

Operating instructions

Flow controller with integrated bypass for **INTEGRAL XT**



English
Translation of the original operating instructions
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Valid from approval for the following software:

Analogue module 3.12
Command 3.39
Ethernet 2.21
Profibus 3.22

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Appendix:

- Declaration of clearance for service or repair jobs.

1. Safety

1.1 Safety instructions



Type and source	
<i>Consequences in the case of non-compliance</i>	
•	Measure 1
•	Measure...

“**DANGER**” indicates an immediately hazardous situation which can result in death or severe, irreversible injuries if the safety regulations are disregarded.



Type and source	
<i>Consequences in the case of non-compliance</i>	
•	Measure 1
•	Measure...

“**WARNING**” indicates a potentially hazardous situation which can result in death or severe, irreversible injuries if the safety regulations are disregarded.



Type and source	
<i>Consequences in the case of non-compliance</i>	
•	Measure 1
•	Measure...

“**CAUTION**” indicates a possibly hazardous situation which can result in minor irreversible injuries if the safety regulations are disregarded.



Type and source	
<i>Consequences in the case of non-compliance</i>	
•	Measure 1
•	Measure...

“**NOTE**” warns about possible property or environmental damage.

⇒ “**Reference**” refers to information in other chapters.

1.2 General safety instructions

Read this operating manual carefully. It contains important information about how to handle this device. In addition to these operating instructions, the operating instructions of the main device Integral XT are also to be given full consideration. If you have any questions, please contact the LAUDA service department (⇒ chapter 8.2).

Follow all instructions in this operating manual. That is the only way to ensure that you handle the device correctly.

- Ensure that the device is only operated by trained personnel (⇒ chapter 2.4).
- The device may not be operated without heat transfer liquid.
- Use suitable protective equipment when working on the device or connected components.
- Use the integrated bypass to ensure that there is a constant flow rate of heat transfer liquid (⇒ chapter 5.2.5).
- Never operate the device if:
 - Damage has been ascertained on device components or
 - the device is leaking.
- Switch off the device and unplug the mains plug:
 - for service and repair work,
 - when moving the device,
 - if there is danger.
- Do not make technical changes to the device. In the case of infringement, any warranty claim is void.
- Only allow service and repair work to be performed by specialists.

Addition for devices with an additional pump:

- The additional pump may not have fluid flowing through it when at a standstill, as this may damage the pump.
- The additional pump, together with the process thermostat from the LAUDA XT series, is a system requiring monitoring in accordance with §14 of the German Industrial Health and Safety Ordinance¹. (Classification in accordance with Pressure Equipment Directive 97/23/EC: Category I). Before commissioning, the system must be subjected to an inspection of the installation, order and functions by qualified personnel (⇒ chapter 2.4) Certification of this inspection shall be created, documenting the scope and result of the inspections.

¹ The national regulations of the country in which the system is set up must be followed.

2. General

2.1 Description of the device

The flow controller complements the function of the Integral XT process thermostat by receiving the flow of heat transfer liquid and regulating it by means of a valve. At the pressure output of the flow meter, there is an internal temperature sensor that allows temperature control at this point or allows the values to be read out.

In the case of devices with a higher-pressure pump, it is also possible to increase the flow pressure and thus the flow within the device parameters.

The flow controller is equipped with a bypass as the Integral XT process thermostat requires a minimum flow rate of 5 L of heat transfer liquid per minute for optimum heating and cooling capacity. If the flow in the flow meter is lower, the bypass must be opened to ensure that there is a sufficient quantity of heat transfer liquid flowing back into the Integral XT before flow measurement.

2.2 Intended use

The device is an accessory for the Integral XT process thermostat and has the function of regulating the flow quantity in the range of 0.2 to 20 L/min. The heat transfer liquid must have a minimum conductivity of 1 $\mu\text{S/cm}$ and be operated within its working temperature range. Silicone oils and mineral oils are not suitable.

Devices with an additional pump offer the ability to increase the flow pressure.

The device may only be operated in accordance with the intended procedures and under the conditions specified by these operating instructions and the operating instructions of the Integral XT process thermostat. Any other type of operation is considered to be unintended and can impair the protection provided by the device.

LAUDA does not accept liability in the case of damage caused by improper use of the device.

2.3 Non-intended use

The device may not be used:

- for medical or pharmaceutical applications.
- in potentially explosive areas.
- with combustible, flammable, highly flammable or explosive heat transfer liquid or silicone oil.
- if the permissible working temperature range of the heat transfer liquid is exceeded.
- in outdoor installation.
- to heat or cool food.

2.4 Personnel qualification

Operating personnel

Operating personnel are personnel who have been instructed by specialist personnel about the intended use of the device according to the operating manual, about the hazards posed by the heat transfer liquid, about the working temperature ranges and the pressures within the application as well as the necessary protective measures.

Specialist personnel

Specific activities on the device must be carried out by technical staff. Technical staff is personnel that can evaluate functions and risks of the device and the application based on their training, skills and experience. Typically, this personnel has had appropriate training or third-level education in a relevant technical area. Specialist personnel must be able to judge the hazard posed by the heat transfer liquid, the working temperature ranges and the pressures within the application and to determine the necessary protective measures and the effectiveness thereof.

2.5 Owner's responsibility

- The owner is responsible for the qualification of the specialist and operating personnel.
- The thermostat may only be configured, installed, maintained and repaired by specialist personnel.
- Persons who operate the device must have been instructed in their duties by specialist personnel.
- Ensure that specialist personnel and operators have read and understood the operating instructions.
- The device is to be used in the intended manner (⇒ chapter 2.2).

2.6 EC conformity



The device complies with the applicable basic occupational health and safety requirements of the Directives listed below:

Manufacturer

LAUDA

LAUDA DR. R. WOBSE R GMBH & CO. KG
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Germany

- Low Voltage Directive 2014/35/EU
- EMC Directive 2004/108/EC
- Safety requirements for electrical equipment for measurement, control and laboratory use
DIN EN 61010-1

3. Controls

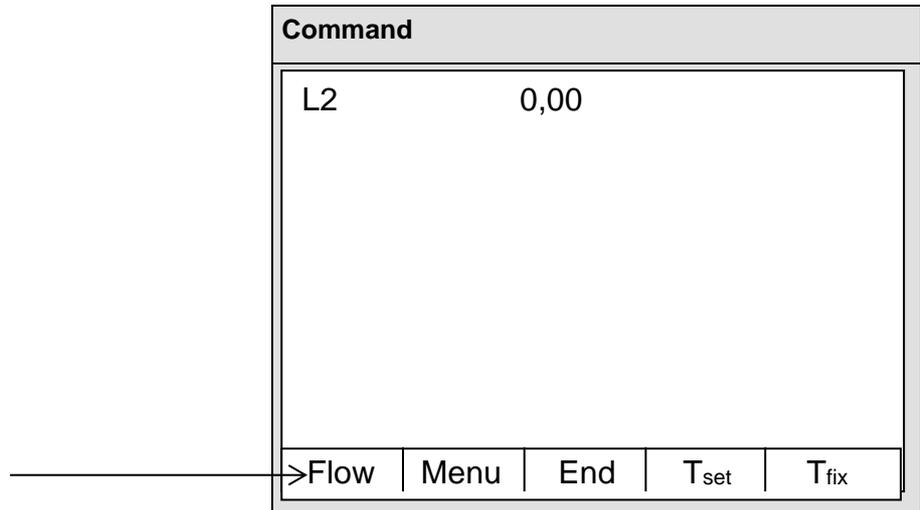
3.1 Function elements of the flow controller



Position	Designation	Function
1	Connection socket return XT	Connection socket between return and process thermostat
2	Main switch	Flip to switch the device on/off
3	Lemo connection socket	Output of the internal temperature probe
4	LiBus connection socket	Receives control signals from the Integral XT
5	Setting wheel for bypass	Turn to set the degree of bypass opening
6	Outlet	To drain the device
7	Connection socket outflow XT	Connection of pressure side of process thermostat
8	Lever for outlet	Flip to open the outlet
9	Connection socket outflow user	Connection socket of the application's pressure side
10	Connection socket return user	Connection socket of application return

3.2 Deviating command function elements

Here, function elements that deviate from the standard command operating unit are described.



Position	Designation	Function
1	Flow	Access to flow meter settings.

4. Installation

Note

Falling down / tipping over of the device
<i>Damage to property</i>
<ul style="list-style-type: none"> - Only place the device upright and on a level surface. - Do not tilt the device.

4.1 Unpacking

Unpacking procedure
<ol style="list-style-type: none"> 1. Open the package at the top. 2. Keep the original packaging of your device for later storage or transport. 3. Inspect the device and the accessories immediately after unpacking for completeness and transport damage. 4. If there is unexpected damage to the device or accessories, inform the carrier immediately so that a damage report is produced and a check of the transport damage can be made by the LAUDA service department (⇒ chapter 8.2).

4.2 Contents of package

Figure <i>(not to scale)</i>	Designation	Quantity
	Flow controller	1
No figure	Declaration of clearance for service or repair jobs.	1

4.3 Recommended accessories

(Not included in the scope of delivery)

Article number	Designation	Quantity
UK 246	Connecting cable 2.5 m with 2 Lemo connectors	1

If you have questions about accessories you can contact our **LAUDA service department** (⇒ chapter 8) or visit our website **lauda.de**. Under the tab “Product solutions/temperature control devices/accessories” you will find a wide selection of different accessories including connecting materials.

4.4 Placement

Note

Errors during placement

Damage to property

- Observe the minimum clearance on all sides and do not cover the ventilation openings.
- The device may not be operated if its temperature has dropped below the dew point during transport or storage.

We recommend that the devices be placed as described. Other placement options are possible, but the type of heat dissipation of the Integral XT, the temperature change if bridging paths are too long and the ambient conditions of the placement location(s) must be taken into account.

Figure (not to scale)	Placement procedure
	<ol style="list-style-type: none"> 1. Select a suitable location for the devices. 2. Position the flow meter on the right-hand side of the Integral XT. 3. Ideally, the application is to the right of the flow meter.

4.5 Connecting device components



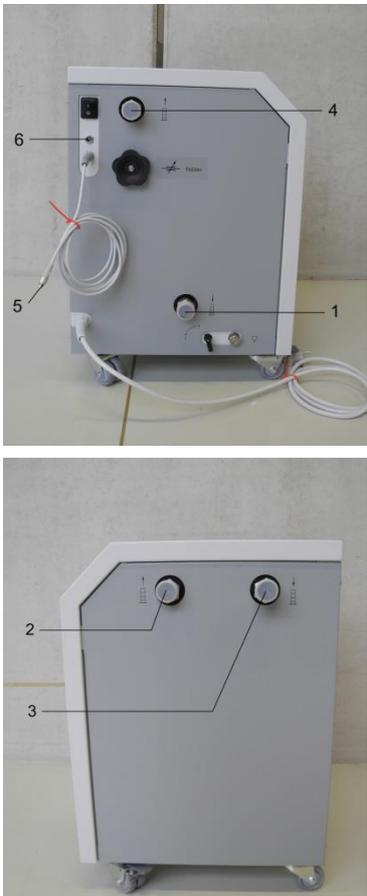
Use unsuitable connecting materials
<i>Material damage and injuries</i>
<ul style="list-style-type: none"> • Note the requirements that the expected temperature and pressure ranges place on the hose material. • Only use hose material that is suitable for the chemical makeup of the heat transfer liquid. • Note the requirements that the expected temperature range places on the insulation of the connecting hoses and connection elements.



Contamination/damage to the connections or the piping
<i>Damage to property</i>
<ul style="list-style-type: none"> • Before connecting, ensure that the connections are clean and free of foreign objects. • When connecting the hoses to the connectors, use a second spanner to counter the tightening torque. • Ensure that the nipple does not turn when tightening. • Do not tighten the connections more tightly than is necessary.



Consumer overflow
<i>Damage to property/contamination</i>
<ul style="list-style-type: none"> • Only connect closed consumers.

Figure <i>(not to scale)</i>	Procedure when connecting the device components
	<ol style="list-style-type: none"> 1. Connect the outlet connector on the pressure side of the Integral XT to the pressure input connector on the flow controller (1). 2. Connect the outlet connector on the pressure side of the flow controller to the input connector on the application (2). 3. Connect the outlet connector on the return of the application to the input connector for the return on the flow meter (3). 4. Connect the outlet connector on the return side of the flow controller (4) to the input connector for the return on the Integral XT. 5. Connect the LiBus cable of the flow meter (5) to the LiBus socket of the Integral XT. 6. <i>Option when using the internal temperature sensor: Connect the Lemo socket of the flow meter (6) with the Lemo socket of the Integral XT. To do so, use a connecting cable. This is available as an accessory (⇒ chapter 4.3).</i>

4.6 Establishing a power supply



Contact with live parts
<i>Electric shock</i>
<ul style="list-style-type: none"> • Check the device and the accessories for damage before switching it on. • Never put the device into operation if you have discovered any damage.



Use of unauthorised mains voltage or mains frequency
<i>Damage to property</i>
<ul style="list-style-type: none"> • Compare the type plate of the power supply with available mains voltage and mains frequency.

Procedure for establishing a power supply
<ol style="list-style-type: none"> 1. Connect the plug of the flow meter to the power supply using earthing.

5. Operation



Improper operation
<i>Scalding, freezing, burning</i>
<ul style="list-style-type: none"> • Only use heat transfer liquid that is suitable for the application's temperature range. • Ensure that no substance or material that comes into contact with heat energy during operation exceeds or falls below the working temperature range. • Ensure that all components are designed for the pressures encountered during operation. • Never use the application outside of its specification range (⇒ chapter 9).



Contact with heat transfer liquid or device or connection components
<i>Corrosion, poisoning, scalding, freezing</i>
<ul style="list-style-type: none"> • Use suitable protective equipment. • Avoid contact with hot, cold, corrosive or poisonous temperature control fluid or sample fluid. • Avoid contact with hot or cold device components. • During operation, ensure that device and connection components are appropriately insulated. • Bring the heat transfer liquid to room temperature before draining. • Only carry out work on device, socket or connection components when the device is empty.



Change the fill level
<i>Damage to property</i>
<ul style="list-style-type: none"> • Note the heat expansion and/or drop in volume of the heat transfer liquid when regulating its temperature. • Note that, before continuous operation of the application, the air in the piping must be allowed to escape in order to avoid damage or incorrect measurements. This can lead to the fill level dropping below the minimum fill level. • Note that, during longer temperature control, the heat transfer liquid can evaporate. This can lead to the fill level dropping below the minimum fill level.

5.1 Filling, venting and degassing the application

To do so, follow the operating instruction of the LAUDA Integral XT (⇒ chapter 7.6).

5.2 Operation

5.2.1 Switching on

Note

Error when switching on/off

Damage to property

- Always switch the flow controller on first
- Ensure that the device has been filled with heat transfer liquid before it is switched on.

Procedure for switching on

1. Set the mains switch of the flow controller to position 1.
2. Set the mains switch of the main device to position 1.
3. Select the soft key "Flow".
4. Use the "up" and "down" arrow buttons to move the cursor to the "Status" menu item and press "Enter" or the "right" arrow button to confirm.
5. Use the "up" and "down" arrow buttons to move the cursor to "On" and press "Enter" or the "right" arrow button to confirm.

If the status "On" has been selected, the valve regulates to the desired flow rate. This setting is active until you set the status to "Off". Note that the flow through the flow controller is highest when the position "Off" is selected.

5.2.2 Setting the target flow rate

Procedure for setting the target flow rate

1. Select the soft key "Flow".
2. Use the "up" and "down" arrow buttons to move the cursor to the "Target flow rate" menu item and press "Enter" or the "right" arrow button to confirm.
3. The input field is now above the current value of the target flow rate. Now press "Enter".
4. Now use the soft keys to enter a value between 0 and 20 L per min and confirm the value with "Enter".

Example: Inputting a target value of 7.53 L per min.

Use the soft keys to enter 00753 and confirm by pressing "Enter".

5.2.3 Settings for the higher-pressure pump

If your device has a higher-pressure pump, the existing LiBus software connection is detected and the setting automatically switches from **Aux. Pump OFF** to **Aux. Pump ON**. When the flow controller of the Integral XT is dismantled, the automatic setting described above must be undone manually on the command remote control unit of the Integral XT.

Procedure for deregistering the flow controller

1. Select the soft key "Menu".
2. Use the "up" and "down" arrow buttons to move the cursor to the "Pump" menu item and press "Enter" or the "right" arrow button to confirm.
3. Use the "up" and "down" arrow buttons to move the cursor to the "Aux. Pump ON" menu item and press "Enter" or the "right" arrow button to deregister the pump of the flow controller.

5.2.4 Setting the control parameters

For flow rate control, the actuating signals are a continuous valve and the pump speed. The two actuating signals can be parameterised using separate PI controllers.

Procedure for setting the control parameters

1. Select the soft key "Flow".
2. Use the "up" and "down" arrow buttons to move the cursor to the "Control parameters" menu item and press "Enter" or the "right" arrow button to confirm.
3. Use the "up" and "down" arrow buttons to move the cursor to the desired control parameter and press "Enter" to confirm.
4. Now use the soft keys to enter a value between 0 and 10 and confirm the value with "Enter".

Control parameters	Meaning	Basic setup (default)
Valve Kp	Proportional share, controller valve	5.0
Valve Ki	Integral share, controller valve	1.25
Pump Kp	Proportional share, controller pump	0.8
Pump Ki	Integral share, controller pump	0.1

5.2.5 Setting the bypass

In order to protect the main device, the Integral XT, from damage, a continuous flow rate of heat transfer liquid must be guaranteed. In order to guarantee this for applications in which the flow is interrupted, the device has an internal bypass.

Procedure for setting the bypass

1. Switch the flow rate control function "off".
2. Open the bypass fully.
3. Set the pump level such that the flow is sufficient to maintain the desired minimum flow rate.
4. If the flow rate is not attained, closed the bypass slowly until the flow rate is set.

5.2.6 Standby

Procedure for switching device to standby

1. Press the standby button on the Command remote control unit.

When the standby button is pressed, the pump(s) of the Integral XT and the flow meter (for devices with an additional pump) is/are switched off. The heating and cooling unit are also switched off. The operating unit remains active, meaning that status displays can be viewed and settings can be made.

5.2.7 Switching off

Procedure for switching off

1. Press the standby button on the Command remote control unit in order to place the device in standby mode.
2. Set the mains switch of the main device to position 0.
3. Set the mains switch of the flow meter to position 0.

6. Interface commands

The following interface commands are valid for flow rate control. Input is via the selected interface on the Integral XT.

6.1 Additional commands for RS 232/485 and Ethernet interface

6.1.1 Write commands

Data specifications to the flow meter:

Command	Meaning
PO_4_25_0_E6	Switch on the flow rate control.
PO_4_25_1_E7	Switch off the flow rate control.
PO_4_24_XX.XX_CS	Specify the target value for the flow rate control.

Setup of the write command PO_4_24_XX.XX_CS

The value CS is a checksum.

The value XX.XX is within the range of 00.00 to 20.00 in the unit L/min

CS depends on the value XX.XX and can be calculated as follows:

All digits before the checksum are shown in decimal and added up. The calculated value is converted to hexadecimal and the last two digits are added to the command as a checksum.

Example:

Target flow rate value: PO_4_24_XX.XX_CS

With a target flow rate of 12.34 L/min, the calculation is as follows:

'P' = 80_D

'O' = 79_D

'_' = 95_D

'4' = 52_D

'_' = 95_D

'2' = 50_D

'4' = 34_D

'_' = 95_D

'1' = 49_D

'2' = 50_D

'.' = 46_D

'3' = 51_D

'4' = 52_D

'_' = 95_D

The sum of "PO_4_24_12.34_" is 923_D = 39B_H.

The CS is then the last two digits of the hexadecimal checksum, i.e. 9B_H.

The following character string must thus be transferred:

PO_4_24_12.34_9B<CR>

6.1.2 Read commands

Data requests from the flow meter:

Command	Meaning
PI_4_25_51	Query of flow rate control status switched on or off
PI_4_26_52	Query of flow rate actual value.
PI_4_24_50	Query of target flow target value.

6.2 Additional commands for Profibus interface

6.2.1 Write commands

Data specifications to the flow meter:

CMD Byte 2	Cmd No Byte 3	Meaning
4	5	Flow rate control off/on (0=off / 1=on)
2	7	Write flow rate target value

6.2.2 Read commands

Data requests from the flow meter:

CMD Byte 2	Cmd No Byte 3	Meaning
14	5	Flow rate control off/on (0=off / 1=on)
12	7	Read flow rate target value
11	7	Read flow rate actual value

7. Error messages for flow controller

If one of the following error messages appears on the display of the Integral XT, try to solve the problem with the user action described.

Error messages	User action
Error 1305	Switch both devices off. Then wait approx. 20 s. Then, first switch on the flow controller and then the Integral XT.
Error 1305 and error 146	Switch both devices off. Then wait approx. 20 s. Then, first switch on the flow controller and then the Integral XT.
Error 146	Switch off the Integral XT and check the LiBus cable connection between the Integral XT and the flow controller respectively insert the LiBus cable. Then, switch on the Integral XT.

If the error message persists, please contact the **LAUDA service department** (⇒ chapter 8.2).

8. Service

8.1 Displaying device data

For service or diagnostic purposes, you can use the command remote control unit of the Integral XT to view device data for the additional pump.
This only applies for the flow controller with a higher-pressure pump.

Input for service menu

1. Press the “Menu” soft key.
2. Use the “up” and “down” arrow buttons to move the cursor to the “Settings” menu item and press “Enter” or the “right” arrow button to confirm.
3. Use the “up” and “down” arrow buttons to move the cursor to the “Device status” menu item and press “Enter” or the “right” arrow button to confirm.
4. Use the “up” and “down” arrow buttons to move the cursor to the “Device data” menu item and press “Enter” or the “right” arrow button to confirm.
5. Use the “up” and “down” arrow buttons to move the cursor to the “Display” menu item and press “Enter” or the “right” arrow button to confirm.

Device data	Description
P2 power	Power of pump 2 in watts
Pump rpm	Pump speed in rpm
Pump current	Current consumption in amperes
Pump voltage	Voltage in volts
Temp. pump	Reference temperature of pump in °C. The value should not exceed 100 °C.

8.2 Contact address

Contact LAUDA Service in the following cases:

- In the event of faults on the device
- For technical questions about the device
- For spare part orders

LAUDA Service

Telephone: +49 (0)9343 503 350

Fax: +49 (0)9343 503 283

Email: service@lauda.de

If you have application-specific questions, please contact your responsible LAUDA sales employee.

9. Maintenance and repair



Danger from electric power
<i>Electric shock</i>
<ul style="list-style-type: none"> • Before all maintenance and repair work, unplug the mains plug of the flow controller and the main device. • Have repairs carried out by specialist personnel only.



Error when switching on/off
<i>Damage to property</i>
<ul style="list-style-type: none"> • Always switch the flow controller on first • Ensure that the device is filled with heat transfer liquid.

9.1 Maintenance intervals

Maintenance and servicing intervals are to be observed in accordance with VDI 3033. If maintenance does not take place in accordance with the specified intervals, the manufacturer can no longer guarantee safe operation of the temperature control device and the flow controller.

System part	Frequency	Note
	At each commissioning:	
Flow controller		
Checking for damage	Daily	Visual inspection
Hydraulic circuit		
Leaktightness	Daily	Visual inspection
External tubes		
Material fatigue	Monthly	Visual inspection

9.2 Fuses

Description
In order to protect the device from overvoltage, two 5-amp fuses are installed. If required, specialist personnel can check and replace them.

10. Technical data

10.1 Ambient conditions

Ambient conditions	Unit	Value
Installation location	-	Indoor areas
Ambient temperature	°C	5...40
Storage temperature of the device	°C	5...50
Contamination level	-	2
Permissible operating altitude above sea level	m above mean sea level	2000
Relative humidity	-	80% at 31 °C and up to 40 °C decreasing linearly to 50%
EMC classification as a device for Europe	-	Class B: Operation on mains power supplies with connected residential areas
EMC classification as a device for Canada and the USA	-	Class A: Operation only on mains power supplies without connected residential areas

10.2 Technical characteristics of flow measurement

Technical characteristics	Unit	Value
Working temperature range	°C	-30...80
Electrical conductivity		
Water	μS/cm	> 20
Standard (heat transfer liquid)	μS/cm	> 1
Mains voltage range	V	230
Mains frequency range	Hz	50
Current consumption for devices without an additional pump	A	0.5 A
Current consumption for devices with an additional pump	A	4 A
Max. power consumption for devices without an additional pump	W	100
Max. power consumption for devices with an additional pump	W	800
Protection class for electrical operating equipment as per DIN EN 61140 (VDE 0140-1)	-	1
Protection level as per DIN EN 60529	-	IP 21
Hydraulic connections		M30 x 1.5 A
Interface	-	LiBus
Additional connection	-	LEMO socket
Dimensions of flow controller (WxDxH)	mm	503 x 422 x 605

Product Returns and Clearance Declaration

Product Returns

Would you like to return a LAUDA product you have purchased to LAUDA? For the return of goods, e.g. for repair or due to a complaint, you will need the approval of LAUDA in the form of a *Return Material Authorization (RMA)* or *processing number*. You can obtain the RMA number from our customer service department at +49 (0) 9343 503 350 or by email service@lauda.de.

Return address

LAUDA DR. R. WOBSEER GMBH & CO. KG

Laudaplatz 1

97922 Lauda-Königshofen

Deutschland/Germany

Clearly label your shipment with the RMA number. Please also enclose this fully completed declaration.

RMA number	Product serial number
Customer/operator	Contact name
Contact email	Contact telephone
Zip code	Place
Street & house number	
Additional explanations	

Clearance Declaration

The customer/operator hereby confirms that the product returned under the above-mentioned RMA number has been carefully emptied and cleaned, that any connections have been sealed to the farthest possible extent, and that there are no explosive, flammable, environmentally hazardous, biohazardous, toxic, radioactive or other hazardous substances in or on the product.

Place, date	Name in block letters	Signature

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