ABB MEASUREMENT & ANALYTICS | TECHNICAL DESCRIPTION

ControlMaster

CM10, CM30, CM50 controllers, CM15 indicators and CMF160/CMF310 controller/indicators

Wear levelling in Duty/Assist applications using Bank Control

Measurement made easy

ControlMaster – CM10, CM15, CM30, CM50, CMF160/CMF310

Introduction

This Technical Description provides an overview of the Bank Control feature available in ControMaster products and the benefits of wear levelling in Duty/Assist applications.

Bank Control enables automated, sequencing/cycling of a primary or duty device to level out the amount of wear across (same type) multiple devices within a system.

Use of the Bank Control feature can prolong the primary device life, lower system maintenance costs and enhance system reliability.

Sales

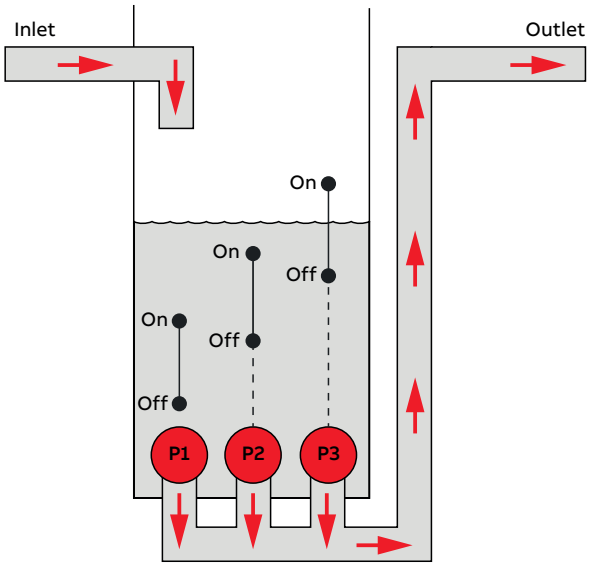
Service

Duty/Assist

Duty/Assist is a term used to refer to applications where the design incorporates multiple devices such as a pump or heater that are used together to meet demands on a system that increase and decrease over time.

The duty device would be expected to be the primary device that is always running during the process. In times of high demand, other devices of the same type would be brought on board to 'assist' the duty device and increase system output.

These 'assist' devices would be then turned off as demand decreases. The number of devices within this strategy is referred to as a bank.



Wear levelling

In this type of set up, the wear experienced by the duty device is much higher than the others due to its level of usage. This means that it will require more regular servicing than the other devices, has a greater risk of failure and, over time, may end up being a more costly device.

To overcome this, sites use a system of device cycling or wear level algorithms to regularly change the primary or duty device and ensure that the amount of wear across all the devices is levelled out, essentially prolonging the primary device life and keeping the costs associated with maintaining the system lower whilst ensuring it is reliable for longer.

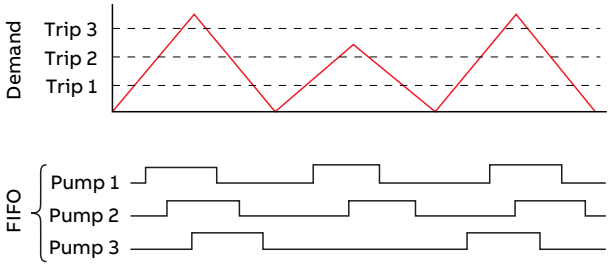
Bank Control and ControlMaster

The ControlMaster range has the Bank Control feature available as part of the standard build functionality on controller and Indicator products. It does not use PID values, but an inbuilt wear levelling algorithm for Bank Control of up to 6 devices.

There are two options to choose from:

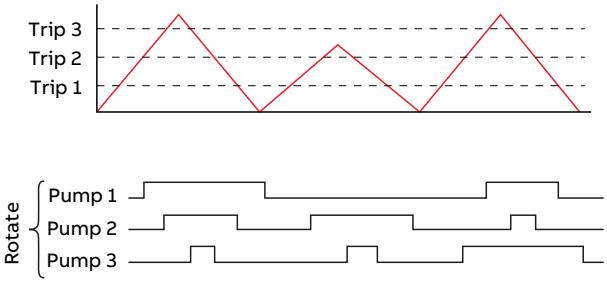
First In, First Out (FIFO)
The diagrams below show the First In, First Out (FIFO) mode. It works by turning (in this example) pump 1 on first, it then brings the other pumps online in order as their individually configured trip points require it.

Then, as the demand falls, it turns them off in the order in which they were turned on; so pump 1 is turned off first, followed by pump 2 and pump 3.

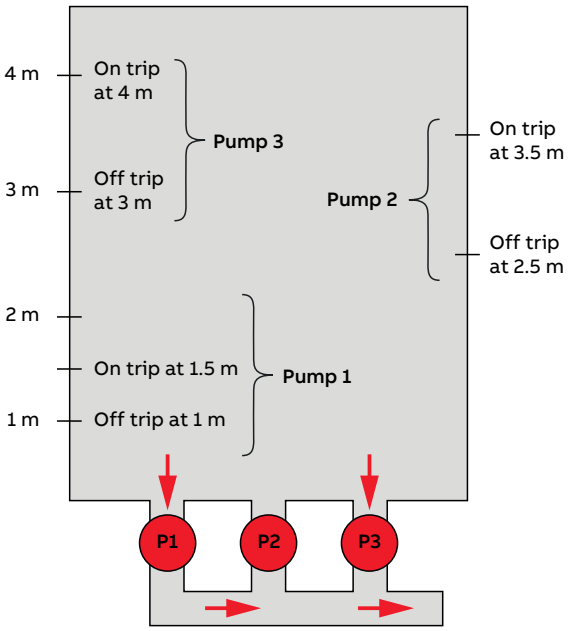


Rotate
The diagram below show the rotate mode. It works by rotating which pump acts as pump one throughout a cycle to ensure that all the pumps are active for the same time in a single cycle.

Initially pump 1 is the duty or primary pump, as the cycle progresses pump 1 is turned off and pump 2 becomes the duty pump and then as we continue through the cycle pump 3 becomes the duty pump.



If we look at an example of a 3-pump system:



We have a trip level for the on and off of each pump.

The table below shows the logic for the **FIFO** mode:

First In First Out (FIFO)

	Level	P1	P2	P3		Level	P1	P2	P3
Seq. 1	1.3 m (4.26 ft)	×	×	×	Seq. 1	2.2 m (7.21 ft)	×	×	✓
Seq. 2	2.2 m (7.21 ft)	✓	×	×	Seq. 2	0.8 m (2.62 ft)	×	×	×
Seq. 3	3.6 m (11.81 ft)	✓	✓	×	Seq. 3	1.8 m (5.90 ft)	✓	×	×
Seq. 4	4.3 m (14.10)	✓	✓	✓	Seq. 4	0.8 m (2.62 ft)	×	×	×
Seq. 5	2.8 m (9.18 ft)	×	✓	✓	Seq. 5	1.8 m (5.90 ft)	×	✓	×

Here pump 1 turns on at its designated trip point of 1.5 m (4.92 ft), as the level gets higher the other pumps activate at their designated trip points, but at the level begins to fall, pump 1 turns off first at the rip point of 3 m (9.84 ft) rather than its own designated trip.

As the level continues to fall the pumps turn off in the order they were turned on, but at the designated process trip values.

The table below shows the logic for **Rotate** mode:

Rotate pump cycling

	Level	P1	P2	P3		Level	P1	P2	P3
Seq. 1	1.3 m (4.26 ft)	×	×	×	Seq. 1	2.2 m (7.21 ft)	✓	×	×
Seq. 2	2.2 m (7.21 ft)	✓	×	×	Seq. 2	0.8 m (2.62 ft)	×	×	×
Seq. 3	3.6 m (11.81 ft)	✓	✓	×	Seq. 3	1.8 m (5.90 ft)	×	✓	×
Seq. 4	4.3 m (14.10)	✓	✓	✓	Seq. 4	0.8 m (2.62 ft)	×	×	×
Seq. 5	2.8 m (9.18 ft)	✓	✓	×	Seq. 5	1.8 m (5.90 ft)	×	×	✓

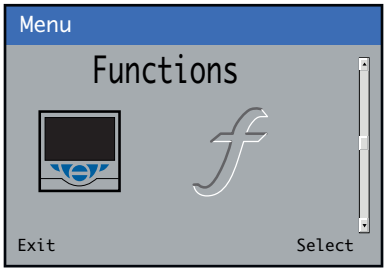
Here pump 1 comes on at its designated trip point of 1.5 m (4.92 ft) and the other pumps are activated as before. They then turn off in the order that you would expect them to according to their trip points. However as we progress through the cycle, the next time the level rises pump 2 becomes the duty pump and turns on first at the initial trip point and then pump 3 and pump 1.

Configuring the ControlMaster for Bank Control

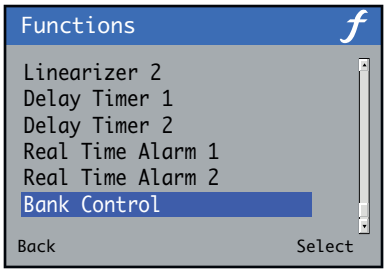
Configuration of the ControlMaster begins in the same way as any other process. An application template and the required control output type must be selected first, then the inputs and any process alarms required must be configured in the usual way. Once the unit is configured for the basic application, **Bank Control** can be configured.

To confgure **Bank Control**:

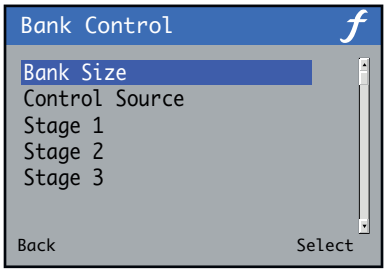
1 Enter the **Functions** page:



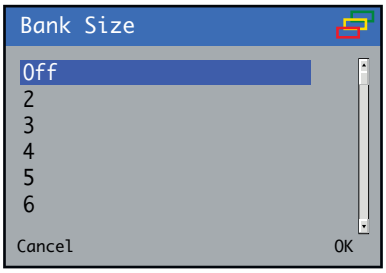
2 Select **Bank Control:**

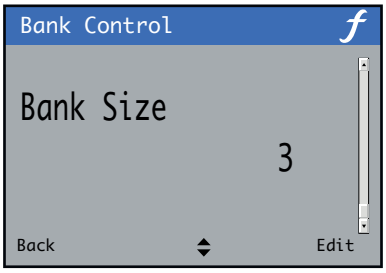


3 Select **Bank Size**:

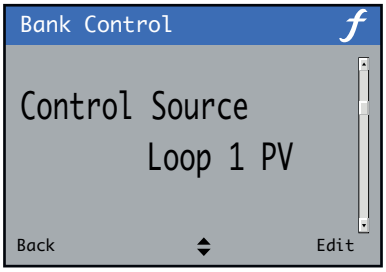


4 Select **Bank Size** (number of devices) – up to 6 devices can be configured:

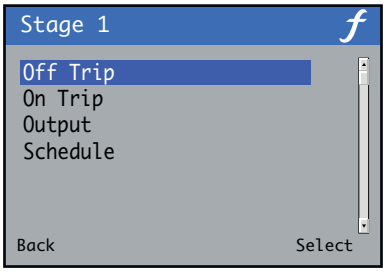




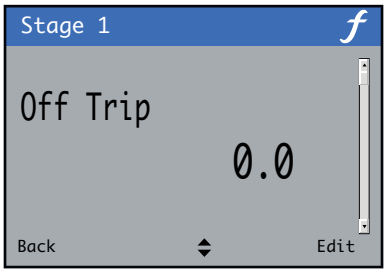
5 Select **Control Source** (the analog source that is the control value for wear levelling):



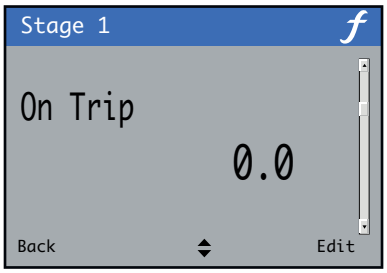
6 Select **Stage 1**:



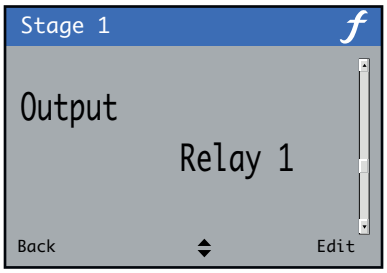
7 Select the **Off Trip value** (the process value at which you want the **Stage 1** device to turn off):



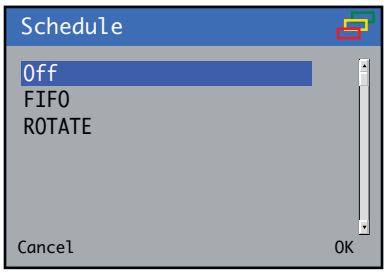
8 Select the **On Trip value** (the process value at which you want the stage 1 device to turn off):



9 Select the **Output** (the digital output from the controller you wish to control the device according to the trip points):



10 Select the **Schedule** you require the **Bank Control** to operate at (**FIFO** or **Rotate**):



You can then set up the other stages in the same way up to stage **6** (depending on the number of devices you wish to operate using the bank control functionality).

Configuring Bank Control using ConfigPilot

Bank control can also be configured using ABB's ConfigPilot configuration software:

With an easy-to-use graphical display, ConfigPilot makes configuration of the products simple and quick, with clear indication of instrument behavior.

Benefits of Bank Control

The benefits of using Bank Control in Duty/Assist applications are clear:

- Simple to configure
  - Dedicated menu enables simple configuration, with graphical representation available in the ConfigPilot software
- Reduces maintenance costs
  - By spreading the running time of devices, the wear across the system is evened out, reducing device breakdown
- Improves process reliability
  - By reducing reliance on a single duty device, break-downs are minimized meaning processes have a longer-term reliability

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