Continuous valve actuator CHEOPS drive

CHEOPS drive	731 9 200

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1 Functional characteristics

The CHEOPS drive continuous valve actuator can be controlled via Cheops control or via a continuous room temperature controller.
Cheops drive has 2 inputs for presence sensors and window contact. The input statuses can be transmitted on the bus.

1.1 Benefits

- Infinite valve adjustment through continuous actuating value
- Display of actual valve position via 5 LEDs
- Monitoring the actuating value
- Emergency program on actuating value failure (e.g. for non-operational room thermostat)
- Any forced position possible via object
- Establishing the maximum actuating value
- Alarm on actuating value failure
- Valve protection program
- Input for window contact
- Input for presence contact
- Limit of actuating value
- Precise adaptation at each valve
- Operation with both standard and inverted valves
- Site function for operation without application
- Large valve stroke enables adjustment to almost all valves
- Simple assembly with provided valve adapter

1.2 Hardware versions

There are 2 hardware versions of Cheops, *up to* 2008 and *from 2008*, with some different features.
The version up to 2008 (left) has two circuit boards mounted at right-angles to each other.
The version from 2008 (right) only has one circuit board.

The different features of the two versions are indicated in this manual by "*up to 2008*" and "*from 2008*".

Distributed software (firmware) versions (displayed by the LEDs see Reading the software version number):

Devices up to 2008	Devices from 2008
V110 V121	V44 since March 2008 V61 since May 2008

1.3 Differences

Devices up to 2008	From 2008: Version V 44	From 2008: from V61
• Only one calibration strategy • The former positions are adopted after reset (small calibration) • Valve protection every 24 hours if there is no change in actuating value. • Site function always active (25% after adjustment) • Error code in $1FB • Continuous light with known errors	• New calibration strategy: End position via force with fixed stroke. • Cheops always performs two calibration runs and compares the results • Site function is fully deleted after the first download. • No more error codes • Changed LED display during calibration run • Corrective measures are automatically started in the event of an error.	• New calibration strategy: Starting point as position, end point via force. • Valve protection only every 7 days • Calibration strategy code filed in address in $1FB (N.B.: Number can look like the earlier error codes).

1.4 Application options

Cheops drive is used in combination with a continuous room temperature controller.
This involves the actuating value of the room temperature controller (RTC) being combined with Object 0.
In order to avoid unnecessary energy loss if a window is open, the heating output should be reduced in this case, which necessitates the use of window contacts. Because Cheops drive is often positioned near a window, it is possible to use the external interface in this case. In this case, Object 5 is combined with the frost protection or window object of the room temperature controller. To create a simple solution, Object 5 can also be combined with Object 1. In this case, when the window is opened, the valve moves to a pre-defined position.

A switch for presence reporting can be connected via the second input of the external interface. In this case, Object 6 is combined with the comfort object of the room temperature controller.

Object 4 is controlled by a timer or a switch. Cheops drive switches to summer mode via a 1 on this object, i.e. the valve remains closed.
RTC actuating values are ignored, which prevents unnecessary heating, in the morning for instance, before the set point temperature is not yet reached.

Cheops drive can monitor the RTC function and for this purpose regularly expects actuating value messages from the RTC. Should these messages fail, an alarm message can be sent via Object 7. These can be evaluated for maintenance purposes in the central controller.

If a heating boiler with control for needs-driven forward control, the objects 3 (maximum position of all Cheops drive and the corresponding input of the boiler control are connected to a common group address.

1.5 Special features

- Monitoring the actuating value

Cheops drive can control the function of the room temperature controller. To do this, the time delay between 2 actuating value messages is monitored and an alarm message triggered on actuating value failure.

- Determining the maximum actuating value (= maximum position)

To adapt the forward flow temperature, Cheops drive can send an acknowledgement to the heating boiler regarding the current power requirement.
This can reduce its temperature if the requirement drops.

- Window and presence contact inputs

Cheops drive has 2 external inputs, one for a presence contact and
one for a window contact. These inputs can be sent on the bus and used to initiate frost protection or comfort mode.

2 Technical data

2.1 General

Voltage supply:	Bus voltage
Permitted working temperature:	0°C ...+ 50°C
Runtime:	< 20s / mm
Controlling torque:	> 120 N
Max. control stroke:	7.5 mm (linear movement)
Detection of valve limit stops:	Automatic
Linearisation of characteristic valve curve:	Possible via software
Protection class:	III
Protection rating:	EN 60529: IP 21
Dimensions:	HxWxD 82 x 50 x 65 (mm)
Adapter rings suitable for:	Danfoss RA, Heimeier, MNG, Schlösser from 3/93, Honeywell, Braukmann, Dumser (Distributor), Reich (Distributor), Landis + Gyr, Oventrop, Herb, Onda
Typical power consumption	Motor off: < 5 mA Motor on, seal not pressed: 10 mA Motor on, seal pressed: 12..15 mA (depending on force)

3 The Application Program "CHEOPS drive V1.2"

3.1 Selection in the product database

Manufacturer	Theben AG
Product family	valve actuators
Product type	valve actuator
Program name	Cheops drive V1.2

Download the application from: http://www.theben.de

3.2 Parameter pages

Table 1

Function	Description
Characteristics of valve	Standard / user-defined valve settings and transmitting the valve position
Security and forced mode	Monitoring the actuating value, emergency program, actuating value failure, forced operation, maximum actuating value
External interface	Configure inputs for window and presence contact
User-defined characteristics of valve	Inverted valve, fine adjustment of the valve parameters, special characteristic curve, actuating value limitation, response to actuating value changes
Own characteristic curve of valve	Prof. parameters for valves with known characteristic curve
Linear characteristic curve of valve	Parameters for high-end linear valve

3.3 Communication objects

3.3.1 Object characteristics

Table 2

No.	Function	Object name	Type	Response
0	Drive to position	Actuating value	1 byte EIS 6	Receive
1	Drive to forced position	forced position	1 bit	Receive
2	Indicate actual valve position	Actual valve position	1 byte EIS 6	Send
3	Determine maximum position	Maximum position	1 byte EIS 6	Send and receive
4	Close valve in summer	Summer mode	1 bit	Receive
5	Indicate state of window contact	Window contact	1 bit	Send
6	Indicate state of presence contact	Presence contact	1 bit	Send
7	signal failure of actuating value	Failure of actuating value	1 bit	Send

3.3.2 Object description

- **Object 0 "Actuating value"**

Receives the actuating value defined by the room temperature controller (0…10%)
The valve is positioned accordingly.

- **Object 1 "forced position"**

If a 1 is sent to this object, the valve is moved into the predefined position for forced operation (see Security and forced mode).
The valve remains in this position until the forced mode is cleared again by a 0.
This operating mode takes top priority.

- **Object 2 "actual valve position"**

Sends the actual valve position (0…10%) on the bus.
This function can be enabled (e.g. trouble shooting) or disabled.
This object is not required for normal operation.

- **Object 3 "Maximum position"**

This object has the following functions after configuration:

1. Receive the actuating values of the other valve actuators (other rooms) to be able to compare them with the internal actuating value and send the own actuating value to the heating boiler if it is higher than each other one.
2. Send the internal actuating value to the other valve actuators, in order to start a new comparison.

- **Object 4 "Summer mode"**

A 1 on this object starts summer operation, i.e. the actuating value is no longer considered and the valve remains closed.
If valve protection is active, the feature is also run during summer operation
(see "Safety and forced operation").

- **Object 5 "Window contact"**

Sends the status of the window contact input if it is used (see External interface).

- **Object 6 "Presence contact"**

Sends the status of the presence contact input if selected
(see Appendix External interface).

Note:
The window and presence contact objects can be linked to the room thermostat or another of the unit's objects via their group address (see below).

- **Object 7 "Actuating value failure"**

Sends an alarm message if, within a specific period, no new actuating values are received from the room temperature controller.
This object is present only if the "Monitoring the actuating value" parameter has been activated (see parameter page "Safety and forced operation": user-defined and in Appendix: Monitoring the actuating value)

Example of the window contact:

Object 5 "Window contact" be linked either with Object 1 "Forced position" of Cheops drive or with the "Frost protection" object of the room thermostat.
Benefit: If a window is opened for venting, the radiator can be throttled (pre-configured valve position), in order to save heating energy.

Note: If the window input is linked with the forced position and a forced position from (or approximating) 0% is selected, the radiator may freeze when the window is opened for prolonged periods at low outdoor temperatures.

Example of presence contact

Object 6 "Presence contact" can be linked with the "Comfort" object of the room thermometer (e.g. Cheops control).
Benefit: When a room in which the heating temperature has been lowered has been entered, the room thermostat can be set to comfort operation via a switch.

3.4 Parameters

3.4.1 Characteristics of valve

Table 3

Designation	Values	Meaning
Valve settings	**Standard** User-defined	For standard valves and applications Prof. setting options
Transmission of valve position	**no transmission** At change of 1% At change of 2 % At change of 3 % At change of 5 % At change of 7 % At change of 10 % At change of 15 %	Is the new valve position to be sent if it has changed from the last sent value? If yes, from which variance? This function is not required in normal operation and is used largely for diagnostic purposes. When the pre-defined valve position (actuating value) is reached, it is sent even if the selected change since the last message is not reached (apart from "Do not send")
Cyclical transmission of valve position	**Does not send in cycles** Every 2 min Every 3 min Every 5 min Every 10 min Every 15 min Every 20 min Every 30 min Every 45 min Every 60 min	Is the current valve position to be sent in cycles? If so, at what intervals?

3.4.2 Security and forced mode

Table 4

Designation	Values	Meaning
Security settings	**Standard** User-defined	No security settings Monitoring the actuating value and valve protection
Monitoring of actuating value*	**No monitoring** 5 min 10 min 15 min 20 min 30 min 45 min 60 min	Is the reception of the actuating value to be monitored by the room temperature controller (RTC)? Recommended setting: 2x the cycle time of the RTC. See Monitoring the actuating value
Valve position in case of failure of actuating value *	0% 10% 20% 30% 40% **50%** 60% 70% 80% 90% 100%	Setting the emergency program. On actuating value failure, the valve moves into its predefined position. The emergency program is ended as soon as a new actuating value is received.
Transmission of object “failure of actuating value” *	**Only in case of failure of actuating value** Always after a monitoring period has passed	Sent only when the emergency program is active: (Value = 1). Sent at regular intervals: In normal operation with Value 0, in emergency program with Value 1.
Valve position at forced mode	**0%** 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%	Which fixed position is to be approached if the forced operation object is active? One potential application for this function is ventilation.

Continued:

Designation	Values	Meaning
Valve protection*	**Active** Inactive	This function prevents the valve from stopping if it is not actuated for a prolonged period. The valve protection program (if active) is always run if after 24 hrs the control variable has not changed. In this case, the valve is completely open and then closed. This procedure is not indicated on the LEDs.
Transmission of object "Max. actuating value" (for boiler control)	**Only if own actuating value is higher** Every 2 min Every 3 min Every 5 min Every 10 min Every 15 min Every 20 min Every 30 min Every 45 min Every 60 min	For all valve actuators Cyclical transmission time for the one valve actuator, which has to re-initiate the actuating value comparison. This function is required in order to transfer the energy requirement of the entire system to the heating boiler.

* Visible only with **security settings:** ***User-defined***

3.4.3 External interface

Table 5

Designation	Values	Meaning
Function of ext. interface	**None** E1: Window contact, E2: None, E1: Window contact, E2: Presence	Which external interfaces are used?
Type of connected window contact	**Window open – contact closed**, Window open – contact open	Enables both NC and NO contacts to be used
Transmission of window state	**No cyclical transmission** Every 2 min Every 3 min Every 5 min Every 10 min Every 15 min Every 20 min Every 30 min Every 45 min Every 60 min	Is the status of the connected window contact to be sent to the bus?
Type of connected presence contact	**Present = contact closed**, Present = contact open	Enables both NC and NO contacts to be used
Transmission of presence state	**No cyclical transmission** Every 2 min Every 3 min Every 5 min Every 10 min Every 15 min Every 20 min Every 30 min Every 45 min Every 60 min	Is the status of the connected presence contact to be sent to the bus?

3.4.4 User-defined characteristics of valve

This parameter page appears only when the user-defined valve settings are selected on the "Valve characteristics" page

Table 6

Designation	Values	Meaning
Mode of operation of valve	**Normal, closed with pushed tappet** Inverted, open with pushed tappet	For all standard valves Adjustment to inverted valves
Strategy for identifying valve	**Standard**	Standard identification for most valve models.
	Automatic	Only for devices from software V61. The valve is closed with a pre-defined force (see below, "Closing force for" parameter). The 0 % position is checked at the valve with every run and the “100 % open” position is measured at the valve.
	With defined valve stroke	Only for devices from software V61. The 0 % position is checked at the valve with every run and the 100 % (open) position is established from the set stroke.

Continuation:

Designation	Values	Application
Strategy = Standard		
Additional pressing of rubber seal in 1/100mm	0..79 (Default = **20**)	The set value determines the additional pressing in 1/100 mm. This allows the valve to be further closed by a set path if, due to the characteristics of the rubber seal, it fails to close completely. **Caution:** In order to avoid seal damage, the value should be increased by max. 10 increments. Setting: 1 is equivalent to 1/100mm 10 is equivalent to 0.1 mm 20 is equivalent to 0.2 mm etc. See appendix: Valves and valve seals
Strategy = Automatic (from SW V61)		
Closing force for	**Standard valves** Valves with high spring tension	This parameter determines the closing force for the 0 % position
Strategy = With defined valve stroke (from SW V61)		
Closing force for	**Standard valves** Valves with high spring tension	See above.
Valve stroke	2 mm, **3 mm**, 4 mm, 5 mm, 6 mm	The traverse from the 0% to the 100 % position are set manually.
Type of valve seal	**Valve with Standard seal** Valve with hard seal Valve with soft seal Valve with medium-soft seal	This parameter should be changed only if the valve does not open with low control variables. (see Troubleshooting)
Characteristic curve of valve	**Typical characteristic curve** Own characteristic curve Linear characteristic curve	For all standard valve types For special valves with known characteristic curves For high-value valves

Continued:

Designation	Values	Meaning
Minimum actuating value	0% 5% **10%** 15% 20% 25% 30% 40%	Smallest valve position to be approached This parameter prevents the valve whistling if the flow rate is too low.
Behaviour at minimum actuating value underflow	0% **0 % = 0 % otherwise min. actuating value**	Cheops drive runs to 0% for every actuating value that lies below the minimum value For every actuating value that lies below the minimum value, Cheops drive runs to the position of the predefined minimum actuating value. The valve does not close fully until an actuating value of 0% is reached.
Maximum actuating value	60% 70% 75% 80% 85% 90% 95% **100%**	Highest valve position to be approached. Hint: Because most valves do not change their flow between 60% and 100%, the positioning frequency can be reduced by indicating a maximum actuating value of 60%.
Drive to new valve position	position always accurate At change of act. value >1 % At change of act. value >2 % At change of act. value >3 % **At change of act. value >5 %** At change of act. value >7 % At change of act. value >10 % At change of act. value >15 %	The valve is re-positioned each time the control variable is changed. The valve is never re-positioned until the control variable has changed from the last position by more than the set value. Enables frequent, small positioning increments to be suppressed **Important:** Too high values can affect the temperature control.

3.4.5 Own characteristic curve of valve

Prof. setting for special valves.

This parameter appears only when an internal characteristic valve curve has been selected from the "Valve settings" page.
The actuator response can be accurately adjusted using the characteristic valve curve (manufacturer's documentation).
This parameter enables the Cheops drive to be adjusted on a valve at 9 points of the characteristic curve (10%.....90%). A certain flow is reached for each point at a certain % of the valve stroke.

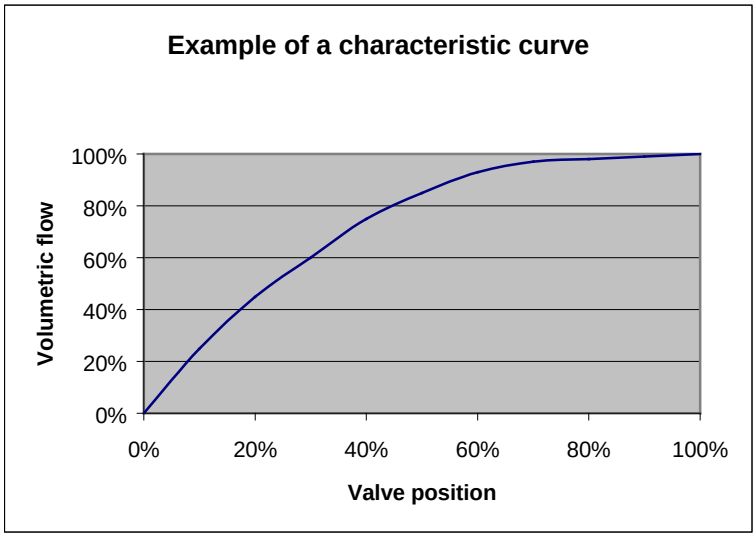
Table 7

Designation	Values	Meaning
Valve position in % for 10% volume flow (1..99)	1..99 (**10**)	At what % valve stroke is a volumetric flow of 10% reached?
Valve position in % for 20 % volume flow (1..99)	1..99 (**20**)	At what % valve stroke is a volumetric flow of 20% reached?
Valve position in % for 30 % volume flow (1..99)	1..99 (**30**)	At what % valve stroke is a volumetric flow of 30% reached?
Valve position in % for 40 % volume flow (1..99)	1..99 (**40**)	At what % valve stroke is a volumetric flow of 40% reached?
Valve position in % for 50 % volume flow (1..99)	1..99 (**50**)	At what % valve stroke is a volumetric flow of 50% reached?
Valve position in % for 60 % volume flow (1..99)	1..99 (**60**)	At what % valve stroke is a volumetric flow of 60% reached?
Valve position in % for 70 % volume flow (1..99)	1..99 (**70**)	At what % valve stroke is a volumetric flow of 70% reached?
Valve position in % for 80 % volume flow (1..99)	1..99 (**80**)	At what % valve stroke is a volumetric flow of 80% reached?
Valve position in % for 90 % volume flow (1..99)	1..99 (**90**)	At what % valve stroke is a volumetric flow of 90% reached?

The values in brackets indicate a linear valve.

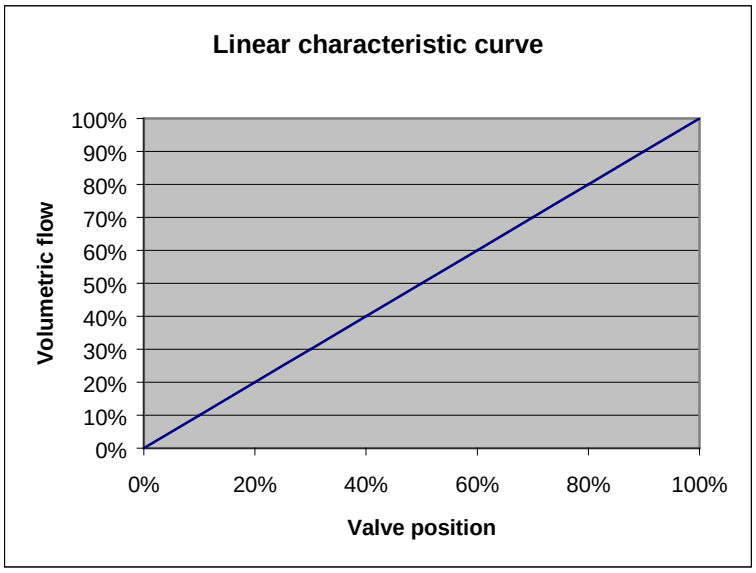
Diagram 1 shows a characteristic valve curve, as occurs frequently in practice.
In this characteristic curve, a 30% flow occurs at a valve stroke as low as 10%. At a valve stroke of 50%, the flow is over 80%.

Diagram 1



A linear characteristic curve as shown in Diagram 2 would be ideal for the control.
A non-linear characteristic curve can be linearised by inputting an own characteristic curve. To do this, the valve position (stroke) at 10, 20.....90% is taken from Diagram 1 and "internal characteristic curve" entered into the parameter page.

Diagram 2



3.4.6 Linear characteristic curve of valve

This setting should be used only for valves described exclusively as linear.
Note: The values can be shown but not changed in this table.

Table 8

Designation	Values	Meaning
Valve position in % for 10% volume flow (1..99)	**10**	At 10% valve stroke, a volumetric flow of 10% is reached, at 20%, a volumetric flow of 20% is reached etc.
Valve position in % for 20 % volume flow (1..99)	**20**	
Valve position in % for 30 % volume flow (1..99)	**30**	
Valve position in % for 40 % volume flow (1..99)	**40**	
Valve position in % for 50 % volume flow (1..99)	**50**	
Valve position in % for 60 % volume flow (1..99)	**60**	
Valve position in % for 70 % volume flow (1..99)	**70**	
Valve position in % for 80 % volume flow (1..99)	**80**	
Valve position in % for 90 % volume flow (1..99)	90	

4 Start-up

IMPORTANT INFORMATION.

- During maintenance work on the radiator, the actuator is always dismounted and the valve securely closed by an alternative method (original protective cap etc…).
  The valve could be unexpectedly opened, potentially causing water damage, through either the control or the valve protection mode.
- Cheops must already be mounted on the valve when the application is downloaded, otherwise no Adaption can take place.

4.1 Installation

First, the unit is mounted onto the valve using the correct adapter ring.
The bus voltage can then be applied.
This automatically starts the adaption process.

When does the adjustment process occur?
Automatic adjustment occurs for the first time after the bus voltage is applied in the Site function, and afterwards each time the application is downloaded.
A new calibration run is performed at regular intervals after reset and during the course of the heating phase.
In order to correct the changes of the Valve characteristics over the course of time (aging of the rubber seal), the valve is automatically remeasured on a regular basis.
NOTE:

- **If an adjusted device is mounted on a different valve, the adjustment process must be repeated by downloading the application.**
- **The previously stored positions are deleted after a download.**
  The calibration run is performed twice on account of the plausibility test.

4.2 Calibration strategies

2 additional calibration strategies from software V61 / V61 (drive).
The aim is to enable adjustment to maximum number of different valves.
The selection of the calibration strategy is made via input in the "Strategy for valve identification" parameter

4.2.1 Strategy 1, standard

The valve is measured during a calibration run (e.g. after reset) and the "valve open" and "valve closed" positions are stored. The calibration run is performed twice after download and the resulting values compared for plausibility. The calibration run is performed until two successive matching value pairs have been measured. These values are then stored and the positions used for future runs. The measured values are compared with the stored values during the calibration run so that the process is only performed once for plausibility.

4.2.2 Strategy 2, Automatic (only for devices from software version 63/ 61 drive)

With this option, only the "Open" valve position is calculated during the calibration run. In order to close the valve, the actuator pushes out the tappet until the set force is exerted on the valve. The following closing forces are available:

Closing force for	Closing force
Standard valves	approx. 100 N
Valves with high spring tension	approx. 120 N

It is always recommended to use the "normal valve" setting first as this is completely sufficient for most valves.
The "Valve with high spring tension" setting should only be tried if you cannot close the valve. This enables the current consumption to be increased to 15 mA during the pressing of the rubber seal.

4.2.3 Strategy 3, with defined valve stroke. (Only for devices from software version 63/61 drive)

With this option, only the Open position of the valve is calculated by working back from a set path from the closing position. In order to close the valve, the actuator pushes out the tappet until the set force is exerted on the valve (closing force for standard valves/valves with high spring tension).
This calibration strategy is primarily to be used if the actuator tappet touches the valve tappet, even if it is completely withdrawn, and measurements cannot be performed.
With a completely unknown valve, the **3 mm** with closing force for standard valves value is a usable starting value.
It is always recommended to use the closing force for standard valves first.
This setting is completely suitable for most valves.
The Valve with high spring tension setting should only be tried if you cannot close the valve. This enables the current consumption to be increased to 15 mA during the pressing of the rubber seal.
The sequence light comes on if this calibration method fails three times.

4.2.4 LED display during calibration run

LEDs	Version up to 2008	Version from 2008
4 3 2 1 **0**	Flashes as long as the spindle is in its maximum inner position	
4 3 2 **1** 0	Flashes until the 100 % position has been found	Flashes while valve is scanned
4 3 **2** 1 0	Flashes until the 0 % position has been found	Flashes during position calculation (can be very brief)

4.3 Site function

While the unit remains in the delivered condition, i.e. no application has been downloaded, Cheops drive functions in site mode.

This causes the valve to open to 25%, in order to prevent the radiator from freezing.

This function enables Cheops drive to **be used immediately on site with limited functions.**

The site function is finally deleted once the application software has been downloaded.
Cheops assumes a predefined position after reset from this point and provided no actuating value has been received.

Up to 2008: Cheops opens the valve to 25 %
From 2008: Cheops completely closes the valves.

The ETS database can be found on our download page: http://www.theben.de/downloads.htm.

4.4 Verification of 0 % position.

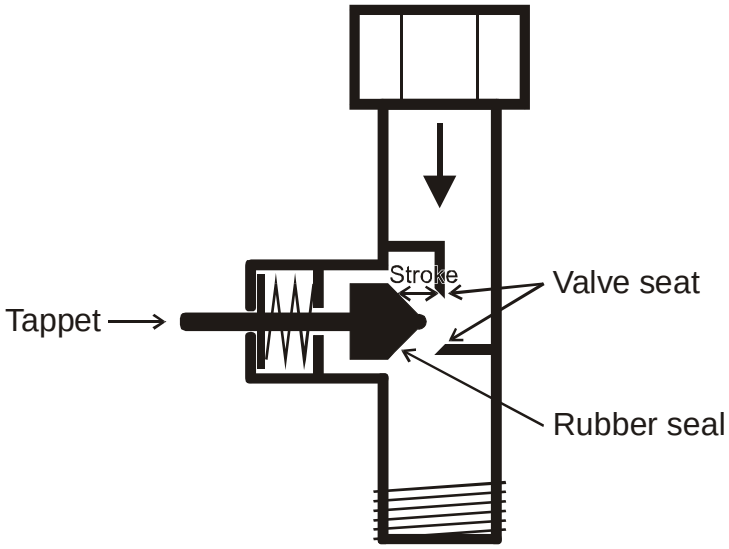
After set-up and completed adjustment it is recommended to check whether a radiator valve closes correctly.
It is essential to wait for the radiator to completely cool down (after heating up during calibration run).
This can take a long time depending on the feed temperature.

Please ensure that no actuating values > 0% are sent to Cheops during this phase.
In addition, forced mode can be activated with 0 % or summer mode as a precaution.

5 Appendix

5.1 Valves and valve seals

5.1.1 Valve structure



5.1.2 Valves and valve seals

When idle, i.e. tappet not actuated, the tappet is pushed outwards by the spring and the valve opens (100% with normal effect).
When the tappet is pushed, the rubber seal is pressed into the valve seat and the valve closes (0% position with normal effect).

The valve does not close immediately on touching the valve seat. Depending on the characteristics, the existing tappet may have to move onwards until the valve is fully closed. This response depends on the hardness, shape, aging or damage to the valve seal.

To correct the influence of this parameter, Cheops allows an additional pressing of the valve seal to be entered (see also Troubleshooting).

Caution: In order to avoid seal damage, the value should be increased by max. 10 increments.

5.2 Limit of actuating value

Cheops drive receives a actuating value (0%…100%) from the room temperature controller or from a Cheops control. It is not usually necessary to use the entire bandwidth of between 0% and 100%).

5.2.1 Maximum actuating value

In the upper ranges of many valves, the flow ceases to vary at actuating values of between 60% and 100%, i.e. the radiator has already heat to an actuating value of 60% at its maximum output.
Consequently, valve actuator readjustment in the upper range can be suppressed without detriment, thereby significantly reducing the positioning frequency.

5.2.2 Minimum actuating value

The unpleasant whistling noise that some valves can generate at low actuating value can be avoided by specifying a minimum actuating value (see User-defined valve characteristics)
If, for instance, this response is determined at below 8%, a minimum actuating value of 10% is specified.
On receipt of a actuating value below the specified limit value, Cheops drive can respond in one of 2 ways ("Behaviour at minimum actuating value underflow "):

- Either move to immediately to 0% ("0%")
- or stop at the position of the minimum actuating value and on receiving the actuating value 0%, closing the valve completely (0%=0% otherwise minimum actuating value)

5.3 Determine the maximum control variable

5.3.1 Application

If within a system all valve actuators are only slightly open, e.g. one at 5%, one at 12%, another at 7% etc., the heating boiler can reduce its output because only a small amount of heating energy is required.
In order to guarantee this, the heating boiler requires the following information:
How high is the actuating value in the room, which currently exhibits the greatest heat requirement?

With Cheops valve actuators, this task is handled by the "Maximum position" function.

5.3.2 Principle

The actuating values are constantly compared between all participants (Cheops valve actuators). Those participant with a higher actuating value than the one received may send it, those with a smaller one may not.
In order to accelerate the process, the greater the difference between its own and the received actuating value, the greater the speed at which the valve actuator sends.
Thus, the valve actuator with the highest actuating value sends first and beats the remainders.

5.3.3 Practice

The actuating value comparison takes place via Object 3 ("Maximum position") where for each valve actuator, a common group address for the maximum position is placed on Object 3.

In order to start the actuating value comparison between the participants, one (and only one) participant must send a value to this group address cyclically.
This task can be handled by either boiler or valve actuator.
If it is the boiler, it must send the smallest possible value, i.e. 0%.
If it is a Cheops valve actuator, the parameter " Transmission of object "Max. actuating value"(for boiler control)" on parameter page " Security and forced mode" must be set to any cycle time.
This valve actuator then regularly sends its own actuating value and the others can respond accordingly.

Irrespective of which participants act as initiator, the "Transm. of object "max. actuating value" (for heating system)" must be set to the default value for all other valve actuators, see Figure:

5.4 Monitoring the actuating value

5.4.1 Application

Should the room temperature controller (RTC) fail, despite the last sent actuating value being 0%, all valves remain closed, irrespective of the continued temperature characteristic curve. This can result in considerable damage, if for example, cold air enters the room when the outdoor temperature is below zero.

To avoid this situation, Cheops drive is able to guarantee the following functions:

- monitor the correct function of the room temperature controller
- start an emergency program on actuating value failure
- send the status obtained from actuating value monitoring

5.4.2 Principle

Cheops drive monitors whether, within the configured time value, at least
1 actuating value message is received and assumes a pre-defined position should the actuating value fail.

5.4.3 Practice

The RTC is configured for cyclical sending of the actuating value.

On Cheops drive, the monitoring time is set to a value that is at least twice the cycle time of the RTC.
If the RTC sends an actuating value every 10 minutes, the monitoring time must be at least 20 minutes.

After an actuating value failure, normal operation is resumed as soon as a new actuating value is received.

5.5 External interface

The external interface consists of inputs E1 and E2.
Both inputs are routed through the Cheops connection line.

The inputs are configured on the "External interface" parameter page.

Depending on the configuration, the current status of the two inputs is sent on the bus and can therefore be evaluated by other participants (Cheops control, room thermostat etc.)

5.5.1 Connections

Table 9

Name	Colour	Function
BUS	Black (-)	EIB bus line
	Red (+)	
E1	Yellow	Binary input for window contact(s)
	Green	
E2	White	Binary input for presence indicator or presence key
	Brown	

5.5.2 Input E1

E1 is used for window contacts (if present).
The window contacts can be connected directly and without additional supply voltage.

5.5.3 Input E2

A presence indicator or key can be directly connected

6 Troubleshooting

Caution: Error codes are only available in the version up to 2008.

Table 10

Response	Error code	Potential cause	Remedy
All LEDs flash as continuous light from bottom to top, i.e. valve adaption was unsuccessful	82	No valve	Plug unit onto valve and reload application
	84	Valve tappet is already touched, although the spindle of the valve actuator is fully returned.	Use other valve adapter. Please contact our Customer Service. When the spindle is returned, the valve tappet must be at least 3/10 mm away from the spindle (see below, Check adapter ring).
	81	Valve tappet cannot be moved, even with maximum force (120N).	Check whether tappet sits correctly, if so, replace valve.
	81	Following start-up, valve actuator with valve was mounted onto a different valve and must be readapted.	Re-download the application, valve actuator is then automatically adapted
	81	Valve seal too heavily pressed	Cancel additional pressing of rubber seal
	83	Valve jams	Check valve

Table 11: General, for every hard and software version.

Valve does not close when actuating value is 0%	Valve seal is insufficient for pressing onto the valve seat	Enter additional pressing of rubber seal. **Caution:** Increase parameter by max. increments of 10 OR (from 2008): Choose another calibration strategy.
	Valve seal is damaged	Replace valve.
Valve opens only with an unexpectedly large actuating value	Existing valve seal is too soft	Adapt parameter type of valve seal. Valve opens only with actuating values over: 5% ⇒Standard valve seal 10% ⇒ medium-soft seal 20% ⇒ select soft seal
Valve doesn´t move to positions below or above a certain value	Minimum or maximum actuating value parameter(s) have been changed	Check minimum and maximum actuating value parameters
No LED display and no automatic adaption after reset	Device was unloaded with ETS software	Reload individual address + application program
Error message with ETS device info / Application program: Run state → Halted	Device was unloaded with ETS software	Reload individual address + application program

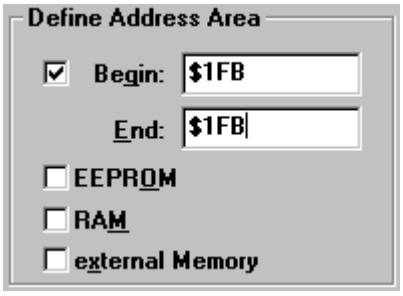
6.1 Read-out error code

IMPORTANT: The error code was replaced by the code for the calibration run from 2008.

Up to 2008:
If the valve causes an error message and the LEDs flash as continuous light, Cheops generates an error code.
This remains in the BCU memory and can (start-up/test) be read-out using the ETS software.

1. Select device in the project and click on Test / Device memory viewer menu item

2. Enter memory area 1FB, deselect RAM and EEPROM



3. Click the button

4. The error code appears in the results window

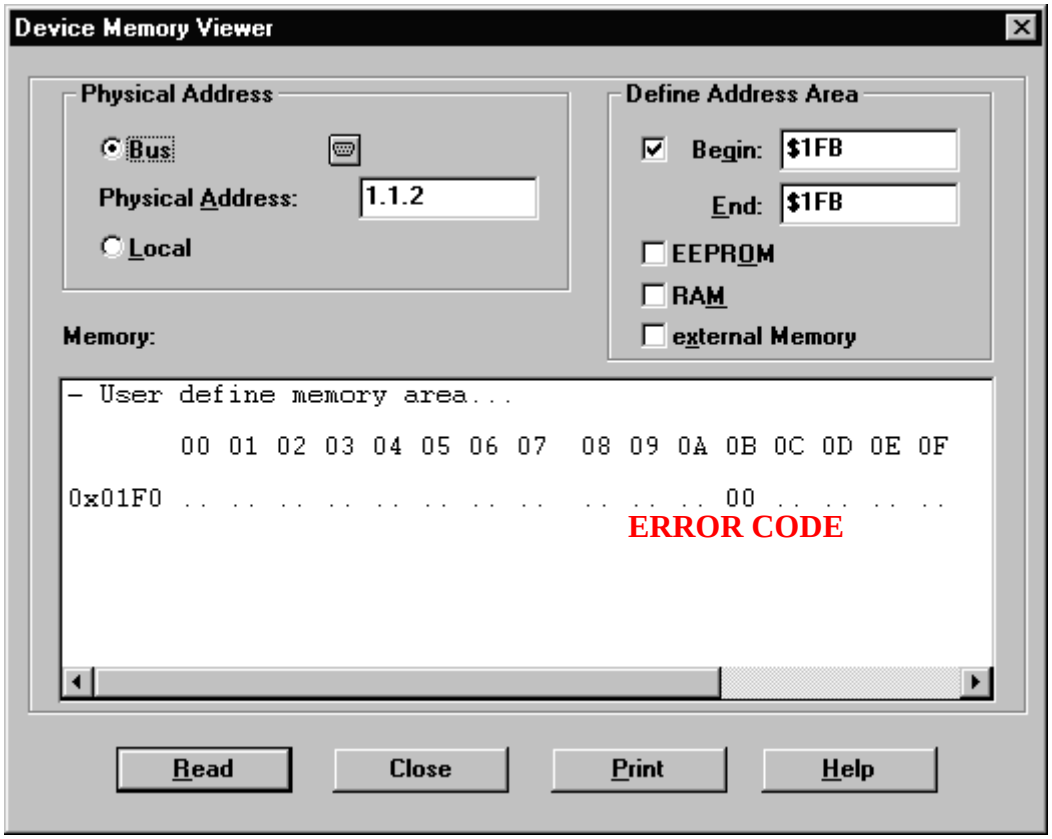


Table 12

Code	Name
00	No error
81	Overload switch-off (overcurrent)
82	Valve not found
83	Valve does not move
84	Stroke too short

6.2 Checking end position

The end positions stored during the adaption process can be read out in exactly the same way as the error numbers using the ETS software.

The internal stop position (spindle inserted, valve open) is stored in Hex-format under the address $1FC and the external stop position under $1FD.

After downloading the application, these values are reset (i.e. $1FC = 00 and $1FD = FF).
The found stop positions are stored here following successful adaption.
If both addresses show 00 after adaption, the adaption is deemed to have been unsuccessful.

To determine the stop positions in millimetres, the values are converted into decimal and divided by 20.

Example calculation:

Table 13

Position	Valve	Address	Hexadecimal Value	Equivalent to decimal value	Result decimal value/20 =
Internal stop	Open	$1FC	24	36	1,8 mm
External stop	Closed	$1FD	61	97	4,85 mm

The stroke is calculated from the two values as follows:

Stroke = external stop - internal stop

In our example:
Stroke = 4.85 – 1.8 mm = 3.05 mm

Limit values for successful adaption

The following values must be respected:

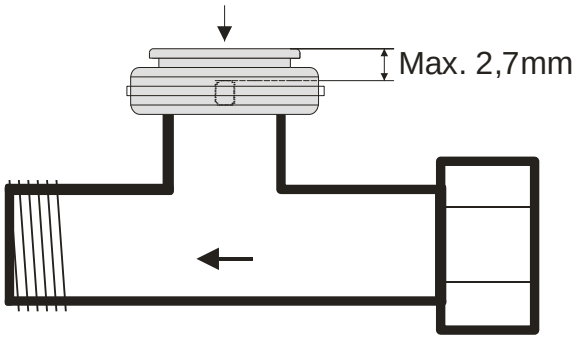
Table 14

Internal stop		External stop		Stroke	
Dimension	Hex value	Dimension	Hex value	Dimension	Hex value
≥ 0,3mm	≥ 6	≤ 7,5mm	≤ 96	≥ 1.2mm	≥ 18

6.3 Checking adapter ring

6.3.1 Depressed status

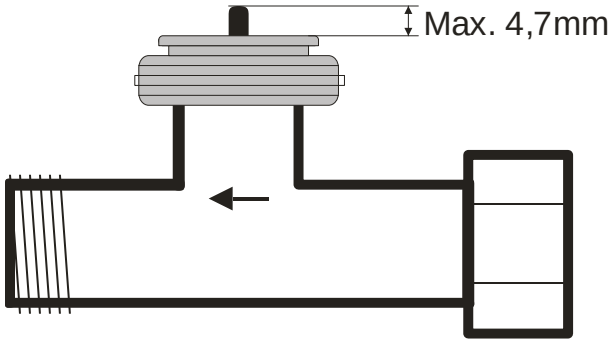
Before + from 2008: The space between the top edge of the adapter and the top edge of the depressed tappet must not exceed 2.7 mm.



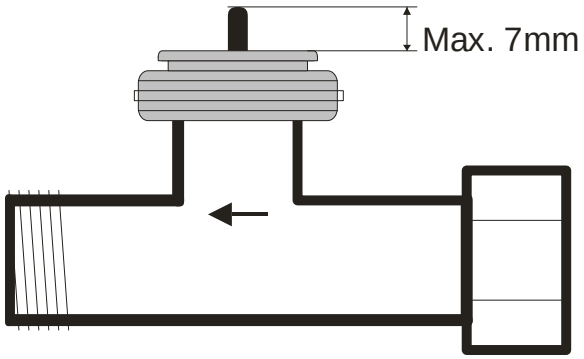
6.3.2 Unpressed status

***Up to 2008*:** The maximum dimension between top edge of adapter ring and end of tappet is 4.7 mm.
If this dimension is under-run, an alternative adapter ring must be used.

***From 2008*:** All calibration strategies can be used up to a maximum dimension of 4.7 mm.



***From 2008*:** A dimension of up to 7 mm can be used with the third calibration strategy.
Caution: The valve cannot completely open with a dimension > 4.7 mm.
This is irrelevant in most cases as the flow of many valves is sufficient if they are half open.
A stroke of up to a maximum of 4.7 mm can be used, so the remaining stroke and characteristic valve curve must 4,7 mm must be estimated to determine whether the valve adapter is suitable.



6.4 Reading the software version number

Cheops displays the current software version via LEDs.
After reset, this is displayed as a binary number in three stages.

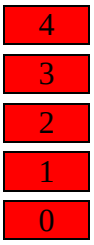
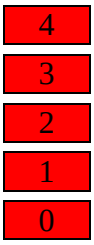
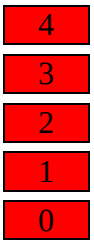
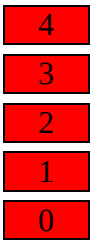
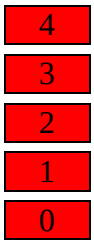
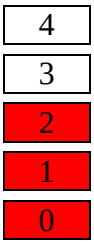
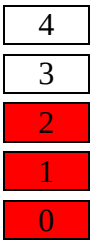
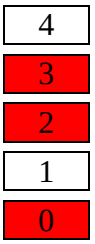
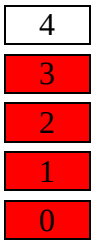
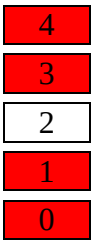
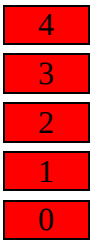
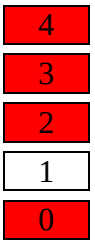
- Stage 1: Full display: All LEDs = ON
- Stage 2: LED 0 is ON and the upper 4 Bits are shown (= Hi-Nibble, value: see table)
- Stage 3: LED 0 is ON and the lower 4 Bits are displayed (= Lo-Nibble).

The values of the individual LEDs are displayed as follows

LEDs	Value
4	8 (=2^3)
3	4 (=2^2)
2	2 (=2^1)
1	1 (=2^0)
0	none

The number is produced from the sum of the values of the illuminated LEDs 1..4.
LED 0 is not counted.

1.2.1 Examples of different versions

Devices from 2008			Devices up to 2008	
Example 1 Version **044** = $2C (1 circuit board)	**Example 2** Version **061** = $3D (1 circuit board)	**Example 3** Version **063** = $3F (1 circuit board)	**Example 4** Version **110** = $6E (2 circuit boards)	**Example 5** Version **121** = $79 (2 circuit boards)
Stage 1 = All LEDs ON				
				
Stage 2 = Hi-Nibble				
				
Stage 3 = Lo-Nibble				
				
00101100 = $2C	00111101 = $3D	00111111 = $3F	01101110 = $6E	01111001 = $79

7 Glossary

7.1 Valve stroke

Mechanical path that is between the two end positions, i.e. 0% (valve closed) and 100% (valve fully open) covered (see Valve arrangement diagram).