

Operating instructions

Integral XT

Process thermostats and High-temperature thermostats

Read the instructions prior to performing any task!



Operating instructions

GNTEGRAL XT

Process thermostats XT 150, XT 250 W, XT 280, XT 280 W, XT 350 W, XT 350 HW, XT 490 W, XT 550, XT 550 W, XT 750, XT 750 S, XT 750 H, XT 750 HS, XT 950 W, XT 950 WS, XT 1590 W, XT 1590 WS, XT 1850 W, XT 1850 WS

High-temperature thermostats XT 4 H, XT 4 HW, XT 8 H, XT 8 HW

Read the instructions before starting work!

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software version of Command (Control Panel) 3.47 software version of Control system (Master) 2.47 software version of Security system (Master) 2.19 software version of Chilling system 3.39 software version of Pump 2.28 software version of Analogue IO module 3.21 software version of Serial IO module 3.27 software version of Digital IO module 3.14 software version of Ethernet module 1.23 software version of EtherCAT module 1.06 LAUDA DR. R. WOBSER GMBH & CO. KG Laudaplatz 1 97922 Lauda-Königshofen Germany

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Prefixed safety notes

Before operating the equipment please read carefully all the instructions and safety notes in Section 1.

If you have any questions please phone us!

Follow the instructions on setting up, operation etc. This is the only way to avoid incorrect operation of the equipment and to ensure full warranty protection.

- Transport the equipment with care! The unit may NEVER be overturned nor put upside down!
- Equipment and its internal parts can be damaged:
 - by dropping,
 - by shock.
- Equipment must only be operated by technically qualified personnel!
- Never operate the equipment without the heat transfer liquid!
- Do not start up the equipment if,
 - it is damaged or leaking,
 - cable (not only supply cable) is damaged.
- Switch off the equipment and pull out the mains plug:
 - for servicing or repair,
 - moving the equipment!
- Drain the device before moving the equipment!
- Do not carry out any technical changes on the device!
- Have the equipment serviced or repaired by properly qualified personnel only!

The Operating Instructions include additional safety notes which are identified by a triangle with an exclamation mark. Carefully read the instructions and follow them accurately! Disregarding the instructions may have serious consequences, such as damage to the equipment, damage to property or injury to personnel!

We reserve the right to make technical alterations!



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Explanation of signs:

	Danger:	This sign is used where there may be injury to person- nel if a recommendation is not followed accurately or is disregarded.
	Note:	Here special attention is drawn to some aspect. May include reference to danger.
\Rightarrow	Reference:	Refers to other information in different sections.

1 Safety instructions

1.1 Obligations of the operator

The national regulations for operation applicable in the country in which the system is installed must be complied with. In particular, the application of statutory regulations concerning operational safety must be observed.

1.2 General safety instructions

A process thermostat is used to heat, cool and circulate heat transfer liquids as specified. Hazards arise from this due to high or low temperatures, excess pressures, fire and the general hazards due to the application of electrical energy.

The user is largely protected by the application of the relevant standards.

Further hazard sources can arise from the type of material for which the temperature is to be stabilized, e.g. by the exceeding or undercutting certain temperature thresholds or by the fracture of the container and reaction with the heat transfer liquid.

It is not possible to include all possibilities. They remain essentially subject to the judgment and responsibility of the operator.

The devices may only be used as intended, that is as described in this operating manual. This includes operation by instructed specialist personnel.

The devices are <u>not</u> designed for use in medical applications in accordance with DIN EN 60601-1 or IEC 601-1.

EU conformity

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The device complies with the basic health and safety requirements outline in the Directives listed below.

Machinery Directive 2006/42/EC

EMC Directive 2014/30/EU

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The device does not fall under Pressure Equipment Directive 2014/68/EU because the device is only classified as high as Category 1 and is covered by the Machinery Directive.

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Classification in accordance with EMC requirements				
Device	Immunity requirements	Emissions class	Customer power supply	
Integral XT high-	Table 2 (Industrial) in	Emissions Class B	Worldwide	
stat	DIN EN 61326-1	CISPR 11	No limitation	

Classification in accordance with EMC requirements				
Device	Immunity requirements	Emissions class	Customer power supply	
Integral XT process thermostat single-phase and triple-phase devices	Table 2 (Industrial) in accordance with DIN EN 61326-1	Emissions Class B in accordance with CISPR 11	Only for EU Domestic connection value ≥ 100 A	
Integral XT process thermostat single-phase and triple-phase devices	Table 2 (Industrial) in accordance with DIN EN 61326-1	Emissions Class B in accordance with CISPR 11	Rest of the world (outside EU) No limitation	

Valid for the USA:

Instructions for Class A digital devices

"This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC (Federal Communication Commission) Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense."

"This device complies with Part 15 of the FCC (Federal Communication Commission) Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation."

Valid for Canada:

"This Class A digital apparatus complies with Canadian ICES-003" (ICES = Interference Causing Equipment Standards).

« Cet appareil numérique de la Classe A est conforme à la norme NMB-003 du Canada ».

1.3 Other safety information

- Check the device carefully for shipping damage before putting into operation. The device should not be put into operation if shipping damage has been found.
- Only connect equipment to PE grounded mains sockets.
- At higher operating temperatures, parts of the device (e.g. connection, drain points) can take on surface temperatures of over 70 °C. Be careful when touching the device → Danger of burns.
- After a mains failure or after switching off the device, the device surfaces can further heat up briefly.
- Use suitable hoses (\Rightarrow 6.2).
- Check the hoses from time to time for any material fatigue. Hot liquid can escape due to hose fracture and become a danger to personnel and materials.
- Heat transfer hoses and other hot parts must not come into contact with the mains cable.
- The following actions may start the thermostat unintentionally from the standby mode: Previously activated timer mode (⇒ 7.14), "Start" command via interfaces (⇒ 8).

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- Withdraw the mains plug before cleaning, servicing, repairing or moving the thermostat.
- Have repairs carried out only by specialists. The device may only be serviced by trained specialist personnel.
- Keep to service and maintenance intervals (⇒ 9.2.6).
- Observe the permissible storage and operating temperatures (⇒ 11).
- The device should not be subjected to fire; otherwise there is the danger of an explosion.
- The device may only be operated with its housing in place.
- Do not site the device in areas where there are aggressive media.
- Only site the device on a level surface.
- Do not put any heavy parts on the device.
- The operating personnel must wear suitable protective equipment.
- Do not operate the device when leaks have been found; ventilate the siting room immediately.
- With pressure sensitive loads (e.g. glass apparatus) with a maximum permissible operating pressure below the maximum pressure of the pump (3.5 bars for water, with XT 1850 W 7.0 bars with water), the hoses of the load must be routed such that kinking or squashing is not possible. In addition, a separate safety valve must be installed to protect against faulty operation (⇒ 7.9.4, 7.9.5 and page 37).
- When selecting the heat transfer liquid, observe the permissible temperature range.
- Heat transfer liquids from LAUDA are recommended which have been tested for use with the device (⇒ 6.2).
- Always set the over temperature cut-off point immediately according to the heat transfer liquid used when filling (⇒ 7.16.1).
- If required, the heat transfer liquid should be checked for fitness for use (e.g. when changing the method of operation), or half-yearly. Further use of the heat transfer liquid is only permissible if the inspection indicates this (⇒ 9.3.1 and 9.3.4).
- Keep the cover of the filling point closed during operation.
- Under certain operating conditions (degassing, rapid heating phases), the temperature may increase in the expansion vessel. In extreme cases, the outflow temperature of the device is reached. If heat transfer liquids are heated near to the flash point at a certain temperature, then sources of ignition must be kept away from the filling opening and overflow (and at the aeration point of the expansion tank). In such cases, a nitrogen overlay of the expansion vessel is recommended (cover XT with connection for nitrogen overlay LWZ 072).
- Degas carefully (slowly) (\Rightarrow 7.6.3).
- It is essential to avoid gas cushions in the load system. This can be done by reducing the pump power by one or two levels and checking that the level indication of the device does not increase.
- If an overflow catchments container is connected, it must be suitable (including the connecting hose) for the maximum operating temperature. The connection hose must be securely fitted.
- The overflow must not be closed.
- Draining / drain mode is only permissible with an established temperature range (\Rightarrow 7.7).
- During operation the drainage openings must be closed with plugs (standard accessories).
- On changing the heat transfer liquid, thoroughly clean the device and completely drain it. It is recommended that the device is rinsed with the new heat transfer liquid (⇒ 7.8).
- It is essential to prevent the ingress of secondary liquids (e.g. via a customer's defective heat exchanger).

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Safety instructions for water-cooled devices:

- Use suitable cooling water to prevent corrosion in the cooling water circuit (\Rightarrow 6.2).
- The return hose of the water cooling must be securely fixed on the outlet port in order to prevent the hose sliding off uncontrollably, also during pressure surges.
- The return hose of the water cooling must be fixed on the outlet port that hot cooling water cannot splash out.
- It is essential to prevent kinking or squashing of the return hose for the water cooling. Excessive pressure can cause the cooling water hoses to tear and hot water to escape.
- To prevent damages by a leakage of the cooling water system it's recommended to use a leak-water detector with shut-off valve (Aqua Stop).

Safety instructions for high-temperature thermostats with watercounter-cooling:

• The high-temperature thermostats with cooling water connection (type W) <u>always</u> require a cooling water supply, even if they are only used in heating mode.

2 **Brief operating instructions**



These brief instructions shall give you the possibility to operate the unit quickly.

For safe operation of the unit, it is absolutely necessary to read carefully all the instructions and safety notes!

- 1. Set up the device or complete the configuration as required (\Rightarrow 6.1). The device should never be tilted or stood upside down! Note the connection of the hose joints (\Rightarrow 6.2).
- 2. Pay attention to pressure sensitive loads (e.g. glass apparatus) with a maximum permissible operating pressure (\Rightarrow 7.9.4).
- 3. Only operate the Integral XT when flow through the external load is possible.
- 4. Open any shut-off valves in the external loads.
- 5. Compare the details on the rating label with the mains voltage. Three-phase device: Ensure a clockwise phase sequence.

Only XT 1850 W Order No. LWP 732 and XT 1590 W Order No. LWP 742: Check the switch position [400 V; 3/PE; 50 Hz or 440-480 V; 3/PE; 60 Hz] for presence of mains voltage and frequency. An incorrect setting does not result in any damage, but an error message occurs $\Box = \Box = 1 (\Rightarrow 9.4)$. With the unit switched off, set the incorrectly set switch to the correct voltage and frequency values. The switch is fitted on the back of the unit at the top left, behind the cover panel (\Rightarrow 2.3).

- 6. Only connect device to a socket having a safety earth conductor.
- 7. Switch on the device by the main fuse-switch on the front panel ("ON = I").



8. In the display you see either the current out-

flow temperature, e.g.:

Floor-standing device





or if the device has not yet been filled:

Fill device °C 4

If instead, a warning or error message is displayed, then refer to Section 7.16.



- Fill device with heat transfer liquid and follow Section 7.6. Use suitable heat transfer liquid (⇒ 6.2). The devices are rated for operation with non-flammable and flammable liquids according to DIN EN 61010-2-010. Water is not permissible!!
- 10.Set the over temperature cut-off point with → according to the heat transfer liquid used (⇒ 7.16.1).

2.1 Menu structure: Master







Brief operating instructions



2.3 View of the device and connections

Integral XT 150

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- 1 Main switch
- 2 Filling point for heat transfer liquid
- 3 Interface section
- 4 Mains cable
- 5 Drain point M16 x 1
- 6 Drain tap

Refer to page 22 for an illustrated side view of connections and taps.





Refer to page 22 for an illustrated side view of connections and taps.







Refer to page 23 for an illustrated side view of connections and taps.





Refer to page 23 for an illustrated side view of connections and taps.







Integral XT 490 W, XT 1590 W, XT 1590 WS, XT 1850 W, XT 1850 WS

Refer to page 23 for an illustrated side view of connections and taps.



Rear view



- 1 Overflow and venting for the equalizing container (all units)
- 2 Switch for setting mains voltage and frequency (⇒ 2 and 9.4) (only XT 1850 W Order No. LWP 732; XT 1590 W Order No. LWP 742).

Interface section



Two LiBus sockets for the Command remote control (standard) and LiBus accessories, socket for external Pt100 temperature probe (resistance thermometer to DIN EN 60751) (accessory), two slots for LiBus interface modules (accessories).

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Side view of connections (with XT 250 W as example)



- 1 Exit cooling water connection R3/4" (only water cooled devices W).
- 2 Entrance cooling water connection R3/4" (only water cooled devices W).
- 3 Pump connector outflow M30 x 1.5 (to the consumer).
- 4 Pump connector return M30 x 1.5 (from the consumer).



Side view of connections and taps (with XT 350 HW as example)

- 1 Pump connector outflow M30 x 1.5 (to the consumer) (XT 1850 W(S): M38 x 1.5).
- 2 Pump connector return M30 x 1.5 (from the consumer) (XT 1850 W(S): M38 x 1.5).
- 3 Drain point M16 x1 with drain tap: expansion vessel.
- 4 Drain point M16 x1 with drain tap: main emptying.
- 5 Drain point M16 x1 with drain tap: HT-cooler (only devices with temperature range up to 300 °C.)
- 6 Drain point M16 x1 with drain tap: cooling unit.
- 7 Exit cooling water, connection R3/4" (XT 1590 W(S), XT 1850 W(S): R1") (only water cooled devices W)
- 8 Entrance cooling water, connection R3/4" (XT 1590 W(S), XT 1850 W(S): R1") (only water cooled devices W)

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3 Controls and functional elements



RS 232 socket (concealed on the back of Command)

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the display

4 Device description

4.1 Environmental conditions

The operation of the thermostats is only allowed under the following conditions as specified in EN 61010-2-010:2003 and EN 61010-1:2001:

- Indoor use.
- Altitude up to 2000 m above sea level.
- Foundation must be dense, even, non-slippery and non-flammable.
- Keep clear distance (\Rightarrow 6.1).
- Ambient temperature range (⇒ 11).
 Use only within this range for an undisturbed operation.
- Mains supply voltage fluctuations (⇒ 11).
- Maximum relative humidity (⇒ 11).
- Transient over voltage according to Installation Categories (Over voltage Categories) II.
- Pollution degree: 2.

4.2 Types of devices

Process thermostats

The type designation of the Integral XT Process Thermostat consists of the numerical figures for the cooling power (in kW at 20 °C, mathematically rounded) and the minimum temperature (rounded, without arithmetical sign). The identifying letter "H" stands for devices with a maximum operating temperature of 300 °C or "W" stands for water-cooled variants.

Examples: XT 750 is a device with approx. 7 kW cooling power, approx. -50 °C lowest temperature and 220 °C highest temperature.

XT 350 HW is a device with approx. 3 kW cooling power, approx. -50 °C lowest temperature, 300 °C highest temperature and water cooling.

High-temperature thermostats

The type designation of the Integral XT High-temperature thermostat consists of the numerical figures for the heating power (in kW, starting from 230 V devices, mathematically rounded) and an identifying letter. The identifying letter "H" stands for high-temperature thermostats and "W" stands for water-cooled variants.

High-temperature thermostats with cooling water connection (type W) <u>always</u> require a cooling water supply, even if they are only used in heating mode.

Precise figures can be taken from the Technical Data (\Rightarrow 11).



4.3 Hydraulic circuit and Vario pump

The hydraulic circuit in the unit partly consists of a pipe system through which the temperature stabilizing liquid flows under pressure.



The main components are: pipe system, equalizing tank (with no flow), pump, heater and heat exchanger.

All devices are equipped with an eight-level, hermetically sealed (magnetically coupled) pump. The pump power can therefore be optimally matched to the respective task: High pump pressure when, for example, long hoses lead to external loads.

Alternative to eight power levels, operation with closed loop pressure control is available for supplying processes (loads) with a maximum permissible pressure rating e.g. pressure sensitive glass reactors.

On the right side of the device outflow and return connection pieces are fitted for external loads.

In the heating range the pump operates up to cinematic viscosities of 200°mm²/s. In normal operation 50°mm²/s should not be exceeded. From 30°mm²/s the temperature control is optimum.

The device pump connections are fitted with threaded connections M30 x 1.5 or M38 x 1.5 according to DIN 3863.

Pump characteristics (⇒ 11).

4.4 Substances / materials

All parts coming into contact with the media liquid are made of high quality material suitable for the operating temperature. Non-rusting stainless steel is used almost exclusively. To a slight extent brass/copper is used where the media temperature is 200 °C maximum. Sealing materials: Graphite, copper, PTFE, FKM, polymer seals.

4.5 Temperature display, control and safety circuit

The devices are fitted with a removable command operating console with back-lit graphical display which is used for displaying the measurements and setting values as well as the operating states. The entry of the set value and other settings occurs using menu guidance via context sensitive cursor and "soft" keys.

A Pt100 temperature probe measures the outflow temperature in the device. A high resolving A/D converter processes the measurement. Further measurement processing occurs via a special control algorithm for driving the heating power actuator and the special cooling system with further measurement transducers.

An external Pt100 can be connected via a socket (10S) for measuring an external temperature. This value can be displayed and if required, used as the controlled variable when the external controller (master) is switched on. In this way the system control is based on the external measurement and not on the outflow temperature.



The safety system conforms to DIN EN 61010-2-010. A dual-channel system is used in which two micro-controllers monitor one another. Apart from the outflow temperature or temperature probe, there is a second safety temperature probe (Pt100) for the safety circuit for switching off due to excessive temperature and for monitoring the outflow temperature probe. This fulfills the requirements of

DIN EN 61010-2-010. The over temperature switch-off point is displayed by pressing the key igvee on the Master.

Changing the over temperature cut-off point: (\Rightarrow 7.16.1).

The level in the expansion vessel is acquired by the SelfCheck Assistant in 15 levels. If the minimum level is undercut, the pump, heating and refrigerating machine are switched off. The behavior in the case of an excessive level can be set (\Rightarrow 7.16). Different reactions can be chosen depending on the thermostatic medium.

With low level, over temperature or other alarms the SelfCheck Assistant switches the heater off on all poles. The pump and the refrigerating machine are also switched off.

This fault switch-off remains, i.e. once the fault has been rectified the alarm must be released with the

reset key

Other device functions are described in the corresponding sections and in Section 7 (Starting up).

4.6 Programmer and ramp function

The units are equipped with a programmer function which enables five temperature/time programs to be saved. Each program consists of a number of temperature/time segments. These also include details of how often the program is to be executed. Up to 150 segments can be distributed amongst the five programs (\Rightarrow 7.12).

With the ramp function a rate of change can be directly entered in °C/unit time.

4.7 Interfaces

As standard, the device is fitted with the following sockets:

- One socket (10S), for an external Pt100 temperature sensor.
- Two sockets (70S), for the Command remote control and for LiBus Components.
- An RS 232/RS 485 interface (65S) at the back of the Command remote control.



4.8 Interface modules (accessories)

Other interface modules can be inserted into two slots (refer to Section 8). The following modules are currently available:

- RS 232/485 Interface Module (Order No. LRZ 913) with 9-pole SUB-D socket. Electrically isolated through optocouplers. Command set largely compatible with the ECO, Ecoline, Proline, Integral XT and Integral T Series. The RS 232 interface can be directly connected to the PC with a cable wired 1:1 straight through (Order No. EKS 037). Further details can be found in section 8.3.
- Analog Module (Order No. LRZ 912) with two inputs and two outputs on 6-pole DIN socket. The inputs and outputs can be set independently as 4 20 mA, 0 20 mA or 0 10 V interface. Further details can be found in section 8.4.
- Contact Module (Order No. LRZ 915) on 15-pole SUB-D socket. With three relay contact outputs (changeover, max. 30 V / 0.2A) and three binary inputs for control via external voltage-free contacts. Plug 15-pole, Order No. EQM 030 and plug case Order No. EQG 017. Further details can be found in section 8.5.1.
- 4. Contact Module (Order No. LRZ 914) with connector to NAMUR NE28. Functionality as LRZ 915, but only one output and one input on each of two DIN sockets. Coupling socket 3-pole, LAUDA Order No. EQD 047 and coupling plug 3-pole, LAUDA Order No. EQS 048. Further details can be found in section 8.5.2.
- Profibus (LAUDA Order No. LRZ 917). Further details can be found in the operating instructions Q4DA-E_13-014 of the Profibus Modules.

4.9 Refrigerating unit

The refrigerating machine mainly consists of one or two fully hermetically sealed compressors. The dissipation of the condensation and motor heat takes place via a fan-ventilated laminated condenser. Here, fresh air is drawn in at the front of the unit, heated towards the back and output at the side. To ensure proper air circulation the ventilation slots must not be restricted. (\Rightarrow 6.1). The condenser must be cleaned regularly to prevent soiling (\Rightarrow 9.3.2.1). The SelfCheck Assistant outputs a warning signal when the condenser is soiled.

On water cooled devices the heat dissipation takes place via a plate-type heat exchanger or a bundle tubing heat exchanger using cooling water. Regular cleaning is also required here depending on the water contamination (\Rightarrow 9.3.2.2).

The compressors are equipped with over temperature cutouts which respond to the compressor temperature and the compressor current consumption. In addition the refrigerating system is backed up by a pressure control device against over pressure. The refrigerating unit is normally switched in automatically, but can be switched manually via the operating menu (\Rightarrow 2.2).

When the fault circuit trips, the refrigerating unit is also switched off.

5 Unpacking

Falling down / tipping over of the device		
	Damage to property	
 Do not tip the refrigerator and never place it upside down! 		
	 If the device is overthrown or overturned on also the LAUDA Service Constant Tempera 	the shipping, log the fall and contact ture Equipment. (⇒ 9.5)

To repack the unit carefully and properly, it is necessary to store the original package!

5.1 After unpacking

	Transport damage			
	Electric shock			
•	Closely inspect the device for transport damage prior to commissioning! Never operate a device that has sustained transport damage!			

After unpacking, firstly check the device and accessories for any damage in transit. If contrary to expectations the unit is found to be damaged, the shipping company must be immediately informed so that verification can take place.

Please also inform the LAUDA Service (Contact \Rightarrow 9.5).

5.2 Standard accessories:

Quantity	Article		Article no.
1 x	Operating Instructions	for all devices	YAWE0028
each 1 x	Plug and union nut (for M16 x 1)	for bench-top devices	HKN 065 HKM 032
each 3 x	Plug and union nut (for M16 x 1)	for floor-standing devices	HKN 065 HKM 032
each 4 x	Plug and union nut (for M16 x 1)	for floor-standing devices with HT cooler (H)	HKN 065 HKM 032
2 x	Threaded hose coupling Nipple ½"; Nut R¾"	for all water-cooled devices (W) except XT 1590 W(S) and XT 1850 W(S)	EOA 001
2 x	Threaded hose coupling Nipple ¾"; Nut R1"	XT 1590 W(S), XT 1850 W(S)	EOA 053
2 x	Screw cap M30 x 1.5 (plastic)	XT 150,, XT 1590 W(S)	EZV 101
2 x	Screw cap M38 x 1.5 (plastic)	XT 1850 W, XT 1850 WS	EZV 129



5.3 Unpacking and packing with original transport packaging material

5.3.1 Sector of application

From Integral XT 280 up to and including XT 1850 WS. There are two different sizes of transport palettes, one for middle chassis (XT 280 / 350 / 550 / 750 / 950) and one for big (XT 490 / 1590 / 1850) chassis.

5.3.2 Background

For the customer to allow a properly packaging, e.g. for further transport or return transport to LAUDA.

5.3.3 Supposition

You need a crane with two textile slings or lashings; or a fork lifter with adjustable fork.

5.3.4 Unpacking the device

To unpack the device with crane or fork lifter see the order "Packing and unpacking order Integral XT". Art. No. YVW 0001.

5.3.5 Packing for shipping with original transport packaging material





Integral XT





Transportation board

Recess on the pallet for the cooling water in and out connections.

Pallet with transportation board in place.

5.3.5.2 Packing the device

Align the wheels on the device length.





Move transportation board underneath. The longer part of the board with end-to-end bar to the front side of the XT unit.



Place transportation strips under both sides of the transportation board. Do not use chains!



Lift the XT unit up and move it over the pallet. Take care for good position between the fixtures of the pallet and take care for the cooling water connections.

Recess on the pallet is giving space for the cooling water connections.





Place the operating instructions of Integral XT device on top of the device.





Slip over the outer cardboard box. It is fixed by transportation board and pallet.

First bring in the small distance cardboard (\Rightarrow 5.3.5.1). The two beads shall be on the front and rear side of the unit.





Then place the large distance cardboard 90° rotated to the small distance cardboard.

Close the outer cardboard box with retaining clips and adhesive tape.

Lauda



Secure the outer cardboard box twice on its larger and once on its smaller side.

Stick on labels, markings and shock sensors!

This unpacking instruction has to be placed prominent in a transparent plastic bag.

6 **Preparations**

Falling down / falling over of the device on inclined plane / table edge

Crushing of the hands and feet

• Only position the device on level surfaces and not close to table edges.

Falling down / tipping over of the device

Damage to property

 Do not tip the refrigerator and never place it upside down.

6.1 Assembly and siting





- Site the unit on a flat surface.
- The unit must not be put into operation if its temperature during storage or transport has dropped below the dew point.
 Wait for about one hour.
- The device should **never** be tilted or stood upside down.
- Do not cover the ventilation openings.
- Leave free space on all sides (\Rightarrow 11).
- Plug the bus connector of the Command remote control into the 70S socket and secure it.
 Further T-adaptors are available as accessories EKS 073.
- Check that the drain tap [D] is closed (position 0), and that the sealing cap on the drain is fully tightened. Tighten the sealing cap only slightly with the open-ended wrench (AF 19). (There are one to four drain taps depending on the device).
- Check that with water-cooled (optional) devices the cooling water inlet and the cooling water outlet [C] are correct and firmly connected.

Watercooled high-temperature thermostats: Always connect cooling water
Cooling water	r connection is n	ot established
---------------	-------------------	----------------

Equipment damage

- (lasting damage to the high temperature valve)
- The High-temperature thermostat has to be connected to the cooling water supply!

Connection of the load

Burs	ting of the external consumer due to overpressure
	Scalding, frostbite, cutting
٠	Use a pressure relief device on pressure-sensitive con- sumers (e.g. glass reactors).



Connection of closed loads only!

In order that gas and vapor bubbles can be driven out of the system and undisturbed operation is possible, the external load must be connected according to the sketch. The outflow is connected to the external load point located at the bottom and the return line must be connected to the external load point located at the top so that liquid passes through the load from the bottom to the top.



Fitting instructions for the connections to the load

Ball-type nipples and olives:

- The sealing surfaces of tapers and ball-type nipples/ olives must not be damaged (dropping on hard floors etc.).
- Contamination on the sealing surfaces (taper and ball-type nipple/ olive) must be carefully removed before fitting.
- Place the ball-type nipple/ olive vertically onto the cone (support the hose, etc. when tightening).
- The ball-type nipple/ olive must not turn when tightening the union nut (if necessary, apply a little grease or oil between the ball-type nipple/ olive and the union nut.
- Tighten the union nut only slightly with an open-ended wrench and counter with a second wrench on the connection nozzle.

Olives:

- Push a hose onto the hose olive. Secure hoses against slippage with the aid of hose clips etc.

General notes:

- Always ensure the largest possible passages in the external circuit. For a hose cross-section that is too small → Temperature gradients occur between the device and external load due to low volume flow.
- Only operate the Integral XT when flow through the external load is possible.
- Open any shut-off valves in the external loads.
- Depending on the configuration of the load circuit, a venting valve can significantly simplify the venting process. The venting valve should be positioned at the highest point of the hydraulic circuit (⇒ see the drawing on page 37).
- Reactors for steam heating are not suitable as external loads, because they generally have an area through which flow does not pass and in which vapor cushions can form.
- If external control is to be used, provide a Pt100 probe in the external load.



- Pay attention to pressure sensitive loads (e.g. glass apparatus) with a maximum permissible operating pressure (⇒ 7.9.4).
- Check whether the hoses for external loads have been mounted.
- With outflow temperatures over 70 °C the supplied self-adhesive label (EZB 260) should be applied on the device at an easily visible point.
- Do **<u>not</u>** carry out technical changes on the device!



- The unit can be safely operated up to an ambient temperature of 40 °C.
- An increased ambient temperature (above the reference temperature of 20 °C) reduces the cooling capacity and the minimum temperature that can be achieved.
- With loads situated at a higher level and with the pump stopped and air seeping into the thermostatic circuit (for example a not completely closed or defective venting valve), then even with enclosed circuits, the external volume can run empty.
 → Danger that the process thermostat will overflow!
- Install a dirt trap if the complete heat transfer system on the customer side is not guaranteed to be dirt free.

Connection of the cooling water

Note that the following conditions apply for the connection of the cooling water supply:

Cooling water pressure (feed - outlet)	maximum 10 bar overpressure
Differential pressure (feed - outlet)	minimum 3.0 bar
Cooling water temperature	10 to 15 °C recommended, 10 to 30 °C admissible (with power restrictions)
Cooling water quantity	see Technical Data (⇒ 11)
Cooling water hose for connection to the device	minimum 13 mm (up to XT 950 W) minimum 19 mm (XT 1590 W(S), XT 1850 W(S))



6.2 Heat transfer liquids, cooling water and hoses

Filling, venting and degassing of heat transfer liquids (\Rightarrow 7.6). Testing of the heat transfer liquid (\Rightarrow 9.3.4).

LAUDA designation	Tempera- ture range	Chem. characteri- sation	Viscosity (kin)	Viscosity _(kin) at temperature	Flash point	Packing drum Order number		im er
	from °C to °C		mm²/s at 20 °C	mm²/s	°C	5 L	10 L	20 L
Ultra 301 @	40 - 300	Mineral oil	76.5	35.4 at 40 °C	245	LZB 153	LZB 253	LZB 353
Ultra 350	30 – 350	Synthetic heat transfer liquid	47	28 at 30 °C	ca. 200	LZB 107		
Кгуо 30 🛈	-30 – 90	Monoeth- ylene glycol/water mixture	4	35 at -20 °C	-	LZB 109	LZB 209	LZB 309
Kryo 65	-65 – 140	Synthetic heat transfer liquid	1.7	15 at -50 °C	62	LZB 118	LZB 218	LZB 318
Kryo 70	-70 – 220	Silicone oil	5	43 at -60 °C	121	LZB 127	LZB 227	LZB 327
Kryo 70 A	-70 – 220	Silicone oil	5.3	44 at -60 °C	125	LZB 131	LZB 231	LZB 331
Kryo 95	-95 – 160	Silicone oil	1.6	20 at -78 °C	64	LZB 130	LZB 230	LZB 330

a) Approved heat transfer liquids



① The proportion of water reduces with longer working at high temperatures → Mixture becomes flammable (flash point 119 °C). → Check the mixing ratio using a hydrometer.

- 2 Recommendation: Overlay with nitrogen at 150 °C and above
- When choosing the heat transfer liquid it must be noted that at the lower limit of the temperature range a worsening of the properties is to be expected due to the increasing viscosity. Therefore only fully exploit temperature ranges when required.
- The working ranges of the heat transfer liquids and hoses are general figures which can be tightened due to the operating temperature range of the devices.

With silicone rubber, silicone oils lead to substantial swelling. \rightarrow Never use silicone oil with silicone hoses.

EPDM hose is not suitable for Ultra 350, not for Ultra 301 and not for mineral oils!

Safety data sheets for heat transfer liquids can be ordered if required.

b) Cooling water

Certain requirements are placed on the cooling water with regard to purity. Depending on the cooling water contamination, a suitable method of purification and/or treatment of the water must be employed. The condenser and the complete cooling water circuit can become blocked, damaged and leaky due to unsuitable cooling water. Extensive consequential damage may arise on the whole cooling circuit. The cooling water quality depends on local conditions. If a fault or damage occurs due to unsuitable water quality, it is not covered by our guarantee.

Important: Danger of corrosion of the cooling water circuit due to water of unsuitable quality.

- Free chlorine (e.g. from disinfectants) and water containing chlorine lead to pitting in the cooling water circuit.
- Distilled, deionized or demineralized water is unsuitable due to its corrosive properties and leads to corrosion in the cooling water circuit.
- Seawater is unsuitable due to its corrosive properties and leads to corrosion in the cooling water circuit.
- Water containing iron or iron particles leads to rust formation in the cooling water circuit.
- Due to the high lime content hard water is not suitable for cooling and leads to calcification in the cooling water circuit.
- Cooling water with suspended matter is not suitable.
- Untreated and unpurified river or cooling tower water is not suitable due to its microbiological content (bacteria), which can become deposited in the cooling water circuit.
- Putrid water is not suitable.

Suitable cooling water quality

pH – value	7.5 – 9.0
Sulfates [SO ₄ ²⁻]	< 70 mg/L
Hydrocarbonates [HCO ₃ -]/ sulfates [SO ₄ ²⁻]	> 1.0
Total hardness	4.0 – 8.5 °dH
Hydrocarbonates [HCO ₃ -]	70 – 300 mg/L
Conductivity	10 - 500 µs/cm
Chlorides (Cl ⁻)	< 50 mg/L
Sulfites [SO ₃ ²⁻]	< 1 mg/L
Free chlorine gas (Cl ₂)	< 1 mg/L
Nitrates (NO ₃ -)	< 100 mg/L
Ammonia (NH ₃)	< 2 mg/L
Iron (Fe), dissolved	< 0.2 mg/L
Manganese (Mn), dissolved	< 0.1 mg/L
Aluminum (Al), dissolved	< 0.2 mg/L
Free aggressive carbonic acid (CO ₂)	< 5 mg/L
Hydrogen sulfide (H ₂ S)	< 0.05 mg/L
Algae growth	Not permissible
Suspended matter	Not permissible

Note:

Risk to the environment due to oil contamination of the cooling water circuit

With a leaky condenser there is the danger that refrigerating machine oil from the coolant circuit of the cooling thermostat can pass into the cooling water.

Follow all the legal requirements and the regulations of the water supply utility which apply at the point of use.

Water pollution due to leakage

To avoid pollution due to a leak in the cooling water system it is recommended that a leakage-water detector with a water cut-off is installed.

Servicing intervals

Follow the information for cleaning and decalcifying the cooling water circuit (⇒ 9.3.2.2).

c) Hoses

Metal hoses in non-rusting stainless steel with union nut M30 x 1.5 internal width 20 mm

Hose type	Length (cm)	Temperature range °C	Field of application	Order number
MXC 100S	100	-50 – 300	With special insulation for cold and hot areas for all heat transfer liquids	LZM 081
MXC 200S	200	-50 – 300	"	LZM 082
MXC 300S	300	-50 – 300	"	LZM 083

Metal hoses in non-rusting stainless steel with union nut M38 x 1.5 internal width 25 mm

MX2C 100S	100	-50 – 300	11	LZM 084
MX2C 200S	200	-50 – 300	n	LZM 085
MX2C 300S	300	-50 – 300	11	LZM 086

Torque specifications for the assembling

The threads of the pump connectors or the threads of the union nuts and the seat of the mother must be moistened with a lubricating medium.

Catalogue number and type designation	Maximum torque speci- fication	Thread	Maximum permitted pres- sure
LZM 081 / MXC 100S	70 Nm	M30 x 1.5	max. 10 bar
LZM 082 / MXC 200S	70 Nm	M30 x 1.5	max. 10 bar
LZM 083 / MXC 300S	70 Nm	M30 x 1.5	max. 10 bar

Note:

When using metal hoses M16 x 1 with reduction (from M30 x 1.5 to M16 x 1), the following maximum permitted pressures are valid, depending on the temperature (Hoses LZM 040 - 049, LZM 052 - 055, LZM 069).

Temperature range	Maximum permitted pressure
up to 20 °C	2.3 bar
up to 100 °C	1.9 bar
up to 300 °C	1.5 bar

7 Starting up

7.1 Mains connection

Compare the rating on the name-plate (\Rightarrow 9.5) with the mains voltage.

Only valid for the USA:

Instructions for Class A digital devices

"This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC (Federal Communication Commission) Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense."

"This device complies with Part 15 of the FCC (Federal Communication Commission) Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation."

Only valid for Canada:

"This Class A digital apparatus complies with Canadian ICES-003" (ICES = Interference Causing Equipment Standards).

« Cet appareil numérique de la Classe A est conforme à la norme NMB-003 du Canada ».



Connect unit only to sockets with a protective earth conductor (PE). No liability is accepted for incorrect mains connections!

Ensure that the unit is filled according to Section 6.2 and 7.6.

Three-phase device:

Ensure a clockwise phase sequence. If the device is connected with the wrong direction of rotation, an alarm signal is output.

Note for electric installation on site:

Single-phase devices:

Single-phase devices must be protected with a 16 ampere circuit breaker fitted during installation.

Exception: Devices with 13 ampere UK plugs.

Three-phase devices:

For three-phase devices the rating of the circuit breaker must match the power consumption of the device. The value will be found on the type plate. In each case, select the next higher value. Using an excessively high rated circuit breaker is not permissible.



7.2 Switching on



High-temperature thermostats with cooling water connection (type W) <u>always</u> require a cooling water supply, even if they are only used in heating mode.

	Failure of the cooling water supply
	Equipment damage (lasting damage to the high temperature valve)
•	Note the beeps, warnings and alarms of the device! $(\Rightarrow 9.4)$





Overtemp. cut-off.	Check or set over temperature cut-off point: - The switching point is shown in the LED display on pressing the key the		
	 Change over temperature cut-off (⇒ 7.16.1). Top up with heat transfer liquid as required which is pumped out due to filling up the external load 		
Level alarm	 Display for LEUEL (low level) appears when the expansion vessel has too little liquid. Red LED * above the fault triangle flashes. 		
	 Find cause of fault (⇒ 9.4) and, where necessary, top up missing liquid (⇒ 6.2). Press the Enter key. Also press the key if unit has been switched off in the fault state. No release is possible on Command remote control! 		
Command	Language		
English Deutsch França	 If the Command remote control is being switched on for the first time, the illustrated window appears automatically, enabling you to select the dialog language with the appropriate soft key. 		
Display Sounds Master Sounds Command Language Master-Mode Autostart Current Consumpt.	Image: Settings → The dialog language also can be changed later via → Settings → Basic settings → Image: Settings → Settings → Basic settings → Image dialog language Image: Settings → Settings → Basic settings → Image: Settings → Image Image - Mark the required language with Image Image - Image: Settings - Mark the required language with Image Image - - Confirm the selection with Image -		



7.3 Switching off / standby

Switching off: Set mains switch to position 0.

Standby operation: Use the key on the Command remote control. The pump, heating and cooling unit are switched off.

The operating display remains active, so that the device status is visible and adjustments can be made.



The timer continues to run. Stop as required with Pause (\Rightarrow 7.14).

7.4 Key functions

7.4.1 General key functions and pilot lamps

Master	
\square	Enter key:
[لم]	 From the actual-value display at the main menu level,
	 activates input, display flashes,
	 saves input, display ceases to flash and menu point is left,
	 press for approx. 3 s: Exit function and return to outflow tempera- ture display.
or 🔶	 Paging with keys is possible within the relevant level, or setting of numerical values.
	Speeds up entry by moving the counting position to the left:
	a) Keys are pressed and held down or
	 b) one of the two keys is pressed and held down, followed immediate- ly by brief pressing of the other key.
	Moves counting position to the right:
	 Switching one place to the right occurs by briefly (1 s) releasing the key, followed by another pressing of the key.
	Useful additional information:
	 2 dots in the Master display indicate that a submenu follows.
°C	 3 dots in the display indicate that a submenu for a module (inter- face) or a component (thermostat, Command remote control) follows. Module/component-specific possible settings are only dis- played when the hardware is connected.
(L)	 The following always applies: After termination of the relevant settings, they are accepted automatically after approx. 4 s or
	 the setting is accepted immediately with the Enter key.

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	_	Fault signal. Flashin	g re	d Alarm LED and acoustic signal.
and 🔆	-	An acoustic signal ca ly deactivated! (⇒ 7.	an c 10.	only sound when it has not been intentional- 5).
EXT	-	The control occurs v green LED is lit.	ia tl	ne external temperature probe when the
<u> </u>	-	Heating is active wh	en t	he yellow LED is lit.
***	_	Cooling is active. Wi take up to one minut	hen :e b	the setpoint temperature is lowered, it may efore the blue LED is lit.
EXT	_	The temperature of	the	external probe is displayed.
Command				
L			_	Enter key ("Confirm selection") and go back one level.
End			_	Soft key function to confirm a selection or input and to return to the main display window.
esc			_	Escape key to quit a window without changes and to go back one level.
	.)	(-	Cursor keys for Up, Down, Left and Right.
			-	Standby activation (pump, heater and re- frigerating machine are deactivated when the yellow LED is lit). But timer continues to run. Refer to safety information in (\Rightarrow 7.9.3).
\bigcirc			Du	io key:
			-	Top: Decimal-point key,
\cup			-	Bottom: Key for arithmetic sign.
			-	Soft keys: 5 duo-keys which each have the function shown in the display above them. Soft-key entries are shown framed in the operating instructions. Example: You would like to change the setpoint temperature, then press the duo-key un- der T_{set} .



Display Sounds Master Sounds Command Language Master-Mode Autostart Current Consumpt.	 Brightness Contrast The brightness and contrast can be set on the Command remote control: The works setting can be changed via → Settings → Basic settings → Display → Brightness or → Contrast The brightness of the LCD illumination can be selected from 8 steps or switched off completely. The contrast can be set in 8 steps.
Pump Menu End T _{set} T _{fix}	
Screen	There are six different screen displays availa- ble. The screen is switched over with the soft key Screen:
T _{set} °C 55,3 ↓ ∭	 Basic window with the three most important items of information:
	 T_{out}, current outflow temperature,
Z3,00 0,0 □ ** T _{out} <u>°C</u>	 T_{set}, set point of the outflow temperature or external temperature,
25,01	 Information: Heating / cooling. Here, heat- ing is taking place at 55.3% and 0.0% cooling.
	Soft keys:
	 Pump: Set Pump level.
Pump Menu Screen T _{set} T _{fix}	 Menu: Set unit parameters.
	 Screen: Changes between basic, normal, super, graphics recorder windows and the process overview.
	 T_{set}: Changes setpoint temperature.
	 T_{fix}: Calling and setting of saved set- points.
T _{set} °C	2. Normal window with five important items of information:
25,00 ⁹	 T_{out}, current outflow temperature,
T _{out} °C	 T_{set}, setpoint,
	 T_{ext}, current temperature on external probe (if connected),
	 Current level of the heat transfer liquid,
Pump Pint 2,00bar 25_02 Step 7	 System pressure in the outflow and pump level of the Vario pump.
Pump Menu Screen Tort Ter	 Soft keys as above.





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0,0 Y(%) -100,0 ★ 0,24bar 7 set 50,00°C Text,-°C Niveau 8 Pumpe 4	Picture on the left: Process overview of high- temperature thermostates XT 4 HW and XT 8 HW.
PumpMenuScreenTsetTfix	
$\begin{tabular}{ c c c c c c c } \hline T max & 185,00^\circ C \\ T max & 185,00^\circ C \\ T max & 20,00^\circ C \\ T max & 20,00^\circ C \\ T max & 20,00^\circ C \\ \hline T max & 20,00$	 6. Window limits T_{max}, (⇒ 7.16.1), T_{ih}, T_{il} (⇒ 7.10.2), dynamic heating limit (⇒ 7.15.7.2), max. heating, cooling and Smart Cool (⇒ 7.15.7.1), pictogram for degassing (⇒ 7.6.3).



7.4.2 Changing window information

Command		Display info
T _{set} °C 25,00 T _{out} 25 T _{ext} °C 25,02 Pump Menu Scr	Level 9 °C Pump Pint 2,00bar Step 3 reen Tset Tfix	 You can adapt the information displayed by your Command remote control to your requirements. For example, if you have not connected any temperature probe, you can exchange it in the standard setting of the normal window for the maximum temperature T_{max} (safety cut-off). This is how it is done:
Basic Window Normal Window Super Window	Edit Default	soft key Menu → with → and → change from Settings Display Data Normal Window Edit
Pump Menu Ei Center Up left Up right Down left Down right	nd T _{set} T _{fix} T internal T external Setpoint T max Pump level Control value Level Control variable Date/ time Programmer	 - + or + takes you to the illustrated window. - + and + marks T max as illustrated. - Confirm selection with + or End , - or guit the window with esc without any
Pump Menu E	nd T _{set} T _{fix}	changes being made.



7.4.3 Locking the keyboard

The keyboards of the Master console and Command remote control can be locked <u>independently of one</u> <u>another</u>. This is particularly advantageous when the thermostat is located in another room and the Command remote control is used as a remote control. Then the Master keyboard can be locked to prevent unintentional alteration of setting.

Master	SAFE		
	Locking:		
and hold	 – SEE appears for 3 seconds, 		
ultaneously for 3 s	– then the segments of the first right $ar{U}$ are formed,		
[]]]]] ○-○-○-○	 hold both keys pressed until the display can be seen <u>completely</u>. 		
SAFE °C	 SAFE flashes briefly and the display returns to the actual temperature. The Master keyboard is now locked. The SAFE display signals the locked condition when any Master key is pressed. 		
and hold			
pressed sim-	- for 3 seconds, then $\exists \Pi \Gamma \Box$ appears.		
for 3 s	– Then the segments of the left \dot{U} are formed.		
actual outflow temper- ature	 When all ¹/₂'s have been formed, the actual temperature reappears. 		

LAUDA

Command	
	Locking:
Locking keyboard	 First press and then hold simultaneously pressed for 3 s.
	 The Locking window appears.
	 Hold both keys pressed until the pro- gress bar is completely filled.
	 Then the display skips back into the pre- viously set Screen mode,
Pump Menu End T _{set} T _{fix}	 The softkey boxes are now empty, sig- naling that the keyboard is locked.
	 On pressing any Master key the display appears: Keyboard locked!
	Unlocking:
Unlocking keyboard	 First press and then press and hold first simultaneously for 3 s.
	 The Unlocking window appears.
	 Hold both keys pressed until the pro- gress bar is completely filled.
	 Then the display skips back into the pre- viously set Screen mode.

7.5 Level display

The level display renders the current liquid level in the expansion vessel visible.

Master	LE	
and 2 x	_	Call level display LE.
<u>LE_5</u> °c	_	The current level indication is displayed (here 5).

Command	_	Display in the various windows of the Command re-
		mote control is possible (⇒ 7.4.1).

Significance of the level indication

0	Low level alarm (⇔ 7.16.2)
1	Low level warning (\Rightarrow 7.16.2)
1 – 14	Stable operation possible.
15	High level (⇔ 7.16.3 and 7.16.4)

Estimating the filling amount per step of level indication

The range of level indication steps 1 to 15 corresponds to the additional filling volume in the expansion vessel (\Rightarrow 11).

Example:

Additional filling volume in the expansion vessel for Integral XT 150: 5.5 liters. Volume per level indication step (average): 6 liters / 14 level indication steps = approx. 0.4 liters.

7.6 Filling, venting and degassing

Your Integral XT has no bath which actively takes part in the temperature stabilization. There is however an expansion vessel which is filled with the liquid. The liquid passes to the external loads via the internal piping and the connected hoses.



- The devices are rated for use with non-flammable and flammable liquids according to DIN EN 61010-2-010. The temperature in the expansion vessel must stay lower than the temperature of the flash point of the heat transfer liquid (\Rightarrow 1.3).
- With the use of heat transfer oils note that they expand on heating (approx. 10%/ 100 K).
- Set the lower and upper temperature limits (⇒ 7.10.2) such that the limits for the heat transfer liquid are not infringed.



Close the drain taps.

- 1 tap for XT 150, XT 250 W ... up to max. 4 taps with XT 750 H and larger.
- Check whether the sealing caps on the drains (1 to 4 depending on the thermostat) are tight. Tighten only slightly with an open-ended wrench (AF19).
- Before filling, remove all the residue of the previous liquid (⇒ 7.8).

7.6.1 Filling



- Switch on the thermostat.
- The filling with the filling program starts automatically if a low level is found when the device is switched on.
- With Tmax enter the maximum permissible liquid temperature (⇒ 7.16.1).
- Start filling. When Level 1 is reached, the display changes to F and shows the corresponding level indication.



- Minimum device filling volume (⇒ 11).
- Alternatively, watch the level indication as displayed on both, the Master or Command control head.

- Fill the heat transfer liquid at room temperature up to Level 4.
- Only operate the thermostat when flow in the load system is possible. Open any shut-off taps in the load.
- During filling, the device can overflow if the load is located higher than the device and the filling is interrupted (e.g. mains failure). There may still be large quantities of air in the load which allows a return flow of the filled liquid. In case of doubt a shut-off tap should be fitted on the lower load connection.



7.6.2 Venting





- With devices up to 300 °C operating temperature range (H devices) switchover occurs alternately every 20 seconds between the individual hydraulic paths. When this happens, a long whirring sound is heard for about 5 seconds and the displayed pressure changes.
- Terminate the filling mode with the soft key Stop.
- A venting valve (⇒ see drawing on page 37 for arrangement) can significantly simplify the venting process. To do this, carefully open the valve periodically and allow air to escape until liquid is emitted from the valve, close the valve again. Collect the liquid in a suitable container. Open the valve again at regular intervals until no more air is emitted.

7.6.3 Degassing



7.6.3.1 Automatic degassing program

After filling and venting, the heat transfer liquid should be heated up to 20°K above the later maximum operating temperature (note the maximum temperature range of the heat transfer liquid (\Rightarrow 6.2)), note the maximum working temperature range of the connected consumer).



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- With this program the following parameters are automatically set:
 - The pump level is set to Level 2. The pump level should only be changed when necessary (⇒ 7.9.3).
 - The heater power is reduced, round about 50 % (⇒ 7.15.7.1).
 - The cooling unit is switched off (⇒ 7.15.7.1). The outflow temperature may rise above the setpoint due to the heat input from the pump.
 - Pressure control is not recommended (⇒ 7.9.4). Take care to the selection of the pump level with pressure sensitive loads (e.g. glass apparatus). Pay attention to a maximum permissible operating pressure.
- As with venting, the pump switches off briefly every 45 seconds for improved degassing.
- With units up to 300 °C, after briefly switching the pump off, switching occurs between the cooling unit and the high temperature cooler under certain operating conditions. So that it can be ensured that both, the cooling unit and the high temperature cooler are degassed. In addition, flushing occurs every 20 K.
- To simplify the removal of low-boiling solvents during out gassing, it may be practical to open the cover of the filling point so that the vapor can escape more easily (use air extraction if required). In this operating state, check the device continuously; it is essential to keep sources of ignition away from the filling aperture and to protect the operating personnel from splashes (e.g. place the cover diagonally on the filling aperture). Appropriate protective equipment and clothing must be worn. Close the cover again at the end of degassing.
- The end of degassing is reached when the outflow temperature has approached the set temperature (<10 K) and does not increase further. Similarly, the end of the degassing is reached when the outflow temperature has exceeded the set temperature due to self-heating.
- Terminate the degassing program with the softkey Stop. The device is then in the standby mode. All the above described parameters are reset to the previous settings.

7.6.3.2 Permanently and automatic degassing

- The device carries out the degassing permanently and automatically further on. When the device finds gas, first the heating and cooling power is reduced or sometimes completely switched off. If the pump pressure falls significantly (clear sign of degassing), the pump speed is limited, and the pump may switch off briefly. The device then starts up again automatically.
- With devices up to 300 °C and after the pump switches off briefly, switchover occurs between the cooling unit and the high temperature cooler in certain operating conditions. This ensures that both the cooling unit and the high temperature cooler are degassed.

7.6.4 Topping up

- Topping up during operation is possible. Volume per level indication step (\Rightarrow 7.5).

7.7 Draining



- Follow the regulations for disposing of the used heat transfer liquid.



- Use all available drain taps to achieve optimum draining.



Do not drain the heat transfer liquid in the hot state over 90 °C or below 0 °C.



Draining residues XT 150, XT 250 W

After draining, liquid residues may still be located in the return hose. Proceed as follows:



7.8 Changing the heat transfer liquid and internal cleaning

After draining there are residues of heat transfer liquid in the device depending on the type of liquid was used.

Remove these with the following cleaning procedure:

- 1. Connect a short-circuit hose to the outflow and return (\Rightarrow 2.3).
- Fill the device with a suitable cleaning liquid whilst operating in the filling mode (⇒ 7.6). If water with a cleaning agent (fat solvent) is used, it is essential to ensure that the device is only operated in the filling mode (refrigerating machine is therefore off). Otherwise there is the risk that the device may ice up internally and be damaged.

Suitable cleaning liquids	for
Ethanol It is essential to follow the relevant safety precautions when using ethanol!	Kryo 65 Kryo 70 Kryo 95 Ultra 350
Water	Kryo 30

- 3. Drain (⇒ 7.7) and remove the short-circuit hose. Dry the device with compressed air. To do this, carefully allow compressed air to flow into the device, alternately via the outflow and return. If cleaning is carried out with liquids which readily dissolve oil, such as ethanol, do not let the unit stand dry or transport it dry for a longer period (more than one day), because the pump requires a minimum lubrication. Therefore, continue with point 4.
- 4. After cleaning, fill with new heat transfer liquid and vent (\Rightarrow 7.6).
- 5. If contamination is still found (remove 0.5 liters with draining program (⇒ 7.7)), it is recommended that the new heat transfer liquid is again changed and cleaned externally, or the residues of the old heat transfer liquid are separated.



If residues of an old heat transfer liquid are not removed and remain in the device and the device is then operated above the thermal loading limit for this heat transfer liquid, deposits may form, particularly on the heaters, which reduce the performance capacity of the device or even reduce the service life of the device.

7.9 Important settings

7.9.1 Temperature setpoint setting

The setpoint is the temperature which the thermostat should reach and maintain constant.

Master (main level)	SEL
(tr	 Press key until SEE (Setpoint) appears.
(tr	 Press, display flashes.
or 🗸	 Enter the setpoint with the two keys ((⇒ 7.4.1) General key functions and pilot lamps).
Wait 4 seconds or	− Display flashes 4 s \rightarrow new value is automatically accepted,
(+)	or value is accepted immediately with Enter key.
	 For safety reasons the setpoint can only be set up to 2 °C above upper limit of the operating temperature range for the relevant de- vice type.
	 In the following cases the manual setpoint entry is blocked: Setpoint is taken from the analog module, from the programmer in the Command remote control or via the serial interface.
	- When the setpoint temperature is to be lowered, it may take up to
	one minute before the blue LED \divideontimes lights.

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Command	k				T _{set} or T _{fix}
				L	- or the soft key T _{set} opens the setpoint window.
					 123.45 is the setpoint which is still active. The upper and lower limit temperatures are displayed (device-specific values).
En	Enter new setpoint:				There are three different possible entry methods:
123,45 Min: -40.00°C Max:202.00°C				С	 Change the value with the for values. If keys. First you vary the 1/10°C values. If you hold the key pressed longer, then full degrees change.
		0			2. Enter the complete number with the nu-
6	2 7	3 8	4 9	5 0	merical duo keys and the 🗟 key for the negative sign and decimal point.
					 Using ← or →, move the flashing cursor line to the decimal place which you would like to change and then change it with f or ↓. Confirm the value with ← or quit the
					window with without having made any changes.
Fixed se	ettings	Re	ecent set	points	Two other ways of entering the setpoint:
0.00°	C C		80.00°C ·35.50°C		 With the soft key T_{fix} open the window shown on the left.
0.00°	С		20.00°C		 The setpoints which you last entered are
0.00°	C		38.00°C		shown in the right-hand column. In the il- lustrated screen the last setpoint was
0.00	C C		0.00°C		80.0°C.
0.00°	C		0.00°C		 To accept an earlier setpoint, enter the
0.00°	С		0.00°C		right-hand column with and select the
Pump	Menu	End	T _{set}	Edit	or cancel with .
					 In the left-hand column, setpoint temper- atures which are to be used frequently can be defined as "fixed settings".



E	nter new s 1 lin: -40.00	setpoint: 23. °C Max:	45 202.00°0	C	 Select desired position with the cursor keys (black background). With the soft key (Edit open the window shown on the left. Enter fixed temperature setpoint as described above and accept into the list with or cancel with (sec.)
1	2	3	4	5	 Select and accept values from the list of fixed settings as described above for the
6	7	8	9	0	"Recent setpoints".

7.9.2 Displaying the actual external temperature

With all Integral XT Thermostats an external temperature probe can be connected, which for example.....

- 1. ...can be used as an independent temperature measurement channel,
- ...can be used as the controlled variable for the bath temperature in applications with a noticeable temperature gradient (between the internal bath temperature and an external load). The setup is described in Section (⇒ 7.9.6). With the function described in the following, you only change over the display.

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External actual temperatures can also be read in by interface modules (\Rightarrow 8).

Connection of the external Pt100 to the Lemo socket 10S.

Bench-top device



Floor-standing device

Contact on socket 10S

1	+	Ι	Current circuit	— † — д.	D+100
2	+	U	Voltage circuit	— <i>V</i>	DIN EN 60751
3	-	U	Voltage circuit	— {J	
4	-	I	Current circuit	_	

- Plug: 4-pole Lemosa for Pt100 connection (Order No. EQS 022).
- Use screened connecting leads. Connect screen to plug case.





7.9.3 Pump capacity or setting standby

With the Integral XT Vario pump, 8 pump levels are available with which the flow rate and pressure, the noise generated and the mechanical heat input can be optimized. See (\Rightarrow 7.15.7.3).

Master	Pu
and 1 x	– Call pump power levels display P_{u} .
	– The current pump level is displayed (here \square).
(+)	 The pump levels display flashes.
or 🔗	 Select pump level (pump speed = pump power): I to I for pump operation. Pump responds immediately!
	 activates the standby function (pump, heater and refrigerating machine are deactivated).
wait 4 seconds or	- Display flashes 4 s \rightarrow new value is automatically accepted, or
(+)	 value is immediately accepted with Enter key.



Command	Pump Level
Pump LevelLevel 8Pressure controlLevel 7Start Fill modeLevel 6Start Unfill modeLevel 5Max.Press.[bar] 1,0Level 3Start unfill heat exch.Level 2Level 1Level 1	 Open the device parameter menu via the soft key Menu . Change from Pump → Pump Level using →. With ↔ or → you enter the illustrated window. Level 5 is active. Select another pump level with ↔ or and confirm with ↔ or
Pump Menu End T _{set} T _{fix}	or quit the window with without mak- ing any changes.
	Standby activation
• + *	 Standby activation (Pump, heater and refrigerating machine are deactivated when the green LED in the lower part of the key is lit.)

Please exercise caution when the thermostat is in standby mode. The thermostat is not switched off absolutely safely.

The following settings/ actions may start the thermostat unintentionally from the standby mode:

- A previously activated timer mode (⇒ 7.14), because a started timer continues to run.
- "Start" command via interfaces (\Rightarrow 8).



7.9.4 Pressure control

Alternatively to the 8 pump power levels, a mode with pressure control is provided which facilitates a very effective supply of pressure-sensitive glass reactors with a maximum permissible pressure rating.



7.9.5 Maximum pressure control

With the operation of double-shell vessels or other pressure-sensitive applications, the maximum system pressure must be set (reduced).



This setting does not replace the function of the component-tested safety valve (\Rightarrow 1.3 and picture on page 37).

Bursting of the external consumer

Scalding, frostbite

• For consumers with a maximum permissible operating pressure below the maximum pressure of the pump, use a safety valve for protection. This safety valve must be installed in the outflow of the device.





7.9.6 Activating external control

An external temperature probe can be connected to the Integral XT Thermostats. How this is done is explained in Section 7.9.2. If the set point temperature is to be controlled using this sensor instead of the internal sensor, the setting can be made here.

Furthermore, control can also occur based on the signal from the analog or serial module (\Rightarrow 4.8).



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If EP ER or ES has been selected,
 then the green LED indicates that the control has regulated to the external temperature signal.

Command	Control Variable
Control Variable	 Open the device parameter menu with the soft key Menu. With the cursor keys, change further to: → Control → Control Variable. Internal is currently active. Select other control variables (only displayed when present) with or ↑ and confirm with or End ,
Pump Menu End T _{set} T _{fix}	 or quit the window with without mak- ing any changes.

7.9.7 Current consumption from the mains

If your mains fuse is rated below 16 A, the current consumption can be reduced in steps from 16 A to 10 A using this function. The maximum heating power is then, of course, also reduced accordingly. Take into account whether other loads are still connected to the fused circuit or whether your Integral XT Thermostat is the only load.

Valid for single-phase alternating current devices only (e.g. XT 150, XT 250 W, XT 350 W, XT 350 HW).

Command	ł				Current Consumption
Display Sounds Sounds Langua Master Autosta Curren	y s Master s Comma age -Mode art t consum	and npt.	16.0 A		 Open the device parameter menu via the soft key Menu . With the cursor keys change further to: → Settings → Basic settings → Current Consumpt 16.0 A is presently active.
Pump	Menu	End	Tset	T _{fix}	
Max. current consumption (in A): 16,0 Min: 10,0 A Max: 16,0 A					 Open the settings window with . Change the current with cursor or soft keys and accept with . or End, or quit the window with . without making changes.
1	2	3	4	5	
6	7	8	9	0	
					-

With the three-phase alternating current units the current consumption cannot be reduced.



7.9.8 Setting the date and time

Command		Clock Time Date
Pump Settings Graph Clock Programmer Interfaces Control Limits		 Open the device parameter menu via the soft key Menu . With the cursor keys continue to: → Clock → Set time or to Set date.
Pump Menu End	Tset Tfix	
Enter time: 15:38:	12	 Open the settings window with . Change the time with cursor or soft keys and accept with . or quit the window with . or quit the window with . The date is set just the same with Set date .
1 2 3 6 7 8	4 5 9 0	 The date format (Day Month Year or Month Day Year) can be set under: Format of date

7.9.9 Display resolution setting

The Command remote control allows for different resolutions of the displayed temperature.

Command		Display resolution
Pump Settings Graph Clock Programmer Interfaces Control Limits	Calibration Works settings Resolution Device status Display data Basic settings Overlevel handling	 Open the device parameter menu via the soft key Menu . With the cursor keys continue to: → Settings → Display resolution .
Pump Menu Er	nd T _{set} T _{fix}	
Resolution	0,1 0,01	 Select the desired resolution with f or Accept selection with or End or quit the window with so without making changes.
Pump Menu Er	nd T _{set} T _{fix}	



7.10 Special settings

7.10.1 Defining the type of start mode

Usually it is desirable that the thermostat carries on operating again after an interruption in the voltage supply. However, if for safety reasons you do not wish this, you can insert an intervening manual activation step.

Command		P	utostart
			Open the device parameter menu via the
Display	Off		soft key 🔽 Menu .
Sounds Master Sounds Command Language		_	With the cursor keys continue to: \rightarrow Settings \rightarrow Basic settings \rightarrow Autostart .
Autostart		-	On is currently active.
Current consumpt.		-	If the standby mode is to be activated after a mains interruption, activate "Off" with $\overrightarrow{\downarrow}$ or $\overbrace{\uparrow}$.
			Confirm the selection with .
Pump Menu E	nd T _{set} T _{fix}]	Accept the change with or End,
		_	or quit the window with without mak- ing changes.
– Wr	nen the mains voltage has	been re	estored after an interruption, you can quit
the	standby mode with \bigcirc .		
7.10.2 Defining temperature limits

With this function it is possible to set the minimum and maximum limit value of the flow temperature in the range of which the device operates. If a temperature limit value is reached, the heating or the chiller is regulated off and a warning is issued.

Already 2 K before the limit value, the thermostat starts to regulate the heating or the refrigerating machine and a warning is issued. In this way, a flow temperature can be prevented which heats up or cools down the temperature control liquid too much without the unit being switched off (cf. the Section "Over-temperature protection" (\Rightarrow 7.16.1)). If, for example, Kryo 30 is used as the heat transfer liquid, 90 °C is the maximum temperature and -30 °C the minimum temperature.

Command				Temp. Limits
Pump Settings Graph Clock Programmer Interfaces Control Limits		(min) -50 n (max)30	.0 °C 2.0 °C	 Open the device parameter menu via the soft key Menu . With the cursor keys continue to: Temp. Limits. The minimum and maximum temperatures are displayed. T il (min) is currently active. Select the limit to be changed with
Pump Menu	End	Tset	T _{fix}	or \frown and confirm with \frown .
				 Enter the desired limit temperature.
Lower limit (Min: -50.0 °	(T il) 50. C Max:	0 301.0 ℃	;	 Accept the change with , or quit the window with without making changes.
	1	I		_
1 2	3	4	5	
6 7	8	9	0	



7.10.3 Setpoint offset operating mode

With this function it is possible to apply an offset value to the temperature provided by the external temperature probe or a module and then to use it as the setpoint. The heat transfer liquid temperature can, for example, be operated at -25 °C below the temperature of a reactor which is being measured by the external temperature probe.

Command		Offset source and Set point offset
Offset source Set point offset	off extern Pt100 RS232	 Open the device parameter menu via the soft key Menu . With the cursor keys continue to: → Control → Setpoint offset → Offset source .
Pump Menu E	nd T _{set} T _{fix}	 Select the setpoint onset is currently deactivated. Select the setpoint source with or interfaces (e.g. RS232) are only displayed if a valid setpoint has already been transmitted.
Offset source Setpoint offset	0,00 °C	 With the cursor keys continue to: → Offset source → Setpoint offset . The standard value is 0.00°C.
Input setpoint of O Min: -500,00°C	fset: 00 Max: 500,00°C 3 4 5	 Open the left-hand window with . Enter the desired temperature. Accept the change with . quit the window with . without making changes.
6 7	8 9 0	



7.10.4 Restoring works settings

Command	Works settings
All modules Master Command Cool Pump All default only control par. int. only control par. ext only miscellaneous	 Open the device parameter menu via the soft key Menu. With the cursor keys continue to: → Settings → Works settings. The window shown opposite appears. Master and then only control par. int. is shown as a possible choice. There are however various possibilities, which can be selected with or
Pump Menu End T _{set} T _{fix}	 Under all modules Master, Command and all connected modules are reset to the works setting with all default. Under Master you have the choice between: all default, then all Master settings are reset, only control para. int. for the internal control parameters, only control para. ext. similar for external
Confirm input! Enter key: Continue Escape key: Cancel Pump Menu End T _{fix}	 only miscellaneous which resets setpoint, pump level, max. current consumption, control to internal and autostart to "Auto". Under Command all command settings are reset with All default . Confirm selection with . Confirm the control dialog shown on the left with or cancel with . Return to measurement window with End or .



7.10.5 Setting the volume of the acoustic signals

The LAUDA Integral XT Thermostats signal alarms as a dual-tone acoustic signal and warnings as a continuous tone.

Command	Sounds
Alarm Ioud medium Iow off	 Open the device parameter menu via the soft key Menu. With the cursor keys continue to: > Settings > Basic Settings > Sounds Master or Sounds Command. Select either Alarm or Warning . Example on left: Alarm is set to loud. Select the desired volume with 1 or . Accept selection with 1 or End or
Pump Menu End Tset Tfix	quit the window with ^{the w} ithout making
	changes.

7.10.6 Entering the offset of the internal temperature probe

If, during checking with a calibrated reference thermometer probe, e.g. from the LAUDA DigiCal Series, a deviation is found, then the offset (i.e. the additive part of the characteristic) of the internal measuring chain can be adjusted with the following function. The reference thermometer must be fitted according to the details on the calibration certificate in the outflow.

Command		Calibration
internal Pt100 external Pt100	Calibration Default	 Open the device parameter menu via the soft key Menu. With the cursor keys continue to: Yestings → Calibration → Internal Pt100 → Calibration. The window shown on the left appears. Confirm selection with .
Pump Menu E	and T _{set} T _{fix}	



Temperature value of the ref. temp. measurement device:					_	 The temperature measurement device shows the true temperature value (with glass thermometers take the correction into account where applicable). 	
20,15					-	Change the display in the adjacent win- dow to the true value with cursor or soft keys and accept with er or End,	
					-	or quit the window with ^{esc} without mak-	
1	2	3	4	5	1	ing changes.	
6	7	8	9	0]		

7.10.7 Restoring the works setting of the internal temperature-probe offset

If the offset has been misadjusted unintentionally, the works setting can be restored with this function.

Command	Default
internal Pt100 external Pt100 Default	 Open the device parameter menu via the soft key Menu. With the cursor keys continue to: → Settings → Calibration → intern Pt100 → Default. The window shown adjacent appears. Confirm selection with .
Pump Menu End T _{set} T _{fix}	
Confirm input! Enter key: Continue Escape key: Cancel	 Confirm the control dialog on the right with or cancel with . Return to the measurement window with End or .
Pump Menu End T _{set} T _{fix}	

7.10.8 Entering the offset of the external temperature probe

If a deviation is found during the check using a calibrated reference thermometer probe, e.g. from the LAUDA DigiCal Series, then the offset (the additive part of the characteristic) of the external measurement chain can be adjusted with the following function. The probe of the calibrated reference thermometer must be placed close to the external temperature probe (external Pt100) so that its thermal contact to the material is as good as the external Pt100.

Command		Calibration
internal Pt100 external Pt100	Calibration Default	 Open the device parameter menu via the soft key Menu. With the cursor keys continue to: > Settings > Calibration > External Pt100 > Calibration. The adjacent window appears. Confirm selection with . Continue as described in (⇒ 7.10.6) for the internal temperature probe.
Pump Menu E	nd T _{set} T _{fix}	

7.10.9 Restoring the works setting of the external temperature-probe offset

If the offset has been misadjusted unintentionally, the works setting can be restored with this function.

Command	Default
internal Pt100 external Pt100 Default	 Open the device parameter menu via the soft key Menu. With the cursor keys continue to: Yettings → Calibration → external Pt100 → Default. The adjacent window appears. Confirm selection with . Continue as described in (⇒ 7.10.7) for the internal temperature probe
Pump Menu End T _{set} T _{fix}	

7.10.10 SmartCool

The chiller of the cooling thermostats is operated in the "automatic" operating mode as standard. Here, the cooling unit switches on or off automatically depending on the temperature and operating status. However, you can also switch the cooling unit on or off manually.

Command	•	Cooling mode
Cooling mode	off on automatic	 Open the device parameter menu via the soft key Menu . With the cursor keys continue to: Interfaces → SmartCool → Cooling mode . The adjacent window appears. Confirm selection with
Pump Menu E	End T _{set} T _{fix}	

7.11 Graphical display of temperature measurements

Command	Screen and Graph
Tset 25,00 — Tout 25,01 — Text 25,01 Rec 26,00	 Press the soft key Screen a number of times as required until the graph recorder window appears. With the soft key Graph you enter the menu for the configuration of the graph recorder. Mode defines, whether the recording is to run continuously as Online graph , or whether it is to be started with Start record and later terminated with Stop record . When this start/stop mode is active, Rec flashes at the top left of the display. Displayed value defines, which of the measurements Tint, Tset and/or Text is to be graphically displayed. In the menu all combinations are offered. Legend defines, whether the axis label is to be invisible
Pump Menu End T _{set} T _{fix}	or visible . Sample time defines with which time interval
ModeDisplayed valueLegendSample TimeTime axisTime baseTemp. scale	 the measurements are recorded. 5 possibilities are offered: From 2s (max. 1h45min) up to 2min (max. 105h). Time axis defines over which time range the measurements are to be displayed. With Automatic the program finds the optimum display. From 9min up to 144h. Time base defines whether seeling is to be
Pump Menu End T _{set} T _{fix}	carried out.
	 With Relative the start occurs at 00:00:00. With Absolute the current time is displayed.



Mode Displayed Legend Sample T Time axis Time base Temp. sca	value ime ale	Temp. min Temp. max	22.00 27.00	 Temp. scale defines how the scaling is to be carried out: automatic, by the program, or manual in that you yourself define the limits with the next menu point. The minimum and maximum values for the graphical display are manually entered with
Temp. lim	its 1enu E	nd T _{set}	T _{fix}	 Temp. limits Temp. min 22.00°C is the momentary minimum value. Temp. max 27.00°C is the momentary menineration.
y-axis Limit: 22,00 Min: -150,00°C Max: 26,90 °C			°C	 maximum value. The highlighted value can in each case be changed with . Enter the desired new value in the changes window in the usual way. When setting the minimum value, the largest permissible value (here 26.90 °C, since the maximum value is 27 °C) is stated.
1 6	2 7	3 4 8 9	5	 When setting the maximum value, it is conversely the minimum value which is entered. However, if a value is entered which exceeds the other corresponding limit, then this warning is issued: Warning: Value not in input range .



7.12 Programmer

Almost any temperature/time profile can be created with the programmer. A desired bath temperature can be approached as quickly as possible or via a defined ramp. Furthermore, the pump level and the behavior of the switching outputs can be defined. Five temperature/time programs are provided for free programming. Each program consists of a number of temperature/time segments. Also included are details of how often the program is to be executed (loops). The sum of all segments of all programs may be up to a maximum of 150.

Typical segments are:

Ramp: If a time is specified, then the segment is a ramp which is described by the target temperature, i.e. the temperature at the end of the segment, and the duration from the start to the end of the segment.

Step: Without any specified time the final temperature is approached as quickly as possible. **Temperature hold phase:** No temperature change (i.e. the temperatures at the start and end of a segment are the same).



The programmer can be controlled or changed via the RS 232 interface, the timer or switching contacts.

7.12.1 Program example



Real program example with 6 segments

No	T end °C	Time [h:m	To	lerance	No	Pump	Out 1	Out 2	Out 3
Start	30,00°C	/		0,00°C	Start				
1	30,00°C	00:20		0,10°C	1	2			
2 4	50,00°C	00:20		0,00°C	2	3			
3	70,00°C	00:40		0,00°C	3	4			
4	70,00°C	00:10		0,10°C	4	2			
5	60,00°C	00:30		0,00°C	5	2			
6	40,00°C	00:00		0,00°C	6	2			
Pump	Menu	End Ir	nsert	Delete	Pump	Menu	End	Insert	Delete

∐+33

Each program begins with the segment "Start". It defines at which temperature Segment 1 is to continue the program. It is not possible to specify a time for the Start segment.

No	T end °C	Time []	n.ml	Tolerance
]	
Start	30,00°C		-	0,00°C
1	30,00°C	00:2	0	0,10°C
2	50,00°C	00:2	0	0,00° C
30	50,00° C	00:2	00	0,10°C ₃
4	70,00°C	00:2	00	0,00°C
5	70,00°C	00:1	0	0,80°C ₃
6	60,00°C	00:3	0	0,00°C
7	30,00°C	00:0	0	0,00°C
Pump	Menu	End	Inser	t Delete

No	Pump	Out 1	Out 2	Out 3
Start				
1	2			
2	2			
3	2			
4	2			
5	2			
6	2			
7	2			
Pump	Menu	End	Insert	Delete

Edited program example (see dashed curve in the graph on previous page).

Insert new segment (⇒ Section 7.12.4).

② ③ Change segment time or tolerance (\Rightarrow Section 7.12.4).



The field tolerance (refer to the above program table and the graph below):

- It facilitates exact conformance to the dwell time at a specified temperature. Segment
 1 is not processed until the bath temperature is within the tolerance range **0**, so that the ramp (Segment 2) starts delayed at **2**.
- A tolerance range which is too tight can however also cause undesired delays. In particular with external control the range should not be chosen too tightly. In Segment 5 a larger tolerance has been entered, so that the desired time of ten minutes is maintained even with settling action ¹/₁.
- Only flat (slow) ramps should be programmed where necessary with a tolerance range. Steep ramps, which lie close to the maximum possible heating or cooling rates of the thermostat, may be severely delayed by a tolerance range that is too tight (here in Segment 2) ⁽¹⁾.



Example for the influence of the tolerance field input in case of external control:

The setpoint temperature of the programmer is shown in grey.

The actual temperature in the external bath container is represented as a continuous line.

7.12.2 Selecting and starting the program (Start, Hold, Stop)

Here you will learn how to select and start a program that has already been created. If no program has been created see Creating or modifying a program (Edit) (\Rightarrow 7.12.4).

Command		Programmer Program 1
Pump Settings Graph Clock Programmer Interfaces Control Limits	Program 1 Program 2 Program 3 Program 4 Program 5 Ramp function Prog. Optimization	 Open the device parameter menu via the soft key Menu . With the cursor keys continue to: → Programmer → Program 1. Confirm with the key .
Pump Menu E	End T _{set} T _{fix}	-
		– The submenu Status appears.
Status Edit Loops Graph Info	Start	 Using the Status menu, the selected program can be: 1. started Start , 2. paused Hold ,
		3. continued Continue or
		 4. terminated Stop. Also the standby key stops the programmer! (Pause operation).
Pump Menu I	End T _{set} T _{fix}	 After standby is deactivated, the pro- grammer continues!
		Commands which, depending on the situation, cannot be executed are not displayed. Continue therefore only appears when Hold has been activated.
Status Edit Loops Graph Info	Hold Stop	 Once the start has been confirmed with Prog. 1 running appears at the bottom.
Pump Menu E	End Prog. 1 running	



7.12.3 Interrupting, continuing or terminating the program (Hold, Continue, Stop)

Command		Pr	ogrammer Program 1 Status
Status Edit Loops Graph Info	Hold Stop	-	After a program has been started by pressing the key, the command op- tions Hold or Stop are shown. Here, with the aid of the keys or and or the running program can be paused with Hold or terminated with Stop. Once the program has been terminated, the device runs with the last setpoint set-
Pump Menu	End Prog. 1 active		ting.
Status Edit Loops Graph Info	Continue Stop		Continuation of a program paused with Hold occurs using Continue which is obtained with .
Pump Menu	End Prog. 1 active		
Status Edit Loops Graph Info	Continue Stop		Also the standby key stops the pro- grammer. The pump, heater and cooling unit are switched off. Follow the safety information (⇒ 7.9.3). After pressing the standby key again, the programmer returns to the previously selected operating mode: Pause or active operation depending on what was previously selected.
Pump Menu I	Ind Pr. 1 Standby		



7.12.4 Creating or modifying a program (Edit)

Here, there are the following functions:

- Entry of a program.
- Display of the program data of a saved program and modification of the segment data.
- Insertion or appending of a new segment.
- Deletion of a segment.

- Also when a program has just been executed, new segments can be inserted and existing ones modified, even the currently active segment. Furthermore, all segments, except the currently active one, can be deleted at any time.
- Modifications to the currently running segment are possible. The segment then continues as though the modification had been applicable since the start of the segment.
- **But:** If the new segment time is shorter than the segment time that has already run, then the program skips to the next segment.
- If a segment time >999 h 59 min is required, then this time period must be shared over a number of consecutive segments.

Entering a program:

Program example (\Rightarrow 7.12.1)

Command		Programmer Program1 Edit Modify
Status Edit Loops Graph Info	Modify Erase	 In the Edit menu one can Modify or Delete a program. Press the key. Continue to Modify with the key . There is the possibility of modifying single segments, i.e. segments can be entered as new, changed and also deleted.
Pump Menu	End T _{set} T _{fix}	



			_		-	In the "Start" line enter in the field "T end
No	T end °C	Time [I	n:m] Tol	erance		°C" the temperature at which the se-
Start	30,00°C		- ;	3,00°C		°C). A time entry is not possible in the
1	30,00°C	00:3	0 :	3,00°C		"Start" segment, because the thermostat immediately executes Segment 1 on reaching the start temperature.
					-	Delete single segments (rows) with De-
Pump	o Menu	End	Insert	Delete		
-	Using the cu	Irsor keys	move the b	lack back	ground to	the field which you would like to change.
	It can be edi	ted by pre	ssing the k	ey 🖵 (s	ee followi	ng pages).
-	The soft key	Insert	inserts in	the marke	d line a n	ew segment which has a default value
	always spec	ified as 0.0	s segment)0. All follo	with the e	nent lines	will be moved one line downwards.
_	In the above	window S	egment 1	was create	ed in this	way.
_	Continue wit	\rightarrow to the	a fields \rightarrow	"Time" → '	'Toleranc	e" See program example in (⇒ 7.12.1)
	If there is no		o "Timo" fi	iold (ctop)		temporature) the outflow temporature is
_	approached	as quickly	as possibl	e. With a	time entry	the final temperature is obtained exactly
	after the time	e expires (ramp).			
-	When passin how accurat When passin point and ac	ng through ely the fina ng along a	a step cha al temperat ramp, the	ange in tei ture is to b "Toleranc	mperature e attaine e" reflects	e, the entry in the field "Tolerance" defines d before the next segment is processed. s the maximum distance between the set-
	If the tel		adure.	on colocte	d too cm	all, it may be that the program door not
	continue	erance rai e, because	the require	ed toleran	ce is neve	er achieved.
	External	l temperatu	ure control	Especial	y with rar	nps, a tolerance range that is too close
	can cau	se undesn	eu uelays	in the star	t priase o	
						Then continue with \rightarrow to the pump and
Nr.	Pumpe	Out 1	Out 2	Out 3	-	signal output setting.
Start					-	The right-hand part of the entry table appears as shown on the left.
1	4					Here, in the "Pump" field, the pump level
					_	and, in the fields "Out 1" to "Out 3", the
					-	contact outputs of the contact mode (ac- cessory) can be programmed. With the
					-	setting "" the starting value is re-
					-	tained which was either set before the program start or was defined by a previ-
						ous segment in the running program.
					-	Further details are given on the following pages
Pum) Menu	End	Insert	Delete	-	P 4900.

Er Mi	nd of segr 2 n: -150,0	ment ter 2 5, 0 0°C Max	nperature 0	e: PC	_	A new segment is produced by moving the cell with the black background to a blank line with the cursor keys and then pressing the soft key Insert . The values of the cell located above it are automatically copied. If the field in the column T end °C has a black background, the entry mode "End of segment temperature" is
1 6	27	3 8	4 9	5 0		obtained by pressing the key. De- pending on the setting, that is the tem- perature which the thermostat is to achieve on the internal or external tem- perature probe.
					-	Enter the value, confirm with the $rac{1}{2}$ key and continue to the "Time" entry field with $ ightarrow$.
					-	If the field in the column Time has a black background, the entry mode for the "Segment time" time setting is ob-
In	out seam	ent time				tained by pressing the 💾 key.
H	Durs (max)3:(x.999):M	DO inutes		_	If 0 is entered into the field "Time", appears. Then the final temperature is approached as quickly as possible. With a time entry the final temperature is ob- tained exactly after the time expires (ramp).
L	-				_	Enter the segment time and confirm with
1	2	3	4	5	-	the 🛃 key.
6	7	8	9	0] –	Continue to the "Tolerance" entry field with \rightarrow .
					_	If the field in the column "Tolerance" has a black background, the entry mode for the "Temperature tolerance" is obtained
Temp. tolerance (0=off): 10,00 Min: 0,00°C Max:450,00°C						by pressing the end of segment tempera- ture is to be obtained before the next segment is processed. A tolerance which is selected too small can stop the next segment from being started according to plan.
L					-	Set the temperature tolerance and con-
1	2	3	4	5		firm with 🥲 .
6	7	8	9	0	_	Continue with 🗩 to the entry field "Pump".

LAUDA



Pump level Level 8 Level 7 Level 7 Level 5 Level 3 Level 2 Level 1 Pump Menu End Tset	 If the field in the column "Pump" has a black background, the entry mode for the Pump level is obtained by pressing the key . With I or 1 select Pump Level 1 – 8 or and confirm with stands for "no change to previous segment", i.e. when is present in all fields, the pump level always retains the start setting or the setting before the program start. Continue with i to the field "Out 1", "Out 2" or "Out 3".
Contact out open closed	 The contact outputs of the contact module (if present, special accessory) are programmed here. If the field in the column "Out1" has a black background, then access to the entry mode for the Contact output is obtained by pressing the key . Select, open or closed with stands for no change to the pre-
Pump Menu End T _{set} T _{fix}	vious segment, i.e. if ensure is present in all fields, the contact setting of the start setting or of that before the pro- gram start is always retained.
	 If applicable, continue to "Out 2" und "Out 3" with →. Programming is terminated with or End.



7.12.5 Defining the number of program loops (Loops)



7.12.6 Viewing the program sequence as a graph (Graph)

Command	Programmer Program1 Graph
Status Edit Loops Graph Info	 If takes you to the submenu Graph. Press the → key → Show chart press If the program sequence is shown.
PumpMenuEndTsetTfix	





7.12.7 Obtaining information on a program (Info)

Command		Programmer Program1 Info
Status Edit Loops Graph Info	Segments2Temp. min20,00°CTemp. max40,00°CDuration01:00Seg. free145Actual Seg.5Seg. Remain00:05Loop actualLoop actual3	 Continue with to Info. Here, all information is displayed about the entered program sequence. Number of segments. Minimum temperature in °C. Maximum temperature in °C. Program duration in hh:mm without the time which is necessary to process step changes in temperature.
Pump Menu I	End Prog.1 Standby	 Number of free segments. Segment which is at present (currently) being processed
		 Residual time of the current segment in hours and minutes.
		 Current pass; in the example the third of all passes is running.
	-	The last three points are only displayed if a pro- gram is running.
		– Quit the window with or End .



7.12.8 Optimized programmer

Activating the optimized programmer yields very good control performance in practice. With programs including both ramps and other types of segments, the actual temperature profile matches the target temperature profile more closely than when using the programmer without optimization. It reduces overshoots. There can only be large undershoots at the ends of ramps if the control parameters are very unfavorable. In this case optimization can be deactivated.

Tolerances that are too small will impair control. Work without tolerances where possible.

Command		Prog. Optimization
Pump SettingsPro Pro<	ogram 1 ogram 2 ogram 3 ogram 4 ogram 5 amp function og.Optimization	 Open the device parameter menu via the soft key Menu. With the cursor keys continue to: → Programmer → Prog. Optimization Conform with key
Pump Menu End	T _{set} T _{fix}	
Prog.Optimization Op	otimization on otimization off	 In this submenu you are able to switch on/off the program optimization.
Pump Menu End	T _{set} T _{fix}	



7.13 Ramp function

With the ramp function temperature changes over any time period can be conveniently entered. This is especially advantageous with very low temperature changes (e.g. 0.1 °C/day). Example: From the current outflow temperature (e.g. 242.4 °C) 200 °C of cooling is to occur over 5 days. Then the temperature change is entered as 200 °C and the time as 5 days.



The ramp function is executed until it is manually terminated or until the temperature limits T_{il} (min) or T_{ih} (max) described in Section 7.10.2 are attained.

Command		Ramp function
Pump Settings Graph Clock Programmer Interfaces Control Limits	Program 1 Program 2 Program 3 Program 4 Program 5 Ramp function Prog. Optimization	 Open the list of device parameters using the soft key Menu. With the cursor keys continue to: → Programmer → Ramp function. Confirm with the key .
Pump Menu	End T _{set} T _{fix}	
Status Temp. change Time Time unit	Second(s) Minute(s) Hour(s) Day(s)	 Enter a positive or negative temperature value with Temp. change. With Time enter a figure (without time unit). With Time unit choose between Second(s) up to Day(s). Under Status the ramp is started → Start or stopped → Stop. When the ramp function is being executed, Ramp active appears in the window bor
Pump Menu	End T _{set} T _{fix}	 Without manual switch-off the ramp terminates at the latest at T_{il} (min) or T_{ih} (max).



7.14 Timer function / Timer

Using the timer function, the thermostat can carry out an action at a certain time or after a certain waiting period. Actions are: Switching on the thermostat, entering the standby mode or one of the 5 programs in the programmer.

Command		Clock Timer 1 Timer 2
Pump Settings Graph Clock Programmer Interfaces Control Limits	Set time Set date Timer 1 Timer 2 Format of date	 Open the device parameter menu via the soft key Menu. With the cursor keys continue to: → Clock → Timer 1, or to Timer 2, with the menu Status the selected timer is switched off or on . The standby key does not stop the timer.
Pump Menu E	nd T _{set} T _{fix} se exercise caution when switched off absolutely sa viously activated timer mo	the thermostat is in standby mode. The thermostat afely.
Status Function Action Set Time Set Date	Week plan Time absolute Time relative	 The menu Function is used to define when an action is executed: Similar to an electronic mains timer, Week plan enables two switching events to be carried out each day. The cycle is repeated after 7 days. Time absolute defines a time and a date on which a once-only action (switching event) occurs. The time point is set with Set time and with Set date. Time relative defines a waiting period
Pump Menu E	nd T _{set} T _{fix}	 after which a once-only action occurs. With Set time up to 99h59min can be entered. ("Set date" is masked out with this function selection.) If the Week plan is activated, in this window only Status, Function and Week plan are displayed.



Week plan] –	-	Week plan → Arrange takes you to
	Time	Action	Time	Action			the window shown on the left.
Monday	07:30	Start	17:00			-	Using the cursor keys (1), 🖻 select the
Tuesday	10:00	Prog.4	17:00				field which is to be filled in.
Wednesday	08:00		17:00			-	Open the input dialog of the field with
Thursday	08:00		17:00				: Select a time in the time fields and
Friday	08:00		16:00	Standby			an action in the action field.
Saturday	08:00		17:00		-	-	In the example on the right the thermo- stat is started on Monday at 7:30h Pro-
Sunday	08:00		17:00				gram 4 is executed at 10:00h on Tues-
Pump Me	nu	End	T _{set}	T _{fix}			day and the standby mode is switched in on Friday at 16:00b, Fields displaying
					1		"" are passive.
					C w	Confirm each field selection with or or with without making changes.	
Status		Start] –	- ,	The menu Action is used to define what is to be carried out:
Function Action		Stand Progi	dby ram 1		-	-	Start activates the thermostat from the standby mode.
Set time Set date		Progi Progi Progi Progi	ram 2 ram 3 ram 4 ram 5		_	-	 Standby activates the standby mode (refrigerating unit, heater and pump are switched off). Program X all actions of this program defined in the programmer are processed.
Pump Me	nu	End	Tset	T _{fix}]		

7.15 Control and Control parameters

The control parameters are optimized ex-works for operation as a process thermostat. The parameters are also preset for the operation with external control. Sometimes however, the operation of external containers requires adaptation. Also the thermal capacity and viscosity of the heat transfer liquid sometimes require adaptation.



- The intelligent menu guidance with the Master and Command detects whether you have set the device (as described in Section 7.9.6), to internal or external control and only displays the relevant dialog boxes in each case.

 Some control parameters are automatically optimized by your Integral XT process thermostat. This automatic mechanism should only be deactivated and manually optimized in exceptional cases.

In order to obtain good control characteristics, the hydraulic system should provide the best possible coupling of the object to be temperature stabilized to the thermostatic device. The following should be fulfilled in this respect:





- Low viscosity heat transfer liquids: e.g. thin-bodied oil, water-glycol.
- Short hose connections with a large cross-section.
 The flow resistance is then low and a large amount of thermostatic medium can be pumped in a short time. In addition, the circulation time is short.
- Select a sufficiently high pump level (pump pressure):

LAUDA device	Pump level
XT 150	2-6
XT 750	4 – 8

 Observe the return temperature (an external return temperature sensor can be connected via the analog interface, accessory): During the heating up phase (100 % heating power) the difference temperature Outflow - Return temperature should less than 5 – 7°K.



- If the flow through the hydraulic circuit is too low, then on heating up the warning レリターロー ヨヨコ or on cooling the warning レリターロ ロロフ is triggered.
- An adjustable bypass can be connected to prevent these warnings. The bypass ensures that the flow in the thermostat is maintained such that the controller can operate properly. More measures (⇒ 9.4).

7.15.1 Setting instructions for bypass

When the warnings described in the previous section appear, a bypass can be connected which passes a partial flow from the thermostat output directly to the input. Set the optimum bypass flow as follows:

 Depending on the pump level according to the table, reduce the pressure by opening the bypass. The specified values should also be sufficient if no flow was previously present. If the pressure with the bypass is too low, close the bypass slightly. If warnings occur, the bypass must be opened further again.

Pump level	1	2	3	4	5	6	7	8
Pressure reduction	0.25	0.3	0.35	0.4	0.45	0.5	0.5	0.5

Keep this setting also with a changed pump level or also with pressure control.

7.15.2 Configuration examples

Example 1, favorable configuration:

- LAUDA Integral XT 750 with connected metal double-shell vessel (20 L),
- 2 x 2 m metal corrugated hose, 20 mm clearance (M30 x 1.5),
- no by-pass,
- oil LAUDA Kryo 55, in temperature range -50...220 °C,
- pump on Level 6.

Example 2, unfavorable configuration:

- LAUDA Integral XT 150 with connected glass double-shell vessel (5 L),
- 2 x 4 m metal corrugated hose, 10 mm clearance,
- no by-pass,
- oil LAUDA Kryo 55, in temperature range -50...220 °C,
- pump set to pressure control at 1 bar.

Example 2, improved configuration:

- Metal corrugated hose shortened to 2 x 3m, but 10mm clearance could not be enlarged,
- with by-pass, see above for setting,
- pump increase to pressure control at **1.3 bar**.

Flow was better and therefore no more warning messages. Also the control can be adjusted better, but a larger clearance in the hoses is more effective for optimum operation.



7.15.3 Internal control variable (integral measurement probe)

Only read further here if you have no external temperature probe connected (and activated according to Section 7.9.6 as control variable).

The outflow controller compares the setpoint temperature with the outflow temperature and computes the actuating signal, i.e. the measure used for heating or cooling.

These parameters can be set on the outflow controller:

If "**Tv** manual/auto" is set to "automatic", **Tv** and **Td** cannot be changed. They are in this case derived from **Tn** with fixed factors.

Description	Short form	Unit
Proportional range	Хр	К
Reset time	Tn	S
Derivative time	Tv	S
Damping	Td	S

In addition the following parameters can affect the control:

Temperature limits: Tih, Til (⇒ 7.10.2),	
Actuating signal limit : Heating, cooling (⇒ 7.15.7.1).

Command Control Parameters				
Control Parameters Control para. sets Tv manual/auto Correction limitation Self Adaption	Xp 6,0 Tn 30 Tv (auto) 21 Td (auto) 3,5	 Open the device parameter menu via the soft key Menu . With the cursor keys continue to: → Control → Control Parameters → Control Parameters . The adjacent window appears. Change parameters marked with (auto) where necessary to manual input with Tv manual/auto . 		
Pump Menu	End T _{set} T _{fix}	with \checkmark and confirm with \checkmark .		
		 Then in the following settings window, change the value and confirm with . 		



 The viscosity of the heat transfer liquids changes substantially with the temperature. At low temperatures the liquids are highly viscous. The control quality is therefore generally worse at low temperatures.

- The controller should therefore be set close to the lowest temperature of the temperature range to be covered.
- If the control at low temperatures is stable, then generally it is also stable at high temperatures.
- If, vice versa, a system is just stable at high temperatures, then it is highly probable that it is unstable at low temperatures, i.e. it oscillates.
- If the operating temperature range of a system is for example -20...150 °C, then the controller setting should be carried out at approx. -10...20 °C.

7.15.3.1 Procedure for setting the control parameters for internal control

- 1. Choose a set of control parameters from the table of control parameters (⇒ 7.15.3.2).
- 2. Adjust the setpoint by 5 °C (5 K setpoint step change) and record the outflow temperature for at least 5 minutes.
- 3. If the outflow temperature oscillates (>0.1 K), then enlarge Xp until the oscillation dies away. Always wait a number of minutes between the changes.
- 4. +20 K setpoint step change, await transient response, -20 K setpoint step change, await transient response.
- 5. Assess transient responses:
 - if an overshoot is to be reduced, then slowly increase Tv (until about 90 % of Tn),
 - if settling is too slow, then reduce Tv to about 60 % of Tn,
 - always adjust Td: Td = 20 % of Tv,
 - after each change repeat Point 4. Carry out and evaluate ±20 K setpoint step changes.
- 6. If the response takes too long, then Tn can be reduced. Similarly reduce Tv, Td as a percentage. Reduce Xp to 70...50 % so that the system oscillates. Then continue from Point 2.
- 7. If the tendency to oscillate increases without the overshoot being acceptably reduced, then
 a) Xp can be slightly increased; continue with Point 3,
 b) larger time constants should be chosen: Increase Tn, Tv, Td by 30...80 %,

and Xp to 70...50 % so that the system oscillates. Then continue from Point 2.

7.15.3.2 Table with control parameters and pump level for internal control

Outflow control Device type	Heat transfer liquid in the outflow	External ap- plication	Хр	Tn En	Tv בט	Td 눈d	Pump level
201100 1960							
XT 150, XT 250 W	KRYO 30	a)	30	80	68	15	6
	KRYO 30	b)	40	100	84	18	4
	KRYO 55	c)	30	50	40	8	3
XT 750 H, XT 950 W	KRYO 55	d)	50	50	40	8	8
	KRYO 55	e)	80	100	85	16	5

Description

a)	20 m pipe,	D = 10 mm	(internal),	bypass use	əd.
----	------------	-----------	-------------	------------	-----

b) 20 m pipe, D = 10 mm (internal), bypass used.

c) Glass double-shell reactor with 4 liters, uninsulated, thermostatic oil in the reactor, 2 x 1.5 m metal corrugated hose D = 10 mm (internal).

- **d)** Metal double-shell reactor, 17 liters of thermostatic oil in the reactor, 2 x 1.5 m metal corrugated hose D = 20 mm
- e) Glass double-shell reactor with 4 liters, uninsulated, thermostatic oil in the reactor, 2 x 5 m metal corrugated hose D = 10 mm (internal), bypass used.



7.15.4 External control variable (External measurement probe)

You only need to read further here if you have connected an external temperature probe or the actual temperature is read in from a module (and you have activated it as control variable according to Section 7.9.6).

Only modify the control parameters if you have knowledge of control techniques.

The control system for external actual values is implemented for improvement of the control behavior as a two-stage cascade controller.

From the temperature setpoint and the external temperature, which is generally measured by the external Pt100, a "master controller" determines the "internal setpoint" passed to the slave controller.

The control value of the slave controller controls the heating and cooling. When a setpoint step change is specified, it may be that the optimum control would set an outflow tem-

perature which might significantly exceed the temperature desired on the external vessel.

There is a correction limitation which specifies the maximum permissible deviation between the temperature on the external load and the temperature of the outflow liquid.

These parameters can be set on the master controller (PIDT₁ controller or external controller):

Description	Short form	Unit
Gain	Kpe	-
Proportional range	Prop_E	К
Reset time	Tne	S
Derivative time	Tve	S
Damping time	Tde	S

These parameters can be set on the slave controller (P controller):

If "Tv manual/auto" is set to automatic, Tve, Tde and Prop_E cannot be changed. Tve and Tde are in this case derived from Tne with fixed factors. DescriptionShort formUnitProportional rangeXpfK

In addition the following parameters can affect the control: Temperature limits: T_{il}, T_{ih} (⇒ 7.10.2).

> Actuating signal limit: Heating, cooling (\Rightarrow 7.15.7.1). Correction limitation.

Set the temperature limits (T_{il} / T_{ih}) corresponding to the physical boundary conditions; examples:

Heat transfer liquid	Correction limitation	T _{il}	T _{ih}
Kryo 55	Depends on heat transfer	-50 °C	220 °C
Kryo 30	liquid and on load.	-30 °C	90 °C

 \rightarrow Aids in viewing the temporal progression:

- Graphic mode on the Command remote control,
- LAUDA Wintherm PC Program.



Command	Control Parameters
Control Parameters Control para. sets Tv manual/auto Self Adaption Correction limitation Prop_E	 1,50 200 co) 164 co) 16 10,0 a) 20 A) 20 Control Parameters A) 20 Control Parameters Control Parameters Anticipation Control Parameters Anticipation Control Parameters Anticipation Anticipation Control Parameters Anticipation <li< td=""></li<>
Pump Menu End Tse	T _{fix} – Where applicable change parameters marked with (auto) to manual input with
	 Select the parameters to be changed with 4 and confirm with 4.
	 Then change the value in the following settings window and confirm with . Correction limitation see introduction

7.15.4.1 Procedure for setting the control parameters for external control

First of all select a set of control parameters from the table in Section 7.15.4.2. Wait until the product temperature in the external vessel has approached to within at least ± 3 K and the outflow temperature no longer increases or no longer falls. Oscillation of the outflow temperature does not matter yet.

A) Set slave controller (internal controller):

Tests have shown that a pure P controller is perfectly sufficient as a slave controller.

- 1. Set the master controller to "idle"; to do this set Kpe to 0.1. The master controller now operates only very weakly.
- 2. If the outflow temperature oscillates > ± 0.1 K, then continue with Point 3.
- 2a. Reduce Xpf until the outflow temperature oscillates (> ± 0.1 K).
- 3. Slowly increase Xpf until the oscillation dies away. Increase Xpf further by about 20 % (safety margin).
- 4. If Xpf < 10..... \rightarrow good outflow control circuit/hydraulics.
 - If Xpf 10...15 \rightarrow average outflow control circuit/hydraulics.
 - If Xpf > 15 \rightarrow poor outflow control circuit/hydraulics.

If the outflow control circuit (hydraulics) is of poor quality, then the quality of the external controller is also detrimentally affected.

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B) Setting the master controller (external controller):

Experience has shown that the setting of the master controller demands much more time than the setting of the internal controller for a pure outflow temperature control. Many days may be necessary for a difficult control circuit.

- 1. Alter the setpoint by 5 °C (5 K setpoint step change) and record the outflow temperature and the external temperature for a sufficient length of time (approx. 20-40 min).
- 2. If the external temperature oscillates (> 0.1 K), then reduce Kpe until the oscillation dies away. Always wait a sufficient length of time between the changes (at least 2 oscillation periods).
- 3. +20 K setpoint step change, await transient response; -20 K setpoint step change, await transient response.
- 4. Assess transient responses:
 - if an overshoot is to be reduced, then slowly increase **Tve** (until about 90 % of **Tne**),
 - vice versa, reduce **Tve** to about 60 % of Tne,
 - in doing this, adjust Tde. Tde = 20 % of Tve,
 - continue at 3) after each change: Carry out and evaluate ±20 K setpoint step changes.
- 5. If the response takes too long, then **The** can be reduced. Similarly reduce **Tve**, **Tde** as a percentage. Reduce **Kpe** to 150...200 % so that the system oscillates. Then continue from Point 2.
- 6. If the tendency to oscillate increases without the overshoot being acceptably reduced,
 a) Kpe can be slightly reduced; continue with Point 3,
 b) is a larger time constant need to be chosen: Kpe to 150..200 % so that the system oscillates. Then continue from Point 2.

			Master controller (external controller)					Slave control- ler (internal con- troller)		
Type of device	Heat transfer liquid	Exter- nal applic- ation	Кре ЕР	Tne En	Tve Eบ	Tde Еd	Prop_E Eb	Xpf ₁₽	Pump level	Press. control
XT 150, XT 250 W	KRYO 55	a)	4.0	300	246	24.0	20	5.0	3	
	KRYO 55	b)	1.5	300	246	24.0	20	7.0	1	1bar
	KRYO 55	c)	0.7	100	84	8.0	20	7.0	4	
XT 750 H, XT 950 W	KRYO 55	d)	1.5	200	164	16.0	20	5.0	8	
	KRYO 55	e)	1.5	300	246	24.0	20	15.0	5	
	KRYO 55	f)	0.4	70	61	7.0	20	12.0	6	

7.15.4.2 Well-proven settings for control parameters and pump level for external control

Description

- a) Glass double-shell reactor with 4 liters, uninsulated, thermostatic oil in the reactor, 2 x 1.5 m metal corrugated hose D = 10 mm (internal).
- b) Glass double-shell reactor with 4 liters, uninsulated, thermostatic oil in the reactor, 2 x 6 m metal corrugated hose D = 10 mm (internal), pressure control to P = 1 bar, bypass used.
- c) Load with low volume, low thermal capacity, low flow (cross-sections < 10 mm).
- d) Metal double-shell reactor, 17 liters of thermostatic oil in the reactor, 2 x 1.5 m metal corrugated hose
 D = 20 mm
- e) Glass double-shell reactor with 4 liters, uninsulated, thermostatic oil in the reactor, 2 x 5 m metal corrugated hose D = 10 mm (internal), bypass used.
- f) Load with low volume, low thermal capacity, low flow (cross-sections < 10 mm), bypass used.

7.15.5 Internal and external control parameter sets

If a thermostat is used for a number of applications, which always leads to a change of the control parameters, these control parameters (up to 9 sets) can be saved in the thermostat and activated again as required.

Also saving is useful for finding the best control parameters; in this way external management of the control parameters can be avoided.

There are 9 sets (each for internal and external sets of control parameters) saved at the factory. In this menu the control parameters cannot be edited, they are only displayed.

- With Activate the currently valid control parameters are used.
- With Upload actual the actual ones are read in and saved (for later reuse).
- With **Default** the set of control parameters saved at the works is loaded again (in this case the control parameters set by the customer are lost).

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Command		Control parameter sets			
Control Parameters Control para. sets Tv manual/auto Self Adaption Correction limitation	Set 1 Set 2 Set 3 Set 4 Set 5 Set 6 Set 7 Set 8 Set 9	 Open the device parameter menu via the soft key With the cursor keys continue to: With the cursor keys continue to: Control → Control Parameters → Control para. sets. The adjacent window appears. Set 1 to Set 9. Select the desired set with ↓ and cor firm with ↓. 			
Pump Menu Er	nd T _{set} T _{fix}	 Select the desired set to be changed 			
Status intern extern	Activate Upload actual Default	 In the setting window (see left) the selected set is listed under internal or external in the display. Under Status the previously selected set: is activated, is read in and the set, which was saved at the factory, is restored. 			
Pump Menu Er	nd T _{set} T _{fix}				

Editing the control parameter sets

The change in the control parameters is explained in Section 7.15.3 / 7.15.4 (internal / external). Once the value has been changed and confirmed, the set number, e.g. Set 3 and Upload actual, the new value is accepted into the control parameter set to be changed (Set 3) via the command Control parameter sets.



7.15.6 Self Adaption

The function Self Adaption can be used to detect automatically the optimal control parameters for internal or external control.

The Self Adaption can only be performed on a device with active cooling.

Limitation on high-temperature thermostats with water counter-cooling: Self adaption can only be carried out on a high-temperature thermostat with a cooling water connection (type W) (not on XT 4 H or XT 8 H high-temperature thermostats).

This function is available from software version 2.18 of Command. For thermostats with an older software version a software update is necessary.

The Self Adaption determines the parameters by a test run of the thermostat. In this case the thermostat and, if applicable, the external application must be ready for operation. (\Rightarrow 6).

The Self Adaption will be performed with the actually set pump step. Best results can be achieved with high pump steps.

The test run must be performed at a passive system; this means that during the test run an exo- or endotherrmic reaction mustn't take place.

The test run takes depending on the external application about 30 minutes to 3 hours. The bath temperature will oscillate in this time less than about ± 15 Kelvin around the set temperature. After the test run the detected control parameters will be taken over as control parameters automatically.

Command	Self Adaption		
Control Parameters Control para. sets Tv manual/auto Self Adaption Correction limitation	 Open the device parameter menu via the soft key Menu. With the cursor keys continue to: → Control → Control Parameters → Self Adaption → Settings. Confirm selection with . 		
Pump Menu End T _{set} T _{fix}			
Status Setpoint Identification Actual Parameters	 The window shown adjacent appears. With the menu Status the test run of the Self Adaption can be started. When the Self Adaption is finished, the test run will be terminated automatically. As soon as start ¹ is pressed, in the sofkey area the information Adaption on will be displayed followed by the actual status of the test run. 		
Pump Menu End T _{set} T _{fix}			



Status Setpoint Identification Actual Parameters	 With the menu Setpoint the set temperature for the test run can be set. The bath temperature will oscillate less than about ±15 Kelvin around the set temperature. Change the display in the adjacent window and accept with .
Pump Menu End T _{set} T _{fix}	
Status intern Setpoint intern + extern Identification Actual Parameters Actual Parameters Intern + extern Pump Menu End Tset Tfix	 With the menu Identification the optimal control parameters for internal control or for the internal control and the external control can be detected automatically. To detect the control parameters for the external application, a temperature probe must be connected to the thermostat.
Status Setpoint Identification Actual Parameters	 With the menu Actual Parameters the actual set control parameters can be stored in parameter set 9. After the test run the detected control parameters will be taken over as control parameters automatically. If the parameters found do not fulfil your expectations, the before set parameters can be restored (⇒ 7.15.5).
Pump Menu End T _{set} T _{fix}	

7.15.7 Limiting the heating and cooling power

7.15.7.1 Actuating signal limit

With the actuating signal limit the maximum heating and / or cooling power can be limited. The setting occurs in percent of the maximum value.

Command	d				Controller output limit
Contro	ller outp.	limit m	ax. Cool ax. Heat		 Open the device parameter menu with the softkey Menu. With the cursor keys continue to: change → Control → Control → Controller outp. limit. The adjacent window appears. Select max. Cool or max. Heat with the cursor key and confirm with .
Controller outp. limit 100,0 Min: 0,0 Max: 100,0					 Enter the desired percentage. Accept the change with <i>t</i>, or quit the window with without making any changes.
1 6	2 7	3 8	4	5 0	
R	In addition faces \rightarrow	, the cooli Smart Co	ng unit car ol .	n be comp	pletely switched off via the operating menu \rightarrow Inter-

7.15.7.2 Dynamic limitation of heating power

With the dynamic heating power limitation the heating power can be limited to protect the heat transfer liquid from overheating on the heater. See also (\Rightarrow 7.15.7.3).

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Comman	d				dynamic heat limit
dynam	ic heat lir	mit Sta En Se	art d t value	250°C 300°C 50	 Open the device parameter menu with the softkey With the cursor keys continue to: Change → Control → dynamic heat limit. The window shown adjacent appears. Select with the cursor key Start, End or Set value and confirm with
Pump Menu End Tset Tfix Start 250,0 Min: 0°C Max: 299°C				T _{fix}	 Enter the required limit temperature. Accept the change with , or quit the window with , without making any changes.
1	2	3	4	5	
6	7	8	9	0	
Actuating signal in % 100 -					Example: Start = 250 °C End = 300 °C Actuating signal maximum actuating = 50 %

7.15.7.3 Dynamic control of heating power

200

250

300

0

With insufficient flow rates at the heaters there is a risk that the heat transfer liquid is locally overheated. This may lead to earlier aging, oil cracking at silicone oils (depolymerisation) or bubbling up. At small pump levels the heating power is regulated automatically by the dynamic heating power control. Generally up from pump level 5 the maximum heater capacity is available at all devices. This function can not be adjusted or disabled.

T in °C
7.16 Alarms, Warnings and Errors

The SelfCheck Assistant of your Integral XT Thermostat monitors more than 50 device parameters and triggers alarms, warnings or errors as appropriate.

All warnings, alarms and errors are shown on the Command remote control in plain text. Errors are shown in plain text on the Command remote control in an error list.

Alarms: Alarms are safety relevant. Pump, heater and refrigerating unit will be shut off.

Warnings: Warnings normally are not safety relevant. The device continues to operate.

Error: If a fault occurs, the pump, heater and cooling unit switch off automatically. Switch off the device at the mains switch. If the fault recurs after switching on the device, please contact the LAUDA Service (⇒ 9.5).

Find cause of alarm or warning and rectify where necessary. Then press \forall on the Master keyboard in order to remove the alarm message. Warning messages can be removed either on the Master keyboard

with ${f U}$ or on the Command board with ${f U}$

Warnings may be ignored by pressing \bigcirc or \bigcirc on the Master keyboard or by activating the Screen Softkey on the Command remote control. Otherwise warnings will be repeated periodically.

7.16.1 Overtemperature protection and checking

The units are DIN EN 6101	designed for operation with non-flammable and flammable liquids to 0-2-010.
Tmax	Setting the overtemperature cut-off: Recommended setting: 5°C above desired bath temperature.
	Caution!! The overheat switch-off point T_{max} is controlled by a system functioning independently of the bath control. Setting of the nominal temperature, however, can be limited via the functions T_{ih} and $T_{il} \iff 7.10.2$) independently of T_{max} .
	 The cut-off point is displayed in the LED display on pressing the key
	Changing the overtemperature cut-off point:
	- For safety, to guard against unintentional adjustment, the key must be held pressed during all the following entries. Now, briefly press $(-)$. The display flashes and the overtemperature cut-off can be set with the keys $(-)$ or $(-)$.
	 Quit the change mode by pressing for a few seconds or automatically after 5 seconds, while you keep pressed.
	 This somewhat complicated procedure is intended to prevent unin- tentional adjustment.



- Set the fer liqu (⇒ 6.2	 Set the overtemperature switch-off point T_{max} <u>below</u> the flash point of the heat trans- fer liquid (⇒ 6.2). 			
– The se ture ra	The setting range is restricted to 5 °C above the upper limit of the working temperature range (Tih \Rightarrow 7.10.2).			
\frown	 If the outflow temperature rises above the overtemperature cut-off: 			
	1. Alarm sounds as dual-tone signal.			
Overtemp. alarm	2. EERRP for overtemperature appears in the display.			
	 3. The red LED			
	 Rectify cause of fault (⇒ 9.4). 			
	 Unlock with the key. 			
	 Unlocking is not possible on the Command remote control! 			
Before long	er periods of unsupervised operation, the overtemperature protection checked. To do this:			
	 − slowly lower T_{max}, as described above. → Cut-off at the outflow temperature should occur. 			
	 Step 1 – 2 (see above) must follow. 			
	 Set the overtemperature cut-off higher than the outflow temperature again and wait until LETTP appears in the display. 			
(+)	 Unlock with the key. 			
	Unlocking is not possible on the Command remote control!			
Command	Overtemperature alarm!			
	Overtemperature alarm! is shown in the display and signifies that <u>unlocking</u> is only possible on the Master control panel.			

7.16.2 Low-level alarm and low-level checking

Various levels (⇒ 7.5).

Low level warning: With the Integral XT the warning is activated at Liquid Level 1, then the operator should top up (also possible in running operation) and check why less medium is present (cooling, degassing or leakage?) (\Rightarrow 9.4).	
If the liquid level in the expansion vessel continues to fall (Level 0), an alarm is triggered.	
1. The alarm sounds as a dual-tone signal.	



Level alarm		 Display for LEUEL (low level) is shown when the expansion vessel contains too little liquid. The red LED			
- C le - S	 Checking the safety system at regular intervals by lowering the expansion vessel level. For that purpose do <u>not</u> use the draining program. Step 1 – 2 (see above) must follow. 				
- V o - If n - F	 With this test the outflow temperature must not be below 0 °C or above max. 50 °C, otherwise there is a risk of burning! Besides which, the device can be damaged. If irregularities arise during the checking of the safety devices, switch off the unit immediately and pull out the mains plug. Have the equipment checked by LAUDA Service. 				
Command		Low-level alarm!			
	– Low-le	vel alarm! is shown in the display and signifies that <u>unlocking is on-</u> ble on the Master control panel.			

7.16.3 High-level settings

Different reactions can be chosen when the level sensor detects the height of the bath liquid level. Depending on the setup, heat transfer liquid or operation conditions, one of the following settings may be suitable:

Setting	Command settings	Reaction and application recommendation
No warning	none	Select only when no safety sensitive application.
Warning	Warning	Acoustic and optical warning as long as the level goes down. This is the factory setting.
Warning and heater off	Warning + heater off	Warning and additional heater off as long as the level goes down.
Alarm	Alarm	Alarm switches off the pump and the heater until the alarm is re- moved by pressing on the Master keyboard.

Command		Over level handling
Over level handling Marnin War. + Alarm	g Heater off	 Open the device parameter menu via the soft key Menu. With the cursor keys continue to: → Settings → Over level handling. The shown window appears. Select the preferred parameter with ↓ or 1 and confirm with ↓. Explanation of parameters see introduction.
Pump Menu End T	set T _{fix}	

7.16.4 High-level warning or alarm

A) 3 Sec.	 Acoustic warning signal sounds for 3 seconds when the liquid level rises so far that the uppermost switching point of the level sensor has been reached,
\cap	or in case the warning function as described in 7.16.3 was chosen:
61	 The acoustic signal with dual-tone sounds.
Level warning	- Warning LUAFT 103 (high level) appears when the expansion vessel contains too much liquid.
	– The ムロガーロ flashes by turns with the numeral.
\bigcirc	In case the alarm function as described in 7.16.3 was chosen:
	 The acoustic signal with dual-tone sounds.
Level alarm	 The red LED
	 Rectify cause of fault (⇒ 9.4).
(+)	 If Alarm: Press Enter key. Warnings disappear automatically when the cause is gone.
Ŭ	 Also press this key if the unit has been switched off in the fault state. Warnings disappear automatically when the cause is gone.
Command	High-level warning/alarm
	The display shows Warning. To release press Enter key Security 3 Level too high or Alarm AL 6: Level too high is shown in the display and signifies that unlocking is only possible on the Master control panel

7.16.5 Pump-motor supervision: Overload or blockage

•	-
\frown	The SelfCheck Assistant monitors the Vario Pump:
	 Alarm sounds as dual-tone signal for pump-motor overload or blockage.
Pump alarm	2. Display of
	 3. The red LED
	- Rectify cause of fault (\Rightarrow 9.4).
	 Press the enter key.
	 Also press this key if the unit has been switched off in the fault state.
Command	Pump-motor alarm!
	Pump-motor alarm! is shown in the display and signifies that <u>unlocking is</u> only possible on the Master control panel.

7.16.6 Pump-motor supervision: Dry running

\frown	The SelfCheck Assistant monitors the Vario Pump:		
	 Alarm sounds as dual-tone signal when the pump runs without liquid. 		
Pump alarm	2. The display of PuLEU signals that the SelfCheck Assistant has detected a pump low level.		
	 3. The red LED		
The cause of the failure of the level measurement with the floatation sensor must be found and rectified (\Rightarrow 9.4).			
	 Press the Enter key. 		
	 Also press this key if the unit has been switched off in the fault state. 		
Command	Alarm! Low level (pump)		
	n! Low level (pump) is shown in the display and signifies that ing is only possible on the Master control panel.		

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8 Interface modules

8.1 Installing of modules

The Master <u>and</u> Command can be supplemented with further interface modules. They will be simply inserted in 2 module cavities, at the front of the floor-standing device or at the right side of the bench-top device.



Bench-top device



Floor-standing device



on the Integral XT to discharge any electrostatic charge.Switch off the Integral XT thermostat and

Touch the bare part of the interface panel

Remove the module from its packaging.

pull out the mains plug.

 Insert a screwdriver into the lower recess of the module cavity and prise up the plastic cover. The cover can then be pulled off downwards.

Pull out the plug of the bus connecting cable from the plastic cover.





- Plug on the bus connecting cable (red plug onto red socket).
- Insert the module and secure with the two cross-head screws.
- Connect the mains plug again and switch on the Integral XT.
- P
 - The plugs are protected against reverse polarity. The plugs have a ridge which slides into a groove in the socket.



8.2 Menu structure for all modules

All existing menu points are illustrated. However, the Command remote control masks out menu points which cannot be executed. Further information can be found in the following sections.



8.3 Serial interfaces RS 232/485 (only Command remote control or Module)

RS 232/485 interface Module (order no. LRZ 913) with 9-pole SUB-D socket. Electrically isolated by optocoupler. With the LAUDA instruction set essentially compatible to the ECO, Ecoline, Proline, PRO, Integral XT and Integral T Series. The RS 232 interface can be connected directly to the PC with a 1:1 through-contact cable (order no. EKS 037).

Computer					Thermost	at	
Signal	9-pin sub-D-socket		25-pin sub-D-socket		9-pin sub-D-socket		Signal
	1	2	1	2	1	2	
R x D	2	2	3	3	2	2	ТхD
T x D	3	3	2	2	3	3	R x D
DTR	4		20		4		DSR
Signal Ground	5	5	7	7	5	5	Signal Ground
DSR	6		6		6		DTR
RTS	7		4		7		стѕ
CTS	8		5		8		RTS

8.3.1 Connecting cables and interface test RS 232

① with hardware handshake: For connecting a thermostat to the PC use 1:1 cable and not a null-modem cable!

② without hardware handshake: the computer / PC must be set to the operating mode "without hard ware handshake".



- Use screened connecting cable.

- Connect screen to connector case.
- The connections are isolated from the remainder of the electronics.
- Any pins not in use must not be connected!!

When a PC is connected up the RS 232 interface can easily be **tested** using the Microsoft Windows operating system. On Windows[®] 95/ 98/ NT/ XP with the "Hyper Terminal" program.

"HyperTerminal" is no longer included in the operating systems Windows Vista, Windows 7, and Windows 8.

- It is possible to communicate with the RS 232-interface using the LAUDA control and application software, Wintherm Plus (catalog number LDSM2002).
- Terminal programs are available on the Internet as freeware. These programs offer features similar to "HyperTerminal" (for example PuTTY). Search query "serial port terminal program".



8.3.2 Protocol RS 232



- The interface operates with 1 stop bit, no parity bit and 8 data bits.

- Transfer rate either 2400, 4800, 9600 (factory setting) or 19200 baud as selected.
- The RS 232 interface can be operated with or without hardware handshake, (RTS/CTS).
- The command from the computer must be terminated with CR, CRLF, or LFCR.
- The response of the thermostat is always terminated with CRLF.
- After each command sent to the thermostat, it is necessary to wait for the reply before sending another command. This ensures that the sequencing of inquiries and answers is clear.

CR = Carriage Return (Hex: 0D) LF = Line Feed (Hex: 0A)

Example: Transfer of setpoint 30.5 °C to the thermostat

Computer	Thermostat
"OUT_SP_00_30.5"CRLF	⇔
4	"OK"CRLF

8.3.3 Connecting cable RS 485

Thermostat		
9-pin sub-D-socket		
Contact	Data	
1	Data A (-)	
5	SG (Signal Ground) optional	
6	Data B (+)	

- Use screened connecting cables.



- Connect screen to connector case.

- The connections are isolated from the remainder of the electronics.
- Any pins not in use must not be connected!!



An **RS 485** bus always requires bus termination in the form of a termination network which ensures a defined rest status in the high-resistance phases of bus operation. The bus termination is as follows:

This termination network is usually incorporated on the PC plug-in card (RS 485).

8.3.4 Protocol RS 485

- The interface operates with 1 stop bit, no parity bit and 8 data bits.
- Transfer rate either 2400, 4800, 9600 (Factory setting) or 19200 baud as selected.
- The RS 485 commands are always preceded by the device address. There is provision for 127 addresses. The address must always have 3 digits (A000_...to A127_...).
- The command from the computer must be terminated with CR.
- The response of the thermostat is always terminated with CR.

CR = Carriage Return (Hex: 0D)

Example: Transfer of setpoint 30.5 °C to the thermostat with address 15.

Computer	Thermostat
"A015_OUT_SP_00_30.5"CR	
\Leftrightarrow	"A015_OK"CR

8.3.5 Write commands (Data commands to the thermostat)

Command	Explanation	
OUT_PV_05_XXX.XX	External temperature to be set through the interface.	
OUT_SP_00_XXX.XX	Setpoint transfer with up to 3 places before the decimal point and up to 2 places	
	behind.	
OUT_SP_01_XXX	Pump power level 1 to 8.	
OUT_SP_02_XXX	Cooling operating mode cooling (0 = OFF / 1 = ON / 2 = AUTOMATIC).	
OUT_SP_04_XXX.X	TiH outflow temperature high limit.	
OUT_SP_05_XXX.X	TiL outflow temperature low limit.	
OUT_SP_06_X.XX	Set pressure (with pressure control)	
OUT_PAR_00_XXX	Setting of the control parameter Xp.	
OUT_PAR_01_XXX	Setting of the control parameter Tn (5180s; 181 = Off).	
OUT_PAR_02_XXX	Setting of the control parameter Tv.	
OUT_PAR_03_XX.X	Setting of the control parameter Td.	
OUT_PAR_04_XX.XX	Setting of the control parameter KpE.	
OUT_PAR_05_XXX	Setting of the control parameter TnE (0979s; 980 = Off).	
OUT_PAR_06_XXX	Setting of the control parameter TvE (0 = OFF).	
OUT_PAR_07_XXXX.X	Setting of the control parameter TdE.	
OUT_PAR_09_XXX.X	Setting of the correction limitation	
OUT_PAR_10_XX.X	Setting of the control parameter XpF.	
OUT_PAR_14_XXX.X	Setting of the setpoint offset.	
OUT_PAR_15_XXX	Setting of the control parameter PropE	
OUT_MODE_00_X	Master keyboard: 0 = free / 1 = locked (corresponds to "KEY").	
OUT_MODE_01_X	Control: 0 = internal / 1 = external Pt100 / 2 = external analogue / 3 = external serial.	
OUT_MODE_03_X	Command remote control keyboard: 0 = free / 1 = locked	
OUT_MODE_04_X	Setpoint offset source: 0=normal / 1=ext. Pt / 2=ext. analog / 3=ext. serial.	
OUT_MODE_05_X	Setting the through-flow control: 1 = ON / 0 = OFF	
OUT_MODE_06_01	Activation of Safe Mode	
START	Switches the device on (after Standby). See safety information (⇒ 7.9.3).	
STOP	Switches the device into Standby (pump, heater, cooling unit OFF).	
RMP_SELECT_X	Selection of program (15) to which the further instructions apply. When the device	
	is switched on, program 5 is selected automatically.	
RMP_START	Start the programmer.	
RMP_PAUSE	Hold (pause) the programmer.	
RMP_CONT	Restart the programmer after pause.	
RMP_STOP	Terminate the program.	
RMP_RESET	Delete the program (all Segments).	
RMP_OUT_00_XXX.XX_XXXXX_XXX.	Sets a programmer segment (temperature, time, tolerance and pump level). A seg-	
XX_X	ment is added and appropriate values are applied to it.	
RMP_OUT_02_XXX	Number of program loops: 0 = endless / 1250.	



For "_" use also " " (blank character).

 Response from thermostat "OK" or in case of error " ERR_X" (RS 485 interface e.g. "A015_OK" or in case of error "A015_ERR_X".).



Permitted data formats:

-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	Х.	Х
XX	X	.XX	.X				

8.3.6 Read commands (Data requested from the thermostat)

Command	Explanation	
IN_PV_00	Query of outflow temperature.	
IN_PV_01	Query of controlled temperature (int./ext. Pt/ext. Analogue/ext. Serial).	
IN_PV_02	Query of outflow pump pressure in bar.	
IN PV 03	Query of external temperature TE (Pt100).	
IN PV 04	Query of external temperature TE (Analogue input).	
IN_PV_05	Query of bath level.	
IN_PV_10	Query of outflow temperature in 0.001 °C.	
IN_PV_13	Query of external temperature TE (Pt100) in 0.001 °C.	
IN_SP_00	Query of temperature setpoint.	
IN_SP_01	Query of current pump power level	
IN_SP_02	Query of cooling operation mode ($0 = OFF / 1 = ON / 2 = AUTOMATIC$).	
IN_SP_03	Query of current overtemperature switch-off point.	
IN_SP_04	Query of current outflow temperature limit TiH.	
IN_SP_05	Query of current outflow temperature limit TiL.	
IN_SP_06	Query of set pressure (at pressure control)	
IN_PAR_00	Query of control parameter Xp.	
IN_PAR_01	Query of control parameter Th (181 = OFF).	
IN_PAR_02	Query of control parameter Tv.	
IN_PAR_03	Query of control parameter 1 d.	
IN_PAR_04	Query of control parameter KpE.	
	Query of control parameter THE (980 = OFF).	
	Query of control parameter TVE (0 = OFF)	
IN_PAR_IU	Query of the control parameter Apr.	
	Query of setpoint offset.	
IN_DI_01	Status of contact input 1: 0 = open/ 1 = closed.	
IN_DI_02	Status of contact input 2: 0 = open/ 1 = closed.	
IN_DI_03	Status of contact input 3: 0 = open/ 1 = closed.	
IN_DO_01	State of Contact output 1:	
	0 = make-contact open / 1 = make-contact closed.	
IN_DO_02	State of Contact output 2:	
	0 = make-contact open / 1 = make-contact closed.	
IN_DO_03	State of Contact output 3:	
	0 = make-contact open / 1 = make-contact closed.	
	Master keyheard: 0 - free / 1 - leeked	
	$\frac{1}{1}$	
	Control. $0 = \text{Init} / 1 = \text{ext} + \text{Init} 0 = 2 \text{ext} + 1 $	

L	

Command	Explanation	
IN_MODE_03	Command remote control keyboard: 0 = free / 1 = locked	
IN_MODE_04	Setpoint offset source: 0=normal / 1=ext. Pt / 2=ext. analogue / 3=ext. serial.	
IN_MODE_05	Status of through-flow control: 1 = ON / 0 = OFF	
IN_MODE_06	Status of Safe Mode: 0 = inactive / 1 = active	
TYPE	Query of device type (response = "XT")	
VERSION_R	Query of software version number of control system.	
VERSION_S	Query of software version number of protection system.	
VERSION_B	Query of software version number of Command.	
VERSION_T	Query of software version number of cooling system.	
VERSION_A	Query of software version number of analogue module.	
VERSION_V	Query of software version number of RS 232/485 module.	
VERSION_Y	Query of software version number of Ethernet module	
VERSION_Z	Query of software version number of EtherCAT module	
VERSION_D	Query of software version number of digital (contact I/ 0) module.	
VERSION_M_0	Query of software version number of solenoid valve (cooling water)	
VERSION_M_3	Query of software version number of solenoid valve (reverse flow protection device 1)	
VERSION_M_4	Query of software version number of solenoid valve (reverse flow protection device 2)	
VERSION_P_0	Query of software version number of pump module 0	
VERSION_P_1	Query of software version number of pump module 1	
VERSION_P_2	Query of software version number of pump module 2	
VERSION_P_3	Query of software version number of pump module 3	
STATUS	Query of the equipment status 0 = OK, -1 = error.	
STAT	Query for the error diagnosis response:	
	$XXXXXXX \rightarrow X = 0$ no error, $X = 1$ error.	
	1st character = error.	
	2nd character = Alarm.	
	3rd character = Warning.	
	4th character = over temperature.	
	5th character = low level error.	
	6th character = high level error (at adjustment alarm).	
	7th character = no external control variable.	
	Quary of a program apgment XXX	
	(1000) ($1000)$ (1000) (
	$(1 \text{ esponse. e. g. 0.50.00}_{10.00} = 3 \text{ set point temperature 50.00} C, time = 10 min, toter-$	
RMP IN 01	Query of the current segment number	
	Query of the current segment humber.	
	Query of the program to which further instructions apply.	
RMP_IN_05	Query of which program is currently running (0 = none).	
LOG IN 00 XXXX	Query of a measuring point XXXX from data logger	
	(Reply: e. g. 020.00 021.23 030.50 => set point temperature = 20.00 °C, outflow tem-	
	perature = 21.23 °C, external temperature = 30.5 °C).	
LOG IN 01 Query of all measuring points from data longer		
	As a difference to the command "LOG IN 00", a tabulator is used here as separator	
	instead of . '. The measuring points are separated by CR and LF. The end is marked by	
	CR LF CR LF.	
LOG_IN_02	Query of the start time from the data logger	
	(Reply: e.g. 20_14_12_20 => day 20, 14:12:20).	
LOG_IN_03	Query of acquisition interval from the data logger	
	(Reply in seconds).	

R

For "_" use also " " (blank character).

 The equipment response is always in the fixed decimal format "XXX.XX" or for negative values "-XXX.XX" or "ERR_X". (RS 485 interface e.g. "A015_ XXX.XX" or "A015_-XXX.XX" or "A015_ERR_X").

8.3.7 Error messages

Message	Explanation
ERR_2	Wrong input (e.g. buffer overflow).
ERR_3	Wrong command.
ERR_5	Syntax error in value.
ERR_6	Illegal value.
ERR_8	Module (ext. temperature) not available.
ERR_30	Programmer, all segments occupied.
ERR_31	Set point not possible, analogue set point input ON.
ERR_32	TiH <= TiL.
ERR_33	No external sensor.
ERR_34	Analogue value not available.
ERR_35	Automatic is selected.
ERR_36	No set point input possible. Programmer is running or is paused.
ERR_37	No start from programmer possible, analogue setpoint input is switched on.

8.3.8 Driver-software for LABVIEW®

An individual, easy-to-use control and automation software for operating the Integral XT device and PROLINE device can be programmed with the aid of the National Instruments program development tool LABVIEW[®] (http://sine.ni.com/apps/we/nioc.vp?cid=1381&lang=US).

In order to make program operation possible on the RS 232/RS 485 interface, LAUDA provides drivers specially designed for LABVIEW[®] which can be downloaded free of charge under <u>www.lauda.de/spec-e.htm</u>.

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8.4 Analogue module

The analogue module (order no. LRZ 912) has 2 inputs and 2 outputs which are brought out on a 6-pole DIN socket to Namur Recommendation (NE28). The inputs and outputs can be set independently as 0 - 20 mA, 4 - 20 mA or 0 - 10 V interface. Various functions can be selected for the inputs and outputs. Accordingly, the signal on the input is interpreted differently and different information is output via the output connection.

In addition the interfaces can be scaled freely according to the set function. For measuring transducer is 20 V DC available.

The following values can be specified via the input:

- Setpoint temperature with function: 77 25 or Set temperature.
- Return flow temperature T_{ret}
- External actual temperature with function: "" E or ext. actual temperature .
- Pump power with function: PP or Pump power.

The following values can be specified via the outputs:

- Setpoint temperature with function: Master: 77 25 or Command: Set temperature.
- The temperature source with which active control occurs: Ph E Controlled temp.
- Outflow temperature: "" E I or Outflow temp. .
- External actual temperature from Pt100: PDEP or Temp. external Pt100.
- External actual temperature from analogue input: THER or Temp. external analogue.
- External actual temperature from the serial interface: PRE5 or Temp.external serial.
- Actuating signal: " 4 or Actuating signal.
- Pump power: P7 PP or Pump power.
- Pump speed: Phen or Pump speed.

- Pump pressure .

In addition the interfaces can be scaled freely with L DD/H IDDD in % or minimal value / maximal value according to the set function.

For example: 4 mA corresponds to 0 °C and 20 mA corresponds to 100 °C.

- Accuracy of the inputs and outputs after calibration better than 0.1 % F.S.



- Inputs, current
 Input resistance < 100 Ohm
 Inputs, voltage
 Input resistance > 50 kOhm
 - Outputs, current Burden < 400 Ohm
 - Outputs, current Burden < 400 Ohm
- Outputs, voltage
 Load > 10 kOhm



Connection of the analogue inputs and outputs

A 6-pole round connector with screw locking and contact arrangement according to DIN EN 60130-9 or IEC 130-9 is needed. A suitable coupling plug can be obtained under order no. EQS 057.

View of the socket (front) or solder side of plug:



socket 71S till end 2006

- Pin 1 Output 1
- Pin 2 Output 2
- Pin 3 0V reference potential
- Pin 4 Input 1
- Pin 5 0V reference potential
- Pin 6 Input 2

socket 74S since May 2010Pin 1Output 1Pin 2Output 2Pin 3OV reference potentialPin 4Input 1Pin 5+20 V (max. 0,1 A)Pin 6Input 2socket 74S from 2007 on till April 2010Pin 1Output 1

 Pin 2
 Output 2

 Pin 3
 0V reference potential

 Pin 4
 Input 1

 Pin 5
 +24 V (max. 0,1 A)

 Pin 6
 Input 2

P

Use shielded lines. Connect shielding with connector housing!

Show Inflow temperature T_{ret} in process overview window

If the return temperature is measured using an LRZ 912 analog module it can be displayed in the Command remote control unit in the process overview window.

Command	Inflow temperature
Status Setpoint temperature Function ext.actual temperature Interface type Pump power minimum value Inflow temperature Calibration Inflow temperature	 Show Inflow temperature T_{ret} in display: Open the device parameter menu via the soft key <u>Menu</u>. With the cursor keys continue to: → Interfaces → Analogue interfaces → Analogue Input 1 / 2 → Function → Inflow temperature . Confirm selection with ,
Pump Menu End T _{set} T _{fix}	 or quit the window with ∨ without making changes.





8.5 Contact module

8.5.1 Contact module LRZ 915 with three inputs and three outputs

Contact module (order no. LRZ 915) on 15 pole SUB-D socket. With three relay contact outputs (changeover, max. 30 V/0.2 A) and three binary inputs for control via external voltage-free contacts.

The following functions are made available by the inputs:

- Set fault with function: Master: F RLR or Command: Fault.
- Set Standby with function: F 54b or Standby. See safety information (\Rightarrow 7.9.3).
- Control programmer (Input 1 activates programmer 1, input 2 activates programmer 2 etc. At the first "close" the programmer gets starting, "open" removes it in "pause". The next "close" initiate "continue") with function: *F PrG* or **Programmer**.
- Control alternating mode (the switching state contact "open" or "closed" allot to two different set point temperatures) : *F L2L* or alternating mode.
- Controller mode the switching state input "open" or "closed" can allotted to two different control temperature sources. E. g. internal ↔ external control): F [an or type of control.

The following functions are made available by the outputs:

- Signal various fault states: F d R or fault diagnosis.
- Signaling standby: F 5Eb or Standby.
- Providing status of the window discriminators (inside ↔ outside): F Lu , or temperature range.
- Providing the programmer status: F Pr 6 or Programmer.
- Signalling refill of heat transfer liquid: F F L or Refill.





Contact inputs and outputs



- View of the socket from the plug side or of the plug on the solder side.
- A suitable 15-pole Sub-D plug can be obtained together with a suitable housing:
 - Order no. EQM 030 and plug housing order no. EQG 017.

8.5.2 Namur-Contact module LRZ 914 with only one input and one output

Contact module (order no. LRZ 914) with connector to NAMUR NE28. Functionality as LRZ 915, but only one output and one input on each of two DIN sockets.



Contact inputs and outputs:

Output	Input
 View on flange plug (Front) or solder side coupler socket. 	 View on flange plug (Front) or solder side coupler socket.
– Max. 30 V; 0.2 A.	 Signal ca. 5 V, 10 mA. Do not use pin 3!
Coupler socket order no. EQD 047.	Coupling plug order no. EQS 048.
1 = n.o. (make) 2 = common 3 = n.c. (break)	



Use shielded lines. Connect shielding with connector housing. Cover unused plug connections with protecting caps!

9 Maintenance

9.1 Cleaning

9.1.1 Cleaning the surface of the device



Withdraw the equipment mains plug before cleaning.

Cleaning can be carried out with water to which a few drops of surfactant (washing-up liquid) have been added and using a damp cloth.



No water must enter the control section.

Carry out appropriate decontamination if hazardous material is spilt on or in the equipment.

The cleaning or decontamination method is determined by the user's specialist knowledge respectively the corresponding data sheets. In case of doubt contact the manufacturer of the hazardous material.

9.1.2 Cleaning the hydraulic circuit

Refer to cleaning procedure (\Rightarrow 7.8).

9.1.3 Draining the water-cooled condenser



Important: With the risk of frost (e.g. transport in winter) drain the condenser on water-cooled devices.

XT 250 W:

To do this, heat up the outflow to about 20 °C. Remove the water hose on the water tap. Set the setpoint to, for example, 10 °C and immediately after the compressor start-up, blow into the water return hose with compressed air. Continue until all water has flowed out of the device. Switch the device off immediately.

From XT 350 W:

To do this, select the condenser draining mode (\Rightarrow 7.7). Remove the water hose on the water tap. Blow into the water return hose with compressed air. Continue until all water has flowed out of the device. Switch the device off immediately.

9.2 Device status

The process thermostat Integral XT can be conveniently checked with the Command remote control.

9.2.1 Interrogating the device type



With low temperature thermostats the device type is detected automatically and cannot be changed.



9.2.2 Software version

Here, only the version of the control system in the Master is displayed.

Menu \rightarrow Settings \rightarrow Device status \rightarrow Software version .

With the Command remote control the versions of the control system (Control), safety system (Safety), Command remote control (Command), cooling system (Cool), the pump (Pump 0) and, where applicable, other connected modules are displayed.

9.2.3 Serial numbers

Menu \rightarrow Settings \rightarrow Device status \rightarrow Serial numbers.

With the Command remote control the serial number of the Master (Master), Command remote control (Command), cooling system (Cool), pump (Pump 0) and other connected modules are displayed.

9.2.4 Device data

This display is used for diagnosis during servicing. No settings are possible here.

Command	Device data
T ext Pt 25,70 Tout 25,55 T ext analog, Mains U(%)100,74	Menu → Settings → Device status → Device data → Display .
T ext serial,Mains E(76) 100,11T ext serial,Mains Frequ.50T cont. head39,80 Level8T heatsink51,68 Low voltage.27,90Pump Pow.44,90 5Volt SupplyOKPump rpm5460 Fan voltage7,0	 T ext shows various actual temperatures in °C from the external Pt100 and mod- ules.
	 T head and T heatsink are temperatures of the electronics in the Master in °C.
Pump Cur. 1,68 Cur. cons. 10,10 Pump Volt 53,80	 Pump power watts, – speed in rpm, cur- rent in amperes, and voltage in volts.
Temp. pump24°CPumpMenuEndTsetTfix	 Temp. pump → is the reference temper- ature of the pump. The value should not be above 100 °C.
	 T out indicates the outflow temperature in °C.
	 Mains voltage in % of setpoint and frequency in hertz.
	 Level indicates the liquid level in the ex- pansion vessel.
	 Voltages on the power transformer, of the 5 V supply and fan voltages in volts.
	 Cur. cons.: Total current consumption in amperes.

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9.2.5 Fault memory

For the analysis and localization of faults the Command version includes a fault memory in which up to 46 fault and alarm messages are saved.

Com	nmand	Error store
No.	Source Code Type Date Time	Menu \rightarrow Settings \rightarrow Device status
10 0	Safety 2 Alarm	- The last message is at the top.
8	Contro. 32 Error 17.07.0310.:52:02 Contro. 3 Warn. 06.06.03 11:15:11	 Each message line can be marked with the cursor keys. The message appears
6	Contro. 9 Alarm 05.06.03 08:45:01	in plain text in the footer.
5 4	Contro. 3 Alarm 01.06.0317:58:22 Contro. 4 Warn. 28.05.0320:01:22	 Under Source the CAN node is dis- played which signaled the fault.
3	Contro. 5 Warn. 27.05.0307:58:00	 Code is the number which in the Master
Low level is shown in the has been rec		is shown in the display until the cause has been rectified.
Pu	mp Menu End T _{set} T _{fix}	 Type: Alarm, Warning or Fault (Error).

9.2.6 Runnig time

A running hour counter displays the running hours for the whole thermostat and for the compressor (if present).

Command		Operating info
Pump Settings Graph Clock Programmer Interfaces Control Limits	Calibration Works Settings Resolution Device Status Display Data Basic Settings Overlevel Handling	 Open the device parameter menu via the softkey Menu With the cursor keys, change further to: → Settings → Device Status → Operating info → Display
Pump Menu E	nd T _{set} T _{fix}	

Operating info			[h]	
Thermo Compre Compre at temp	ostat tota essor 1 essor 2 . >200 °(C	08370 08034 00000 00000	
Pump	Menu	End	T _{set}	T _{fix}

9.2.7 Heater Info

The heater information window shows whether the heater power is limited by one of the parameters displayed.

Command		Operating info
Device type SW verson Serial numbers Device data Errorstore Operating info Heater Info		 Open the device parameter menu via the softkey Menu. With the cursor keys, change further to: → Settings → Device Status → Heater Info → Display.
Pump Menu End T _{set}	T _{fix}	
Heated limited due to		
Pump step Current Consumpt. dynamic heat limit int. Temperature >Tih (max) Degas mode Fill mode Controller outp. limit max.Heat T heatsink	No No No No No No No	
Pump Menu End T _{set}	T _{fix}	



9.3 Servicing and repair

-	 Withdraw the mains plug before all service and repair work.
	 Repairs in the control section must be carried out only by specialists.
	 Keep to service and maintenance intervals. If servicing does not occur at the stated intervals, then the manufacturer can no longer guarantee the safe opera- tion of the thermostatic circulator.

9.3.1 Service intervals

System part	Mandatory for initial operation and before any longer unsu- pervised operation, then with recommended frequency	Chapter	Comment
Complete device			
External condition of the device	Monthly		
Heat transfer liquid			
Analysis of heat transfer liquid	Half-yearly (and as required)	(⇔ 9.3.4)	
Heat transfer system			
Sealing	Daily		External visual inspection
External hoses			
Material fatigue	Monthly		External visual inspection
Cooling unit			
Cleaning of air-cooled condenser	Monthly	(⇒ 9.3.2)	Air-cooled thermostat
Cleaning the dirt trap	Monthly	(⇒ 9.3.2.2.1)	Water-cooled thermostat
Decalcifying the water cooling circuit	Quarterly	(⇔ 9.3.2.2.2)	Water-cooled thermostat
Electronics			
Over temperature protec- tion	Quarterly	(⇔ 7.16.1)	
Pressure indication	Quarterly		Zero-point check
Low level alarm / warning	Quarterly	(⇒ 7.16.2)	

9.3.2 Cleaning the condenser

9.3.2.1 Air-cooled condenser

In order that the full cooling power is available, the condenser of the cooling unit must be removed of dust – at one month intervals or longer, depending on the operating time and accumulation of dust in the vicinity of the device.

The SelfCheck Assistant detects external soiling and outputs a warning.



To clean, grasp underneath of front grill cover and pull out slightly. Similarly, pull out above. Place the grill on one side.

Brush down the condenser and blow out with compressed air if necessary.

Then, press in the grill cover in the retaining bolts below and then press on the top corners.

The picture on the left shows the removal of the grill cover. This applies to floor-standing and bench-top models.

9.3.2.2 Water-cooled condenser

9.3.2.2.1 Cleaning the dirt trap

At regular intervals of one month or longer, the dirt trap must be cleaned, depending on the degree of soiling.



XT 250 W:

Take off the water feed hose on the device and remove the filter. Clean the filter and insert it again into the cooling water feed.

From XT 350 W:

Unscrew the panel at the back. Open the filter housing with an open-ended wrench AF 19, for XT 1590 W(S), XT 1850 W(S) use AF 27, clean the filter and replace it.



9.3.2.2.2 Decalcifying the water cooling circuit

At regular intervals of 3 months or longer, the water-cooled condenser must be decalcified or cleaned. This depends on the hardness of the cooling water and the degree of soiling. Drain according to (\Rightarrow 9.1.3).

Required equipment:

- Two containers of approx. 10 to 20 liters volume.
- Use a suitable pump (drum pump) or a hose with funnel. Place the funnel as high as possible so that the device can fill quickly.
- Fit connecting hoses between container, pump, cooling water inlet and between cooling water outlet and back to container.



<u>XT 250 W</u>:

Via the water inlet hose, fill the device with decalcifier (pump or hose). To do this, set the setpoint to 10 °C. After starting the compressor, the water circuit can be filled. Circulate the decalcifier with the pump resp. continue to top up the decalcifier as necessary. Allow the decalcifier to take effect (refer to table below). Drain according to (\Rightarrow 9.1.3). Reconnect the device to the water supply and thoroughly flush out (refer to table below). While liquid is being pumped around the cooling water circuit, operate the device as described above at 10 °C.

From XT 350 W:

Carry on with selecting the condenser drain mode. Fill the device with decalcifier using the water feed hose. Circulate the decalcifier with the pump resp. continue to top up the decalcifier. Allow the decalcifier to take effect (refer to table below). Drain according to (\Rightarrow 9.1.3). Reconnect the device to the water supply and thoroughly flush out (refer to table below).

Acting time	Continue the pump stage until most of the foamy reaction, usually at the start, has decayed. Generally, this is achieved after about 15 to 30 minutes.
Decalcifier	Only permitted: Water with decalcifier from LAUDA LZB 126 (5 kg). It is essential to follow the safety instructions and the handling instructions at the packing when handling the chemicals.
Flushing:	Allow at least 30 liters of water to flow through.

9.3.3 Fuses

Single-phase alternating current units

XT 150 up to XT 350 HW.

In the event of an overload a circuit breaker interrupts the power supply. In an overload condition the circuit breaker may be manually reset by returning the switch to the "I" position.

Three-phase alternating current units

XT 490 W up to XT 950 WS.

The main switch also acts as a circuit breaker and trips when the current becomes too high. In an overload condition the main switch may be manually reset by returning the switch to the "I" position. The compressor circuit breaker F11 is located behind the cover panel (the main switch is fitted to the panel). In an overload condition the compressor circuit breaker may be manually reset by returning the switch to the "I" position.

XT 1590 W up to XT 1850 WS.

The illustration shows the motor circuit breaker F100 and the compressor circuit breaker F11 behind the cover panel. The main switch (rotary switch) is fitted to the cover panel. In an overload condition the circuit breaker may be manually reset by returning the switch to the "I" position.

View from the front into the device.



F3 Control fuse

Also, high ambient temperatures (approx. 45 to 50 °C) can trip a circuit breaker (fuse).

If the circuit breaker trips again, then the cause must be found by the LAUDA Service.

Circuit boards (optional) with melting fuses in the device



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List of the fuses in the devices

From XT 490 W upwards:

Control fuse F3 \rightarrow T 0A2 (slow blow) Order no. EES 069.

Single-phase alternating cur- rent units Order no.	Circuit boards		
	UL 533 (mains)	UL 555-9 (power supply)	
for all devices		F5/6/7 → T10A0 (slow blow) EEF 026	
XT 150 LWP 112; 230 V; 50 Hz	F1 → T10A0 (slow blow) EEF 026	F3, F4 → see table below (⇒ 137)	
XT 150 LWP 512; 200 V; 50/60 Hz LWP 812; 208-220 V; 60 Hz	F1 → T10A0 (slow blow) EEF 026		
XT 250 W LWP 113; 230 V; 50 Hz	F1 → T10A0 (slow blow) EEF 026		
XT 250 W; LWP 513; 200 V; 50/60 Hz LWP 813; 208-220 V; 60 Hz	F1 → T10A0 (slow blow) EEF 026		
XT 350 W LWP 117; 230 V; 50 Hz	F1 → T10A0 (slow blow) EEF 026		
XT 350 W LWP 517 ; ; 200 V; 50/60 Hz LWP 817; 208-220 V; 60 Hz	F1 → T10A0 (slow blow) EEF 026		
XT 350 HW LWP 119; 230 V; 50 Hz	F1 → T10A0 (slow blow) EEF 026		
XT 350 HW LWP 519; 200 V; 50/60 Hz LWP 819; 208-220 V; 60 Hz	F1 → T10A0 (slow blow) EEF 026		



_

For the PCB UL 555 and the fuses F3 and F4, consider the following:

Only use UL fuses (listed according to UL 248-14!

Table fuses for single-phase alternating current units

IJ	A2/F3, F4 anly	UL fuses
200V	10AT 250VAC	EES 004
215V	10AT 250VAC	EES 004
230V	8AT 500VAC	EES 072

View of PCB UL 555 (⇒ page 140)



Three-phase alternating current units Order no.	Circuit boards		
	UL 555-9 (power supply)	UL 571 (heating)	UL 563 (distributor 2)
for all devices	F5/6/7 → T10A0 (slow blow) EEF 026		
XT 280 LWP 334 208-220 V; 3/PE~60 Hz	F3, F4 → see table (⇒ 140)	F1 to F6 → F 10A (quick blow) EES 067	
XT 280 LWP 434 200 V; 3/PE~50/60 Hz		F1 to F6 → F 10A (quick blow) EES 067	
XT 280 LWP 534 400 V; 3/PE~50 Hz		F1 à F6 → F 6A3 (quick blow) EES 065	
XT 280 W LWP 535 400 V; 3/PE~50 Hz		F1 à F6 → F 6A3 (quick blow) EES 065	
XT 490 W LWP 339 208-220 V; 3/PE~60 Hz	F3, F4 → see table (⇒ 140)	F1 to F6 → FF 12A5 (extra quick blow) EES 015	
XT 490 W LWP 439 200 V; 3/PE~50/60 Hz		F1 to F6 → F 10A0 (quick blow) EES 067	
XT 490 W LWP 539 400 V; 3/PE~50 Hz		F1 to F6 → F 6A3 (extra quick blow) EES 065	
XT 550 LWP 324 208-220 V; 3/PE~60 Hz	F3, F4 → see table (⇒ 140)	F1 to F6 → FF 12A5 (extra quick blow) EES 015	
XT 550 LWP 424 200 V; 3/PE~50/60 Hz		F1 to F6 → FF 12A5 (extra quick blow) EES 015	
XT 550 LWP 524 400 V; 3/PE~50 Hz		F1 to F6 → F 6A3 (quick blow) EES 065	
XT 550 W LWP 325 208-220 V; 3/PE~60 Hz		F1 to F6 → FF 12A5 (extra quick blow) EES 015	
XT 550 W LWP 425 200 V; 3/PE~50/60 Hz		F1 to F6 → FF 12A5 (extra quick blow) EES 015	
XT 550 W LWP 525 400 V; 3/PE~50 Hz		F1 to F6 → F 6A3 (quick blow) EES 065	



Three-phase alternating current units Order no.	Circuit boards		
	UL 555-9 (power supply)	UL 571 (heating)	UL 563 (distributor 2)
XT 750 LWP 320 208-220 V; 3/PE~60 Hz	F3, F4 → see table (⇒ 140)	F1 to F6 → FF12A5 (extra quick blow) EES 015	
XT 750 LWP 420 200 V; 3/PE~50/60 Hz		F1 to F6 → F10A0 (quick blow) EES 067	
XT 750 LWP 520 400 V; 3/PE~50 Hz		F1 to F6 \rightarrow F6A3 (quick blow) EES 065	
XT 750 H LWP 322 208-220 V; 3/PE~60 Hz	F3, F4 → see table (⇒ 140)	F1 to F6 → FF12A5 (extra quick blow) EES 015	
XT 750 H LWP 422 200 V; 3/PE~50/60 Hz		F1 to F6 \rightarrow F10A0 (quick blow) EES 067	
XT 750 H LWP 522 400 V; 3/PE~50 Hz		F1 to F6 \rightarrow F6A3 (quick blow) EES 065	
XT 750 S LWP 552 XT 750 HS LWP 553 400 V; 3/PE~50 Hz		F1 to F6 → F10A0 (quick blow) EES 067	
XT 950 W LWP 321 208-220 V; 3/PE~60 Hz	F3, F4 → see table (⇒ 140)	F1 to F6 \rightarrow FF12A5 (quick blow) EES 015	
XT 950 W LWP 421 200 V; 3/PE~50/60 Hz		F1 to F6 \rightarrow F10A0 (quick blow) EES 067	
XT 950 W LWP 521 400 V; 3/PE~50 Hz		F1 to F6 \rightarrow F 6A3 (quick blow) EES 065	
XT 950 WS LWP 554 400 V; 3/PE~50 Hz		F1 to F6 \rightarrow F10A0 (quick blow) EES 067	
XT 1590 W LWP 642 440-480 V; 3/PE~60 Hz	F3, F4 → see table (⇒ 140)		F1 à F6 → F 6A3 (quick blow) EES 065
XT 1590 W LWP 742 400 V; 3/PE~50 Hz + 440-480 V; 3/PE~60 Hz			F1 à F6 → F 6A3 (quick blow) EES 065
XT 1590 WS LWP 551 400 V; 3/PE~50 Hz		F1 to F6 \rightarrow F 10A0 (quick blow) EES 067	
XT 1850 W LWP 532 400 V; 3/PE~50 Hz	F3, F4 → see table (⇒ 140) 2x UL 555	F1 to F6 \rightarrow F10A0 (quick blow) EES 067	

Three-phase alternating current units Order no.	Circuit boards		
	UL 555-9 (power supply)	UL 571 (heating)	UL 563 (distributor 2)
XT 1850 W LWP 632 440-480 V; 3/PE~60 Hz	F3, F4 → see table (⇒ 140) 2x UL 555		F1 to F6 → FF12A5 (extra quick blow) EES 015
XT 1850 W LWP 732 400 V; 3/PE~50 Hz + 440-480 V; 3/PE~60 Hz	F3, F4 → see table (⇒ 140)		F1 to F6 → FF12A5 (extra quick blow) EES 015
XT 1850 WS LWP 533 400 V; 3/PE~50 Hz			F1 to F6 → FF 16A (extra quick blow) EES 071



- For the PCB UL 555 and the fuses F3 and F4, consider the following:

- Only use UL fuses (listed according to UL 248-14)!

Table fuses for three-phase alternating current units

U	F3/F4 or	ly UL fuses
200V	10AT	EES 004
215V	10AT	EES 004
230V	8AT	EES 072
400V	5AT	EES 073
440V	SAT	EES 073
480V	5AT	EES 073



Mains PCB UL 555j j





PCB heating UL 571

Fuses for replacement



Bench-top device



Floor-standing device

9.3.4 Testing the heat transfer liquid

If the heat transfer liquid becomes contaminated or degenerated, it should be renewed.

If required, the heat transfer should be checked for fitness for use (e.g. when changing the method of operation), or at least half-yearly. Further use of the heat transfer liquid is only permissible if the inspection indicates this.

The test of the thermal transfer medium should takes place according to DIN 51529; Testing and assessment of used heat transfer media. Source: VDI 3033; DIN 51529.

9.3.5 Repair information

If you want to send in a device for repair, it is essential to first contact the LAUDA Service (⇒ 9.5).



- When sending in a device, please ensure that it is carefully and properly packed. LAUDA cannot be held liable for any damage due to improper packing.

- For a fee, we send a new package.

9.4 Remedying faults

Before you contact the LAUDA Service (\Rightarrow 9.5), check whether the problem can be remedied with the following instructions:

a) **Process thermostats**

Fault	Possible remedy
Device does not cool or only very slowly.	 The module "Smart Cool" is set to "off" → Switch on "Smart Cool" module (⇒ 7.15.7.1 and 8.2).
	 Actuating signal limitation is active → Switch off actuating signal limitation (⇒ 7.15.7.1).
	3. Dirty condenser \rightarrow clean condenser (\Rightarrow 9.3.2).
	 Temperature limit Til too high. → Reduce temperature limit Til (⇒ 7.10.2).
Device does not heat up or only very slowly.	 Actuating signal limitation is active → Switch off actuating signal limitation (⇒ 7.15.7.1).
	 Temperature limit Tih too low → Increase temperature limit Tih (⇒ 7.10.2).
	 Dynamic heating power limit active → Switch off dynamic heating power limit (⇒ 7.15.7.2).
	 At small pump levels the heating power is regulated automatically by the dynamic heating power control.(⇒ 7.15.7.3) → increase pump level.
Pump levels cannot be set.	 Pump pressure control is active. → Switch off pump pressure control (⇒ 7.9.4).
Degassing does not function very well.	 Pump pressure control is active. → Switch off pump pressure control (⇒ 7.9.4).
	 Pump level too high. → Select a lower pump level (⇒ 7.9.3).
	 Heater power too high. → Reduce heater power (⇒ 7.15.7.1).
	 Cooling unit active. → Switch off cooling unit (⇒ 7.15.7.1).
	 Heat transfer liquid heavily contaminated. → Change heat transfer liquid; to do this, com- pletely drain the device, working with the cleaning procedure if required (⇒ 7.8).
	 Filling point cover closed. → Open filling point cover.

LAUDA

Fault	Possible remedy		
Master: Warning message LuArn 332 Command: Low flow (cooling unit). (Not enough flow in region of evaporator). (⇒ 7.15).	 Check whether there is a blockage in the hy- draulic circuit (closed valves, pinched hose, dirt). → Rectify cause. 		
	 Pump level too low. → Select a larger pump level (⇒ 7.9.3). 		
	 Pipe cross-section is too small. → Enlarge cross-section or use bypass (⇒ 10 and 7.15.1). 		
	 4. Cooling power for the existing volume flow too high. → Reduce cooling power (⇒ 7.15.7.1). 		
Master: Warning message LuArn 007 Command: Low flow (heater). (Not enough flow in region of heater). (⇒ 7.15).	 Check whether there is a blockage in the hy- draulic circuit (closed valves, pinched hose, dirt). → Rectify cause. 		
	 Pump level too low. → Select a larger pump level (⇒ 7.9.3). 		
	 The device has not been vented or degassed sufficiently. → Degas device (⇒ 7.6.2 and 7.6.3). 		
	 Pipe cross-section is too small. → Enlarge cross-section or use bypass (⇒ 7.15.1 and 10). 		
	 5. Heater power for existing volume flow too high. → Limit heater power (⇒ 7.15.7.1 and 7.15.7.2). 		
Master: Alarm message とEアコア Command: Overtemperature protection. (⇒ 7.16.1).	 Wait until the outflow temperature has cooled below the overtemperature cut-off point or set the cut-off point higher than the outflow tem- perature. 		
Master: Warning message 니니유다 10년 Command: Level very low (Imminent low level in the expansion vessel).	 Check hoses, connections and load for whether a leaky location is present. → As applicable, rectify the leakage and top up the missing heat transfer liquid (⇒ 7.6.4). 		
Master: Alarm message LEUEL Command: Low level. (Low level in the expansion vessel)	 Check the Integral XT for whether a leaky location is present. → If necessary, contact LAUDA Service Constant Temperature Equipment (⇒ 9.5). 		
(⇒ 7.16.2).	 The liquid may drop due to cooling or degassing. → If necessary, top up the missing heat transfer liquid (⇒ 7.6.4). 		
Fault	Possible remedy		
---	--	--	--
Master: Warning message	1. Volume expansion during heating up.		
Command: Level too high (Imminent excessive level in the expansion vessel). Master: Alarm message $\exists L$ \equiv Command: Level too high (Excessive level in the expansion vessel) (\Rightarrow 7.16.4). Master: Alarm message $\exists L \Box \Box$	 Moisture absorption in the thermostatic medium. The viscosity of the heat transfer liquid is too high > Change the heat transfer liquid as too 		
Command: Pump blocked (Pump motor monitoring: Overload, blockage). (⇒ 7.16.5).	 high. → Change the heat transfer liquid or raise the setpoint temperature. 2. The pump is blocked. → Contact the LAUDA Service Constant Temperature Equipment (⇒ 9.5). 		
Master: Alarm message PuLEU Command: Low level (pump) (Pump motor monitoring: No load). (⇒ 7.16.6).	 No liquid in the system. If this occurs, the level monitoring has failed. → Check whether the float in the expansion vessel is blocked by for- eign bodies. Otherwise, contact LAUDA Ser- vice Constant Temperature Equipment (⇒ 9.5). 		
	 With the option "open load" the device draws air out of the open load. → Move the return (suction line) into the heat transfer liquid of the load. 		
Master: Alarm message Error 11	 Pump level too high. → Select a lower pump level (⇒ 7.9.3). 		
(outflow pressure too high).	2. Pressure control setpoint pressure too high. \rightarrow Reduce setpoint pressure (\Rightarrow 7.9.4).		
	 Maximum pressure too low. → Increase maximum pressure (⇒ 7.9.5). 		
Only for XT 1850 W Order No. LWP 732. Master: Alarm message $\boxed{\begin{subarray}{c} \begin{subarray}{c} \be$	 Switch for mains voltage setting [400 V; 3/PE~50 Hz or 440-480 V; 3/PE~60 Hz] in incorrect position → Switch off unit → Check whether existing mains voltage and frequency match [400 V; 3/PE~50 Hz or 440-480 V; 3/PE~60 Hz]; if necessary, set the switch correctly → Remove the top back panel → At the back of the unit switch the switch into the correct position → Fit the rear panel again → Switch on the unit again. 		

b) High-temperature thermostats

Fault	Possible remedy			
Master: Alarm message Cool FLoud (Equipment damage (lasting damage to the high temperature valve))	 Cooling water temperature above 80 °C and longer than 8 seconds. → Restore correct cooling water supply. Contact LAUDA Service Constant Temperature Equipment (⇒ 9.5). Cooling water temperature above 85 °C. → Restore correct cooling water supply. Contact LAUDA Service Constant Tempera- ture Equipment. At high-temperature valve temperature above 140 °C. → Restore correct cooling water sup- ply. Contact LAUDA Service Constant Tempera- ture Equipment. 			
Master: Warning message HE UALUE Eoo HoE (Equipment damage (lasting damage to the high temperature valve))	 At high temperature valve temperature above 120 °C and more than 8 seconds. → Restore correct cooling water supply. Otherwise contact LAUDA Service Constant Temperature Equipment (⇒ 9.5). 			
 Device enters the degassing mode (⇒ 7.6.3).) (Entry of cooling water in the hydraulic circuit by defective condenser). However, please note: If necessary, the device performs a "permanently and automatic degassing" by (⇒ 7.6.3.2). This automatic process is not a malfunction. 	 Contact LAUDA Service Constant Tempera- ture Equipment. 			
Entry of heat transfer liquid in the cooling water circuit by defective condenser.	 Note Suitable cooling water quality (⇒ 6.2). Otherwise there is a danger of corrosion! 			

9.5 Service, ordering replacement parts and rating label

When ordering spares please quote serial number (rating label). This avoids queries and supply of incorrect items.



Your contact for maintenance and support:

LAUDA Service Telephone: +49 (0)9343 503-350 (English and German) Fax: +49 (0)9343 503-283 E-Mail <u>service@lauda.de</u>

We are available any time for your queries and ideas!

LAUDA DR. R. WOBSER GMBH & CO. KG Laudaplatz 1 97922 Lauda-Königshofen Germany Telephone: +49 (0)9343 503-0 Fax: +49 (0)9343 503-222 E-Mail info@lauda.de Internet http://www.lauda.de



9.6 Disposal information



The following applies to Europe: The disposal of the device is regulated by EC Directive 2012/19/EU (WEEE Waste of Electrical and Electronic Equipment).

9.6.1 Disposal of the refrigerant

The type and filling quantity can be read on the unit or on the rating plate. Repair and disposal are only to be carried out by refrigeration specialists!

The following applies to Europe: The disposal of the coolant must be carried out according to regulation 2015/2067/EU in conjunction with regulation 517/2014/EC.

9.6.2 Disposal of the packaging

The following applies to Europe: The disposal of the packaging must be carried out according to the EC Directive 94/62/EC.



10 Accessories

Desc	cription	Application	Catalogue number
	LAUDA Wintherm Plus PC Program.	Control of the thermostat, online display of all values as a graph with free choice of time frame. Incl. RS232 cable (2 m).	LDSM2002
	T-piece connection for the internal LAUDA device bus (LiBus)①	For the connection of further LiBus ① components (with heating thermostats two LiBus ① connections are not occu- pied and one with cooling thermostats).	EKS 073
	Extension cable for LiBus ① 5 m	For LiBus ① components, but especially for remote opera-	EKS 068
	Extension cable for LiBus ① 25 m	tion with the Command re- mote control.	EKS 069
	Equipment trolley for bench- top cooling thermostats	Movable on lockable castors, height adjusts from 370 mm to 455 mm, footprint 555 mm x 465 mm, holds up to 160 kg load.	LCZ 036
	Roller kit option, only factory fitting	4 rollers, 2 with brake; suitable for XT 150 and XT 250 W	LWZ 051
	Ball cock for thermostating circuit	M16 x 1 I to M16 x 1 A; temperature range: -30 to 180 °C	LWZ 047

① LiBus = LAUDA internal BUS (based on CAN)



Interfaces and modules			
RE STORAGE CEST	RS 232/485 Interface Module	Digital communication, opera- tion of the LAUDA PC soft- ware Wintherm Plus (⇒ 8.3).	LRZ 913
	RS 232 cable (2 m)	Thermostat-PC Sub-D (9 pin. 9 pin).	EKS 037
	RS 232 cable (5 m)	Thermostat-PC Sub-D (9 pin. 9 pin).	EKS 057
715 Aug 10	Analog module	Current and voltage interfaces (⇒ 8.4).	LRZ 912
	Contact module with 3 inputs and outputs	Input and output of device signals (⇔ 8.5.1).	LRZ 915
	Contact module with 1 input and 1 output	NAMUR NE28 functionality (⇒ 8.5.2).	LRZ 914
25 Profess	Profibus module	Digital communication via field bus, Profibus.	LRZ 917
Heat transfer liquids (⇒ 6.2)	1		
	Ultra 350	For safe and reliable opera-	LZB 107
	Kryo 30	tion the correct choice of heat transfer liquid is of crucial importance.	LZB 109, LZB 209, LZB 309
	Kryo 70	Containers in 5, 10 and 20 liters size.	LZB 127, LZB 227, LZB 327
	Kryo 95		LZB 130, LZB 230, LZB 330



Adapter M30 x 1.5 (according to DIN 3863 and DIN 3870)						
	Reduction	M30 x 1.5 I to M16 x 1 A	UD 660			
	Reduction	M30 x 1.5 A to M16 x 1 I	HKA 152			
	Double nipple	M30 x 1.5	EOV 208			
	Screw-in sleeve	M30 x 1.5 A to G ¾"A	EOV 194			
	Flange adapter	M30 x 1.5 A to DIN 2633/DN25	HKA 156			
	Union nut	M30 x 1.5	EOV 196			
	Olive	³ ⁄ ₄ " olive with ball-type nipple for M30 x 1.5	HKA 162			
	Angular screwed joint	M30 x 1.5 I to M30 x 1.5 A	HKA 153			
	By-pass	M30 x 1.5 I to M30 x 1.5 A; Temperature range -40 to 350 °C. Use recommended with con- nection of loads with high hydraulic resistance (low cross-section \rightarrow low flow).	LWZ 046			
	By-pass	M30 x 1.5 I to M30 x 1.5 A; Temp. range: -90 to 220 °C.	LWZ 089			
Adapter M16 x 1 (according	g to DIN 3863 and DIN 3870)					
	Olive	¹ / ₂ " olive with ball-type nipple for M16 x 1 union nut.	HKO 026			



Metal thermostat hoses (⇒ 6.2)		
	MXC 100S; 100 cm	M30 x 15 I both ends; -50 to 300 °C	LZM 081
Station .	MXC 200S; 200 cm	M30 x 1.5 I both ends; -50 to 300 °C	LZM 082
	MXC 300S; 300 cm	M30 x 1.5 I both ends; -50 to 300 °C	LZM 083
Metal thermostat hoses	M 38x1.5 suitable for XT 1850 W	(⇒ 6.2)	
	MX2C 100S; 100 cm	M38 x 1.5 l both ends; -50 to 300 °C	LZM 084
(alar	MX2C 200S; 200 cm	M38 x 1.5 l both ends; -50 to 300 °C	LZM 085
	MX2C 300S; 300 cm	M38 x 1.5 I both ends; -50 to 300 °C	LZM 086
Cooling water hoses; the	ermostat hoses (EPDM*)		
Janaton soul	Rubber hose	1/2", textile reinforced; -40 to 100 °C; max. 20 bar	RKJ 031
	Rubber hose for XT 250 W, XT 350 HW, XT 950 W	3/4", textile reinforced; -40 to 100 °C; max. 20 bar	RKJ 032
	Rubber hose for XT 1850 W	1", textile reinforced; -40 to 100 °C; max. 20 bar	RKJ 033
* EPDM hose is not suitabl	e for Ultra 350 and mineral oils.		
Quick-release couplings			
	Coupling socket	Socket G3/4" I; suitable for EOA 007	EOA 006
	Coupling plug	for ½" hose	EOA 007
	Coupling socket	Socket G1" I; suitable for EOA 026	EOA 027
	Coupling plug	for ¾" hose	EOA 026

Other accessories on request (\Rightarrow 9.5).

Also refer to our special and accessory brochures.

11 Technical data

Refrigerant and Filling quantity

The cooling thermostat contains fluorinated greenhouse gases.

	Unit	XT 150	XT 250 W	XT 350 W	XT 350 HW
Refrigerant		R-404A	R-404A	R-404A	R-404A
maximum filling quantity	kg	0.7	0.9	1.2	1.2
GWP _(100a) *		3922	3922	3922	3922
CO ₂ equivalent	t	2.7	3.5	4.7	4.7

	Unit	XT 550 (W)	XT 750 (H)	XT 750 S	XT 750 HS
Refrigerant		R-404A	R-404A	R-404A	R-404A
maximum filling quantity	kg	2.0	2.0	2.0	2.0
GWP _(100a) *		3922	3922	3922	3922
CO ₂ equivalent	t	7.8	7.8	7.8	7.8

	Unit	XT 950 W	XT 950 WS	XT 1850 W	XT 1850 WS
Refrigerant		R-404A	R-404A	R-404A	R-404A
maximum filling quantity	kg	2.0	2.0	3.5	3.5
GWP _(100a) *		3922	3922	3922	3922
CO ₂ equivalent	t	7.8	7.8	14	14

Devices with two compressors

	Unit	XT 280	XT 280 W	XT 490 W	XT 1590 W	XT 1590 WS
Refrigerant 1		R-404A	R-404A	R-404A	R-404A	R-404A
maximum filling quantity 2	kg	0.8	0.9	1.6	3.5	3.5
GWP _(100a) *		3922	3922	3922	3922	3922
CO2 equivalent	t	3.1	3.5	6.3	14	14
Refrigerant 2		R-23	R-23	R-508B	R-508B	R-508B
maximum filling quantity 2	kg	0.5	0.5	1.38	1.55	1.55
GWP _(100a) *		14800	14800	13400	13400	13400
CO ₂ equivalent	t	7.4	7.4	18	21	21

Global Warming Potential (GWP), Comparison CO₂ = 1.0 * Time span 100 years - according to IPCC IV

The figures have been determined according to DIN 12876.

Table 1 F	Process therr	nostats		XT 150	XT 250 W	XT 280	280 XT 280 W XT 350 W XT 350 HW			
Operating te	emp./ACC rar	nge	°C	-45 – 220	-45 – 220	-80 - 220	-80 – 220	-50 – 220	-50 - 300	
Ambient ten	np. range		°C			5 –	- 40			
Humidity				maximum relati	ve humidity 80 %	for temperature humidity	s up to 31 °C, de at 40 °C	creasing linearly	to 50 % relative	
Device dista ings	ince to the su	irround-								
		front	cm	50	20	50	20	20	20	
		back	cm	50	20	50	20	20	20	
		right	cm	50	20	50	20	20	20	
		left	cm	50	6	50	6	6	6	
Storage terr	perature rang	ge	°C	the co	ondenser must be	-20 e completely emp	– 44 otied by a water-c	cooled device (⇒	9.1.3)	
Setting reso	lution		°C			0.	01			
Display resolution °C Master: 0.01 Command: 0.1 / 0.01 / 0.001										
Display accu	uracy					0.2 °C can be ca	librated additively	/		
Filling volum	ne, minimum		L	2.6	2.6	5.0	5.0	5.0	5.3	
Additional fil expansion v	lling volume i essel	n the	L	5.5	5.5	6.7	6.7	6.7	6.7	
Cooling refrigerating unit				Air	Water	Air	Water			
Cooling air t without perfe	emperature r ormance loss	ange	°C	10 – 20	10 – 40	10 – 20	10 – 40			
Cooling wat	er connectior	IS			R¾" A		R¾" A			
minimum dia water hose	ameter of the	cooling	mm		13		13			
Cooling wat	er temperatur ormance loss	re range /	°C		10 – 30		10 – 30	10 – 30	10 – 30	
					10 – 15		10 – 15	10 – 15	10 – 15	
Cooling wat	er pressure		bar		3 – 10		3 – 10	3 – 10	3 – 10	
Cooling wat perature 15	er consumpti °C, pressure	on tem- 3bar ④	L/h		300		900	800	800	
ar; ar;	Thermal	300 °C	KW						12.00	
3 bç	transfer oil	200 °C	KW	1.50 3	2.10 ③	1.50 3	2.00 3	3.10	12.00	
e; cc sure d	2	100 °C	KW	1.50 ③	2.10 ③	1.50 3	2.00 3	3.10	6.00	
ature ress note	Ethanol	20 °C	KW	1.50 ③	2.10 ③	1.50 3	2.00 3	3.10	3.10	
ipera ier p ent r	Ethanol	10 °C	KW	1.30 ③	1.80 ③	1.50 3	2.00 3	3.10	3.10	
tem wat	Ethanol	0 °C	KW	1.10 ③	1.30 ③	1.40 3	2.00 3	3.10	3.10	
ient ling ot di	Ethanol	-10 °C	KW	1.00 ③	1.00 ③	1.40 ③	1.90 ③	2.00	2.00	
amb coc if n	Ethanol	-20 °C	KW	0.62 ③	0.62 ③	1.30 ③	1.80 ③	1.20	1.20	
ပ္ရွိ ဂ်္ဂ 🖯	Ethanol	-30 °C	KW	0.28 ③	0.28 ③	1.30 ③	1.70 ③	0.70	0.70	
t 20 ∋ 15 vel ∠	Ethanol	-40 °C	KW	0.06 3	0.06 ③	1.30 3	1.60 3	0.25 ③	0.25 ③	
Ethanol Ethanol	-50 °C	KW			1.20 3	1.40 3	0.02 ③	0.02 ③		
	-60 °C	KW			1.00 3	1.00 3				
tem F	Ethanol	-70 °C	KW			0.40 3	0.40 3			
Cooli	Ethanol	-80 °C	KW			0.10 3	0.10 3			
Ŭ Š	Ethanol	-90 °C	KW							
Temperatur	e stability at		±Κ	0.05	0.05	0.1	0.1	0.10	0.10	
-10 °C, etha	nol with exter	rnal load	-10 °C, ethanol with external load L 2 2 2 2 5				2	5	5	

Integral XT

		n
	L	H

Table 1	Process thermostats		XT 150	XT 250 W	XT 280	XT 280 W	XT 350 W	XT 350 HW
Heater pow Power cons	er / sumption							
230 V; 50 Hz		kW	3.5 / 3.68	3.5 / 3.68			3.5 / 3.68	3.5 / 3.68
	208-220 V; 3/PE~60 Hz	kW			2.9 / 7.0	2.9 / 7.0		
	200 V; 3/PE~50/60 Hz	kW			2.65 / 6.5	2.65 / 6.5		
	200 V; 50/60 Hz	kW	2.65 / 3.2	2.65 / 3.2			2.65 / 3.2	2.65 / 3.2
	400 V; 3/PE~50 Hz	KW			4.0 / 9.0	4.0 / 9.0		
	208-220 V; 60 Hz	kW	2.9 / 3.5	2.9 / 3.5			2.9 /3.5	2.9 / 3.5
Surface loa	ding (Heater)							
230 V; 50 Hz		W/cm ²	6.1	6.1			6.1	6.1
208-220 V; 3/PE~60 Hz		W/cm ²			5.1	5.1		
200 V; 3/PE~50/60 Hz W/		W/cm ²			4.6	4.6		
200 V; 50/60 Hz W/cm			4.6	4.6			4.6	4.6
	400 V; 3/PE~50 Hz	W/cm ²			7.1	7.1		
	208-220 V; 60 Hz	W/cm ²	5.1	5.1			5.1	5.1
Protection			IP21C					
Pump type					Pressu	re pump		
Pump capacity	Discharge pressure max.	bar	2.9	2.9	2.9	2.9	2.9	2.9
(water 20 °C)	Flow rate max.	L/min	45	45	45	45	45	45
Connection	s for consumers				Thread M30	x 1.5 (DN 20)		
Overall dimensions B x L x H mm			335 x 550 x 660	335 x 550 x 660	460 x 550 x 1285			
Weight		kg	87	90	180	180	150	150
Safety equi	pment	Class		III, FL suita	ble for flammable	e and non-flamm	able liquids	
Protection of	class			Protection cl	ass I according to	o DIN EN 61140;	VDE 0140-1	

Table 2 P	rocess thermo	ostats		XT 490 W	XT 550	XT 550 W
Operating tem	perature/ACC	-range	°C	-90 - 220	-50 – 220	-50 – 220
Ambient temp	. range		°C		5 – 40	
Humidity				maximum relative humidity 5	80 % for temperatures up to 3 0 % relative humidity at 40 °0	31 °C, decreasing linearly to
Device distance	ce to the surro	undings				
		front	cm	20	50	20
		back	cm	20	50	20
righ			cm	20	50	20
		left	cm	6	50	6
Storage tempe	erature range		°C	the condenser must be c	-20 – 44 ompletely emptied on a wate	r-cooled device (⇒ 9.1.3)
Setting resolut	tion		°C		0.01	
Display resolu	tion		°C	Master	: 0.01 Command: 0.1 / 0.01	/ 0.001
Display accura	асу				0.2 °C calibrated additively	
Filling volume	minimum		L	9.5	5.0	5.0
Additional fillir sion vessel	ig volume in th	e expan-	L	17.4	6.7	6.7
Cooling refrige	erating unit			Water	Air	Water
Cooling air temperature range without performance loss			°C	10 – 40	10 – 20	10 – 40
Cooling water	connections			R¾" A		R¾" A
minimum diameter of the cooling water hose			mm	13		13
Cooling water temperature range / without performance loss			°C	10 – 30 / 10 – 15		10 – 30 / 10 – 15
Cooling water	pressure		bar	310		3 – 10
Cooling water temperature 1	consumption 5 °C, pressure	3bar ④	L/h	1200		800
έ ≍		300 °C	KW			
erte	Thermal	200 °C	kW	4.4	5.0	5.4
wate evel	transfer oll @	100 °C	kW	4.4	5.0	5.4
ling np le	Ethanol	20 °C	kW	4 4	5.0	54
coo	Ethanol	10 °C	kW	1.1	5.0	5.4
ure; bar;	Ethanal			4.4	3.0	5.4
re 3 re 3 oted	Ethanol	0.0	KVV	4.4	4.0	5.4
emp sssui nt n	Ethanol	-10 °C	KVV	4.4	3.4	4.3
ent t r pre ffere	Ethanol	-20 °C	kW	4.4	2.2	2.9
mbi vate ot dif	Ethanol	-30 °C	kW	4.4	1.25	1.6
°C a Dg v Du	Ethanol	-40 °C	kW	4.0	0.6	0.8
20 Sooli	Ethanol	-50 °C	kW	3.3	0.15	0.15
er at °C; c	Ethanol	-60 °C	kW	2.3		
15 15	Ethanol	-70 °C	kW	1.35		
ling	Ethanol	-80 °C	kW	0.7 3		
Cool	Ethanol	-90 °C	kW	0.2 3		
Temperature	i stability at	<u> </u>	±K	0.1	0.05	0.1
-10 °C, ethance	ol with external	load	Liters	5	5	5

Integral XT

·				1			
Table 2 Pro	cess thermostats		XT 490 W	XT 550	XT 550 W		
Heater power / Power consump	tion						
	230 V; 50 Hz	kW					
20	08-220 V; 3/PE~60 Hz	kW	5.7 / 9.5				
2	200 V; 3/PE~50/60 Hz	kW	5.3 / 8.6				
	200 V; 50/60 Hz	kW					
	400 V; 3/PE~50 Hz	kW	5.3 / 9.0	5.3 / 7.8	5.3 / 7.8		
Surface loading (Heater) 230 V; 50 Hz		W/cm ²					
208-220 V; 3/PE~60 Hz		W/cm ²	5.1				
200 V; 3/PE~50/60 Hz		W/cm ²	4.6				
	200 V; 50/60 Hz	W/cm ²					
	400 V; 3/PE~50 Hz	W/cm ²	4.6	4.6	4.6		
Protection				IP21C			
Pump type				Pressure pump			
Pump capacity	Discharge pressure max.	bar	2.9	2.9	2.9		
(water 20 °C)	Flow rate max.	L/min	45	45	45		
Connections for	consumers			Thread M30 x 1,5 A (DN 20)			
Overall dimension	ons B x L x H	mm	700 x 550 x 1600	460 x 550 x 1285	460 x 550 x 1285		
Weight		kg	245	150	155		
Safety equipmer	nt	Class	III, FL suitable for flammable and non-flammable liquids				
Protection class			Protection clas	s I according to DIN EN 6114	10; VDE 0140-1		

Table 3 Process thermostats		rmostats		XT 750 (S)	XT 750 H(S)	XT 950 W(S)	XT 1590 W(S)	XT 1850 W(S)
Operating te	mp AC	C range	°C	-50 – 220	-50 – 300	-50 – 220	-90 – 220	-50 – 220
Ambient terr	np. range		°C			540		
Humidity				maximum relative I	numidity 80 % for ter	nperatures up to 31 humidity at 40 °C	°C, decreasing linea	arly to 50 % relative
Device dista roundings	ince to th	e sur-						
fron			cm	50	50	20	20	20
		back	cm	50	50	20	20	20
		right	cm	50	50	20	20	20
		left	cm	50	50	6	6	6
Storage tem	perature	range	°C	the conde	enser must be comp	-20 – 44 letely emptied on a	water-cooled device	(⇒ 9.1.3)
Setting reso	lution		°C			0.01		
Display reso	olution		°C		Master: 0.0	1 Command: 0.1 / 0	0.01 / 0.001	
Display accu	uracy				0.2 °C	can be calibrated ac	lditively	
Filling volum	ne, minim	um	L	5.0	5.3	5.0	10.5	9.0
Additional fil expansion v	ling volur essel	me in the	L	6.7	6.7	6.7	17.4	17.4
Cooling refri	gerating	unit		А	.ir		Water	
Cooling air temperature range without performance			°C	10 – 20 10 – 40				
Cooling water connections						R¾" A	R1	" A
minimum diameter of the			mm			13	19	19
Cooling wate	er tempei	rature	°C			10 – 30	10 – 30	10 – 30
without perfe	ormance	loss				10 – 15	10 – 15	10 – 15
Cooling wat	er pressu	re	bar			3 – 10	3 – 10	3 – 10
Cooling wate temperature 3bar ④	er consur 15 °C, p	nption: ressure	L/h			1300	1500	1300
	_, , 300 °C		KW		5.50			
oling 3baı	transfer	200 °C	KW	7.00	7.00	9.00	15.00	18.50
nre co	oil 2	100 °C	KW	7.00	7.00	9.00	15.00	18.50
ture essi oted	Ethanol	20 °C	KW	6.70	6.70	9.00	15.00	18.50
era er pi nt n	Ethanol	10 °C	KW	6.10	6.10	7.50	13.00	12.50
wate fere	Ethanol	0 °C	KW	4.80	4.80	6.60	10.50	10.30
ent t ling it dif	Ethanol	-10 °C	KW	3.40	3.40	4.60	9.20	7.70
mbie cool if no	Ethanol	-20 °C	KW	2.20	2.20	3.00	8.50	5.90
Ü Ç 🕀	Ethanol	-30 °C	KW	1.25	1.25	1.70	8.50	3.80
20° 9 15 (el 4	Ethanol	-40 °C	KW	0.60 3	0.60 3	0.90 3	7.00	2.20 ③
er at ature o lev	Ethanol	-50 °C	KW	0.30 3	0.30 3	0.35 ③	5.30	1.20 ③
pera	Ethanol	-60 °C	KW				3.70	
ng p p	Ethanol	-70 °C	KW				1.80	
ter	Ethanol	-80 °C	KW				0.90 3	
0 š	Ethanol	-90 °C	KW				0.35 3	
Temperature	e stability nol with e	at external	±Κ	0.05	0.05	0.10	0.30	0.30
load	load			5	5	5	10	10



Table 3 Pro	cess thermostats		XT 750 (S)	XT 750 H(S)	XT 950 W(S)	XT 1590 W(S)	XT 1850 W(S)	
Heater power / Power consumption 400 V: 3/PE~50 Hz		F/V/	LWP 520:	LWP 522:	LWP 521:		LWP 532:	
	50 V, 3/1 E-30 HZ	kW	LWP 552: 8.0 / 9.7	LWP 553: 8.0 / 9.7	LWP 554: 8.0 / 9.7	LWP 551: 8.0 / 13.8	LWP 533: 16.0 / 17.3	
208-22	20 V; 3/PE~60 Hz	kW	5.7 / 7.6	5.7 / 7.6	5.7 / 7.6			
200	V; 3/PE~50/60 Hz	kW	5.3 / 6.9	5.3 / 6.9	5.3 / 6.9			
440-48	30 V; 3/PE~60 Hz	KW				7.0 / 16.6	14.0 / 20.8	
400	V; 3/PE~50 Hz or	KW				5.3 / 16.6 or	10.6 / 20.8 or	
440-48	30 V; 3/PE~60 Hz	KW				7.0 / 16.6	14.0 / 20.8	
Surface load	ling (Heater)							
400 V; 3/PE~50 Hz		W/cm ²	LWP 520: 4.6	LWP 522: 4.6	LWP 521: 4.6		LWP 532: 4.6	
		W/cm ²	LWP 552: 7.1	LWP 553: 7.1	LWP 554: 7.1	LWP 551: 7.1	LWP 533: 7.1	
208-220 V; 3/PE~60 Hz		W/cm ²	5.1	5.1	5.1			
200 \	V; 3/PE~50/60 Hz	W/cm ²	4.6	4.6	4.6			
440-48	30 V; 3/PE~60 Hz	W/cm ²				6.1	6.1	
400 440-48	V; 3/PE~50 Hz or 30 V; 3/PE~60 Hz	W/cm ²				4.6 or 6.1	4.6 or 6.1	
Protection				IP21C				
Pump type					Pressure pump			
mp acity ater °C)	Discharge pres- sure maximum	bar	2.9	2.9	2.9	2.9	5.8	
20 (we build be cap	Flow rate max.	L/min	45	45	45	45	90	
Connections	for consumers			Thread M30	x 1.5 (DN 20)		Thread M38 x 1.5 (DN 25)	
Overall dime	ensions B x L x H	mm	460 x 550 x 1285	460 x 550 x 1285	460 x 550 x 1285	700 x 550 x 1600	700 x 550 x 1600	
Weight kg 155			155	160	160	280	250	
Safety equip	oment	Class		III, FL suitable for	flammable and non-	flammable liquids		
Protection cl	ass			Protection class I a	ccording to DIN EN	61140; VDE 0140-1		

① The refrigerating powers are reduced by about 320 watts when Pump Level 8 is selected instead of Pump Level 4. The refrigerating powers are reduced by about 470 watts when Pump Level 8 is selected instead of Pump Level 2. With XT 1850 W(S) the refrigerating power is reduced by about 640 watts when Pump Level 8 is selected instead of Pump Level 4. With XT 1850 W(S) the refrigerating power is reduced by about 940 watts when Pump Level 8 is selected instead of Pump Level 4. With XT 1850 W(S) the refrigerating power is reduced by about 940 watts when Pump Level 8 is selected instead of Pump Level 4. With XT 1850 W(S) the refrigerating power is reduced by about 940 watts when Pump Level 8 is selected instead of Pump Level 4. With XT 1850 W(S) the refrigerating power is reduced by about 940 watts when Pump Level 8 is selected instead of Pump Level 4. With XT 1850 W(S) the refrigerating power is reduced by about 940 watts when Pump Level 8 is selected instead of Pump Level 2.

⁽²⁾ Devices filled with Kryo 55 up to a maximum temperature of 200 °C. Devices filled with Ultra 350 up to a maximum temperature of 300 °C.

③ Pump Level 2.

④ Water consumption for maximum refrigerating power



Fuses of the mains connection data

	Mains connection	XT 150	XT 250 W	XT 280	XT 280 W	XT 350 W	XT 350 HW
	230 V; 50 Hz	T16 A	T16 A			T16 A	T16 A
	208-220 V; 3/PE~60 Hz			T20 A	T20 A		
	200 V; 3/PE~50/60 Hz			T20 A	T20 A		
	200 V; 50/60 Hz	T16 A	T16 A			T16 A	T16 A
Fuse	400 V; 3/PE~50 Hz			T16 A	T16 A		
_	440-480 V; 3/PE~60 Hz						
	400 V; 3/PE~50 Hz or 440-480 V; 3/PE~60 Hz						
	208-220 V; 60 Hz	T16 A	T16 A			T16 A	T16 A

	Mains connection	XT 490 W	XT 550	XT 550 W
	230 V; 50 Hz			
	208-220 V; 3/PE~60 Hz	T25 A	T20 A	T20 A
	200 V; 3/PE~50/60 Hz	T25 A	T20 A	T20 A
	200 V; 50/60 Hz			
Fuse	400 V; 3/PE~50 Hz	T16 A	T16 A	T16 A
_	440-480 V; 3/PE~60 Hz			
	400 V; 3/PE~50 Hz or 440-480 V; 3/PE~60 Hz			
	208-220 V; 60 Hz			

	Mains connection	XT 750	XT 750 S	XT 750 H	XT 750 HS	XT 950 W	XT 950 WS
	230 V; 50 Hz						
	208-220 V; 3/PE~60 Hz	T20 A		T20 A		T20 A	
	200 V; 3/PE~50/60 Hz	T20 A		T20 A		T20 A	
	200 V; 50/60 Hz						
Fuse	400 V; 3/PE~50 Hz	T16 A	T16 A	T16 A	T16 A	T16 A	T16 A
	440-480 V; 3/PE~60 Hz						
	400 V; 3/PE~50Hz or 440-480 V; 3/PE~60 Hz						
	208-220 V; 60 Hz						



	Mains connection	XT 1590 W	XT 1590 WS	XT 1850 W	XT 1850 WS
	230 V; 50 Hz				
	208-220 V; 3/PE~60 Hz				
	200 V; 3/PE~50/60 Hz				
	200 V; 50/60 Hz				
ense	400 V; 3/PE~50 Hz		T20 A	T25 A	T25 A
-	440-480 V; 3/PE~60 Hz	T20 A		T25 A	
	400 V; 3/PE~50Hz or 440-480 V; 3/PE~60 Hz	T20 A		T25 A	
	208-220 V; 60 Hz				

We reserve the right to make technical alterations!

High-tempe	Table 4 erature therm	ostats		XT 4 H	XT 4 HW	XT 8 H	XT 8 HW
Operating temp	perature/ACC	-range	°C	80 - 320	30 - 320	80 - 320	30 - 320
Ambient temp.	range		°C		5 -	40	
Humidity				maximum relative humidity 80 % for temperatures up to 31 °C, decreasing linearly to 50 % relative humidity at 40 °C			
Device distanc	e to the surro	undings					
		front	cm	20	20	20	20
		back	cm	20	20	20	20
		right	cm	6	6	6	6
		left	cm	6	6	6	6
Storage tempe	rature range		°C	the condenser m	-20 - ust be completely emp	44 tied on a water-cooled	device (⇒ 9.1.3)
Setting resoluti	ion		°C		0.0	01	
Display resolut	ion		°C		Master: 0.01 Comma	and: 0.1 / 0.01 / 0.001	
Display accura	су				0.2 °C calibra	ted additively	r
Filling volume,	minimum		L	2.6	2.6	2.6	2.6
Additional filling	g volume in th	e expan-	L	5.5	5.5	5.5	5.5
Cooling refrige	rating unit			Air	Water	Air	Water
Cooling air tem performance lo	nperature rang oss	e without	°C	10 - 40		10 - 40	
Cooling water connections device (outside) hose (inside)			inch mm		1/2" id 19		1/2" id 19
minimum diameter of the cooling water hose			mm		13		13
Cooling water t without perform	temperature ra nance loss	ange /	°C		10 - 30 / 10 - 15		10 - 30 / 10 - 15
Cooling water	pressure		bar		3 - 10		3 - 10
Cooling water of temperature 15	consumption 5 °C, pressure	3bar ④	L/h		600		600
ater ater ar;	Ultra 350	300 °C	kW		16		16
o an Can C; « C;	Ultra 350	250 °C	kW		16		16
20 °(oolir 15 ° ssure ssure	Ultra 350	200 °C	kW		16		16
r at ; re; c ture pres	Kryo 55	200 °C	kW		16		16
owe ratul erater ater	Krvo 55	150 °C	kW		15		15
ing p teml ng v p	Kryo 55	100 °C	kW		9		9
Cool nt te cooli	Kryo 55	50 °C	kW		2		2
	tability at		±Κ	0.05	0.1	0.05	0.1
-10 °C, ethano	l with external	load	Liters	5	5	5	5
Heater power /	Power consu	mption					
	230) V; 50 Hz	kW	3.5 / 3.7	3.5 / 3.7		
2	208-220 V; 3/I	PE~60 Hz	kW			8.0 / 8.8	8.0 / 8.8
	200 V; 3/PE-	-50/60 Hz	kW			8.0 / 8.7	8.0 / 8.7
	200 V;	50/60 Hz	kW	2.65 / 3.2	2.65 / 3.2		
	400 V; 3/ł	PE~50 Hz	kW			8.0 / 8.8	8.0 / 8.8
	208-220) V; 60 Hz	kW	2.85 - 3.2 / 3.3 - 3.5	2.85 - 3.2 / 3.3 - 3.5		



Table 4 High-temperature thermostats			XT 4 H	XT 4 HW	XT 8 H	XT 8 HW	
Surface loading (Heater)							
	230 V; 50 Hz	W/cm ²	6.1	6.1			
20	08-220 V; 3/PE~60 Hz	W/cm ²			7.1	7.1	
2	200 V; 3/PE~50/60 Hz	W/cm ²			7.1	7.1	
	200 V; 50/60 Hz	W/cm ²	4.6	4.6			
	400 V; 3/PE~50 Hz	W/cm ²			7.1	7.1	
	208-220 V; 60 Hz		5.0 - 5.6	5.0 - 5.6			
Protection				IP2	21C		
Pump type			Pressure pump				
Pump capacity	Discharge pressure max.	bar	2.9	2.9	2.9	2.9	
(water 20 °C)	Flow rate max.	L/min	45	45	45	45	
Connections for	consumers			Thread M30 x	1,5 A (DN 20)		
Overall dimension	ons B x L x H	mm	335 x 550 x 660	335 x 550 x 660	335 x 550 x 660	335 x 550 x 660	
Weight		kg	60	64	62	66	
Sound pressure	level	db(A)	51	51	51	51	
Safety equipmer	nt	Class	III, FL suitable for flammable and non-flammable liquids				
Protection class			Protect	ion class I according to	DIN EN 61140; VDE	0140-1	

Fuses of the mains connection data

		XT 4 H	XT 4 HW	XT 8 H	XT 8 HW
Fuse:	230 V; 50 Hz	T16 A	T16 A		
	208-220 V; 3/PE~60 Hz			T25 A	T25 A
	200 V; 50/60 Hz	T16 A	T16 A		
	400 V; 3/PE~50 Hz			T16 A	T16 A
	200 V; 3/PE~50/60 Hz			T25 A	T25 A
	208-220 V; 60 Hz	T16 A	T16 A		

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Lauda

Pump characteristics (pump level 1 – 8) Integral XT XT 150, XT 250 W, XT 280, XT 280 W, XT 350 W, XT 350 HW, XT 490 W, XT 550, XT 550 W, XT 750, XT 750 S, XT 750 H, XT 750 HS, XT 950 W, XT 950 WS, XT 1590 W and XT 1590 WS Measured with water



Pump characteristics (pump level 1 – 8) Integral XT 1850 W and XT 1850 WS Measured with water



We reserve the right to make technical alterations!

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Zip code	Place
Street & house number	
Additional explanations	

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