Manual

Superheat Controller, type EKD 316

Advantages

- The superheat is regulated to the lowest possible value.
- The evaporator is charged optimally – even when there are great variations of load and suction pressure.

Main features

- Regulation of superheat
- MOP function
- ON/OFF input for start/stop of regulation
- Relay output to alarm

EKD 316 is a superheat controller for the stepper motor valve that can be used where there are requirements for accurate control of superheat in connection with refrigeration.

The controller and valve can be used where there are requirements for accurate control of superheat in connection with refrigeration.

Applications:

- Processing plant (water chillers)
- Cold store (air coolers)
- A/C plant
- Heat pumps
- Air conditioning

Energy savings – the adaptive regulation of the refrigerant injection ensures optimum utilisation of the evaporator and thus a high suction pressure.

MOD bus communication

Safety features and

Alarm indications
Applications

The following gives an idea of the application scope of the EKD 316 controller.

Water chiller using direct expansion

The most common application is water chillers using direct expansion. The regulation can be single loop using an AKS 32R pressure transmitter to measure evaporator pressure and an S2 sensor to measure superheated gas. If double loop regulation is used, the S4 sensor should be located at the water outlet pipe to measure the leaving water temperature. It is recommended to start with factory settings.

The application diagram shows the use of EKD 316 as a superheat controller, where temperature sensor AKS 21A and pressure transmitter AKS 32R have been shown as an example.

Function overview

Minimum Stable Superheat (MSS)

The controller will search for the minimum stable superheat between an upper and lower boundary. If the superheat has been stable for a period, the superheat reference is decreased. If the superheat becomes unstable, the reference is raised again. This process continues as long as the superheat is within the bounds set by the user. The purpose of this is to search for the lowest possible superheat that can be obtained while still maintaining a stable system. The superheat reference can also be fixed, in which case this function is disabled.

Maximum Operating Pressure (MOP)

In order to reduce the stress of the compressor, a maximum operating pressure can be set. If the pressure comes above this limit, the controller will control the valve to provide a lower pressure instead of a low superheat. The limit for this function is usually a fixed pressure, but it is possible to offset the limit temporarily.

Stand-alone function

EKD 316 is designed to operate in conjunction with a system master controller, which will control the EKD 316 via MODBUS or analog signal. It is however possible to use it in a standalone mode using one temperature and one pressure transducer.

Manual Control as a valve driver

The valve can be controlled manually by setting the desired operating degree using MODBUS. Alternatively, the controller may also be started and stopped externally using the analog signal 4 to 20 mA/0 to 10 V d.c./1 to 5 V d.c.

Forced opening during startup

In some applications it is necessary to open the valve quickly when the compressor turns on to prevent suction pressure becoming too low. This is ensured by setting a fixed opening degree and a startup time for the controller. Note that this will give a fixed opening degree for the duration of the start time, regardless of the superheat value.

Relay

The relay for the alarm function is an alternating relay. In the event of an alarm, the relay will close, which may, for instance, be used for an alarm buzzer.
## Manual

### Superheat controller type EKD 316

#### Data

| Supply voltage | ±15% 50/60 Hz, 10 VA (the supply voltage is not galvanically separated from the input and output signals) |
| Power consumption | Controller: 0.3 VA. ETS step motor: 1.3 VA |
| Input signal | 0-20 mA or 4-20 mA |
| Voltage signal | 0-10 V or 1-5 V |
| Pressure transmitter | AKS 32R |
| Digital input from external contact function |  |
| Sensor input | 2 x Pt 1000 ohm |
| Alarm relay | 1 pcs. SPDT (AC-1: 4 A (ohmic) AC-15: 3 A (inductive)) |
| Step motor output | Pulsering 30 - 300 mA |
| Data communication | Mounted with MODBUS data communication |
| Environment | 0 to +55°C, during operations. -40 to +70°C, during transport. 20 - 80% Rh, not condensed |
| Enclosure | IP 20 |
| Weight | 300 g |
| Montage | DIN rail |
| Operation | External display type EKA 164A or AK-ST via data communication and system unit |
| Approvals | EU Low Voltage Directive and EMC demands re: CE-marking complied with. LV-tested acc. to EN60730-1 and EN 60730-2-9. EMC-tested acc. to EN50081-1 and EN 50082-2. |
| Battery backup | If battery backup is used, the requirements for the battery are: 18-24 V d.c. See also page 12. |
| Max. distance between controller and valve | 30 m |

#### Ordering

<table>
<thead>
<tr>
<th>Type</th>
<th>Function</th>
<th>Code no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EKD 316</td>
<td>Superheat controller (with terminals)</td>
<td>084B8040</td>
</tr>
<tr>
<td>EKA 164A</td>
<td>Display (with MODBUS communication)</td>
<td>084B8563</td>
</tr>
<tr>
<td>EKA 183A</td>
<td>Programming key</td>
<td>084B8582</td>
</tr>
</tbody>
</table>

#### Dimensions

![Dimensions Diagram]

#### Connections

##### Necessary connections

**Terminals:**

1-2 Supply voltage 24 V a.c./d.c.

3-4 Battery (the voltage will close the ETS valve if the controller loses its supply voltage). The battery voltage must not be connected from terminals 1 and 2.

5-8 Supply to stepper motor

9-13 Operation via data communication EITHER EKA 164A OR System unit + software. It is important that the installation of the data communication cable be done correctly.

20-21 Switch function for start/stop of regulation.

#### Application-dependent connections

**Superheat control**

- 14-15 PT 1000 sensor at evaporator outlet (S2)
- 15-16 PT 1000 sensor for measuring air temperature (S4)
- 17-19 Pressure transmitter type AKS 32R

**Control of the valves opening degree with analog signal**

- 21-22 Current signal or voltage signal from other regulation (Ext. Ref.)
- 24-26 Alarm relay

There is connection between 24 and 26 in alarm situations.

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### Accessories

<table>
<thead>
<tr>
<th>Pressure transducer</th>
<th>Temperature sensor</th>
<th>External display</th>
<th>Programming key</th>
</tr>
</thead>
<tbody>
<tr>
<td>AKS 32R, NSK</td>
<td>AKS 21, AKS 11</td>
<td>EKA 164A</td>
<td>EKA 183A</td>
</tr>
</tbody>
</table>

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### Warning

Any external connection with grounding could create a ground loop through a diode in the rectifier bridge which could destroy the power supply in EKD 316.
Configuration

Independent superheat regulation

The superheat in the evaporator is controlled by one pressure transmitter P and one temperature sensor S2. This can be done setting s01 = 2.

The expansion valve has a stepper motor of type ETS 6/ETS. Fitting the “s4” temperature sensor is optional, but the regulation is improved by an “inner loop control” when the sensor is fitted.

Valve driver (Via Analog Signal)

This is where the controller receives signals from another controller, after which it controls the valve’s opening degree. The signal can either be a current signal or a voltage signal. The valve can either be an ETS 6, ETS or KVS type. Details can be found on page 13.

Relays

The relay for the alarm function is an alternating relay. In the event of an alarm the relay will close to connect terminals 24 and 26. This can, for instance, be used for an alarm buzzer. When there is no alarm or the controller is off, terminals 24 and 25 are connected.

Parallel evaporators with common suction line

The valve allows the connection of two evaporators in parallel. Since the introduction of EEV, it has been observed the phenomena the so-called Sleeping Evaporators phenomena have been observed. This happens when the outlet of the evaporators has a common suction line. We recommend this inner loop control application mode setting, if the superheating is to be regulated with precision. Here the S4 and T0 temperature are part of an inner loop control. The regulation algorithms require that a temperature sensor be fitted in the chilled medium.

The temperature sensor is connected to input "S4" and mounted in the chilled medium after the evaporator. (Danfoss calls a sensor S4 when it is mounted in the refrigerant after the evaporator).

External start/stop of regulation

The controller can be started and stopped externally via a contact function connected to input terminals 20 and 21. Regulation is stopped when the connection is interrupted. The function must be used when the compressor is stopped. The controller then closes the ETS valve so that the evaporator is not charged with refrigerant.

Battery

For safety reasons the liquid flow to the evaporator must be cut off if there is a power failure to the controller. As the ETS valve is provided with a stepper motor, it will remain open in such a situation. When mounting the battery backup, the valve will close in the event of a power cut.

Data communication

Data communication with the EKD 316 is possible using one of the following two ways:

- 1. Via external display (EKA 164A)
- 2. Via standard MODBUS Device

Via external display (EKA 164A)

Use an external display to operate the controller. This must be done as follows:

Note:

- Max. distance between controller and display is 30 m.
- The supply voltage to the display must be maintained at 12 V +/- 15%.
- The values are shown in three digits, and with a setting you can determine whether the temperature is shown in °C or °F (Pressure in bar or psig).

In order to change a setting, the upper and lower buttons will give you a higher or lower value depending on the button you are pushing. But before you change the value, you must have access to the menu. You obtain this by pushing the upper button for a couple of seconds – you will then enter the column with parameter codes. Find the parameter code you want to change and push the middle button until the value for the parameter is shown. When you have changed the value, save the new value by pushing once more on the middle button.

By pushing the middle button you go directly to the Main Switch setting (r12).

Example

Set a menu

1. Push the upper button until a parameter is shown
2. Push the upper or the lower button and find the parameter you want to change
3. Push the middle button and the value is shown
4. Push the upper or the lower button and select the new value
5. Push the middle button again to conclude the setting

Communication from a third party controller or monitoring system

Settings and values can be read from the EKD 316 via MODBUS. However, the sensor values are from the local sensors and software has not been developed to receive values from another source.

A data list of EKD 316 parameters is provided in Appendix II.

Please note that it is not possible to connect the EKA 164A universal display in this configuration.
Installation

The EKD 316 is normally mounted on a DIN rail, and the necessary connections are shown in the diagram. If the sensor S4 is not used to measure air temperature in connection with thermostat function or as part of the controlling loop, then it is not necessary to connect the S4 sensor. The 18-24 V battery input at terminals 15 and 16 is not required if battery back-up is not needed.

Power supply considerations

The terminals 1 and 2 for the voltage supply are not isolated from the rest of the controller terminals. This means care should be taken when connecting two or more controllers to the same voltage supply. In the example below, the two controllers are connected to the same voltage supply and on the input side, terminals 21 (Analogue Input) are connected to each controller and similarly terminals 22 (GND).

This way of connecting the controllers can cause damage and should be avoided.

Note:
The same applies to other signal inputs e.g. terminals 2 and 4. See warning page 5.

Stepper motor output

After installation the following checks can be made to the connection between the EKD 316 controller and the stepper motor of the ETS 6/ETS valve.

With the power off, check that resistance between terminals 5 and 6 and terminals 7 and 8 is approximately 53 Ohms. Make slight allowances for cable resistance.

If resistance values differ from above, ensure that the cable is properly connected to the actuator of the ETS 6/ETS valve.

With the power on and parameter o18 set to 1, measure the phase current from terminal 5 (or 6) and terminal 7 (or 8) with a true RMS multimeter when the valve is operating. The phase current should be 70 mA rms when operating.

This way of connecting the controllers can cause damage and should be avoided.

Output relay contact

The contact of the alarm relay will be made when there is an alarm.

Battery back-up

A battery back-up can be connected to terminals 3 (+) and 4 (-). The voltage should be at least 18 V and this can be achieved by using two 9 V 100 mAh batteries in series. The back-up voltage can also come from UPS giving 24 V.

If the controllers are operated by a common analogue signal as above, the voltage supply should be separate as shown below.

Installation sensors

S2 sensor positioning in the suction line

The position of the S2 sensor is crucial for an optimal control of the liquid injection.

The main purpose is to measure temperature of the superheated gas leaving the evaporator. In addition to this, the S2 sensor plays an important role detecting fast changes of superheat. Suction pressure is on the whole stable whereas the leaving gas condition is dependent on the temporary mixture of gas, liquid refrigerant and oil.

The sensor is also there to react quickly on liquid passing the evaporator, to avoid damage to the compressor.

An S2 sensor placed two thirds of the way up a riser after an oil trap is where conditions are at their optimum, i.e. good mixture of gas, oil and liquid droplets, provided this is not more than 0.5 m from the evaporator.

If a horizontal pipe is the only option, the S2 sensor must be placed at least half a meter away from the evaporator.

S1 (Po pressure) is less critical but must be close to the actual suction pressure right after the evaporator.

If the measured value is 1-2 K lower than the actual value of Po right after the evaporator, it may cause the evaporator to flood. This is the case when the pressure transmitter is located in the machine room away from the evaporator. If the measured value is higher than the actual value of Po, the evaporator might be starved of liquid.

Choice of S2 sensor type

Surface sensor S2 *

Suction pipe of copper or on thin (≤ 3mm) steel pipe.

Remember to put on heat conducting paste and insulate the sensor.

Pocket sensor S2 **

Suction pipe of steel ≥ 3mm

*) Pt1000 Ω Type AKS21 or AKS10

**) Pt1000 Ω Type AKS21W

AKS 21W

Heat compound

S2 sensor fixing on the suction pipe:

When the S2 sensor is fixed to the surface of the suction pipe, the angle of the sensor position will depend on the diameter of the pipe, as given in the following diagram:
Start of controller
When the electric wires have been connected to the controller, the following points have to be attended to before the regulation starts:
1. Switch off the external ON/OFF switch that starts and stops the regulation.
2. Follow the menu survey in Appendix I, and set the various parameters to the required values.
3. Switch on the external switch, and regulation will start.
4. Follow the actual superheat on the display.

Settings and checks to be made before start

Basic settings
Before using the EKD 316 controller, there are settings that have to be made for each individual application. These are the refrigerant type, the pressure transducer range and the total number of steps for the ETS valve.

It is good practice and in some cases necessary to set the Main Switch (r12) to OFF when making these changes. If terminal 20-21 has been used as a start/stop regulation, then the Switch r12 to OFF when making these changes.

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Refrigerant type
It is possible to choose from a list of 37 different refrigerants in the controller:

If the refrigerant is not found on the list, it is possible to enter the Antoine constants for the unlisted refrigerant using MODBUS communication and setting o30 to 13.

ETS valve type
It is important to select the right valve type as listed under Valve definition. On using external display EKA 164A, the valve selection will be displayed as 25, 50, 100, 250, 400, uS, SaF, 6 and CC.

The number of steps and steps/sec can also be set in the controller at addresses n37 and n38 respectively.

In practise, the EKD 316 external display can only manage three digits. Therefore the set value at address n37 is always 10 times greater, i.e. if n37 is set to 263 then the true value is 2630. The same applies to the n37 address in the MODBUS communication system.

Pressure transmitter
The range of the pressure transmitter can be set by entering the transmitter’s minimum value at address o20 and maximum value at address o21. The pressure sensor input is set up by default to accept an AKS 32R pressure transducer. If another sensor is to be used, it is important to note that it needs to be a 5 V ratiometric type (10%-90% of supply voltage).

Working range for pressure transmitter
Depending on the application a pressure transmitter with a given working range is used.

For the range of (-1 to 12) bar, the min. value is set to -1 bar o20 MinTransPres.
For the range of (-1 to 12) bar, the max. value is set to 12 o21 MaxTransPres.

ETS valve type
For the range of (-1 to 12 bar), the max. value is set to 12 bar o21 MaxTransPres. and the maximum transducer pressure, “o20 MinTransPres.”

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Operation
Superheat function
You may choose between two kinds of superheat regulation, either:
• Minimum stable superheat (MSS)
• Load defined superheat

The regulation modes for controlling superheat
There are two different ways of controlling superheat, i.e. controlling according to the minimum stable superheat (MSS) and

Load defined superheat
The parameter SH mode selects the controlling form where it can be set to MSS when set to 1, or Load Defined superheat when set to 2.

Minimum stable superheat (MSS)
The superheat control algorithm will attempt to regulate the superheat down to the lowest stable superheat value between the minimum superheat setting, “Min SH” and the maximum superheat setting, “Max SH”.

The superheat reference SH-ref is adaptive and adjusted.
When using this form of control, there are three settings that have major affect on this mode of control.

Max SH – The maximum limit of SH ref. If the maximum value is too low in order to avoid flooding back into the compressor.
Min SH – The minimum limit of SH ref. Care should be taken not to set this value too low in order to avoid flooding back into the compressor.

Stability – This factor determines how much instability can be accepted. Small values will cause the SH ref to increase if the slightest instability on SH is detected. Higher values will accept a higher degree of instability.

The reference follows a defined curve. This curve is defined by three values: the closing value, the min. value and the max. value.

These three values must be selected in such a way that the curve is situated between the MSS curve and the curve for average temperature difference ∆Tn (temperature difference between media temperature and evaporating temperature. Setting example = n22=4, n10=6 and n99=10 K).

Using the MOP
In order to reduce the current to the compressor it is possible to control the maximum operating pressure of the evaporator. Evaporator pressure exceeding the “MOP” limit, the valve opening degree is controlled by the MOP function which will keep the pressure below the “MOP” limit. This function takes precedence over the superheat control, so during MOP control the superheat is not controlled.

The MOP function (address n11) is active when it is set to values less than 200 bar (200 bar corresponds to 0). The pressure value is converted to the corresponding temperature value and when the MOP is active, the controller will prevent the evaporating temperature T1 from exceeding this value.

If Maximum Operating suction Pressure MOP parameter n11 is reset from factory setting 20 to 1 bar (gauge) From the MOP i.e 1 bar point the OD increases slower and slower until the pressure reaches MOP + 0.5 i.e 1.5 bar. Subsequently the OD decreases rapidly as the pressure increases.

Manual Superheat controller type EKD 316

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Types of regulation
As a general rule, do not use mode 2 (Load define application) if the effect is not evaluated by e.g. an OEM chiller manufacturer in a laboratory. An incorrect setting will only make regulation poorer than the factory setting of mode 1.

Single Loop (address 056 Reg.type = 1)
The EKD 316 has the traditional PI controlling function with the Kp factor for Proportional Gain and Tn for Integration Time in seconds. This is also known as the Single loop control with only one PI block, as shown in the diagram below.

Double Loop (address 056 Reg.type = 2)
The controller can regulate the superheat using a double loop system. The so-called outer loop is really the same as in the single loop system except that the output of PI block is the reference for the inner loop.

The feedback of the inner loop is the temperature difference between media temperature S4 and S1. This value represents the fixed superheat reference by making SH max the same as SH min.

The inner loop also has a PI block where the Proportional Gain factor is KpT0 and the Integration Time is TnT0.

The feedback of the inner loop is the temperature difference between media temperature S4 and S1. This value represents the load on the evaporator and large values will tend to increase the opening degree OD% of the valve.

The tuning of the double loop is more complicated than the single loop and it is advisable not to change too many parameters at the same time. The starting point should be to use the following settings:

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kp factor</td>
<td>n04</td>
<td>0.7</td>
</tr>
<tr>
<td>Tn sec</td>
<td>n05</td>
<td>120</td>
</tr>
<tr>
<td>KpT0</td>
<td>n20</td>
<td>3</td>
</tr>
<tr>
<td>TnT0 sec</td>
<td>n44</td>
<td>30</td>
</tr>
</tbody>
</table>

The opening degree of the ETS can be operated manually from the external display (or via MODBUS).

When tuning the superheat stability, it is good practice to have a fixed superheat reference by making SH max the same as SH min.

Note:
- If the superheat is unstable, the KpT0 parameter should be slightly reduced. The value parameter Kp factor is not large so it is gained by reducing this parameter.
- For details refer to the "Finding the optimum setting" section.

Recommended control loop type and settings for some applications
From the experience of using single loop and double regulation, the following recommendations are given. These are only recommendations and the final choice is made by the end user.

### Application | Reg. type | Kp factor | Tn sec | KpT0 | TnT0 sec
--- | --- | --- | --- | --- | ---
Air cooler | 1 (Single loop) | 3.0 | 120 | 0.4 | -
Water chiller | 2 (Double loop) | 0.7 | 120 | 2.0 | 30

### Types of operation

#### Manually operating the valve
There are two modes for operating the valve manually, and these are described in the following sections.

**Operating the valve manually from the external display (or via MODBUS)**
The opening degree of the ETS can be operated manually by setting parameter o18 to 1 and then setting parameter o45 to the required opening degree between 0% and 100%. Relay outputs can also be checked using parameter o18.

<table>
<thead>
<tr>
<th>Manual control of outputs</th>
<th>018 Manual ctrl</th>
</tr>
</thead>
<tbody>
<tr>
<td>For service purposes the ETS 6/ETS output and alarm relay outputs can be forced, but only when regulation has been stopped. Off: No override. 1: Manual control via o45 is enabled. 2: The alarm relay releases so that there is a connection between 24 and 25 (= alarm). 3: The alarm relay picks up so that there is a connection between 25 and 26 (= no alarm).</td>
<td></td>
</tr>
<tr>
<td>Manual control of the valve's opening degree</td>
<td>045 0-100% valve OD</td>
</tr>
</tbody>
</table>

**Operating the valve manually using an external analogue signal**
The opening degree of the ETS 6/ETS valve can be operated manually with 0 to 20 mA or 4 to 20 mA or 0 to 10 V or 1 to 5 V external analogue signal connected to terminals 21 (−) and 22 (+) of the controller.

<table>
<thead>
<tr>
<th>Controlling a valve with an analogue signal</th>
<th>061 Application mode 061=1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input signal for external control of the valve's opening degree</td>
<td>o10 Ai type</td>
</tr>
<tr>
<td>Only used if o61 is set to 1. Definition of the signal's range: 0: No signal 1: 0-20 mA 2: 4-20 mA 3: 0-10 V 4: 1-5 V (At the lower value the valve will be closed. At the upper value the valve will be fully open. There is a linear relationship between the signal and the opening degree. The height of the valve is not taken into account.)</td>
<td></td>
</tr>
</tbody>
</table>

#### Note:
The S4 sensor has to be connected when Reg. type = 2, otherwise an alarm sounds.

#### Note:
After o56 is changed, the controller must be switched off and powered up again.
Finding the optimum settings
Details on the controller algorithm and settings

Kp factor (n04) and Kp min (n19)
The Proportional Gain is dependent on the value of the measured superheat SH relative to Reference superheat SH ref. The Proportional Gain has the following values relative to superheat SH:

- If SH is more than 2.5K greater than SH ref, then Gain equals Kp factor.
- If SH is within the range -0.5 and 2.5K from SH ref, then Gain equals Kp factor times Kp min.

The reason for this variable Gain is to provide stable superheat for values near the superheat reference.

Note:
The value of Gain does not change suddenly but gradually when

Kp factor

OD%

Start

Kp factor* (SH - SH Close)

when Kp factor = 3, SH = 12, close = 2

If the superheat fluctuates
When the refrigerating system has been made to work steadily, the controller’s factory-set control parameters should in most cases provide a stable and relatively fast regulating system. If the system, however, fluctuates this may be due to the fact that superheat parameters that are too low have been selected. Before starting any adjustment of the factory settings check the 52 sensor location – see page 9.

If adaptive superheat has been selected (n27 = 1):
Adjust: n09, n10 and n18.

Alternatively it may be due to the fact that the set regulation
parameters are not optimal.

If load-defined superheat MSS has been selected (n27 = 2):
Adjust: n09, n10 and n22.

If the time of oscillation is longer than the time of integration:

- If Tp > 2Tn (Tn is e.g. 240 seconds)
  1. Increase Tn to 1.2 times Tn
  2. Wait until the system is in balance again
  3. If there is still oscillation, reduce Kp by e.g. 20%
  4. Wait until the system is in balance
  5. If it continues to oscillate, repeat 3 and 4

If the time of oscillation is shorter than the time of integration:

- If Tp < Tn (Tn is e.g. 240 seconds)
  1. Reduce Kp by e.g. 20% of the scale reading
  2. Wait until the system is in balance
  3. If it continues to oscillate, repeat 1 and 2.
Appendix I

Menu survey

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Min.</th>
<th>Max.</th>
<th>Fac. set-ting</th>
<th>Application choice</th>
<th>menu</th>
<th>e=01</th>
</tr>
</thead>
<tbody>
<tr>
<td>The menus from either column 1 or column 2 are shown</td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal display</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During regulation the actual level of superheating is displayed.</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If you would like to see the display's actual opening degree, press the bottom button for approx. one second.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During control with an analogue signal the opening degree is displayed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valve definition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery monitoring A34 Off/0 On/1 Off/0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Units (°C=bar/°F=psig) r05 0 1 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start/stop of refrigeration r12 Off/0 On/1 Off/0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error code (only if n03 = 5 (User-defined)) n04 0.5 20 2.0/0.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal reliability during startup: Safety time period. Should only be changed by trained staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal reliability during startup – opening degree's start value. Should only be changed by trained staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stability factor for superheat control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changes should only be made by trained staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changes of amplification around reference value</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of steps from 0-100% opening degree (only if n03 = 5 (User-defined)) n32 0 % 100 % 100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valve overview</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n37</td>
<td>n38</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>ETS 12, ETS 25, KVS 15</td>
<td>5</td>
<td>Sagomotya UVK/9VK/UV/9VK</td>
<td>n03 0 8 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>ETS 100, CCM 40</td>
<td>7</td>
<td>ETS 9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>ETS 250, KVS 42</td>
<td>8</td>
<td>CCM 2, CCM 4, CCM 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>ETS 400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Manual

Superheat controller type EKD 316

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This function is only for manual operation. It must not be used as a regulation function.

Selection of control mode:
1: Normal
2: With inner loop (S media temperature less T0)

Application mode. Menus blanked out so only the shaded menus are seen. See the two columns to the right.
1: Controlling a valve with an analogue signal
2: Superheat regulation

Manual control of the valve's opening degree. The function can only be operated if e18 has been set to 1.

---

Manual control of outputs:
1: Manual control with "o65" enabled
2: Simulate Alarm off: connection between 24 and 25
3: Simulate Alarm on: connection between 24 and 26

Working range for pressure transmitter - min. value | 0.0 1 bar | 0 bar | 1.0 |

Refrigerant setting | 37 | 6 |

Factory settings are indicated for standard unit (see code number, page 1). Other code number have customised settings.

---

Superheat controller type EKD 316

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Configuration settings (n03, n07, n18, n30, n40, n60, n90 and n15) available only when regulation is stopped (y12=off).
Factory settings are indicated for standard unit (see code number, page 1). Other code number have customised settings.

---

Valve overview
Survey of functions

### Survey of functions (continued)

#### Normal display
The superheat is normally shown.
The opening degree is displayed during manual operation or if the valve is under analogue control.

#### Reference
Here you select whether the controller is to indicate the temperature values in °C or °F and pressure values in bar or psig.
If indication in °F is selected, other temperature settings will also switch to Fahrenheit, either as absolute values or as delta.

#### Correction of signal from S2
(Correction possibility through long sensor cable).

#### Start/stop of refrigeration
With this setting, refrigeration can be started and stopped. Start/stop of refrigeration can also be accomplished with the external switch function. See also appendix 1.

#### Alarm
If there is an alarm, the LEDs on the front of the external display will flash if it is connected. The alarm relay in the controller is closed.

#### Battery alarm
Here it is defined whether the controller is to monitor the voltage from the battery connected. The alarm relay in the controller is closed.

### Control parameters

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve definition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 = ETS 12½, ETS 25, KVS 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 = ETS 50, CCM 10, CCM 20, CCM 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 = ETS 100, CCM 40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 = ETS 250, KVS 42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 = ETS 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On using external display EKA 164A, please check page 9 section ETS valve</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Injection control

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amplification factor Kp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If the Kp value is reduced the regulation becomes slower.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integration time Tn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Tn value is increased the regulation becomes slower.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differentiation time Td</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The D-setting can be cancelled by setting the value to min. (0).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. value for the superheat reference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min. value for the superheat reference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A: Warning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Due to the risk of liquid flow, the setting should not be lower than approx. 2-4 K.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOP: Note</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If no MOP function is required, select pos. Off. (A value of 200 corresponds to Off)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Startup time for safety signal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The controller does not obtain a reliable signal within this period of time the controller will try to establish a stable signal in other ways. (A value that is too high may result in a flooded evaporator).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The value should only be changed by specially-trained staff.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal safety during startup</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The control function uses the value as a start value for the valve's opening degree at each thermostat cut-in. By adaptive control the controller continuously calculates a new value.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The value should only be changed by specially-trained staff.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stability factor for regulation of superheat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With a higher value, the control function will allow a greater fluctuation of the superheat before the reference is changed. The value should only be changed by specially-trained staff.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Parameter by operation via data communication

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal display</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The superheat is normally shown.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The opening degree is displayed during manual operation or if the valve is under analogue control.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Here you select whether the controller is to indicate the temperature values in °C or °F and pressure values in bar or psig.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If indication in °F is selected, other temperature settings will also switch to Fahrenheit, either as absolute values or as delta.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correction of signal from S2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Compensation possibility through long sensor cable).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start/stop of refrigeration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With this setting, refrigeration can be started and stopped. Start/stop of refrigeration can also be accomplished with the external switch function. See also appendix 1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If there is an alarm, the LEDs on the front of the external display will flash if it is connected. The alarm relay in the controller is closed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery alarm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Here it is defined whether the controller is to monitor the voltage from the battery connected. If there is low voltage, or no voltage, an alarm will be given.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Miscellaneous

<table>
<thead>
<tr>
<th>Function</th>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kp factor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tn sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Td sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. SH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min SH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOP: Note</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If no MOP function is required, select pos. Off. (A value of 200 corresponds to Off)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>StartUp time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The controller does not obtain a reliable signal within this period of time the controller will try to establish a stable signal in other ways. (A value that is too high may result in a flooded evaporator).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The value should only be changed by specially-trained staff.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal safety during startup</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The control function uses the value as a start value for the valve's opening degree at each thermostat cut-in. By adaptive control the controller continuously calculates a new value.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The value should only be changed by specially-trained staff.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stability factor for regulation of superheat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With a higher value, the control function will allow a greater fluctuation of the superheat before the reference is changed. The value should only be changed by specially-trained staff.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Definition of superheat regulation
2. Load-defined superheat. The reference is established based on the line formed by the three points: n09, n10 and n22.

#### Value of min. superheat reference for loads under 10%
The value must be smaller than “n10”.

#### Max. opening degree
The valve's opening degree can be limited. The value is set in %.

#### Number of steps from 0% to 100% open
(Open defined valve, n03 = 5)

#### Stability factor for regulation of superheat
With a higher value, the control function will allow a greater fluctuation of the superheat before the reference is changed. The value should only be changed by specially-trained staff.

#### Start OD%

### Manual
Superheat controller type EKD 316

#### Survey and function (continued)

#### Damping of amplification near reference value
This setting damps the normal amplification Kp, but only just around the reference value. A setting of 0.5 will reduce the KP value by half. The value should only be changed by specially-trained staff.

#### Amplification factor for the superheat
This setting determines the valve's opening degree as a function of the change in evaporating pressure. An increase of the evaporating pressure will result in a reduced opening degree. When there is a drop-out on the low-pressure thermostat during startup, the value must be raised slightly. If there is pending during start-up, the valve must be reduced slightly.

The value should only be changed by specially-trained staff.

#### Definition of superheat regulation (Ref. section "Operation")
2. Load-defined superheat. The reference is established based on the line formed by the three points: n09, n10 and n22.

#### Value of min. superheat reference for loads under 10%
(Open defined valve, n03 = 5)

#### Max. opening degree
The valve's opening degree can be limited. The value is set in %.

#### Number of steps from 0% to 100% open
(Open defined valve, n03 = 5)

#### Spindle stroke speed
(Definition when valve is selected in n03).

#### Integration time for the inner loop gain
(Definition when valve is selected in n03).

#### Miscellaneous

#### Address/data communication
The controller must always have an address. The factory-set address is 240. When an external display is connected, the display itself will find the address of the controller so that communication can take place.

#### Note:
A display and a system unit must not be connected at the same time.

The display will not be able to communicate in this situation.

If the controller is to be part of a network with other controllers and a system unit, the controller's address must be within the range 1 to 200.

This address must EITHER be set via a display before it is connected to the data communication cable, OR the controller's address must be within the range 1 to 200.

The display will not be able to communicate in this situation.

#### Requirements for the installation and data communication cable are discussed in the separate document no. "RC8AC".

#### The controller can be operated via the system unit and AK service tool.

#### It cannot be operated via AN08 type system software.

#### Application mode
1. The controller receives signals from another controller and must control the valve’s opening degree.
2. Superheat regulation.

#### Input signal for external control of the valve's opening degree
Only used if o61 = 2

#### The valve should only be changed by specially-trained staff.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOP: Note</td>
<td>If no MOP function is required, select pos. Off. (A value of 200 corresponds to Off)</td>
</tr>
<tr>
<td>StartUp time</td>
<td>The controller does not obtain a reliable signal within this period of time the controller will try to establish a stable signal in other ways. (A value that is too high may result in a flooded evaporator).</td>
</tr>
<tr>
<td>The value should only be changed by specially-trained staff.</td>
<td></td>
</tr>
<tr>
<td>Signal safety during startup</td>
<td>The control function uses the value as a start value for the valve's opening degree at each thermostat cut-in. By adaptive control the controller continuously calculates a new value.</td>
</tr>
<tr>
<td>The value should only be changed by specially-trained staff.</td>
<td></td>
</tr>
<tr>
<td>Stability factor for regulation of superheat</td>
<td>With a higher value, the control function will allow a greater fluctuation of the superheat before the reference is changed. The value should only be changed by specially-trained staff.</td>
</tr>
</tbody>
</table>
Survey and function (continued)

**Manual control of outputs**
For service purposes the ETS-output and alarm relay outputs can be forced. However, only when regulation has been stopped.

- OFF: No override
- 1: Manual control via o45 is enabled
- 2: The alarm relay releases so that there is a connection between 24 and 25 (= alarm)
- 3: The alarm relay picks up so that there is a connection between 25 and 26 (= no alarm)

**Manual control of the ETS valve**
The valve’s opening degree can be set manually. However, it does require “o18” to be set to “1”, “2”, or “3”. This function must only be used for manual operation. It must not be used for external control.

**Working range for pressure transmitter**
Depending on the application, a pressure transmitter with a given working range is used.

- For the range of (-1 to 12 bar), the min. value is set to -1 bar.
- For the range of (-1 to 12 bar), the max. value is set to 12 bar.

**Selection of control algorithm**
Depending on the application, control can be carried out based on different parameters.

- 1=normal control (single loop)
- 2=with inner loop regulation and S4 temperature less T0 (double loop)

**Note:** After o36 is changed, the controller must be switched off and powered up again.

**Refrigerant setting**
Before refrigeration can be started, the refrigerant must be defined. You can select the following refrigerants:

1 = R12
2 = R134a
3 = R502
4 = R717
5 = R13
6 = R13b1
7 = R23
8 = R22
9 = R500
10 = R13b
11 = R114
12 = R142b
13 = User-defined

A number of controller values can be printed for use in a service situation.

**Example:**
EKD 316 as simple ETS valve driver function with the following settings:

- PNU 117 [0] r12 Main switch = 0
- PNU 2064 [OD%] o45 Manual ETS OD% (replace 0-10V signal)
- PNU 3032 [262] n37 Max. steps 2620
- PNU 3033 [250] n38 Steps pr. sec 250
- EKD 316 address: 240
- PNU 2064 will go back to 0% at power off as the only one

**Appendix II**
General information to MODBUS communication via a PLC etc.

- Baudrate: 19200
- EKD Address: 240
- Polarity A-A and B-B
- Termination with 120 ohm resistor

Some parameters have what is called a “config lock”. This means that they can only be changed when the main switch of the EKD is set to OFF (r12 = 0). This applies for instance to the type of refrigerant (o30). If you want to change the refrigerant, the main switch (r12) must first be set to 0; then the refrigerant type (o30) can be changed.

The following parameters require the main switch to be OFF:

- n03 Valve type
- n37 Max steps
- n38 Max steps/sec
- o03 Unit address
- o30 Refrigerant
- o56 Regulation type
- o61 Application mode

Please refer to the manual for descriptions of these parameters.

It should be possible to change all other parameters while the unit is running (regulation parameters etc.).
### Installation considerations

Accidental damage, poor installation, or site conditions can give rise to malfunctions of the control system, and ultimately lead to a plant breakdown. Every possible safeguard is incorporated into our products to prevent this. However, an incorrect installation, for example, could still present problems. Electronic controls are no substitute for normal, good engineering practice.

Danfoss will not be responsible for any goods, or plant components, damaged as a result of the above defects. It is the installer's responsibility to check the installation thoroughly, and to fit the necessary safety devices.

Particular attention is drawn to the need for a “force closing” signal to controllers in the event of compressor stoppage, and to the requirement for suction line accumulators.

Your local Danfoss agent will be pleased to assist with further advice, etc.

---

### List of literature

www.danfoss.com

Click: "Technical literature" in the left bar

Click: Refrigeration and Air Conditioning  > Technical literature

Paste or write the no. in the box “ Literature No. ”

- **Catalogue** RK0YG
- **ETS valves, technical brochure** DKRCC.PD.VD
- **Installation guide for data communication** RC8AC

---

### EKD 316 – Parameter identification (modbus)

#### Parameter identification

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN0108 Addr</td>
<td>Register address (modbus)</td>
</tr>
</tbody>
</table>

#### Explanations:

- **Parameter**
  - The parameter name and description
- **PNU**
  - The Parameter Number
- **Max**
  - The maximum value of the parameter
- **Default**
  - The default value of the parameter (factory setting)
- **Actual value**
  - Values are read/written as 16 bit integer values without decimals. This is the default value as read via modbus

#### Scope

- This shows the scaling factor of the value. *1 means that there is no scaling and that the read value is 10 times larger than the actual value.

#### Injection control (1)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNU</td>
<td>0x0001</td>
<td>IN0108 Addr</td>
</tr>
<tr>
<td>RW</td>
<td>0</td>
<td>Register write only</td>
</tr>
<tr>
<td>Min</td>
<td>0</td>
<td>Minimum value</td>
</tr>
<tr>
<td>Max</td>
<td>0x00FF</td>
<td>Maximum value</td>
</tr>
<tr>
<td>Default</td>
<td>0</td>
<td>Default value (factory setting)</td>
</tr>
</tbody>
</table>

#### Miscellaneous (11)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNU</td>
<td>0x0014</td>
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#### Service (12)

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<td>Max</td>
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#### Alarms (13)

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#### Danfoss only (14)

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<td>Minimum value</td>
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<tr>
<td>Max</td>
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<tr>
<td>Default</td>
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<td>Default value (factory setting)</td>
</tr>
</tbody>
</table>

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### Parameter PNU R/W Config lock Min Max Default Actual value Scale

- **Injection control (1)**
  - n04 Kp factor 3003 R/W 0.5 20.0 2.0 20 *10
  - n05 Tn seconds 3004 R/W 30 600 120 120 *1
  - n06 Td seconds 3005 R/W 0 90 0 0 *1
  - n09 Max SH 3015 R/W 2.0 15.0 10.0 100 *10
  - n10 Min SH 3021 R/W 1.0 12.0 6.0 60 *10
  - n11 MOP 3013 R/W 0.0 200.0 20.0 200 *10
  - n15 Start time 3017 R/W 1 90 0 0 *1
  - n17 EKD2Serial 3011 R/W 0 0 0 0 *1
  - n18 Stability 3014 R/W 0 5 0 0 *1
  - n19 Tp max 3024 R/W 0.0 1.0 0.2 0.4 *1
  - n20 Tp T0 3025 R/W 0.0 10.0 0.4 4.0 *1
  - n21 SH mode 3026 R/W 0 1 0 0 *1
  - n22 SH close 3027 R/W 1.0 15.0 4.0 40 *10
  - n32 ETS OD% Max 3023 R/W 0 100 100 100 *1
  - n44 TnT0 sec. 3039 R/W 10 120 30 30 *1
  - o56 Reg. type 2076 R/W x 1 2 1 1 *1

### Motor(2)

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<td>n38 Max StepsSec 3033 R/W x 5 300 300 300 *1</td>
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<td>n39 Start backlash 3034 R/W x 0 100 10 10 *1</td>
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<td>n40 Backlash 3035 R/W x 0 100 23 23 *1</td>
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### Alarm settings (3)

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<td>o02 Adjust S1</td>
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<tr>
<td>o03 Adjust S2</td>
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<td>o04 Adjust S3</td>
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<td>o05 Alarm input</td>
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</tr>
<tr>
<td>o06 Diag. code</td>
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### Manual Superheat controller type EKD 316

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### Superheat controller type EKD 316

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### Danfoss only (14)

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<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>PNU</td>
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![Danfoss logo](image-url)

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