ABB Controller

Process Automation

User Guide

Festo Didactic
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8209870

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Order no.: 8209870 (Printed version) 8209871 (Electronic version)
First Edition
Revision level: 2024/05

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Printed in Canada

ISBN 978-2-89834-580-7 (Printed version)
ISBN 978-2-89834-581-4 (Electronic version)
Legal Deposit - Bibliothèque et Archives nationales du Québec, 2024
Legal Deposit - Library and Archives Canada, 2024

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Document Preliminaries

About this document

Safety considerations

Safety symbols that may be used in this course and on the equipment are listed in the Safety and Common Symbols table at the beginning of this document.

Safety procedures related to the tasks that you will be asked to perform are indicated in each exercise.

Make sure that you are wearing appropriate protective equipment when performing the tasks. You should never perform a task if you have any reason to think that a manipulation could be dangerous for you or your teammates.

Systems of units

Units are expressed using the International System of Units (SI) followed by units expressed in the U.S. customary system of units (between parentheses).

Introduction to the learning system

Automated process control offers so many advantages over manual control that most of today's industrial processes use it to some extent. Breweries, wastewater treatment plants, mining facilities, and the automotive industry are just a few industries that benefit from automated process control systems.

Maintaining process variables such as pressure, flow, level, temperature, and pH within a desired operating range is of the utmost importance when manufacturing products with a predictable composition and quality.

The Instrumentation and Process Control Training System is a state-of-the-art system that faithfully reproduces an industrial environment. Throughout this course, students develop skills in the installation and operation of equipment used in the process control field. The use of modern, industrial-grade equipment is instrumental in teaching theoretical and hands-on knowledge required to work in the process control industry.

The modularity of the system allows the instructor to select the equipment required to meet the objectives of a specific course. Two mobile workstations, on which all the equipment is installed, form the basis of the system. Several optional components used in pressure, flow, level, temperature, and pH control loops are available, as well as various valves, calibration equipment, and software. These add-ons can replace basic components having the same functionality, depending on the context. During control exercises, a variety of controllers can be used interchangeably depending on the instructor's preference.

We hope that your learning experience with the Instrumentation and Process Control Training System will be the first step toward a successful career in the process control industry.

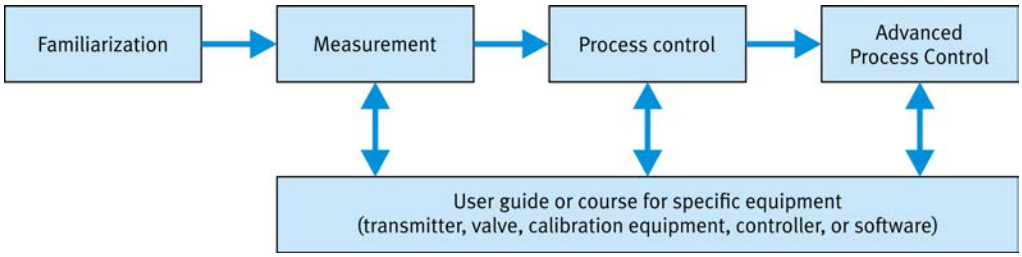

Figure 1: Standard learning path for the Instrumentation and Process Control Learning System.

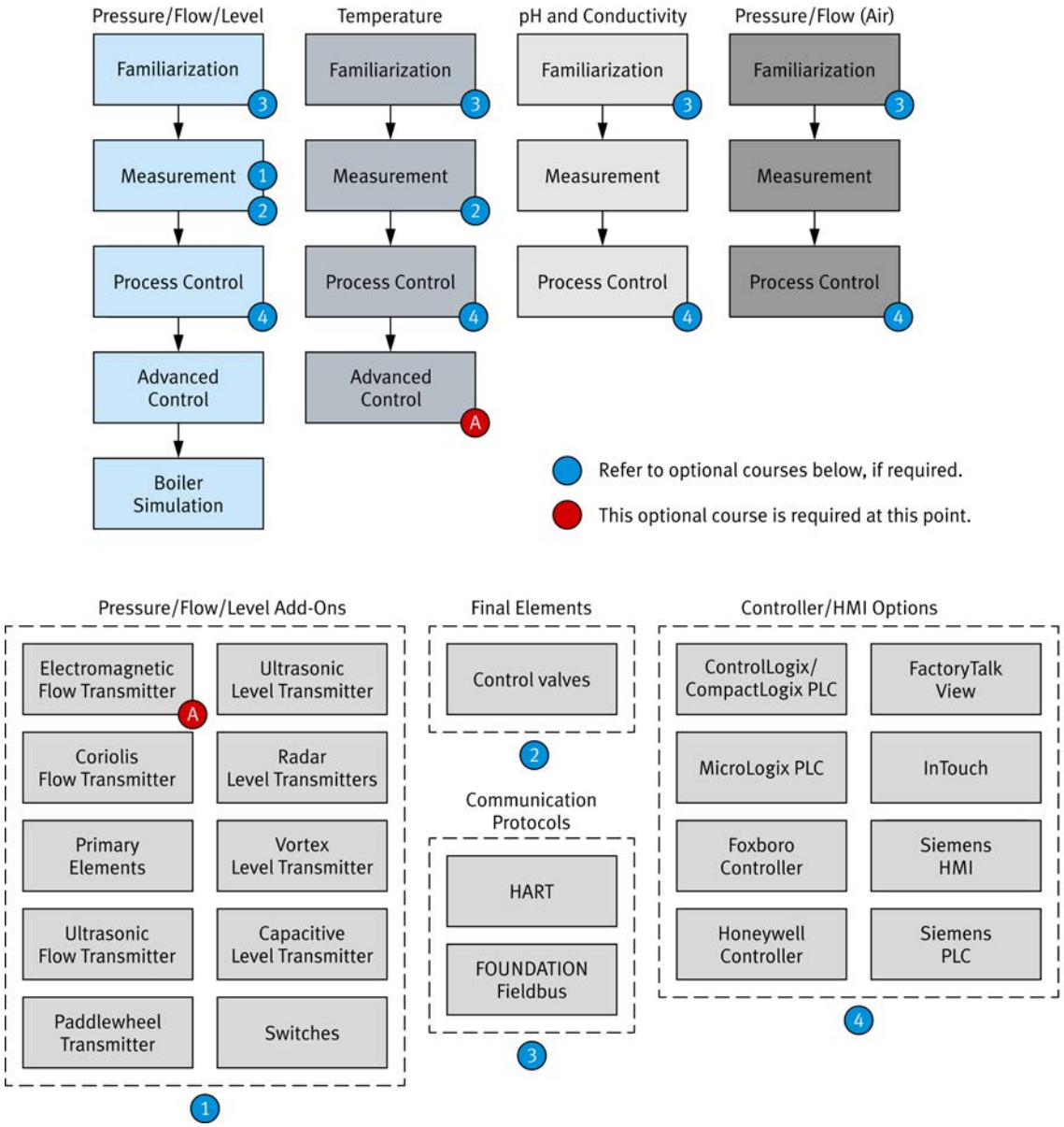

Figure 2: Instrumentation and Process Control Learning System.

Safety symbols and procedures

The following table lists the safety and common symbols that may be used in this document and on the equipment. Before performing procedures with the equipment, you should read all sections regarding safety in the User Guide accompanying the equipment. Additional safety procedures are given before any task requiring specific safety precautions.

Symbol	Description
⚠ DANGER	**DANGER** indicates a hazard with a high level of risk, which, if not avoided, will result in death or serious injury.
⚠ WARNING	**WARNING** indicates a hazard with a medium level of risk, which, if not avoided, could result in death or serious injury.
⚠ CAUTION	**CAUTION** indicates a hazard with a low level of risk, which, if not avoided, could result in minor or moderate injury.
NOTICE	**NOTICE** indicates a hazard with a potentially hazardous situation, which, if not avoided, may result in property damage.
	Caution, risk of danger. Consult the relevant user documentation.
	Caution, risk of electric shock.
	Caution, lifting hazard.
	Caution, hot surface.

Symbol	Description
	Caution, risk of fire.
	Caution, risk of explosion.
	Caution, belt drive entanglement hazard.
	Caution, chain drive entanglement hazard.
	Caution, gear entanglement hazard.
	Caution, hand crushing hazard.
	Static sensitive contents. Observe precautions for handling electrostatic discharge sensitive devices.
	Notice, non-ionizing radiation.
	Consult the relevant user documentation.
	Radio Equipment Directive (RED) geographical restrictions – consult the relevant user documentation.

Symbol	Description
	Direct current.
	Alternating current.
	Both direct and alternating current.
	Three-phase alternating current.
	Earth (ground) terminal.
	Protective conductor terminal.
	Frame or chassis terminal.
	Equipotentiality.
	On (supply).
	Off (supply).
	Equipment protected throughout by double insulation or reinforced insulation.

Symbol	Description
	In position of a bi-stable push control.
	Out position of a bi-stable push control.

Familiarization with the Controller

The ABB controller, Model 46967, is an easy-to-use, yet complete controller. It can be configured to perform various control strategies, such as PID, on-off, cascade, feedforward, ratio, and split-range control, among others. Moreover, its robust capabilities enable it to extend its functionality beyond these options.

This user guide presents the basic features of the ABB controller you will need to complete the exercises in the student manuals of the 3530 series. For further details, please consult the manufacturer's product manual.

This section presents the operator interface of the ABB controller as well as the connectors available on the main panel.

The controller also comes with a software that allows changing its configuration using a computer. The software is the preferred method to load the parameters to and from the controller. To use it, you will also need to install an IrDA driver on your PC to communicate with the controller. Details on the installation of the software and the driver are presented in Appendix A.

Description of the controller

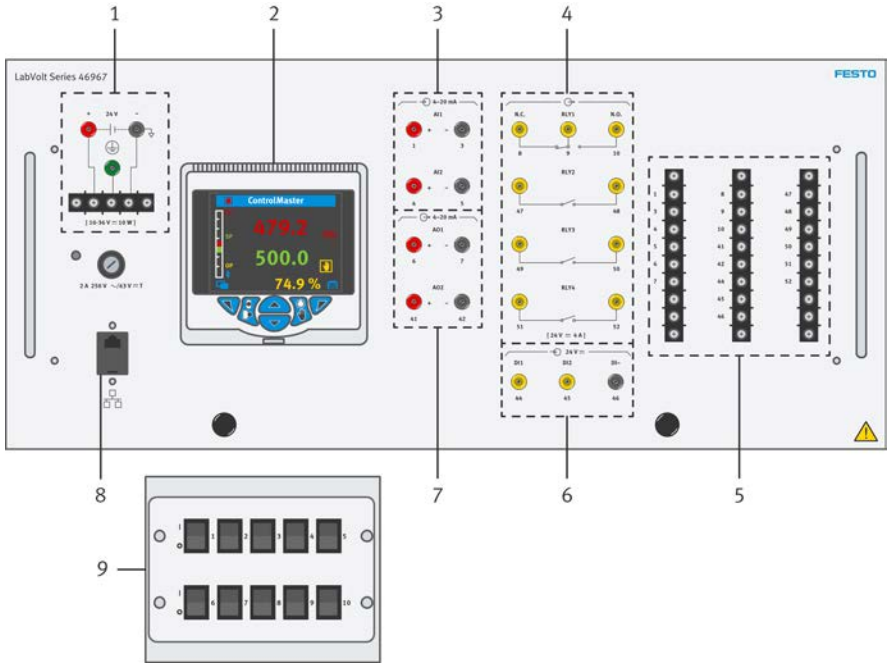

Figure 3: ABB controller model 46967.

The controller is embedded in a panel that is easily installed on the instrumentation workstation. The wiring of the controller can be done using either the banana jacks or the terminal screws available on the panel. The previous figure shows the main elements of the ABB controller model 46967. A brief description of each of these elements is given next.

1. 24 V dc input

   Used to energize the controller with a 24 V dc source.

2. ABB controller

   The controller itself is embedded in the panel. It is equipped with a display and six keys that allow the manual configuration of the controller.

3. Analog inputs

   Two analog current inputs are available on the controller (AI1 and AI2). You can connect any devices that output a 4-20 mA current on these inputs. How the controller processes the input current depends on the configuration of the controller.

4. Relays

   Four relays are available from the front panel (RLY1, RLY2, RLY3, and RLY4). Normally closed and normally open contacts are available for RLY1. Only normally open contacts are available for RLY2, RL3, and RLY4.

5. Terminal blocks

   Each of these terminals corresponds to a banana jack with the same number.

6. Digital inputs

   Two digital inputs are available (DI1 and DI2). These inputs can be used to trigger various features of the controller such as alarms.

7. Analog outputs

   The two analog outputs of the controller give a 4 20 mA output signal. The amplitude of the signal follows the control algorithm set in the controller.

8. Ethernet connector

   Allows integration of the controller into a MODBUS TCP network. It also has a built-in webserver to monitor the status of the process remotely. Refer to Appendix B for details on the configuration of the Ethernet communication.

9. Fault switches

   Located at the back of the controller, there are ten available fault switches that can be activated by the instructor to insert one or more electrical faults. The faults are activated when the switch is in the on position (I). Ensure that these faults are in the off position (O) if you are not performing a troubleshooting exercise.

Controller keys and display

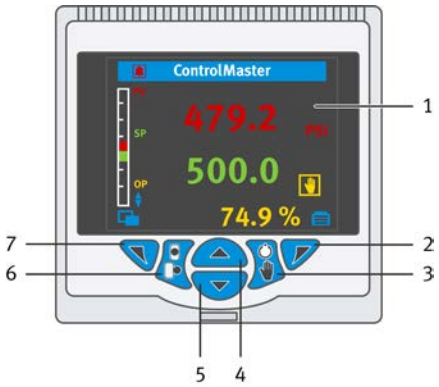

Figure 4: ABB controller model 46967 keys and display.

Table 1: ABB controller keys and display.

Element	Function	Description
1	Display	Displays information during the operation of the controller.
2	Navigation key (right)	Used to expand menus and select options. Also a programmable soft key (Advanced level only).
3	Auto / Manual selection key	Switches between the manual and automatic control modes.
4 / 5	Up / Down keys	Navigate menus and increase / decrease displayed values.
6	Local / Remote setpoint mode	Used to select operation via local or remote setpoint.
7	Navigation key (left)	Serves as the Operator access key. Also used to return to previous menu. Used to select values to adjust when applicable.

The display of the ABB controller is completely configurable using the ConfigPilot software. When multiple screens are available a number is shown by the icon over the left navigation key. To navigate to other pages, press on the left navigation key and go to View Select. Select the page to display or activate Autoscroll to go through all of them at a 10 second interval.

Operation levels

There are three distinct levels of operation available on the ABB controller, Model 46967:

- **Operator level.** From the operator menu, it is possible to adjust the setpoints and outputs, select the view and access the other levels. Autotuning can also be started for this menu when enabled.
- **Basic level.** Gives access to the configuration of the PID parameters and the adjustment of the alarms. Autotuning can be enabled at this level.
- **Advanced level.** Gives access to the configuration of all parameters.

A password can be added to prevent access to the basic and advanced levels but there is none configured by default. If needed, they can be set in the Device Setup / Security Setup of the Advanced level.

PID Control

The ABB controller offers the possibility to use diverse types of loop control. The choice of the proper mode is dictated by the situation at hand. The modes are:

- **On/Off Control.** This mode is akin to a P only control scheme where the gain coefficient is set to a very large value. In direct action, the output of the controller is 100% when the error is positive and the output is 0% when the error is negative. A configurable hysteresis is available to limit wear on the final control element caused by the constant switching on and off.
- **PID Control with fixed parameters.** This mode can be used on a linear process which doesn't change with time.
- **Gain Scheduling PID Control.** This mode can be used when the process is not linear or changes with time and where the change of properties can be related to a reference signal.
- **pPI (Predicting Proportional plus Integral) Control.** This mode compensates deadtime by providing short damping time following a transition in the process. Note that it cannot be used with Autotune or Adaptative Control or with integrating process.
- **Feed Forward Control.** This mode can be used to anticipate changes in process output by adjusting control inputs based on measured disturbances before they affect the process.
- **Adaptative Control.** This mode also uses PID control. It can be used when the process is not linear or changes with time but when these changes cannot be related to a reference signal.

You can use the Autotune feature for all modes except pPI. When adaptative control is selected, the autotune results only serve as starting parameters.

Commissioning the ABB controller for PID control

Connecting the controller to the process loop

1. Make sure the process is not running. Connect the output of the transmitter measuring the process variable related to the loop you want to control to the first analog input (AI1) of the controller.

2. Connect output 1 (AO1) of the ABB controller to your control element.

3. The following figure shows how to connect the controller to components of a process in the case of a single PID flow control loop. The same basic connections are appropriate as well to the control of a different variable.

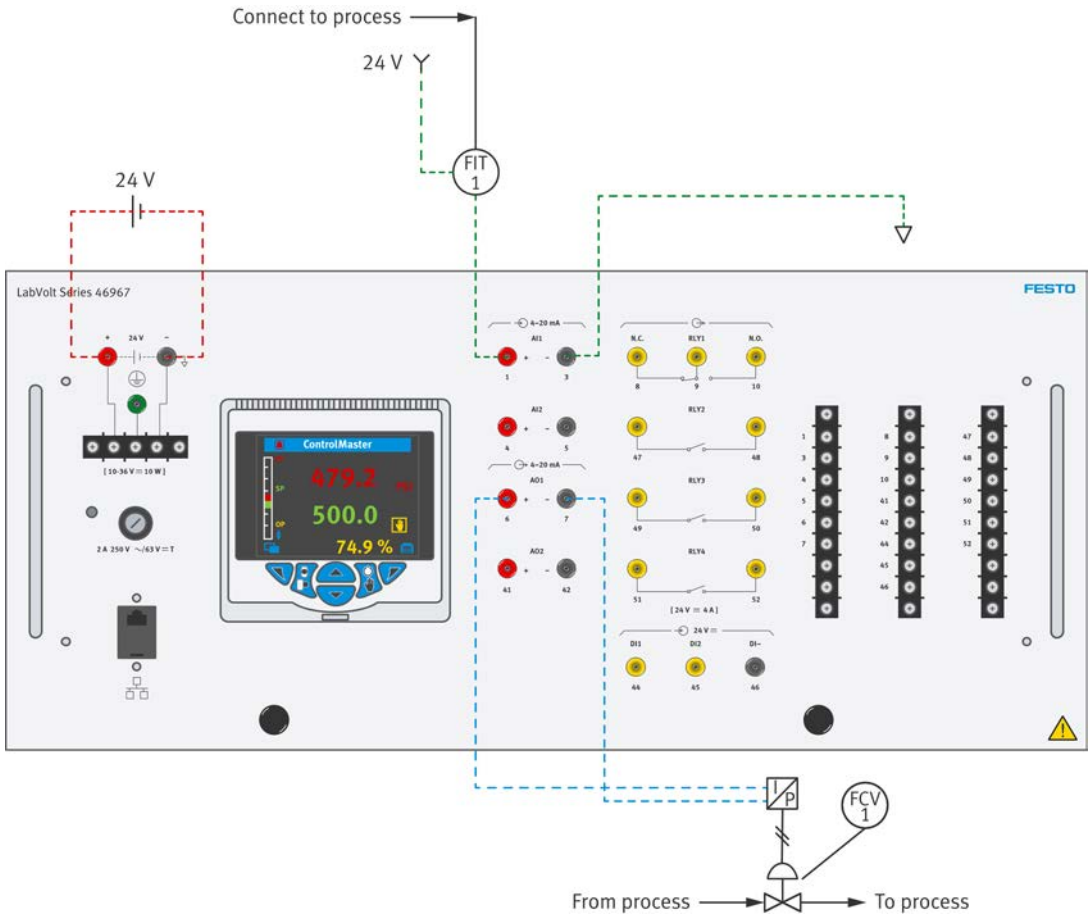

Figure 5: Typical connection of the ABB controller 46967 for PID control.

Configuring the controller

4. Copy the appropriate configuration file to your PC using the following link.

Single Loop PID Control configuration.

https://lx.festo.com/media/e082bb9769004cb8aa90d9352c096b04

5. Power on the controller and plug the IrDA adaptor into your PC.

6. Open the configuration file and download it to the controller. Refer to Appendix A for details.

The following table lists some important parameters for this setup. Analog inputs are scaled between 0 and 100 for a reading from 4 to 20 mA.

Table 2: PID control configuration.

Menu	Parameter description	Setting
Device Setup	Initial Setup/App. Template	Single Loop
	Initial Setup/Loop 1 Output Type	Analog
	Custom Config/Loop 1 PV	Anlg IP 1
Analog Outputs	Analog Output 1/Source	Loop 1 Control OP
	Analog Output 2/Source	Loop 1 PV
Control	Loop 1 Control/Control Type	PID
	Loop 1 Control/Control Action	Reverse

Tuning a PID control loop

7. If you wish to tune the loop with a method requiring a step change, read the following. If you want to use another method skip to Learning Unit 2.

   It is simpler to use a calibrator to perform a step change in the output of loop 1. Simply connect the calibrator to the control element and perform the step change.

   Another method is to manually change the output of the controller from the panel. To do so, press the Manual / Auto key to go to manual mode. Change the output (OP) with the up and down keys when the arrows symbol is located next to it on the display as the following figure shows. You can calculate the parameters with the Ziegler-Nichols method once the process is characterized.

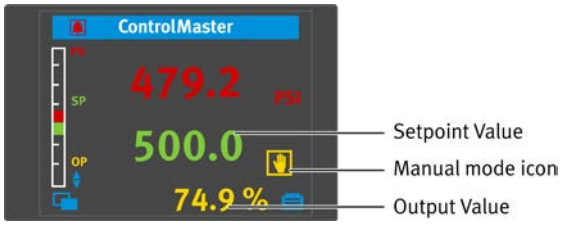

Figure 6: Changing the output of loop 1 in manual mode.

8. An initial set of parameters have been configured with ConfigPilot. You can change the relevant PID control parameters using the controller keypad in the Basic Setup / Loop 1 Control menu. The available parameters are:

    - **Proportional Band 1.** Proportional band is the inverse of proportional gain. It can be set from 0 to 999.9%.
    - **Integral Time 1.** Can be set from 0 to 10000 seconds. Integral action increases when integral time decreases.
    - **Derivative Time 1.** Can be set between 0 and 999.9 seconds. Derivative action increases when derivative time increases.
    - **Manual Reset.** Manual reset, or bias, is activated when the integral effect is turned off. It is the output of the transmitter when the error is zero.

Figure 7: PID parameters in ConfigPilot.

To deactivate the integral action, set Integral Time to 0 or 10000 s. Derivative effect can also be disabled by setting the Derivative Time to 0 s.

9. Set loop 1 to Auto mode by pressing the Manual / Auto key on the front panel of the controller.

10. If you have not yet tuned the controller, you can now proceed to the tuning of the loop with a method not requiring an output step change. Enter the relevant control parameters in the PID menu using the controller keypad.

11. Test the efficiency of loop 1 and fine-tune the parameters if required. You can change the local setpoint of loop 1 using the up and down arrows of the controller to change the setpoint.

Cascade Control

Cascade control utilizes two control loops: a master loop and a slave loop. The particularity of this type of control is that the output of the master loop becomes the setpoint of the slave loop.

It is important to note that the ABB controller is designed to operate in cascade mode with the following characteristics:

- Loop 1 is the master loop (or primary loop).
- Loop 2 is the slave loop (or secondary loop).
- The output of loop 1 serves as the remote setpoint of loop 2.

Commissioning the ABB controller for cascade control

Connecting the controller to the process loop

1. Make sure the process is not running. Connect the output of the transmitter measuring the process variable related to the slave loop to the second analog input (AI2) of the ABB controller.

2. Connect output 2 (AO2) of the ABB controller to your control element.

3. Connect the output of the transmitter measuring the process variable related to the master loop to the first analog input (AI1) of the ABB controller.

4. The following figure shows how to connect the controller to components of a process in the case of a flow/level cascade control scheme. Make the necessary modifications if your cascade control loop is different from the flow/level cascade control loop shown next.

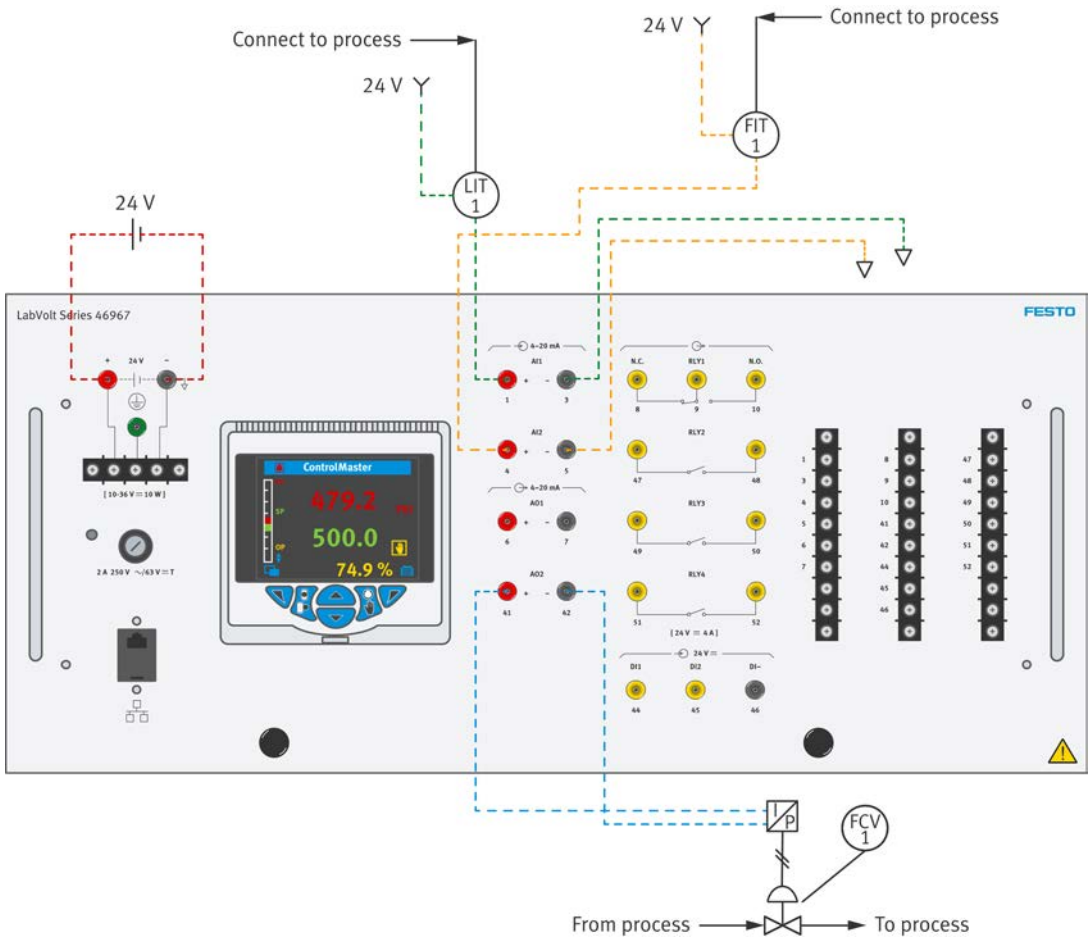

Figure 8: Typical connection of the ABB controller for cascade control.

Configuring the controller

5. Power on the controller.

6. Copy the appropriate configuration file to your PC using the following link.

Cascade control configuration.

https://lx.festo.com/media/06cb89465c2541029f83f16c37a55cfb

7. Open the configuration file and download it to the controller. Refer to Appendix A for details.

   When the controller has restarted, the screen should display the information of the 2 loops as the following figure shows.

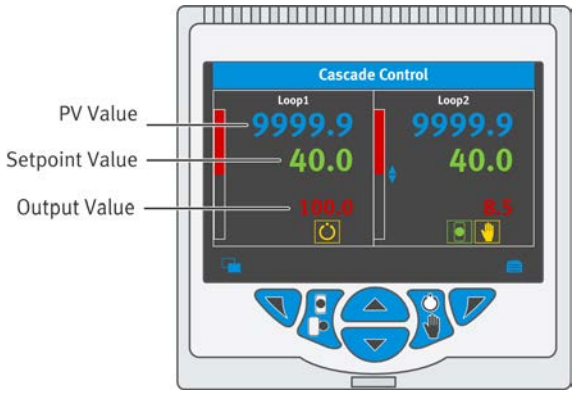

Figure 9: Two process loops displayed on ABB controller 46967.

The following table lists some important parameters for this setup.

Analog inputs are scaled between 0 and 100 for a reading of 4 to 20 mA.

Table 3: Cascade control configuration.

Menu	Parameter description	Setting
Device Setup	Initial Setup/App. Template	Cascade
	Initial Setup/Loop 2 Output Type	Analog
	Custom Config/Loop 1 PV	Anlg IP 1
	Custom Config/Loop 2 PV	Anlg IP 2
	Custom Config/Loop 2 RSP	Loop 1 Control OP
Analog Outputs	Analog Output 1/Source	Loop 1 Control OP
	Analog Output 2/Source	Loop 2 Control OP
Control	Loop 1&2 Control/Control Type	PID
	Loop 1&2 Control/Control Action	Reverse

Tuning a cascade control loop

Tuning the slave loop

When using multiple loops, you can select the value you want to modify by pressing on the left navigation key. Then, follow the steps described next.

- Enter the Adjust menu using the right navigation key.
- Select the parameter to adjust with the up and down keys.
- Confirm with the right navigation key.

The display shows an icon with blue arrows next to the selected parameter indicating that it can be modified with the controller up and down keys.

8. Put the master loop control in manual using the Auto / Manual key and select MANUAL Loop 1. Confirm your selection with the right navigation key.

9. If you wish to tune the slave loop using a method requiring a step change read the following. If you want to use another method skip the next step.

10. It is simpler to use a calibrator to perform a step change in the output of loop 2. Simply connect the calibrator to the control element and perform the step change. The other method is to change the output of the controller using the front panel keys. To do so, with the loop 2 control in manual, change the output with the up and down keys.

    Enter the relevant PID control parameters in the Loop 2 Control menu using the controller keypad. To access this menu, use the left navigation key to go to the Config Mode. Then select Basic and go to the Basic Setup menu.

11. Set the slave loop (loop 2) in Auto mode by pressing the Manual / Auto key.

12. If you have not yet tuned the controller, you can now proceed to the tuning of the slave loop with a method not requiring an output step change. Enter the relevant control parameters in the PID menu using the controller keypad.

13. Test the efficiency of loop 2 and fine-tune the parameters if required. The slave loop should remain in automatic mode until the end of the procedure.

Tuning the master loop

14. If you wish to tune the master loop using a method requiring a step change read the following. If you want to use another method, jump to the Learning Unit 3.

15. In theory, you should perform a step change with the output of the master loop to tune this loop. However, it is simpler to change the setpoint of the slave loop to simulate this step change. This has the same effect, since the output of the master loop controls the setpoint of the slave loop in cascade mode.

To change the loop 2 setpoint, press on the left navigation key and select Adjust Control SP2. A blue arrows icon will be shown next to the loop 2 setpoint value and it will be possible to change it using the up and down arrows on the controller.

Enter the relevant control parameters in the Loop 1 Control PID menu (Proportional Band, Integral Time, Derivative Time, and Manual Reset).

16. Toggle to the remote setpoint mode using the Local / Remote selection key in front of the controller. In this mode, the setpoint of the slave loop is linked to the output of the master loop.

When the control loop uses a remote setpoint, an icon is shown with a dot located outside an oval symbol. When the setpoint selection is local, the dot is shown inside the oval.

17. Set the master loop (loop 1) in Auto mode by pressing the Manual / Auto key.

18. You can now use an appropriate tuning method to tune the controller, if you did not already tune the controller previously with a step-change method. To do so, enter the relevant control parameters in the Loop 1 Control PID menu (Proportional Band, Integral Time, Derivative Time, and Manual Reset).

19. Test the efficiency of loop 1 and fine-tune the parameters if required. The master loop is now tuned and the controller operates in Cascade mode.

    The setpoint of the master loop can be modified using the up and down keys on the controller.

Ratio Control

The process controller can be used to perform ratio control whenever you need to keep a certain ratio between two process variables, usually two fluid flows. This section explains how to configure your controller to a ratio setpoint with proficiency.

Suppose we have two measurement variables A (process 1) and B (process 2) that represent the flow of two different fluids that you want to mix together while keeping a strict proportion R between the two flows, so that:

$$R = \frac{A}{B}$$

The first step is to adjust the parameters of the controller to control the process variable A. Once the controller is correctly tuned, program a ratio setpoint such that $SP_{(A,Ratio)}$ = B·R. This ensures that the targeted value of A is always in the proper proportion with respect to B.

Commissioning the ABB controller for ratio control

Connecting the controller to the process loop

1. The following figure shows how to connect the controller to components of a process in the case of a typical flow control loop where the ratio of the first and second variable is controlled. The same basic connections are appropriate as well to the control of variables different from flow rates.

2. Make sure the process is not running. Connect the output of the transmitter measuring the process variable related to the loop you want to control to the first analog input (AI1) of the ABB controller.

3. Connect the output of a second transmitter measuring the second process variable to the second analog input (AI2) of the ABB controller.

4. Connect output 1 (AO1) of the ABB controller to your control element.

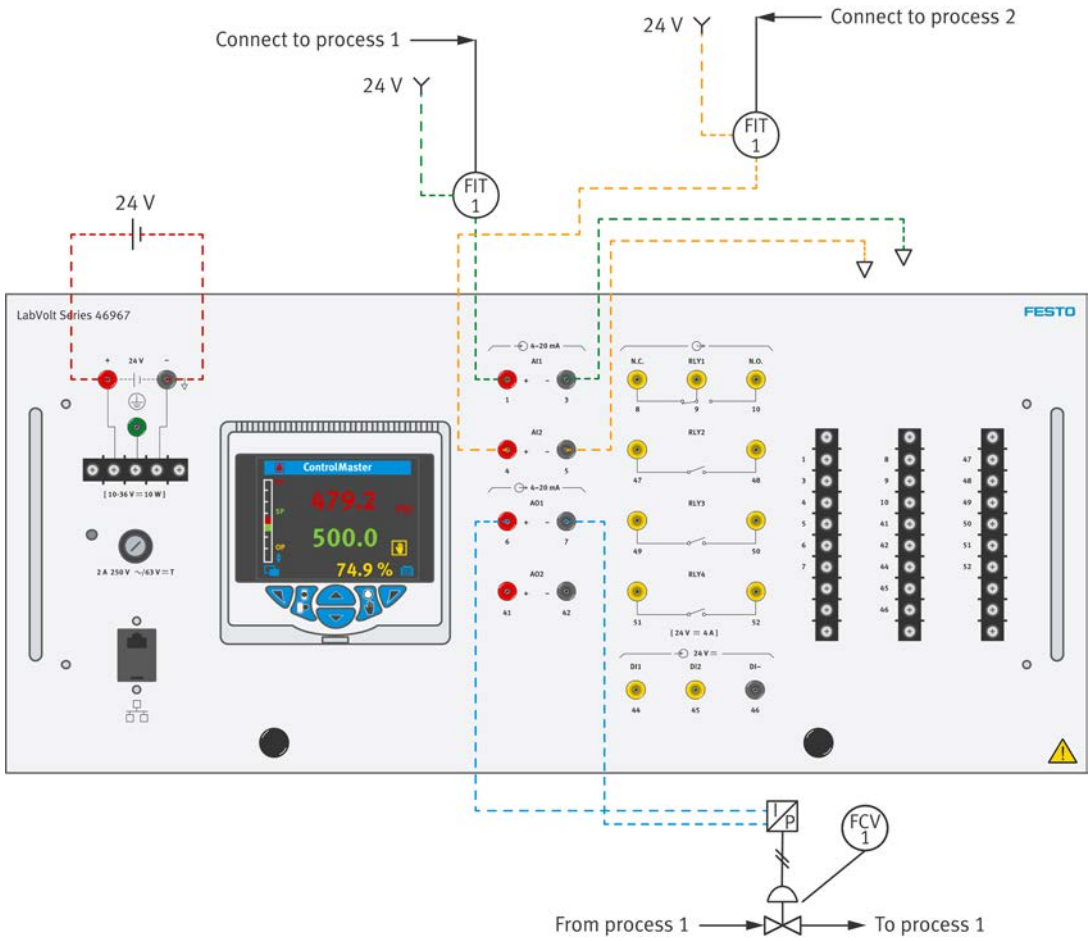

Figure 10: Typical connection of the ABB controller for ratio control.

Configuring the controller

5. Power on the controller.

6. Copy the appropriate configuration file to your PC using the following link.

Ratio Control configuration.

https://lx.festo.com/media/61366f06cdce475b8cef545afafcf2df

7. Open the configuration file and download it to the controller. Refer to Appendix A for details.

   The following table lists some important parameters for this setup. Analog inputs are scaled between 0 and 100 for a reading of 4 to 20 mA. Analog outputs 1 and 2 are also configured for a 4 to 20 mA range.

Table 4: Ratio control configuration.

Menu	Parameter description	Setting
Device Setup	Initial Setup/App. Template	Ratio Control
	Initial Setup/Loop 1 Output Type	Analog
	Custom Config/Loop 1 PV	Anlg IP 1
	Custom Config/Loop 1 RSP	Anlg IP 2
	Custom Config/Loop 2 PV	Anlg IP 2
Analog Outputs	Analog Output 1/Source	Loop 1 Control OP
	Analog Output 2/Source	Loop 1 PV
Control	Loop 1 Setpoints/RSP Ratio	2
	Loop 1 Control/Control Type	PID
	Loop 1 Control/Control Action	Reverse

Using ratio control on the ABB controller

8. Start the process and tune your process loop as explained previously in the PID Control section. Make sure you have adequate control over the first process variable (A) before you proceed to the next step.

   Have the control loop operate in automatic mode.

9. The key to ratio control is to set the Loop 1 Setpoints / RSP Ratio to R, where R is the ratio of the two process variables. In the configuration file provided, the setpoint of loop 1 is equal to 2 times the process value of variable 2.

   You can change this parameter to experiment with different ratios.

Split-Range Control

This section explains how to configure your controller to perform split-range control with proficiency.

The ABB controller allows you to drive its two analog 4-20 mA outputs with a single controller. This is performed in specific schemes to control a single measured variable with two distinct control variables (consequently, two control valves or control elements are required). The total range of the controller is split into two parts: A low-acting part from 0% to the split point and a high-acting part from the split point to 100%. The high-acting range is rescaled from 0 to 100% and is sent to output OP1. The low-acting range is also rescaled to a 0 to 100% signal and it is sent to output OP2.

In the ABB controller, the configuration of the linear relationship between the PID algorithm's input and its two outputs is achieved by setting the Min/Max Input/ Output parameters of the Loop 1 Split O/P menu.

The following figure shows an example where the split point is set to 50% as programmed in the ConfigPilot Split Range Control file.

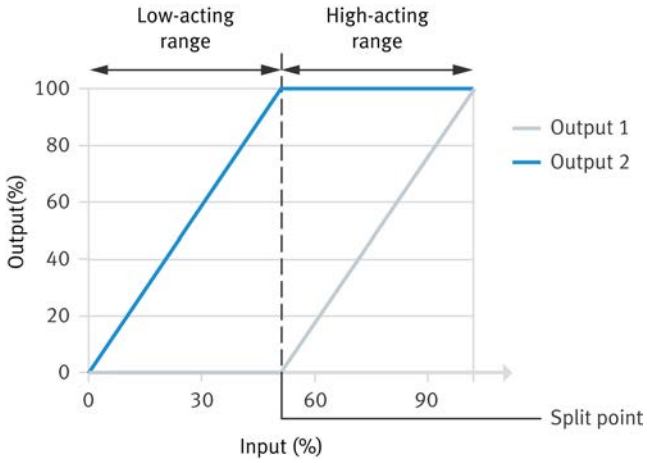

Figure 11: Example of a split-range application.

Commissioning the ABB controller for split range control

Connecting the controller to the process loop

1. Make sure the process is not running. Connect the output of the transmitter measuring the process variable you want to control to the first analog input (AI1) of the ABB controller.

2. Connect output 1 (AO1) of the ABB controller to the control element which will vary when the controller output is above 50%. Likewise, connect output 2 (AO2) of the ABB controller to the control element which will vary when the controller output is below 50%.

3. The following figure shows how to connect the controller to components of a process in the case of a split-range level control loop. The same basic connections are appropriate as well to the control of a different variable.

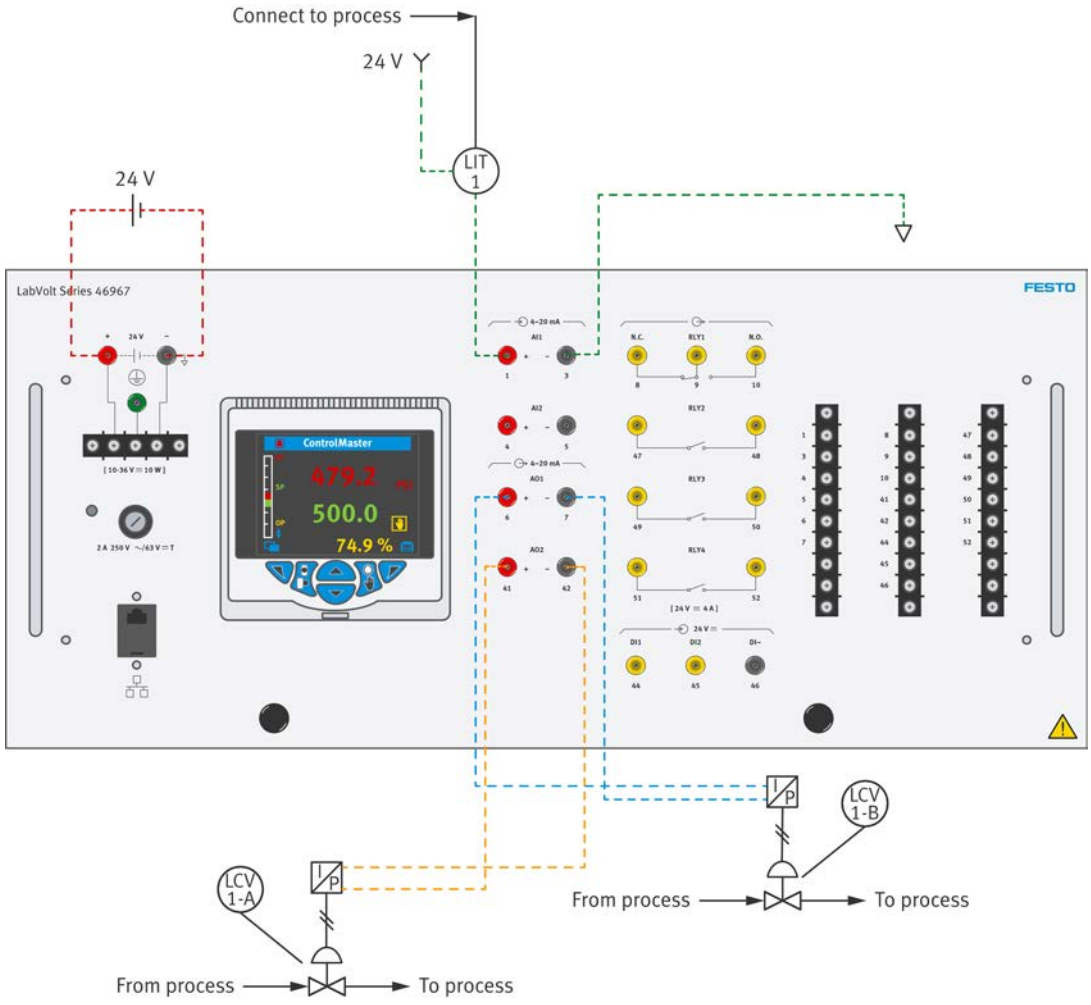

Figure 12: Typical connection of the ABB controller for split-range control.

Configuring the controller

4. Power on the controller.

5. Copy the appropriate configuration file to your PC using the following link.

Split Range Control configuration.

https://lx.festo.com/media/b58a8c5d9155407a98c140ebc3f391e4

6. Open the configuration file and download it to the controller. Refer to Appendix A for details.

   The following table lists some important parameters for this setup. Analog inputs are scaled between 0 and 100 for a reading of 4 to 20 mA.

Table 5: Split-range control configuration.

Menu	Parameter description	Setting
Device Setup	Initial Setup/App. Template	Single Loop
	Initial Setup/Loop 1 Output Type	Split Output
	Initial Setup/Loop 1 Split O/P	Analog/Analog
	Custom Config/Loop 1 PV	Anlg IP 1
	Custom Config/Loop 1 Split O/P	Loop 1 Control OP
Analog Outputs	Analog Output 1/Output Type	Analog
	Analog Output 1/Source	Loop 1 Split OP1
	Analog Output 2/Source	Loop 1 Split OP2
Control	Loop 1 Control/Control Type	PID
	Loop 1 Control/Control Action	Reverse

Tuning the control loop for split-range control

7. Make your process run as it should with its control elements in place. To tune the high-acting part, have the output set manually to 70% for instance with the control valve of the low-acting part adjusted as it should be (typically fully open). Perform a step change from 70 to 80% and obtain the process parameters.

8. Do the same for the low-acting part, using a step change from, for example, 30 to 40%. Obtain your process characteristics and your PID parameters.

9. Select a parameter set that is suitable for both ranges. Test and fine tune the parameters.

10. Let your controller run in automatic mode to perform split-range control on your process.

Some controllers allow you to use two different sets of PID parameters for split-range control. which makes it easier to tune. With the ABB controller, it is possible to use gain scheduling to define three sets of PID parameters that are loaded based on a reference signal, such as the controller output in this case.

Feedforward Control

Feedforward control is a control strategy that uses a separate input signal, such as a disturbance or setpoint, to predict and compensate for changes in the process before they affect the output.

The ABB controller can use static or adaptive gain applied to the feedforward loop to try to eliminate these disturbances.

- Static gain refers to a fixed gain value that is predetermined and remains constant throughout the operation.
- On the other hand, adaptive gain in a feedforward loop refers to a gain value that can be continuously adjusted based on the system's response and performance, allowing for dynamic optimization and compensation for changing process conditions.

Commissioning the ABB controller for feedforward control

Connecting the controller to the process loop

1. Make sure the process is not running. Connect the transmitter measuring the process variable after the control element to the second analog input (AI2) of the ABB controller.

2. Connect output 1 (AO1) of the ABB controller to your control element.

3. Connect the output of the transmitter measuring the process variable before the control element to the first analog input (AI1) of the ABB controller.

4. The following figure shows how to connect the controller to components of a process in the case of a flow feedforward control scheme. Make the necessary modifications if your control loop is different from the feedforward control loop shown next.

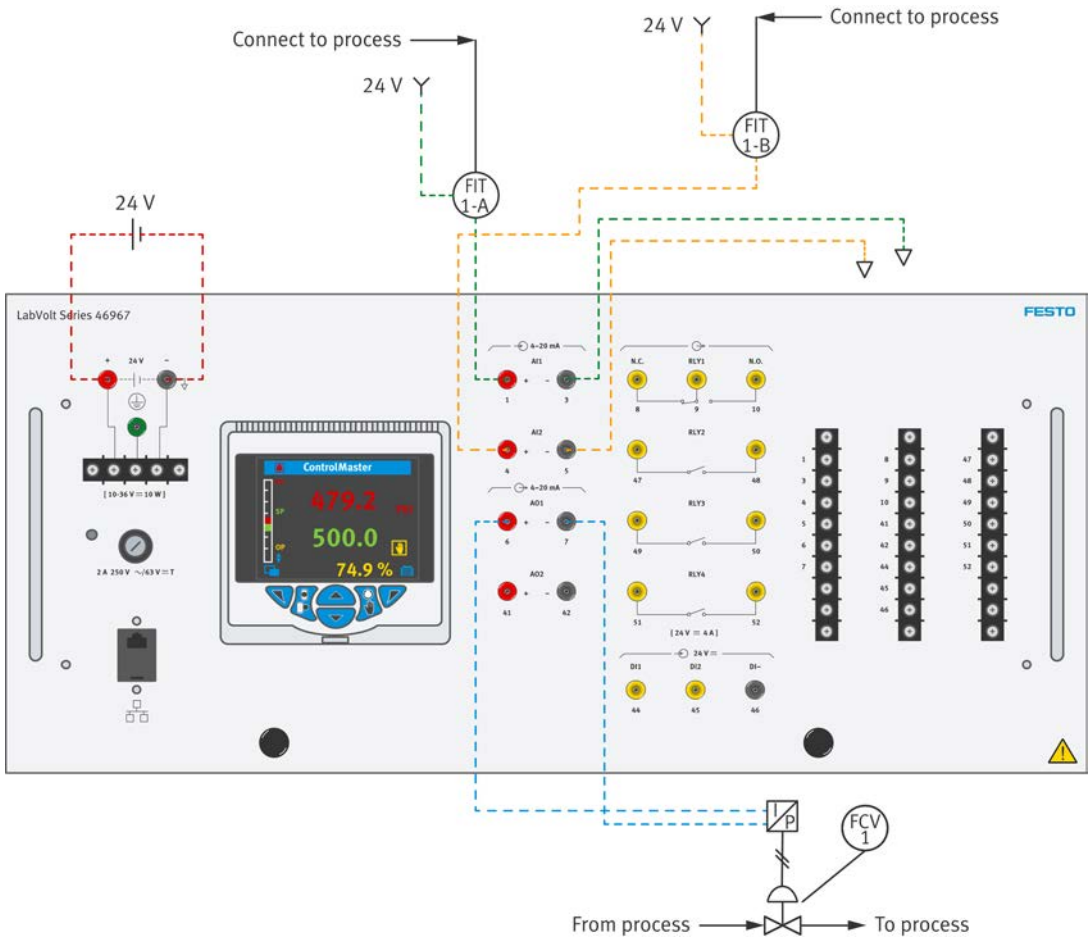

Figure 13: Typical connection of the ABB controller for feedforward control.

Configuring the controller

5. Power on the controller.

6. Copy the appropriate configuration file to your PC using the following link.

Feedforward Control + RSP configuration.

https://lx.festo.com/media/0439e71173304614b23dcb51e68cdcf7

7. Open the configuration file and download it to the controller. Refer to Appendix A for details.

   The following table lists some important parameters for this setup.

   Analog inputs are scaled between 0 and 100 for a reading of 4 to 20 mA.

Table 6: Feedforward control configuration.

Menu	Parameter description	Setting
Device Setup	Initial Setup/App. Template	Feedforward + RSP
	Custom Config/Loop 1 PV	Anlg IP 1
	Custom Config/Loop 1 RSP	Anlg IP 2
	Custom Config/Loop 1 Feedforward	Loop 1 Feedforward
Analog Outputs	Analog Output 1/Source	Loop 1 Control OP
	Analog Output 2/Source	Loop 1 PV
Control	Loop 1 Control/Control Type	PID
	Loop 1 Control/Control Action	Reverse

Using feedforward control with remote setpoint

8. Put the master loop control in manual using the Auto / Manual key and select MANUAL Loop 1. Confirm your selection with the right navigation key.

9. Start the process and tune your process loop as explained previously in the PID Control section. Make sure you have adequate control over the first process variable (A) before you proceed to the next step.

10. Set controller in Auto mode by pressing the Manual / Auto key to operate in feedforward control only and change the local setpoint as needed with the controller front keys.

11. Press on the Local / Remote setpoint mode selection key on the front of the controller to activate the remote setpoint. The feedforward loop will now use the flow rate from the orifice plate transmitter as the setpoint to control the inlet flow loop.

ConfigPilot Software for ABB Controller

Configuration software

Requirements

The ABB controller comes with a software that allows an easy configuration of the controller. This software, called ConfigPilot, requires a minimum of configuration before you can use it for communication with the controller. It also comes with an infrared interface named IrDA USB.

This section details how to install and configure the required software and feature to your computer in order to communicate with the controller.

The minimum system requirements to install the needed software are :

- Windows® 7 SP2, Windows 8 Pro or Windows 10 (minimum version 1607)
- 2 GHz Intel Pentium dual core processor (or equivalent)
- 4 GB RAM
- 200 MB free hard disk space
- 1024 x 768 minimum screen resolution

Software and driver installation

USB IrDA adaptor driver installation

Except for Windows 7/8 users, install the driver before plugging the adapter into the USB port as it may cause problem to use it.

1. To enable the IrDA interface support in Windows 10, open the Settings and select System and then Optional features.

2. Look in the installed feature to see if IrDA infrared is present. If not, click on "Add a feature" and select it from the list.

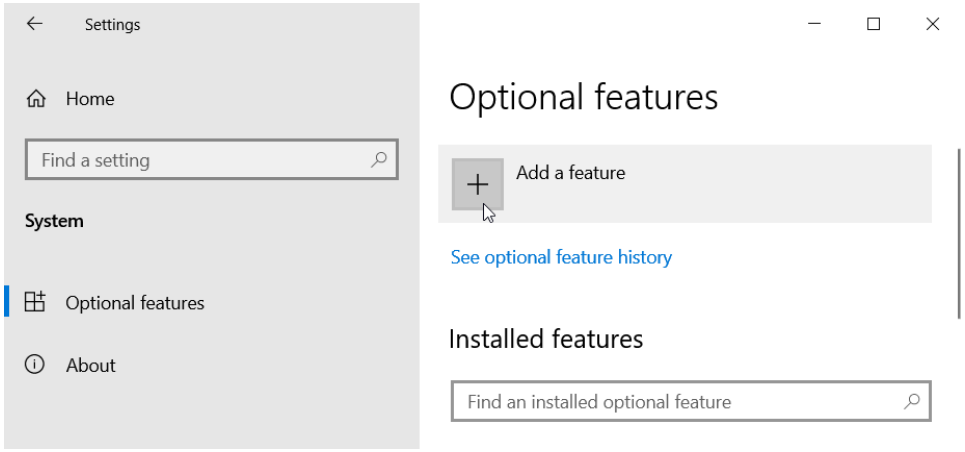

Figure 14: Installation of the IrDA infrared feature.

3. Proceed with the installation of the IrDA infrared feature.

4. Install the IrDA interface driver. To do so, execute the setup.bat from the CD or download the file from the internet on the ABB controller website.

ConfigPilot installation

5. Make sure you have the ConfigPilot software installation files on hand. They can be found on the provided CD or on the manufacturer website.

6. Execute the Setup.exe file from the ConfigPilot CD or installation folder.

7. Complete the installation by following the instructions displayed on your screen.

You can uninstall ConfigPilot through the Add/Remove programs feature found in the Windows Control Panel. Always proceed with uninstall process before updating your software version.

ABB controller configuration using ConfigPilot

IrDA interface

The ABB controller 46967 can be configured with the ConfigPilot software. To upload and download a configuration file to the controller, a PC uses an IrDA adaptor connected to its USB port.

This adapter needs to be aligned with the IrDA port on the front of the controller. A mounting bracket can be used to facilitate the alignment as the following figure shows.

The IrDA adaptor should be located no more than 8 inches or 200 mm away from the controller port.

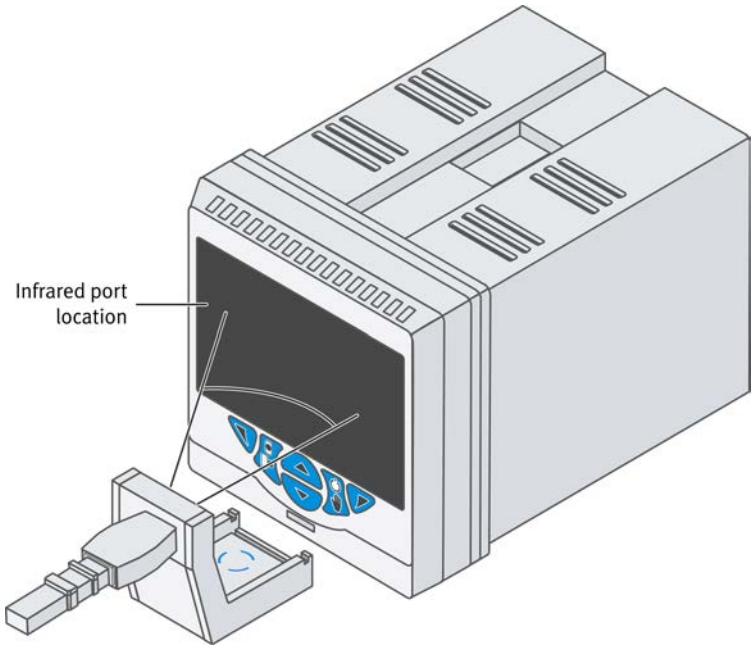

Figure 15: IrDA adaptor mounting bracket.

8. Press on the right navigation key on the controller and go to Access Level / Advanced / Device Setup menu.

9. Press on Select and go to IrDA Configuration menu. Choose Connect to start the connection process.

10. Make sure the IrDA adaptor is directed toward the controller.

    Once connection is established, a Connected message is displayed on the controller screen. The communication status is also shown at the bottom of the ConfigPilot window.

11. Once connected to the controller, you can upload the configuration file to your PC if you wish to work with the actual configuration of the controller.

    To do so, press on the Read icon and wait for the process to complete.

12. Configuration files can be stored on your computer as a reference. They can be downloaded later to the controller if needed.

    To use an existing file to configure the controller, open the desired file using the Open icon.

13. To download the configuration, click on the Write icon while the controller is connected to the PC. A warning message will be shown. Choose Yes to proceed.

14. Once download is done, the controller screen will display Complete. Press on the left navigation key to exit and restart the controller.

When the transfer of a configuration file fails, you need to reset the controller to default before trying again.

To do so, power it off and on again. Go to the Advanced / Initial Setup menu and select Reset to Defaults. When the controller reboots after its reset, repeat the previous steps to try again the download process.

Creating a new configuration file

15. To create a new project for a CM30 controller, select New in ConfigPilot home page.

16. Configure the required build options as shown in the following figure and proceed by setting the parameters as needed.

    Save your new configuration file and download it to the controller to test it.

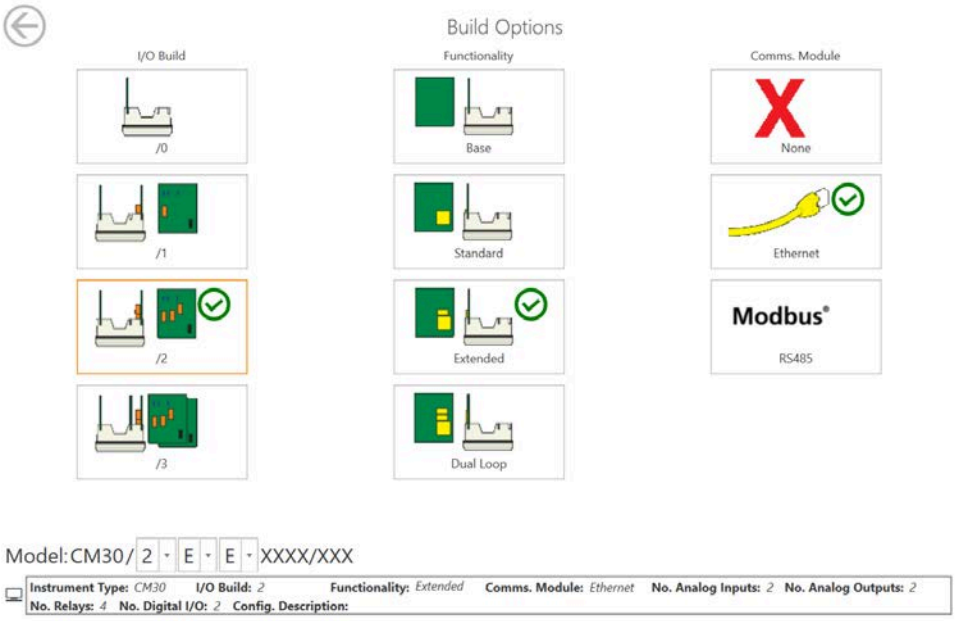

Figure 16: ConfigPilot build options.

Ethernet Configuration for ABB Controller

How to configure Ethernet communication

To be able to communicate with the ABB controller via Ethernet, a network card on your computer must be configured properly as well as the controller. The parameters needed for Ethernet communication are not part of the configuration file from ConfigPilot so they must be set manually.

This section describes how to configure both the Ethernet interface of your computer and the controller.

How to configure the PC Ethernet card

1. From the computer Control Panel, open the Network Connections folder and double-click on Local Area Connection to open the Local Area Connection Status window (see the following figure). This allows you to change your LAN (Local Area Network) parameters.

If there is more than one connection available in the Network Connections folder, make sure to double-click on the Local Area Connection associated with the Ethernet card to which the equipment will be connected.

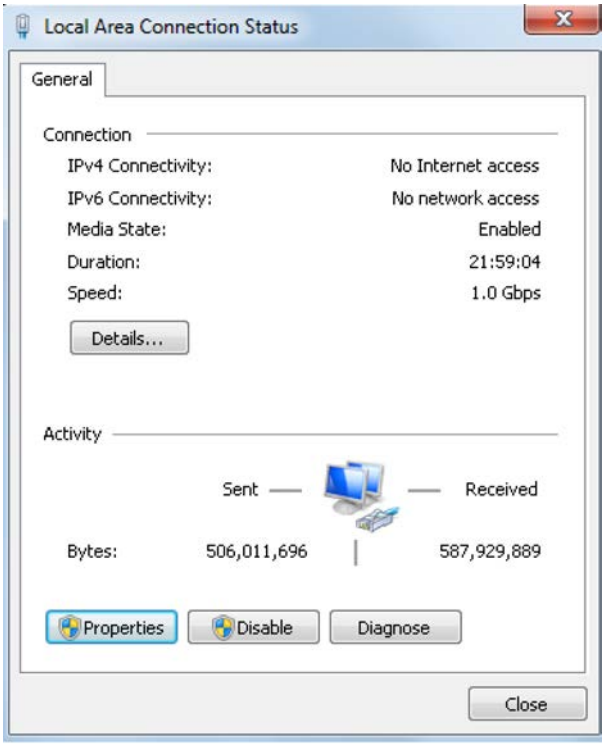

Figure 17: Local Area Connection Status window.

2. Click on Properties (see the following figure) to display the Local Area Connection Properties window.

3. Double-click on the Internet Protocol Version 4 (TCP/IPv4) item to open the properties window.

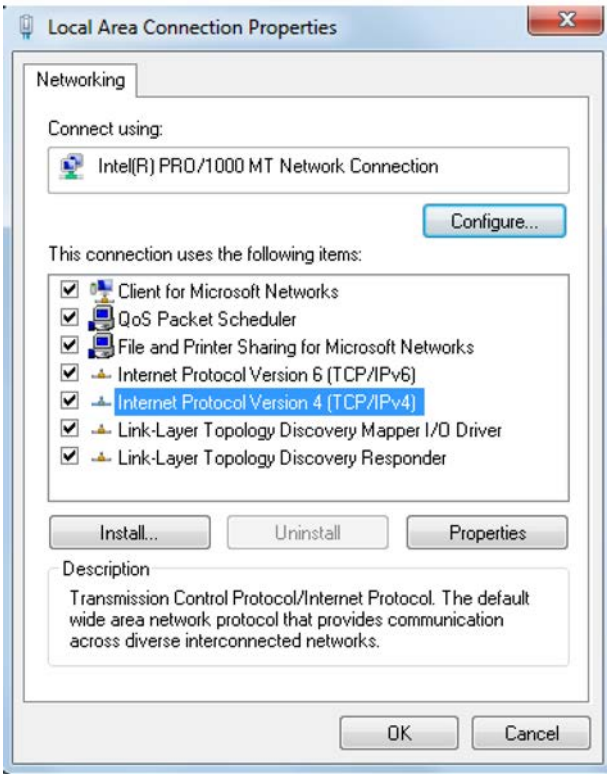

Figure 18: Local Area Connection Properties window.

4. Select "Use the following IP address" and enter 192.168.2.40 in the IP address section and 255.255.255.0 in the Subnet mask section as shown in the following figure.

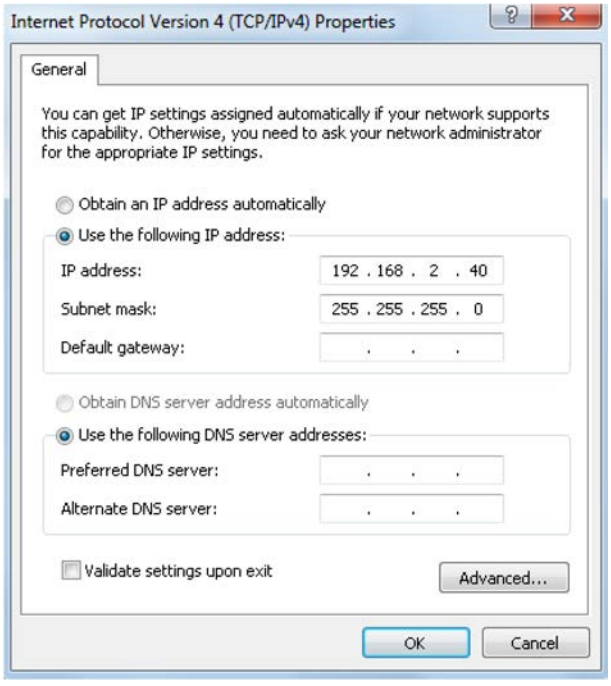

Figure 19: Internet Protocol (TCP/IP) Properties window.

5. Once the IP address and subnet mask are entered, click OK to apply the changes and close the Internet Protocol (TCP/IP) Properties window.

6. Click OK to close the Local Area Connection Properties window.

7. Click Close to close the Local Area Connection Status window.

Controller configuration

8. Once your computer is properly configured, use an Ethernet cable to connect your computer to the ABB controller. Be sure the controller is powered by a 24 V source.

9. Use the right navigation key, go to the Access Level menu.

   Select Advanced and then use the arrows to go to the menu Communication.

10. Select Ethernet and set the parameters as shown in the following table.

Table 7: ABB controller Ethernet parameters.

Parameter	Setting
DHCP	OFF
IP Address	192.168.2.1
SubnetMask	255.255.255.0
Default Gateway	0.0.0.0

Testing Ethernet communication

11. Open a page in a web browser on your PC and enter the IP address of the controller in the address bar. The controller status is displayed in real time in a webpage as the following figure shows.

The webpage may differ depending on the number of loops configured in the controller.

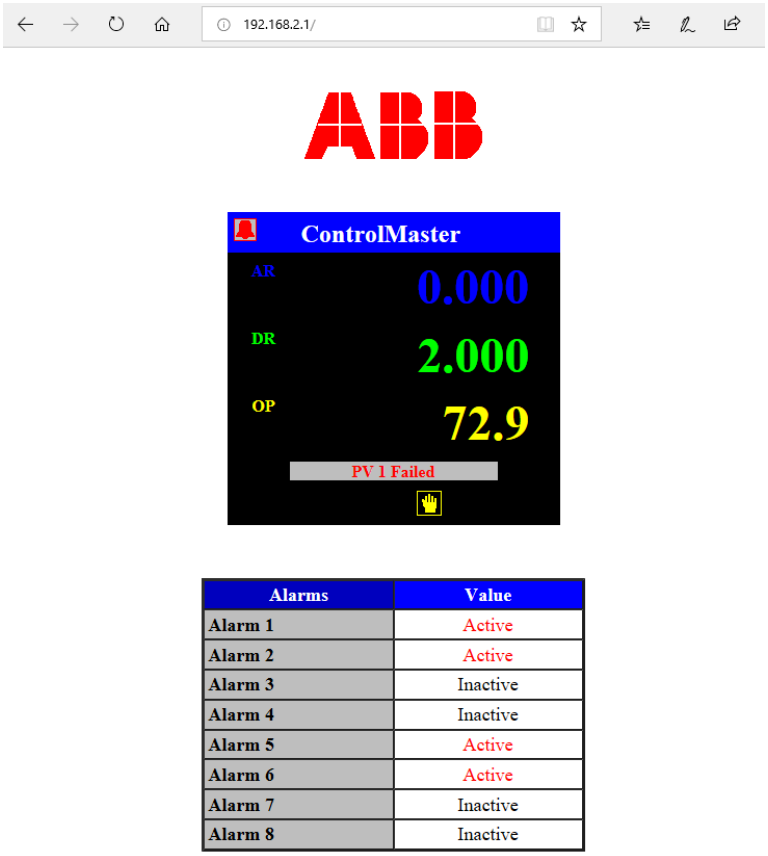

Figure 20: Real-time status of the ABB controller is available through a webpage.

List of Faults on the ABB Controller

Table 8: List of faults on the ABB controller, Model 46967.

Fault	Fault Description
1	Cuts the 24 Vdc power supply to the controller.
2	Opens circuit relay RLY 4 (terminal 51).
3	Opens analog input 1 (terminal 1).
4	Opens analog input 2 (terminal 4).
5	Opens circuit relay RLY 2 (terminal 47).
6	Opens digital input 1 (terminal 44).
7	Opens circuit relay RLY 1 (terminal 9).
8	Opens circuit relay RLY 3 (terminal 49).
9	Opens analog output 1 (terminal 6).
10	Opens analog output 2 (terminal 41).

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User Guide

ABB Controller

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