Application description AG/FB114-EN Rev. A

Flowmeters for batch dosing

Use of flowmeters in the food industry to optimize simple batch dosing

Measurement made easy

Introduction

In the food industry, it is frequently necessary to dose, pump, mix and blend liquids. Continuous mixing processes can be implemented directly in piping using ratio-based or Blendline control systems,
which removes the need for mixing containers. In smaller batch processes, the required components are dosed and mixed in containers one after the other using suitable flowmeters and counting equipment.

Components can also be dosed at a later stage after technical and sensory analyses. Not all systems are large enough to justify the investment in a control system, it may be more economical to use individual counters.
The following description outlines a number of potential applications and implementation methods for batch dosing using individual counters.

Flowmeters for batch dosing

Implementation using an electromagnetic flowmeter with an internal counter

The electromagnetic flowmeter FEH500 with an internal counter can be used directly for batch dosing. Dosing times must be longer than three seconds for this purpose. An internal presetting counter, which can also be adjusted directly on the device, is installed in the flowmeter transmitter. Batches can be started via an external contact and stopped via the counter's output contact.
If a precontact is available, this can also be used in connection with a suitable valve to slow dosing at the end of the batch before the main contact terminates the entire process. To improve accuracy for short dosing processes, the device is equipped with automatic overrun correction, whereby the transmitter measures the quantity that continues to flow after its close command, thus indicating excess dosing.

Calculations are performed to determine the length of time by which the transmitter's close command should be moved forward in subsequent cycles in order to ensure accurate dosing.
This is a cost-effective solution which is simple to implement as no additional counter is required. One drawback of this arrangement is that inputs must always be made directly at the device in the piping (if the flowmeter has an integral mount design), and in-process counter readings are therefore laborious.
Centralization may also pose a challenge if several components are used. The dosing process is enabled via a contact input on the flowmeter which resets the internal counter. Any additional control functions required must be implemented via hardware or a PLC.

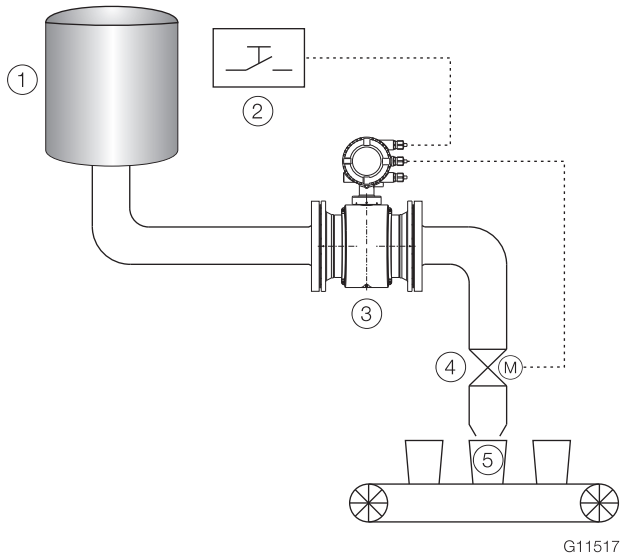


Fig. 1: Schematic representation
(1) **Supply tank** (2) **Start / stop contact** (3) **Flowmeter**
(3) **Motor valve** (5) **Filled container**

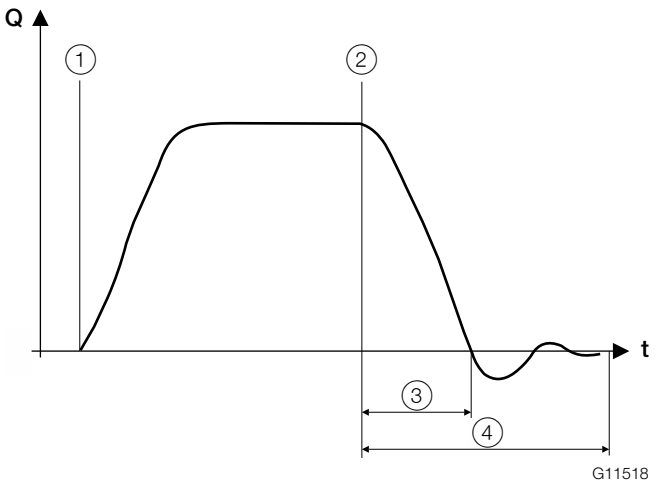


Fig. 2: Dosing procedure
(1) **Valve opened (filling started)**
(2) **Valve closed (fill volume reached)**
(3) **Valve close time tv** (4) **Overrun time tn**

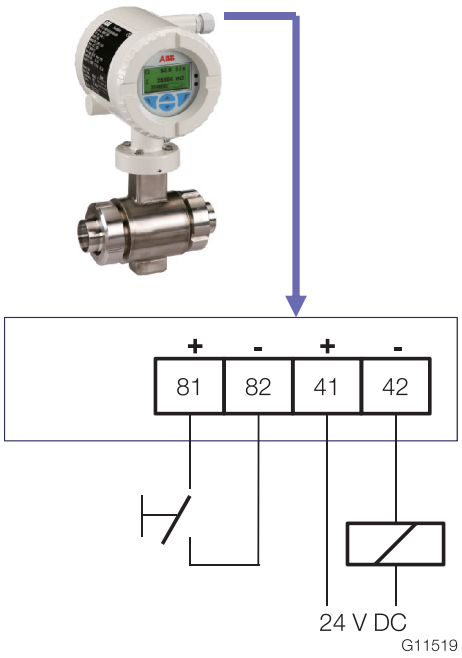
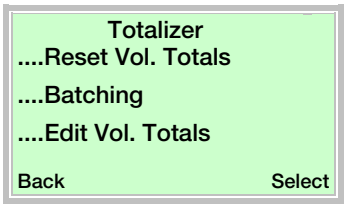
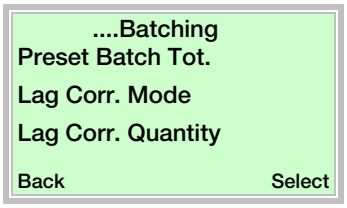


Fig. 3: Electrical connection for the electromagnetic flowmeter





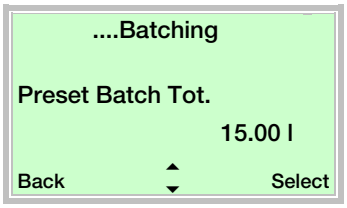
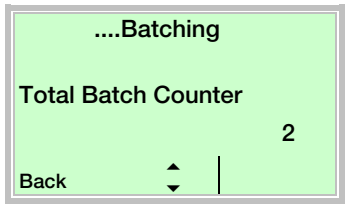
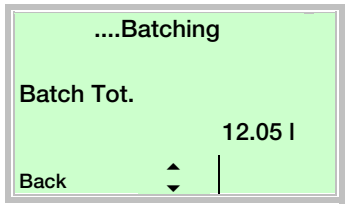


Fig. 4: Setting the dosing volume





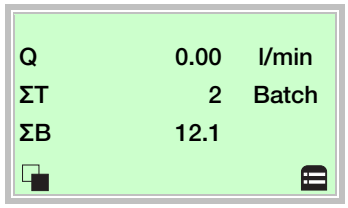


Fig. 5: Reading the batch number, current batch quantity or both with current flow rate

Flowmeters for batch dosing

Implementation using a Coriolis mass flowmeter and indicator / totalizer

Use of an ABB type CM15 indicator as a counting device makes reading and operating procedures more convenient. The indicator can be installed in a measuring station or another easily accessible location.

The intuitive operating buttons positioned directly on the indicator can be used for preselection purposes. An additional button or a contact on the indicator's binary input can be used to start the batch. If extra operating options and control functions are required, these must be implemented via additional buttons/switches and hardware, and the contacts can of course also be controlled via a PLC.

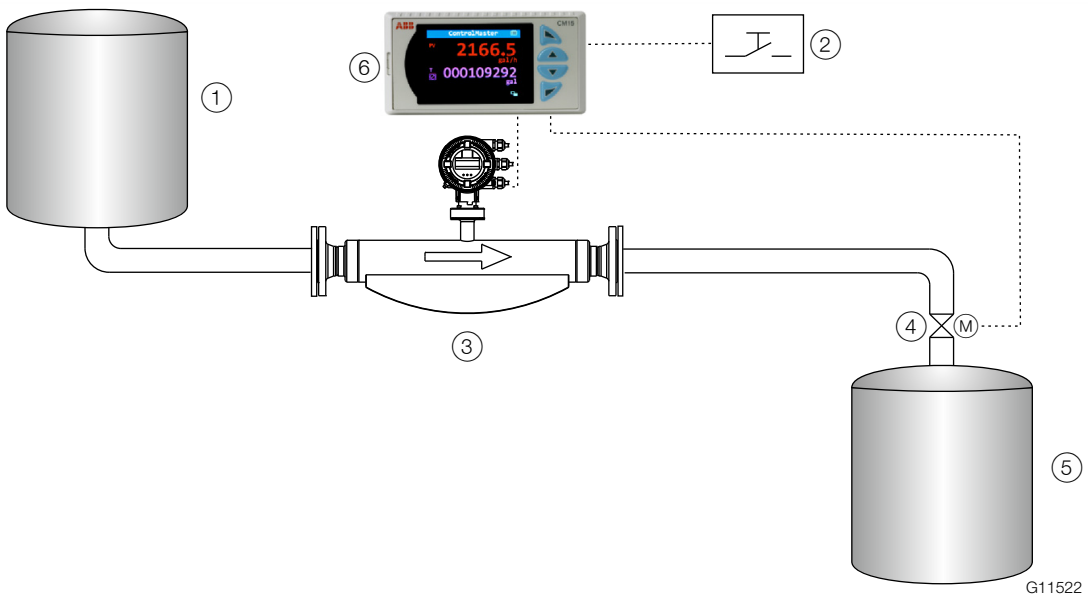


Fig. 6: Schematic representation
(1) Supply tank (2) Start/stop contact (3) Flowmeter (4) Motor valve (5) Filled container (6) Indicator / totalizer

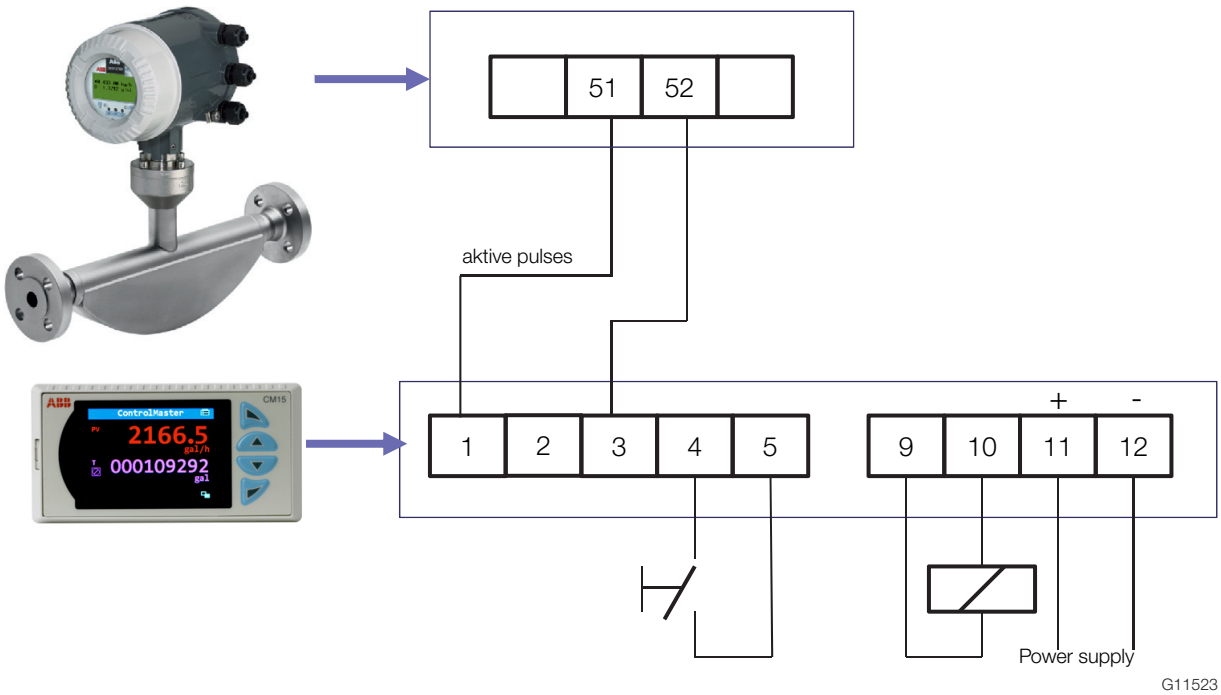


Fig. 7: Electrical connection for the Coriolis mass flowmeter FCB350 with integrator

Fig. 8: Preselection input screen for the indicator / totalizer CM15

Flowmeters for batch dosing

Implementation using a flowmeter and compact controller AC500eco

An ABB AC500 eco compact controller can be used as a counter and control device if the options provided by the above solution fall short of what is required. One or more presetting counters can be programmed in a controller of this kind, and control parameters such as locks, interruptions and similar can also be implemented.

A touchscreen (72 x 72 mm) is used to operate the device as well as to display preset quantities, the flow counter, and buttons and switches. The counter can only display figures up to 64000, but this does not generally present a problem since the counter is only used as a dosing counter for limited quantities rather than as a flow counter.

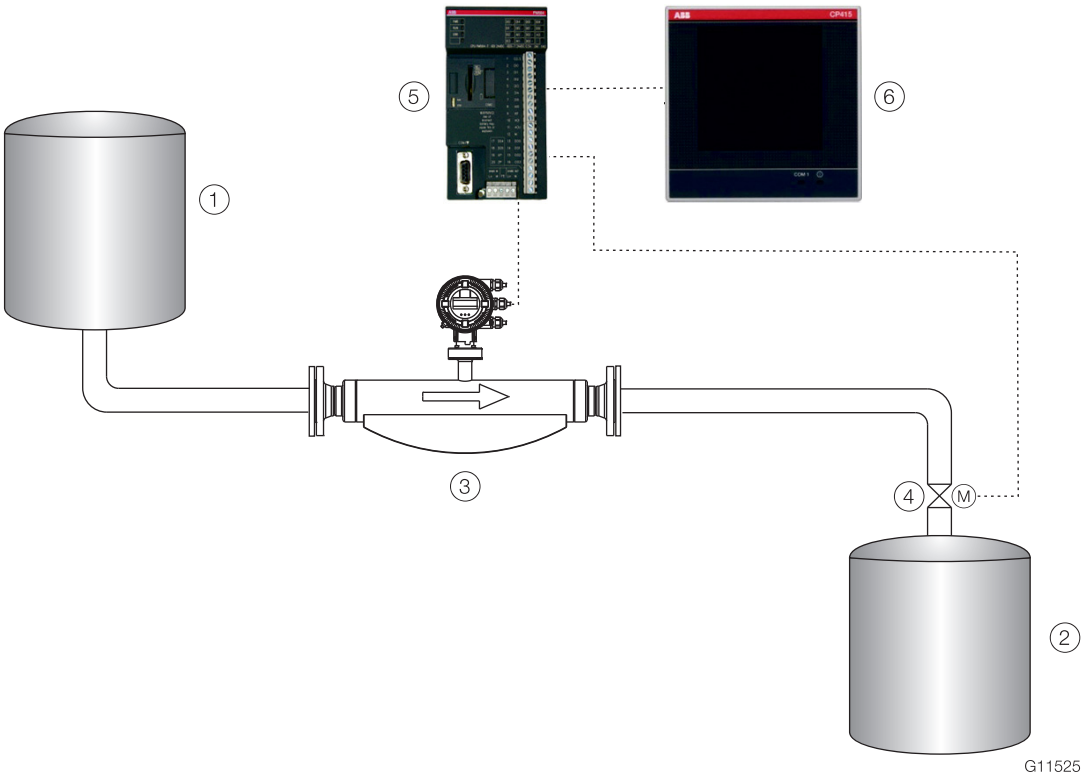


Fig. 9: Schematic representation
(1) Supply tank (2) Filled container (3) Flowmeter (4) Motor valve (5) Compact controller AC500eco (6) Display for the compact controller CP415

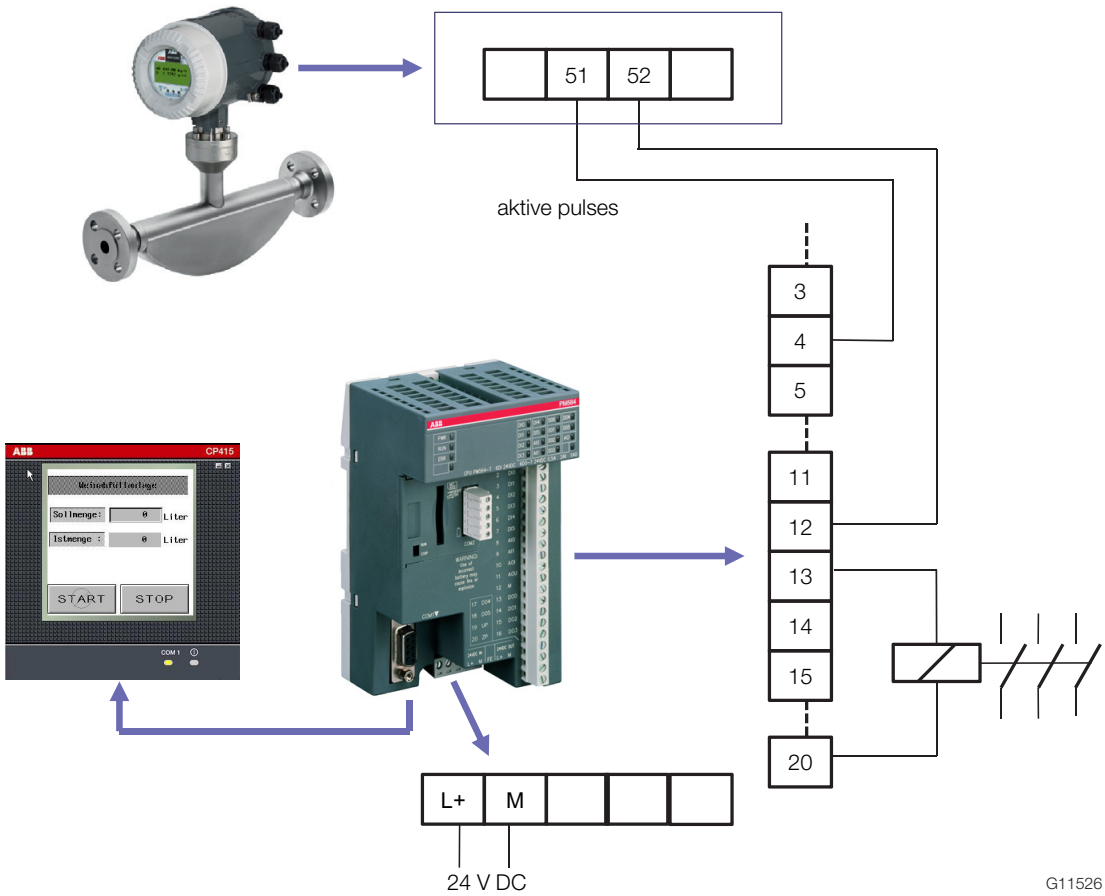


Fig. 10: Electrical connection for the Coriolis mass flowmeter

Flowmeters for batch dosing

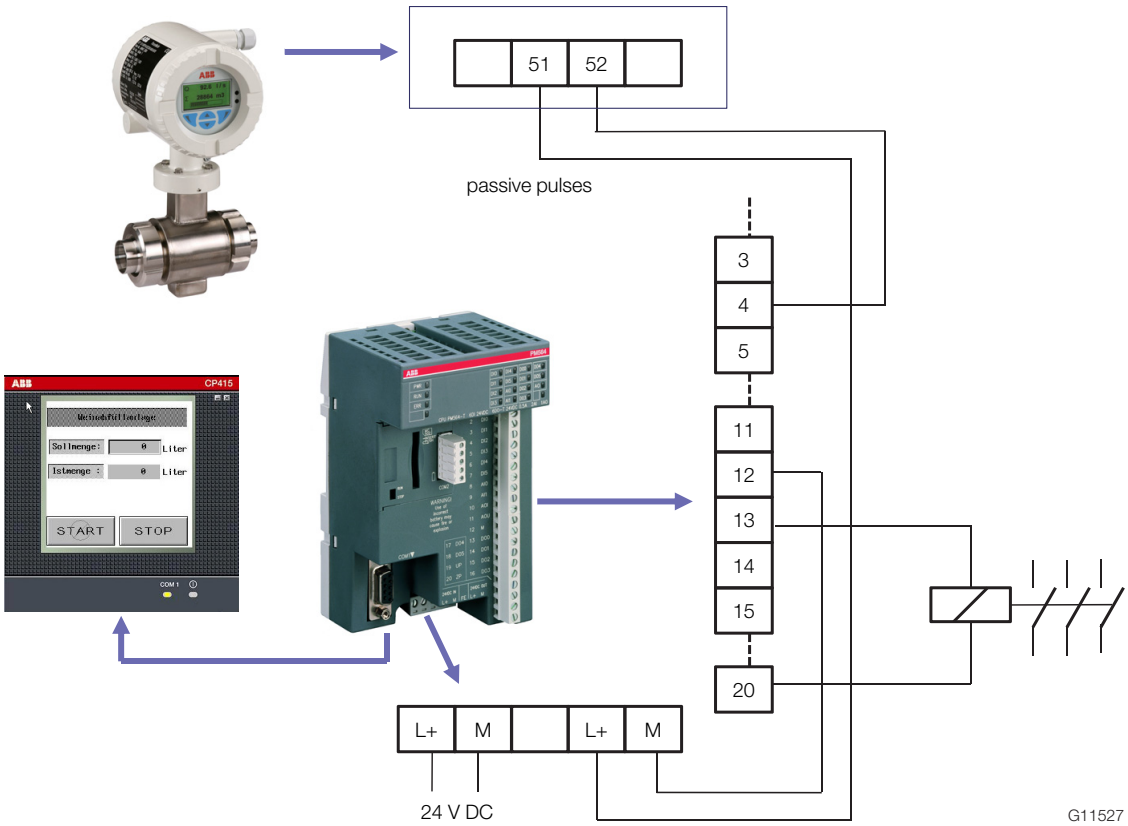


Fig. 11: Electrical connection for the electromagnetic flowmeter

Fig. 12: Sample user interface with presetting counter, switch elements and other supplementary information

Fig. 13: Components of a batch dosing system with electromagnetic flowmeter and compact controller AC500eco

Implementation of a filling application using a rapid mass flowmeter, AC500eco and rapid Modbus connection

Very short dosing processes such as those frequently required by filling applications can be achieved by combining a Coriolis mass flowmeter and the AC500eco with a rapid Modbus connection used for communications between the two. The controller features software which has been specially developed for filling processes. The system also records any overrun quantities after the close command and can perform self-corrections. Filling times must be greater than or equal to three seconds.

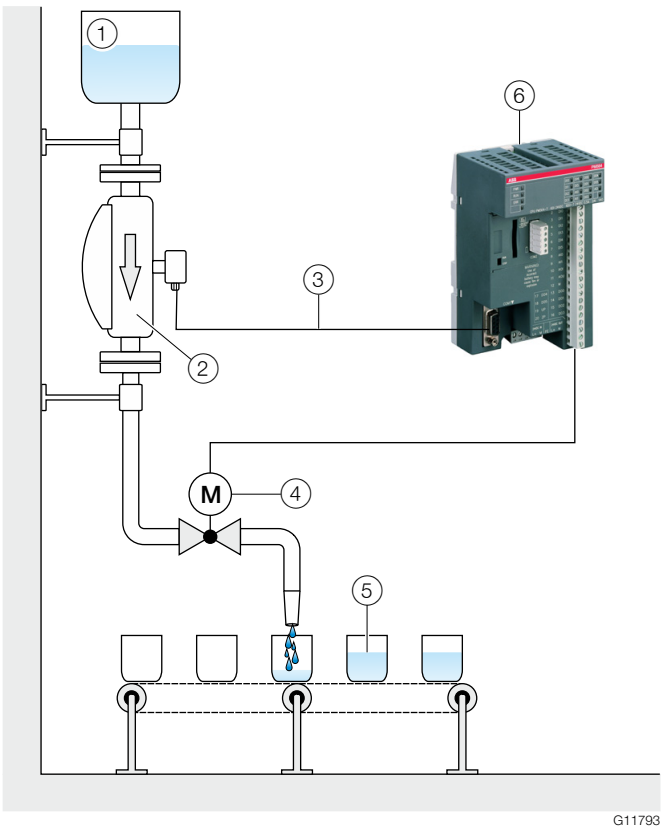


Fig. 14: Rapid filling with FCB100 and AC500eco
(1) **Supply tank** (2) **FCB100** (3) **Modbus connection**
(4) **Selector valve with reproducible close times**
(5) **Container to be filled** (6) **AC500eco**

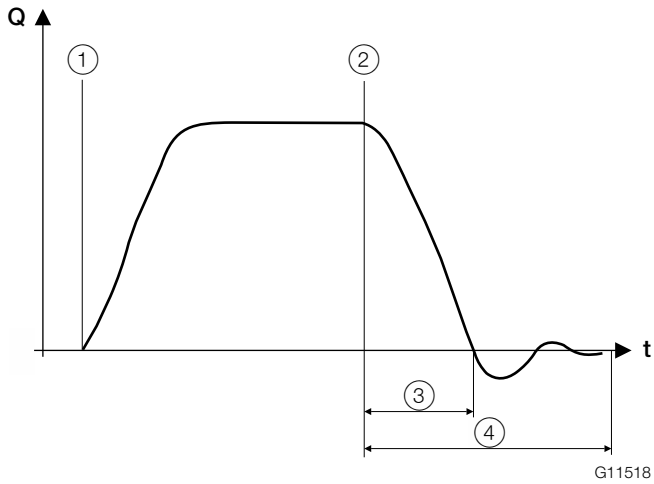


Fig. 15: Dosing procedure
(1) Valve opened (filling started) (2) Valve closed (fill volume reached)
(3) Valve close time tv (4) Overrun time tn

Flowmeters for batch dosing

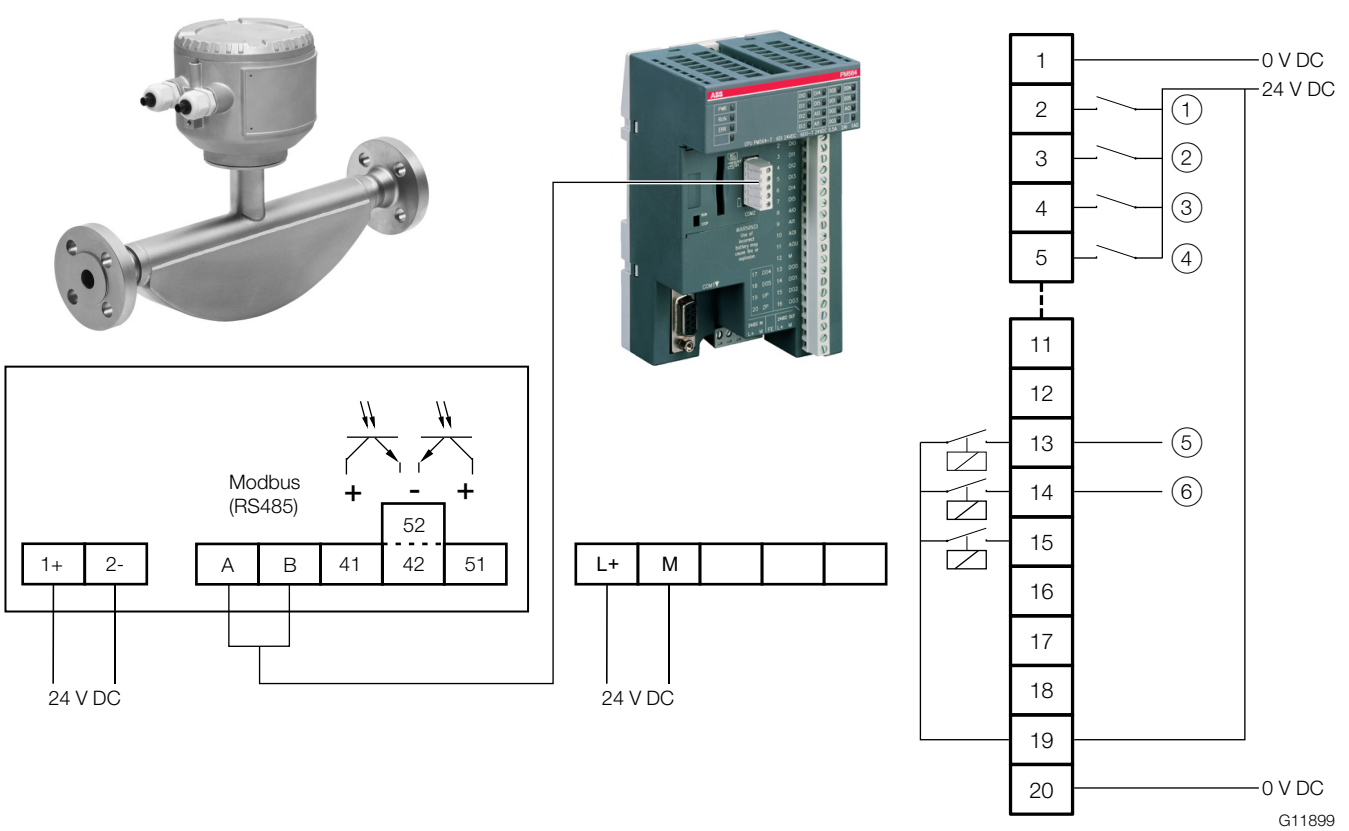


Fig. 16: Wiring for FCB100 and AC500eco
(1) **Fill enable (1 = active; 0 = inactive)** (2) **Pause (1 = pause)** (3) **Reset (1 = reset)** (4) **Cleaning (1 = cleaning)** (5) **Open valve (1 = open)**
(6) **Fine dosing (1 = active)**

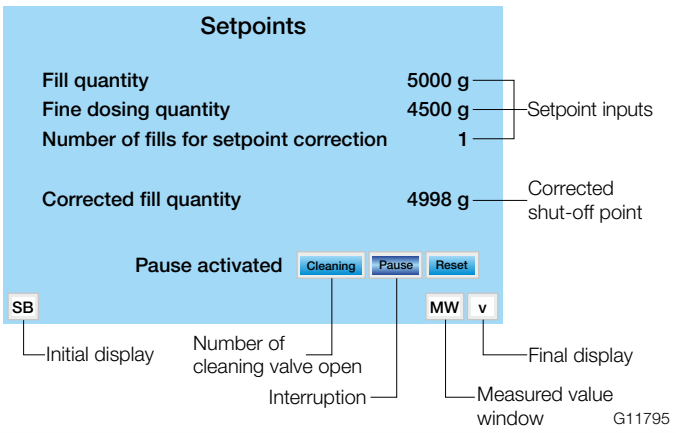


Fig. 17: Example: set point control screen

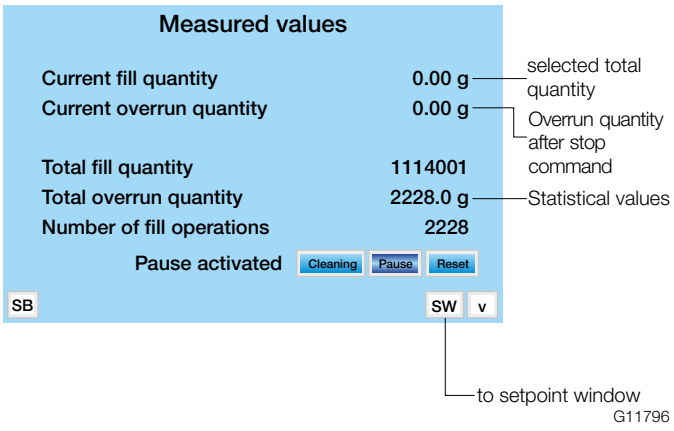


Fig. 18: Example: measured value control screen

Product information

Electromagnetic flowmeter FEH500

Integral mount design
Nominal diameter DN (if required)
PFA liner
Electrodes made of SST 1.4571 (AISI 316Ti)
Material used for sensor: stainless steel
Material used for transmitter housing: cast aluminum, painted
Adjustable flow velocity
Power supply: 100 … 230 V AC, 24 V AC/DC
Output signal: 4 … 20 mA

Coriolis mass flowmeter CoriolisMaster FCH300

Simultaneous measurement of mass flow, density and concentration
No conductive medium required
High level of accuracy of up to 1 g per liter for density measurements
High level of accuracy of up to 0.15 % of measured value for flow measurements
Wetted materials made of stainless steel
Self-draining
Power supply: 100 … 230 V AC, 24 V AC/DC
Output signal: 4 … 20 mA

Coriolis mass flowmeter CoriolisMaster FCB100, FCH100

Nominal diameter range: DN 10 to DN 200 (DN 25 to DN 80 for hygienic applications)
Materials: stainless steel, polished meter tube (optional)
Measuring accuracy of flow measurements: mass flow rate 0.1 % and 0.15 % of measured value, volume flow rate 0.15 % of measured value
Accuracy of density measurements for liquids: 0.002 kg/l, 0.001 kg/l, 0.0005 kg/l (with field adjustment)
Outputs: 2 active/passive digital outputs, Modbus communications
Power supply: 11 ... 30 V DC

Indicator / integrator ControlMaster CM15

Analog / frequency input
Totalizer and counter functions
Variable display
Computational and logic functions
Variable inputs / outputs
Standard: 2 universal inputs, 1 analog output, 1 relay output

Compact controller AC500eco with display

Controller with analog, frequency and binary inputs
Binary outputs

Touch display
Program for dosing functions

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