

SIEMENS



Application description • 02/2014

Easy and Reliable Detection of Objects by Means of Optical Proximity Switches

LOGO! OBA6 and OBA7
Set 18

<http://support.automation.siemens.com/WW/view/en/23588559>

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1 Task

Introduction

LOGO! sets are functioning and tested automation configurations for simple, fast and inexpensive implementation of automation tasks for small-scale automation. The sets help you to obtain answers with regards to required products and the question of how they function when combined.

Overview of the automation task

A logistics center features several rolling shutter gates for persons and industrial trucks such as fork-lift trucks and other motorized means of transport. For easier and faster passing, the aim is to automate the opening and closing of these rolling shutter gates while considering the protection of persons and goods. Except for authorized staff, the rolling shutter gate must not be opened outside working hours. Automatic control of the rolling shutter gate is to be implemented centrally via a module.

Figure 1-1

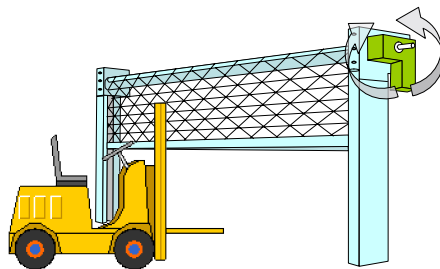
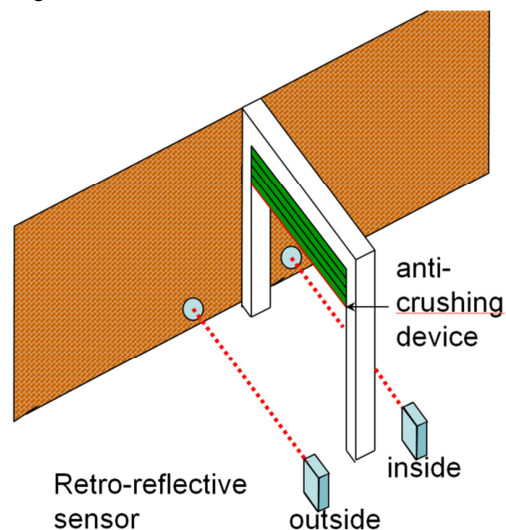
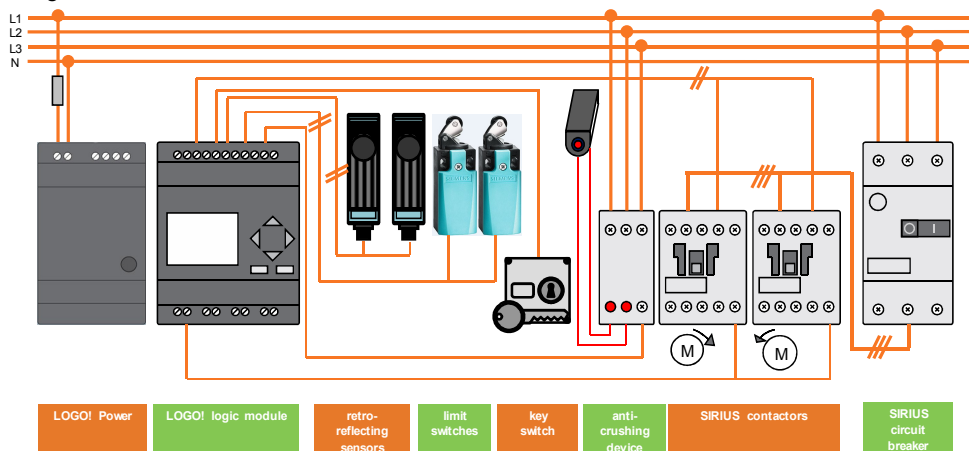


Figure 1-2



2 Solution

Figure 2-1



2.1 Overview of the overall solution

Two retro-reflective sensors connected to the LOGO! logic module allow detection of incoming and outgoing objects and objects in the hazardous area.

An anti-crushing device on the bottom of the rolling shutter gate provides additional protection for objects in the hazardous area.

The LOGO! logic module direct the rolling shutter gate motor to OPEN or CLOSED by means of a reversing contactor combination that consists of two SIRIUS contactors. A SIRIUS circuit breaker protects the motor. The movement in the respective direction is stopped after 5 seconds.

To control the rolling shutter gate motor, the automation solution uses a LOGO! logic module with a weekly timer. It allows locking the rolling shutter gate outside working hours. This function can be enabled or disabled using a key switch.

The LOGO! display shows the position of the rolling shutter gate as a text and as a bar graph. In the event of a malfunction of the rolling shutter gate, a “gate malfunction” diagnostic message will appear on the display.

The activation type that makes the rolling shutter gate ready for operation is displayed on the LOGO! display.

In manual mode, the rolling shutter gate can be set to “open” and “closed” using the LOGO! cursor keys.

Fields of application

Applications

- Hoisting devices
- Transport equipment
- Rolling shutter gate controls
- Conveyor systems
- Access monitoring
- Automotive industry

Advantages/benefits

- Cost-effective combination of sensor technology and control functions through the LOGO! logic module
- Precise detection of objects by means of fast and accurate optical proximity switches
- Direct display of messages and device states (e.g., motor operating hours, rolling shutter gate malfunction) via the integrated display of the LOGO! logic module. The display has 4 lines with 16 characters each. "Ticker mode" allows the display of up to 32 characters per line.
- Manual control with the LOGO! cursor keys (e.g., rolling shutter gate OPEN / CLOSED)
- Unassigned digital outputs of LOGO! can be programmed, for example, for switching signal lamps.

2.2 Hardware and software components used

Products

Table 2-1

Manufacturer	Component	Qty.	Order no.	Note
Siemens	LOGO!Power 24V 1.3A	1	6EP1331-1SH03	*
Siemens	LOGO! 12/24RC	1	6ED1052-1MD00-0BA6 6ED1052-1MD00-0BA7	Alternatively *
Siemens	LOGO! TD	1	6ED1055-4MH00-0BA0	Optionally
-	Retro-reflective sensor with accessories	3	E.g., Pepperl + Fuchs 3RG7201-3CC00-PF	Alternatively, retro-reflective sensors with break contact can be used
-	Anti-crushing device with accessories	1	-	Optical or mechanical versions with break contact can be used
Siemens	SIRIUS contactor, AC-3, 3KW/400V	1	3RT1015-1BB42	1NC, 24V DC, S00 *
Siemens	CES SSG10 lock	1	3SB3000-4LD11	
Siemens	Closer for bottom attachment	1	3SB3420-0B	
Siemens	Installation housing, gray	1	3SB3801-0AA3	
Siemens	SIRIUS circuit breaker	1	3RV1011-0KA10	0.9A ... 1.25A *
Siemens	Asynchronous motor	1	1LA7060-4AB10	230VD/400VY 0.12kW
Siemens	230V mains: SINAMICS G110 frequency inverter	1	6SL3211-0AB13-7BA1	*

* Attachment to DIN rail

2 Solution



All hardware components such as circuit breakers, retro-reflective sensors, anti-crushing device, contactors, motors, etc. must be adapted to the conditions in your plant.

The solution presented in this application is not suitable for controlling gates with requirements for the protection of persons in hazardous areas.

If there is such a requirement, the hardware components of the required safety category have to be selected. (E.g., safety sensors from Leuze electronic GmbH + Co. KG).

Accessories

Table 2-2

Manufacturer	Component	Qty.	Order no.	Note
Siemens	Miniature circuit breaker	1	5SL6116-6	1-pole, B, 16A *
Siemens	DIN rail mounting kit	1	6SL3261-1BA00-0AA0	For mounting SINAMICS G110*
Siemens	Basic Operator Panel	1	6SL3255-0AA00-4BA1	For mounting SINAMICS G110
Siemens	LV HRC fuse link	1	3NA3803 + 3NH3030	10A + base When mounting SINAMICS G110
Siemens	Feed-through terminal, beige		8WA1011-1DF11	Ø 2.5 mm ² , up to 24 A, >800V *
Siemens	Jumper		8WA1822-7VF01	
Siemens	PE feed-through terminal		8WA1011-1PF00	Ø 2.5 mm ² *
Siemens	Standard 35 mm DIN rail	1	6ES5 710-8MA11	483 mm *

* Attachment to DIN rail

Configuration software/tools

Table 2-3

Manufacturer	Component	Qty.	Order no.	Note
Siemens	LOGO!Soft Comfort V7.0	1	6ED1058-0BA02-0YA1	
Siemens	LOGO! PC cable	1	6ED1057 1AA00-0BA0	For LOGO! 0BA6
-	Standard Ethernet cable	1	-	For LOGO! 0BA7

Sample files and projects

Table 2-4

Component	Note
23588559_Set18_Opto_V2.0_en.lsc	LOGO!Soft Comfort configuration for the LOGO! logic module

3 Function Mechanisms of this Application

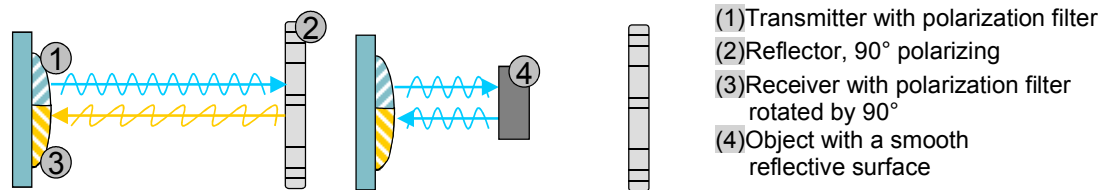
3.1 Retro-reflective sensor

Measuring principle

The optical proximity switches used here are retro-reflective sensors. Transmitter and receiver are located in one housing.

A special reflector is necessary that rotates the polarized light by 90°. This ensures that even objects with a smooth reflective surface such as stainless steel are reliably detected although the light beam is reflected.

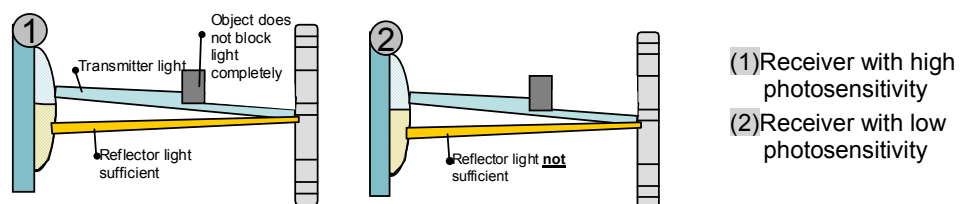
Figure 3-1



Sensitivity setting

In order to reliably detect even small objects in the light beam, you have to set the sensitivity of the retro-reflective sensor. For more information, please refer to the appropriate manual.

Figure 3-2



Switching outputs

The retro-reflective sensor used here has 2 switching outputs.

Output WH (2) provides a 1 signal when the light beam is interrupted.

Output BK (4) provides a 1 signal when the light beam is not interrupted.

The application uses the BK output.

3.2 Anti-crushing device

Types

For all types, the anti-crushing device consists of a hollow rubber profile. They differ in the method of measurement of how contact is detected.

- Optically: The rubber profile's change in shape reduces the light beam in the hollow space.
- Mechanically: The rubber profile's change in shape causes two conductors in the hollow space to contact.

For both methods of measurement, a module connected downstream detects the signal difference and signals the contact via a switching contact.

3.3 LOGO! logic module / LOGO! TD

Inputs and outputs

Table 3-1

Inputs	Function
I1	Contactors checkback signal, rolling shutter gate OPEN = 1 (NO)
I2	Contactors checkback signal, rolling shutter gate CLOSED = 1 (NO)
I3	Retro-reflective sensor outside, light beam interrupted = 0 (NC)
I4	Retro-reflective sensor inside, light beam interrupted = 0 (NC)
I5	Anti-crushing device, contact activated = 0 (NC)
I6	Key switch, no calendar control = 1 (NO)
I7	Limit switch OPEN (NO)
I8	Limit switch CLOSED (NO)
Outputs	Function
Q1	Set rolling shutter gate to OPEN = 1
Q2	Set rolling shutter gate to CLOSED = 1

Controlling the rolling shutter gate

The rolling shutter gate opens when at least one of the two retro-reflective sensors is interrupted. When no retro-reflective sensor is interrupted, the rolling shutter gate closes after a delay time of 10 seconds.

The downward movement of the rolling shutter gate stops and reverses for 0.5 seconds if the anti-crushing device on the bottom of the rolling shutter gate is activated.

Opening the rolling shutter gate is restricted to working hours. The key switch can be used to work around this restriction.

In manual mode, the rolling shutter gate can be set to “open” and “closed” using the LOGO! cursor keys as described in section 5.2. When doing so, the LOGO! cursor keys must be kept pressed for safety reasons. If the rolling shutter gate has been set to “open” using the cursor key, it cannot be closed by another activation type. Manual mode stops when the rolling shutter gate has been set to “closed” using the cursor key.



WARNING

The retro-reflective sensors are not active in manual mode (using the cursor keys of LOGO! or LOGO! TD).

The runtime for opening and closing the rolling shutter gate is limited to 5 seconds. After this time has elapsed, the relevant contactor will be deactivated. The counter-clockwise and clockwise rotation of the motor is controlled using a reversing contactor combination by reversing two of the three phases.

The program includes mutual interlocking of the two contactors.

LOGO! display / LOGO! TD

Diagnostics can be derived from comparing actual and setpoint state of the contactors. For this purpose, an auxiliary contact of the contactor is read in via a LOGO! input.

3 Function Mechanisms of this Application

If this comparison yields a difference, a malfunction can be assumed – an appropriate “gate malfunction” diagnostic message will be displayed on the LOGO! display for 10 seconds.

When the rolling shutter gate opens or closes and the new position has not been reached after 5 seconds, the “gate malfunction” diagnostic message will also be displayed on the LOGO! display for 10 seconds.

In any case of “gate malfunction” the reason has to be solved. For clearance of the malfunction the rolling shutter gate must be relieved by driving in manual mode via LOGO! cursor keys in the opposite direction.

The position of the rolling shutter gate is displayed as a text and as a bar graph. The position of the rolling shutter gate is emulated from the runtime of the rolling shutter gate and the signals of the limit switches.

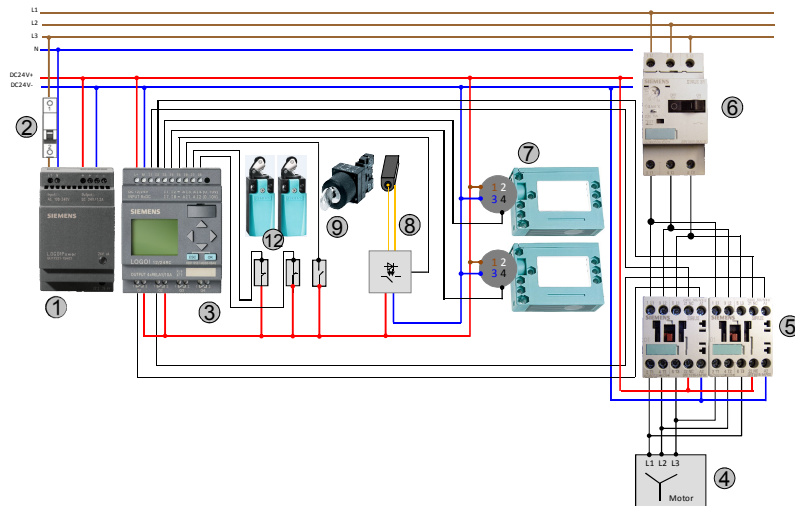
If there is a malfunction of the rolling shutter gate, the position of the rolling shutter gate is unknown. In this case, the bar graph is alternately displayed with 0 % or 100 %.

The activation type of the rolling shutter gate, i.e. weekly timer, key switch or cursor keys, is also displayed on the LOGO! display.

4 Installation

4.1 Connection to a 400V three-phase mains

Figure 4-1



LOGO! Set 18 consists of the components described in chapter 2.2:

LOGO!Power (1) provides the power supply for the 24V loads and is protected by a miniature circuit breaker (2).

The LOGO! logic module (3) has relay outputs and an integrated calendar and time function.

Two digital outputs control the direction of rotation of the asynchronous motor (4) by means of a reversing contactor combination that consists of SIRIUS contactors (5). The contactor checkback signals are connected to two digital inputs (I1, I2) of the LOGO! logic module.

A SIRIUS miniature circuit breaker (6) connected directly to the three-phase mains protects the asynchronous motor.

Two retro-reflective sensors (7) are connected to two digital inputs (I3, I4) of the LOGO! logic module.

The evaluation unit of the anti-crushing device (8) is connected to a digital input (I5) of the LOGO! logic module.

A key switch (9) is connected to a digital input (I6) of the LOGO! logic module.

Two limit switches (12) are connected to two digital inputs (I7, I8) of the LOGO! logic module.

Note

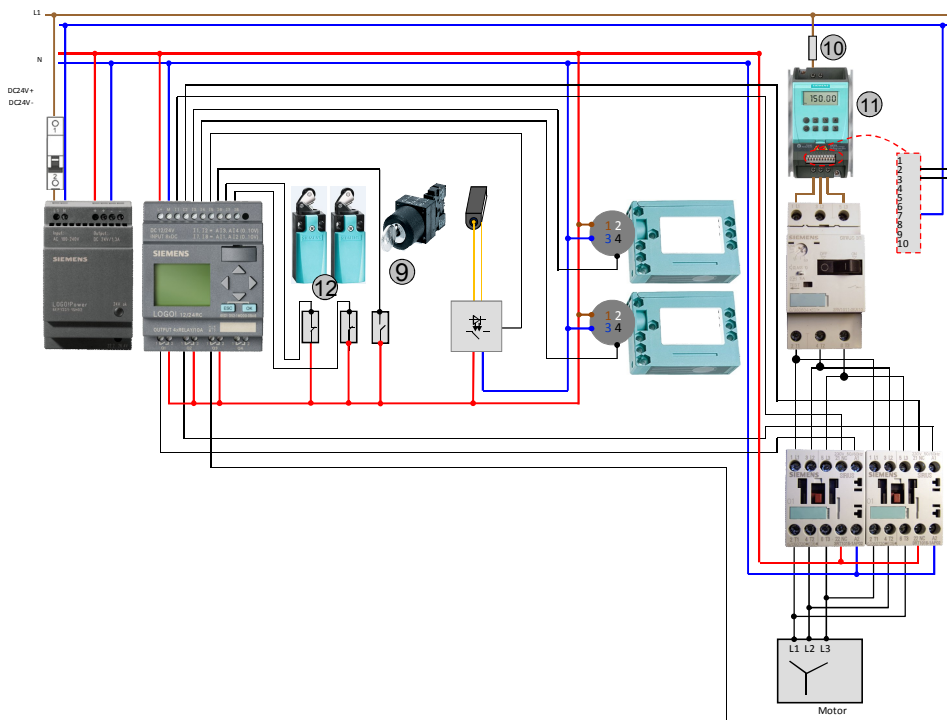
Always follow the installation guidelines for LOGO! and all components shown here (see section 6.2 \5).

4.2 Connection to a 230V mains

Note If no three-phase mains is available, a SINAMICS G110 can be connected to a single-phase mains for test setup purposes. At its output, the SINAMICS G110 provides a three-phase alternating voltage.

This setup is only suitable for test purposes.

Figure 4-2



The connection diagram of LOGO! Set 18 for the 230V mains is based on the connection diagram for the 400V mains.

Deviating from this connection diagram, a SINAMICS G110 frequency inverter (11) is connected in front of the SIRIUS circuit breaker. The SINAMICS G110 frequency inverter is connected to the 230V mains via an I.v. h.b.c. fuse (10).

A digital output of the LOGO! logic module (Q3) is connected to digital inputs 2 and 3 of the frequency inverter to enable the frequency inverter.

4.3 Installing, wiring and parameterizing the hardware

Table 4-1

No.	Action	Remark
1.	Install the components listed in chapter 2.2	Mount the components marked with * on a DIN rail
2.	Wire all components. Do not switch on the power supply yet.	See • Chapter 4.1: Connection to a 400V mains • Chapter 4.2: Connection to a 230V mains
3.	The motor must not yet be connected.	-

4.4 Parameterizing LOGO!

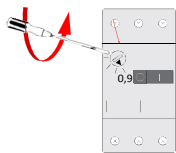
The program listed in Table 2-4 contains a parameterization for LOGO! 0BA6. If you are using LOGO! 0BA7, you have to set the following parameters:

Table 4-2

No.	Action	Remark
1.	In LOGO!Soft Comfort, go to the Tools > Select Hardware... menu option	
2.	Select the 0BA7 device	
3.	In LOGO!Soft Comfort, go to the Tools > Ethernet Connections... menu option	
4.	Enter the IP address and subnet mask of your LOGO!	E.g., IP address: 192.168.1.11 Subnet mask: 255.255.255.0 see \5\

4.5 Configuring the SIRIUS circuit breaker

Table 4-3

No.	Action	Remark
1.	If you are using the motor listed in chapter 2.2, set the setting screw of the SIRIUS circuit breaker to 0.9A.	

4.6 Configuring the SINAMICS G110 frequency inverter

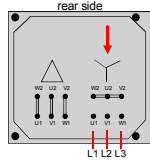
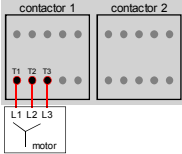
Follow the steps in the table below only if you are using the SINAMICS G110 frequency inverter listed in chapter 2.2. The values in the “Value” column refer only to the asynchronous motor listed in chapter 2.2.

Table 4-4

No.	Action	Value	Parameter
1.	Press the P parameter key on the BOP of the SINAMICS G110 to go to parameterization mode. Use the arrow keys to access the parameters listed below.	-	P 0000
2.	Start quick commissioning.	1	P 0010
3.	Set the regional settings to Europe.	0	P 0100
4.	Set the rated motor voltage to 230V.	230	P 0304
5.	Set the rated motor current to 0.73A.	0.73	P 0305
6.	Set the rated motor output to 0.12kW.	0.12	P 0307
7.	Set the rated motor frequency to 50Hz.	50.00	P 0310
8.	Set the rated motor speed to 1350 min-1.	1350	P 0311
9.	As the command source of the SINAMICS G110, select the terminal strip.	2	P 0700
10.	As the frequency setpoint for the SINAMICS G110, allow fixed frequencies.	0	P 1000
11.	Set the minimum frequency to 0Hz.	0.00	P 1080
12.	Set the maximum frequency to 50Hz.	50.00	P 1082
13.	Set the startup time from minimum to maximum speed of the asynchronous motor to 1s.	1.00	P 1120
14.	Set the ramp-down time from maximum to minimum speed of the asynchronous motor to 1s.	1.00	P 1121
15.	Finish quick commissioning.	1	P 3900
16.	Enable more parameters.	3	P 0003
17.	Set the function for digital input 0 to “Fixed frequency + ON”.	16	P 0701
18.	Set the function for digital input 1 to “ON / OFF1”.	1	P 0702
19.	Set the fixed frequency selected via digital input 0 to 50Hz.	50.00	P 1001
20.	Save all values in the EEPROM.	1	P 0971

4.7 Configuring and connecting the motor

Table 4-5

No.	Action	Remark
1.	Remove the motor cover. Change the wiring to "star" as shown in the picture to the right.	
2.	Connect the motor to the contactor combination.	

Installing the software

Note

It is assumed that the necessary **LOGO!Soft Comfort V7** software has been installed on your PC and that you are familiar with handling this software.

5 Operation of the Application

5.1 Functions

The following functions are included in this application:

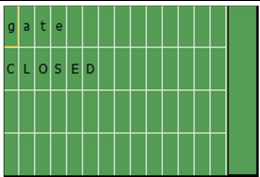
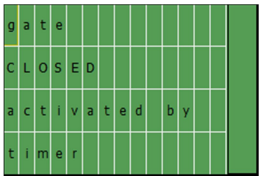
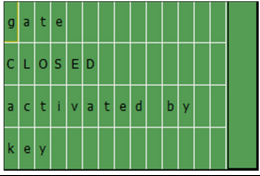
- Manually setting the rolling shutter gate to OPEN and CLOSED using the LOGO! cursor keys; alternatively, LOGO! TD can also be used for operation.
- Automatically setting the rolling shutter gate to OPEN and CLOSED by means of retro-reflective sensors
- Anti-crushing device
- Access during working hours with the LOGO! weekly timer
- Access outside working hours with the key switch
- "Gate malfunction" diagnostics

5.2 Activation types and operation using LOGO! cursor keys

Activating the rolling shutter gate via weekly timer or key switch

The activation type is displayed in line 4.

Table 5-1

No.	Description / activity	Picture / explanation
1.	The gate is not activated	 <p>← gate position</p>
2.	The gate was activated ...	
3.	<ul style="list-style-type: none"> • by weekly timer 	 <p>← weekly timer</p> <p>... during working hours by</p>
4.	<ul style="list-style-type: none"> • by key switch <p>Use the key to activate the gate outside working hours</p>	 <p>← key switch</p> <p>... by</p>

Activating and moving the rolling shutter gate in manual mode using LOGO! cursor keys

Table 5-2

No.	Description / activity	Picture / explanation
5.	The gate was activated:	gate activated ...
6.	<ul style="list-style-type: none"> Using LOGO! cursor keys Press the following key combination: ESC + ▲	← gate activated ...
7.	<ul style="list-style-type: none"> Using LOGO! cursor keys Press the following key combination: ESC + ▼	... by ← cursor key

5.3 Status displays and diagnostic messages

Status display of the rolling shutter gate

Table 5-3

No.	Description / activity	Picture / explanation
1.	No malfunction of the gate	← gate position ← bar graph
2.	Gate moves up or down	← bar graph

Diagnostic message of the rolling shutter gate

Table 5-4

No.	Description / activity	Picture / explanation
1.	Malfunction of the gate	← error message bar graph changes between ← black and ← green

6 References

6.1 Bibliography

This list is by no means complete and only presents a selection of related references.

Table 6-1

	Topic	Title
/1/	LOGO!	LOGO! Practical Training Authors: Uwe Graune; Mike Thielert; Ludwig Wenzl Publicis Corporate Publishing ISBN: 978-3-89578-338-8

6.2 Internet links

This list is by no means complete and only provides a selection of useful information.

Table 6-2

	Topic	Title
\1\	LOGO! information	http://www.automation.siemens.com/mcms/programmable-logic-controller/en/logic-module-logo/Pages/Default.aspx
\2\	LOGO! Starter Kit	http://www.automation.siemens.com/mcms/programmable-logic-controller/en/logic-module-logo/logo-starter-kit/Pages/Default.aspx
\3\	Reference to the entry	http://support.automation.siemens.com/WW/view/en/23588559
\4\	Siemens Industry Online Support	http://support.automation.siemens.com
\5\	LOGO! manuals	http://support.automation.siemens.com/WW/view/en/10805245/133300
\6\	LOGO! forum	http://www.automation.siemens.com/WW/forum/guests/Conferences.aspx?Language=en&onlyInternet=False
\7\	LOGO! software updates	http://www.automation.siemens.com/mcms/programmable-logic-controller/en/logic-module-logo/demo-software/Pages/Default.aspx
\8\	LOGO! application examples	http://www.automation.siemens.com/mcms/programmable-logic-controller/en/logic-module-logo/application-examples/Pages/Default.aspx
\9\	SINAMICS G110 Operating Instructions	http://support.automation.siemens.com/WW/view/en/22102965
\10\	SINAMICS G110 Parameter List	http://support.automation.siemens.com/WW/view/en/20977026
\11\	Retro-reflective sensor data sheet	http://files.pepperl-fuchs.com/selector_files/navi/productInfo/edb/mdoc4720a.pdf
\12\	Leuze electronic GmbH + Co. KG, protective switches	http://194.175.173.197/fss/

7 History

Table 7-1

Version	Date	Modifications
V1.0	09/2006	First version
V2.0	03/2013	Restructured, adapted to current components, new features added
V2.1	02/2014	Layout changes and addition of security advice

