Superheat controller
EKC 315A

REFRIGERATION AND
AIR CONDITIONING

Manual

Contents

The parameter list in this technical leaflet is valid for software versions 1.3x .

Introduction

The EKC 315A controller can be applied where there is a need for accurate control of superheat and temperature in refrigeration systems, for example:

- Air coolers
- Process water chillers
- Air conditioning systems

Advantages

- The evaporator is optimally charged, even when there are great variations in load and suction pressure.
- Energy savings -- adaptive regulation of refrigerant injection ensures optimum utilization of the evaporator, resulting in a higher suction pressure.
- Using adaptive control, superheat is maintained at the minimum stable level -- an energy-efficient way to optimize the evaporator while at the same time, media temperature is thermostatically controlled

Valve Compatibility

The EKC 315A can control evaporator superheat by means of one pressure transmitter and one temperature sensor using either an ICM motorized modulating valve with ICAD motor actuator or an AKV or AKVA pulse-width-modulating expansion valve.

In systems where there is one evaporator, one compressor, and one condenser, and a relatively small refrigerant charge, the type ICM valve is recommended.

In systems with an AKV/A valve, the capacity can be distributed by using up to three valves in parallel. When using more than one AKV/A per evaporator, an EKC 347 controller is required for each additional AKV/A in the master-slave configuration. The controller will generate pulses to the multiple valves in such a way that they will not be pulsed simultaneously.

Features and Functions

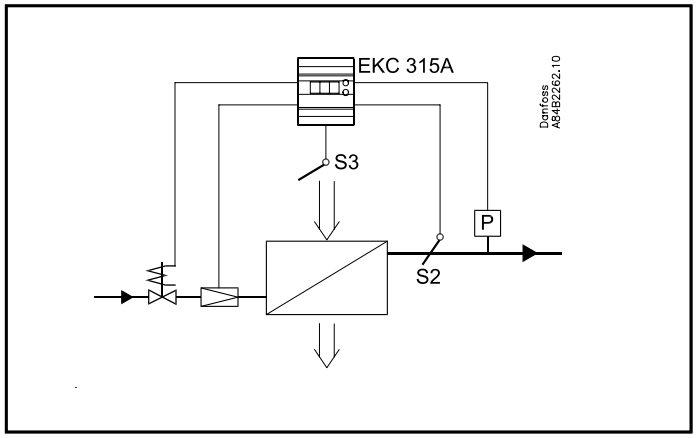
- Superheat regulation
- Temperature control via thermostat function
- MOP function (limits valve opening degree as long as evaporating pressure is higher than user-set value)
- ON-OFF input for start-stop of regulation
- Input signal that can offset the superheat reference or the temperature reference.
- Capable of generating alarms if user-set limits are exceeded
- Relay output for solenoid valve control
- PID regulation
- Analog output to either (a) control an ICM motorized valve; or (b) to monitor superheat, valve opening degree of an AKVA, or air temperature.

Ordering

Type	Function	**Code No.**
EKC 315A	Industrial evaporator controller	**084B7086**

Operation

Superheat control with thermostat function
The superheat is controlled by pressure transmitter P and temperature sensor S2. The temperature is controlled by the solenoid valve, the thermostat setting, and the temperature sensor S3 in the return air.

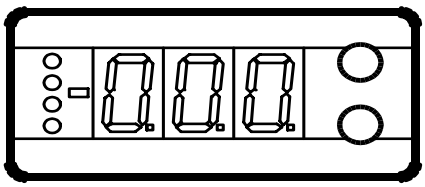


Operating the EKC 315A

The Display
The EKC 315A has a three character digital display. Four status LEDs (Light Emitting Diodes) are to the left of the numerals. To the right of the display are two push buttons.

By default, the display normally shows the superheat but user programming allows the valve's opening degree or air temperature to be selected as the normal display. At any given time, depressing the lower pushbutton will change from what was selected to be in the normal display to one of the other values depending on the setting in parameter o17, which will be displayed for 5 seconds.

The default setting is for °C and bar to be shown in the display, but the units can easily be changed to °F and psig. See parameter r05.



The Front Panel LEDs
The upper LED (next to the valve symbol) lights to indicate the valve's opening degree. A short pulse indicates a small liquid flow and a long pulse a heavy liquid flow.

The LED next to the snowflake symbol lights to indicate that the controller is calling for refrigeration.

The three lowermost LED's will flash, if there is an alarm or an error in regulation. In this situation, pushing the upper button for 1 second will cause the alarm or error code to be displayed.

When an alarm code is displayed by pushing the upper button, the alarm relay will be cut out.

The error (prefix E), alarm (prefix A), and status (prefix S) codes that can appear, along with the meaning of each code, are given in the table below.

LED's on front panel

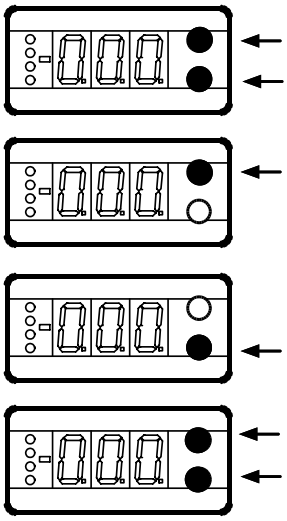
- Opening signal to valve
- Controller in refrigeration mode
- Indicates an alarm, or a controller error
- Indicates an alarm, or a controller error

Error, Alarm, and Status Codes

Code	Description
E1	Errors in the controller
E11	TQ valve's actuator temperature outside its range (discontinued valve)
E15	Temperature sensor S2 (for superheat calculation) has a bad connection
E16	Temperature sensor S2 (for superheat calculation) is shortcircuited
E17	Temperature sensor S3 (air temperature sensor) has a bad connection
E18	Temperature sensor S3 (air temperature sensor) is shortcircuited
E19	The analog input signal on terminals 18 & 19 is outside the range
E20	The pressure transmitter signal on terminals 14 & 15 is outside the range
A1	High temperature alarm A1 has been detected (sensor S3)
A2	Low temperature alarm A2 has been detected (sensor S3)
A11	No refrigerant has been selected in parameter o30
S10	Regulation stopped by internal (par. r12) or external (terminals 1and 2) start/stop
S11	Thermostat relay is cut out

Operating the EKC 315A

To view or change the thermostat setpoint:



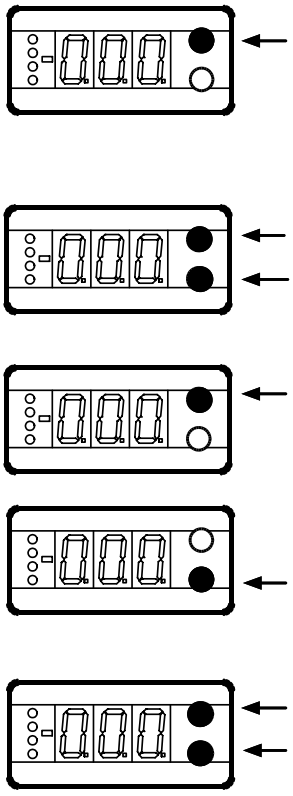
To enter change mode
Press both buttons simultaneously

To raise the setpoint
Press the upper button

To lower the setpoint
Press the lower button

To save the change
Press both buttons simultaneously

To change a parameter setting:



To access parameter menu
Press the upper button for 5 seconds, then
Use the upper and lower buttons to scroll through the parameter list

To enter change mode for a parameter you have scrolled to
Press the both buttons simultaneously

To increase the setting
Press the upper button

To decrease the setting
Press the lower button

To save the new setting and return to the parameter menu
Press both buttons simultaneously. You can then make other parameter changes
or,
The EKC 315A will exit the parameter menu and return to its normal display when no buttons have been pressed for approximately 18-20 seconds.

To reset to factory default values:
1) Remove the supply voltage to the EKC 315A
2) While pressing both buttons simultaneously, restore power. Factory settings will have been restored.

Quick Setup Guide

NOTE: For most applications, only the below parameters need to be reviewed and possibly changed. For each parameter, record your setting and other pertinent settings if any, in the "Field Settings" column provided in each parameter table on the following pages. After going through the quick start procedure below, it is best to review the complete parameter list to ensure all needed changes have been done for your application.

Essential settings that must be made before others will take effect:

1) If the controller is already wired it may be best to put the controller into standby by setting parameter r12 to OFF. This way the controller will not try to regulate while setting up the parameters. If this is done, parameter r12 must be changed back to ON for the controller to regulate.
2) The desired units must be set prior to programming any settings. For the units to be entered and displayed in °F and psig, parameter r05 must be changed to F-P (the default units are °C and bar pressure).
3) Change parameter o12 to 60 Hz unless the supply is 50 Hz.

Setting up the controller for superheat regulation

1) Select the valve that is being used, parameter o09. Typical settings are par. o09=4 when using the pulse-width expansion valve type AKVA or par. o09=7 when using the ICM motor valve with ICAD motor actuator's default settings input setting.
2) Enter the pressure transmitters working range in parameters o20 (min value) and o21 (max. value). Note: These settings must be entered in gauge pressure and most transmitter ranges are listed in absolute pressure which will need converted to gauge pressure before entered.
3) Select the refrigerant that is being used, parameter o30. For R717 (ammonia) that setting would be par. o30=5.
4) Set the superheat regulation method, parameter n21. For industrial refrigeration systems, it is best to try load-defined superheat regulation which would be par. n21=2.
5) The controller will regulate superheat based on a user-defined superheat range in parameters n09 and n10. It is best to leave these at the default settings and later fine tune them if needed. *Note: parameter n10 must be set higher than parameter n22.*
6) For most applications the shaded parameters in the parameter list should not be changed.
7) Verify that parameter r12 is ON.

Setting up the thermostat function for controlling a liquid line solenoid valve

The additional temperature sensor S3 must be installed for use of the thermostat function. The controller will then control the solenoid relay and alarm relay based on the sensor S3 reading and the user defined setpoints.

1) Set the thermostat set point. This setting is not changed by entering the parameter list, but by pushing both buttons simultaneously.
2) Set the differential for the thermostat function, parameter r01.
3) Turn on the thermostat function with parameter r14 (r14=1 for ON).
4) If desired, set up the alarm parameters A1, A2 and A3.
5) Verify that parameter r12 is ON.

Survey of functions, settings, and parameters

Regulating settings

Description of setting	Parameter	Minimum	Maximum	Factory setting	Field setting
Setpoint for thermostat function for controlling a liquid line solenoid valve Not used for superheat function. Used only for thermostat function. Regulation is based on this user-set value unless there is a displacement of setpoint by an analog signal (see parameter 010). This setting is not changed by entering the parameter list, but by pushing both buttons simultaneously, then using the buttons individually to adjust the setpoint up and down (see the section "Operating the EKC 315A.")	-	-76°F (-60°C)	122°F (50°C)	50°F (10°C)	
Differential for thermostat function When temperature is higher than reference plus this user-set differential, the solenoid valve's relay will be energized. It will be de-energized when the temperature drops below the setpoint.	r01	0.2°F (0.1°K)	36°F (20°K)	3.6°F (2.0°K)	
Units Setting 0: °C and bar Setting 1: °F and psig	r05	C - b (0)	F- P (1)	C - b (0)	
Maximum displacement of thermostat setting or superheat reference by an analog signal from a PLC or other external device. Determines how great a displacement will be added when the input signal is maximum (20 mA). (See parameter o10.)	r06	-90°F (- 50°K)	90°F (50°K)	0°F (0°K)	
Offset of temperature sensor S2 signal To calibrate the sensor reading, or to compensate, for example, for loss due to a long sensor cable.	r09	-18°F (-10°K)	18°F (10°K)	0°F (0°K)	
Offset of temperature sensor S3 signal To calibrate the sensor reading, or to compensate, for example, for loss due to a long sensor cable.	r10	-18°F (-10°K)	18°F (10°K)	0°F (0°K)	
Start-stop of refrigeration Using this setting, refrigeration can be started or stopped. Start and stop can also be accomplished with the external switch function on terminals 1 & 2 (see wiring section).	r12	0 (OFF)	1 (ON)	1	
Thermostat function for controlling a liquid line solenoid valve 0: No thermostat function. Only superheat is regulated. 1: Thermostat function enabled in addition to superheat regulation.	r14	0 (OFF)	1 (ON)	0 (OFF)	

Alarms

The controller is capable of generating alarms. When there is an alarm, the three lower LEDs on the front panel will flash and the alarm relay will cut in.

Alarm for high temperature (sensor S3). When S3 temperature exceeds reference plus this differential temperature setting, the alarm is activated. Note that there may be an alarm delay (A03). Reference can be seen in u28.	A01	5.4°F (3°K)	36°F (20°K)	9°F (5.0°K)	
Alarm for low temperature (sensor S3). When S3 temperature is lower than reference minus this differential temperature setting, the alarm is activated. Note that there may be an alarm delay (A03). Reference can be seen in u28.	A02	1.8°F (1°K)	18°F (10°K)	5.4°F (3.0°K)	
Alarm delay If this parameter is set, a timer is activated when one of the two alarm settings is exceeded. The alarm is generated only after the time delay has passed.	A03	0 (min.)	90 (min.)	30 (min.)	

Regulating parameters

NOTE: Only a trained Danfoss technician should adjust settings given in the gray blocks. Misadjustment could cause serious system malfunction.

Description of setting	Parameter	Minimum	Maximum	Factory setting	Field setting
P: Amplification factor, K_p Increasing proportional factory Kp leads to larger changes in controller output for a given input (regulation becomes faster). Too high a K_p can cause the valve to hunt.	n04	0.5	20	3.0	
I: Integration time T_n Decreasing T_n results in faster response to sensor value changes.	n05	30 (sec)	600 (sec)	120 (sec)	
D: Differentiation time T_d This setting can be turned off by setting its value to minimum (0). Increasing Td increases controller output changes, but can lead to instability.	n06	0 (sec)	90 (sec)	0 (sec)	
Maximum value for superheat reference	n09	4°F (2°K)	90°F (50°K)	10.8°F (6°K)	
Minimum value for superheat reference WARNING: Due to the risk of liquid floodback, the setting should not be lower than approximately 4 - 7°F (2 -4°K).	n10	2°F (1°K)	22°F (12°K)	7°F (4°K)	
MOP If MOP function is not desired, adjust to maximum setting. MOP function limits valve opening degree as long as evaporating pressure is higher than user-set value.	n11	0 psig (0 bar)	870 psig (60 bar)	870 psig (60 bar)	
Period time for AKV and AKVA pulse valves *In most cases, this parameter should not need to be changed.* This parameter determines the length of the control period. The valve is opened for a certain percentage of each successive period. For example, when full valve capacity is called for, the valve will be opened for the entire period. When 60% valve capacity is required, the valve will be opened for 60% of the period. The control algorithm computes the capacity required for each period.	n13	3 (sec)	10 (sec)	6 (sec)	
Stability factor for superheat regulation *This value should only be changed by specially trained service technicians.* A higher value will allow greater superheat fluctuation before the reference is changed.	n18	0	10	5	
Damping of amplification near the reference value *This value should only be changed by specially trained service technicians.* This setting damps Kp near the reference value. A setting of 0.5 will reduce Kp by half.	n19	0.2	1.0	0.3	
Amplification factor for superheat (only in 1:1 systems) This setting determines the ICM or AKV valve's opening degree as a function of the change in evaporating pressure. An increase in evaporating pressure will result in a lower opening degree. When there is a drop-out on the low pressure thermostat during start-up, the value must be raised. If there is pendling during start-up, the value must be reduced a small amount. This value should only be changed by specially trained service technicians.	n20	0.0	10.0	0.4	
Defines superheat regulation (see Appendix 2**)** 1) Minimum stable superheat (MSS). Adaptive regulation. 2) (Works best for industrial refrigeration systems) Based on Load-defined superheat. The reference is established based on the line formed by the three points: n09, n10, and n22.	n21	1	2	1	
Value of minimum superheat reference for loads under 10% The value must be less than n10. The controller will force the valve closed when superheat is below this set value.	n22	2°F (1°K)	27°F (15°K)	4°F (2°K)	
Standby TQ valve (discontinued valve) temperature when valve closed The TQ actuator is kept warm when the valve closes. As the closing point can not be defined exactly due to tolerances and pressure variations, the setting can be changed as needed to affect valve closing tightness.	n26	-27°F (-15°K)	36°F (20°K)	0°F (0°K)	
Standby TQ valve (discontinued valve) temperature when valve open The TQ actuator's temperature is kept low when the valve reaches its fully open position. This parameter sets the number of degrees that the temperature is to be above the expected open temperature when the valve is completely open. A greater value ensures that the valve is open, but a greater value will also result in slower closing.	n27	-27°F (-15°K)	126°F (70°K)	36°F (20°K)	
Maximum opening degree The ICM or AKV valve's opening degree can be limited. The value is set in %. This value should only be changed by specially trained service technicians.	n32	0 (%)	100 (%)	100 (%)	
Minimum opening degree *This value should only be changed by specially trained service technicians.* The ICM or AKV valve's opening degree can be set to a minimum valve that disables full closure.	n33	0 (%)	100 (%)	0 (%)	

Miscellaneous parameters

Description of setting	Parameter	Minimum	Maximum	Factory setting	Field setting
Define valve and AO (analog output) signal The controller can control 3 types of valves: pulse-width modulation valve AKVA, motorized valve type ICM with ICAD motor-actuator, and discontinued valve type TQ. 0: No valve selected 1: TQ valve (discontinued), AO is 0-20 mA for remote monitoring 2: TQ valve (discontinued), AO is 4-20 mA for remote monitoring 3: AKV/A valve, AO is 0-20 mA for remote monitoring 4: AKV/A valve, AO is 4-20 mA for remote monitoring 5: AKV/A valve, AO is signal for another controller. See appendix 3. 6: ICM/ICAD, AO is 0-20 mA for communication with valve 7: ICM/ICAD, AO is 4-20 mA for communication with valve (this is the default setting in ICAD) Note: the AO for remote monitoring (when ICM/ICAD is not used) corresponds to the selection made in parameter o17 for what is to appear in the normal display.	o09	0	7	0	
Input signal from PLC, etc., for offsetting the thermostat setpoint or superheat reference **Definition of function and input signal current range** 0: No signal 1. Displacement of temperature reference with 0-20 mA 2. Displacement of temperature reference with 4-20 mA 3. Displacement of superheat reference with 0-20 mA 4. Displacement of superheat reference with 4-20 mA NOTE: At minimum AI, there will be no offset. At maximum AI, the offset will be as set in parameter r06.	o10	0	4	0	
Frequency Must be set to the frequency of the 24 Vac power source.	o12	0 (50 Hz)	1 (60 Hz)	0 (50 Hz)	
Selection of normal display contents and AO This parameter determines what will be shown in the normal display. While viewing the normal display, briefly pushing the lower button will temporarily display the following: if 1 has been selected, media temperature (S3); if 2 has been selected, superheat; or, if 3 has been selected, temperature reference. When the controller is not being used with ICM/ICAD or AKV/A as MASTER (parameter o09=5, 6, or7), then the AO (analog output) on terminals 1 & 2 will correspond to what is shown in the normal display. 1: Superheat 2: Valve's opening degree 3: Media temperature (S3 sensor)	o17	1	3	1	
Manual control of outputs For service purposes, the individual relay outputs and the AKV/A output can be overridden (forced ON), but only when regulation has been stopped. When this setting is OFF, there is no override. 1) Relay to the solenoid valve is ON 2) AKV/A output is ON 3) Alarm relay is activated (shorts terminals 12 & 13	o18	0FF	3	OFF	
Minimum of pressure transmitter range The working range of the pressure transmitter must be entered in gauge pressure. The minimum value is set by this parameter and the maximum value by the next. Example: A transmitter with the specified range of 0 to 200 psia, must be entered as -14.5 and 185 psig.	o20	-14.5 psig (-1 bar)	870 psig (60 bar)	-14.5 psig (-1.0 bar)	
Maximum of pressure transmitter value range (see above explanation)	o21	-14.5 psig (-1 bar)	870 psig (60 bar)	174 psig (12 bar)	

Miscellaneous parameters (continued)

Description of setting	Parameter	Minimum	Maximum	Factory setting	Field setting
Value of analog output at minimum current (terminals 2 & 5) (only applicable to AKV/A or TQ) Lower end of temperature or opening degree range that will yield a current output of 0 mA or 4 mA, depending on the selection made for parameter o09 (only if AKV/A is used)	o27	-94°F (-70°C)	320°F (160 °C)	-31 °F (-35 °C)	
Value of analog output at maximum current (terminals 2 & 5) (only applicable to AKV/A or TQ) Upper end of temperature or opening degree range that will yield a current output of 20 mA.	o28	-94°F (-70 °C)	320°F (160 °C)	59°F (15 °C)	
Refrigerant Setting The refrigerant must be defined before startup. ***Failure to select the correct refrigerant may result in compressor damage.*** 1 = R-12 2 = R-22 3 = R-134a 4 = R-502 5 = R-717 6 = R-13 7 = R-13b1 8 = R-23 9 = R-500 10 = R-503 11 = R-114 12 = R-142b 13 = user defined 14 = R-32 15 = R-227 16 = R-401A 17 = R-507 18 = R-402A 19 = R-404A 20 = R-407C 21 = R-407A 22 = R-407B 23 = R-410A 24 = R-170 25 = R-290 26 = R-600 27 = R-600a 28 = R-744 29 = R-1270	o30	0	29	0	

Service Parameters for Troubleshooting (view only)

Description of parameter	Parameter	Units*
Current TQ valve's (discontinued valve) actuator temperature	u04	°F or °C
Reference for TQ valve's (discontinued valve) actuator temperature	u05	°F or °C
Analog input current signal (terminals 18 & 19) from PLC, etc.	u06	mA
Analog output current signal on terminals 2 & 5	u08	mA
Digital input status. Combination of parameter r12 and terminals 1 & 2	u10	ON-OFF
Ongoing cut-in time for thermostat or duration of last completed cut-in	u18	minutes
Temperature of S2 temperature sensor (used for superheat)	u20	°F or °C
Current calculated superheat	u21	°F or °K
Controller's superheat reference (target superheat controller is trying to achieve)	u22	°F or °K
Valve's opening degree	u24	%
Evaporating pressure based on pressure transmitter	u25	psig or bar
Evaporating temperature based on pressure transmitter and selected refrigerant	u26	°F or °C
Temperature of S3 temperature sensor (used for thermostat function for solenoid valve)	u27	°F or °C
Control reference (setpoint + any offset provided by an input signal from a PLC or other source)	u28	°F or °C
Pressure transmitter current signal (terminals 14 & 15)	u29	mA

** The displayed units will depend on the units setting parameter r05.*

Technical Data

The supply voltage is galvanically isolated from the input and output signals, but the input and output signals are not galvanically isolated from each other.

Supply voltage
24 V ac ± 15%, 50-60 Hz
80 VA maximum (5 VA for controller and additional 55 VA when the controllers powers the coil for an AKV/A pulse valve or an additional 75 VA when used with the discontinued TQ valve).

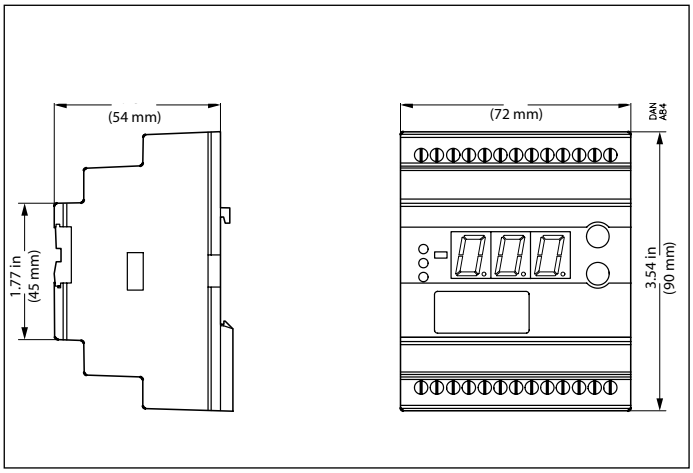
Input signals
Current input signal on terminals 18 & 19, 4-20 mA or 0-20 mA
Pressure transmitter, 4-20 mA from AKS 33
Digital input on terminals 1 and 2 for start-stop of regulation
Temperature sensor input, 2 PT 1000

Analog output (terminals 2 and 5)
Current signal: 4-20 mA or 0-20 mA
Load: 200Ω maximum

2 Relay outputs
each SPST, AC-1/4A resistive or AC-15: 3A inductive

Ambient temperature
During operation: +14°F to 131°F (-10 °C to 55°C)
During transport: -40°F to 158°F (-40°C to 70°C)

Approvals
EU Low Voltage Directive complied and EMC demands re CE-marking complied with
LVD tested according to EN 60730-1 and EN 60730-2-9
EMC tested according to EN50081-1and EN 50082-2



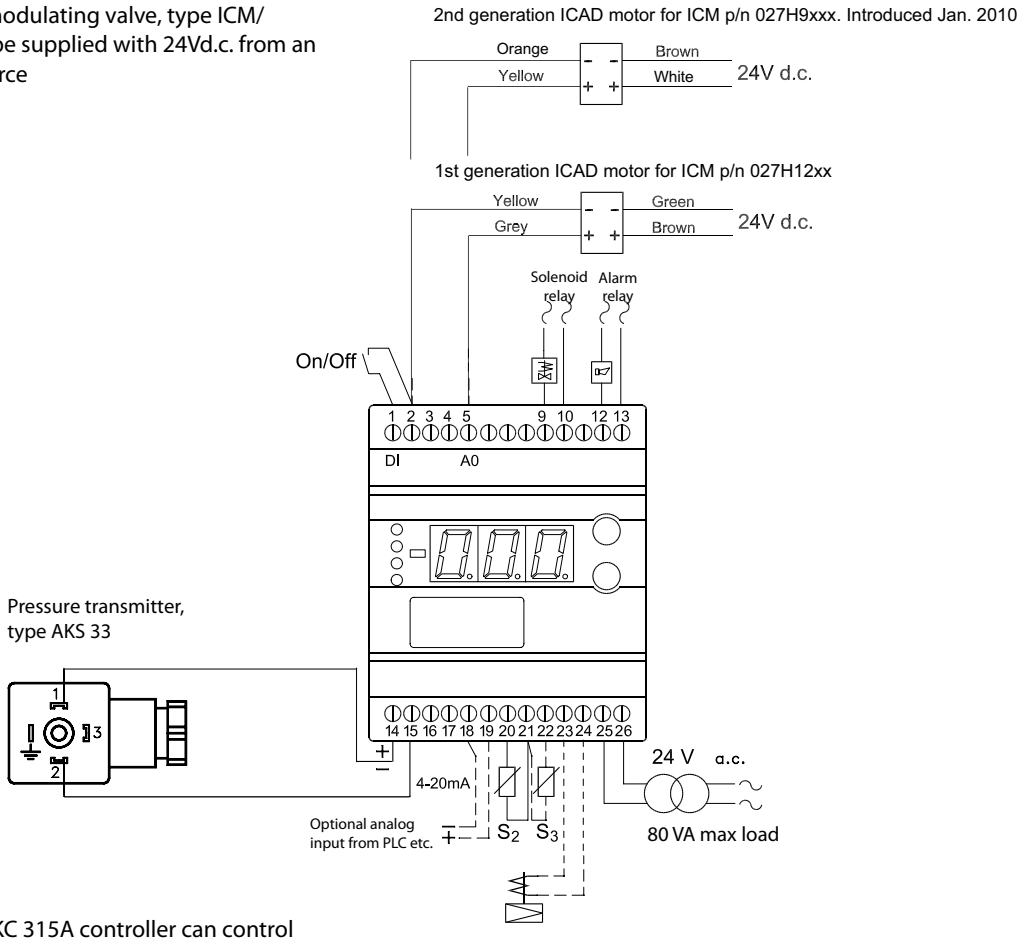
Mounting: DIN rail
Enclosure: IP 20 (approximately NEMA 1)
Weight: 0.66 lbs (300 g)
Display: LED, 3 digits
Terminals: Maximum 2.5 mm^2 multicore

Wiring diagram and terminal functions

Terminal pairs	Description
1-2	Switch function for start-stop of regulation. When there is no connections between terminals 1 & 2, the controller will send a signal to close the valve. ***If not using a switch, terminals must be shorted with a jumper wire.***
2-5	Current output that is used: 1. To control a motorized valve type ICM with ICAD motor actuator, or 2. For remote monitoring when the ICM/ICAD is not used (see parameter o09).
9-10	Optional relay output for control of a liquid line solenoid valve. Control is based on thermostat setting. The relay is closed on power failure.
12-13	Alarm relay. There is no connection between 12 and 13 during alarm conditions or when the controller is not functioning.
14-15	Pressure transmitter, type AKS 33 or equivalent. Note: controller powers the 4-20 mA loop (no additional power source needed.

Terminal pairs	Description
17-18	Signal from TQ (discontinued valve actuator. See Appendix 1 for TQ wiring diagram).
18-19	Optional current input from PLC or other source, for offsetting the thermostat setting or superheat reference.
20-21	Temperature sensor S2 (PT 1000) at evaporator outlet for superheat.
21-22	Temperature sensor S3 (PT 1000) for thermostat function controlling a liquid line solenoid valve.
23-24	24 Vac output for control of pulse width modulated valve type AKV/A (Maximum 20Ws coil). Can also be used to power the discontinued type TQ valve (see Appendix 1 for TQ wiring diagram.
25-26	Supply voltage 24 Vac. 80 VA maximum load depending on valve

Motorized modulating valve, type ICM/ ICAD, must be supplied with 24Vd.c. from an external source



Note: Each EKC 315A controller can control a type AKV/A valve or an ICM, but not both simultaneously.

AKV or AKVA pulse-width modulation expansion valve
Note: controller powers the 24Va.c., max 20W coil

Troubleshooting

Failure to regulate after Setup

If, after setting up according to the Quick Setup Guide on page 6, the valve will not regulate, the cause may be one of the following:

1. There is no connection (either a closed switch or a jumper wire) between terminals 1 & 2.
2. The internal start-stop parameter (r12) has been set to OFF.
3. No valve has been selected by parameter o09.
4. The thermostat function is being used and the thermostat is satisfied.

If superheat fluctuates excessively

Once the refrigeration system is stable, the controller's factory settings will usually provide fast reaction to changes in load. If, however, the superheat fluctuates excessively, there are two possible causes: Either superheat parameters are set too low, or regulation parameters need some adjustment.

Adjustment of superheat parameters:
First, try to solve the problem by increasing the superheat parameters as follows:
it is likely that superheat parameters should be adjusted to higher values. This is accomplished as follows:

If adaptive superheat has been selected:
Adjust: n09, n10 and n18.

If load-defined superheat has been selected:
Adjust: n09, n10 and n22.

Adjustment of regulating parameters:
These adjustments should only be undertaken by specially trained technicians using data monitoring equipment. If superheat parameter adjustment does not result in stability, Adjust regulation parameters using the following procedures:

If the oscillation time (T_p) is longer than the integration time (T_n, parameter n05) time:
($T_p > T_n$, (T_n is, say, 240 seconds))

1. Increase T_n to 1.2 times T_p
2. Wait until the system is in balance again
3. If there is still oscillation, reduce K_p (initially by about 20%)
4. Wait until the system is in balance
5. If it continues to oscillate, repeat 3 and 4, reducing K_p by smaller amounts.

If the oscillation time is shorter than the integration time:
($T_p < T_n$, (T_n is, say, 240 seconds))

1. Reduce K_p by, say, 20% of the scale reading
2. Wait until the system is in balance
3. If hunting continues, repeat steps 1 and 2, decreasing K_p by a smaller amount.

If the superheat has excessive underswing during start-up

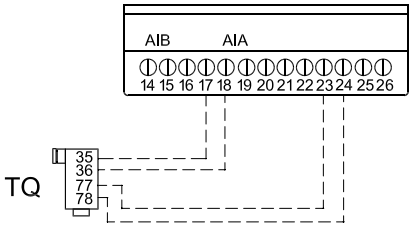
If regulation is by valve type ICM with ICAD motor or by AKV/A pulse-width modulation valve:
Increase n22 slightly, or decrease n04 slightly, or both.

If you regulate with discontinued valve type TQ:
Decrease n26 slightly.

Appendices

These appendices are referenced in various parts of the text.

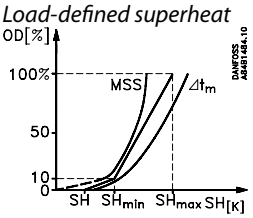
Appendix 1: Wiring diagram for discontinued TQ valve



Appendix 2

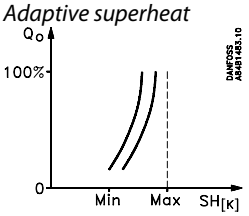
The two types of superheat regulation, load-defined control and adaptive control are shown below. For industrial refrigeration applications, load-defined control should be tried first.

Load-defined superheat



The reference follows a defined curve. This curve is defined by three values: the superheat value that will close the expansion valve (parameter n22), the minimum superheat reference value (parameter n10), and the maximum superheat reference value (parameter n09). These three values must be selected in such a way that the curve is situated between the minimum stable superheat (MSS) curve and the curve for average temperature difference ΔTm (temperature difference between media temperature and evaporating temperature).

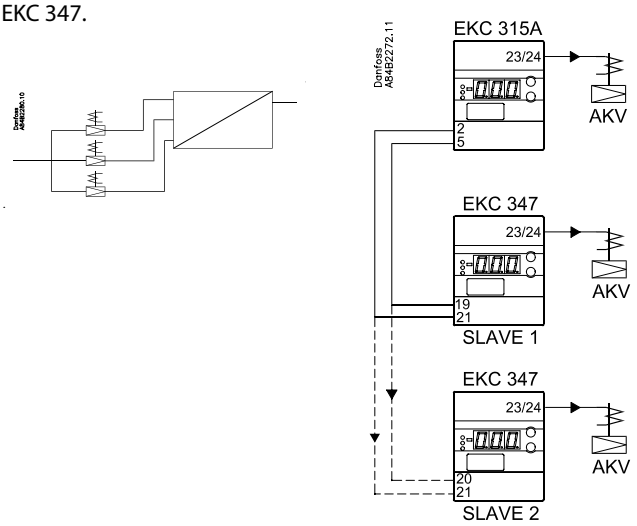
Adaptive superheat



Regulation is based on evaporator load by establishing minimum stable superheat (MSS). The superheat reference is lowered to the exact point where instability begins.
The superheat is limited by the settings for minimum and maximum superheat.

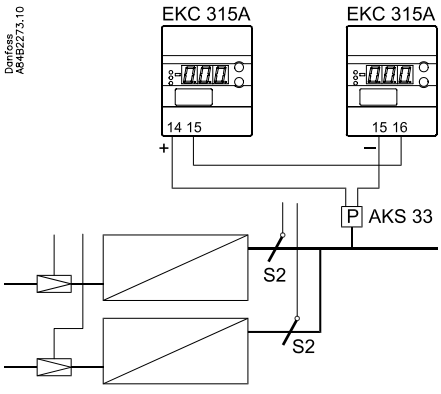
Appendix 3

Wiring diagram for applications that use more than one AKV/A pulse width modulating expansion valve in parallel to control the refrigerant flow to a single evaporator. This strategy is used in situations where the evaporator to be controlled exceeds the capacity of a single expansion valve.
Remember to set parameter o09 in both the EKC 315A and the EKC 347.



Appendix 4

If there are two evaporators sharing the same suction line, the signal from the pressure transmitter can be used by up to two controllers.



Danfoss Inc. · Refrigeration & Air Conditioning Division · 7941 Corporate Drive · Baltimore, MD 21236
Ph 410-931-8250 · Fax 410-931-8256 · E-mail: baltimore@danfoss.com · Internet: www.danfoss.us/Industrial_Refrigeration