

## Recorders – Totalization Industry: General



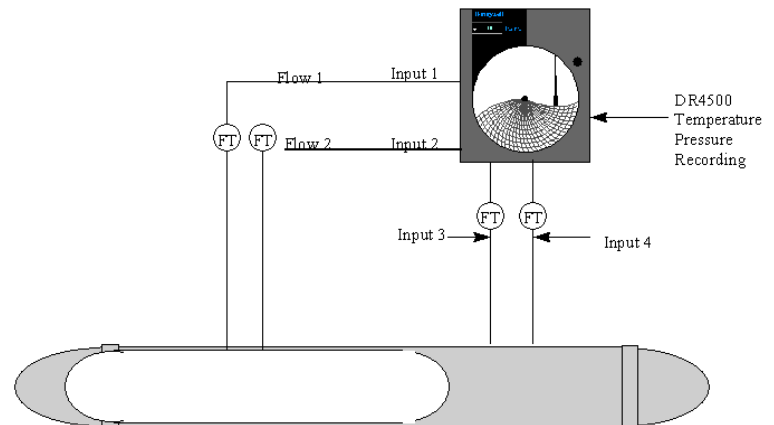
In many industries, totalization is an important part in the measurement and monitoring of flows to obtain the total flow over a given time period. The flow, whether it involves gas or liquid, can be determined using a variety of instruments such as a pressure transmitter, a Magnetic Flow meter or a Coriolis meter. No matter what instrument is doing the actual measurement, this signal is typically sent to either a recorder, controller, distributed control system or even a mechanical totalizer to do the actual flow totalization. The most cost effective method depends on the accuracy requirements, the number of loops and what is to be done with the totalized values.

Honeywell has a number of solutions using standalone recorders to do flow totalization, whether it requires Circular Chart, Strip Chart or Video type recorders. Each recorder offers varying levels of showing and documenting the totalized values. The selection of which recorder to use depends on the accuracy required, the values being totalized, the level of documentation required, and preference of recorder type.

### Circular Chart Recorders

The Honeywell Circular Chart recorders, such as the DR4300 and the DR4500 Truline<sup>®</sup>, have the capability to do Totalization. The **DR4300** provides a basic totalization capability in a low cost circular chart recorder. It can totalize one or two inputs from a flow device and display the totalized value on the recorder's vacuum fluorescent display for the customer to view. The DR4300 can display up to 6 digits with a configurable scale factor up to 100,000,000. The rate of integration can be in time units of seconds, minutes, hours, day or million units per day. The totalizer is capable of being reset either from the front key panel or from a remote digital input. The totalized value is stored in battery backed ram so it is not lost in the event of a power failure. The DR4300 does not provide print out of the totalized value on the chart.

Fig 1 - TOTALIZATION



The **DR4500** Recorder offers expanded totalization capability not available with the DR4300. This includes such features as:

- The ability to totalize up to 4 individual flow values
- One or two pulse outputs based on a totalized value
- The ability to print the totals at each major time line
- The ability to measure in one set of units and to totalize in different units such as having a flow in gals/hour but totalize in acre-feet/day.
- The ability to print a Grand Total on the chart
- Alarm on Total
- Low Flow Cutoff to inhibit the totalizer based on a customer selected limit.
- Totalizer can be reset either locally or with an external contact.
- Eight digit display of the totalizers with multiplier
- 14 digit values printed on the chart.

An example of the chart is shown in Fig 2.

### Strip Chart Recorders

Honeywell has a complete line up of Strip Chart Recorders capable of providing totalization. These include the **DPR100C/D** 100mm Strip Chart, the **DPR180** 180mm Strip Chart, and the **DPR250** 250mm Strip Chart recorders. Each of the recorders are designed to address specific customer needs based on chart size, performance and price.

### DPR100C/D Recorder

The DPR100C/D Recorder provides totalization capability as part of the Math Option. Totalization is included in Math Level 2 and allows the customer to totalize up to 6 different variables independently. Math Level 4 provides additional flexibility to sync the totalizers to a real time clock and to program the recorder to print the totalized values at specific time intervals. The DPR100 can totalize in seconds, minutes, hours, days and million units per day. The totalizer can be controlled remotely using the digital inputs. The Digital Inputs can be programmed to Start, Stop or Reset the any individual Totalizer or it can be programmed to Start, Stop or Reset all totalizers at the same time. This is done in the Math function by programming the Start, Stop and Reset functions with the appropriate digital input. Up to 4 Digital Inputs can be ordered with the recorder. The Right Arrow Key on the front of the recorder can also be used to reset the totalizers individually or to reset all of them at the same time.

The totalizer values can be displayed using the Down Arrow Key on the front of the recorder and setting this to display Math Results. The display can be set to scan through the math results or to hold on a specific value. The recorder can display a totalized value from -99999999 to 999999999.

To set the DPR100 recorder up to totalize, the totalizer is first set up using the totalizer function in Math Level 2. The time duration of the totalization is set using Coefficient A. If Coefficient A is set to 0, then the totalizer will run indefinitely. Otherwise, it will totalize over the specific time interval programmed using Coefficient A, print the totalization result on the chart at the end of the time period, reset the totalizer to zero and start over again. Coefficient B is used as a scaling or multiplier in the totalization equation. Coefficient C is used to set the time units of the flow measurement. An example of how to set up a totalization using the Math is shown below:

MA1 = Totalization (Math 2)

MA 1 Coef A = 1.25 (1 hour, 15 minutes; If = 0 then Infinite)

MA 1 Coef B = 1 (Multiplier)

MA 1 Coef C = 2 (Hours)

MA 1 VAR A = ANALOG 1 (Input to be totalized.)

MA 1 Backup = Enabled

MA 1 Start = Continuous

MA 1 Reset = No

This example will totalize Analog Input 1 for 1 Hour, 15 minutes as Eng. Units per minute, (such as gal/min), print the result and start over. The Backup feature is used to determine if the Math Result is to be stored in the event of a power loss. This is either Enabled or Disabled depending on the customer need. Start and Reset can be programmed to have the Digital Inputs control the math computation. In this case, they are not used and the Totalization runs based on the programmed time values.

To print the results on a periodic basis without resetting the totalizer requires the use of the **Periodic Timer** function in Math Level 3. To accomplish this, the timer function is set up to generate an output of 1 or 0 which is then tied to a soft alarm which has been programmed to Print on Alarm the Math Results. An example of this is as follows:

MA2 = Periodic Pulse (Math 3)

MA 2 Coef A = 0 Seconds

MA 2 Coef B = 2.00

MA 2 Coef C = 600.00

MA 2 Start = CONTINUOUSLY

MA 2 Reset = NO RESET

This will create a 2 second pulse every 10 minutes which is then used to trigger the Print Math on Alarm. The Alarm Function is set up as follows:

AL1SP VALUE=1 (timer output)

CHANNEL = MATH 2

TYPE = HIGH

ACTION= PRT MATH LOG

This alarm causes the DPR100 to print out the Math Results periodically without having to use any external timers and digital inputs to trigger the printing of the totalized values.

To synchronize the Math Results to the real time clock requires the use of the **Synchronize On Time** function in Math Level 4. An example of this set up is:

MA03 = Sync On Time (Math 4)

MA 3 Coef A = Hours (13)

MA 3 Coef B = Min (00)

MA 3 Coef C = -1 (Sync Math)

MA 3 VAR A First Math Result to be synchronized (MA 1)

MA 3 VAR B Last Math Result to be synchronized (MA 2)

MA 3 Backup = Disabled

MA 3 Start = Continuous

MA 3 Reset = No

This example will sync MA 1 and MA 2 to start at 1:00 PM. An example of the recorder print out is shown in Fig 3.

By combining the Totalizer Math, the Periodic Timer, the Alarm function and the Sync On Time Math; the DPR100C/D Recorder provides the flexibility to document the totalization of a flow and customize it to meet the customer's requirements. The DPR100 Alarm function provides a capability to Hold each individual Math calculation based on an Alarm Value. This allows the customer to set up an alarm limit that can act as a low flow cut-off for the totalizer. By using this feature a customer can stop the totalizer from reacting to unwanted signal outside of the desired limits.

The DPR100 can calculate a Grand Total by using the Addition Math function and adding the desired Totalization Math Results. The DPR100 is limited to six math results and the addition can only add 2 results at a time, therefore the maximum number of totalizers that can be added together is 3. An example of how this could be done is shown in Fig 4.

### DPR180/250 Recorder

The DPR180 and DPR250 are very similar in functionality and they handle Totalization in a manner that is similar to the DPR100C/D Recorder. The Totalization function is part of the Math Package on the DPR180/250 Recorders with the main difference being that the DPR180/250 Math has only one Math Package, which includes all of the math functions. Totalization is one of the functions included in the DPR180/250 Math. The DPR180 can Totalize up to 24 different inputs while the DPR250 can do up to 32 inputs. These inputs can be Analog Inputs, another Math or a Communications signal. The Totalization function can be set up to integrate the volume of a flow signal over a pre-configured time period and print the results at the end of that period at which time it will reset to zero and start again or it can be set to run continuously. The DPR180/250 Recorders provide a great deal of flexibility when it comes to documenting the results. As stated previously, it will print the results at the end of the programmed totalization time period before resetting the totalizers. If an interim result is desired there is a CHART DOCUMENTATION feature of the recorder that can be set up to periodically print out the Math Results at a specific time interval. The Information # would be programmed to print a SNAP SHOT MATH causing the recorder to print the instantaneous totalization value. Another method of printing the totalizations is to use the PERIODIC REPORT feature of the recorder, which will print a summary report. The Periodic Report feature allows you to define up to 20 parameters (Analog or Math Parameters can be selected) that will be printed as part of this report. The report will print the input type (Analog or Math), the Tag Name, Eng. Units, the Minimum Value, the Maximum Value and the Average Value. In the case of the Totalization, generally only the maximum value would be of interest. This report can be synchronized to print at a specific time of day. Another method of documenting the Math Results would be to use a Periodic Timer function similar to the method shown for the DPR100. The values printed on the chart depend on how the FORMAT was set up during the configuration of the MATH Function. The Math value will print out up to 8 digits (includes decimal point) and the format can be set to any of the following:

- Automatic (Recorder chooses depending on the value to be printed)
- XXXXXXXX (8 Digits)
- XXXXXX.X (1Decimal Place)
- XXXXX.XX (2Decimal Place)
- XXXX.XXX (3Decimal Place)
- Exponential (X.XXE+XX)

The Math Result can be identified with up to 5 alphanumeric characters (such as GAL/H) for the ENG Units and an 8 alphanumeric TAG NAME, which is printed when the Math Result is printed. An example of a sample chart is shown in Fig. 5.

Math Results can be assigned to a Chart Trace if they need to be recorded on a continuous basis. This would be set up under the CHART configuration item of the recorder and requires the use of one of the Chart Channels (DPR180 has 24 Traces max. / DPR250 has 32 Traces max.) The channel would be configured to record MATH instead of Analog Inputs or Communications Values.

Displaying the Math Results would be done using the DISPLAY key on the front of the recorder. The values displayed would follow the same format used for the printing of math results. The limits of the Math are -9999999 to 99999999 when using the decimal format and -1e38 to 1e37 for the exponential format.

Starting, Stopping and Reset of the Math Results can be controlled using the Digital Inputs or Alarms of the recorder or they can be set to run Continuously. These are programmed when the Math is initially set up. The DPR180/250 currently does not contain a Sync On Time Math function like the DPR100 so the Digital Inputs have to be used if it is necessary to sync the results to a real time clock.

The DPR180/250 can calculate a Grand Total by using the Addition Math function and adding the desired Totalization Math Results together. Since the Addition function can add up to 3 Variables together at once, it provides more capability than the DPR100. A similar method as shown for the DRP100 would be used to calculate this Grand Total. (Fig 4)

## VRX100/150 Video Recorders

The VRX100 and VRX150 are the Honeywell Video or Paperless Recorder offerings. What is important with the video recorder is how the totalization data is displayed and stored to the storage media. Since both units are based on the same software, they handle Totalization in the same manner. The totalization is independent from any Math function and therefore can be ordered separately. The VPX100/150 can have up to 12 nine-digit totalizers. Analog Inputs or Calculated Values can be used as inputs to the totalization function. The totalizer can be configured to run Continuously, Integrate Up, Integrate Down, or to Integrate on Demand.

- Continuous - the totalizer runs continuously unless reset manually.
- Integrate Up - This adds to the running total and when the total reaches the programmed preset value; the totalizer generates a discrete output pulse, resets and starts over. The discrete output pulse is for one machine cycle and can be programmed to initiate some other action.
- Integrate Down - This subtracts from the preset value until the running total reaches or goes below zero; the totalizer generates a discrete output pulse, resets and starts over. The discrete output pulse is for one machine cycle and can be programmed to initiate some other action.
- On Demand - the totalizer only counts up when the programmed discrete parameter is ON.

The totalizer does have a low cutoff that can be programmed that prevents the integration if the input signal if it goes below this value. The totalizer can be reset using a discrete input, an internal status, the keypad or the keypad reset can be locked out. The totalizer time base can be set for Seconds, Minutes, Hours or Days. Fig. 6 shows how the totalizer display looks on the VRX100 Video Recorder.

Totalizer Data Storage is set up the same way any of the other data storage parameters are set up. The data can be stored in a trend file or unit data file and with each record the data is time stamped. Fig. 7 shows the SCF Software Configuration screen which is used to configure the totalizer function on the recorder when SCF is used.

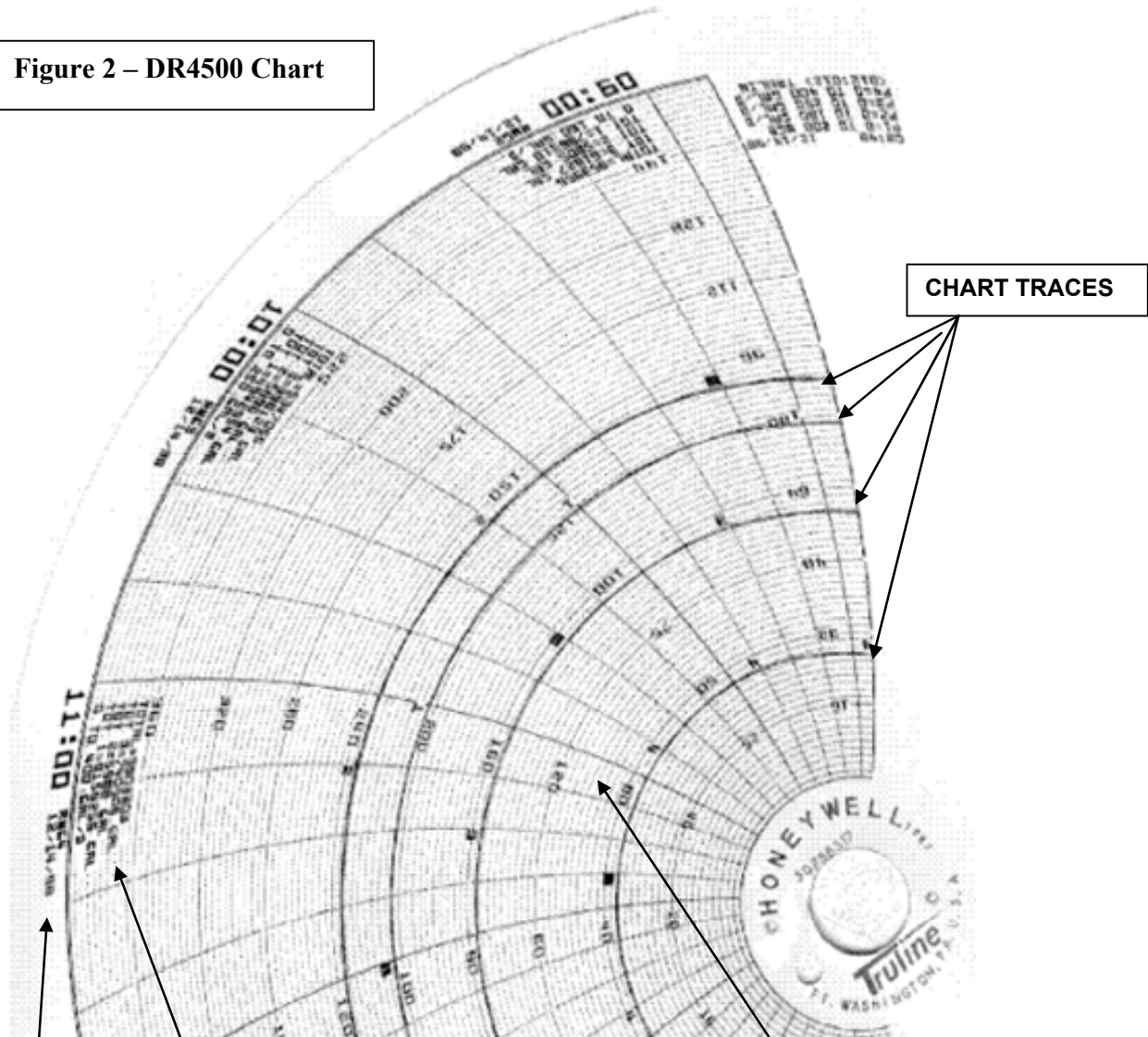
## Totalizer Upgrades

All of the recorder products that support the Totalizer function can be upgraded in the field to add the totalizer option if it was not originally ordered with the recorder.

In most cases, this requires either replacing the product prom or adding the math function to the recorder. The following are the part numbers or method used to upgrade an existing recorder:

- DR4300- 51197993-501 (Provides 1 Totalizer)
- DR4500- (Adds 2 Totalizer)
  - DR45AT Model
    - 30757205-002
  - DR45A1/A2
    - 30757205-008
  - DR45AW - Order replacement Processor 51309355-504 This provides 4 Totalizers.
- DPR100C/D -
  - Math 2 46187201-502
  - Math 3 46187201-503
  - Math 4 46187201-504
- DPR180/250
  - Math 46190424-501
- VRX100/VPR100
  - Use Upgrade Model Selection Guide to order the number of totalizers required.

**Figure 2 – DR4500 Chart**



**Time/Date Range**

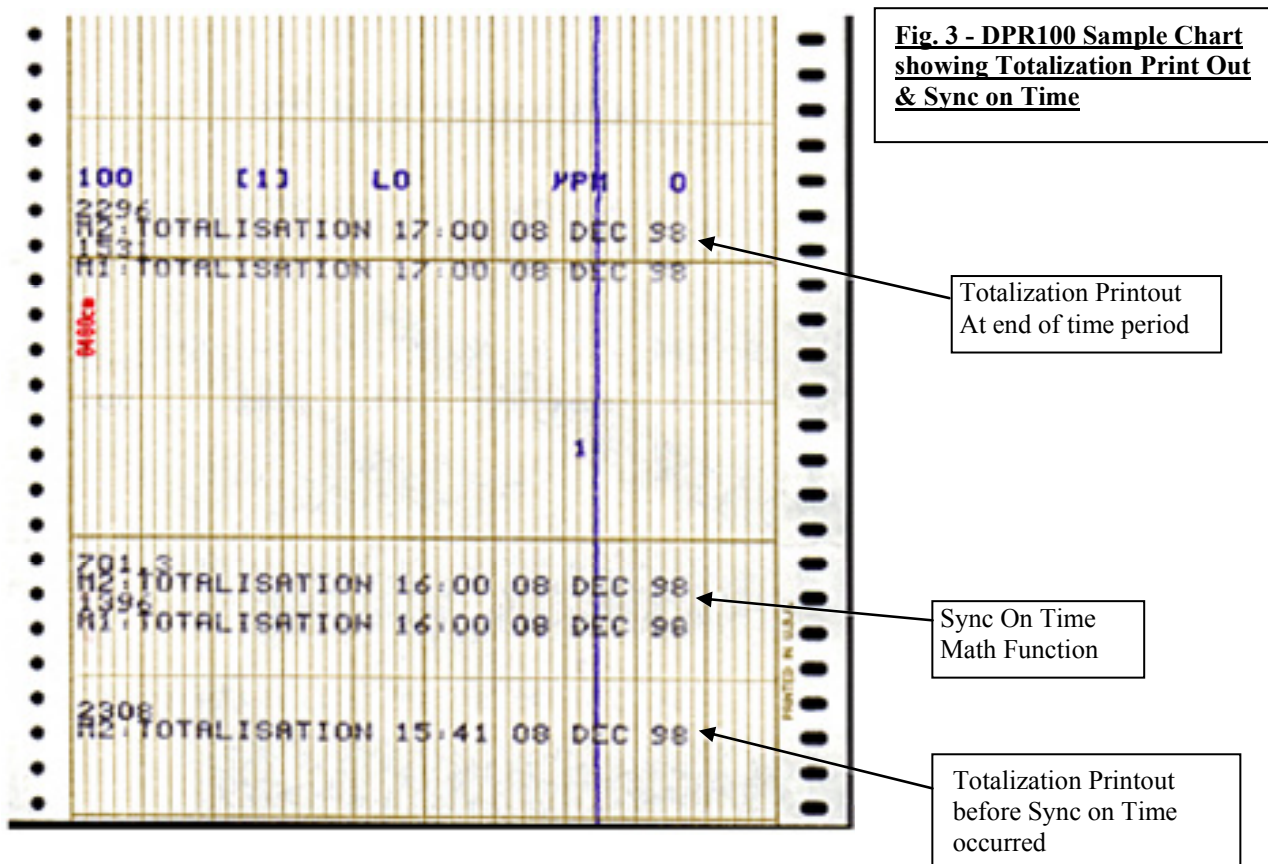
**HEADER**  
 Grand Total  
 Individual Totals 1, 2, & 3  
 Input Range

TOTAL=9903303  
 TOT 3=740906 GAL  
 TOT 2=5988 GAL  
 TOT 1=9156256 Gal  
 0 TO 400GAL/D

**Input Range**

**CHART TRACES**

NOTE: Totalization is printed at each major time line. If the Grand Total feature is enable then the total of all active totalizers is printed, if it is not enabled and Total 4 is used then the Totalization 4 is printed on the chart. Up to 14 digit totalizations are printed on the chart.



DPR100 Grand Total Calculation - Fig 4

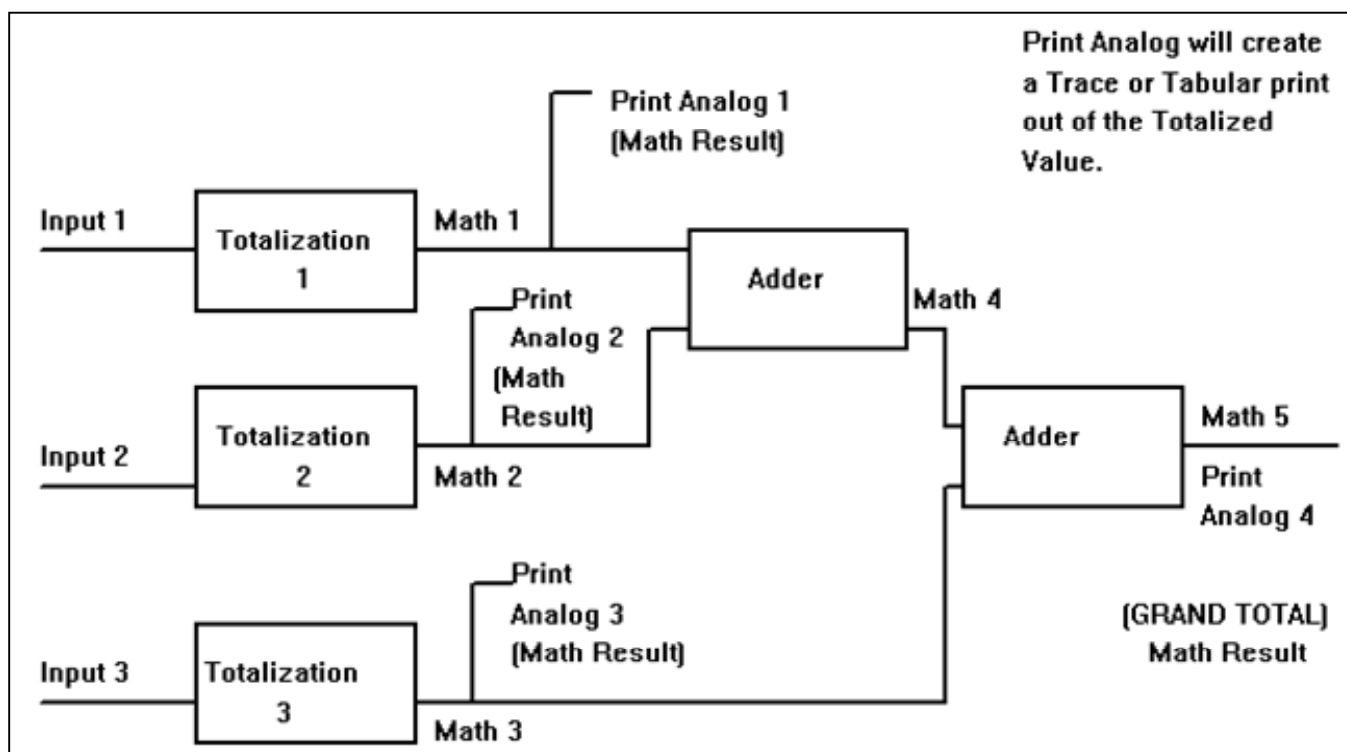
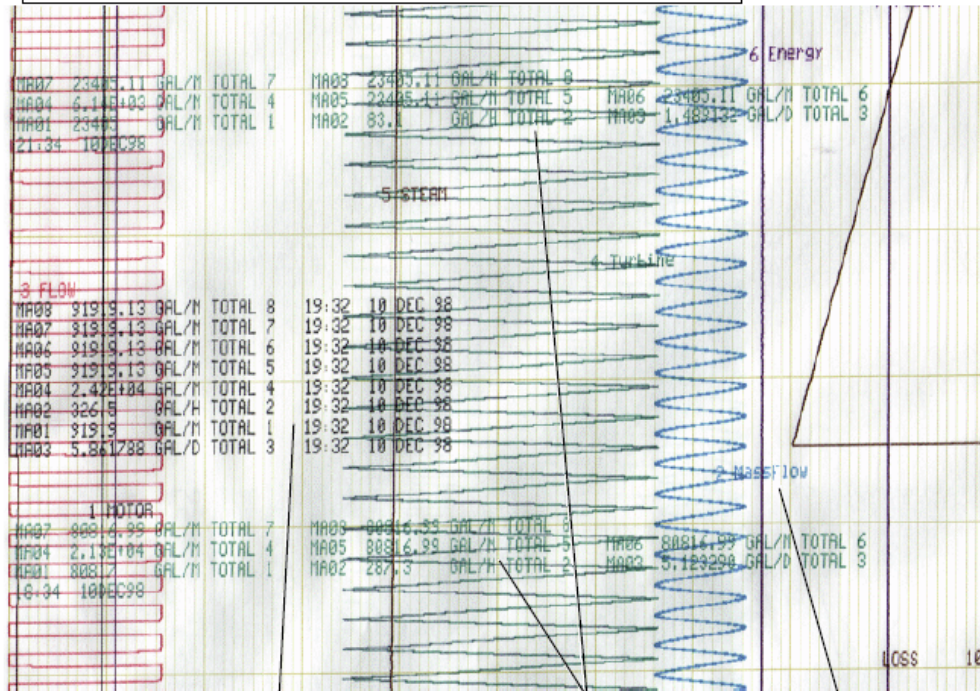


Fig. 5 - DPR250 Chart with Totalization Printout



Print out at end of Totalization period with value, Eng units, Tag name and Time

Totals printed periodically by Chart Doc.

Channel Trace and Tag Name

**Honeywell**

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**TOTALIZERS**

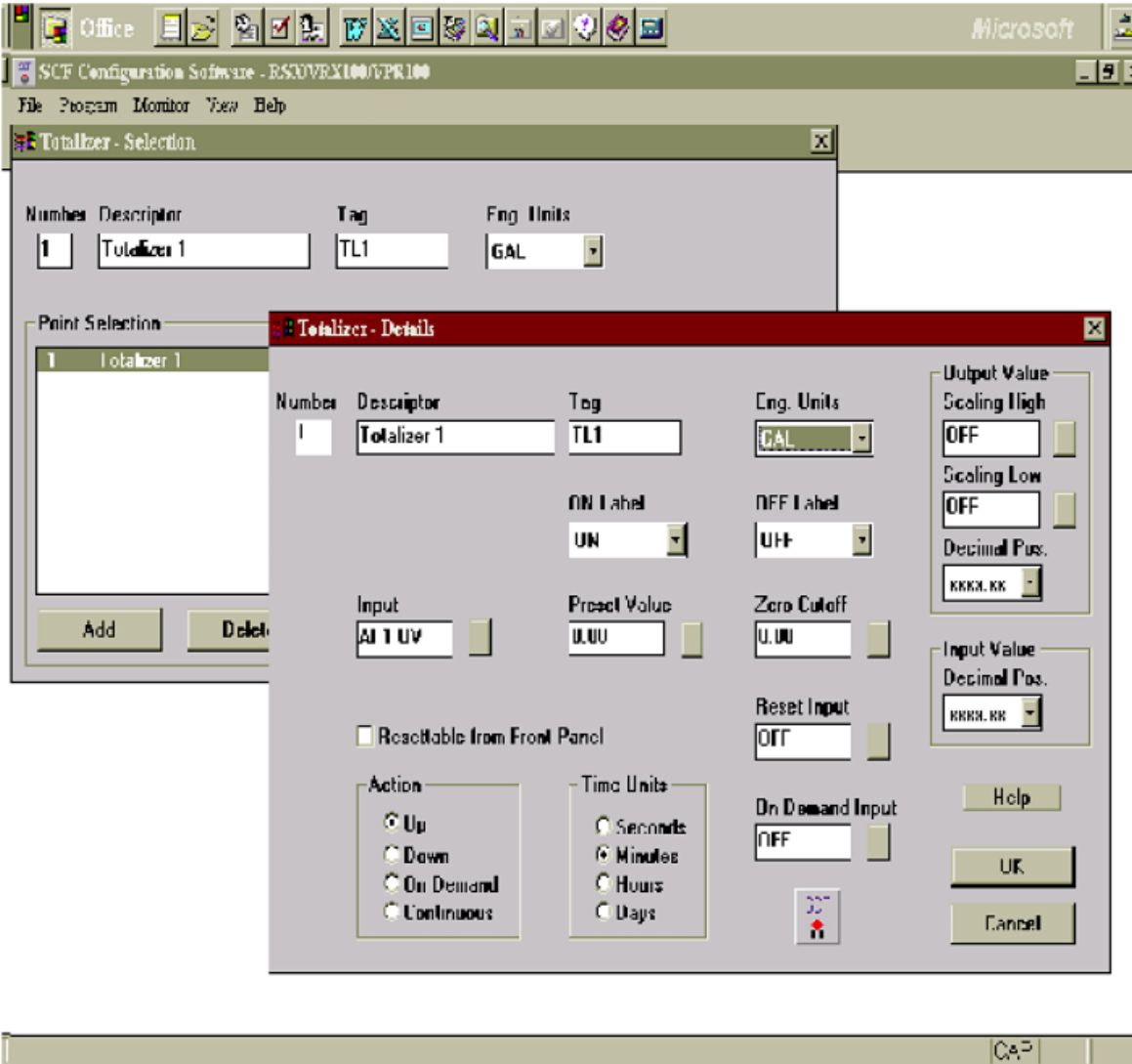
<b>GALLONS</b>	<b>123456.78</b>
<b>KWATT HR</b>	<b>2300.33</b>
<b>BTU</b>	<b>111.66</b>
<b>TL4</b>	<b>9999.8</b>
<b>TL5</b>	<b>77.884</b>
<b>KG</b>	<b>12982</b>

START    1    [Hand icon]    [Right arrow]    [Up arrow]    [List icon]

HOLD    RESET    [Left arrow]    [Down arrow]    [Return arrow]



**Fig 7 - SCF Set Up Screen for VRX/VPR Totalizers**



**More Information**

For more information on Recorders visit [www.honeywellprocess.com](http://www.honeywellprocess.com), or contact your Honeywell account manager.

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