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Dimming with LOGO! 8

LOGO! 8

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Table of Contents

1 Task

1.1 Overview

Introduction

The LOGO! controller is a logic controller for simple applications. It is frequently used in building automation. This application example shows how to dim different lamp types using a LOGO!.

Overview of the automation task

The following figure provides an overview of the automation task.

Figure 1-1
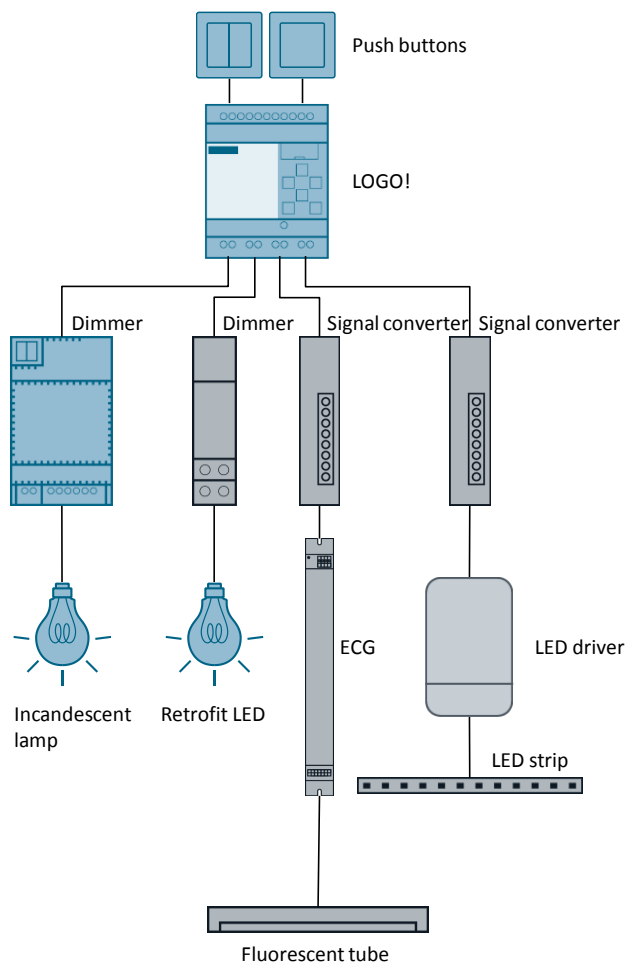
Two scenarios show you how to "intelligently" use your standard lighting control by using a LOGO! and the simple programming function of LOGO! Soft Comfort.

1.2 Scenarios

1.2.1 Scenario A: Seminar Room Lighting

Scenario A describes lighting control of a seminar room with the following equipment:

- Room illumination using fluorescent tubes
- Push button for selecting the lighting mode

The following table provides an overview of how the room is used in Scenario A.

Table 1-1: Room use – Scenario A

Mode	Room use	Function
1	Video	This mode significantly dims all lights.
2	Presentation with beamer	Significantly dims the row of lamps closest to the video projector. Slightly dims the center row of lamps. Does not dim the row of lamps at the window.
3	Presentation without beamer	Makes all lamps as bright as possible.
4	Celebration	Slightly dims all lamps.
5	Unused	Turns off all lights.

1.2.2 Scenario B: Living Room Lighting

Scenario B describes lighting control of a living room with the following lighting elements:

- Incandescent lamps
- Retrofit LEDs
- LED strips

The following lighting functions are available:

- Long-press push button:
  Pressing the push button increases and/or reduces the brightness of the light.
- Short-press push button:
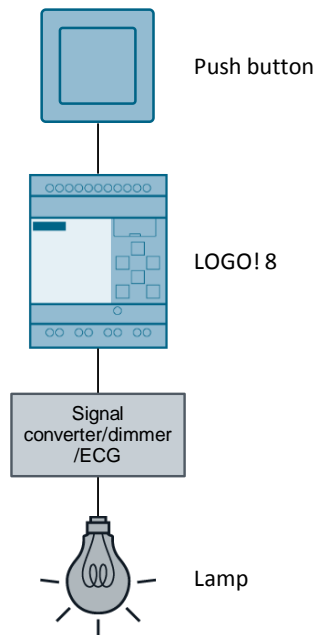 The lighting is turned on or off.

2 Solution

2.1 Overview

Diagrammatic representation

The diagrammatic representation below shows the most important components of the solution.

Figure 2-1

Push button

LOGO! 8

Signal converter/dimmer /ECG

Lamp

A push button or the LOGO! 8 cursor keys are used to set the brightness of the appropriate lamp. Scenario A additionally allows control with the cursor keys using the integrated Web server of the LOGO! 8.

Depending on the respective dimmer or electronic control gear (ECG), the brightness is set via an analog value or a digital signal. The dimmer/ECG sets the lamp to the desired brightness.

Scenario A: Seminar Room Lighting

To dim a fluorescent tube, a dimmable ECG must be connected in series to the fluorescent tube.

In addition, a signal converter must be connected between the LOGO!'s analog output and the ECG.

Scenario B: Living Room Lighting

An LED strip is powered by direct current. This requires that a dimmable LED hardware driver be connected in series.

In addition, a signal converter must be connected between the LOGO!'s analog output and the LED hardware driver.

In order to dim an incandescent lamp or retrofit LED, a dimmer must be connected in series to the lamps. This dimmer can be controlled via one or two digital signals.

Advantages

The solution presented here offers the following advantages:

- Integration of your LOGO! into home automation
- Flexible brightness control with the LOGO!

Required knowledge

Knowledge of LOGO! Soft Comfort and basics of electrical engineering.

2.2 Hardware and software components

2.2.1 Validity

This application example is valid for LOGO! Soft Comfort V8 and LOGO! 8.

2.2.2 Components used

The application example was created with the following components:

Hardware components

Table 2-1

Component	No.	Manufacturer	Article number	Note
LOGO!Power 24V power supply	1	Siemens	6EP1332-1SH43	Power supply for LOGO! and AM2 AQ
LOGO! 8 controller	1	Siemens	6ED1052-1MD00-0BA8	-
LOGO! AM2 AQ signal module	3	Siemens	6ED1055-1MM00-0BA2	-
Push button	3	Siemens		Here you can find various inserts for push buttons: https://mall.industry.siemens.com/mall/en/de/Catalog/Products/10000549
Signal converter	4	e.g., Rinck	NP-SPS10V.EVG/24V	-
LED driver	1	e.g., TCI	122400	To control LED strips
LED strip	1	e.g., Lumitronix	37915	-
Dimmer	1	e.g., Hager	EVN011	To dim a retrofit LED.
Dimmer	1	Siemens	5WG1527-1AB41	To dim an incandescent lamp.
Incandescent lamp	1	e.g., Philips	EAN 8711500354532	-
Retrofit LED	1	e.g., Philips	19200800	-

Component	No.	Manufacturer	Article number	Note
ECG	1	e.g., Philips	91190230	Electronic control gear for dimming fluorescent tubes
Fluorescent tube	3	Osram	EAN 4050300517841	-

Software components

Table 2-2

Component	No.	Article number	Note
LOGO! Soft Comfort V8	1	6ED1058-0BA08-0YA1	This application example uses version V8.0.0.

Sample files and projects

The following list contains all files and projects that are used in this application example.

Table 2-3

Component	Note
109739085_dimming_with_LOGO_CODE_v10.zip	This .zip file contains one LOGO! Soft Comfort file for each scenario.
109739085_dimming_with_LOGO_DOCU_v10_en.pdf	This document.

3 Basics

The requirements for dimming the lamp types presented in this document differ significantly.
The following chapters provide more information on

- how the respective lamp type works

- the lamp type requirements for dimming

- controlling the lamp types with the LOGO!.

3.1 Incandescent lamps

Function of an incandescent lamp

Incandescent lamps are powered by alternating current.

Requirements of an incandescent lamp for dimming

Incandescent lamps can be dimmed using leading-edge or trailing-edge phase control.
During the process, the r.m.s. value of the transmitted voltage is reduced by suppressing a part of each sinusoidal half-wave.

Figure 3-1

Requirements for dimming an incandescent lamp with the LOGO!

This requires a dimmer with the following features:

- Control via a 0-10 V, 1-10 V, 4-20 mA signal or a digital signal

- Dimming via leading-edge or trailing-edge phase control

Note	This application example uses a dimmer from Hager. This dimmer can be controlled via a digital signal. Alternatively, the Siemens dimmer can also be used. This application example uses this dimmer to dim the retrofit LED.

3.2 Retrofit LED

Function of the retrofit LED

LED luminaires consist of one or more bright light-emitting diodes.

These light-emitting diodes are powered by direct current.
Retrofit LEDs were developed to use LEDs in a socket for incandescent lamps.
These retrofit LEDs have additional electronics installed that provide the LED with constant current.

Note	Not all retrofit LEDs are dimmable and not all dimmable retrofit LEDs can be dimmed via leading-edge phase control. Please refer to the retrofit LED's product data sheet.

Requirement for dimming a retrofit LED with the LOGO!

This requires a dimmer with the following features:

- Control via a 0-10 V, 1-10 V, 4-20 mA signal or a digital signal

- Dimming via leading-edge phase control (applies only to the retrofit LED used in this application example)

Note	This application example uses a dimmer from Siemens. This dimmer can be controlled via a digital signal.

3.3 LED strips

Function of LED strips

LED strips consist of multiple bright light-emitting diodes. LED strips are powered by direct current.

Requirement for dimming an LED strip with the LOGO!

Dimming with the LOGO! requires a dimmer with the following features:

- Control via a 0-10 V, 1-10 V, 4-20 mA signal or a digital signal

- The dimmer output supplies direct voltage

- The current and voltage range of the dimmer output is matched to the LED strip

Note	This application example uses a dimmer that is controlled via a 0-10 V signal. As the dimmer supplies 10 V via the control inputs, a signal converter is connected between the LOGO! and the dimmer. The signal converter allows dimming to 0 V. Chapter 3.5 Background information on using a signal converter describes the background in greater detail.

3.4 Fluorescent tube

Function of the fluorescent tube

To illuminate a fluorescent tube, a high igniting voltage must be applied at the beginning. This igniting voltage causes the gas fill to ionize. Once the gas fill is ionized, current flows. The fluorescent tube is illuminated as long as the fluorescent tube's minimum current flows. Electronic control gear (ECG) is connected in series to the fluorescent tube. This increases the frequency and therefore the fluorescent tube's life.

Requirement for dimming a fluorescent tube with the LOGO!

Dimming a fluorescent tube requires ECG with the following features:

- Control via a 0/1-10 V, 4-20mA signal or a digital signal
- Voltage, current and frequency at the ECG output are matched to the fluorescent tube

Note	This application example uses ECG that is controlled via a 1-10 V signal. As the ECG supplies 10 V via the control inputs, a signal converter is connected between the LOGO! and the ECG. The signal converter allows dimming to 0 V. Chapter 3.5 Background information on using a signal converter describes the background in greater detail.

3.5 Background information on using a signal converter

The logic controller is a voltage source that supplies 0-10 V and has an internal resistance R1.

The component for dimming, too, is a voltage source that constantly supplies 10 V and has an internal resistance R2.

Figure 3-2
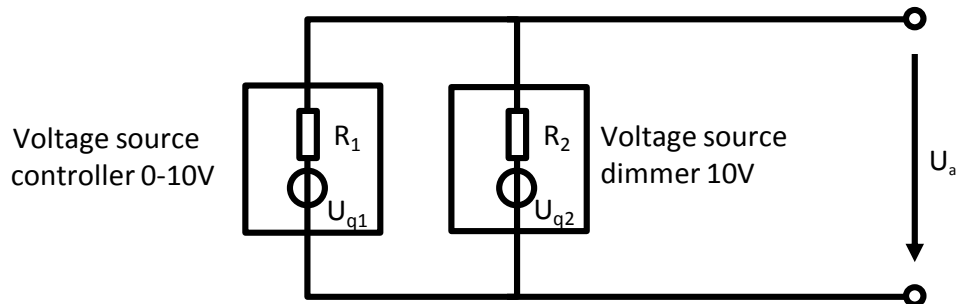
$$U_a = \frac{U_{q1} * R_2 + U_{q2} * R_1}{R_1 + R_2}$$

Dimming to the minimum (the LOGO!'s analog output supplies 0 V) results in the following signal states:

- U_{q1} = 0 V.

- U_{q2} = 10 V.

For the output voltage, this results in the following formula:

$$=> U_a = \frac{0V * R_2 + 10V * R_1}{R_1 + R_2} = 10V \frac{R_1}{R_1 + R_2}$$

As the internal resistance of the LOGO! (R_1) is high, R_2 must be very high so that the output voltage U_a becomes approx. 0 V. As this is mostly not the case, dimming to 0 V (corresponds to 0 %) would not be possible. The signal converter connected between the LOGO! and the dimmer allows dimming from 0-100 %.

4 Principle of Operation

To control a lamp, an analog or digital output of the LOGO! must be set. The following two scenarios show you how to design your program such that you can control a dimmer via an analog or digital output.

4.1 Scenario A: Seminar Room with Fluorescent Tubes

4.1.1 Requirements for the program

- Three lamps are dimmed depending on the selected mode and the row of lamps the lamp is in.
1. The mode can be changed using the "right" and "left" cursor keys of the LOGO!.
2. The mode can be changed using an external push button at input I1.

4.1.2 Structure of the program

This chapter divides the program into different functional parts and describes them in detail.
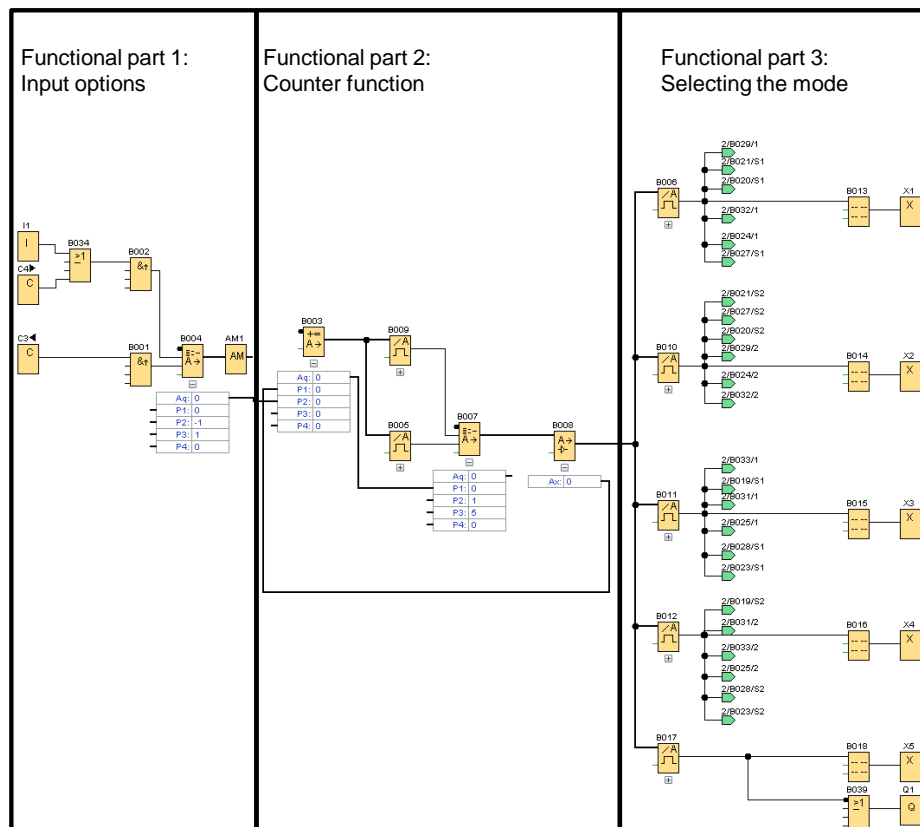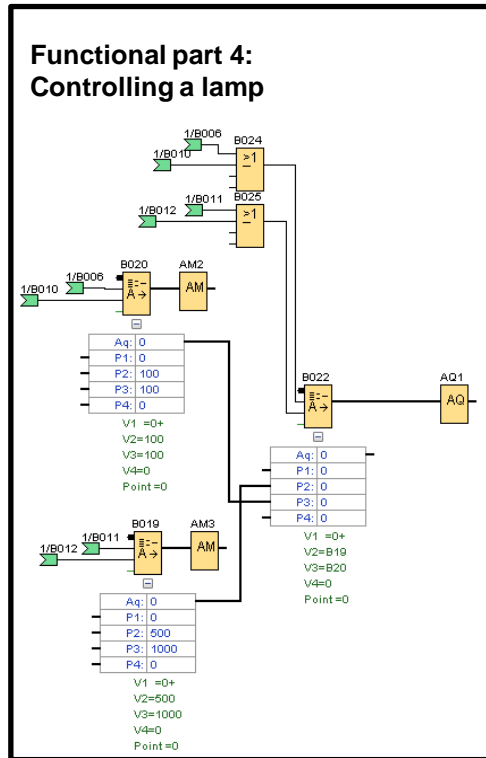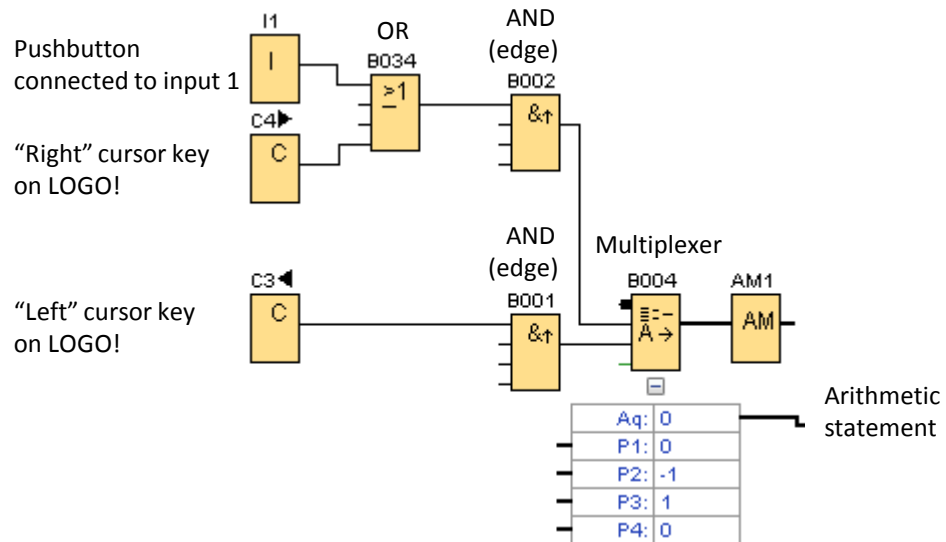
Figure 4-1: Functional part 1-3

Figure 4-2: Functional part 4

Functional part 1: Input options

This section shows the control elements and their direct influence on the program.

Figure 4-3: Input options

- The following input options are available:
  - Push button at input I1
  - "Right" cursor key on the LOGO!
  - "Left" cursor key on the LOGO!
- In this application example, the push button at input I1 has the same function as the "right" cursor key.
- The "AND (edge)" gates make sure that a pulse with a maximum duration of one cycle is sent to the multiplexer.
- Depending on which key is pressed, the multiplexer returns the value "1" for counting up or the value "-1" for counting down to the arithmetic statement that serves as a counter.

Functional part 2: Counter function

As there are only a certain number of modes, the counter must not increment without limits. The current count must be checked. If the count is too high, the system returns to the first mode. If the count is too low, the system goes to the last mode. The following section shows the software implementation.

Figure 4-4: Counter function
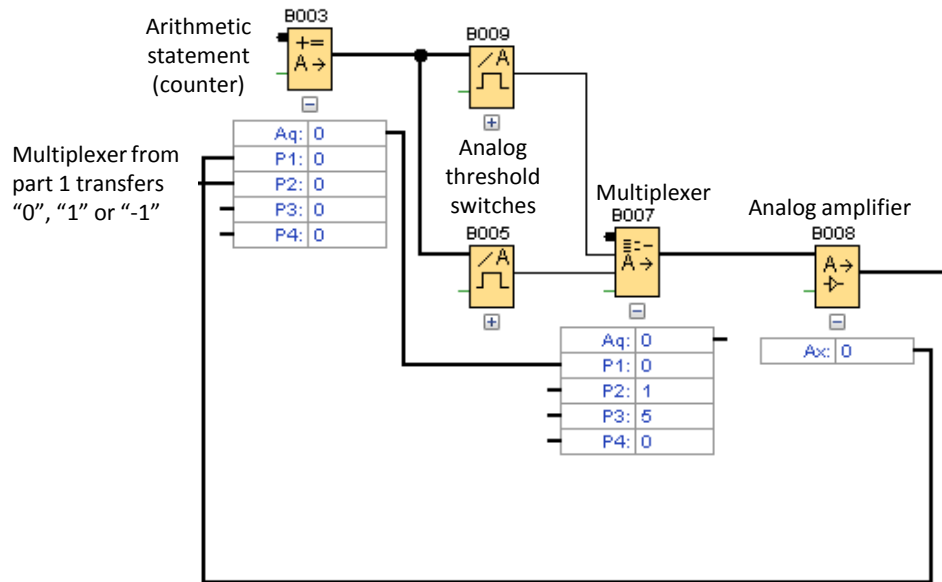
- The value from the previous cycle is transferred to the arithmetic statement via P1.
- The multiplexer from functional part 1 determines whether the arithmetic statement counts up, down or not at all.
- The analog threshold switches check whether the new value is in the range from "1" to "5".
- If the new value is "6", the multiplexer overwrites it with the value "1".
- If the new value is "0", the multiplexer overwrites it with the value "5".
- The analog amplifier is required to transfer the determined value back to the arithmetic statement.

Functional part 3: Selecting the mode

The following section shows how the count is checked and, subsequently, the appropriate mode is selected.

Figure 4-5: Selecting the mode
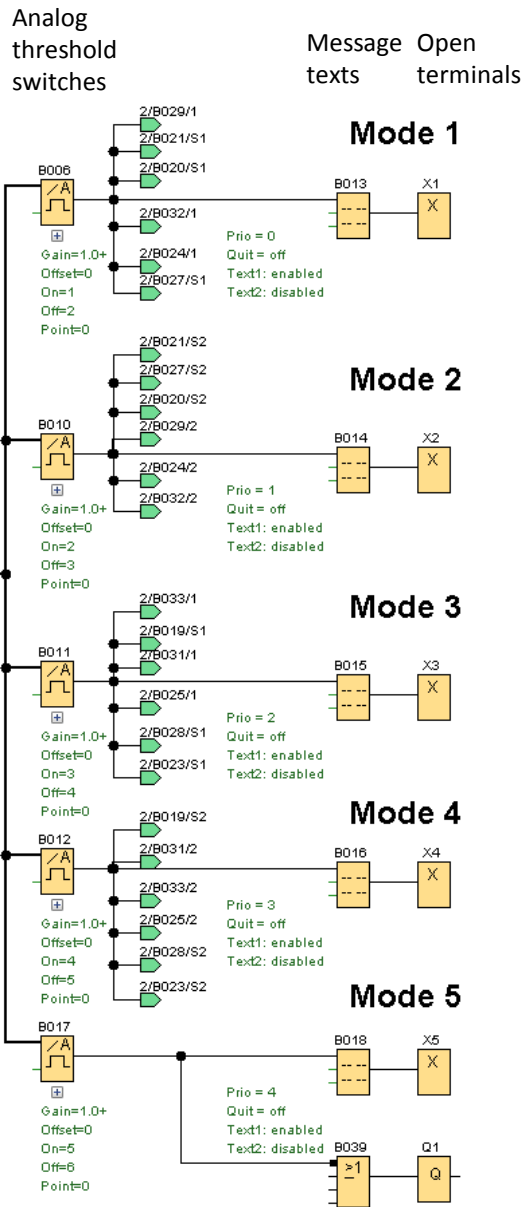
- The analog threshold switches monitor the determined analog value from functional part 2 and enable the appropriate mode.
- The message texts display the selected mode.
- The green arrows represent connections to functional part 4.

Functional part 4: Controlling a lamp

Multiplexers are interconnected to output the correct analog value depending on the selected mode (see Figure 4-6).

Figure 4-6: Controlling a lamp
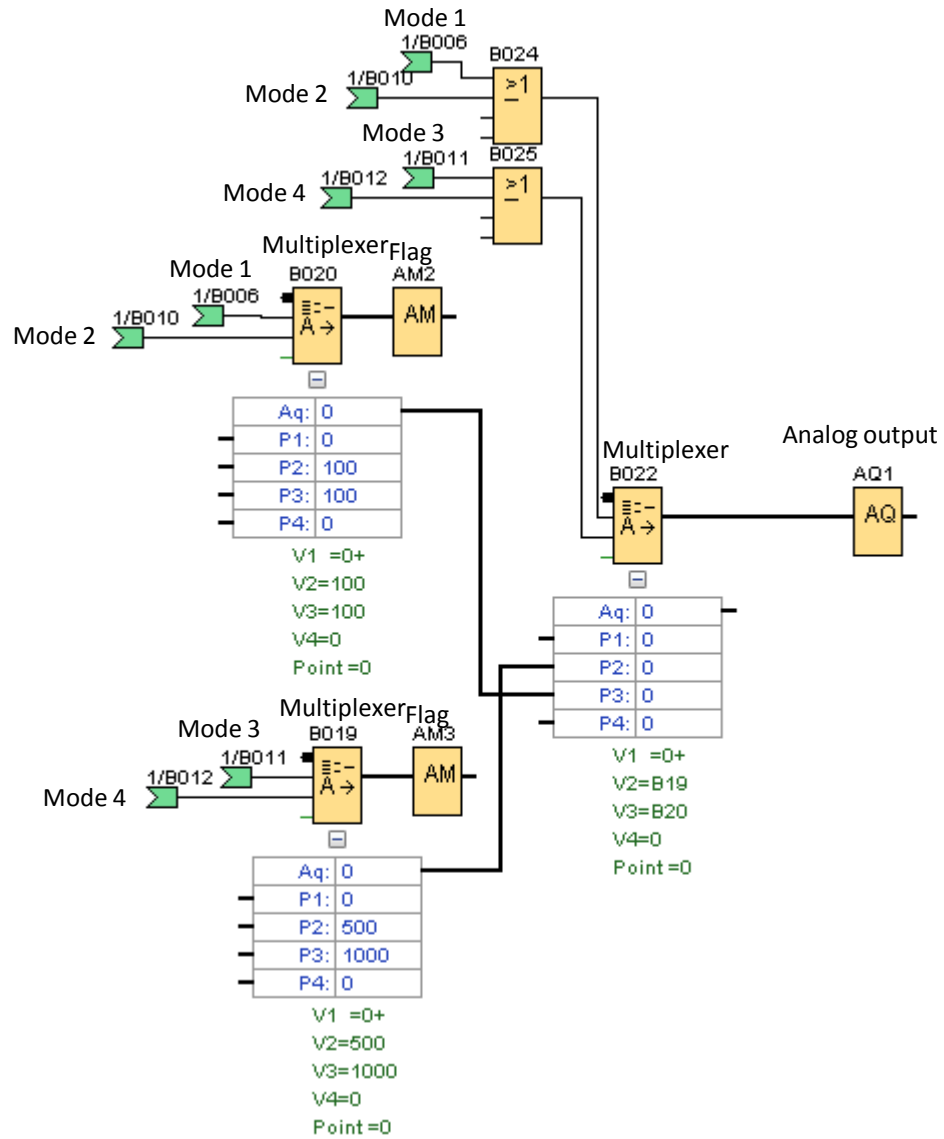
4.2 Scenario B: Living Room with Incandescent Lamps, Retrofit LEDs and LED Strips

4.2.1 Requirements for the program

3. The lamps are dimmed using push buttons or the LOGO! cursor keys.

4. Long-pressing a cursor key on the LOGO! or a push button increases and/or reduces the brightness of the lamps until the push button is released.

5. Short-pressing a cursor key on the LOGO! or a push button turns the lamps off or on.

4.2.2 Structure of the program

This chapter divides the program into different functions and describes them in detail.

Figure 4-7: Overview of the functional parts
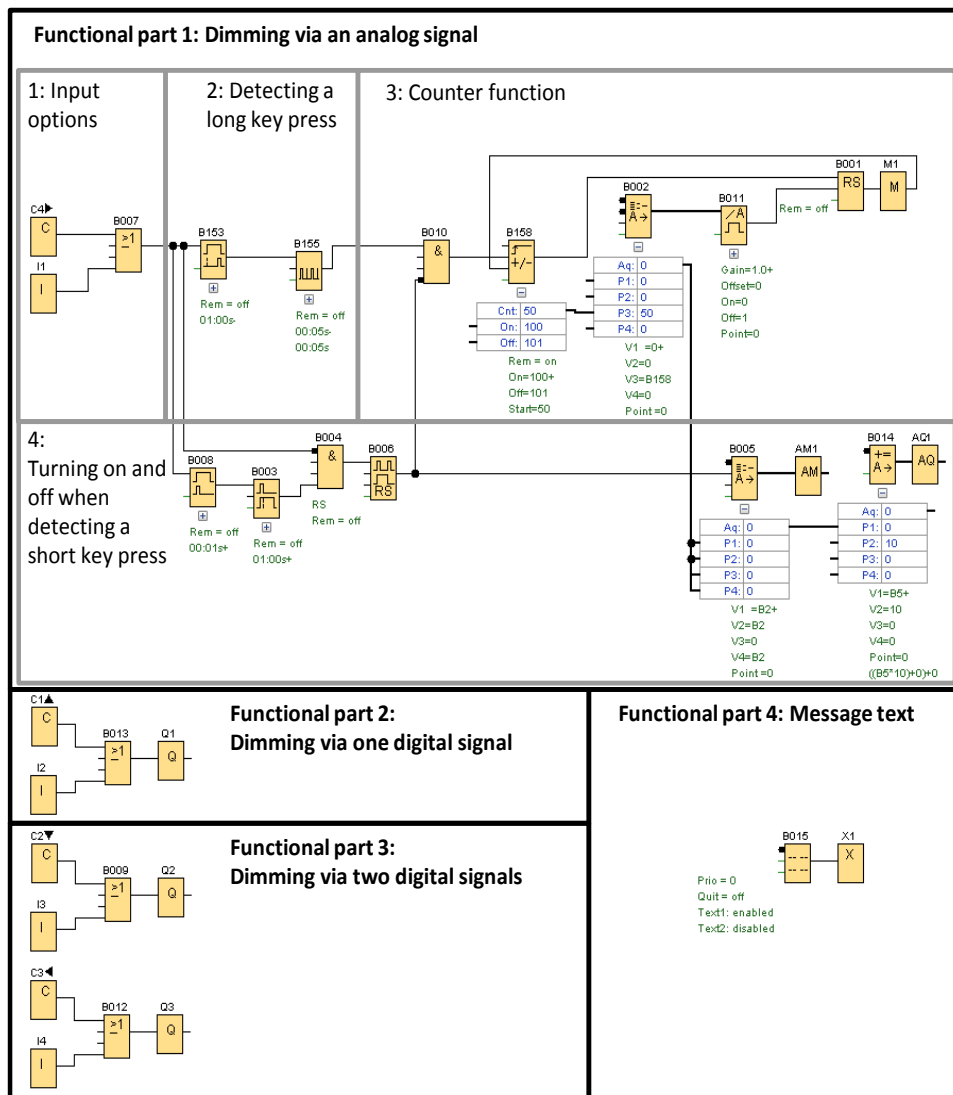
Functional part 1 – Dimming via an analog signal

This functional part controls a dimmer whose brightness is set via an analog value.

Functional part 1: Input option

The following section shows the input options for dimming an LED strip.

Figure 4-8: Input option

"Right" cursor key on LOGO!
or Web interface

Push button connected to
input 1
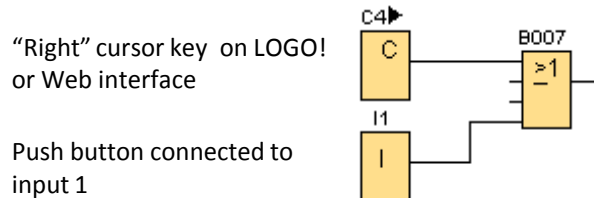
- The connected push button and the "right" cursor key represent the control options.
- Short-pressing the "right" cursor key or the push button connected to input I1 turns the light on or off.
- Long-pressing the "right" cursor key or the push button connected to input I1 automatically increases and/or reduces the brightness of the light until the key or push button is released.

Functional part 1: Detecting a long key press

The following section shows how a long key press is detected.

Figure 4-9: Detecting a long key press

Switch-on delay
Pulse generator
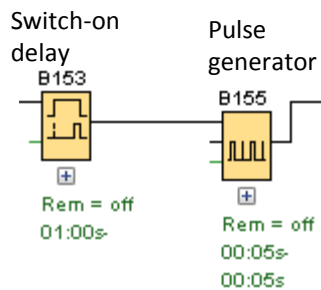
- Due to the switch-on delay, a present "1" signal is not passed on until the set time has elapsed.
- When the set time has elapsed, the pulse generator outputs pulses until the present signal at the switch-on delay changes to a "0" signal.

Functional part 1: Counter function

The following section shows how the counter function for determining the degree of dimming is implemented.

Figure 4-10: Counter function
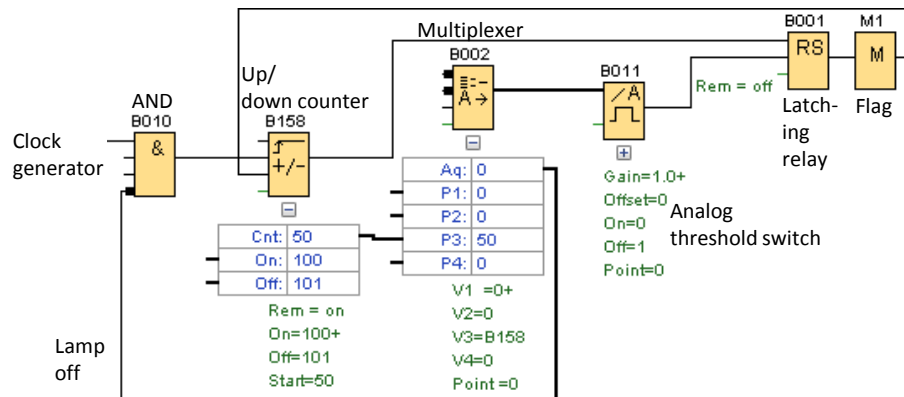
- When the clock generator (see pulse generator from Figure 4-9) outputs a pulse and the lamp is on, the up/down counter is enabled.
- The counting direction of the up/down counter is determined by the latching relay.
- If the up/down counter has exceeded the parameterized value (in this application example: "100"), the latching relay is set and counting down continues.
- If the analog threshold switch signals that the analog value is "0", the latching relay is reset and counting up continues.
- The multiplexer is required to evaluate the current value of the up/down counter later in the program.

Functional part 1: Turning on and off when detecting a short key press

The following section shows how a short pulse is detected and the response to this pulse.

Figure 4-11: Turning on and off via a short key press
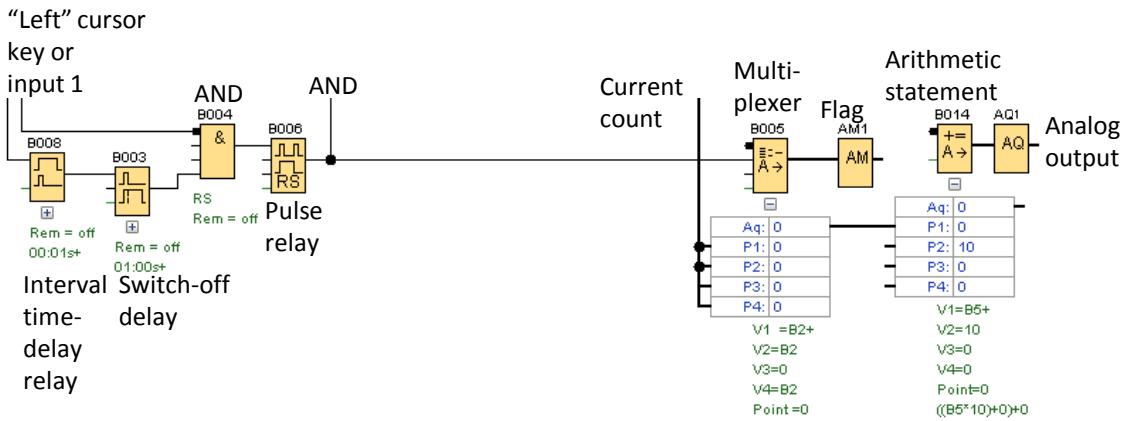
- When pressing the "left" cursor key or activating input I1, the interval time-delay relay outputs a pulse.
- This pulse enables a one-second switch-off delay.
- If the cursor key or the push button at input I1 is released during this one second, the "AND" function is enabled.
- The active "AND" function triggers the pulse relay (change at the pulse relay output from "0" to "1" and vice versa).
- If a "0" signal is present at the pulse relay output, the current count is output at analog output AQ1 via the multiplexer.
- If a "1" signal is present at the pulse relay output, the value "0" is output at analog output AQ1 via the multiplexer.

Functional part 2 – Dimming via one digital signal

This functional part controls a dimmer that is controlled via one digital signal. If a long "1" signal is present at the dimmer input, the brightness of the light is increased or reduced. If a short "1" signal is present, the light is turned on or off.

Figure 4-12: Dimming via one digital signal
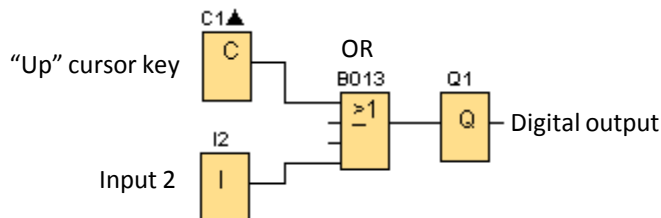
When pressing the "up" cursor key or activating input I2, the "OR" function is enabled and the output is set to a "1" signal.

Functional part 3 – Dimming via two digital signals

This functional part controls a dimmer that is controlled via two digital signals. If a long "1" signal is present at one of the dimmer's inputs, the brightness of the light is increased.

If a short "1" signal is present at the same input, the light is turned on.

With the other input, the light can be turned off or its brightness can be reduced in the same manner.

Figure 4-13: Dimming via two digital signals
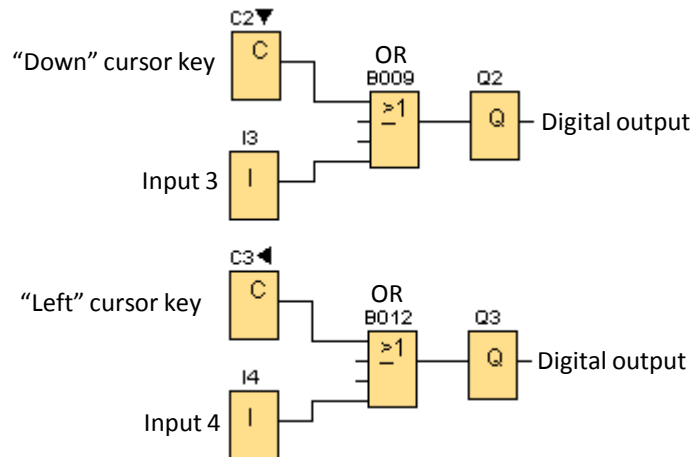
- When pressing the "down" cursor key or activating input I3, "OR" is enabled and the output is set to a "1" signal.

- When pressing the "left" cursor key or activating input I4, "OR" is enabled and the output is set to a "1" signal.

Functional part – Message text

Control using the LOGO! cursor keys is possible only if you insert a message text block into the wiring diagram and enable it by inverting the "En" input. A message text allows you to clearly show information about the control options.

In order to download the program, the message text's output must be connected to an "open terminal".

Figure 4-14: Message text
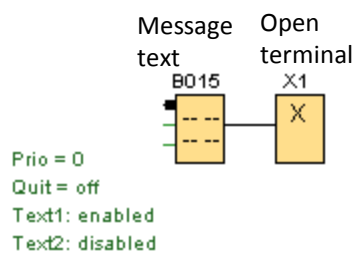
5 Configuration

Configuring Web server access for Scenario A

Table 5-1: Configuring Web server access in LOGO! Soft Comfort

No.	Action
1.	In the LOGO! Soft Comfort menu bar, click "Tools > Select Hardware…" or press "Ctrl+H".
2.	Select the "Online settings" tab.
3.	Enter the IP address of your CPU and click "Connect".
4.	On the left-hand side, select the "Access control settings" option.
5.	If prompted to enter a password, enter the password of your LOGO!. (Default password: "LOGO")
6.	In Web server access, check "Allow Web server access".
7.	Confirm the warning with "Yes".
8.	Assign a password for Web server access.
9.	Scroll down and select the "Apply" button.

Note	For message texts to be displayed via the Web server, check the "Web server" option for the message destination in the message text's block properties.

Note	For a more detailed description of configuring the Web server, please refer to this FAQ: "How do you enable and call the web server on LOGO! 8?"
	https://support.industry.siemens.com/cs/ww/en/view/108994400

6 Installation and Startup

This chapter describes the steps necessary to install the hardware and start up the code.

6.1 Installing the hardware

Note	Please follow the instructions in the product descriptions and the generally applicable safety rules.

6.1.1 Installing the hardware for Scenario A

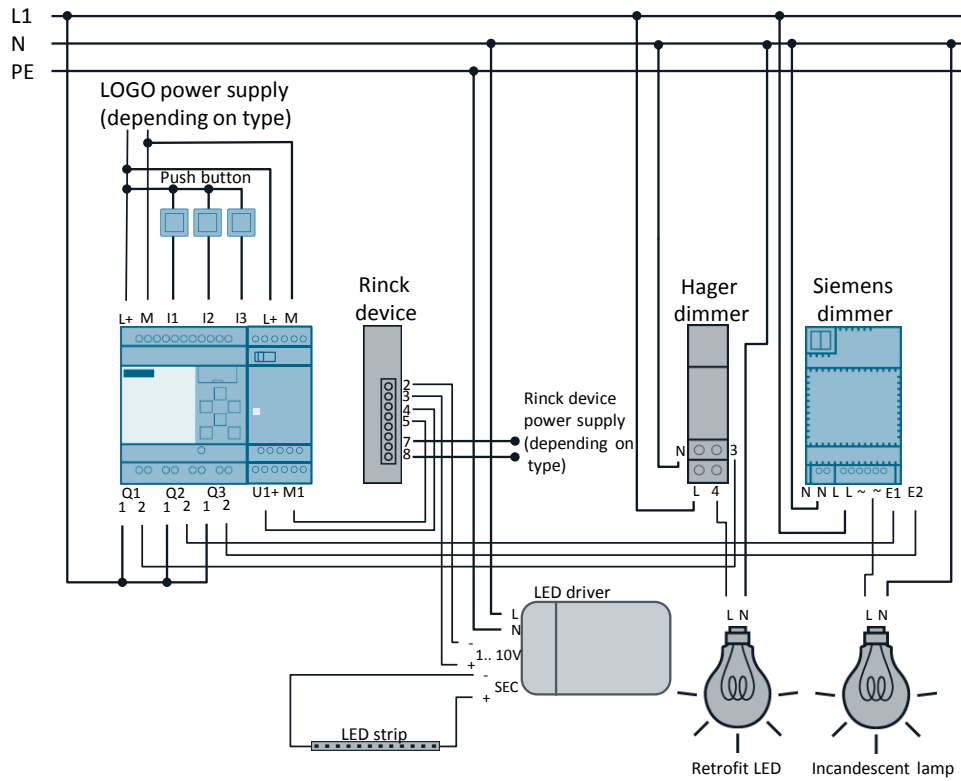The following figure shows the hardware configuration for Scenario A.

Figure 6-1: Hardware configuration for Scenario A
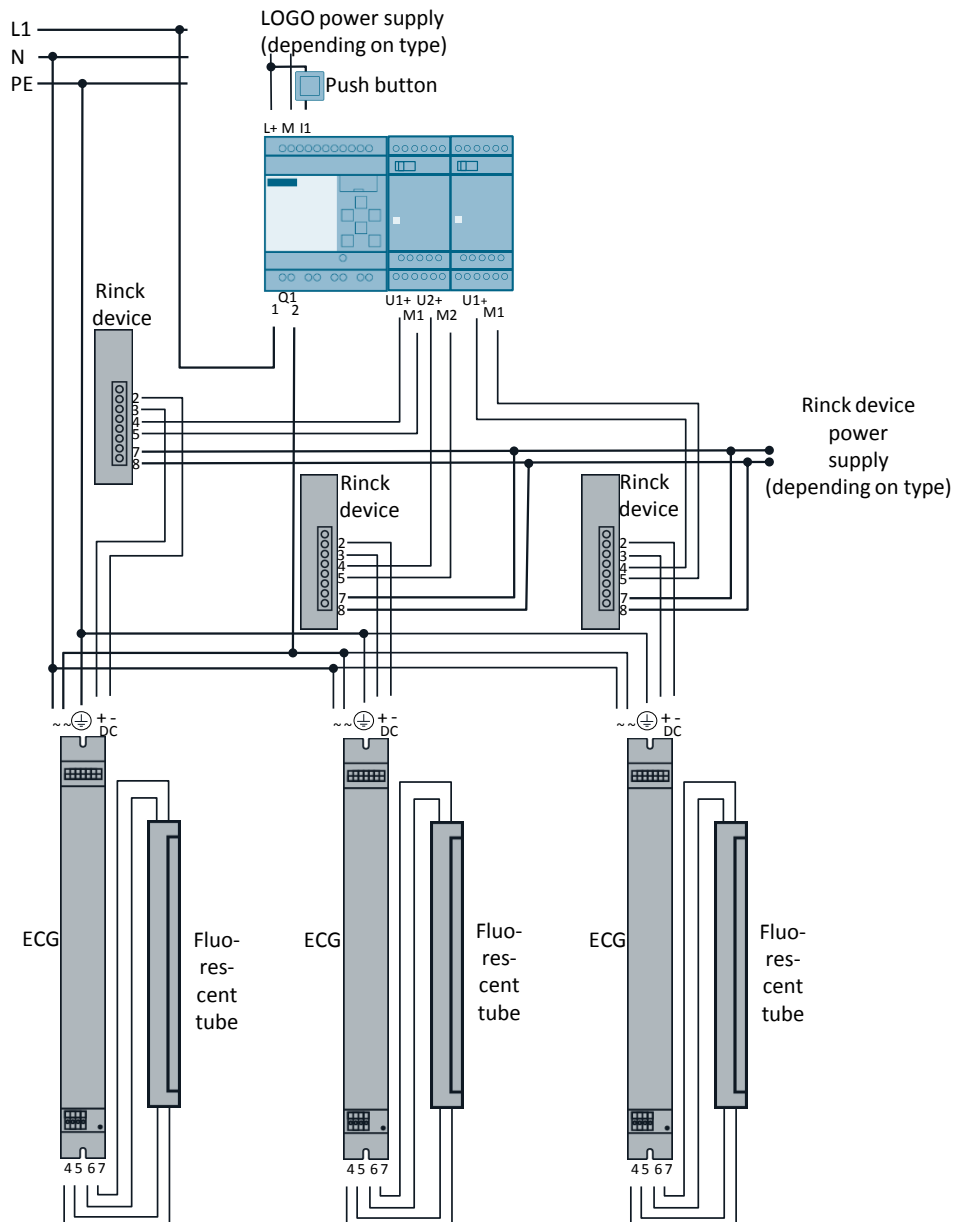
6.1.2 Installing the hardware for Scenario B

The following figure shows the hardware configuration for Scenario B.

Figure 6-2: Hardware configuration for Scenario B

6.2 Starting up the application example

Note	Starting up the application example requires the following:
	• The necessary LOGO! Soft Comfort V8 software is installed on your PC.
	• You are familiar with the basic handling of LOGO! Soft Comfort V8.

Table 6-1: Downloading the program to the LOGO!

No.	Action	Comment
1.	Download the "10939085_dimming_with_LOGO_CODE_v10.zip" file from the Web page of this application example.	-
2.	Unzip the downloaded file.	The .zip file contains two projects. One for each scenario.
3.	Open LOGO! Soft Comfort V8 on your PC.	-
4.	Click File and select "Open...".	-
5.	In the downloaded folder, select the desired file.	The files are named after the scenarios.
6.	Click "Open".	-

No.	Action	Comment
7.	Click "Tools".	-
8.	Click "Transfer".	-
9.	Click "PC -> LOGO!".	-
10.	Enter the IP address of your CPU.	Default: "192.168.0.1"
11.	Click "OK".	-
12.	If prompted whether you want to change the LOGO!'s mode, click "Yes".	-

7 Operation of the Application Example

7.1 Control of Scenario A

Control on the LOGO!

To select the next mode, either simultaneously press the "ESC" key and the "right" cursor key on the LOGO! or press the push button connected to input I1.

To select the previous mode, simultaneously press the "ESC" key and the "left" cursor key on the LOGO!.

The modes are sorted in the following order:

- Mode 1: Video
- Mode 2: Presentation with beamer
- Mode 3: Presentation without beamer
- Mode 4: Celebration
- Mode 5: Unused

The currently selected mode is displayed on the LOGO! display.

Control using the integrated Web server

Scenario A can be additionally controlled using the integrated Web server.

To do this, proceed as follows:

Table 7-1: Control using the integrated Web server

No.	Action
1.	Check whether the LOGO! is in the same network (same subnet) as your terminal.
2.	Open the browser on your terminal.
3.	In the browser, enter the IP address of your LOGO!.
4.	Log in with the name "Web User" and your password. If you have not set up a password, "LOGO" is the default password.
5.	In the navigation column, click "LOGO! BM".
6.	Click the "ESC" button.
7.	Click the "►" or "◄" button to change the mode.

7.2 Control of Scenario B

Dimming the LED strip with an LED driver

Control the LED strip by pressing the external push button I1 or by simultaneously pressing the "ESC" key and the "right" cursor key on the LOGO!.

- Short-press push button or LOGO! keys:
  The LED light is turned on or off.

- Long-press push button or LOGO! keys:
  The brightness of the LED light is increased or reduced.

Dimming the retrofit LED with a dimmer from Hager

Control the retrofit LED by pressing the external push button I2 or by simultaneously pressing the "ESC" key and the "up" cursor key on the LOGO!.

- Short-press push button or LOGO! keys:
  The retrofit LED's light is turned on or off.

- Long-press push button or LOGO! keys:
  The brightness of the retrofit LED's light is increased or reduced.

Note	If the retrofit LED is not turned on when there is a short pulse, the retrofit LED might be set to a very low or no brightness. In this case, press the push button or the LOGO! keys longer to increase the brightness of the lamp.

Dimming the incandescent lamp with a dimmer from Siemens

Control the incandescent lamp by pressing the external push buttons I3 or I4 or by simultaneously pressing the "ESC" key and the "down" or "left" cursor keys on the LOGO!.

- Short-press push button at I3 or "ESC" and "down" LOGO! keys:
  Incandescent lamp turns on.

- Long-press push button at I3 or "ESC" and "down" LOGO! keys:
  Incandescent lamp brightens.

- Short-press push button at I4 or "ESC" and "left" LOGO! keys:
  Incandescent lamp turns off.

- Long-press push button at I4 or "ESC" and "left" LOGO! keys:
  Incandescent lamp dims.

8 Links & Literature

Table 8-1

	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	This document https://support.industry.siemens.com/cs/ww/en/view/109739085

9 History

Table 9-1

Version	Date	Modifications
V1.0	01/2017	First version