PI Controller for Simple Applications – Optimum Motor Speed Control

Real Application with LOGO! and SINAMICS V20
Set 23

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1 Task

1.1 Overview

Introduction

The features in the application will be explained with the example of an automation task so that they can be understood more easily.

In an injection molding plant, the molded parts are cooled down to a certain final temperature by a water cooling system. Several water consumers are connected for cooling down up to three parts simultaneously.

To optimize the cooling performance and to reduce failures, it is to be ensured that - independent from the number of active consumers, a constant pressure is always provided for the central feed. The adaptation of the pump flow rate, and therefore of the pressure, must be stepless.

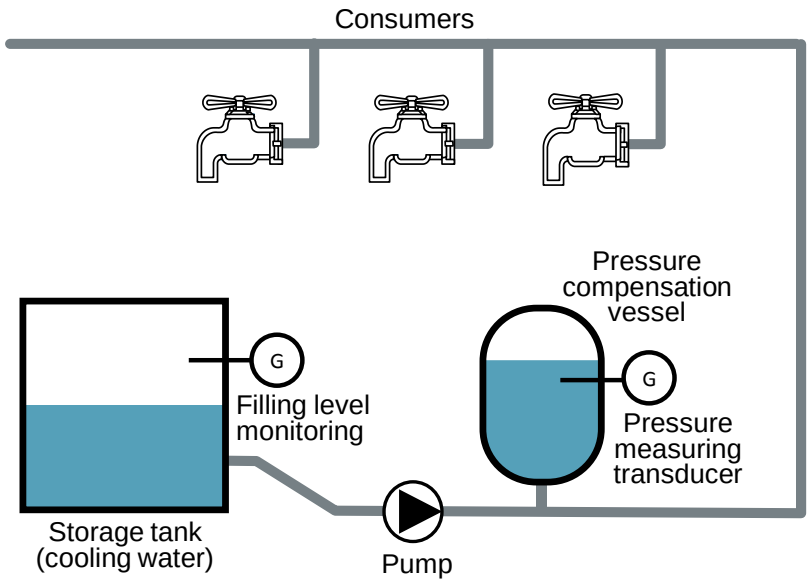
It is to be ensured that the pump is only operated when sufficient cooling water is supplied.

The current pressure (actual value) and the operating hours of the pump are to be displayed. It must be possible to edit the pressure needed by the consumers (setpoint value).

Overview of the automation task

The figure below provides an overview of the automation task.

Figure 1-1



Requirements for the automation task

With the following description and the set-up shown, a system as described above can be operated for real.

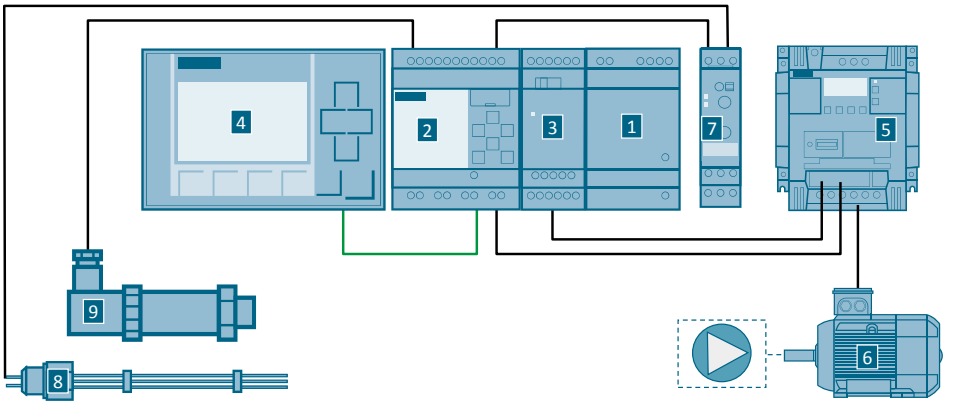
2 Solution

2.1 Overview

Schematic layout

The following figure gives a schematic overview of the most important components of the solution:

Figure 2-1



Automation solution – Set 23

The automation solution uses a LOGO! logic module with a connected SITRANS P pressure measuring transducer for capturing the current pressure in the cooling water cycle.

A PI controller in the LOGO! logic module adjusts the pressure by varying the motor speed depending on the pressure that is being measured. The pressure of the cooling water system is thus kept constant, independent from the number of consumers. The cooling performance is optimized and failures caused by a shortfall of pressure are prevented.

The motor is connected to a SINAMICS V20 frequency converter, which receives the setpoint motor speed as a frequency setpoint via the analog output of the LOGO! expansion module AM2 AQ. The speed of the asynchronous motor is adjusted steplessly via the SINAMICS V20.

A SIRIUS wire electrode for level-monitoring is connected to a SIRIUS monitoring relay. This is to ensure and monitor that the pump is supplied with fluid during operation. The monitoring status of the SIRIUS monitoring module is transmitted to a digital input of the LOGO! logic module.

The current pressure at the cooling water system, the setpoint pressure and the operating hours of the pump can be directly displayed in an external LOGO! TDE. The setpoint value of the cooling water system can also be edited. On an integrated display of the LOGO! logic module, the setpoint pressure, the current pressure and the speed of the pump are displayed as bars.

Advantages

The solution presented here offers you the following advantages:

- Cost-effective and stepless speed control
- Simple combination of drive tasks with sensor and control functions by combining a SINAMICS V20 with a LOGO!
- Protection and supervision function of the motor via SINAMICS V20
- Excellent energy efficiency by a motor output adapted to the consumption
- Direct display of messages and device states on the integrated display of the LOGO!
- Simple modification of parameters of the control functions of the LOGO! via the integrated operating function of the LOGO!
- Time-saving by implementing your individual application by means of an executable, tested example project
- Planning security by adapted products adapted to the example application
- Avoid errors thanks to step-by-step instructions

Fields of application

This application is especially suitable for a cost-effective and comfortable speed control of motors. The motor speed is changed steplessly to react to disturbances in the system.

This application is suited especially for the following industries and scenarios:

- Water supply/sewage systems
- Oil and gas industry
- Filling plants
- Building management: pump control
- Machine management: extraction plants, mixing plants

Assumed knowledge

Basic knowledge about LOGO! and SINAMICS V20 is assumed.

2.2 Description of the core functionality

- Capturing pressure as a measured variable and providing it as an analog value
- Constantly controlling and adapting the pressure in the system
- Addressing the motor via an analog interface of the LOGO!
- Monitor storage tanks and react to a dry run

2.3 Hardware and software components

2.3.1 Validity

This application is valid for:

- LOGO! 8
- SINAMICS V20

2.3.2 Components used

Note The cooling water system is designed for a 0.12 kW motor with a SINAMICS V20 frequency converter.

Hardware components

Table 2-1

No.	Component	No.	Article number	Note
1	LOGO! Power 24V/1.3A	1	6EP3331-6SB00-0AY0	
2	LOGO! 12/24RCE	1	6ED1052-1HB08-0BA0	DC
3	LOGO! AM2 AQ	1	6ED1055-1MM00-0BA2	0-10V
4	LOGO! TDE	1	6ED1055-4MH08-0BA0	incl. cable
5	SITRANS P Pressure measuring transducer	1	7MF1567-3BD10-1AA1	0 to 2.5bar
6	Analog monitoring relay	1	3UG4501-1AW30	
7	Wire electrode for level monitoring	1	3UG3207-3A	three-pole
8	SINAMICS V20 frequency converter	1	6SL3210-5BE13-7CV0	
9	Motor	1	1LA7060-4AB10	

Accessories

Table 2-2

No.	Component	No.	Article number	Note
1	Miniature circuit breaker	1	5SY6116-6	1 pole B, 16A
2	NH fuse cartridge	3	3NA3810 + 3NH3030	25A + base
3	Passage terminal, beige	*	8WA1011-1DF11	Ø 2.5 mm², up to 24A, >800V
4	PE passage terminal	*	8WA1011-1PF00	Ø 2.5 mm²
5	Jumper	*	8WA1822-7VF01	
6	Standard mounting rail 35 mm	1	6ES5 710-8MA11	483 mm
7	Ethernet patch cable	2	6XV1850-2H…	LOGO! ↔ PC

* as needed

Configuration software/tools

Table 2-3

Component	No.	Article number	Note
LOGO!Soft Comfort V8	1	6ED1058-0BA08-0YA1	

2.4 Sample files and projects

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

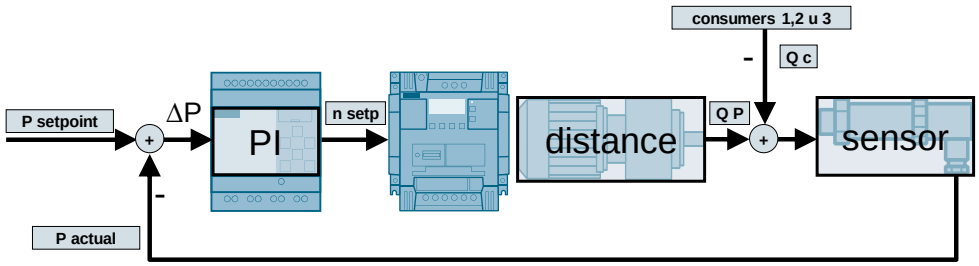
Table 2-4

Component	Note
LOGO!Soft Comfort V8 – Program 23753479_Set23_RegReal_V24.lsc	Contained in the zip file: 23753479_Set23_RegReal_CODE_V24.zip
23753479_Set23_RegReal_DOKU_V24_en.pdf	This document.
23753479_Set23_FLYER_V24_de.pdf	Set 23 Flyer

3 Operation

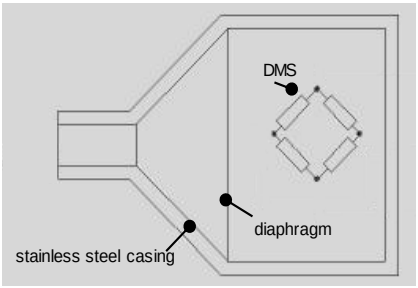
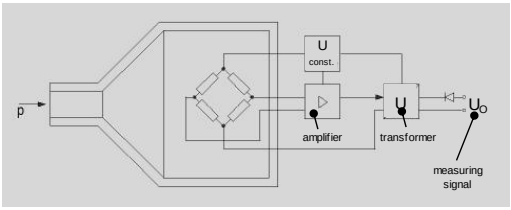
3.1 General overview

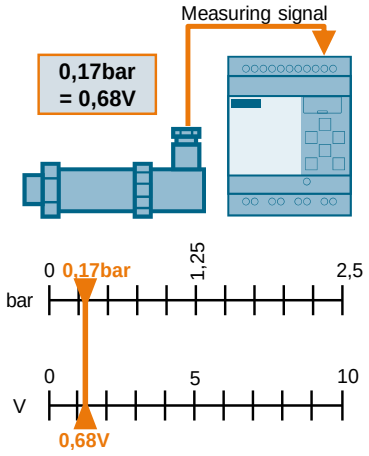
Figure 3-1



3.2 Capturing pressure as a measured variable and providing it as an analog value

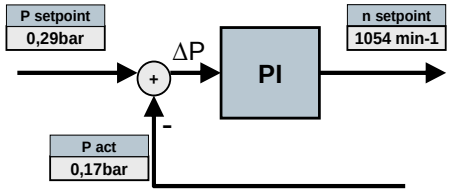
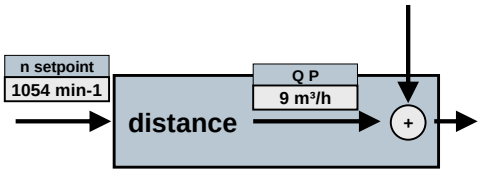
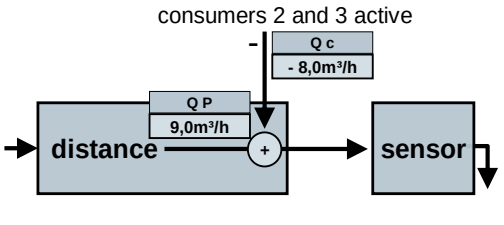
Table 3-1

No.	Function	Comments
1.	The measured variable in the cooling water cycle is the pressure. A pressure measuring transducer is used for measuring this variable.	
2.	The SITRANS P pressure measuring transducer serves for converting a physical power into an electric signal. In a stainless steel casing, an expansion measuring strip (DMS) is fixed on a ceramic diaphragm.	
3.	When the operating pressure p is present at the ceramic diaphragm, the DMS is expanded or shrunk. Due to the resulting increased or decreased resistance, there is a drop in voltage, which is fed into the amplifier and converted into an output voltage of DC 0 to 10V. (Output voltage is linear-proportional to the input pressure)	

No.	Function	Comments
4.	Via the integrated analog input at the LOGO! logic module, the measuring voltage (0 to 10V) of the pressure measuring transducer is continuously read off. The current pressure can be calculated by means of the scaling of the pressure measuring range 0 to 25bar and the voltage range 0 to 10V. (The conversion p→V only serves for explanation purposes. In the LOGO! logic module, the measuring signal is used in V)	

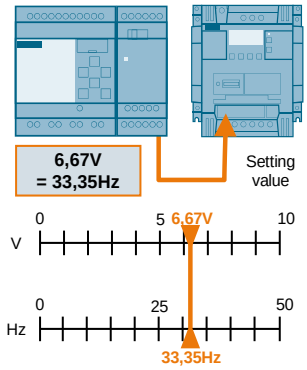
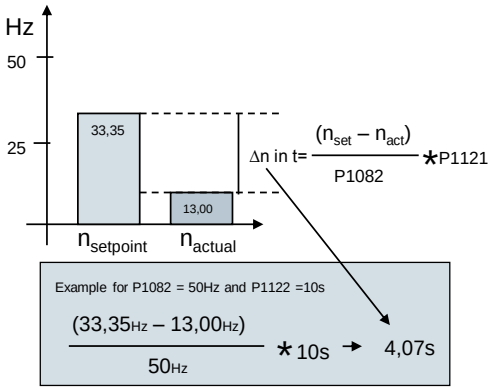
3.3 Constantly controlling and adapting the pressure in the system

Table 3-2

No.	Function	Comments
5.	In order to provide the consumers in the cooling water system with a consistent pressure even under varying loads, a PI controller is used.	
6.	The measured actual pressure (P_{actual}) is compared to the set pressure ($P_{setpoint}$) saved in the LOGO! logic module. The PI controller balances the difference ΔP by modifying the calculated setpoint speed.	
7.	• The difference ΔP is balanced out by increasing or decreasing the motor speed $n_{setpoint}$ and therefore the flow rate Q_P. • If the motor speed $n_{setpoint}$ is increased, more cooling water Q_P is pumped through, and the pressure P in the system increases. • If the motor speed $n_{setpoint}$ is decreased, less cooling water Q_P is pumped through, and the pressure P_{actual} in the system decreases.	
8.	The difference ΔP is caused by the variable load (consumer flow Q_C) of the consumers 1, 2 and 3. • When consumers are connected, the consumer flow Q_C is increased, and the pressure P_{actual} in the system decreases. • When consumers are disconnected, the consumer flow Q_C is decreased, and the pressure P_{actual} in the system increases.	

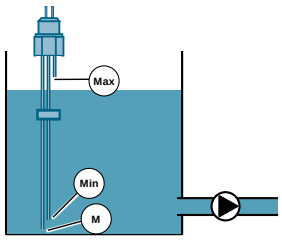
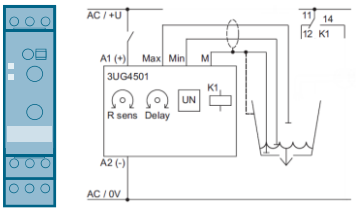
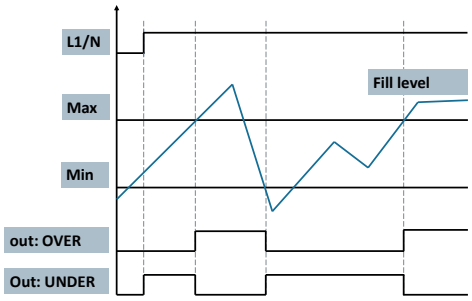
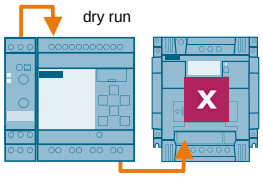
3.4 Addressing the motor via an analog interface of the LOGO!

Table 3-3

No.	Function	Comments
1.	The setting value (0 to 10V) for the motor speed n setpoint is continuously transmitted by the LOGO! expansion module AM2 AQ to SINAMICS V20 and scaled into a frequency setpoint (0 to 50Hz) there. *The lower and upper limit of the frequency setpoint depends on the minimum and maximum motor speed which has been configured in SINAMICS V20 (P1080=min and P1082=max).*	
2.	The motor connected to SINAMICS V20 accelerates or decelerates the frequency setpoint (n setpoint → n actual) supplied by the frequency converter. *The duration of the acceleration and deceleration phases depend on the ramp-up time and ramp-down time (P1122=ramp-up time and P1121=ramp-down time) configured in SINAMICS V20.*	

3.5 Monitor storage tanks and react to dry run

Table 3-4

No.	Function	Comments
1.	To avoid the pump running dry in this cooling water system, a three-pole wire electrode is used for monitoring the water level in the storage tank.	
2.	For an electrode, the reference point (M), the minimum fill level (Min) and the maximum fill level (Max) are set,	
3.	The three-pole wire electrode is connected to the SIRIUS monitoring relay.	
4.	The functional principle of the SIRIUS monitoring relay is based on the measurement of the electric resistance of the fluid between two diving probes (Min, Max) and a reference terminal (M). If the measured value is lower than the sensitivity (R sens) set in the SIRIUS monitoring relay at the front, the relay will change its switching position. The monitoring relay is situated in the operating mode “dry run protection” (setting “OV”). It changes its switching position (time diagram out: OVER), as soon as the fluid level Max is reached. It switches back to its original position, as soon as the Min probe does not touch the fluid any longer.	 The monitoring relay has two operation modes, which can be selected by means of a switches in the device: • dry run protection, switch position OVER • overflow protection, switch position UNDER
5.	The SIRIUS monitoring relay is wired to a digital input of the LOGO! logic module. If a dry run is detected, the release for the V20 frequency converter is stopped.	

Note At the Min and Max terminals of the SIRIUS monitoring relay, other resistance sensors in the range of 5 to 100kOhm, e.g. photo sensors, temperature sensors, distance transducers on a resistance basis can also be connected. Therefore, the monitoring relay is not only suitable for level monitoring of fluids.

4 Installation

This chapter shows the necessary steps to put the example into operation with the code from the download and the hardware list.

Note

The installation guidelines for LOGO! and SINAMICS V20 always have to be observed.

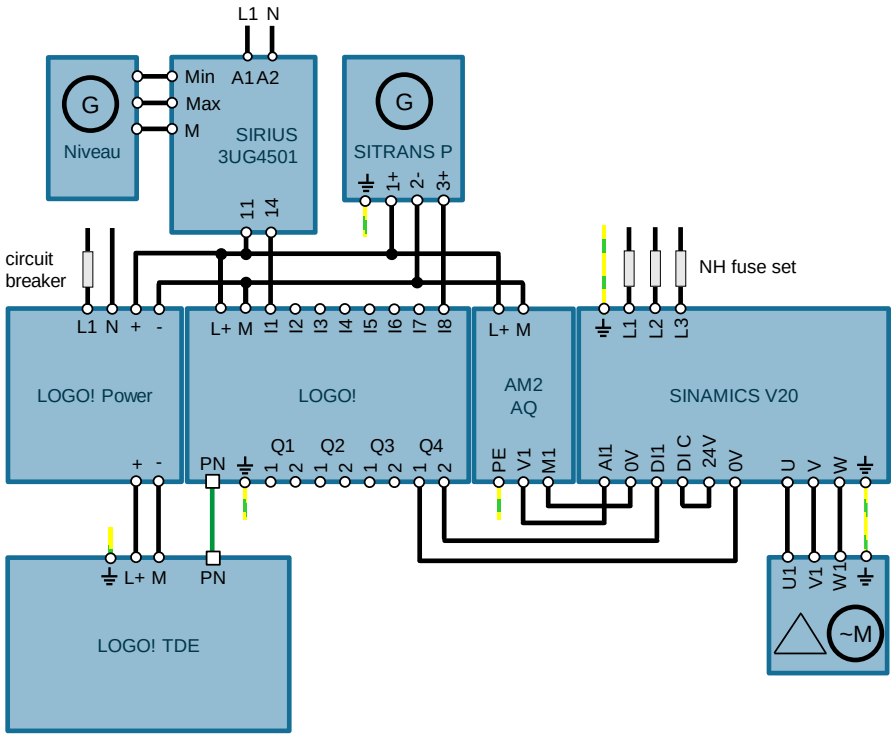
Warning

Before installing the SINAMICS V20 and putting it into operation, please read all the safety instructions and warnings in its operation instructions and observe the warning signs in the device. Please make sure that the warning sign remains readable and is not removed.

4.1 Set-up plan

The set-up plan shows the wiring of the components needed to use the functions of the LOGO! Set 23.

Figure 4-1



A LOGO! Power 1.3A ensures the 24V power supply for the devices.

The automation solution uses a LOGO! logic module with relay outputs and an integrated clock function

A LOGO! TDE is connected to the LOGO! logic module for displaying messages.

The LOGO! AM2 AQ is used as expansion module with two analog outputs. One analog output is connected to the SINAMICS V20 frequency converter.

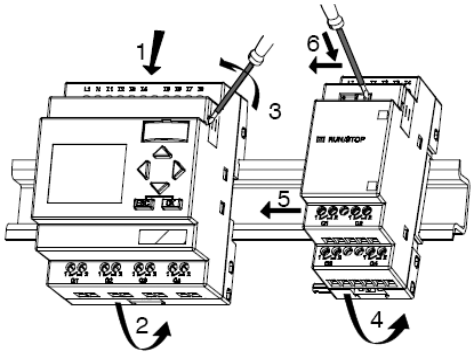
The motor is connected to the SINAMICS V20 frequency converter.

A SITRANS P pressure measuring transducer is connected to an integrated analog input of the LOGO! logic module

The SIRIUS monitoring relay is connected to a digital input of the LOGO! logic module. A three-pole wire electrode is connected to the SIRIUS monitoring relay.

Installing and wiring the hardware

Table 4-1

No.	Action	Comments
1.	Install the components no. 1, 2, 3 and 6 from Table 2-1 and no. 1, 3, 4, 5 from Table 2-2 onto the top-hat rail.	
2.	Put the LOGO! logic module on the top-hat rail (1) and snap in the clip (2). Remove the cover with a screw-driver (3). Put the LOGO! expansion module to its right on the top-hat rail and snap in the clip (4). Push the LOGO! expansion module flush with the LOG! logic module (5). Push the slider in the LOGO! expansion module to the left with a screwdriver (6).	
3.	Connect the LOGO! TDE via Ethernet cable to the LOGO! logic module.	
4.	Wire the three-pole wire electrode and the SIRIUS monitoring relay.	See Table 3-4 no. 3.
5.	Wire the remaining components as depicted in Figure 4-1 .	**Do not switch on the power supply yet!**
6.	Switch on the power supply for the LOGO! Power.	**Do not switch on the power supply of the SINAMICS V20 frequency converter!**

4.2 Software installation (download)

This chapter describes the steps for the installation of the example code.

Note

The software examples are available on the HTML page from which you downloaded this document.
The software examples are always assigned to the components used in the set and show their basic interaction. However, they are no real applications in the sense of a technological problem solution with definable properties.

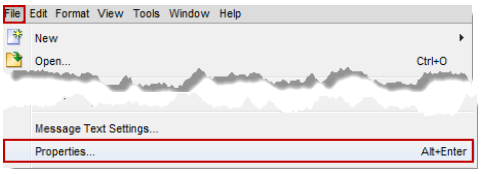
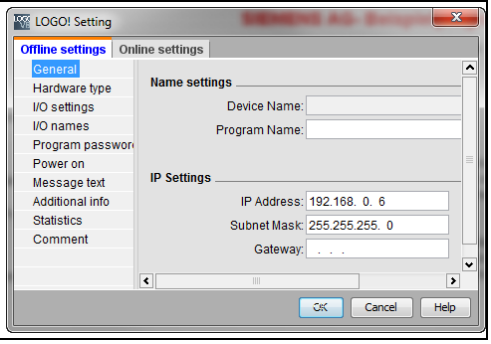
Download file

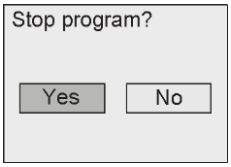
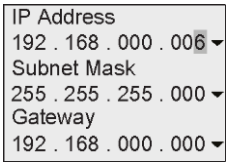
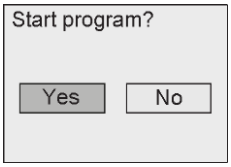
Table 4-2

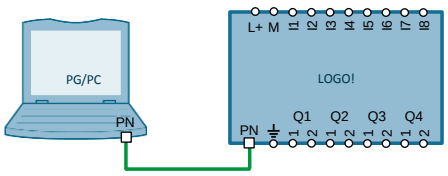
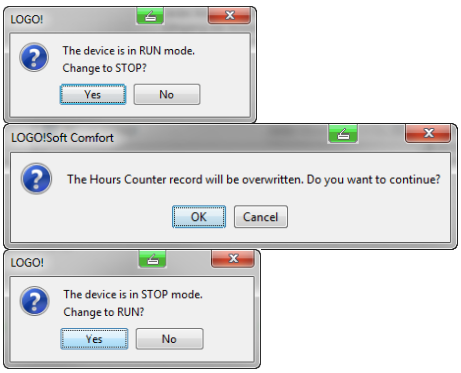
No.	File name	Contents
1.	23753479_Set23_RegReal_CODE_V24.zip	LOGO!Soft Comfort V8 – Program 23753479_Set23_RegReal_V24.lsc

Installation of the LOGO!Soft Comfort Program

Table 4-3

No.	Action	Comments
1.	Load the example project 23753479_Set23_RegReal_DOKU_V24.zip into a separate folder.	
2.	Extract the zip-file into a separate folder.	
3.	Start LOGO!Soft Comfort V8.	
4.	Open the file 23753479_Set23_RegReal_V24.lsc with the menu: “File > Open”.	In the “unpacked folder” 01_LOGO!
5.	Make sure that the PG interface is in the same IP band, analog to the other Ethernet nodes.	Can be set via “PC Control Panel > Network and Sharing Center” e.g. IP addr.192.168.000.100 and subnet mask on 255.255.255.0
6.	Open your project. Follow the menu path: „File > Properties“.	
7.	Thus the dialogue „LOGO! Setting“ opens. Go to menu item „General“ and set the LOGO! IP-address and save the setting by „OK“.	

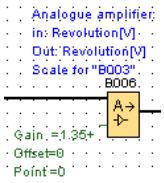
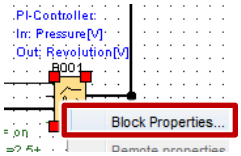
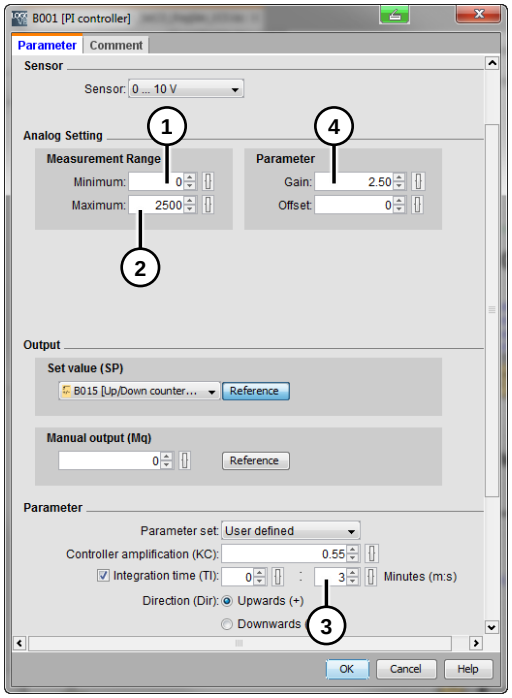
No.	Action	Comments
8.	Set the IP address at the LOGO!:	See also LOGO! Manual \3\
9.	Navigate, if necessary with the LOGO! key ▼ to the menu item “Date/Time”	
10.	To stop the LOGO! operating the program navigate to menu “Stop“ by means of ▲ or ▼ keys. Press the key OK.	
11.	Stop the execution of the program with the key sequence ◀ and OK.	
12.	Navigate to “Network” with the keys ▼ or ▲ .	
13.	Click the OK key three times to reach the menu “Set IP address”	
14.	Skip this point if you do not wish to modify the address. Use the keys ▶ and ◀ to navigate to the spot you want to adjust. Set the value with the keys ▼ and ▲.	 IP address 192.168.000.006 subnet mask 255.255.255.0 for this application
15.	Complete the setting with the OK key. Leave the menu item by pressing the ESC key twice.	
16.	For starting the LOGO!, navigate to the menu item “Start“ with the keys ▼ or ▲ and press the OK key.	
17.	Start the execution program with the key sequence ◀ and OK.	

No.	Action	Comments
18.	Connect the PC via an Ethernet cable directly or via a switch according to Figure 4-1 with the LOGO! logic module.	
19.	Load the program to the LOGO! logic module by means of the “PC -> LOGO!” symbol. Please note these LOGO!Soft Comfort dialog boxes. The default password of LOGO is “LOGO”. LOGO!Soft Comfort checks the operating state of the LOGO! and sets it to “STOP” when it is confirmed. Download is only possible in LOGO! “STOP” mode. The operating hours counter is reset at the same time. After loading LOGO!Soft Comfort checks the operating state of the LOGO! and sets it to “RUN” when it is confirmed.	 
20.	Set the operating mode of the LOGO! logic module to “RUN” by means of the symbol “Change LOGO! operating mode”.	

5 Configuration and Settings

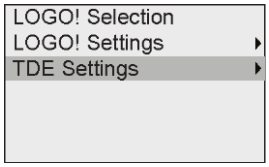
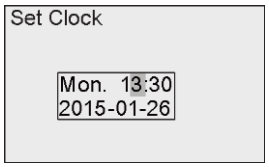
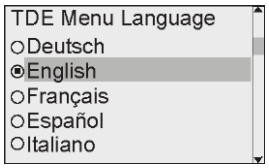
5.1 Scaling analog values into physical values in the LOGO!

Table 5-1

No.	Function	Comments
1.	Coming and going analog values can be optionally scaled by means of the analog blocks so that the user can have real physical values (such as pressure, temperature, revs/min) displayed in the LOGO! program.	
2.	Set the measuring range of the incoming signal of the sensor to the real physical values. No decimals can be entered in the physical values. For example: analog input signal 0 - 10V corresponds to a physical pressure of 0 - 2.50 bar. In the properties of the PI controller block, set the following: • Minimum (1): 0 • Maximum (2): 250 • Integration time (3): 2s The parameter “Gain” (4) is calculated automatically.	 

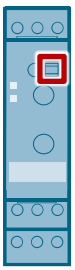
5.2 Configuring the LOGO! TDE

Table 5-2

No.	Function	Comments
1.	Connect the LOGO! TDE with an Ethernet cable the direct way or via switch to the LOGO! Logic module according to Figure 4-1.	
2.	Connect the LOGO! TDE according to Figure 4-1 with LOGO! Power. Switch on the power supply.	
3.	Set the operating mode of the LOGO! Logic module to “Stop”.	
4.	The first time LOGO! TDE is connected to power after shipment the display shows „LOGO! Selection“. Press key ENTER and put here the IP address of your LOGO! 8 just the way you are used to by addressing LOGO! 8.	 The factory setting of LOGO! TDE is 192.168.0.2 and has to be kept for this application.
5.	Navigate to the menu item “Admin” by means of keys ▶, ▼ respectively. ▲ and ENTER via menu sequence “LOGO! Settings > Setup > Switch to ADMIN” Enter the password by means of keys ▶, ▼ respectively ▲ and ENTER.	
6.	Navigate to the menu item “Set clock” by means of keys ▶, ▼ respectively ▲ and ENTER via menu sequence “LOGO! Settings > Setup > Clock > Set Clock” Set the clock by means of keys ▶, ▼ respectively ▲ and ENTER.	
7.	If you want to change the language setting: Navigate by means of keys ▼, ▲, ▶ and ◀ to the menu item “TDE Settings > TDE Setup > TDE Menu Language“. Press the key ENTER. Select the preferred language by means of using keys ▼ and ▲ and confirm with key ENTER.	
8.	Set the operating mode of the LOGO! Logic module to “Start”.	

5.3 Configuring the SIRIUS monitoring relay

Table 5-3

No.	Action	Comments
1.	Set the SIRIUS monitoring relay to the desired sensitivity: With the potentiometer, the specific resistance of the fluid to be monitored is entered. Set the sensitivity to about 20kOhm.	<table><tr><th>Product</th><th>kOhm</th><th>Product</th><th>kOhm</th></tr><tr><td>Butter milk</td><td>1</td><td>Natural water</td><td>5</td></tr><tr><td>Fruit juice</td><td>1</td><td>Waste water</td><td>5</td></tr><tr><td>Vegetable juice</td><td>1</td><td>Starch solution</td><td>5</td></tr><tr><td>Milk</td><td>1</td><td>Oil</td><td>10</td></tr><tr><td>Soup</td><td>2,2</td><td>Condensation</td><td>18</td></tr><tr><td>Beer</td><td>2,2</td><td>Lather</td><td>18</td></tr><tr><td>Coffee</td><td>2,2</td><td>Jams</td><td>45</td></tr><tr><td>Ink</td><td>2,2</td><td>Jelly</td><td>45</td></tr><tr><td>Salt water</td><td>2,2</td><td>Sugar solution</td><td>90</td></tr><tr><td>Wine</td><td>2,2</td><td>Whisky</td><td>220</td></tr><tr><td></td><td></td><td>Distilled water</td><td>450</td></tr></table>
2.	The monitoring mode of the SIRIUS monitoring relay must be set to dry run. To do so, set the position switch to “OVER”.	

5.4 Configuring the SINAMICS V20

Note

The cooling water system has been designed for a 0.12kW motor and a SINAMICS V20 frequency converter, and a supply voltage with a mains frequency of 50Hz.

If another motor or another frequency converter is to be used, or of the supply voltage has a different mains frequency than 50Hz, the drive parameters must be adjusted differently from Table 5-5.

Modifying parameters

The following table shows how to modify and save parameters in the SINAMICS V20. This operation sequence is generally applicable for the settings of all the parameters from Table 5-5.

Table 5-4

No.	Action	Operation	Display
1.	Use the arrow keys to navigate to the parameter you want to change.	▲▼	P0004
2.	Press the OK button if you wish to adjust a value.	OK	P0010
3.	The value is now displayed.		0
4.	Change the value with the arrow keys.	▲▼	30
5.	Save the value with the OK button.	OK	P0010

Parameters

This table describes all the parameters of the SINAMICS V20 that are necessary for the operation of this application.

Table 5-5

No.	Action	Operation/display	Value
1.	Activate the power supply for the SINAMICS V20.	You will find the Introduction to the built-in BOP, its menu structure and its Parameter list in the Operating instructions of the SINAMICS V20.	
2.	Press the multifunction key in the SINAMICS V20 for a short time (< 2s) to reach the "**Parameter menu**". Use the arrow keys to reach the parameters described in the following.	M ▲▼	
3.	Set the SINAMICS V20 to **Factory Settings**.	P0010 P0970	30 21
4.	Then the following will be displayed. • If the SINAMICS V20 is operated with a mains frequency of 50Hz, save with OK. • If the SINAMICS V20 is operated with a mains frequency of unequal 50Hz, select the correct frequency with the arrow keys and save them with OK. The SINAMICS V20 is now in the **setup menu**.	8888 50? OK ▲▼ → 60? + OK ▲▼ → 60hP? + OK	

No.	Action	Operation/display	Value
5.	Set the motor voltage to 230V.	P0304	230
6.	Set the motor nominal current to 0.73A.	P0305	0.73
7.	Set the motor nominal power to 0.12kW.	P0307	0.12
8.	Set the factor motor nominal power to 0.75 cos φ.	P0308	0,750
9.	Set the motor nominal frequency to 50Hz.	P0310	50.00
10.	Set the motor nominal motor speed to 1350RPM.	P0311	1350
11.	Press the multifunction key for a short time (< 2s) to reach the “Connection macros”.	M → -Cn000	
12.	Activate the terminal strips as command source of the SINAMICS V20 by selecting the connection macro Cn002.	▲▼ → Cn002 OK → -Cn002	Cn002
13.	Press the SINAMICS multifunction twice for a short time (< 2s). The menu will change to the “General parameters”.	M → -AP000 M → 8888	
14.	Set the minimum frequency to 0Hz.	P1080	0.00
15.	Set the maximum frequency to 50Hz.	P1082	50.00
16.	Set the ramp-up time from the minimum to the maximum motor speed to 3s.	P1120	5.00
17.	Set the ramp-down time from the maximum to the minimum motor speed to 3s.	P1121	5.00
18.	Press the multifunction key in the SINAMICS V20 for a long time (> 2s) to go back to the display menu.	M ⟶ 0.00	
19.	Press the SINAMICS multifunction for a short time (< 2s). SINAMICS V20 changes to the **“Parameter menu”** where you can go to further parameters.	M → P0970	
20.	Select the access step “Expert”.	P0003	3
21.	Transfer the data from RAM to the EEPROM.	P0971 OK → 8888	1
22.	Select the access step “Standard”.	P0003	1
23.	Press the multifunction key in the SINAMICS V20 for a long time (> 2s) to go back to the display menu.	M ⟶ 0.00	
24.	Switch off the supply voltage of the SINAMICS V20 to apply the values.		

6 Operating the Application

The functionality of the LOGO! Set 23 were “packed” in an application example of a cooling water system for an injection molding plant.

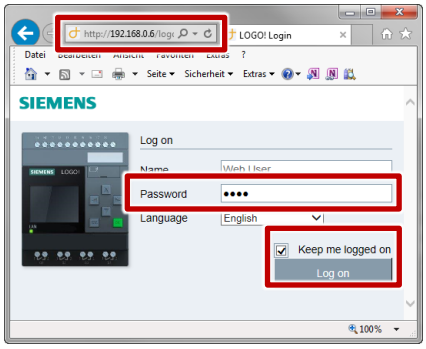
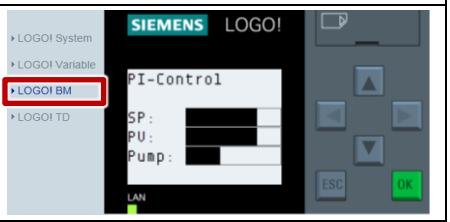
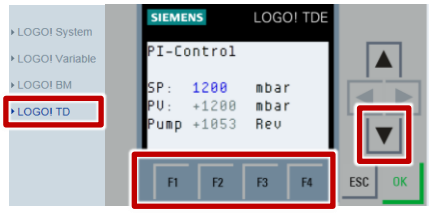
The functionalities and features of the program code and the hardware, can be testes as follows, if the components have been configured correctly as described in section 5.3.

6.1 Display via integrated web server

The LOGO! 8 basic module contains an integrated web server, able to display projected messages. For this purpose the LOGO! 8 basic module has to be connected to your PC, smartphone or tablet PC directly via LAN or indirectly via WLAN.

The operation via web browser is conform to the operation of LOGO! 8 basic module respectively LOGO! TDE.

Tabelle 6-1

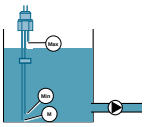
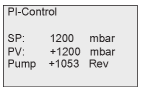
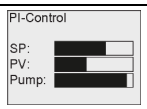
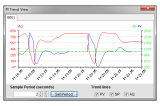
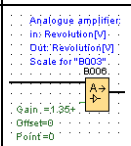
Nr.	Aktion	Anmerkung
1.	Open the web browser on your PC, smartphone or tablet PC.	
2.	Enter the address of the LOGO! 8 basic module in the address line: for this example 192.168.0.6.	
3.	The web browser shows the initial site of the LOGO! 8 basic module. Enter the password. The default setting is „LOGO“. Set the checkmark at „Keep me logged on“. Click button „Log on“.	
4.	Click the button „LOGO! BM“. The display of the LOGO! 8 basic module shows the bargraphs of the PI control.	
5.	Click the button „LOGO! TD“. The display of LOGO! TDE shows the numerical presentation of the PI control. Click on F4 to increase the set value. Click on F1 to decrease the set value. Click on F3 to switch on and off the display lighting. Click on F2 for switching the language. Click the cursor key ▼ to change to operating hour meter.	
6.	The display changes over to operating hour meter. Clicking the cursor key ▲ takes you back to the numerical presentation of the PI control.	

6.2 Overview of the scenarios and simulations

The description how the controlling can be operated and monitored by means of the integrated LOGO! display and LOGO! TDE can be found in the following table in the section “LOGO!”.

The individual items for the operation of the application are not subject to any specific order.

Table 6-2

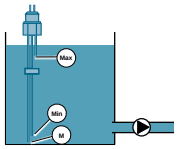
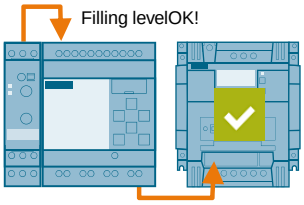
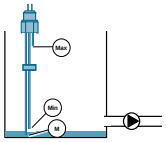
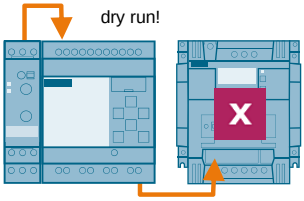
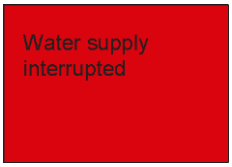
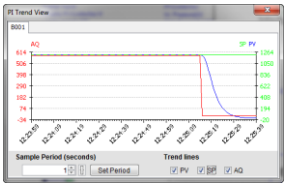
Overview of the scenarios and simulations	
Scenario 1: Testing the wire electrode for level monitoring	
Scenario 2: Changing the language and switching the backlight on/off via LOGO! TDE	
Scenario 3: Display values by means of LOGO! TDE	
Scenario 4: Change setpoint value by means of LOGO! TDE operator panel	
Scenario 5: Display values by means of LOGO! Display	
Scenario 6: Observe the course of the controlling by means of LOGO!Soft Comfort	
Scenario 7: Change control parameters	

6.3 Scenario 1: Testing the wire electrode for level monitoring

In the present cooling water system a pump is blocked as soon as a low fill level in the tank is detected.

To check for a sufficient fill level of the tank or a dry run, the following steps have to be carried out:

Table 6-3

No.	Action	Comments
1.	For the level monitoring, dip the probe so deep into the water that all the electrodes are in contact with the water. You can use a water glass for the tank.	
2.	• The relay output of the SIRIUS monitoring relay switches. • The LED for the relay output of the SIRIUS monitoring relay lights up. • The connected LOGO! logic module switches the relay output for the release of the SINAMICS V20 and • starts the operating hours counter at the same time.	
3.	Test the dry run by pulling the level monitoring probe out of the water so far that only the electrode (M) touches the water.	
4.	• The SIRIUS monitoring relay deactivates the relay output. • The LED for the relay output of the SIRIUS monitoring relay goes out. • The connected LOGO! logic module deactivates the output for the release of the SINAMICS V20. • The operating hours counter is stopped. • The pressure in the system decreases when consumers are active.	
5.	On the display of the LOGO! logic module and on the LOGO! TDE, the message “Water supply interrupted” is displayed.	
6.	Observe the motor speed setpoint value and the pressure loss in the trend view of the LOGO!Soft Comfort. Please refer to the instruction steps of Table 6-8 for this trend view.	
7.	Make sure that after the test, all the electrodes of the probe for level monitoring are actually in contact with the water.	

6.4 Scenario 2: Changing the language and switching the backlight on/off via LOGO! TDE

With the function keys of the LOGO! TDE the language can be switched from English to German and vice versa. The backlight of the LOGO! TDE and of the integrated display of the LOGO! logic module can be switched on and off.

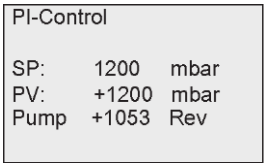
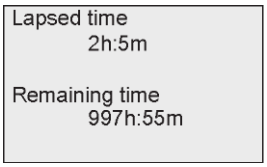
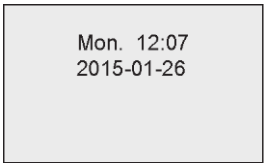
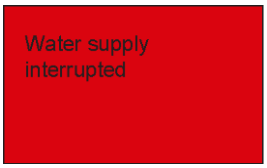
Table 6-4

No.	Action	Comments
1.	Press the “F2” key in the LOGO! TDE to switch between English and German.	
2.	Press the “F3” key to switch the backlight of the LOGO! TDE and of the integrated display of the LOGO! logic module on and off in the following order. • Backlight LOGO! logic module on, and backlight LOGO! TDE on • Backlight LOGO! logic module off, and backlight LOGO! TDE on • Backlight LOGO! logic module on, and backlight LOGO! TDE off • Backlight LOGO! logic module off, and backlight LOGO! TDE off	

6.5 Scenario 3: Display values by means of LOGO! TDE

By means of the LOGO! TDE, certain process data can be output or operated at the PI controller.

Table 6-5

No.	Action	Comments
1.	In the default message text of the LOGO! TDE, the setpoint pressure, the actual pressure of the cooling water system and setpoint speed of the motor are output. The values are given as the physical variables “bar” and “revolutions per minute”. Press the cursor keys ▼ or ▲ to show more message texts.	
2.	In the second message text of the LOGO! TDE; the operating hours counter is displayed. The value “Lapsed time” indicates how many hours the motor has already been in operation. The output box “Remaining time” displays the hours until the next maintenance of the motor. When loading the program into the LOGO!, the operating hours counter is reset.	
3.	In the third message text of the LOGO! TDE, the current date and time are displayed. If you wish to set the date and time, you can go on with the following item, starting from this display.	
4.	If the fill level in the tank falls to “dry run” during operation, the display automatically changes to this message text.	

6.6 Scenario 4: Change setpoint value by means of LOGO! TDE operator panel

The following section describes how to change the setpoint value.

Table 6-6

No.	Action	Comments
1.	Press the “F4” key in the LOGO! TDE to increase the setpoint value by “1”. Keep the “F4” key pressed to continuously increase the setpoint value.	
2.	Press the “F1” key in the LOGO! TDE to decrease the setpoint value by “1”. Keep the “F1” key pressed to continuously decrease the setpoint value.	

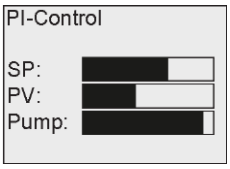
Note The FAQ “How can I increment/decrement a setpoint value using the function keys of LOGO! TDE?” provides a better understanding of changing the setpoint via function keys “

https://support.industry.siemens.com/cs/ww/en/view/34914500

6.7 Scenario 5: Display values by means of LOGO! Display

By means of the display integrated in the LOGO! logic module, the process values are displayed as bars.

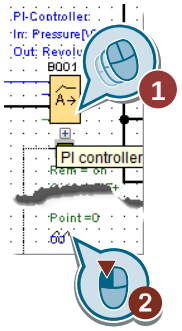
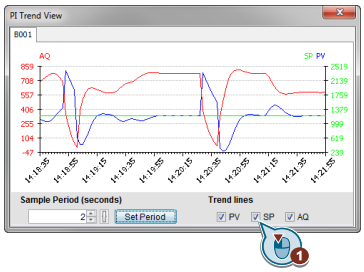
Table 6-7

No.	Action	Comments
1.	Bar display of the process values in the LOGO! logic module display A bar display of 100% corresponds to • SP: 2500mbar • PV: 2500mbar • Pump: 1350 revolutions per minute	

6.8 Scenario 6: Observe the course of the controlling by means of LOGO!Soft Comfort

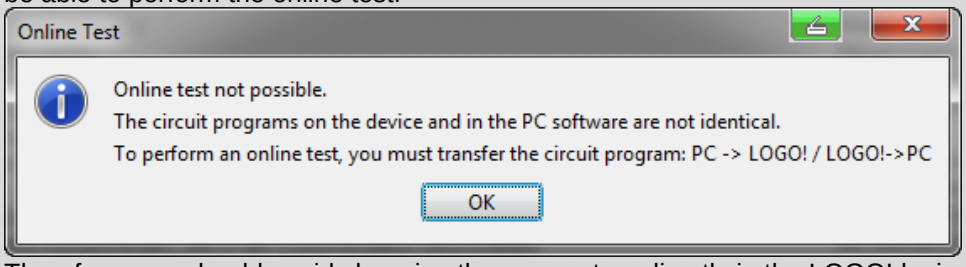
LOGO!Soft Comfort V8 offers the possibility of displaying the course of the controlling of the PI controller in a curve and to observe it live

Table 6-8

No.	Action	Comments
1.	Open the LOGO!Soft Comfort project (file 23753479_Set23_RegReal_V24.lsc, see Table 4-2).	
2.	Click on the function “Online Test”.	
3.	Drag the mouse cursor to the PI controller and then click on the symbol with the glasses. The trend view of the LOGO!Soft Comfort opens up.	
4.	Click on the “trendline” “SP” to display the trend “SP”. The red trend named “AQ” displays the setpoint speed (n set) [‰]. The green trend named “SP” displays the setpoint pressure (P set) [mbar]. The blue trend named “PV” displays the actual pressure (P act) [mbar].	

Note

If the following message pops up, you must transfer the LOGO! project again to be able to perform the online test.



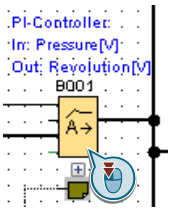
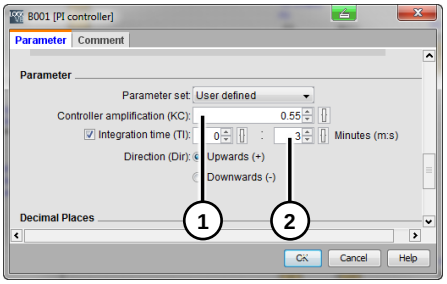
Therefore, you should avoid changing the parameters directly in the LOGO! logic module.

6.9 Scenario 7: Change control parameters

If you want to optimize the controlling process, the following parameters can be adjusted:

- P-component of the PI controller (default: 2)
- I-component of the PI controller (default: 1s)
- Ramp-up/ramp-down time of the motor (speed: 3s)

Table 6-9

No.	Action	Comments
1.	Open the LOGO!Soft Comfort project (File 23753479_Set23_RegReal_V24.lsc, see Download file Table 4-2) with LOGO!Soft Comfort V8	
2.	Double-click on the PI controller.	
3.	• Increase the P-component of the PI controller KC (1) to 10. • Increase the I-component of the PI controller TI (2) to 30s.	
4.	Save the LOGO!Soft Comfort project and proceed as described in Table 4-3 “Installation of the LOGO!Soft Comfort Program”, number 6 to transfer the modified project.	
5.	If required, change the ramp-up and ramp-down time of the motor in the SINAMICS V20 from **5** to **3** seconds each.	See chapter 3.2.1 “Configuring the SINAMICS V20” Table 5-5 number 16 and number 17

7 Appendix

7.1 Service and Support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services. Product information, manuals, downloads, FAQs, application examples and videos – all information is accessible with just a few mouse clicks: support.industry.siemens.com

SITRAIN – Training for Industry

We support you with our globally available training courses for industry with practical experience, innovative learning methods and a concept that's tailored to the customer's specific needs.

For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page: www.siemens.com/sitrain

Industry Online Support app

You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for Apple iOS, Android and Windows Phone: https://support.industry.siemens.com/cs/ww/en/sc/2067

7.2 Links and Literature

Table 7-1: Links and Literature

	Topic	Title
\1\	Siemens Industry Online Support	https://support.industry.siemens.com/cs/ww/en
\2\	Download page of this entry	https://support.industry.siemens.com/cs/ww/en/view/23753479
\3\	LOGO! Manual	https://support.industry.siemens.com/cs/ww/en/view/100761780
\4\	SINAMICS V20 Operating Instructions	https://support.industry.siemens.com/cs/ww/en/view/67267484
\5\	SINAMICS V20 Getting Started	https://support.industry.siemens.com/cs/ww/en/view/68321612
\6\	Gerätehandbuch Überwachungsrelais 3UG4 / 3RR2	https://support.industry.siemens.com/cs/ww/en/view/54397927

7.3 Change documentation

Table 7-2: Change documentation

Version	Date	Modifications
V2.0	10/2006	First version
V2.1, V2.2	04/2009	Layout changes and adaptation of the application to LOGO! 0BA6
V2.3.R	02/2014	• Layout changes, addition of security advice and adaptation of the application to • Controlling with LOGO! 0BA7 and • SINAMICS V20
V2.4.R	04/2015	• Controlling with LOGO! 8 • LOGO! TDE • Update of hardware components