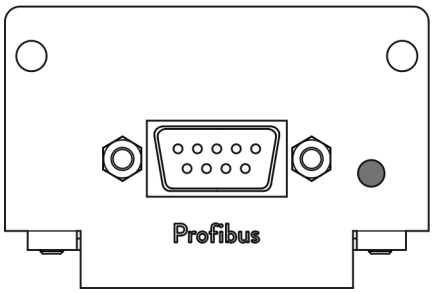
Operation manual

Interface module LRZ 929

Profibus modul Advanced



V3R6

Read this manual prior to performing any task!

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Translation of the original operation manual

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Table of contents

1 General

Many types of LAUDA constant temperature equipment have vacant module slots for installing additional interfaces. The number, size and arrangement of the module slots vary depending on the device and are described in the operating manual accompanying the constant temperature equipment. Two additional module slots available as accessories can be fitted to a LiBus module box, which is then connected as an external casing to the LiBus interface on the constant temperature equipment.

This operating manual describes how to install and configure the Profibus interface module (catalog no. LRZ 929).

The Profibus interface is designed for activating constant temperature equipment via the LAUDA command set. The interface functions provided for this purpose are described in chapters Chapter 7.4.1 “Read commands (input data Profibus Controller)” on page 21 and .

1.1 Intended use

The interface module can only be operated as intended and under the conditions specified in this operating manual.

The interface module may only be used in the following areas:

- Production, quality assurance, research and development in an industrial environment

The interface module is an accessory item that is used to control and monitor the LAUDA constant temperature equipment. The interface module is built into the device and connected to the 24 volt supply. It may only be installed in constant temperature equipment that supports the interface provided. Refer to the chapter "Compatibility” in this operating manual for a list of compatible product lines.

Operation of the interface module is also permitted in combination with the LiBus module box (LAUDA catalog no. LCZ 9727). This operating manual also contains a description of how to install and connect up the module box.

Reasonably foreseeable improper use

- Operation on a non-compatible device
- Outdoor operation
- Operation in a potentially explosive area
- Operation after incomplete assembly
- Operation using defective cables or connections or those that do not confirm to standards
- Operation under medical conditions in accordance with DIN EN 60601-1 or IEC 601-1

1.2 Compatibility

The interface module is available as an accessory for the following LAUDA product lines:

- Integral IN
- PRO
- Variocool
- Variocool NRTL

No operation of interfaces of the same type

Depending on the constant temperature equipment, only one Profibus interface can be used.

No operation of different interfaces

Combining the Profibus interface with a Profinet, RS 232/485 or CAN interface is not permitted. These interfaces cannot be combined with one another.

1.3 Technical changes

All technical modifications are prohibited without the written consent of the manufacturer. Damage resulting from a failure to observe this condition will void all warranty claims.

However, LAUDA reserves the right to make general technical modifications.

1.4 Warranty conditions

LAUDA grants a standard warranty of one year.

1.5 Copyright

This operating manual was written in German, checked and approved. If the content of other language editions deviates from the German edition, the information in the German edition shall take precedence. If you notice any discrepancies in the content, please contact LAUDA Service, see Chapter 1.6 “Contact LAUDA” on page 7.

Company and product names mentioned in the operating manual are usually registered trademarks of the respective companies and are therefore subject to brand and patent protection. Some of the images used may also show accessories that are not included in the delivery.

1.6 Contact LAUDA

Contact the LAUDA Service department in the following cases:

- Troubleshooting
- Technical questions
- Ordering accessories and spare parts

Please contact our sales department for questions relating to your specific application.

Contact information

LAUDA Service

Phone: +49 (0)9343 503-350

Email: service@lauda.de

2 Safety

2.1 General safety information and warnings

- Read this operating manual carefully before use.
- Keep the operating manual in a place within easy reach of the interface module.
- This operating manual is part of the interface module. If the interface module is passed on, the operating manual must be kept with it.
- This operating manual is applicable in combination with the operating manual of the constant temperature equipment in which the interface module is installed.
- Manuals for LAUDA products are available for download on the LAUDA website: https://www.lauda.de
- The warnings and safety instructions in this operating manual must be observed without fail.
- There are also certain requirements for personnel, see Chapter 2.3 “Personnel qualification” on page 9.

Structure of warnings

Warning signs	Type of danger
	Warning – danger zone.

Signal word	Meaning
WARNING!	This combination of symbol and signal word indicates a potentially dangerous situation that can result in death or serious injury if it is not avoided.
NOTICE!	This combination of symbol and signal word indicates a potentially dangerous situation that can result in material and environmental damage if it is not avoided.

2.2 Information about the interface module

- Always disconnect the constant temperature equipment from the power supply before installing the interface module or connecting interfaces.
- Always take the recommended safety measures against electrostatic discharge before handling interface modules.
- Avoid touching the circuit board with metallic tools.
- Do not start up the constant temperature equipment before installation of the interface module is complete.
- Store any unused interface modules in their packaging in accordance with the specified ambient conditions.
- Use only suitable cables of sufficient length for cable connections.
- Make sure that the protective screen on the cables and connectors complies with EMC regulations. LAUDA recommends using preassembled cables.
- Always lay cables correctly so that they do not pose a tripping hazard. Secure the laid cables and make sure that they cannot be damaged during operation.
- Check the condition of the cables and interfaces prior to each operation.
- Immediately clean any soiled parts, in particular unused interfaces.
- Make sure that the signals transmitted via the interface correspond to the permitted operating parameters of the interface module.

2.3 Personnel qualification

Specialized personnel

Only specialized personnel are permitted to install interfaces modules. Specialized personnel are personnel whose education, knowledge, and experience qualify them to assess the function and risks associated with the device and its use.

3 Unpacking

NOTICE!
Transport damage

Device damage

- Closely inspect the device for transport damage prior to starting up.
- Never operate a device that has sustained transport damage!

NOTICE!
Electrostatic discharge

Material damage

- Always observe safety measures against electrostatic discharge.

Please observe the following installation sequence:

1. Remove the interface module from its packaging.
2. If you want to store the interface module at the installation location, use the outer packaging. This packaging is protected against static charging.
3. After installing the equipment, dispose of the packaging materials in line with environmental regulations, see ↳ “Packaging” on page 42.

If you discover any damage on the interface module, contact LAUDA Service immediately, see ↳ Chapter 1.6 “Contact LAUDA” on page 7.

4 Device description

4.1 Purpose

The Profibus module is designed for installation in constant temperature equipment that supports the Profibus interface. The Profibus interface allows the user to activate constant temperature equipment via the LAUDA command set (for example, control station).

4.2 Structure

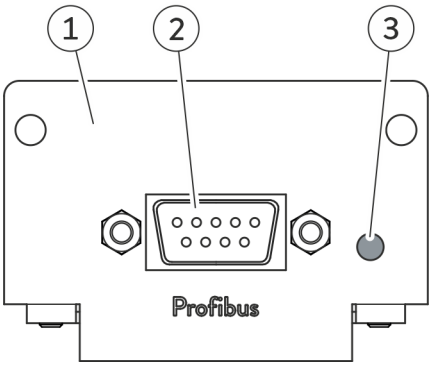

Fig. 1: Profibus module

1 Cover with holes for fastening screws
2 D-Sub socket, 9-pin
3 Red LED *

* The red LED indicates that the interface module has detected an error on the Profibus.

Refer to Chapter 6.1 “Contact assignment” on page 15 for more information on contact assignment.

5 Before starting up

5.1 Installing the interface module

The interface module is connected to an internal LiBus ribbon cable and inserted into a vacant module slot. The number and arrangement of the module slots vary depending on the device. The module slots are protected by a cover that is screwed onto the casing or attached to the slot opening.

WARNING!
Touching live parts

Electric shock

- Disconnect the device from the power supply before starting any installation work.
- Always observe safety measures against electrostatic discharge.

The module installation description essentially applies to all LAUDA constant temperature equipment; the example diagrams here show the installation of an analog module in constant temperature equipment from the Variocool product line.

Please note that an interface module with a small cover can only be installed in a low module slot. The fitted cover must cover the opening on the module slot completely.

You will require two M3 x 10 screws and a suitable screwdriver to secure the interface module.

Please observe the following installation sequence:

1. Turn off the constant temperature equipment and pull out the mains plug.
2. If necessary, remove the screws from the cover on the relevant module slot. If necessary, use a slotted screwdriver to prise off the cover.

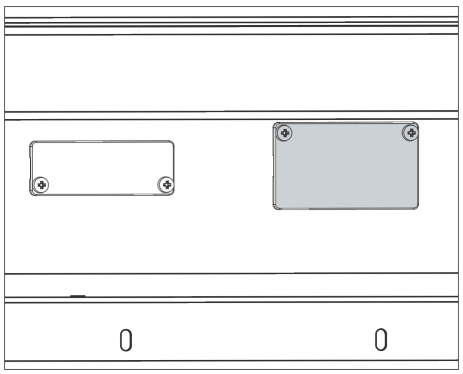

Fig. 2: Removing the cover (schematic diagram)

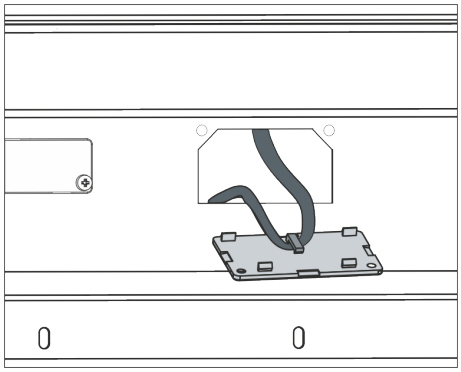

Fig. 3: Detaching the LiBus ribbon cable (schematic diagram)

3. Remove the cover from the module slot.
   - ▶ The module slot is open. The LiBus ribbon cable is attached to the inside of the cover and is easily accessible.
4. Disconnect the LiBus ribbon cable from the cover.

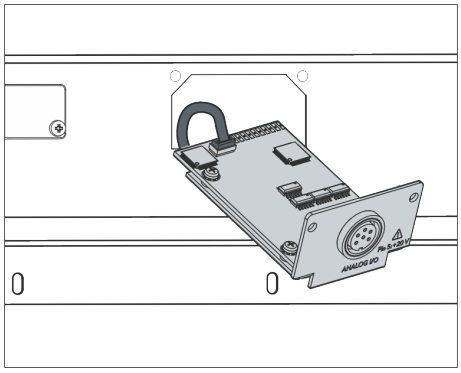

Fig. 4: Connecting the interface module (schematic diagram)

5. Connect the red plug on the LiBus ribbon cable to the red socket on the circuit board of the interface module. Plug and socket are reverse polarity protected: Make sure that the lug on the plug is aligned with the recess in the socket.
   - ▶ The interface module is correctly connected to the constant temperature equipment.
6. Slide the LiBus ribbon cable and the interface module into the module slot.

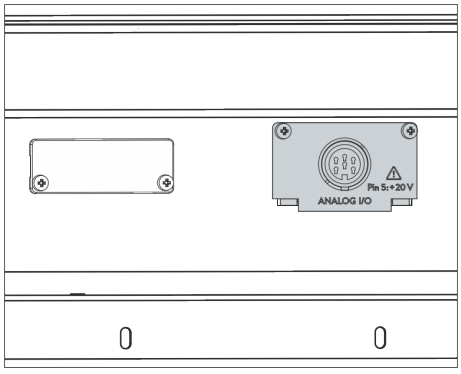

Fig. 5: Securing the cover (schematic diagram)

7. Secure the cover to the casing using two M3 x 10 screws.
   - ▶ The new interface on the constant temperature equipment is ready for operation.

5.2 Using the module box

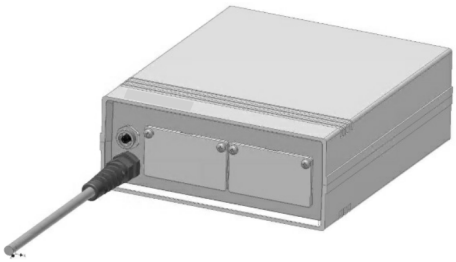

Fig. 6: LiBus module box, catalog no. LCZ 9727

You can extend LAUDA constant temperature equipment by two additional module slots using the LiBus module box. The module box is designed for interface modules with a large cover and is connected to constant temperature equipment via a vacant LiBus socket.
The socket on the constant temperature equipment bears the label **LiBus**.

Please observe the following installation sequence:

1. Switch off the constant temperature equipment.
2. Disconnect the cable on the module box from the constant temperature equipment.
   - ▶ The module box is disconnected from the power supply.
3. Check which interfaces are already present on the constant temperature equipment and module box.

   Observe the information on interface module compatibility. Only install an interface module with the same type of interface if operation with several of these interfaces is permitted.
4. Install the required interface module in the module box. Please read the information on installing the module box in the constant temperature equipment, see chapter "Installing the interface module".
5. Position the module box close to the constant temperature equipment.
6. Connect the cable on the module box to the LiBus socket on the constant temperature equipment.
   - ▶ The interfaces on the module box are ready for operation.

6 Commissioning

6.1 Contact assignment

If you have assembled the cables yourself, please note the following:

- *Statutory EMC requirements also apply to the cable connections. Use only shielded connection lines with shielded plugs/sockets.*
- *Reliably isolate all equipment connected to the extra-low voltage inputs and outputs according to DIN EN 61140 to safeguard against dangerous contact voltages. For example, use double or reinforced insulation according to DIN EN 60730-1 or DIN 60950-1.*

The use of standard Profibus cables is recommended to avoid high contact resistances.

The Profibus interface is designed as a 9-pin D-Sub socket. Data is transferred according to the RS 485 standard.

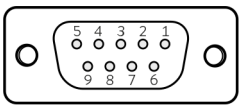

Fig. 7: Profibus socket

Table 1: Contact assignment of Profibus interface

Contact	Signal	Function
1	–	*Reserved **
2	–	*Reserved **
3	B	Data line +
4	CNTR-P	Control signal for repairs
5	GND	Supply termination - and data reference potential
6	5 V	Supply termination +
7	–	*Reserved **
8	A	Data line -
9	–	*Reserved **
Casing	Shield	Shield

* Reserved contacts must not be connected.

6.2 Software update

Older software installed on constant temperature equipment may have to be updated for the new interface to work.

1. Switch on the constant temperature equipment after installing the new interface.
2. Check whether a software warning appears on the display.
   - Warning 510 - 532 *SW update required* or *SW too old*: Please contact LAUDA Service, see ↳ Chapter 1.6 “Contact LAUDA” on page 7.
   - No software warning: Operate the constant temperature equipment as normal.

6.3 Module generation

To see which generation of an interface module is involved, proceed as follows:

1. Switch on the constant temperature equipment after installing the interface module.
2. Press the [Enter key] on the constant temperature equipment to open the menu.
3. On the constant temperature equipment Variocool, select the menu items → *Settings* → *Device status* → *Hardware version*.

   ▶ A list of hardware versions opens.

   If the revision number *(1)* appears in brackets in front of the printed circuit board index, a second generation interface module (with the suffix "Advanced") is installed in the constant temperature equipment.

7 Operation

7.1 Profibus basics

Abbreviations

Abbreviation	Meaning
GSD	General Station Description; data format for Profibus and Profinet devices
ASIC	Application-Specific Integrated Circuit

GSD file and identification number

Name of GSD file:	LPBM0A2B.GSD
Identification number	0x0A2B

A ZIP archive containing a GSD file and a graphic in bitmap format (*.bmp) is provided for configuration of the Profibus system. The GSD file provides the Master with device information required for project planning. The bitmap file contains a symbol that shows the LAUDA logo. The Profibus project planning software can use the file to display a clear graphic representation of the overall system in certain situations. The bitmap file and GSD file must be stored in the same file, however.

Baud rate

The Profibus interface automatically detects the transmission speed used by the Master. Transmission speeds of up to 12 Mbaud are supported.

Addressing

The address of the Profibus interface is either entered on the constant temperature equipment or assigned via the Profibus.

Before the Profibus network is started up, each connected Profibus device must be assigned a unique address within a range of 1 – 125. Each Profibus interface is assigned the address 126 in the factory, which enables the new address to be assigned via the Profibus.

7.2 Interface protocols

One of the following two protocols is used for communication between Profibus Master and Profibus Slave (constant temperature equipment):

Large - 7 bytes are periodically sent from the Master to the Profibus interface and 6 bytes are sent in the opposite direction, see ↳ Chapter 7.2.1 "*Large* protocol" on page 18.

Short - Periodic exchange of 32 bytes between the Master and Profibus interface, see ↳ Chapter 7.2.2 "*Short* protocol" on page 20.

The planning tool is used to determine which of the two protocols is used. During initialization, the Profibus master first sends special telegrams containing parameterization and configuration data to the Profibus interface (Slave) as well as specifying the defined protocol. Only then can the Master and Slave exchange user data via the Profibus.

7.2.1 *Large* protocol

Syntax

When the *Large* protocol is used, 7 bytes are sent periodically from the Master to the Profibus interface (Slave) and 6 bytes are sent in the opposite direction:

Table 2: Master >> Slave (7 bytes)

Byte	Content / function
1	Toggle info
2	Command (Cmd)
3	Command number (Cmd No)
4 – 7	Value

Table 3: Slave >> Master (6 bytes)

Byte	Content / function
1	Toggle info
2	Command (Cmd)
3 – 6	Value

Toggle info

The integrated toggle byte is used to identify queries sent multiple times in succession by the Master, as well as the response times of the Slave. The Master therefore changes the toggle byte when it sends a new command. In order to assign its responses unambiguously, the Slave includes the received toggle byte unchanged in the response.

Command and command number

The combination of command and command number defines the type and content of the Master request, see Chapter 7.4.1 “Read commands (input data Profibus Controller)” on page 21 and .

The slave includes the command in the request (byte 2) in its response to clearly identify its reaction.

Value

Numerical values are always transmitted in 4-digit format at a resolution of 1:1000. This also applies to integer settings such as status values.

Example: The constant temperature equipment should be switched to standby mode. The status value 1 required to switch to this mode is transmitted by the numerical value 1000.

Responses from the constant temperature equipment

The constant temperature equipment (Slave) sends the following responses in reply to the read and write commands from the Profibus Master. In every response from the Slave to a read command from the Master, bytes 3 - 6 contain the status value that must be transmitted in the required unit. In responses to write commands, bytes 3 - 6 only contain a value if the response applies to a specific parameter.

Table 4: Responses to write commands

Cmd (byte 2)	Value (bytes 3 – 6)	Meaning
0	0	Communication successful
0xFF	*Error number*	Communication error, see table below for error type

Table 5: Responses to read commands

Cmd (byte 2)	Value (bytes 3 – 6)	Meaning
Command in request	*Requested data values*	Response to request sent
0xFF	*Error number*	Communication error, see table below for error type

If the slave responds with an error message, the transmitted value (bytes 3 - 6) contains an error number, which indicates one of the following errors:

Table 6: Overview of error numbers

Error number	Meaning
0x02	Internal communication error
0x03	Wrong command
0x05	Syntax error in value
0x06	Impermissible value
0x08	Interface or value not available
0x30	Programmer: All segments occupied
0x31	Not possible to specify set point value: Analog set point value input is activated
0x32	TiH <= TiL
0x33	External sensor missing
0x34	Analog value not present
0x35	Automatically configured
0x36	Not possible to specify set point value: Programmer is running or paused
0x37	Not possible to start the programmer: Analog set point value input is activated
0x38	No operating rights. Another control section has exclusive operating rights, which means that writing via this interface is not permitted.

7.2.2 *Short* protocol

Syntax

When the *Short* protocol is used, 32 bytes are exchanged periodically between the Master and the Profibus interface (Slave). How these bytes are assigned depends on the transmission direction (output data/input data, see below).

For the "Short" protocol, the following rules apply to the syntax and sequence of the commands:

- Temperatures are transmitted in ASCII fixed point format (syntax `XXX.XX` / `-XX.XX`; output 000.00 means that the associated value does not exist).
- The Slave can only report a change in value by the Master (set temperature, standby) when the constant temperature equipment has accepted the new value. The value is changed in the input data with a corresponding delay.

See chapters ↳ Chapter 7.4.1 “Read commands (input data Profibus Controller)” on page 21 and for a list of interface functions that can be used with the *Short* protocol.

7.3 Menu structure

The menu only ever shows functions that are available for the current constant temperature equipment.

The menu for configuring the interface is integrated in the main menu of the relevant constant temperature equipment:

All operating units

Menu → *Modules* → *Profibus*

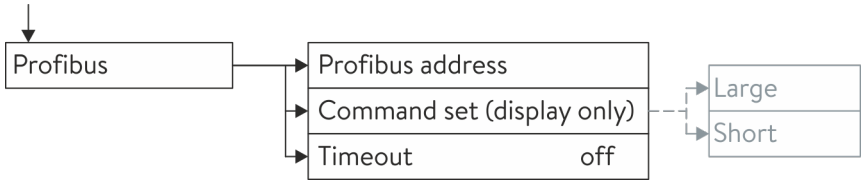

Fig. 8: Profibus interface menu

The command set used is specified by the Profibus Master.

7.4 Interface functions

Interface functions such as read and write commands make it possible to read out the current operating parameters of constant temperature equipment and predefine specific settings and process values.

The interface functions supported by this interface are presented briefly below. They are sorted by topic according to the component affected and assigned a unique ID. Depending on the technical configuration of your constant temperature equipment, the number and scope of the interface functions actually available may vary from the list shown here, see chapter "Availability of the interface functions".

7.4.1 Read commands (input data Profibus Controller)

The Profibus module recognizes the following read commands, which can be used to query the operating data of the constant temperature equipment:

Table 7: Temperature

ID	Function	Unit, resolution	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
2	Temperature set point	[°C]	12	0	0 – 5	ASCII: XXX.XX / -XX.XX
3	Bath temperature (outflow temperature)	[°C], 0.01 °C	11	0	6 – 11	ASCII: XXX.XX / -XX.XX
5	Controlled temperature (internal / external Pt / external analog / external serial)	[°C]	11	1	–	
7	External temperature TE (Pt)	[°C]	11	3	18 – 23	ASCII: XXX.XX / -XX.XX
8	External temperature TE (analog input)	[°C]	11	4	–	
25	Overtemperature turn off point T_Max	[°C]	12	3	–	
27	Limitation of outflow temperature TiH (upper limit)	[°C]	12	4	–	
29	Limitation of outflow temperature TiH (lower limit)	[°C]	12	5	–	
162	Overtemperature turn off point, tank	[°C]	12	12	–	
163	Overtemperature turn off point, outlet	[°C]	12	13	–	

Table 8: Pump

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
6	Outflow pressure / pump pressure, relative to the atmosphere	[bar]	11	2	–	
12	Flow rate	[L/min]	11	7	–	
18	Pump power stage	[–]	12	1	–	
31	Outflow pressure set point / pump pressure (for pressure control settings)	[bar]	12	6	–	
37	Through-flow control set point	[L/min]	12	9	–	

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
71	Status of through-flow control: 0 = off / 1 = on	[–]	14	5	–	
154	Outflow pressure of through-flow control, relative to the atmosphere	bar	11	9	--	

Table 9: Fill level

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
9	Bath level (fill level)	[–]	11	5	–	

Table 10: Actuating signal

ID	Function	Unit, resolu-tion	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
11	Controller actuating signal	[%], 0.1 %	11	6	–	
136	Controller actuating signal	[%]	–		12 – 17	ASCII: 00-100 = 000100

Table 11: Safety

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (Byte 2)	Cmd No. (Byte 3)	Byte	Meaning
35	Timeout communication via interface (1 – 99 seconds; 0 = Off)	[s]	12	8	–	

Table 12: Control parameters

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
39	Control parameter Xp	[–]	13	0	–	
41	Control parameter Tn	[s]	13	1	–	
43	Control parameter Tv	[s]	13	2	–	

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
45	Control parameter Td	[s]	13	3	–	
47	Control parameter KpE	[–]	13	4	–	
49	Control parameter TnE	[s]	13	5	–	
51	Control parameter TvE	[s]	13	6	–	
53	Control parameter TdE	[s]	13	7	–	
55	Correction limitation	[K]	13	9	–	
57	Control parameter XpF	[–]	13	10	–	
61	Control parameter Prop_E	[K]	13	15	–	

Table 13: Control

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
59	Set point offset	[K]	13	14	–	
67	Control in control variable X: 0 = internal 1 = external Pt 2 = external analog 3 = external serial 5 = external Ethernet 6 = external EtherCAT 7 = external Pt 2 8 = external OPC UA 9 = external Modbus TCP	[–]	14	1	–	
69	Offset source X for set point: 0 = off 1 = external Pt 2 = external analog 3 = external serial 5 = external Ethernet 6 = external EtherCAT 7 = external Pt 2 8 = external OPC UA 9 = external Modbus TCP	[–]	14	4	–	

Table 14: Rights

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
63	Status of Master keyboard: 0 = free / 1 = blocked	[–]	14	0	–	
65	Status of keyboard (remote control): 0 = free / 1 = blocked	[–]	14	3	–	

Table 15: Status

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
75	Status of standby: 0 = Device is switched on / 1 = Device is switched off	[–]	14	2	30	Standby mode: 0 = off, 1 = on
130	Device status: 0 = OK, 1 = fault (error, alarm or warning)	[–]	15	0	31	HEX: 0x00 = OK, 0xFF = fault
137	Error status: 0 = OK, 1 = error	[–]	15	1	–	
138	Alarm status: 0 = OK, 1 = alarm	[–]	15	2	–	
139	Warning status: 0 = OK, 1 = warning	[–]	15	3	–	

Table 16: Software version

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
108	Control system	[–]	16	0	–	
109	Protection system	[–]	16	1	–	
110	Remote control (command)	[–]	16	2	–	
111	Cooling system	[–]	16	3	–	
112	Analog interface module	[–]	16	4	–	
113	Through-flow control	[–]	16	22	–	

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
114	Interface module RS 232/485 or Profibus /Profinet/CAN	[–]	16	5	–	
115	Ethernet interface module	[–]	16	18	–	
116	EtherCAT interface module	[–]	16	19	–	
117	Contact interface module	[–]	16	6	–	
118	Solenoid valve for cooling water	[–]	16	7	–	
119	Solenoid valve for automatic filling device	[–]	16	8	–	
121	Solenoid valve, shut off valve 1	[–]	16	10	–	
122	Solenoid valve, shut off valve 2	[–]	16	11	–	
123	High-temperature cooler	[–]	16	16	–	
124	Pump 1	[–]	16	12	–	
125	Pump 2	[–]	16	13	–	
126	Heating system 1	[–]	16	14	–	
127	Heating system 2	[–]	16	15	–	
128	External Pt interface 1	[–]	16	17	–	
129	External Pt interface 2	[–]	16	20	–	
142	Remote control Base	[–]	16	21	--	

Table 17: Pressure overlay

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
165	Set pressure for pressure overlay	bar	12	14	–	
166	Tank pressure of pressure overlay	bar	11	14	–	
168	Pressure overlay hysteresis	bar	12	15	–	

Table 18: Filling system

ID	Function	Unit, resolution	*Large* protocol		*Short* protocol	
			Cmd (Byte 2)	Cmd No. (Byte 3)	Byte	Meaning
169	Status of the filling and draining unit (0 = Initialization, 1 = Standby, 2 = Pre-tempering, 3 = Drain, 4 = Change application, 5 = Leak test, 6 = Fill, 7 = Pause, 8 = Refill, 9 = Decommission) Filling and draining unit must be connected!	[–]	4	7	–	
172	Draining temperature	[°C]	12	16	–	
174	Pressure specification for leak test	[bar]	12	17	–	
176	Leak test duration	[s]	13	16	–	
178	Maximum permissible pressure difference during leak test	[bar]	13	17	–	
180	Venting time at the end of the filling process	[s]	13	18	–	
182	Target filling level of the expansion tank of the constant temperature equipment during the filling process	[–]	12	18	–	
184	Status of automatic filling device for the filling and draining unit tank (0 = off, 1 = on)	[–]	14	8	–	
186	Start of automatic filling device (lower fill limit ➔ refilling on)	[%]	13	19	–	
188	Stop of automatic filling device (upper fill limit ➔ refilling off)	[%]	13	20	–	

7.4.2 Write commands (Profibus controller output data)

The Profibus module recognizes the following write commands, which can be used to transfer values to the constant temperature equipment:

Table 19: Temperature

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
1	Temperature set point	[°C]	2	0	0 – 5	ASCII: XXX.XX / -XX.XX
15	Actual value of external temperature (via interface)	[°C]	1	0	–	
26	Limitation of outflow temperature TiH (upper limit)	[°C]	2	4	–	
28	Limitation of outflow temperature TiH (lower limit)	[°C]	2	5	–	

Table 20: Pump

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
17	Pump power stage (1 – 6 or 1 – 8)	[–]	2	1	–	
30	Set pressure (for pressure control settings)	[bar]	2	6	–	
36	Through-flow control set point	[l/min]	2	9	–	
70	Activate through-flow control: 0=Switch = switch off / 1 = switch on	[–]	4	5	–	

Table 21: Safety

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (Byte 2)	Cmd No. (Byte 3)	Byte	Meaning
34	Timeout communication via interface (1 – 99 seconds; 0 = Off)	[s]	2	8	–	

Table 22: Control parameters

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
38	Control parameter Xp	[–]	3	0	–	
40	Control parameter Tn	[s]	3	1	–	
42	Control parameter Tv	[s]	3	2	–	
44	Control parameter Td	[s]	3	3	–	
46	Control parameter KpE	[–]	3	4	–	
48	Control parameter TnE	[s]	3	5	–	
50	Control parameter TvE	[s]	3	6	–	
52	Control parameter TdE	[s]	3	7	–	
54	Correction limitation	[K]	3	9	–	
56	Control parameter XpF	[–]	3	10	–	
60	Control parameter Prop_E	[K]	3	15	–	

Table 23: Control

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
58	Set point offset	[K]	3	14	–	
66	Control in control variable X: 0 = internal 1 = external Pt 2 = external analog 3 = external serial 5 = external Ethernet 6 = external EtherCAT 7 = external Pt 2 8 = external OPC UA 9 = external Modbus TCP	[–]	4	1	–	
68	Offset source X for set point: 0 = off 1 = external Pt 2 = external analog 3 = external serial 5 = external Ethernet 6 = external EtherCAT 7 = external Pt 2 8 = external OPC UA 9 = external Modbus TCP	[–]	4	4	–	

Table 24: Rights

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
62	Master keyboard (equivalent to "KEY"): 0 = unlock / 1 = lock	[–]	4	0	–	
64	Remote control keyboard Command: 0 = unlock / 1 = lock	[–]	4	3	–	

Table 25: Status

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
74	Switch equipment on / off (standby)	[–]	4	2	6	Standby mode: 0 = off, 1 = on

Table 26: Pressure overlay

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (byte 2)	Cmd No. (byte 3)	Byte	Meaning
164	Set pressure for pressure overlay	[bar]	2	14	–	
167	Pressure overlay hysteresis	[bar]	2	15	–	

Table 27: Filling system

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (Byte 2)	Cmd No. (Byte 3)	Byte	Meaning
170	Action at the filling and draining unit (0 = No action, 1 = Start draining, 2 = Start filling) Filling and draining unit must be connected.	[–]	4	7	–	
171	Draining temperature	[°C]	2	16	–	
173	Pressure specification for leak test	[bar]	2	17	–	
175	Leak test duration	[s]	3	16	–	
177	Maximum permissible pressure difference during leak test	[bar]	3	17	–	
179	Venting time at the end of the filling process	[s]	3	18	–	
181	Target filling level of the expansion tank of the constant temperature equipment during the filling process	[–]	2	18	–	
183	Status of automatic filling device for the filling and draining unit tank (0 = off, 1 = on)	[–]	4	8	–	

ID	Function	Unit	*Large* protocol		*Short* protocol	
			Cmd (Byte 2)	Cmd No. (Byte 3)	Byte	Meaning
185	Start of automatic filling device (lower fill limit ➔ refilling on)	[%]	3	19	–	
187	Stop of automatic filling device (upper fill limit ➔ refilling off)	[%]	3	20	–	

7.4.3 Availability of the interface functions

The following table shows the read and write commands that the interface module provides for all compatible product lines of constant temperature equipment.

Special functions (for example, "[ID 6] outflow pressure / pump pressure") are only available if the constant temperature equipment is equipped accordingly. Optional accessories may have to be connected correctly and ready for operation.

ID	Universa	Integral IN			Variocool		
	MAX and PRO*	IN...XT *	IN...P*	IN...T *	VC NRTL	VC	PRO
1	✓	✓	✓	✓	✓	✓	✓
2	✓	✓	✓	✓	✓	✓	✓
3	✓	✓	✓	✓	✓	✓	✓
5	✓	✓	✓	✓	✓	✓	✓
6	–	✓	✓	–	–	–	–
7	✓	✓	✓	✓	✓	✓	✓
8	✓	✓	✓	✓	✓	✓	✓
9	✓	✓	✓	✓	✓	✓	✓
11	✓	✓	✓	✓	✓	–	–
12	–	✓	✓	–	–	–	–
15	✓	✓	✓	✓	✓	✓	✓
17	✓	✓	✓	–	–	–	✓
18	✓	✓	✓	–	–	–	✓
25	✓	✓	✓	✓	✓	✓	✓
26	✓	✓	✓	✓	✓	✓	✓
27	✓	✓	✓	✓	✓	✓	✓
28	✓	✓	✓	✓	✓	✓	✓
29	✓	✓	✓	✓	✓	✓	✓
30	–	✓	✓	–	–	–	–
31	–	✓	✓	–	–	–	–
34	✓	✓	✓	✓	✓	✓	✓
35	✓	✓	✓	✓	✓	✓	✓
36	–	✓	✓	✓	✓	–	–
37	–	✓	✓	✓	✓	–	–

* Equipment type as per rating label

ID	Universa	Integral IN			Variocool		PRO
	MAX and PRO*	IN...XT *	IN...P*	IN...T *	VC NRTL	VC	
38	✓	✓	✓	✓	✓	✓	✓
39	✓	✓	✓	✓	✓	✓	✓
40	✓	✓	✓	✓	✓	✓	✓
41	✓	✓	✓	✓	✓	✓	✓
42	✓	✓	✓	✓	✓	✓	✓
43	✓	✓	✓	✓	✓	✓	✓
44	✓	✓	✓	✓	✓	✓	✓
45	✓	✓	✓	✓	✓	✓	✓
46	✓	✓	✓	✓	✓	✓	✓
47	✓	✓	✓	✓	✓	✓	✓
48	✓	✓	✓	✓	✓	✓	✓
49	✓	✓	✓	✓	✓	✓	✓
50	✓	✓	✓	✓	✓	✓	✓
51	✓	✓	✓	✓	✓	✓	✓
52	✓	✓	✓	✓	✓	✓	✓
53	✓	✓	✓	✓	✓	✓	✓
54	✓	✓	✓	✓	✓	✓	✓
55	✓	✓	✓	✓	✓	✓	✓
56	✓	✓	✓	✓	✓	✓	✓
57	✓	✓	✓	✓	✓	✓	✓
58	✓	✓	✓	✓	✓	✓	✓
59	✓	✓	✓	✓	✓	✓	✓
60	✓	✓	✓	✓	✓	✓	✓
61	✓	✓	✓	✓	✓	✓	✓
62	✓	✓	✓	✓	✓	✓	✓
63	✓	✓	✓	✓	✓	✓	✓
64	–	✓	✓	✓	✓	✓	✓
65	–	✓	✓	✓	✓	✓	✓
66	✓	✓	✓	✓	✓	✓	✓
67	✓	✓	✓	✓	✓	✓	✓
68	✓	✓	✓	✓	✓	✓	✓
69	✓	✓	✓	✓	✓	✓	✓

* Equipment type as per rating label

ID	Universa	Integral IN			Variocool		
	MAX and PRO*	IN...XT *	IN...P*	IN...T *	VC NRTL	VC	PRO
70	–	✓	✓	✓	✓	–	–
71	–	✓	✓	✓	✓	–	–
74	✓	✓	✓	✓	✓	✓	✓
75	✓	✓	✓	✓	✓	✓	✓
108	✓	✓	✓	✓	✓	✓	✓
109	✓	✓	✓	✓	✓	✓	✓
110	✓	✓	✓	✓	✓	✓	✓
111	✓	✓	✓	✓	✓	✓	✓
112	✓	✓	✓	✓	✓	✓	✓
113	✓	✓	✓	✓	✓	–	–
114	✓	✓	✓	✓	✓	✓	✓
115	✓	✓	✓	✓	✓	✓	✓
116	✓	✓	✓	✓	✓	✓	✓
117	✓	✓	✓	✓	✓	✓	✓
118	✓	–	–	✓	–	–	✓
119	✓	–	–	–	–	–	✓
121	✓	–	–	–	–	–	–
122	✓	–	–	–	–	–	–
123	–	✓	✓	–	–	–	–
124	–	✓	✓	–	–	–	–
125	–	✓	✓	–	–	–	–
126	–	✓	✓	✓	✓	–	–
127	–	✓	✓	–	–	–	–
128	✓	✓	✓	✓	✓	✓	✓
129	✓	✓	✓	✓	✓	–	–
130	✓	✓	✓	✓	✓	✓	✓
136	–	–	–	–	–	✓	✓
137	–	✓	✓	✓	✓	✓	✓
138	–	✓	✓	✓	✓	✓	✓
139	–	✓	✓	✓	✓	✓	✓
142	–	–	–	–	–	–	✓
154	–	✓	✓	✓	✓	--	--

* Equipment type as per rating label

ID	Universa	Integral IN			Variocool		PRO
	MAX and PRO*	IN...XT *	IN...P*	IN...T *	VC NRTL	VC	
162	–	✓	✓	--	--	--	--
163	–	–	✓	--	--	--	--
164	–	–	✓	--	--	--	--
165	–	–	✓	--	--	--	--
166	–	–	✓	--	--	--	--
167	–	–	✓	--	--	--	--
168	–	–	✓	--	--	--	--
169 - 188	–	✓	✓	–	–	–	–
* Equipment type as per rating label							

7.4.4 Operating rights

Valid for Integral IN and Variocool NRTL constant temperature equipment

As soon as a write command is sent to the device via the interface, the interface automatically obtains the operating rights.

> *If another control section already has exclusive operating rights, writing is not possible and the interface responds with error message 38 .*

If you subsequently want to operate the device from a different control section, you must first explicitly obtain the relevant operating rights.

Example

If you wish to take over operation and operate the device using its keyboard, you must press the softkey with the lock symbol on the device display and confirm your entry.

Exclusive operating rights

If you wish to prevent any other control section from obtaining operating rights, you have the option of using the command with the ID 34 – setting the timeout value for communication – to secure exclusive operating rights for the interface. The timeout setting must be greater than 0 seconds.

When the timeout is set to a value greater than 0 ↳ Chapter 7.4.5 “Communication monitoring” on page 36, communication monitoring is activated.

If the status of exclusive operating rights changes again, the timeout value for communication monitoring must be reset to 0. Monitoring is deactivated as a result.
Subsequently, the operating rights are no longer exclusive and another control section can obtain the operating rights, if required.

See also the chapter "Operator and viewer" in the operating manual accompanying your constant temperature equipment.

7.4.5 Communication monitoring

The write command with the *ID 34* allows you to set the timeout value for communication monitoring. If the selected value is greater than 0 seconds, communication monitoring is activated for the interface. The timeout value can also be set from the device menu of the interface module.
If a command is not sent via the interface for the duration of the preset timeout, the timeout has expired and a disconnection is detected.

Valid for Integral IN, Variocool NRTL and PRO constant temperature equipment

In this case, *Alarm 22* is triggered and the device:

a) - Stops the pump, the heater and the refrigerating machine if the Safe Mode function is deactivated.

b) - Starts Safe Mode if the Safe Mode function is activated.

Valid for Variocool constant temperature equipment

In this case, *Warning 503* is triggered and the device sets the stored safety set point once (write command *ID 32*, factory setting 20 °C) and continues to control the temperature with this operating status.

It is therefore necessary to send any messages periodically so that the monitoring feature recognizes that communication is still active.

If the status of communication monitoring changes again, the timeout value for communication monitoring must be reset to 0. Monitoring is deactivated as a result.
The timeout value can also be adjusted from the device menu.

8 Maintenance

The interface module is maintenance-free.

Any dust and dirt deposits should be cleaned from the connections on the interface module on a regular basis, especially if the interfaces are not being used.

WARNING!
Live parts in contact with cleaning agent

Electric shock, material damage

- Disconnect the device from the mains supply before starting any cleaning work.
- Water and other fluids should not be allowed to enter the device.

NOTICE!
Repairs performed by unauthorized persons

Material damage

- Only specialized personnel are permitted to carry out repairs.

1. Use a damp cloth or brush to remove any dust and dirt deposits.
2. When using compressed air: Always set a low working pressure to prevent mechanical damage to the connections.

If you have any questions about technical modifications, please contact LAUDA Service, see ↳ Chapter 1.6 “Contact LAUDA” on page 7.

9 Faults

If a fault occurs, the interface distinguishes between different message types, e.g. alarms, errors and warnings. The procedure for rectifying a fault depends on the device. Follow the corresponding instructions in the operating manual accompanying the constant temperature equipment.

If you are unable to rectify a fault, please contact LAUDA Service, see Chapter 1.6 “Contact LAUDA” on page 7.

9.1 Error messages

If an error occurs on the Profibus module, the error number is sent to the Master as an external diagnostic byte.

The Profibus interface recognized the following error types:

Error - Errors are reported continuously on the constant temperature equipment; the LED on the interface lights up. In this case, the Profibus is not in the "Data Exchange" state.

Warning - Warnings are displayed on the constant temperature equipment for a period of 1 minute for information purposes. The LED on the interface does not light up; data transfer is still possible.

Table 28: Profibus error messages

Number	Type	Error	Measures
0	*Reserved*		
1	Error	Hardware error	Switch the constant temperature equipment off and on again. If the error message appears again, replace the interface or have it repaired.
2	Error	EEPROM error	
3	Error	Internal memory error	
4	Error	Fieldbus hardware error or incorrect fieldbus ID	
5	Error	Script error	
6	*Reserved*		
7	Warning	RS transmit buffer overflow	Warnings are reset automatically after 1 minute.
8	Warning	RS receive buffer overflow	
9	Warning	RS timeout	
10	Warning	General fieldbus error	
11	Warning	Parity error	
12	*Reserved*		
13	Warning	Configuration error on Profibus Master	
14	Warning	Fieldbus buffer overflow	
15	*Reserved*		

9.2 Troubleshooting

If Profibus communication errors occur, the following information provides initial guidance:

Error source: Profibus configuration

- The address preset on the Profibus interface does not match the address assigned in the Master.
- There are too many Masters on the bus (e.g. parameterization tools). The individual Master does not have sufficient time on the bus to control the system correctly.
- There are large gaps between the assigned addresses. It takes longer to transfer tokens between two masters if there are large gaps.
- Too many devices are connected to the Profibus segment of the constant temperature equipment. A maximum of 32 devices per segment are permitted when transmitting according to the RS485 standard.
- A device with a different transmission technology was connected to the Profibus segment (e.g. current-modulated transmission technology according to IEC 61158-2, H1, Profibus PA).

Error source: Bus line

- The bus line was not connected to the Profibus interface. Data lines A and B (or + and -) were mixed up.
- One bus line is inadequate (high contact resistances) or faulty. The use of standard Profibus cables is recommended.
- The bus line is too long. The maximum length depends on the selected transmission speed.
- The bus line type is not suitable:
  - Type B cables are only suitable for transmission speeds up to 1.5 Mbaud and shorter bus lengths.
  - Type A cables can be used for speeds of up to 12 Mbaud and achieve longer maximum bus lengths than type B cables, even at transmission speeds below 1.5 Mbaud.
- The bus line was laid near to high-current cables.
- The branch lines used were too long. The branch lines cause reflections that can falsify signals. Avoid using branch lines wherever possible.

Error source: Cable shield

- The bus lines used were not shielded.
- The braided shield and the foil shield underneath, if available, are not connected to the protective earth at both ends (e.g. connector shell).
- EMC interference disrupts the transmission momentarily or permanently due to the inadequate shielding of the bus line.
- An equalizing current may flow through the shield connected at both ends due to potential differences between the grounding points. An additional equipotential bonding line can be used between the connected devices to minimize the consequential effects.
- The integral bus termination of a Profibus device has been set incorrectly.

Error source: Bus termination

- The Profibus is not terminated at both ends by active bus terminations.
- The resistors of the active bus terminations are not switched on. They must be activated on the first and last device of a Profibus segment.
- There is no voltage supply to the active bus terminations.
- A bus termination at the center of the Profibus segment is switched on.
- The integral bus termination of a Profibus device has been set incorrectly.

10 Decommissioning

WARNING!
Touching live parts

Electric shock

- Disconnect the device from the power supply before starting any installation work.
- Always observe safety measures against electrostatic discharge.

Decommission the interface module by removing it from the constant temperature equipment:

1. Observe the information in Chapter 5.1 “Installing the interface module” on page 12. Proceed in reverse order to remove.
2. Always attach the LiBus connecting cable to the inside of the module slot cover.
3. Fit the cover to the vacant module slot to protect the constant temperature equipment against the ingress of dirt.
4. Protect the interface module against static charging before placing it in storage. The storage location must meet the ambient conditions specified in the technical data.
5. If you intend to dispose of the module, please read the information in “Old device” on page 42 first.

11 Disposal

Packaging

The packaging normally consists of environmentally friendly materials that can be easily recycled when properly disposed of.

1. Dispose of packaging materials in accordance with the applicable disposal guidelines in your region.
2. Comply with the requirements of Directive 94/62/EC (packaging and packaging waste) if disposing of the product in a member state of the EU.

Old device

The device must be properly decommissioned and disposed of at the end of its life cycle.

1. Dispose of the device in accordance with the applicable disposal guidelines in your region.
2. Comply with Directive 2012/19/EU (WEEE Waste of Electrical and Electronic Equipment) if disposing of the product takes place in a member state of the EU.

12 Accessories

Complete connection cables and plugs are available for assembling cables.

Table 29: Accessories

Item	Catalog number
LiBus module box; extension of constant temperature equipment by up to two interface modules with large cover	LCZ 9727
D-Sub 9 socket, complete	EKS 210
RS 232 cable, shielded, 2 m in length	EKS 037
RS 232 cable, shielded, 5 m in length	EKS 057

13 Technical data

Characteristic	Unit	Value/version
Interface module		
Catalog number	[–]	LRZ 929
Size of module slot, W x H	[mm]	51 x 27
External dimensions (excluding connectors), W x H x D	[mm]	56 x 37 x 82
Weight	[kg]	0.12
Operating voltage	[V DC]	24
Maximum current consumption	[A]	0.2
Connection type	[–]	D-Sub socket, 9-pin
Service life	[–]	The interface module is designed for 20,000 operating hours.
Ambient conditions		
Relative humidity	[%]	Maximum relative humidity 80% at an ambient temperature of 31°C, relative humidity linearly decreasing to 50% at 40°C.
Height up to	[m]	2000
Ambient temperature range	[°C]	5 – 40
Temperature range during storage and transport	[°C]	-20 – 60
Degree of pollution according to EN 60664-1 / VDE 0110-1	[–]	2
IP protection level	[IP]	21

14 Declaration of Conformity

EU DECLARATION OF CONFORMITY

Manufacturer: LAUDA DR. R. WOBSER GMBH & CO. KG
Laudaplatz 1, 97922 Lauda-Königshofen, Germany

We hereby declare under our sole responsibility that the products described below

Product line: Accessories **Serial number:** from S250000001

Device type: Interface modules
LRZ 912, LRZ 914, LRZ 915, LRZ 918, LRZ 926, LRZ 927, LRZ 928, LRZ 929, LRZ 930, LRZ 931, LRZ 932, LRZ 933, LRZ 934, LRZ 935, LCZ 9727

comply with all the relevant provisions of the Directives listed below, based on the design and type of the version we have placed on the market:

EMC Directive	2014/35/EU
RoHS Directive	2011/65/EU in conjunction with (EU) 2015/863

The products may only be operated when incorporated or connected in accordance with the operating instructions.

Applicable standards:

- EN IEC 61326-1:2021

Authorized representative for the composition of the technical documentation:

Dr. Jürgen Dirscherl, Head of Research & Development

Lauda-Königshofen, Germany, 27.02.2025

A. Dinger

Dr. Alexander Dinger,
Head of Quality and Environmental Management

Q5WA-QA13-026-EN-04

°FAHRENHEIT. °CELSIUS. °LAUDA.

15 Index

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