

Data Sheet

NeoCharge
Evaporator control panel
**CCR and WDX low-charge Ammonia
and CO₂ Retrofit Control Panel**

The Danfoss Retrofit Control Panel is a control solution for NeoCharge (low-charge ammonia and CO₂) existing industrial refrigeration systems



The NeoCharge Standard Retrofit Control Panel are distributed control logic panels designed specifically for low-charge ammonia and CO₂ industrial refrigeration existing control applications.

Application-specific, energy-efficient control algorithms in each panel, achieve low charge ammonia goals for safe, efficient, trouble-free operation.

For customized panels please contact your Danfoss Sales representative for more details.

Required system components for compatibility:

- ICM Motorized Valve with ICAD-B Actuator
- Pressure Transmitter
- Temperature Sensor

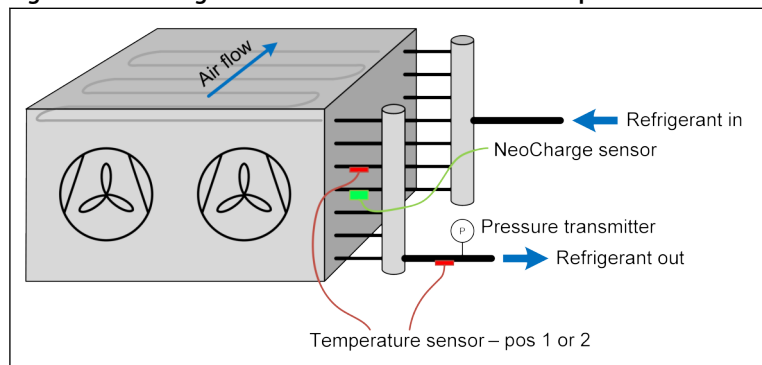
Features

- Designed ready-to-mount-and-connect supply power, sensors and actuator wiring needed for existing low-charge industrial refrigeration control applications
- High quality standardized panel electrical components
- Rigorously tested control sequences and algorithms
- Well laid-out Type 4 rated panels (Type 1 when front door display used)
- Modbus RTU communication
- Standardized documentation

NeoCharge sensor

The Danfoss NeoCharge sensor consists of a heating element and a PT1000 temperature sensor build together into one sensor. The NeoCharge sensor is designed to be mounted on one of the individual tubes out of a fin and tube evaporator, before the outlet manifold.

Figure 1: NeoCharge sensor mounted on one of the evaporator outlet tubes



Mounting the sensor on one of the evaporator tubes has several advantages:

- The sensor will always be placed horizontally. Placing the sensor after the manifold would sometimes mean that it would be placed on a vertical pipe where the flow patterns are completely different
- There is much less variation in flow velocity and tube diameter. The variation in tube sizes for different sizes of heat exchangers is not large – a larger heat exchanger normally means increasing tube length and the number of parallel runs
- One size sensor can be used for many sizes of evaporators

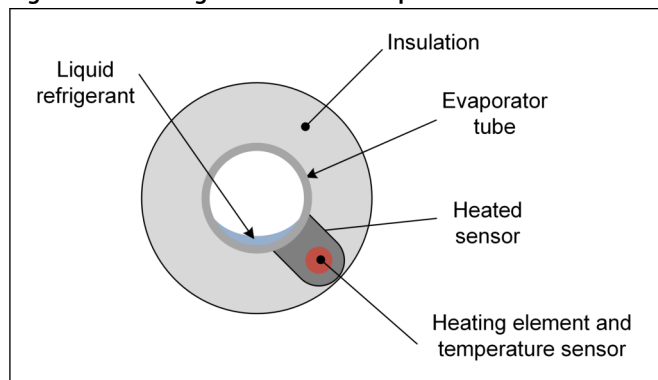
Further advantages of the NeoCharge sensor, is that it is mounted outside on the evaporator tube, making it much easier to install and service the sensor (no welding or refrigerant evacuation is required). Outside mounting also means that the sensor does not disturb the flow regime or introduce a pressure drop.

The heating element of the NeoCharge sensor is adding heat to the evaporator tube and depending on the amount of liquid inside the tube, the measured temperature varies.

Function of the NeoCharge sensor

The heating element of the NeoCharge sensor is adding heat to the evaporator tube and depending on the amount of liquid inside the tube, the measured temperature varies.

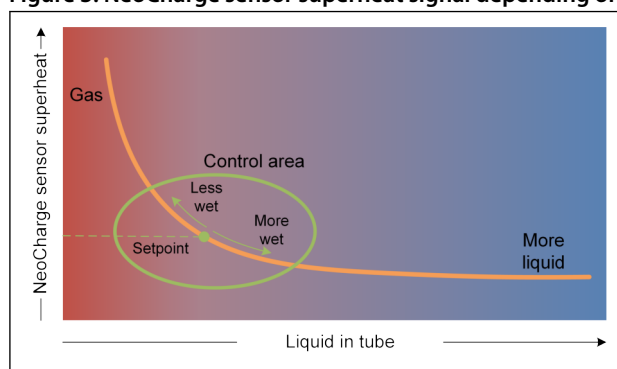
Figure 2: NeoCharge sensor on an evaporator tube



The mounting of the NeoCharge sensor on an evaporator tube is shown in Figure 2. The NeoCharge sensor is providing a temperature signal, which is depending on the overall heat transfer coefficient from the temperature sensor to the refrigerant inside the pipe.

Tests and simulations have shown that the temperature signal from the NeoCharge sensor temperature sensor depends on the amount of liquid in the tube as shown in Figure 3:

Figure 3: NeoCharge sensor superheat signal depending on amount of liquid in the tube



NOTE:

That it is the NeoCharge sensor superheat that is shown in Figure 2 – measured as the difference between the NeoCharge sensor temperature and the evaporation temperature.

If there is only gas in the tube where the NeoCharge sensor is mounted, then the temperature will increase dramatically, and when the amount of liquid increases considerably, the temperature will be constant, giving no signal to control the injection valve by. But in between “only gas” and “more liquid”, there is an area where the amount of liquid out of the evaporator can be controlled – this is the area indicated by the green circle in Figure 7.

The superheat response of the NeoCharge sensor depends on several properties, the most important being:

1. The power to the heating element
2. The dimension and material of the evaporator tubes
3. The evaporator capacity
4. The evaporating temperature

Tests and simulations have shown that variations in the dimensions and material of the evaporator tubes can be compensated by adjusting the power to the heating element and that differences in evaporator capacity can be handled by selecting a proper setpoint for the NeoCharge sensor superheat. Selecting the right power and setpoint for the NeoCharge sensor is done by the EKE 450 controller in an automatic adjustment process.

Mounting the NeoCharge sensor

Mounting the NeoCharge sensor on an evaporator requires that:

1. The NeoCharge sensor is mounted in the correct angle from vertical on the tube
2. The right tube for mounting the NeoCharge sensor is identified

Mounting in the correct angle is relatively uncomplicated – especially if the clamp provided by Danfoss is used.

Figure 4 and Figure 5 below, shows the NeoCharge sensor position on an evaporator tube. Figure 4 shows the angle of the NeoCharge sensor from vertical, and Figure 5 shows that the mounting automatically complies with this angle if the NeoCharge sensor clamp is used and the arrows on the clamp are pointing vertically upwards.

Figure 4: NeoCharge sensor position on evaporator tube. Either 30° left or 30° right

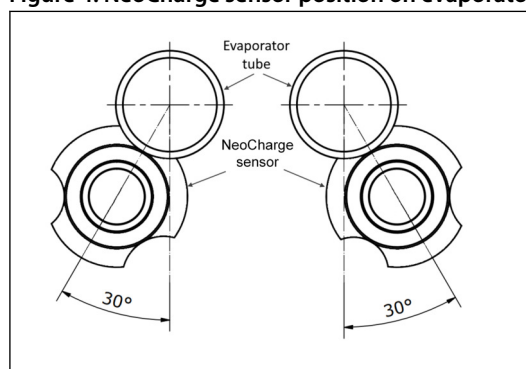
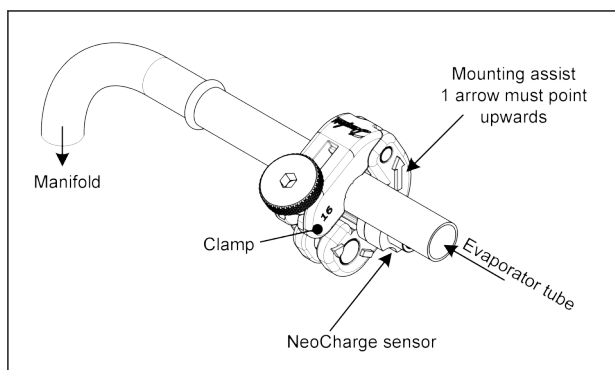
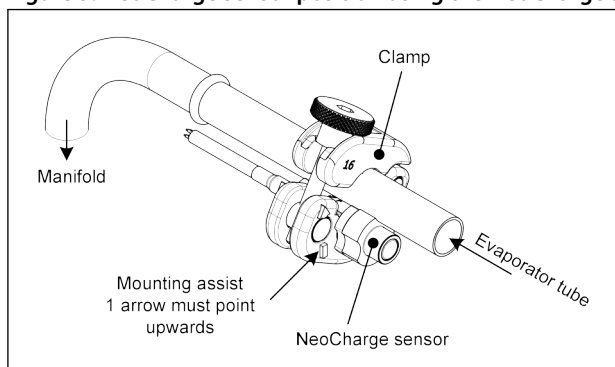


Figure 5: NeoCharge sensor position using the NeoCharge sensor clamp



Application

Application principles: General

The NeoCharge Standard Retrofit Control Panel has different application choices available that are designed for existing Industrial Refrigeration applications. It is possible to assign different control applications to each of the only controlling liquid feeding solenoid or motorized valve, if required. Some of the control possibilities offered are as follows:

Figure 6: Direct expansion (WDX) Motorized Valve

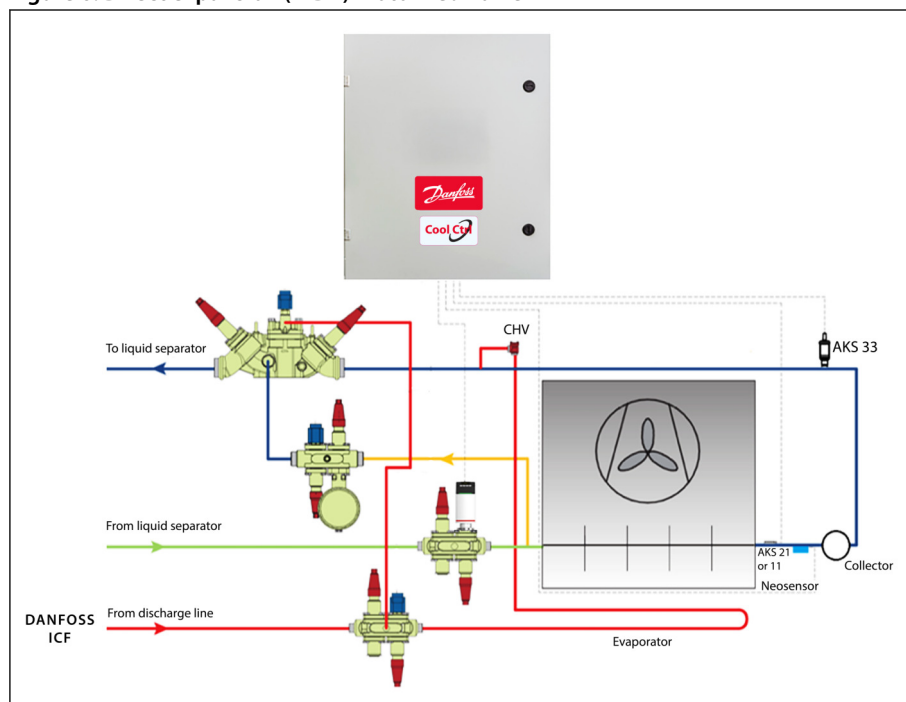
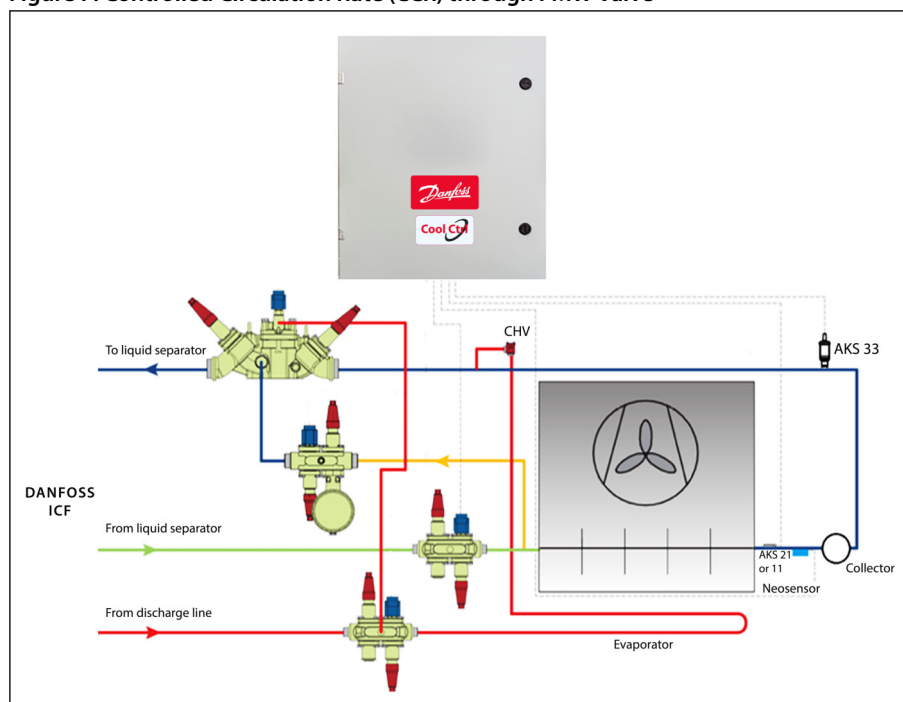


Figure 7: Controlled Circulation Rate (CCR) through PMW Valve



Product specification

Technical data and dimension

Table 1: Technical data

Standards	UL/cUL listed	Units
Class of protection	Type 4 rated	
Short circuit current rating	10 kA	kA
Ue Supply voltage	1 x 120 + N + PE	V AC
Ue Control voltage	120	V AC
Frequency	60	Hz
Dimensions (Height x Width x Depth)	20 x 16 x 8 (508 x 406 x 203)	inches (mm)
Panel color – Painted steel	Painted ANSI 61 Gray outside. Painted white inside	
Temperature range ambient	-4 to +104 (-20 to +40)	°F (°C)
Communication protocol	Modbus RTU for PLC integration CANbus for front door display communication Danfoss SM-800 interoperable	
User interface	Controller LCD setup wizard	
Maximum Current	5 A	

NeoCharge (low-charge Ammonia and CO2) evaporator retrofit control panel

Ordering

Table 2:

Type	Description	Code Number
NeoCharge Retrofit panel	NeoCharge function only, includes NeoCharge sensor and adaptor. Neo Sensor Evaporator Tubing Compatibility with 3/8", 1/2", 5/8" or 10, 12, 16 mm	12850030
	NeoCharge function only, includes NeoCharge sensor and adaptor. Neo Sensor Evaporator Tubing Compatibility with 3/4", 7/8", 1" or 20, 22, 27 mm	12850031

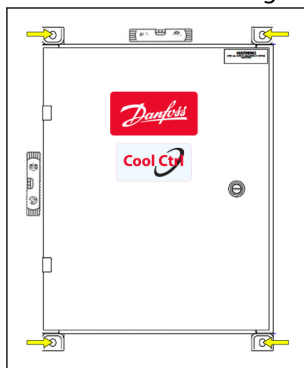
NeoCharge Evaporator Control Panel Mounting Instructions

Mounting Procedure

Wall/column mounting

Retrofit Control Panel must be mount securely on a wall or sturdy steel channels.

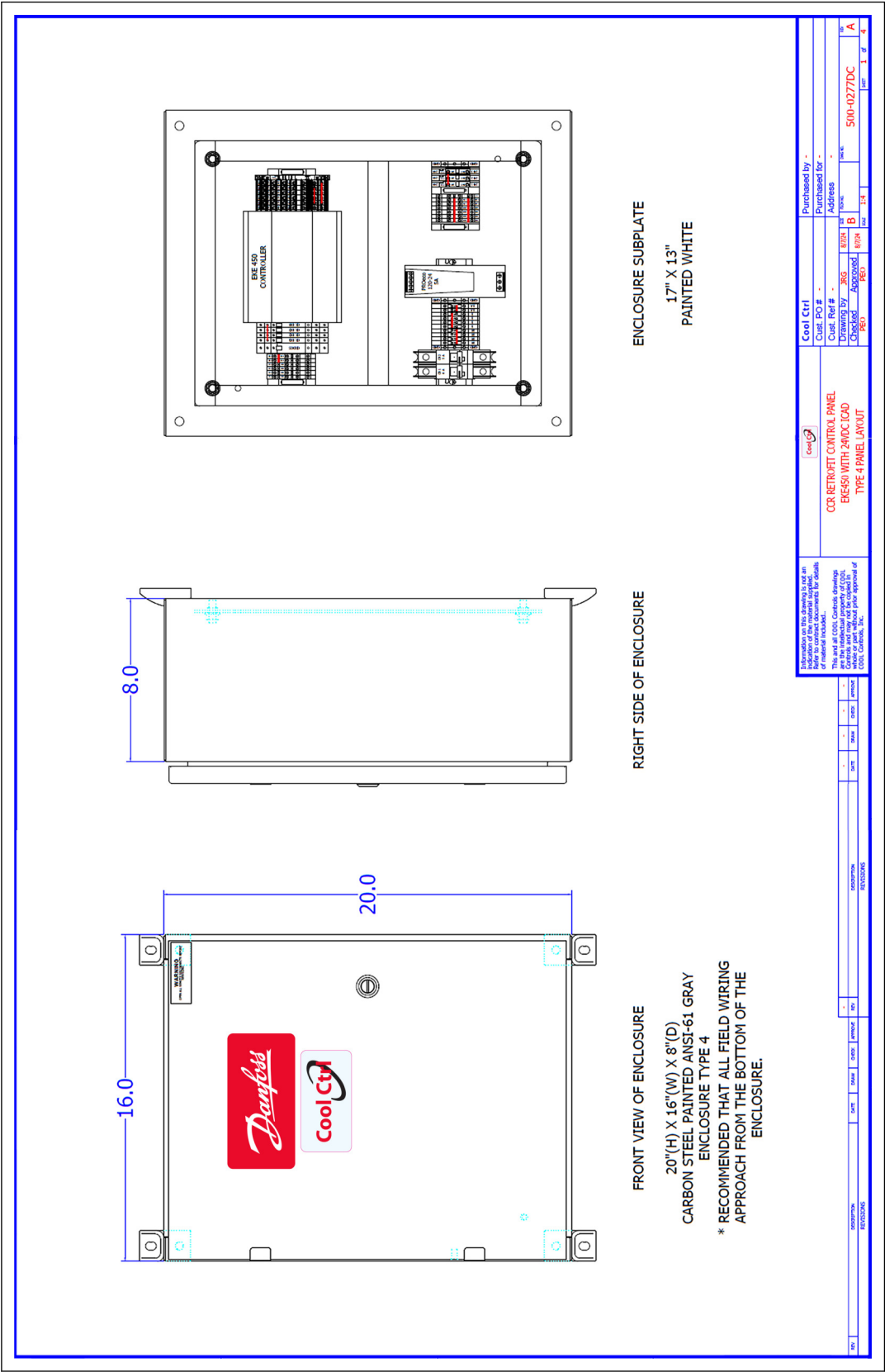
There are four mounting holes in the frame which are provided to support the unit. See image below.



⚠ CAUTION:

Maximum distance between Neosensor and Control Panel must not exceed 32 ft (10 meters).
If distance is over 32 ft, please, contact Danfoss representative.

Figure 8: NeoCharge Evaporator Control Panel



NeoCharge Control Panel Component layout

For comprehensive wiring details please refer to the detailed wiring diagram that is delivered complete with NeoCharge Control Panel.

Figure 9: wiring diagram

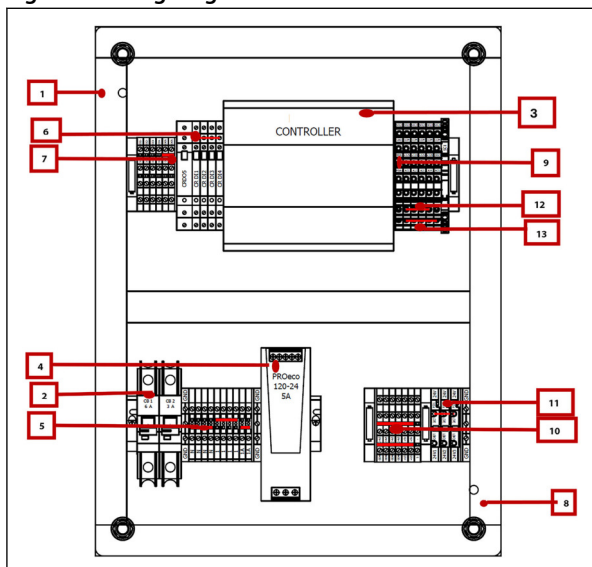


Table 3: Detailed wiring diagram

Part No.	Description
1	Customer wireway
2	Miniature circuit breaker
3	Configurable controller
4	Power supply
5	DI terminals
6	#26 - #12 AWG 120 V contact relays (DI)
7	DO dry contacts for customer connections
8	Customer wireway
9	#26 - #12 AWG Modbus terminals
10	#26 - #12 AWG 24VDC terminals
11	Fuses
12	#26 - #12 AWG AI terminals
13	#26 - #12 AWG AO terminals

Table 4: Overview For Field Wiring for Low Charge ammonia Evaporator

Terminal	Description	Comment
CB1	Power supply: 120 V AC/60 HZ/1-PH Source	H & N. Ground terminal
CR1-DI1⁽²⁾	Danfoss Default Jumper 1-2 (Main Switch Optimization)	120 V AC relay
CR2-DI2	It might be used for Cooling ON-OFF signal	120 V AC relay
CR3-DI3	Customer configurable DI to application needs	120 V AC relay
CR4-DI4	Customer configurable DI to application needs	120 V AC relay
CR5-DI5⁽¹⁾	Customer configurable DI to application needs	
CR6-DI6⁽¹⁾	Customer configurable DI to application needs.	
CR7-DI7⁽¹⁾	Customer configurable DI to application needs	
CR8-DI8⁽¹⁾	Customer configurable DI to application needs	
DO1	Liquid Solenoid Valve Must be field wired	N.O. contact 10 A 250 V AC for resistive load 3.5 A 230 V AC for inductive load
DO2⁽¹⁾	Customer configurable DO to application needs	N.O. contact 10 A 250 V AC for resistive load 3.5 A 230 V AC for inductive load
DO3⁽¹⁾	Customer configurable DO to application needs	Changeover contact 6 A 250 V AC for resistive load 4 A 230 V AC for inductive load

NeoCharge (low-charge Ammonia and CO2) evaporator retrofit control panel

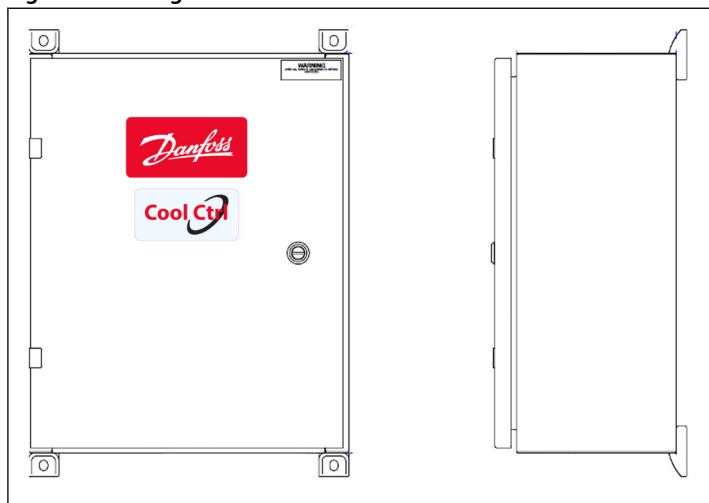
Terminal	Description	Comment
DO4⁽¹⁾	Customer configurable DO to application needs	Changeover contact 6 A 250 V AC for resistive load 4 A 230 V AC for inductive load
DO5	NeoSensor Must be field wired	Solid state relay for NeoSensor AC only. I _{max} = 0.5 A. I _{min} = 50 mA Red Wires from Heating element must be wired to Solid State Relay: 24 V DC (+) to Relay Terminal (11) Heating element to Relay Terminal (14) Heating element to 24 V DC (-)
DO6	PWM Liquid Expansion Valve	Solid state relay for PWM valve AC only. I _{max} = 0.5 A. I _{min} = 50 mA
DO7⁽¹⁾	Customer configurable DO to application needs	Changeover contact 6 A 250 V AC for resistive load 4 A 230 V AC for inductive load
DO8⁽¹⁾	Customer configurable DO to application needs	Changeover contact 6 A 250 V AC for resistive load 4 A 230 V AC for inductive load
AI1	Motorized Valve ICAD Actuator Feedback Must be field wired	4–20 mA signal Blue Cable (+): 4–20 mA Brown Cable (-): COMMON (GND)
AI2	NeoSensor Must be field wired	PT1000 (White wires)
AI3	Suction Temperature Sensor PT1000 Must be field wired	PT1000 RTD
AI4	Suction Pressure Sensor AKS33 Must be field wired	4–20 mA signal
AI5⁽¹⁾	NOT USE FOR Neocharge application Customer configurable AI to application needs Must be field wired	Example
AI6⁽¹⁾		Ratiometric pressure transmitter
AI7⁽¹⁾		1–5 V pressure transmitter
AI8⁽¹⁾		0–20 mA/4–20 mA pressure transmitter PT1000 temperature sensor NTC temperature sensor
AO1	Motorized Valve ICAD Actuator Must be field wired	ICM Motorized Valve ICAD-B Actuator Yellow Cable (+): 4–20 mA Orange Cable (-): COMMON (GND)
AO2⁽¹⁾	NOT USE FOR Neocharge application	0–10 V signal output (optional 4–20 mA signal output on request)
AO3⁽¹⁾	Customer configurable AO to application needs	
AO4⁽¹⁾	Must be field wired	

⁽¹⁾ **NOT used for Neocharge application**

⁽²⁾ Please note: Optimization periodicity is based on specific application and system conditions. Everytime optimization occurs, unit might take up to one hour to start Neocharge Control.

Wiring Procedure

Figure 10: Wiring Procedure

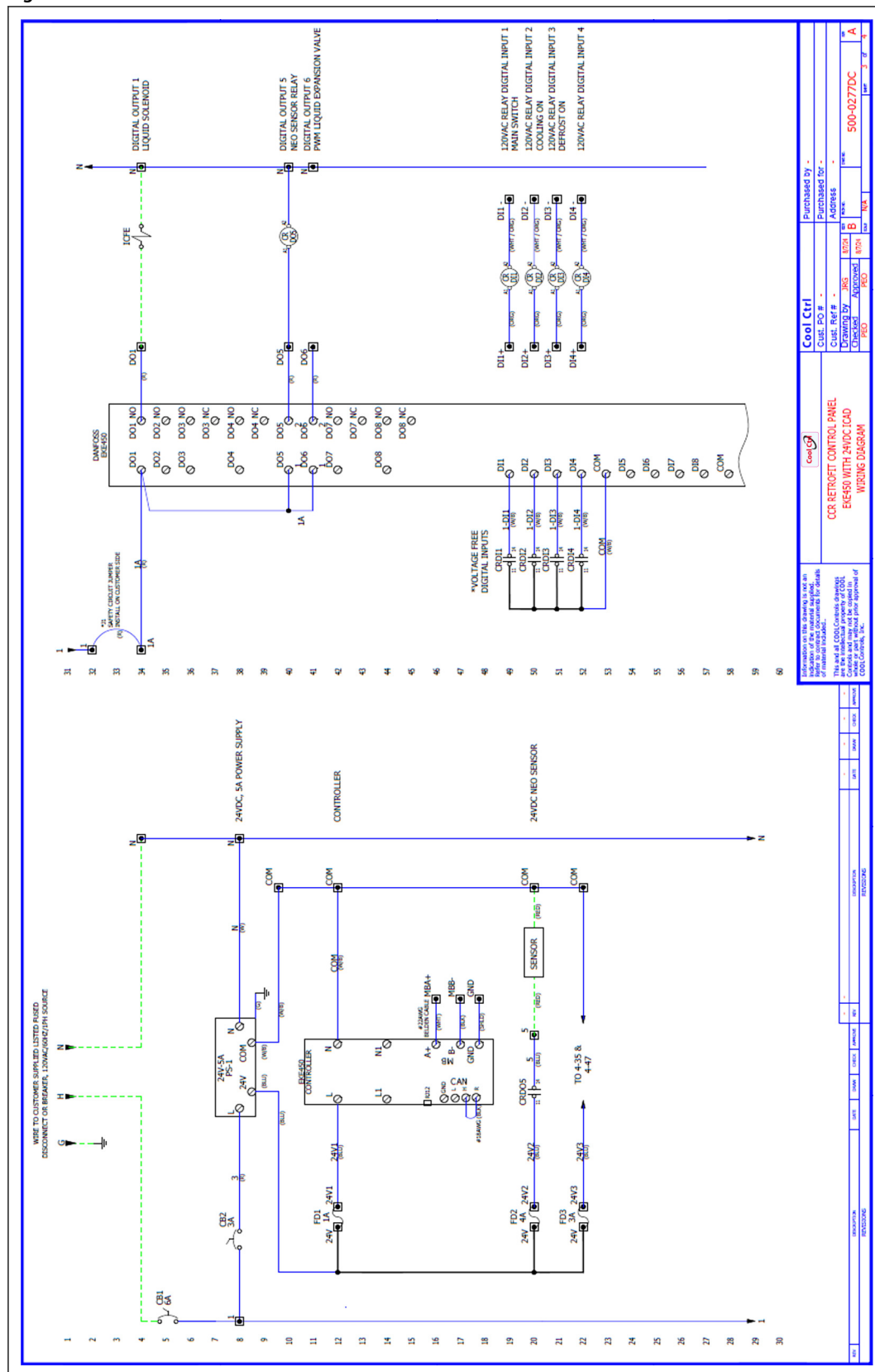


1. Field wiring per local codes or NEC/Regulations
2. Use best wiring practice to enter bottom or sides of enclosure. avoid any penetrations on top of enclosure. seal any entrances that may allow for condensing water within enclosure
3. Before drilling into panel, protect all devices inside the panel from metal filings
4. All intended field additions & conduit fittings must be of the same environmental type as enclosure to maintain enclosure rating
5. All field control wiring to be **#14AWG** minimum unless otherwise specified by local codes
6. Field installed conductors should be copper rated 75 °C minimum unless otherwise designated
7. Consult manufacturer's wiring recommendation for type, size and termination requirement as related to the application
8. Before energizing panel clean out all metal filings and wire clippings
9. Check all terminals for tightness prior to energizing
10. Disconnect main power to panel when service is required
11. Disconnect power before removing any fuse guards. fuse guards must be reinstalled before turning power back on
12. Replacement fuses must be of the same type, size, amperage and voltage rating
13. Motor starter wiring will vary. Refer to starter manufacturer's diagram for actual wiring
14. To maintain overcurrent, short circuit, and ground fault protection, the manufacturer's instructions for selection of overload and short circuit protection must be followed to reduce the risk of fire and electrical shock
15. Tripping of the instantaneous trip circuit breaker is an indication that a fault current has been interrupted
16. Current carrying components of the magnetic motor controller should be examined and replaced if damaged to reduce the risk of fire and electrical shock
17. All grounding/bonding conductors and lugs must terminate on bare metal and not painted surfaces

Retrofit Neocharge evaporator Control Panel

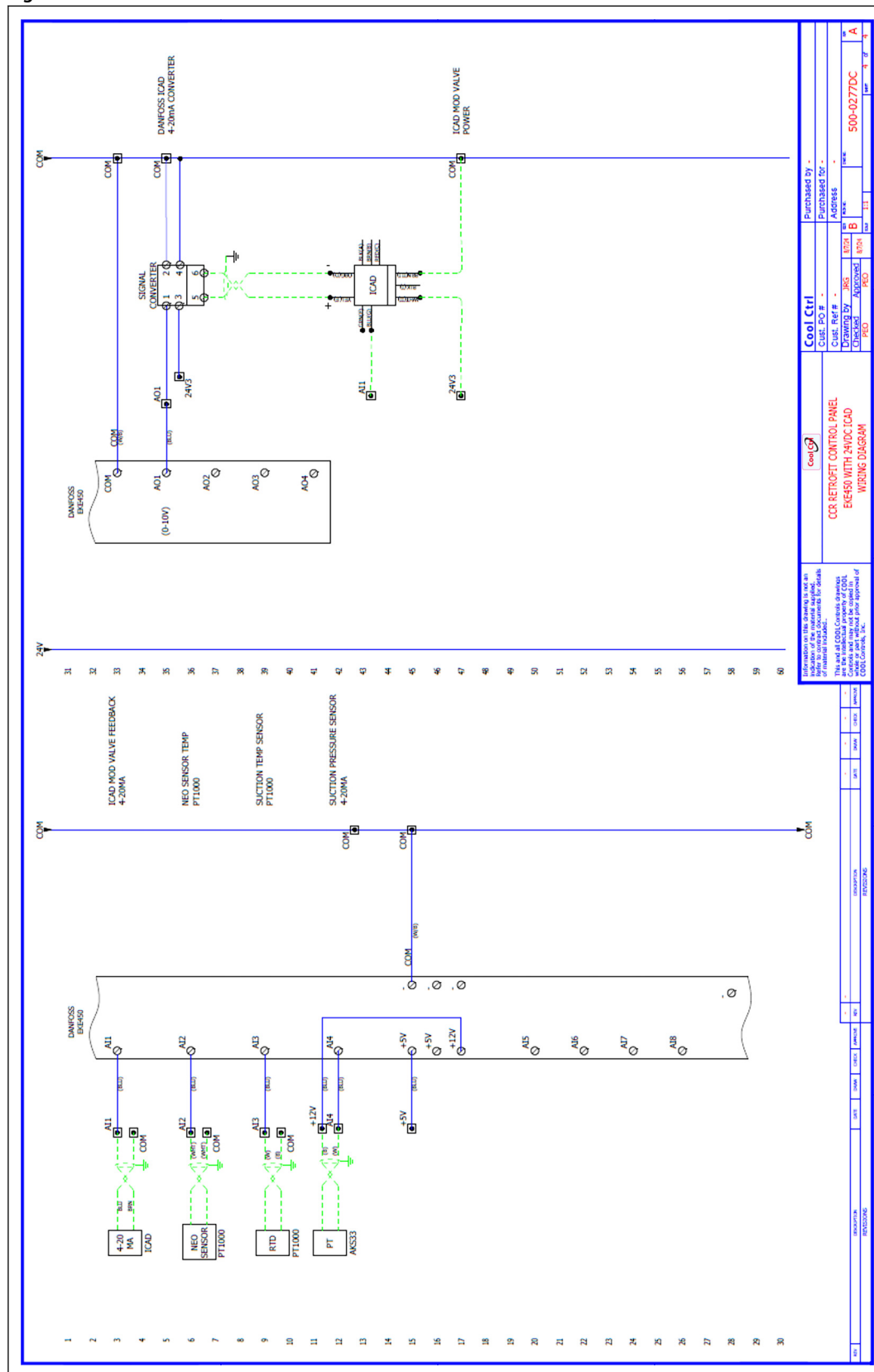
Wiring Diagram – DO and DI

Figure 11:



Wiring Diagram – AO and AI

Figure 12:



Retrofit Control Panel Application Examples

Application example WDX

Direct Expansion (DX) system evaporator with Motorized Valve liquid line control and hot gas defrost. Extra DI from PLC.

Figure 13: Application example WDX

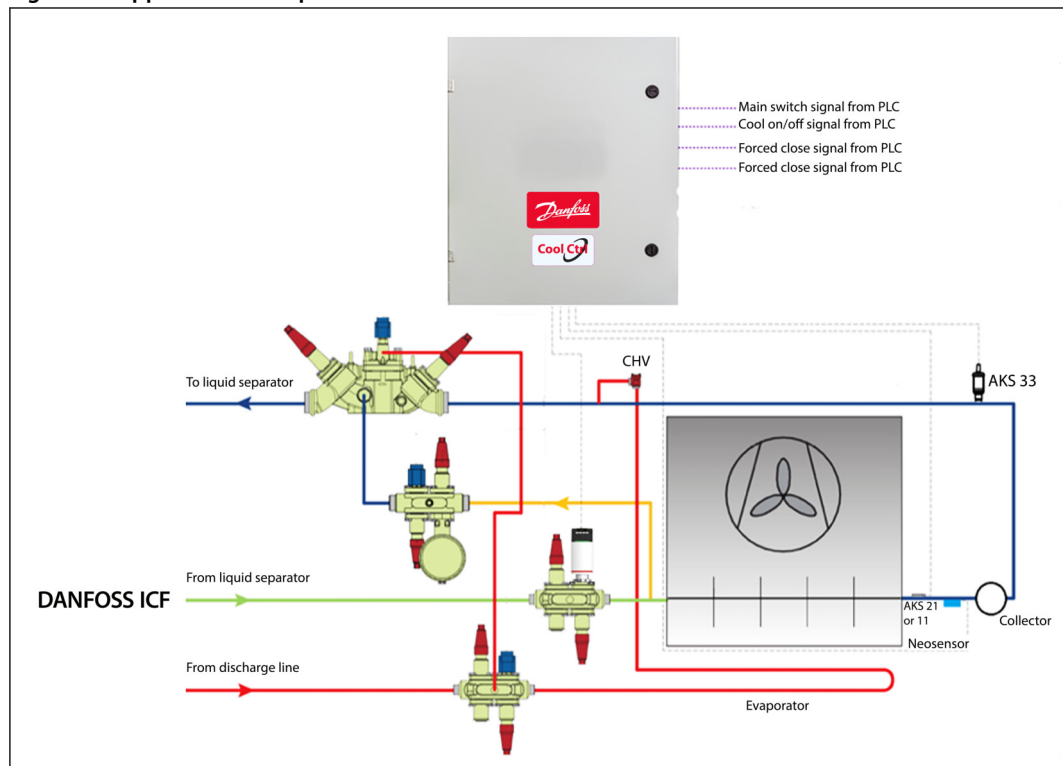


Table 5: Panel terminal description

Panel terminal	Description
D11	Main switch signal from PLC
D12	Liquid feed solenoid
D13	Forced cooling on/off switch input from PLC/external
D14	Forced close on/off switch input from PLC/external
D05	NeoSensor on/off
A11	Motorized Valve (ICM) feedback
A12	NeoSensor
A13	Suction Temperature Sensor
A14	Suction Pressure Sensor
A01	Motorized Valve (ICM)Modulating Opening Degree

Application example CCR

Direct Expansion (DX) system evaporator with PWM Valve liquid line control and hot gas defrost. Extra DI from PLC.

Figure 14: Application example CCR

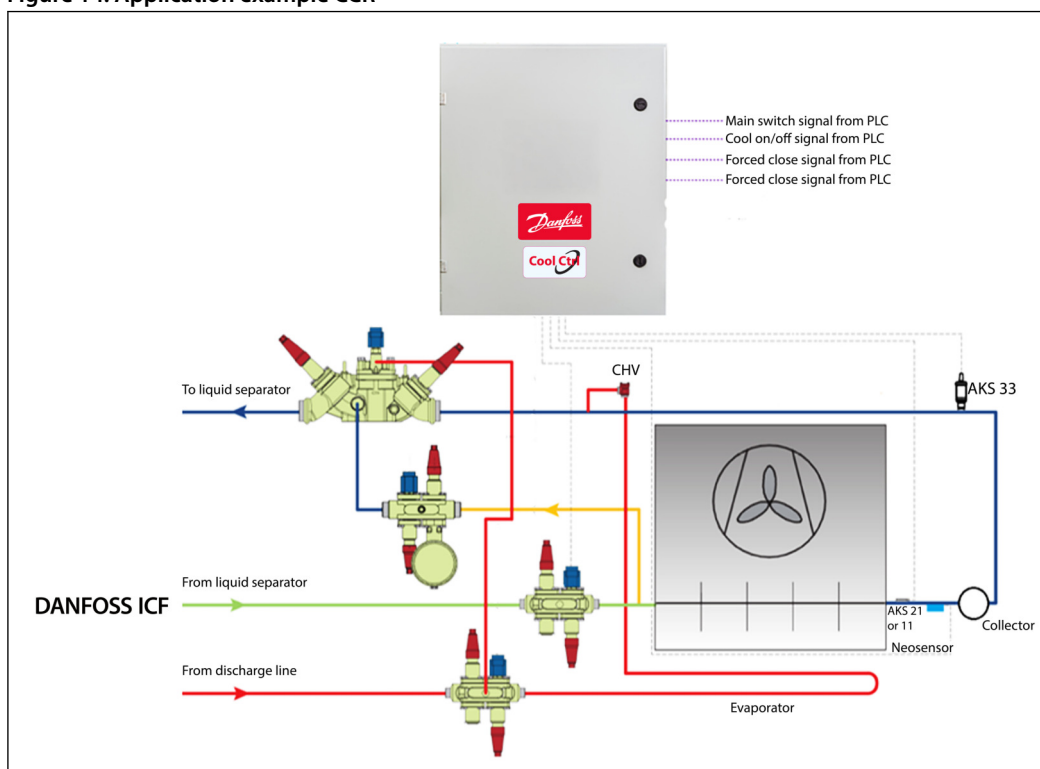


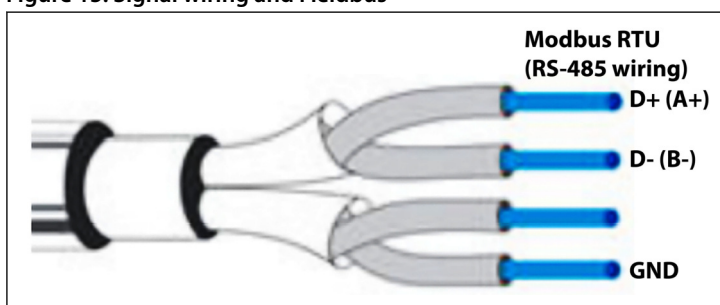
Table 6: Panel terminal description

Panel terminal	Description
D11	Main switch signal from PLC
D12	Liquid feed solenoid
D13	Forced cooling on/off switch input from PLC/external
D14	Forced close on/off switch input from PLC/external
DO5	NeoSensor on/off
DO6	PWM modulation Valve AKV
AI2	NeoSensor
AI3	Suction Temperature Sensor
AI4	Suction Pressure Sensor

Standard Evaporator Control Panel: External wiring considerations: Signal wiring and Fieldbus

- The wiring of Modbus RTU (RS485) must be carried out in accordance with the standard ANSI/TIA/EIA-485-A-1998. Galvanic separation shall be provided for segments crossing buildings. Common ground shall be used for all devices on the same network inclusive router, gateways etc. All bus connections in the cables are made with twisted pair wires. The recommended cable type for this is AWG 22/0.32 mm²
- If the cable length exceeds 1200 meters (1312 yards) a repeater must be inserted. One repeater must be added for every 32 controllers
- If the data communication cable runs through an electrically noisy environment which impairs the data signal, one or more repeaters must be added to stabilize the signal
- When configuring Modbus devices on the control bus, the highest device address that can be used is 120 (max 120 Modbus control devices in total)
- The wires are looped from device to device and must observe polarity. A is connected to A and B is connected to B
- The shield must be connected and complete a path from the device, all controllers, and any repeaters. The shield must not be connected to earth ground
- Remember to terminate the RS485 network following the last physical device

Figure 15: Signal wiring and Fieldbus



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