

Installation guide

# Electronic superheat controller

Type EKE 1D (PV02)

English

UK  
CA



More info

## Introduction

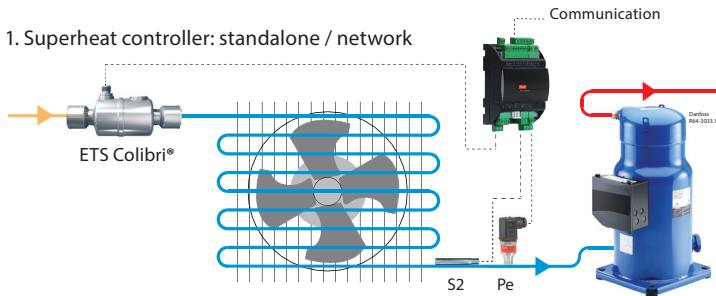
Superheat controller EKE 1D is for use where superheat must be accurately controlled, typically in commercial air conditioning, Commercial and industrial heat pumps, Commercial refrigeration, food retailing and industrial applications.

Compatible valves: Danfoss ETS 6, ETS 8M (Bipolar) / ETS / ETS Colibri® / ETS L, KVS / KVS Colibri® and CCM / CCMT / CCMT L / CTR valves.

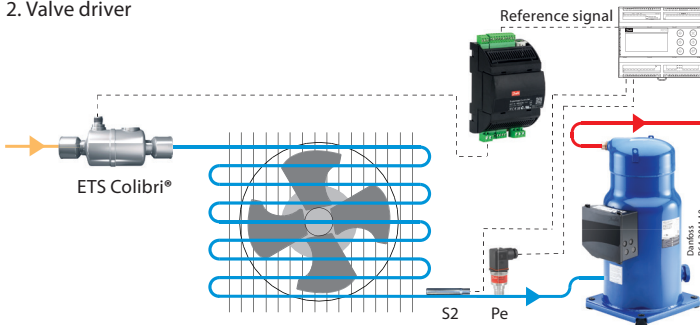
Reference: For details please see EKE data sheet.

## Applications

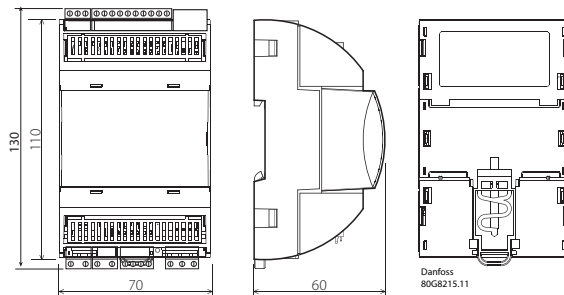
### 1. Superheat controller: standalone / network



### 2. Valve driver



Dimensions in mm  
EKE 1D



Weight: 152 gram

## Technical specifications

### POWER SUPPLY

EKE has galvanic isolation by switch-mode power supply.

24 V AC  $\pm 20\%$ , 50/60 Hz. Maximum power consumption: 18 VA.

Input voltage rating (DC): 24 V DC  $\pm 20\%$ , 15 W.

I/O	TYPE	NUMBER	SPECIFICATION
Analog inputs			Max. 15 V input voltage Do not connect voltage sources to unpowered units without limiting the current to analog inputs (overall 80 mA). Open circuit HW diagnostics available for voltage input on : <b>A14</b>
	Voltage	2	<b>A13</b> (Pe) 0 – 5 V ratiometric, <b>A14</b> 0 – 5 V, 0 – 10 V
	NTC	2	<b>A11</b> (S3, S4), <b>A12</b> (S2) NTC temperature probes, 10 k $\Omega$ at 25 °C
	Auxiliary Supplies	1	<b>5 V +</b> Sensor supply: 5 V DC / 15 mA, overload protection approximately 150 mA
Digital inputs	Voltage free contacts	2	<b>DI1, DI2</b> Steady current minimum 1mA Cleaning current 100 mA at 15 V DC On: RIL < = 300 $\Omega$ Off: RIH > = 3.5 k $\Omega$

Digital output	Relay	1	<b>C1-NO1</b> Normally Open: 3 A General purpose, 250 V AC, 100 k cycle Normally Open: 3 A Inductive (AC-15), 250 V AC, 100 k cycle Normally Closed: 2 A General purpose, 250 V AC, 100 k cycle
Stepper motor	Bipolar	1	<b>Stepper valves: A1, A2, A3, A4</b> Bipolar stepper motor output: - Danfoss ETS 8M (Bipolar) / ETS C / ETS L / KVS / KVS C / CCMT 2 – CCMT 42 / CCMT L / CTR Valves Other Valves: - speed 10 – 400 pps - drive mode 1/8 microstep - max. peak phase current: 1.2 A (848 mA RMS) - max. drive voltage 40 V - max. output power 12 W
Battery backup		1	<b>VBATT:</b> 18 – 24 V DC (24 V DC recommended): - max. battery current: 850 mA at 18 V - battery alarm will be activated below 16 V DC.
Communication	CAN	1	<b>CAN</b> - 3 way screw plug-in connector No Built-in termination
		1	<b>CAN - RJ</b> RJ connector to directly connect and supply a MMI No built in termination

## General features and warnings

### Plastic housing features

- DIN rail mounting complying with EN 50022
- Self-extinguishing V0 according to IEC 60695-11-10 and glowing/hot wire test at 960 °C according to IEC 60695-2-12
- Ball test: 125 °C according to IEC 60730-1. Leakage current:  $\geq 250$  V according to IEC 60112

### Other features

- Operating conditions CE: -20T60, 90% RH non-condensing
- Storage conditions: -30T80, 90% RH non-condensing
- To be integrated in Class I and/or II appliances
- Index of protection: IP 20 on product and IP40 only on the front cover
- Period of electric stress across insulating parts: long
- Suitable for using in a normal pollution environment
- Category of resistance to heat and fire: D
- Immunity against voltage surges: category II
- Software class and structure: class A

### 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 for residential, commercial and light-industrial environments)
  - EN61000-6-2, EN61000-6-4 (immunity and emission standard for industrial environments)
  - EN60730 (Automatic electrical controls for household and similar use)

### General warnings

- Every use that is not described in this manual is considered incorrect and is not authorized by the manufacturer
- Verify that the installation and operating conditions of the device respect those specified in the manual, especially concerning the supply voltage and environmental conditions
- This device contains live electrical components. All service and maintenance operations must therefore be performed by qualified personnel
- The device must not be used as a safety device
- Liability for injury or damage caused by the incorrect use of the device lies solely with the user

### Installation warnings

- Recommended mounting position: vertical
- Installation must comply with local standards and legislation
- This product is not subject to the UK PSTI regulation, as it is for supply to and use only by professionals with the necessary expertise and qualifications. Any misuse or improper handling may result in unintended consequences. By purchasing or using this product, you acknowledge and accept the professional-use-only nature of its application. Danfoss does not assume any liability for damages, injuries, or adverse consequences ("damage") resulting from the incorrect or improper use of the product and you agree to indemnify Danfoss for any such damage resulting from your incorrect or improper use of the product.
- Before working on the electrical connections, disconnect the device from the main power supply
- Before carrying out any maintenance operations on the device, disconnect all electrical connections
- For safety reasons the appliance must be fitted inside an electrical panel with no live parts accessible
- Do not expose the device to continuous water sprays or to a relative humidity greater than 90%.
- Avoid exposure to corrosive or pollutant gases, natural elements, environments where explosives or mixes of flammable gases are present, dust, strong vibrations or shock, large and rapid fluctuations in ambient temperature that might cause condensation in combination with high humidity, strong magnetic and/or radio interference (e.g. transmitting antennae)
- When connecting loads be aware of the maximum current for each relay and connector
- Use cable ends suitable for the corresponding connectors. After tightening connector screws, tug the cables gently to check their tightness
- Use appropriate data communication cables. Refer to the EKE data sheet for the kind of cable to be used and setup recommendations
- Minimize the length of probe and digital input cables as much as possible, and avoid spiral routes around power devices. Separate from inductive loads and power cables to avoid possible electromagnetic noises
- Avoid touching or nearly touching the electronic components fitted on the board to avoid electrostatic discharges

### Product warnings

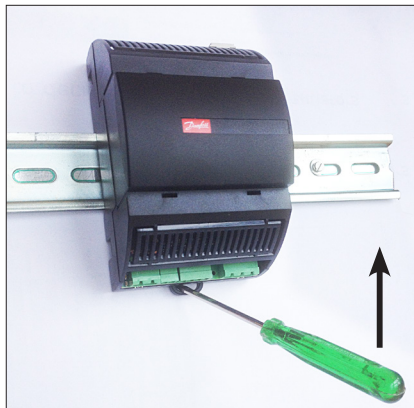
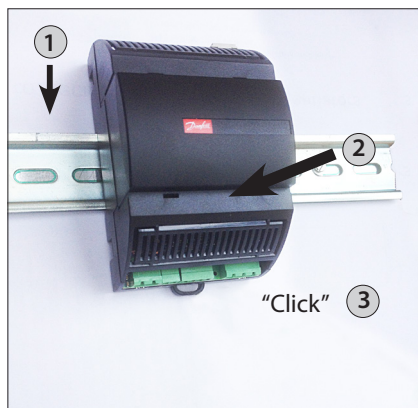
- Use a class II category transformer for 24 V AC power supply.
- Connecting any EKE inputs to mains voltage will permanently damage the controller.
- Battery Backup terminals does not generate power to recharge a device connected.
- Battery Backup - the voltage will close the stepper motor valves if the controller loses its supply voltage.
- Do not connect an external power supply to the digital input DI terminals to avoid damaging the controller.



# 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.

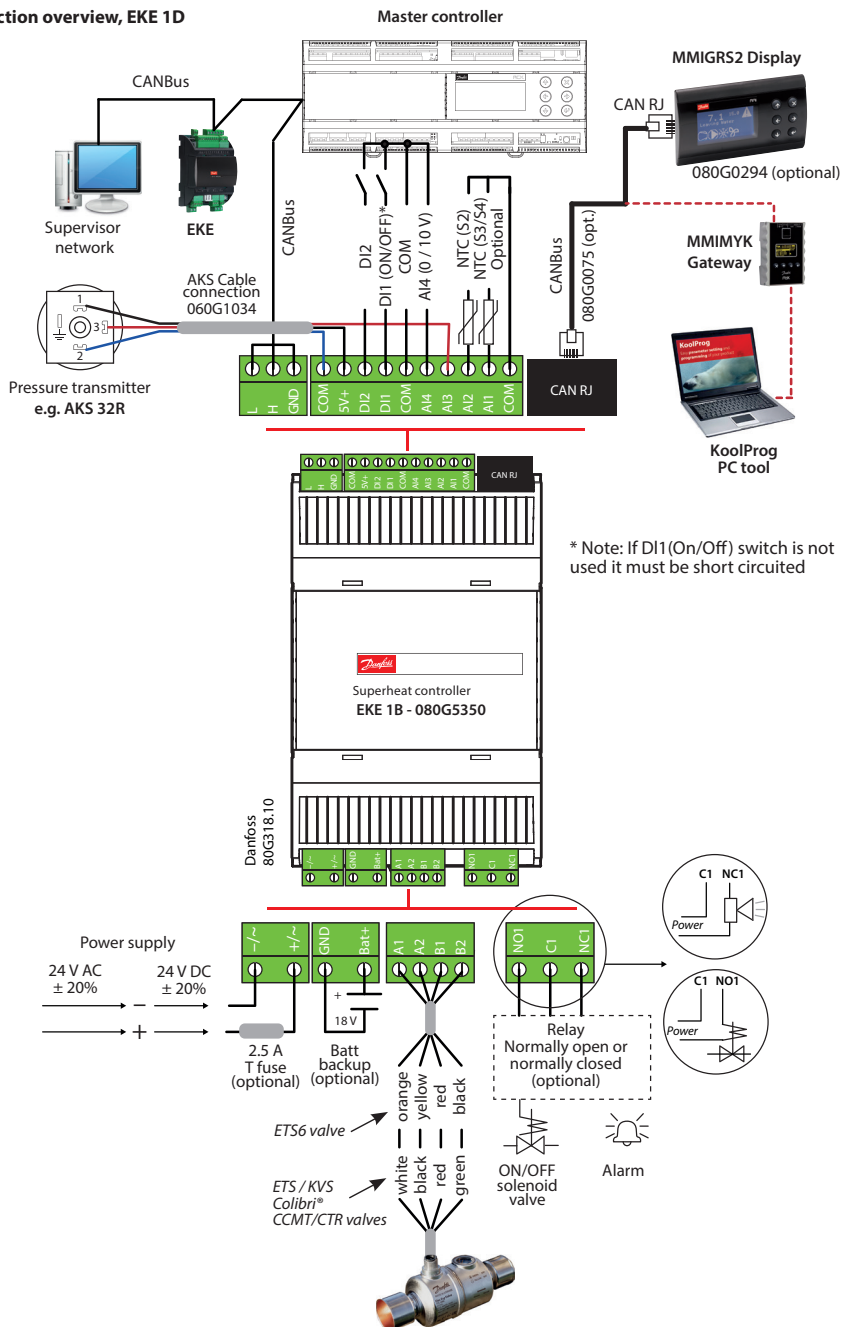
It is demounted by gently pulling the stirrup located in the base of the housing.



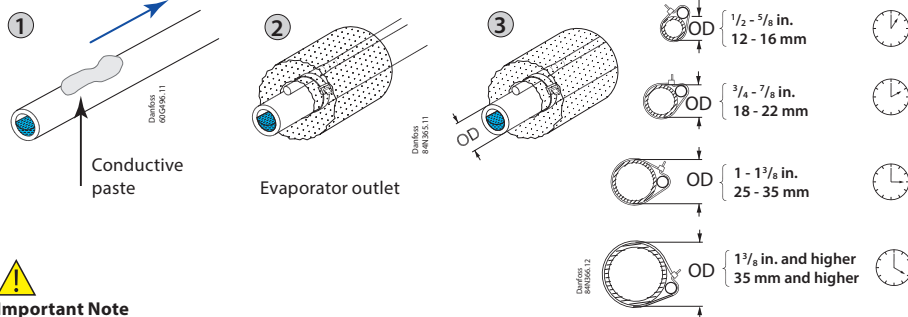
## Connection overview: EKE 1D



## Connection overview, EKE 1D

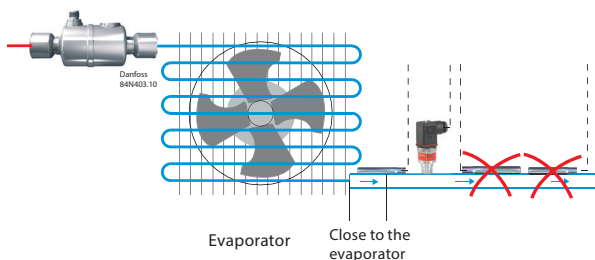


## Sensor mounting: Temperature sensor



### Important Note

- Mount the sensor on a clean paint-free surface.
- Remember to use heat conducting paste and insulate the sensor.
- For precise measurements, mount the sensor max. 5 cm from the outlet of the evaporator.

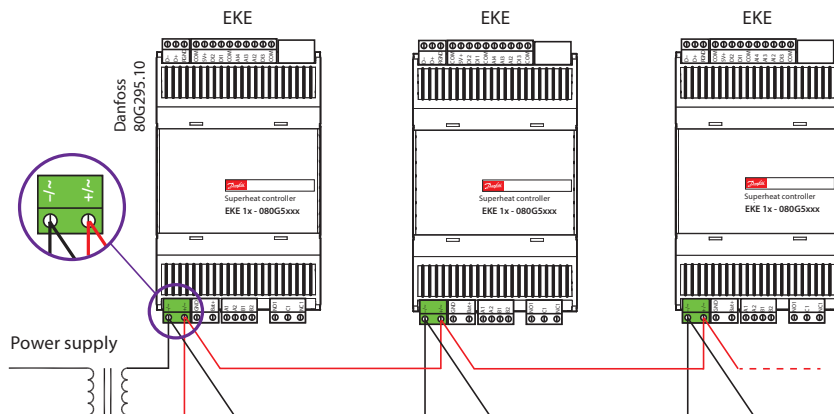


### Pressure transmitter

- Installation of the pressure transmitter is less critical. However, the pressure transmitter should be closer to the temperature sensor, right after the evaporator and with its head upright. It is a good practice to select a pressure transmitter with an average load of 40 - 60% of full scale.
- 5 EKEs at maximum are allowed to share the output signal of a ratiometric pressure transmitter. In order to get a correct acquisition on all the units all the three wires (GND, 5 V and transmitter signal output) must be routed to every unit.

### Power supply

- Power sharing is allowed in EKE controller.
- It is a good practice not to reverse the polarity of the power connection cables. Selection of the common power supply depends on the total number of sharings and the valve in use.



## Relay Outputs

EKE 1D has 1 relay output:

- Type SPDT relay. Digital Output can be used to connect either a solenoid valve or an alarm.
- The relays cannot be used for the direct connection of capacitive loads such as LEDs and ON/OFF control of EC motors. All loads with a switch-mode power supply must be connected with a suitable contactor or similar.

## Cable length

EKE controller supports the following max. cable length.

	Cable length	Wire size min. / max.
	[m]	[m²]
Analog inputs (Current/Voltage)	max. 10	0.14 / 1.5
Temperature sensor	max. 10 *)	–
Stepper valve connection	max. 30	0.14 / 1.5
Power supply	max. 5	0.2 / 2.5
Digital input	max. 10	0.14 / 1.5
Digital output	–	0.2 / 2.5
Digital MMI	max. 3 over CAN RJ	–
Communication bus	max. 1000	0.14 / 1.5

## Cable and wiring \*)

- 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.

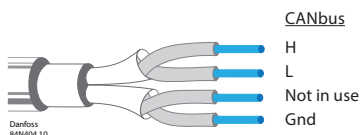


### Warning

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).

## Connecting CANbus

- 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  $\Omega$  impedance.
- The controller provides a communication interface which is connected to the RJ and CAN terminals (see connection overview).
- Terminal resistors 120  $\Omega$  for terminal devices are recommended at both ends of the bus, Terminal resistance between H and L terminals.
- The default unit address is 1, which can be changed using parameter "G001 Controller adr".



### Stepper Motor Output

- All valves are driven in a bipolar mode 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 a standard 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 manual for details).
- The default valve setting in EKE 1D is: none.
- The correct valve must be defined in “Valve configuration”, i.e. parameter I067. An overview of valve types is given in the “Parameter identification” section.

### Valve Cable Connection

Stepper valve connector	ETS/KVS/CCM/ CCMT/CTR/ CCMT L (Using Danfoss M12 Cable)	ETS 8M Bipolar	ETS 6
A1	White	Orange	Orange
A2	Black	Yellow	Yellow
B1	Red	Red	Red
B2	Green	Black	Black
Not connected	-	-	Grey



- All valves are driven in a bipolar mode 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 a standard 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 by selecting user defined valve.

### Guideline for long M12 cables on Danfoss stepper motor valves

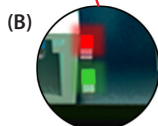
- Long cables will lead to degradation of performance.
- You can overcome this degradation by changing the settings for the valve driver. This guideline is based on the cable type being the same type as the standard Danfoss stepper motor cable.

### Recommended wire size and cable distance between EKE controller and stepper motor valve

Cable length	1 m – 15 m	15 m – 30 m
Wire diameter	0.52 / 0.33 mm <sup>2</sup> (20 / 22 AWG)	0.33 mm <sup>2</sup> (20 AWG)



## LED indication



### (A) Two status LEDs to indicate operational status

- Steady green = power ON
- Flashing green = data transmission / initialization
- Flashing 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

## User interface

EKE 1D can be setup using one of the following user interfaces:

1. Danfoss KoolProg software
2. Danfoss MMIGRS2 external display
3. Communication bus: CANbus

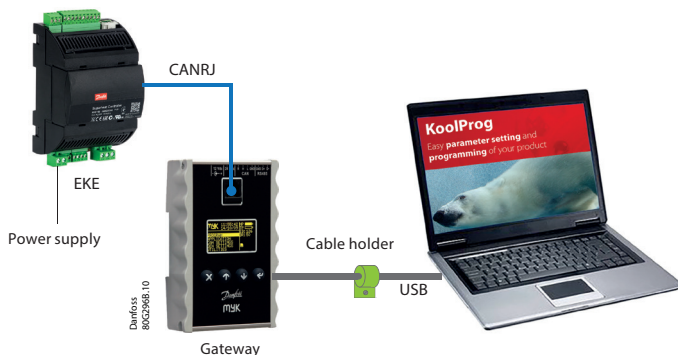
## KoolProg

KoolProg is a software tool for quickly and easily configuring EKE controllers. It enables you to make online changes to parameter configuration, copy settings to multiple controllers, monitor the live status of input/outputs, and quickly analyze controller behavior and program patterns with a graphical trending tool.

KoolProg Software is available for download free of charge at <http://koolprog.danfoss.com>.

KoolProg requires a Gateway (code 080G0073) to connect to the PC.

Always use latest KoolProg version and User must check the software version of EKE and create configuration file in KoolProg for that version. Configuration made with the different software version should not be copied to controller.



## Important note!

To guarantee a reliable USB connection to a host device (e.g. industrial PC), you must:

- Connect terminals R and H on MMIMYK CAN port using a termination wire.
- Place cable holder close to MMIMYK to keep USB connector firmly in place.
- Keep USB cable length < 1 m.
- Place MMIMYK and route USB cable far from noise sources (inverter, motors, contactors etc.)

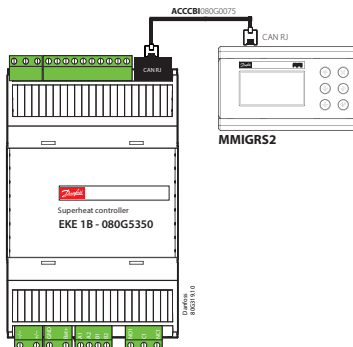
## Danfoss MMIGRS2 display

### Connecting external MMIGRS2 display

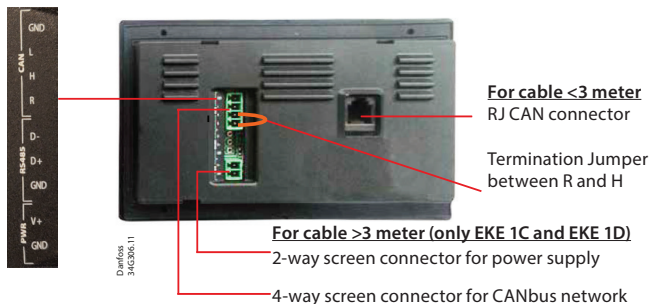
MMIGRS2 display can be used to set up EKE 1D. The display can be used not only for setting up the necessary parameters, but also as an external display during operation to show important parameters, e.g. degree of opening of valve, superheat, etc.

#### Important note:

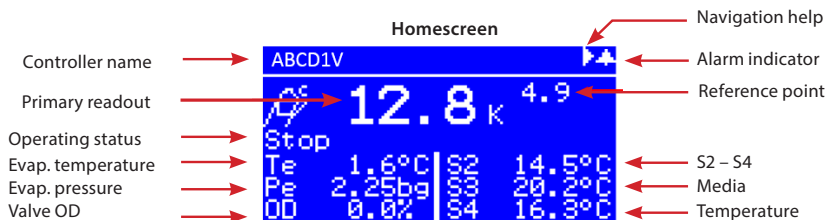
- Max. distance between controller and display is 3 m over CAN RJ.
- CANbus requires termination in both ends of the cable by a 120 Ohm resistor to ensure reliable communication. On EKE 1D terminate L and H with resistor and on MMIGRS2 terminate R and H with jumper.
- External power for MMIGRS2 is not needed while using CAN RJ connector. In case of connecting via 3 way screw plug-in connector external power supply is required for MMIGRS2.



### MMIGRS2 (Back view)



### MMIGRS2 (Front view)



**Note:** Setup and service menu requires login with the default password 100 (daily use), 200 (service use) or 300 (commissioning use). Long press Enter key to access login menu.

## Setup wizard via MMIGRS2 display

When all connections to the controller have been made, after the power is switched on, the Danfoss logo will appear for 5 seconds, then the Home screen will be displayed.

To access the Wizard: press and hold enter to access the Login screen, the commissioning password is 300, scroll down the Setup and service menu and select "Setup wizard".

The Wizard workflow is: a. Language selection; b. Application selection; c. Input configuration; and 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.)

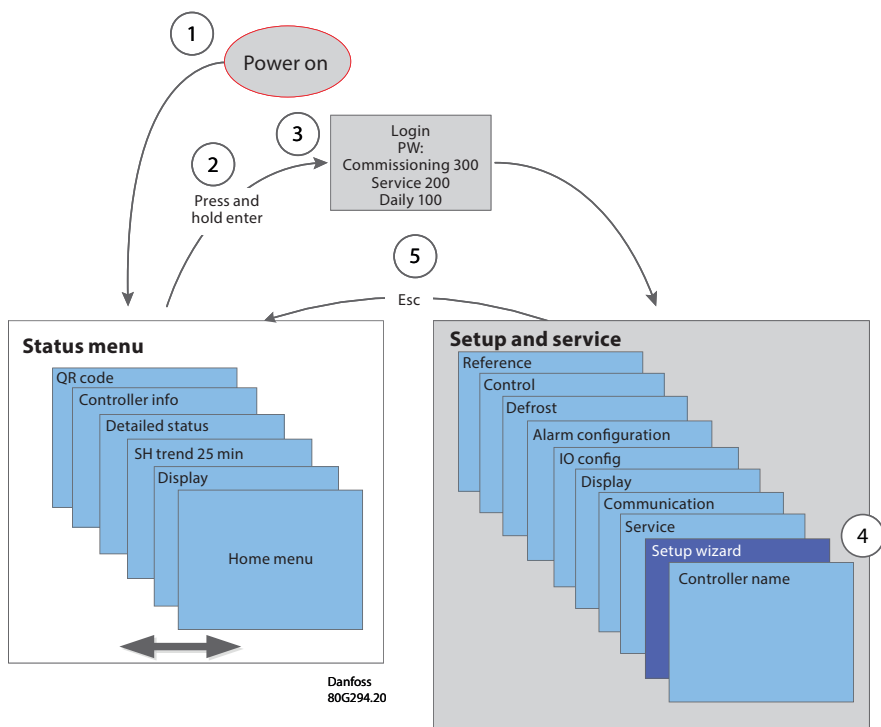
### Note:

- If you do not have sufficient information to complete the Wizard, leave settings on their default values. To generate the requested info, you can use Danfoss Coolselector2 software to calculate operating conditions and valve OD for the same operating point.
- Setup Wizard only covers the most important parameters. If other features are to be enabled (e.g. Alarm settings, MOP/LOP, etc.), they must be configured separately once the Setup Wizard is done.

Setup Wizard is also available in KoolProg PC tool.

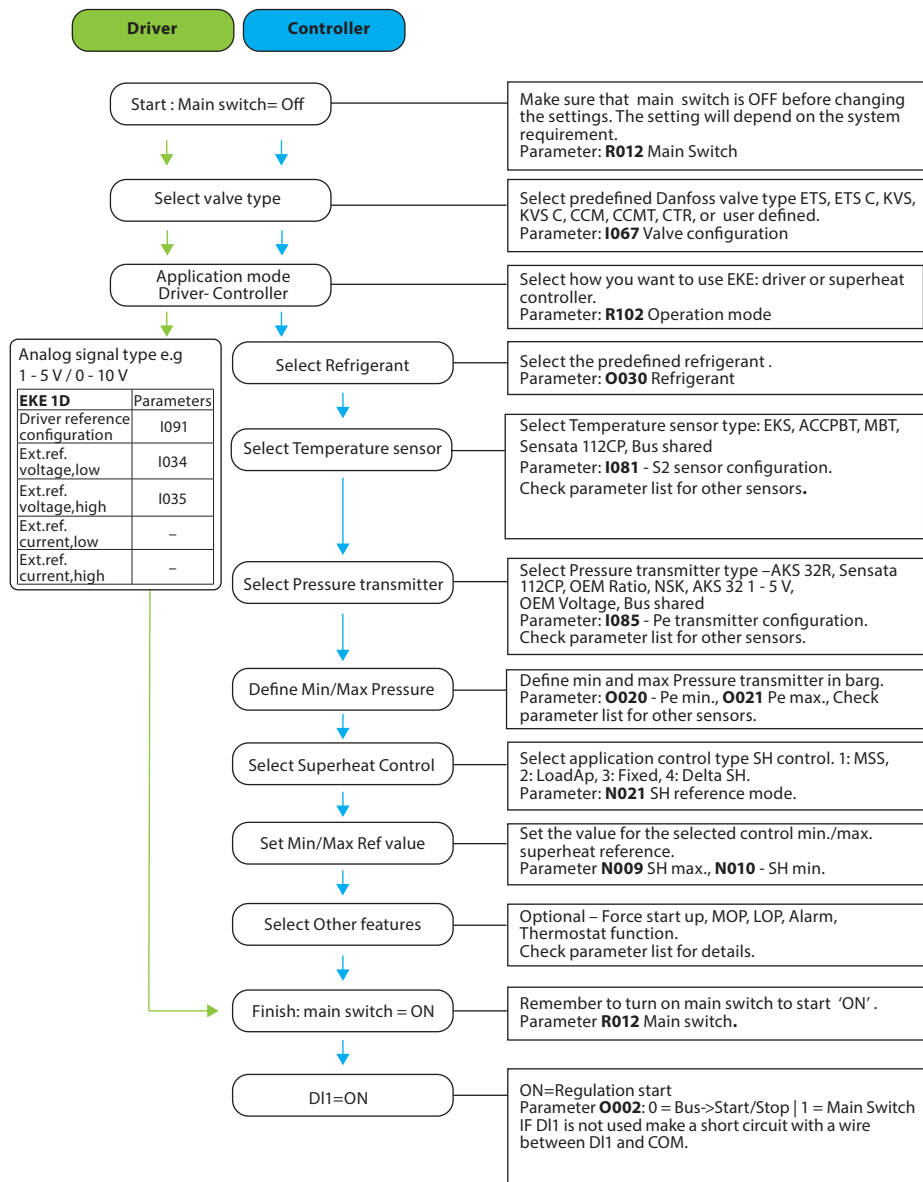
The workflow process is the same as that described above for MMIGRS2 display.

For details, please refer to EKE data sheet.



## Quick guide for parameter selection

Apart from wizard setup, users can also use the following section which describes quick parameter settings for general applications.



## EKE 1D – Commonly used parameter identification

▲ If the parameter value is outside the range, controller will not detect error.

Parameter	CAN Index	CAN Subindex	De-fault	Description																																																							
R012 Main switch	550B	B8	0	0 = regulation Off   1 = regulation On																																																							
R102 Operation mode	550B	B9	0	0 = Superheat control   1 = Valve driver																																																							
O002 DI1 configuration	550C	1C	1	0 = Bus->Start/Stop   1 = Main Switch																																																							
I091 Driver reference configuration	550C	D1	0	0 = Voltage to OD   1 = Bus to OD   2 = Bus to steps																																																							
I034 Ext ref. voltage low	550C	39	0	Range 0 – 10 V. To be used with I091																																																							
I035 Ext ref. voltage high	550C	38	10	Range 0 – 10 V. To be used with I091																																																							
I067 Valve configuration	550C	3B	0	<p>0 = no valve, 1 = UserDef  2 = ETS 12C, 3 = ETS 24C, 4 = ETS 25C, 5 = ETS 50C, 6 = ETC 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 Імпортёр:ТОВ з іі “Данфосс ТОВ” 04080, Київ 80,  п/с 168, Україна = 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  33 = CCMT 3L, 34 = CCMT 5L, 35 = CCMT 8L, 36 = CCMT 10L,  37 = ETS 175L, 38 = ETS 175L OFHT, 39 = ETS 250L,  40 = ETS 250L OFHT, 41 = ETS 400L, 42 = ETS 400L OFHT,  43 = ETS 500L, 44 = ETS 500L OFHT, 45 = ETS 8M Bipolar</p>																																																							
O030 Refrigerant	550B	C8	0	<table> <tr> <td>0 = Undef</td><td>10 = R503</td><td>20 = R407C</td><td>30 = R417A</td><td>40 = 448A</td></tr> <tr> <td>1 = R12</td><td>11 = R114</td><td>21 = R407A</td><td>31 = R422A</td><td>41 = 449A</td></tr> <tr> <td>2 = R22</td><td>12 = R142b</td><td>22 = R407B</td><td>32 = R413A</td><td>42 = 452A</td></tr> <tr> <td>3 = R134A</td><td>13 = R User</td><td>23 = R410A</td><td>33 = R422D</td><td>43 = R450A</td></tr> <tr> <td>4 = R502</td><td>14 = R32</td><td>24 = R170</td><td>34 = 427A</td><td>44 = R452B</td></tr> <tr> <td>5 = R717</td><td>15 = R227</td><td>25 = R290</td><td>35 = R438A</td><td>45 = R454B</td></tr> <tr> <td>6 = R13</td><td>16 = R401A</td><td>26 = R600</td><td>36 = R513A</td><td>46 = R1233zdE</td></tr> <tr> <td>7 = R13b1</td><td>17 = R507</td><td>27 = R600a</td><td>37 = R407F</td><td>47 = R1234zeZ</td></tr> <tr> <td>8 = R23</td><td>18 = R402A</td><td>28 = R744</td><td>38 = R1234ze</td><td>48 = R449B</td></tr> <tr> <td>9 = R500</td><td>19 = R404A</td><td>29 = R1270</td><td>39 = R1234yf</td><td>49 = R407H</td></tr> <tr> <td>50 = R469A</td><td></td><td></td><td></td><td></td></tr> </table>	0 = Undef	10 = R503	20 = R407C	30 = R417A	40 = 448A	1 = R12	11 = R114	21 = R407A	31 = R422A	41 = 449A	2 = R22	12 = R142b	22 = R407B	32 = R413A	42 = 452A	3 = R134A	13 = R User	23 = R410A	33 = R422D	43 = R450A	4 = R502	14 = R32	24 = R170	34 = 427A	44 = R452B	5 = R717	15 = R227	25 = R290	35 = R438A	45 = R454B	6 = R13	16 = R401A	26 = R600	36 = R513A	46 = R1233zdE	7 = R13b1	17 = R507	27 = R600a	37 = R407F	47 = R1234zeZ	8 = R23	18 = R402A	28 = R744	38 = R1234ze	48 = R449B	9 = R500	19 = R404A	29 = R1270	39 = R1234yf	49 = R407H	50 = R469A				
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I081 S2 sensor configuration	550C	C1	0	0 = Not defined   1 = EKS 221   2 = ACCPBT NTC10K   3 = MBT 153 10K   4 = 112CP   5 = Bus Shared																																																							
I083 S3 sensor configuration	550C	BF	0	0 = Not defined   1 = EKS 221   2 = ACCPBT NTC10K   3 = MBT 153 10K   4 = 112CP   5 = Bus Shared																																																							
I084 S4 sensor configuration	550C	BD	0	0 = Not defined   1 = EKS 221   2 = ACCPBT NTC10K   3 = MBT 153 10K   4 = 112CP   5 = Bus Shared																																																							
I085 Pe transmitter configuration	550C	C5	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   8 = Bus shared, 9 = DST P110																																																							
O020 Pe transmitter min. (in bar g)	550C	2A	-1	Define pressure range in bar gauge																																																							
O021 Pe transmitter max. (in bar g)	550C	2B	12	Define pressure range in bar gauge																																																							

N021 SH reference mode	550B	D2	2	0 = Fixed SH   1 = Loadap   2 = MSS   3 = Delta temp
N107 SH fixed setpoint ( K)	550B	D3	7	Range 2 – 40 K
N009 SH max. ( K)	550B	D4	9	Range 4 – 40 K
N010 SH min. ( K)	550B	D5	4	Range 2 – 9 K
N116 SH ref. delta temp. factor (%)	550B	DA	65	Range 20 – 100

For a detailed parameter list and explanation, please check the EKE data sheet.

## Related products

MMIGRS2 Display	Power Supply	MMIMYK Gateway
		
User interface module <b>MMIGRS2 Display</b>	<b>AK-PS</b> Input: 100 – 240 V AC, 45 – 65 Hz Output: 24 V DC: available with 18 VA, 36 VA and 60 VA  <b>ACCTRD</b> Input: 230 V AC, 50 – 60 Hz Output: 24 V AC, available with 12 VA, 22 VA and 35 VA	MMIMYK device is used as a gateway to connect EKEs and the PC tool i.e KoolProg software for parameter setting or data logging.
Pressure Transducer	Temperature Sensor	Backup power module
		
<b>AKS Pressure Transducer</b> Available with ratiometric and 4 – 20 mA.  <b>NSK</b> Ratiometric pressure probe  <b>XSK</b> Pressure probe 4 – 20 mA	<b>PT 1000</b> AKS is a High precision temp. sensor AKS 11 (preferred), AKS 12, AKS 21 ACCPBT PT1000  <b>NTC sensors</b> EKS 221 ( NTC-10 Kohm) MBT 153 ACCPBT NTC Temp probe (IP 67 /68)	EKE 2U Backup power module can provide enough energy during power failure to the stepper controller to ensure closure of the electronic valves.
ACCCBI Cable	Stepper motor valves	M12 cable
		
ACCCBI cables for MMI display and gateway.	EKE is compatible with Danfoss stepper motor valves i.e Danfoss ETS 6, ETS, KVS, ETS Colibri®, KVS colibri®, CTR, CCMT	M12 Angle cable to connect Danfoss stepper motor valve and EKE controller

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