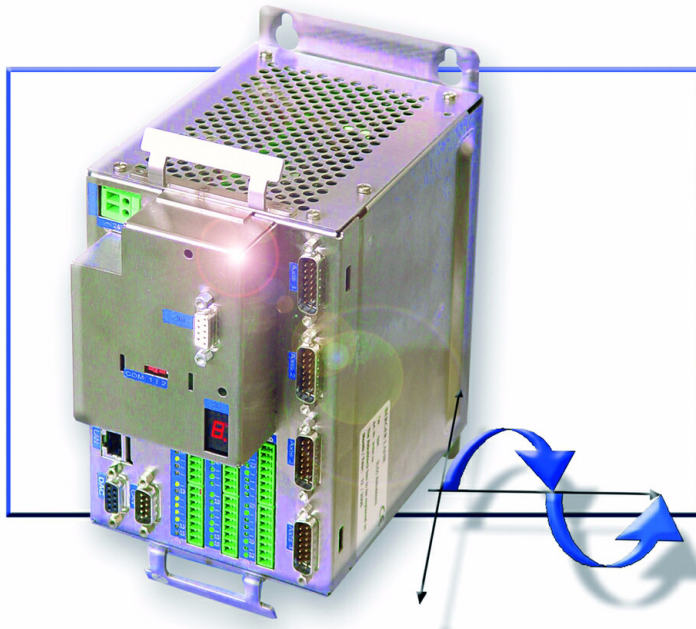


Technical Documentation



Twin Line
Multi-Axis Motion Controller

TLM2

Operating system: 1.1xx

Order no.: 0098 441 113 247

Version: V1.03, 05.05

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Twin Line

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Writing conventions and symbols

Work steps If work steps must be carried out in sequence, they are shown as follows:

- Special prerequisites for the following work steps
- ▶ Step 1
- ◁ Important response to this work step
- ▶ Step 2

If a response to a work step is specified, this will inform you that the step has been carried out correctly.

Unless otherwise stated, the individual instruction steps must be carried in the given sequence.

Lists Lists can be sorted alphanumerically or by priority. Lists are structured as follows:

- Point 1
- Point 2
 - Subpoint to 2
 - Subpoint to 2
- Point 3

Making work easier Information on making work easier can be found at this symbol:



*This offers supplementary information on making work easier.
See the chapter on safety for an explanation of the safety instructions.*

Parameters Parameters are shown as follows:

Group.Name Index:Subindex

1 Introduction

1.1 Scope of delivery

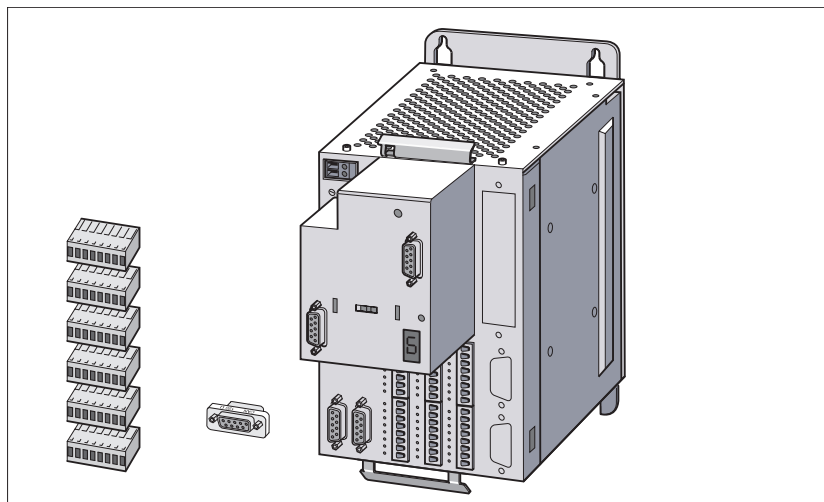


Figure 1.1 Scope of delivery TLM2

Scope of delivery TLM2

The delivery scope of the TLM2 comprises:

Qty	Item	Order number
1	TLM 271TCNA4PE with Berger Lahr Product Insert	0086 505 000 100
6	Terminals for I/O connection	0000 002 102 200
1	CAN terminating resistor 120 W with 2x D-Sub 9 pin plug	0000 002 106 013

After receiving the shipment, please ensure that all parts of the delivery scope are actually included.

The following parts comprise the delivery scope of the TLM2 4-axis P/R:

- The TLM2
- CAN moving load
- Six 8-pin counter plugs to connect the digital inputs and outputs. They have already been plugged into the device.
- This document / on CD.

If you notice that parts are missing, please contact your local Berger Lahr Sales Partner immediately.

Accessories

Accessories for the Multi Axis Motion Controller are:

Item	Order number
ACC 2RK BBDE003 Encoder adapter cable, Sub-D 15 pin female, Sub-D 9 pin male, length: 0.3 m	0086 300 901 000

Delivery condition The TLM2 is delivered without application program. Only the part of the software designated as firmware is on the TLM2. It enables transferring an application program to the TLM2 and starting it there. The firmware alone does not control any inputs and does not act at the CANopen Bus. An application on the TLM2 is necessary for this.

1.2 Documentation and references

This manual is to be regarded as supplemental documentation to the manual of the Twin Line Cell Controller TLCC. It describes the additions and deviations of the TLM2 compared to the TLCC.

If this manual contradicts information from the manual of the TLCC, then the statements in this manual apply to the TLM2.

The application of this documentation alone is not sufficient. Always consult the documentation of the TLCC as well. The documentation of the TLCC has the material number 00 9844 111 3208 and can be found as PDF-file on the CD accompanying this device.

1.3 Device overview

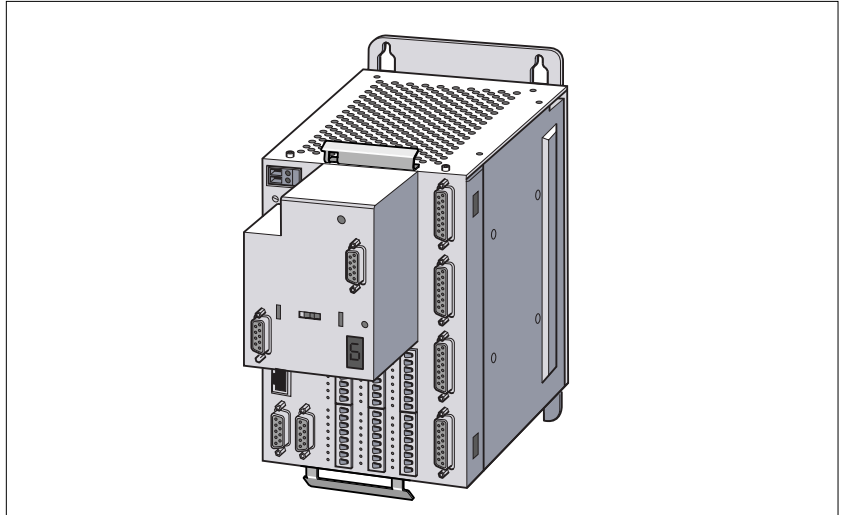


Figure 1.2 Twin Line Multi Axis Motion Controller TLM2

The Twin Line Multi Axis Motion Controller TLM2 is part of the family of the Twin Line Cell Controllers. The TLM2 is a variation of the TLCC with additional functions and connections. The basic properties of the TLCC also apply to the TLM2. The descriptions for the TLCC basic device can be found in the TLCC manual.

The TLM2 also has the property to carry out complex and interpolated driving motions to four motors controlled by pulse/direction signals. The TLM2 can also be programmed in IEC 61131-3.

Primary use The TLM2 with the 4 pulse/direction interfaces, is used for interpolated drive functions due to its calculation abilities and its P/R extension. For this, drives of the Twin Line, CPD and lclA families with pulse/direction inputs are used

In addition, simple drives using the CANopen network can be controlled by this variation of the TLM2 (e.g. point-to-point positioning as with the standard TLCC).

Ideally, drives are used which have a positioning control integrated in the drive controller so that only positioning commands with the drive can be exchanged through the CAN bus. Especially suited for this are Berger Lahr drives of the families Twin Line for step motors and AC servo-motors, CPD for AC servo-motors as well as lclA for the compact drives

1.4 Connections and extensions

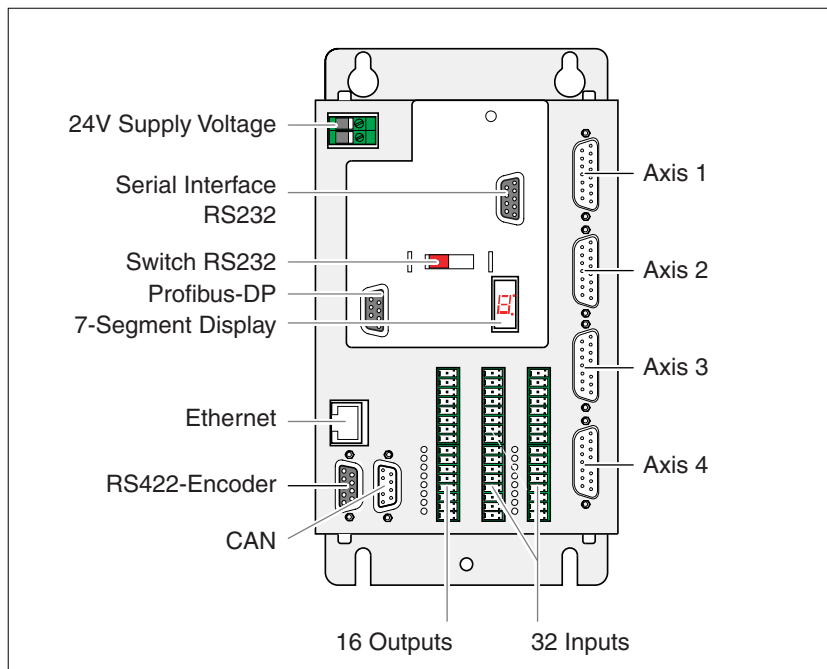


Figure 1.3 TLM2 overview

Pulse/direction outputs The four 15 pin Sub-D plugs can be used to control the four axis which are moving "interpolated".

RS422-Encoder input Contrary to the TLCC, the TLM2 has an RS422 encoder input.

Installation Information on the installation of additional interfaces of the Multi Axis Motion Controller can be found in chapter 3 "Installation" on page 3-1.

2 Safety

2.1 Hazard categories

Safety notes and general information are indicated by hazard messages in the manual. In addition there are symbols and instructions affixed to the product that warn of possible hazards and help to operate the product safely.

Depending on the seriousness of the hazard, the messages are divided into three hazard categories.



DANGER!

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death, serious injury, or equipment damage.



WARNING!

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.



CAUTION!

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

2.2 Safety instructions



DANGER!

Electric shock, fire or explosion

- Only qualified personnel who are familiar with and understand the contents of this manual and the other relevant manuals are authorised to work on and with this drive system.
- Before working on the drive system:
 - Switch off power to all terminals.
 - Place a sign "DO NOT SWITCH ON" on the switch and lock to prevent switching on.
 - **Wait 6 minutes** (for discharge of DC bus capacitors).
 - Measure voltage between DC+ and DC- and check for <48V. (The DC bus LED is not a safe indication for absence of the DC bus voltage).
- Do not short-circuit DC bus or touch unshielded components or screws of the terminals with voltage present.
- Install all covers and close the housing doors before applying power.
- The motor generates voltage when the shaft is rotated. Lock the shaft of the motor to prevent rotation before starting work on the drive system.
- The system manufacturer is responsible for compliance with all applicable regulations relevant to earthing the drive system.
- Do not reach into the drive system (e.g. no pointed objects).



WARNING!

Unexpected responses may cause injury and damage to the system

Enabling and disabling inputs and outputs can cause unexpected states and unexpected responses in the system.

- Start the system only if there are no persons or materials in the danger zone and the system can be operated safely.

2.3 Intended use

2.3.1 Environmental conditions

Environmental temperature	0°C to +50°C
Transport and storage temperature	-40°C to +70°C
Relative humidity	15% to 85% (no condensation allowed)
Installation altitude	h < 1000m above sea level
Protection class	IP20

2.3.2 Intended application

The Twin Line Multi Axis Motion Controller TLM2 with 4-axis pulse/direction card is an electrical component for controlling and regulating system parts.

The TLM2 has to be mounted into a control cabinet and be firmly attached. It may be used only with fixed connections in industrial applications.

The Multi Axis Motion Controller can be used as control for drives.

2.3.3 Tasks of the operator

The drive systems described here are products for general use that conform to the state of the art in technology and are designed to prevent any dangers. However, drives and drive controllers that are not specifically designed for safety functions are not approved for applications where the functioning of the drive could endanger persons. The possibility of unexpected or unbraked movements can never be totally excluded without additional safety equipment. For this reason personnel must never be in the danger zone of the drives unless additional suitable safety equipment prevents any personal danger. This applies to operation of the machine during production and also to all service and maintenance work on drives and the machine. The machine design must ensure personal safety. Suitable measures for prevention of property damage are also required.

2.4 Qualification of personnel

Only technicians who are familiar with and understand the contents of this manual and the other relevant manuals are authorised to work on and with this drive system. The technicians must be able to detect potential dangers that may be caused by setting parameters, changing parameter values and generally by the mechanical, electrical and electronic equipment.

The technicians must have sufficient technical training, knowledge and experience to recognise and avoid dangers.

The technicians must be familiar with the relevant standards, regulations and safety regulations that must be observed when working on the drive system.

3 Installation

3.1 Electrical installation

In the following, only those connections are described which the TLM2 is equipped with in addition to the connections of the TLCC. All other connection descriptions can be found in the TLCC manual.



WARNING!

Malfunction and danger of injury!

To ensure the functions and flawless operation of the device, the EMC of the cables needs to be guaranteed. Using unsuited, non-EMC-safe cables can damage the device and cause malfunctions.



WARNING!

Interference with signals and devices may cause injury

Distorted signals can cause unexpected device responses.

- Install the wiring in accordance with the EMC requirements.
- Check compliance with the EMC requirements, particularly in an environment subject to strong interference.

3.1.1 Connection of the pulse/direction outputs

The TLM2 has four additional 15 pin Sub-D plugs. These four plugs can be used to control the four axis which are moving "interpolated".

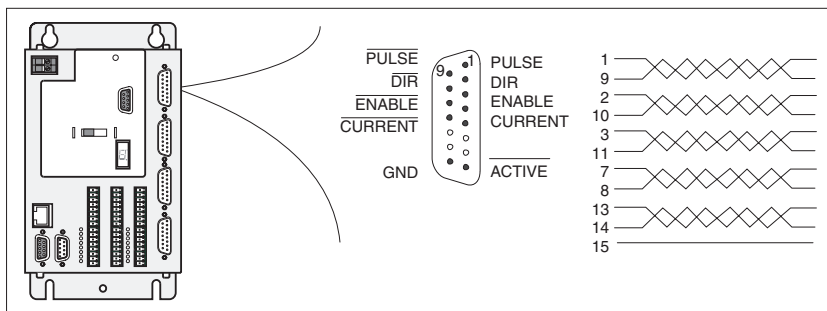


Figure 3.1 Interface connections of the pulse/direction modules



WARNING!

Damage of system parts through short circuiting!

Before start-up, please ensure that the pulse/direction plugs are connected in accordance with the active program.

PIN	Signal	Colour	Pair	Meaning	I/O
1	Pulse	white	1	Motor step "pulse"	O
9	$\overline{\text{Pulse}}$	brown	1	Motor step "pulse" inverted	O
2	DIR	green	2	Turning direction "dir"	O
10	$\overline{\text{DIR}}$	yellow	2	Turning direction "dir" inverted	O
3	ENABLE	grey	2	Release signal	O
11	$\overline{\text{ENABLE}}$	pink	3	Release signal inverted	O
7	GND	grey/pink	43	Ground/earth	O
8	$\overline{\text{ACTIVE}}$	red/blue	44	Drive ready	I
13	-	white/green	5		-
14	GND	brown/green	5		-
15	GND	white/yellow	6		-
4	PWM	blue	7	Phase power value	O
12	$\overline{\text{PWM}}$	red	7	Phase power value inverted	O
5	-	black	-		-
6	-	purple	-		-

For devices with cover, the cable needs to be led up from the connection.

- Cable specification*
- Shielded cable
 - Minimum cross-section of the signal wires 0.14 mm²
 - Twisted-pair lines
 - Shield earthed at both ends
 - Maximum length: for RS422 connection 100 m for Open Collector connection up to 10 m.

Function The guide signals for positioning the motor and a control signal are guided to the high level release through the pulse-direction interface. At the same time, the device signals the readiness of the drive as well as operation malfunctions via the interface.

Operation mode pulse-direction With rising flank of the PULSE signal, the motor carries out an arc step. The turning direction is controlled with the DIR signal.

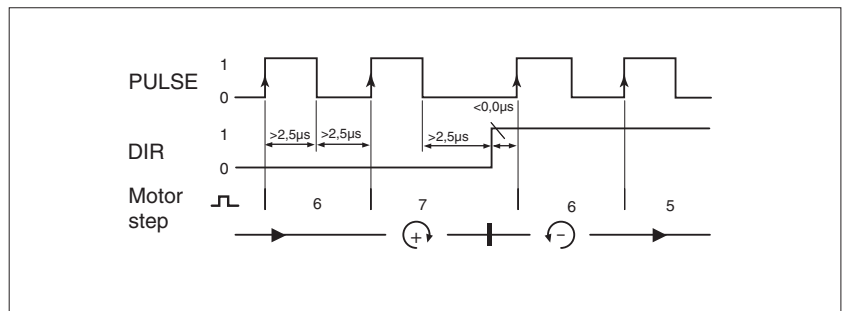


Figure 3.2 Operation mode pulse/direction

PULSE, DIR PULSE/DIR: Pulse-direction signal

Pin	Signal	Function	Value
1, 9	PULSE	Motor step	low -> high
2, 10	DIR	positive turning direction, negative turning direction	low/ open high

ENABLE The ENABLE signal releases the high level so that the motor can be controlled.

Pin	Signal	Function	Value
3, 11	ENABLE	High level restricted, High level released	low/ open

If there is no operation malfunction, the output ACTIVE indicates readiness approx. 100 ms after release of the high level.

PWM The preset motor phase power and therefore the torque of the motor can be lowered to between 0% and 100% using the pulse-wide modulated signal.

In case of constant high level at PWM input, no phase power is flowing, the motor is without power. In case of constant low level, the motor works with set, maximum phase power

Utilise the PWM control only together with the ENABLE function, not with the GATE function. The motor receives the full motor power with the

GATE function in case the PWM control is switched off. The PWM value is configured via the control configuration to each drive.

Pin	Signal	Function	Value
4, 12	PWM	Maximum motor phase power, lowered motor phase power	low/ open

ACTIVE

The output indicates readiness of position control. ACTIVE is an open collector output against GND. The logical inverted signal function becomes available at the output ACTIVE_CON of the signal interface.

Pin	Signal	Function	Value
8	<u>ACTIVE</u>	High level restricted, High level released	high low

Circuit of the signal inputs

It is recommended to switch the signal inputs via the RS422-interface. The switch of the signal inputs PULSE, DIR and ENABLE is displayed. Up to 10 inputs of the PULSE-C module can be connected to an RS422 sender. For line lengths ≤ 10 m and frequencies ≤ 50 kHz, Open Collector outputs can be used if the requirements to the resistance to jamming are low.

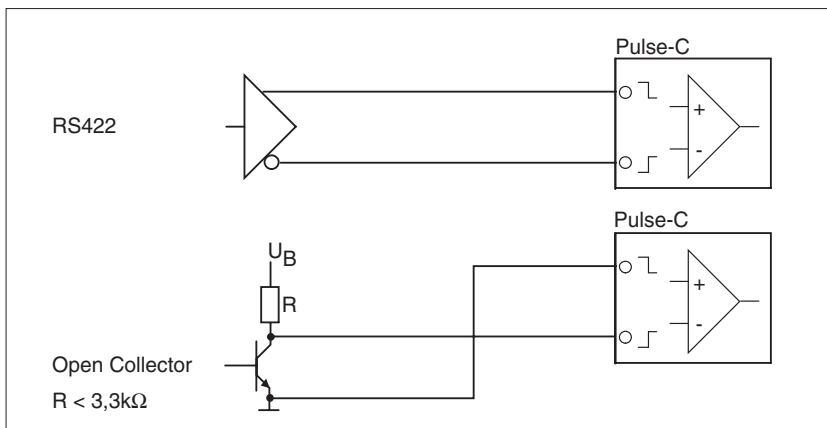


Figure 3.3 Circuit of the signal inputs

3.1.2 Connection of the RS422 encoder input

The TLM2 has an RS422 encoder input.

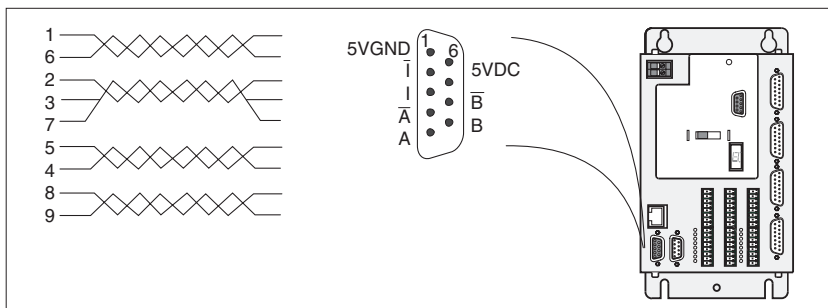


Figure 3.4 Interface connections of the RS422 encoder input

Pin	Signal	Pair	Meaning	I/O
5	A	1	Shaft encoder signal A	I
4	\bar{A}	1	Shaft encoder signal A inverted	I
9	B	2	Shaft encoder signal B	I
8	\bar{B}	2	Shaft encoder signal B inverted	I
1	GND	3	Encoder supply, mass	O
6	5VDC	3	Encoder supply, 5 V, max. 300 mA	O
7	24VDC	3	Encoder supply, 24 V	O
2	I	4	Channel index plus	I
3	\bar{I}	4	Channel index plus inverted	I

Cable specification

- Shielded cable
- Minimum cross-section of the signal wires: 0,25 mm², 5VDC, 24VDC and GND: 0,5 mm²
- Twisted-pair lines
- Shield earthed at both ends
- Maximum length 100 m.

3.1.3 Connection to the Profibus interface

Interface The Profibus-DP interface is equipped with a sub-D plug, 9-pin with UNC fastening.

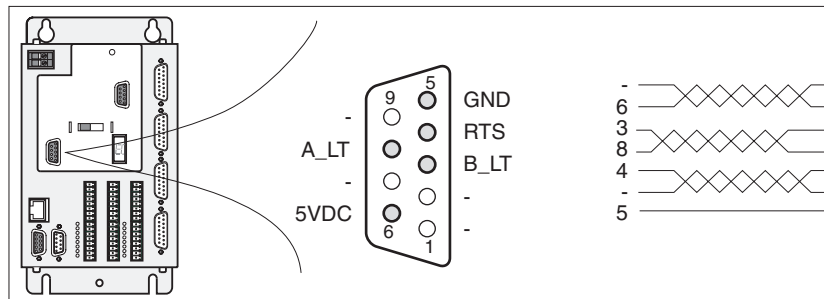


Figure 3.5 Interface connections of the field-bus module

Pin	Signal	Colour	Pair	Meaning	I/O
1	-	-	1	not used	-
6	5VDC	-	1	Power supply, max. 10 mA for circuit termination	O
2	-	-	-	not used	-
7	-	-	-	not used	-
3	B_LT	-	2	Data line, inverted	I/O
8	A_LT	-	2	Data line	I/O
4	RTS	-	3	Request to send	O
9	-	-	3	not used	-
5	GND	-	-	Ground/earth	-

A bus terminal forms the docking point to the Profibus. The data lines between module and bus terminal are wired 1:1.

Minimum wire connections are the terminals A_LT and B_LT to the A and B wires in the network.

On devices that have a cover the cable needs to be led down from the connection.

Cable specifications for connection to a bus terminal

- Shielded cable
- Minimum cross-section of the signal wires 0.14 mm²
- Twisted-pair lines
- Shield earthed at both ends
- Maximum length 100 metres



As a protection against interference, the shielding of digital cables is connected at both ends. Potential differences can cause undesirable currents on the shields and have to be prevented by potential equalisation lines: cable cross-section up to 200 m length: 16 mm², over 200 m length: 20 mm²

Function Using the Profibus-DP field-bus module, the cell controller can be connected as a slave to a Profibus-DP network.

The cell controller receives data and commands from a superior bus user; the master. As an acknowledgement the control sends back to the master information on the status of for example the device and operation. The data exchange is conducted by a special communication protocol.

The data is exchanged in cycles between master and slave. Each device in the network can be identified by a unique, settable device address.

Baud rate The baud rate depends on the transmission rate of the master.

Field-bus manual Integrating a Twin Line device into the field-bus is described in the respective field-bus manual in the chapters on installation and start-up.

4 Commissioning

The TLM2 does not have a start/stop button. It starts the run-time system with or without application program with the set-up of the supply voltage.

In delivery condition, i.e. without user program, Point 7 of the segment display may not light up. You may now transfer a program to the TLM2. An exact description for this can be found in the TLCC documentation.



DANGER!

Injuries through uncontrolled machine movements!

The TLM2 carries out a saved application immediately after switching on!

If you are not sure whether an application program is saved on the TLM2:

- ▶ Remove all connections of the TLM2 except for the power supply and the programming line (TCP/IP or serial COM1).
- ▶ Switch on the TLM2.
- ▶ Check with the programming tool whether a program is on the control.

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