

Full Example of ReFreeX™ Method

1. Content

1. Content
2. Introduction
 - 2.1. What is ReFreeX™?
 - 2.2. What is this example about?
 - 2.3. Disclaimer
3. The application
 - 3.1. Usage
 - 3.2. Main specification
 - 3.3. The ReFreeX refrigeration circuit
 - 3.4. Full specification
 - 3.5. Attachment list
 - 3.6. Cross reference
4. Patents, marks and contacts
 - 4.1. Patents
 - 4.2. Marks
 - 4.3. Contacts

2. Introduction

2.1. What is ReFreeX™?

It is a new and improved refrigeration method described elsewhere in the document D133V and D133W.

2.2. What is this example about?

This is a full example of a modern refrigeration plant built with the ReFreeX technology.
This example is meant to be understood by an experienced designer of refrigeration plants.

2.3. Disclaimer

The information herein provided is believed to be accurate and this specific refrigeration plant has been successfully installed and tested like several other similar plants but nor the author nor the company Micheletti Impianti do assume any responsibility for the information herein provided. This is a guidance example for expert designers of refrigeration plants to be used under their own responsibility with any eventual modification that can be required. Local regulation may impose different or additional safety devices.

3. The application

3.1. Usage

The refrigeration plant is to be used in a cold room for frozen food storage at -25°C .

3.2. Main specification

The refrigeration plant has a 30 hp compressor, air condensation and R404A refrigerant. Nominal cooling capacity is 9350 watt at -35°C evaporation and $+45^{\circ}\text{C}$ condensation.

3.3. The ReFreeX refrigeration circuit

The ReFreeX™ refrigeration system is a dry-expansion refrigeration system and includes a compressor, a condenser coil, and an evaporator coil. No liquid receiver is installed and no thermostatic valve is provided. Expansion is performed in the piping connecting the condenser to the evaporator. Regulation is performed by a plain solenoid valve, periodically pulsed on and off.

3.4. Full specification

Full specification is provided in the attached part list and in the other attached drawings.
Part list omits small components and complements like

- anchors
- fixings
- fittings
- bends
- siphons
- soldering alloy
- evaporator drain
- wiring materials

3.5. Attachment list

- attachment 1: part list
- attachment 2: circuit drawing
- attachment 3: electric board
- attachment 4: electric plant
- attachment 5: controller wiring
- attachment 6: user manual

3.6. Cross reference

- doc D133V - ReFreeX Refrigeration Method: an explanation of method and principles
- doc D133W - Economical Analysis of ReFreeX Method: cost comparison versus the traditional method

4. Patents, marks and contacts

4.1. Patents

European patent nr. 04425426.6 is pending.

USA patent nr. US10/956,297 is pending.

PCT patent deposited with international application number PCT/IT/2005/000268.

4.2. Marks

ReFreeX USA mark application filed with serial nr. 78509794 .

4.3. Contacts

Please contact

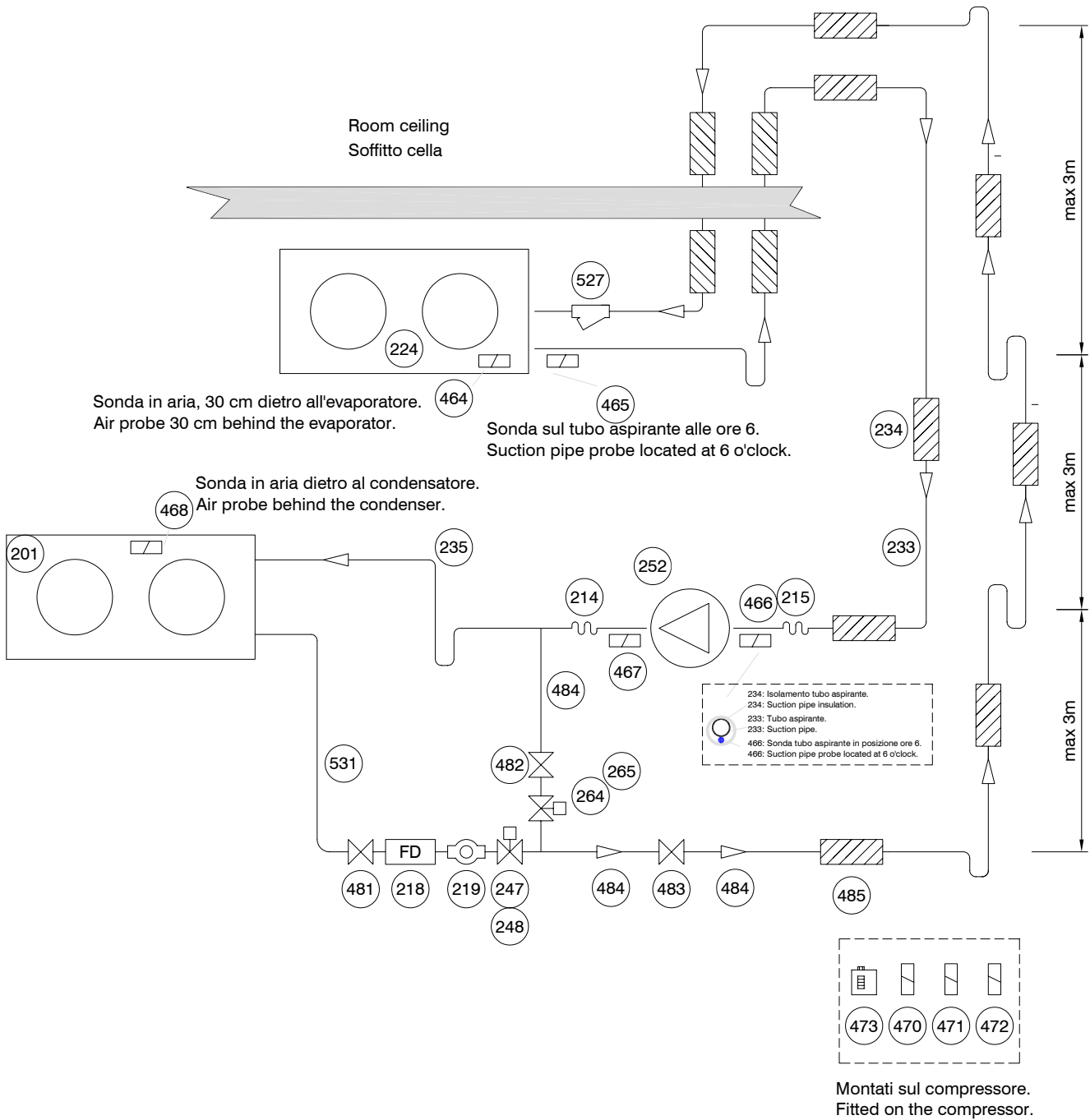
Micheletti Impianti
C.ne Appia, 33
00179 Roma
Italy

www.micheletti.org

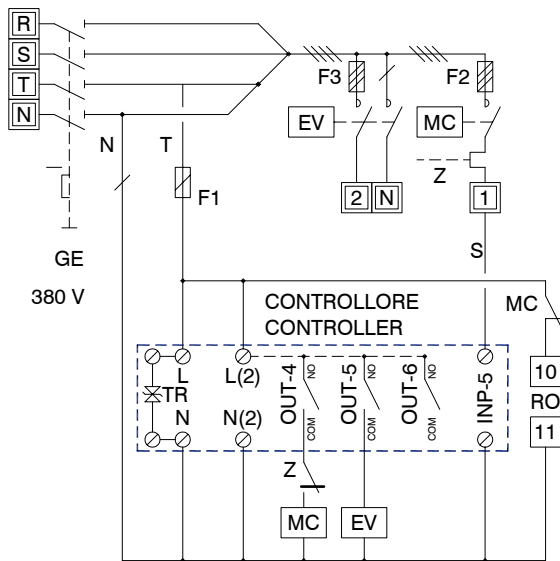
Mr. Emidio Barsanti
Phone nr. +39 06 7883363
Fax nr. +39 06 789716
E-mail Emidio.Barsanti@micheletti.org

Code	Component	Qty	Unit	Description
252	compressor	1	pc	Bitzer 4G-30.2Y - 30 hp - 84.5 m ³ /h - semi-hermetic reciprocating compressor
208	crankcase oil heater	1	pc	Bitzer 140 w oil heater
522	mc electric box heater	1	pc	heating cable - 50 cm - 30 ohm - 12 V - 5 w
214	vibration isolator	1	pc	vibration isolator D22 mm
215	vibration isolator	1	pc	vibration isolator D42 mm
472	oil probe	1	pc	0...30 bar - 4...20 mA pressure probe
470	lp probe	1	pc	0...30 bar - 4...20 mA pressure probe
471	hp probe	1	pc	0...30 bar - 4...20 mA pressure probe
466	suction temp probe	1	pc	ntc ss141 25°C 10kohm 1% stainless case - 3m silicon cable (standard ntc)
467	discharge temp probe	1	pc	ntc ss141 25°C 10kohm 1% stainless case - 3m silicon cable (standard ntc)
473	fixed hp switch	1	pc	Danfoss-Saginomyia mini pressure switch ACB 28/21 bar
235	discharge line	15	m	copper piping D22x1 mm
201	condenser	1	pc	LU-VE SHVN 38/1 - phi 2x2x350mm - 36.4 kw at dT=15K
468	condenser air temp probe	1	pc	ntc ss141 25°C 10kohm 1% stainless case - 3m silicon cable (standard ntc)
531	liquid line from condenser	15	m	copper piping D12x1 mm
481	liquid line shut-off	1	pc	ball shut-off D12 mm
218	filter drier	1	pc	Danfoss DML84S D12 mm - drying 8g H ₂ O at +52°C and 30ppm
219	sight glass	1	pc	Danfoss SGN12S D12 mm - showing H ₂ O at 25...100 ppm
247	liquid solenoid valve body	1	pc	EVR6 NC D12 - min dp=0.05 bar - kv=0.8 m ³ / h of H ₂ O at dp=1 bar
248	liquid solenoid valve coil	1	pc	Danfoss coil NC 230 V-50 Hz-10 w-21 VA - IP67 - 1 m cable
483	liquid/hot gas shut-off	1	pc	ball shut-off D16 mm
482	hot gas shut-off	1	pc	ball shut-off D16 mm
264	hot gas solenoid valve body	1	pc	Danfoss EVR10 NC D16 - min dp=0.05 bar - kv=1.9 m ³ / h of H ₂ O at dp=1 bar
265	hot gas solenoid valve coil	1	pc	Danfoss coil NC 230 V-50 Hz-10 w-21 VA - IP67 - 1 m cable
484	liquid/hot gas line	30	m	copper piping D16 mm
485	liquid/hot gas line insulation	30	m	armaflex-like mm 16 x 9
527	refrigerant net filter	1	pc	Y filter - D16 mm
224	evaporator without defrost	1	pc	LU-VE S3HC 284 N80 - phi 4x350mm - 15.8 kw dry at TC=0° C and dT1=8K
512	evaporator drain tray heater	3	pc	heating cable - 10 m - 650 ohm - 230 V - 80 w
464	room air temp probe	1	pc	ntc ss141 25°C 10kohm 1% stainless case - 3m silicon cable (standard ntc)
465	defrost temp probe	1	pc	ntc ss141 25°C 10kohm 1% stainless case - 3m silicon cable (standard ntc)
233	suction line	30	m	copper piping D42x1 mm
234	suction line insulation	30	m	armaflex-like mm 42 x 13
237	refrigerant gas	4	kg	R404A refrigerant
238	lubricating oil	-	kg	ester oil already present in the compressor crankcase
232	electric board	1	pc	30 hp ReFreeX electric board
461	master controller	1	pc	ReFreeX master controller
460	slave controller (mc side)	1	pc	ReFreeX slave controller
460	slave controller (room side)	1	pc	ReFreeX slave controller
475	door limit switch	1	pc	metal case limit switch with adjustable wheel arm

SCHEMA FRIGORIFERO MICRO SBR GAS CALDO REFRIGERATING CIRCUIT - HOT GAS DEFR - MICRO



QUADRO 1...80 HP MICRO BOARD 1...80 HP MICRO



	LEGENDA	LEGEND
EV	FRIGODIFFUSORE	EVAPORATOR
MC	MOTOCOMPRESSORE	MOTORCOMPRESSOR
RO	RISCALDAMENTO OLIO	OIL HEATER
TR	FILTRO P1.5KE400CA	FILTER P1.5KE400CA

IMPIANTO ELETTRICO 1...80 HP SBR. G.C. - MICRO ELECTRIC PLANT 1...80 HP H.G. DEFR. - MICRO

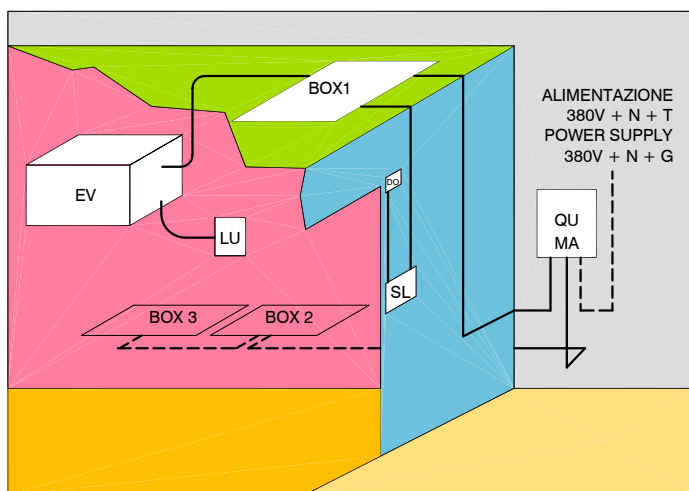
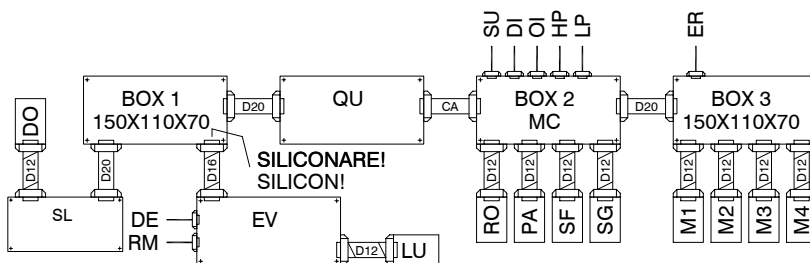
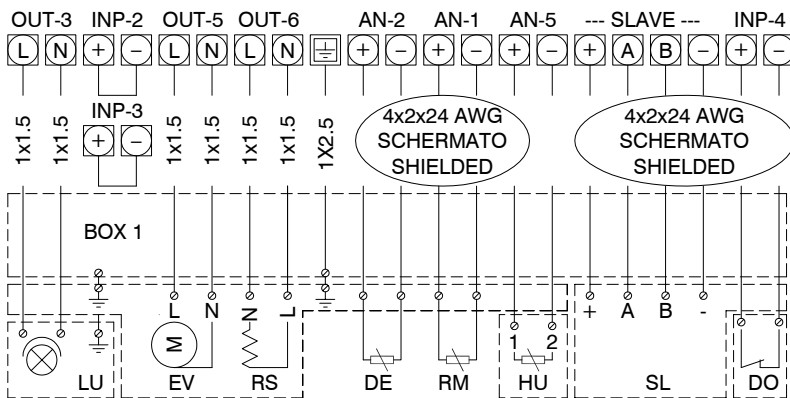
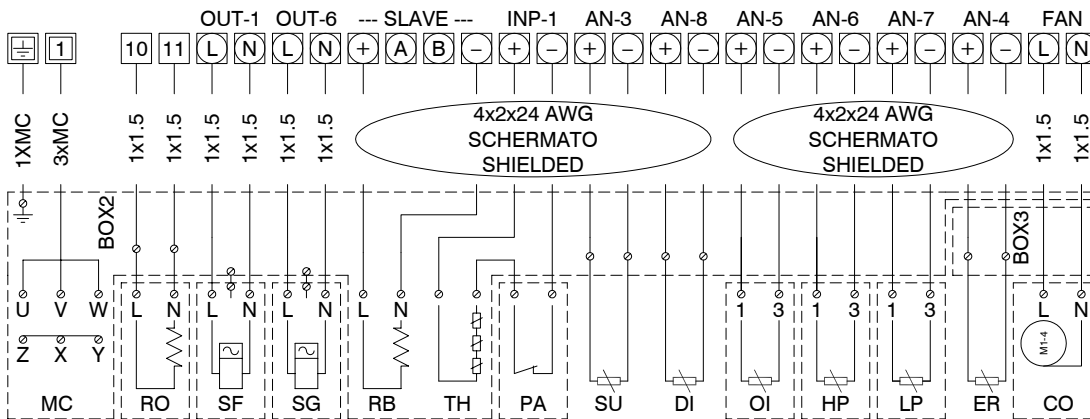
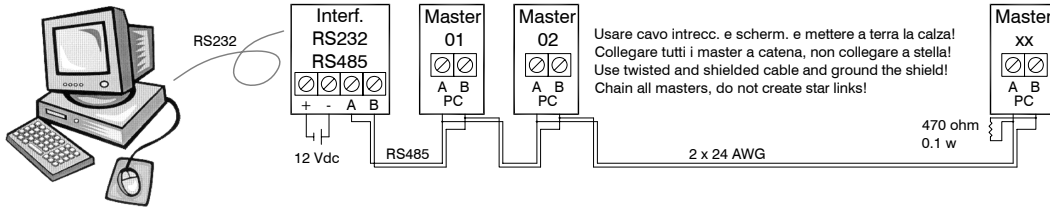
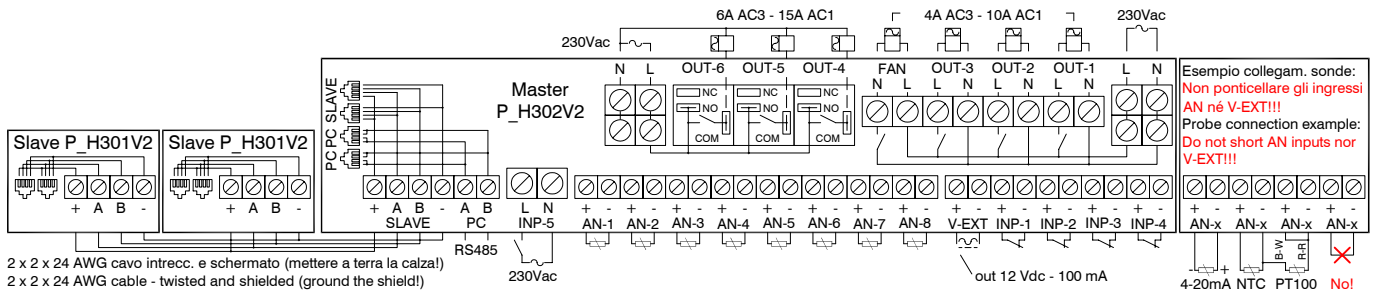


Tabella sezioni Wire and pipe table		
MC hp	MC mm ²	CA mm
7,5	2,5	25
10	4	25
15	6	32
20	10	32
25	10	32
30	16	32
35	16	40
40	25	40
50	25	40
60	35	40
70	50	50
80	50	50

	Legenda	Legend
CO	condensatore	condenser
DE	temperatura sbrinam	defrost temperature
DI	temperatura premente	discharge temperat
DO	microswitch porta	door switch
DS	sicurezza sbrinamento	defrost safety
ER	temperat aria ingr CO	CO air inlet temperat
EV	frigodiffusore	evaporator
HP	alta pressione	high pressure
HU	umidità	humidity
LP	bassa pressione	low pressure
LU	illuminazione	lighting
MA	controllore master	master controller
MC	motocompressore	motorcompressor
OI	pressione olio	oil pressure
PA	pressostato alta	high pressure switch
QU	quadro elettrico	electric board
RB	riscaldam scatola mc	mc box heater
RM	temperat aria ingr EV	EV air inlet temperat
RO	riscaldamento olio	oil heater
RS	risc sc con e piatto	drain pipe and tray
SF	solenoido liquido	liquid solenoid
SG	solenoido gas caldo	hot gas solenoid
SL	controllore slave	slave controller
SU	temperatura aspirante	suction temperature
TH	sonde termistori MC	thermistor probes
☐	morsetto QU	QU terminal
☐	mors. potenza QU	QU power termin.
☐	morsetto MA	MA terminal

Note:	Remarks:
Se manca il cavo giallo-verde per la terra del compressore, usare del cavo colorato e segnarlo con il nastro g-v.	If there is no green-yellow wire for compressor ground, use the coloured one and mark it with the g-y tape.
Per frigodiffusori trifase collegare INP-2 al termico e portare 3 cavi da 1.5 mm ² per le ventole.	For triphases evaporators connect thermal safety to INP-2 and connect the fans with 3 x 1.5 mm ² wires.
La resistenza nello scarico condensa e nel piatto evaporatore è installata solo nelle celle negative.	Drain tray and drain pipe resistances are installed in low temperature rooms only.
I compressori senza pompa olio non hanno la sonda olio.	Compressor without oil pump do not have oil probe.

COLLEGAMENTI PER CONTROLLORI MI MI CONTROLLER WIRING



Input analogici del master / Master analog inputs

Modello Model	AN-1	AN-2	AN-3	AN-4	AN-5	AN-6	AN-7	AN-8
5xNTC+3x20 mA	ntc	ntc	ntc	ntc	mA	mA	mA	ntc

Note	Parameter	Description	Range	Default	Unit
	S__	Functions about storage	/	/	/
	St_	Functions about storage temperature	/	/	/
	_t0	storage room temperature	_tL ... _tH	2	°C
	_tb	room temperature dead band	0 ... 99	0	°C
	_td	room temperature differential	0 ... 99	0,2	°C
	_tH	maximum room temperature set	-55 ... 145	45	°C
	_tL	minimum room temperature set	-55 ... 145	55	°C
	_i0	storage room humidity	_iL ... _iH	85	%
	_ib	room humidity dead band	0 ... 99	0	%
	_id	room humidity differential	0 ... 99	5	%
	_iH	maximum room humidity set	0 ... 100	100	%
	_iL	minimum room humidity set	0 ... 100	0	%
	SA_	Functions about air renew during storage	/	/	/
	SAH	enable air renew during storage	oFF / on_	oFF	/
	SA0	immediate delay before first air renew	dd:hh:mm:ss	0	h
	SAd	on-time duration in the air renew cycle	dd:hh:mm:ss	30	min
	SAP	period of air renew cycle	dd:hh:mm:ss	12	h
	SAh	enable forced air renew by keyboard short cut	oFF / on_	on_	/
	SAF	forced air renew duration	dd:hh:mm:ss	30	min
	SAo	start / stop forced air renew	oFF / on_	oFF	/
	Fd_	Functions about defrost duration and timing	/	/	/
	Fd0	immediate delay before next defrost	dd:hh:mm:ss	0	min
	Fdd	on-time duration of the defrost	dd:hh:mm:ss	30	min
	Fdg	dripping time after defrost	dd:hh:mm:ss	2	min
	FdE	evaporator fan activation delay after the defrost	dd:hh:mm:ss	2	min
(1)	FdP	overall period of the defrost (time between two consecutive starts or stops)	dd:hh:mm:ss	4	h
	Fd1	evaporator fan pulse duration (0.005 s units - select 0 for no pulse during defrost)	0 ... 255	0	par
	Fd2	evaporator fan pulse period	dd:hh:mm:ss	1	min
	FF_	Functions about forced defrost	/	/	/
	FFh	enable forced defrost by keyboard short cut	oFF / on_	on_	/
	FFd	forced defrost duration	dd:hh:mm:ss	30	min
(2)	FFo	start immediate forced defrost	oFF / on_	oFF	/
	FP_	Functions about defrost preference	/	/	/
	FPt	defrost type: 0=none / 1=pause / 2=air / 3=electric / 4=hot gas / 5=heat pump	0 ... 5	2	par
	Ft_	Functions about defrost temperature	/	/	/
	Ftt	defrost probe stop temperature	-55 ... +145	6	°C
	M__	Functions about compressor	/	/	/
	MU_	Functions about pressure switches	/	/	/
	MLH	low pressure safety restart (similar to Danfoss KP15 lp set point)	0 ... 30	1,2	bar
	MLL	low pressure safety stop (similar to Danfoss KP15 lp set point - differential)	0 ... 30	0,2	bar
	MHH	high pressure safety stop (similar to Danfoss KP15 hp set point)	0 ... 30	16,0	bar
	MHL	high pressure safety restart (similar to Danfoss KP15 hp set point - differential)	0 ... 30	14,0	bar
(3)	MUO	minimum oil differential pressure	0 ... 30	2,0	bar
(4)	MUU	pump down	oFF / on_	oFF	/
	H__	Heating	/	/	/
	HP_	Heating preference	/	/	/
	HPP	heating method: 0=none / 1=electric / 2=hot gas / 3=heat pump	0 ... 3	0	par
	HPF	heating source: 0=dedicated heating / 1=defrost / 2=light	0 ... 2	0	par
	U__	Dehumidification	/	/	/
	UP_	Dehumidification preference	/	/	/
	UPP	concurrent refrigeration and heating / alternate refrigeration and heating	con / ALt	con	/
(5)	UP1	during concurrent run force active: refrigeration / heating	rEF / HEA	rEF	/
	n__	Functions about fans	/	/	/
	nc_	Functions about condenser fans	/	/	/
	ncH	enable condenser fans when compressor is off and discharge pressure is over maximum	oFF / on_	on_	/
(6)	ncr	enable condenser fans speed regulation	oFF / on_	oFF	/
	ncU	fan minimum speed	0 ... 255	128	par
	ncd	minimum pressure difference between discharge and suction	0 ... 30	2,0	bar
	n1H	fan 1 start pressure (similar to Danfoss KP5 set point) - active just when ncr is oFF	0 ... 30	10,0	bar
	n1L	fan 1 stop pressure (similar to Danfoss KP5 set point - differential)	0 ... 30	6,0	bar
	nE_	Functions about evaporator fans	/	/	/
	nEH	enable evaporator fans when refrigeration is off	oFF / on_	oFF	/
	c__	Functions about door and light	/	/	/
	cP_	door switch and evaporator fan	/	/	/
	cPH	stop evaporator fans when door is open	oFF / on_	on_	/
	cPF	pause defrost timer when air defrost is suspended by evaporator fan stop	oFF / on_	on_	/
	cPd	delay of fan automatic switch on	dd:hh:mm:ss	30	min
	cl_	Functions about light	/	/	/
(7)	clH	switch on the light when the door is open and off when closed	oFF / on_	on_	/

(8)		clo	switch off the light automatically if it has been switched on from outside	oFF / on_	on_ /	
		clD	delay of light automatic switch off	dd:hh:mm:ss	30	sec
	v__		Functions about electronic expansion valve	/	/ /	
		vP_	Functions about electronic expansion valve preference	/	/ /	
(9)		vPH	enable electronic expansion valve	oFF / on_	on_ /	
		vPP	refrigerant gas type: 0=R134A / 1=R404A	0 ... 1	0	par
		vt_	Functions about electronic expansion valve temperature	/	/ /	
(10)		vt	wanted overheating (similar to Danfoss thermostatic overheating spring regulation)	0 ... 99	8,0	°C
(11)		vtH	maximum overheating	0 ... 99	12,0	°C
(12)		vtL	minimum overheating	0 ... 99	6,0	°C
		vtU	maximum pressure allowed in the suction line (similar to Danfoss MOP)	0 ... 30	10,0	bar
		vd_	Functions about electronic expansion valve timing	/	/ /	
(13)		vd1	on-off duty cycle duration	dd:hh:mm:ss	15	sec
(14)		vd2	on duty cycle duration when refrigeration starts (set to 0 to remember previous stop value)	dd:hh:mm:ss	2	sec
(15)		vdd	on duty cycle adaptation speed (low value for slow adaptation and small swinging)	1 ... 255	8	par
	b__		Functions about probes	/	/ /	
		b1_	Probe nr. 1	/	/ /	
		b1C	calibration offset of analog input 1 (temperature)	-99 ... 99	0,0	°C
		b1A	use probe to calculate room temperature	oFF / on_	on_ /	
		b2_	Probe nr. 2	/	/ /	
		b2C	calibration offset	-99 ... 99	0,0	°C
		b2A	use probe to calculate defrost temperature	oFF / on_	on_ /	
		b3_	Probe nr. 3	/	/ /	
		b3C	calibration offset	-99 ... 99	0,0	°C
		b3A	use probe to calculate suction line temperature	oFF / on_	on_ /	
		b4_	Probe nr. 4	/	/ /	
		b4C	calibration offset	-99 ... 99	0,0	°C
		b4A	use probe to calculate condenser air inlet temperature	oFF / on_	on_ /	
		b5_	Probe nr. 5	/	/ /	
		b5C	calibration offset	-99 ... 99	0,0	%
		b5A	use probe to calculate room humidity - connected to AN-5	oFF / on_	on_ /	
		b6_	Probe nr. 6	/	/ /	
		b6C	calibration offset	-99 ... 99	0,0	bar
		b6A	use probe to calculate discharge pressure	oFF / on_	on_ /	
		b7_	Probe nr. 7	/	/ /	
		b7C	calibration offset	-99 ... 99	0,0	bar
		b7A	use probe to calculate suction pressure	oFF / on_	on_ /	
		b8_	Probe nr. 8	/	/ /	
		b8C	calibration offset	-99 ... 99	0,0	°C
		b8A	use probe to calculate discharge line temperature	oFF / on_	on_ /	
		b9_	Probe nr. 9	/	/ /	
		b9C	calibration offset	-99 ... 99	0,0	bar
		b9A	use probe to calculate oil pressure - connected to AN-5	oFF / on_	oFF /	
	L__		Functions about alarm and stand-by	/	/ /	
		Lt_	Temperature alarm	/	/ /	
(16)		LtL	low temperature alarm set point	-55 ... 145	2	°C
(17)		LtH	high temperature alarm set point	-55 ... 145	14	°C
		Ltd	alarm delay	dd:hh:mm:ss	30	min
		LF_	Full stop temperature alarm	/	/ /	
		LFL	low temperature alarm set point	-55 ... 145	5	°C
		LFH	high temperature alarm set point	-55 ... 145	20	°C
		LFd	alarm delay	dd:hh:mm:ss	30	min
		Li_	Humidity alarm	/	/ /	
		LiL	low humidity alarm set point	0 ... 100	0	%
		LiH	high humidity alarm set point	0 ... 100	100	%
		Lid	alarm delay	dd:hh:mm:ss	30	min
		Lj_	Full stop humidity alarm	/	/ /	
		LjL	low humidity alarm set point	0 ... 100	0	%
		LjH	high humidity alarm set point	0 ... 100	100	%
		Ljd	alarm delay	dd:hh:mm:ss	30	min
		LO_	Door alarm	/	/ /	
		LOH	enable door alarm	oFF / on_	on_ /	
		LOd	door alarm delay	dd:hh:mm:ss	30	min
		LOt	temperature alarm minimum delay after door opening	dd:hh:mm:ss	15	min
		LL_	Other alarm inputs	/	/ /	
		L1H	enable digital input 1 alarm (compressor safety devices)	oFF / on_	on_ /	
		L1d	digital input 1 alarm delay	dd:hh:mm:ss	30	min
		L2H	enable digital input 2 alarm (defrost safety thermostat)	oFF / on_	on_ /	
		L2d	digital input 2 alarm delay	dd:hh:mm:ss	30	min
		L3H	enable digital input 3 alarm (heating safety thermostat)	oFF / on_	on_ /	
		L3d	digital input 3 alarm delay	dd:hh:mm:ss	30	min
		L5H	enable digital input 5 alarm (compressor phase monitor / thermal overload relay)	oFF / on_	on_ /	

	L5d	digital input 5 alarm delay	dd:hh:mm:ss	1	sec
	Lo_	On / stand-by status	/	/	/
	Loo	actual status: stand-by or on	SbY / on_	SbY	/
d_		Functions about delays	/	/	/
	dF_	Delay from previous stop	/	/	/
	dF4	delay from stop to activation of relay nr. 4: compressor	dd:hh:mm:ss	5	min
P_		Functions about master preferences	/	/	/
	Pd_	Functions about network address	/	/	/
	PdM	master address for global network communication	0 ... 254	1	par
	PdS	number of slaves connected to this master	1 ... 2	1	par
	PO_	Output assignment	/	/	/
	PO2	assign out-2 relay to: 0=alarm / 1=heating / 2=humidifier / 3=air renew	0 ... 3	0	par
I_		Functions about input-output and machine state (read only)	/	/	/
	IA_	Analog input	/	/	/
	IA1	analog input 1 (temperature)	-55 ... +145	/	°C
	IA2	analog input 2 (defrost temperature)	-55 ... +145	/	°C
	IA3	analog input 3 (suction temperature)	-55 ... +145	/	°C
	IA4	analog input 4 (engine room temperature)	-55 ... +145	/	°C
	IA5	analog input 5 (humidity)	0 ... 100	/	%
	IA6	analog input 6 (high pressure)	0 ... 30	/	bar
	IA7	analog input 7 (low pressure)	0 ... 30	/	bar
	IA8	analog input 8 (discharge temperature)	-55 ... +145	/	°C
	IA9	analog input 5 (oil pressure)	0 ... 30	/	bar
	Id_	Digital input	/	/	/
	Id1	digital input 1 (compressor hardware safety)	oFF / on_	/	/
	Id2	digital input 2 (evaporator hardware safety)	oFF / on_	/	/
	Id3	digital input 3 (defrost hardware safety)	oFF / on_	/	/
	Id4	digital input 4 (door opening)	oFF / on_	/	/
	Id5	digital input 5 (phase-1 software safety)	oFF / on_	/	/
	OS_	Machine status	/	/	/
	OSn	evaporator fan stopped by door opening or manual control	oFF / on_	/	/
	OA_	Analog output	/	/	/
	LLA	actual alarm - read only (0 means no alarm)	0 ... 255	/	/
	OA1	analog output 1 (condenser)	0 ... 255	/	/
	OA2	analog output 2 (humidity - 4...20 mA)	0 ... 255	/	/
	Od_	Digital output	/	/	/
(18)	Od1	digital output 1 (solenoid)	oFF / on_	/	/
	Od2	digital output 2 (heating)	oFF / on_	/	/
	Od3	digital output 3 (light)	oFF / on_	/	/
	Od4	digital output 4 (compressor)	oFF / on_	/	/
	Od5	digital output 5 (evaporator)	oFF / on_	/	/
	Od6	digital output 6 (defrost)	oFF / on_	/	/
	Od7	alarm - eventually connected to relay nr. 2	oFF / on_	/	/
	Od8	steam producer - eventually connected to relay nr. 2	oFF / on_	/	/
	Od9	air renew - eventually connected to relay nr. 2	oFF / on_	/	/
E_		Functions about slave preferences	/	/	/
	Ed_	Functions about network address	/	/	/
	EdS	slave address for local network communication	1 ... 254	1	/
	EY_	Functions about display	/	/	/
	EYY	input to show on display: 1=temperature / 2=humidity	1 ... 2	1	/

Note list

- 1 The period of each cycle includes on-time + off-time, that is the overall duration of the cycle.
- 2 Following defrost cycles will be aligned to the end of forced one.
- 3 Fixed time 120 s and manual reset.
- 4 When activated, pump down mode forces compressor continuous run, switched off only by low pressure limit.
- 5 Forced refrigeration is disabled when room temperature is under LtL while forced heating is disabled over LtH
- 6 Caution! Speed regulation can cause fan fault or electronic board fault. Low and average minimum speed can increase the risk.
- 7 The first pressure of push button inside the room - near the door - switches on the light, the second one activates the man alarm.
- 8 No action if the light is switched on from inside the room.
- 9 When off, the refrigeration solenoid is steadily on during cooling
- 10 Caution! Low overheating causes liquid return and compressor damage
- 11 Overheating over the maximum forces valve anticipated opening
- 12 Overheating under the minimum delays valve opening
- 13 Caution! Short duty cycle reduces valve life
- 14 Caution! Low overheating causes liquid return and compressor damage
- 15 Caution! High adaptation speed causes swing in the suction line and damage to the compressor
- 16 The low temperature differential is fixed, and alarm status stops at 0.2 °C above the set point
- 17 The high temperature differential is fixed, and alarm status stops at 0.2 °C under the set point
- 18 The minus sign on display ("-") signals that output is going to start after a delay

Push button	Function
B1 esc-silence	Exit without saving from any menu - Alarm buzzer silence
B2 up	Up navigation in the menu
B3 on - stand-by	Toggle between on and stand-by - toggle evaporator fan stop
B4 left - light	Left navigation in the menu - Switch light on and off
B5 down - defrost	Down navigation in the menu - Force immediate defrost
B6 right - menu	Display and set temperature - Right navigation in the menu - Enter menu
B7 light - man alarm	Remote button located inside the room, near the door: Switch light on - Man in room alarm
Led	Function
L1 cooling	On during cooling - blinking slowly during activation delay
L2 evaporator fan	On when evaporator fans are activated - blinking slowly during activation delay
L3 defrost	On when defrost is activated - blinking slowly during activation delay
L4 air renew	On when air renew is activated - blinking slowly during activation delay
L5 heating	On when heating is activated - blinking slowly during activation delay
L6 ethylene	On when ethylene is activated - blinking slowly during activation delay and during ripening
L7 light	On when light is activated - blinking slowly during switch-off delay
How to ...?	Operation description
Switch between on and stand-by	Keep pressed the B3 button to toggle between on and stand-by. In stand-by every output is disabled except light. In stand-by leds L1 to L6 blink, counters continue to count, you can enter the menu and change parameters.
Stop and restart evaporator fans	Press the B3 button to manually stop or restart evaporator fans. When evaporator fans are stopped, the display blinks.
Program the menu	Keep pressed B6 to enter the menu. Navigate up and down with B2 and B5. Select the submenu by B6. Change the parameter by B2 and B5, confirm it pressing B6 or go back without saving by B4. The changes will have effect when you exit from programming pressing B4 repeatedly. Press B1 to exit immediately without saving any parameter.
Show / change temperature	Enter programming - modify _t0 then confirm it. Keyboard short cut: press shortly B6 - the display shows the current set point - change it and confirm it by B6
Force an air renew	Keep pressed B6 + B2.
Force a defrost	Keep pressed B5.
Buttons to press	Shortcut description - keep pressed 5 seconds
B5	Immediate defrost
B6 B2	Activate forced air renew
Alarm	Alarm description
A01 min temperature	Minimum temperature exceeded
A02 max temperature	Maximum temperature exceeded
A03 mc alarm	Pressure switch or other hardware compressor safety has disconnected
A04 evaporator alarm	Evaporator thermal relay or other hardware evaporator safety has disconnected
A05 defrost alarm	Defrost thermostat of other hardware defrost safety has disconnected
A06 door alarm	Door open
A07 phase alarm	Compressor overload/thermal relay disconnected or missing mains phase -manual reset
A08 min temperature	Minimum temperature exceeded - full plant stop
A09 max temperature	Maximum temperature exceeded - full plant stop
A10 oil alarm	Minimum oil pressure alarm - manual reset
A11 min humidity	Minimum humidity exceeded
A12 max humidity	Maximum humidity exceeded
A13 min humidity	Minimum humidity exceeded - full plant stop
A14 max humidity	Maximum humidity exceeded - full plant stop
Display	Status description
- - - 3 dashes	Slave is receiving settings from master
. . . 3 dots	Slave is sending settings to master

Led and push button location

