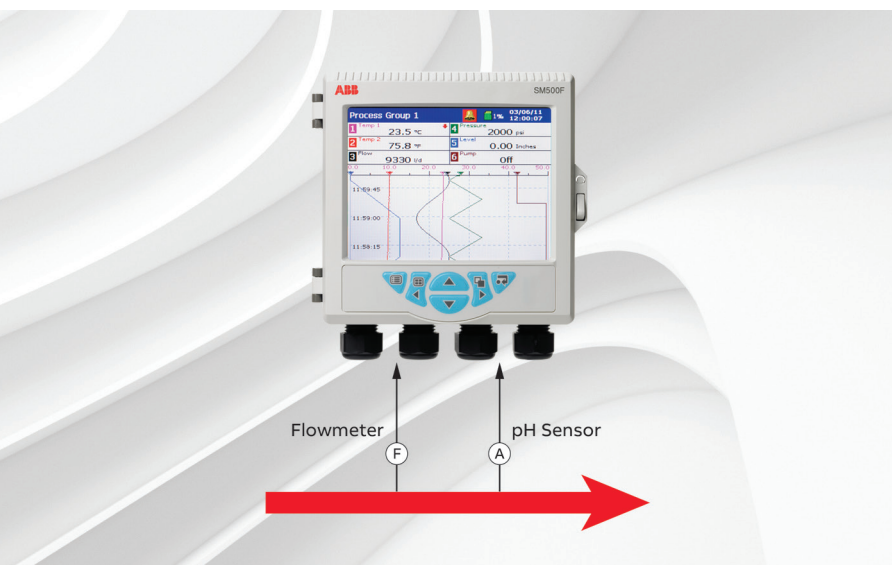


# ScreenMaster and ControlMaster

Process recorders, controllers and indicator



Using totalizers with recorders and controllers

**Measurement made easy**

SM500F paperless recorder

## Introduction

A flowmeter is generally fitted to a pipe to measure the instantaneous flow rate of the substance through the pipe. This effectively gives a 'snapshot' view of the amount of the substance at any given time; but how do you calculate the actual amount of the substance that passes through the pipe over a fixed time period?

For this you use a totalizer. A totalizer is effectively a counter used to record the total flow through a pipe over a period of time. Substances measured range from liquids such as water, through to gases such as air.

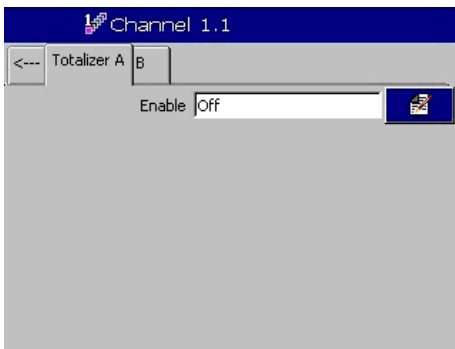
A meter is fitted to a pipe and either a 4 to 20 mA or pulse/frequency signal is taken from the flowmeter and fed into another recorder for either indication or recording purposes. This signal is then displayed as an instantaneous flow rate – how much of the substance is flowing through the pipe at that precise time. This value can then be totalized on the indicator or recorder to give a total flow.

The Screenmaster paperless recorders and ControlMaster universal controller ranges both have the option to display totalized values. This publication is designed to show how to configure those options in order to display and/or record the totalized values for record-keeping purposes.

## Totalizers and ScreenMaster recorders

Totalizer functionality is available on all the ScreenMaster paperless recorders. The SM500F and SM1000 recorders have this functionality available as a software option that can be purchased with the recorder at manufacture or purchased later as an upgrade kit to be added on site. The SM2000 and SM3000 recorders have this functionality included as standard on every recorder. The ScreenMaster paperless recorders can totalize an analog signal and also act as a count for a digital input, but are unable to measure and totalize frequency or pulse inputs from a flowmeter.

The totalizer set-up is found in the **Channel Configuration** parameters of the configuration menu:

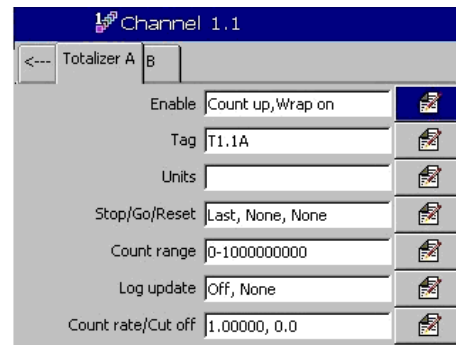


When you first enter the configuration parameter the totalizer is set to **Off**:



The options presented are **Count up** and **Count down**. In a typical flow application, where the requirement is the total flow through a pipe, you would select the **Count up** option. However for certain applications (such as batching) the option to **Count down** is more appropriate.

Once you have selected the count direction, the rest of the totalizer parameters required for configuration are enabled:



The **Tag** parameter is a configurable tag used to identify the totalizer in the totalizer log easily and also to identify the recording channel it refers to.

The **Units** parameter is used for configuring the units you want to totalize in. For example, you may be measuring the instantaneous flow in liters/second that can lead to very large numbers. In this case you might decide to totalize in kilo liters/second or meters cubed, to restrict the final totals to a more manageable number. On the SM500F a list of units is provided for ease of configuration and on the SM1000, SM2000 and SM3000 units a keyboard enables freeform entry of engineering units.

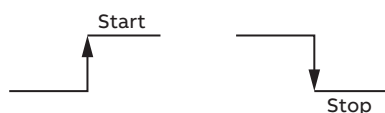
The next set of configuration parameters are the **Stop/Go/Reset** parameters. These parameters set the totalizer's stop/go recovery status action following a power failure to the recorder.



The options available are:

- Last** – on power recovery the totalizer continues to run in the same state as before the power failure.
- Stop** – the totalizer stops counting
- Go** – the totalizer counts from the last recorded value.

The other parameters for configuration here are the **Stop/Go** source, a digital source assigned by the operator to start and stop the totalizer. This could be a software source that is internal to the recorder or an external digital signal. Totalizer start/stop is edge-triggered:



The **Reset** source is a digital source that can be used to reset the totalizer. As with the **Stop/Go** source this is either an internal or external edge-triggered digital signal.

The next set of parameters for configuration are your count range – there are 3 parameters:

The screenshot shows the 'Count range' configuration window for Channel 1.1. It contains three input fields with associated icons: 'Preset count' set to 0, 'Predetermined count' set to 1000000000, and 'Intermediate count' set to 900000000. An 'OK' button is at the bottom right.

The **Preset count** is the value at which the totalizer starts counting from – the value applied when the totalizer is reset.

The **Predetermined count** is the value the totalizer counts to – the value at which the totalizer stops counting or wraps.

The **Intermediate count** is a value in the midrange of the full scale count span that is used as an internal digital source within the recorder.

The next parameters are the log update parameters:

The screenshot shows the 'Log update' configuration window for Channel 1.1. It contains two input fields with associated icons: 'Log update time' set to 15 secs and 'Log update source' set to None. An 'OK' button is at the bottom right.

All totalizer events are recorded automatically in the totalizer log. This means whenever you start, stop or reset a totalizer it is recorded along with the value the totalizer has reached at that point. However you also have the option to have the totalizer values entered into the log at regular intervals, either at specified time intervals or by using a digital source.

The final parameters to set up on a ScreenMaster are the **Count rate** and **Cut off** parameters:

The screenshot shows the 'Count rate/Cut off' configuration window for Channel 1.1. It contains two input fields with associated icons: 'Count rate' set to 1.00000 and 'Cut off' set to 0.0. An 'OK' button is at the bottom right.

The count rate is determined by the maximum number of engineering units per second and the smallest totalizer increment.

For example – to totalize a flow with a maximum rate (**Eng High**) of 2500 liters/minute (= 2.5 m<sup>3</sup>/minute) to the nearest 0.1 m<sup>3</sup>, the calculation is as follows:

$$\frac{150 \text{ m}^3/\text{hour}}{3600 \text{ seconds}} = 0.04167$$

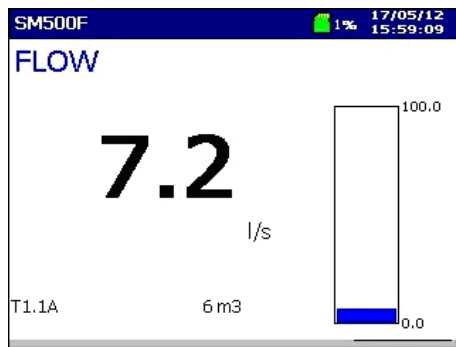
The resulting value must be within the range of 0.00001 to 99.99999. The increment of the totalizer is dependent on the position of the decimal places in the predetermined count value. The SM500F is unique within the ScreenMaster range in that, if it identifies a direct relationship between the Instantaneous flow rate units and the required totalizer units, it automatically calculates the count rate.

## ...Totalizers and ScreenMaster recorders

The totalizer Cut off is the input value at which the totalizer stops counting and is represented in engineering units.

While the totalizer is active it is recorded in the totalizer log. However, in normal chart view it is not displayed on the front panel of the unit. To display the totalizer the indicator view must be enabled in the group configuration page.

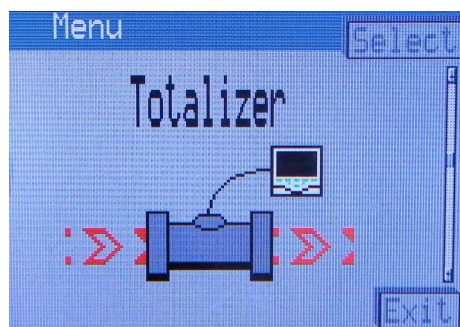
Once enabled the totalizer is displayed together with the instantaneous flow rate:



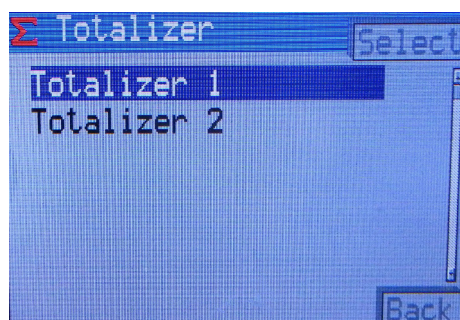
## Totalizers and ControlMaster indicator and universal controllers

The basic totalizer configuration is the same for the CM15, CM30 and CM50. However, there is a slight difference in the way the totalizers are displayed, as the CM15 has the totalizer option available as an application template and not just an option.

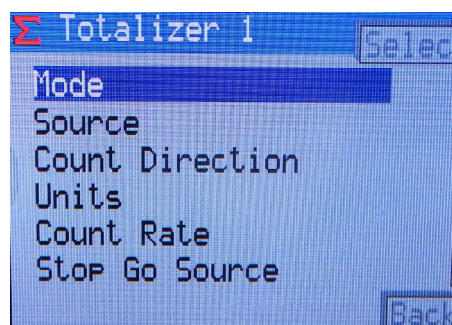
The configuration is performed by entering the advanced configuration level and selecting the totalizer page:



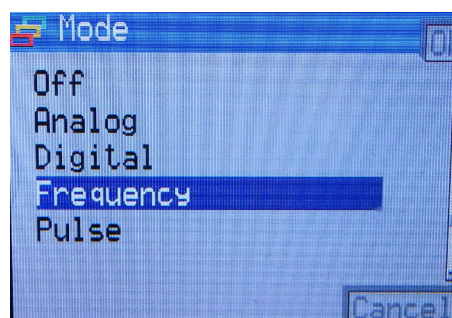
Depending on the functionality available in the CM15, or if you are using the CM30 or CM50, you have up to 2 totalizers available to configure. Select the required totalizer:



Once you have selected a totalizer, the totalizer configuration screen is displayed:



The first option is to choose the mode in which you wish to use the totalizer – completely off or totalizing an analog, frequency, digital or pulse input:

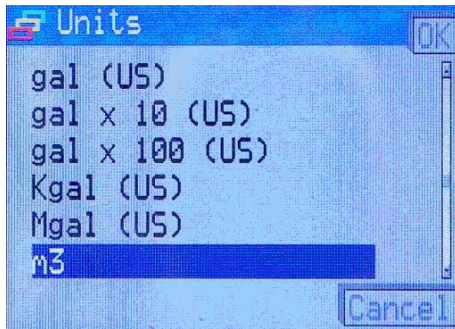


Frequency totalizers or pulse type totalizers are configured automatically within the controller as there is only a single input capable of accepting a frequency or pulse input. However, if you totalize an analog or digital input, an extra screen is displayed where the source for that totalizer is assigned.

Once the source (if required) is selected, a prompt to select the direction in which you wish to count (as for the ScreenMaster totalizer) is displayed, where options are to count up or to count down.

## ...Totalizers and ControlMaster indicator and universal controllers

The next option is to configure the units. The Controlmaster contains a list of units available (in the same way the SM500F does) and as a result of this also contains the same feature where the count rate is calculated automatically when there is a direct relationship between the instantaneous flow rate units and the required totalizer units:



However, if the count rate is not set automatically, the value must be entered manually. It can be calculated as shown in the following examples:

### Analog totalizer

$$\text{Count rate} = \frac{\text{Eng Hi} \times \text{volume unit conversion}}{\text{time unit conversion}}$$

$$\text{Count rate} = \frac{\text{Eng Hi} \times \text{volume unit conversion} \times \text{pulse duration}}{\text{time unit conversion}}$$

#### Example:

Eng Hi (of source) = 6000 l/m.

Frequency input fullscale(electrical high) = 500 Hz.

Totalizer required to increment in m<sup>3</sup>.

Volume unit conversion: 1 l = 0.001 m<sup>3</sup>.

Source time units = minutes, count rate units = seconds.

Time unit conversion: 1 min = 60 s.

$$\text{Pulse duration} = \frac{1}{\text{Analog input 1 electrical high (Hz)}}$$

$$\text{Count rate} = \frac{6000 \times 0.001 \times 0.002}{60} = 0.0002 \text{ m}^3/\text{s}$$

If the input source is at a fixed rate of 6000 l/min (500 Hz) the totalizer increments at 0.0002 m<sup>3</sup>/s.

If the input source is reduced to a fixed rate of 3000 l/min (250 Hz), the totalizer increments at:

$$\frac{3000}{6000} \times 0.0002 = 0.0001 \text{ m}^3$$

## Frequency totalizer

$$\text{Count rate} = \frac{\text{Eng Hi} \times \text{volume unit conversion} \times \text{pulse duration}}{\text{time unit conversion}}$$

### Example:

Eng Hi = 6000 l/m.

Frequency input fullscale (electrical high) = 500 Hz.

Totalizer required to increment in m<sup>3</sup>.

Volume unit conversion: 1 l = 0.001 m<sup>3</sup>.

Source time units = minutes, count rate units = seconds.

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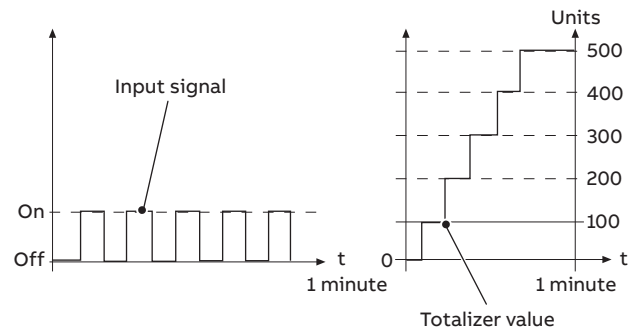
If the input source is reduced to a fixed rate of 3000 l/min (250 Hz), the totalizer increments at:

$$\frac{3000}{6000} \times 0.0002 = 0.0001 \text{ m}^3$$

## Digital totalizer

The count rate setting determines the scaling of the digital input pulses.

For example, with a count rate = 100 totalizer units/pulse, 5 digital input pulses increment the totalizer from 0 to 500 in 100 unit steps:



## Pulse totalizer

$$\text{Count rate} = \frac{\text{Volume unit conversion}}{\text{Pulse/Unit}}$$

### Example:

Pulse/Unit = 50.

Pulse units = l.

Totalizer required to increment in m<sup>3</sup>.

Volume unit conversion: 1 l = 0.001 m<sup>3</sup>.

$$\text{Count rate} = \frac{0.001}{50} = 0.00002 \text{ m}^3/\text{pulse}$$



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