Controller-based Automation

PROFIBUS®
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## About this documentation

This documentation:

- contains detailed information about the commissioning, configuration, and diagnostics of the PROFIBUS® bus system as part of the Lenze automation system Controller-based Automation.
- is part of the "Controller-based Automation" manual collection. It consists of the following sets of documentation:

<table>
<thead>
<tr>
<th>Documentation type</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product catalogue</strong></td>
<td>Controller-based Automation (system overview, sample topologies)</td>
</tr>
<tr>
<td></td>
<td>Lenze controllers (product information, technical data)</td>
</tr>
<tr>
<td><strong>System manuals</strong></td>
<td>Visualisation (system overview/sample topologies)</td>
</tr>
<tr>
<td><strong>Communication manuals</strong></td>
<td>Bus systems</td>
</tr>
<tr>
<td>Online helps</td>
<td>- Controller-based Automation EtherCAT®</td>
</tr>
<tr>
<td></td>
<td>- Controller-based Automation CANopen®</td>
</tr>
<tr>
<td></td>
<td>- Controller-based Automation PROFIBUS®</td>
</tr>
<tr>
<td></td>
<td>- Controller-based Automation PROFINET®</td>
</tr>
<tr>
<td><strong>Reference manuals</strong></td>
<td>Lenze Controllers:</td>
</tr>
<tr>
<td>Online helps</td>
<td>- Controller 3200 C</td>
</tr>
<tr>
<td></td>
<td>- Controller c300</td>
</tr>
<tr>
<td></td>
<td>- Controller p300</td>
</tr>
<tr>
<td></td>
<td>- Controller p500</td>
</tr>
<tr>
<td><strong>Software manuals</strong></td>
<td>Lenze Engineering Tools:</td>
</tr>
<tr>
<td>Online helps</td>
<td>- »PLC Designer« (programming)</td>
</tr>
<tr>
<td></td>
<td>- »Engineer« (parameter setting, configuration, diagnostics)</td>
</tr>
<tr>
<td></td>
<td>- »VisiWinNET® Smart« (visualisation)</td>
</tr>
<tr>
<td></td>
<td>- »Backup &amp; Restore« (backup, restore, update)</td>
</tr>
</tbody>
</table>
1 About this documentation

More technical documentation for Lenze components

Further information on Lenze products which can be used in conjunction with Controller-based Automation can be found in the following sets of documentation:

<table>
<thead>
<tr>
<th>Design / configuration / technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Product catalogues</td>
</tr>
<tr>
<td>• Controller-based Automation</td>
</tr>
<tr>
<td>• Controllers</td>
</tr>
<tr>
<td>• Inverter Drives/Servo Drives</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Installation and wiring</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Mounting instructions</td>
</tr>
<tr>
<td>• Controllers</td>
</tr>
<tr>
<td>• Communication cards (MC-xxx)</td>
</tr>
<tr>
<td>• I/O system 1000 (EPM-Sxxx)</td>
</tr>
<tr>
<td>• Inverter Drives/Servo Drives</td>
</tr>
<tr>
<td>• Communication modules</td>
</tr>
</tbody>
</table>

| ☐ Hardware manuals                     |
| • Inverter Drives/Servo Drives         |

<table>
<thead>
<tr>
<th>Parameterisation / configuration / commissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Online help/reference manuals</td>
</tr>
<tr>
<td>• Controllers</td>
</tr>
<tr>
<td>• Inverter Drives/Servo Drives</td>
</tr>
<tr>
<td>• I/O system 1000 (EPM-Sxxx)</td>
</tr>
</tbody>
</table>

| ☐ Online help/communication manuals            |
| • Bus systems                                   |
| • Communication modules                         |

<table>
<thead>
<tr>
<th>Sample applications and templates</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Online help / software manuals and reference manuals</td>
</tr>
<tr>
<td>• i700 application sample</td>
</tr>
<tr>
<td>• Application Samples 8400/9400</td>
</tr>
<tr>
<td>• FAST application template</td>
</tr>
<tr>
<td>• FAST technology modules</td>
</tr>
</tbody>
</table>

Tip!

Current documentation and software updates with regard to Lenze products can be found in the download area at:

www.lenze.com

Target group

This documentation is intended for persons who commission and maintain a Controller-based automation system by means of a Lenze Controller and the »PLC Designer« engineering tool.

Information regarding the validity

The information provided in this documentation is valid for the Lenze automation system “Controller-based Automation” from release 3.0.

Screenshots/application examples

All screenshots in this documentation are application examples. Depending on the firmware version of the field devices and the software version of the Engineering tools installed (e.g. »PLC Designer«), screenshots in this documentation may differ from the representation on the screen.
# 1 About this documentation

## 1.1 Document history

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.6</td>
<td>11/2016</td>
<td>TD17 Update for the Lenze automation system &quot;Controller-based Automation&quot; 3.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Chapter <a href="#">Controller-based Automation: Central motion control</a> (LI 12)</td>
</tr>
<tr>
<td>4.5</td>
<td>10/2015</td>
<td>TD17 Update for the Lenze automation system &quot;Controller-based Automation&quot; 3.12</td>
</tr>
<tr>
<td>4.4</td>
<td>01/2015</td>
<td>TD17 Update for the Lenze automation system &quot;Controller-based Automation&quot; 3.9</td>
</tr>
<tr>
<td>4.3</td>
<td>11/2014</td>
<td>TD17 Update for the &quot;Controller-based Automation&quot; 3.8 Lenze automation system</td>
</tr>
<tr>
<td>4.2</td>
<td>11/2013</td>
<td>TD17 Update for the Lenze automation system &quot;Controller-based Automation&quot; 3.6</td>
</tr>
<tr>
<td>4.1</td>
<td>03/2013</td>
<td>TD17 Update for the Lenze automation system &quot;Controller-based Automation&quot; 3.5</td>
</tr>
<tr>
<td>4.0</td>
<td>11/2012</td>
<td>TD17 • General corrections</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• New layout</td>
</tr>
<tr>
<td>3.3</td>
<td>07/2012</td>
<td>TD17 Revision on the Lenze automation system &quot;Controller-based Automation&quot; 3.3</td>
</tr>
<tr>
<td>3.2</td>
<td>12/2011</td>
<td>TD17 Update for the Lenze automation system &quot;Controller-based Automation&quot; 3.2</td>
</tr>
<tr>
<td>3.1</td>
<td>03/2011</td>
<td>TD17 Update for the &quot;Controller-based Automation&quot; 3.1 Lenze automation system</td>
</tr>
<tr>
<td>3.0</td>
<td>10/2010</td>
<td>TD17 Commissioning and configuration with the Lenze »PLC Designer« V3.x</td>
</tr>
<tr>
<td>2.0</td>
<td>10/2009</td>
<td>TD17 General revision</td>
</tr>
<tr>
<td>1.0</td>
<td>05/2009</td>
<td>TD17 First edition</td>
</tr>
</tbody>
</table>
About this documentation

1.2 Conventions used

This documentation uses the following conventions to distinguish between different types of information:

<table>
<thead>
<tr>
<th>Type of information</th>
<th>Highlighting</th>
<th>Examples/notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spelling of numbers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decimal</td>
<td>Normal spelling</td>
<td>Example: 1234</td>
</tr>
<tr>
<td>Decimal separator</td>
<td>Point</td>
<td>The decimal point is always used. For example: 1234.56</td>
</tr>
<tr>
<td>Hexadecimal</td>
<td>0x[0 ... 9, A ... F]</td>
<td>Example: 0x60F4</td>
</tr>
<tr>
<td>Binary</td>
<td>0b[0, 1]</td>
<td>Example: ‘0b0110’ / Example: ‘0b0110.0100’</td>
</tr>
<tr>
<td>Text</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program name</td>
<td>« «</td>
<td>PC software Example: Lenze «Engineer»</td>
</tr>
<tr>
<td>Window</td>
<td>italics</td>
<td>The message window... / The Options dialog box...</td>
</tr>
<tr>
<td>Variable names</td>
<td></td>
<td>Setting bEnable to TRUE...</td>
</tr>
<tr>
<td>Control element</td>
<td>bold</td>
<td>The OK button... / The Copy command... / The Properties tab... / The Name input field...</td>
</tr>
<tr>
<td>Sequence of menu commands</td>
<td></td>
<td>If several successive commands are required for executing a function, the individual commands are separated from each other by an arrow: Select the command File ➔ Open to...</td>
</tr>
<tr>
<td>Shortcut</td>
<td>&lt;bold&gt;</td>
<td>Use &lt;F1&gt; to open the online help. If a key combination is required for a command, a “+” is placed between the key identifiers: With &lt;Shift&gt;+&lt;ESC&gt;...</td>
</tr>
<tr>
<td>Program code</td>
<td>Courier</td>
<td>IF var1 &lt; var2 THEN a = a + 1 END IF</td>
</tr>
<tr>
<td>Keyword</td>
<td>Courier bold</td>
<td></td>
</tr>
<tr>
<td>Hyperlink</td>
<td>Underlined</td>
<td>Optically highlighted reference to another topic. Can be activated with a mouse-click in this documentation.</td>
</tr>
<tr>
<td>Icons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Page reference</td>
<td>(7)</td>
<td>Optically highlighted reference to another page. Can be activated with a mouse-click in this documentation.</td>
</tr>
<tr>
<td>Step-by-step instructions</td>
<td></td>
<td>Step-by-step instructions are indicated by a pictograph.</td>
</tr>
</tbody>
</table>
### Terminology used

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>Parameter for parameterising or monitoring the field device. The term is also referred to as &quot;index&quot; in common usage.</td>
</tr>
<tr>
<td>Controllers</td>
<td>The Controller is the central component of the Lenze automation system which controls the motion sequences by means of the operating system. The Controller communicates with the field devices (inverters) via the fieldbus.</td>
</tr>
<tr>
<td>Engineering PC</td>
<td>The Engineering PC and the Engineering tools installed serve to configure and parameterise the system &quot;Controller-based Automation&quot;. The Engineering PC communicates with the controller via Ethernet.</td>
</tr>
<tr>
<td>Engineering tools</td>
<td>Software solutions for easy engineering in all phases which serve to commission, configure, parameterise and diagnose the Lenze automation system.</td>
</tr>
<tr>
<td>FAST</td>
<td>By default, the Lenze FAST application software is installed on the Lenze Controller in the &quot;FAST runtime&quot; version with &quot;FAST Motion&quot; for the central control of PLC applications.</td>
</tr>
<tr>
<td>Fieldbus node</td>
<td>Devices integrated in the bus system as, for instance, Controller and inverter</td>
</tr>
<tr>
<td>Field device</td>
<td></td>
</tr>
<tr>
<td>GSD / GSE</td>
<td>Device data base file (device description for PROFIBUS stations)</td>
</tr>
<tr>
<td>PLC</td>
<td>Programmable Logic Controller</td>
</tr>
<tr>
<td>Subcode</td>
<td>If a code contains several parameters, they are stored in &quot;subcodes&quot;. In the documentation, the slash &quot;/&quot; is used as a separator between the code and the subcode (e.g. &quot;C00118/3&quot;). In everyday language, the term is also referred to as &quot;subindex&quot;.</td>
</tr>
</tbody>
</table>

### Bus systems

| CAN              | CAN (Controller Area Network) is an asynchronous, serial fieldbus system. |
| CANopen®         | CANopen® is a communication protocol based on CAN. The Lenze system bus (CAN on board) operates with a subset of this communication protocol. CANopen® is a registered community trademark of the CAN user organisation CiA® (CAN in Automation e. V.). |
| EtherCAT®        | EtherCAT® (Ethernet for Controller and Automation Technology) is an Ethernet-based fieldbus system which fulfils the application profile for industrial real-time systems. EtherCAT® is a registered trademark and patented technology, licenced by Beckhoff Automation GmbH, Germany. |
| ETHERNET         | Ethernet specifies the software (protocols) and hardware (cables, plugs, etc.) for wired data networks. In the form of "Industrial Ethernet", the Ethernet standard is used in industrial production systems. On the basis of IEEE 802.3, standard Ethernet is specified by the Institute of Electrical and Electronics Engineers (IEEE), USA. |
| EtherNet/IP™     | EtherNet/IP™ (EtherNet Industrial Protocol) is an Ethernet-based fieldbus system that uses Common Industrial Protocol™ (CIP™) to exchange data. EtherNet/IP™ and Common Industrial Protocol™ (CIP™) are brand labels and patented technologies, licensed by the ODVA user organisation (Open DeviceNet Vendor Association), USA. |
| PROFIBUS®        | PROFIBUS® (Process Field Bus) is a widely used fieldbus system for the automation of machines and production lines. PROFIBUS® is a registered trademark and patented technology licensed by the PROFIBUS & PROFINET International (PI) user organisation. |
| PROFINET®        | PROFINET® (Process Field Network) is a real-time capable fieldbus system based on Ethernet. PROFINET® is a registered trademark and patented technology licensed by the PROFIBUS & PROFINET International user organisation. |
1 About this documentation

1.4 Definition of the notes used

The following signal words and symbols are used in this documentation to indicate dangers and important information:

Safety instructions

Layout of the safety instructions:

<table>
<thead>
<tr>
<th>Pictograph</th>
<th>Signal word</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>🚨 Danger! 🚨</td>
<td>Danger of personal injury through dangerous electrical voltage</td>
<td>Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.</td>
</tr>
<tr>
<td>🚨 Danger! 🚨</td>
<td>Danger of personal injury through a general source of danger</td>
<td>Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.</td>
</tr>
<tr>
<td>⏰ Stop! ⏰</td>
<td>Danger of property damage</td>
<td>Reference to a possible danger that may result in property damage if the corresponding measures are not taken.</td>
</tr>
</tbody>
</table>

Application notes

<table>
<thead>
<tr>
<th>Pictograph</th>
<th>Signal word</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>💡 Note! 💡</td>
<td>Important note to ensure trouble-free operation</td>
<td></td>
</tr>
<tr>
<td>💡 Tip! 💡</td>
<td>Useful tip for easy handling</td>
<td></td>
</tr>
<tr>
<td>📅 Reference to another document</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2 Safety instructions

Please observe the safety instructions in this documentation when you want to commission an automation system or a plant with a Lenze Controller.

The device documentation contains safety instructions which must be observed!

Read the documentation supplied with the components of the automation system carefully before you start commissioning the Controller and the connected devices.

Danger!

High electrical voltage
Injury to persons caused by dangerous electrical voltage

Possible consequences
Death or severe injuries

Protective measures
Switch off the voltage supply before working on the components of the automation system.

After switching off the voltage supply, do not touch live device parts and power terminals immediately because capacitors may be charged.

Observe the corresponding information plates on the device.

Danger!

Injury to persons
Risk of injury is caused by ...
- unpredictable motor movements (e.g. unintended direction of rotation, too high velocities or jerky movement);
- impermissible operating states during the parameterisation while there is an active online connection to the device.

Possible consequences
Death or severe injuries

Protective measures
- If required, provide systems with installed inverters with additional monitoring and protective devices according to the safety regulations valid in each case (e.g. law on technical equipment, regulations for the prevention of accidents).
- During commissioning, maintain an adequate safety distance to the motor or the machine parts driven by the motor.
Stop!

Damage or destruction of machine parts
Damage or destruction of machine parts can be caused by ...
- Short circuit or static discharges (ESD);
- unpredictable motor movements (e.g. unintended direction of rotation, too high velocities or jerky movement);
- impermissible operating states during the parameterisation while there is an active online connection to the device.

Protective measures
- Always switch off the voltage supply before working on the components of the automation system.
- Do not touch electronic components and contacts unless ESD measures were taken beforehand.
- If required, provide systems with installed inverters with additional monitoring and protective devices according to the safety regulations valid in each case (e.g. law on technical equipment, regulations for the prevention of accidents).
Controller-based Automation: Central motion control

The Lenze "Controller-based Automation" system serves to create complex automation solutions with central motion control. Here, the Controller is the control centre of the system.

System structure of the Controller-based Automation

Example: PROFIBUS with the 3231 C Lenze Controller (I/O system 1000 and Servo Drive 9400 as slaves)
Lenze provides especially coordinated system components:

- **Engineering software**
  The Lenze Engineering tools on your Engineering PC (Windows® operating system) serve to parameterise, configure and diagnose the system. The Engineering PC communicates with the Controller via Ethernet.
  The Lenze engineering tools are available for download at: www.lenze.com ➔ Download ➔ Software Downloads

- **Controllers**
  The Lenze Controller is available as Panel Controller with integrated touch display and as Cabinet Controller in control cabinet design.
  Cabinet Controllers provide a direct coupling of the I/O system 1000 via the integrated backplane bus.

- **Bus systems**
  EtherCAT is the standard "on-board" bus system of the Controller-based Automation. EtherCAT enables the control of all nodes on one common fieldbus.
  Optionally, CANopen, PROFIBUS and PROFINET can be used as extended topologies.
  With Controllers 3200 C and p500 it is also possible to use EtherNet/IP via the Ethernet interfaces.
  Controllers c300 and p300 are provided with an "on board" CANopen interface (in addition to EtherCAT).

- **Inverter (e.g. Servo-Inverter i700)**

"**Application software**" of the Lenze Controllers
The "application software" of the Lenze Controllers enables the control and/or visualisation of motion sequences.

**FAST technology modules** provide for an easy development of a modular machine control in the »PLC Designer«.

The following "Application Software" versions are available:

- **"FAST Runtime"**
  The sequence control takes place (by logically combined control signals) in the Controller.
  The motion control takes place in the inverter.

- **"FAST Motion"**
  The sequence control and the motion control take place in the controller.
  The inverter merely serves as actuating drive.
  Motion applications make special demands on the cycle time and real-time capability of the bus system between the Controller and the subordinate fieldbus nodes. This is the case, for instance, if the nodes are to be traversed in a synchronised way or position setpoints are to be transferred.

- **"Visualisation"**
  The optional visualisation of the automation system can be used separately or additionally to "FAST Runtime" or "FAST Motion".
  For this purpose, an external monitor panel/display can be connected to the Cabinet Controller 3231 C/3241 C/3251 C.
Fieldbus communication

The Lenze controllers have different interfaces for fieldbus communication:

<table>
<thead>
<tr>
<th>Range</th>
<th>Cabinet Controller</th>
<th>Panel Controller</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>c300</td>
<td>3200 C series</td>
</tr>
<tr>
<td>Interfaces (on board)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethernet</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>EtherNet/IP</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>EtherCAT</td>
<td>1 1)</td>
<td>1</td>
</tr>
<tr>
<td>CANopen</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Optional interfaces (communication cards)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CANopen</td>
<td>-</td>
<td>●</td>
</tr>
<tr>
<td>MC-CAN2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROFINET master</td>
<td>■</td>
<td>●</td>
</tr>
<tr>
<td>MC-P8M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROFINET slave</td>
<td>■</td>
<td>●</td>
</tr>
<tr>
<td>MC-PBS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROFINET device</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>MC-PND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethernet</td>
<td>-</td>
<td>●</td>
</tr>
<tr>
<td>MC-ETH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serial interfaces</td>
<td>■</td>
<td>●</td>
</tr>
<tr>
<td>MC-ISI</td>
<td>-</td>
<td>●</td>
</tr>
</tbody>
</table>

1) Only the master functionality is supported.
2) Up to release 3.9: "EL 100 CAN" driver / from release 3.10: "Lenze CAN driver"

Ethernet interface

The Ethernet interface serves to connect the Engineering PC or to create line topologies (no integrated switch for Controller c300/p300).

With Controllers 3200 C and p500, the Ethernet interfaces also provide for EtherNet/IP communication.
4 The Lenze automation system with PROFIBUS

4.1 Brief description of PROFIBUS

This chapter provides basic information about ...

- the structure of the Lenze automation system using the PROFIBUS bus system;
- the Lenze Engineering tools required for commissioning;
- the interaction of the components.

Note!

In the Lenze automation system PROFIBUS is exclusively used as Logic bus.
The Motion functionality is not supported when PROFIBUS is used. Always use EtherCAT to connect inverters to be controlled via the central motion functionality.

> Mixed operation PROFIBUS with EtherCAT (43)

4.1 Brief description of PROFIBUS

Today, PROFIBUS is the most commonly used fieldbus system. As it comes with the widest range of various field devices, PROFIBUS is occasionally prioritised over more modern bus systems. Due to the low bandwidth and synchronisation mechanisms, PROFIBUS is only provided as a logic bus as part of the Lenze automation system.

We recommend using PROFIBUS for the following applications:

- Equipment and extension of system parts that have already been automated with PROFIBUS before.
- Use of field devices that are not available for e.g. EtherCAT or CANopen.
- Combination of PROFIBUS as logic bus and EtherCAT as logic/motion bus

Tip!

Detailed information about PROFIBUS can be found on the website of the PROFIBUS & PROFINET user organisation:

www.profibus.com
4.1.1 Structure of the PROFIBUS system

Example: PROFIBUS with the 3231 C Lenze Controller (I/O system 1000 and Servo Drive 9400 as slaves)

In the example (Fig. [4-1]), the 3231 C Lenze Controller is the PROFIBUS master. It can communicate with one or several stations (slaves).

PROFIBUS has an internal line topology (without repeater) or a tree topology (with repeater).

- Basic wiring of PROFIBUS (18)

The PROFIBUS network must be terminated at the first and last station. The bus terminating resistor is integrated into the bus connector and is activated by a switch.

Using the Lenze Controller as a PROFIBUS slave

Using the MC-PBS communication card, the Lenze Controllers can also be applied as PROFIBUS slaves.

Tip!

A sample project for operation of a 3200 C controller as PROFIBUS slave can be found in the "Download" area at www.Lenze.com:

Application Knowledge Base: All articles → Application Ideas Pool → Controller 3200 C
4 The Lenze automation system with PROFIBUS

4.1 Brief description of PROFIBUS

---

**Parameter setting**

The PROFIBUS stations can be parameterised in different ways.

If field devices are used the parameters of which are completely written to a GSD/GSE file, PROFIBUS can only be configured with the »PLC Designer«:

- Import of the PROFIBUS slaves' GSD/GSE files into the »PLC Designer« project.
- Set-up of the control configuration and creation of the PLC program

If PROFIBUS configuration is only possible via a PROFIdrive parameter channel, the parameterisation can also be done using the »Engineer«/»EASY Starter« – depending on the device type via the following interfaces:

- Ethernet
- CAN
- Diagnostic interface

![Note!](image)

The "L-force Controller as gateway" function is not available in combination with PROFIBUS. Therefore logging in with the »Engineer« via the controller as gateway is not possible.
4.1.2 Basic wiring of PROFIBUS

Two simple RS485 networks are described in the following examples.

Every segment of the network must be terminated at both ends. The bus terminators of the PROFIBUS are marked with a "Z" in the below examples.

In the case of an RS485 network consisting of only one segment, the network starts at the PROFIBUS master (M) with the integrated bus terminating resistor and ends at the last PROFIBUS station (S); its bus terminating resistor in the bus connector must be activated.

A PROFIBUS network consisting of several segments contains repeaters (R) for connecting the segments. The repeaters are provided with integrated bus terminating resistors.

If you do not use a repeater at the end of the segment, the bus terminating resistor in the bus connector of the last device must be activated.

- Activating the bus terminating resistor (27)
4 The Lenze automation system with PROFIBUS

4.1 Brief description of PROFIBUS

Number of nodes

---

<table>
<thead>
<tr>
<th>Segment</th>
<th>Master (M)</th>
<th>Slave (S)</th>
<th>Repeater (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>31</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>30</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>30</td>
<td>1</td>
</tr>
</tbody>
</table>

Tip!

Repeaters do not have a station address. When calculating the maximum number of stations, they reduce the number of stations by 1 on each side of the segment.

By means of repeaters, you can establish line or tree topologies. The maximum total dimension of the bus system depends on ...

- the used baud rate;
- the number of repeaters.
### 4.1.3 Field devices

The Lenze automation system supports the following PROFIBUS-capable Logic components:

<table>
<thead>
<tr>
<th>Logic field devices</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Controllers</td>
<td>Controller 32xx C</td>
</tr>
<tr>
<td></td>
<td>Controller p500</td>
</tr>
<tr>
<td><strong>Servo Drives 9400</strong> 1)</td>
<td>HighLine</td>
</tr>
<tr>
<td></td>
<td>HighLine with CiA402</td>
</tr>
<tr>
<td></td>
<td>PLC</td>
</tr>
<tr>
<td></td>
<td>regenerative power supply module commissioning guidelines</td>
</tr>
<tr>
<td><strong>Inverter Drives 8400</strong> 2)</td>
<td>StateLine</td>
</tr>
<tr>
<td></td>
<td>HighLine</td>
</tr>
<tr>
<td></td>
<td>TopLine</td>
</tr>
<tr>
<td><strong>I/O system 1000</strong></td>
<td>EPM-Sxxx</td>
</tr>
</tbody>
</table>

1) With PROFIBUS communication module E94AYCPM
2) With PROFIBUS communication module E84AYCPM

Field devices of other manufacturers can be implemented if corresponding device descriptions are available.
4.2 PROFIBUS hardware for Lenze Controllers

MC-PBM / MC-PBS communication card

- The MC-PBM communication card serves to connect a Lenze Controller as PROFIBUS master to a PROFIBUS network.
- The MC-PBS communication card serves to connect a Lenze Controller as PROFIBUS slave to a PROFIBUS network.
  - Using the Lenze Controller as a PROFIBUS slave (p. 16)

> Technical data of the MC-PBM / MC-PBS communication card (p. 23)

Application

The MC-PBM / MC-PBS communication card is installed in the respective slot of the Lenze Controller.

Example: Lenze Controller 3231 C with MC-PBM communication card

<table>
<thead>
<tr>
<th>MC-PBM</th>
<th>MC-PBM communication card</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBM1</td>
<td>PROFIBUS connection (p. 24)</td>
</tr>
</tbody>
</table>
### 4.3 Lenze Engineering tools

The Lenze Engineering tools enable the configuration and operation of controller-based Lenze automation systems according to individual requirements. Use the corresponding Engineering tool applicable to the field device.

»EASY Navigator«

The »EASY Navigator« provides an overview of the Lenze Engineering software installed on the Engineering PC.

The Lenze Engineering software consists of the Engineering tools optimised for the respective application case.

The »EASY Navigator« ...  
- simplifies orientation for selecting the suitable Engineering tool;  
- allows for the simple start of the required Engineering tool (depending on the application):

<table>
<thead>
<tr>
<th>What would you like to do?</th>
<th>Button</th>
<th>Engineering tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming</td>
<td></td>
<td>«PLC Designer«</td>
</tr>
<tr>
<td>• Parameterise the Lenze Controller</td>
<td>PLC</td>
<td></td>
</tr>
<tr>
<td>• Parameterisation of the i700 servo inverter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Parameterise the I/O system 1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inverter configuration</td>
<td></td>
<td>«Engineer«</td>
</tr>
<tr>
<td>• Projecting the automation/drive system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Parameterisation/configuration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Inverter Drives 8400, 8400 motec/protec</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Servo Drives 9400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• I/O system 1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visualisation</td>
<td></td>
<td>«VisiWinNET«</td>
</tr>
<tr>
<td>• Visualising the automation system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Creating the user interface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online diagnostics</td>
<td></td>
<td>«EASY Starter«</td>
</tr>
<tr>
<td>Easy online diagnostics of Lenze Controllers and other Lenze field devices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online parameterisation</td>
<td></td>
<td>«EASY Starter«</td>
</tr>
<tr>
<td>• Online parameterisation and commissioning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Direct online parameterisation when the online connection to the Lenze devices is active.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Further Engineering tools that are not called via the »EASY Navigator« are:  
- »WebConfig« (web-based parameterisation, configuration, and online diagnostics)  
- »IPC Backup & Restore« (data backup, data recovery).
5 Technical data

5.1 Technical data of the MC-PBM / MC-PBS communication card

### Range | Values
---|---
Protocol | PROFIBUS-DP (V0, V1), ISO 7498
Communication medium | RS485
Network topology | • Line terminated on both sides (without repeater)
                      • Tree (with repeaters)
Type within the network | • MC-PBM: Master
                      • MC-PBS: Slave
Baud rate | See "Bus cable length" (§ 25)
Bus length | Connection 9-pin Sub-D socket

| Range | Values |
---|---|
Number of DP-V0/DV1 slaves supported | Max. 125
Cyclic output data | Max. 3584 bytes (status information is treated separately)
Total cyclic input data | Max. 3584 bytes
Total cyclic output data | Max. 3584 bytes
Cyclic input data per slave | Max. 244 bytes/slave
Cyclic output data per slave | Max. 244 bytes/slave
Configuration data | Max. 244 bytes/slave

In the »PLC Designer« control configuration, a maximum of 125 PROFIBUS slaves (devices) can be appended below a PROFIBUS master.

For each slave, a maximum of 244 input bytes and 244 output bytes, respectively, can be transferred. Their data type is irrelevant in this context.

### I/O data of MC-PBS (slave)

| Range | Values |
---|---|
Cyclic input data | Max. 244 bytes
Cyclic output data | Max. 244 bytes
Acyclic reading/writing | Max. 240 bytes
Configuration data | Max. 244 bytes
Application-specific parameter data | 237 bytes

In the »PLC Designer« control configuration, a maximum of 24 I/O modules can be appended below a PROFIBUS slave. It is irrelevant whether the modules in question are input or output modules, or of which data type (BYTE, WORD) they are.
PROFIBUS connection

By means of the 9-pin Sub-D socket you can connect the communication card with the bus system.

<table>
<thead>
<tr>
<th>View</th>
<th>Pin</th>
<th>Assignment</th>
<th>Beschreibung</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Not assigned</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Not assigned</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>RxD/TxD-P</td>
<td>Data line B (received data/transmitted data, plus)</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>RTS</td>
<td>Request To Send (received data/transmitted data, no differential signal)</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>M5V2</td>
<td>Data ground (ground to 5 V)</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>P5V2</td>
<td>5 V DC / 30 mA (bus termination)</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>Not assigned</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>RxD/TxD-N</td>
<td>Data line A (received data/transmitted data, minus)</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>Not assigned</td>
<td>-</td>
</tr>
</tbody>
</table>
5.2 Bus cable specification

**Note!**

Only use cables that comply with the specifications of the PROFIBUS user organisation.

<table>
<thead>
<tr>
<th>Range</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable resistance</td>
<td>135 ... 165 Ω/km, (f = 3 ... 20 MHz)</td>
</tr>
<tr>
<td>Capacitance per unit length</td>
<td>≤ 30 nF/km</td>
</tr>
<tr>
<td>Loop resistance</td>
<td>&lt; 110 Ω/km</td>
</tr>
<tr>
<td>Core diameter</td>
<td>&gt; 0.64 mm</td>
</tr>
<tr>
<td>Core cross-section</td>
<td>&gt; 0.34 mm²</td>
</tr>
<tr>
<td>Cores</td>
<td>Twisted in pairs, insulated and shielded</td>
</tr>
</tbody>
</table>

PROFIBUS cables with an integrated bus terminating resistor can be obtained from various cable manufacturers.

**Bus cable length**

The bus cable length depends on the baud rate used:

<table>
<thead>
<tr>
<th>Baud rate</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.6 ... 93.75 kbps</td>
<td>1200 m</td>
</tr>
<tr>
<td>187.5 kbps</td>
<td>1000 m</td>
</tr>
<tr>
<td>500 kbps</td>
<td>400 m</td>
</tr>
<tr>
<td>1500 kbps</td>
<td>200 m</td>
</tr>
<tr>
<td>3000 ... 12000 kbps</td>
<td>100 m</td>
</tr>
</tbody>
</table>

**Note!**

The baud rate depending on the data volume, cycle time and number of stations should only be selected as high as required for the application.
6 Commissioning of PROFIBUS

6.1 Overview of the commissioning steps

This chapter provides information on how to commission the Lenze automation system with PROFIBUS. Depending on the field devices used, the following Lenze Engineering tools are required:
- »EASY Starter«
- »Engineer«
- »PLC Designer«

Note!

Via PROFIBUS, only logic Field devices can be operated. Inverters which are to be controlled via the central Motion functionality must always be connected via EtherCAT.

Mixed operation PROFIBUS with EtherCAT

This chapter provides information on how to commission the Lenze automation system with PROFIBUS. Depending on the field devices used, the following Lenze Engineering tools are required:
- »EASY Starter«
- »Engineer«
- »PLC Designer«

6.1 Overview of the commissioning steps

The main commissioning steps are listed in the following table:

<table>
<thead>
<tr>
<th>Step</th>
<th>Activity</th>
<th>Software to be used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Planning the bus topology</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Installing field devices</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Create a project folder</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Commission the field devices</td>
<td>»Engineer« / »EASY Starter«</td>
</tr>
<tr>
<td>5th</td>
<td>Creating a PLC program with a target system (Logic/Motion)</td>
<td>»PLC Designer«</td>
</tr>
<tr>
<td>6.</td>
<td>Configuring the communication parameters</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Importing missing devices / device description files</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Creating a control configuration (adding field devices)</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Configuration of the PROFIBUS master</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Configuring the PROFIBUS slave</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Compiling the PLC program code</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Logging in on the controller with the »PLC Designer«</td>
<td>With the log-in, the fieldbus configuration and the PLC program are loaded to the controller.</td>
</tr>
<tr>
<td>13.</td>
<td>Starting the PLC program</td>
<td></td>
</tr>
</tbody>
</table>
6 Commissioning of PROFIBUS

6.2 The commissioning steps in detail

In the following sections, the individual commissioning steps are described. Follow the instructions of these sections step by step in order to commission your system.

More detailed information about how to work with the Lenze Engineering tools can be found in the corresponding manuals and online helps.

6.2.1 Planning the bus topology

Before installing a PROFIBUS network, make a diagram of the network.

Note!

Observe the connection between bus cable length and baud rate.

How to plan the bus topology for your configuration

1. Create an overview of the planned PROFIBUS network with all field devices to be integrated.
2. Start with the Lenze Controller (master).
3. Add the other field devices (slaves) below.

6.2.2 Installing field devices

For the installation of a field device, follow the mounting instructions for the respective device.

Activating the bus terminating resistor

PROFIBUS must be terminated at the first and last physical station by a bus terminating resistor. The bus terminating resistor in the bus connector of the bus cable is activated by means of a switch. PROFIBUS cables with an integrated bus terminating resistor can be obtained from various cable manufacturers.

Note!

If you want to disconnect individual bus stations, ensure that the bus terminators at the cable ends remain active.

Please observe that the bus termination is not active any longer if ...

- the bus connector has been disconnected;
- the voltage supply of the field device has been disconnected.
6 Commissioning of PROFIBUS

6.2 The commissioning steps in detail

6.2.3 Create a project folder

Create a project folder on the Engineering PC.
Use this project folder to store the data generated in the following different project configuration steps:

- Project data created in the »Engineer« or »EASY Starter«
- The project file created in the »PLC Designer«

Tip!
Create a separate project folder for every PROFIBUS configuration and store the project files.

6.2.4 Commission the field devices

Parameterise the Lenze field devices connected to the PROFIBUS network by means of the »Engineer« or »EASY Starter«.
PROFIBUS is exclusively configured using the »PLC Designer«.
PROFIBUS settings of the field devices which have possibly been carried out with the »Engineer«/»EASY Starter« are overwritten.

Documentation of the Lenze field devices
Here you are provided with some detailed information relating to the commissioning of the Lenze field devices.

Tip!
We recommend to commission each field device individually and then integrate them into the PLC program.
6 Commissioning of PROFIBUS

6.2 The commissioning steps in detail

6.2.5 Creating a PLC program with a target system (Logic/Motion)

By means of the »PLC Designer« you can map the network topology in the control configuration.

Tip!

In the »PLC Designer«, PROFIBUS stations and stations of other fieldbus systems can be configured.

Mixed operation PROFIBUS with EtherCAT (§ 43)

How to create a PLC program in »PLC Designer«

1. Use the menu command File → New project to create a new »PLC Designer« project.

2. Select "Standard project" in the New project dialog box.

A "Standard project" simplifies the structure of a project in the »PLC Designer«; for instance, a device tree structure with a target system, PLC logic, etc. is provided.

• Go to the Name input field and enter a name for your »PLC Designer« project.

• Select the previously created project folder as storage location in the Location selection field.

Create a project folder (§ 28)

3. Confirm the entries by clicking OK.
4. Go to the Standard project dialog window and select the target system in the **Controller type** selection field:

Further optional project settings

2. Selection of the Controller firmware version

3. Selection of the compiler version

4. Selection of the programming language:
   - Sequential function chart (AS)
   - Instruction list (AWL)
   - Continuous Function Chart (CFC)
   - Function block diagram (FUP)
   - Ladder diagram (KOP)
   - Structured text (ST)

5. Confirm the selection by clicking **OK**.
6 Commissioning of PROFIBUS

6.2 The commissioning steps in detail

6.2.6 Configuring the communication parameters

Set the communication parameters to establish an online connection to the Lenze Controller later on.

How to configure the communication parameters

1. Go to the Communication settings tab of the target system (device, Lenze Controller ...) and click the Add gateway button.

Then go to the Gateway dialog box and enter the IP address of the controller. (By double-clicking the predefined value it can be overwritten.)

2. Confirm the entry by clicking OK.
3. Click the **Scan network** button.

4. Select the suitable controller for the IP address entered under 2. and activate it by means of the **Set active path** button (or by double-click).

5. Now you can carry out the following actions using the »PLC Designer«:
   - **Logging in on the controller with the »PLC Designer«** (§ 42)
6.2.7 Importing missing devices / device description files

The device description file contains the data of the fieldbus peripherals required for the master control. This file is required to program the control system.

With the »PLC Designer«, device descriptions for the following Lenze device series are installed as well:
- i700 servo inverter
- Servo Drives 9400
- Inverter Drives 8400
- I/O system 1000 (EPM-Sxxx)
- Fieldbus communication cards for Lenze Controllers (EtherCAT, CANopen, PROFIBUS, PROFINET)

In order to furthermore integrate missing devices or devices of other manufacturers, the corresponding device description files of the manufacturer are required.

In the »PLC Designer« you can import device description files of the *.XML, *.devdesc.XML, *.EDS, *.DCF, and *.GSx type via the menu command **Tools → Device Repository....**

---

**Tip!**

Current device description files for Lenze devices can be found in the "Download" area at: [www.lenze.com](http://www.lenze.com)
6 Commissioning of PROFIBUS

6.2 The commissioning steps in detail

6.2.8 Creating a control configuration (adding field devices)

Note!

The configuration of a PROFIBUS network must be created in the »PLC Designer«, since, during the start-up of the Lenze Controller, the complete configuration is written to the slaves connected. Settings that have been made previously in the slaves will be overwritten.

How to create the control configuration in the »PLC Designer«:

1. Go to the context menu of the target system (device, Lenze Controller ...) and use the Add device command in order to extend the control configuration by the PROFIBUS master (PROFIBUS MC-PBM).
2. Go to the context menu of the PROFIBUS (master) and execute the **Add device** command.
3. Go to the "Add device" dialog box, select the respective slave field device from the selection list and use the **Add device** button to add it below the PROFIBUS master.

You can only select those devices the PROFIBUS device description file of which has been imported in the »PLC Designer«.

- Importing missing devices / device description files (L3 33)

4. Repeat the **Add Device** command until all slaves connected to the fieldbus are included in the control configuration.
   - In the control configuration, a maximum of 125 PROFIBUS slaves (devices) can be appended below a PROFIBUS master.
   - For each slave, a maximum of 244 input bytes and 244 output bytes, respectively, can be transferred. Their data type is irrelevant in this context.
5. Assign appropriate names to the added slaves (e.g. "Drive_vertical_L9400_HighLine"). The names must ...
   • only contain the characters "A ... Z", "a ... z", "0 ... 9" or "_";
   • must not begin with a digit.

You can enter a name by clicking the element.

Example:
6.2.9 Configuration of the PROFIBUS master

How to configure the PROFIBUS master:

1. Set the DP parameters for the PROFIBUS master (PROFIBUS MC-PBM).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T_Sl</td>
<td>400</td>
<td>Bt</td>
<td>Slot time</td>
</tr>
<tr>
<td>min. T_SDR</td>
<td>11</td>
<td>Bt</td>
<td>Minimum station delay responder time</td>
</tr>
<tr>
<td>max. T_SDR</td>
<td>150</td>
<td>Bt</td>
<td>Maximum station delay responder time</td>
</tr>
<tr>
<td>T_QUI</td>
<td>0</td>
<td>Bt</td>
<td>Quiet time</td>
</tr>
<tr>
<td>T_SET</td>
<td>1</td>
<td>Bt</td>
<td>Setup time</td>
</tr>
<tr>
<td>T_TR</td>
<td>1440</td>
<td>Bt</td>
<td>Target rotation time</td>
</tr>
<tr>
<td>Gap</td>
<td>10</td>
<td></td>
<td>Gap update factor</td>
</tr>
<tr>
<td>Retry limit</td>
<td>2</td>
<td></td>
<td>Maximum retries in case of failure</td>
</tr>
<tr>
<td>Slave interval</td>
<td>100</td>
<td>100μs</td>
<td>Minimum slave interval</td>
</tr>
<tr>
<td>Poll timeout</td>
<td>10</td>
<td>1 ms</td>
<td>Minimum poll timeout</td>
</tr>
<tr>
<td>Data control time</td>
<td>2400</td>
<td>ms</td>
<td>Data control time</td>
</tr>
</tbody>
</table>

1. Station address
   - PROFIBUS master station address
   - The standard setting is '0'.
   - Only change the setting if the address is not supposed to be '0'. If required, you must also manually adapt the station addresses of the slaves.
   - Each station address in a PROFIBUS network must be unique (it must only appear once).

2. Highest station address
   - The standard setting is '125'.
   - (Max. number of PROFIBUS nodes = 126)

3. Baud rate
   - Set the baud rate depending on the Bus cable length (Max. number of PROFIBUS nodes = 125).

4. Default setting
   - By removing the checkmark you can manually change the parameter values in the "Values" column of the table.

5. Groups
   - This button serves to create up to eight device groups.
For each group, select whether it is supposed to be operated in the freeze mode and/or sync mode. By assigning the slaves to different groups (on the DP Parameters tab of the DP slaves, Groups... button), you can synchronise the data exchange from the master via a global control command.

A freeze command causes a master, a slave, or a group, to “freeze” the input in the current status and transfer these data in the next data exchange process.

A sync command causes the slaves to connect the data received by the master through to the outputs synchronously regarding time with the next sync command.

In order to activate or deactivate the freeze and sync mode for one group, you can either set a checkmark at the corresponding place in the table or remove it. Besides, you can change the names of the groups here.
2. Especially in the case of mixed operation with EtherCAT, we recommend selecting a special bus cycle task on the Profibus DP I/O Mapping tab of the PROFIBUS master (PROFIBUS MC-PBM).

The "Cycle settings of the higher-level bus" serve to use the bus cycle task set via the PLC settings tab of the Lenze Controller (device):
6.2.10 Configuring the PROFIBUS slave

Set the DP Parameters for the PROFIBUS slave.

- The PROFIBUS slave **station address** is automatically assigned after adding the slave to the control configuration tree. The PROFIBUS master receives the station address '0', the first slave the address '1', the second slave the address '2', and so on. Do only change this setting if the station addresses shall deviate from the standard setting. If required, you must manually adapt the station addresses of the other PROFIBUS stations, too. Each station address in a PROFIBUS network must be unique (it must only appear once).
- You do not have to set a baud rate, as the slave automatically recognises the baud rate.
- By means of the **Groups...** button, you can assign the slave to one (or several) device group(s).
- We recommend not to change the other standard settings.
6.2.11 Compiling the PLC program code

In order to compile the PLC program code, select the menu command Build → Build, or press the function key <F11>.

- If errors have occurred during the compilation process, you can locate and eliminate them by means of the »PLC Designer« error messages. Then re-translate the program code.
- If no errors have occurred during the compilation process, save the »PLC Designer« project in the project folder.

6.2.12 Logging in on the controller with the »PLC Designer«

Use the menu command Online → Login or <Alt>+<F8> to log in on the Lenze Controller.

- For this, the PLC program must be error-free.
- With the log-in, the fieldbus configuration and the PLC program are loaded to the controller. Any configuration or a PLC program that is possibly available is overwritten.

6.2.13 Starting the PLC program

Before the start, the PLC program must be loaded to the Lenze Controller using the menu command Online → Login.

Use the menu command Debug → Start or the function key <F5> to start the PLC program.

Note!

- The fieldbus starts even if not all stations of the bus are available.
- If the PLC program is stopped (<Shift>+<F8>), the cyclic data transfer continues until a "reset origin" is carried out (menu command Online → Reset origin).
Mixed operation PROFIBUS with EtherCAT

Example: Mixed operation of PROFIBUS with EtherCAT on the 3231 C Lenze Controller

Within the Lenze Controller-based Automation, PROFIBUS can be used in parallel to the EtherCAT bus system. This is useful if not all field devices are available for the same bus system or if a Motion bus (EtherCAT) is required in parallel to PROFIBUS.

The following combinations are permissible: PROFIBUS (Logic bus) and EtherCAT (Logic/Motion bus)

Controller-based Automation EtherCAT communication manual
Here you can find detailed information on how to commission EtherCAT components.
8 Function libraries

8.1 CAA_Device_Diagnosis.lib function library

For configuring the PROFIBUS and for diagnostic purposes, the following function libraries are available in the »PLC Designer«:

- CAA_Device_Diagnosis.lib
- IloDrvDPV1C1.lib

8.2 IloDrvDPV1C1.lib function library

The IloDrvDPV1C1.lib function library supports the acyclic PROFIBUS DP-V1 - class 1 writing and reading services for data transmission between the master and the slaves. The data are addressed via slot and index within the slave nodes (see PROFIBUS-DP standard).

Codes or indexes can be read or written with the IoDrvDPV1_C1_M_Write and IoDrvDPV1_C1_M_Read functions via DP-V1.

---

**Note!**

The diagnostics information in the CAA_Device_Diagnosis.lib function library is currently only partly available. You can only execute a diagnostics process if the node works without errors or if there is a fault. Currently, the PLC does not provide any detailed fault information.
9  Defining the minimum cycle time of the PLC project

9.1 Determining the task utilisation of the application

In this chapter you’ll learn how to ...

- Determining the task utilisation of the application (§ 45)
- Optimising the system (§ 47)

9.1 Determining the task utilisation of the application

In the online mode, the Monitor tab of the Task Configuration shows current status details and measurements of the cycles, cycle times, and jitters of the tasks contained.

The values are updated in the same time interval as that used for monitoring the values from the controller.

If the cursor is on a task name field, the values displayed can be reset to 0 by the Reset context menu command (right-click the task name field).
How to determine the task utilisation:

Initial situation: A complete project, e.g. with a PROFIBUS task and 2 lower priority tasks has been created.

1. For a first measurement of the task utilisation, set the cycle times of all cyclic tasks available in the PLC system "high" (e.g. PROFIBUS task = 10 ms, all other cyclic tasks = 20 ms).

2. Use the menu command Online → Login, or log in on the Lenze Controller with <Alt>+<F8>.
   • For this, the PLC program must be error-free.
   • With the log-in, the fieldbus configuration and the PLC program are loaded to the controller.

3. Reset the values displayed on the Monitor tab of the Task Configuration to 0 after the complete run-up of the system.
   Execute the Reset command from the context menu of the task name field.

4. Read the displayed maximum computing time of the task with the highest priority.
   In the illustration above, the max. cycle time of the PROFIBUS task is 647 μs.

The minimum cycle time \( T_{\text{min}} \) for a system can be calculated by means of the formula:

\[
T_{\text{min}} = \text{Task utilisation} \times \text{safety factor}
\]

Note!

A safety factor of 1.5 should be included in the calculation.
9 Defining the minimum cycle time of the PLC project
9.2 Optimising the system

---

9.2 Optimising the system

How to optimise the system:

1. Use the menu command **Online → Login**, or log in on the Lenze Controller with `<Alt>+<F8>`.
   - For this, the PLC program must be error-free.
   - With the log-in, the fieldbus configuration and the PLC program are loaded to the controller.
2. Check the task processing times.
3. Optimising the cycle times:
   - If technologically required, the cycle times of the remaining tasks with lower priorities can be decreased.
   - **Condition:** No task with a low priority must assign more than 60 percent of the corresponding cycle time in its task utilisation.
10 Diagnostics

10.1 LED status displays of the MC-PBM communication card

The PROFIBUS field devices, communication modules, and the MC-PBM and MC-PBS communication cards have LED status displays for diagnostics. Furthermore, the "PLC Designer" provides a function library for diagnosing PROFIBUS.

![Documentation of the field devices / PROFIBUS communication modules](image)

Here you'll find some detailed information on the LED status displays of the field devices and communication modules.

### 10.1 LED status displays of the MC-PBM communication card

<table>
<thead>
<tr>
<th>LED</th>
<th>Colour</th>
<th>Status</th>
<th>Beschreibung</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYS</td>
<td>Green</td>
<td>On</td>
<td>Communication active (cyclic data exchange with at least one PROFIBUS station</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blinking 5 times per second (5 Hz)</td>
<td>No error in the configuration: Communication is stopped or the device is ready for communication. However, there is no connection to a slave.</td>
</tr>
</tbody>
</table>
|     |        | Blinking irregularly     | • Starting action: Missing or faulty configuration  
|     |        |                         | • Runtime: Host watchdog time error                                           |
| Yellow | Blinking once per second (1 Hz) | The device is in bootstrap loader mode and is waiting for the firmware download |
| Yellow | Blinking 5 times per second (5 Hz) | The firmware download is executed.                                           |
| Yellow | Blinking irregularly | A hardware or severe system error has been detected.                         |
| ST0 | -      | Off                     | No function                                                                |
| ST1 | -      | Off                     | No function                                                                |
| ST2 | Red    | On                      | The device has a communication problem with at least one PROFIBUS slave or has detected a short circuit. |
|     | Yellow | On                      | The device holds the PROFIBUS token and can transmit telegrams.              |
|     |        | Blinking irregularly     | The device is part of the PROFIBUS network and shares the token with other PROFIBUS master devices. |
|     | -      | Off                     | No PROFIBUS communication                                                   |
## 10 Diagnostics

### 10.2 LED status displays of the MC-PBS communication card

#### LED status displays of the MC-PBS communication card

<table>
<thead>
<tr>
<th>LED</th>
<th>Colour</th>
<th>Status</th>
<th>Beschreibung</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYS</td>
<td>Green</td>
<td>On</td>
<td>Communication active (cyclic data exchange with the PROFIBUS master)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blinking 5 times per second (5 Hz)</td>
<td>No communication (no cyclic data exchange with the PROFIBUS master)</td>
</tr>
</tbody>
</table>
|     |        | Blinking irregularly | • Starting action: Missing or faulty configuration  
|     |        |                  | • Runtime: Host watchdog time error  |
| Yellow | Blinking once per second (1 Hz) | The device is in bootstrap loader mode and is waiting for the firmware download  |
|     |        | Blinking 5 times per second (5 Hz) | The firmware download is executed.  |
|     |        | Blinking irregularly | A hardware or severe system error has been detected.  |
|     | -      | Off             | No voltage supply or hardware is defective.  |
| ST0 | -      | Off             | No function  |
| ST1 | -      | Off             | No function  |
| ST2 | Red    | On              | The application program (bus-synchronous/device-controlled communication mode) is no longer synchronous with the bus cycle.  |
|     | Yellow | On              | The slave has received parameter/configuration data from the PROFIBUS master and is in the "DataExchange" state."  |
|     | -      | Off             | No PROFIBUS communication ("DataExchange" state not reached)  |
10.3 Diagnostics in the »PLC Designer«

For the diagnostics of PROFIBUS, the »PLC Designer« provides the `CAA_Device_Diagnosis.lib` function library.

**Note!**

The diagnostics information in the `CAA_Device_Diagnosis.lib` function library is currently only partly available. You can only execute a diagnostics process if the node works without errors or if there is a fault. Currently, the PLC does not provide any detailed fault information.
11 Parameter reference

This chapter complements the parameter list in the online help of the Lenze Controller by the parameters of the MC-PBM / MC-PBS communication card.

These parameters ...

• are for instance shown in the Lenze »WebConfig« (Engineering tool for web-based parameterisation);
• are listed in numerically ascending order.

C1031

Parameter | Name: C1031 | Device: type key
Data type: VISIBLE_STRING
Index: 23544 = 0x5BF8

Identification of the card
☑ Read access ☐ Write access ☐ CINH ☐ PLC-STOP ☐ No transfer

C1032

Parameter | Name: C1032 | Device: type version
Data type: VISIBLE_STRING
Index: 23543 = 0x5BF7

Version number of the card
☑ Read access ☐ Write access ☐ CINH ☐ PLC-STOP ☐ No transfer

C1033

Parameter | Name: C1033 | Device: name
Data type: VISIBLE_STRING
Index: 23542 = 0x5BF6

Device name of the card
☑ Read access ☐ Write access ☐ CINH ☐ PLC-STOP ☐ No transfer

C1034

Parameter | Name: C1034 | Device: software revision
Data type: VISIBLE_STRING
Index: 23541 = 0x5BF5

Software version of the card
☑ Read access ☐ Write access ☐ CINH ☐ PLC-STOP ☐ No transfer

C1035

Parameter | Name: C1035 | Device: hardware revision
Data type: VISIBLE_STRING
Index: 23540 = 0x5BF4

Hardware version of the card
☑ Read access ☐ Write access ☐ CINH ☐ PLC-STOP ☐ No transfer

C1036

Parameter | Name: C1036 | Device: serial number
Data type: VISIBLE_STRING
Index: 23539 = 0x5BF3

Serial number of the card
☑ Read access ☐ Write access ☐ CINH ☐ PLC-STOP ☐ No transfer
## 11 Parameter reference

### C1037

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Name: C1037</th>
<th>Device: manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer of the card</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Read access:missible
- Write access: impossible
- CINH: impossible
- PLC-STOP: impossible
- No transfer: possible

### C1038

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Name: C1038</th>
<th>Device: manufacturing date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing date of the card</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Read access:missible
- Write access: impossible
- CINH: impossible
- PLC-STOP: impossible
- No transfer: possible
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Your opinion is important to us

These instructions were created to the best of our knowledge and belief to give you the best possible support for handling our product. Perhaps we have not succeeded in achieving this objective in every respect. If you have suggestions for improvement, please e-mail us to:

feedback-docu@lenze.com

Thank you very much for your support.

Your Lenze documentation team