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## Why use a Ratio Control System?

Ratio control systems are used extensively throughout industry to optimize the relationship of the mixture between two flows in a processing plant.

- ▶ Using the remote set point facility (with the C355/C505 series of instrumentation), the relationship between any two flows can be set and controlled automatically to minimise wastage.
- ▶ Automatic control of systems allows the plant to operate independently to maximise output.

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## Why use ABB Instrumentation?

- ▶ Ratio between the two flows can be preset and secure from unauthorised adjustment, or made available for operator setting in the instruments front scroll.
- ▶ Front panel and case design of the C355/C505 (NEMA 4X/IP66 front panel) is easy to clean and very durable, especially suitable for use in the food industry.
- ▶ The controller requires no further calibration after configuration making it easy to install without specialist test equipment.
- ▶ Proven reliability – over 100 years of process instrumentation experience.

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## What ABB Products are Suitable?

- ▶ C355 Controllers
- ▶ C505 Controllers
- ▶ TIP I/P Converter
- ▶ MagMaster and AquaMaster flowmeters

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## Ratio Control System Theory and Installation

### System Theory

- ▶ Ratio control is used when one process variable needs to be controlled in relation to another. For example, adding 1 litre of a solution for every 100 litres of another.
- ▶ The C355/C505 with fully configurable process variable and remote set point inputs is ideally suited to these applications.
- ▶ In the figure on page 1, **flow 1** is used as the set point for controlled **flow 2**. The ratio setting scales **flow 1** to give the required set point for **flow 2**.

### Installation Considerations

- ▶ When using the C355/C505 Controller in a Ratio Control system, it is important to consider the scaling of the two variables. If the two streams have the same flow range, computation of the flow ratio is simple. The two variables can be expressed in either %, span or engineering units.
- ▶ If the streams do not have the same flow range, there may be confusion if there is a common display facility. In this case the scaling factor between the two flows must be determined which modifies any ratio it is necessary to set between the two flows (refer to page 1 illustration).

Assuming both flowmeters have the same range, let flow 1 be a concentrate which must be mixed with water (flow 2). The normal way of expressing the ratio between two mixtures is 1 part concentrate to x parts water. The objective is to control the ratio reliably. By expressing the ratio as below, x becomes the ratio setting on the remote set point input.

$$\text{So: } R=1: \text{ or } \frac{X}{1} \text{ or } \frac{\text{Required flow 2}}{\text{Required flow 1}}$$

If two parts concentrate are required to nine parts water, the ratio would be:

$$2:9 \text{ or } 1:4.5 \text{ or } \frac{9}{2} \text{ giving a ratio setting of 4.5.}$$

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## Associated Applications for Ratio Control System

- ▶ Flow applications
  - MagMaster and AquaMaster flowmeters.
- ▶ Fuel dosing plants, as a method of optimizing fuel consumption.
- ▶ Paint mixing plant.
- ▶ Mixing of mains water and sewage.
- ▶ Chemical dosing.

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**ABB Limited**

Howard Road, St. Neots  
Cambridgeshire  
PE19 8EU  
UK  
Tel: +44 (0)1480 475 321  
Fax: +44 (0)1480 217 948

**ABB Inc.**

125 E. County Line Road  
Warminster  
PA 18974  
USA  
Tel: +1 215 674 6000  
Fax: +1 215 674 7183