

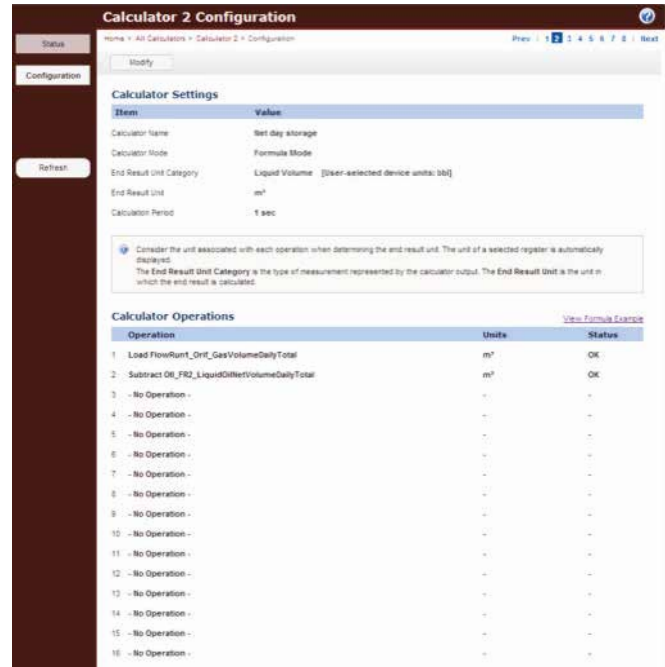
+ Scanner 3100 Flow Computer Calculators

How It Works

The calculator's feature expands the versatility of nearly any other functions within the Scanner* 3100 flow computer. It is modeled after a common desk calculator to provide the mathematical operators +, -, ×, ÷, x (raised to the Y power), √x.

The following lists the broad functionality:

- + The mathematical operations can be applied to a constant or any measured or computed value in the flow computer.
- + Formulas involving up to 16 values or functions can be created within one calculation. For example, the average flow rate from six flow runs can be calculated.
- + Eight calculations can be run simultaneously.
- + The outcome of any calculation can be routed to:
 - another calculation
 - the setpoint of a proportional integral derivative (PID) throttling controller
 - an alarm that can be associated to a status output or simply recorded and indicated
 - the local display
 - the data logger
 - an analog output.
- + Temporary memory functions M+, MC, MR, and MX provide bracket functions.

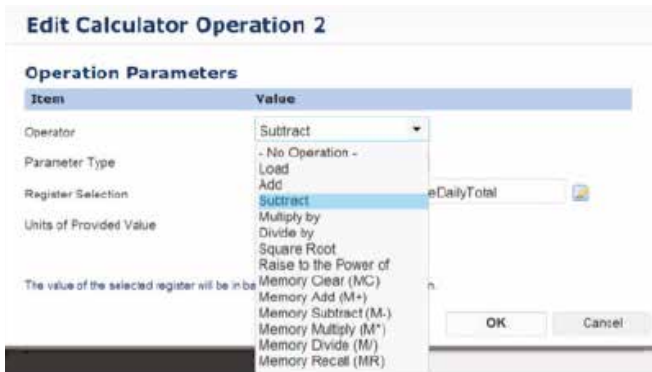


Application examples, addition and subtraction

There are many applications where the comparison by subtraction or sum by addition of multiple flow streams is useful. Some of these applications are cited here:

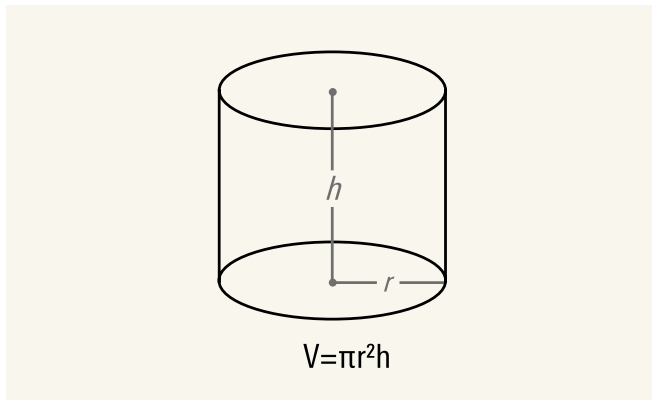
1. Leak detection where the amount of fluid in is compared to the amount of fluid out. In energy management, where the net energy transferred would be determined by subtracting the energy in hot water returning from the process from the energy in the steam flowing into the process.
2. Because the Scanner 3100 flow computer can manage up to 22 streams, it is feasible that there could be multiple combined flows in being compared to multiple flows out. All such combinations are possible; while flow has been used as an example, the calculator tool can be applied to any measured or computed value. Therefore, if tank levels were the measured variable, calculators could be applied to determine the quantity in each tank using the simple formula and then calculating the total liquid inventory in multiple tanks.





Run 1 + Run 3 – Run B + Run D can be rates or totals or anything like value within the flow run.

Station totals, station rates, and comparisons of flow runs, such as net engine fuel or net of a bidirectional flow run (supply - return) = net can be subsequently applied to an alarm and compared against the setpoint.



Ratios: Division and multiple applications

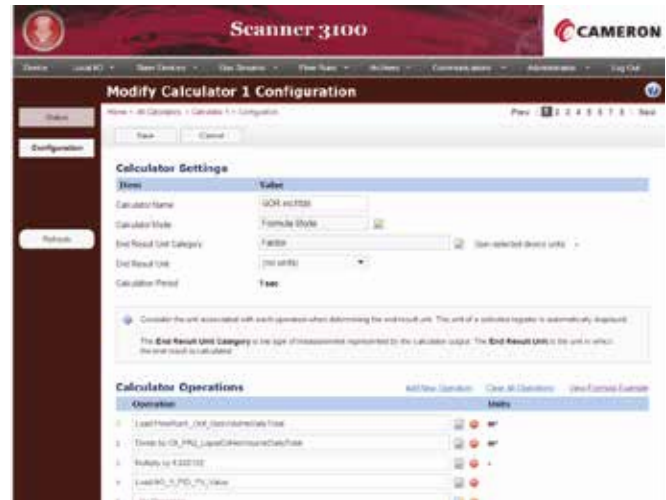
Division is essential in the computation of ratios. As an example, given that the Scanner 3100 flow computer measures water, oil, and gas, it may be of value to compute the ratio of gas to oil or water to oil.

Another application would be in control where one might want to inject an amount of chemical that maintains a concentration in the final mixture into the flow stream. By measuring the flow and applying a factor, the result would be fed as a setpoint to the controller function in the Scanner 3100 flow computer, e.g., gas to oil ratio, water to oil ratio.

Multiplication applications

Ratio control

Run A x 1.35 = setpoint for Run B PID controller



Alarm combinations

A calculator can be used to create the equivalent to multiple logic gates. To create gated alarms, the user begins by configuring a standard alarm. Configuration is accomplished on the "alarms", where up to 32 individual parameters can be simultaneously monitored. Each alarm has a one or both high- and low-setpoints. Once defined, they can then be monitored on the "alarms status" page.

Any of the eight calculators can be used to configure the sum or subtract alarms. This is easiest understood as an active alarm having a digital 1 and inactive alarm having a digital 0. Formulas are then written to determine the desired combination that will activate the output as a gated alarm.

In turn, the output of the calculated alarm can be assigned and monitored on the alarms page. As a final step, the calculated alarm can be assigned to a status output, where a hold-off delay can be allocated.

A significant advantage of the calculator's feature is simplicity of operation; most people are familiar with a handheld calculator. No special programming languages or training is required. For sophisticated applications, the Scanner 3100 flow computer also includes a comprehensive programmable logic capability.