also reference additional information for expressions and syntax by clicking the Information  icon. A reference table appears with examples that can be copied, and pasted as needed.

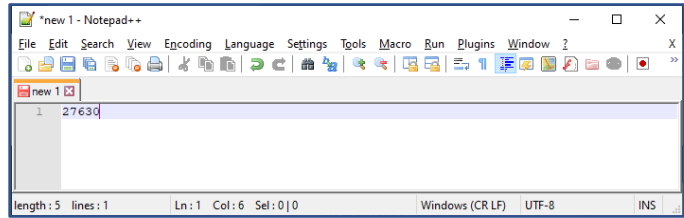
Procedure — Creating an Average Uptime Expression

In order to create an expression, you must login to ShiftWorx with administrator permissions and access the **Administration Center**. This process is basically the same for all expressions. In the example that follows, it is recommended that you open a Text editor to copy and paste Data Source Identifiers (DSIDs). These IDs will be required later in order to finalize the expression.

1. Select **Data Sources** within the **Administration Center**.
2. Organize your expressions within a single node, separate from your other Data Sources. Create a new node in the tree:
 - a. Click the **Add New Data Source** button below your factory name.
 - b. Define the Data Source Type as **Generic**.
 - c. Enter “Expressions” within the Name field.
 - d. Click **Create**.
3. Determine the Data Source IDs (DSIDs) you need.
 - a. Navigate down the Data Sources tree and expanding one of your machines (Rolling Press 1).
 - b. Locate and expand the desired input (Shear).

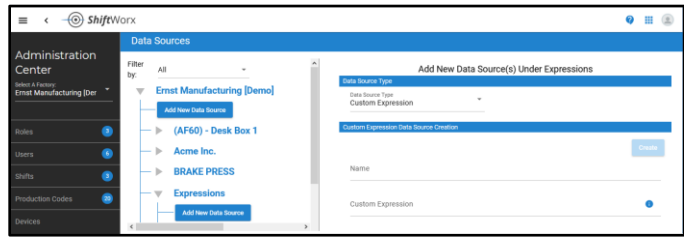


- c. Select the desired **Data Primitive (state)** and locate the Data Source ID field.
- d. Click the **Copy**  icon next to the Data Source ID.
- e. Paste this number into a Text Editor like Notepad.
- f. Repeat Steps 3a to e for each DSID that you need.

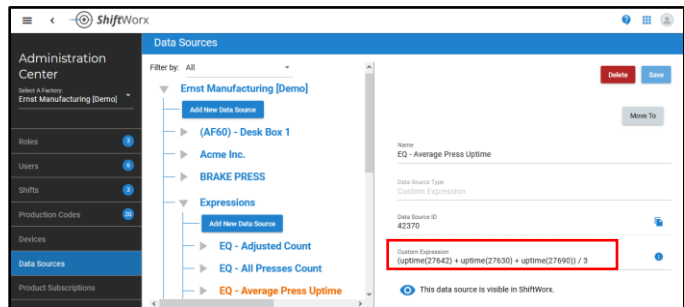
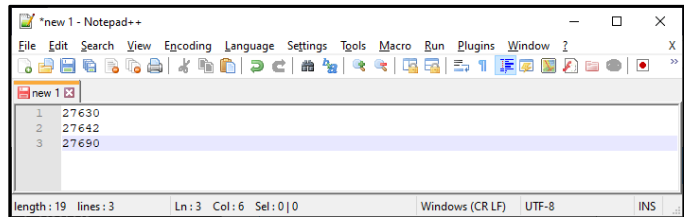


4. Locate and expand the **Expressions** node.
5. Create a new expression.

- a. Click the **Add New Data Source** button within Expressions.
- b. Define the **Data Source Type** as **Custom Expression**.
- c. Enter a name for your expression within the **Name** field.
- d. Copy/Paste or enter the mathematical expression within the **Custom Expression** field.
- e. Access Notepad and copy the IDs you need; one at a time; and paste them within the brackets. Repeat for all required IDs.



- f. Click **Create** to finalize the expression.
- NOTE:**
If there are no errors, a green bar appears stating "Successfully created Data Source". If there are errors in your syntax, a Red bar will appear saying "Invalid Expression" and you will need to correct the expression.



This completes the procedure.

Procedure — Creating A KPI that References An Expression

In order to create a KPI that references an expression, you will need to login and launch the ShiftWorx application and be in **Design Mode**.

1. Open an existing layout and/or create a new layout as required.
2. Select **KPI** to insert a KPI panel within your layout and click **Add**.
3. Add a **Title** for the KPI. For example, type “3 Presses - Average Uptime”.
4. Define **Settings** for the KPI. For example,
 - a. Select **Number** from the Category drop-down menu.
 - b. Select **Custom Expression** from the **All KPI Types** drop-down menu.
 - c. Click the **Select Custom Expression** field.
 - d. Click to expand nodes and navigate your Data Sources. Expand your Expressions node.
 - e. Select the expression that you want to use and click **Select**.
5. Using skills that you have already learned, define all Time Range options for the KPI.
6. Using skills that you have already learned, define **Display Options**, as required.
7. Click **Save** to finalize your changes.
8. Click **Exit Design Mode** to review the results.

This completes the procedure.

The screenshots illustrate the following steps:

- DESIGN MODE:** The user is in the design mode of the ShiftWorx application, viewing a layout with three KPI panels showing uptime for different presses: 391 mins, 302 mins, and 271 mins.
- KPI CONFIGURATION:** The user is configuring a new KPI. The 'Settings' section is expanded, showing 'Category' set to 'Number', 'All KPI Types' set to 'Custom Expression', and 'Select Custom Expression' set to a blank field.
- Select Custom Expression:** A dialog box titled 'Select Custom Expression' is open, showing a tree structure of data sources. The 'Expressions' node is expanded, and the user has selected 'EQ - Average Press Uptime'.
- Final Result:** The KPI panel is now configured and displays the title '3 Presses - Uptime' and a value of '321'.