Technical description TD/RandC/017–EN

ControlMaster CMF160
Universal process indicator, fieldmount

Replacing the C320 booster pump controller with a CMF160

Measurement made easy

Introduction

The Commander C320 was a booster pump controller for use in pasteurization applications.

The C320 is now obsolete and can be replaced by the ControlMaster CMF160 indicator with 'Dual' functionality. This document explains the pasteurization process, the required settings and describes how to configure the CMF160 to act as a booster pump controller.

Pasteurization overview

The pasteurization process works by heating a product to kill any unwanted bacteria (see Fig. 1). In the initial stages of pasteurization, untreated (raw) product is passed through a heat exchanger (in a process also known as regeneration) where heat from the treated product is used to raise the temperature of the raw product before it is finally heated to the target temperature value.

During its time in the heat exchanger, the raw product passes directly alongside the treated product, but the two are separated by a thin barrier. This enables the heat from the treated product to transfer to the raw product, increasing the efficiency of the heating and cooling processes. The treated product is at higher pressure than the raw product so that in the event of a breakdown of the barrier, raw product will not mix with treated product.

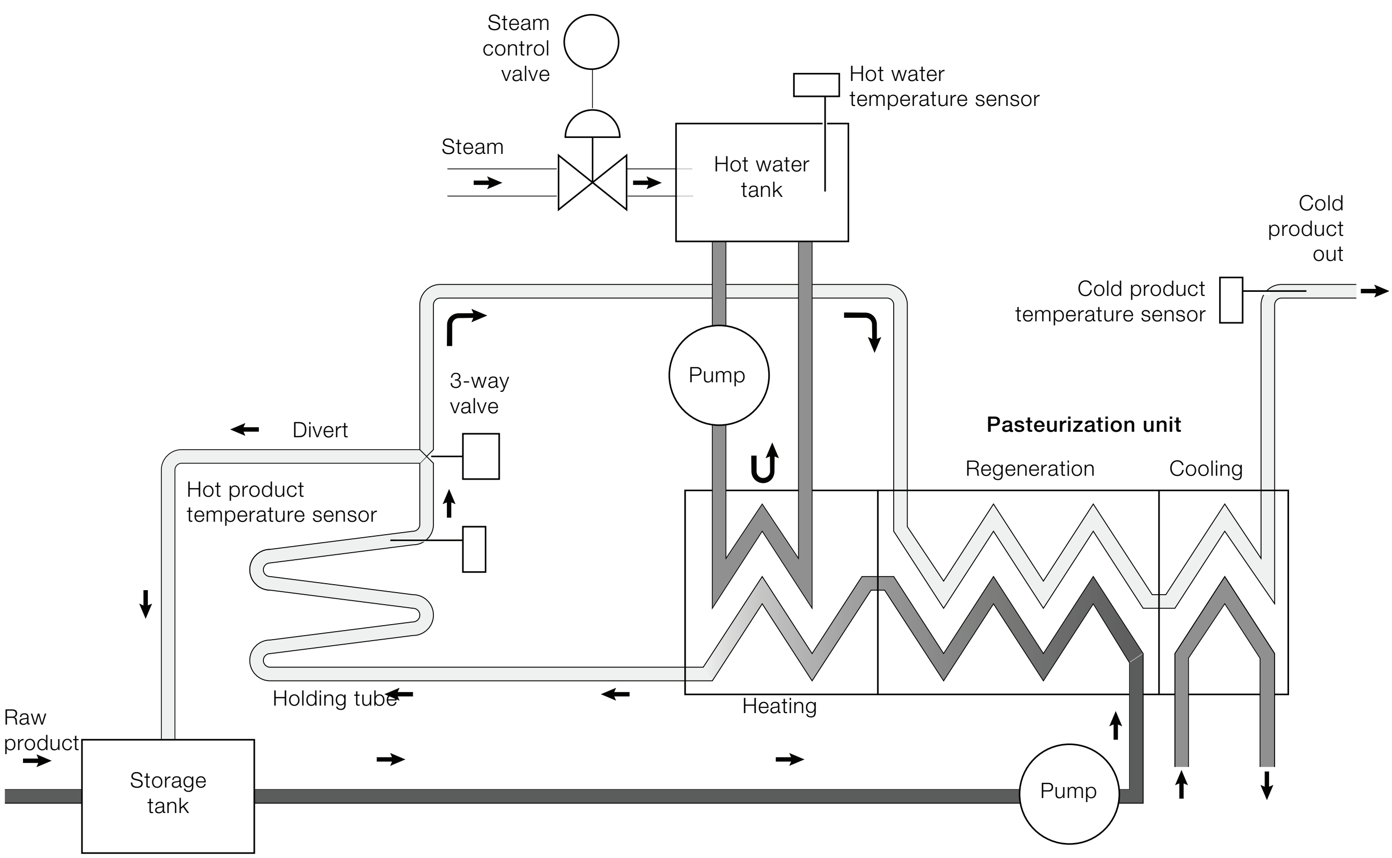


Fig. 1 Pasteurization overview

The role of the booster pump controller is to monitor the pressure in each side of the regeneration process (see Fig. 2). If the pressure differential falls below a certain level, the controller stops the pump and activates a bypass valve to prevent contaminating treated product with raw product. This application does not require PID control, therefore the functionality of the C320 can be replicated by the ControlMaster CMF160 indicator.

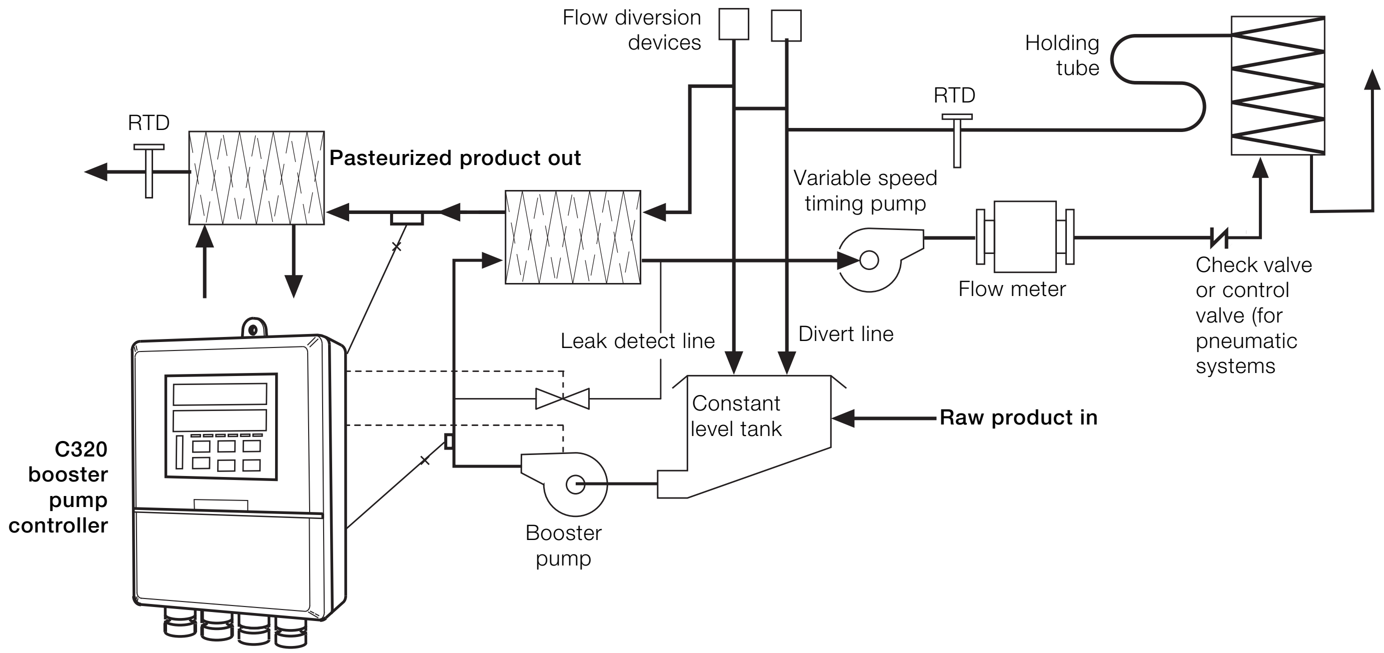


Fig. 2 Booster pump control

General functionality

The functionality required for the booster pump application is relatively simple – see Fig. 3. Two pressure inputs are connected to the pump controller and the controller compares them. It then uses the differential value to determine if there is a leak between the 2 sides of the regenerator. If the pressure difference falls below a predetermined value, an internal alarm is triggered that deactivates a pump control relay and activates a second relay that drives a divert valve. A third relay is also available to provide an external signal (for example, a beacon or siren) to indicate process status.

2 analog outputs are available to retransmit variables to another system or recorder. Typically, one is reserved for retransmission of the calculated pressure difference and the second for either the pasteurized product pressure or the raw product pressure. There is also an optional digital input that is used to advise the controller of the status of the system, either normal operation or manual override. All of this functionality can be replicated in the CMF160 with optional dual functionality.

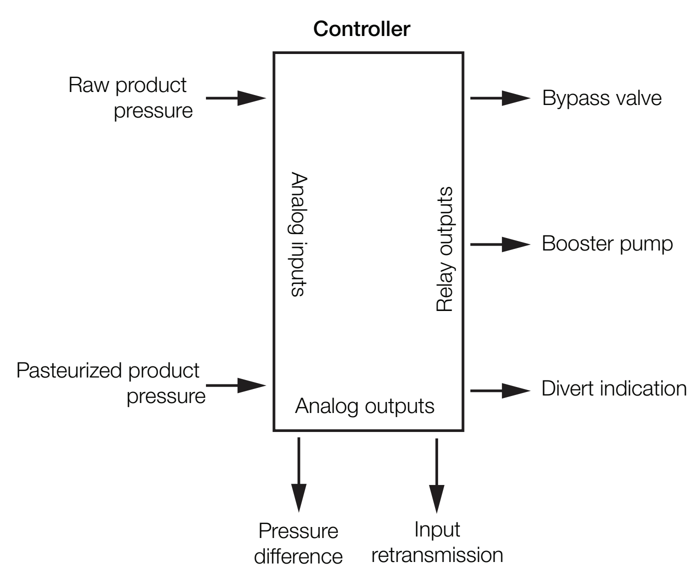


Fig. 3 Controller inputs and outputs

Approvals

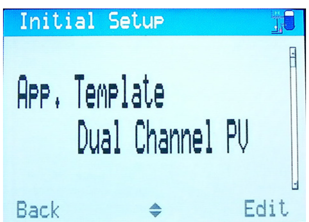
A standard requirement for equipment intended for use on the pasteurization process within North America is acceptance from the FDA that the equipment meets the operational requirements detailed in the Pasteurized Milk Ordinance (PMO) guidelines. Although the CMF160 has not been submitted to the FDA for acceptance, it is able to meet the PMO requirements for the booster pump controller role within the pasteurization process.

Configuring the CMF160

Configuring the CMF160 is straightforward. The first step is to select the required application template.

Selecting the application template

1. Enter the configuration level through the 'Advanced' Menu option as described in Section 5.4 of the User Guide (IM/CM/I-EN).
2. Select the `Device Setup` page and the ***Dual Channel PV*** template from the `Initial Setup` page:

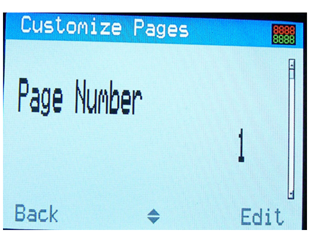


The **Dual Channel PV** template enables display of both the raw and pasteurized product on a single screen.

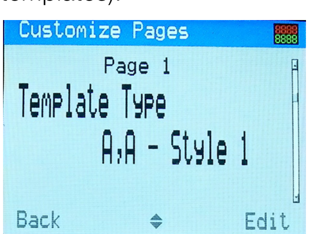
Customizing the display

The next step is to enter the `Display` page and customize the display template by changing the PV tags to identify the raw and pasteurized products.

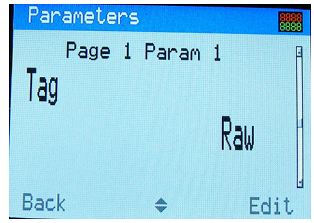
1. In the `Display` page select ***Customize Pages***, and ***Page Number***:



2. Select the display template required (refer to TD/RandC/001 for further information regarding display templates):



3. Press **Back** to return to the ***Customize Pages*** menu and select ***Parameters***. Depending on the chosen template type, the sources for each parameter may be selected automatically. If not, select the correct source for each parameter and modify the associated tag:



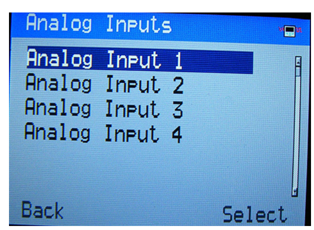
The final display should look similar to this...

...but can be customized further as required.

Configuring the inputs

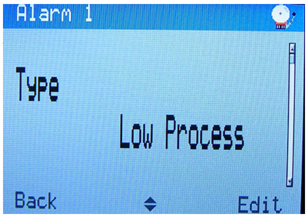
The input signals for the raw and pasteurized product line pressures come from pressure transmitters mounted on each of the lines. These signals are usually mA. To configure the input types engineering ranges and associated units, go to the `Input/Outputs` page in the configuration menu and select the ***Analog Inputs*** menu option.

In this example, analog input 1 has been assigned to the raw product and analog input 2 to the pasteurized product:

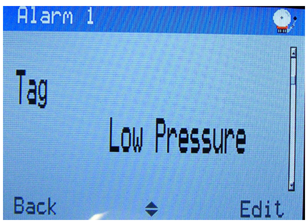


Configuring the alarms

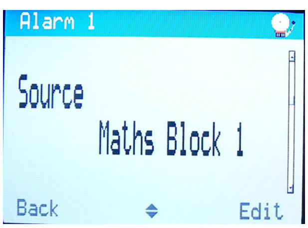
Two process alarms are required for the pasteurizer application. The first, and most critical, is the alarm that is triggered if the pressure differential between the raw and pasteurized product lines has fallen below the set limit. According to legislation, this difference should never be less than 1 psi. Therefore, the first alarm required is a low process alarm.



A unique tag can be assigned to the alarm:

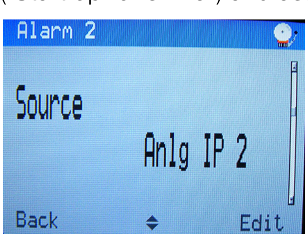


The analog source that the low process alarm is assigned to is a differential calculation that is set up within a Math block (see next section):



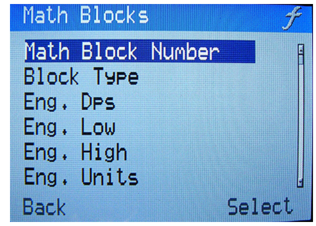
The second Alarm is referred to as the start up alarm. This is used to indicate when the pressure in the pasteurized line is lower than the required minimum operating pressure. This is a condition that normally occurs on start up, but in the event of a fault, could happen during normal operation. This alarm triggers a relay that is used to send a signal elsewhere in the process to indicate this has happened.

Alarm 2 is again a low process alarm, but this time the tag ('Start up' or similar) and associated source are different:



Configuring the math block

To calculate the difference in pressure between the raw and pasteurized product lines, the 2 pressure values are assigned to a math block and compared. The result is then compared against the set point value for the low pressure alarm. To configure the Math block go to the `Functions` page and select ***Math Blocks***.



Select ***Math Block Number 1*** and enter the following equation:

Math Block Type: Equation

- ***Operand 1***: Analog Input 2 (pasteurized product pressure)
- ***Operator 1***: Subtract
- ***Operand 2***: Analog Input 1 (raw product pressure)
- ***Operator 2***: End

Configuring the logic equations

To ensure that the relays are active at the correct times, the CMF160 must be configured to enable the relay to be on and off only under certain process conditions. This is done using logic equations. The three relays each require activation under different process conditions therefore 3 individual logic equations are required.

Logic Equation 1 (Relay 1)

Relay 1 is active under the following conditions:

when alarm 1 is inactive
and

when alarm 2 is inactive
and

when digital input 1 is present

All 3 conditions must be met to activate the relay.
Configure logic equation 1 as follows:

Operand 1:	Alarm State 1
Invert:	Yes
Operator 1:	AND
Operand 2:	Alarm State 2
Invert:	Yes
Operator 2:	AND
Operand 3:	Digital Input 1 State
Invert:	No
Operator 3:	END

Logic Equation 2 (Relay 2)

Relay 2 is active under the following condition:
when Alarm 1 is inactive.

Configure logic equation 2 as follows:

Operand 1:	Alarm State 1
Invert:	Yes
Operator 1:	END

Logic Equation 3 (Relay 3)

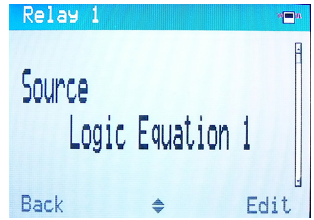
Relay 3 is active under the following condition:
when Alarm 1 is active, but not acknowledged

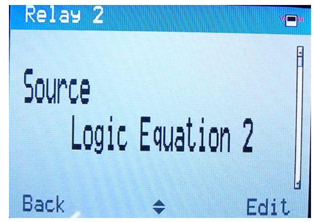
Configure logic equation 3 as follows:

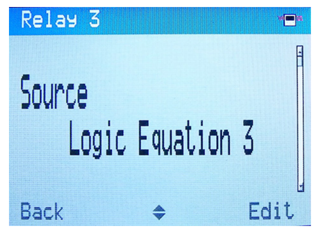
Operand 1:	Alarm State 1
Invert:	No
Operator 1:	AND
Operand 2:	Alarm 1 Acknowledge state
Invert:	Yes
Operator 2:	END

Configuring the relays

To ensure that the relays are active at the correct times, the correct source is assigned to each relay. Each relay has its own logic equation:



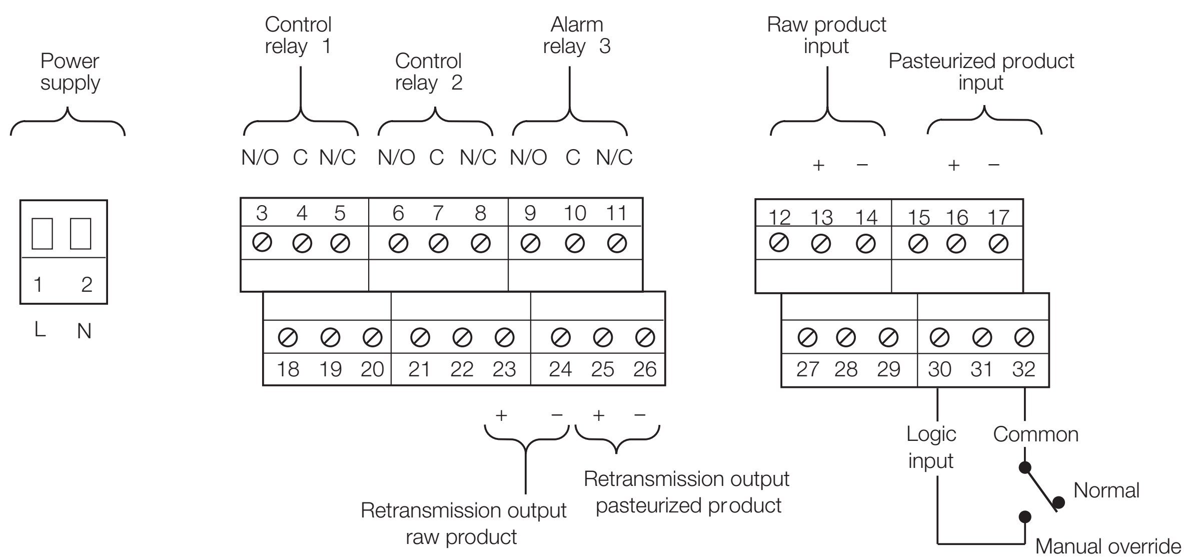




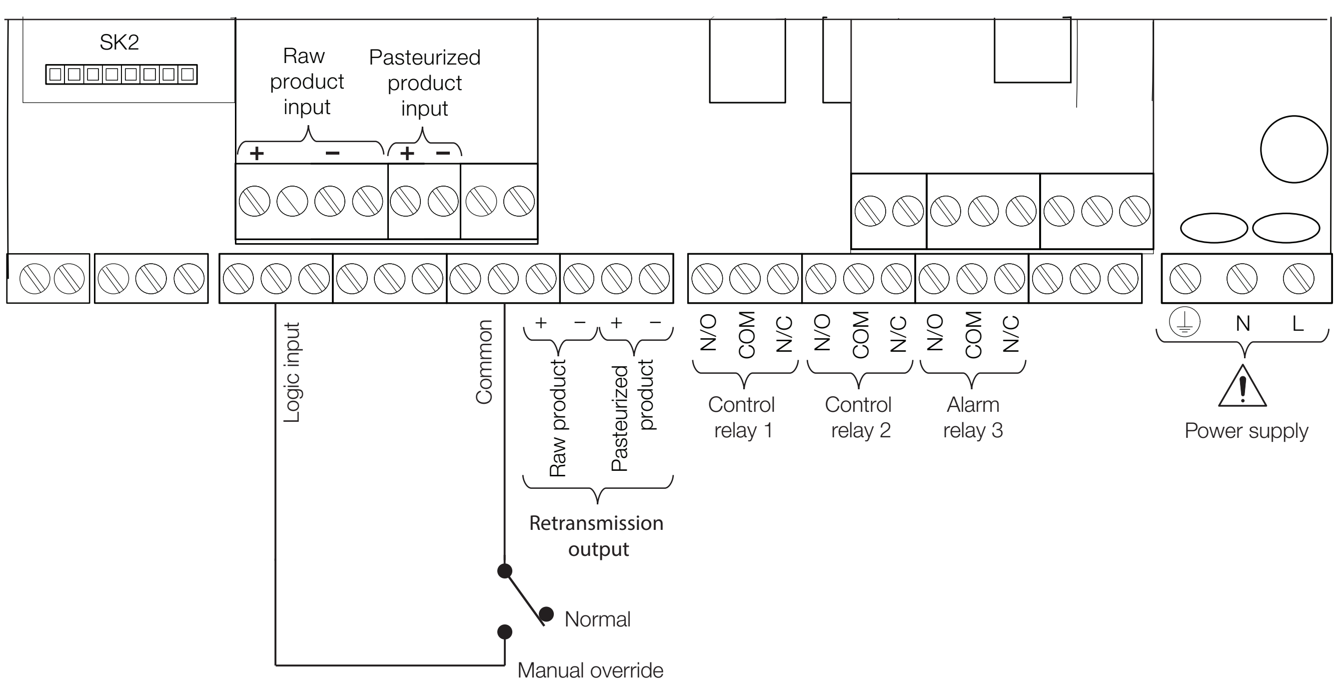
Once completed, the relays activate and deactivate at the required process points.

Electrical connections

C320



CMF160



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