KRACK

Monoblock R-290 (Propane)

microDS™

IMPORTANT

Keep in store for future reference!

PRE-CHARGED REFRIGERATION SYSTEMS

Installation & Operation Manual

P/N 3153769_A
June 2022

Spanish 3167860
French 3167861

BEFORE YOU BEGIN

Read the safety information completely and carefully.

The precautions and use of the procedures described herein are intended to use the product correctly and safely. Comply with the precautions described below to protect you and others from possible injuries. Relative to their potential danger, the relevant matters are divided into four parts as defined by ANSI Z535.5

ANSI Z535.5 DEFINITIONS

- **DANGER –** Indicate[s] a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING –** Indicate[s] a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION –** Indicate[s] a hazardous situation which, if not avoided, could result in minor or moderate injury.

• **NOTICE –** *Not related to personal injury* **–** Indicates[s] situations, which if not avoided, could result in damage to equipment.

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WARNING

PERSONAL PROTECTION EQUIPMENT (PPE)

Only qualified personnel should install and service this equipment. Personal Protection Equipment (PPE) is required whenever servicing this equipment. Wear safety glasses, gloves, protective boots or shoes, long pants, and a long-sleeve shirt as required when working with this equipment. Observe all precautions on tags, stickers, labels and literature attached to this equipment.

WARNING

Only Hussmann or factory trained technicians should install, service or repair this R-290 (propane) equipment. Failure to follow instructions can result in an explosion, death, injury and property damage.

WARNING

Contractors shall strictly adhere to specifications provided by the Engineer of Record (EOR), as well as US Environmental Protection Agency regulations, OSHA regulations, and all other federal, state and local codes. This work should only be done by qualified, licensed contractors. There are numerous hazards, not limited to, but including: burns due to high temperatures, high pressures, toxic substances, electrical arcs and shocks, very heavy equipment with specific lift points and structural constraints, food and product damage or contamination, public safety, noise, and possible environmental damage. Never leave operating compressors unattended during the manual soft-start process. Always power rocker switches off when unattended.

⚠ WARNING

Proper Field Wiring and Grounding Required! Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes.

⚠ CAUTION

This manual was written in accordance with originally perscribed equipment that is subject to change. Hussmann reserves the right to change all or part of the equipment for future stores such as, but not limited to, controllers, valves and electrical specifications. It is the installers responsibility to reference the refrigeration drawings supplied for each installation, as directed by the Engineer of Record.

⚠ WARNING

— LOCK OUT / TAG OUT —

To avoid serious injury or death from electrical shock, always disconnect the electrical power at the main disconnect when servicing or replacing any electrical component. This includes, but is not limited to, such items as controllers, electrical panels, condensers, lights, fans, and heaters.

⚠ WARNING

This equipment is prohibited from use in California with any refrigerants on the “List of Prohibited Substances” for that specific end-use, per California Code of Regulations, Title 17, Section 95374.

Use in other locations is limited to refrigerants permitted by country, state, or local laws and is the responsibility of the installer/end-user to ensure only permitted refrigerants are used.

This disclosure statement has been reviewed and approved by Hussmann and Hussmann attests, under penalty of perjury, that these statements are true and accurate.

This warning does not mean that Hussmann products will cause cancer or reproductive harm, or is in violation of any product-safety standards or requirements. As clarified by the California State government, Proposition 65 can be considered more of a ‘right to know’ law than a pure product safety law. When used as designed, Hussmann believes that our products are not harmful. We provide the Proposition 65 warning to stay in compliance with California State law. It is your responsibility to provide accurate Proposition 65 warning labels to your customers when necessary. For more information on Proposition 65, please visit the California State government website.

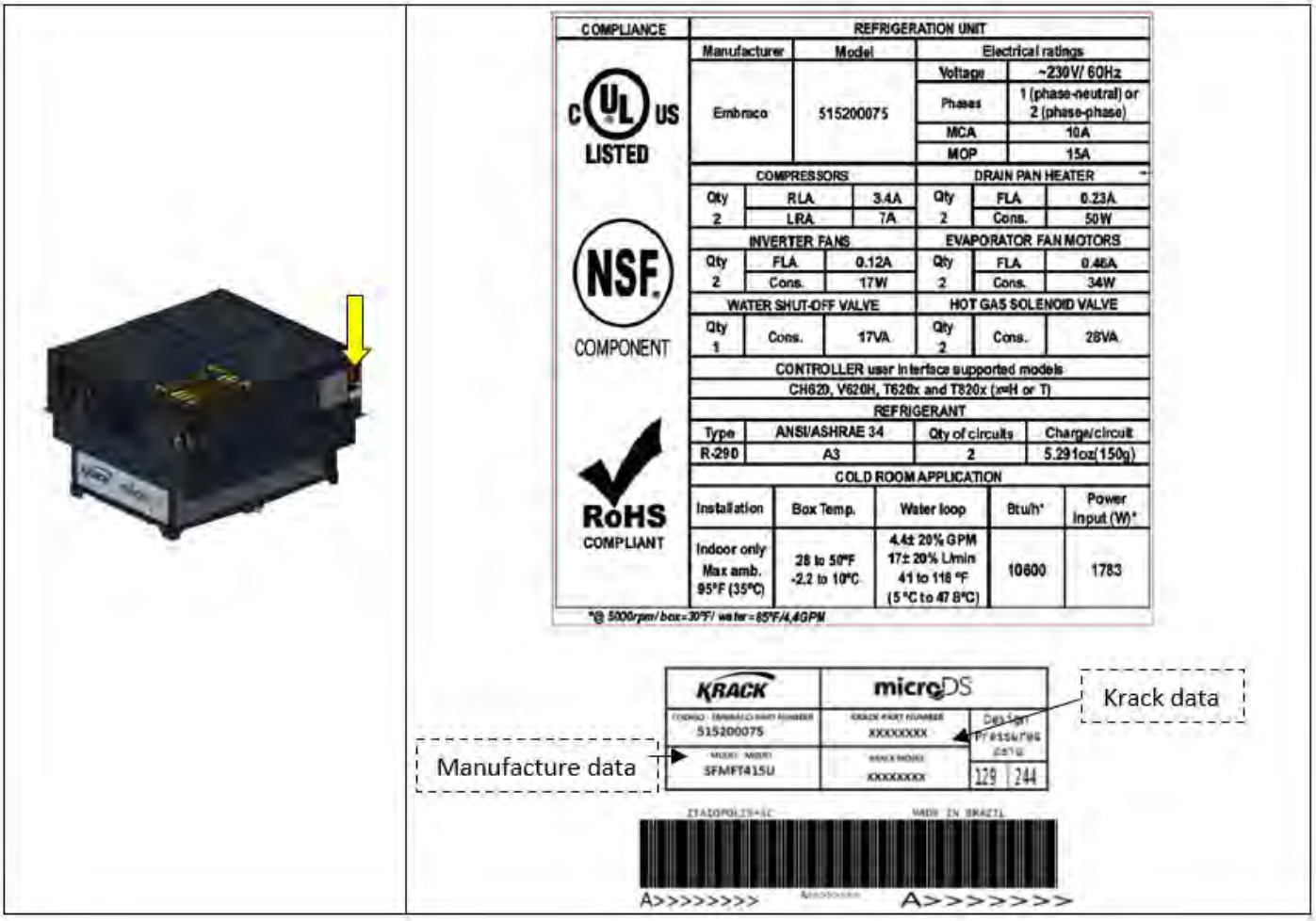
PN 3153769_A

This document applies to the following products:

Condenser Type	Application	Model	Model Number
Water-Cooled	Walk-in Coolers	MicroDS	KM2VW15UGDR
Water-Cooled	Walk-in Coolers	MicroDS	KM2VW15UGDN
Water-Cooled	Walk-in Freezers	MicroDS	KL2VW15UGDR

Serial data location:

Overall product information including serial data and electrical ratings are shown below:



REVISION HISTORY

ORIGINAL ISSUE — JANUARY 2022

(FORMERLY VERSION 1.5)

TABLE OF CONTENTS

1. General Information

This guide contains required information for installing, handling, and disposing of the Krack MicroDS refrigeration systems. It is recommended that technicians thoroughly review this document prior to installation as these systems contain propane (R-290) which is a flammable refrigerant.

The settings presented in this manual may be slightly different due to constructional or application characteristics. In these cases, the recommendations will be presented in a generic way to safeguard the applicability of this document. Pictures and drawings shall be considered as reference only.

This guide will be provided by Hussmann to facility owners in both a hard and electronic copy. Hussmann recommends that the hardcopy is stored in easily accessible place for reference for technicians that operate and maintain this equipment in a location that prevents deterioration and degradation.

The installation site of these packaged refrigerating systems is in accordance with local, federal, and national standards and procedures related to safety and technicians responsible for installation, handling, and maintenance are trained to operate in accordance with the procedures outlined in this manual.

⚠ WARNING

This equipment uses propane (R-290), a flammable refrigerant. Installation, service, and repair should be done only by qualified and trained technicians in accordance with this manual.

2. Product Description

Krack MicroDS is specifically designed to support equipment manufacturers and end- users to transition to highly efficient and environmentally friendly refrigeration systems. All units are pre-charged with propane (R-290) with charges equal or below 150 grams (5.290 ounces) per circuit complying with IEC 60335-1, CSA 22.2, UL 427, and UL 471 standards.

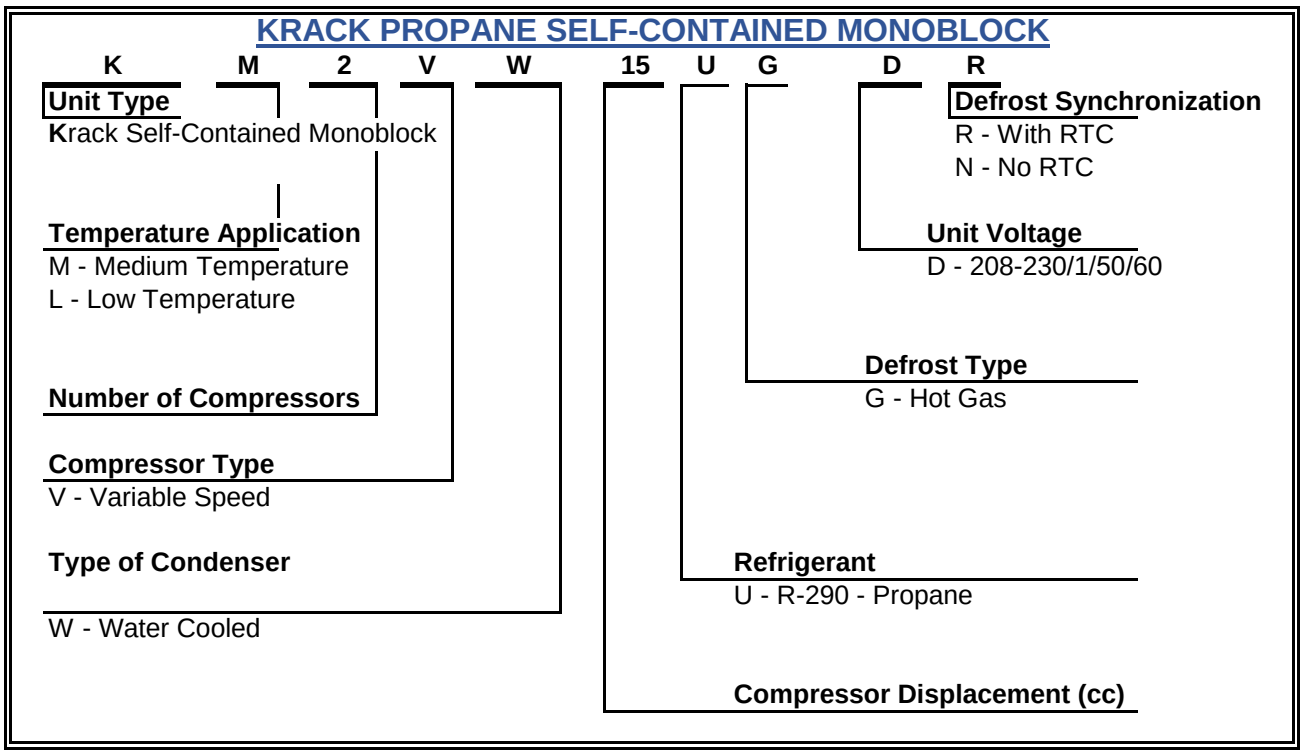
The Krack MicroDS is a complete cooling system that integrates condensing, evaporative, control, and ventilation in one packaged solution. Units can be equipped with one or more independent refrigeration circuits and removal of heat from the high temperature side (condensing) occurs by water. The Krack MicroDS water pumping mechanism, interconnections, and external heat exchange system (water loop) are not part of this product. A brief overview of the different product configurations are shown in Table 1.

Krack Model	Krack Model Number	Voltage	Application Box temp.	Condenser	Real Time Clock
MicroDS	KM2VW15UGDR	230V/50/60HZ/1PH	MT 28°F to 50°F	Water Cooled	YES
MicroDS	KM2VW15UGDN	230V/50/60HZ/1PH	MT 28°F to 50°F	Water Cooled	NO
MicroDS	KL2VW15UGDR	230V/50/60HZ/1PH	LT -15°F to 5°F	Water Cooled	YES

Note: DS: Distributed System | Self Contained | MT: Medium Temperature | LT: Low Temperature

Table 1 – Krack MicroDS Refrigeration System Overview

PRODUCT NOMENCLATURE:



The units are designed to provide maximum energy efficiency including the use of Variable Capacity Compressors (VCC), Electronically Commutated Fan Motors (ECMs) and Propane (R-290) refrigerant that is classified as an A3 (highly flammable and low toxicity) per standard EN0378-1:2008 (Table 2).

	Toxicity	
Flammability	Low	High
No Flame Propagation	A1	B1
Low Flammability	A2	B2
High Flammability	A3	B3

Table 2 – Refrigerant Flammability and Toxicity Classifications

2.1. Reference Standards

Krack MicroDS systems have been built with reference to the following government standards:

- IEC 60335-1: Household and similar electrical appliances – Safety – Part 1: General Requirements
- EN 378-2: Refrigerating systems and heat pumps — Safety and environmental requirements — Part 2: Design, Construction, Testing, Marking, and Documentation
- UL 471: Standard for Safety for Commercial Refrigerators and Freezers
- UL 427: Standard for Safety for Refrigerating Units
- CSA 22.2 Nr. 120-13: Refrigeration Equipment

2.2. Training of Technical Teams

Hussmann recommends personnel who are interacting with these products are trained on flammable fluids. Technical support specialists, contractors, installers, and service/maintenance providers are examples of professionals that should receive such training. Hussmann supports cabinet manufacturers by providing relevant information to its technical teams on the operation of these applications.

2.3. Product Overview

The product contains all the basic elements of a refrigeration system: compressor, condenser, fans, evaporator, controller, valves, and drain pan heater. Krack MicroDS systems are classified as heavy equipment (Table 3) and, therefore, must be handled with the aid of specific equipment for handling heavy machinery. Do not drop the product.

⚠ WARNING

Do not drop the product. Use the appropriate tools for handling and installation to avoid either damaging the refrigerant tubing or increasing the risk of a leak.

Take the necessary actions to avoid damages in the product during handling in installation, maintenance or use to avoid leakage or performance degradation.

Product Weight:	110 kg (242 lbs)
Refrigerant Charge:	150 g (5.29 oz) (each refrigeration circuit)
Refrigerant:	Propane (R-290)
Applications:	Walk-in Coolers or Freezers
Certifications:	UL Listed, NSF
Defrost Type:	Hot Gas with Electric Pan Heaters
Mounting Setup:	Top Mounted

Table 3 - Krack MicroDS and Refrigerating System Information

The critical dimensions of the Krack MicroDS refrigerating system are shown below in Figure 1.

Figure 1 – Critical Dimensions

2.4. Airflow Overview

Figure 2 briefly shows how air flows through the refrigeration unit. The assembly window allows insertion of the cold side of the cooling unit in the cabinet/unit cooler and should be positioned in a way that allows airflow stratification. Follow the minimum space between units as recommended in Figure 3.

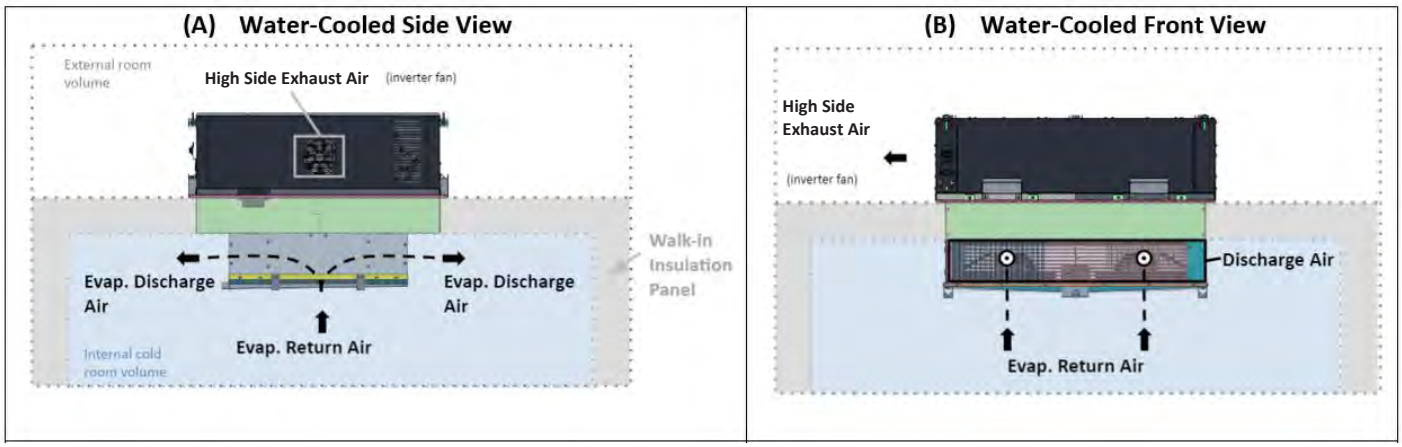


Figure 2 – Airflow schematics

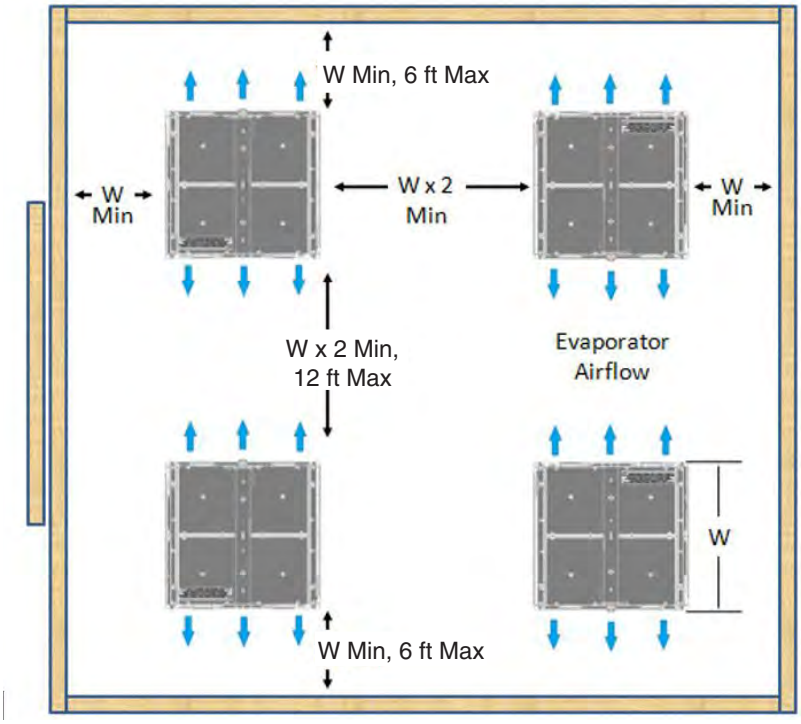


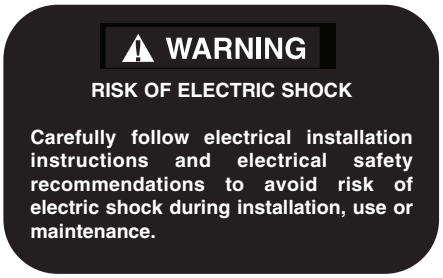
Figure 3 – Roof Top View – Recommended Distances for Installation

3. Installation Instructions

The refrigerating unit must be installed in accordance with ASHRAE 15 (Safety Standard for Refrigeration Systems) with focus on refrigeration concentration limits where the minimum size room is 590 cubic feet.

Observe the following precautions to avoid the risk of fire, electrical shock, or injury:

- Strictly follow the installation instructions to ensure safety of installer and users of these systems.
- Read all instructions before installing and operating system.
- Trained professionals should only be handling these systems.
- Do not install or store the product in a place subject to weather elements such as rain (including with original packaging).
- Do not replace any component of this product or make any repairs that are not explicitly recommended in this guide.
- Products are designed to operate in the indoor ambient temperature of 75° F (allowable range: 50° F to 95° F).



Carefully observe the installation instructions especially with the supply voltage, electrical connections, grounding, and application of electrical safety devices (i.e., circuit breakers).

Install in a unit cooler to ensure adequate ventilation around the product. Since propane is denser than air, the refrigerant tends to accumulate in the lower part of the cabinet. Proper installation should prevent formation of refrigerant pockets in confined spaces.

There should be no equipment near these systems that generate sparks during normal operation (i.e., relays, contactors, switches, or motors (screw drivers, vacuum cleaners, etc.)) unless the components are certified to be used with flammable refrigerants. These components increase the risk of ignition in the event there is a refrigerant leak from the system.

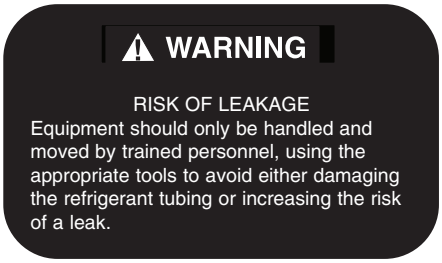
3.1. Storage, Transportation, Unpacking, and Handling

It is recommended that these systems be transported independently from the chamber in which they are installed. If this is not possible, ensure the proper fixation of the refrigeration unit to the cabinet/case.

- The packages have openings in their base that allow refrigerant exhaustion in the event of leakage. Do not block these openings.
- Do not store the product in confined spaces and always use ventilated areas.
- Do not unpack the product near ignition sources.
- Transport the product in its original packaging.

- This is a heavy piece of equipment therefore it must be handled by at least two people and with the aid of specific tools for the operation of heavy machinery.
- Do not drop this equipment

Once the product is removed from its crate, it must be moved and/or handled by the lift rings available on the corners. Always use the four lift rings together to lift the unit. The handles on the unit are only for adjusting or positioning and not for moving it.



Take the necessary actions to avoid damages to the product during handling, installation, maintenance, or use to avoid leakage or performance degradation.

Take the necessary actions to avoid damages to the product during handling, installation, maintenance, or use to avoid leakage or performance degradation.

Refrigerated cooling systems containing flammable fluid above 100 grams (3.53 ounces) cannot be transported by air in accordance with the International Air Transport Association (IATA) standard.

3.2. Mounting and Fixation

Before installing the unit, the gasket needs to be assembled. Hussmann recommends installing the gasket in the appropriate frame of the product. However, in some cases, it can also be installed in the roof of the chamber (an analysis identifying the best positioning is required). Some suggestions of gasket assembling are shown in Figure 4 below:

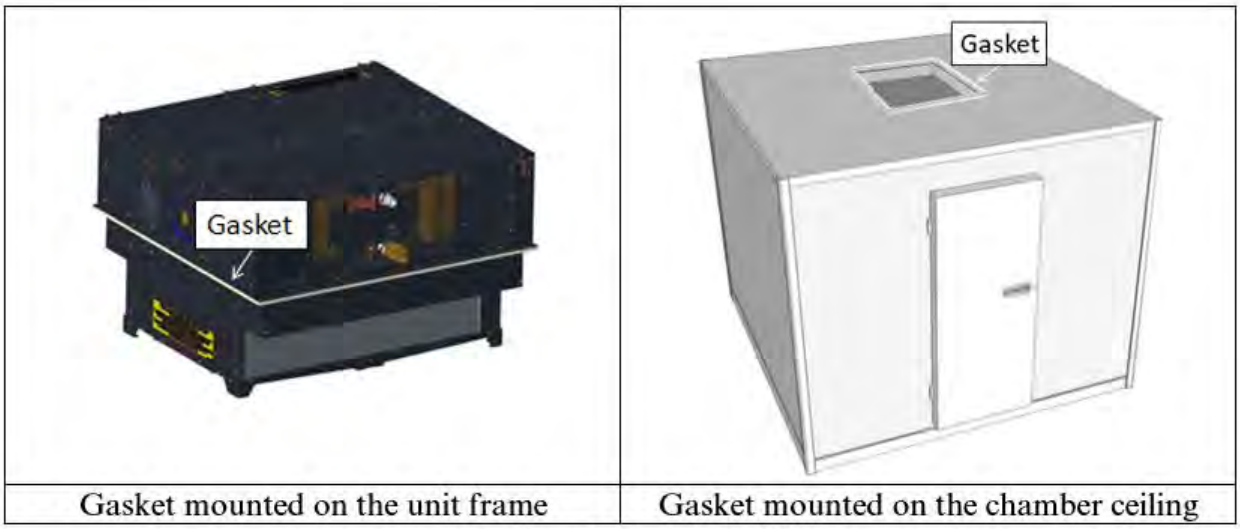


Figure 4 – Gasket Installation.

Keep in mind the purpose of the gasket is the following:

- To avoid cold air leakage to leverage efficiency.
- To avoid water pooling due to condensation that may result in insect penetration and poor sanitation.
- To suppress noise and vibration.

The Krack units also include a set of trims to be installed on the rooftop, inside the cooler. The trims are supplied inside the packaging along with other ship-loose items.

Attachment screws are not provided. It is recommended to use: $^{5}/_{32}$" self-taping screws for this installation.

The unit was developed to be mounted on the roof of unit cooler rooms and mounted by two different configuration options (dependent upon on unit cooler or available structure):

- Unit Cooler Ceiling – In this configuration, the unit is mounted on the ceiling of the unit cooler into the roof opening shown in Figure 5. The unit cooler's structure must be reinforced and able to sustain the system's weight.

- Suspended/Hang – In this configuration, the unit is mounted on a structure above the unit cooler with hanger rods according to the instructions described in Figure 6. The mounting kit is not included with the product.

Note 1: The equipment is designed to be level. A maximum slope of ¼" is allowed if in the direction of the drain fittings, allowing for proper draining of defrost water.

Note 2: In any mounting configuration, it is imperative that the structure can withstand the weight of the system. Avoid air gaps between the unit cooler room's ceiling and gasket to ensure the units operate at the designed performance.

3.2.1. Roof Opening Installations:

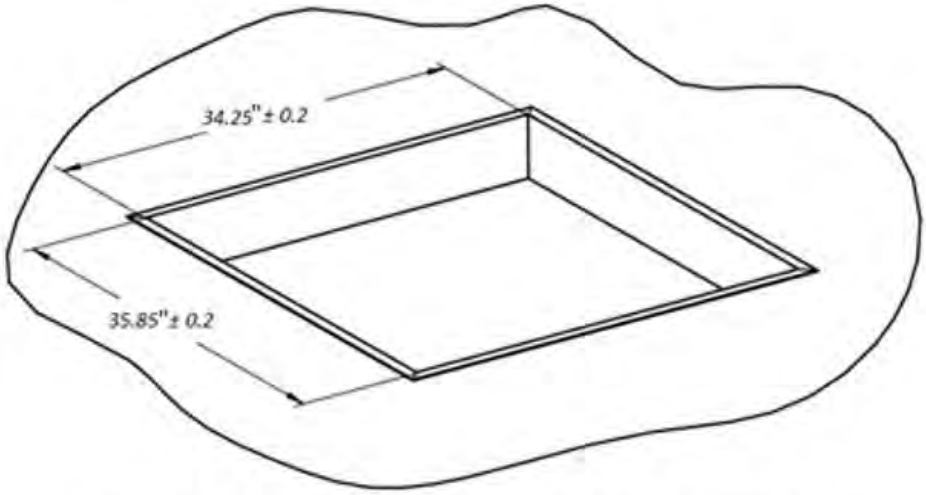


Figure 5 – Window Dimensions (inches) for Unit Installation.

Figure 6 – Example of Unit Mounting - Suspended.

Ensure that there is neither air leakage nor water condensation on the external part of the unit cooler. Seal the internal part of the case to protect against dirt and insect access. Use safety gear and tools for moving and transporting the unit and leverage the handles. If necessary, add devices to lock the system in the required position (not included).

3.3. Drain Connection (Condensation Water)

Krack MicroDS systems have a drain for removing condensate water during the defrost cycle (Figure 7). For the system to operate properly, it must be leveled (maximum variation: 3°) and the drain connected to a sewer line. Ensure sewer line has a siphon to prevent odors and insects from accessing the cabinet. The system's drain connection gauge is male 3/4"-14NPT.

Figure 7 – Drain Connection position

If required, a heater element must be added to the drainpipes to avoid clogging by ice formation.

3.4. Water Loop Connection (Water-Cooled Condenser)

Do not make the water connection without first confirming the system is disconnected from the power supply. The quick connectors supplied with the equipment do not have a check valve therefore isolation valves are also required in the inlet and outlet lines to enable the circuits be individually handled (isolation valves not included).

A factory supplied normally open solenoid valve is fixed in the product by strips (for transportation reasons) and must be assembled directly in the water loop inlet fast connector. Its function is to turn off the water supply during the defrost cycle. The water inlet solenoid valve connector is female 3/4" 14NPT while the water outlet connection is male 3/4" – 14NPT (Figure 8). It is recommended to keep the water valve in the upright position. Never remove the cap or the rubber O-rings from the coil. This is mandatory to avoid humidity infiltration and reduce the risk of failure.

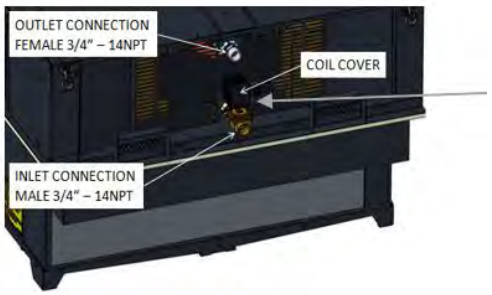


Figure 8 – Water Loop Connections

Note: The coil cover must not be removed unless for maintenance purposes. Do not touch a hot coil. Make sure it is cool before handling.

To prevent pressure buildup, precautions should be taken using surge suppressors or similar solutions in the design of pipe routing and selection of components.

Pipes must be adequately supported according to tube diameter, number of joints, weight, and required spacing distance. Piping should not be routed where it is likely to be walked on or used as lifting beams. When this is not possible, protective covers and warning labels should be provided by the installing contractor to avoid damage to the pipes and/or injury personnel.

Special attention for pipe installation must be taken into account for expansion and contraction due to temperature variation. Piping must be also designed to minimize the effects of vibration. Plastic piping is not recommended unless it meets all pressure, temperature, and material compatibility requirements.

The product is equipped with water balancing valves to control the flow and ensure best operation of the equipment. This product is designed to operate with water temperatures of 85°F (29°C) ranging from 50 to 115°F (10 to 46°C) and minimum flow of 4.4 gallons/minute (17 liters per minute) limited by the balancing valves. In colder climate areas, water inside the piping may freeze. To ensure water temperature remains in range, control external heat exchanger outlet temperature to prevent water from cooling below 50°F (10°C). In the case anti-freeze additives are necessary, use a maximum of 38% Propylene Glycol. Purge the air from the water circuit. If necessary, stabilize the water chemically to prevent corrosion and encrustation.

NOTE: Strainers, isolation valves, surge suppressors and air vent points are not supplied with the product and must be assembled by the installing contractor. See valves position in Figure 9 below.

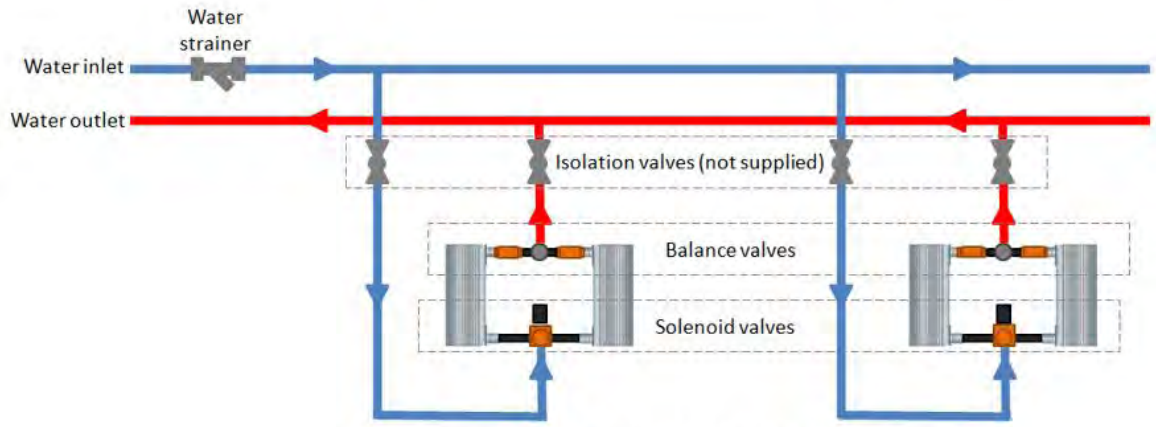


Figure 9 – Water Loop valves position

Influence of water composition on corrosion resistance of water loop components requires some recommendations. Table 4 (on the following page) is presented by the brazed plate condensers and attempts to give a picture of the corrosion resistance of stainless steel and brazing materials in tap water at room temperature. In the table, a number of important chemical components are listed, however the actual corrosion is a very complex process influenced by many different components in combination. This table is therefore a considerable simplification and should not be overvalued. (MicroDS stainless steel condensers have cooper as brazing material.)

CHLORIDE CONTENT	MAXIMUM TEMPERATURE			
	60°C	80°C	120°C	130°C
= 10 ppm	SS 304	SS 304	SS 304	SS 316
= 25 ppm	SS 304	SS 304	SS 316	SS 316
= 50 ppm	SS 304	SS 316	SS 316	Ti / 254 SMO
= 80 ppm	SS 316	SS 316	SS 316	Ti / 254 SMO
= 150 ppm	SS 316	SS 316	Ti / 254 SMO	Ti / 254 SMO
= 300 ppm	SS 316	Ti / 254 SMO	Ti / 254 SMO	Ti / 254 SMO
> 300 ppm	Ti / 254 SMO	Ti / 254 SMO	Ti / 254 SMO	Ti / 254 SMO

			Plate Material			Brazing Material		
WATER CONTENT	CONCENTRATION (mg/l or ppm)	TIME LIMITS Analyze before	AISI 304	AISI 316	254 SMO	COPPER	NICKEL	Stainless
Alkalinity (HCO_3^-)	< 70	Within 24 h	+	+	+	0	+	+
	70-300		+	+	+	+	+	+
	> 300		+	+	+	0/+	+	+
Sulphate[1] (SO_4^{2-})	< 70	No limit	+	+	+	+	+	+
	70-300		+	+	+	0/-	+	+
	> 300		+	+	+	-	+	+
HCO_3^- / SO_4^{2-}	> 1.0	No limit	+	+	+	+	+	+
	< 1.0		+	+	+	0/-	+	+
Electrical conductivity	< 10 µS/cm	No limit	+	+	+	0	+	+
	10-500 µS/cm		+	+	+	+	+	+
	> 500 µS/cm		+	+	+	0	+	+
pH [2]	< 6.0	Within 24 h	0	0	0	0	+	+
	6.0-7.5		+	+	+	0	+	+
	7.5-9.0		+	+	+	+	+	+
	>9.0		+	+	+	0	+	+
Ammonium (NH_4^+)	< 2	Within 24 h	+	+	+	+	+	+
	2-20		+	+	+	0	+	+
	>20		+	+	+	-	+	+
Chlorides (Cl^-)	<100	No limit	+	+	+	+	+	+
Please also see	100-200		0	+	+	+	+	+
table below	200-300		-	+	+	+	+	+
	>300		-	-	+	0/+	+	+
Free chlorine (Cl_2)	< 1	Within 5 h	+	+	+	+	+	+
	1-5		-	-	0	0	+	+
	> 5		-	-	-	0/-	+	+
Hydrogen sulfide (H_2S)	< 0.05	No limit		+	+	+	+	+
	>0.05			+	+	0/-	+	+
Free (aggressive)	< 5	No limit	+	+	+	+	+	+
carbon dioxide (CO_2)	5-20		+	+	+	0	+	+
	> 20		+	+	+	-	+	+
Total hardness (°dH)	4.0-8.5	No limit	+	+	+	+	+	+
Nitrate[1] (NO_3^-)	< 100	No limit	+	+	+	+	+	+
	> 100		+	+	+	0	+	+
Iron[3] (Fe)	< 0.2	No limit	+	+	+	+	+	+
	> 0.2		+	+	+	0	+	+
Aluminium (Al)	< 0.2	No limit	+	+	+	+	+	+
	> 0.2		+	+	+	0	+	+
Manganese[3] (Mn)	< 0.1	No limit	+	+	+	+	+	+
	> 0.1		+	+	+	0	+	+

[1] Sulfates and nitrates works as inhibitors for pitting corrosion caused by chlorides in pH neutral environments;
[2] In general low pH (below 6) increases corrosion risk and high pH (above 7.5) decrease the corrosion risk;
[3] Fe3+ and Mn4+ are strong oxidants and may increase the risk for localized corrosion on stainless steels; SiO2 above 150ppm increase the risk of scaling;
+ Good resistance under normal conditions;
0 Corrosion problems may occur especially when more factors are valued 0;
- Use is not recommended;

The information in these tables is subject to change without prior notice.

Table 4 – Water Composition

3.5. Electrical Connections

This equipment must be installed in a properly protected electrical circuit with a Residual Current Device (RCD) with maximum 30 mA of leakage current. For two-line circuits (L-L without neutral), apply a differential residual bipolar circuit breaker to protect both phases.

The recommendation of the electrical wiring gauge (per cooling unit) is minimum 14 AWG copper only conduits. Grounding the entire system is a mandatory requirement. The critical electrical unit data is shown in Table 5 and also on the product labels.

The product is supplied with an electrical terminal block for field connections. Electrical connections must follow the color and positions of cables as shown in Figure 10.

Figure 10 – Electrical Field Connection

A two pole convenience switch is available for servicing. Always turn the switch off when servicing the unit. The upper position is marked "ON" and will energize the whole unit. When in "OFF" position, the disconnect switch will de-energize the unit after the switch.

This means all electrical connections before the switch must be considered energized. If servicing requires opening the electrical box, it is recommended to turn off the main circuit branch. The locations of the electrical components and connections are shown in Figure 11 below:

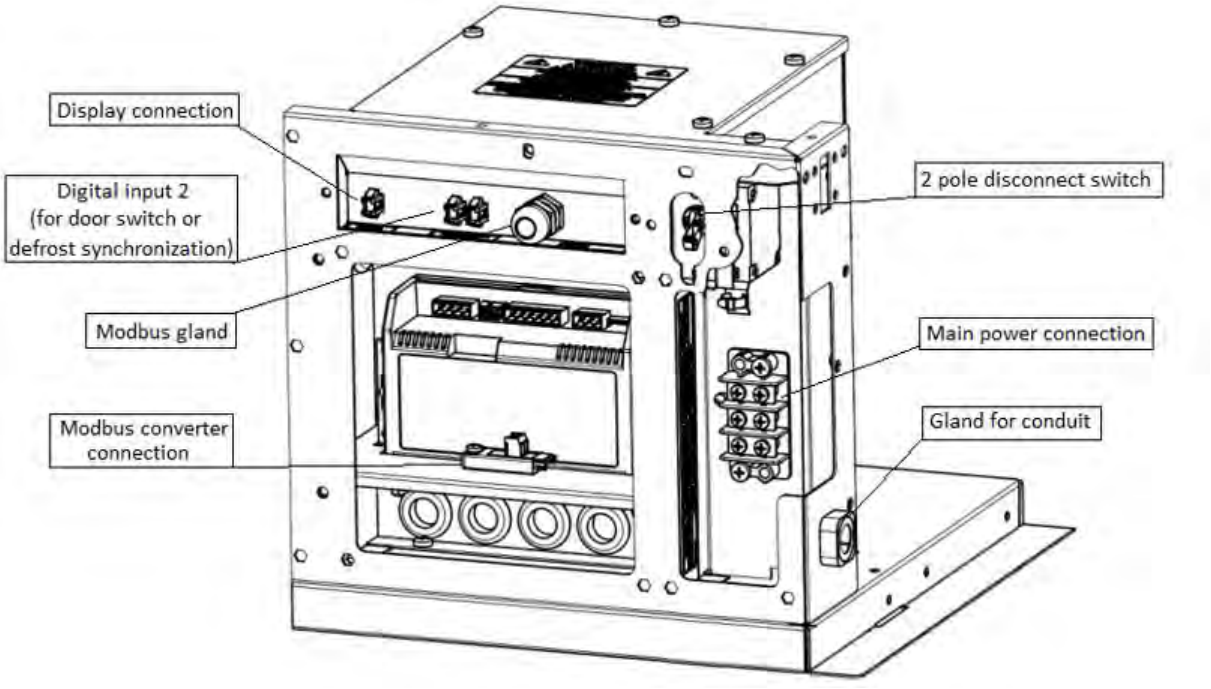


Figure 11 – Electrical and Communication Connections and Components

Electrical terminals must be properly sized as per the wire gauges used. Terminal crimps must be made with the proper crimping tool in order to ensure good contact and robust connections.

Krack Model	Krack Part Number	Voltage / Frequency	Voltage Range (Min – Max)	Phases	MCA (A)	MOP (A)	Max. Fuse or Circuit Breaker (A)
MicroDS	KM2VW15UGDR	230V/50/60HZ	208–255V	1 PH	10.4	15	20
MicroDS	KM2VW15UGDN	230V/50/60HZ	208–255V	1 PH	10.4	15	20
MicroDS	KL2VW15UGDR	230V/50/60HZ	208–255V	1 PH	11.0	15	20

Table 5 – Electrical Data

3.5.1. Power Input

The Krack MicroDS systems are designed to operate at 230V ± 10% at 50/60 Hertz. It can be connected with single-phase + neutral and ground OR bi-phase + ground.

	Single Phase Connection (Phase-Neutral) *(208V/50/60HZ)*	**Bi-Phase Connection (Phase-Phase)** *(240V/50/60HZ)*
Terminal	*Electrical Connection*	*Electrical Connection*
L1	Phase 1	Phase 1
N	Neutral	Phase 2
Gr	Grounding	Grounding

Table 6 - Power Input

3.6. Inverter (Compressor Driver)

Krack units have 2 refrigeration circuits where the variable speed compressors are driven by Embraco electronic inverters model CF10B01 as shown in Figure 12.

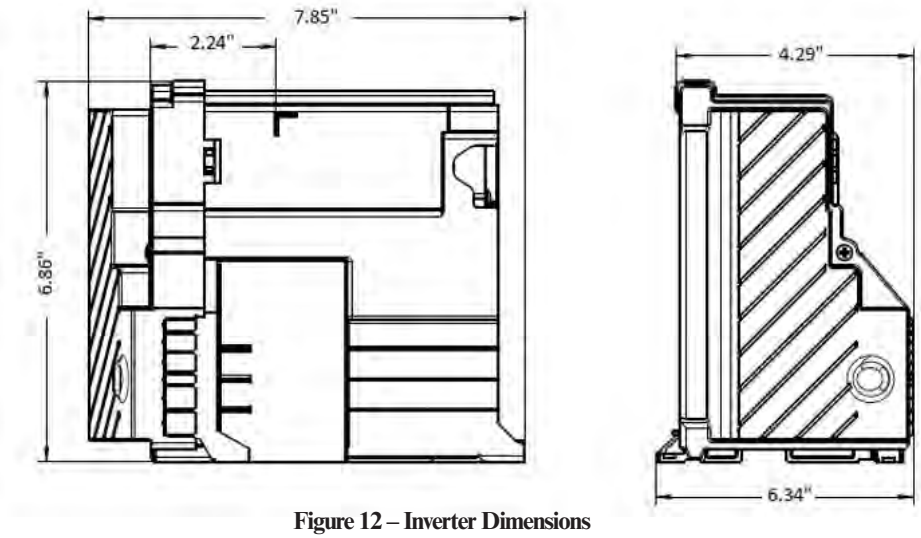
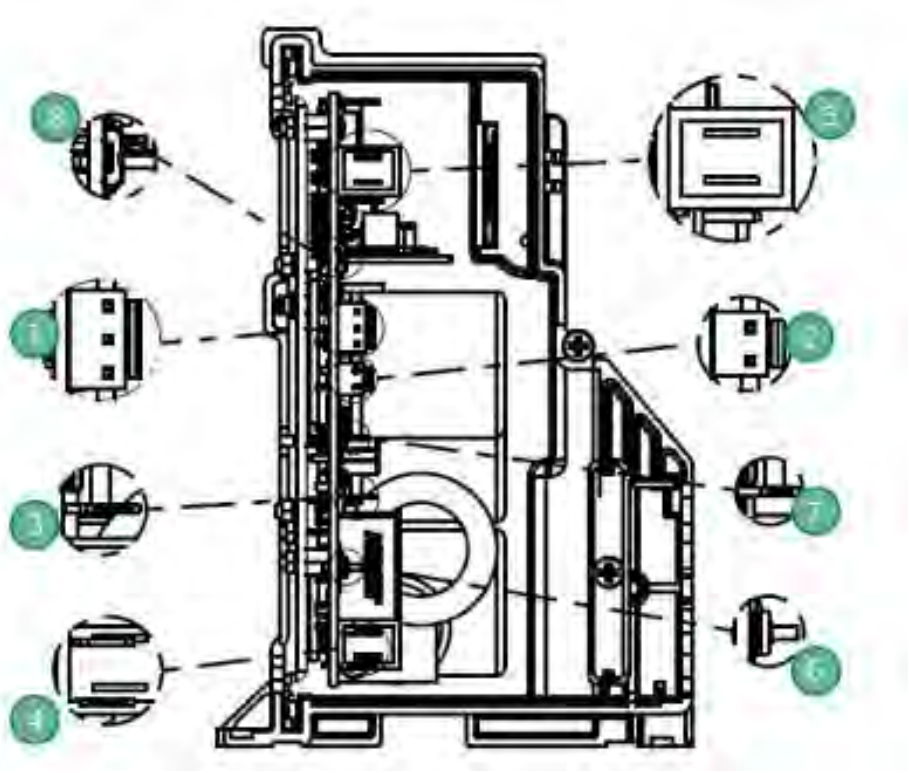


Figure 12 – Inverter Dimensions

Inverter Connections:



#	Description
1	Serial communication
2	Frequency input (not applied for Krack units)
3	Drop-in (not applied for Krack units)
4	AC input
5	AC fan triac
6	EMI earth (not applied for Krack units)
7	Defrost signal input (not applied for Krack units)
8	“you” control input (not applied for Krack units)

Table 7 - Inverter

3.6.1. LED diagnostic function

The LED diagnostics function helps services technicians to diagnose possible fault components by blinking a LED inside the box in different patterns. Basically, it indicates if there is a problem with Compressor, CF10B Inverter or Thermostat. The Table 8 below describes the failure modes.

LED Status	Period	Color	Description
1 flash	30 seconds	Green	Normal operation
2 flashes	5 seconds	Green	Communication problem
3 flashes	5 seconds	Red	Inverter problem
4 flashes	5 seconds	Red	Compressor problem
No flash	----	----	No input power / Damaged inverter

Table 8 - LED Diagnostic Function

For more details and the complete list of parameters, please visit https://www.hussmann.com/.

3.7. Controller

The controller applied in the Krack microDS units is a Dixell XWi70K, with frequency signal to control the speed of variable speed compressors.

3.7.1. Sequence of operation

STEP A: NORMAL REFRIGERATION CYCLE

a) Controller communicates with the inverters by a serial signal so compressors start the refrigeration cycles; once energized, inverters close a TRIAC and the inverter fans starting running together with compressors.

NOTE: Compressor speed curves and operation routine are pre-defined by the manufacturer.

b) A parameter in the controller (FSt) defines the evaporator temperature to start / stop the evaporator fans. Once achieved the pre-defined temperature (by default = 50° F), controller switches ON the evaporator fans at maximum speed (1550 RPM). The fans are kept OFF when the system returns to the refrigeration cycle after the defrost cycle to avoid water spillage into the storage area. This option is also programmable by parameter "Fnd."

c) The compressor modulates speed/capacity according to the system load. During this process, the condenser and evaporator fans will keep operating until the set point is achieved. If compressor is already in the minimum speed and the set point is achieved, the controller will turn the compressor off. The minimum and maximum speed of compressor is adjustable by the controller via parameters "FMi" and "FMA". Then, the inverter TRIAC will disconnect condenser fans and coolers.

d) During compressor and condenser fan OFF time, the evaporator fan will run in idle speed (around 800 RPM).

e) When the return air temperature probe senses the temperature above the preset differential set point, the compressor and condenser fans/coolers are switched ON and evaporator fans run at maximum speed (around 1550 RPM).

f) For several units applied in the same storage room, each unit will follows its own logic to define compressor speed and operating conditions. Thus, it is recommended to interconnect the units by the defrost coordination cable (digital input 2), to guarantee the defrost will happen at the same time for all units. This is recommended for the models without a Real Time Clock (RTC). For units with RTC, defrost cycle must be defined by the internal clock. If an external server is applied, then the inter-communication for operating and defrost cycles is defined by this Modbus interface. Follow 3.7.4.2 for more details.

STEP B: HOT GAS DEFROST CYCLE

g) Hot gas defrost cycle is recommended for applications where storage temperature is close or below freezing point (~32° F) or when high humidity condition is reached. The hot gas defrost cycle is initiated by time and temperature terminated with a timer and/or high temperature over-ride. Each circuit follows its own input to define the end of the cycle.

h) The initiation of defrost cycle can also be defined by the internal clock (RTC) when available. It is recommended to use digital input 2 to synchronize the defrost cycle between units when the controller has no RTC (see item 3.6.2.2). The timer starts the defrosting of the evaporator coil at predetermined intervals. A typical setting would be six defrost periods per 24-hour day.

i) Upon initiation of the defrost cycle, the controller opens the hot gas solenoid valve, closes the water flow on the condensers, and shuts off the evaporator fan motors. Simultaneously, power is connected to the drain pan heaters.

j) The compressor speed is increased to maximum value (5000 RPM).

k) As the frost melts, it drops into the heated drain pan and flows down the drain.

l) During this period, the evaporator pressure will remain close to the corresponding melting point of water. Refrigerant in liquid state can migrate to the compressor by the suction line. This process is normal and the compressor is approved for liquid handling.

m) Once the ice is melted, the evaporator temperature will increase. The probe in the evaporator outlet is responsible for termination of the cycle, once the preset temperature is achieved. The parameters for the defrost termination are "dtE" and "dtS" and the pre-defined value is 55° F.

n) The controller will initiate the dripping time (parameter "Fdt") before starting the normal refrigeration cycle again. Pre-defined value for "Fdt" is 5 minutes for medium temperature and 15 minutes for low temperature units. During dripping time, the pan heaters are turned OFF for medium temperature units but kept ON for low temperature units.

3.7.2. Keyboard

The unit is provided with one Dixell digital display model CH620 to be connected in the controller. The connection of display is optional when the supervisor or Visotouch are used. A ~33 foot (10 M) connecting cable is supplied as an accessory. The display is supplied and fixed close to the electrical box for convenience.

3.7.2.1. LED Functions

Each LED function is below in Table 9 with display view example in Figure 13:

LED	MODE	Function
❄	ON	The compressor is running
	FLASHING	- Programming menu - Anti-short cycle delay enabled
	ON	The fan is running
	FLASHING	Programming menu
	ON	The defrost is enabled
	FLASHING	Drip time in progress
	ON	- ALARM signal - In "Pr2" indicates that the parameter is also present in "Pr1"
	ON	Pull down is running
ECO	ON	Energy saving enabled
	ON	Light on
AUX	ON	Auxiliary output on
C, F	ON	Measurement unit

Table 9 – LED description

Figure 13– Display View

3.7.3. Configuration

The configuration parameters are divided in groups (named menu). After entering the programming mode, the first label corresponding to the first available group (menu) will appear on the display depending on the visibility level. Every parameter belonging to a specific menu has its own visibility rules for placement in PR1 (user accessible parameters) or PR2 (hidden parameters). Any menu can have parameters placed both in PR1 and/or PR2.

3.7.3.1 How to enter parameter programming menu "PR1"

To enter a parameter list under "Pr1" level (user accessible parameters), under a specific menu, operate as follows:

SET + ▽ (3 seconds)	1. Enter the Programming mode by pressing the **SET+DOWN** key for 3 seconds. 2. The display will show the first menu available under "Pr1" level

3.7.3.2. How to enter parameter programming menu "PR2"

In the PR2 level there are all the parameters of the instrument.

SET + ▽ (3 seconds)	1. Enter the Programming mode by pressing both **SET+DOWN** buttons for 3 sec: the label of the first menu available in Pr1 will be displayed (example: rEG)
SET + ▽ (7 seconds)	2. Release the **SET+DOWN** buttons and then push them again for 7 sec: during this time both compressor and fan icon will blink. After 7 sec the "**Pr2**" label will be displayed immediately, and, after releasing the **SET+DOWN** buttons, the first parameter menu available will be displayed (example: rEG)

3.7.3.3. How to change a parameter value

1. Enter the programming mode (both in PR1 or PR2 level).
2. Select the required menu with UP or DOWN.
3. Press the SET button to enter the parameter list belonging to the selected menu.
4. The first available parameter label (depending on the visibility level) will be displayed. The compressor icon will blink to indicate the position in the selected menu.
5. Select the required parameter by using UP or DOWN buttons.
6. Press the SET key to display the current value (compressor and fan icon starts blinking to indicate this condition).
7. Use UP or DOWN to change its value.
8. Press SET to store the new value and move to the following parameter (belonging to the same menu).

To exit: Press SET+UP or wait for 30 sec without pressing any button.

NOTE:
- The new programming is stored even when the procedure ends by waiting the time-out.
- The LIGHT button is used as BACK function when into PROGRAMMING MODE: press it to exit from a parameter list and return to the upper menu or to discard a parameter value modification and return to the same parameter label (without changing the previous parameter value).

3.7.3.4. Parameter list

The configuration parameters are divided in groups (named menu) to speed up the browsing operations. The list in Table 10 below is all menus with its meaning:

rEG	**Regulation menu:** to set regulation band
Prb	**Temperature probe menu**
vSC	**Variable Speed Drive menu:** to set the VS functional parameters
vSF	**Modbus Variable Speed Fan menu:** to set Modbus VSF functional parameters
diS	**Display menu:** to set the visualization rules
dEF	**Defrost menu:** to set the defrost operational mode
FAn	**Fan menu:** to set the evaporator and condenser fan control mode
AUS	**Auxiliary menu:** to set the auxiliary output mode
ALr	**Alarm menu:** to set the alarm thresholds
oUt	**Output menu:** to set the function linked to any configurable output
inP	**Input menu:** to set the function linked to any configurable input
ES	**Energy saving menu:** to set the energy saving mode
rtC	**Real Time Clock menu:** to set the internal clock
CoM	**Serial communication menu:** to set serial port speed and baudrate
Ui	**User Interface:** to set keyboard related functions
inF	**Info menu:** to read probe values and FW information

Table 10– Parameter Menu

The list of parameter shown is an extraction from the controller manufacturer manual and presents the most common parameters configured during the commissioning and also by users for the Krack MicroDS and SC systems. For more details and the complete list of parameters, please access the website:
https://webapps.emerson.com/Dixell/Pages/Manuals#famSeq_12
Go to family XRi-XWi and then XWi70K for more details if required.

3.7.3.5. Alarms

A list of main alarms is presented in Table 11 below:

System alarms		
Message	**Cause**	**Outputs**
P1	Thermostat probe failure	Alarm output ON; Compressor output according to parameters Con and CoF
P2	Second probe failure	Alarm output ON; Other outputs unchanged
P3	Third probe failure	Alarm output ON; Other outputs unchanged
P4	Fourth probe failure	Alarm output ON; Other outputs unchanged
HA	Maximum temperature alarm	Alarm output ON; Other outputs unchanged
LA	Minimum temperature alarm	Alarm output ON; Other outputs unchanged
dA	Door open	Compressor and fans restarts
EA	Warning	Output unchanged
PAL	High pressure alarm (i1F=PAL)	All outputs OFF
EE	Data or memory failure	Alarm output ON; Other outputs unchanged
noL	No communication between base and keyboard	Unchanged
Compressor serial communication alarms		
EC1	VSC communication error	Unchanged
CP1, CP2	Compressor 1 or 2 stopped	Regulation stopped, retry function active
HP1, HP2	Compressor 1 or 2 start fail	Regulation stopped, retry function active
E11, E21	Compressor 1 or 2 overload	Regulation stopped, retry function active
E13, E23	Compressor 1 or 2 under speed	Regulation stopped, power off active
E14, E24	Compressor 1 or 2 short circuit	Regulation stopped, power off active
HT1, HT2	Inverter 1 or 2 high temperature	Regulation stopped, retry function active

Table 11– Alarm List

3.7.3.5.1. High pressure (Thermal cut-off) Alarm

The Krack MicroDS systems are equipped with two levels of high pressure control shown in Figure 14 below. The first level is defined by the actuation of a thermal cut-off switches, installed on the condenser refrigerant outlet line and aims to actuate in case of water flow reduction of fault. These thermal cut-off switches are connected in the digital input 1 from the controller, where parameter "i1F" is configured as "PAL" (High pressure alarm). The actuation will happen into the boundary of compressor operating envelope and the main purpose is to call for a corrective maintenance of the water loop. The number of events is configured by the parameter "nPS" (by default is 3) and the delay is defined by the parameter "did"(by default is 120). All of these parameters, including the assembling position of the sensors, were defined by laboratory tests. Changes in these specifications are not recommended unless with specific recommendation from the manufacturer.

If, during the interval time set by "did" parameter, the digital input 1 has reached the number of activation of the "nPS" parameter, the "PAL" pressure alarm message will be displayed. The compressor and the regulation are stopped. To restart the operation, switch OFF and ON the system.

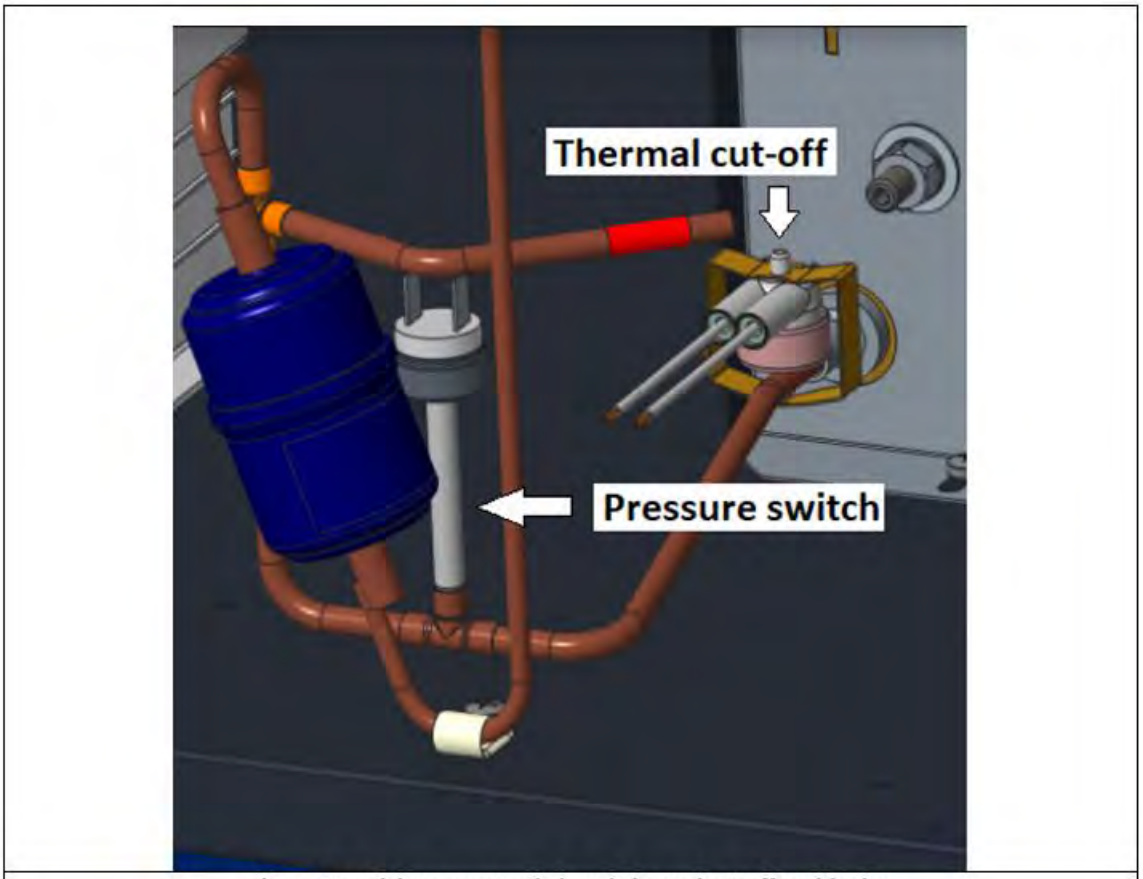


Figure 14 – High pressure switch and Thermal cut-off positioning

The second level of high pressure control is designed for safety aspects, where the system is equipped with 2 pressure switches, installed one in each refrigeration circuit. The actuation of the pressure switches will happen out of the compressor boundary operating envelope, so it is not expected to have pressure switch events while the thermal cut-off devices are properly operating. In this case, the EC1 alarm will be activated during the time the pressure switch is opened.

3.7.4. Interfaces

Table 12 presents a summary of input and output instrumentation in the Dixell XWi70K controller (Figure 15). Items listed as “Factory” are connected by the manufacturer and items listed as “User” are connected by the contractor and service technicians.

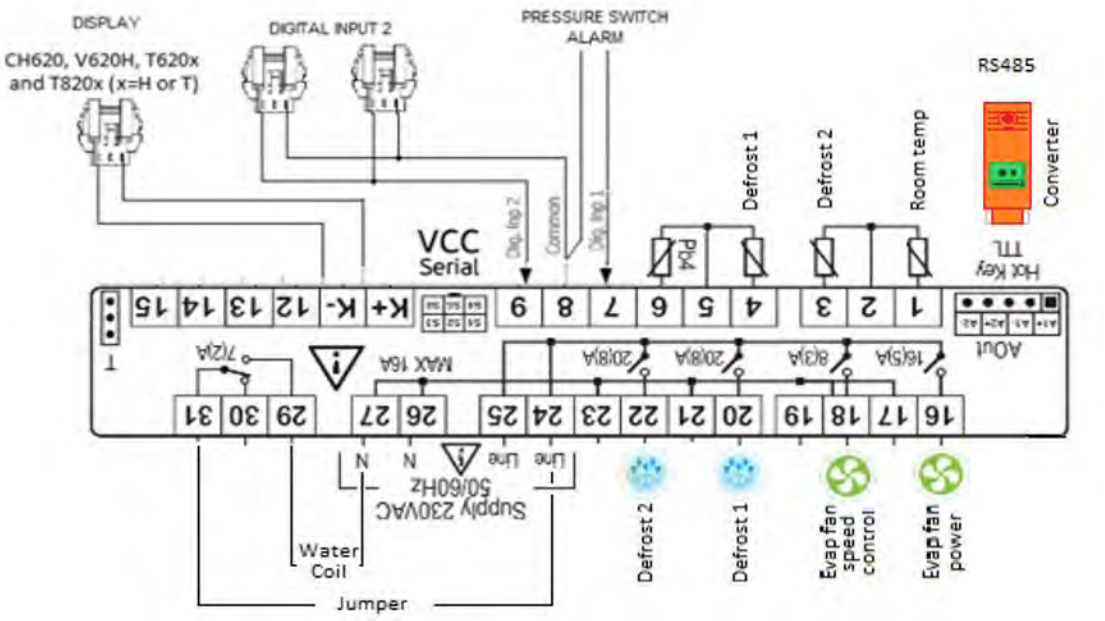


Figure 15 – Dixell XWi70K interface

Terminal	Functionality	Responsible
16	Evaporator fan power supply	Factory
18	Evaporator fan motor speed control (Closed = 1550 RPM / Opened = 800 RPM)	Factory
20	Defrost output for refrigeration circuit # 1	Factory
22	Defrost output for refrigeration circuit # 2	Factory
24	Jumper for water solenoid valve power	Factory
25	Power supply 230V/60Hz	Factory
26	Power supply 230V/60Hz	Factory
27	Water solenoid coil	Factory
29	Water solenoid coil	Factory
31	Jumper for water solenoid valve power	Factory
Pb1	Room temperature Sensor	Factory
Pb2	Defrost Sensor circuit # 2	Factory
Pb3	Defrost Sensor circuit # 1	Factory
Pb4	-	-
Digital Input 1	High pressure alarm	Factory
Digital Input 2	Door switch alarm (in some case it is replaced by defrost synchronization)	User
VCC Serial	Inverter 1 & Condenser Fan / Cooler 1 Inverter 2 & Condenser Fan / Cooler 2	Factory
Kbrd	Remote Display / User Terminal	User
Hot Key TTL	Connection with converter TTL to RS485	Factory
Converter	Integration into supervisory system via RS485	User

Table 12 – IO List

3.7.4.1. Door Switch Alarm

The door switch can be connected in the digital input 2. Two parallel JST XMR-02V receptacles are available for convenience. Use a dry contact (I/0) from the door switch as a signal in the first unit and then interconnect the units by the parallel receptacle using a proper wiring cable (supplied as an accessory). These can be connected in series or in parallel if two doors are available. For more than two doors, use series only connections. See option of door switch alarm connections below (Figures 16 and 17). If no door switch is used, the digital input (2) must be changed from “dor” to “nu” by parameter “i2F”.

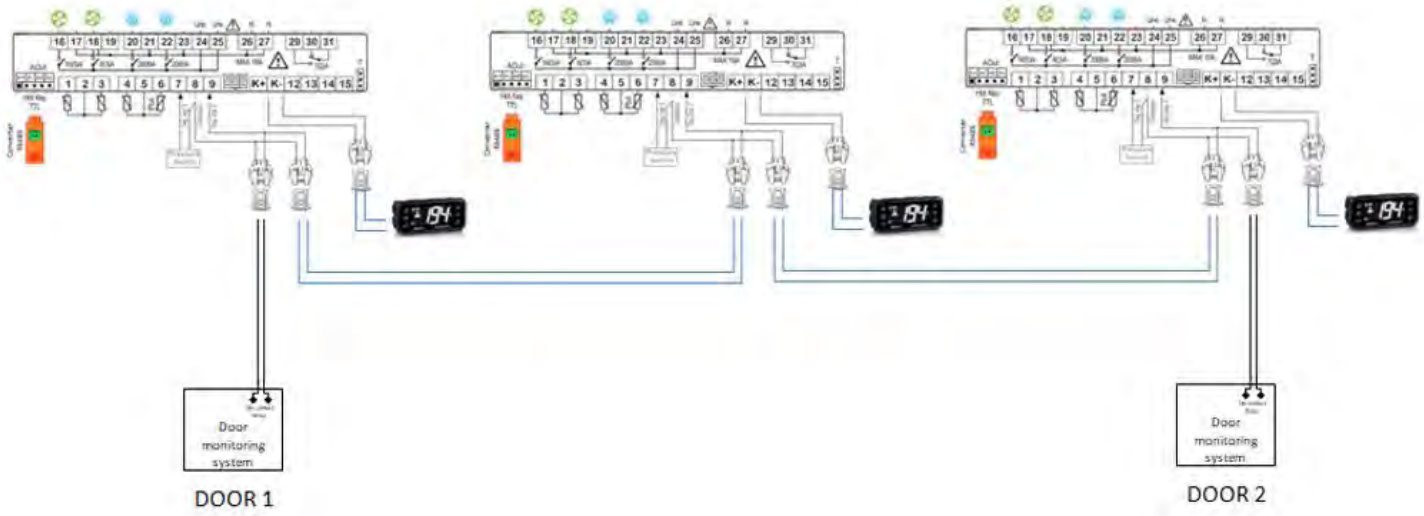


Figure 16 - Door Switch Parallel Connection

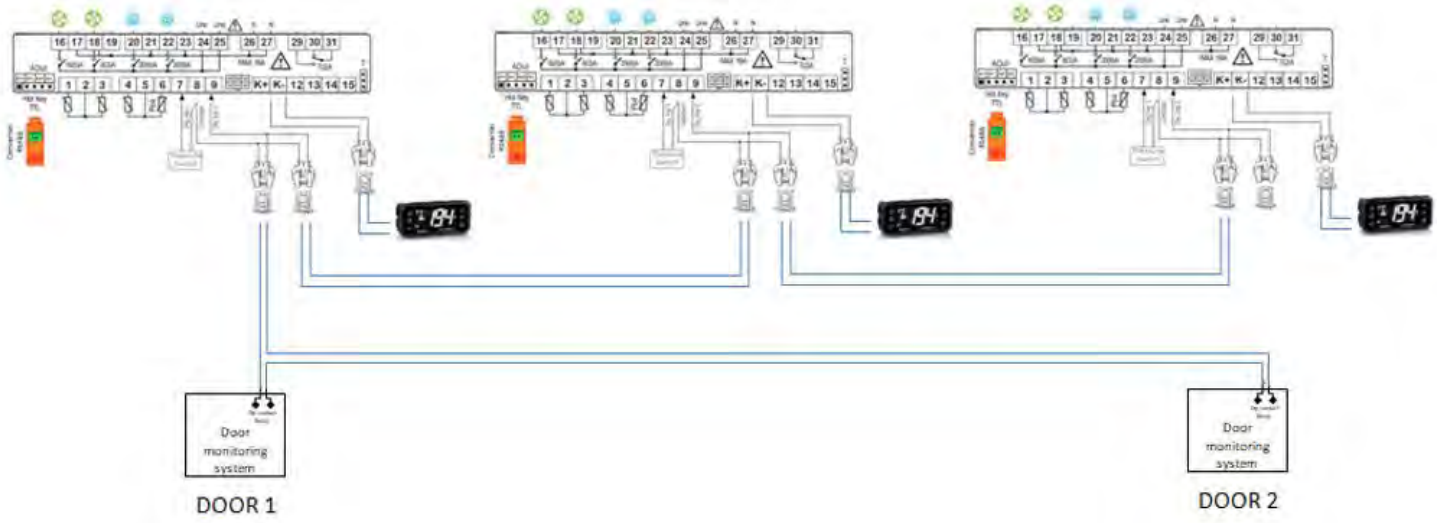


Figure 17 - Door Switch Series Connection

3.7.4.2. Defrost Synchronization

Defrost synchronization is recommended when several units are applied in a room with the intention that all units start the defrost cycle simultaneously (terminations are independent). Defrost can be synchronized by several ways, depending on the structure available. Some options below:

3.7.4.2.1. Assembling with Supervisor

The defrost cycles can be synchronized by the Supervisor. In this case, Supervisor instructions must be followed to configure the defrost starts (by internal real time clock). See Figure 18.

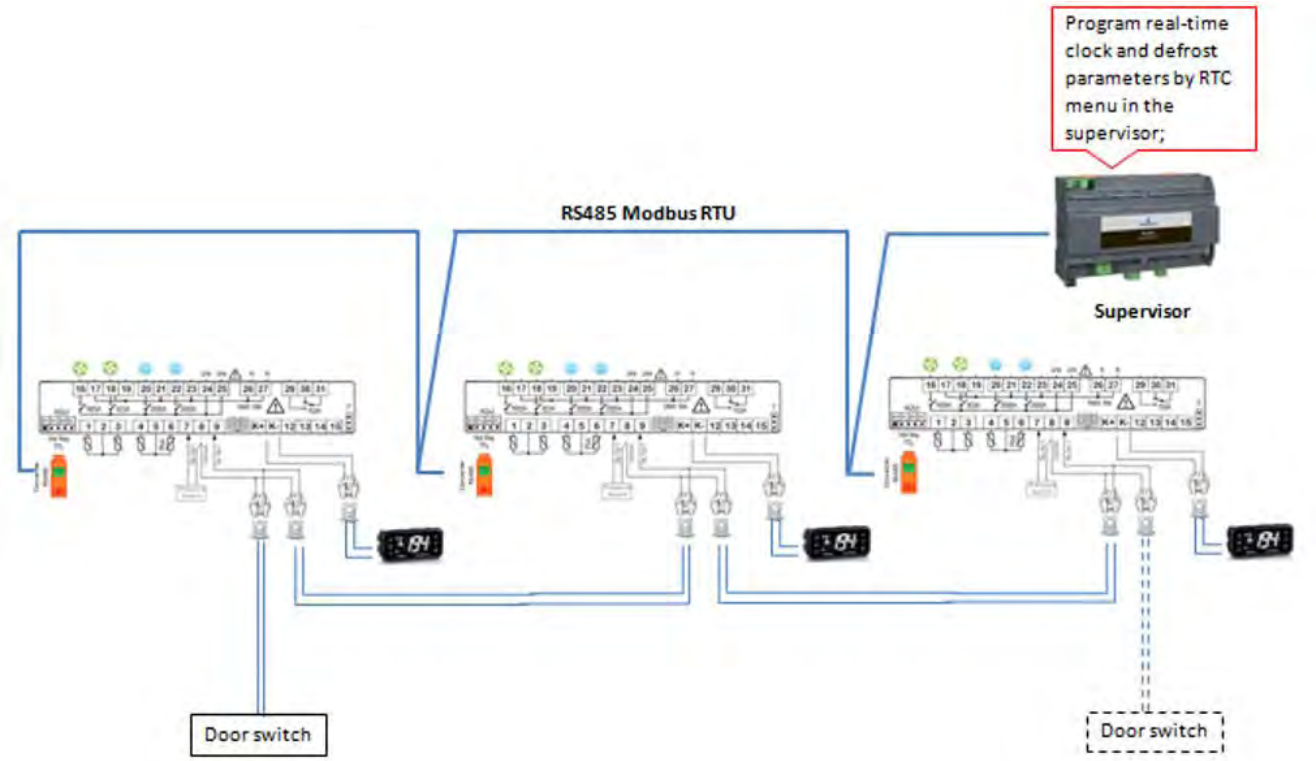


Figure 18 – Defrost Synchronization by Server and Controllers

3.7.4.2.2. Assembling Visotouch and Controller with Real Time Clock (RTC)

This combination requires the defrost synchronization by the RTC for each controller and must be adjusted during start-up. There is no communication between controllers so each one will start the defrost cycle when the preset time is achieved.

Due to this characteristic, the synchronization of the internal clock of each controller is important (see Figure 19 below).

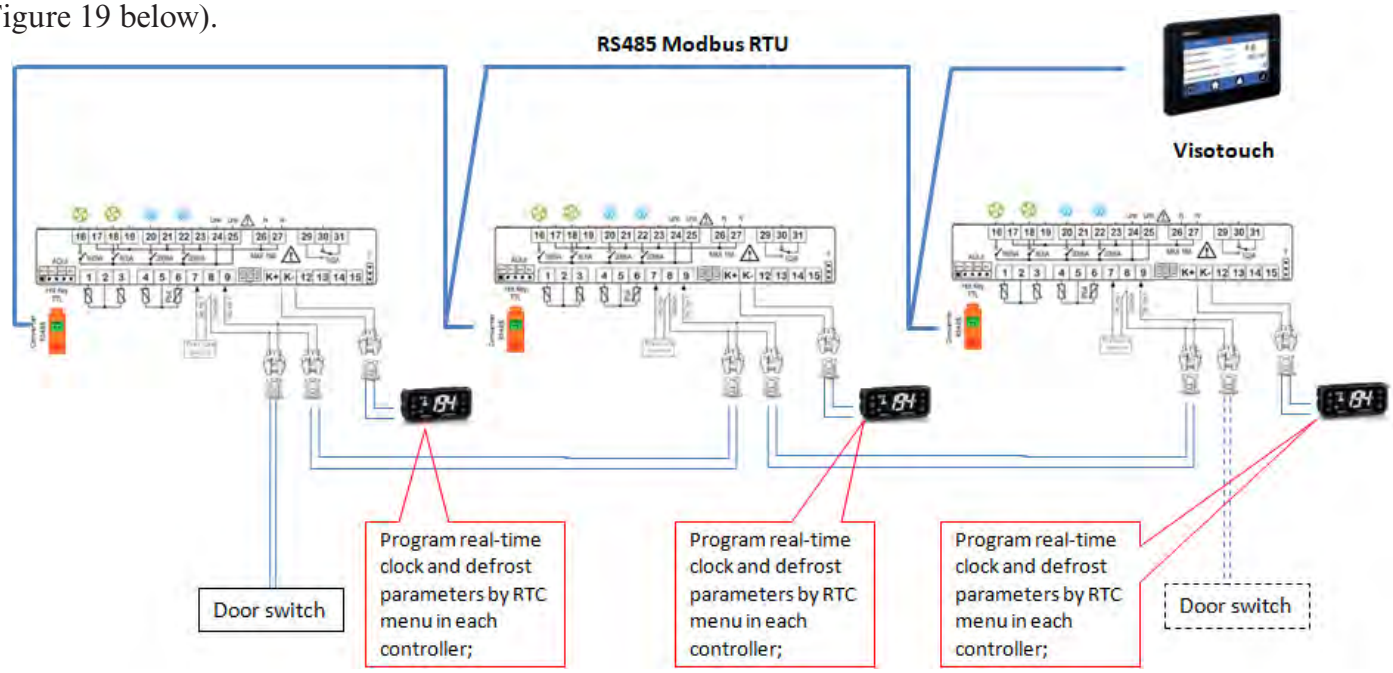


Figure 19 – Defrost Synchronization by RTC for each Controller

3.7.4.2.3. Assembling Visotouch and Controller without RTC

The digital input (DI2 parameter) must be changed from "door switch (dor)" to "defrost synchronization (dEF)." Go to parameter "i1F" in the digital input menu "inP." In this case, the door switch alarm will be disabled (see Figure 20 below).

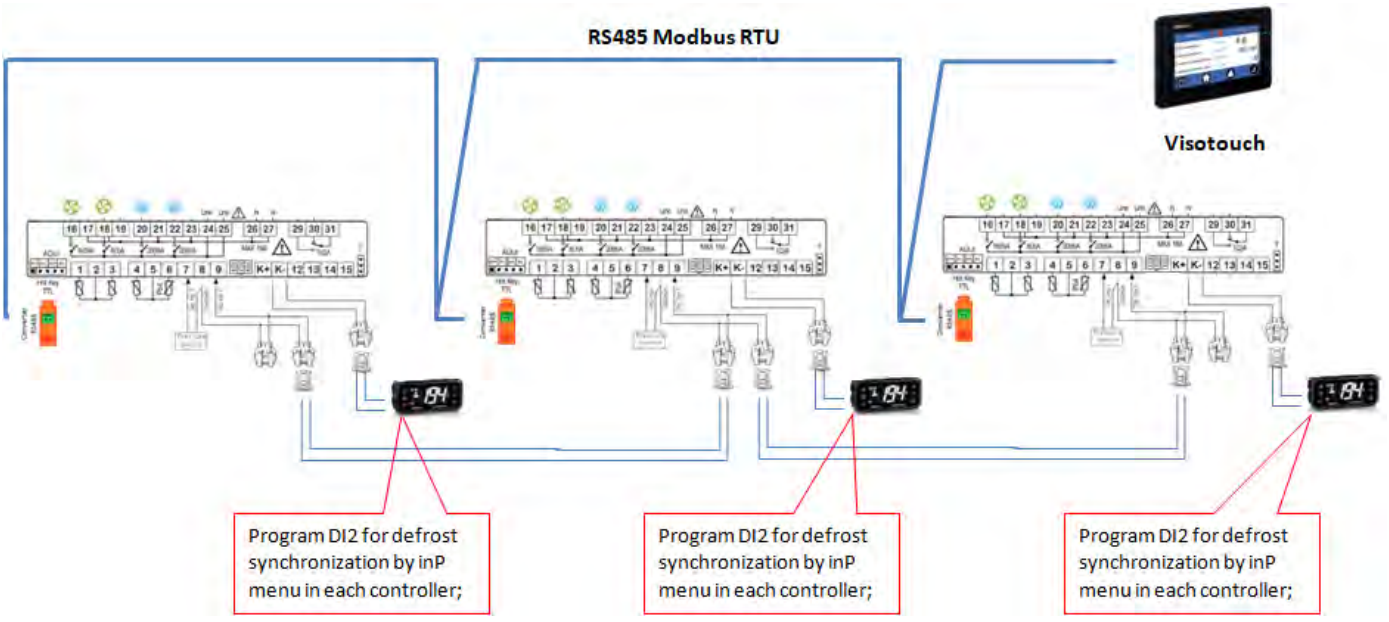


Figure 20 – Defrost Synchronization by DI2 for each Controller

3.7.4.2.4. Assembling Controller with RTC alone

This combination requires the defrost synchronization by the RTC for each controller and must be adjusted during start-up. There is no communication between controllers so each one will start the defrost cycle when the preset time is achieved. Due to this characteristic, the synchronization of the internal clock for each controller is important (see Figure 21 below).

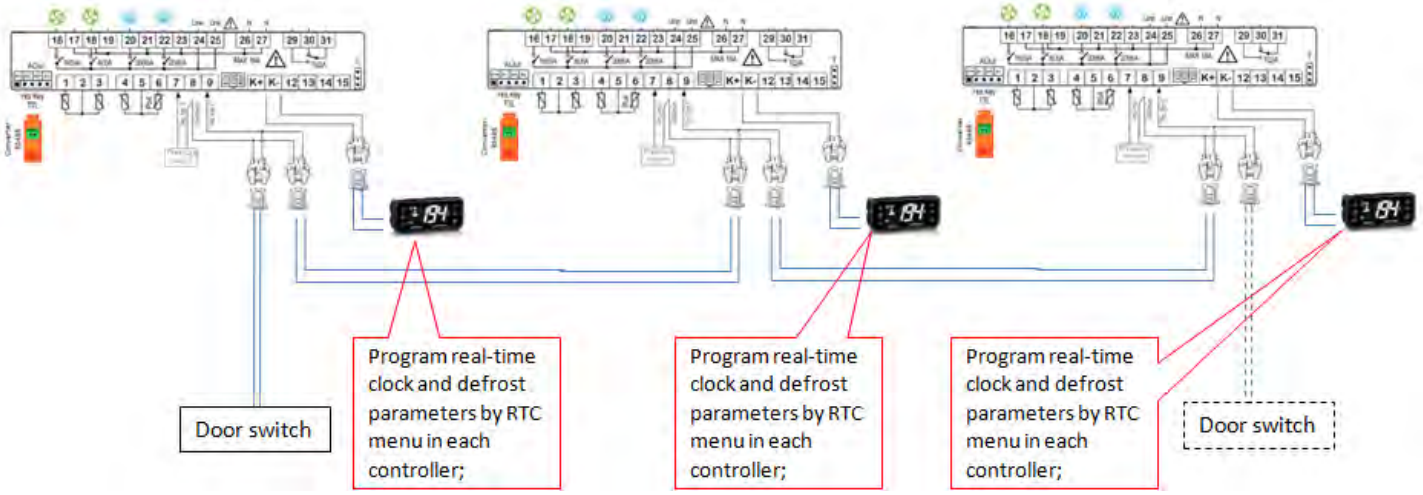


Figure 21 – Defrost Synchronization by RTC for each Controller

3.7.4.2.5. Assembly with only Controller and without RTC

Similar to 3.5.2.3.3, the digital input (DI2 parameter) must be changed from "door switch (dor)" to "defrost synchronization (dEF)." Go to parameter "i1F" by the digital input menu "inP." In this case, the door switch alarm will disable (Figure 22).

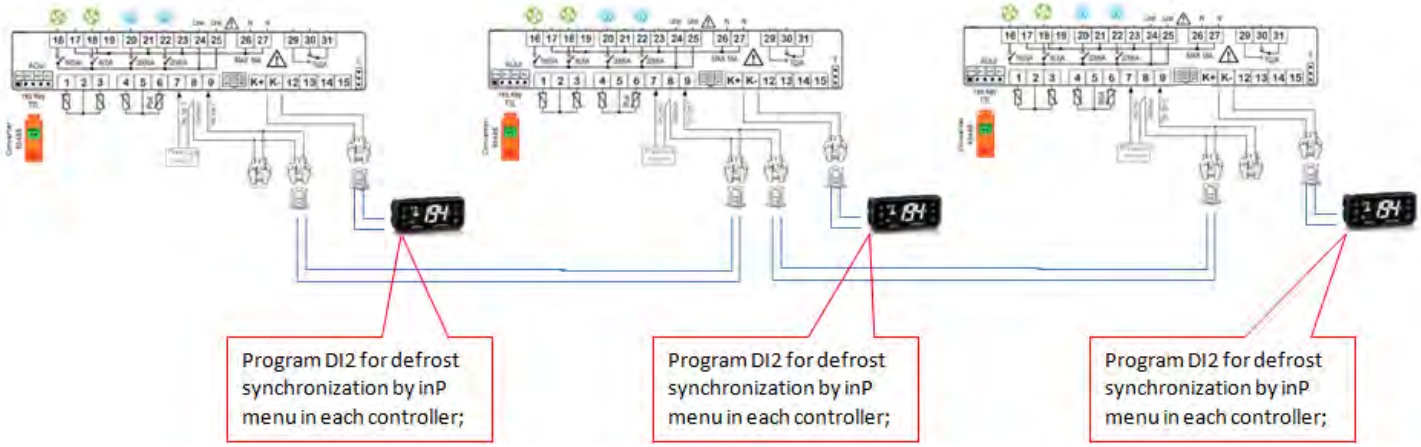


Figure 22 – Defrost Synchronization by DI2 for each Controller

3.7.4.3. Server

The server / supervisor system must be connected in the RS485 master terminal. The compatible Dixell XWEB 500E model is recommended but other options can be evaluated by the contractor due to the number of interfaces and features required. Follow the server manufacture instructions for correct operation.

3.7.4.4. Temperature sensors

The unit is equipped with 3 temperature sensors type NTC 10kΩ (@ 25° C), Dixell model NS6-BN01000150. Each sensor location and functionality is explained in Table 13 below. In case of servicing or replacing probes, keep the correct positioning.

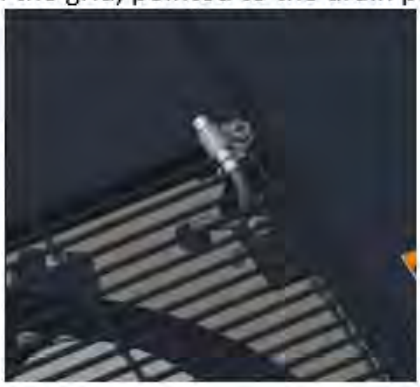
Sensor #	Function	Position
Probe 1	Air return temperature (room temperature)	On the grid, pointed to the drain pan 
Probe 2	Defrost sensor: circuit 2	On the evaporator outlet tube, equalization "T" region 
Probe 3	Defrost sensor: circuit 1	

Table 13 – Temperature Probes Positioning

4. Operation, Servicing, and Disposal

This equipment is designed for walk-in coolers and requires horizontal surface installation only (roof mounted). Pay attention to the safety instructions and information available in the package and refrigeration unit related to the handling, servicing and operation of products using flammable refrigerant (Figure 23).

Figure 23 – Warning Labels and its Position

This product is designed to operate exclusively with propane (R-290) refrigerant. It is recommended to have fire extinguishers available near product installation. In order to reduce the risk of flame propagation, the product must remain free of combustible materials such as plastics, paper, oil, solvents, and cotton waste.

⚠ WARNING

RISK OF FIRE OR EXPLOSION

Do not apply refrigeration units that use hydrocarbon fluids in places that have flames or sparkling components.

- This product is designed to operate in locations where the risk of sparks or flames is prevalent.

⚠ WARNING

RISK OF FIRE AND EXPLOSION

Do not use electrical appliances inside the food storage compartments of the appliance, unless they are of the type recommended by the manufacturer.

- Electrical equipment can generate sparks in normal operation and may become a source of ignition if refrigerant leakage occurs.

This product must be protected against weathering.
Follow the screw and nut torque specifications below.

Position	Screw diameter	Torque (in-lb)
Water side condenser connections, balance valves	3/4”-14NPT	1015 maximum
Water drain connection	3/4”-14NPT	350 maximum
ECM Kryo fan motor mounting screws	#8-36	40 maximum
ECM Kryo fan motor shaft nuts	1/4”-20 HEX	20-24
Structures, assemblies, covers	M4, M5	15-20

Table 14 – Torque Specifications

4.1. Cleaning

It is important to perform periodic maintenance with this equipment (i.e., every three (3) months). Evaluate extending or reducing the cleaning periods and maintenance with visual observation.

Avoid dust accumulation. Do not apply solvents, soaps, alcohols, or chemicals that may react with the components of the refrigeration system. These chemicals may become combustible under certain temperature and humidity conditions. For external cleaning (region of the cooling system), use only a duster.

⚠ WARNING

RISK OF ELECTRICAL SHOCK

Carefully follow electrical installation instructions and electrical safety recommendations to avoid risk of electrical shock during installation, use or maintenance.

- Turn off and disconnect the product from the power supply before cleaning.

⚠ WARNING

RISK OF FIRE AND EXPLOSION

Do not use a vacuum cleaner to clean the product. It has a motor with brushes that generate sparks during normal operation and may form an unsafe condition if there is a flammable mixture.

- Do not use a vacuum cleaner or any other electrical appliance that is not designed to operate around flammable refrigerants since the system is susceptible to sparks during operation. In the case of leakage, a flammable mixture may occur.

-Never use mechanical devices to defrost refrigerating units.

-Do not puncture refrigerant tubes.

4.2. Maintenance

Technicians must be properly qualified to conduct maintenance in refrigeration systems with flammable refrigerants. Strictly follow the work instructions:

- Maintain a periodic cleaning program for the equipment. Initially, it is recommended to evaluate the operating condition of the system every three (3) months. Based on observed conditions, evaluate the possibility of extending or reducing the period for maintenance.

- Every three (3) months, perform a detailed inspection to identify potential refrigerant leaks. The presence of oil is a signal for refrigerant leakage.

- In the event repairs are needed to the system, determine a specific location to work with the cooling system that is suitable to handle flammable refrigerant equipment. The working area must be free of ignition sources, and the area should be well ventilated. Fire extinguishers should be available and easily accessible.

- Monitor the working area using a hydrocarbon detector (HC) located at a low level (hydrocarbons are denser than air). The detector shall provide an audible and visual alarm before there is sufficient hydro carbon in the air to form a flammable mixture (approximately 2% of hydrocarbon by volume).

- When replacing or servicing electrical components in a system that uses flammable refrigerants, make sure that all components comply with IEC / UL 60079-15.

- Component parts shall be replaced with like components with servicing done by factory authorized service personnel. This ensures risk of possible ignition due to incorrect parts or improper service is minimized.

- Remove refrigerant with a recovery machine suitable for flammable fluids. Do not use a blowtorch to remove pipes or cut with a pipe cutter. Process tubes suitable for service are marked in red.

- Repair unit and reduce inspection interval to one (1) month until to ensure reprocessing is effective.

- Use the correct tools and equipment.

- Use only tools and equipment certified for use in hazardous areas and use an anti-static bracelet to avoid static electricity.

4.3. Disassembly and Disposal

Always transport the products in its original packaging (if not possible, develop a solution to safely transport the product).

- After completing the cycle of using the Krack MicroDS system, set an appropriate destination for it.
- Do not reuse components or restore the unit without a thorough analysis of the usage for each component.
- Use appropriate packaging (robust and ventilated) to transport units from installation site to the repair or disassembly area.
- Never dispose refrigeration systems in normal trash.
- Remove the refrigerant from the system with proper precautions.
- Disassemble cooling system and corresponding equipment.
- Separate materials according to its characteristic and recycling are encouraged.
- Properly dispose refrigerant, oil, and other materials to appropriate collection stations.
- Follow all federal and / or local regulations regarding disposal of flammable refrigerant equipment.

4.4. In Case of Failure

Call an authorized technician to assess whether failure is related to maintenance, component issues (i.e., fans, water pumps, etc.), or refrigerant leakage. In the event the issue is system related, the technician must turn off equipment, remove, and send in appropriate packaging to a suitable location for analysis and maintenance. If available, request replacement product to operate walk-in cooler during maintenance of equipment.

4.5. Inappropriate Use

Krack MicroDS systems are not designed for pull-down. Goods must be loaded at the proper temperature and pre-cooled prior to being loaded into the walk-in room that is equipped with either the Krack MicroDS systems. Using Krack MicroDS systems for operations other than those specified may cause damage to equipment, goods, or personnel.

4.6. Troubleshooting

Note: Only Qualified Personnel Can Carry Out the Recommendations Below:

Problem	Probable Cause	Solution
Product Does Not Operate	No Power.	Check supervisory system or circuit breaker of the electrical installation. Check if plug is connected to power supply.
	Low voltage. Compressor and fans will shut off or not operate correctly.	Check electrical wiring impedance. Evaluate the need to correct voltage via stabilizer.
	Wrong or damaged electrical connection.	Check electrical connections and replace damaged components (i.e., electrical connectors). Follow manufacturer's recommendations.
	Fault or flow reduction in water supply (MicroDS water cooled versions).	Check water loop system to ensure proper water flow to system condensers.
Abnormal Noise	Presence of loose elements in refrigeration unit or on cabinet ceiling.	Check installation site. Fix and dispose of any loose parts.
	Dirty and blocked heat exchangers resulting in actuating of thermal protector.	Review preventive maintenance schedule and clean condenser to remove dirt or particles. Check display faults in supervisory system.
	Fan motor with excessive wear or propeller in contact with external elements.	Disconnect the blade from the fan motor. Replace motor if necessary
Insufficient Cooling	Dirty and blocked heat exchangers, leading to the thermo cut-off or high pressure switch to actuate	Review preventive maintenance schedule and clean condenser to remove dirt or particles. Check display faults in supervisory system.
	Fault or flow reduction in water supply (MicroDS water cooled versions).	Check water loop system to ensure proper water flow to system condensers.
	Refrigeration Leaks	Call authorized service center to evaluate if unit replacement is required. Ventilate location before installing and connecting new equipment. Open unit room doors for at least 5 minutes to eliminate possibility of refrigerant accumulation inside cabinet.
	Excessive ice formation on evaporator.	Review defrost logic and parameters.
		Check defrost synchronization connections to avoid communication errors between controllers or supervisors.
		Check defrost water drain is not clogged.
		Check proper operation of the water inlet solenoid valve.
External Condensation	High ambient air humidity, normal in certain climates and times of the year.	Install product in a ventilated place. Dry with soft cloth.
	Lack of proper sealing between gasket and cabinet.	Replace gasket.

For more information about natural refrigerant usage, visit http://naturalrefrigerants.info/.

4.7. List of parameters for Dixell XWi70K

Menu	Description	Label	MBP versions	LBP versions
Regulation - **rEG**	Set point	SEt	35	-5
	Minimum Set point	LS	-30	-30
	Maximum Set point	US	60	20
	Compressor regulation differential in normal mode	Hy	3	2
	Variable Speed Compressor Differential in normal mode	Hy1	1	3
	Output activation delay at start-up	odS	0	0
	Anti-short cycle delay	AC	2	2
	Anti-short cycle delay (2nd compressor)	AC1	0	0
	Activation mode for 2nd compressor: HAF=step logic; FUL=delayed	2CC	FUL	FUL
	Enable compressor rotation	rCC	No	No
	Maximum time with compressor on (0=disabled)	MCo	0	0
	Regulation percentage=F(P1; P2) (100=P1; 0=P2)	rtr	100	100
	Maximum duration for Pull Down	CCt	02:00	04:00
	Pull Down phase differential (SET+CCS or SET+HES+CCS)	CCS	5	2
	Threshold for automatic activation of Pull Down in normal mode (SET+HY+oHt)	oHt	5	10
	Compressor ON time with faulty probe	Con	30	30
	Compressor OFF time with faulty probe	CoF	10	10
Probe - **Prb**	Probe selection	PbC	ntC	ntC
	Probe P1 calibration	ot	0	0
	Probe P2 presence	P2P	Yes	Yes
	Probe P2 calibration	oE	0	0
	Probe P3 presence	P3P	yes	yes
	Probe P3 calibration	o3	0	0
	Probe P4 presence	P4P	no	no
	Probe P4 calibration	o4	0	0
Velocity speed drive - **vSC**	Minimum value for Variable Speed Compressor (RPM * 10)	FMi	160	160
	Maximum value for Variable Speed Compressor (RPM * 10)	FMA	500	500
	Minimum value for Variable Speed Compressor in energy saving mode (RPM * 10)	EMi	160	160
	Maximum value for Variable Speed Compressor in energy saving mode (RPM * 10)	EMA	500	500
	Output value when Variable Speed Compressor is OFF	Fr0	0	0
	PI regulator: temperature sampling time	tSt	01:00	00:40
	PI regulator: integral sampling time	iSt	10:00	04:00
	Type of Variable Speed Compressor	vdC	vC1	vC1
	Signal output variation for Variable Speed Compressor	voS	3	4
	Signal output variation for Variable Speed Compressor	vo2	5	5
	Signal output variation for Variable Speed Compressor	vo3	10	10
	Variable Speed Compressor (in percentage) during any Pull Down	PdP	100	100
	Compressor speed (in %%) in case of any probe error during Con interval	SPi	80	80

	Compressor speed (in %%) during any defrost cycle (valid if tdf=in)	Aod	100	100
	Compressor speed during any pre-defrost phase (valid if tdf=in)	AoF	100	100
	PI regulator: max interval for output variation	tHv	20	120
	PI regulator: min interval for output variation	tLv	5	5
	PI regulator: range for output value calculation (RPM * 10)	rSr	140	20
	PI regulator: delay before range drift	Str	20	60
	PI regulator: divisor for PI response time reduction (acts on both par. tSt and iSt)	dPt	2	5
	Continuous control ON in normal mode	CMn	Yes	Yes
	Continuous control ON in energy saving	CME	Yes	Yes
	Compressor speed threshold to activate lubrication	MnP	Nu	Nu
	Time range with compressor speed below MnP to activate lubrication cycle	tMi	00:00	00:00
	Time range with compressor speed at 100%% to activate lubrication cycle	tMA	0	0
	Number of serial controlled compressors	A00	2	2
	Serial address for compressor 1	A01	1	1
	Serial address for compressor 2	A02	2	2
Display - **diS**	Temperature measurement unit: Celsius; Fahrenheit	CF	°F	°F
	Temperature resolution: decimal, integer	rES	dE	dE
	Remote keyboard visualization	rEd	P1	P1
	Temperature display delay (resolution 10 sec)	dLy	00:00	00:00
	Probe visualization percentage	dtr	99	99
Defrost - **dEF**	Defrost mode: in=fixed intervals; rtC=following real time clock	Edf	rtC	rTC
	Defrost type: electric heating, hot gas	tdF	In	in
	Probe selection for defrost control	dFP	P3	P3
	Probe selection for 2nd defrost control	dSP	P2	P2
	End defrost temperature	dtE	55	55
	End 2nd defrost temperature	dtS	55	55
	Interval between two successive defrost cycles	idF	4	4
	Maximum length of defrost cycle	MdF	30	30
	Maximum length of 2nd defrost cycle	MdS	30	30
	Start defrost delay	dSd	0	0
	Compressor off-cycle before starting any defrost	StC	0	0
	Displaying during defrost	dFd	dEF	dEF
	Displaying during defrost	dAd	10	10
	Draining time	Fdt	5	15
	Drain heater enabled after draining time (par. Fdt)	Hon	0	5
	Sampling time to calculate the average compressor speed before any desfrost cycle	SAt	8	8
	Defrost cycle enebled at stat-up	dPo	No	No
	Pre-defrost time	dAF	0	0
	Automatic defrost (at the beginning of any energy saving)	od1	No	No
	Optimized defrost	od2	No	No
	Tipe of synchronized defrost	Syd	nU	nU

	Differential temperature for latent heating control	dt1	0.3	0.3
	Number of connected controllers for random refrost (Syd=rnd)	ndE	1	1
Fan - **FAn**	Probe selection for evaporator fan	FAP	P3	P3
	Evaporator fan stop temperature	FSt	50	50
	Evaporator fan regulator differential	HyF	2	2
	Evaporator fan operating mode	FnC	O_n	O_n
	Evaporator fan delay after defrost cycle	Fnd	7	7
	Differential temperature for cyclic activation of evaporator fans (0=disabled)	FCt	0	0
	Evaporator fan ON time in normal mode (with compressor OFF)	Fon	0	0
	Evaporator fan OFF time in normal mode (with compressor OFF)	FoF	0	0
	Maintenance interval for evaporator fans (tens of hours)	LA1	0	0
	Maintenance function reset	rS1	No	No
	Probe selection for condenser fan	FAC	P1	P1
	Set Point 2 Regulation (for condenser fan)	St2	200	200
	Set Point 2 differential (for condenser fan)	Hy2	5	5
	Condenser fan operating mode	FCC	O_Y	O_Y
	Condenser fan deactivation delay	FCo	0	0
	Condenser fan working hours (x100) for maintenance alarm	LA2	0	0
	Condenser fan maintenance alarm reset	rS2	No	No
Alarm - **ALr**	Probe selection for temperature alarms	ALP	P1	P1
	Temperature alarms configuration: relative, absolute	ALC	rE	rE
	High temperature alarm	ALU	10	10
	Low temperature alarm	ALL	10	10
	Temperature alarm differential	AFH	2	2
	Temperature alarm delay	ALd	30	30
	Temperature alarm delay with open door	dot	10	0
	Temperature alarm delay at start-up	dAo	02:00	05:00
	Probe selection for 2nd temperature alarm	AP2	P3	P3
	2nd low temperature alarm	AL2	-20	-40
	2nd high temperature alarm	AU2	300	300
	2nd temperature alarm differential	AH2	5	5
	2nd temperature alarm delay	Ad2	0	0
	2nd temperature alarm delay at start-up	dA2	04:00	04:00
	Temperature alarm 2 disabled during every defrost and dripping phase	dE2	nU	nU
	Compressor OFF due to 2nd low temperature alarm	bLL	No	No
	Compressor OFF due to 2nd high temperature alarm	AC2	Yes	Yes
	Differential for anti-freezing control	SAF	6	6
	Alarm relay deactivation	tbA	Yes	Yes
	Buzzer muting	bUM	Yes	Yes
Output - **oUt**	Relay output oA1 configuration	oA1	Def	Cnd
	Relay output oA2 configuration	oA2	Fan	Fan
	Relay output oA3 configuration	oA3	CP1	CP1

	Relay output oA4 configuration	oA4	dF2	Cnd
	Relay output oA5 configuration	oA5	Cnd	Cnd
	Analogue output 1 configuration	1Ao	nU	nU
	Analogue output 2 configuration	2Ao	nU	nU
	Analogue output 3 configuration	3Ao	nU	nU
	Alarm relay polarity	AoP	CL	CL
Digital input - **inP**	Digital input 1 polarity	i1P	Op	Op
	Digital input 1 configuration	i1F	PAL	PAL
	Digital inputs 1 alarm delay (base time depends on par. ibt)	did	120	120
	Digital input 2 polarity	i2P	Op	Op
	Digital input 2 configuration	i2F	Dor	Dor
	Digital inputs 2 alarm delay (base time depends on par. ibt)	d2d	10	3
	Number of external pressure switch alarms before stopping the regulation	nPS	3	3
	Compressor and fan status after door opening	odC	No	CPr
	Regulation restart after door alarm	rrd	No	No
Real time Clock - **rtC**	Hours: 0 to 23 hours	Hur	---	---
	Minutes: 0 to 59 minutes	Min	---	---
	Day of the week: Sun to Sat	dAY	---	---
	Day of the month: 1 to 31	dYM	---	---
	Month: 1 to 12	Mon	---	---
	Year: 00 to 99	Yar	---	---
	First day of weekend: (Sun to SAt; nu) setting for the first day of the weekend.	Hd1	---	---
	Second day of weekend: (Sun to SAt; nu) setting for the second day of the weekend	Hd2	---	---
	Energy saving cycle starting time on working days	iLE	00:00	00:00
	Energy saving cycle duration on working days:	dLE	00:00	00:00
	Energy saving cycle starting time on weekends:	iSE	00:00	00:00
	Energy saving cycle duration on weekends	dSE	00:00	00:00
	Daily defrost enabled	dd1...dd6	no	no
	Defrost starting time:	Ld1...Ld6	nu	nu
Serial Com. - **CoM**	Serial address	Adr	1	1
	Baudrate	bAU	9.6	9.6
Info menu - **inF**	Probe P1 value visualization	dP1	0	0
	Probe P2 value visualization	dP2	0	0
	Probe P3 value visualization	dP3	0	0
	Probe P4 value visualization	dP4	0	0

5. Legal Concerns

All product, specifications, and information are subject to change without notice. Customers should always check for the latest updates on Krack.com (see QR code on the product) and with technical information before relying on this manual.

It is the responsibility of the Original Equipment Manufacturer (OEM) and authorized service personnel to validate this Hussmann product solution are suitable for the use in a customer's specific application. Hussmann does not certify the integration of its product (Krack MicroDS and the unit cooler room). This is a responsibility of the customer installing in the unit cooler room.

The parameters provided in the datasheets and/or specifications may vary in different applications. Product specifications are not extended or otherwise modified to bypass Hussmann's terms and conditions of purchase, including, but not limited to the expressed warranty.

Hussmann rejects any liability for damages caused by its products and/or applications that are installed or repaired by persons without training and/or in disagreement with these safety instructions.

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