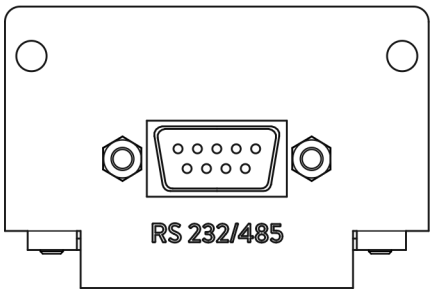
Operation manual

Interface module LRZ 913

RS 232/485 module



V1R64

Read this manual prior to performing any task!

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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 analog interface module RS 232/485 module (catalog no. LRZ 913).

The RS 232/485 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 7.2.2 “Read commands” on page 19 and Chapter 7.2.3 “Write commands” on page 24.

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 is an accessory that increases the connections options of LAUDA constant temperature equipment. 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 after incomplete assembly
- Operation on incompatible constant temperature equipment
- Operation using cables or connections that are defective or do not confirm to standards

1.2 Compatibility

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

- ECO
- Integral XT
- Integral IN
- PRO
- Proline
- Variocool
- Variocool NRTL

Operating interfaces of the same type

Only one RS 232/485 type analog interface can be used for each item of constant temperature equipment. This applies irrespective of the interface operating mode.

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 6.

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

Fax: +49 (0)9343 503-283

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 8.

Structure of warnings

Warning signs	Type of danger
	Warning – danger zone.

Signal word	Meaning
DANGER!	This combination of symbol and signal word indicates an imminently dangerous situation that will result in death or serious injury if it is not avoided.
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

DANGER!
Transport damage

Electric shock

- Closely inspect the device for transport damage prior to commissioning!
- 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 36.

If you discover any damage on the interface module, contact LAUDA Service immediately, see Chapter 1.6 “Contact LAUDA” on page 6.

4 Device description

4.1 Purpose

The RS 232/485 module is designed for installation in constant temperature equipment that supports the serial interface. The RS 232/485 interface allows the user to activate constant temperature equipment via the LAUDA command set (for example, control station).

Combining the RS 232/485 interface with a Profibus interface is only permitted in conjunction with the Command remote control, whose RS 232/485 interface can be used independently.

4.2 Structure

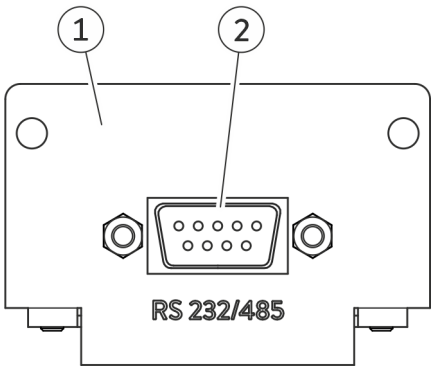


Fig. 1: RS 232/485 module

1 Cover with holes for fastening screws
2 D-Sub socket, 9-pin

The RS 232/485 module is equipped with a serial interface with 9-pin D-Sub socket that incorporates a galvanically isolated optocoupler to ensure electrical isolation and greater immunity to interference. The module is connected to a PC or control station via a 1:1 contacted cable, see Chapter 6.1.1 “Contact assignment RS 232” on page 14.

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.

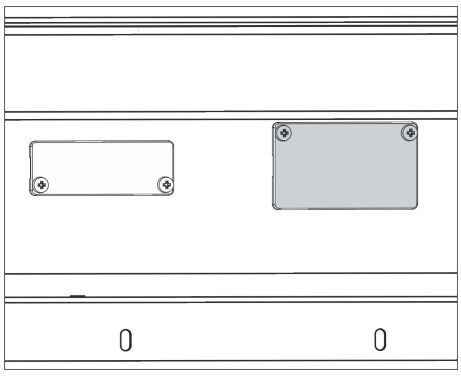


Fig. 2: Removing the cover (schematic diagram)

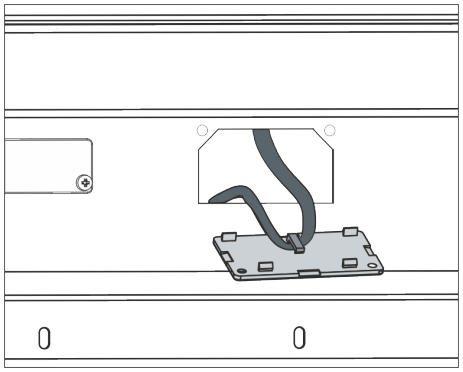


Fig. 3: Detaching the LiBus ribbon cable (schematic diagram)

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.

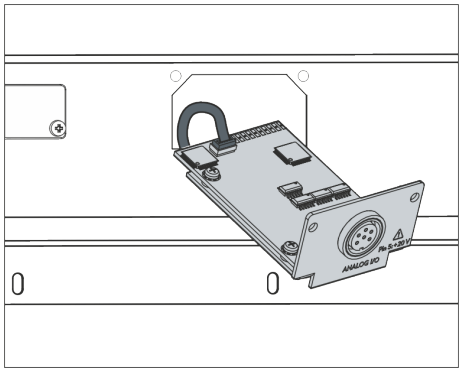


Fig. 4: Connecting the interface module (schematic diagram)

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.

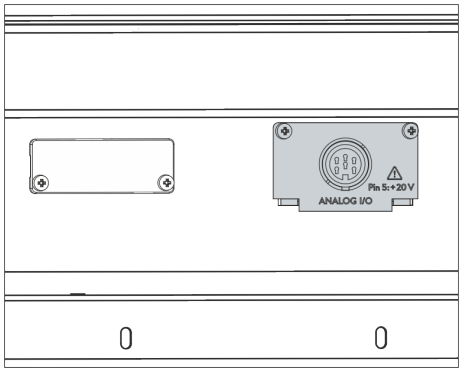


Fig. 5: Securing the cover (schematic diagram)

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

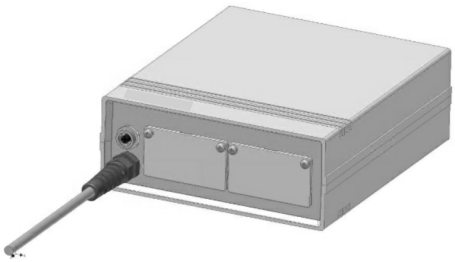


Fig. 6: LiBus module box, catalog no. LCZ 9727

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.*
- *Note the contact assignment required in each case, see* Chapter 6.1.1 “Contact assignment RS 232” on page 14 *and* Chapter 6.1.2 “Contact assignment RS 485” on page 16.

The RS 232/485 interface is designed as a 9-pin D-Sub socket. The connector can be configured for a 9- or 25-pin connection to a PC or control station according to the contact assignments listed below. The plugs must always be secured with the integral screw connection.

Refer to Chapter 12 “Accessories” on page 37 for accessory information on assembling connection cables.

6.1.1 Contact assignment RS 232

Systems connected to RS 232 connections use so-called "handshake signals" to transmit status information, which enable the receiving system to stop transmitting data that it can no longer process. The handshake therefore helps protect against data loss.

Status information can be transmitted in two different ways:

Software handshake	- The status information is part of the actual data transfer. A three-wire cable is adequate, while signaling is performed via an additional coding.
Hardware handshake	- Status information is transmitted at the same time as the data. Status information is not included in the operating data, but the signaling requires a 7-wire cable for additional signal lines.

RS 232 with software handshake

A 1:1 contacted, 3-wire cable (not a null modem cable) is required for an RS 232 connection with software handshake. The operating mode *RS 232 without hardware handshake* must be set on the PC. Contacts should not be connected unless they are needed. The following contact assignment applies, depending on the version of the D-Sub socket on the PC:

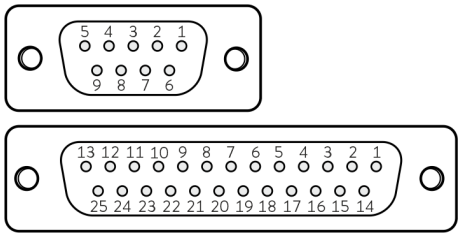


Fig. 7: D-Sub socket contacts, 9 and 25-pin

Table 1: D-Sub sockets for RS 232 with software handshake

Constant temperature equipment		PC / control station		
Signal	Contact (9-pin)	Contact (9-pin)	Contact (25-pin)	Signal
TxD	2	2	3	RxD
RxD	3	3	2	TxD
GND	5	5	7	GND

RS 232 with hardware handshake

A 1:1 contacted, 7-wire cable (not a null modem cable) is required for an RS 232 connection with hardware handshake. Contacts should not be connected unless they are needed. The following contact assignment applies, depending on the version of the D-Sub socket on the PC:

Table 2: D-Sub sockets for RS 232 with hardware handshake

Constant temperature equipment		PC / control station		
Signal	Contact (9-pin)	Contact (9-pin)	Contact (25-pin)	Signal
TxD	2	2	3	RxD
RxD	3	3	2	TxD
DSR	4	4	20	DTR
GND	5	5	7	GND
DTR	6	6	6	DSR
CTS	7	7	4	RTS
RTS	8	8	5	CTS

6.1.2 Contact assignment RS 485

An RS 485 connection can be implemented using a 3-wire cable; contacts should not be connected unless they are needed. The following contact assignment applies, depending on the version of the D-Sub socket on the connected system:

Table 3: D-Sub socket, RS 485, 9-pin

Signal	Contact
Data A (-)	1
GND (optional)	5
Data B (+)	6

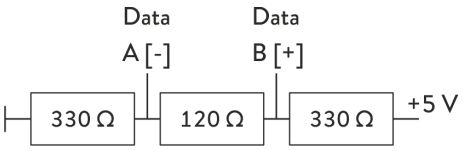


Fig. 8: RS 485 termination

A RS 485 bus always requires a bus termination in the form of a termination network (see Figure) that guarantees a defined standby state in the high-ohm phases of bus operation. This termination network is usually integrated in the insertable PC card (RS 485).

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 *SW too old* : Please contact LAUDA Service, see ↳ Chapter 1.6 “Contact LAUDA” on page 6.
   - No software warning: Operate the constant temperature equipment as normal.

7 Operation

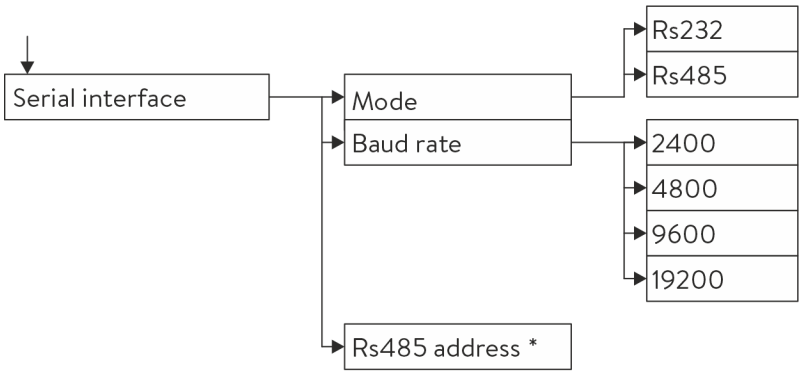
7.1 Menu structure

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 except the Master

Menu → *Modules* → *Serial interface*



* Only when operating according to the RS485 standard.

Fig. 9: RS 232/485 interface menu

Master operating unit

(Only available for product lines Proline and Integral XT.)

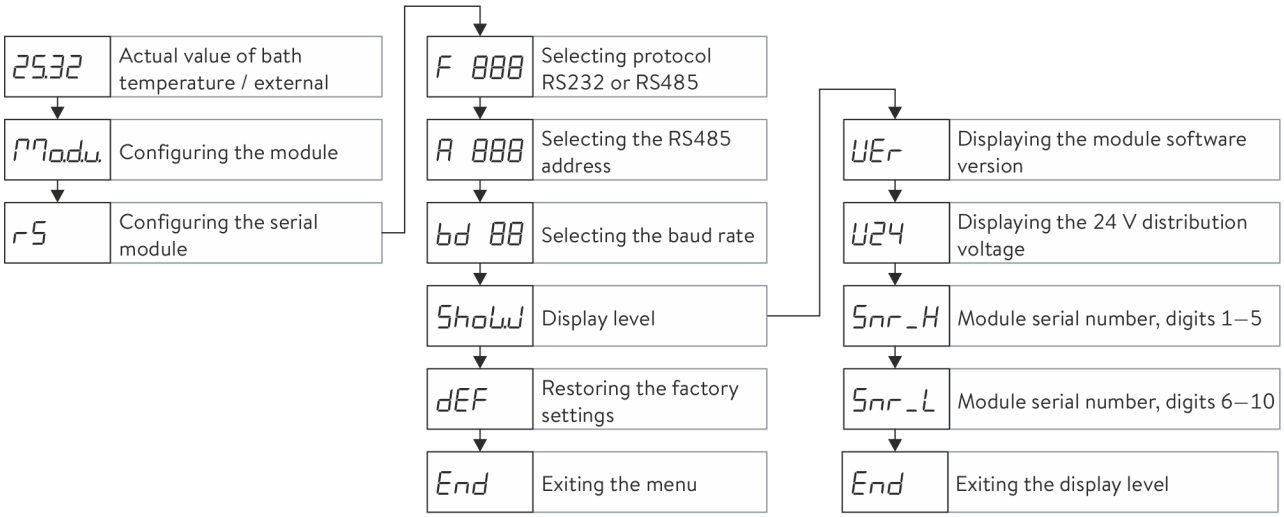


Fig. 10: Menu - RS 232/485 interface to Master operating unit

7.2 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".

7.2.1 General Information

Communication takes place according to the master/slave principle. In order to ensure that a request and response are uniquely assigned to one another, commands can only be sent to the constant temperature equipment once a response to the previous command has been received.

All available read and write commands as well as the meaning of any error messages that may occur are presented below. Note the following information relating to syntax and sequencing when using these commands:

Numerical values are provided in fixed point format; numbers with up to 4 places in front of the decimal point and up to 2 places after the decimal point are permitted:

Table 4: Acceptable data formats

-XXXX.XX	-XXXX.X	-XXXX.	-XXXX	XXXX.XX	XXXX.X	XXXX.	XXXX
-XXX.XX	-XXX.X	-XXX.	-XXX	XXX.XX	XXX.X	XXX.	XXX
-XX.XX	-XX.X	-XX.	-XX	XX.XX	XX.X	XX.	XX
-X.XX	-X.X	-X.	-X	X.XX	X.X	X.	X
-.XX	-.X	.XX	.X				

- Error messages are output with the syntax "ERR_X":
  - ERR = Identification as an error message
  - X = Error number (whole number without leading zero, maximum of 4 digits)
- Space " " and underscore "_" can be used synonymously.

RS 232 protocol

- The interface operates with 1 stop bit, 8 data bits and no parity bits.
- 4 transmission speeds are available for selection: 2400, 4800, 9600 or 19200 baud. 9600 baud is the factory preset.
- Commands from an external source must always end with CR, CRLF or LFCR. The response from the constant temperature equipment always ends with CRLF. Meaning of the abbreviations:
  - CR = Carriage Return, (Hex: 0D)
  - LF = Line Feed, (Hex: 0A)
- In order to ensure that a request and response are uniquely assigned to one another, commands can only be sent to the constant temperature equipment once a response to the previous command has been received.

Example

Example with set point transfer of 30.5 °C to the constant temperature equipment.

PC / control station	Constant temperature equipment
"OUT_SP_00_30.5"CRLF	➔
←	"OK"CRLF

RS 485 protocol

- The interface operates with 1 stop bit, 8 data bits and no parity bits.
- 4 transmission speeds are available for selection: 2400, 4800, 9600 or 19200 baud. 9600 baud is the factory preset.
- RS 485 commands are always preceded by the device address; up to 128 device addresses are available. Device addresses always contain three digits and start with "A": "A000_..." – "A127_...".
- Commands from an external source must always end with CR. The response from the constant temperature equipment always ends with CR.

Example

Example with set point transfer of 30.5 °C to the constant temperature equipment. In this example, the address 15 is used.

PC / control station	Constant temperature equipment
"A015_OUT_SP_00_30.5"CR	➔
←	"A015_OK"CR

7.2.2 Read commands

The interface module recognizes the following read commands, which you can use to retrieve operating data of the constant temperature equipment.

Table 5: Temperature

ID	Function	Unit, resolution	Command
2	Temperature set point	[°C]	IN_SP_00
3	Bath temperature (outflow temperature)	[°C], 0.01 °C	IN_PV_00
4	Bath temperature (outflow temperature)	[°C], 0.001 °C	IN_PV_10
5	Controlled temperature (internal / external Pt / external analog / external serial)	[°C]	IN_PV_01
7	External temperature T_E (Pt)	[°C]	IN_PV_03
8	External temperature T_E (analog input)	[°C]	IN_PV_04
14	External temperature T_E (Pt)	[°C], 0.001 °C	IN_PV_13

ID	Function	Unit, resolution	Command
25	Overtemperature turn off point T_Max	[°C]	IN_SP_03
27	Limitation of outflow temperature TiH (upper limit)	[°C]	IN_SP_04
29	Limitation of outflow temperature TiH (lower limit)	[°C]	IN_SP_05
33	Set temperature T_{set} in Safe Mode (safe set point in case of communication interruption).	[°C]	IN_SP_07
158	Actuating signal of master controller in case of external control	[°C]	IN_PV_11

Table 6: Pump

ID	Function	Unit	Command
6	Outflow pressure / pump pressure, relative to the atmosphere	[bar]	IN_PV_02
12	Flow rate of the pump (MID flow controller must be connected)	[l/min]	IN_PV_07
18	Pump power stage	[–]	IN_SP_01
31	Outflow pressure set point / pump pressure (for pressure control settings)	[bar]	IN_SP_06
37	Flow rate control set point	[L/min]	IN_SP_09
71	Status of flow rate control: 0 = off / 1 = on	[–]	IN_MODE_05
154	Outflow pressure of flow controller, relative to the atmosphere (MID flow controller must be connected)	[bar]	IN_PV_09
156	Pressure limitation set point with active flow rate control (MID flow controller must be connected)	[bar]	IN_SP_10
157	Overpressure turn off point with active flow rate control (MID flow controller must be connected)	[bar]	IN_SP_11

Table 7: Fill level

ID	Function	Unit	Command
9	Bath level (fill level)	[–]	IN_PV_05

Table 8: Actuating signal

ID	Function	Unit, resolution	Command
11	Resolution of controller actuating signal in per mill – negative value → device is cooling – positive value → device is heating	[‰]	IN_PV_06
13	Controller actuating signal in watts – negative value → device is cooling – positive value → device is heating	[W]	IN_PV_08

Table 9: Cooling

ID	Function	Unit	Command
24	Cooling mode: 0 = off / 1 = on / 2 = automatic	[–]	IN_SP_02

Table 10: Safety

ID	Function	Unit	Command
35	Timeout communication via interface (1 – 99 seconds; 0 = Off)	[s]	IN_SP_08
73	Status of Safe Mode: 0 = off (inactive) / 1 = on (active)	[–]	IN_MODE_06

Table 11: Control parameters

ID	Function	Unit	Command
39	Control parameter Xp	[–]	IN_PAR_00
41	Control parameter Tn (181 = Off)	[s]	IN_PAR_01
43	Control parameter Tv	[s]	IN_PAR_02
45	Control parameter Td	[s]	IN_PAR_03
47	Control parameter KpE	[–]	IN_PAR_04
49	Control parameter TnE	[s]	IN_PAR_05
51	Control parameter TvE	[s]	IN_PAR_06
53	Control parameter TdE	[s]	IN_PAR_07
55	Correction limitation	[K]	IN_PAR_09
57	Control parameter XpF	[–]	IN_PAR_10
61	Control parameter Prop_E	[K]	IN_PAR_15

Table 12: Control

ID	Function	Unit	Command
59	Setpoint offset	[K]	IN_PAR_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 second (only for Integral)	[–]	IN_MODE_01
69	Offset source X for set point: 0 = normal / 1 = external Pt / 2 = external analog / 3 = external serial / 5 = external Ethernet / 6 = external EtherCAT / 7 = external Pt second (only for Integral)	[–]	IN_MODE_04

Table 13: Rights

ID	Function	Unit	Command
63	Status of keyboard Master: 0 = free / 1 = blocked	[–]	IN_MODE_00
65	Status of keyboard remote control: 0 = free / 1 = blocked	[–]	IN_MODE_03

Table 14: Status

ID	Function	Unit	Command
75	Status of standby: 0 = Device is switched on / 1 = Device is switched off	[–]	IN_MODE_02
107	Device type (e.g.: "ECO", "INT" or "VC")	[–]	TYPE
130	Device status: 0 = OK / -1 = fault	[–]	STATUS
131	Fault diagnosis; a 7-digit answer in the format XXXXXXX is output, whereby each character X contains fault information (0 = no fault / 1 = fault). The following information is defined for the seven places of the answer format: ■ 1st character = Error ■ 2nd character = Alarm ■ 3rd character = Warning ■ 4th character = Overtemperature ■ 5th character = Low level ■ 6th character = 0 (with alarm setting: High level ■ 7th character = External control value missing	[–]	STAT

Table 15: Programmer

ID	Function	Unit	Command
77	Program used as a basis for further commands	[–]	RMP_IN_04
88	Current segment number	[–]	RMP_IN_01
90	Number of preset program sequences	[–]	RMP_IN_02
92	Current program loop	[–]	RMP_IN_03
94	Currently running program (0 = no program currently running)	[–]	RMP_IN_05

Table 16: Contact input / output

ID	Function	Unit	Command
96	Contact input 1: 0 = open / 1 = closed	[–]	IN_DI_01
98	Contact input 2: 0 = open / 1 = closed	[–]	IN_DI_02
100	Contact input 3: 0 = open / 1 = closed	[–]	IN_DI_03
102	Contact output 1: 0 = open / 1 = closed	[–]	IN_DO_01

ID	Function	Unit	Command
104	Contact output 2: 0 = open / 1 = closed	[–]	IN_DO_02
106	Contact output 3: 0 = open / 1 = closed	[–]	IN_DO_03

Table 17: SW version

ID	Function	Unit	Command
108	Control system	[–]	VERSION_R
109	Protection system	[–]	VERSION_S
110	Remote control (Command) (remote control unit must be present)	[–]	VERSION_B
111	Cooling system (only for devices with active cooling)	[–]	VERSION_T
112	Analog interface module (interface module must be present)	[–]	VERSION_A
113	Flow controller (flow controller must be present)	[–]	VERSION_A_1
114	RS 232/485 interface module or Profibus / Profinet (interface module must be present)	[–]	VERSION_V
115	Ethernet interface module (interface module must be present)	[–]	VERSION_Y
116	EtherCAT interface module (interface module must be present)	[–]	VERSION_Z
117	Contact interface module (interface module must be present)	[–]	VERSION_D
118	Solenoid valve for cooling water (solenoid valve must be present)	[–]	VERSION_M_0
119	Solenoid valve for automatic filling device (solenoid valve must be present)	[–]	VERSION_M_1
120	Solenoid valve for level controller (solenoid valve must be present)	[–]	VERSION_M_2
121	Solenoid valve, shut off valve 1 (solenoid valve must be present)	[–]	VERSION_M_3
122	Solenoid valve, shut off valve 2 (solenoid valve must be present)	[–]	VERSION_M_4
124	Pump 0	[–]	VERSION_P_0
125	Pump 1	[–]	VERSION_P_1
126	Heating system 0	[–]	VERSION_H_0
127	Heating system 1	[–]	VERSION_H_1

ID	Function	Unit	Command
128	External Pt100 interface 0 (module must be present)	[–]	VERSION_E
129	External Pt100 interface 1 (second module must be present)	[–]	VERSION_E_1

7.2.3 Write commands

The interface module recognizes the following write commands, which you can use to transfer values to the constant temperature equipment.

The constant temperature equipment confirms each write command with OK, e.g. the reply from the device address A015 is "A015_OK". In the event of an error, an error message is output as a reply, e.g. "A015_ERR_6", see ↳ Chapter 7.2.5 “Error messages” on page 30.

Table 18: Temperature

ID	Function	Unit	Command
1	Temperature set point	[°C]	OUT_SP_00_XXX.XX
15	Actual value of external temperature (via interface)	[°C]	OUT_PV_05_XXX.XX
26	Limitation of outflow temperature TiH (upper limit)	[°C]	OUT_SP_04_XXX
28	Limitation of outflow temperature TiH (lower limit)	[°C]	OUT_SP_05_XXX
32	Temperature set point T_{set} in Safe Mode	[°C]	OUT_SP_07_XXX.XX

Table 19: Pump

ID	Function	Unit	Command
17	Pump power stage (device-specific, e.g. 1 – 6)	[–]	OUT_SP_01_XXX
30	Set pressure (for pressure control settings)	[bar]	OUT_SP_06_X.XX
36	Flow rate control set point	[l/min]	OUT_SP_09_X.XX

ID	Function	Unit	Command
70	Activate flow rate control: 0 = switch off / 1 = switch on	[–]	OUT_MODE_05_X
155	Pressure limitation set point with active flow rate control (MID flow controller must be connected and equipped with an integrated pressure sensor)	[bar]	OUT_SP_10_X.X

Table 20: Cooling

ID	Function	Unit	Command
23	Cooling mode: 0 = off / 1 = on / 2 = automatic	[–]	OUT_SP_02_XXX

Table 21: Safety

ID	Function	Unit	Command
34	Timeout communication via interface (1 – 99 seconds; 0 = Off)	[s]	OUT_SP_08_XX
72	Activation of Safe Mode	[–]	OUT_MODE_06_1

Table 22: Control parameters

ID	Function	Unit	Command
38	Control parameter Xp	[–]	OUT_PAR_00_XX.X
40	Control parameter Tn (5 – 180 s; 181 = Off)	[s]	OUT_PAR_01_XXX
42	Control parameter Tv	[s]	OUT_PAR_02_XXX
44	Control parameter Td	[s]	OUT_PAR_03_XX.X
46	Control parameter KpE	[–]	OUT_PAR_04_XX.XX
48	Control parameter TnE (0 – 9000 s; 9001 = Off)	[s]	OUT_PAR_05_XXXX
50	Control parameter TvE (5 = Off)	[s]	OUT_PAR_06_XXXX
52	Control parameter TdE	[s]	OUT_PAR_07_XXXX.X
54	Correction limitation	[K]	OUT_PAR_09_XXX.X
56	Control parameter XpF	[–]	OUT_PAR_10_XX.X
60	Control parameter Prop_E	[K]	OUT_PAR_15_XXX

Table 23: Control

ID	Function	Unit	Command
58	Setpoint offset	[K]	OUT_PAR_14_XXX.X
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 second (only for Integral)	[–]	OUT_MODE_01_X

ID	Function	Unit	Command
68	Offset source X for set point: 0 = normal / 1 = external Pt / 2 = external analog / 3 = external serial / 5 = external Ethernet / 6 = external EtherCAT / 7 = external Pt second	[–]	OUT_MODE_04_X
Note (ID 66 and 68): If X = 3, the commands ID 66 and ID 68 cannot be executed in some constant temperature control devices until an external temperature specification has been received (via the command ID 15).			

Table 24: Rights

ID	Function	Unit	Command
62	Keyboard Master (equivalent to "KEY"): 0 = unlock / 1 = lock	[–]	OUT_MODE_00_X
64	Keyboard remote control unit (command): 0 = unlock / 1 = lock	[–]	OUT_MODE_03_X

Table 25: Status

ID	Function	Unit	Command
74	Switch the device on / off (standby)	[–]	START / STOP

Table 26: Programmer

ID	Function	Unit	Command
76	Select the program for the subsequent commands (X = 1 – 5). The default program is 5 when the constant temperature equipment is switched on.	[–]	RMP_SELECT_X
78	Start programmer	[–]	RMP_START
79	Pause programmer	[–]	RMP_PAUSE
80	Continue programmer (after pause)	[–]	RMP_CONT
81	End programmer	[–]	RMP_STOP

7.2.4 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	Integral IN		Variocool		PRO	ECO	Proline, Proline Kryomats	Integral XT *
	IN...XT *	IN...T *	VC NRTL	VC				
1	✓	✓	✓	✓	✓	✓	✓	✓
2	✓	✓	✓	✓	✓	✓	✓	✓
3	✓	✓	✓	✓	✓	✓	✓	✓
4	✓	✓	✓	✓	✓	✓	✓	✓
5	✓	✓	✓	✓	✓	✓	✓	✓
6	✓	–	–	–	–	–	–	✓
7	✓	✓	✓	✓	✓	✓	✓	✓
8	✓	✓	✓	✓	✓	✓	✓	✓
9	✓	✓	✓	✓	✓	–	✓	✓
11	✓	✓	✓	✓	✓	✓	✓	✓
12	✓	✓	✓	–	–	–	–	–
13	✓	✓	✓	✓	✓	✓	✓	✓
14	✓	✓	✓	✓	✓	✓	✓	✓
15	✓	✓	✓	✓	✓	✓	✓	✓
17	✓	–	–	–	✓	✓	✓	✓
18	✓	–	–	–	✓	✓	✓	✓
23	✓	✓	✓	✓	✓	✓	✓	✓
24	✓	✓	✓	✓	✓	✓	✓	✓
25	✓	✓	✓	✓	✓	✓	✓	✓
26	✓	✓	✓	✓	✓	✓	✓	✓
27	✓	✓	✓	✓	✓	✓	✓	✓
28	✓	✓	✓	✓	✓	✓	✓	✓
29	✓	✓	✓	✓	✓	✓	✓	✓
30	✓	–	–	–	–	–	–	✓

* Equipment type as per rating label

ID	Integral IN		Variocool		PRO	ECO	Proline, Proline Kryomats	Integral XT *
	IN...XT *	IN...T *	VC NRTL	VC				
31	✓	–	–	–	–	–	–	✓
32	✓	✓	✓	✓	✓	✓	✓	✓
33	✓	✓	✓	✓	✓	✓	✓	✓
34	✓	✓	✓	✓	✓	✓	✓	✓
35	✓	✓	✓	✓	✓	✓	✓	✓
36	✓	✓	✓	–	–	–	–	✓
37	✓	✓	✓	–	–	–	–	✓
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	✓	✓	✓	✓	✓	✓	✓	✓

* Equipment type as per rating label

ID	Integral IN		Variocool		PRO	ECO	Proline, Proline Kryomats	Integral XT *
	IN...XT *	IN...T *	VC NRTL	VC				
63	✓	✓	✓	✓	✓	✓	✓	✓
64	✓	✓	✓	✓	✓	✓	✓	✓
65	✓	✓	✓	✓	✓	✓	✓	✓
66	✓	✓	✓	✓	✓	✓	✓	✓
67	✓	✓	✓	✓	✓	✓	✓	✓
68	✓	✓	✓	✓	✓	✓	✓	✓
69	✓	✓	✓	✓	✓	✓	✓	✓
70	✓	✓	✓	–	–	–	–	–
71	✓	✓	✓	–	–	–	–	–
72	✓	✓	✓	–	✓	–	–	–
73	✓	✓	✓	–	✓	–	–	–
74	✓	✓	✓	✓	✓	✓	✓	✓
75	✓	✓	✓	✓	✓	✓	✓	✓
76	✓	✓	✓	✓	✓	✓	✓	✓
77	✓	✓	✓	✓	✓	✓	✓	✓
78	✓	✓	✓	✓	✓	✓	✓	✓
79	✓	✓	✓	✓	✓	✓	✓	✓
80	✓	✓	✓	✓	✓	✓	✓	✓
81	✓	✓	✓	✓	✓	✓	✓	✓
88	✓	✓	✓	✓	✓	✓	✓	✓
90	✓	✓	✓	✓	✓	✓	✓	✓
92	✓	✓	✓	✓	✓	✓	✓	✓
94	✓	✓	✓	✓	✓	✓	✓	✓
96	✓	✓	✓	✓	✓	✓	✓	✓
98	✓	✓	✓	✓	✓	✓	✓	✓
100	✓	✓	✓	✓	✓	✓	✓	✓
102	✓	✓	✓	✓	✓	✓	✓	✓
104	✓	✓	✓	✓	✓	✓	✓	✓
106	✓	✓	✓	✓	✓	✓	✓	✓
107	✓	✓	✓	✓	✓	✓	✓	✓
108	✓	✓	✓	✓	✓	✓	✓	✓
109	✓	✓	✓	✓	✓	✓	✓	✓

* Equipment type as per rating label

ID	Integral IN		Variocool		PRO	ECO	Proline, Proline Kryomats	Integral XT *
	IN...XT *	IN...T *	VC NRTL	VC				
110	✓	✓	✓	✓	✓	✓	✓	✓
111	✓	✓	✓	✓	✓	✓	✓	✓
112	✓	✓	✓	✓	✓	✓	✓	✓
113	✓	✓	✓	–	–	–	–	–
114	✓	✓	✓	✓	✓	✓	✓	✓
115	✓	✓	✓	✓	✓	✓	✓	✓
116	✓	✓	✓	✓	✓	✓	✓	✓
117	✓	✓	✓	✓	✓	✓	✓	✓
118	–	✓	–	–	✓	✓	–	–
119	–	–	–	–	✓	–	✓	–
120	–	–	–	–	–	–	–	–
121	–	–	–	–	–	✓	–	–
122	–	–	–	–	–	–	–	–
124	✓	–	–	–	–	–	–	✓
125	✓	–	–	–	–	–	–	✓
126	✓	✓	✓	–	–	–	–	–
127	✓	✓	✓	–	–	–	–	–
128	✓	✓	✓	✓	✓	✓	–	–
129	✓	✓	✓	–	–	–	–	–
130	✓	✓	✓	✓	✓	✓	✓	✓
131	✓	✓	✓	✓	✓	✓	✓	✓
* Equipment type as per rating label								

7.2.5 Error messages

The following is a description of the error messages of the interface modules. The string *ERR_X* or *ERR_XX* is output after an incorrect command.

Error	Description
ERR_2	Incorrect entry (for example, buffer overflow)
ERR_3	Wrong command
ERR_5	Syntax error in value
ERR_6	Impermissible value
ERR_8	Module or value not available

Error	Description
ERR_30	Programmer, all segments occupied
ERR_31	Not possible to specify set point (analog set point value input is ON)
ERR_32	TiH ≤ TiL
ERR_33	External sensor missing
ERR_34	Analog value not present
ERR_35	Automatically configured
ERR_36	Not possible to specify set point, programmer is running or has been paused
ERR_37	Not possible to start programmer (analog set point value input is ON)

7.3 Control and automation software

Terminal

A terminal program can be used to communicate with the constant temperature equipment. For example, the freeware *RealTerm* , which can be downloaded from the following address: https://realterm.sourceforge.io/

The following settings are required to establish a connection to the constant temperature equipment:

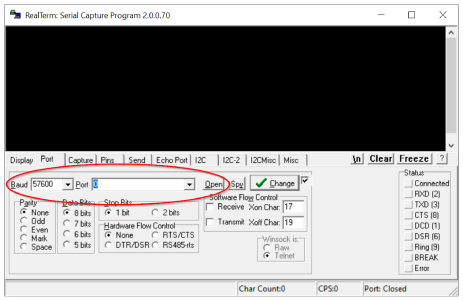


Fig. 11: Example in RealTerm: selecting the baud rate and COM port

1. Start the terminal program on the connected system.
2. Open the *Port* tab:
   - Select the preset baud rate in the *Baud* field.
   - Select the relevant COM port in the *Port* field.
   - Press *Open* to confirm your selection.

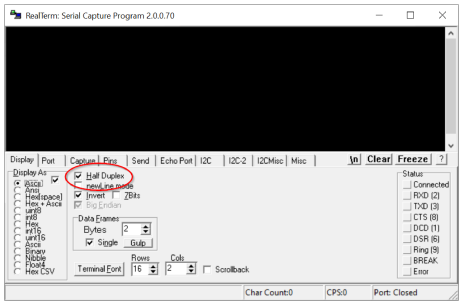


Fig. 12: Setting the transmission type

3. Activate the option *Half Duplex* in the *Display* tab.

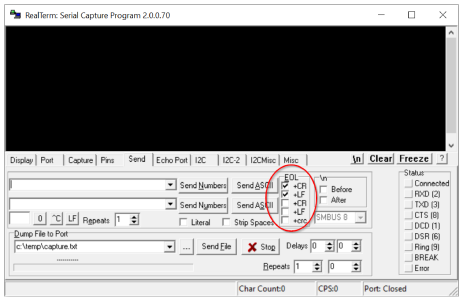


Fig. 13: Setting command lines to end automatically with CR/LF

4. Open the *Send* tab and activate the options *+CR* and/or *+LF* in the *EOL* area.
5. Send a test command such as the read command "TYPE" to the constant temperature equipment.
   - ▶ If the device type designation, for example "ECO", is received in response, the connection has been set up correctly.

LabVIEW

The program development tool LabVIEW® from National Instruments https://www.ni.com/de-de/shop/labview.html can be used to create convenient, personalized control software or automation software for operating constant temperature equipment. In order to cater for the programming needs of the interface used here, drivers designed specially for LABVIEW® can be downloaded free of charge from the download area of its LAUDA website: https://www.lauda.de/de/services/download-center/filter/Software

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 6.

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 6.

9.1 Alarm

The RS 232/485 interface recognizes the following alarms:

Table 27: RS 232/485 alarms

Code	Meaning
11	Triggers if the command `OUT_PV_05` is not received for several seconds when regulating to the "external serial" control variable.

9.2 Error

The RS 232/485 interface recognizes the following error messages:

Code *	Meaning
501 – 504, 507, 508	Interface module hardware faulty. Contact the LAUDA department.
505	Internal 24 V voltage of the interface module is too low.
506	Internal 24 V voltage of the interface module is too high.

9.3 Warning

The RS 232/485 interface recognizes the following warnings:

Code	Meaning
501	Internal communication overloaded.
502	Unexpected reset. If the error occurs multiple times, contact LAUDA Service.
503	An interruption in communication is detected by `OUT_SP_08_X` while communication monitoring is switched on. In this case, no communication has occurred for X seconds, which is why the temperature safety set point specified by `OUT_SP_07` was activated.
508	Bus system faulty. If the error occurs multiple times, contact LAUDA Service.
509	Unknown module connected.
510 – 532	Software for specified component outdated. Contact the LAUDA department.

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 11. 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 36 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

The following LAUDA accessories are available for assembling the required connection cables:

Article	Catalog number
LiBus module box; Extension of constant temperature equipment by up to two interface modules with large cover	LCZ 9727
Pin header, 9-pin D-SUB, soldered	EQM 042
Connector shell F. 9-pin D-SUB	EQG 020
RS 232 cable, shielded, 2 m in length	EKS 037
RS 232 cable, shielded, 5 m in length	EKS 057

13 Technical data

Feature	Unit	Value / version
Interface module		
Catalog number	[–]	LRZ 913
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]	0.1
Operating voltage	[V DC]	24
Maximum current consumption	[A]	0.1
Connection type	[–]	D-SUB socket, 9-pin
Ambient conditions		
Air humidity	[%]	Maximum relative air humidity 80 % at 31 °C and up to 40 °C, 50 % with linear decrease.
Ambient temperature range	[°C]	5 – 40
Temperature range for storage	[°C]	5 – 50

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