ENGINEERING
TOMORROW

User Guide

Superheat controller
Type **EKE 1A, 1B, 1C, 1D** (PV04)

For commercial air conditioning and pvo4 refrigeration applications

Contents

1 Introduction

The flexible pre-programmed EKE superheat controller from Danfoss provides ultimate software control, allowing you to tailor the performance of your system to your exact requirements. EKE is ideal for controlling a wide range of commercial air conditioning and refrigeration applications, such control helps you to achieve the highest efficiency in the system reducing the operational cost by up to 20% with minimal effort. EKE is generally used where there is a requirement for accurate control of superheat or temperature control in connection with air conditioning and refrigeration. The superheat is regulated to the lowest possible value within a short period of time. It regulates the superheat of the evaporator by charging optimally even when there are great variations of load resulting in reduction of energy consumption and operational cost

Typical Applications

- Chillers
- Processing plant / Cabinet cooling
- Cold store (air coolers)
- A/C plant / Air conditioning
- Heat pumps. Residential Heat Pump
- Transport cooling
- Stepper Motor Driver

2 Portfolio overview

Table 1: Portfolio overview

Features		EKE 1A	EKE 1B	EKE 1C	EKE 1D
Power supply					
Power Supply Type	24 V AC / DC ± 20%	•	•	•	•
Battery Backup input	18-24 V DC	•	•	•	•
Class of insulation		Class II			
Data communication					
MODBus	RS 485 RTU		•	•	
Wired CANbus				• (4 wires)	• (3 wires)
CANbus RJ 12	Danfoss MMI service port	•	•	•	•
Inputs					
Number of temperature sensors		1	2	3	2
Temperature sensor types	PT1000			•	
	NTC 10K, type EKS	•	•	•	•
	NTC 10K, type ACCPBT	•	•	•	•
	NTC 10K, type Sensata	•	•	•	•
Number of Pressure sensor		1	1	2[1]	1
Pressure Transmitter types	Ratiometric 0.5 - 4.5 V	•	•	•	•
	Voltage signal 0 – 10 V	•	•	•	•
	Current signal 0 – 20 mA			•	
Share Pressure Signal	Hardware (Up to 5 devices)	•	•		•
	Via wired CANbus (not possible to share ratiometric sensor)			•	•
	Via MODbus		•	•	
Number of external references		1	1	1	1
External reference	0-20mA			•	
	User defined current			•	
	0-10V	•	•	•	•
	0- 5V	•	•	•	•
	User defined voltage(max 10V)	•	•	•	•
Digital input Dry contact		3		2	
Outputs					
Digital output		1			
Relay	Normally Open	3A General purpose, 250V ac, 100k			
	Normally closed	2A General purpose, 250V ac, 100k			
Relay Function		Alarm relay or LLSV (Liquid Line Solenoid Valve)			
User interfaces	Koolprog Software tool	•	•	•	•
	MMIGRS2 screen	•	•	•	•
	Master controller		•	•	•

[1] The 2nd pressure sensor is connect to AI4

Table 2: Accessories and Related products

MMIGRS2 Display	ACCCBI Cable	MMIMYK Gateway
		
User interface module MMIGRS2 Display.	ACCCBI cables for MMI display and gateway.	MMIMYK device is used as a gateway to connect EKEs and the KoolProg PC software for parameter setting or data logging.

Table 3: Accessories and Related products

Pressure Transducer	Temperature Sensor	Power Supply
		
AKS Pressure Transmitter,available with ratiometric and 4 - 20 mA. NSK Ratiometric Pressure Probe. XSK Pressure probe 4 - 20 mA.	PT 1000 AKS is a High precision temp. sensor AKS 11 (preferred), AKS 12, AKS 21 ACCPBT PT1000 NTC sensors EKS 221 (NTC-10 Kohm) ACCPBT NTC Temp probe (IP 67 / 68)	AK-PS Input: 100 - 240 V AC / 45 - 65 Hz Output: 24 V DC: available with 18 VA, 36 VA and 60 VA ACCTRD IInput: 230 V AC, 50 – 60 Hz Output: 24 V AC, available with 12 VA, 22 VA and 35 VA

Table 4: Accessories and Related products

Stepper motor valves	M12 Angle Cables
	
EKE is compatible with Danfoss stepper motor valves i.e Danfoss ETS 5M, ETS 6, ETS, KVS, ETS Colibri®, KVS colibri®, CTR, CCMT.	Various lengths of standard M12 cable are available for connecting stepper motor valves.

3 Installation

3.1 Environmental conditions

Table 5: Environmental conditions

Operating conditions	-20 – 60 °C, 90% RH non-condensing
Storage / Transport conditions	-30 – 80 °C, 90% RH non-condensing
Vibration and shock	According to IEC 60068-2-27 Ea
Integration	In Class I and / or II appliances
Index of protection	IP40 only on the front cover (General IP20)
PCB protection	None (no conformal coating)
Period of electric stress across insulating parts	Long
Resistance to heat and fire	Category D
Immunity against voltage surges	Category II
Approvals	CE compliance: This product is designed to comply with the following EU standards: • Low voltage guideline: 2014/35/EU • Electromagnetic compatibility EMC: 2014/30/EU and with the following norms: - EN61000-6-1. EN61000-6-3 (immunity and emission standard for residential. commercial and light industrial environments) - EN61000-6-2. EN61000-6-4 (immunity and emission standard for industrial environments) - EN60730-1 and EN60730-2-9 (Automatic electrical controls for household and similar use) • RoHS compliance to 2011/65/EU and no components from negative list acc. to 500B0751

3.2 Mounting

DIN rail mounting / demounting. The unit can be mounted onto a 35 mm DIN rail simply by snapping it into place and securing it with a stopper to prevent sliding. It is demounted by gently pulling the stirrup located in the base of the housing

Figure 1: Mounting

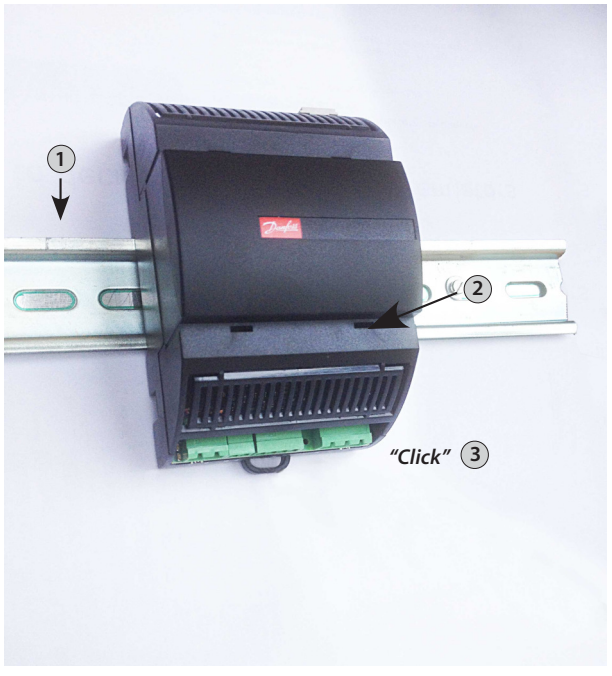
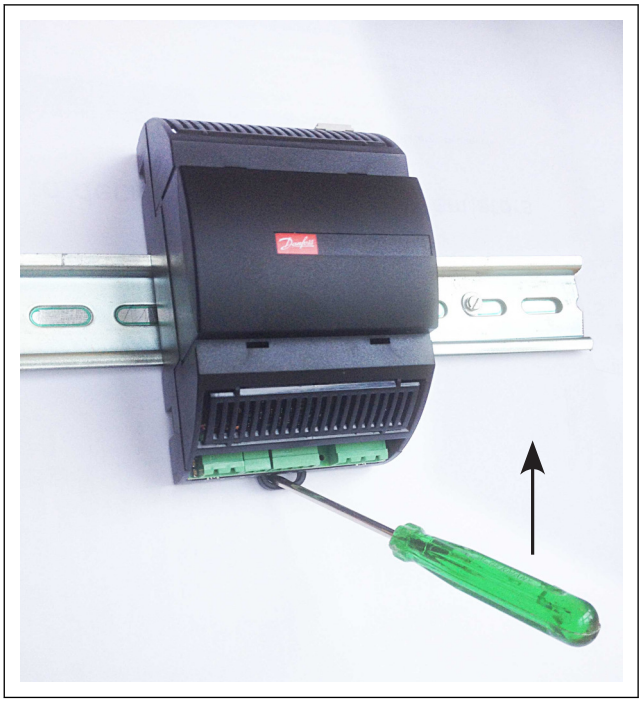


Figure 2: De-mounting



3.3 General Connection's overview

This is an overview of all the different possible installation of the EKE 1x series, the connection details will be explained separately in the configuration section

Figure 3: EKE 1A connection overview

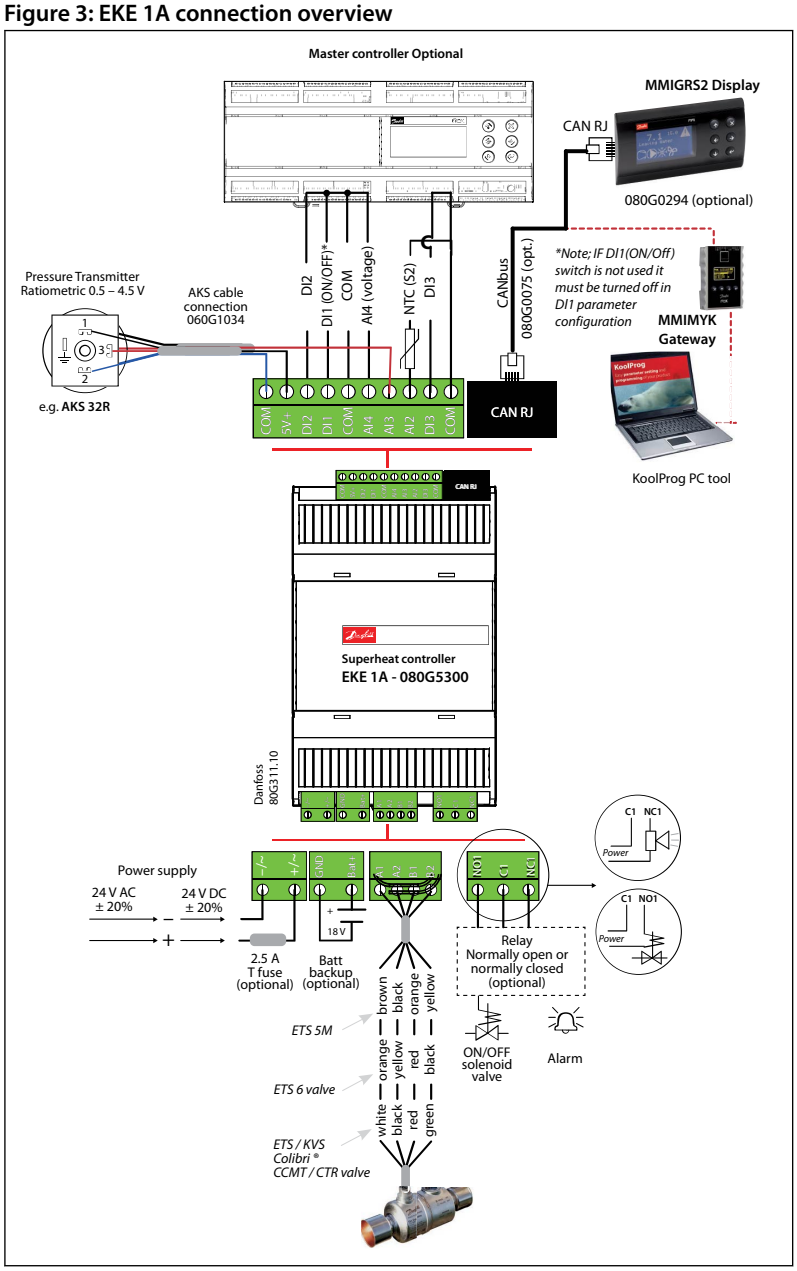


Table 6: EKE 1A pinout

COM	Common	
DI3	Digital input 3	Software configurable DI
AI2	Analog input NTC 10K	S2
AI3	Analog inputs 0 – 5 V / Ratiometric pressure transmitter	Pe
AI4	analog inputs 0 – 10 V	External Reference signal
COM	Common	
DI1	Digital input 1	Main switch (hardware)
DI2/3	Digital input 2 and 3	Software configurable DI
5V+	Power output for Ratiometric pressure transmitter 0 – 5V	
COM	Common	

NOTE:

- If DI1(On/Off) switch is not used it must be short circuited
- EKE 2U Backup power module is recommended to use to ensure closure of the electronic valves. in case of power failures

Figure 4: EKE 1B connection overview

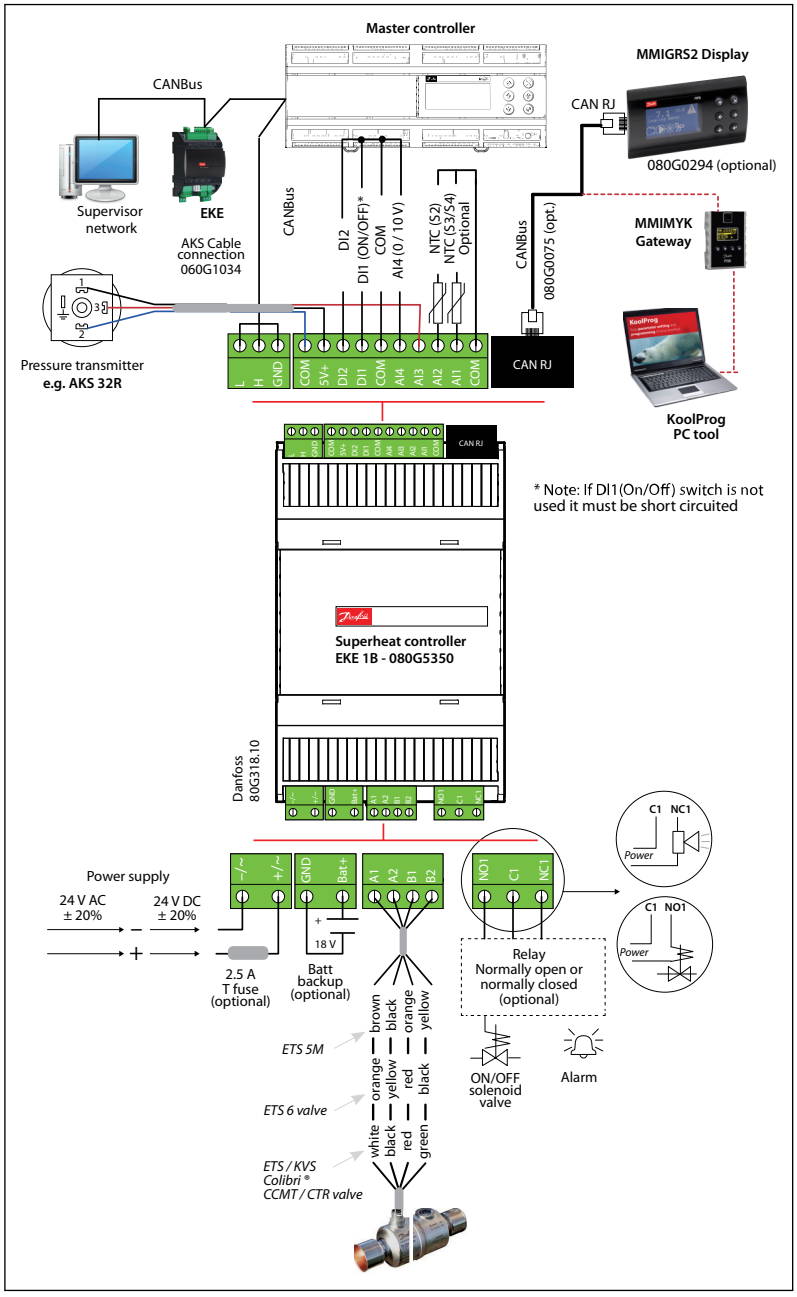


Table 7: EKE 1B pinout

COM	Common	
AI	Analog inputs NTC 10K	S3/S4 selectable via software
AI2	Analog input NTC 10K	S2
AI3	Analog inputs 0 – 5 V / Ratiometric pressure transmitter	Pe
AI4	analog inputs 0 – 10 V	External Reference signal
COM	Common	
DI1	Digital input 1	Main switch (hardware)
DI2/3	Digital input 2 and 3	Software configurable DI
5V+	Power output for Ratiometric pressure transmitter 0 – 5V	
COM	Common	

NOTE:

- If DI1(On/Off) switch is not used it must be short circuited
- EKE 2U Backup power module is recommended to use to ensure closure of the electronic valves. in case of power failures

Figure 5: EKE 1C - Front board connection overview

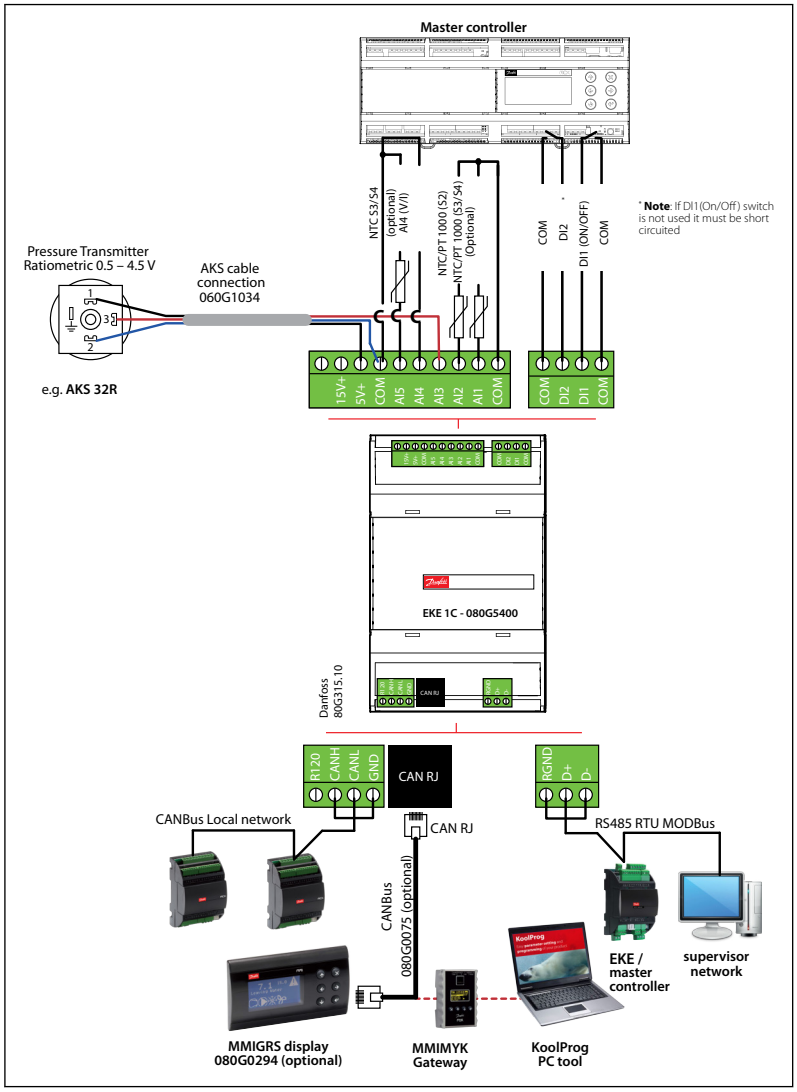


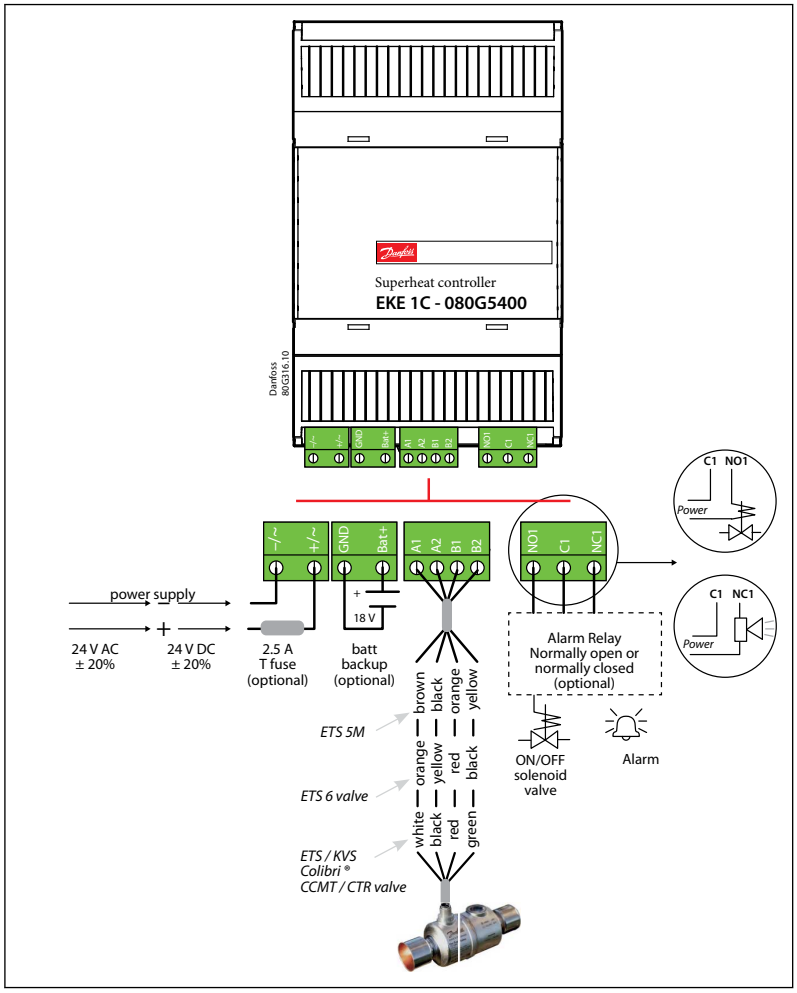
Table 8: EKE 1C pinout

COM	Common	
AI1	Analog inputs temperature NTC 10K / PT1000	S3/S4 selectable via software
AI2	Analog inputs temperature NTC 10K / PT1000	S2
AI3	Analog inputs voltage / current	Pe
AI4	Analog inputs voltage / current	Ext. Ref. or Pc
AI5	Analog inputs NTC temperature	S3/S4 selectable via software
COM	Common	
5V+	Power outputs for Ratiometeric pressure transmitter 0 – 5V	
15V+	Power output for current signal pressure transmitter	
DI1	Digital input 1	Main switch (hardware)
DI2	Digital input 2	Software configurable DI
24V+	Not used in EKE 1C	
AO1	Not used in EKE 1C	

NOTE:

- EKE 2U Backup power module is recommended to ensure closure of the electronic valves. in case of power failures
- If DI1(On/Off) switch is not used it must be short circuited
- EKE 1A/1B/1D only support Ratiometric 0.5 to 4.5V pressure transmitter

Figure 6: EKE 1C - Back board connection overview

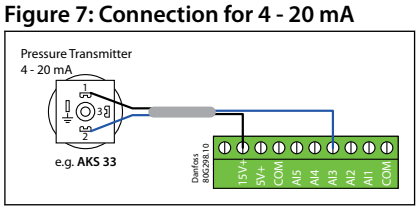


Different types of 4 - 20 mA pressure Transmitters need different supply levels. Check the guide below

Table 9: EKE 1C pressure transmitters range

User selection EKE connection	Signal	EKE Connection
Not defined	-	-
AKS 32R	Ratiometric 10-90%	5V supply from EKE
112CP (Sensata)	Ratiometric 10-90%	5V supply from EKE
OEM Ratio	Defined by parameters	5V supply from EKE
NSK (Saginomiya)	Ratiometric 10-90%, 0.5 to 4.5V	5V supply from EKE
AKS 32 1-5V	1-5V	15V supply from EKE
OEM Voltage	Defined by parameters	15V supply from EKE
Bus shared	Via RS485 Modbus	-
AKS 32 1-6V	1-6V	15V supply from EKE
AKS 32 0-10V	0-10v	15V supply from EKE
AKS 33	4-20mA	15V supply from EKE
XSK (Saginomiya)	4-20mA	15V supply from EKE
OEM Current	Defined by parameters	15V supply from EKE

Figure 7: Connection for 4 - 20 mA



NOTE:

- EKE 2U Backup power module is recommended to ensure closure of the electronic valves. in case of power failures
- If DI1(On/Off) switch is not used it must be short circuited
- EKE 1A/1B/1D only support Ratiometric 0.5 to 4.5V pressure transmitter

Figure 8: EKE 1D connection overview

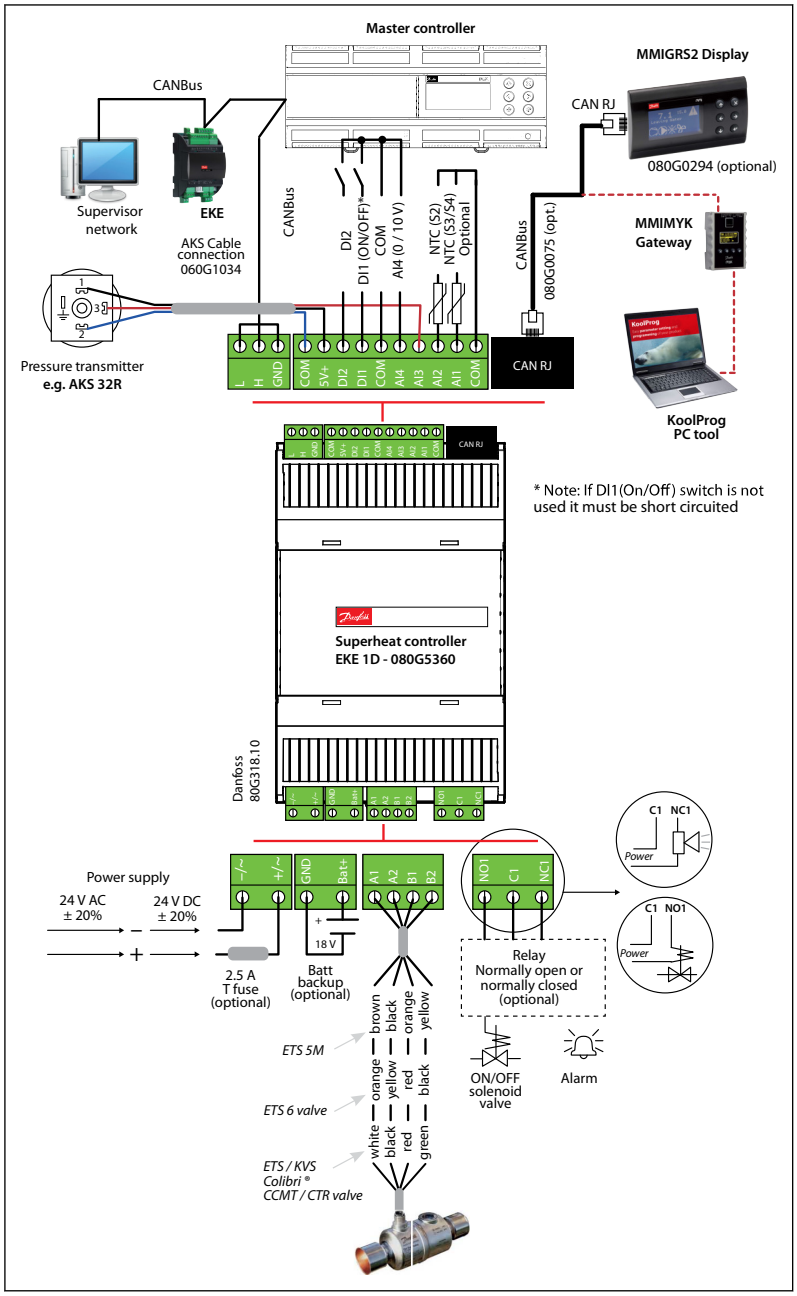


Table 10: EKE 1D pinout

COM	Common	
AI	Analog inputs NTC 10K	S3/S4 selectable via software
AI2	Analog input NTC 10K	S2
AI3	Analog inputs 0 – 5 V / Ratiometric pressure transmitter	Pe
AI4	analog inputs 0 – 10 V	External Reference signal
COM	Common	
DI1	Digital input 1	Main switch (hardware)
DI2/3	Digital input 2 and 3	Software configurable DI
5V+	Power output for Ratiometric pressure transmitter 0 – 5V	
COM	Common	

NOTE:
- EKE 2U Backup power module is recommended to ensure closure of the electronic valves. in case of power failures
- If DI1(On/Off) switch is not used it must be short circuited

3.4 Cabling lengths for different connections

Considerations:
- The max. cable distance between the controller and the valve depends on many factors like shielded/unshielded cable, the wire size used in the cable, the output power for the controller and EMC.
- Keep controller and sensor wiring well separated from mains wiring.
- Connecting sensors by wires more than the specified length may decrease the accuracy of measured values.
- Separate the sensor and digital input cables as much as possible (at least 10 cm) from the power cables to the loads to avoid possible electromagnetic disturbance. Never lay power cables and probe cables in the same conduits (including those in the electrical panels).
- For the CANbus cable, it is best to use 24 AWG shielded twisted-pair cable with a shunt capacitance of 16 pF/ft and 100 Ω impedance.
- The controller provides a communication interface which is connected to the RJ and CAN terminals.
- Terminal resistors 120 Ω for terminal devices are recommended at both ends of the bus (first and last node) Terminal resistance between H and R terminals.

Table 11: EKE controller supports the following max. cable length

Inputs	Cable length	Wire size (Min. / Max.)
Analog inputs (Current/Voltage)	max. 10 m	0.14 /1.5 mm^2
Temperature sensor	max. 10 m	-
Stepper valve connection	max. 30 m	0.14 /1.5 mm^2
Power supply	max. 5 m	0.2 /2.5 mm^2
Digital input	max. 10 m	0.14 /1.5 mm^2
Digital output	-	0.2 /2.5 mm^2
Digital MMI	max. 3 m over CAN RJ	-
Communication bus	max. 1000 m	0.14 /1.5 mm^2

- All valves are driven with a 24 V supply chopped to control the current (Current driver).
- The stepper motor is connected to the “Stepper Valve” terminals (see terminal assignment) with Danfoss M12 connection cable.
- To configure stepper motor valves other than Danfoss stepper motor valves, the correct valve parameters must be set as described in the Valve configuration section (see the configuration section for details).
- The correct valve must be defined in “Valve configuration”, i.e., parameter I067.

Table 12: ETS Colibri / KVS Colibri / ETS / KVS / CCM / CCMT / CTR

Danfoss M12 Cable	White	Black	Red	Green
ETS Colibri® / KVS Colibri / CCMT / CTR / CCM Pins	3	4	1	2
EKE terminals	A1	A2	B1	B2

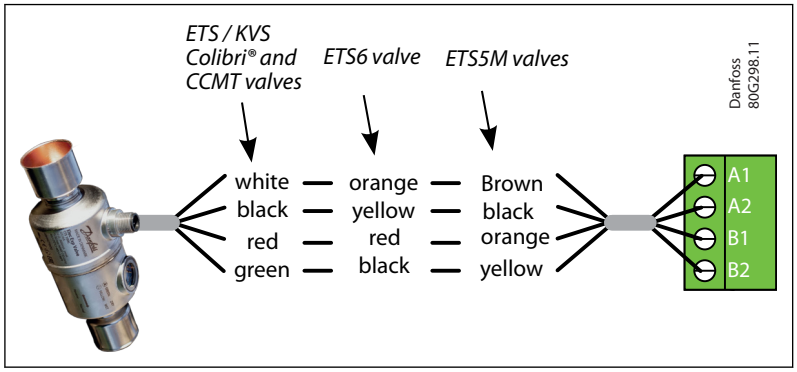
Table 13: ETS 6

Wire color	Orange	Yellow	Red	Black	Gray
EKE terminals	A1	A2	B1	B2	Not connected

Table 14: ETS 5M

Wire color	Brown	Black	Orange	Yellow	Red
EKE terminals	A1	A2	B1	B2	Not connected

Figure 9: ETS/KVS colibri



Guideline for long M12 cables on Danfoss stepper motor valves

- Long cables will lead to degradation of performance
- You can overcome this degradation by changing the settings for the valve driver. This guideline is based on the cable type being the same type as the standard Danfoss stepper motor cable

Table 15: Recommended wire size and cable distance (twisted pair) between EKE controller and stepper motor valve

Cable length	1 m – 15 m	15 m – 30 m
Wire diameter	0.52 / 0.33 mm^2 20 / 22 AWG	Min. 0.52 mm^2 20 AWG

Tip for updating I028 parameter for 15m - 30m cables:

1. Use koolProg online service option (EKE should be connected)
2. Select the desired valve first
3. Again change to user defined option, the valve default settings of previous selected valve will be loaded automatically
4. Change only the I028 parameter. According to the value in below table

Table 16: Parameter setting for long M12 cable 15 - 30 m

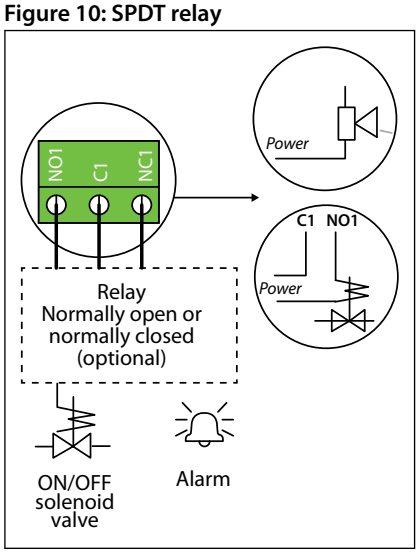
Product	I028 Valve drive current
ETS 12C - ETS 100C KVS 2C - KVS 5C	925mA peak
ETS 12.5 - ETS 400 KVS 15 - KVS 42 CTR 20 CCMT 2 - CCMT 8 CCM 10 - CCM 40	200 mA peak
ETS 6	270mA peak
CCMT 0	270mA peak
CCMT 1	400mA peak
CCMT 16 - CCMT 42	450mA peak
ETS 5M	190mA peak

3.5 Connecting Relay Outputs

EKE1 series has 1 relay output

- Type SPDT relay. Digital Output can be used to connect either a solenoid valve or an alarm

Figure 10: SPDT relay



NOTE:
The relays cannot be used for the direct connection of loads such as LEDs and ON/OFF control of EC motors. All loads with a switch-mode power supply must be connected to a suitable contactor or similar

3.6 Temperature Sensor Mounting

Figure 11: Temperature sensor mounting

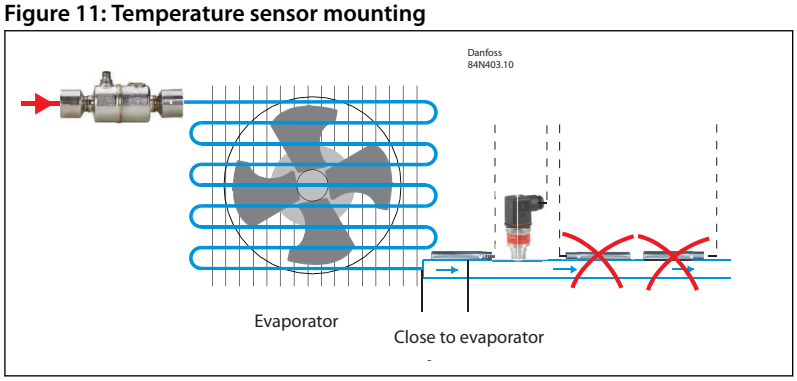
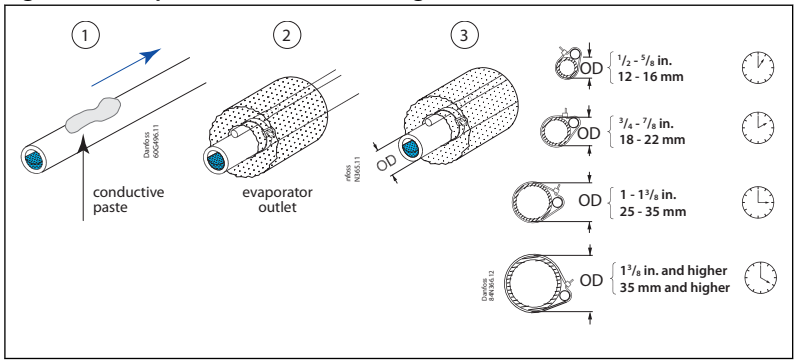


Figure 12: Temperature sensor mounting



NOTE:
- Mount sensor on a clean surface without any paints
- Remember to put on heat conducting paste and insulate the sensor
- Sensor mounting max. 5 cm from the outlet of the evaporator
- Physical temperature sensor can't be shared

NOTE:
Installation of the pressure transmitter is less critical. but mounting of pressure transmitter should be closer to the temperature sensor right after the evaporator and with its head in "upright position

3.7 Power and signal sharing

3.7.1 Sharing Power Sources

The EKE 1x series can share common power supplies with multiple controllers because the power supply input of the EKE is galvanically isolated from the outputs. The external power supply must have enough power rating Watt/VA to operate multiple EKEs and most importantly enough power to run the valves. The Battery backup is an optional feature. If Battery backup is connected to EKE terminals, the EKE will close the stepper motor if the controller losses its supply voltage

1. A special attention is needed on sharing both external power supply as well as battery backup. it is not allowed to share AC power supply and DC EKE 2U backup battery simultaneously with multiple controllers
2. In case both DC power supply and battery are shared between several units, it is recommended to have the negative poles of battery and power input shorted together at each unit. Such solution requires EMC test to be conducted on the final equipment by customer

Figure 13: Power sharing from EKEs

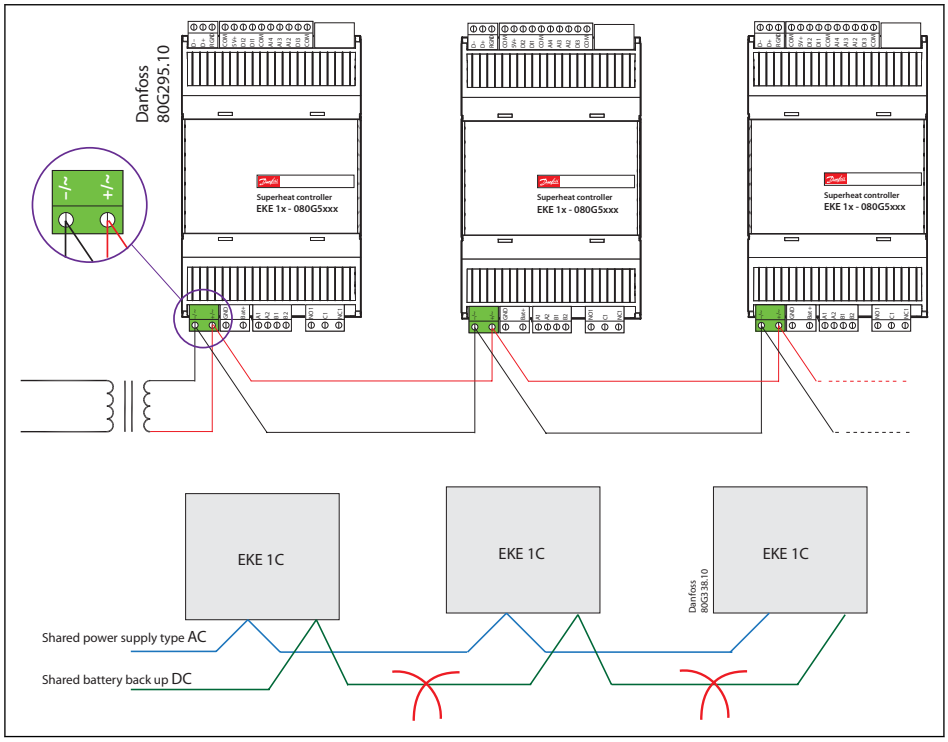
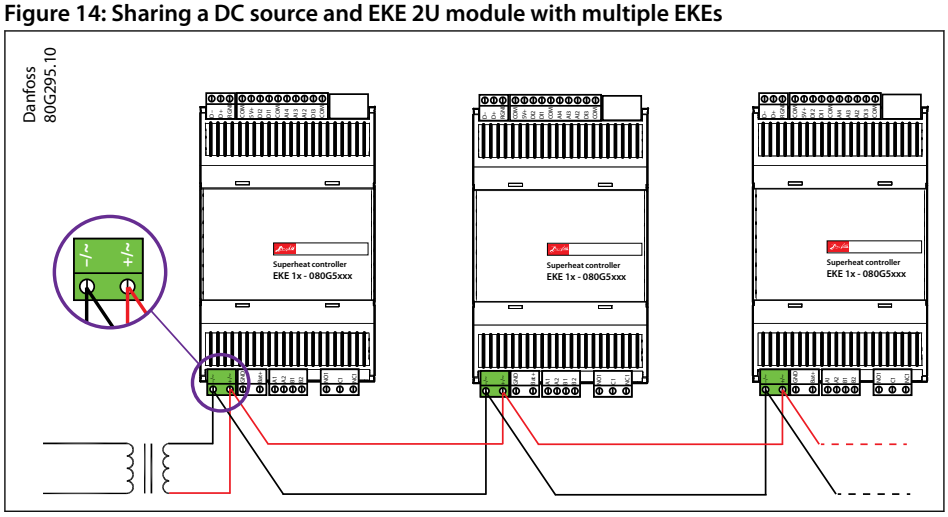


Figure 14: Sharing a DC source and EKE 2U module with multiple EKEs



Danfoss recommends using EKE 2U as the preferred battery backup device, for more details check the EKE 2U datasheet. The battery backup device power rating Watt/VA must match the valves requirements

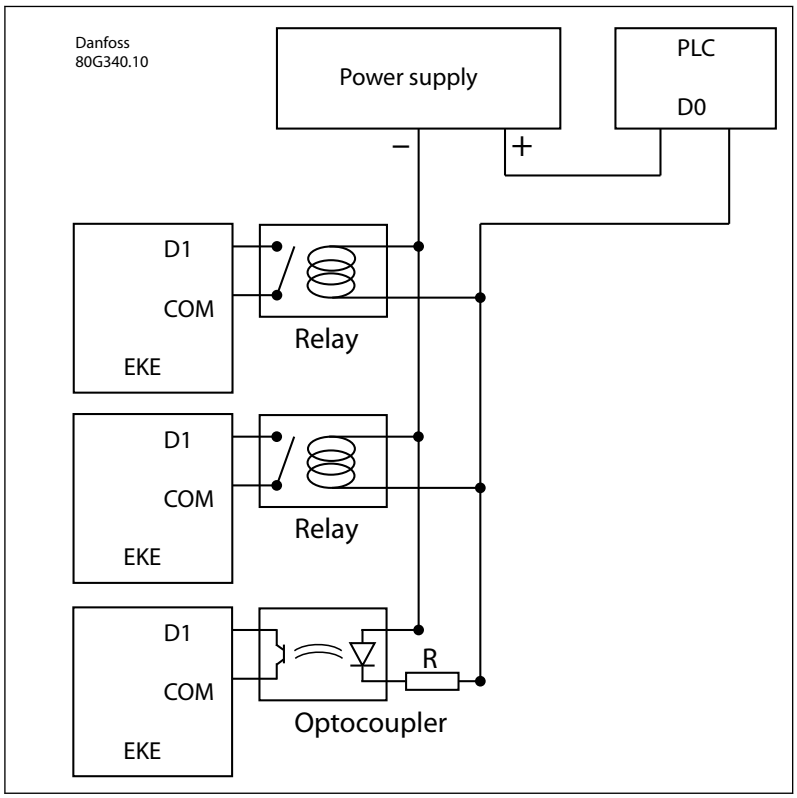
NOTE:

- The power supply terminals must be connected at every Unit.
- The battery voltage must not be connected from main power supply connected to EKE.
- A battery voltage lower than 16.5 V and higher than 27V will trigger the battery alarm.
- It is not allowed to shared AC power supply and DC backup battery simultaneously with multiple controllers.
- EKE 2U can only support a maximum of two valves for emergency closing, or only one valve in case the valve used consumes higher power. See EKE 2U documents for more details.

3.7.2 Sharing input signal

The EKE cannot share digital inputs.The digital inputs (voltage free Contacts) cannot share the same signal directly or be connected to external power supply.To share a digital signal between multiple digital inputs, a special circuitry is needed. For example, Each DI can be provided with its own relay (or optocoupler) that must withstand 100mA impulses at15V. EKE 1 series (Except 1C) can share analog input between multiple controllers

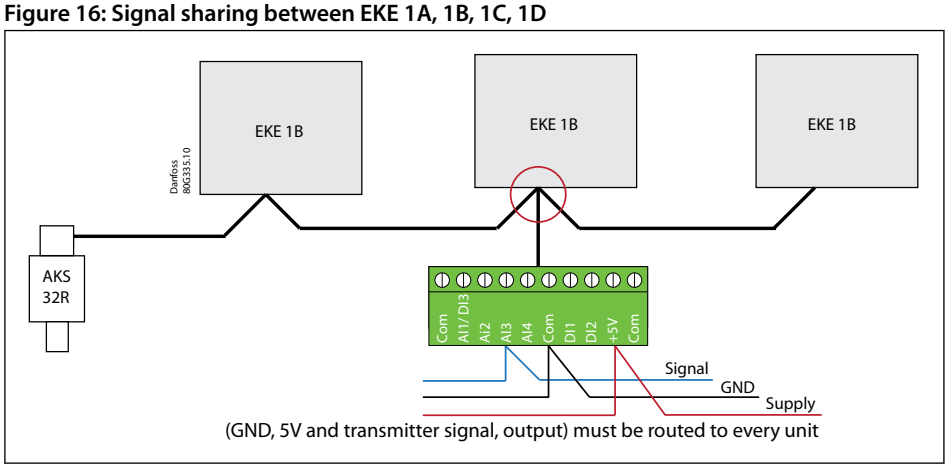
Figure 15: Possible circuitry to share a digital signal between Multiple EKE



3.7.3 Sharing pressure sensor signal

For **EKE 1A, EKE 1B, EKE 1D** up to 5 controllers can share one Ratiometric pressure transmitter readings. To get a correct acquisition on all the units all the three wires (GND, 5V and transmitter signal, output) must be routed to every unit

Figure 16: Signal sharing between EKE 1A, 1B, 1C, 1D



NOTE:
For a correct acquisition on all the units all the three wires (GND, 5V and transmitter signal, output) must be routed to every unit

In ***EKE 1C***, a physical pressure transmitter can only be shared via wired CANBus or Modbus

Sensor Signal sharing via CANBus in EKE 1C, 1D in EKE 1C, 1D Signal can be broadcasted once per second to all the following parameters enable/disable broadcasting of local signals (refer to the configuration parameter section):

[G012 - Signal sharing Pe]
[G013 - Signal sharing Pc]
[G014 - Signal sharing S3]

- If two or more sensors are connected to same sharing group, the controller which start up as the first one will broadcast the signal.
- If the receiving controllers has not received a shared signal from another controller for 3 seconds (parameter G003 CAN bus min update interval) it will start broadcast the local sensor.
- When more controllers are connected via CANBus each end of the bus must be terminated with a jumper between CANH and R120

NOTE:
Broadcasting is not possible via Modbus. In case of Sensor error, broadcast will stop.

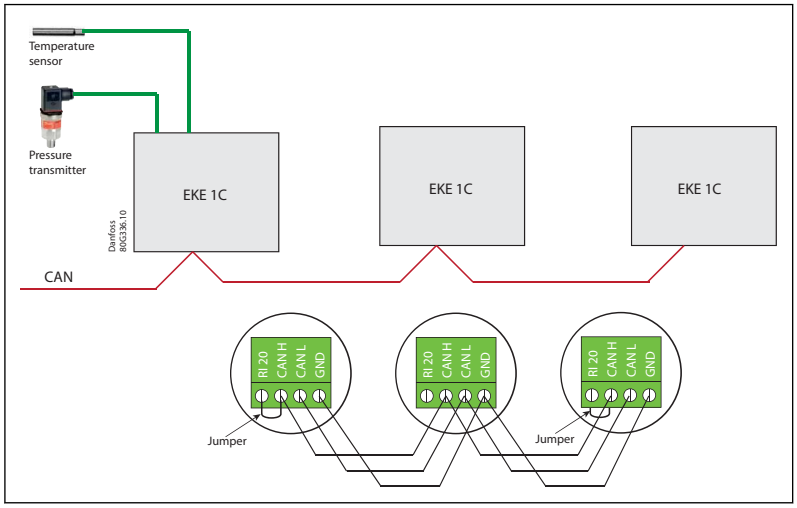
Only EKEs from the same group address can share signals

- Group 1 address 1 to 31
- Group 2 address 32 to 63
- Group 3 address 64 to 95
- Group 4 address 96 to 125

A controller knows its own address and knows from which address the broadcast is coming, this information is used to discard broadcast signals for controllers outside own group.

Address 0 is invalid, Address 126 and 127 are reserved for remote displays.

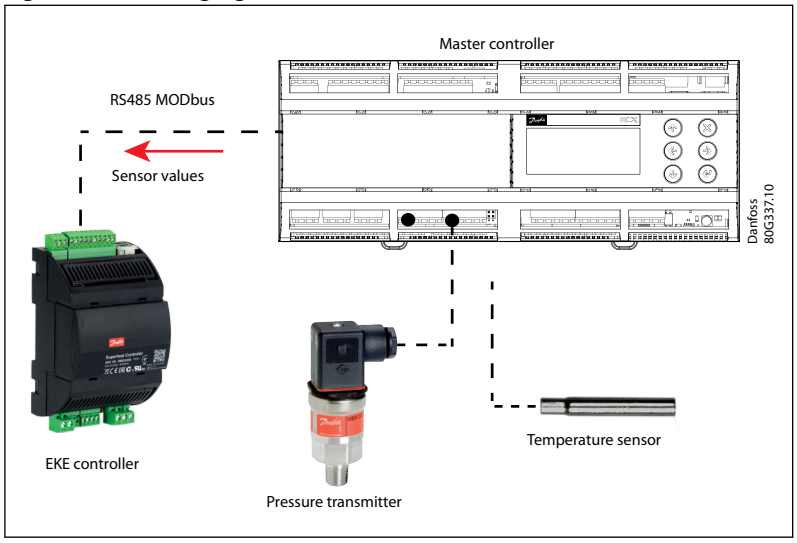
Figure 17: Sensor Signal sharing



Receiving Sensor Signal via Modbus:EKE 1B/1C controllers can receive the external sensor values like Po, Pc, S2, S3 and S4 via Modbus. In some applications, the suction pressure and/or the refrigerant temperature on the evaporator outlet, is measured by a system controller. In these cases, the sensors can be omitted from EKE, and the sensor values can be received via Modbus instead. This requires that the systems main controller continuously transmits these values to EKE, If no new sensor value is received within defined Modbus time interval in seconds i.e. G004 of the last transmission, the EKE will raise sensor alarm which will stop the regulation.

Example: The suction gas temperature S2 and the evaporator pressure Pe can be set by activating bus shared sensor configuration registers i.e "I040 = 5" and "I044 = 8" respectively.

Figure 18: Receiving signal via Modbus



4 Applications

EKE series devices are used where precise control of superheat in air conditioning system is needed. It helps achieving high energy efficiency and reliable operation

EKE serves 2 main applications:

- Controller Mode
  - Standalone Superheat control
  - Temperature control
- Driver Mode

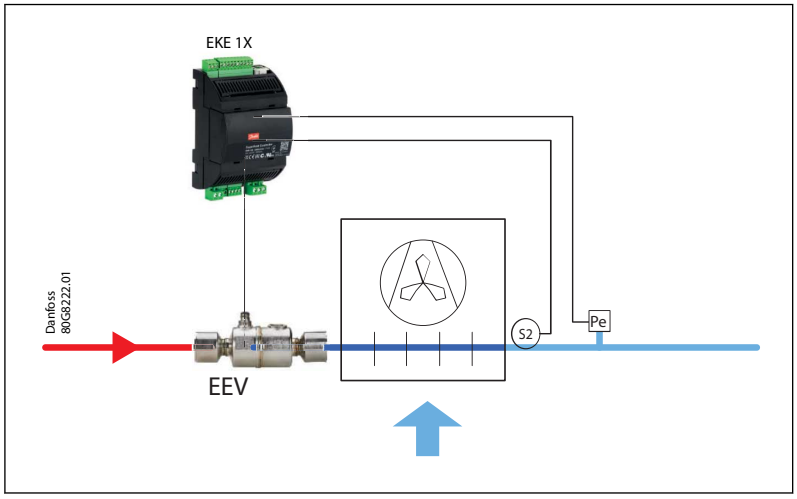
The need for cooling can either be defined by the incoming media (S3) or the outgoing media (S4) temperature

4.1 Controller Mode

4.1.1 Superheat control mode

EKE can serve as a PI controller for stepper motor valve that controls the superheat of the evaporator based on a pressure Pe and temperature (S2) sensors. In superheat mode the controller will control the superheat to be stable and close to the superheat reference. If superheat is too low the flow in the expansion is decreased and superheat will be higher

Figure 19: Superheat control application



4.1.2 Temperature control mode

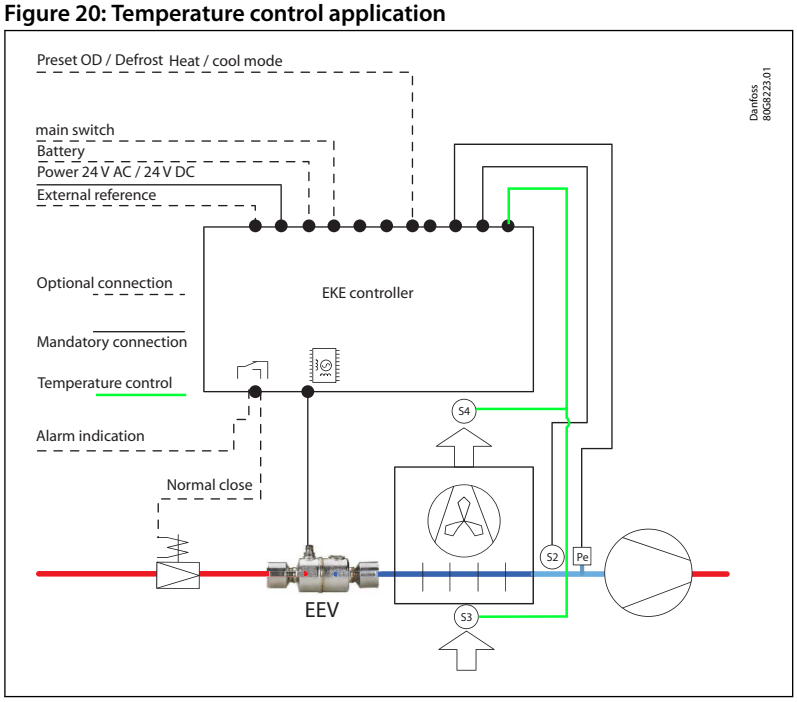
Temperature control Can be accomplished via a signal from temperature sensor S3 placed in the air flow before the evaporator or S4 placed in the air flow after the evaporator.

EKE has 2 methods of controlling temperature:

- ON/OFF thermostat
- Modulating thermostat (MTR)

The temperature control can be done using an ON/OFF thermostat that opens/closes the stepper valve as per S3/S4 temperature values or modulating thermostat that regulates the stepper valve more smoothly based on S3/S4 temperature setpoints. The need for cooling can either be defined by the incoming media (S3) or the outgoing media (S4) temperature

Figure 20: Temperature control application



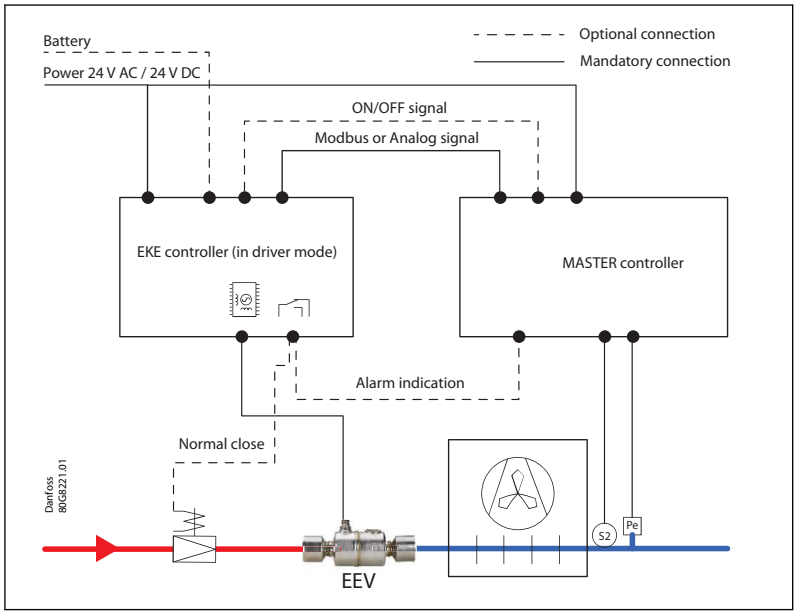
NOTE:
EKE1A cannot support thermostatic modes

4.2 Driver Mode

A master is commanding the valve open degree to the EKE controller. The control signal can be fed for example by:

- Analog signal e.g., 0 – 10 V, a 0 – 20 mA
- Bus communication

Figure 21: EKE as Driver Mode



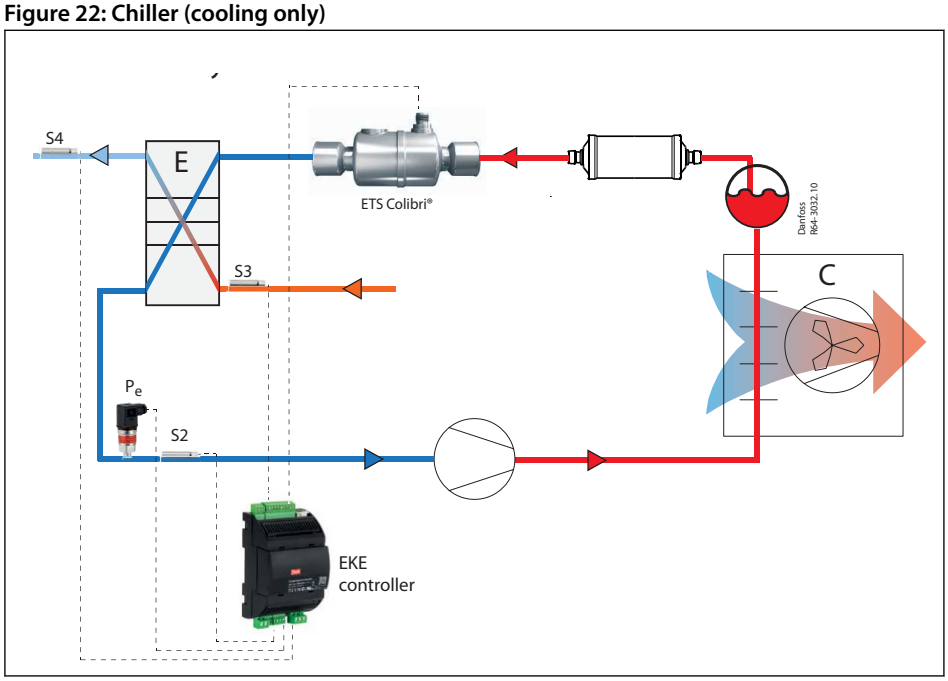
NOTE:
'Normal closed' valve in front of EEV is optional alternative to a battery backup solution which closes the EEV in case of power fail. The Digital output can also be used as alarm indication to the master controller. The Master can send a start signal to EKE DI terminals

4.3 Typical EKE applications

The EKE 1x series can be used for various refrigeration applications like Chiller, Reversible Chillers, Reversible Heat pump, AC air handler, cold room Standalone, Multi evaporators ext.

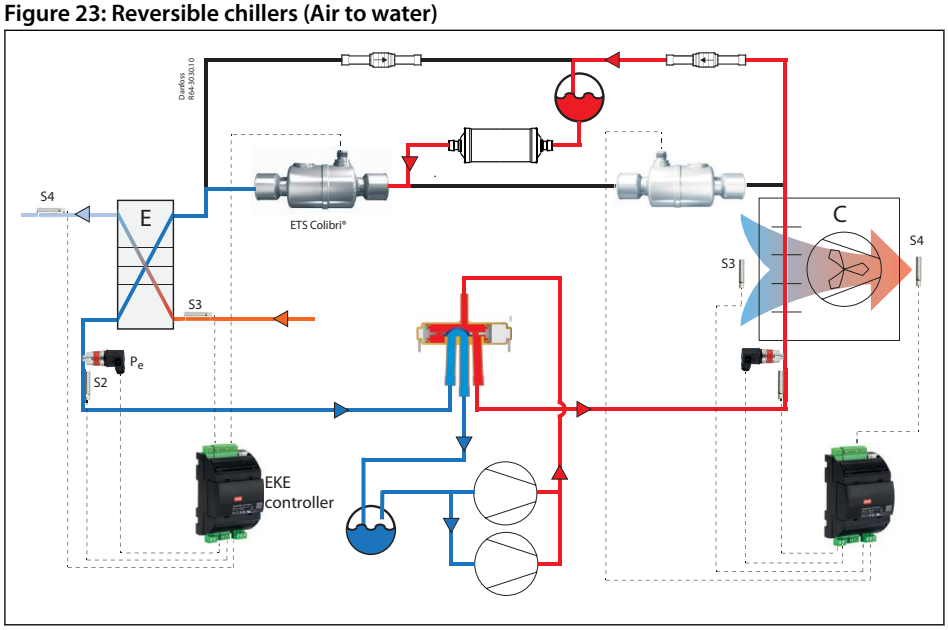
Chiller (cooling only)

Figure 22: Chiller (cooling only)



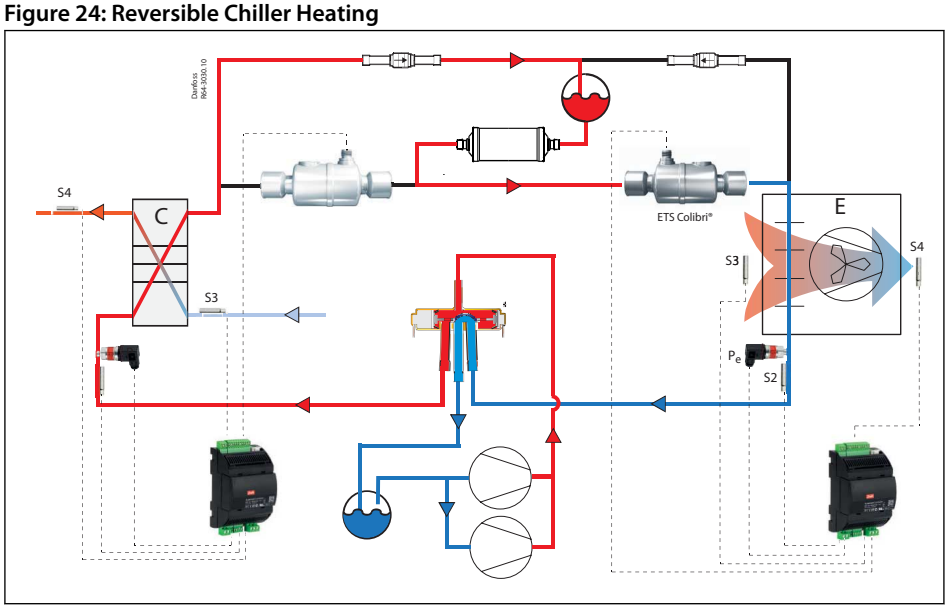
Reversible chillers (Air to water)

Figure 23: Reversible chillers (Air to water)



Reversible Chiller Heating

Figure 24: Reversible Chiller Heating



Reversible heat pump

Figure 25: Air to water heat pump cooling

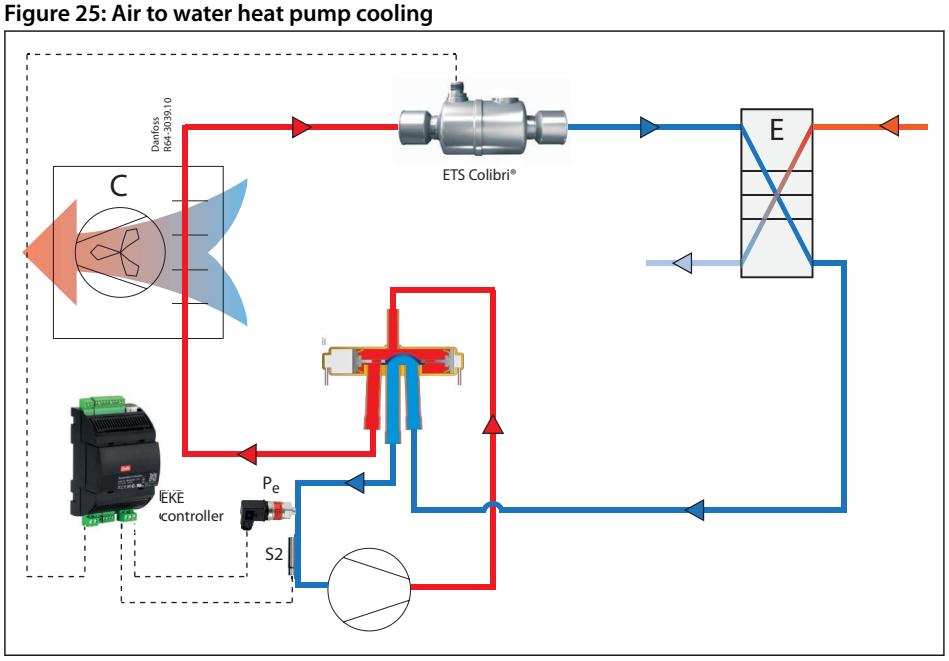
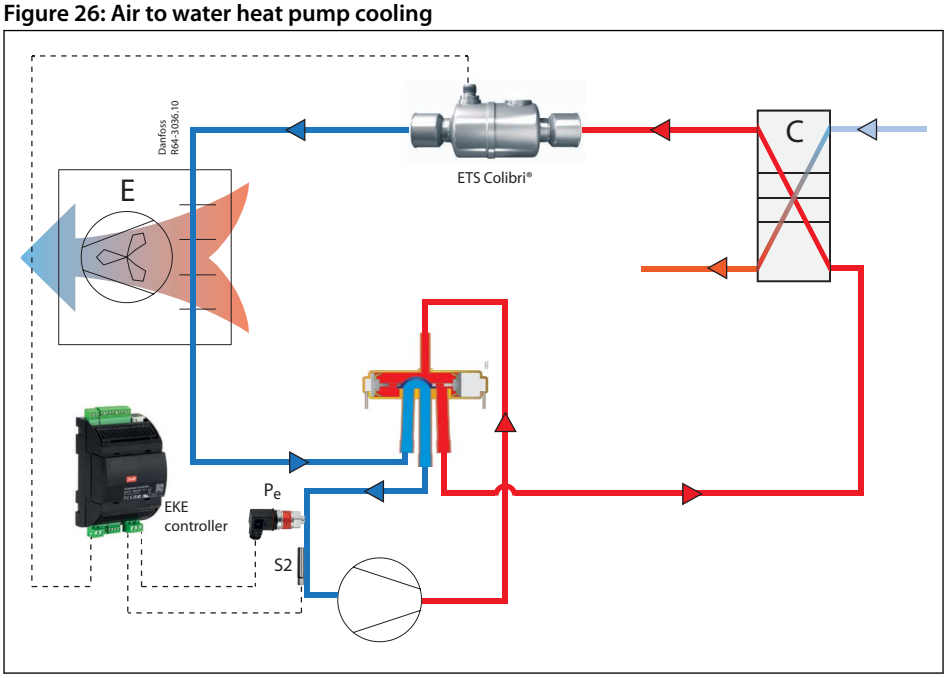
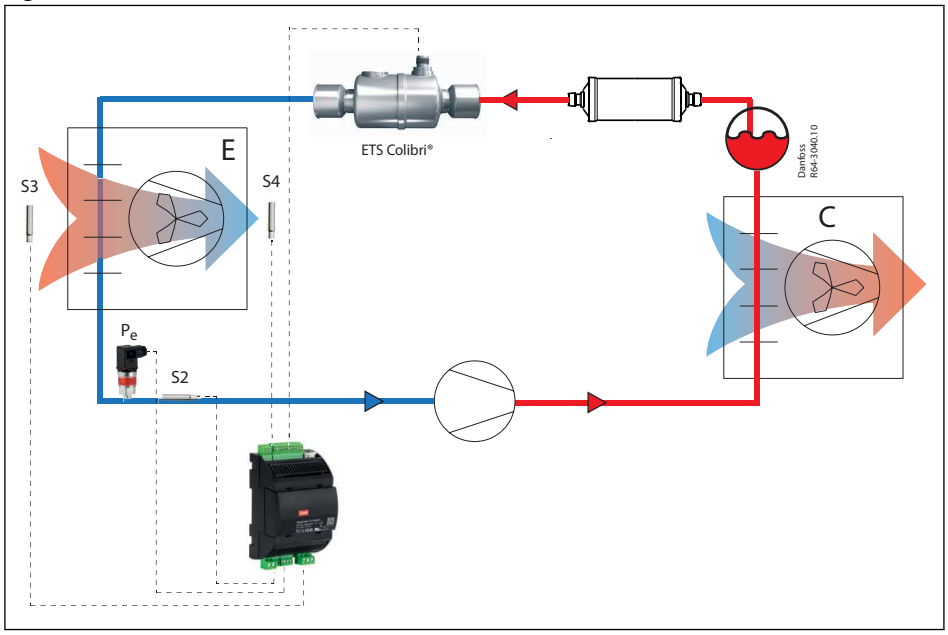


Figure 26: Air to water heat pump cooling



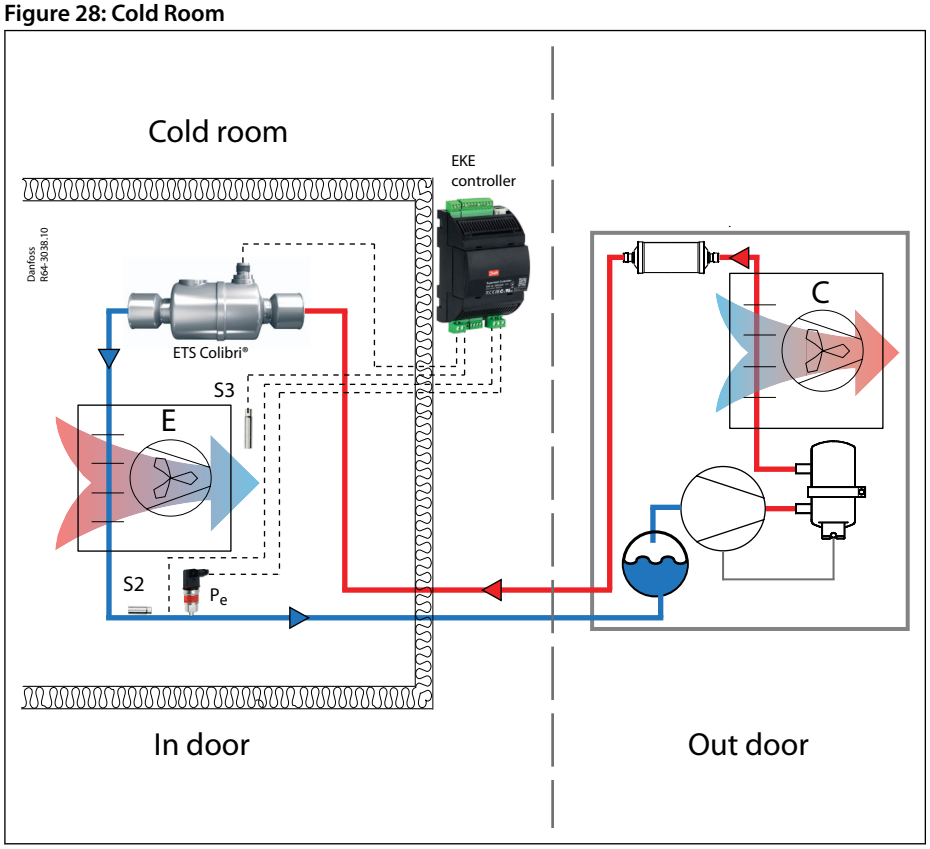
AC air handler

Figure 27: AC air handler



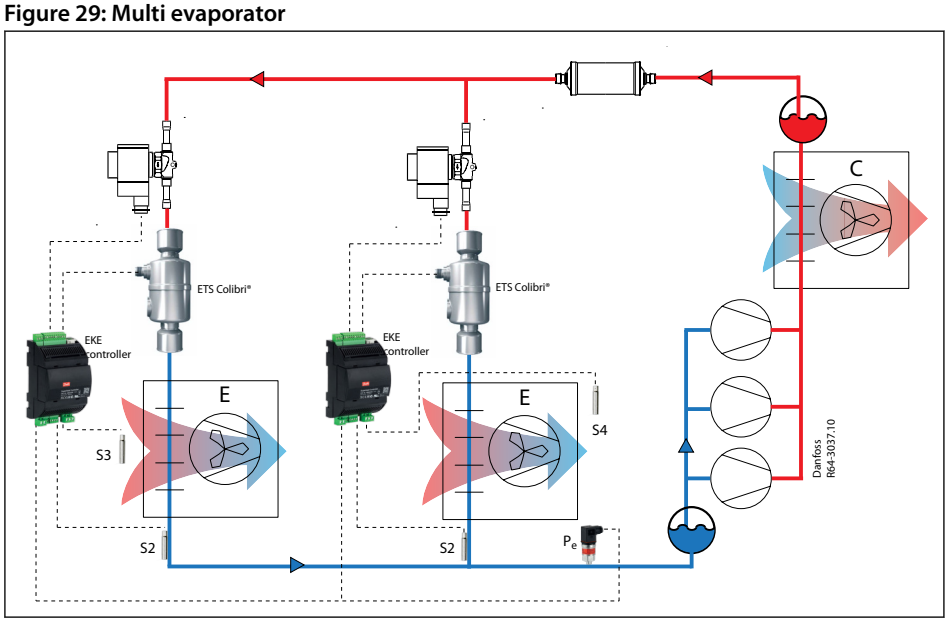
Cold Room

Figure 28: Cold Room



Multi evaporator

Figure 29: Multi evaporator



5 User Interface

In this section the user interfaces are described. EKE 1x controllers can be used with 2 main user interfaces:

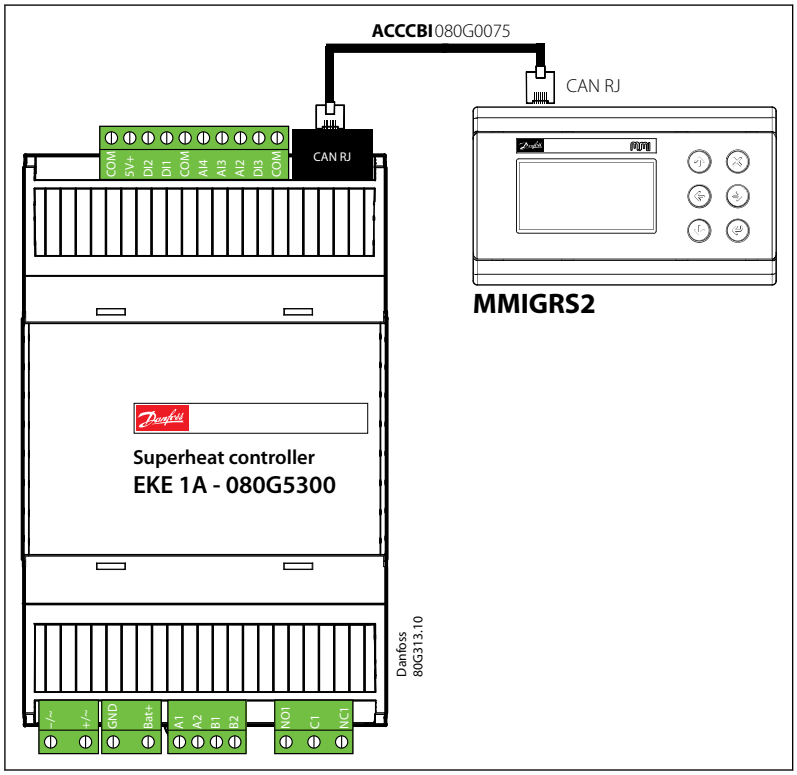
- MMI display
- KoolProg Software

5.1 Configuration using MMI Display

MMIGRS2 is a graphical display. The connection with each EKE controller is made through the CAN RJ or CANBus network. All the information about the user interface is loaded inside the EKE controller. that's why there is no need of programming the MMIGRS2 interface.

MMIGRS2 is powered externally or from the controller (while using RJ12) which it is connected to and automatically shows its user interface. EKE can be configured with basic settings quickly using the wizard setup and advanced settings can be made afterwards.

Figure 30: Connecting MMIGRS interface



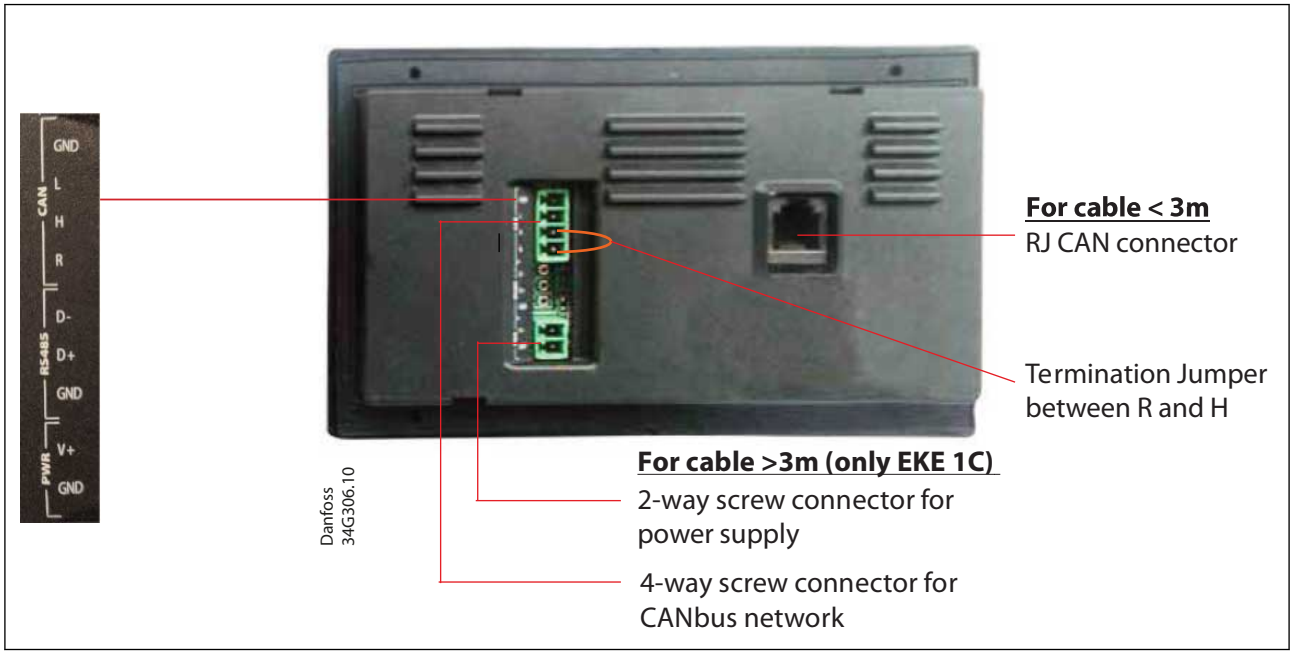
When MMI is not connected to EKE via CANRJ12 the autodetection feature of the EKE CAN address will not work.

Therefore, check the following MMIGRS2 setting:

1. enter BIOS menu pressing and holding X + Enter keys for 5 s.
2. select "MCXselection"->" Manual Mode" and set the CAN address of the EKE you wish to connect to. CAN H-CAN R shorting should be done only on the first and last node of the network.

For the series EKE 1C and EKE 1D, to connect via MMI via the wired CAN, the R and H terminal of the MMI needs to be shorted.

Figure 31: MMIGR2 Back view



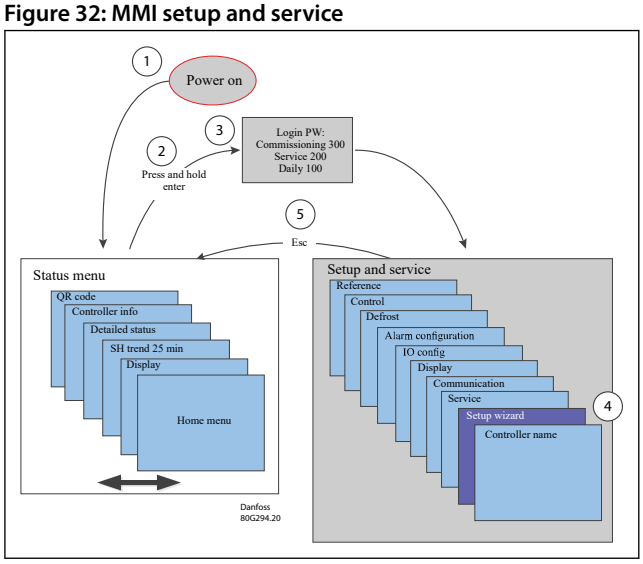
NOTE:
Even when connecting to the MMI via CAN RJ12 cable, it is still required to short R and H of the MMI.

5.1.1 MMIGRS2 Setup and service

Table 17: MMI setup and service

Setup and service	Setup description
Reference	Main switch, Mode selection
Control	General control parameter for example selecting control mode, protection function ext..
Defrost	Parameters about the defrost mode
Alarm configuration	Alarm parameters
IO config	IO configuration Sensor's configuration Valve Configuration External reference configuration
Display	For: Changing the language. Login timeout. Changing passwords. Brightness. Display unit (Metric or Imperial). Opening Degrees Unit
Communication	Communication settings Signal sharing, signal sharing update interval
Service	Service Mode allows Entering -Manual mode, Service Mode and Applying factory default.
Setup wizard	The Wizard is a quick tool for configuration, the workflow is as follows a. Language selection. b. Application selection. c. Input configuration. d. Output configuration. When using the Setup Wizard, repeat the following sequence for all parameter settings: a. From Setup wizard, select relevant parameters. b. Press ENTER to highlight 1st option c. Scroll with UP / DOWN to your desired option d. If the selected default value is acceptable, press DOWN to get to the next settings. Otherwise, press ENTER to set your choice e. Scroll with DOWN to the next parameter (repeat sequence a. to e.)

Figure 32: MMI setup and service



NOTE:
For more parameter and settings refer to the parameter table

5.1.2 MMIGRS2 Main screen

On the main screen the following data are displayed:

- The main analog inputs measurements or other information.
- The icon indicating operating status.
- The alarm or service icon.

Figure 33: MMIGRS2 Main screen

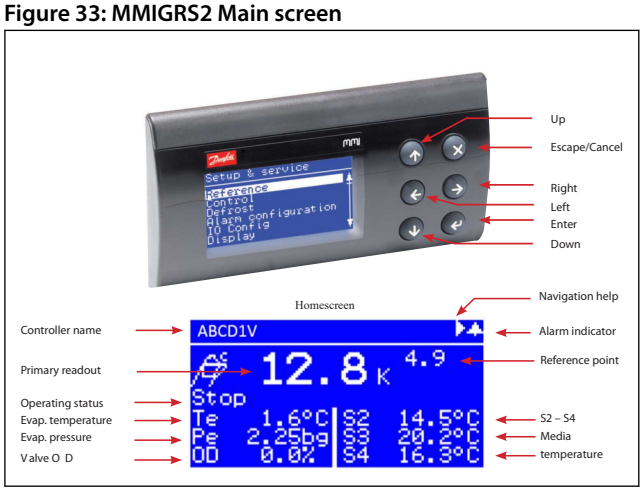


Table 18: Navigation through MMIGRS2

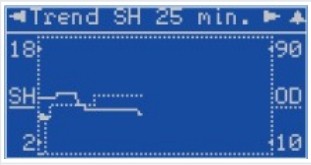
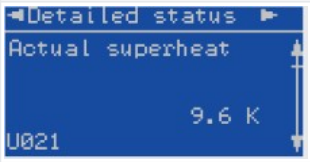
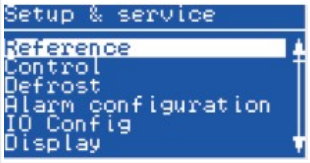
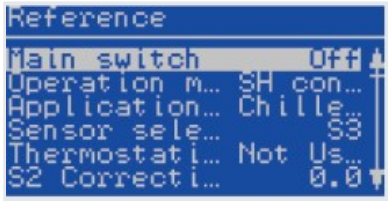
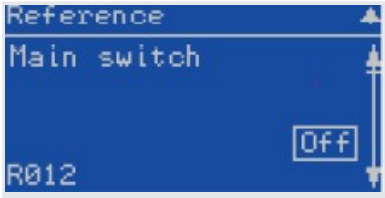
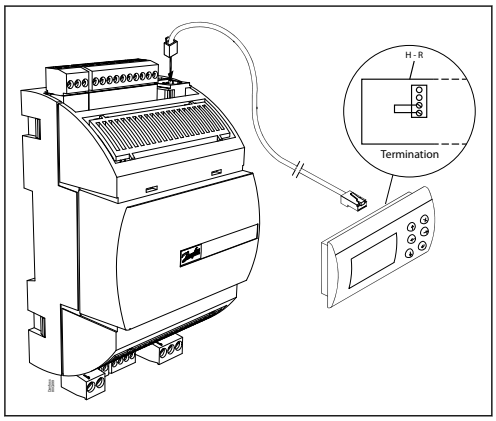
Unit Status	Key	Function	Description
		Home screen	Shows the operating status.
	Right x1	Active alarms	Access to Active alarm list. Press UP and Down button to see complete list
	Right x2	Trend SH 25 min	Shows logged Superheat graph for 25 minutes.
	Right x3	Detail Status	Shows detail operating status. Press UP and Down to see complete list.
	Right x4	Controller info	Provides information about the product
	Right x 5	QR code	QR code that directs you to the product webpage for more info.
	Holding Enter for 3 seconds	Log in / Setup and Service	If User has not logged in, Enter password. Press UP/Down to change digit and Enter to confirm the value.
	Escape/Cancel		Go back to main screen
	Holding Escape for 3 Sec	Logged out	User logout
Login			
	Up	+	Increment the selected digit
	Down	-	Decrement the selected digit
	Enter	ok	Confirm the vale and skip to the next digit or execute login
	Escape/cancel		Go back to main menu.

Table 19: Examples

Parameter Navigation	Parameter change(R012)	Factory re-setting of display:
		
Navigation and reading the status of the parameters is possible.	For examples, parameter R012 (for the main switch). Can be changed through reference => main switch	1. Pressing the bottoms X and ENTER at the same time for 5 second 2. Select MCX SELECTION 3. Select CLEAR UI

⚠ WARNING:



5.1.3 ERR31 Error Alarm on the external display - MMIGRS2

If the communication to the display is not carried out correctly, it will send an “ERR31” error notification. This may be caused by the displayed wires H to R not being shorted, or that there have been interruptions in data communication during the time when the display retrieves the basic information from the controller. Once the terminations have been inspected, you should then check the software version of the external display. This is done by holding down the Enter key and the X key for 5 seconds, until the Bios menu appears. Next, press the X key and read off the software version in the bottom right corner. The software version must be 1.13 or newer. Once the display’s software version has been checked, check the display’s settings as follows:

1. Hold the Enter key and the X key down for 5 seconds, until the Bios menu appears.
2. Select the “MCX selection” menu - Select the “Clear UI” line and press Enter - Select the “Autodetect” line and press Enter.
3. Press the X key to return to the Bios menu.
4. Select the “COM selection” menu - Select the “CAN” line and press Enter .
5. Press the X key to return to the Bios menu.
6. Select the “Startup mode” menu - Select the “Remote application” line and press Enter.
7. Press the X key to return to the Bios menu.
8. Select the “CAN” menu - Select the “Baudrate” line and check that it is 50K - Select the “Node ID” line and check that it is 126
9. Press the X key to return to the Bios menu.
10. Select the “Application” menu and press Enter. The display will once again retrieve data from the controller. This process will take about 5 minutes

5.1.4 Service mode through MMIGRS2

Service mode is designed to provide a very simple way of operating the valve for diagnostic and service purpose. There is neither application nor protection in this mode. The user can open and close the valve using simple button presses on MMIGRS2.

NOTE:
This mode only has a home screen and do not have any menu structure. All function is carried out using the "Escape", "Up", "Down" and "Enter" buttons on MMIGRS2

Service mode is only available via MMIGRS2 display. This function is not possible in KoolProg

Figure 34: Service mode through MMIGRS2

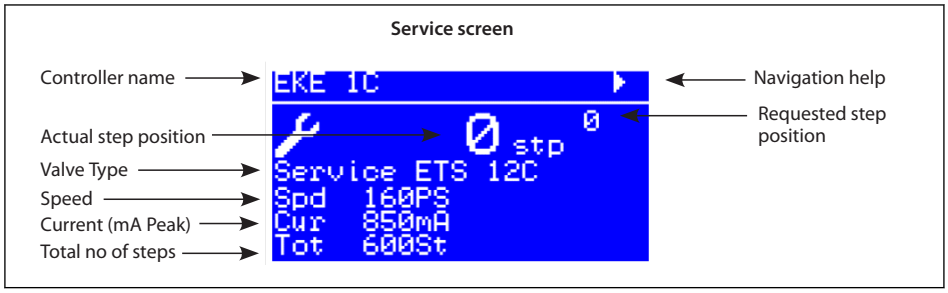
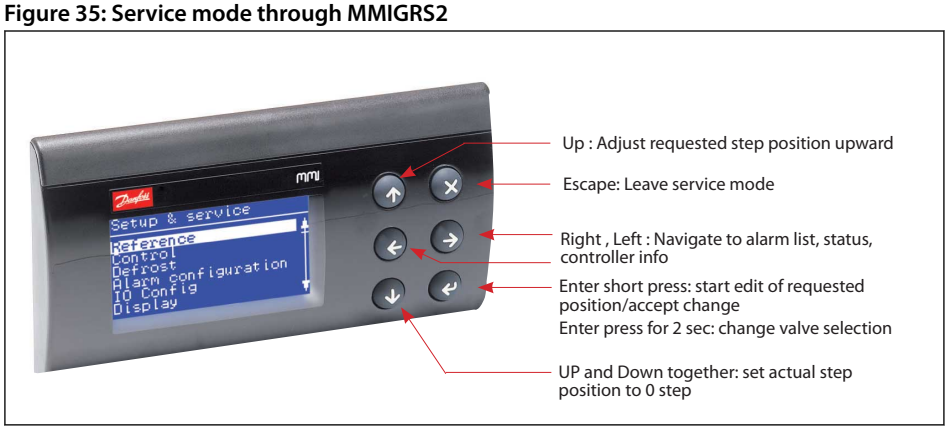


Figure 35: Service mode through MMIGRS2

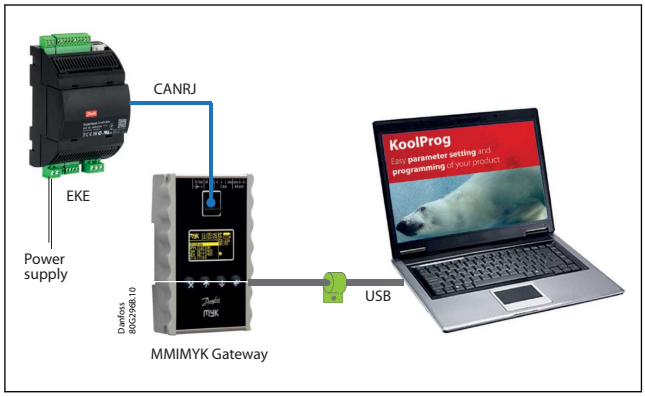


5.2 Configuration using KoolProg Software:

KoolProg is a software tool that can configure the EKE Controllers in fast and easy way. The main features of the KoolProg are listed as follows

- Make Online changes to parameter configurations
- Monitor live status of inputs and outputs
- Quickly analyze controller behavior. and program patterns by using the graphical trending tool

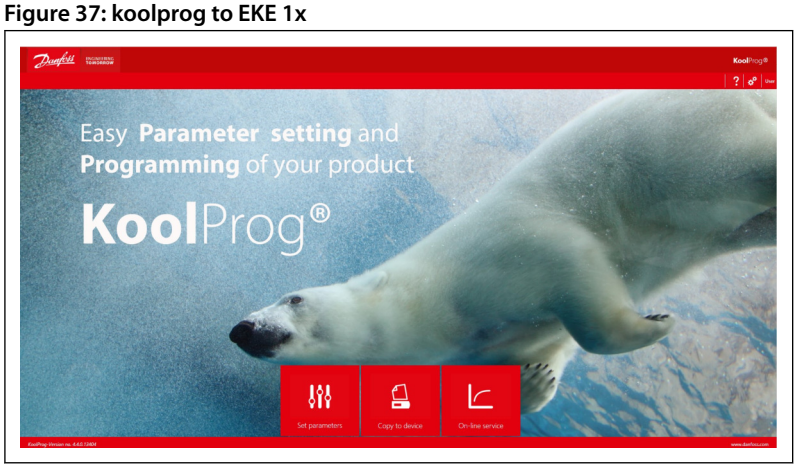
Figure 36: Connecting koolprog to EKE 1x



NOTE:
- Make sure to install the latest version of the EKE.
- The connection of the EKE to the koolprog software, must be done through the MMIKYK gateway.
- KoolProg software do not support multiple EKE controllers in a daisy chain network.

- EKE must be powered up before starting programming.
- To guarantee a reliable USB connection to a host device (e.g., industrial PC), you must: keep USB cable length < 1 m.
- When prgoramming with koolprog if there is any error with values set then EKE will go to factory defualt settings after restart. Make sure values entered are within range specfied for each parameter.

Figure 37: koolprog to EKE 1x

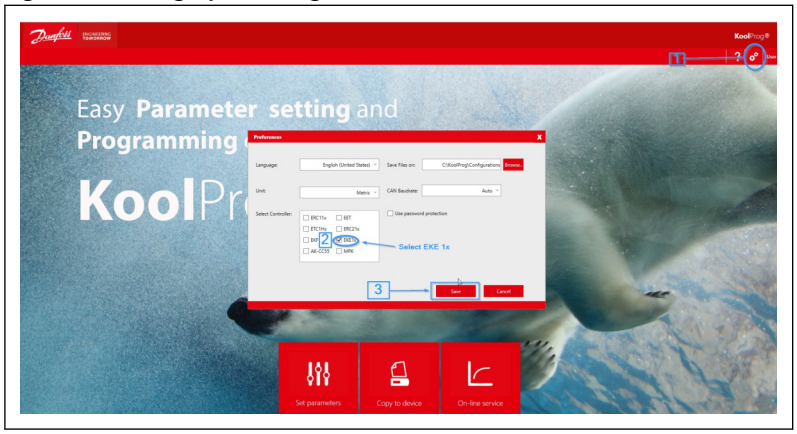


Set parameters	Copy to device	On-line service
• Create your own configuration files on your PC without having to connect a controller • Import a parameter configuration file to your PC from a connected controller. Save the file and download it to other controllers of the same model • Select the most frequently used parameters as your favorites • Find all the technical documentation for each controller model within one location	• Quickly program one. or multiple controllers by using the progress and completion status indicators	• Quickly analyze controller behavior and program patterns by using the graphical trending tool • Make Online changes to parameter configurations • Monitor live status of inputs and outputs

4.2.1 Setting Up KoolProg

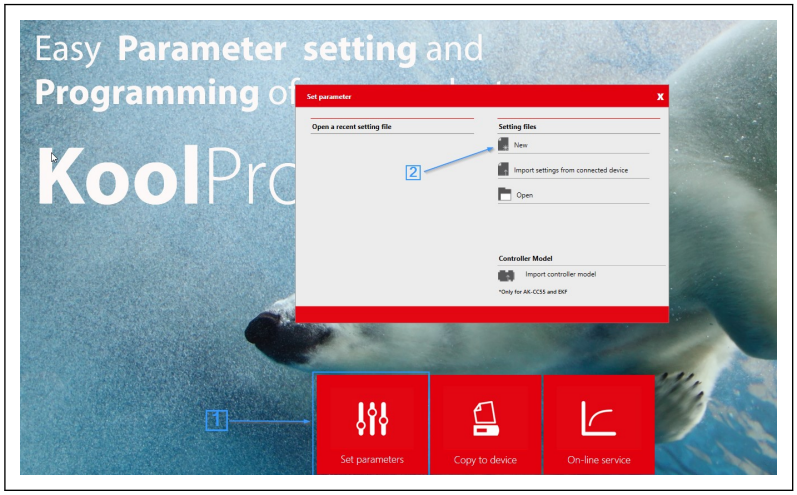
KoolProg software supports wide range of Danfoss product, so first you need to select the EKE 1x series from the preferences.

Figure 38: Setting Up KoolProg



Then if you want to setup, click the set parameter and select a new project

Figure 39: Setting Up KoolProg



Then select the EKE variant you have

Figure 40: Setting Up KoolProg

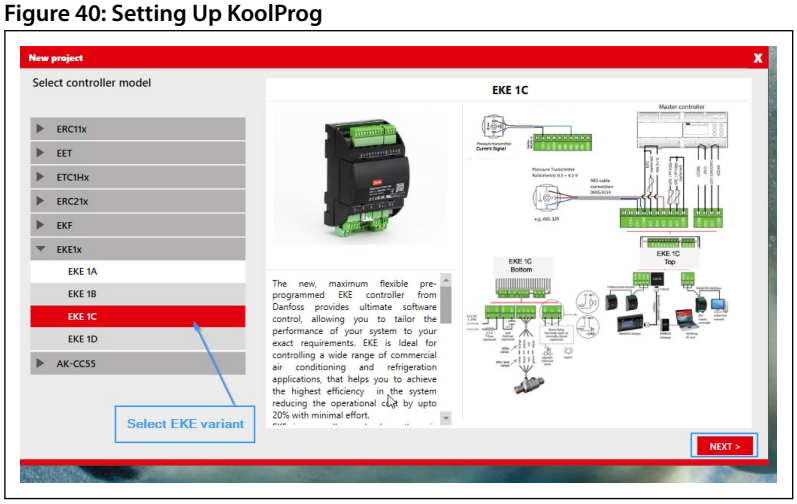
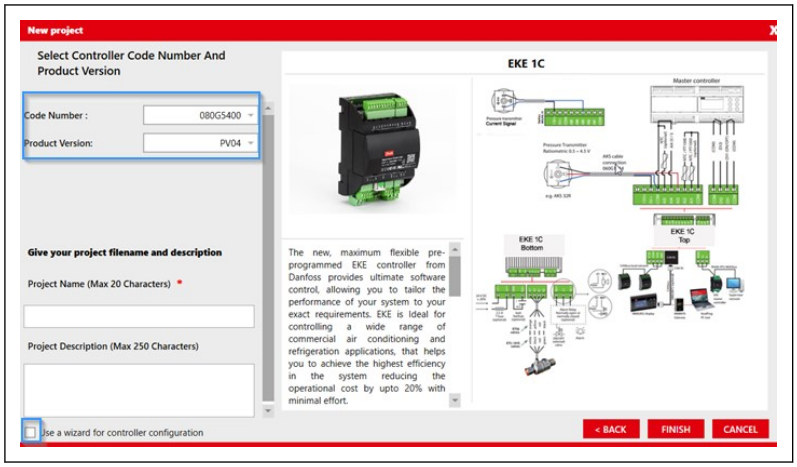


Figure 41: Setting Up KoolProg



NOTE:

- The product code number and product versions are found in the product label.
- The wizard tool is optional, it allows to go through a quick configuration for a specific application. You can still configure it through the koolprog main menu

4.2.2 KoolProg Wizard for Rapid Controller Configuration:

The KoolProg wizard, is a tool that allows you to quickly set the parameters for your specific application. The workflow for the wizard is as follows:

The Wizard is a quick tool for configuration, the workflow is as follows

1. Language selection
2. Application selection
3. Input configuration
4. Output configuration

Figure 42: Wizard for Rapid Controller Configuration

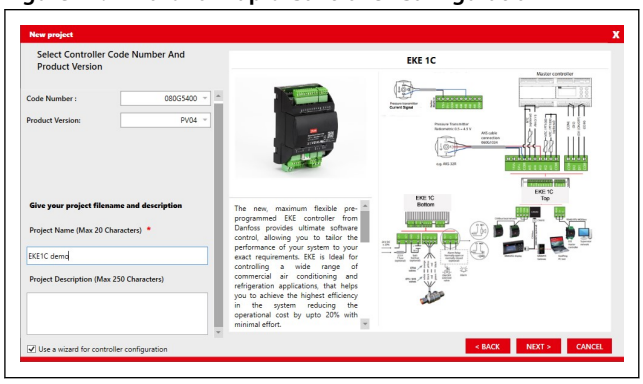


Figure 43: Wizard for Rapid Controller Configuration

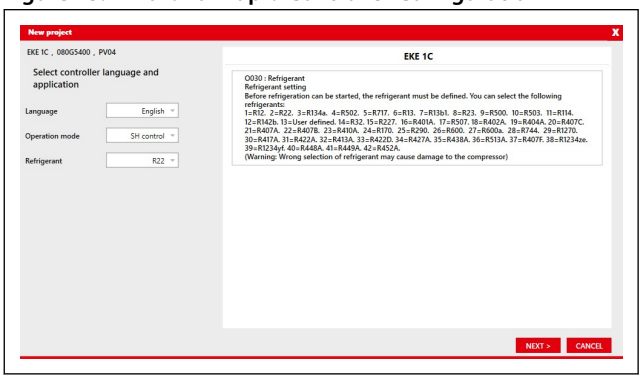


Figure 44: Wizard for Rapid Controller Configuration

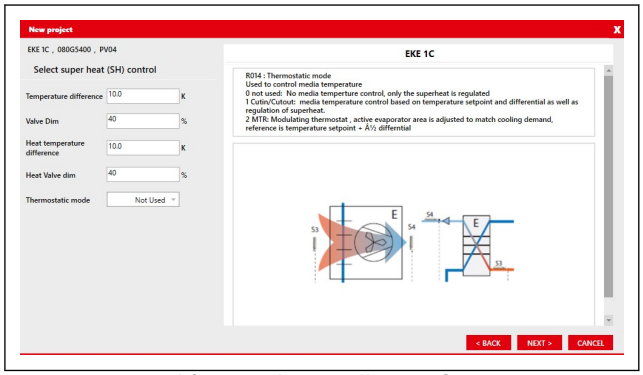


Figure 45: Wizard for Rapid Controller Configuration

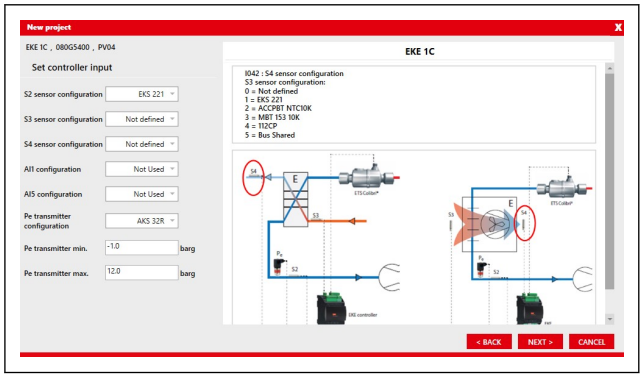
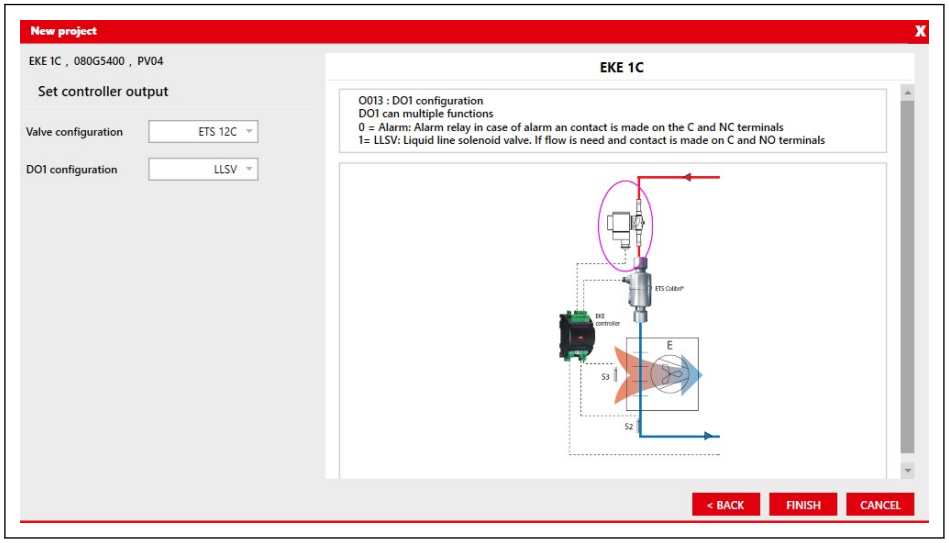


Figure 46: Configuration using KoolProg wizard



4.2.3 KoolProg Set parameters menu

The main menu is used to get a configuration file with the desired settings that can be uploaded to EKE 1x devices, you can customize the parameter according to your specific application. The parameters are organized in parameter groups. Also, you can use the search box to search for a parameter, however Search feature will only display the parameters relevant to your settings. Example I035, I034 min max external voltage reference only appears if you select R102 as 'Valve driver' and I033 as 'Voltage to OD'

NOTE:
The parameters for various applications are illustrated in the configuration section

Figure 47: koolprog main menu, example EKE 1C

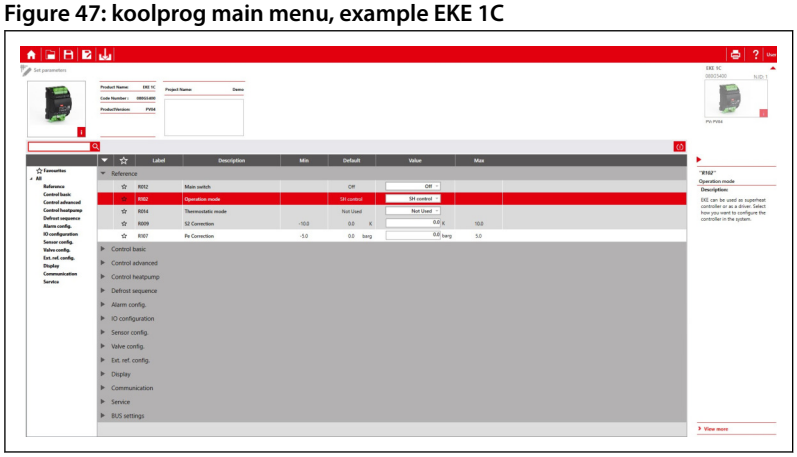


Figure 48: Uploading the settings to EKE

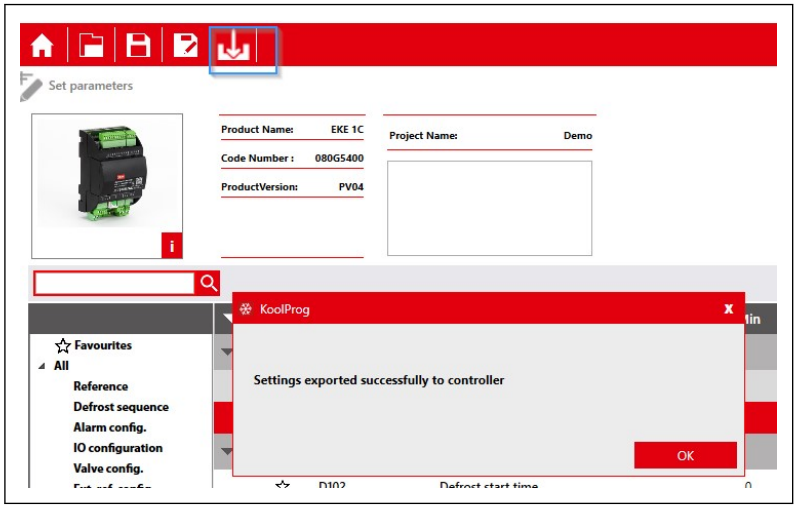


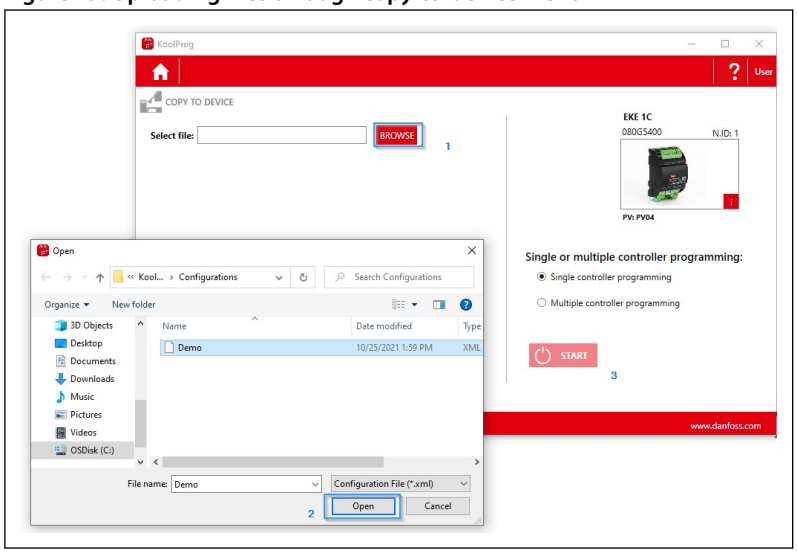
Table 20: KoolProg main Menu Summary

Parameter Group	Setup description
Reference	Main switch, Mode selection
Control	General control parameter for example selecting control mode, protection function ext.., it is divided into 3 sections: Control Basic, Control Advanced, Control heatpump
Defrost Sequence	Parameters about the defrost mode
Alarm configuration	Alarm parameters
IO config	Confuguring For analog and digital inputs
Sensor's configuration	Configuring pressure and temperature sensor
Valve Configuration	Configure settings for the valve
External reference configuration	For more settings for External reference and the AI4
Display	Display Settings of the MMI screen, and passwords and logout configuration
Communication	-Communication settings (controller address, communication baud rate for CANbus and Modbus) -Signal Sharing settings
Service	Service Mode allows Entering -Manual mode, Service Mode and Applying factory default.

4.2.4 Copy to device- Uploading configuration file to KoolProg:

From the parameter selection menu, any change made can be saved as file using the saving options, save or save as, also you can know the folder containing these files by clicking the folder icon. To upload a configuration file. Click on browse, select the file you saved from the parameter selection menu, then click open, then Start.

Figure 49: Uploading files through copy-to-device menu

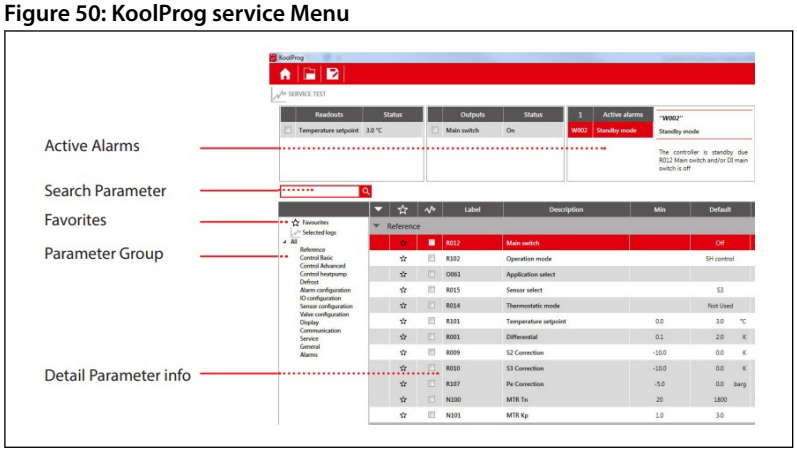


4.2.5 KoolProg On-line service Menu:

The service menu allows a quick analyze controller behavior and program patterns by using the graphical tool. It is also possible to make online changes to parameter configurations and monitor live status of inputs and outputs.

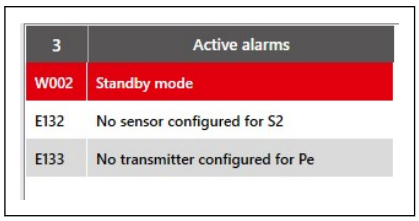
NOTE:
The service menu is only available in the service mode

Figure 50: KoolProg service Menu



The alarm Menu shows all the warnings or missing I/O in a dynamic way, that depends on the specific application. For example, if your application requires connecting a Sensor S2 and a pressure sensor Pe, and they are not connected, it will appear in the active alarms, if you connect the missing sensors the alarm will disappear

Figure 51: Service Menu Active alarms



Monitoring the operation is also possible through the koolprog datalogger tool. if you decide to log a parameter you need to select it first then, press the graph icon on top.

NOTE:
When the startup is complete with success you can setup the datalogger. The datalogger work over the service port so use of KoolProg / MMIGRS2 is not possible when datalogging is active. In case of need to check operation, it requires to stop the datalogger and reconnect KoolProg/MMIGRS2

Figure 52: Parameter logging

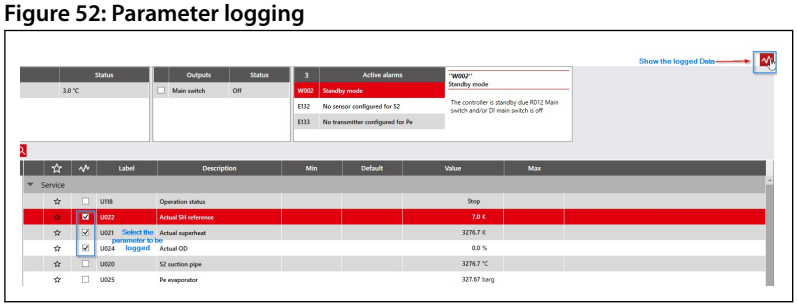
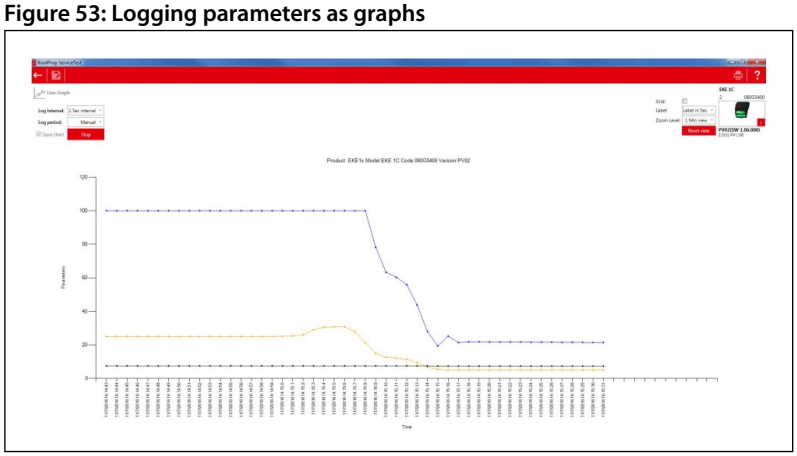


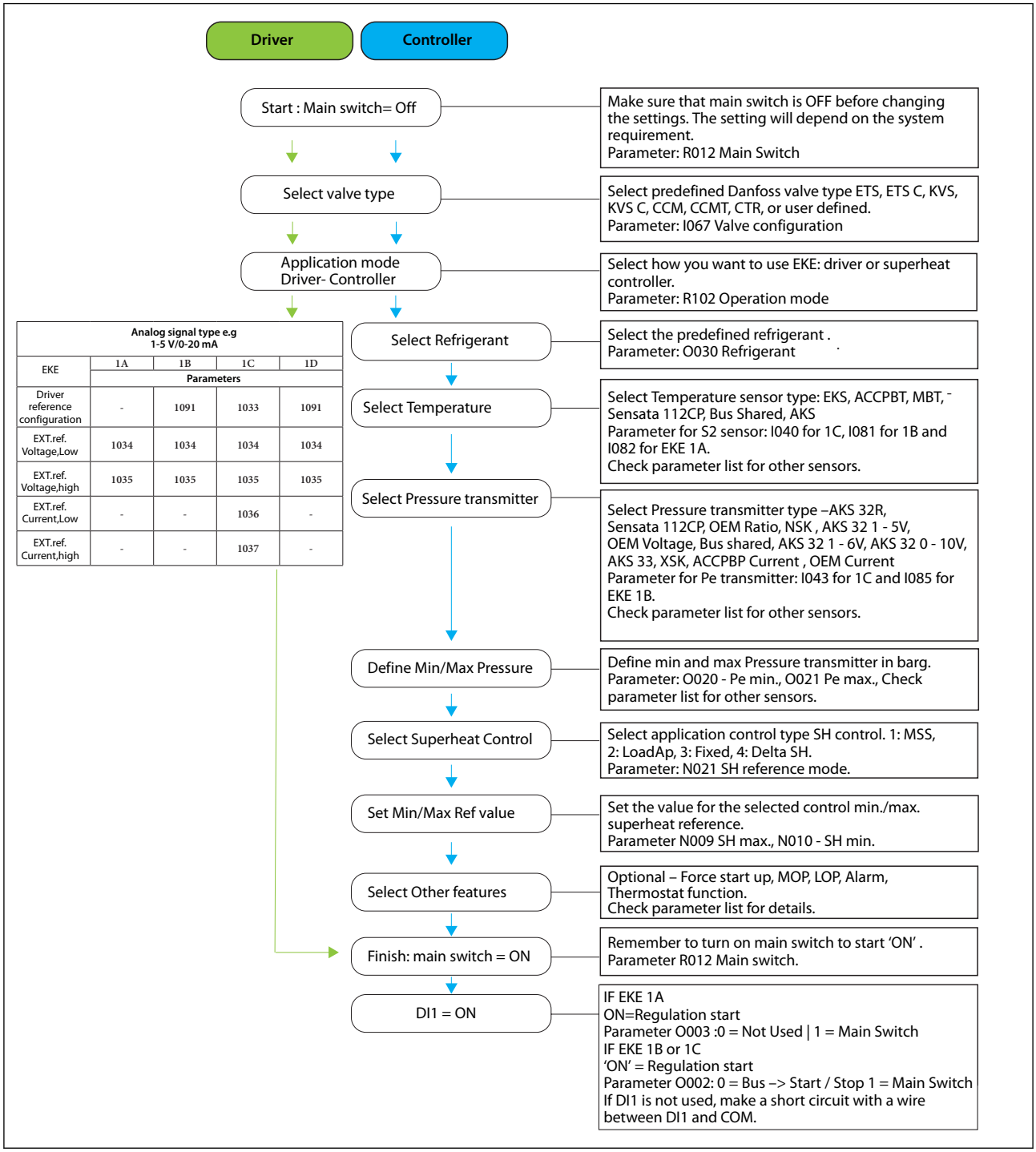
Figure 53: Logging parameters as graphs



5.3 Quick Configuration

Apart from wizard setup, users can also use the following section which describes quick parameter settings for general applications. For both mode Controller Mode or Driver Mode. The parameters are explained in more detail in the following section.

Figure 54: Quick guide for parameter selection



Analog signal type e.g 1-5 V/0-20 mA

EKE	1A	1B	1C	1D
	Parameters			
Driver reference configuration	-	1091	1033	1091
EXT.ref. Voltage,Low	1034	1034	1034	1034
EXT.ref. Voltage,high	1035	1035	1035	1035
EXT.ref. Current,Low	-	-	1036	-
EXT.ref. Current,high	-	-	1037	-

NOTE:

Some important Parameters e.g., Superheat close function, P control[SO1] , valve neutral zone are enabled in a default setting. Make sure that you activate other feature/function/ alarm as per the application requirement before you start the controller. Refer to the configuration section for more details.

6 Configuration

6.1 Driver Mode

In this mode The EKE 1x is acting as stepper motor valve driver, where master is commanding the valve opening degrees to the EKE controller. In this mode, no sensor is needed as we are not doing any superheat control. The control signal can be:

- Analog signal e.g., 0 – 10 V or 4 – 20 mA
- Bus communication via RS485 (Modbus RTU)

Table 21: Driver mode

EKE	1A	1B	1C	1D
Applicable	✓	✓	✓	✓
Voltage signal	✓	✓	✓	✓
Current signal	-	-	✓	-
Bus	-	✓	✓	✓

6.1.1 Driver Mode using analog signal

The signal can be used to drive the valve's opening degree to a desired position. This feature is used to drive the stepper motor valve to the desired level.

Figure 55: Driver Mode using analog Signals Parameters

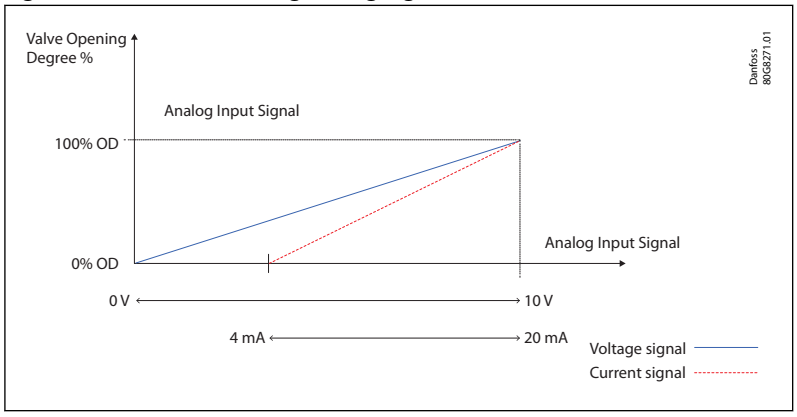


Table 22: Driver Mode using analog Signals Parameters

Parameter	Function	Description
RI02	Operation mode	1 = valve Driver, select 1 to operate as valve driver
I091	Driver reference configuration for 1B, 1D	0 = Voltage to OD
I033	Driver reference configuration for 1C	0 = Voltage to OD 3 = Current to OD
I034	Ext ref voltage low	If I091 or I033 = 0, define min reference voltage
I035	Ext ref. voltage high	If I091 or I033 = 0, define max reference voltage
I036	Ext ref. current low	If I033 = 3, define min reference current
I037	Ext ref. current high	If I033 = 3, define max reference current

⚠ WARNING:
EKE 1A can implement Voltage to OD only

6.1.2 Driver Mode using Communication Bus

Driver Mode using Communication Bus

The opening degree of a stepper valve can be operated manually between 0% and 100% OD via communication bus.

Table 23: Driver Mode using Communication Bus

Parameter	Function	Description
RI02	Operation mode	Mode selection, select 1 to operate as valve driver 1 = valve Driver,
I091	Driver reference configuration for 1B	Select reference configuration, 1- Modbus to OD| the controller receives opening degrees from the bus 2- Modbus to steps| the controller receives opening degrees from the bus
I033	Driver reference configuration for 1C	1 = Bus to OD| 2 = Bus to step
O045	Manual OD	Set the desired OD in percent
B100	Manual step	Set the desired OD in number of steps
X004	Modbus main switch	1 = ON, 0 = OFF
X002	Modbus preset OD	1 = ON, 0 = OFF

6.2 Superheat Control Mode

In this section some important parameters for SH control mode and other sub modes are described.

For basic superheat control, one temperature sensor S2, and one pressure sensor Pe are needed. The actual superheat is calculated based on these two sensor readings, and the controller will adjust the OD of the valve to bring the superheat to the desired reference. If superheat is too low the flow in the expansion is decreased and superheat will be higher and vice versa. For advanced SH control the use of additional temperature and pressure sensors are needed.

Figure 56: EKE as SH controller

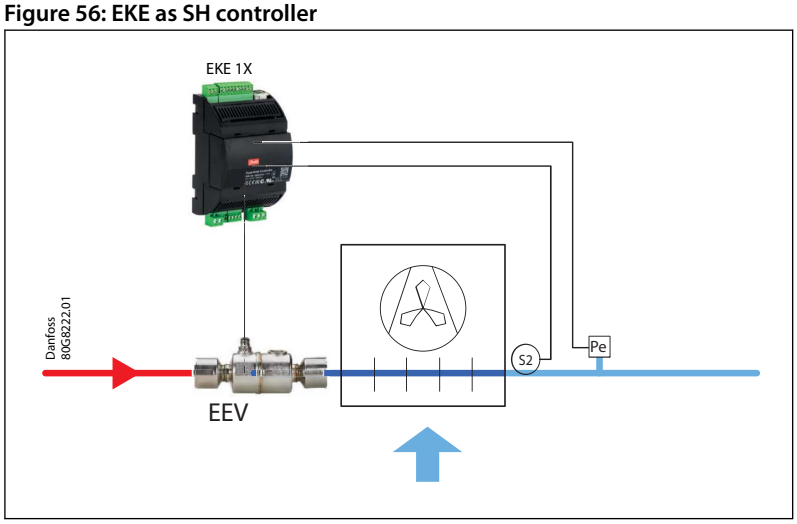


Table 24: Super Heat Control Parameters

Parameter	Function	Selector	Description
Reference			
R012	Main switch	On	• The software main switch is used to start / or stop refrigerating • The hardware main switch (DI) can be used also. • If the main switch is on changes are not allowed.
R102	Operation mode	SH control	Selected to use EKE in the superheat control mode
R014	Thermostatic Mode	0-Not Used 1-Cut-in/cut-out mode 2-MTR modulating thermostat mode.	If you select Not used, only superheat is regulated regardless of the media temperature.

Parameter	Function	Selector	Description
R009	Temperature Sensor S2 correction	Defined by the user in K	Correction value for temperature sensor. This value is defined by the user.
R107	Pressure sensor Pe correction	Defined by the user in Brag	Correction value for pressure sensor. This value is defined by the user.
Sensor configuration			
I082	S2 sensor configuration	Select based on the supported temperature sensors	Selection of the used temperature sensor.
I086	Pe transmitter configuration	Select based on the supported pressure sensors	Selection of the used pressure sensor.
Control Basic			
O030	Refrigerant	Select from variety of refrigerants.	User defined refrigerant is possible by Selecting **R user** and define Antoine constants A1, A2, A3
N102	Startup mode	0-Prop.cntrl 1-Fix OD with protection 2-fix OD without protection	This feature is used when it is necessary to open the valve Quickly when the compressor turns on, to prevent too low suction pressure
N021	SH Reference Mode	0-Fixed step 1-Loadap 2-MSS 3-DeltaTemp	Used to choose how the superheat reference is calculated
I066	Minimum OD		The valve minimum OD can be set to a required minimum opening position. Default: 0%
N032	Maximum OD		To limit the maximum OD of an oversized valve used in the system. This maximum OD % can be set to lower value if required. Default: 100%
Control Advanced			
N143	SH control sensor error action	0-Stop 1- Fixed OD 2-Average	If SH control sensor S2, S3*, Pe has an error, then an action can be set top position the valve OD. • Stop: Close the valve and SH control. • Fixed OD: set OD to a fixed value defined by parameter N145 • Average OD: set OD to be the average OD for the last hour. *only in delta-temp operation
N144	Thermostatic sensor error action	0-Stop 1- Fixed OD 2-Average	If a thermostatic sensor error as happened (S3 and S4) has an error. • Stop: Close the valve and SH control. • Fixed OD: set OD to a fixed value defined by parameter N145 • Average: ◦ ▪ Cutin /cutout use average on and off time to continue cooling. ◦ MTR use reduced OD based average OD (70% of average OD).

6.2.1 Superheat Reference Calculation Parameters

As mentioned in the previous section, in superheat mode the controller will control the superheat to be stable and closer to the superheat reference. The Superheat reference is determined and calculated based on following different methods:

- Fixed Superheat reference
- MSS
- Load AP
- Delta Temperature Reference

Fixed Superheat reference

In this method, the EKE tries to keep the superheat at a fixed value determined by the user. SH fixed setpoint can be varied according to the need of application.

Table 25: Fixed Superheat reference

EKE	1A	1B	1C	1D
Applicable	✓	✓	✓	✓

Table 26: Fixed superheat parameters

Parameter	Function	Description
R102	Operation mode	0 = SH Control
N021	SH reference mode	0 = Fixed Superheat
N107	SH fixed setpoint	The fixed superheat reference defined by the user.
N117	SH close Function	Safety feature to prevent the flooding of the liquid into the compressor. When the measured superheat goes bellow the SH close setpoint (parameter N119) 0 = Off | 1 = On, default = 1
N119	SH close setpoint	It is recommended to set the SH close setpoint 2k below the minimum SH. Default value =2 K (recommended).
I082	S2 sensor configuration	-Selection of the used evaporator temperature sensor S2
I086	Pe transmitter configuration	-Selection of the used evaporator pressure sensor Po

Minimum Stable Superheat (MSS)

The controller will be searching for the minimum stable superheat between an upper and lower boundary specified by the user. Then if the superheat is stable at a certain value, the controller decreases the superheat reference, if the SH gets unstable, the SH reference is raised again.

The goal of this method is to search for the lowest possible superheat that can be obtained while still maintaining a stable system.

Table 27: Minimum Stable Superheat (MSS)

EKE	1A	1B	1C	1D
Applicable	✓	✓	✓	✓

Figure 57: Minimum stable Superheat

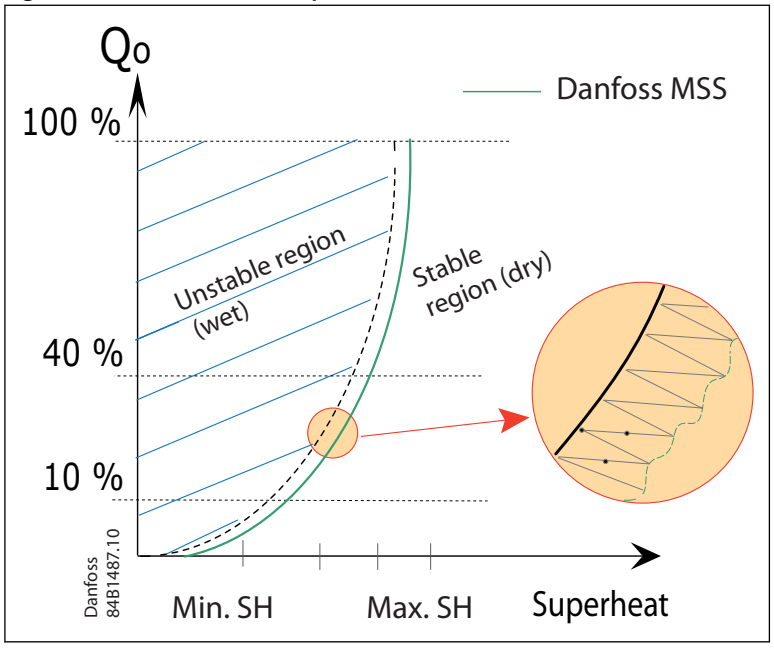


Table 28: MSS parameters

Parameter	Function	Description
R102	Operation mode	0 = SH Control
N021	SH reference mode	2 = MSS
N009	SH max. value	Maximum allowed SH reference in the range.
N010	SH min. value	Minimum allowed SH reference in the range.
N018	MSS Stability	The amount of allowed fluctuation in the superheat before the reference is changed (the range at which the SH is considered stable)
N129	T0 variant factor (Value from 0 to 1)	Defines how Pressure variation (From Pe) influence the SH reference.

Parameter	Function	Description
N117	SH close Function	Safety feature to prevent the flooding of the liquid into the compressor. When the measured superheat goes bellow the SH close setpoint (parameter N119) 0 = Off | 1 = On, default = 1
N119	SH close setpoint	It is recommended to set the SH close setpoint 2k below the minimum SH. Default value =2 K (recommended).
I082	S2 sensor configuration	-Selection of the used evaporator temperature sensor S2
I086	Pe transmitter configuration	-Selection of the used evaporator pressure sensor Po

Load AP

In Load ap application, SH reference follows a defined curve as shown in the diagram. This two-point curve is defined by SH max and SH min. These two values must be selected in such a way that the curve is situated between the MSS curve and the curve for average temperature difference ΔTm (temperature difference between media temperature and evaporating temperature). This makes the regulation more stable compare to MSS because it does not seek a usability.

⚠ WARNING:
Besides the Temperature Sensor S2 and pressure sensor Pe, in this mode a third temperature sensor is needed S3.

Table 29: Load AP

EKE	1A	1B	1C	1D
Applicable	✓	✓	✓	✓

Figure 58: Load AP parameters

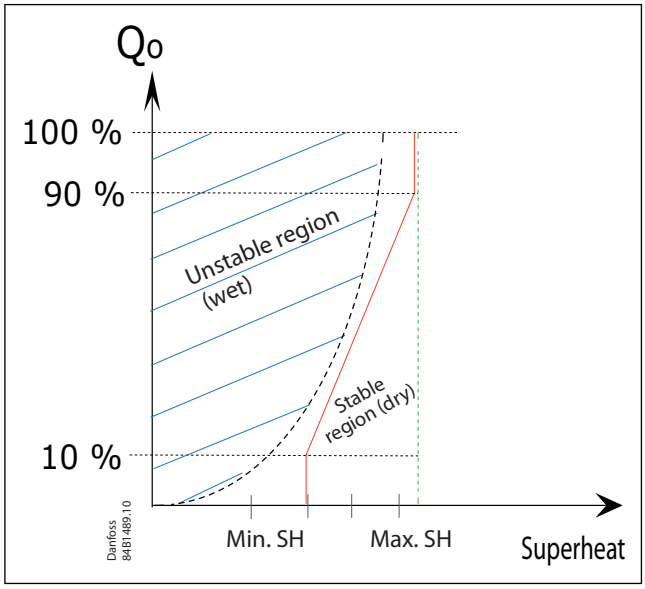


Table 30: Load AP parameter

Parameter	Function	Description
R102	Operation mode	0 = SH Control
N021	SH reference mode	1 = LoadAp
N009	SH max. value	SH max. defines the reference for OD between 90-100% SH max. must be greater than or equal to SH min.
N010	SH min. value	SH min defines the SH reference for OD between 0 and 10 %. Note: SH min. value must be >0.5K higher than SH close value, if N117=1
N117	SH close function	0 = Off | 1 = On, default = 1
N119	SH close setpoint	It is recommended to set the SH close setpoint 2k below the minimum SH. Default value =2 K (recommended).
I082	S2 sensor configuration	-Selection of the used evaporator temperature sensor S2
I086	Pe transmitter configuration	-Selection of the used evaporator pressure sensor Po
I041	S3 Temperature sensor	-Selection of the used Media temperature S3

Delta Temperature Reference

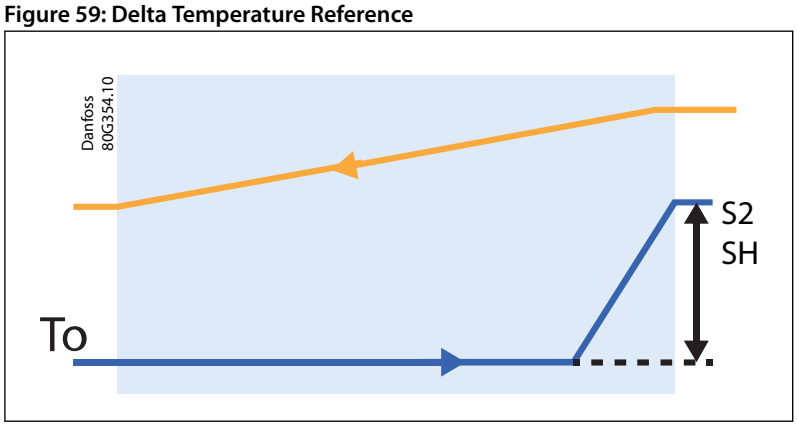
Table 31: Delta Temperature Reference

EKE	1A	1B	1C	1D
Applicable		✓	✓	✓

In delta temperature, the reference is calculated using evaporator pressure Po and Media temperature S3. It is based on the fact that most evaporators have a good efficiency if the SH reference is set to be 0.65 multiplied by temperature difference from inlet temperature to evaporating temperature. The temperature difference is calculated as follows **SH = Delta temp factor * (S3-T0)**.

T0: temperature corresponding to evaporator pressure Po
S3: Media temperature

Figure 59: Delta Temperature Reference



In this mode the response of the controller is quicker in case of load changes.

Table 32: Delta Temperature Reference

Parameter	Function	Description
R102	Operation mode	0 = SH Control
N021	SH reference mode	3 =Delta temp
N009	SH max. value	Maximum allowed SH reference in the range.
N010	SH min. value	Minimum allowed SH reference in the range. Note: Value must be >0.5K higher than SH close value, if N117=1
N116	SH ref. delta temp factor	Note: this value should be between 0.4 and 0.1. Lower value may flood the compressor whereas higher values will result in low efficiency
N117	SH close function	0 = Off | 1 = On, default = 1
N119	SH close setpoint	It is recommended to set the SH close setpoint 2k below the minimum SH. Default value =2 K (recommended).
I082	S2 sensor configuration	-Selection of the used evaporator temperature sensor S2
I086	Pe transmitter configuration	-Selection of the used evaporator pressure sensor Po
I041	S3 Temperature sensor	-Selection of the used Media temperature S3

6.2.2 Temperature Control Parameters

EKE has 2 methods of controlling the superheat while considering the temperature of the incoming media (using temperature sensor S3) or based on the outgoing media (using temperature sensor S4).

The 2 methods are:
- ON/OFF thermostat.
- Modulating thermostat (MTR).

Table 33: Temperature Control Parameters

EKE	1A	1B	1C	1D
Applicable	-	✓	✓	✓

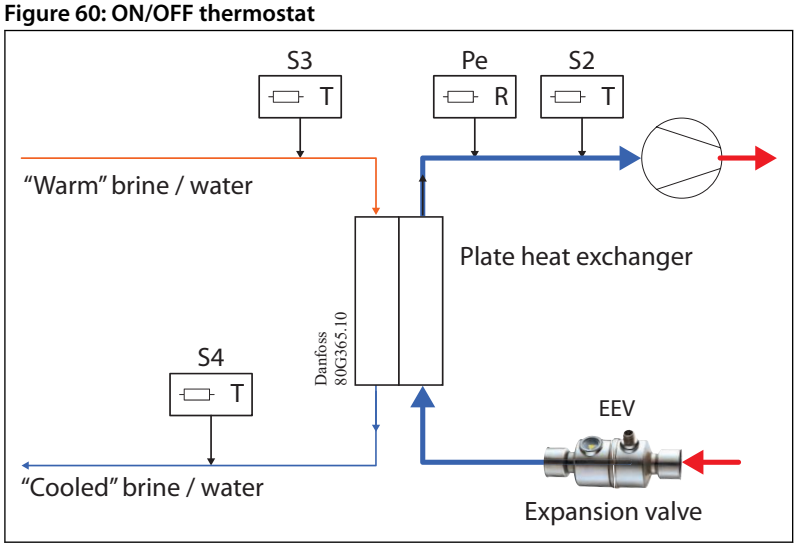
These modes require one extra temperature sensor S3 or S4, the user can select only one sensor not both.

⚠ WARNING:
Superheat control with Thermostatic Mode is not available on EKE 1A.

ON/OFF thermostat

In this mode, if temperature is above the set point + differential cooling is started with maximum cooling capacity. In maximum capacity superheat is controlled to be on superheat set point. Cooling is active until the temperature is below set point. In a startup, cooling will be active if temperature is above temperature set point.

Figure 60: ON/OFF thermostat



⚠ WARNING:
Need for Defrosting During cooling is not considered. If defrosting is needed another system must ensure defrosting is done when needed.

Figure 61: ON/OFF thermostat

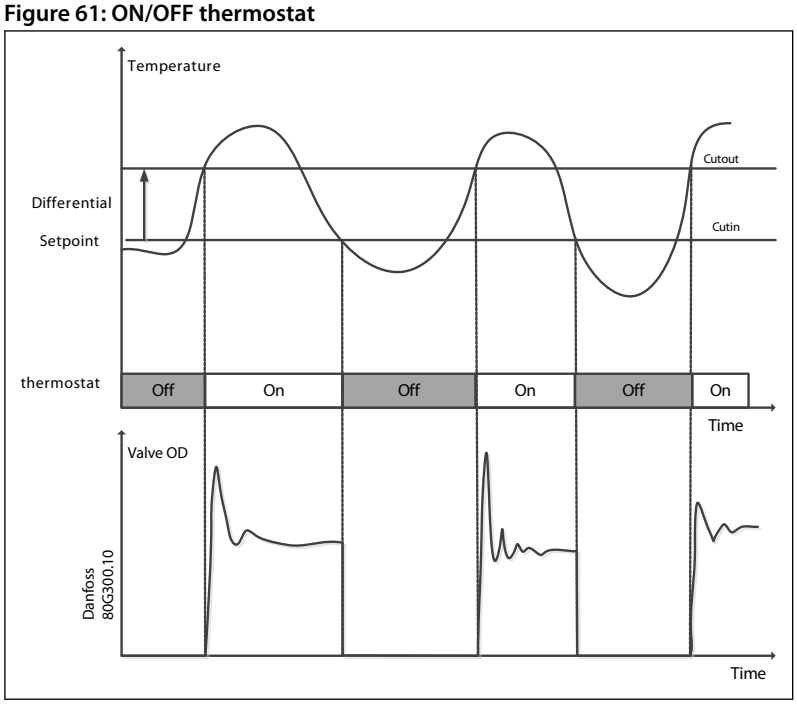


Table 34: ON/OFF thermostat parameters

Parameter	Function	Description
R014	Thermostatic Mode (1-Cutin /cutout)	-Uses a temperature setpoint (parameter R101), and the differential constant(R001). -The temperature media is maintained at a level defined by the set point. -If the temperature is higher than the reference + the differential, the supper heat control will start, and it stops when the temperature goes below the reference.
R015	Sensor	Select the used sensor S3 or S4
I041	S3 Temperature sensor	Only if S3 is selected in R015, Selection of the used Media temperature S3
I041	S4 Temperature sensor	Only if S4 is selected in R015, Selection of the used Media temperature S4
B101	Temperature setpoint, Deg C	Desired media temperature
R001	Differential	Differential constant.
U118	Operational Status	7 = Thermo, cutout, (read value)

Modulating thermostat (MTR)

When the temperature is well above the MTR set point (The MTR reference is defined by temperature set point + ½ differential) cooling capacity is at maximum and superheat is controlled to be on superheat reference. When temperature is getting close to the MTR reference the cooling capacity gradually reduce so that the

temperature can be stable on the MTR reference and the superheat will be floating.

Figure 62: Modulating thermostat (MTR)

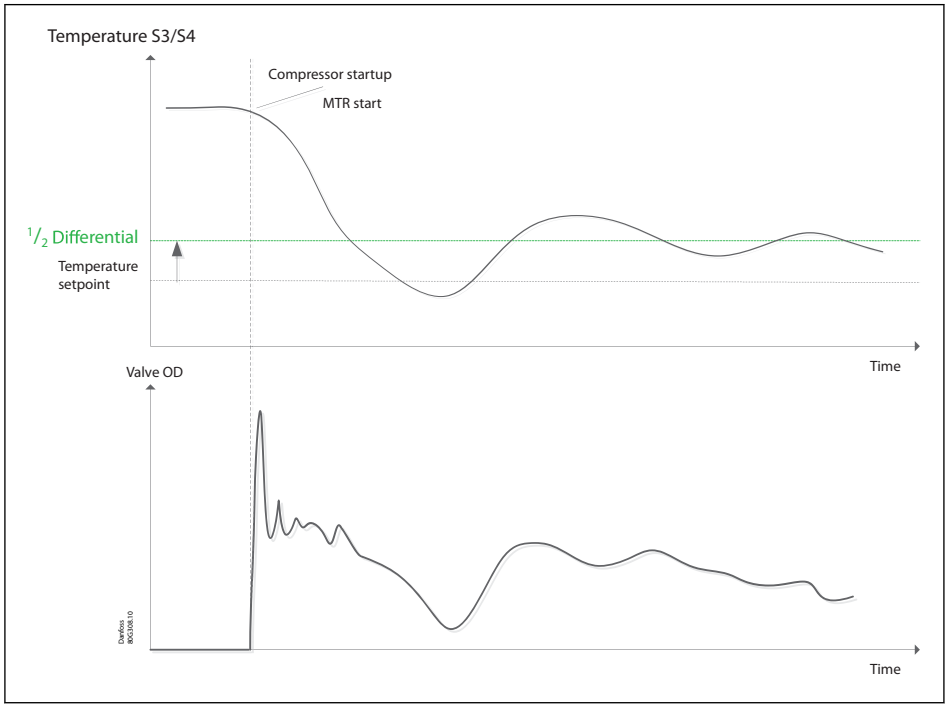


Table 35: Modulating thermostat (MTR) parameters

Parameter	Function	Description
R014	Thermostatic Mode (2-MTR)	• Uses a temperature setpoint (parameter R101), and the differential constant(R001). • The goal is to maintain the temperature media at the level defined by the set point. • If the temperature is higher than the reference + the differential, the supper heat control will start, and it stops when the temperature goes below the reference.
R015	Sensor	Select the used sensor S3 or S4
I041	S3 Temperature sensor	Only if S3 is selected in R015, Selection of the used Media temperature S3
I041	S4 Temperature sensor	Only if S4 is selected in R015, Selection of the used Media temperature S4
B101	Temperature setpoint, Deg C	Desired media temperature
R001	Differential	Differential constant.
U118	Operational Status	11= Injection MTR, (read value)

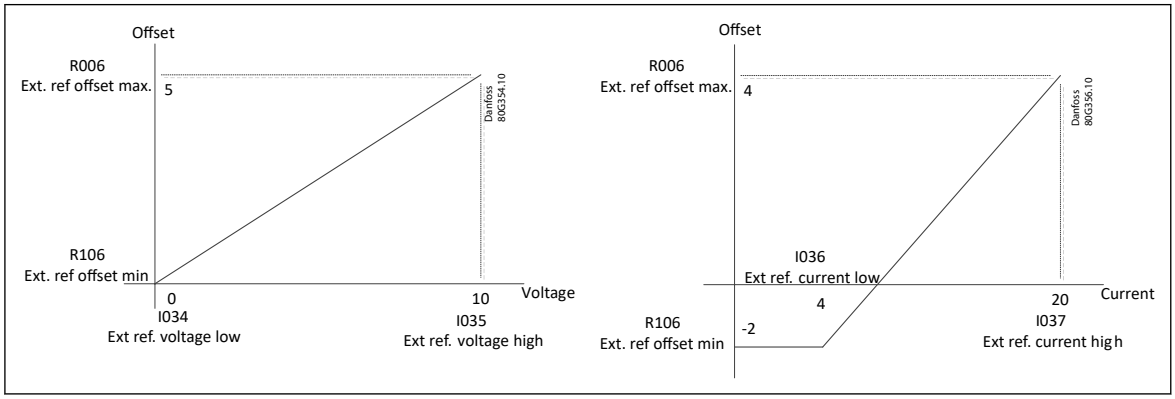
6.2.3 Offsetting Superheat, Temperature and OD Via External signal

Temperature and superheat references can be displaced in positive or negative direction using a current signal (EKE1C only), voltage signal or via Modbus.

Table 36: Offsetting Superheat, Temperature and OD Via External signal

EKE	1A	1B	1C	1D
Offset via External current signal	-	-	✓	-
Offset via Voltage current signal	✓	✓	✓	✓
Offset via Bus	-	✓	✓	✓

Figure 63: Offsetting Superheat, Temperature and OD Via External signal



NOTE:
Offset can be done in positive and negative direction. Extra care must be taken while doing this setting.

Table 37: Offsetting references for EKE 1A

Parameter	Function	Description
I021	AI4 Configuration	Ext. reference
R106	Ext. ref offset min.	This setting determines how large the offset is when input signal is at min.
R006	Ext. ref offset max	This setting determines how large the offset is when input signal is at max.
O089	Ext ref. supply	Define how the external reference signal is used 0 = V->SH: Displacement of SH reference given by External voltage signal. 1 = V->Temp: Displacement of temperature given External voltage signal.
I034	Ext ref voltage low	Define min. reference Voltage
I035	Ext ref. voltage high	Define max. reference Voltage

Table 38: Offsetting references for EKE 1B, 1D

Parameter	Function	Description
I021	AI4 Configuration	Ext. reference
R106	Ext. ref offset min.	This setting determines how large the offset is when input signal is at min.
R006	Ext. ref offset max	This setting determines how large the offset is when input signal is at max.
O089	Ext ref. supply	Define how the external reference signal is used 1 = V->SH: Displacement of SH reference given by External voltage signal. 3 = V->Temp: Displacement of temperature given External voltage signal. 4 = Bus -> SH: Displacement of SH reference given via Modbus. 6 = Bus -> T: Displacement of temperature given via Modbus
I034	Ext ref voltage low	Define min. reference Voltage
I035	Ext ref. voltage high	Define max. reference Voltage

Parameter	Function	Description
I036	Ext ref. current low	Define min. reference current
I037	Ext ref. current high	Define max. reference current
X010	Bus ext. ref	Readout offset in Kelvin

Table 39: Offsetting parameters EKE 1C

Parameter	Function	Description
I021	AI4 Configuration	Ext. reference
R106	Ext. ref offset min.	This setting determines how large the offset is when input signal is at min.
R006	Ext. ref offset max	This setting determines how large the offset is when input signal is at max.
O010	Ext ref. supply	Define how the external reference signal is used 1 = V->SH: Displacement of SH reference given by External voltage signal. 2 = V->Max OD: Maximum opening degree of the valve given by external voltage signal 3 = V->Temp: Displacement of temperature given External voltage signal. 4 = Bus -> SH: Displacement of SH reference given via Modbus. 5 = Bus->Max OD: Maximum opening degree of the valve given via Modbus. 6 = Bus -> T: Displacement of temperature given via Modbus 7 = mA->SH: Displacement of SH reference given by External current signal. 8= Bus->Max OD: Maximum opening degree of the valve given by External current signal. 9 = mA->Temp: Displacement of temperature given External current signal.
I034	Ext ref voltage low	Define min. reference Voltage
I035	Ext ref. voltage high	Define max. reference Voltage
I036	Ext ref. current low	Define min. reference current
I037	Ext ref. current high	Define max. reference current
X010	Bus ext. ref	Readout offset in Kelvin

⚠ WARNING:
- SH reference is not allowed to offset the signal below SH min.
- Only analog input AI4 can be set as an analog external reference for displacing references
- EKE1D receives reference parameter via wired CANBus, while EKE 1C, EKE 1B receive it via Modbus.

6.2.4 Compressor feed Forward function

When a compressor speed changes, system dynamics change correspondingly. Hence, Compressor speed feed forward function changes the PI parameter values according to the actual compressor speed, which means the reactivity of the controller is changed.

For example, when the speed of the compressor is low, this feature increases the integration time which leads to a slower response of the PI controller.

To use this feature bus communication is needed and the master controller must send a feed-back about the compressor speed to the EKE controller.

Table 40: Compressor feedforward function

EKE	1A	1B	1C	1D
Applicable	-	✓	✓	✓

⚠ WARNING:
This function is basically used in one-to-one systems and requires a Modbus (Or CANBus in EKE 1D) to feed the compressor speed. This functionality may not be used in multi-evaporator system.

Figure 64: Compressor feedforward function

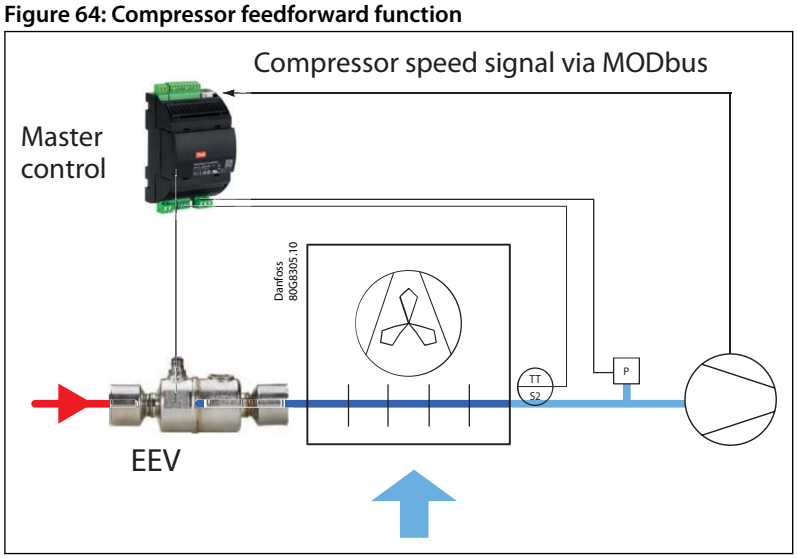


Table 41: Compressor feed Forward

Parameter	Function	Description
N135	Comp. speed feed forward function	0 = Off | 1 = On, default Off
R100	Compressor Capacity	compressor capacity value in percentage via Modbus
N136	FF low capacity turning point	The point where SH control is starting to slow. Below this speed superheat control is slower
N137	FF maximum factor for Tn turning	Define max. reference current

6.3 Other features and modes

6.3.1 Startup and Defrost Modes

A Startup mode allows the valve to open faster on start-up to avoid any unwanted low-pressure situation. EKE 1x controllers implements 3 different modes for startup, and one sequence for startup.

Table 42: Startup and Defrost Modes

EKE	1A	1B	1C	1D
Applicable	✓	✓	✓	✓

P-control

The controller is programmed for auto proportional control that will quickly Change the opening degree based on the superheat of the system. The proportional control is active during the Minimum start time set by the user, and until the Super heat crosses the reference.

⚠ **WARNING:**
If SH didn't cross the Superheat reference after the **minimum stop time**(N104), the Proportional control will stop after the **start time**(N105), set by the user.

Figure 65: proportional control startup mode

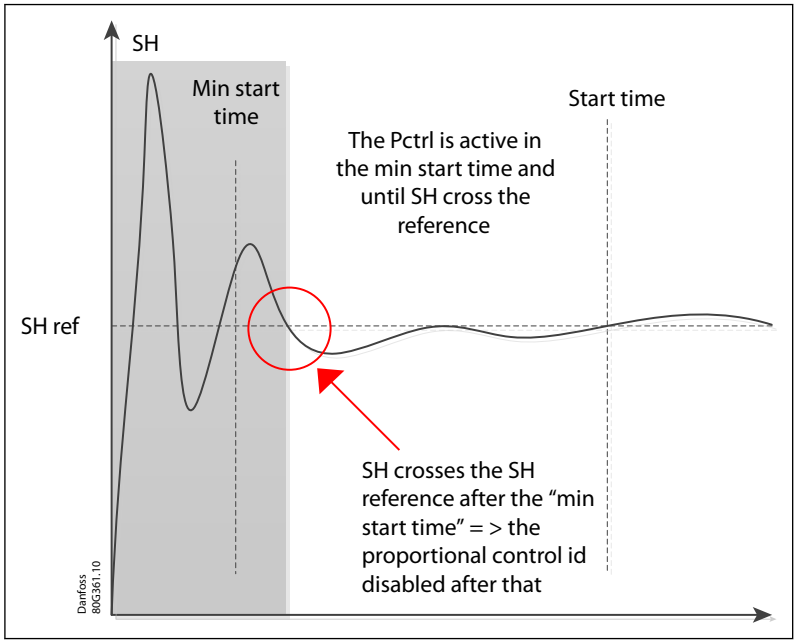


Table 43: The parameters to setup this mode is illustrated in the following table:

Parameter	Function	Description
N102	Startup mode	0 = Prop. Ctrl
N104	Minimum startup time	Min value: 1 second | Max value: 240 seconds If the SH crosses the reference between minimum startup time, and startup time the Proportional control is disabled.
N105	Startup time	Min value: 1 second | Max value: 600 seconds After startup time the Proportional control is disabled even if the SH didn't cross the reference.
N017	Startup OD	Starting OD degree of the valve. ⚠ **WARNING:** This parameter has lower priority then limiters (LOP, SH close, MOP.)

Start OD with protection

This function will provide a start opening degree during a fixed start time. If the limiters such as LOP has been activated, the valve will do the auto adjustment-based set limitations.

Figure 66: Fixed OD with protection

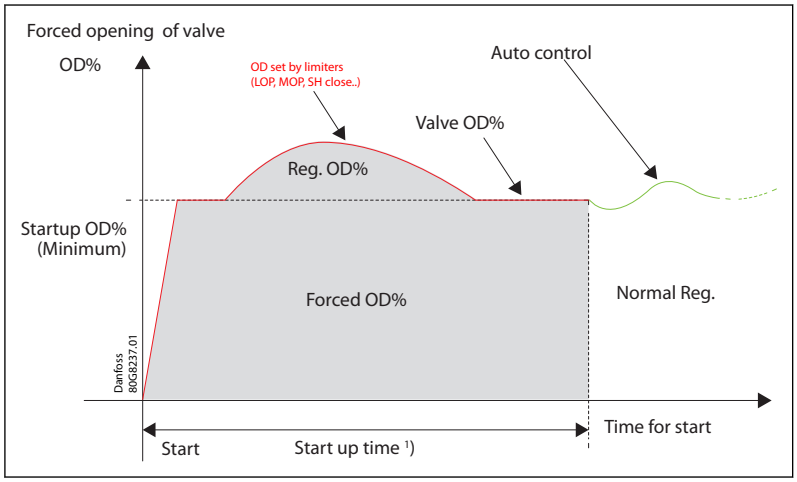


Table 44: Start OD with protection

Parameter	Function	Description
N102	Startup mode	1 = Minimum OD with protection
N105	Startup time	Min value: 1 second | Max value: 600 seconds After startup time the Startup OD is Disabled, and controller will switch to the set control mode.
N017	Startup OD	Starting OD degree of the valve. **WARNING:** This parameter has lower priority then limiters (LOP, SH close, MOP…)

Start OD without protection

This function will provide a start opening degree during a set time. This function is not affected by the limiters such as LOP.

Figure 67: Start OD without protection

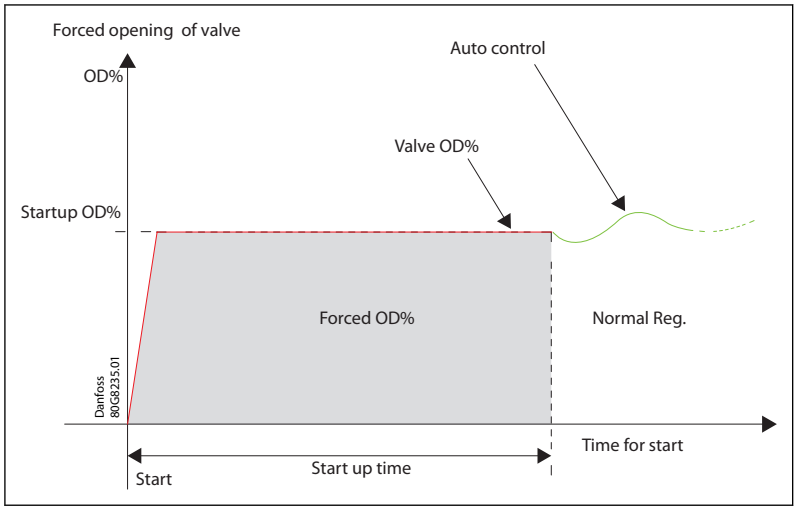


Table 45: Start OD without protection

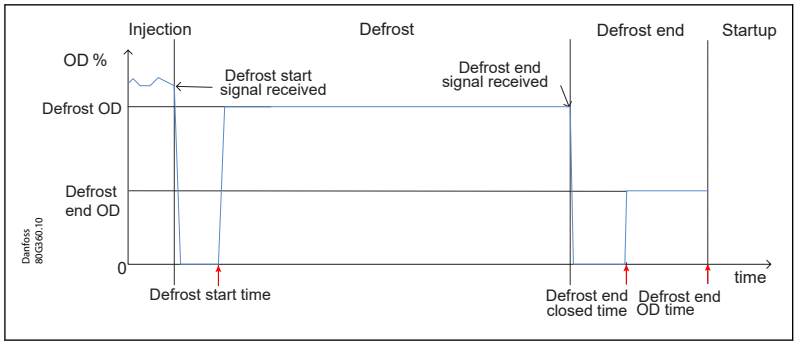
Parameter	Function	Description
N102	Startup mode	2 = Minimum OD without protection
N105	Startup time	Min value: 1 second | Max value: 600 seconds After startup time the Startup OD is Disabled, and controller will switch to the set control mode.
N017	Startup OD	Starting OD degree of the valve.

Defrost sequence

Defrost Sequence must be initiated by the master controller. In a standalone configuration, the defrost mode is not possible.

To initiate defrost, the system mode is changed from Heat pump to A/C, hereby the outdoor unit will act as a condenser and the hot discharge gas from the compressor will defrost the coil. In some system electrical heaters are used instead of reversible system but defrost sequence can still be used.

Figure 68: Defrost sequence



The user sets the Defrost OD, the Defrost end OD, defrost start and end time (see table below).

The defrost start/end commands are received from one of the following options:

1. Modbus register (nonvolatile memory) – default OFF at power-up
2. DI's for use as defrost start/stop. Only one DI can be assigned for defrost start/stop. Start is defined as a transition from off to on, a transition from on to off is a stop signal.

Table 46: Defrost Sequence parameters

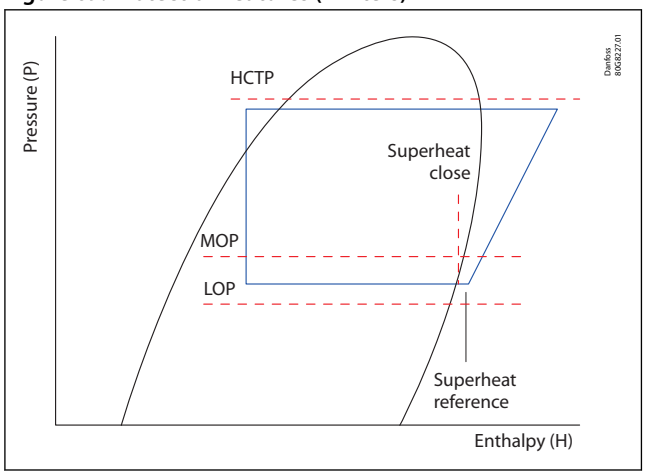
Parameter	Function	Description	Default
D101	Defrost start low pressure limit	The defrost sequence starts by closing the valve, which is kept closed until the 'D101 Defrost start low pressure limit' is reached or D102 'Defrost start time' is exceeded. ⚠ WARNING: This parameter is valid only if the defrost start time >0	1.0 brag
D102	Defrost start time	The defrost sequence starts by closing the valve, which is kept closed until the 'D102 'Defrost start time' is exceeded or 'D101 Defrost start low pressure limit' is reached	0 s
D100	Defrost OD	Sets the valve opening degree after the Defrost start time is passed.	0%
D104	Defrost end closed time	After the defrost stop signal, the valve closes and will open again after 'Defrost end closed time' is exceeded	1s
D103	Defrost end OD time	End of the defrost, start of the startup mode.	1s
D105	Defrost end OD	Sets the valve opening degree after Defrost end closed time.	50%

6.3.2 Protection features

EKE 1x series has protection features that prevents the system from operating under bad conditions, these protection features are:

- Fail safe operation
- Superheat close
- LOP (Low operating pressure)
- MOP (Maximum operating pressure)
- HCTP (High condensing temperature protection)
- Min. S4 (Minimum S4 temperature)

Figure 69: Protection features (limiters)



Fail Safe Operation

In the case of sensor error, the EEV controller will go into an emergency mode (“safe mode”). where the valve opening degree is defined by desired OD scheme as described below

User can read the failure status via [U118 Operation status].

EKE 1x implements two Failsafe mode:

- SH control Failsafe mode
- Thermostat Failsafe mode

Table 47: SH control Failsafe mode

SH control Failsafe mode:	Description
SH control needs Pe and S2 signal. so, if one of these signal fails, SH control based on the actual superheat is not possible.	User can via parameter [**N143]** SH control sensor error action, under control advanced. configure the relevant option **Stop** valve forced closed and SH control (default) **Fixed OD** valve at fixed position (Fail safe OD), this keeps the refrigeration unit running **Use average OD** (calculated as an average of the last hour) to set a reduced OD which will be fixed during error period. This keeps the refrigeration unit running

Table 48: SH control Failsafe mode parameters

Parameter	Function	Description
N143	SH control sensor error	0 = Stop | 1 = Fixed OD | 2 = Average OD
N145 [only if N143= 1]	Fixed OD during emergency cooling	define fixed OD % during Emergency cooling
N138 [only if N144= 2]	Average OD	Calculated When superheat control/ Temperature control is active and stored in EEPROM. Its value is updated every 3 hours. Reset to factory will not delete the calculated average values. Used in average OD

Table 49: Thermostat Failsafe mode

Thermostat Failsafe mode	Description
Thermostat sensor error. Thermostat operation needs the signal selected in [R015 Sensor select] to operate the thermostat function, if this signal fails operation based on actual temperature is not possible	User can via parameter **[N144]** Thermostat sensor error action] configure the relevant option. **Stop** valve forced closed, SH control and Temperature control (default) **Fixed OD** valve at fixed position (Fail safe OD). This Keeps the refrigeration running **Use Average OD** Cutin /cutout use average on and off time to continue cooling MTR use reduced OD based average OD (70% of average OD).

Table 50: Thermostat Failsafe mode parameters

Parameter	Function	Description
N144	Thermostat sensor error action	0 = Stop | 1 = Fixed OD | 2 = Average OD
N145 [only if N144= 1]	Fixed OD during emergency cooling	Define fixed OD % during Emergency cooling
N138 [only if N144= 2]	Average OD	Calculated When superheat control/ Temperature control is active and stored in EEPROM. Its value is updated every 3 hours. Reset to factory will not delete the calculated average values. Used in average OD

Superheat close

SH close ensures that superheat is on or above ‘SH close set point to avoid liquid getting back to the compressor. If the media inlet temperature drops or if compressor goes down in capacity, the superheat may drop below the SH close setpoint, then the flow in the expansion valve is reduced to bring superheat up to SH close setpoint as shown in the figure below.

Figure 70: SH close operation

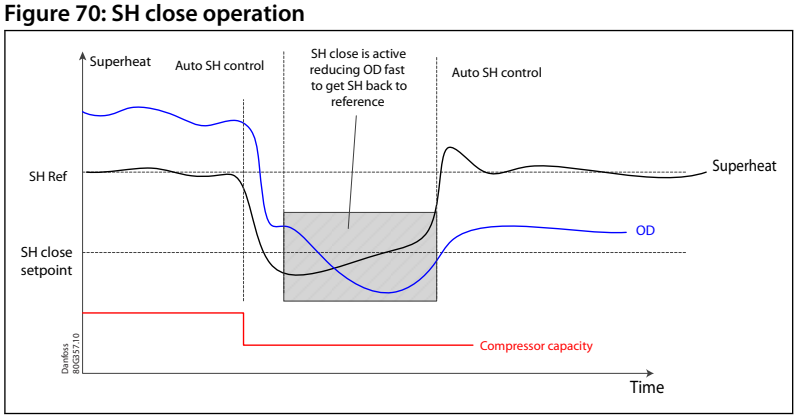


Table 51: Superheat close Parameters

Parameter	Function	Description
N117	SH close function	0 = Off | 1 = On, default Valve = On
N119	SH close setpoint	Default value =2 K

Lowest Operating Pressure (LOP)

Lowest Operating Pressure (LOP) will make sure that the evaporating pressure (Pe) is kept above LOP set point, this will prevent the compressor from stopping due to low suction pressure. If the pressure comes below this limit the controller will quickly open the valve.

Figure 71: Lowest Operating

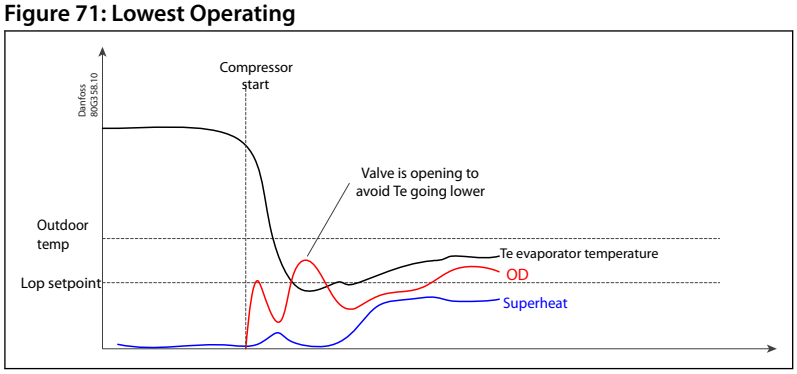


Table 52: Lowest Operating Pressure (LOP) Parameters

Parameter	Function	Description
N140	LOP function	0 = Off | 1 = On, default Valve = Off
N141	LOP setpoint °C	Lowest Operating Pressure setpoint. Setpoint unit is saturated temperature in evaporator
N142	LOP priority mode	In case of conflict between low pressure and SH close, LOP function can be set to override SH close actions. (Could be needed for startup in low ambient temperatures) On: LOP can override low superheat 0 = Off | 1 = On, default= Of **⚠ WARNING:** As default, controller will not be allowed to open the valve when the superheat is low. If such feature is needed for a short time, parameter" N142 LOP priority mode" can be set to ON. This will allow LOP to have higher priority than bringing the superheat out of low superheat for the time defined in" N131 LOP max. time". **⚠ WARNING:** A specialCare should be taking that compressor can handle this condition.
N131	LOP max. time	Maximum time for LOP to override SH close

Maximum Operating Pressure (MOP)

Maximum Operating Pressure (MOP) will make sure that the evaporating pressure (P0) is kept below the MOP setpoint set by the user. This is achieved by lowering the flow in the expansion valve. When this mode is active this Super heat reference will be higher, the controller will switch back to superheat control once the pressure Po is kept on the MOP setpoint.This feature is helpful especially during startup During startup and pulldown to avoid overload of the compressor.

Figure 72: Maximum Operating Pressure (MOP)

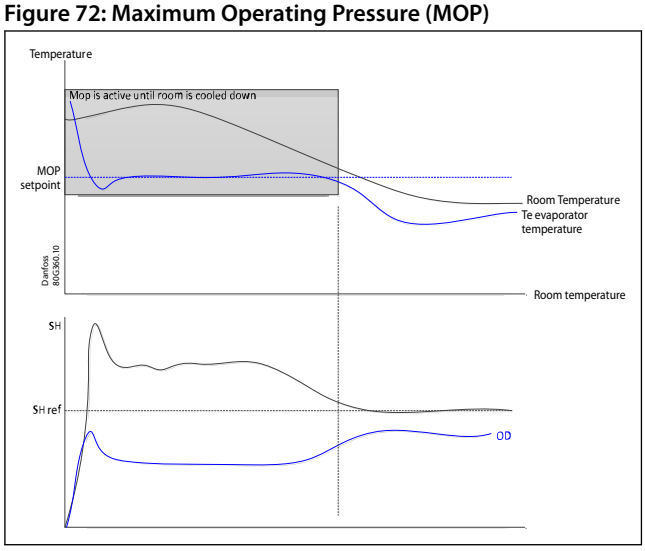


Table 53: Maximum Operating Pressure (MOP) Parameters

Parameter	Function	Description
N130	MOP function	0 = Off | 1 = On, default value = Of
N011	MOP setpoint	Setpoint unit is saturated temperature in evaporator. If the suction pressure reaches the set MOP limit, the valve will close faster irrespective of superheat.

High Condensing Temperature Protection

This protection mode reduces the load on the condenser in case the high condensing temperature by reducing the OD of the valve. The high condensing temperature is defined by the user through the parameter N134 'High cond. temp. protection setpoint', this value is converted from pressure input.

Figure 73: High condensing temperature protection

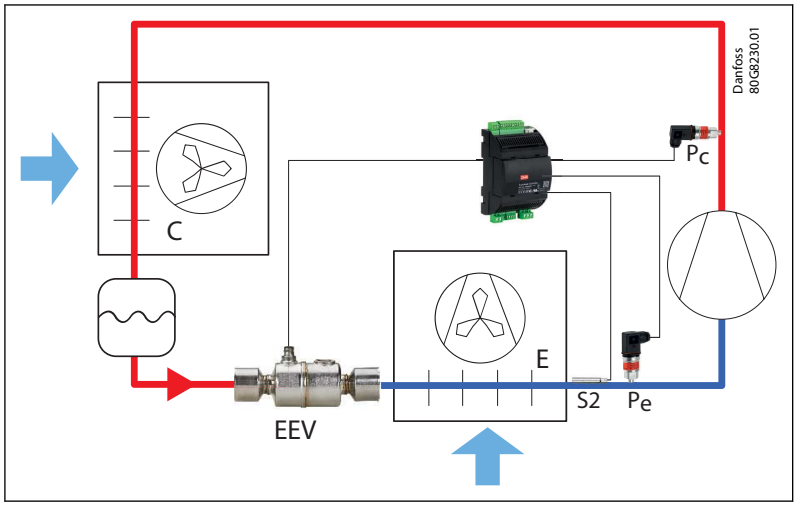
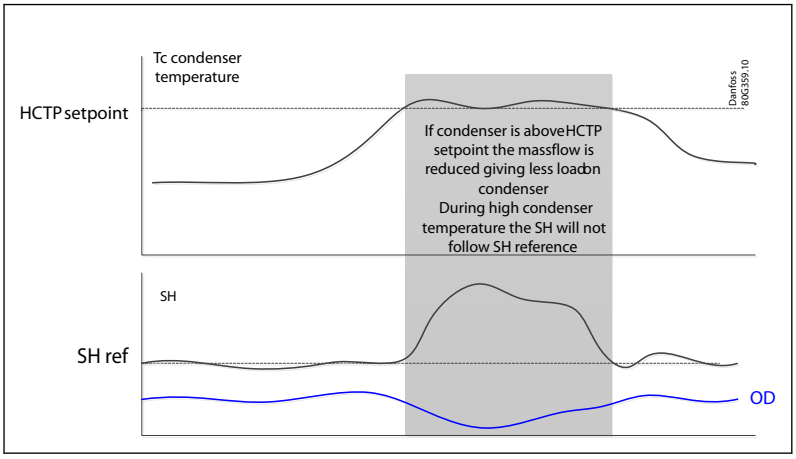


Figure 74: High condensing temperature protection



NOTE:
HCTP feature requires mounting pressure transducer Pc at compressor discharge line or getting its value via Bus

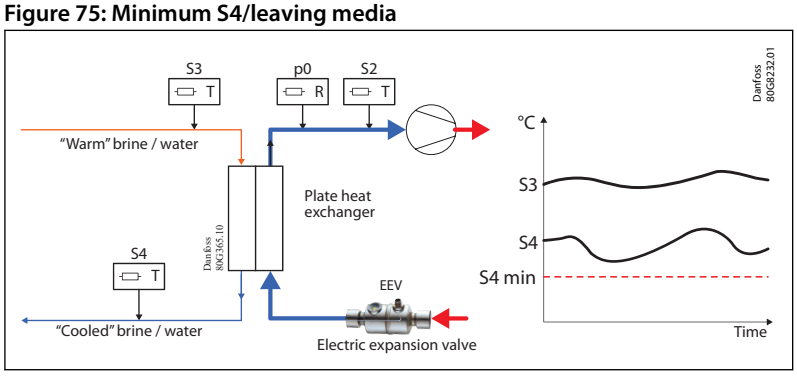
Table 54: High condensing temperature protection Parameters

Parameter	Function	Description
N133	High cond. temp. protection function	0 = Off | 1 = ON
N134	High cond. temp. protection setpoint (converted from pressure value from sensor Pc).	High condensing temperature protection setpoint unit is saturated temperature in condenser.

Minimum S4/leaving media (freeze protection)

This protection modes keeps the temperature of leaving media out of the evaporator (given by temperature sensor S4) on or above of minimum temperature set by the user. This is achieved by lowering the flow in the expansion valve. When this mode is active this Super heat reference will be higher, the controller will switch back to superheat control once the Temperature of leaving media goes above S4 min

Figure 75: Minimum S4/leaving media



NOTE:
An undershoot below the Min S4 is possible, so a frost protection is still needed to secure that the compressor is stopped before the braze plate heater is destroyed by ice.

Table 55: Minimum S4/leaving media parameter table

Parameter	Function	Description
N126	Min. S4 mode	0 = Off | 1 = ON
N127	Min. S4 setpoint	Minimum S4 (media outlet) protection setpoint

Priority of Protection features:

To overcome conflicts between different limiters, a priority function is implemented as follows:

1. Superheat close (it is always important to avoid liquid back to the compressor)
2. LOP (Low operating pressure)
3. HCTP (High condensing temperature protection)
4. Min. S4 (Minimum S4 temperature)
5. MOP (Maximum operating pressure)

As an example, if the pressure is low and at the same time the superheat is low. LOP control would like to open the valve to raise the pressure. but SH close will decrease the flow to regain a safe superheat. In this case the LOP demand is overruled by SH close. So, in the end if the conflict still is active the mechanical low-pressure switch will need stop the compressor.

6.3.3 Manual Mode

In the manual mode, the user can select actions based on signals from digital inputs DI2/DI3. In the manual mode we can use 4 different options:

1. Manual OD from preset parameter via DI
2. Manual control of Relay
3. Manual control Valve
4. Manual Homing

NOTE:
Too often use of Manual Homing could wear out the valve. For normal operation use overdriving feature.

Manual OD When DI 2 is configured as Preset OD, the valve OD will be positioned as defined by valve OD parameter [I078 - Preset OD].

Table 56: Manual OD

Digital input	O022 DI2 configuration	2 = Preset OD
	O037 DI3 configuration (only in EKE 1A)	2 = Preset OD
Manual Preset via DI	078 Preset OD	desired Valve OD %

When manual mode becomes active, the state of alarm output will remain the same and be transferred to the parameter(s) for Manual relay DO1. When manual mode becomes inactive the actual state of Manual relay DO1 will be the starting point for the next mode.

Table 57: Manual control of Relay:

Parameter	Function	Description
O018	Manual mode	1 = On
B101	Manual mode timeout	time in sec. When timed out the parameter [O018 - Manual Mode] will be set to of
B103	Manual relay DO1	0 = Off | 1 = ON

When DI2 /DI 3 is configured as Preset OD, the valve OD will be positioned as defined by valve OD parameter [I078 - Preset OD].

Table 58: Manual Control Valve:

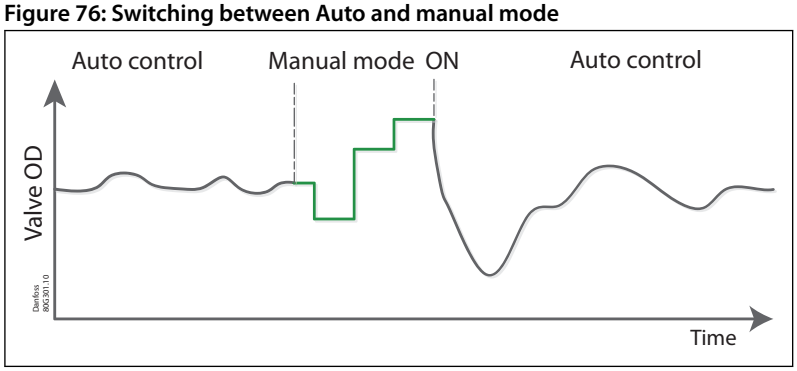
Parameter	Function	Description
O018	Manual mode	1 = On
B101	Manual mode timeout	time in sec. When timed out the parameter [O018 - Manual Mode] will be set to Off
O045	Manual OD	Set desired OD in Percentage %

Used to calibrate the valve at Zero OD %. When the user set the manual homing, a full closing operation will be performed (same as initial closing). After the operation is performed the manual homing parameter [B104 - Manual Homing] will be set back to off and the parameter for [O045 Manual OD] will be set to 0%. When manual mode becomes inactive the actual OD will be the starting point for automatic control

Table 59: Manual Homing:

Parameter	Function	Description
O018	Manual mode	1 = On
B101	Manual mode timeout	time in sec. When timed out the parameter [O018 - Manual Mode] will be set to Off
O045	Manual OD	Set desired OD in Percentage %

Figure 76: Switching between Auto and manual mode



6.3.4 Valve configuration

Table 60: Valve Configuration

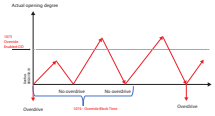
Parameter	Function	Description
I067	Valve Configuration	Danfoss stepper motor are easily selected from Valve configuration list. On selecting the valve, the controller will automatically load pre-defined default values. The user is not required to set other stepper motor parameters for a selected valve from the valve configuration list. **NOTE:** I028 parameter (Valve drive current) needs to be adjusted if the chosen cable length is between 15 and 30m, refer to the installation section
I067	User Defined valve	If a valve from other manufacturers is used, such valve can be defined as 1. Set I067 to "User defined Valve" 2. Enter the Valve parameters (Parameters described below).

Table 61: Parameters Non-Danfoss valves: for Danfoss vales these parameters are preconfigured, if the user decides to use a valve from a different manufacturer, then these parameters must be provided by the user.

Parameter	Function	Description
I027	Valve Motor Type	Define a type of motor used in the stepper valve (Unipolar/Bipolar).
I028	Valve drive current	Setting the Peak current requirement of the motor in mA. **NOTE:** Please be aware that this value must be set in a Peak value. Some valve manufacturers are using RMS current (1mA RMS = 1.41mA Peak).
I029	Valve step positioning	Defines which position step the valve motor should stop, while changing the opening degree of the valve. Choose between: • Full-step • Half-step • Auto - controller will automatically choose based on the valve type right arrow Half step if Unipolar valve |Full step whereas Bipolar valves
I030	Valve Total Steps	The number of steps that correspond to a valve position of 100%. The total no of steps will vary according to the selected Valve motor type. For example: ETS 6 has total number of 480 half steps on driving with half phase excitation whereas only 240 full steps on driving with Full phase excitation.
I031	Valve speed	The desired valve drive rate in steps per second. **NOTE:** Higher valve speed will produce a lower torque. If the valve is used in system having high differential pressure, it is better to operate the valve with lower step rate
I032	Valve start speed	Valve initial speed as % of the valve speed (I031). The parameter Is used to avoid high acceleration rate of the stepper motor. **NOTE:** Make sure to select a start speed which is recommended for the used valve.
I061	Valve emergency speed	During power failure conditions, the valve can be driven at higher speed when required to close faster. To run this feature, it is required to connect EKE with backup battery.
I062	Valve acceleration current	To control the torque in the start and stop sequence, the unit is % of the normal valve driving current I028 (I031). Note that the torque of the motor is directly proportional to the supplied current **NOTE:** Make sure not to exceed the rated current of the valve motor, because this might damage it.
I063	Valve Acceleration Time	Defines the time of the acceleration/ deacceleration in the start/stop of the motor.

Parameter	Function	Description
I077	Holding Current	For some valves, this represents the percent of the programmed Max Phase Current that should be applied to each phase of the stepper motor to maintain the valve at its last programmed position. Not all valve designs require a holding current, make sure to check this with your valve manufacturer
I064	Valve step Mode	Stepper motor can be driven with various step excitation method, which depends valve requirements as well as operating conditions of an application. The user can choose • Full stepping 1/1 • Half stepping 1/2 • Micro-stepping (1/4, 1/8, 1/16) **NOTE:** For half and micro stepping, the risk of step loss is higher because the torque provided is lower Danfoss recommends using 1/8 stepping mode as this provides a good balance between torque, speed, and smooth operation.
I065	Valve duty cycle	Defines the valve motion and stop time in a window of 60 seconds.
I070	Start Backlash	The parameter defines the operation of the start backlash function. The valve will normally open from this point onwards.
I071	Start backslash	The number of steps needed to correct for mechanical hysteresis when a reduction gear is part of the valve design.
I072	Overdrive	The extra steps taken to secure the closure of the valve.it is defined as a percentage of the full opening.
I076	Valve Excitation Time After Stop	The time that the drive current is applied after the motor has stopped before going to holding current. This will make sure that the valve has achieved the final position before going to holding current.

Table 62: Common Valve parameters (For Danfoss/Non-Danfoss valves)

Parameter	Function	Description
I069	Valve OD During Stop	For some application, it is required that the valve remains open after the controller is off. This parameter defines that OD in %. **NOTE:** This parameter requires connecting a Battery Backup
I073	Overdrive Enable OD	The Overdrive happens only after Exceeding Override Enable OD.
I074	Overdrive Block time	To limit how frequent overdrive can performed the parameter [I074 - Overdrive block time] defines the minimum time between 2 overdrive actions. The default value is 10 minutes 
I078	Preset OD	The DI can be used to force the valve to go to this opening degree.
I068	Valve neutral Zone	EKE controller has a complex algorithm implemented to handle oscillation issues related to output valve OD by defining some neutral zone. In neutral zone, the valve will not move until it overcomes the definite variation in the valve opening degree. The benefit of using such techniques will not affect the performance of the system but will reduce the problem related with the fluctuating signal, step loss and hysteresis in the valve.

NOTE:

Failsafe Position: During failsafe mode of operation (e.g., SH control sensor error or Thermostat sensor error) the valve position can be set to full close, fixed opening degree or average calculated OD. For detail check section Failsafe operation and parameter list under section control advance sub section Diagnostic SH and Emergency cooling.

6.3.5 Adding user Defined Refrigerant

Most of the used common Refrigerants have been defined as a pre selectable profile under “Refrigerant list para O030”. for unlisted refrigerants, user defined refrigerants can be used.

Table 63: Adding user defined refrigerants

Parameter	Function	Description
O030	Refrigerant	13 = R User. to select user defined refrigerant
O100	Antoine Constant A1	Antoine Constant A1 for the user defined refrigerant. Available only if O030 is on R user option.
O101	Antoine Constant A2	Antoine Constant A2 for the user defined refrigerant. Available only if O030 is on R user option.
O102	Antoine Constant A3	Antoine Constant A3 for the user defined refrigerant. Available only if O030 is on R user option.

7 Parameter List

Table 64: Parameter list

	Label	Parameter name	Variants	Min	Max	Default	Unit	Modbus PNU	Can Index	Can Sub-index	Enumeration
Reference											
Refrigeration on/of	R012	Main switch		0	1	0		3001	550B	B8	0 = Off | 1 = On
Application configuration	R102	Operation mode		0	1	0		3002	550B	B9	0 = SH control | 1 = Valve driver
	R100	Compressor capacity		0	100	0	%	4001			
	R015	Sensor	1B, 1C, 1D	0	1	0		3004	550B	BB	0 = S3 | 1 = S4
Temperature control	R101	Temperature setpoint		-70	70	3	°C	3006	550B	BD	
	R001	Differential		0.1	10	2	K	3007	550B	BE	
	R014	Thermostatic mode	1B, 1C, 1D	0	2	0		3005	550B	BC	0 = Not Used | 1 = CutIn/CutOut | 2 = MTR
	N100	MTR Tn		20	3600	1800		3015	550B	C6	
	N101	MTR Kp		0.2	20	3		3016	550B	C7	
External reference signal	R006	External reference offset max.		-50	50	0	K	3008	550B	BF	
	R106	External reference offset min.		-50	50	0	K	3009	550B	C0	
Sensor/transmitter correction	R009	S2 Correction		-10	10	0	K	3010	550B	C1	
	R010	S3 Correction	1B, 1C, 1D	-10	10	0	K	3011	550B	C2	
	R105	S4 Correction	1B, 1C, 1D	-10	10	0	K	3012	550B	C3	
	R107	Pe Correction		-5	5	0	barg	3013	550B	C4	
	R108	Pc Correction		-5	5	0	barg	3014	550B	C5	
Valve configuration											
	I027	Valve motor type		0	1	0		3133	550C	3C	0 = Unipolar | 1 = Bipolar
	I028	Valve drive current		10	1000	10	mA	3134	550C	3D	
	I029	Valve step positioning		0	2	0		3135	550C	3E	0 = Fullstep | 1 = Halfstep | 2 = Auto
	I030	Valve total steps		1	8000	1	stp	3136	550C	3F	
	I031	Valve speed		10	400	10	PPS	3137	550C	40	
	I032	Valve start speed		1	100	20	%	3138	550C	41	
	I061	Valve emengency speed		50	200	100	%	3139	550C	42	
	I062	Valve acceleration current		100	150	100	%	3140	550C	43	
	I063	Valve acceleration time		10	150	10	ms	3141	550C	44	
	I064	Valve step mode		0	4	3		3143	550C	46	0 = Full | 1 = Half | 2 = 1/4 | 3 = 1/8 | 4 = 1/16
	I065	Valve duty cycle		5	100	100	%	3144	550C	47	
	N032	Maximum OD		0	100	%		3146	550C	49	
	I066	Minimum OD		0		0	%	3145	550C	48	

	Label	Parameter name	Variants	Min	Max	Default	Unit	Modbus PNU	Can Index	Can Sub-index	Enumeration
	I067	Valve configuration		0	32	0		3132	550C	3B	0 = no valve | 1 = User-Def | 2 = ETS 12C | 3 = ETS 24C | 4 = ETS 25C | 5 = ETS 50C | 6 = ETS 100C | 7 = ETS 6 | 8 = ETS 12.5 | 9 = ETS 25 | 10 = ETS 50 | 11 = ETS 100 | 12 = ETS 250 | 13 = ETS 400 | 14 = KVS 2C | 15 = KVS 3C | 16 = KVS 5C | 17 = KVS 15 | 18 = KVS 42 | 19 = CCMT 0 | 20 = CCMT 1 | 21 = CCMT 2 | 22 = CCMT 4 | 23 = CCMT 8 | 24 = CCMT 16 | 25 = CCMT 24 | 26 = CCMT 30 | 27 = CCMT 42 | 28 = CCM 10 | 29 = CCM 20 | 30 = CCM 30 | 31 = CCM 40 | 32 = CTR 20
	I068	Valve neutral zone		0	5	0.5	%	3156	550C	53	
	I069	Valve OD during stop		0	100	0	%	3147	550C	4A	
	I070	Start backlash		0	50	0	%	3148	550C	4B	
	I071	Compensation backlash		0	10	0	%	3149	550C	4C	
	I072	Overdrive		0	20	4	%	3150	550C	4D	
	I073	Overdrive enable OD		0	100	0	%	3151	550C	4E	
	I074	Overdrive block time		0	1440	10	min	3152	550C	4F	
	I076	Valve excitation time after stop		0	1000	10	ms	3154	550C	51	
	I077	Valve holding current		0	100	0	%	3142	550C	45	
	I078	Preset OD		0	100	50	%	3155	550C	52	
IO configuration											
	I020	AI1 configuration	1B, 1C, 1D	0	2	0		3098	550C	19	0 = Not Used | 1 = S3 | 2 = S4
	I021	AI4 configuration		0	2	0		3099	550C	1A	0 = Not Used | 1 = ExtRef | 2 = pc
	I022	AI5 configuration	1C	0	2	0		3100	550C	1B	0 = Not Used | 1 = S3 | 2 = S4
	I080	AI4 configuration		0	1	0		3260	550C	BB	0 = Not Used | 1 = ExtRef
	O013	DO1 configuration		0	2	0		3104	550C	1F	0 = Alarm | 1 = LLSV | 2 = Max cap
	O003	DI1 configuration	1A	0	1	0					0 = Not Used | 1 = Main Switch
	O002	DI1 configuration	1B, 1C, 1D	0	1	1		3101	550C	1C	0 = Bus->Start/Stop | 1 = Main Switch
	O022	DI2 configuration		0	4	0		3102	550C	1D	0 = Not Used | 1 = Defrost Start | 2 = Preset OD | 3 = Heat/Cool | 4 = PWR Backup
	O037	DI3 configuration	1A	0	4	0					0 = Not Used | 1 = Defrost Start | 2 = Preset OD | 3 = Heat/Cool | 4 = PWR Backup
Sensor configuration											

	Label	Parameter name	Variants	Min	Max	Default	Unit	Modbus PNU	Can Index	Can Sub-index	Enumeration
Temperature sensor type	I040	S2 sensor configuration	1C	0	6	0		3105	550C	20	0 = Not defined | 1 = EKS 221 | 2 = ACCPBT NTC10K | 3 = MBT 153 10K | 4 = 112CP | 5 = Bus Shared | 6 = AKS
	I041	S3 sensor configuration	1C	0	6	0		3106	550C	21	0 = Not defined | 1 = EKS 221 | 2 = ACCPBT NTC10K | 3 = MBT 153 10K | 4 = 112CP | 5 = Bus Shared | 6 = AKS
	I042	S4 sensor configuration	1C	0	6	0		3107	550C	22	0 = Not defined | 1 = EKS 221 | 2 = ACCPBT NTC10K | 3 = MBT 153 10K | 4 = 112CP | 5 = Bus Shared | 6 = AKS
	I081	S2 sensor configuration	1B, 1D	0	5	0		3266	550C	C1	0 = Not defined | 1 = EKS 221 | 2 = ACCPBT NTC10K | 3 = MBT 153 10K | 4 = 112CP | 5 = Bus Shared
	I082	S2 sensor configuration	1A	0	4	0					0 = Not defined | 1 = EKS 221 | 2 = ACCPBT NTC10K | 3 = MBT 153 10K | 4 = 112CP
	I083	S3 sensor configuration	1B, 1D	0	5	0		3264	550C	BF	0 = Not defined | 1 = EKS 221 | 2 = ACCPBT NTC10K | 3 = MBT 153 10K | 4 = 112CP | 5 = Bus Shared
	I084	S4 sensor configuration	1B, 1D	0	5	0		3262	550C	BD	0 = Not defined | 1 = EKS 221 | 2 = ACCPBT NTC10K | 3 = MBT 153 10K | 4 = 112CP | 5 = Bus Shared

	Label	Parameter name	Variants	Min	Max	Default	Unit	Modbus PNU	Can Index	Can Sub-index	Enumeration
Pe and Pc Pressure Transmitter	I038	Pc current low	1C	0	10	4	mA	3122	550C	31	
	I039	Pc current high	1C		20	20	mA	3123	550C	32	
	I043	Pe transmitter configuration	1C	0	14	0		3108	550C	23	0 = Not defined | 1 = AKS 32R | 2 = ACCPBP Ratio | 3 = 112CP | 4 = OEM Ratio | 5 = NSK | 6 = AKS 32 1-5V | 7 = OEM Voltage | 8 = Bus shared | 9 = AKS 32 1-6V | 10 = AKS 32 0-10V | 11 = AKS 33 | 12 = XSK | 13 = ACCPBP Current | 14 = OEM Current
	I044	Pc transmitter configuration	1C	0	14	0		3117	550C	2C	0 = Not defined | 1 = AKS 32R | 2 = ACCPBP Ratio | 3 = 112CP | 4 = OEM Ratio | 5 = NSK | 6 = AKS 32 1-5V | 7 = OEM Voltage | 8 = Bus shared | 9 = AKS 32 1-6V | 10 = AKS 32 0-10V | 11 = AKS 33 | 12 = XSK | 13 = ACCPBP Current | 14 = OEM Current
	I045	Pe ratio. low		3	97	10	%	3109	550C	24	
	I046	Pe ratio high		3	97	90	%	3110	550C	25	
	I047	Pe voltage low	1C	0	10	0	V	3111	550C	26	
	I048	Pe voltage high	1C	0	10	10	V	3112	550C	27	
	I049	Pe current low	1C	0	10	4	mA	3113	550C	28	
	I050	Pe current high	1C	0	20	20	mA	3114	550C	29	
	I051	Pc transmitter configuration	1B, 1D	0	8	0		3308	550C	EB	0 = Not defined | 1 = 8=Bus shared
	I023	Pc ratio. low	1C	3	1	3	%	3118	550C	2D	
	I024	Pc ratio high	1C	3	97	97	%	3119	550C	2E	
	I025	Pc voltage low	1C	0	10	0	V	3120	550C	2F	
	I026	Pc voltage high	1C	0	10	10	V	3121	550C	30	
	O047	Pc transmitter min.	1C	-1	0	-1	barg	3124	550C	33	
	O048	Pc transmitter max	1C	1	200	34	barg	3125	550C	34	
	O020	Pe transmitter min.		-1	0	-1	barg	3115	550C	2A	
	O021	Pe transmitter max.		1	200	12	barg	3116	550C	2B	
	I085	Pe transmitter configuration	1B, 1D	0	8	0		3270	550C	C5	0 = Not defined | 1 = AKS 32R | 2 = ACCPBP Ratio | 3 = 112CP | 4 = OEM Ratio | 5 = NSK | 6 = AKS 32 1-5V | 7 = OEM Voltage | 8 = Bus shared
	I086	Pe transmitter configuration	1A	0	7	0					0 = Not defined | 1 = AKS 32R | 2 = ACCPBP Ratio | 3 = 112CP | 4 = OEM Ratio | 5 = NSK | 6 = AKS 32 1-5V | 7 = OEM Voltage
	I087	Pe voltage low	1A, 1B, 1D	0		0	V	3276	550C	CB	
	I088	Pe voltage high	1A, 1B, 1D		5	5	V	3274	550C	C9	

	Label	Parameter name	Variants	Min	Max	Default	Unit	Modbus PNU	Can Index	Can Sub-index	Enumeration
External reference signal	I090	Ext ref. configuration	1A	0	2	0					0 = Not Used | 1 = V->SH | 2 = V->Max OD
	I089	Ext ref. configuration	1B, 1D	0	6	0		3278	550C	CD	0 = Not Used | 1 = V->SH | 2 = V->Max OD | 3 = V->Temp | 4 = Bus->SH | 5 = Bus->Max OD | 6 = Bus->Temp
	O010	Ext ref. configuration	1C	0	9	0		3126	550C	35	0 = Not Used | 1 = V->SH | 2 = V->Max OD | 3 = V->Temp | 4 = Bus->SH | 5 = Bus->Max OD | 6 = Bus->Temp | 7 = mA->SH | 8 = mA->Max OD | 9 = mA->Temp
	I035	Ext ref. voltage high	1A, 1B, 1D		10	10	V	3129	550C	38	
	I036	Ext ref. current low	1C	0		4	mA	3128	550C	37	
	I037	Ext ref. current high	1C		20	20	mA	3127	550C	36	
	I034	Ext ref. voltage low	1A, 1B, 1D	0		0	V	3130	550C	39	
	I091	Driver reference configuration	1B, 1D	0	2	0		3282	550C	D1	0 = Voltage to OD | 1 = Bus to OD | 2 = Bus to steps
	I033	Driver reference configuration	1C	0	3	0		3131	550C	3A	0 = Voltage to OD | 1 = Bus to OD | 2 = Bus to steps | 3 = Current to OD
	I079	AI4 lowpass bandwidth		0	5	5		3257	550C	B8	0 = None | 1 = 4 Hz | 2 = 2 Hz | 3 = 1 Hz | 4 = 1/2 Hz | 5 = 1/5 Hz
Control Basics											
Refrigerant configuration	O030	Refrigerant		0	49	0		3017	550B	C8	0 = Undef | 1 = R12 | 2 = R22 | 3 = R134a | 4 = R502 | 5 = R717 | 6 = R13 | 7 = R13b1 | 8 = R23 | 9 = R500 | 10 = R503 | 11 = R114 | 12 = R142b | 13 = R user | 14 = R32 | 15 = R227 | 16 = R401A | 17 = R507 | 18 = R402A | 19 = R404A | 20 = R407C | 21 = R407A | 22 = R407B | 23 = R410A | 24 = R170 | 25 = R290 | 26 = R600 | 27 = R600a | 28 = R744 | 29 = R1270 | 30 = R417A | 31 = R422A | 32 = R413A | 33 = R422D | 34 = R427A | 35 = R438A | 36 = R513A | 37 = R407F | 38 = R1234ze | 39 = R1234yf | 40 = R448A | 41 = R449A | 42 = R452A | 43 = R450A | 44 = R452B | 45 = R454B | 46 = R1233zdE | 47 = R1234zeZ | 48 = R449B | 49 = R407H
	O100	Antoine constant A1		8	12	9.8		3018	550B	C9	
	O101	Antoine constant A2		-3000	-1300	-2250		3019	550B	CA	
	O102	Antoine constant A3		210	300	253		3020	550B	CB	
	O103	Refrigerant min. temperature		-100		-100	°C	3021	550B	CC	
	O104	Refrigerant max. temperature			100	100	°C	3022	550B	CD	

	Label	Parameter name	Variants	Min	Max	Default	Unit	Modbus PNU	Can Index	Can Sub-index	Enumeration
Start up	N102	Startup mode		0	2	0		3023	550B	CE	0 = Prop. Ctrl | 1 = Fix OD w prot | 2 = Fix OD wo prot
	N015	Startup time		1	600	90	s	3024	550B	CF	
	N104	Minimum startup time		1	240	15	s	3025	550B	D0	
	N017	Startup OD		1	100	32	%	3026	550B	D1	
Superheat configuration	N021	SH reference mode		0	3	2		3027	550B	D2	0 = Fixed sp. | 1 = Loadap | 2 = MSS | 3 = Delta temp
	N107	SH fixed setpoint		2	40	7	K	3028	550B	D3	
	N009	SH maximum			40	9	K	3029	550B	D4	
	N010	SH minimum		2		4	K	3030	550B	D5	
	N116	SH reference delta temp. factor		20	100	65	%	3035	550B	DA	
	N005	SH Tn		20	900	90	s	3031	550B	D6	
	N019	SH Kp Min.		0.1	1	0.6		3032	550B	D7	
	N004	SH Kp		0.1	20	1.5		3033	550B	D8	
	N020	SH KpTe		0	20	3		3034	550B	D9	
Control Advanced											
SH Close	N117	SH close function		0	1	1		3036	550B	DB	0 = Off | 1 = On
	N119	SH close setpoint		-5	20	2	K	3037	550B	DC	
	N120	SH close Tn divide		1	5	3		3038	550B	DD	
	N121	SH close Kp factor		0.5	10	1.5		3039	550B	DE	
S4 Temperature protection	N126	Minimum S4 mode	1B, 1C, 1D	0	1	0		3042	550B	E1	0 = Off | 1 = On
	N127	Minimum S4 setpoint	1B, 1C, 1D	-50	60	5	°C	3043	550B	E2	
Superheat configuration Advance	N123	Limit Kp		1	20	5		3040	550B	DF	
	N125	Limit Tn		20	900	45	s	3041	550B	E0	
	N018	MSS Stability		0	10	5		3044	550B	E3	
	N129	MSS T0 stability factor		0	1	0		3045	550B	E4	
MOP/LOP	N130	MOP function		0	1	0		3046	550B	E5	0 = Off | 1 = On
	N011	MOP setpoint		-70	60	0	°C	3047	550B	E6	
	N140	LOP function		0	1	0		3048	550B	E7	0 = Off | 1 = On
	N141	LOP setpoint		-90	40	-40	°C	3049	550B	E8	
	N142	LOP priority mode		0	1	0		3050	550B	E9	0 = Off | 1 = On
	N131	LOP maximum time		0	600	120	s	3051	550B	EA	
	N132	LOP oscillation detection		0	1	1		3052	550B	EB	0 = Off | 1 = On
HCTP	N133	High condensing temp. protection function	1B, 1C, 1D	0	1	0		3053	550B	EC	0 = Off | 1 = On
	N134	High condensing temp. protection setpoint	1B, 1C, 1D	0	100	50	°C	3054	550B	ED	

	Label	Parameter name	Variants	Min	Max	Default	Unit	Modbus PNU	Can Index	Can Sub-index	Enumeration
Compressor Feed Forward	N135	Compressor speed feed-forward function		0	1	0		3055	550B	EE	0 = Off | 1 = On
	N136	FF low capacity turning point		0	100	25	%	3056	550B	EF	
	N137	FF maximum factor for Tn tuning		1	5	2		3057	550B	F0	
Diagnostic SH	N143	SH control sensor error action		0	2	0		3058	550B	F1	0 = Stop | 1 = Fixed OD | 2 = Average
Emergency cooling	N144	Thermostatic sensor error action	1B, 1C, 1D	0	2	0		3059	550B	F2	0 = Stop | 1 = Fixed OD | 2 = Average
	N145	Fixed OD during emergency cooling		0	100	0	%	3060	550B	F3	
Control Heat-pump setup	N112	Heat startup time		1	600	s	0	3061	550B	F4	
	N103	Heat minimum start-up time		1	240	s	0	3062	550B	F5	
	N105	Heat startup OD		1	100	%	0	3063	550B	F6	
	N106	Heat SH fixed set-point		2	40	K	1	3064	550B	F7	
	N108	Heat SH maximum			40	K	1	3065	550B	F8	
	N109	Heat SH minimum		2		K	1	3066	550B	F9	
	N115	Heat SH ref. delta temp. factor		20	100	%	0	3067	550B	FA	
	N110	Heat SH Tn		20	900	s	0	3068	550B	FB	
	N111	Heat SH Kp minimum		0.1	1		1	3069	550B	FC	
	N113	Heat SH Kp		0.1	20		1	3070	550B	FD	
	N114	Heat SH KpTe		0	20		1	3071	550B	FE	
	N118	Heat SH close set-point		-5	20	K	1	3072	550B	FF	
	N124	Heat limit Tn		20	900	s	0	3073	550C	00	
	N122	Heat limit Kp		1	20		1	3074	550C	01	
Defrost sequence	D102	Defrost start time		0	600	s	0	3076	550C	03	
	D100	Defrost OD		0	100	%	1	3077	550C	04	
	D104	Defrost end closed time		0	600	s	0	3078	550C	05	
	D103	Defrost end OD time		0	600	s	0	3079	550C	06	
Alarm configuration											

	Label	Parameter name	Variants	Min	Max	Default	Unit	Modbus PNU	Can Index	Can Sub-index	Enumeration
Alarm and Errors	A100	Low Min S4 delay		0	1200	s	0	3081	550C	08	
	A101	Low Min S4 band		0	30	K	1	3082	550C	09	
	A001	Upper temperature alarm		0	40	K	1	3083	550C	0A	
	A002	Lower temperature alarm		0	40	K	1	3084	550C	0B	
	A003	Temperature alarm delay		0	90	min	0	3085	550C	0C	
	A034	Battery alarm		0	1		0	3086	550C	0D	0 = Off | 1 = On
	A103	MOP alarm delay		0	1200	s	0	3087	550C	0E	
	A104	MOP alarm differential		0	40	K	1	3088	550C	0F	
	A105	LOP alarm delay		0	1200	s	0	3089	550C	10	
	A106	LOP alarm differential		0	40	K	1	3090	550C	11	
	A107	Condensing temp. alarm delay		0	1200	s	0	3091	550C	12	
	A113	Condensing temp. alarm differential		0	40	K	1	3092	550C	13	
	A108	High SH alarm delay		0	1800	s	0	3093	550C	14	
	A109	High SH alarm differential		0	40	K	1	3094	550C	15	
	A110	Low SH alarm delay		0	1200	s	0	3095	550C	16	
	A102	Low SH alarm differential		0	40	K	1	3096	550C	17	
	A112	Lack of capacity alarm delay		0	120	min	0	3097	550C	18	
Display											
	O011	Language		0	0		0	3157	550C	54	0 = $ActiveLanguageList
	K004	Login timeout		1	120	min	0	3158	550C	55	
	K006	Backlight timeout		0	120	min	0	3159	550C	56	
	O005	Password daily		0	999		0	3160	550C	57	
	K002	Password service		0	999		0	3161	550C	58	
	K003	Password commission		0	999		0	3162	550C	59	
	K005	Contrast		0	100	%	0	3163	550C	5A	
	K001	Brightness		0	100	%	0	3164	550C	5B	
	R005	Display unit		0	1		0	3165	550C	5C	0 = MET | 1 = IMP
	K010	Opening degree unit		0	1		0	3166	550C	5D	0 = Percentage | 1 = Step
Communication											

	Label	Parameter name	Variants	Min	Max	Default	Unit	Modbus PNU	Can Index	Can Sub-index	Enumeration
CAN/MODBus	G001	Controller address		1	127		0	3167	550C	5E	
	G005	Modbus baudrate	1B, 1C	0	8		0	3170	550C	61	0 = 0 | 1 = 1200 | 2 = 2400 | 3 = 4800 | 4 = 9600 | 5 = 14400 | 6 = 19200 | 7 = 28800 | 8 = 38400
	G008	Modbus mode	1B, 1C	0	2		0	3171	550C	62	0 = 8N1 | 1 = 8E1 | 2 = 8N2
	G007	Modbus mapping	1B, 1C	0	1		0	3172	550C	63	0 = Operation | 1 = Configuration
	G002	CANbus baudrate		0	5		0	3173	550C	64	0 = 20k | 1 = 50k | 2 = 125k | 3 = 250k | 4 = 500k | 5 = 1M
	G004	Bus sharing minimum update interval	1B, 1C, 1D	1	60	s	0	3169	550C	60	
	G003	Signal sharing minimum update interval		1	60	s	0	3168	550C	5F	
Signal sharing via BUS	G012	Signal sharing Pe		0	1		0	3174	550C	65	0 = Off | 1 = On
	G013	Signal sharing Pc	1B, 1C, 1D	0	1		0	3175	550C	66	0 = Off | 1 = On
	G014	Signal sharing S3		0	1		0	3176	550C	67	0 = Off | 1 = On
BUS Settings											
Modbus DI signal	X001	Bus shared Heating		0	1		0	4043	550F	CA	0 = Off | 1 = On
	X002	Bus shared Preset OD		0	1		0	4044	550F	CB	0 = Off | 1 = On
	X003	Bus shared Defrost start		0	1		0	4045	550F	CC	0 = Off | 1 = On
	X004	Bus shared Main switch		0	1		0	4046	550F	CD	0 = Off | 1 = On
Modbus Sensor signal	X005	Bus shared Pc		-1	200	barg	2	4047	550F	CE	
	X006	Bus shared Pe		-1	200	barg	2	4048	550F	CF	
	X007	Bus shared S2		-200	200	°C	1	4049	550F	D0	
	X008	Bus shared S3		-200	200	°C	1	4050	550F	D1	
	X009	Bus shared S4		-200	200	°C	1	4051	550F	D2	
	X010	Bus shared Ext. ref.		-100	100		1	4052	550F	D3	
Alarms status	X015	Number of active alarms		0	100		0	4055	550F	D6	
	X016	Alarm notification		0	1		0	4056	550F	D7	0 = No alarms | 1 = Alarms active
	X040	Alarm status		0	1		0	4057	550F	D8	0 = Off | 1 = On
	X017	Warning status		0	1		0	4058	550F	D9	0 = Off | 1 = On
	X018	Error status		0	1		0	4059	550F	DA	0 = Off | 1 = On
Valve status	X027	Valve current position		0	10000	steps	0	4068	550F	E3	
	X028	Valve target position		0	10000	steps	0	4069	550F	E4	
	X031	Service number of steps		-32767	32767		0	4072	550F	E7	

	Label	Parameter name	Variants	Min	Max	Default	Unit	Modbus PNU	Can Index	Can Sub-index	Enumeration
	X037	User controls LEDs		0	1		0	4074	550F	E9	0 = Off | 1 = On
User control LEDs	X038	Green LED pattern		0	65535		0	4075	550F	EA	
	X039	Red LED pattern		0	65535		0	4076	550F	EB	
Service											
Status Readout	U118	Operation status		0	20		0	4005	550F	A4	0 = Power up | 1 = Stop | 2 = Manual | 3 = Service | 4 = Safe State | 5 = Defrosting | 6 = Valve driver | 7 = Ther. Cutout | 8 = Emer. cooling | 9 = SH ctrl err. | 10 = SH start Pctrl | 11 = SH start fix OD | 12 = SH ctrl normal | 13 = SH ctrl MTR | 14 = SH ctrl LOP | 15 = SH ctrl minPC | 16 = SH ctrl MOP | 17 = SH ctrl maxPc | 18 = SH ctrl SH cl | 19 = SH ctrl minS4 | 20 = SH ctrl Tc
	U022	Actual SH reference		0	100	K	1	4006	550F	A5	
	U021	Actual superheat		0	100	K	1	4007	550F	A6	
	U024	Actual OD		0	100	%	1	4008	550F	A7	
	U100	Actual step		0	10000	stp	0	4009	550F	A8	
	U028	Actual temperature reference		0	100	K	1	4010	550F	A9	
	U020	S2 suction pipe		-50	150	°C	1	4011	550F	AA	
	U027	S3 media inlet	1B, 1C, 1D	-50	150	°C	1	4012	550F	AB	
	U016	S4 media outlet	1B, 1C, 1D	-50	150	°C	1	4013	550F	AC	
	U025	Pe evaporator		-1	200	barg	2	4014	550F	AD	
	U026	Te saturated evaporation temperature		0	100	°C	1	4015	550F	AE	
	U104	Pc condenser	1B, 1C, 1D	-1	200	barg	2	4016	550F	AF	
	U105	Tc saturated condenser temperature	1B, 1C, 1D	0	100	°C	1	4017	550F	B0	
	U101	Actual battery voltage		0	30	V	1	4018	550F	B1	
	U058	Liquid line solenoid valve		0	1		0	4026	550F	B9	0 = Off | 1 = On
	U114	Alarm relay		0	1		0	4027	550F	BA	0 = Off | 1 = On
	U007	External reference signal	1A, 1B, 1D	0	12	V	1	4028	550F	BB	
	U006	External reference signal	1C	0	24	mA	1	4029	550F	BC	
	U107	Act. ext. ref. temperature offset		0	40	K	1	4030	550F	BD	
	U108	Act. ext. ref. SH offset		0	40	K	1	4031	550F	BE	
	U124	Act. ext. ref. maximum OD		0	100	%	1	4092	550F	FB	
Digital Input Readout	U109	DI main switch		0	1		0	4032	550F	BF	0 = Off | 1 = On

	Label	Parameter name	Variants	Min	Max	Default	Unit	Modbus PNU	Can Index	Can Sub-index	Enumeration
	U110	DI defrost start		0	1		0	4033	550F	C0	0 = Off | 1 = On
	U111	DI preset OD		0	1		0	4034	550F	C1	0 = Off | 1 = On
	U112	DI heating		0	1		0	4035	550F	C2	0 = Off | 1 = On
	U113	DI PWR Backup signal		0	1		0	4093	550F	FC	0 = Off | 1 = On
	U115	PWR Backup status		0	4		0	4094	550F	FD	0 = Initializing | 1 = Ready | 2 = Charge | 3 = Replace | 4 = Failure
	U018	Thermostat cut-in time		0	16300	min	0	4019	550F	B2	
	U119	Thermostat average cut-in time		0	16300	min	0	4020	550F	B3	
	U120	Thermostat average cut-out time		0	16300	min	0	4021	550F	B4	
	U122	Average temperature		0	100	°C	1	4091	550F	FA	
	U121	Average SH		0	100	K	1	4090	550F	F9	
	U123	Average OD		0	100		0	4002	550F	A1	
	U125	Estimated KpTe		0	100		1	4003	550F	A2	
	U126	Average delta temperature	1B, 1C, 1D	0	50		1	4004	550F	A3	
Manual operation	O018	Manual mode		0	1		0	4036	550F	C3	0 = Off | 1 = On
	B101	Manual mode time-out		0	3600	s	0	3177	550C	68	
	O045	Manual OD		0	100	%	1	4037	550F	C4	
	B100	Manual step		0	8000	stp	0	4038	550F	C5	
	B104	Manual homeing		0	1		0	4039	550F	C6	0 = Off | 1 = On
	B103	Manual relay DO1		0	1		0	4040	550F	C7	0 = Off | 1 = On
	B007	Apply defaults		0	3		0	4041	550F	C8	0 = None | 1 = Factory | 2 = EKD 316 like | 3 = EKC 316 like
	B105	Enter service state		0	1		0	3178	550C	69	0 = Off | 1 = On

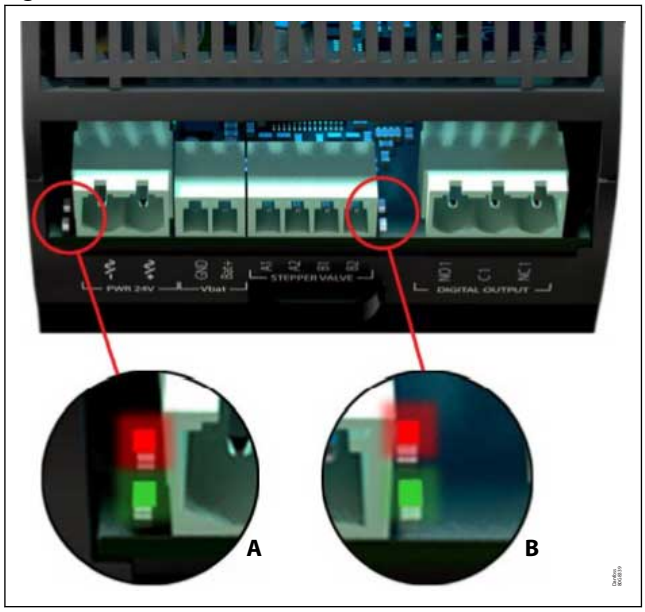
8 Alarms and troubleshooting

Depending on the application, the EKE 1x series implements error codes and alarms to help the user troubleshoot and correct parameters easily. When an alarm occurs, the following actions generally ensue:

- the “Alarm” or “Warning” relay is activated
- an icon and the alarm code are displayed on the screen

The alarms are reset automatically. The alarm is deactivated as soon as the alarm condition ceases. Otherwise, the user must follow the deactivation procedure once the alarm conditions is over. When the alarm is eliminated the alarm, relay is deactivated, and the alarm code will no longer be displayed.

Figure 77: LED indication



A	Two status LEDs to indicate operational status • Steady green = power ON • Flashing green = data transmission / initialization • Flickering red = alarm / error condition
B	Two status LEDs to indicate valve operation • Flashing red = valve closing • Steady red = valve fully closed • Flashing green = valve opening • Steady green = valve fully open • Both green and red flashing = valve-related alarm

8.1 Alarms

8.1.1 Configuration errors

Table 65: Configuration errors

Label	Alarm description	Actions during active	Trigger (how the alarm IS raised)	How to clear the alarm	Remark
E101	Configuration error	Auto operation blocked	Active when: - D12 and D13 have the same mapping configuration. - All and AI5 have the same mapping configuration.	Correct application settings	One or more configuration errors is blocking operation to start. Check the other active alarms to identify the configuration problem.
E011	No refrigerant selected	Auto operation blocked	0030 refrigerant set to none	Set 0030 refrigerant set to an actual refrigerant	No refrigerant is selected, configure the correct refrigerant. See "0030 Refrigerant"
E104	SH reference too close to SH close set point	Auto operation blocked	SH close is used and SH close set pint is too close the actual reference/ reference minimum	Disable SH close or correct the actual SH reference / reference minimum to have 0.5K difference to SH close set point	SH reference can come to close to the SH close safety functions et point. which can result in unstable operation. Keep min. 0.5K separation between minimum SH reference and N119 SH close set point.
E105	LOP set point too close to MOP set point	Auto operation blocked	If MOP and LOP is used, Mop set point - Lop set point must > 5K	Disable MOP or LOP, or adjust the difference on MOP-LOP set point >= 5K	The set point for the 2-pressure safety function Lop and Mop is to close. Keep min. 5K separation between NO11 MOP set point and N140 LOP set point
E129	No sensor configured for S4	Auto operation blocked	Application need a S4 signal for either thermostat or Min S4. but S4 signal is configured	Disable the functions needing S4 or configure a S4 signal	Operation is configured to use S4 (media out) sensor, but no S4 sensor is configured. Correct I020 All configuration or AI5 configuration and check I042 S4 sensor configuration
E106	No sensor configured for S3	Auto operation blocked	Thermostat need a S3 signal and no s3 signal is configured	Disable the functions needing S4 or configure a S4 signal	Operation is configured to use S3 (media in) sensor, but no S3 sensor is configured, Correct 1020 All configuration or AI5 configuration and check I041 S3 sensor configuration

Label	Alarm description	Actions during active	Trigger (how the alarm IS raised)	How to clear the alarm	Remark
E107	SH min higher than SH max	Auto operation blocked	SH max lower than SH low	Adjust SH max or SH low, SH Max >=SH low	NO10 SH min. is set higher than N009 SH max.
E108	OD min higher than OD max	Auto operation blocked	OD max lower than OD low	Adjust OD max or OD low, OD Max >=0D low	1066 Minimum OD is set higher than NO32 Maximum OD
E109	No transmitter configured for Pc	Auto operation blocked	Application needs PC signal for high condensing temperature protection	Disable High condensing temperature protection or configure PC transmitter	Operation is configured to use Pc transmitter. but no Pc transmitter is configured. Correct I022 AI4 configuration and check I044 Pc transmitter configuration
E125	AI5 can't operate with AKS sensor	Auto operation blocked	ON EKE 1C AI5 configuration is setup as AKS sensor	Set AI5 configuration to the of NTC1OK type	EKE 1C don't support AKS sensor on AI5. Please use a temperature sensor on NTC type on AI5. Correct, I022 AI5 configuration
E132	No sensor configured for S2	Auto operation blocked	S2 Sensor configuration = Not defined		No sensor type defined for S2
E133	No transmitter configured for Pe	Auto operation blocked	Pe transmitter configuration = Not defined		No pressure transmitter type defined for Pe
E134	Ext. ref. configuration error			Correct setting	Check the ext. ref. signal and the ext. ref. configuration.

8.1.2 Sensor alarms/errors

Table 66: Sensor alarms/errors

Label	Alarm description	Actions during active	Trigger (how the alarm IS raised)	How to clear the alarm	Remark
E024	S2 suction pipe sensor error	Alarm if backup signal is found, error if no backup possible, emergency cooling	Local sensor problem local sensor outside range + hysteresis	Get the local sensor inside signal range	S2 suction pipe sensor signal is found to be out of out of range, please check connection and I040 S2 sensor configuration
E025	S3 media inlet sensor error	Alarm if backup signal is found, error if no backup possible, emergency cooling	If S3 is used: local sensor problem local sensor outside range + hysteresis	S3 not used or get the local sensor inside signal range	S3 media inlet sensor signal is found to be out of out of range, please check connection and I041 S3 sensor configuration
E026	S4 media outlet sensor error	Alarm if backup signal is found, error if no backup possible, emergency cooling	If S4 is used: local sensor problem local sensor outside range + hysteresis	S4 not used or get the local sensor inside signal range	S4 media outlet sensor signal is found to be out of out of range, please check connection and I042 S4 sensor configuration
E020	Pe evaporator transmitter error	Alarm if backup signal is found, error if no backup possible, emergency cooling	Local sensor problem local sensor outside range + hysteresis	Get the local sensor inside signal range	Pe evaporator transmitter signal is found to be out of out of range, please check connection and I043 Pe transmitter configuration
E121	Pc condenser transmitter error	Alarm if backup signal is found, error if no backup possible	Local sensor problem local sensor outside range + hysteresis	Pc not used or get the local sensor inside signal range	Pc transmitter signal is found to be out of out of range, please check connection and I044 Pc transmitter configuration
A982	Thermostatic signal missing	Emergency Cooling thermostat	If thermostat is used and S3 or S4 signal missing (depending on sensor select	Get valid signal on S3 or S4	Signal for thermostat is missing due to sensor errors, check S3 or S4
A981	SH control signal missing	Emergency cooling SH control	Pe or S2 signal missing	Get valid signal on Pe and S2	Signal for superheat calculation is missing, check S2 and Pe
E019	External reference signal alarm		External reference out of range + hysteresis	get external signal inside range	External offset/reference signal is out of range, please check connection and 0010 Ext ref configuration and relevant high/low settings
A999	DI1 unstable input	DI is set to off	DI is unstable, loose connection more than 10 transition per minute	DI has stable low or high signal, below 6 transitions per minute	DI1 is found be unstable (many on/off within a Short time). DI1 is set off until stable value is present. Check connection
A998	DI2 unstable input	DI2 is set to off	DI2 is unstable, loose connection more than 10 transitions per minute	DI2 has stable low or high signal, below 6 transitions per minute	DI2 is found be unstable (many on/off within a Short time). DI2 is set off until stable value is present. Check connection
A983	DI3 unstable input	DI3 is set to off	DI3 is unstable, loose connection more than 10 transitions per minute	DI3 has stable low or high signal, below 6 transitions per minute	DI3 is found be unstable (many on/ off within a Short time). DI3 is set off until stable value is present. Check connection
E102	Sensor supply overload	Bios make power state on the actual supply, automatic operation blocked	Too much current draw on +5V 150mA+ or +15V (200mA+)	+5V below 50mA and +15V below 30mA	Sensor supply is overloaded. The output is set off until the load is reduced, Check for Short to COM
E123	Low supply voltage	Operation is blocked (main switch is set to off; stepper is not operational)	Stepper voltage below 16V	Stepper voltage above 16V	Supply voltage is found to be lower than expected tolerance

8.1.3 Stepper alarms/errors

Table 67: Stepper alarms/errors

Label	Alarm description	Actions during active	Trigger (how the alarm IS raised)	How to clear the alarm	Remark
E103	No valve configured	Auto operation blocked	I067 valve configuration set none	I067 valve configuration set a valve from the list	No valve selected. Please configure the correct valve in I067 Valve configuration
E100	Valve configuration error	Auto operation blocked	One or more stepper configuration errors	Correct stepper config	One or more valve configuration errors is blocking operation of stepper valve. Check the other active alarms to identify the valve configuration problem
E114	check valve step mode vs positioning	Auto operation blocked	Stepper mode is full step and half as final is requested	If full step mode is wanted set final positioning to full. If half step as final position is wanted, set step mode to minimum half step	With 1064 Valve step mode set to "full" and IO29 Valve step positioning set Half step operation is possible, Correct either IO29 or IO64
E115	Valve speed too fast	Auto operation blocked	Combination of step mode and speed give too few micro speed per sec (below 8)	Adjust valve speed and/ or valve step mode to be with limits	Number of micro steps/sec is too high (higher than 12800 micro step/sec), Reduce IO31 Valve speed or use less micro step per full step (IO64 Valve step mode)
E116	Valve speed to slow	Auto operation blocked	Combination of step mode and speed give too many micro speed per sec (higher than 12800)	Adjust valve speed and/ or valve step mode to be with limits	Number of micro steps/sec is low (higher than 8 micro step/sec), increase IO31 Valve speed or increase IO32 Valve start speed or use more micro step per full step (IO64 Valve step mode)
E117	Valve emergency speed too fast	Auto operation blocked	Combination of step mode and speed give too few micro speed per sec (below 8)	Adjust valve speed and/ or valve step mode to be with limits	Number of micro steps/sec is too high (higher than 12800 micro step/sec), Reduce IO61 Valve emergency speed
E118	Valve emergency speed too slow	Auto operation blocked	Combination of step mode and speed give too many micro speed per sec (higher than 12800)	Adjust valve speed and/ or valve step mode to be with limits	Number of micro steps/sec is low (higher than 8 micro step/sec), increase IO61 Valve emergency speed
E119	Valve start speed too slow	Auto operation blocked	Combination of step mode and speed give too few micro speed pr sec (below 8)	Adjust valve speed and/ or valve step mode to be with limits	Number of micro steps/sec is low (higher than 8 micro step/sec), increase IO31 Valve speed or increase IO32 Valve start speed or use more micro step per full step (IO64 Valve step mode)
E126	Valve Short circuit or driver too hot	Auto operation blocked, stepper will try to recover every 10 secs	Stepper driver report thermal Shutdown,	Stepper driver has recovered from thermal overload	Valve driver is unable to drive valve. Check for Short the coils or if ambient is higher than 60 °C
A997	Battery critical low voltage		Battery input below 12V	Battery input above 12.2V	Battery voltage is found to be critical low; valve will not be closed in case of power fail. Replace battery /check connections
A996	Battery too high voltage		Battery input above 27V	Battery input below 25V	Battery voltage is too high. Valve will not be closed in case of power fail. Replace battery with one of correct type (18-24V.).
W001	Battery low voltage		Battery input below 17V	Battery input above 17.2V	Battery voltage is found to be low, replace battery.
E124	Open circuit on valve	Auto operation blocked; stepper will try to recover every 10 secs	Stepper detect one or 2 open coils	Current in both coils match valve profile	Valve have an open circuit on one or more coils. Check connections to valve.

8.1.4 Bus alarms/errors

Table 68: Bus alarms/errors

Label	Alarm description	Actions during active	Trigger (how the alarm IS raised)	How to clear the alarm	Remark
E122	Shared signal timeout		One or more signals (S2, S3, S4, P0, PC) are not Shared through CAN within "CAN bus Min. update interval" or Modbus with" Modbus min. update interval seconds".	All needed signal is updated at right frequency	A needed control / sensor / reference signal via CAN bus is missing. Check CAN bus connection and operation of other CAN bus controllers.
E128	Ext. ref. via Modbus timeout	If bus signal via Modbus	Bus ext ref. needs to be updated within "Modbus min. update interval seconds".	Ext reference signal updated within Modbus min. update interval	A needed control / sensor / reference signal via Modbus is missing. Check Modbus connection and operation of other Modbus controllers.

8.1.5 Application alarms

Table 69: Application alarms

Label	Alarm description	Actions during active	Trigger (how the alarm IS raised)	How to clear the alarm	Remark
A994	Low S4 media outlet temperature		Injection active and Min S4 function active and S4 below MIN S4 set point - Low Min S4 band and Low Min S4 delay expired	Injection not active or Min S4 function disabled or S4 above MIN S4 set point - Low Min S4 band	Media out temperature is below alarm limit and alarm delay has expired.
A991	High evaporation pressure (MOP)		Injection active and Mop active and Te higher than mop set point + MOP alarm differential and MOP alarm delay expired	Injection not active or Mop disabled or Te below mop set point + MOP alarm differential	Pe /Te is higher than alarm limit and alarm delay has expired.
A990	Low evaporation pressure (LOP)		Injection active and Lop active and Te lower than lop set point - LOP alarm differential and Cond temp alarm delay expired	Injection not active or Lop disabled or Te above lop set point + LOP alarm differential	Pe /Te is lower than alarm limit and alarm delay has expired.
A989	High condensing temperature		Injection active and HCTP active and Tc above HCTP set point + Cond. temp.alarm differential and LOP alarm delay expired	Injection not active or HCTP disabled or Tc below HCTP set point + Cond. temp.alarm differential	Pc / Tc is higher than alarm limit and alarm delay has expired.
A988[1]	High superheat		Injection active and SH above SH reference +High SH alarm differential and High SH alarm delay expired	Injection not active or SH below SH reference +High SH alarm differential	Superheat is higher than alarm limit and alarm delay has expired.
A987[2]	Low superheat		Injection active and SH below SH reference - low SH alarm differential and low SH alarm delay expired	Injection not active or SH above SH reference - low SH alarm differential	Superheat is below alarm limit and alarm delay has expired.
A986	Lack of valve capacity		Injection active and OD higher than max OD - 5% for more than 90 96 of Lack of capacity alarm delay time	Injection not active or OD higher OD - 5% in less than 88% for Lack of capacity alarm delay time	Valve is running close to full capacity for long time.
E135	Error in Heat/Cold in thermostat mode		Use of DI as H/C function in thermostat mode.	Avoid H/C function in DI while in thermostat mode.	H/C function not available in thermostat mode.

(1)
- Length of monitoring window for High superheat detection can be adjusted using parameter [A108 – High SH alarm delay]. If the parameter is set to 0 the function is disabled.
- The high superheat limit is defined by the user through parameter [A109 – High SH alarm differential] High superheat limit= SH ref+ High SH alarm differential.

(2)
- Length of monitoring window for Low superheat detection can be adjusted using parameter [A110 – Low SH alarm delay]. If the parameter is set to 0 the function is disabled.
- The high superheat limit is defined by the user through parameter [A998 - Low SH alarm differential]
  Low superheat limit= SH ref- Low SH alarm differential, If Low superheat limit is lower than SH close set point, then

  Low superheat limit= SH close set point.

8.1.6 Thermostat alarms

Table 70: Thermostat alarms

Label	Alarm description	Actions during active	Trigger (how the alarm IS raised)	How to clear the alarm	Remark
A993	High temperature		Thermostat active and thermostat temperature (s4/ S3) above actual reference + Upper temperature alarm for Temperature alarm delay time	Thermostat not active or thermostat temperature (s4/S3) below actual reference + Upper temperature alarm	Thermostat temperature is higher than alarm limit and alarm delay has expired
A992	Low temperature		Thermostat active and thermostat temperature (s4/ S3) below actual reference - lower temperature alarm for Temperature alarm delay time	Thermostat not active or thermostat temperature (s4/S3) above actual reference - lower temperature alarm	Thermostat temperature is lower than alarm limit and alarm delay has expired

8.1.7 Stop state alarm

Table 71: Stop state alarm

Label	Alarm description	Actions during active	Trigger (how the alarm IS raised)	How to clear the alarm	Remark
W002	Standby mode		Controller is in stop state	Controller not in stop state	The controller is standby due R012 Main switch and/or DI main switch is off

8.1.8 Manual mode alarm

Table 72: Manual mode alarm

Label	Alarm description	Actions during active	Trigger (how the alarm IS raised)	How to clear the alarm	Remark
W003	Manual control		Controller is in manual state	Controller not in manual state	The controller is manual control, no automatic control is active, and many alarms are disabled

8.2 Troubleshooting

Table 73: Troubleshooting

ID	Symptom	Possible cause/Reaction	Solution
1	Regulation does not start on using control modes i.e., MSS	DI is not connected, if defined as ON/OFF hardware switch.	• Turn on DI switch.
		Sensor / transmitter error.	• Check and clear alarm.
		Alarm configuration conflict i.e. S2 sensor not defined or no refrigerant selected.	• Clear and clear Alarm.
		Alarm: standby mode active i.e. Parameter R012 is OFF.	• Set R012 main switch to 1.
2	Suction pressure too low	Pressure drops across evaporator too high.	• Check refrigerant ahead of expansion valve, If valve is placed much higher than condenser outlet. • Check pressure difference.
		Lack of sub cooling ahead of expansion valve.	• Limit max opening degree of the valve setting in controller. • Check refrigeration system capacity and compare with expansion valve capacity. • Use proper valve size, Suitable for the system.
		Evaporator superheat too high.	• Check the section " High Superheat".
		Pressure drop across the expansion valve less than valve is sized for.	• Check pressure drop across expansion valve. Replace with larger valve.
		Expansion valve too small.	• Check refrigeration system capacity and compare with expansion valve capacity. Replace with larger valve if necessary. • Check selected valve type in the controller valve list.
		Expansion valve block with foreign material.	• Remove valve and examine the orifice /piston.
		Wrong selection of Refrigerant in the controller settings.	• Choose the correct Refrigerant from the pre-defined list.
		Lack of Charge in the system.	• Charge the system with appropriate refrigerant capacity. • Check for leakage in the system.
		Pressure transmitter ranges or type is wrongly defined.	• Define the correct pressure range.
		MOP set point is defined very low.	• Check the MOP setting, if Modbus is used, check if the values have been scaled as indicated in the parameter list
		Evaporator wholly or partly iced up.	• De-ice evaporator.
		Low chilled water flow	• Check flow as per design
		chilled water temp too low	• Check temp set points as per Design
3	Low pressure cut out due to compressor cut in and cut out	Missing start signal.	• Check for digital input DI signal or its settings.
		Startup problem.	• Check section start- up problem and its solution.

ID	Symptom	Possible cause/Reaction	Solution
4	Liquid hammer in compressor (noisy or unusual compressor sound) and /or frost on the suction line	Superheat reference set too low.	• Increase the SH reference by changing the SH min. max. parameter.
		Superheat is too low.	• Make sure SH Close function is ON. • Increase the values of SH close and SH min. • Also check section "Too low superheat"
		Inaccurate SH measurement or slow response in S2 sensors.	• Ensure that S2 sensor is secured on suction line. • Insulate temperature sensor properly. • Check the product installation guide section temperature sensor.
		Refrigerant or pressure transmitter is not set correctly.	• Check the related parameters.
5	Too Low superheat	Min. SH parameter is too low set.	• Raise the min. SH parameter.
		Valve Cannot Close fully.	• Reduced the Valve OD or forced opening time at Start up.
		Valve OD too large at start up.	• Use P-control. • Reduce Start OD.
		Inaccurate superheat.	• Mounting position of Temperature sensor. Place sensor close to evaporator.
		High-pressure drop-in suction line.	• Mounting position of the pressure transmitter. Place the transmitter close to evaporator. • Check the product installation guide section temperature sensor.
		Valve is stuck at open.	• Check valve installation.
		Liquid returns to compressor.	• Check section Liquid hammering.
6	High superheat	Lack of sub-cooling.	• Limit max opening degree of the valve setting in controller. • Check refrigeration system capacity and compare with expansion valve capacity. Use proper valve size suitable for the system.
		Controller is not setup/tuned properly.	• Check the controller superheat settings SH min, SH max and sensors connected to it. • Tune PID parameters in the controller.
		Wrong valve selected from the controller list or undersized valve installed.	• Check the right valve type and setting or use the appropriate valve size for the needed condition.
		Seasonally high load condition or overloaded the system.	• Check the heat exchanger for dirt's. • Check superheat performance.
7	Too high or too low measured superheat	Wrong sensor type, refrigerant type, pressure transmitter type and/or range.	• Check the related setting and range. • In case of offset in sensor or pressure transmitter, perform the sensor correction. • Always use accurate pressure transmitter
8	Measured Superheat is higher than reference - more than 5K for 5 - 10 min.	Load condition has changed, and the superheat controller is too slow to adapt to the change.	• TN can be adjusted to 20% lower and Kp can be adjusted to be 20% higher, monitor that the adjustment doesn't make the valve OD and Pe/Te oscillate.
		Compressor capacity has changed, and the superheat controller is too slow to adapt to the change.	• Compensation for compressor change is done with KpTe in this case KpTe can be adjusted to be 20% higher.
		Missing valve capacity.	• Check if valve OD is close to 100 %, if so, the valve is missing capacity, check if sub cooling is OK. • System might have loss charge.
	Measured Superheat is lower than reference - lower 3K	SH close parameter is disabled or not setup optimally.	• Enable the SH close function and set the setpoint 2K below the reference.
		Compressor capacity has changed, and the superheat controller is act too aggressive to adapt to the change.	• Compensation for compressor change is done with KpTe in this case KpTe can be adjusted to be 20% lower.
9	Fluctuating superheat	The S2 sensor not in good contact with the suction line.	• Check proper mounting of the temperature sensor.
		Fast change in load and ambient condition.	• Wait for the stable condition and check again.
		Periodic flash gas at the valve inlet.	• Secure stable sub cooling
		Aggressive gain Kp and Kp Te parameter.	• Decrease gain in the controller, ex set SH Tn to be 20 % higher and reduce Kp 20%, if still SH is fluctuating, reduce KpTe by 20%. • Try with the higher SH reference.
10	Negative superheat	Wrong sensor type, refrigerant type, pressure transmitter type and range.	• Check the related setting and range.
		During start up suction pressure is low because of low Ambient temperature.	• Check the startup problem.
		System is not running.	• Check the system.

ID	Symptom	Possible cause/Reaction	Solution
11	Superheat outside the defined range or does not reached the setpoint	Wrong valve selected or its valve parameter.	• Check the right valve type and its setting.
		Loss of refrigerant in the system.	• Charge the system with appropriate refrigerant capacity. • Check for leakage in the system.
		Expansion valve too small.	• Replace with larger valve if necessary. • Check the selected valve in the controller valve list.
		Step loss in the valve.	• Drive the stepper valve with the recommended Speed. • Too high or too low speed could result in loss step in the valve. • For the user defined valves, check the other valve settings such as current, duty cycle, holding current and another relevant parameter.
			• Use overdrive features to mitigate the loss steps. Use the correct overdriving values with respect to the used value.
			• Wrong defined valve type or its setting.
			• Longer cables mounted than specified for the controller. • Separate Valve cable from other high-power cables and do not bundle the cables.
			• Obstruction in the valve or high friction in the valve.
			• MOPD exceeded than specified in the valve specification.
12	Takes too long to settle SH at reference point	Too low gain Kp and KpTe or long integration time Tn.	• Increase Kp by factor of 1.5% • Decrease Tn 25% of the set value • Perform 1 and 2 in a loop if needed.
		At start up. the pull-down time for SH or temp is longer.	• Use start with P. control and increase start OD. • If the superheat in general is 4K higher than reference 1 minute alter start up. the startup OD can be adjusted to be 20 % higher.
		Wrong selection of the valve.	• Check the valve type and in setting.
		Wrong selection of the reference point.	• Correctly define the min, max SH setting and/or reference type i.e MSS/Load defined ap / Fixed/delta Temp. • Also check section, High superheat and 'Too high and too low superheat'
13	Startup problem	low pressure cut out at start up	• Check the LEO Alarm connection. • Missing synchronization with controller and the compressor Le. D4 not connected to EKE. • Wrong Of missing valve connection. Check the M12 cable connection to the valve and to the controller. • Check other component in the suctions liquid 'Meta any keel of blockage. • Use the LOP feature during start up.
		Unsynchronized signals.	• Make sure that main switch signal and the compressor start are synchrony, it ok to have until 2 sec delay.
		High Superheat after startup.	• Check section Too high or too low superheat.
14	Startup problem after defrost	low suction cut out	• Use EKE defrost sequence feature. • Use LOP feature • Use P- control at start method and prolong the start tine
			• Check the right signal from the controller.
15	Unable to maintain media temperature	Lack of sub-cooling ahead of expansion valve	• Limit max opening degree of the valve setting in controller. • Check refrigeration system capacity and compare with expansion valve capacity. Use proper valve size suitable for the system.
		Check section High superheat and Low suction Pressure	
		Wrong selection of temperature sensor and or installation.	• Check for the right sensor configuration
		Check Working condition of the unit	• Check Superheat.

ID	Symptom	Possible cause/Reaction	Solution
16	Flash gas	Loud refrigerant or undercharged refrigerant.	• Charge the system with appropriate refrigerant capacity. • Check for leakage is the system. • If the valve is placed much higher than condenser tweet check pressure difference.
		Flash gas can lead to high SH or low suction pressure	• Use the right valve size. • Also refer to section "High Superheat" and "Suction pressure too low"
		Pressure drops across filter.	• Check and replace the Stet.
17	Steppe valves open/ close too slow	Incorrect selection of valve type.	• Dane the correct valve type.
		Incorrect valve installation.	• Check the physical vale and cable and intake in light way.
		MOPD is higher than valve specification.	• Check the valve spec and choose the correct vane.
		Check valve speed setting.	• Drive the stepper valve with the recommended Speed. • Too high or too low speed could result in loss step in the valve. • For the user defined valves, check the other valve settings such as current, duty cycle, holding current and other relevant parameter.
18	Opening degree of valve at maximum OD for longer time period	Lack of cooling capacity.	• Check the cooling capacity in the system Also check section, expansion valve too small
		The condenser pressure is too low.	• Check the ambient temperature. • Adjust the condenser controller.
		The filter drier is blocked by dirt	• Replacement Filter drier.
		Flash gas in liquid line due to loss of refrigerant or undercharge of refrigerant.	• Check section flash gas.
		Wrong valve setting.	• Check valor setting matching installed valve.
		Pressure transmitter is wrongly defined.	• Oita pressure range and correct pressure transmitter type.
		Wrong refrigerant selected	• Choose the correct refrigerant in the controller.
19	Hunting or fluctuation valve position	Too high gain (Kp and KpTe) or too low integration time (Tn).	• Decrease Kp by factor of 1.5% • Increase Tn 25% of the set value. • Perform 1 and 2 in loop if needed.
		S2 thermal contact.	• Check mounting of S2 sensor, Check the installation guide section temperature sensor mounting.
		Fluctuating AI signal for SH reference.	• Check AI signal quality.
		Fluctuating pressure signal.	• Check section Fluctuating pressure signal.
		Fluctuating Superheat.	• Check section Fluctuating Superheat.
20	Unstable OD on driving the valve in Valve driver mode	Fluctuating AI signal.	• Check the AI signal quality. • Use the Valve neutral zone feature.
21	Internal Leakage in the valve	Wrong selection of the valve.	• Check the valve type and its setting.
		Step loss in stepper motor valve.	• Power cycle the controller. • Enable the step loss feature i.e. overdriving. choose the recommended overdrive value with respect to the installed valve.
			• Drive the stepper valve with the recommended speed. • Too high or too low speed could result in loss step in the valve.
			• Longer cables mounted than specified for the controller. • Separate Valve cable from other high-power cables and do not bundle the cables.
			• Blockage in the valve or high friction in the valve.
			• MOM, exceeded than specified in the valve specification.

ID	Symptom	Possible cause/Reaction	Solution
22	Valve does not move	Valve neutral zone has been defined.	• Check Valve parameter in chapter Stepper motor valve.
		Loose or incorrect M12 cable connection.	• Check proper and firm connection of valve cable wires to ENE terminals. • Also check section Valve rotates in opposite direction'.
		Change in valve setting or other configurations.	• Check for the correct valve parameters. • Check for the correct state of R12 ON/OFF regulation or DI connection. • If AI or Modbus signal is used, make sure that the correct signal is connected to the controller.
		Incorrect voltage supplies to the controller.	• Check the power supply and measure input voltage to the controller.
		Valve got stuck.	• Check the valve installation. • Check for the dirt inside the valve.
		Valve motor is damaged; resistance of the motor varies a lot than specified for a valve.	• Check the resistance in the motor between each coil. • Make sure you consider some tolerances for cable or temperature deviation. • Replace the valve.
23	Valve rotates in opposite direction	Valve M12 cable wire is wrongly connected to the controller.	• Check the connection of wire color codes as stated in Installation guide. • For other valves than Danfoss, check with valve supplier for the right connection.
		Wrong connection of wires at cable joint, if there is extension cable to the main Valve cable.	• Check for the right color configuration at the joint.
24	Valve is overdriven to Zero position	EKE performs valve calibration in the following situation as a normal procedure	• Normal operation
		Wrong defining of valve type.	
		Valve overdrive feature is enabled, and OD is dosed to fully closed position or the overdriving timer is ON.	
		Alarm or Error condition will bring the valve to Zero position and stop regulation	
		On setting DI = Off when DI is set as ON/OFF regulation	
25	Fluctuating pressure signal	Change in load of the system.	• Observe the change in the load of the system.
		Faulty pressure sensor.	• Replace faulty pressure transmitter.
		Flash gas in the system.	• Check the section flash gas.
26	Compressor thermal cut out (Mop is not working or going higher than set value)	MOP is not enabled, or wrongly defined.	• Check mop settings.
		Change in operating condition.	• Observe the operating condition. • Controller need time to adjust to the stable condition.
27	LOP protection doesn't work at low pressure	if low superheat and low suction pressure exist same time for some time, LOP function is disabled.	• Check operating condition and settings.
		Fast change in operating condition.	• Controller need time to adapt to the change condition.
28	Controller is in safe state (check LED or display)	Internal error i.e., EEPROM error in controller software exceptions.	• Power cycle the controller, if continue to get the same error then replace controller.
29	Controller freeze. nothing happens	loose connections.	• Check the connection in the EKE.
		Incorrect voltage supplies to the controller.	• Check the power supply and measure input voltage to the controller.
			• Power cycle controller and observe the LEDs, IF no LEDs are lighting during power cycle, replace controller.
30	No communication (Indicated by LEDs)	Wrong Modbus settings.	• Check Modbus address, baud rate, and protocol. • EKE only supports Modbus RS 485 RTU, it does not support Modicon conventions.
		Loose connection or no termination.	• Check the Modbus terminals and use terminations.
		Check power supply to EKE controller	• If off, power on the controller

9 Appendix

Table 74: Appendix 1: Acronyms and abbreviations used in this document

Full name	Abbreviation
Compressor	Comp.
Capacity	cap
Controller	cont
Actual	act
Temperature at evaporator outlet	S2
Media inlet temperature	S3
Media out temperature	S4
Saturated temperature in evaporator	To /To
Pressure in evaporator	Pe / PO
Saturated temperature in condenser	To
Pressure in condenser	Pc
Proportional gain constant	Kp
Integration time	Tn
Proportional gain constant on saturated temperature	KpTe
Opening degree	OD
Superheat	SH
Minimum	Min.
Maximum	Max.
Reference	Ref.
Temperature	Temp.
Factor	Fac.
Oscillation	Osc.
Condensator	Cond.
Feed forward	FF
Set point	Sp.
Ratiometric	Ratio.
External	Ext.
Address	Adr.
Pulse per second	PPS
Step	Stp
Loss of charge indication	LOC
Temperature difference between media temperature and evaporating temperature	ATm
Maximum operating pressure	MOP
Minimum stable superheat	MSS
Parameter number	PNU

10 Ordering

Table 75: Product part numbers

Description	Pack format	CodeNo.
Electronic controller EKE 1A	Single pack	080G5300
Electronic controller EKE 1B	Single pack	080G5350
Electronic controller EKE 1C	Single pack	080G5400
Electronic controller EKE 1D	Single pack	

Table 76: Accessories part numbers

Description	Pack format	CodeNo.
MMIGRS2 Remote Display	Single pack	080G0294
MMIMYK gateway	Single pack	080G0073
ACCCBI telephone cable user interface connector 1.5 m	Single pack	080G0075

11 Certificates, declarations, and approvals

The list contains all certificates, declarations, and approvals for this product type. Individual code number may have some or all of these approvals, and certain local approvals may not appear on the list.

Some approvals may change over time. You can check the most current status at danfoss.com or contact your local Danfoss representative if you have any questions.

Table 77: Certificates, declarations, and approvals

Document name	Document type	Document topic	Approval authority
080R4003.01	EU Declaration of conformity	EMC directive 2014/30/EU: EN61000-6-3: 2007 +A1: 2011 EN61000-6-2: 2005 LVD directive 2014/35/EU: EN60730-1: 2011 EN60730-2-9: 2010 RoHS directive 2011/65/EU	Danfoss

12 Online support

Danfoss offers a wide range of support along with our products, including digital product information, software, mobile apps, and expert guidance. See the possibilities below.

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